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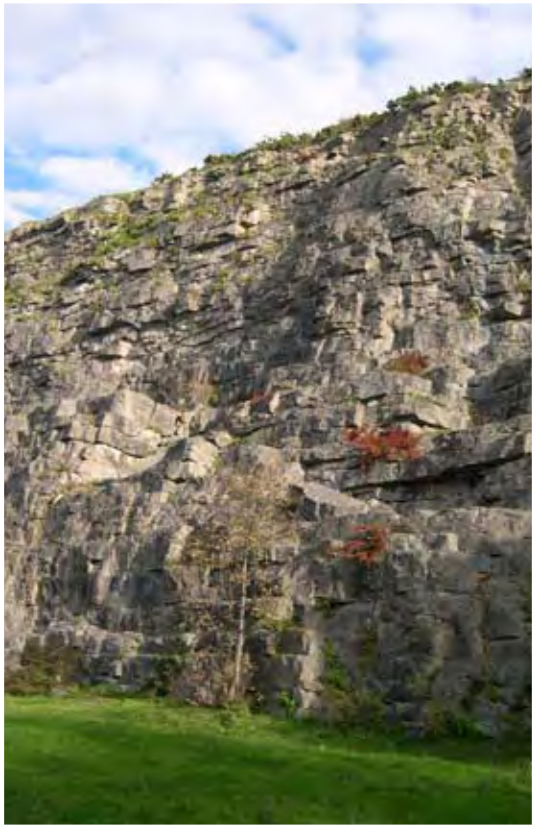
Clwydian Range

Area of Outstanding Natural Beauty (AONB)

Local Geodiversity Action Plan (LGAP)



The aim of this LGAP is to promote collective action to conserve and enhance the landscape of the Clwydian Range AONB through its outstanding geological heritage and to promote and manage the sustainable use of its geodiversity resources for the social and economic well-being of the inhabitants and those of neighbouring areas and visitors.

JUNE 2007
Draft for consultation

AHNE Bryniau Clwyd
Clwydian Range AONB


NEWRIGS


Cyngor Cefn Gwlad Cymru
Countryside Council for Wales


Sir Ddinbych
Denbighshire
COUNTY COUNCIL


British
Geological Survey


CYNGOR
Sir y Fflint
Flintshire
COUNTY COUNCIL


CASTLE CEMENT


Tarmac


CPAT


Arden Early
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COUNCIL
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wrecsam

CLWYDIAN RANGE

Area of Outstanding Natural Beauty (AONB)

Local Geodiversity Action Plan (LGAP)

Compiled by:

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Summary

This project aims to develop a sustainable Local Geodiversity Action Plan (LGAP) partnership for the Clwydian Range AONB.

What is Geodiversity?

It is the rich variety of rocks, fossils, minerals, landforms, soils and natural processes that form our planet. Geodiversity is the link between geology, landscape, biodiversity and people. Geological resources impact our lives by shaping the landscape and determining land use. Geodiversity links geology, landscape and culture. Geology influences where settlements are; where industry develops and the materials used for the built environment. The local flora and fauna are also subject to the underlying geodiversity e.g. limestone grasslands, heath, agricultural land etc. Geodiversity underpins Biodiversity. It is important that there is a mechanism to conserve both.

What is an LGAP?

Developed from the Local Biodiversity Action Planning (LBAP) process, an LGAP can help to conserve and manage the geological heritage of a defined area. It is a partnership between people and organisations with the common aim of conserving geological heritage and allowing everyone to benefit from it.

The project is funded by Aggregates Levy Sustainability Fund, Clwydian Range AONB Sustainability Fund, CCW and Tarmac.

The Clwydian Range AONB LGAP was initiated in 2006 with the prime aims to promote collective action to conserve and enhance the Clwydian Range AONB's outstanding geological heritage, and to promote the sustainable use of its geodiversity resources for the social and economic well-being of the inhabitants and those of neighbouring areas and visitors. This project will enhance and coordinate with existing projects in the AONB by working closely with everyone associated with the AONB to have a holistic approach to conservation and management of the AONB.

The project partners come from a wide range of backgrounds and interests.

The main partners are NEWRIGS (North East Wales Regionally Important Geodiversity Sites); Clwydian Range AONB, with Denbighshire Countryside Services; Denbighshire and Flintshire County Councils; Countryside Council for Wales; Tarmac Ltd and the Association of Welsh RIGS Groups (AWRG).

The project has strong links with other projects and organisations in the area including: Anglesey Geodiversity Project; British Geological Survey; Arden Early Learning; CastleCement; Clwyd Powys Archaeological Trust (CPAT); Millennium EcoCentre, Wrexham; Central Wales RIGS; Gwynedd & Môn RIGS; UKRIGS; Cheshire Region LGAP; Yale College, Wrexham; Fforest Fawr Geopark; North Pennines AONB Geopark and Lafarge Aggregates.

It is proposed that partners for the project will be sought from local community organisations including local government, education, tourism, businesses, wildlife and volunteer organisations associated with the Clwydian Range AONB.

The LGAP will manage the geodiversity of the AONB in order to protect, enhance and interpret geodiversity through a stewardship approach to place value on and conserve geological heritage resources, particularly as it enables us to advance our knowledge of the Earth's history and its future, and its worth in the inspirational, aesthetic, recreational and historical sense.

Project objectives:

The Clwydian Range AONB LGAP has seven main objectives, each explained and then summarised in separate sections. The plan can be summarised thus:

1. Ensure the continued effective conservation and management of the Clwydian Range's unique and outstanding geodiversity by the development of a sustainable management plan for the AONB (Section 1);
2. Establish an effective local partnership to carry forward the objectives of the LGAP (Section 2);
3. Maximise the use of the Clwydian Range's geodiversity to increase knowledge and understanding of all, including local and visiting students of schools, colleges, and universities and to include lifelong and family learning (Section 3);
4. Promote and develop the Clwydian Range's geo-heritage with local people and visitors, to drive sustainable geotourism, attract visitors to the area, promote healthy lifestyles and stimulate the local economy (Section 4);
5. Develop suitable AONB policies and influence the policies of national and local government, other groups and organisations to ensure effective geoconservation and sustainable use of geo-resources for education and geotourism (Section 5);
6. Manage information efficiently to achieve all the above (Section 6)

   and

7. Ensure a sustainable future for the Clwydian Range AONB's Geodiversity and LGAP

The Clwydian Range AONB's LGAP is geoconservation-led, with the management and protection of local geo-heritage at the forefront.

Contents:

Geodiversity *means the natural range (diversity) of geological (rock), geomorphological (landform) and soil features, assemblages, systems and processes. It includes evidence of past life, ecosystems and environments in the history of the Earth as well as a range of atmospheric, hydrological and biological processes currently acting on rocks, landforms and soils.*

More simply put, ***Geodiversity*** *is the rich variety of rocks, minerals, fossils, landforms, soils and related processes that form our planet. It is the stage upon which the drama of life unfolds. S Campbell 2006*

Introduction

Every area in Wales has a unique rock, fossil and mineral resource. The type of rock and millions of years of natural processes such as mountain building, glacial processes and weathering have produced unique landscapes. The landscape then has an effect on land-use, history and culture. These factors together are known as the **Geodiversity**. Geodiversity links geology, landscape and culture.

Biological conservation is very much in the public eye and the term Biodiversity, meaning the diversity of the biological world, is now in common usage and the importance of conserving the diverse flora and fauna of our fragile planet is well understood. Geodiversity however, is a newer term and its increasing use testifies to the increasing awareness within Wales and the United Kingdom as to the equal importance of understanding and conserving our geodiversity.

Geodiversity provides a foundation for modern society and all of our lives. It provides natural resources, such as building stones, aggregates, minerals and metals such as lead, zinc and iron; it harbours natural gas, oil and groundwater; it forms the basis of all our productive soils and agricultural land; it influences where we live; it gives rise to our spectacular and cherished landscapes; provides an irreplaceable archive of past climatic and environmental conditions, as well as the rich cultural heritage and history of mineral extraction, and is the basis of the our natural environment. Without *geodiversity* there is no *biodiversity*.

The rocks of Wales are as varied as the landscape they produce, and our small country has few rivals anywhere in the world with as rich a geological heritage or geodiversity. Thus it was in the United Kingdom in general, and Wales in particular, that many of the pioneering geologists worked. Here, they named some of the divisions that define the international geological timescale – for example, the Cambrian, Ordovician and Silurian periods, the last two named after Celtic tribes. The rich geological legacy of Wales continues to attract geologists from all over the world.

