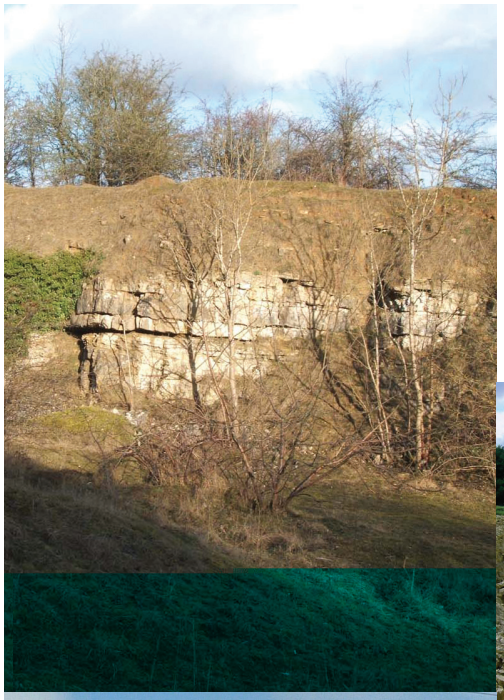
Oxfordshire Geology Trust

Local Geodiversity Action Plan

for Oxfordshire's Lower and Middle Jurassic



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Introduction

Oxfordshire's geology has long been admired by geologists and utilised by industry. In fact, it was a driving force for the industrialization of the nation through the exploitation of ironstone. Our geodiversity however, extends beyond our exposures of rocks and fossils to include landscape and geomorphology, building stones, museums collections and soils. All of these area valuable resources for learning about our geological history and for making predictions about how our planet might change in the future. This has particular relevance with current concerns about climate change.

If our geodiversity is to be understood and enjoyed by everyone in the future it is essential that this resource is conserved and promoted. We understand that our geodiversity is not static and that it will change with natural processes and use. It is important therefore that our approach to geoconservation is one of conservation and not preservation.

This Local Geodiversity Action Plan is based on our current understanding of our geodiversity resource. It is a framework for the conservation, management and promotion of Oxfordshire's Lower and Middle Jurassic Geodiversity. It includes objectives and actions and identifies potential partners for these and all of this can be sustained over the coming years. Of course our objectives and actions will change as our understanding progresses and as new issues arise; the LGAP will be regularly revised to reflect these changes.

A public Oxfordshire Geology Trust fieldtrip from Stonesfield

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What is Geodiversity?

Geodiversity is defined as the geological diversity of an area. This can include not only the rocks, fossils, minerals and natural processes (geomorphology) of the area but also its soils, landscape, museum collections and building stone.

Geodiversity is not just important for our understanding of our ancient history. It underpins almost every part of our natural and man-made environment forming the framework for life on Earth. Rock types dictate the type of soils which are produced which in turn determine the types of habitats and species which will develop. It also influences where we build, where we dispose of waste and how we design our transport links. The geodiversity also influences the local water resources, climate and topography of an area, all of which influence human, animal and plant life. As a result geodiversity is responsible for providing a good portion of an areas local character and distinctiveness, providing communities with a sense of place.

The major influence on geodiversity of course is the local rock types and the processes which have acted on these since their formation. However, other features also affect the geodiversity not least of which is human exploitation. Humans exploit the local geodiversity both for natural resources such as aggregate, fuels, and building stone and also for transport routes. These activities can be a positive influence determining the amount of geodiversity which is accessible, particularly for those areas where natural exposure of rocks, minerals and fossils are poor such as in Oxfordshire. Many eminent geologists have studied this geodiversity including William Smith, Rev William Buckland, John Phillips, William J Arkell and Stuart McKerrow. Their work has greatly extended our geological understanding and utilisation of natural resources. However, our geodiversity is a finite resource. Once it has been destroyed it can not be regrown, reintroduced to an area or redeveloped. Loss and destruction by human activities is one of the most damaging threats to our geodiversity.

Small Exposure of Lower Jurassic sediments near Banbury

River Evenlode in its underfit valley at Stonesfield

© Oxfordshire Geology Trust

The Conservation of our Geodiversity

Although the value of geodiversity has been recognised for hundreds of years the realisation of the need to conserve and promote this most valuable resource is still often overlooked. In spite of recent initiatives such as Local Geodiversity Action Plans, geoconservation is still often only applied to our *in situ* geodiversity with features such as local building stones and museum collections being overlooked.

National Geoconservation Initiatives

The Geological Conservation Review (GCR)
The Geological Conservation Review was begun in 1977 by the Nature Conservancy Council (now Natural England) and was the first national geological audit in the world. The GCR's aim was to identify and safeguard some of the most important national and international geological sites in Britain showing key elements of our Earth Heritage. The review was completed in 1990 and is being published in a series of 45 volumes by the Joint Nature Conservation Committee (JNCC).

Over 3000 sites have been selected nationally representing around 100 categories (Blocks) of geology and geomorphology. Many of these sites are already notified as Sites of Special Scientific Interest.
Within the LGAP area there are 13 GCR sites.

Sites of Special Scientific Interest (SSSI)
Sites of Special Scientific Interest represent some of the country's best wildlife and geological sites designated for their scientific value at a national level. The first SSSIs were designated in 1949 by the then Nature Conservancy Council. Natural England is now responsible for designating SSSIs and ensuring that they are kept in favourable condition. SSSIs receive statutory protection through the Countryside and Rights of Way Action 2000.

There are over 4,000 SSSIs in England many of which are internationally important. Some sites have been designated for both their wildlife and geological value. In the LGAP area there are 12 SSSIs designated for their geological value.

