Isle of Wight Local Geodiversity Action Plan (IWLGAP)

Geodiversity (geological diversity) is the variety of earth materials, forms and processes that constitute either the whole Earth or a specific region of it.

The sequence of early Cretaceous Wealden rocks at Barnes High.
Sedimentation by rivers, lakes and river deltas can all be seen at this one site.

February 2010

(First Draft [2005] produced for: English Nature contract no. EIT34-04-024)

‘The primary function of the Isle of Wight Local Geodiversity Action Plan is to formulate a strategy to promote the Isle of Wight through the conservation and sustainable development of its Earth Heritage.’

Geodiversity (geological diversity) is the variety of earth materials, forms and processes that constitute either the whole Earth or a specific region of it.

Relevant materials include minerals, rocks, sediments, fossils, and soils.

Forms may comprise of folds, faults, landforms and other expressions of morphology or relations between units of earth material.

Any natural process that continues to act upon, maintain or modify either material or form (for example tectonics, sediment transport, pedogenesis) represents another aspect of geodiversity. However geodiversity is not normally defined to include the likes of landscaping, concrete or other significant human influence.

Gray, M. 2004. Geodiversity: Valuing and Conserving Abiotic Nature. John Wiley & Sons Ltd, Chichester.

EXECUTIVE SUMMARY

Much of what we do is heavily influenced by the underlying geology; from where we build, grow crops, collect water and where we carry out our recreational activities. It affects every aspect of our natural landscape and the things that live on it. The geology of the Isle of Wight is often overlooked – the purpose of this plan is to widen the audience and make more people aware of the Island's diverse geology.

What you can find in this document –

Part One: is an introduction to why we produced this document.

Part Two: provides a summary of the geological formation of the Isle of Wight.

Part Three: details what we propose to do to enhance public awareness and support geoconservation measures; and what we have achieved so far.

Part Four: contains useful appendices, for example – lists of abbreviations and terms, websites and further reading, and a list of the contents of the accompanying CD.

Part Five: is a separate CD containing a number of detailed forms (and photographs) describing a selection of important places, and historical influences on our knowledge of the Island's geology.

Contents

PART FOUR: APPENDICES

PART FIVE: CD containing The Geological Record Audit (2005)

Supplied separately.

ISSUE HISTORY:

First Draft	January 2005	Dr. M. Munt
Second Draft	August 2009	T. Price
1st online issue	February 2010	T.Price

THIS IS A WORKING DOCUMENT AND IS SUBJECT TO REVISION.

The latest version can be downloaded from http://www.dinosaurisle.com/lgap.aspx

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PART ONE: INTRODUCTION

Background

The Island's spectacular and varied geology records over 125 million years of changing climate, geography, animal and plant life. Whilst its unique and important dinosaur heritage is more widely known other aspects of the Island's diverse geological and palaeontological heritage are perhaps not so well known to the wider public. To broaden the awareness of that geological knowledge, and conserve what is important, a process of identifying and recording that geological diversity, then identifying key tasks to enhance it has been undertaken by this LGAP (Local Geodiversity Action Plan).

The Isle of Wight County Museum Service was originally contracted in 2003 to undertake work to formulate a Geodiversity Action Plan for the Isle of Wight. To produce the action plan an audit officer was appointed under the supervision of the Curator of Geology and other parts of the project were contracted out to staff of the Isle of Wight Council's Centre for the Coastal Environment. The overall project has been coordinated by the Isle of Wight Council's Dinosaur Isle Museum (formerly the Museum of Isle of Wight Geology).

The Isle of Wight LGAP

The primary function of the Isle of Wight Local Geodiversity Action Plan is to formulate a strategy to promote the Isle of Wight through the conservation and sustainable development of its Earth Heritage.

The plan sets objectives, targets and determines indicators that will focus resources to conserve and enhance the heritage. The secondary function is to produce, for the first time an electronic database audit of the Island's geodiversity.

The LGAP is intended to link into other existing initiatives such as the Isle of Wight AONB, Local Biodiversity Action Plan, Historic Environment Action Plan, Historic Landscape Assessments and the Isle of Wight Council's corporate objective of 'Protecting the Island's Physical Environment'.

The action plan has a thematic approach. Seven themes are listed in Table 2; each comprises a separate part of the document (it should be noted that the themes are not listed in any order of relative importance).

Geological Highlights

Figure 1: Aerial view of the Island - © IWCCE, courtesy of Wight Light Gallery.

High white Chalk cliffs at the western and eastern ends of the Island pass into low red silts, and brown sandy cliffs and then on into high Greensand bluffs above the southern shore. The mosaic of fields, urban centres and roads mirrors the underlying geological complexity of the Isle of Wight.

The Isle of Wight contains so much geodiversity, and fantastic exposures along long coastal cliffs and inland sites that it would be easy to produce an extensive list of what is important; however amongst that diversity are certain gems that stand out above the others. These are listed in the boxes that follow.

The Isle of Wight is recognized as the **best site in Europe for dinosaur remains**, with fresh exposures revealed in the ever-eroding cliffs. Large numbers of early Cretaceous dinosaurs have been found here – including the type specimens for *Neovenator salerii*, *Eotyrannus lengi*, *Hypsilophodon foxii, Iguanodon* (*Mantellisaurus) atherfieldensis*, *Valdosaurus canaliculatus* and *Yaverlandia bitholus* (an alleged pachycephalosaur).
Amongst the larger finds was the 1992 discovery of a large brachiosaur in the cliffs of the south-west coast.
In addition, other finds include a neck vertebra from what may have been the largest dinosaur to have been found in England.

The Ventnor Undercliff on the southern coast, and parts of the northern coast from Cowes to Gurnard, are subject to complex land-movements. Landsliding is the result of weak clay layers amongst more porous rock types in a sequence generally tipping towards the sea. Failure is triggered by high water levels in the ground and coastal erosion of the toe of the landslide complex. The area is vulnerable to sea-level rise and climate change. The southern section from Luccombe to Niton is **the largest urban landslide complex in northern Europe** and is the subject of extensive study and active landslide management.

From the geo-tourism point of view **Alum Bay is a popular destination for its distinctive coloured sand cliffs**. The fine multi-coloured layers, exposed vertically across the bay, are now known to be formed from different coatings on sand grains which were washed, probably relatively uncoated, into the area when the rock was first formed. Rain-water runoff from the surrounding hills brought in iron and other minerals which then coated the grains forming the stunning colour variety we see today.

Along the northern coast there is evidence of **the former Solent River**; now fully marine after rising sea-levels breached the former Chalk ridge to the west of the Island about 8,000 years ago letting the sea rush into the upper river valley and opening the western Solent to the full force of the sea. Gravel and peat, and other deposits record this flooding, the change of environment from river to sea, and the effects it had on the people, animals and plants that once lived there.

The **Palaeogene silts, clays, muds and sands of the northern coast** contain a rich diversity of fossils and environmental information arguably unrivalled in northern Europe. The site localities of Whitecliff Bay and Alum Bay are amongst a number of important Sites of Special Scientific Interest (SSSI) for their stunning geology. Of notable importance is the Insect Bed within the Solent Group which is the most important source of insects from this time in Europe. The mammal and bird fauna, and the plant flora from the Solent Group of the north coast form an expanding research area. They tell us much about the environmental changes that were happening around 37 to 33 million years ago.

The **Quaternary gravels of the north coast,** and elsewhere, contain a number of human artefacts from the Palaeolithic. Priory Bay is the most important of these locations, yielding a large number of flint hand-axes and other cutting implements. This is entirely due to the geological factors at this site.

Figure 2: A limestone reef from the Headon Hill rocks of the Palaeogene; exposed on the foreshore near Newtown Estuary.

Why produce an LGAP?

The reasons proposed by Natural England (DEFRA) for producing an LGAP are as follows –

'LGAPs are being developed to provide a framework for the delivery of geoconservation. LGAPs are, in part, developed from the model of Biodiversity Action Plans and have adopted the process of setting clear aims and objectives, with measurable targets, for local geoconservation.

This approach can provide:

- **a structured approach to local geoconservation**
- **a framework for grant applications**
- **wider awareness of geological sites and geoconservation**
- **increased protection for existing and newly identified sites.'**

(From the Natural England LGAP webpage.)

The visible evidence of our nations' diverse Earth Heritage is under increasing pressure from climate change and the demands of a growing population. Climate change effects include increased rainfall, other weather extremes and rising sea-level. Pressure is also exerted through the tipping and infill of old quarries, new housing and industrial developments and new infrastructure. LGAPs are needed to identify, then conserve or record valuable sites before they are lost forever. They can also influence the planning process, for example through encouraging greater use of local stone, or designing new buildings in sympathy with older stone buildings.

Formation of the Isle of Wight LGAP Partnership

The partnership was established between November and December 2003 by Dinosaur Isle geological museum, with support from English Nature (now called Natural England). Key partners such as the Isle of Wight Countryside Section, The National Trust and the Isle of Wight AONB Unit joined the group. The first formal meeting was convened in early January 2004. At the meeting, representatives of the following organisations agreed to form the partnership:-

Dinosaur Isle
English Nature (now Natural England)
National Trust
Isle of Wight AONB Partnership
Isle of Wight Biodiversity Action Plan partnership
Country Landowners Association
Dinosaur Farm Museum
Medina Valley Centre
Isle of Wight Council's Coastal Management section
IW County Archaeology and Historic Environment Service
The Isle of Wight Natural History and Archaeological Society
Geological Society of the Isle of Wight

Original principal partners: (First Draft, 2005)	**Updated principal partners: (2009)**
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Table 1: Principal partners

Objectives

The objectives of the LGAP are:

1. To audit the existing Earth Heritage resource of the Isle of Wight.
2. To audit existing Earth Heritage interpretation on the Isle of Wight.
3. To form an action plan to help conserve the Island's Earth Heritage resource.
4. To form an action plan to develop in a sustainable way the Island's Earth Heritage Resource to the benefit of the Island community and visitor.

Themes

Themes:

The Isle of Wight LGAP examines geodiversity through the following themes:

1. The role of the Isle of Wight in the history of the Earth Sciences.
2. Dinosaurs.
3. The role of geology in the development of the Isle of Wight tourism industry.
4. Coastal mass movement phenomena.
5. The Isle of Wight's Geological Record.
6. Fossils and fossil collecting.
7. Geology and landscape.

Table 2: Themes

Themes 1,2,3,5 and 6 have been undertaken by staff of Dinosaur Isle, with theme 4, and much of 7, audited and written by staff of the Isle of Wight Centre for the Coastal Environment, Isle of Wight Council.

Process and Timescale

Form LGAP partnership (November – December 2003)

Recruit and appoint consultants (December 2003 – January 2004)

Research (November 2003 – August 2004)

Issue first draft LGAP document (January 2005)

Begin review and reissue of LGAP2 (August 2009)

The LGAP partners were invited to contribute to, and comment upon, the proposals and reports during the operation of the project. The first draft was produced by Dinosaur Isle at the beginning of 2005 and was issued to the then English Nature. The document was subject to a major rewrite in 2009 prior to being issued to the original partners, and new organizations that had expressed an interest since the first draft. The 2009 objectives included ensuring that the document could be accessed by a wider audience.