It might at first seem hard to conceive of threats to rocks and landscapes that have endured for millennia and that geodiversity hardly needs active conservation and management. However, the geodiversity of Wales and the Clwydian Range AONB is subject to a range of activities – tourism, quarrying past and present, rural development, land-fill, waste disposal, road building, pipelines and other issues, for example wind farms that may affect the landscape. Unlike biodiversity, once an important rock sequence or glacial landform has been destroyed, it can never be re-created. However, unlike biodiversity, some activities, such as quarrying, can reveal new formations, fossils and features of interest.

Recent media coverage of exceptional fossil finds and popular television programmes have awakened an interest in the general public. This provides an excellent opportunity to supply this need and increase awareness of the geodiversity of the Clwydian Range Area of Outstanding Natural Beauty.

With this in mind, it is of paramount importance that the language used in publications,

letters and workshops is free of jargon and is understandable by all users.

Clwydian Range AONB LGAP

The Clwydian Range AONB LGAP was initiated in 2006 with the prime aims to promote collective action to conserve, manage and enhance the Clwydian Range AONB's outstanding geological heritage, and to promote the sustainable use of its geodiversity resources for the social and economic well-being of the inhabitants and those of neighbouring areas and visitors. The funding of the Clwydian Range LGAP is a partnership between NEWRIGS; Clwydian Range AONB; Denbighshire Countryside Services, itself a partnership between Denbighshire and Flintshire County Councils; Countryside Council for Wales (CCW), and Tarmac Ltd..

The Clwydian Range AONB LGAP has seven main objectives, each explained and then summarised in separate sections. The plan can be summarised thus:

8. Ensure the continued effective conservation and management of the Clwydian Range's unique and outstanding geodiversity by the development of a sustainable management plan for the AONB (Section 1);
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    and

14. Ensure a sustainable future for the Clwydian Range AONB's Geodiversity and LGAP

The Clwydian Range AONB's LGAP is geoconservation-led, with the management and protection of local geo-heritage at the forefront.

Geoconservation, SSSI & RIGS

The range of activities concerned with conserving our geological heritage is known as *geoconservation*. It includes the protection of important geological localities – *geosites* – as well as other activities concerned with promoting the sustainable use of geodiversity resources for education and leisure activities and enjoyment. Traditionally, it has been the responsibility of government, through official bodies such as the Countryside Council for Wales, to protect geodiversity by designating **G**eological **C**onservation **R**eview Sites (GCR), **S**ites of **S**pecial **S**cientific **I**nterest (SSSI) and **N**ational **N**ature **R**eserves (NNR) (Fig. 1).

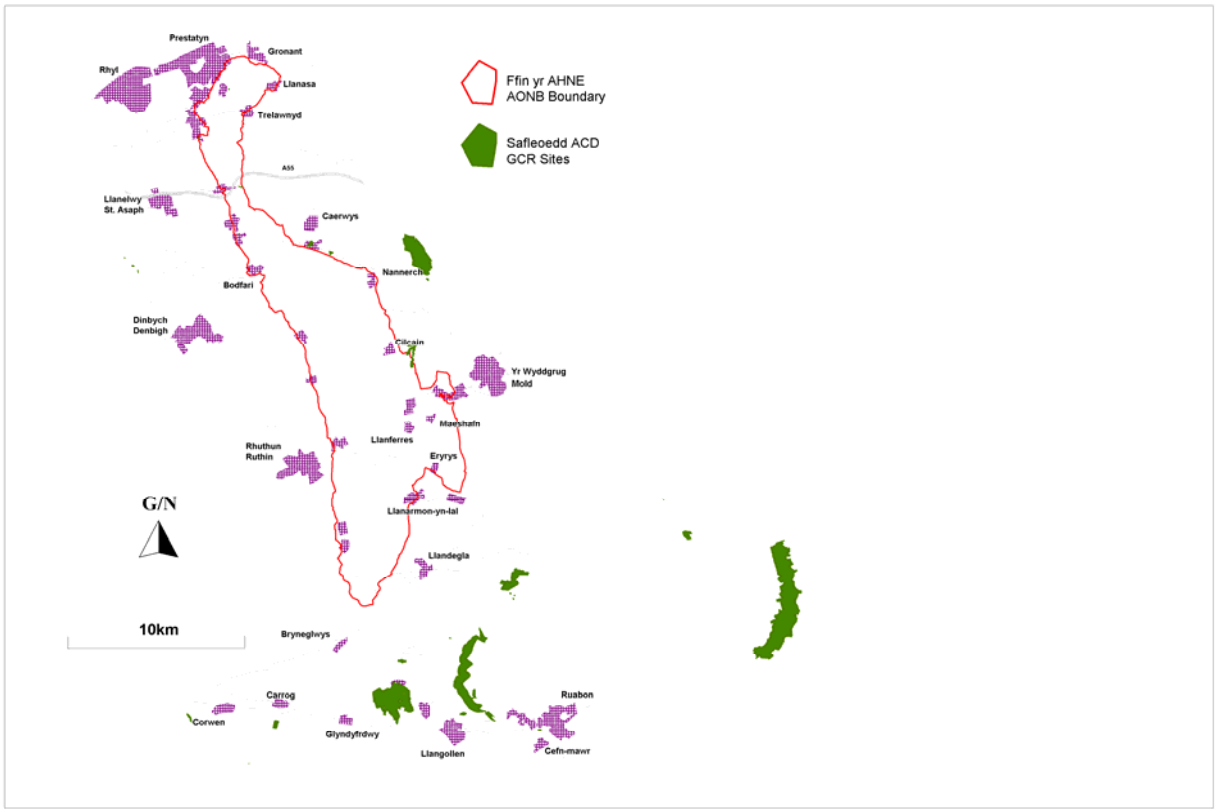

Figure 1 Geological conservation Review sites in the Clwydian Range AONB and surrounding area

In recent years however, this has been supplemented by the work of local voluntary groups who select **R**egionally **I**mportant **G**eodiversity **S**ites (RIGS). These are specially chosen sites of local and regional geodiversity importance (Fig.1). The registration of RIGS with local authorities helps to acknowledge the importance of these Earth Science and landscape features and helps to protect them for future generations to study and enjoy (Fig. 2). RIGS are the most important places for geology, geomorphology and soils outside the nationally recognised network of SSSI. Many RIGS groups operate throughout the United Kingdom, under the umbrella of the UKRIGS organisation. In Wales, groups in North East Wales (NEWRIGS), Gwynedd & Môn and Central Wales operate under a national body called the Association of Welsh RIGS Groups (AWRG). RIGS unlike SSSIs, which are designated for their scientific interest only, can be designated under 4 criteria: scientific, historical, educational and aesthetic. This allows RIGS to more closely reflect the geodiversity of an area and highlight the regional importance of a site.