Regionally Important Geological and Geomorphological Sites (RIGS)
RIGS work in a similar way to the non-statutory County Wildlife Sites in that they have no statutory protection from damage or destruction but they are often recognised by planning authorities providing them with some level of protection. The RIGS scheme was initiated by the Nature Conservancy Council (now Natural England) in the early 1990s and is now largely managed by county based dedicated geoconservation organisations either Geology Trusts, local RIGS Groups, Earth Heritage Trusts or the like. It was created in response for the need to fill in 'gaps' within the GCR and is managed on defined geographical boundaries often county or unitary authorities.

RIGS are designated on their aesthetic, educational, historical and/or scientific value. Considerations such as access and rarity are also taken into account. This means that SSSIs can also be designated as RIGS but under different criteria. In Oxfordshire, Oxfordshire Geology Trust is the body which designates RIGS.
There are currently (June 2006) 32 RIGS in the LGAP area.

The Geology Trusts
The Geology Trusts was launched in 2003 as a national umbrella organisation for independent, dedicated geoconservation organisations. Geology Trusts involve a wide range of people in protecting and enjoying our geodiversity. Membership is not restricted to geologists or other scientists with Trusts often working with a variety of other orgnaisations and individuals to deliver benefits for geodiversity as well as other interests.

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UKRIGS
UKRIGS is a national umbrella for county RIGS Groups. They were established in 1999 and aim to "encourage the appreciation, conservation and promotion of Regionally Important Geological and Geomorphological Sites for education and public benefit".

Geoconservation in Oxfordshire
Oxfordshire Geology Trust (OGT) is the only dedicated geoconservation organisation in the county. The Trust was launched in 2000 (under its former name of Oxfordshire RIGS Group) and continues to undertake both protection and promotional work. OGT is run by dedicated volunteers with a wide range of skills, experience and local knowledge.

Protection of sites is gained, not necessarily through restricting development or use of sites but through continued working with landowners, land managers, developers and local communities. By advising on management techniques we can help to enhance the value of a sites geodiversity and help to manage the site for the future. This can often be done through the development of detailed holistic site geodiversity management plans. Sites can also receive protection through the RIGS designation (Regionally Important Geological and Geomorphological Sites). Oxfordshire Geology Trust is the organisation which designates RIGS in the county. These sites are included on GIS layers which are used by the planning authorities in the area.

In order to be effective at protection it is essential to first promote the value and range of our geodiversity. The Trust does this in a number of ways. Through public and school events, publicity, publications such as newsletters and the 'Secrets in the Landscape' trail guides, training events, and consultation meetings.

The Trust holds the only comprehensive database of geological and geomorphological sites in the area, which is constantly growing as survey work continues. It should be noted that there are a substantial number of geodiversity sites in the area which do not have a national or local designation. This does not detract from their geodiversity value especially for local communities. These sites are still in need of surveying, monitoring and where appropriate promotion. OGT undertakes a rolling programme of geodiversity surveying in order to monitor aspects of sites such as their condition, changes in ownership, use, access or designations at the site, and the development of other interests at the site for example habitat development.

School children become geologists for the day at a their local restored quarry.

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Local Geodiversity Action Plans – Purpose and Process

The purpose of LGAPs

The LGAP process and framework follows on the realisation that geodiversity and geoconservation needed an effective mechanism for delivering benefits just as biological conservation received from the Biodiversity Action Plan (BAP) process. Unlike biological conservation, there was no statutory requirement or legislation driving the LGAP initiative, just the knowledge that something was required to move geoconservation forward. This has its advantages in that each LGAP area can focus on the issues and requirements important to that area. Natural England is currently assessing the feasibility of a national GAP.

This action plan will form the basis for future geoconservation work within the LGAP area. It will be valuable to geoconservation organisations working in the area and to landowners, quarry operators and local communities who wish to take an active role in the management of their local environment. It will also help to guide planners and local authorities as well as provide information to other conservation organisations such as those involved with biological and archaeological conservation.

For LGAPs to be effective they should involve a wide range of stakeholders in the consultation and implementation process. Individual stakeholders may prefer to be involved at different stages of the LGAP process. This should be encouraged as each brings with them their own experience and resources to the process which may be more relevant at specific stages.

The LGAP will also highlight that geodiversity is not just about our exposed rocks and fossils which have already received protection, to a greater or lesser extent, through designations such as Sites of Special Scientific Interest or Regionally Important Geological and Geomorphological Sites but that there are a wealth of local sites and features which have no designations but are still considered to be of value by local communities and geologists alike.

LGAPs are evolving documents. It is planned that this LGAP will be reviewed every year initially. This is particularly necessary as many stakeholders are still unaware of the value of our geodiversity, its conservation and the benefits that their involvement can bring to all parties.

The Geographical Boundary

As with all management plans for the natural environment it is essential that the plan covers a well defined geographical area. This LGAP covers the Lower and Middle Jurassic of Oxfordshire. These rocks are restricted to the northern and central parts of the county and underlie the Cotswold Hills and the northern part of the Thames Clay Vale. They fall predominantly within Cherwell and West Oxfordshire District Councils.

This area was chosen for the LGAP for a number of reasons. First, the area has been greatly affected by aggregate extraction which has exposed a wealth of the local geology which we would otherwise be unaware of. Second, it was necessary to ensure that the Trust could carry out a geodiversity audit within the area prior to the production of the LGAP in order to ascertain exactly the current extent and state of the geodiversity. As resources are limited it was not possible to audit the whole of the county as part of an LGAP.