Finances for forming the partnership and producing the first draft (January 2005)

English Nature		£5000
Dinosaur Isle Museum		£5194
Research and Report	30 days @ £100	= £3000
Administration	10 days @ £ 50	= £ 500
Photography	24 hours@ £22	= £ 528
Graphics	37 hours @ £18	= £ 666
Misc. materials		= £ 500

Context of the Isle of Wight LGAP

The Isle of Wight

The Isle of Wight is situated 2 miles off the coast of central southern England. It covers an area of about 147 square miles and has a resident population of over 132,000, rising to over 200,000 during the peak tourist season. The main element of the Island economy is tourism. There is limited manufacturing industry with the bulk of the working population engaged in the service industry. Some 34% of the population are classed as retired. The county town is Newport which sits almost centrally on the Island; other main towns include Ryde, Cowes, Freshwater and the Sandown-Lake-Shanklin spread on the south-east coast. Approximately half the Island's land area is designated an Area of Outstanding Natural Beauty (AONB) and there are about 30 Sites of Special Scientific Interest (SSSI) on the Island. The Isle of Wight is unusually rich in species and habitats; and its chalk grasslands, maritime cliffs and slopes, and estuaries are important on a national and international scale.

Figure 3: The traditional holiday pursuit – viewing the coloured sands at Alum Bay. Variability in the mineral coatings of the Eocene sands results in the striped cliffs.

The Planning context

In 1995 the Isle of Wight became a Unitary Authority, with the Isle of Wight Council replacing the previous structure of the Isle of Wight County Council and the two Borough Councils of Medina and South Wight.

Planning responsibility currently sits within the Environment and Neighbourhoods Directorate of the Isle of Wight Council (located at Seaclose Offices, Newport).

Coastal matters are coordinated by the Coastal Management Section, which along with the Parks and Countryside Section and AONB Unit are also contained within the Environment and Neighbourhoods Directorate.

Geological issues are otherwise dealt with by Dinosaur Isle Museum as part of the Island Heritage Service currently within the CX Strategy and Performance Unit of the Isle of Wight Council. (The IW County Archaeology and Historic Environment Service [IWCAHES] is also part of the Island Heritage Service).

Issues related to Sites of Special Scientific Interest are within the realm of the regional office of Natural England.

Figure 4: The southern town of Ventnor, part of the largest urban landslide complex in north-west Europe. © IWCCE.

Geoconservation on the Isle of Wight

It is not unreasonable to state that site-based geoconservation on the Isle of Wight lags behind other parts of England in some respects; having said this, significant steps are being made. As stated above there is a good network of SSSI's which embrace most of the Island's geodiversity. More recently the publication of the Isle of Wight AONB Management Plan 2009-2014 highlights the importance of Earth Heritage and recognises the threats and challenges to Earth Heritage within the AONB. Three policies are proposed to tackle the threats (see Table 3).

Threats and Challenges to Earth Heritage	Management Policies
Agricultural intensification Mineral extraction Water Quality Climate Change and Sea level rise Fossil Collecting Interference with natural erosion and sedimentation Lack of awareness of the importance of Earth Heritage	EH-P1: Awareness Promote the outstanding earth heritage resource of the AONB to all audiences. EH-P2: Recording and Monitoring Ensure changes to the earth heritage resource of the AONB are researched, recorded and monitored. EH-P3: Conserving and Enhancing Ensure the earth heritage resource is given due consideration in all policies, strategies, regulatory process and other activities.

Table 3: AONB Management Plan Policies: Earth Heritage

Within the Local Biodiversity Action Plan (LBAP), Earth Heritage considerations lie within individual Habitat Action Plans, in particular within the Maritime Cliffs and Slopes management plans. Within the framework of the Isle of Wight LBAP an objective is to establish a RIGS (Regionally Important Geological / Geomorphological Site) network for the Island. To date just a few RIGS have been established for the Isle of Wight; these were founded on areas outside of SSSI protection.

Whereas historical coastal defence probably had greater impact upon the Earth Heritage, fossil collecting has remained the greatest focus of debate on the Island – where a wide variety of fossils can be discovered loose on the local beaches as exposures are naturally created, and eroded. In 1995 (Radley, 1995) the former English Nature along with Isle of Wight County Council staff, fossil collectors and landowners produced a (voluntary) Code of Conduct for fossil collecting. Subsequent to that was the formation of the Geological Society of the Isle of Wight (GSIW), which has become a focus group for amateur fossil collecting on the Island.

Moving away from site based geoconservation to that perhaps more properly described as interpretation the Isle of Wight can regard itself steps ahead. For example, whereas Dorset has World Heritage Status for its sites, it still lacks a centre point to interpret the heritage. In 2001 **Dinosaur Isle Museum** opened on Sandown seafront. This replaced the long out-grown Museum of Isle of Wight Geology, also located in Sandown. The museum is a local authority administered museum initially registered under the *Resource* national scheme for museum standards. In September 2008 Dinosaur Isle Museum achieved Accredited Status. The museum sees over 70,000 local, national and international visitors each year. In addition a large number of pupils and students visit annually as part of its Education remit; some 10,000 individuals of school age take part, with fossil-handling sessions and visits to coastal sites all part of the programme offered. Public trips at coastal sites of particular interest are also offered as part of its annual field-trip programme. These are becoming increasingly popular, with families pre-booking as part of their annual holiday to the Isle of Wight.

In addition to Dinosaur Isle Museum there is a privately operated museum on the west coast of the Island called **Dinosaur Farm**. A barn complex on the site of Lower Sutton Farm became a private museum after Steve Hutt of Dinosaur Isle Museum discovered the partial skeleton of a sauropod dinosaur at a nearby coastal site called Barnes High. The dinosaur, known as ‘the Barnes High sauropod’, was excavated in the early 1990’s and is now thought to be a juvenile brachiosaur. Parts are displayed here, along with other fossils from the local area. Dinosaur Farm is currently managed by Martin Simpson, and owned by Geoff and Barbara Phillips.

The **Coastal Visitors Centre** at Ventnor is run by the Isle of Wight Council's Coastal Management Service and has displays explaining diversity and management of the coast, including issues of coastal erosion, the natural environment, archaeology, geology, coastal risk reduction and advice on living with landslips. The town of Ventnor is recognized as the largest urban area affected by mass movement in Europe.

Besides Dinosaur Isle Museum, the Coastal Visitors Centre and Dinosaur Farm Museum, there are numerous organizations which offer interpretation in one form or other, such as Chine trips by the West Wight Landscape Partnership (WWLP), The Geological Society of the Isle of Wight (GSIW) and formal education through the Medina Valley Centre.

Dinosaur Isle Museum, Sandown.

Coastal Visitors' Centre, Ventnor.

Dinosaur Farm, near Brighstone.

Figure 5: Sites offering interpretation.

PART TWO: THE GEOLOGICAL HISTORY OF THE ISLE OF WIGHT

Period	lower Cretaceous	upper Cretaceous	Palaeogene	Neogene	Quaternary
Starts (millions of years ago). [See Appendix 4 for a larger timescale.]	**145.5**	**99.6**	**65.5**	**23.03**	**2.588**

Table 4: A simple timeline of the Island's exposed geological succession (oldest unit to the left).

Introduction

The Isle of Wight contains an incredible diversity of geology for such a small island. Broadly the Island can be divided into two terrains, a northern one underlain by Palaeogene strata and the southern by Cretaceous strata, divided by the central ridge of Chalk, often referred to as the backbone of the Island. On the face of it the Island looks like a slightly buckled layer cake of sedimentary rocks, but these layers mask a structural complexity which has asserted its influence for almost 130 million years. A complexity we are only just beginning to understand.

Structural Context

To explain the current surface geology of the Isle of Wight we have to begin about 300 million years ago at the end of the Carboniferous. At that time the British Isles, North America and Scandinavia were part of a giant continent we call Laurentia – Baltica. Europe formed a separate continent to the south (called Armorica). These continents were divided by an extensive sea called the Rheic Ocean.

Over time the Rheic Ocean shrank in size as the continents moved ever closer to each other. When the land masses eventually collided the ocean floor was dragged (subducted) below Armorica (to the south) and also forced up onto the Laurentia – Baltica surface to the north. The rocks to the north were intensely contorted, and pushed up along low angle thrust faults. This early tectonic phase (from the end of the Devonian and throughout the Carboniferous) is referred to as the Variscan Orogeny.

Below the Isle of Wight the Carboniferous sequence is not present. The Permo-Triassic Sherwood Sandstone rests unconformably on Devonian Old Red Sandstone. This boundary is termed the Variscan Unconformity. An enormous sequence of rock is thus missing from the Carboniferous deep below the Island. This has been proven in the Arreton and Sandhills boreholes.

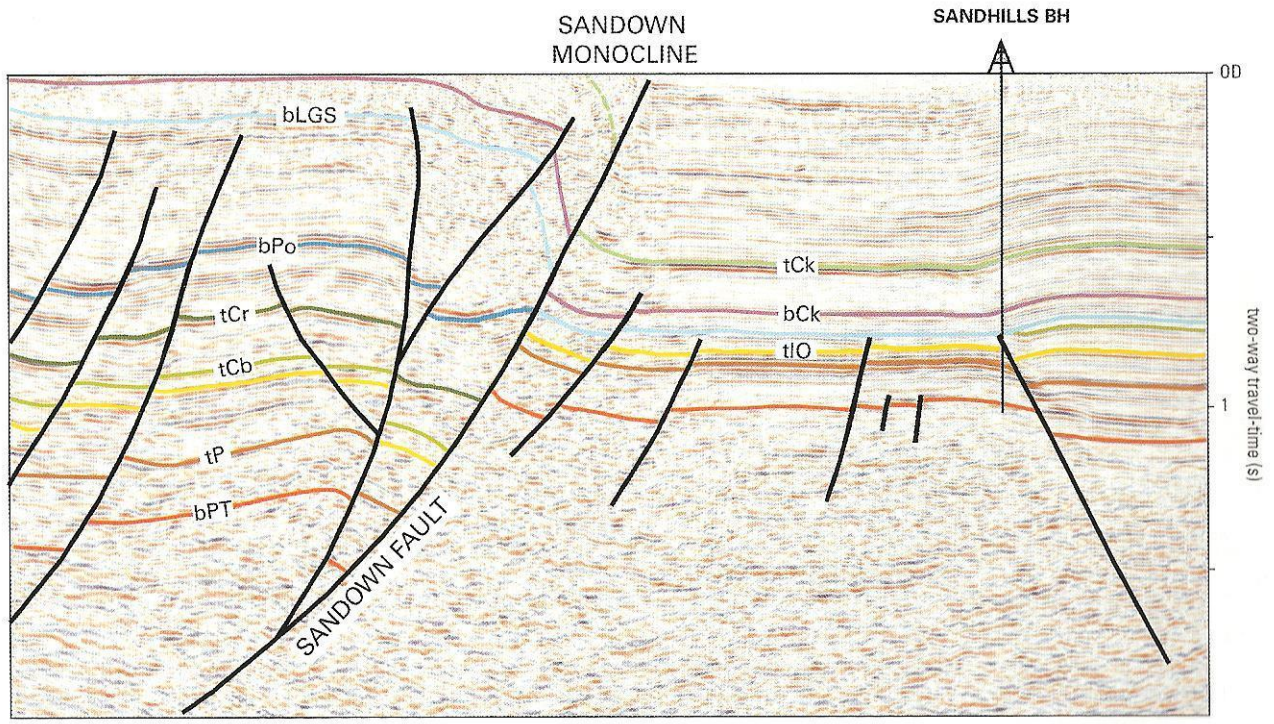
All of this ancient continental movement occurred along a broad front which today lies below Cornwall, southern England and north-east France. Today, highly contorted rocks formed as mud on the floor of the Rheic Ocean can be seen on the north coast of Devon. Similar rocks lay at considerable depth below the Isle of Wight. Two overlapping thrust faults lie directly below the Isle of Wight. We can confidently recognise and date this thrust zone to those times as it has a distinctive signature - it trends east-west and forms a series of gentle arcs opening to the south.