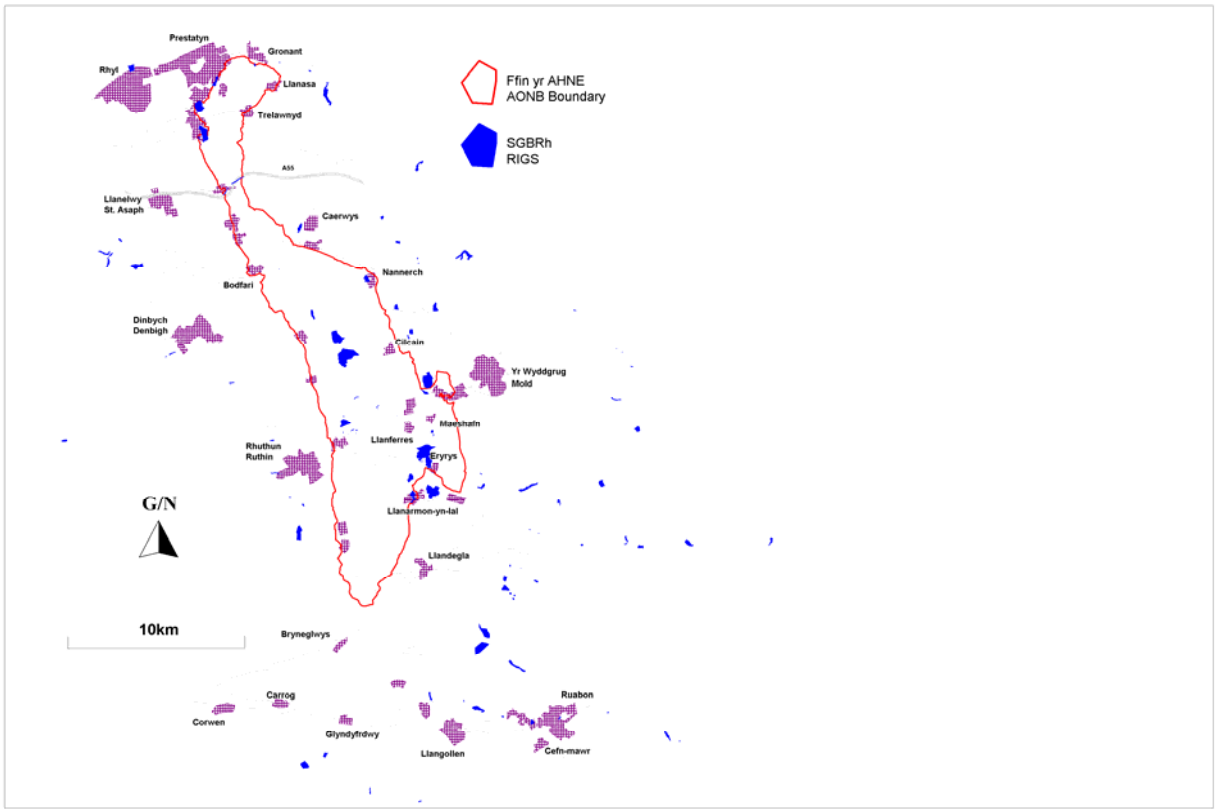

Figure 2 Regionally Important Geodiversity Sites in the Clwydian Range AONB and surrounding area.

Local Geodiversity Action Plans (LGAPs)

Although government agencies and the voluntary sector have achieved much, there is a growing realisation that everyone has a role to play in geoconservation. **L**ocal **G**eodiversity **A**ction **P**lans (LGAPs) recognise this by establishing broad local partnerships with common aspirations for geoconservation and the sustainable use of geodiversity resources. This is logical because, when considered as a resource, the geological landscape affects the lives of everyone through its influence on urban and rural development, land utilisation, *geo*tourism, leisure activities such as walking, mountain biking, climbing, exploration of caves and abandoned mines, building practice and choice of raw materials and through many other factors.

The first LGAP in Britain was produced for the Cheshire Region in 2003, and many others have since been produced. LGAPs break up the complexity of geoconservation into small, manageable actions. Responsibility for carrying out the actions is shared by members of the LGAP partnership. Partnerships have a diverse membership, with representatives from the local authority, conservation agencies and organisations, RIGS group, education, businesses, landowners and industries, to name but a few, and all bring valuable and diverse skills, expertise and points of view. The LGAP must be constantly revised to reflect progress in carrying out actions and the need to identify new priorities.

Local Geodiversity Action Plans developed from the Local Biodiversity Action Plan (ning) process but as yet there is no statutory need for such a plan. However, it is becoming increasingly clear that conservation of an area is greatly enhanced with a holistic view that take into account both the geo- and the bio-diversity and can underpin vital conservation work while increasing awareness of the importance of our geological heritage.

The geological heritage of the Clwydian Range & the Clwydian Range AONB LGAP

The Clwydian Range is the prominent range of hills in the heart of north-east Wales and became an Area of Outstanding Natural Beauty in 1985. The Vale of Clwyd and the Denbigh Moors are to the west and the Dee Valley and Cheshire, England to the east. The landscape reflects the geodiversity with the wild Denbigh Moors underlain by Silurian mudstones, the fertile Vale of Clwyd underlain by Permian-Triassic desert sandstones and overlain by glacial sands, gravels and clays (Fig 2). To the east and north are the Carboniferous Limestone hills of Prestatyn Hillside and Halkyn Mountain, the wild hills of Ruabon Mountain composed of the Carboniferous Millstone Grits and the rolling hills of the Carboniferous Coal Measures. To the south is the Dee Valley with the oldest rocks in north east Wales, the Ordovician age rocks which have been subject to several episodes of massive Earth movements (Fig.3).

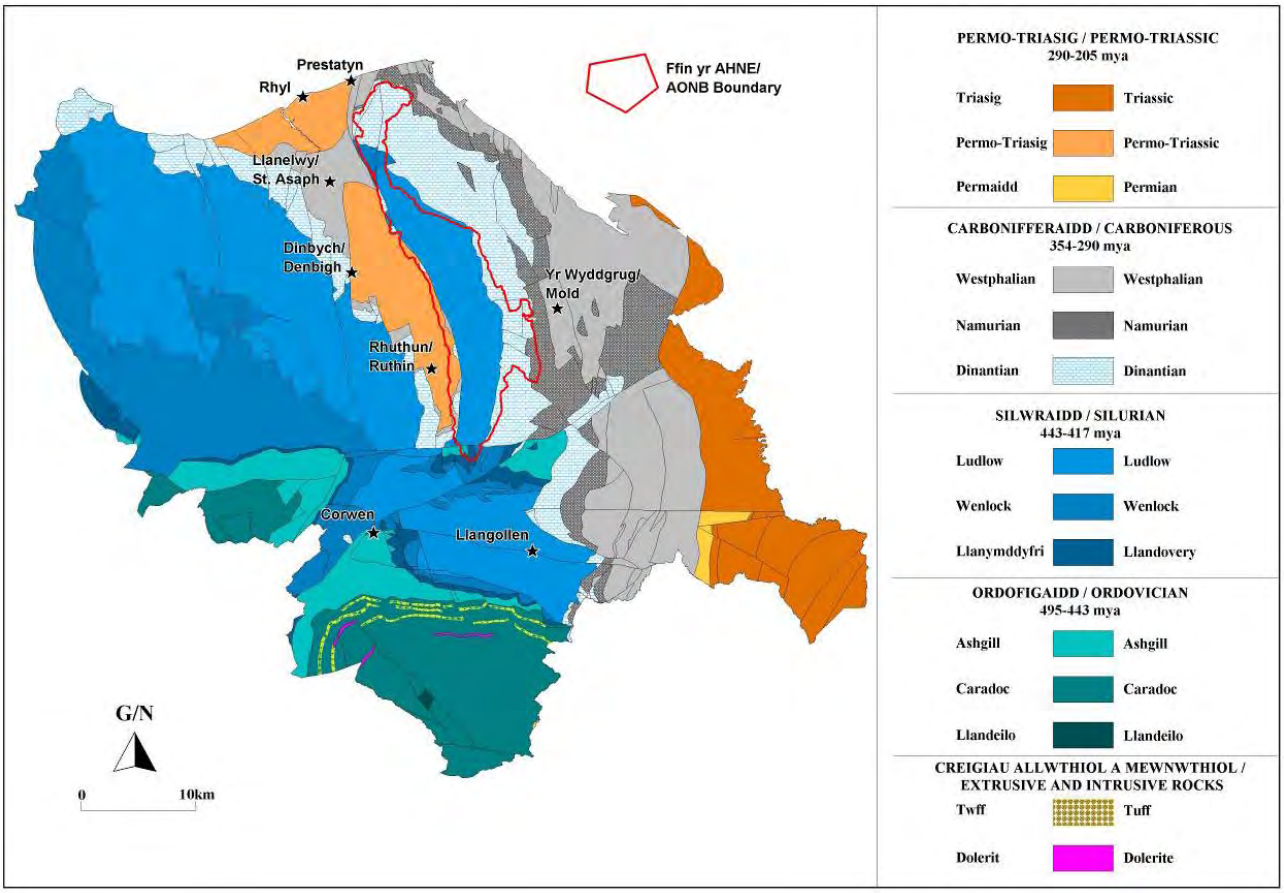

Figure 3. Solid geology of north-east Wales

The Clwydian Range has a unique and internationally important geo-heritage. There are records of Darwin visiting sites in the area while assisting The Reverend Adam Sedgwick to map the strata in North Wales. Sedgwick was Woodwardian Professor of Geology at the University of Cambridge and one of the greatest figures in British Geology. The rocks and fossils of the Clwydian Range were also studied during the late 19th and early 20th centuries by pioneering women geologists working on dating the rock by using tiny, rapidly evolving animals called graptolites. The Clwydian Range has long been a focus of interest, by research scientists and students alike. From this outstanding geo-heritage, the area derives its local and regional distinctiveness and character. As well as influencing the shape of the landscape, geology has an important impact on the built environment. Traditionally local stone has been used for buildings and consequently reflect the local geology which varies throughout the area. Geologists can help in the sourcing and matching of stone to preserve the distinctive character of the AONB(Fig. 4).