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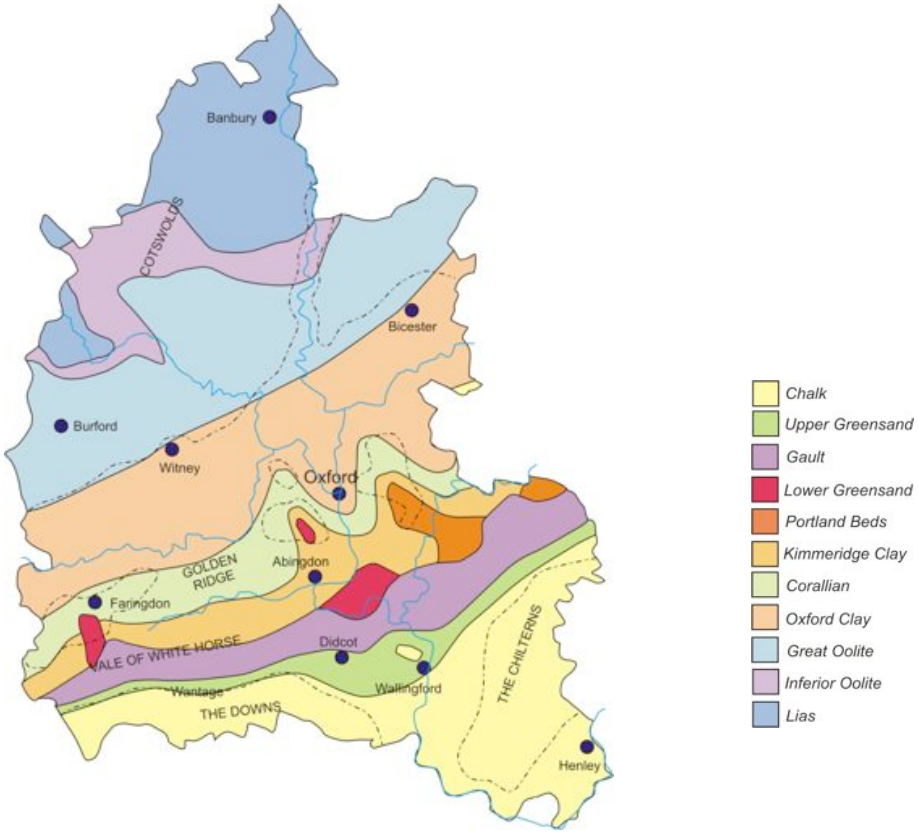
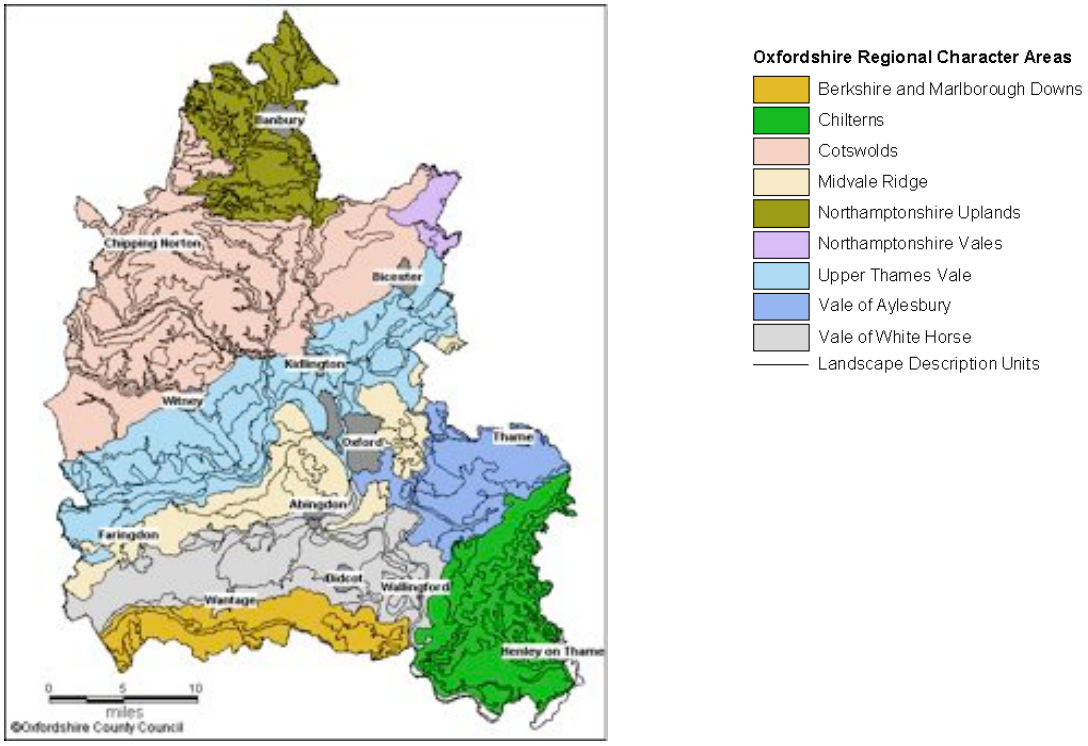


The Geology of Oxfordshire (See Stratigraphic Column, page10)



Regional Character Areas in Oxfordshire

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Preparing the Plan
There is already an existing LGAP for the whole county which was produced in 2002 by Oxfordshire RIGS Group . This was originally produced as a habitat action plan within the county's Biodiversity Action Plan. This habitat action plan has since been removed from the county BAP though it will continue to function as a countywide GAP.

Although Oxfordshire Geology Trust is the author of the LGAP, it has been produced after wide consultation with stakeholders representing a variety of interests from geological through to planning, biological and local interests.