(NOTE: A reference table containing the larger time periods, like the Devonian and Carboniferous, can be found in the appendices).

Through the later Permian and Triassic the Island was subject to extensional tensions caused by the spreading of the former Tethys Ocean which also lay to the south. During the Jurassic the Central Atlantic began to open, with the North Atlantic opening during the Cretaceous. Later during the Palaeogene England separated from Greenland, and the Atlantic was finally open. The later northern movement of Africa produced the Alps and created compressional pressures on the Isle of Wight. This has resulted in the folding of the Island's geology in the form we see it today. This final tectonic phase (from 280 million years ago to the present) is referred to as the Cimmerian-Alpine.

The compressional and extensional tensions over this considerable time-scale were focused along the underlying, more ancient, thrust faults. The landscape we see today is the result of that active movement and the effects it had on the depositional, erosive and biotic processes.

The whole geological story of the Isle of Wight can be tied to the periodic movement of that thrust zone. The deeper geology has only become more understood since the use of seismic reflection data to produce cross-sections like those through the Sandhills Prospect shown in Figure 6.



North–south seismic line through the Sandown Structure on the Isle of Wight.

Figure 6: A seismic cross-section through the Island.

This current seismic-section (by the British Geological Survey - BGS) shows the raised older geology of the southern half of the Island to the left and the younger, northern, sediments to the right. Relevant symbols are 'bLGS' – base of the Lower Greensand, 'tCk' – top of the Chalk, 'bCk' – bottom of the Chalk..

The collection of seismic data, and its interpretation, has been vital to understanding the deeper geology below the Isle of Wight and the causes of its rich diversity.

In this respect the Island played a key part. Professor John Milne established the base for the World's first seismic network at Shide in Newport. He is buried in Newport.

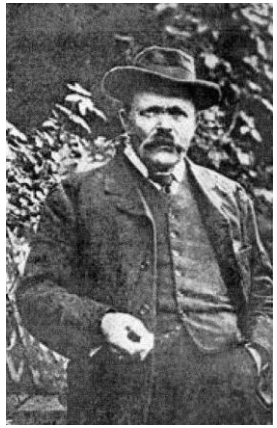


Figure 7: Professor John Milne.

For the next 100 million years after the Carboniferous (during the Permo-Triassic) the area that would become southern England was a land surface covered in desert sands and salt deposits. At the beginning of the Jurassic, about 200 million years ago the sea flooded the land, depositing the layers of Lias and later Jurassic rocks which now form the cliffs of Dorset, and underlie the Isle of Wight.

By the early Cretaceous, about 135 million years ago, the sea had receded and the land was exposed once again. The southern half of the Island formed as a low-lying area (the Wessex – Channel Basin) with a range of low-lying hills comprised of Jurassic rocks forming the northern half of the Island. There was no eastern English Channel, or Solent, as we know them today. It is believed that this arrangement of basin and hill-line was formed by the slow-sinking of the southern half of the Island along the former thrust faults. The rocks that contain the remains of dinosaurs on the southern half of the Island do not continue to the north of the Chalk hills, suggesting a natural barrier existed over the northern half of the Island. Moreover, pebbles thought to be gastroliths (stomach stones of dinosaurs) are found in these southern rocks – these pebbles are much older than the geology of the time, suggesting that they were lying on the surface, and eroding at the time of our dinosaurs.

There is further proof of this eroding land surface to the north in the form of Jurassic rocks and fossils entombed as objects in much younger Cretaceous sediments to the south.

The Geological succession

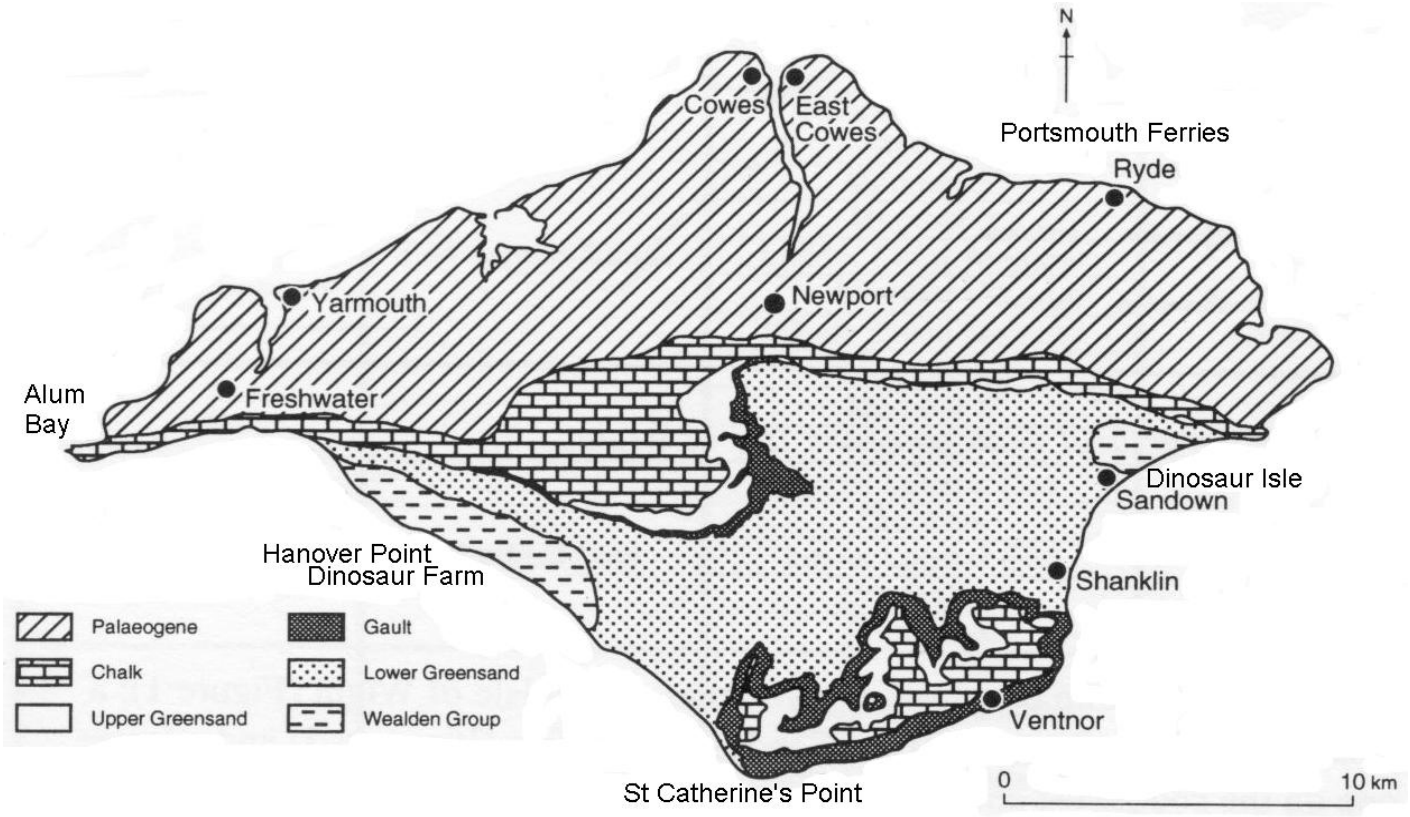


Figure 8: Simplified geological map of the Isle of Wight.

The Chalk ridge, which separates the two distinct halves of the Island, is shown by the brickwork motif.

The deepest, and oldest, rocks are from the Cretaceous. The sequence is summarized in the table below. They form the rocks of the central downs and the land to the south.

Period	Group	Sub-group / Formation	Stage
Late Cretaceous	Chalk Group	White Chalk sub-group Lower Chalk sub-group	Campanian to Cenomanian
Early Cretaceous	Un-named Group	Upper Greensand Formation Gault Clay Formation	Albian
	Lower Greensand Group	Carstone Formation ~~~~~~~~~~~~~~~~~~ unconformity Sandrock Formation Ferruginous Sands Formation Atherfield Clay Formation	Albian Aptian
	Wealden Group	Vectis Formation Wessex Formation	Aptian Barremian

Table.5: Summary of the Cretaceous rocks on the Isle of Wight.

At the moment the best estimate for the age of the oldest exposed rocks on the Island is about 126 million years (in the cliffs of Brook Bay), based on comparing isotopes in carbon from fossilized plant material; however determining the age of sedimentary rocks can be difficult and this date may be refined as further research is carried out.

The early Cretaceous

Wealden Group

The Isle of Wight dinosaurs are found in the rocks called the **Wealden Group**. These rocks we divide into two, the **Wessex Formation** and the (younger) **Vectis Formation**.

The **Wessex Formation** consists of vari-coloured muds and silts, well-sorted sandstones, lignite beds and thin conglomerates. At Yaverland there is a thin limestone containing large gastropods. The red/purple coloured muds are the most distinctive layers. These are thought to have formed as extensive deposits on flood plains, with waterlogged soils forming on them giving the colours. Other layers are grey coloured and contain masses of plant remains; these we call plant-debris beds. These are the principal source of dinosaur remains. The environment is believed, at times, to have been seasonal, with a wet and a dry season; and at others to have been arid for long periods of time. Rivers meandered through the low lying landscape. Copses of pine with cycads and tree ferns grew along the river banks and northern hills. Wildfires, ignited by lightning, occasionally swept through the dry wood and bracken. Seasonal rains would sweep-up the dead trees and dinosaurs and dump them down into festering piles; these would later form the plant-debris beds. As new plants grew the area would have been comprised of trees that were the same age and height. Thick grey layers of mud, and thin course-sandstones, are evidence of flash-floods from the exposed Jurassic hills to the north.

Figure 9: The Hanover Point Sandstone in red Wessex silts.