The geology of the Clwydian Range tells a story of deep-sea muds crumpled and fractured by Earth movements, shallow tropical seas teeming with life, swamps with giant mosses, vast deserts with flash floods, in addition to ice sheets carving the landscape. These environments have led to a variety of rock types which have had a major influence on our complex landscape.

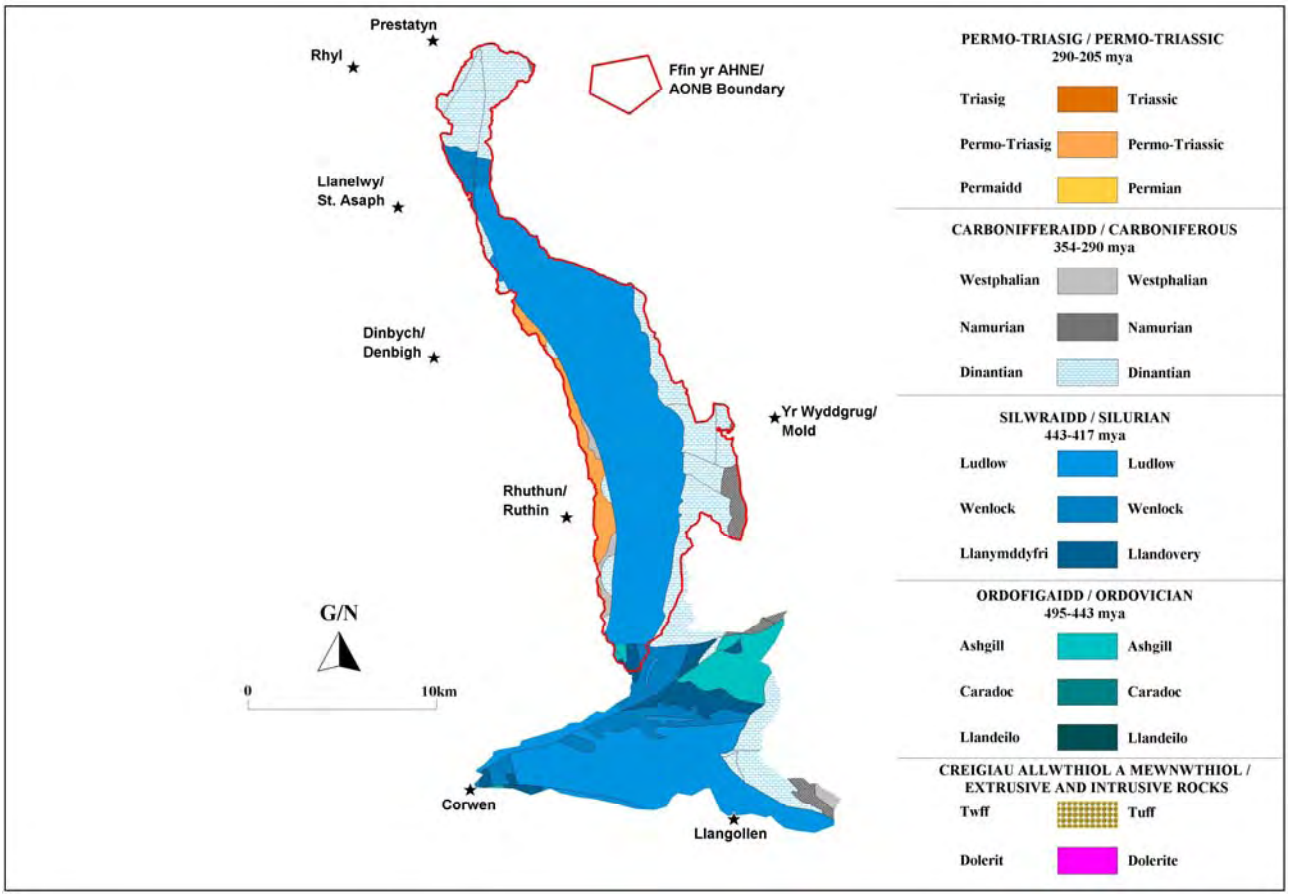

Figure 4 Solid geology of the Clwydian Range AONB and the proposed Dee Valley extension area

Rocks from the Ordovician Period in the south are the oldest in the area (some 490 million years old), and comprise deep-sea muds with layers of volcanic ash recording periodic eruptions from volcanoes that were probably in Snowdonia. The hills of the Clwydian Range are Silurian mudstones that were deposited as mud in deep-seas some 420 million years ago and have since been squeezed by Earth movements to form the slates such as those found at Horseshoe Pass. The next geological period represented in the area is the Carboniferous which began some 350 million years ago. Early in the Carboniferous Period, warm and shallow tropical seas covered much of the area depositing limestone, e.g. Prestatyn Hillside, Eryrys and Eglwyseg. Over time sea-level fell and vast rivers formed deltas along the coast, and these deposits built up to form the Welsh equivalent of the Millstone Grit Group is found on Moel Findeg and Ruabon Mountain. In the upper part of the Carboniferous swamps and vast forests developed on the deltas which ultimately led to the formation of coal deposits that underlie the northern part of the Vale of Clwyd and the coastal areas from Prestatyn to Point of Ayr and the Dee Estuary (Fig. 4).

By about 250 million years ago during the Permian-Triassic Periods, Wales was at the same latitudes as North Africa, about 20° north of the Equator and the red desert sandstones of the Vale of Clwyd were deposited.

The next important phase in the evolution of the landscape was the Quaternary Period (the last 2 million years) which has seen numerous glaciations, the most recent of which ended around 14,000 years ago. A thick ice sheet covered the area during this time, smoothing

the hills and gouging cwms and valleys. When the ice melted it left behind boulders (erratics), as well as sands, gravels and clays which can form a distinctive hummocky terrain in some areas such as the Wheeler Valley.

For more detail of the geology of the Clwydian Range see Appendix 3.

Plate 1 Bryn Alyn Limestone pavement and Moel Famau

Clwydian Range AONB LGAP

In the summary tables that follow, different coloured typefaces are used as follows:

Green typeface denotes significant omissions

Blue typeface denotes completed actions and work well under way

Red typeface denotes planned and desirable work

Violet typeface denotes a cross reference to another section

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1. Conserving the Clwydian Range AONB's Geological Heritage

1.1 Selecting geosites

Rationale

Geological sites or geosites are selected by a range of organisations to fulfil a variety of purposes. The process occurs mainly at three levels:

First; sites may be selected at the international or world level. For example, some geological sites are recognised as World Heritage sites such as the Jurassic Coast of Devon and Dorset, others may be recognised at the European level as European Geosites. The Clwydian Range AONB has no World Heritage sites or European Geosites.

Second; sites have been selected at the national, Great Britain, level by the Geological Conservation Review (GCR), using geological experts from all over the United Kingdom. These are the very best sites in Britain for geological and geomorphological research. In Britain there are approximately 4,000 GCR sites, with about 450 of these being in Wales. It is the Countryside Council for Wales' (CCW) responsibility to designate GCR sites in Wales as Sites of Special Scientific Interest (SSSI) and to notify landowners and local planning authorities of the presence of such sites on their land. Geological SSSI are legally protected like their biological counterparts (Fig. 1).

Third, sites are chosen at the local and regional level. In Britain, this has been carried out largely by RIGS (Regionally Important Geodiversity Sites) Groups and Earth Heritage Trusts. However, in some areas locally important geological sites have been selected alongside their biological counterparts as SINCs (Sites of Interest for Nature Conservation). In north east Wales (including the Clwydian Range AONB), NEWRIGS conducted an audit of RIGS between 2004 and 2006, and selected geosites of regional and local value as part of a wider RIGS survey of north and central Wales, 27 (and counting) of which are within the AONB

Whereas GCR sites are selected primarily for their scientific and research value, RIGS may be selected for historical, educational and aesthetic reasons in addition to scientific qualities. An important aspect of RIGS selection is to represent the distinctiveness and character of local/regional geodiversity. The Clwydian Range AONB's RIGS have been selected by a range of expert Earth scientists co-ordinated by North East Wales RIGS (NEWRIGS) Group and funded from the Aggregates Levy Sustainability Fund (ALSF) by the Welsh Assembly Government. Unlike SSSI, RIGS are not legally protected. Most planning authorities, including Denbighshire and Flintshire County Council, include RIGS in their structure plans, placing them on constraints registers and affording protection through the planning process. This process is ongoing as research continues.