The following organisations/individuals have been consulted:

Banbury Ornithological Society
Banbury Museum
Berkshire Buckinghamshire and Oxfordshire Wildlife Trust
Blenheim Estate
Cherwell District Planners
Cherwell District Countryside Team
Cotswolds AONB
Cornbury Park
Down Stone Company
English Nature
Eynsham Estate
FWAG
GWP Consultants
Individual landowners
Local teachers
Oxford Brookes University
Oxford Geology Group
Oxford University Natural History Museum
Oxfordshire County Council Ecologist
Oxfordshire County Council Waste and Minerals Planners
Oxfordshire Nature Conservation Forum
Oxfordshire Museums Resource Centre
Parish Councils
Peter Bennie
Smiths of Bletchington
Thames Valley Environmental Records Centre
University of Oxford
West Oxfordshire Planners
Wychwood Project

Through this consultation process GWP Consultants have agreed to become partners in the LGAP and to provide resources to assist the delivery of the action plan.

Prior to the production of this plan a field geodiversity audit of the LGAP area was undertaken by Oxfordshire Geology Trust. Over 100 recorded and unrecorded sites have been surveyed. Data collected from this audit has been fed into the Action Plan. All of the field data collected will be maintained at The Geological Record Centre and is open to anyone with an interest in the local geodiversity.

The success and implementation of the LGAP will be continually monitored to ensure that the targets outlined below are being met. Stakeholders will be encouraged to participate in this monitoring so as to help determine the success of the LGAP as well as new issues and needs as they arise.

Geodiversity Audit
As part of the production of this Action Plan a geodiversity audit of the LGAP area was undertaken by Oxfordshire Geology Trust. Information gathered from the audit will feed into the action plan and will help to identify future priorities for protection and conservation of our geodiversity sites.

In addition the audit highlighted that over 80% of disused quarries marked on Ordnance Survey maps are now filled in or no longer contain any geological interest. In addition, around two thirds of exposures detailed by W J Arkell in his 1947 book no longer exist.

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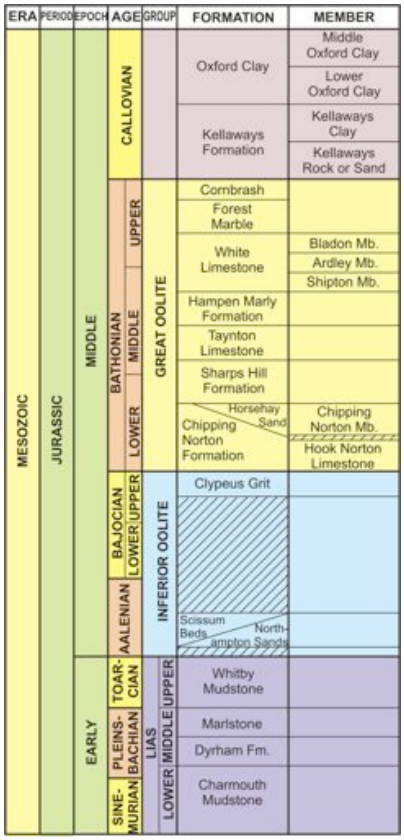
To the unaware Oxfordshire may not appear to be an area blessed with much in the way of geodiversity. Northern and central Oxfordshire certainly have some beautiful landscapes and are renowned for their biological importance but the people who often appreciate the area's outstanding geodiversity are generally quarry operators and geologists who marvel at the internationally important Jurassic rocks and fossils.

Our biggest insight into our geodiversity has been provided without a doubt by the innumerable historic quarries in the LGAP area. These have been worked as sources of aggregate, building and walling stone, decorative stone, cement and iron ore. Almost every lithological unit (rock type) in the area has been exploited at one time or another. Without these quarries our understanding and appreciation of our geology would be most restricted not least because there is only one natural rock exposure in the area! Of course road and rail cuttings have also exposed some of our geology and there are a wealth of geomorphological (landscape and active processes) features in the area which are largely the result of the affects of Quaternary ice and river processes.



Oxfordshire's Lower and Middle Jurassic Stratigraphic Column

Lower Lias, Lower Jurassic

The Lias Group is an alternation of clays, silts and ferruginous limestones. Due to their soft nature they are rarely exposed in the county. Most of the outcrop follows the courses of rivers such as the Cherwell, Evenlode and Sor Brook which have cut down through the overlying resistant strata.

One of Oxfordshire's geological curiosities comes from the Lower Lias. It is the Banbury Marble. Not a true marble but a hard limestone capable of taking an attractive polish on cut surfaces, giving it the appearance of marble. In the 19th century it was cut and polished as an ornamental stone for chimney pieces, mantelpieces and ornaments. Temporary exposures were created in 2003 during road construction in Banbury. No current exposures are known.

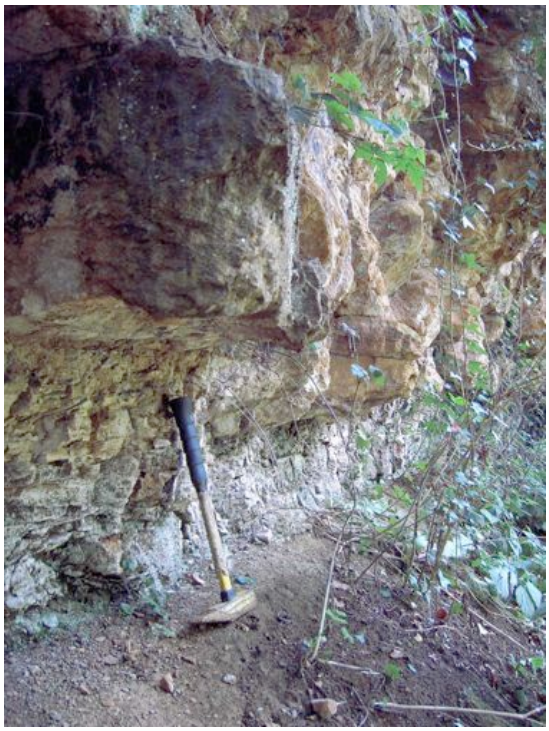
© Oxfordshire Geology Trust

A cut and polished specimen of Banbury Marble

Middle Lias, Lower Jurassic

The Middle Lias consists of two distinctive units. The lowest is a sequence of silts and fine sands of the Dyrham Formation. This is not known to be exposed at any permanent sites in Oxfordshire however, it can often be traced along hill sides and river valleys forming a small bench. Important temporary exposures have been created in the past through excavation of the M40 road cutting. The weak nature of the Dyrham Formation means that these have rapidly degraded.