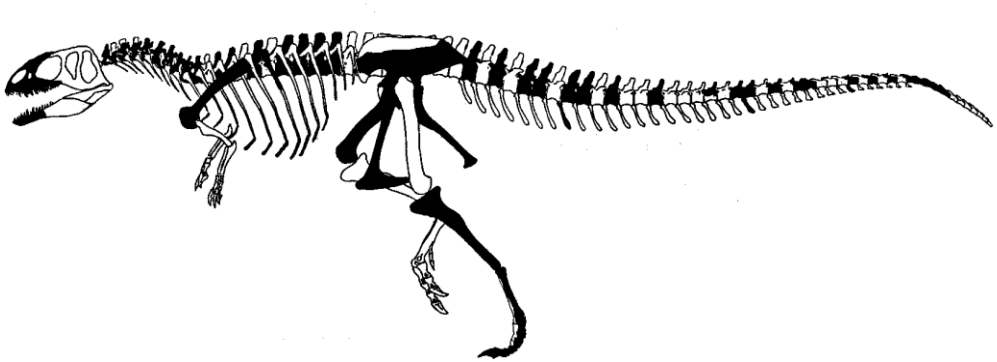


Figure 10: *Neovenator salerii*, a carnivorous dinosaur from the Wessex Formation of the Isle of Wight.
The black areas identify the bones that have been found so far from the type specimen.

About 122 million years ago sea-level rise, and continuing lowering of the ground surface, caused the inundation of the rivers by first freshwater, and then saline, lagoons. The northern range of hills now became the backdrop to an extensive shallow, warm lagoon. The rocks of the **Vectis Formation** (muds, shales, sandstones and thin limestones) were deposited in this lagoon. The floor of the lagoon was home to countless numbers of cockle-like shells called *Filosina*. Layers of grey, paper-thin, shales contain the fossils of numerous ostracods, fish bones, small bivalves and gastropods. Storms would occasionally rip through the lagoon sweeping the organisms up into thin, but extensive, shell banks to form grey and red muddy limestones. These limestones can also contain the fossils of visitors to the lagoon in the form of shark spines and teeth, turtle bones and the bones of marine reptiles called pliosaurs. Nearer to the central Downs the Vectis limestones can contain much older fossils, usually ammonite segments, eroded from the then-exposed Jurassic hills to the north. Other visitors to the lagoon were dinosaurs, probably tempted out post-storm to scavenge carcasses in the shallow lagoon; footprints, mainly from carnivorous theropods, have been found on the underside of limestones at Atherfield. By 120 million years ago the sea had flooded into the lagoon.

Lower Greensand Group

The next 20 million years saw a steady deepening of the sea, as the earth went into a period of 'greenhouse' style warming. The ever deepening sea culminated in the deposition of the Chalk. In the first stages of what is known as the Cretaceous Marine Transgression shallow warm coastal waters replaced the lagoon. Sands and muds were deposited in the shallow sea; we call the rocks of this sequence the **Lower Greensand Group**. The Lower Greensand Sea teemed with life including bivalves, ammonites, corals, lobsters and marine reptiles such as Ichthyosaurs. The base of the **Lower Greensand Group** is marked by the thin but resistant sandstone called the **Perna Beds Member**. This sequence of hard beds probably formed under quite turbulent conditions as it contains many thick shelled bivalves which show features such as coarse bumps on the shell. These are adaptations which help prevent the shell from being washed out of the sand.

The **Atherfield Clay Formation** (to which the **Perna Beds Member** belongs), represents quieter conditions and contains sea urchins, ammonites, and most notably small lobsters. The **Ferruginous Sands Formation** which follows shows evidence of the movement of water currents. These sands are the source of ammonites and nests of brachiopods and clusters of oysters. The ammonites include the heteromorphic *Tropaeum* and *Australiceras.* The **Ferruginous Sands Formation** gets it name from its orange-red iron colour. However, this colour is a result of the weathering of the mineral glauconite. This mineral is green in colour and hence the name Greensand. The presence of glauconite indicates deposition within marine conditions, where this mineral forms on the sea floor. Glauconite forms today in warm shelf seas.

Figure 11: Whale Chine, cuts down into the Ferruginous Sands.

The overlying **Sandrock Formation**, was deposited in a similar setting to the **Ferruginous Sands Formation**. However, the Sandrock is made of a number of cycles of mud and sand; the number of cycles varies around the Island. The widespread occurrence of particular burrows (trace fossils) within the sands indicate rapid deposition. It is considered that the **Sandrock** may have been deposited under cyclical coastal mudflat and estuarine conditions. Some plant material can be found in the clay sequences.

Figure 12: Yellow sands and grey clays of the Sandrock form the upper half of Knock Cliff at Shanklin. The lower half of the cliff is the top of the Ferruginous Sands.

The youngest part of the **Lower Greensand Group** is the **Carstone Formation**. The **Carstone** consists of coarse sands and grits, seemingly deposited in a turbulent shallow marine environment. The **Carstone Formation** is the only part of the **Lower Greensand Group** found under the northern part of the Isle of Wight. This indicates that the northern hills existed throughout much of the Early Cretaceous, only being over-run by the sea at the end of Lower Greensand times. The **Carstone Formation** is not particularly rich in fossils. However, a wide range of marine invertebrates have been found in exposures in the St Catherine's area. Pebble beds near the top of the **Carstone Formation** at Redcliff contain many derived Jurassic fossils, indicating the continued erosion of the northern hills. More recently it has been proposed that the **Carstone** be moved into the Group above. A significant erosion surface (The Late Cimmerian Unconformity) exists between the top of the **Sandrock** and the base of the **Carstone** indicating a large time-period between the two. Mineral similarities suggest that the **Carstone** is a transgressive lag deposit associated with the **Gault Clay** above.

Un-named Group

The **Lower Greensand Group** is overlain by the **Gault Clay Formation** and **Upper Greensand Formation**. The **Gault** represents deep water and the **Upper Greensand** represents shallow marine waters, often showing the effects of storm waves. On the Island both contain only a limited range of fossils, principally, worm burrows, ammonites and bivalves. To the east in Kent where the Gault Clay is thicker, it is a very rich source of fossils including iridescent ammonites. Such preservations are found on the Island, but are scarce. Toward the top of the **Upper Greensand**, layers of chert are seen. These indicate the development of sponge forests on the sea floor, very much a precursor to the extensive sponge forests seen in the Late Cretaceous. The Isle of Wight is important for understanding the relationship between the **Gault Clay** and **Upper Greensand**. To the east of the Island the **Upper Greensand** thins-out, with the **Gault Clay** thickening. The reverse is seen to the west of the Island. On the Island, the Upper Greensand is clearly seen to overlay, and therefore be younger than the **Gault Clay**. The **Gault** and **Greensand** appear to have been deposited in a regional basin, with the **Gault Clay** representing the deeper water deposits, and the **Greensand** representing the margins of the basin.

Figure 13: Brown Carstone, grey Gault Clay slide and chalky white Upper Greensand at Culver Cliff near Sandown.

The late Cretaceous

The Chalk Downlands are the dominant feature of southern England. The **Chalk Group**, which forms our rolling Downland scenery, was deposited between 99 and 65 million years ago. It represents the peak of the Cretaceous Marine Transgression, with a deep sea covering much of Northern Europe. At the same time chalks were being deposited in North America and parts of Australia, a global phenomenon linked to greenhouse heating of the Earth. Chalk is formed from the accumulation of countless billions of tiny planktonic tests (shells) called coccoliths.

The Chalk is a rich source of fossils, notably echinoids, ammonites (**Grey Chalk sub-group**), belemnites, sponges and bivalves. Throughout most of the deposition of the Chalk, the sea floor was soft, and many of the creatures which lived there show adaptations to living on or within a soft mobile substrate (principally features such as spines which disperse the weight of the shell). The **Chalk** is divided into the **Grey Chalk** and **White Chalk sub-groups**. The **White Chalk sub-group** is characterised by pure limestones (chalk) with layers of flint. The **Grey Chalk sub-group** consists of banded grey calcareous sandstones and white limestones.

The **White Chalk** is often regarded as monotonous layers of white limestone interspersed with black flints. The truth is however, somewhat different. Sponge beds and hardgrounds are frequently encountered, some of which contain glauconite covered pebbles and phosphatised erosion surfaces. At such horizons the fauna can be both more abundant and diverse. Hardgrounds form where erosion occurs contemporaneously with deposition. On the Island such horizons have been taken to indicate further movement on the thrust plane.

Locally the youngest part of the Chalk is about 74 million years old; the subsequent 9 – 10 million years of Chalk was probably deposited but subsequently eroded away during the Early Palaeogene. The top of the Chalk on the Island is eroded and the Palaeogene rests unconformably upon it. Terminal Cretaceous events are not recorded on the Isle of Wight.

Figure 14: Chalk at Freshwater Bay.

The Palaeogene

Series	Group	Formation	Stage
Oligocene	Solent Group	Bouldnor	Rupelian
Eocene	Solent Group	Bembridge Limestone	Priabonian
Eocene	Solent Group	Headon Hill	Priabonian
Eocene	Barton Group	Boscombe Sands to Becton Sands	Bartonian
Eocene	Bracklesham Group	Wittering to Branksome Sands	Lutetian
Eocene	Thames	London Clay	Ypresian
Palaocene	Lambeth	Reading	Selandian

Table.6: Summary of the Palaeogene rocks on the Isle of Wight.

By the start of the Palaeogene quite remarkable changes had happened to the Earth, and life on Earth. The dinosaurs on land, and the ammonites in the seas, were amongst the many life forms which had disappeared.

Locally, something else had happened. Throughout most of the Cretaceous, land had probably existed over what is now the northern part of the Island; this had also become sea by the Late Cretaceous. By the Early Palaeogene, the southern part of the Island had probably become land, as rocks were now only forming to the north of the Chalk Downs (geologists call such a swap-over 'Basin Inversion').

This time the land to the south was rising under enormous compressional forces from the slow, but relentless, northwards movement of Africa into southern Europe. The southern half of the Island was sliding up the former thrust fault - pushing that part of the island ever higher into the air. This interpretation has been supported by recent studies indicating that as the Palaeogene sediments were being deposited to the north they were being covered by thin sheets of material eroded from the southern hills. As erosion continued younger Palaeogene sediments were being covered by pebbles and fossils from progressively older rocks to the south. We were being affected by the northern reaches of a central European mountain building phase called the 'Eo-Alpine Orogeny'.

The oldest Palaeogene (Palaeocene and Eocene) deposits on the Island are gravels infilling potholes in the surface of the Chalk. These are overlain by the **Lambeth Group**, here represented by the **Reading Formation**, which is a colour-mottled mud, typically red and purple; these colours derived from soil-forming processes. These are followed by the marine **Thames Group** (**London Clay**), **Bracklesham Group** and **Barton Group**. These were deposited principally by marine waters, but with occasional brackish and freshwater influences, recorded where rocks from Dorset (the **Poole Formation**) continue into the **Bracklesham Group** from the west.

The **London Clay** is an extensive deposit probably extending originally far to the south and north.

The **Thames**, **Bracklesham** and **Barton Groups** contain a wealth of shell fish indicating sub-tropical conditions. Sharks teeth are frequent finds, although they are less common than at Bracklesham in Sussex, which is world famous for collecting sharks teeth. With the exception of fish remains, vertebrate fossils are scarce in these sediments. Layers of highly-rounded flint pebbles are found; these indicate a continued feed of sediment from the eroding Chalk. The high degree of roundness of these pebbles has been taken to indicate that they were in transport in the sea for a very long time. The pebbles had sometimes been colonised by sponges, bryozoans and oysters; but fossils are rare.