Many other geodiversity features occur within the landscape and 'wider countryside' that are not designated for their geodiversity interest. Examples include constructions with notable geological materials, geological features occurring within other non-geological conservation designations (for example a rock exposure within a nature reserve) or geological features occurring on any land where some benefit may accrue from highlighting or managing those features. Such wider-landscape features are usually identified by other groups, individuals and partnerships. Although it is not a statutory responsibility, CCW and NEWRIGS Group traditionally have offered advice on the management, presentation and interpretation of such features where they offer opportunities for raising the profile of geoconservation.

Summary

Geosite selection

Site category	Who	What	When	Longer term
International	UNESCO; ProGeo; BIGC; JNCC	European Geosites; World Heritage Sites	No sites in the current Clwydian Range AONB. WHS application submitted for Llangollen Canal	Possible Llangollen canal Candidate site
National	JNCC; CCW; EN; SNH; geological experts	Geological Conservation Review Sites (GCR); Sites of Special Scientific Interest (SSSI)	Initial survey completed by 1991; minor revisions made 1991-2006	Site networks to be revised in rolling programme by JNCC & CCW
Regional/local	NEWRIGS Group; geological experts	Regionally Important Geodiversity Sites (RIGS)	RIGS audit completed in 2006	New sites to be added as required by NEWRIGS Group
Clwydian Range AONB	NEWRIGS Group; CCW; AONB; local partnerships	Non-designated features of geodiversity value or interest	CCW & NEWRIGS Group have responded to requests for support as required; Ongoing survey to identify potential sites & partners	Establish register & database of AONB geosites and partners

Plate 2 Eglwyseg Escarpment GCR site

1. Conserving the Clwydian Range's Geological Heritage

1.2 Notifying and registering geosites

Rationale

When geosites have been selected it is expedient to inform owners of the land on which the site lies about the nature and extent of the geological, geomorphological or related features.

When GCR sites become SSSI, it is the duty of the Countryside Council for Wales to inform the landowners, any tenants or utility companies (water, electricity, gas), statutory authorities (Environment Agency, Highways Authority, Rail companies) and local planning authorities of the 'special features of interest'. In this way, a dialogue can ensue with all the parties who have an interest in the site, and the site can then be managed appropriately to ensure the survival of the geological features in perpetuity. Local planning authorities have a duty to take due account of SSSI in any proposal/ application for development. Landowners/tenants must discuss certain planned activities (Potentially Damaging Operations) with CCW to avoid damage to the geological features on their land. In the Clwydian Range 11 out of 12 GCR sites are now notified as SSSI.

For RIGS, the process of informing landowners is a much simpler. Normally, the presence of a potential RIGS is discussed with the landowner at an early stage. This is usually during a field visit when the site's potential value is assessed by a member of the NEWRIGS Group or a geological expert co-opted by the group. If the site merits selection as a RIGS, it is rigorously documented. These documents, which include a justification of the site's selection, details of the features of interest, a boundary map and aerial photograph, are then sent to the landowner and local planning authority in a 'registration' process. Although RIGS are not legally protected, the registration process ensures a dialogue between the relevant parties over the site's management and conservation.

At present, most of the identified RIGS are registered with landowners and the Clwydian Range AONB has been notified and provided with the relevant documentation. North East Wales RIGS Group carried out an audit of RIGS in North East Wales and this was completed in March 2006. This resulted in 27 RIGS within the boundary of the Clwydian Range AONB, many more adjacent to the border of the AONB and several in the proposed extension area.

The Clwydian Range AONB currently has no internationally designated geosites. The process involved in any such site becoming official or a legal entity has therefore not yet been explored.

Wider-countryside features with geological interest do not require formal designation or notification, although a register and database of the sites would be beneficial.

Summary

Notifying and registering geosites

Site category	Who	What	When	Longer term
International	UNESCO; ProGeo; BIGC;	Formal designation of European Geosites; World Heritage Sites	None yet selected for the Clwydian Range AONB. WHS application submitted for Llangollen Canal	Possible link with Llangollen canal candidate site
National	Nature Conservancy Council (until 1991); CCW; landowners; tenants; utility companies; statutory authorities; Denbighshire & Flintshire County Councils	Legal notification of Geological Conservation Review Sites (GCR) as Sites of Special Scientific Interest (SSSI)	11 out of 12 GCR sites notified as SSSI; remainder of site series being scheduled for notification by CCW	Few expected additions to GCR register to be notified as SSSI as required
Regional/local	NEWRIGS Group; geological experts; landowners; tenants; utility companies; statutory authorities; Denbighshire and Flintshire County Councils	Registration of Regionally Important Geodiversity Sites (RIGS)	All 127 RIGS registered; by March 2006	Additional RIGS to be registered in rolling programme
Clwydian Range AONB	NEWRIGS Group; CRGP; CCW; local partnerships	Registration of Regionally Important Geodiversity Sites (RIGS)	Establish & register geosites of importance to the AONB	Maintain the register & database of geosites within the AONB

Plate 3 Bryn Alyn Limestone Pavement

1. Conserving the Clwydian Range's Geological Heritage

1.3 Monitoring geosites

Rationale

Geosites are not necessarily robust or indestructible as many assume. Geosites, of any designation, are subject to a wide range of natural processes (such as weathering and erosion) and human influences (intentional or inadvertent modifications), and their condition can vary over time. Periodic visiting to check the geosites is therefore required to ascertain if they are in a suitable condition for their intended purpose (e.g. research, education, geotourism). If a geosite reaches the relevant standard, it is said to be in 'favourable condition'.

The country's conservation agencies (CCW, Natural England and Scottish Natural Heritage [SNH]) and their co-ordinating body, JNCC, have invested much time and effort in developing protocols and procedures for checking the condition of geological sites (GCR sites/SSSI). As a result of this work, certain specific meanings pertain to the terms 'monitoring' and 'surveillance'. Here, however, for simplicity, monitoring is taken to mean any activity, however cursory or detailed, that concerns checking or ascertaining the condition of geosites. Monitoring of a geosite can thus vary from a short visit to determine if the site is still capable of fulfilling its intended use, to lengthy survey work to ascertain if all the site's features and sub-features (e.g. individual beds, fossiliferous horizons, mineral assemblages etc.) are in optimal condition. Detailed work may involve the preparation of a site management plan to identify the condition of all parts of the site and outline measures for restoring or improving the site's condition.

The principal actions involved in any monitoring scheme are:

1. Determining a timetable for visiting and checking sites. Some types of site require less frequent visits than others, and *vice versa*. For example, large upland geological outcrops in remote areas, where there are few pressures on the geological features, will require monitoring less frequently than 'honeypot' sites and walks e.g. Offa's Dyke Path and certain mine sites where, for example, there has been a history of illegal removal of mineral specimens or water-worn limestone
2. Establishing what level of monitoring is required. For example, a much-used research locality may require in-depth monitoring to establish whether all key stratigraphic and fossiliferous horizons are accessible. On the other hand, a RIGS identified for educational use may well require a straightforward check to see if it remains safe and accessible for use.
3. Establishing a baseline of site condition against which future changes can be judged. A baseline photographic survey of more than 90% of Welsh GCR sites/SSSI was carried out by CCW geologists in 1991, providing an invaluable yardstick against which future changes can be compared.
4. Identifying what remedial/restoration or enhancement works are necessary at a site. Although geological SSSI and RIGS may sometimes have different purposes, the ethos involved in monitoring the sites remains broadly similar. While CCW has carried out much work in this field, the preparation of a strategy for monitoring RIGS remains a priority. The monitoring requirements for internationally designated geosites are currently unknown, although they can be expected to be at least as rigorous as for GCR sites/SSSI.
5. Identifying potentially damaging operations (PDOs) in the management strategy for each site.