Overlying the Dyrham Formation is the Marlstone Rock Formation (also known as the Banbury Ironstone and Hornton Stone), a hard ferruginous oolitic limestone with sand. At outcrop the Marlstone is usually deeply weathered giving a very distinctive reddy brown colour. It is richly fossiliferous and contains rhynconellid brachiopods which are often found in concentrated 'nests' representing rapid smothering of colonies. There are also belemnites and bivalves in the formation. The Marlstone has long been exploited for a variety of economic purposes such as building stone, aggregate, iron stone and as a decorative stone. The long term activities of Marlstone extraction have created a great number of exposures within quarries of varying size throughout northern and north-western Oxfordshire such that the Marlstone is superbly represented in exposure even though some sites are overgrown. Small building stone and aggregate quarries still exist providing opportunities for the conservation of exposures into the future.



Exposure of the Marlstone Rock Formation with interbedded silts and clays at the base

© Oxfordshire Geology Trust

An aggregate quarry in the Marlstone Rock Formation

Upper Lias, Lower Jurassic
A sequence of clays and thin marly limestones overly the Marlstone Rock Formation. These are rarely exposed again due to their soft nature and rapid degradation. Part of the Whitby Mudstone Formation has been exposed in the Marlstone quarries in the overburden, but no current exposures are know. The same is true of historical exposures in railway cuttings. Within the Whitby Mudstone Formation is a bed of brown ferruginous limestone which is packed with ammonites and is known as the Cephalopod Bed. Although not exposed in the county it can be traced through the landscape by the presence of abundant ammonites that appear on the surface of ploughed fields.

Inferior Oolite Group, Middle Jurassic
The Inferior Oolite forms the northern part of the Cotswolds both in Oxfordshire and in Gloucestershire. Because of its relative resistance to erosion it forms most of the northern scarp of the hills. Unlike Gloucestershire the Oxfordshire Inferior Oolite sequence is thin – a result of little or no deposition taking place in Oxfordshire. The lowest unit is the Northampton Sand Formation, a sandy ferruginous limestone which becomes less ferruginous to the west and passes into the grey sandy limestone of the Scissum Beds.

The only other Formation within the Group is the Clypeus Grit Formation, a coarse grained, pale buff oolitic limestone. The formation takes its name from the echinoid *Clypeus ploti* which can be found in abundance within the deposits. Again it forms part of the scarp on the northern side of the Cotswold Hills.
The Clypeus Grit is only present in the west of the county as the unit thins to the east where the Great Oolite group sits directly on the Northampton Sands.

Exposures of the Inferior Oolite in Oxfordshire are few and far between. Some exposures are visible in active quarries and these are incredibly important for comparisons with other records from Oxfordshire and with exposures in Gloucestershire.

The Great Oolite Group, Middle Jurassic
Most of Oxfordshire's exposed geodiversity in the northern and central part of the couny is represented by the Great Oolite Group. The variety and complexity of its geology is enormous, hence it is only possible to give a brief overview here. The Great Oolite Group underlies the gentle southeast dipping Cotswold Plateau of Oxfordshire and extends out into Gloucestershire to the west and to Northamptonshire to the north-east.

© Oxfordshire Geology Trust

A rare chance to see the Clypeus Grit Formation in the bottom of an active quarry

The lowest strata is the Chipping Norton Limestone. This fawn coloured sandy limestone which is variably oolitic also exhibits well developed cross stratification throughout much of its exposure. Confined largely to the Chipping Norton area the lithology has been extensively quarried as a building stone as well as an aggregate. However, most of these older quarries have been entirely infilled leaving no exposure. More recent quarrying has created some excellent exposures in the Charlbury and Sarsden area where the whole of the Formation can be examined.

The Chipping Norton Limestone passes laterally into the Horsehay Sand Formation in the east of the county. This poorly cemented sand is a rare example of non-limestone deposition during the Middle Jurassic in this part of the country. The Horsehay Sand Formation is incredibly valuable for determining regional correlations and palaeogeography of the area.

The Rollright Stones, a siliceous form of the Chipping Norton Limestone Formation

© Oxfordshire Geology Trust

A rare exposure of the Horsehay Sand Formation

The following sequences of the Sharp's Hill, Charlbury and Taynton Limestone Formations are dominated by oolitic shelly limestones with the very characteristic cream colour of the Cotswold Villages. All three Formations are extremely variable both laterally and vertically making correlation of particular beds almost impossible from site to site. All three units have historically been exploited for building/walling stone and aggregate, with a number of good exposures still evident. The Sharp's Hill and Taynton Limestone Formations are still exposed in working quarries. The Taynton Limestone Formation is probably the best known of the three Formations as it is both an excellent building stone, having been used in many of Oxford University's colleges and transported for use in buildings such as Windsor Castle and St Paul's Cathedral and the source of the prized roofing tiles Stonesfield Slates.