The coloured sands at Alum Bay are also part of the Palaeogene sequence, their colours coming from the different minerals contained on or between the sand grains. A very wide range of colours are seen in this sequence, which comprises the **Thames**, **Bracklesham**, and **Barton Groups**. One interesting layer, the 'Pipe Clay' (within the Bracklesham Group's Poole Formation) is famous for beautifully preserved leaf impressions. The flora preserved includes both temperate and sub-tropical forms, ginseng, laurel and ferns.

By 37 million years ago when the **Solent Group** was starting to be deposited, the Solent Basin was beginning to fill up and a mixture of lagoonal, land and freshwater environments predominated. The **Solent Group** represents a mosaic of different environments in close proximity to one another. At different times and places there were brackish lagoons and channels, freshwater lakes and ponds, marshes and shallow estuaries. Different environmental conditions are recorded by the fossils found; for example, the snail *Lymnaea* records freshwater, *Potamides* brackish lagoons and channels. Besides the many shellfish, fish, reptiles and mammals were abundant. Reptiles include turtles and alligator. Mammals were very diverse; these include lemurs, hedgehogs, tapir-like Palaeotheres and pig-like Anthracotheres. Teeth of mammals are very common fossils, as are coprolites (fossil dung), although turtle remains are by far the most common. Fossil insects from a thin limestone form the most important source of these creatures in Europe

Figure 15: The Headon Hill Formation (part of the Solent Group) at Whitecliff Bay.

There is little doubt that the boundary between the Eocene and Oligocene sits within the **Solent Group**. However, because the sequence is for the most part non-marine in origin it is currently debatable to say just where the boundary should be placed. By approximately 33 million years ago a tongue of marine water entered the Solent Basin and the youngest parts of the sequence were deposited. The muds that we call the **Cranmore Member** are significant as the only onshore Oligocene, marine, rocks found in the British Isles. As these muds contain fossils which allow for correlation with rocks found in Belgium and Holland, they can be confirmed as Oligocene in date. Evolutionary changes in the mammal fauna have been linked to a major global cooling event at this time.

The Neogene

There is now a gap in the geological record of about 30 million years. Major tectonic pressures from the south reactivated the old thrust faults and the Isle of Wight was heaved up into the air, to begin a new phase of folding and erosion. The Isle of Wight found itself influenced by the distant pressures that formed the modern Alps, far to the south, and this time is termed the Alpine Orogeny. The major monocline of the Chalk Downs, subsequent minor rippling of the rocks along the north coast of the Island, the surface development of near-vertical faults in the rocks of the southern half of the Island and the heaving up of the northern half out of its former lagoonal status occurred at this time.

The Quaternary

About two and a half million years ago the Earth slipped into a pattern of successive periods of extreme cooling and then re-heating called the Ice Ages (correctly termed the Quaternary). On the Island this is marked by gravel terraces in the main river valleys, rock debris called Coombe Rock on the Downs and peats and muds in the estuaries. Most of these deposits are devoid of fossils, but a notable exception is from the last Interglacial (c. 125,000 years ago), with mammal fauna found at Newtown on the north-west coast. This contains bison, hippopotamus and straight-tusked elephant.

The other significant aspect of the Quaternary is the record of early humans. Stone tools dating to the Lower Palaeolithic have been found at a number of localities; notably in a probable marine gravel at Priory Bay, and river gravel terrace at Bleak Down. Stone tools have been recorded associated with mammal remains at Great Pan on the outskirts of Newport. There is some indication that the thrust fault has been active during the last 500,000 years as marine gravels at Priory Bay seem higher than would be expected.

This time has been marked by many cycles of rise-and-fall in sea-level and temperature, by the widening of the English Channel, and isolation of the Island from the mainland about 8,000 years ago.

The last 10,000 years has seen a warming of the Northern Hemisphere and rapid sea level rise. The rising seas have eroded back the rocks of the Isle of Wight at about 1 metre per year. This erosion (whereas it is a threat to the land we live on) is the source of the many exciting discoveries made over the years and the promise of things to come.

PART THREE: ACTION PLAN

THEME 1: THE ROLE OF THE ISLE OF WIGHT IN THE HISTORY OF THE EARTH SCIENCES

AWARENESS:

The LGAP recognizes the major role that the Isle of Wight has played in the development of the Earth Sciences. Furthermore, the LGAP recognizes the diversity of its expression through literature, historically described sites, people, buildings and monuments.

OBJECTIVES:

Determine actions which enable local service providers to improve public access to information on the role the Isle of Wight has played in the development of the Earth Sciences.

Inform the planning process through the development of RIGS.

CASE EXAMPLES:

The eminent 17th century scientist **Robert Hooke** was born on the Island in 1635. In his *Discourse of Earthquakes* he hypothesized on the origin of fossils. In that work many of his descriptions of sediments, rocks or fossils are based upon those of the Island.

When resolving the sequence of the Lower Cretaceous in southern England in the 19th century **W. Fitton** (working on the Island's sequence) was able to determine the position of the Wealden rocks as being of Cretaceous age; thereby resolving the question of the age of the vertebrate fossils being found by Mantell in Sussex.

In 1856 one of the first memoirs of the Geological Survey, *On the Tertiary Fluvio-Marine Formation of the Isle of Wight* was published. **Edward Forbes** described in detail the geology of the Island's northern coasts and provided correlations with deposits in France and Belgium.

The enigmatic pioneer of vertebrate palaeontology **Thomas Hawkins** is buried at Ventnor Cemetery.

Early 19th century research into dinosaurs included reports on the footprints of the southern coast, and their links with mainland finds. More recently the non-dinosaur focus has expanded to include the flying reptiles of the early Cretaceous – the pterosaurs. A few years ago a new species was found at Yaverland; *Caulkicephalus trimicrodon* was named in 2005. The name derives from 'Caulkhead', a local term for Solent workers (caulkers) in the shipyards of Portsmouth.

LINKS:
AONB: *Earth Heritage* and *Historic Environment.*
IWC Corporate Objective: *Protecting the Island's physical Environment.*
LBAP: *Coastal Habitats.*

THEME 1: THE ROLE OF THE ISLE OF WIGHT IN THE HISTORY OF THE EARTH SCIENCES

ACTION	OUTCOME/ MEASURE OF SUCCESS	PARTNERSHIPS	RESOURCES	TIME FRAME	FUNDING SOURCES
Undertake an audit to determine the role the Island has played in the history of the Earth Sciences.	Completed audit identifying key sites and personalities.	DI, NE, IWCCE.	DI staff time	First audits completed in 2005 (See Part 5). New audits to be conducted as required.	NE, DI
Form an archive of relevant literature	Hard copy library – possible online catalogue.	DI, IWLS, IWAS, IWCCE.	DI staff time	2014.	
Form an historic 'trail' of the Island's Geodiversity.	Leaflet and/or online discovery trail to follow.	DI, GSIW, IWNHAS.	DI staff time	2012.	
Update & identify new RIGS which contribute to the understanding of the Island's role in the history of the Earth Sciences.	RIGs updated, new RIGS notified.	DI, NE, IWC, IWCCE, GSIW, IWC Planning.	DI staff time	2014.	

Identify what value the Island's contribution to the history of the Earth Sciences may have towards possible World Heritage Status.	Contribution to potential World Heritage application.	DI, IWCCE, GSIW, NE, IWETD, IWC.	DI and IWCCE staff time	First report completed 2007.	
Identify what value the Island's contribution to the history of the Earth Sciences may have towards possible Geopark Status.	Contribution to potential Geopark application	DI, IWCCE, GSIW, NE, IWETD, IWC.	DI and IWCCE staff time	First report completed 2007.	
Ensure that the use of locally quarried stone in Island buildings and walls is recognized, and that new builds use sympathetic material where practical.	Increased public awareness of Island building materials for example through building stone trails and walks.	DI, AONB, IWC Planning, IWCAHES, EH, NT, IWNHAS.	All.	First Dinosaur Isle stone walks conducted. Additional walk locations to be added. Ongoing.	

THEME 2: ISLE OF WIGHT DINOSAURS

AWARENESS:

The LGAP recognizes that the Isle of Wight is unique in Europe for the diversity and abundance of its Lower Cretaceous dinosaur fauna. Dinosaurs have almost universal public appeal and are therefore a powerful tool in raising public awareness of the importance of our geological heritage.

OBJECTIVES:

Determine actions which enable local service providers to improve public access to information on the Island's dinosaurs.

Determine actions to use the dinosaur heritage to promote the Island.

Determine actions which will focus national interest in dinosaurs, onto the Island.

CASE EXAMPLES:

The Isle of Wight is the richest site for dinosaur remains in Europe, and remains amongst the richest localities in the World.

The Isle of Wight has a popular museum called Dinosaur Isle, based in Sandown. Run by the Isle of Wight Council the museum is the official repository of the Island's geological and palaeontological collection. It has a responsibility for the conservation, display and interpretation of the Island's diverse geology and fossil heritage for current and future generations. It contains, and displays a large number of important dinosaur fossils, many of which are type specimens.

When formulating his definition of the dinosaurian, Richard Owen used a sacrum of Iguanodon found in Sandown Bay to demonstrate the unifying character of the group.

Over twenty five different types of dinosaur are known to occur in the Island's Wealden rocks. Amongst these are the type specimens for *Neovenator salerii*, *Eotyrannus lengi*, *Hypsilophodon foxii, Iguanodon* (*Mantellisaurus) atherfieldensis*, *Valdosaurus canaliculatus* and *Yaverlandia bitholus* (an alleged pachycephalosaur). Further creatures like the 1992 Barnes High sauropod, *Polacanthus foxii*, *Iguanodon bernissartensis* and a variety of other sauropodomorpha and small theropods all add to the rich collection that continues to expand as new finds are made.

LINKS:

AONB: *Earth Heritage* and *Historic Environment.*
IWC Corporate Objective: *Protecting the Island's physical Environment.*

THEME 2: ISLE OF WIGHT DINOSAURS

ACTION	OUTCOME/ MEASURE OF SUCCESS	PARTNERSHIPS	RESOURCES	TIME FRAME	FUNDING SOURCES
Form a national database of the Island's dinosaur heritage.	A website listing what there is and where they are, of significant public holdings of Isle Wight dinosaurs.	DI, UOP, NHM.	DI staff time	2014.	
Form a national archive of literature relating to the Island's dinosaurs.	Hard copy library – possible online catalogue.	DI, UOP, NHM.	DI staff time	Libraries exist at DI, UOP and NHM. Catalogue by 2014.	
Produce a publicly accessible guide to the Island's dinosaurs.	Booklet – 'A popular guide to IW dinosaurs'; and/ or online guide.	DI	DI staff time	2014.	
Form an Isle of Wight dinosaur trail.	Leaflet and/or online discovery trail to follow.	DI, GSIW.	DI staff time	2012.	

Identify what role dinosaurs could play in gaining World Heritage Status for the Isle of Wight.	Contribution to potential World Heritage application.	DI.	DI and IWCCE staff time	First report completed 2007.	
Identify what role dinosaurs could play in gaining Geopark Status for the Isle of Wight.	Contribution to potential Geopark application.	DI.	DI and IWCCE staff time	First report completed 2007.	