Summary
Monitoring geosites

Site category	Who	What	When	Longer term
International	UNESCO; ProGeo; BIGC;	Monitoring condition of European Geosites; World Heritage Sites	None yet selected for the Clwydian Range AONB	Candidate sites are unlikely to be designated
National	CCW Earth Science Officers	Monitoring condition of Geological Conservation Review Sites (GCR) and Sites of Special Scientific Interest (SSSI)	Baseline photo-monitoring survey of GCR sites/SSSI completed; detailed Site Management Reports completed for 26 out of 29 GCR sites/SSSI; timetable established for rolling programme of GCR site/SSSI monitoring; geological 'features' defined; 'rapid review' of a sample of sites completed to test monitoring methods; 'Common Standards Monitoring' guidance produced by JNCC; full monitoring programme to be initiated 2006 onwards; sites not reaching 'favourable condition' to be restored as required	All GCR sites/SSSI to be in 'favourable condition' by 2012; new sites added to the GCR register to fit automatically into monitoring programme; report on site condition according to government timescales
Regional/local	NEWRIGS Group; geological experts; Denbighshire Countryside Services	Monitoring of Regionally Important Geodiversity Sites (RIGS)	Baseline survey of RIGS, including photo-monitoring completed by March 2006; monitoring strategy for RIGS to be developed, including methods, standards & resources; timetable for monitoring of RIGS to be established; full monitoring programme to be initiated 2007 onwards; sites not reaching 'favourable condition' to be restored as required	All RIGS to be in 'favourable condition' by 2015; newly selected RIGS to fit automatically into monitoring programme
Clwydian Range AONB	NEWRIGS Group; CRGP; CCW; local partnerships	Monitoring of Regionally Important Geodiversity Sites (RIGS)	Baseline survey of RIGS, including photo-monitoring completed by March 2006; monitoring strategy for RIGS to be developed, including methods, standards & resources; timetable for monitoring of RIGS to be established; full monitoring programme to be initiated 2007 onwards; sites not reaching 'favourable condition' to be restored as required	All RIGS to be in 'favourable condition' by 2009; newly selected RIGS to fit automatically into monitoring programme. Establish register & database of AONB geosites

1. Conserving the Clwydian Range's Geological Heritage

1.4 Managing, restoring & enhancing geosites

Rationale

From the previous section, it is clear that the condition of geological sites can vary (deteriorate or improve) according to a variety of natural processes and human influences. Site monitoring and surveillance can help to establish whether a site is in a suitable condition for its intended purpose. Although recommendations for site restoration can stem even from a brief monitoring visit, it is more usual to produce a detailed site management plan before trying to restore a failing site to 'favourable condition'.

For GCR sites/SSSI, CCW geologists have produced a variety of documents that assess the condition of a site, detail the preferred management and outline the nature of necessary remedial and restoration works. These range from the Site Management Statement (SMS), a brief outline of the preferred management for a site shared with its owner or manager, to the full Site Management Plan (SMP), which outlines all aspects of the site's condition and required restoration works in full detail. Common problems on sites include concealment of geological exposures by processes such as vegetation growth and the accumulation of scree or talus, and man-made problems such as fly-tipping. In such cases, remedial or restoration works might include selective clearance of scrub vegetation and/or removal of talus and tipped materials. Such works on GCR sites/SSSI always involves the expert involvement of a CCW geologist working closely with the site owner or manager. An external contractor may be employed to excavate or re-expose critical strata or features, and to re-establish adequate access to the site for research. CCW has a rolling programme for such site works. These are usually carried out in winter, outside the bird-breeding season, and also when vegetation is least dense. Such works may also be carried out in advance of a major research programme when international Earth Scientists may require full access to sites. It is also common for works of this kind to be carried out by volunteers from the geological community.

For RIGS, this process has not yet been carried out systematically in Wales. In theory, such works will follow the same pattern of Monitoring and Site Management Planning followed by site restoration and works. This process will involve RIGS and other geological experts, landowners, contractors and volunteers.

A distinction is made here between site restoration and enhancement works. Restoration is taken to mean the return of a site to a condition appropriate for its intended use, whereas enhancement is taken to mean works carried out on a site to prepare it for an enhanced use, such as for site interpretation or geotourism. In the latter case, the works may be more concerned with ingress/egress at a locality or modifications to ensure the safety of visitors [see 2.3, Site owner; 4.1,Geotourism and 4.3,Site Interpretation].

Summary
Managing, restoring & enhancing geosites

Site category	Who	What	When	Longer term
International	UNESCO; ProGeo; BIGC;	Restoring/maintaining condition of European Geosites; World Heritage Sites	None yet selected for the Clwydian Range AONB; candidate sites are unlikely to be designated but; adopt methodology for GCR sites/SSSI & RIGS (below)	Ensure that any sites that may be selected are in appropriate condition
National	CCW Earth Science Officers; geological experts; landowners; tenants; land managers; contractors; volunteers	Restoring/maintaining condition of Geological Conservation Review Sites (GCR) and Sites of Special Scientific Interest (SSSI)	Site Management Reports completed for 26 out of 29 GCR sites/SSSI; Site Management Statements (SMS) produced for all sites; Site Management Plans (SMP) to be produced for all selected sites; sites not reaching 'favourable condition' to be restored in rolling programme [see also site enhancement works under 4.1, Geotourism & 4.3 Interpretation in this LGAP]	All GCR sites/SSSI to be in 'favourable condition' by 2012; new GCR sites/SSSI to be automatically restored when monitoring shows them not to be ion 'favourable condition'
Regional/local	NEWRIGS Group; geological experts; Denbighshire Countryside Servicesl; landowners; tenants; land managers; contractors; volunteers	Restoring/maintaining condition of Regionally Important Geodiversity Sites (RIGS)	Brief Site Condition Documents produced for all RIGS by March 2006; priority list of RIGS requiring restoration to be produced; site restoration strategy, including timetable & resources, to be produced [see also site enhancement works under 4.1, Geotourism & 4.3 Interpretation in this LGAP]	All RIGS to be in 'favourable condition' by 2009; newly selected RIGS to fit automatically into restoration programme
Clwydian Range AONB	NEWRIGS Group; CCW; CRGP; local partnerships	Restoring/maintaining condition of wider-countryside geodiversity features	Brief Site Condition Documents produced for all RIGS by March 2006; priority list of RIGS requiring restoration to be produced; site restoration strategy, including timetable & resources, to be produced [see also site enhancement works under 4.1, Geotourism & 4.3 Interpretation in this LGAP]	All RIGS to be in 'favourable condition' by 2009; new RIGS to fit automatically into restoration programme Establish register & database of geosites; ensure they are maintained in appropriate condition

1. Conserving the Clwydian Range's Geological Heritage

1.5 Providing advice about geosites

Rationale

The successful conservation and protection of geosites require authoritative, accurate and timely advice at all stages from site selection through to management, monitoring and restoration of sites. Here, we make a distinction between this largely internal requirement for advice, and the need to provide information about sites to others for education (Section 3), geotourism (Section 4) and more generally through appropriate records management (Section 6).

For geosites at the GCR/SSSI and RIGS levels, the requirements for advice are broadly similar. Sites are selected using the broadest range of expert advice possible. This includes experts from the Country Conservation Agencies (CCA), British Geological Survey (BGS), universities, museums, consultancies, research institutions, geological societies and associations, and relevant individuals. The GCR site register for Great Britain is maintained by the JNCC (for the CCA), which co-ordinates the addition of new sites to the register and advises on the upkeep and monitoring of the site series as a whole through its Common Standards Monitoring (CSM) guidance. The individual CCA are responsible for advising about sites within their respective territories. For example, in Wales CCW advises the Welsh Assembly Government about the management and conservation of GCR sites/SSSI. It also advises landowners and tenants about all aspects of site management (including Potentially Damaging Operations (PDO)), and informs local planning authorities about development proposals that may adversely affect these nationally important sites (casework). Although most site management issues are resolved through giving advice at the local level, more rarely CCW will provide advice at a public inquiry where the fate of a site will be decided in the public interest. CCW provides advice on geosites through its Earth Science Officers (ESO), who can co-opt more specialist advice from academic and other sources when required. RIGS groups are responsible for advising the Welsh Assembly Government, local planning authorities, landowners, tenants and other relevant bodies about geosites of regional and local value. RIGS groups can also co-opt more specialist advice when required and can give advice and evidence at a public inquiry. Because RIGS personnel are volunteers, some groups have adopted a pricing policy for giving advice to third parties such as consultancies.

No geosites in the Clwydian Range AONB are yet officially recognised at the international level (although some SSSI and RIGS occur within European Special Areas of Conservation (SAC)). There is thus no current requirement to provide specialist advice on geosites at this level. However, it is anticipated that the current infrastructure for providing advice on GCR sites/SSSI and RIGS would also satisfy the need to provide advice should there be any Clwydian Range's candidate international geosites.