Redundant quarry showing the Chipping Norton Limestone, Sharp's Hill, Charlbury and Taynton Limestone Formations. Benching of the quarry face allows safe and easy access to the full suite of rocks.

© Oxfordshire Geology Trust

Overlying the Taynton Limestone Formation is the Hampen Formation. This is a sequence of marls and marly limestones, often with thin beds of oolitic limestone and very rich in fossils. There is poor exposure of the Hampen Formation in Oxfordshire despite there being a number of records in historical literature.

Next in the sequence is another limestone, the White Limestone Formation. As its name suggests it is a very pale limestone which is well cemented, fine grained and can be extremely pure. It is often rich in a variety of fossils and of course is now world famous for its dinosaur footprints which were exposed in an aggregate quarry in northern Oxfordshire. It outcrops in a broad area of northern and central Oxfordshire and has been exploited extensively for roadstone and lime/cement manufacture resulting in an abundance of exposures being created, many of which are still accessible.

A richly fossiliferous limestone, known as the Forest Marble because of the Wychwood Forest where it was first described, overlies the White Limestone Formation. As with the other limestones of the Group it can be extremely variable over short distances though it often has a characteristic blue colour. This limestone has been extensively used as a building stone as well as providing walling stone, roofing tiles, ornamental stone and clay for brick making. There are good exposures of the Forest Marble in the area north west of Oxford and around Wychwood Forest as well as further north where it is found in faulted blocks.

The uppermost unit of the Great Oolite Group is the Cornbrash Formation. A very rubbly but fossiliferous limestone, which does not exhibit the variability of the other Great Oolite limestones. Good exposure of the Cornbrash is rare in Oxfordshire due partially to the thin surface extent but also to the fact that it has not been a significant target for quarrying.

Exposure of White Limestone and overlying Forest Marble at active aggregate site

© Oxfordshire Geology Trust

A rare section, recently cleared of scree and vegetation exposing the Cornbrash

Oxford Clay

The Oxford Clay is the youngest of the Middle Jurassic sediments in the county. Its lack of resistance to erosion and weathering means that it has given rise to the relatively low lying area of the Thames Vale to the south of the Cotswold plateau and north of the Corallian Ridge (Upper Jurassic sands and limestones). As with the Lias clays the Oxford Clay is largely homogeneous with a predominance of ammonites and belemnites, most of which are in poor condition when they reach the surface as they decay rapidly even within the clay. The only exposures recorded are in brick and gravel pits to the south of the LGAP area.

Fossils

The Jurassic period is renowned the world over for its variety and good preservation of fossils. Oxfordshire is no exception. Many scientifically important fossils have been discovered in the county and there is a wealth of fossil material still to be found in our exposures as well as on footpaths and in field margins. There are hundreds of genera of invertebrate fossils to be found in Oxfordshire. Some of the more common ones include *Clypeus ploti*, the sea urchin more commonly known as 'poundstones'. It was named in honour of Robert Plot the great naturalist of the 17th century and was one of the first fossils William Smith found in Oxfordshire. The Marlstone Rock Formation contains some beautiful examples of brachiopod nests – the preservation of colonies of brachiopods in their life position. Throughout the Great Oolite Group there is a rich marine invertebrate fauna. Plants have also been recovered particularly from the Taynton Limestone Formation, though they are now rarely seen.

Clypeus ploti, the fossil sea urchin after which the Clypeus Grit is named. Also known as a pound stone, it was used for weighing butter and was the reason William Smith became interested in geology.

© Oxfordshire Geology Trust

A replica of the Megalosaurus jaw bone described by Buckland in 1824

Some of the most spectacular fossil finds from Oxfordshire have undoubtedly been the dinosaur and other vertebrate bones and footprints. Some of the earliest records of dinosaur finds from the county are in Robert Plot's 1677 Natural History of Oxfordshire. Plot's drawing of what has subsequently been identified as part of a femur from *Megalosaurus* is the first recorded illustration of a dinosaur bone. The first fossil bone ever to be scientifically described also came from Oxfordshire – a partial jaw bone and skull of *Megalosaurus*.

Bones of several other types of dinosaurs have also been found in quarries and brick pits in the Middle Jurassic sediments. Finds are rare now as the scale of quarrying is much reduced from the 18th and 19th Century. However, a major discovery was made in the late 1990s when dinosaur footprints were uncovered in Ardley Quarry. There are over 40 trackways, some up to 200 m in length and containing 100 individual prints. The prints represent the activity of two dinosaurs types, theropods and sauropods. The theropod trackways are the first in the world to record a change in locomotion speed and associated change in gait.

Geomorphological Features

Over the last 2.5 million years a series of 'Ice Ages' dramatically altered the landscape. Melt waters from ice and frozen ground (permafrost) roared over the frozen ground carving huge valleys like those still inhabited by the River Evenlode, River Windrush and River Cherwell. Sediments deposited by the ancient ancestors of these rivers can still be seen in places, often on plateaus above the rivers.

A dry valley on the southern side of the Cotswolds

© Oxfordshire Geology Trust

Dry valleys are the evidence of river channels which would have been carved out at the same time as these larger rivers. They would have been tributaries of the larger rivers helping to drain the area of melt water. Some of these valleys occasionally carry water today when rainfall is high.

Other evidence of the much larger, more powerful rivers of the Quaternary are the abandoned meander cores such as those at Asthall and Pound Hill. Again, now dry, they record the higher energy of the rivers which cut through their meander loops either in times of flood or simply as a result of their erosive power.

Building Stone

Almost every town and village in northern and central Oxfordshire uses local building stone or roofing tiles. Much of the character of villages such as Adderbury, Bloxham, Burford and Chipping Norton are a result of the use of attractive Cotswold stones. Obviously, the Marlstone characterises the northern villages while the oolitic limestones of the Great Oolite dominate in the more central villages.