THEME 3: THE ROLE OF GEOLOGY IN THE DEVELOPMENT OF THE ISLE OF WIGHT TOURISM INDUSTRY

AWARENESS:

Tourism is central to the economic survival of the Isle of Wight. The geological heritage contributes both directly and indirectly to the industry.

OBJECTIVES:

Determine actions which enable local service providers to understand and utilize the contribution of Earth Heritage to the tourism industry.

Determine actions which will promote the sustainable development of the Earth Heritage.

CASE EXAMPLES:

Alum Bay was founded as a tourist attraction based upon 'coloured sand', currently extracted from the cliffs of vertical Palaeogene strata, although inland quarries were also historically worked.

19th century guide books to the Island usually contained accounts of the local geology, and in some cases geological maps.

Dinosaur Isle Museum is a popular, major tourist destination, for national and international tourists and visiting groups. Complimented by Dinosaur Farm, both sites provide a rich visitor experience within their buildings, and on guided walks to sites of geological and palaeontological interest.

LINKS:

AONB: *Earth Heritage, Historic Environment, Living and working* and *Visiting and Enjoying.*
IWC Corporate Objective: *Protecting the Island's physical Environment, Encouraging job creation and economic prosperity.*

THEME 3: THE ROLE OF GEOLOGY IN THE DEVELOPMENT OF THE ISLE OF WIGHT TOURISM INDUSTRY

ACTION	OUTCOME/ MEASURE OF SUCCESS	PARTNERSHIPS	RESOURCES	TIME FRAME	FUNDING SOURCES
Audit of the role that geology has played in the development of the industry.	Paper study.	DI, IWETD.		2014.	
Investigate the current value of the Island's geology in tourism.	Paper study.	DI, IWETD.		2014.	
Investigate what value World Heritage Status may have in promoting tourism to the Island.	Contribution to potential World Heritage application.	DI, IWCCE, IWC, IWETD.	DI and IWCCE staff time	First report completed 2007.	
Investigate what value Geopark Status may have in promoting tourism to the Island.	Contribution to potential Geopark application.	DI, IWCCE, IWC, IWETD.	DI and IWCCE staff time	First report completed 2007.	

THEME 4: COASTAL MASS MOVEMENT PHENOMENA

AWARENESS:

The Ventnor Undercliff along the southern coast of the Isle of Wight is the largest urban landslide complex in north-west Europe (12km long by 2 km wide).

Competent Chalk and Upper Greensand overlies the less competent Gault Clay. A seawards dip of 1 to 2° further encourages the formation of a complex of translational (compound) slides in the seaward part of the Undercliff, and multiple rotational slides (multiple compound-rotational slides) in the landward part.

The Undercliff was formed from a rise in sea-level of approximately 100 metres as the ice melted after the last ice age - with the triggering factors being rainfall and coastal erosion.

The northern coastline has been further affected after isolation of the Island from the mainland about 8,000 years ago when the sea breached the former Chalk ridge to the west and the Solent River became fully marine.

Approximately 7,000 people live in the town of Ventnor and surrounding villages which were developed in Victorian times on the south-facing terraces of this landslide complex, parts of which are still active today.

Parts of the Cowes-Gurnard frontage are also affected by landslides and ground movements in the over-steepened clay coastal slopes.

These unique geological and geomorphological features form a significant proportion of the Isle of Wight coastline, an important environment, and key locations and exposures for research and study.

OBJECTIVES:

To recognize and understand the characteristics and activity of the landslide complex and mass movement phenomena, and to minimize the adverse impacts of predicted climate change where technically sound, economically justifiable and environmentally acceptable solutions can be found.

To inform the planning process of the ground stability conditions in order to avoid new development in inappropriate locations.

CASE EXAMPLES:

The importance of the Ventnor Undercliff as a key geomorphological feature was recognized more fully between 1988 and 1991 when the coastal landslide complex was investigated and highlighted as a case study for the development of the national 'Planning Policy Guidance Note 14 – Development on Unstable Ground' (PPG14) by the former Department of the Environment. Research, investigations and publications have continued since this date.

Three international geotechnical conferences have been held on the Isle of Wight on the subject of slope instability, the first in 1991. The second conference, held in Ventnor in 2002 on Instability – Planning and Management included a Keynote address by eminent Professors J. N. Hutchinson and E. M. Bromhead, entitled "Isle of Wight landslides". The third international conference, in 2007 focused on Landslides and Climate Change; Challenges and Solutions.

Key References:
Hutchinson, J.N. & Bromhead, E.N. 2002. Keynote Paper: Isle of Wight Landslides. In *Instability – Planning & Management, Seeking sustainable solutions to ground movement problems*. London: Thomas Telford Publishing.

McInnes, R.G. 2007. The Undercliff of the Isle of Wight – A guide to managing ground instability. Isle of Wight Council: Isle of Wight Centre for the Coastal Environment, Ventnor.

McInnes, R.G., Jakeways, J., Fairbanks, H. & Mathie, E. (Eds). 2007. Landslides and Climate Change: Challenges and Solutions. Proceedings of the International Conference on Landslides and Climate Change, Ventnor, Isle of Wight, UK. 21-24 May 2007. London: Taylor & Francis / Balkema.

LINKS:

IWC Corporate Objective: Protecting the Island's physical Environment.
IWC Historic Environment Action Plan: The Undercliffe HEAP Report.

THEME 4: COASTAL MASS MOVEMENT PHENOMENA

ACTION	OUTCOME/ MEASURE OF SUCCESS	PARTNERSHIPS	RESOURCES	TIME FRAME	FUNDING SOURCES
To maintain a public exhibition of displays illustrating the Isle of Wight's unique coastal mass movement phenomena, and coastal management.	Displays accessible and undergoing a programme of renewal at the Coastal Visitors' Centre, Ventnor.	IWCCE		Ongoing.	IWCCE
To maintain a comprehensive Library of reports relating to Isle of Wight landsliding and its national and international context.	Library and database held and continually expanded at the Coastal Visitors' Centre, Ventnor. Aim to create an online, searchable, database.	IWCCE		Library completed, ongoing.	IWCCE

Access to Geomorphological, Ground Behaviour and Planning Guidance Mapping for the Ventnor Undercliff and Cowes-Gurnard Landslide Complexes, and advice for homeowners.	Staff hold the maps in GIS and paper form, including updates, for public access at the Coastal Visitors' Centre, Ventnor.	IWCCE		Map set complete. Additional information arising from schemes.	IWCCE
To undertake geotechnical monitoring to understand and review ground instability.	Ongoing IWCCE geotechnical monitoring programme in place (over 130 instruments), including renewal and expansion of the network, where appropriate.	IWCCE, IWC Highways		Underway, ongoing.	IWCCE, IWC Highways
Dissemination of information through talks to school groups, University groups and the general public explaining landslide management techniques.	Talks and tours by IWCCE staff arranged as required.	IWCCE		Ongoing.	IWCCE

THEME 5: THE ISLE OF WIGHT'S GEOLOGICAL RECORD

AWARENESS:

The Island's geological record is the foundation for its geodiversity.

OBJECTIVES:

Determine actions which enable local service providers to improve public access to information on the Island's Earth Heritage.

Inform the planning process through the development of RIGS.

Determine actions which will promote the sustainable development of the Earth Heritage.

CASE EXAMPLES:

The Isle of Wight's geology consists of an almost continuous sequence of rocks running through the Cretaceous, Palaeogene and Quaternary. These rocks can be seen along extensive coastal exposures. Most notably the Island has the most complete sequence of Palaeogene rocks in the British Isles.

The Island is the richest source for Palaeogene vertebrates in the British Isles.

The Island has classic exposures which illustrate the Cretaceous Marine Transgression.

The small size of the Island, and the configuration of the strata, allows for examination of extensive sequences of rocks over short distances.

The long period of study of the Island's geology means that there exists a substantial body of literature documenting its geology.

The Isle of Wight is an ideal site for the study of geomorphological and coastal processes.

Many of the Island's Sites of Special Scientific Interest (SSSI) contain areas designated for the importance of the geology and palaeontology.

LINKS:

AONB: *Earth Heritage.*
IWC Corporate Objective: *Protecting the Island's physical Environment.*
LBAP: *Coastal Habitats.*

THEME 5: THE ISLE OF WIGHT'S GEOLOGICAL RECORD

ACTION	OUTCOME/ MEASURE OF SUCCESS	PARTNERSHIPS	RESOURCES	TIME FRAME	FUNDING SOURCES
Form an archive relating to the Island's geological record.	Hard copy library – possible online catalogue.	DI and partners.	DI staff time	First Geological Audits completed in 2005. Library exists at Dinosaur Isle. Online catalogue by 2014.	
Improve public awareness of the existing RIGS (issued by the former Museum of Isle of Wight Geology).	Publication of RIGS statements on-line. (Dinosaur Isle website).	DI, IWCCE, IWC Planning, AONB.	DI staff time	By the end of 2010.	
Identify and notify new RIGS on the Isle of Wight.	New RIGS notified.	DI, IWCCE, IWC Planning, GSIW, NE, IWC.	DI staff time	Potential sites identified, start review in 2010 with first new site by end of 2011.	

Investigate what role the Island's geological record could play in gaining World Heritage Status for the Isle of Wight.	Contribution to potential World Heritage application.	DI, IWCCE and other partners.	DI and IWCCE staff time	First report completed 2007.	
Investigate what role the Island's geological record could play in gaining Geopark Status for the Isle of Wight.	Contribution to potential Geopark application.	DI, IWCCE and other partners.	DI and IWCCE staff time	First report completed 2007.	
Evaluate sites for their potential use in public education programmes.	New sites identified and in use	DI.	DI staff time	Audited 2005. New sites already in use. Continuing search for new sites. At least two more sites in use by 2013.	
Develop individual stratigraphic based action plans	Detailed action plans in place for each part of the geological record.	DI and partners.	DI staff time	First by 2014.	

THEME 6: FOSSILS AND FOSSIL COLLECTING

AWARENESS:

Fossil collecting represents both a major opportunity and threat to the Island's geodiversity. It is a major interface between the general public and the Earth Heritage. The fossils are a major focus of interest in the Island's Earth Heritage.

Dinosaur Isle Museum and the Isle of Wight Centre for the Coastal Environment both run formal and informal education programmes for visitors from the very young to the retired. Large numbers of local, national and international visitors are catered for; for example Dinosaur Isle Museum sees about 10,000 educational visitors of school age annually. Many of these are taken to coastal sites of interest where they are able to see the Island's geology and fossils in their natural settings.

OBJECTIVES:

Determine actions which enable local service providers to improve public access to information on the Island's fossils.

Inform the planning process through the development of RIGS.

Determine actions which will promote the sustainable development of the Earth Heritage.

Determine actions which encourage participation in debate and policy formulation on fossil collecting.

CASE EXAMPLES:

The Island is an outstanding area for the variety, and quality, of the fossils exposed in its eroding cliffs and the small number of active inland private quarries.

Most notably the Island can lay claim to being -

- the richest source of dinosaur fossils in Europe.
- the richest source for Palaeogene vertebrates in the British Isles.
- a rich source of Cretaceous ammonites, including large heteromorphic forms.

The Island is a major educational resource for visiting schools, colleges, universities and postgraduate researchers.