Summary

Providing advice about geosites

Site category	Who	What	When	Longer term
International	UNESCO; ProGeo; BIGC; JNCC; Geo Conservation Commission; BGS; geological experts	Advising on the protection & management of European Geosites; World Heritage Sites	None yet selected for Clwydian Range AONB; current; adopt methodology for GCR sites/SSSI & RIGS (below)	Candidate sites are unlikely to be designated
National	CCW Earth Science Officers; geological experts;	Advising on the protection & management of Geological Conservation Review Sites (GCR) and Sites of Special Scientific Interest (SSSI)	Advice on all aspects of site management & development control provided by CCW Earth Science Officers, co-opting other experts as required	Continue present arrangement
Regional/local	NEWRIGS Group; geological experts;	Advising on the protection & management of Regionally Important Geodiversity Sites (RIGS)	Advice on all aspects of site management & development control provided by NEWRIGS, co-opting other experts as required. Charges may be levied for information and advice to non-partners	Continue present arrangement
Clwydian Range AONB	NEWRIGS Group; CCW; CRGP; local partnerships	Advising on the protection & management of AONB geodiversity features	Advice on all aspects of site management & development control provided by NEWRIGS, co-opting other experts as required	Establish register & database of ANOB geosites

1. Conserving the Clwydian Range's Geological Heritage

1.6 Other geo-resources (not geosites)

Rationale

Many territories have geodiversity resources other than the geosites described above. These are usually collections found in museums (such as rocks, minerals, fossils etc.) but also include sets of artwork and maps with a geological element. Another major geo-resource, skills, is considered in Section 2.4.

The principal local geological collections related to the Clwydian Range are in the Grosvenor Museum, Chester and the Millennium Eco Centre, Wrexham. There are no other local collections known at time of writing, but many of the local schools especially those teaching Earth Science amy have relevant collections. There are other collections from the Clwydian Range in several other institutions elsewhere. In Wales, for example, the National Museums & Galleries of Wales (NMGW), and in England; the British Geological Survey, Keyworth; Lapworth Museum, Birmingham & Sedgwick Museum, Cambridge; Grosvenor Museum, Chester; World Museum, Liverpool and Manchester Museum house potentially important geological specimens from the Clwydian Range. Any initiative to conserve the Clwydian Range's geological heritage must in parallel consider these resources and its wealth of geosites.

To our knowledge there has been no systematic analysis of the non-geosite resources of the Clwydian Range. This is a prerequisite to developing a comprehensive strategy for conserving these materials and integrating them with site-based resources for education and geotourism.

Plate 4 (above) Margaret Woods and Gertrude Elles, graptolite researchers in the early 20th Century.

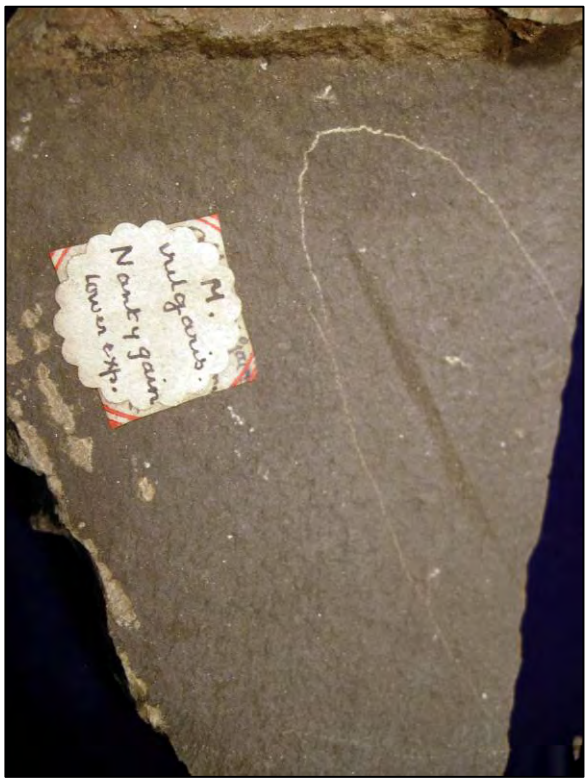

Plate 5 (right) Woods and Crosfield graptolite specimen from the Grosvenor Museum Chester Collection

Summary

Other geo-resources (not geosites)

Resource	Who	What	When	Longer term
International/ National:	1. National Museum & Galleries of Wales 2. World Museum Liverpool 3. The Manchester Museum 4. British Geological Survey	1-3. ?L. Carb trilobites (Hose.T.) otherwise not known 2. Woods and Crosfield's collection of fossils and field notebooks from Woods & Crosfield 1924	Establish scope, importance & potential usefulness of collections; develop a strategy & timetable for displaying relevant materials; NEWRIGS Group & experts to advise on identifications and best use of materials; arrange appropriate publicity for collections to maximise use for education & geotourism	Add to reference collections; encourage donations/loans of private collections; integrate with education & geotourist initiatives
Commercial collections	None known	Not Known	Establish scope, importance & potential usefulness of collections; develop a strategy & timetable for displaying relevant materials; NEWRIGS Group & experts to advise on identifications and best use of materials; arrange appropriate publicity for collections to maximise use for education & geotourism	Add to reference collection; encourage donations/loans of private collections; integrate materials with education & geotourist initiatives
Schools/Colleges	Mold Alun School, Prestatyn High, Yale College	Not Known	Establish scope, importance & potential usefulness of collections; develop a strategy & timetable for displaying relevant materials; NEWRIGS Group & experts to advise on identifications and best use of materials; arrange appropriate publicity for collections to maximise use for education & geotourism	Add to reference collection; encourage donations/loans of private collections; integrate materials with education & geotourist initiatives
Galleries; exhibition centres	1. Millennium Eco Centre 2. Grosvenor Museum, Chester	1. Books, exhibits, rock specimens, fossils, minerals, maps, reference books & site records; 2. Part of Woods and Crosfield fossil collection, displays, maps & reference books	Establish scope, importance & potential usefulness of collections; develop a strategy & timetable for displaying relevant materials; G & M RIGS Group & experts to advise on identifications and best use of materials; arrange appropriate publicity for collections to maximise use for education & geotourism	Integrate materials with education & geotourist initiatives
Private Collections	Unknown			

2. Working with partners & landowners

2.1 Clwydian Range Geodiversity Partnership (CRGP)

Rationale

Geoconservation has a long history in the United Kingdom. Its roots extend back to the late 1940s when the Nature Conservancy started to oversee the designation of the first National Parks in Britain and the development of the Sites of Special Scientific Interest (SSSI) series. Although geological features were a component of both designations, the first comprehensive and systematic review of geological sites in Great Britain was started by the Geological Conservation Review (GCR) in 1977, under the auspices of Nature Conservancy Council (NCC). However, it was not until the Wildlife and Countryside Act (1981) that it became mandatory for the NCC to notify landowners, in addition to local planning authorities, of geological sites on their land. In Wales, the NCC was replaced by the Countryside Council for Wales (CCW) in 1991. The CCW inherited the duty of notifying SSSI, including geological sites identified by the GCR. In addition to the statutory conservation of geosites, a more consensual approach began to emerge at this time with the development of the non-statutory Regionally Important Geological Sites (RIGS) scheme.

These fundamental geoconservation tools have recently been supplemented by the process of developing Local Geodiversity Action Plans (LGAPs). Fundamental to this process is the recognition that most land where geo-features occur, whether designated or not, will be owned by someone who may depend on that land for their living. Other parties (for example, utility companies, heritage trusts of one sort or another, or members of the general public) may also have interests in that land for other genuine reasons. The LGAP process also recognises that geoconservation involves a whole range of activities from the selection of geosites to managing and developing them for education and geotourism. LGAPs are thus a means of establishing a framework and strategy for geoconservation activities in a given area, where decisions are informed by an understanding of geodiversity and for establishing links with partner groups and individuals who have similar interests or aims.

Although LGAPs can be developed by individual organisations and focussed on the needs of their own operations, for example a quarrying company's LGAP to manage geodiversity features in its quarries, it is more usual for the plans to involve a range of partners with broadly similar aims. The Clwydian Range Geodiversity Partnership (CRGP) was formed in 2007 and will comprise a wide range of individuals and organisations with an interest in the geodiversity of the Clwydian Range AONB. It includes AONB officers and wardens; conservationists; planners; landowners; geological experts; enthusiasts, as well as representatives from the quarrying industry; business; tourism and education sectors, and from local government. This broad-based partnership exists to establish a long-term strategic framework for the conservation and sustainable development of the Clwydian Range's outstanding geodiversity resources. The main advantage of this approach is that the broad-base of the LGAP will ensure the widest possible ownership of the LGAP and help to ensure understanding of the needs of stakeholders and promote consensus in the action planning process.

The following table summarises the main categories of organisations and individuals involved in the CRGP and the principal reasons for their participation.