Most of the Great Oolite rocks have been used as building stone at one time or another. One of the most important of these is the Taynton Limestone found around the Burford area. As well as being used extensively in Oxfordshire it has been transported and used in buildings such as Windsor Castle and St Paul's Cathedral,

Stone roofing tiles are also a characteristic of this part of Oxfordshire. Slates from the Taynton Limestone Formation were quarried from Stonesfield and Fulwell while slates from the Forest Marble have been quarried from Filkins. Stonesfield Slates are by far the most well known and come in two types – those which were found at ground level, known as 'presents', and those which were quarried and left to split naturally by frost, known as 'frosted slates' and considered to be true Stonesfield Slates.

Museum Collections

Oxfordshire Museums Service looks after collections from all over the county and provides curatorial services to museums. The collections are housed in the Musuems Resource Centre and contain a good and extensive collection of rock types of both Jurassic and Cretaceous periods, a good collection of Jurassic fossils from the area and a range of borehole information particularly from north and west Oxfordshire.

Buildings utilising local building stone and Stonesfield Slate roofing tiles

© Oxfordshire Geology Trust

Dinosaur footprint casts outside Oxford University Natural History Museum

Oxford University Natural History Museum also houses some important collections. There are over 500,000 geological specimens some of importance include Jurassic vertebrates and invertebrates. Collections of some eminent geologists are held at the museum including Lhwyd, Buckland, Smith, Phillips, Lyell and Arkell. In addition to geological specimens the museum also holds a range of correspondence, manuscripts and illustrative material produced by these and other geologists.

Banbury, Oxfordshire, Chipping Norton and Witney and District Museums have geological displays with specimens available for handling at Banbury Museum. The Vale and Downland Museum in Wantage, south Oxfordshire also has an extensive display of geological specimens and materials though the focus is more towards the Upper Jurassic and Cretaceous geology of the area.

History of Geological Research in the LGAP Area.

Oxfordshire's geodiversity has attracted the attention of many eminent geologists from the early 1800s right through to the present day. William Smith 'the Father of English Geology' was born in Churchill, northern Oxfordshire and undoubtedly acquired his interest in geology from his walks in the area. Smith went on to realise that the position of fossils in the rock units could be used as a method of dating the rocks – a technique now employed the world over and known as biostratigraphy. Smith also produced the first geological map of the country in 1815 and 6 county maps including Oxfordshire (1820).

Professor William Buckland was not only the first professor of geology at a British university but he was also the first person to scientifically describe a dinosaur fossil in 1824 (the word dinosaur was not coined however until 1841). The fossils that Buckland was describing included a jaw bone which had been found in Stonesfield, probably by slate workers. Buckland called the animal to which it belonged *Megalosaurus*, meaning big reptile. Buckland also inspired other geologists with his lively lectures including Charles Lyell who went on to become a leading geologist and mentor to Charles Darwin. Buckland is buried in Islip churchyard where he was rector – his gravestone is in pink granite.

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The memorial to William Smith in Churchill Village using local Middle Jurassic stone

Twentieth Century geologists such as W J Arkell and Stuart McKerrow worked extensively in Oxfordshire and have done much for the advancement of our understanding of Jurassic stratigraphy and palaeontology. Arkell's 1947 books 'The Geology of Oxford' and 'Oxford Stone' remain the most detailed accounts of the county's geology.

This short summary shows just how rich Oxfordshire's geodiversity really is. There is something for everyone, especially for local communities who can explore a great deal of their local heritage and environment through the geodiversity.

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Implementation

Relationships with other Management Plans

The LGAP should not be seen as a stand alone document which exists outside other local and national management plans, documents or policies. Many of these other documents can directly influence the local geodiversity resource and can also be fed into through the LGAP. One of the roles of an LGAP is to derive benefits to the local geodiversity through these other plans and planning strategies. Some of the relevant documents include –

Planning Policy Statement 9 – Biodiversity and Geological Conservation

Planning Policy Statements or PPSs are governmental guidance for local planning policy. The LGAP will form a valuable resource for helping to fulfil the PPS9 requirement to conserve and enhance geodiversity through the planning process.

Local Planning Policies

The local planning system is currently undergoing a re-organisation with the existing Local Development Plans being replaced by Local Development Frameworks (LDFs). The LGAP is an ideal way of ensuring that geodiversity is included within the new LDFs in a similar way to how LBAPs have previously been used.

The new LDFs within the LGAP area are the Cherwell District, West Oxfordshire District and the Oxfordshire Minerals and Waste LDFs.

Cotswolds Area of Outstanding Natural Beauty

The Cotswold AONB Management Plan was released in 2004. This identifies the landscape and geology of the area as being a major influence on its distinctive character. There are specific aims, policies and priority actions which relate directly to the geology of the area. The AONB Conservation Board have recently (2005) commissioned Gloucestershire Geology Trust to produce The Geological and Geomorphological Importance of the Cotswolds AONB report. The combined working of the AONB with the Oxfordshire and Gloucestershire Geology Trusts will help to deliver both AONB and Geology Trusts objectives for the areas outstanding geodiversity.

Local Biodiversity Action Plans

Our biodiversity is inextricably linked to our geodiversity. Many geological sites are important for biodiversity and vice versa. By working with ecologists and with the BAPs covering the area we will be able to deliver significant benefits to both geodiversity and biodiversity.

There are two BAPs covering the LGAP area. The Oxfordshire BAP is co-ordinated by Oxfordshire Nature Conservation Forum and the Cherwell District BAP is co-ordinated by Cherwell District Council. Both BAPs have an Earth Heritage/Geodiversity action plan within them (see below).