The Isle of Wight attracts hundreds of guided fossil-walks each year. Collecting from eroded, loose material on the beach remains the most sustainable way to collect fossils; and guided walks represent the best way to ensure the resource is sustainable. Visitors are encouraged to report significant finds to museums, in particular to the county's geological and palaeontological museum (Dinosaur Isle Museum, Sandown).

LINKS:

AONB: *Earth Heritage.*
IWC Corporate Objective: *Protecting the Island's physical Environment.*
LBAP: *Coastal Habitats.*

THEME 6: FOSSILS AND FOSSIL COLLECTING

ACTION	OUTCOME/ MEASURE OF SUCCESS	PARTNERSHIPS	RESOURCES	TIME FRAME	FUNDING SOURCES
Consult landowners and fossil collectors to determine attitudes towards collecting.	Information available to help inform on policies and decisions.	DI, GSIW, NE, AONB, IWC, FC, LO.		2014.	
Assess what possible impact World Heritage Status would have upon fossil collecting.	Contribution to potential World Heritage application.	ALL		2014.	
Assess what possible impact Geopark Status would have upon fossil collecting.	Contribution to potential Geopark application.	ALL		2014.	
Form a new code of conduct for fossil collecting on the Isle of Wight.	Code of Conduct agreed and published as an online version.	DI, GSIW, NE, IWC. FC, LO, AONB, UOP.	DI staff time to co-ordinate.	Draft by end of 2011.	

Assess sensitivity of sites to pressure of fossil collecting	Feed into stratigraphic action plans.	DI.		First by 2012.	
Improve public, and academic, awareness of the importance of Isle of Wight fossils.	Create an online list of important fossils, (the Type and Figured Catalogue) held by the Isle of Wight Council, that have appeared in research publications.	DI.	DI staff time.	Completed 2009. Continuing to be updated. (See Dinosaur Isle webpage for Collections and Research)	
Maintain records of fossils held by the Isle of Wight Council.	Continue to maintain the accession registers.	DI.	DI staff time.	Ongoing.	
Maintain a record of significant fossils that have been found on the Island and reported to Dinosaur Isle Museum; but which have not become part of the Isle of Wight Council collections held by the museum.	Continue to maintain the existing recording scheme, whereby finds are reported to Dinosaur Isle.	DI	DI staff time.	Ongoing.	

THEME 7: GEOLOGY AND LANDSCAPE

AWARENESS:

The topography and shape of the Isle of Wight is determined predominantly by the underlying geology and the natural processes that have acted on it over many millions of years of changing climate. A combination of hard and soft rocks, horizontal and sloping bedding, differential weathering and the aspect presented to oncoming storms have resulted in the complex land surfaces and cliff profiles we see today.

The resistant Chalk forms a ridge running east-west through the centre of the Isle of Wight and dominates the landscape, guiding its shape. The north coast is generally low-lying with rivers and estuaries opening into the Solent, whereas the southern coast is dominated by cliffs.

The monoclinal Chalk ridge, some of the Ventnor Undercliff coastline and the limestones of the Solent Group, are more resistant to marine erosion than the older Lower Greensand and Wealden rocks exposed in Brighstone, Chale and Sandown Bays. The soft Palaeogene clays and sands forming the northern coasts of the Isle of Wight have receded less than the southern coasts, probably due to their more sheltered situation within the Solent.

Coastal mass movement phenomena (discussed further in Theme 4) have formed the Ventnor Undercliff landslide complex on the south coast (the largest urban area affected by landsliding in Great Britain and has also influenced the northern Cowes-Gurnard coast

The south-east facing coast is exposed to wave-fetches of 100-200km into the English Channel, with much greater fetches from the Atlantic contributing to the erosion of the south-west coast. As an example, average rates of recession of up to one metre per year are typical in Chale Bay. Inter-tidal sites, sub-tidal sites and palaeo-environmental archives are improving our understanding of the evolution of the Isle of Wight, drawing on investigations on the Wootton-Quarr frontage and more recently at Bouldnor, near Yarmouth.

Three main Isle of Wight rivers flow northward into the Solent; from west to east – the Western Yar, the Medina and the Eastern Yar. Palaeochannels in their lower reaches and estuaries connect with offshore drift-filled palaeovalleys; remnants of the Pleistocene Solent and Channel River systems (prior to the breaching of the former Chalk ridge between Ballard Point, near Swanage, and the Needles). The River Medina currently has the largest flow, and a catchment extending to within 2 kilometres of the southern coast. The other two main rivers, which have also cut through the central Chalk ridge, had much more extensive catchments in the past, truncated by ongoing marine erosion.

Two lesser rivers at Newtown and Wootton also drain into the Solent, but with much smaller catchment areas.

The Isle of Wight has never been glaciated, but has been exposed to several phases of severe periglacial conditions.

OBJECTIVES:

Determine actions which improve public access to information on the Island's Earth Heritage and Geomorphology.

Determine actions which will promote the sustainable development of the Earth Heritage.

CASE EXAMPLES:

Dinosaur Isle Museum and the Isle of Wight Centre for the Coastal Environment both run formal and informal education programmes for visitors from the very young to the retired. Large numbers of local, national and international visitors are catered for; for example Dinosaur Isle Museum sees about 10,000 educational visitors of school age annually. Many of them are taken to coastal sites of interest where they are able to see the Island's geology, geomorphology, coast and landslides.

The 2002 report 'Coastal Change, Climate and Instability' includes: Palaeo-environmental investigations around the Isle of Wight Coastline – Study Areas P1 Bouldnor & P2 Wootton-Quarr (by IWC, HWTMA, UOS); by Dr. David Tomalin); Section 2.17 (by Dr. Antony Long) 'Grasping the Holocene timetable of coastal change; a chronological study of sea-level change in the Solent study area, UK, during the past ten millennia';

Reference:
McInnes, R.G. & Tomalin, D. 2000. Coastal Change, Climate & Instability, Final Technical Report of the EC LIFE-Environment Project 1997-2000. Isle of Wight: Isle of Wight Centre for the Coastal Environment, Ventnor.

The keynote address of the international conference on 'Instability – Planning and Management' held in Ventnor in 2002 also provided a review of the evolution of some key features of the Isle of Wight landscape.

Reference:
Hutchinson, J.N. & Bromhead, E.N. 2002. Keynote Paper: Isle of Wight Landslides. In *Instability – Planning & Management, Seeking sustainable solutions to ground movement problems*. London: Thomas Telford Publishing.

LINKS:

IWC Corporate Objective: *Protecting the Island's physical Environment*.
IWC Historic Environment Action Plan.

THEME 7: GEOLOGY AND LANDSCAPE

ACTION	OUTCOME/ MEASURE OF SUCCESS	PARTNERSHIPS	RESOURCES	TIME FRAME	FUNDING SOURCES
Recognition of the intrinsic link between geology, natural processes and landscape is crucial to the investigation of a future 'World Heritage Site' or 'Geopark' Bid (Geoparks focus on interaction of people and landscape, and geotourism).	Contribution to potential World Heritage / Geopark application	DI, IWC, IWCCE, NE, GSIW, IWETD, WWLP.	DI and IWCCE staff time.	First report completed 2007.	
To improve the public understanding of the influence of geodiversity on the Island's topography; its valleys, downs, the presence of palaeo-river terraces and slopes; buildings, quarries, land-use, biodiversity and the presence of mineral resources.	Conduct a series of landscape walks and lectures; and consider publication of trails leaflets for different user groups.	DI, IWCCE, IWC, AONB.	DI staff time.	The first walks have been carried out. Ongoing. Weekend conference by 2011.	
Take part in the development of the new Isle of Wight Minerals and Waste Development Plan.	Issued plan.	IWC, DI, AONB	DI staff time.		

To maintain and update the Geological Record Audit (Part 5).	Review the existing record; update if necessary and add new sites (including inland quarries and topographic/ geomorphological features).	DI, IWCCE	DI and IWCCE staff time.	2010 onwards.	DI.
To improve the understanding of the influence of geodiversity (for formal educational groups) on the Island's topography; its valleys, downs, the presence of palaeo-river terraces and slopes; buildings, quarries, land-use, biodiversity and the presence of mineral resources.	To introduce and maintain a programme of educational activities for schools, special-interest groups, Family, Adult and Lifelong Learning.	DI	DI staff time.	Previously carried out by the Museum of Isle of Wight Geology. At Dinosaur Isle from 2001. Ongoing.	DI.
To examine the future evolution and sustainable management of the 110 kilometre coastline of the Isle of Wight, in line with new DEFRA guidance for the second round of Shoreline Management Planning, and the predicted impacts of climate change.	The Shoreline Management Plan (SMP2) is currently being reviewed through public consultation and study.	IWCCE	IWCCE.	Publication to be undertaken in 2011.	IWCCE, DEFRA

To improve our understanding and sustainable use of estuaries controlled by palaeovalleys in the Palaeogene and Quaternary sequences in the northern half of the Isle of Wight. The estuaries are complex and highly productive ecosystems supporting a wide range of habitats, species, industry and transport links.	Estuary Partnerships have produced Management Plans for the Western Yar and the Medina. Plans are being developed for the Eastern Yar and Wootton Creek.	IWC, Estuaries partnership		Ongoing.	
To use palaeo-environmental evidence and sediment archives to improve our understanding of the evolution of the landscape and coast of the Isle of Wight and plan for the future, building on innovative work by the IWC County Archaeology and Historic Environment Service at Wootton-Quarr and the work of the Hampshire and Wight Trust for Maritime Archaeology at Bouldnor, near Yarmouth.	A research project by SCOPAC (Standing Conference on Problems Associated with the Coastline – the regional coastal group for central-southern England) assessed the potential of the palaeo-environmental archive along the SCOPAC coast.	SCOPAC		Research completed June 2006 (Anon 2006).	SCOPAC

To improve understanding of the evolution of the Isle of Wight and its current coastline.	The evolution of the Solent River has been modeled by SCOPAC in a computer simulation CD-rom.	SCOPAC		Completed.	SCOPAC
To improve public understanding of the evolution of the Isle of Wight and its current coastline.	To introduce and maintain a programme of educational activities for schools, special-interest groups and the wider public.	IWCCE		Ongoing.	
To take part in the review, issue and implementation of other local planning documents where they contain relevant Earth Heritage issues.	Issue of HEAP, BAP, AONBMP, ROWIP and SMP.	DI, AONB, IWCAHES, IWC.	DI staff time.	Ongoing	

To work with partners in identifying, investigating and reporting areas of geological and palaeontological importance that are at risk.	Areas of risk identified and successfully dealt with.	DI, NE, IWCCE, AONB, IWC Planning, IWCAHES, NT, LO.	DI staff time.	Ongoing	
Advise on geological and palaeontological site conservation.	Successful conservation, recording, interpretation and raising of public awareness.	DI, AONB, WWLP, IWCCE, IWC Planning, IWCAHES, NT, LO.	DI staff time.	First site reviews have been carried out for NE and IWC Planning. Ongoing.	