Through continued consultation with BAP authors we will be able to deliver benefits to both our biodiversity and geodiversity through the BAPs and the LGAP.

Other GAPS

The Oxfordshire LGAP was produced in 2002 and was one of the first LGAPs to be produced by a dedicated geoconservation organisation. This LGAP sat within the Oxfordshire BAP as a Habitat Action Plan with the lead partner being Oxfordshire Geology Trust. It has recently been removed from the BAP and is now a stand alone document managed directly by Oxfordshire Geology Trust. The new Lower and Middle Jurassic LGAP does not replace the county LGAP but sits within its framework.

The Gloucestershire Cotswold LGAP was launched in 2005 (produced by Gloucestershire Geology Trust, formerly Gloucestershire Geoconservation Trust) and borders this LGAP area to the west.

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The Future of the LGAP

The LGAP underwent public consultation through 2006 and early 2007. The objectives and actions of the LGAP will be implemented by Oxfordshire Geology Trust with the support and assistance of stakeholders and volunteers. It is envisaged that a Geodiversity Forum (consisting of stakeholders involved in the early development of the LGAP plus others as and when they are identified) will meet once a year to discuss the progress of the LGAP and to identify emerging objectives and actions. This will serve as a way of monitoring the success of the LGAP.

An essential part of the future of the LGAP will be to secure resources for its implementation and development. This is an issue which is identified as needing attention in the action plan. It is hoped that new partners will join the LGAP in the future – bringing resources and renewed drive to the implementation of the action plan. Anyone who would like to be involved with the implementation and further development of the LGAP is strongly encouraged to contact Oxfordshire Geology Trust.

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The Action Plan

Objective	*Action*	*Timescale*	*Potential Partners*
Provide dedicated geoconservation expertise for the management, use and promotion of our geodiversity	Develop a monitoring programme to assess condition of audited sites	2007	
	Audit designated RIGS twice a year	Ongoing	
	Identify sites where clearance work may be needed and produce management plans for these	2008	
	Develop a GIS database at The Geological Records Centre to hold geodiversity audit information	2009	County and District Councils
	Work with Natural England to determine value of land adjacent to SSSIs	2009	NE
	Explore possibilities of Service Level Agreements with landowners/managers for the management of key sites	2008	Landowners and land managers NE
	Provide training opportunities for GeoWardens, members and others	3 per year	Local interest groups, BBOWT
	Undertake a soil survey of the LGAP area to extend our knowledge of the geodiversity	2009	Oxford Brookes University, Oxford University
Promote the value and interest of our geodiversity to all audiences	Deliver the established Earth Heritage education programme to schools	10 schools per year	
	Investigate ways to involve senior schools in a geodiversity/Earth Heritage educational programme	2007	Schools, teachers
	Continue to promote the use of local sites for school field visits	Ongoing	Landowners and land managers
	Publish four additional 'Secrets in the Landscape' trail guides	2008	
	Co-ordinate running of 3 Fabulous Finds days per year at Banbury Museums	3 events per year	Banbury Museum, Archaeological Finds Liaison Officer

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	Continue to provide a varied programme of public events throughout the LGAP area	12 events per year	
	Use seminars and workshops to promote geodiversity to planners, developers, AONBs, statutory organisations, etc	1 per year	
	Use existing biodiversity attractions to raise awareness of the link between geodiversity and the natural environment	3 events per year	BBOWT, BOS
	Produce and disseminate literature about the work of OGT for businesses, statutory organisations, landowners and land managers	2008	
	Work with local interest groups and organisations to raise awareness of geodiversity	Ongoing	Local interest and community groups
	Continue to identify and liaise with stakeholders	Ongoing	
Enhance access to and protection for the whole range of geodiversity	Liaise with planning authorities regarding the inclusion of geodiversity and the LGAP in new Local Development Frameworks	2006-2007	Oxfordshire County Council, Cherwell District Council, West Oxfordshire District Council
	Encourage the inclusion of geodiversity priorities in other management plans and strategies	2007	AONB, Councils, NE, DEFRA, FWAG, CLBA
	Continue to identify potential RIGS working with landowners and other stakeholders	2009	Landowners
	Develop the GeoWarden network to cover 8 sites	2008	BBOWT, local interest groups, landowners
	Encourage the use of Museum collections to promote geodiversity	2008	Oxfordshire Museums Services, Banbury Museum, Oxfordshire Museum, Chipping Norton Museum.

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Establish a monitoring process for the LGAP and secure resources for geoconservation priorities and the implementation of the LGAP	Work with national grant making organisations to include geodiversity within their grant making priorities	Immediately	Grant making organisations
	Secure funding for the upkeep of The Geological Records Centre	2009	Grant making organisations
	Secure funding for the implementation of the LGAP and for other geodiversity priorities	Immediately	Grant making organisations, NE, other stakeholders.
	Create a database of individuals/groups with an interest in geodiversity/geoconservation	Ongoing	
	Hold an annual geodiversity forum meeting	1 per year	All stakeholders
	Encourage the involvement of industry in geoconservation and in the LGAP process	2007	Representatives of industry, CLBA

Where no potential partners are highlighted Oxfordshire Geology Trust will be the lead partner.

Key for potential partners –

AONB	Area of Outstanding Natural Beauty
BBOWT	Berkshire Buckinghamshire and Oxfordshire Wildlife Trust
BOS	Banbury Ornithological Society
CLBA	Country Land and Business Association
DEFRA	Department for Environment Food and Rural Affairs
NE	Natural England
FWAG	Farming and Wildlife Advisory Group

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