THEME: COMMON THREADS

ACTION	OUTCOME/ MEASURE OF SUCCESS	PARTNERSHIPS	RESOURCES	TIME FRAME	FUNDING SOURCES
Form geological archives.	Hard copy archives at 'Gateway' sites.	DI and partners.		2014.	
Scoping studies.	Studies completed	DI and partners.		2014.	
Fossil collecting code of conduct.	New code of conduct in place and most collectors and landowners working within its guidelines.	ALL		2012.	
Stratigraphic based action plans.	Action plans completed and in use.	DI, LBAP.		2014.	

Potential World Heritage application.	Successful application	ALL	DI and IWCCE staff time	First report completed 2007.	
Potential Geopark application.	Successful application	ALL	DI and IWCCE staff time	First report completed 2007.	

PART FOUR: APPENDICES

Appendix 1: Glossary of abbreviations

AONB	Area of Outstanding Natural Beauty.
BGS	British Geological Survey.
DEFRA	Department of Food, Environment and Rural Affairs.
DI	Dinosaur Isle Museum.
EH	English Heritage.
EN	English Nature. (Now NE Natural England)
FC	Fossil collectors.
GSIW	Geological Society of the Isle of Wight.
HEAP	Historic Environment Action Plan.
HWTMA	Hampshire and Wight Trust for Maritime Archaeology.
IWC	Isle of Wight Council.
IWCAHES	Isle of Wight (Council) County Archaeology and Historic Environment Service.
IWCCE	Isle of Wight (Council) Centre for the Coastal Environment.
IWETD	Isle of Wight (Council) Economic & Tourism Development.
IWHS	Isle of Wight (Council) Heritage Service.
IWLS	Isle of Wight (Council) Library Service.
IWNHAS	Isle of Wight Natural History and Archaeological Society.
LBAP	Local Biodiversity Action Plan.
LO	Land owner.
NE	Natural England (DEFRA).
NT	National Trust.
NHM	Natural History Museum, London.
RIGS	Regionally Important Geological/ Geomorphological Site.
SCOPAC	Standing Conference on Problems Associated with the Coastline.
SMP	Shoreline Management Plan.
SSSI	Site of Special Scientific Interest.
UOP	University of Portsmouth.
UOS	University of Southampton.
WWLP	West Wight Landscape Partnership.

Appendix 2: Glossary of geological terms used

Biotic	Applied to the living component of the Earth's surface (abiotic – the non-living part).
Calcareous	Containing a high proportion of calcium carbonate.
Chalk	A porous, fine-grained rock mainly formed from calcium-rich skeletons of micro-organisms. A pure type of limestone.
Conglomerates	Course-grained rocks with rounded grains greater than 2 mm in size.
Geoconservation	The youngest of the conservation sciences, seeking to actively manage geological sites while promoting the concepts of sustainable development and allowing normal evolutionary processes that may still physically change the landscape.
Geology	1: The scientific study of the Earth, including the composition, structure and origin of its rocks, 2: the geological features of a district.
Geo-morphology	The scientific study of the land-forms on the Earth's surface and of the processes that have fashioned them.
Lignite	A poor quality, brown, coal.
Monocline	A fold in rocks where one limb is usually nearly horizontal and the other side is steep.
Orogeny	A period of mountain building.
Palaeontology	The study of life in the geological past.
Palaeochannels	Ancient river channels, now usually buried beneath the sea, or infilled with sediments.

Pedogenesis	The natural process of soil formation.
Sedimentary	Rocks made from pre-existing eroded rocks, from accumulations of fossils or from precipitation of chemicals like salt, or calcites around springs and in caves.
Seismic	when applied to geological surveys it relates to shock-waves, usually generated artificially, which are recorded and analysed to produce cross-sections of the Earth's crust showing deep rock boundaries.
Stratigraphic	Dealing with layers of rock (strata).
Subducted	Pulled under; the process whereby a large slab of the Earth's crust flows down under a neighbouring crustal plate.
Tectonic	related to deformation within the Earth's lower crust and the structural effects it produces.
Theropods	A branch of the saurischian dinosaurs that consisted entirely of bipedal, carnivorous forms.
Transgression	An advance of the sea to cover new land areas, due to a rise in sea level relative to the land.
Unconformity	A surface of contact between two groups of unconformable strata which represents a break in the geological record due to a combination of erosion and a cessation in sedimentation.

Appendix 3: List of geological sites, etc, on the Geological Audit CD

Form No.	Site
Coastal Sites	
CS1	Freshwater Bay
CS2	Tennyson Down and West High Down
CS3	Compton Bay
CS4	Hanover Point
CS5	Brook Bay and Undercliff
CS6	Chilton Chine
CS7	Grange Chine
CS8	Barnes High
CS9	Atherfield Point
CS10	Whale Chine and cliff top loess
CS11	Blackgang Chine
CS12	St Catherine's
CS13	Ventnor Undercliff Landslide Complex
CS14	Gore Cliff & St. Catherine's Point Landslides, Niton
CS15	Bonchurch. The Landslip
CS16	Luccombe Bay
CS17	Shanklin
CS18	Littlestairs
CS19	Sandown Bay
CS20	Yaverland
CS21	Culver
CS22	Whitecliff Bay
CS23	Bembridge Foreland
CS24	The Duver to Puckpool
CS25	Ryde Sands and Binstead Hard

CS26	Kings Quay east
CS27	Gurnard Bay to Burnt Wood
CS28	Hamstead
CS29	Bouldnor
CS30	Fort Victoria
CS31	Colwell Bay
CS32	Totland Bay
CS33	Headon Hill
CS34	Alum Bay
CS35	The Needles and Scratchell's Bay

Inland Sites	
IS1	Prospect Quarry
IS2	Haslett Farm Quarry
IS3	Cheverton Quarry
IS4	Knighton Quarry
IS5	Ventnor Graben
IS6	Gore Cliff
Other Sites	
OS1	Reverend William Fox
OS2	John Milne
OS3	Robert Hooke
OS4	Thomas Hawkins
OS5	Dinosaur Isle
OS6	Coastal Visitors' Centre
OS7	Dinosaur Farm
OS8	Museum of Isle of Wight Geology
OS9	Blackgang Chine Visitor Centre

Appendix 4: Geological timescale

Eon: Phanerozic - **542 million years ago to the present**.

Era:	Period:	Starting age
Caenozoic	Quaternary	2.588 Ma
	Neogene	23.03 Ma
	Palaeogene	65.5 +/- 0.3 Ma
Mesozoic	Cretaceous	145.5 +/- 4.0 Ma
	Jurassic	199.6 +/- 0.6 Ma
	Triassic	251.0 +/- 0.4 Ma
Palaeozoic	Permian	299.0 +/- 0.8 Ma
	Carboniferous	359.2 +/- 2.5 Ma
	Devonian	416.0 +/- 2.8 Ma
	Silurian	443.7 +/- 1.5 Ma
	Ordovician	488.3 +/- 1.7 Ma
	Cambrian	542.0 +/- 1.0 Ma

The dates were published in 2009 by the International Commission on Stratigraphy. (Ma = *Mega annum* - 'million years' ago).

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Appendix 6: Websites

The following websites contain further information, or are the source of additional documents. They should be accessed for the most up-to-date versions of the related information. These webpages were valid on 13th August 2009.

General information

The Natural England LGAP webpage.
http://www.naturalengland.org.uk/ourwork/conservation/geodiversity/protectandmanage/lgaps.aspx

NATURENET – about geodiversity and geoconservation.
http://www.naturenet.net/biodiversity/geodiversity.html

The GeoConservation Commission (part of the Geological Society of London).
http://www.geoconservation.com/Index.htm

Sites of Special Scientific Interest (SSSI).
http://www.natureonthemap.org.uk

Plans

IWLGAP **The Isle of Wight Geodiversity Action Plan.**
www.dinosaurisle.com/lgap.aspx

AONBMP **The Isle of Wight Area of Outstanding Natural Beauty Management Plan.**
http://www.wightaonb.org.uk/en/management/default.aspx

BAP **The Isle of Wight Biodiversity Action Plan.**
http://www.wildonwight.co.uk/haps.php

HEAP **The Isle of Wight Historic Environment Action Plan.**
http://www.iwight.com/living_here/planning/Archaeology/heap.asp

ROWIP **The Isle of Wight Rights of Way Improvement Plan.**
http://www.iwight.com/living_here/environment/Transport_strategies/apr/images/AnnexE-RightsofWayImprovementPlan.pdf

SMP **The Isle of Wight Shoreline Management Plan.**
http://www.coastalwight.gov.uk/smp/index.htm

Organizations within the IWLGAP partnership

Dinosaur Isle Museum.
http://www.dinosaurisle.com

The Isle of Wight Centre for the Coastal Environment, Isle of Wight Council
http://www.coastalwight.gov.uk

Natural England.
http://www.naturalengland.org.uk

National Trust.
www.nationaltrust.org.uk/isleofwight

Isle of Wight AONB Partnership.
http://www.wightaonb.org.uk

IW. Council County Archaeology and Historic Environment Service, Isle of Wight Council.
http://www.iwight.com/living_here/planning/archaeology

IW Biodiversity Action Plan partnership.
http://www.wildonwight.co.uk

Country Landowners Association.
http://www.cla.org.uk/In_Your_Area/South_East

Dinosaur Farm.
http://www.isleofwight.com/dinosaurfarmmuseum

Medina Valley Centre.
http://www.medinavalleycentre.org.uk

Isle of Wight Natural History and Archaeological Society.
http://www.iwnhas.org

Appendix 7: Organizations invited to take part in the 2009 review.

Organization	**Contact c/o**
AONB Partnership.	Fiona Hannah
Bardon Vectis (IW)	Steve Burton
Country Land and Business Association.	David Langford
Dinosaur Farm.	Martin Simpson
Dinosaur Isle Museum.	Steve Hutt
Geological Society of the Isle of Wight.	Steve Hutt
Isle of Wight Biodiversity Action Partnership.	Tina Whitmore
Isle of Wight Centre for the Coastal Environment.	Jenny Jakeways and Natasha Dix
Isle of Wight Council County Archaeology and Historic Environment Service.	Dr Ruth Waller and Rebecca Loader
Isle of Wight Council Economic and Tourism Development	Caroline Young
Isle of Wight Council Island Heritage Librarian	Sheila Caws
Isle of Wight Council Parks and Countryside Section.	Dr Colin Pope
Isle of Wight Council Planning Policy Team.	Chris Mills
Isle of Wight Council Rights of Way Section.	Lee Skinner
Isle of Wight Council Strategic Tourism.	Liz Walker
Isle of Wight Natural History and Archaeological Society.	Lorna Snow
Medina Valley Centre.	Helen Parry
National Trust (IW).	Tony Tutton
Natural England (national office).	Dr Jonathon Larwood
Natural England (regional office).	Graham Horton and Jackie Kelly
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Appendix 8: Acknowledgements

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Photographs by T. Price (except Figs 1, 4, 5[Coastal Visitors Centre] and 7).

Figure 6, and further information on the deep structure below the Isle of Wight and southern England, can be found in –

Chadwick, R.A. & Evans, D.J. 2005. A seismic atlas of southern Britain – images of subsurface structure. *British Geological Survey Occasional Publication No. 7*. Keyworth: Nottingham. Fig 97b.

Figure 16: Fallen Sandrock block at Luccombe Bay.