Summary

Clwydian Range Geodiversity Partnership (CRGP)

Who	Business	Main role in Clwydian Range LGAP	Main motivation & preferred outcomes
Denbighshire County Council (DCC) Flintshire County Council (FCC) through the Joint Advisory Committee (JAC)	1. Statutory planning authority 2. Tourism 3. AONB 4. Education authority 5. Regional Development	1. Have regard for geosites, and give appropriate weighting to different geosite designations in planning process 2. Maximise potential of geo-resources for tourists 3. Protect AONB & promote sustainable use 4. Maximise use of geo-resources in education 5. Promote sustainable use of Clwydian Range's resources (including geo-resources) for socio-economic development	1. Achieve sustainable development & protect geo-heritage 2. Successful integration & use of geo-resources within tourism strategy 3. Successful integration & use of geo-resources within AONB strategy 4. Satisfy curriculum requirements for field-based learning and maximise use of geo-resources in local area 5. Derive maximum socio-economic benefit from sustainable use of local geo-resources; economic regeneration 6. Maximise use & potential of geo-resources
Denbighshire Countryside Services	Management of AONB; Funding body	Enhanced use of local geo-resources & educational/community use of visitor centre; sponsorship	As above plus: Integrate geodiversity into existing projects e.g. Heather & Hillforts; N. Berwyn Way; Walking for health; Out & About; Family Fun etc
Countryside Council for Wales	Conservation; access to the countryside; government advisor; promote sustainable use, understanding & enjoyment of natural environment; Interpretation advice; Funding body	SSSI & GCR sites; promotion of RIGS; raising public awareness of geodiversity	Successful conservation, management & use of GCR sites/SSSI; sustainable use of other geodiversity resources
NEWRIGS Group	Establishment of RIGS	RIGS; raising public awareness of geodiversity; promoting educational use of geo-resources	Successful conservation of RIGS; appropriate use of regional/local geo-resources for education, geotourism & education.
Geological community (AWRG, G&M RIGS, BGS, NWGA, OUGS)	Geoconservation, education	Raising public awareness of geodiversity Promoting educational use of geo-resources	Accessible geosites for research & lifelong learning
Industry (quarrying) inc. small scale quarry operators and the Quarry Products Association (QPA)	Extraction of raw materials (e.g. Tarmac, Heidelberg, Lafarge – limestone; Funding body	Expertise & local knowledge; sponsorship Develop social & educational potential of extractive sites; sponsorship	Demonstrate social responsibility & enhance public image
Denbighshire LBAP Partnership	Management and monitoring of biodiversity in Denbighshire	Local knowledge; awareness of developments at grass-roots level	Successful conservation, management; sustainable use of other resources integrating bio- and geodiversity
Forestry	Forestry management	Major landholdings; site knowledge; site & visitor	Sustainable development of forest resource; maximise

Commission		management	potential of geo-resources within forestry landholdings
Cadwyn Clwyd	Rural development Funding body	Sustainable rural development	Realise the full potential of geo-resources in achieving sustainable rural development
Trusts (Archaeological (CPAT), Cadw & Wildlife) *	Heritage conservation	Ensure archaeological & wildlife issues & sensitivities are taken into account	Maximise use of geo-resources on wildlife & archaeological sites (when of mutual benefit) without compromising these heritage resources
Universities, Colleges, schools & other educational organisations e.g. OCN *	Research & education	Geological expertise; major user of geosites and geo-resources	Accessible geosites for research & education; innovative published research
Environment Agency & Welsh Water *	Environmental & water resource management	Local & site knowledge; owner of utilities & land	Maximise socio-economic benefits of geotourism without damaging water resources
Landowners	Farming, small businesses, accommodation	Involvement in site & visitor management	Maximise socio-economic benefit; minimise adverse impacts
Local Businesses	Various (shops, outdoor leisure pursuits, hotels, B & B, pubs	Provision of possible outlets for geo-tourist materials; knowledge of local markets & conditions. Tailored materials e.g. 'geobike' trails	Socio-economic benefits
N. Wales Tourist Board*	Leisure activities; Long distance paths e.g Offa's Dyke path	Research data on what visitors do/want Knowledge of possible outlets for geo-tourist materials; knowledge of local markets & conditions	Maximise geotourism potential New market for tourists New attractions
National Trust/CPRW	Conservation of built & natural heritage within landholdings	Major landowner & manager of heritage sites with significant geo-resources	Maximise use of geo-resources on landholdings without compromising other heritage interests
Community Councils *	Local issues; management of communities	Local knowledge; awareness of developments at grass-roots level	Maximise use of geo-resources at local level; maximise socio-economic benefits; minimise adverse impacts of developments
Community groups e.g. historical & civic societies,	Local and sensitive issues	Local knowledge; awareness of developments at grass-roots level	Maximise use of geo-resources at local level; maximise socio-economic benefits; consensus on what is effective
Politicians *	Elected representatives	Democratic representation at local, national & international levels	Protection of the environment; economic regeneration; innovative showcase projects
Individual partners	Personal	Expertise	Altruism; a better Clwydian Range
Farmers, FUW *	Agriculture; farming	Involvement in site & visitor management	Maximise socio-economic benefits of geotourism without damaging farming interests
Leisure businesses*	Walking, cycling, climbing	Local knowledge	Socio-economic benefits

* Potential & desirable partners
* Significant omissions
* Completed actions or work well under way

Plate 6 ‘Genius Geology’ fossil hunt to Cefn Mawr Quarry which is owned by Castle Cement

Plate 7 Denbighshire ‘Out and About’ walk to Moel Hiraddug

Plate 8 Scientrific, Wrexham

2. Working with partners & landowners

2.2 Clwydian Range AONB LGAP Project

Rationale

The Clwydian Range LGAP is an innovative project to establish the first LGAP for an AONB in Wales. The first ideas for this project arose during the north east Wales Geodiversity Audit conducted by NEWRIGS and grant aided by a partnership between Aggregates Levy Sustainability Fund for Wales, NEWRIGS and Tarmac.

During this audit, many RIGS were identified within the existing boundary of the AONB with many others in the proposed extension area and adjacent to the AONB.

The landscape of the Clwydian Range AONB and the proposed Dee Valley extension area has a wealth of Earth science features and sites that are an essential part of the distinctive character of the area. Their importance extends beyond the boundaries of the AONB and is key to engaging local landowners and residents with their environment.

The Clwydian Range AONB LGAP will encourage local landowners to become a part of a strong coalition of like-minded partners. This broad-based partnership will establish a long-term strategic framework for the conservation and sustainable development of the Clwydian Range's outstanding geodiversity resources. Many of the geodiversity resources in the AONB are on land in private ownership, although they may be 'open access' land it is important that the views of land owners are incorporated into the LGAP.

It is of paramount importance that the language used in letter, publications and workshops is free of jargon and is understandable

Plate 9 View from lane above Pistyll Gwyn Quarry

Summary

Clwydian Range AONB

Category	Main attributes	Work completed/ongoing	Main projects to develop	Long term aim
Geodiversity resources	Diverse geology from Ordovician to Quaternary	SSSI/GCR sites & RIGS identified & documented;	Geodiversity features local level to be identified	Establish an integrated network of sites
Partnership resources	Numerous organisations & individuals with expertise & similar aspirations (see 2.1); major political backing	Clwydian Range Geodiversity Partnership set up; short-term funding (3 years) procured;	3-year work plan to be written Secure longer-term funding; develop strategies & policies (see below)	Establishment of a permanent LGAP structure
Management & protection of geo-resources	Legal protection for SSSI/GCR sites, AONB; existing planning policies for RIGS & wider countryside features	Most GCR sites legally notified as SSSI; all RIGS notified	Ongoing site survey & notifications	All sites protected by suitable mechanisms
Geotourism	Existing tourism infrastructure including roads, paths, organisations, hotels, B & B; visitor numbers, visitors from abroad (esp. for Eisteddfod), Liverpool, Manchester, Chester	Circular walks based on Offa's Dyke Trail, Earthcaches	Develop geotourism strategy; develop products & facilities Make DCS offices in Prestatyn, Loggerheads & Llangollen part of network of Information points Information & awareness at TICs	All geosites suitably interpreted; appropriate publications & web products for trails & attractions, catering for all abilities
Education	Huge potential for schools & colleges to use geosites & other geo-resources; existing curricula require geo-resources & geosites	CCW/RIGS education pilot project in progress; all curricula requirements for geo-resources being assessed; draft strategy for educational use of Clwydian Range's geosites being prepared which can be adapted for use in the Clwydian Range AONB	Develop education strategy; develop suitable products & facilities for suitable sites; local (& visiting) schools and outdoor education centres to be consulted over their geo-resources requirements; develop worksheets & web-based products for schools as required	Comprehensive range of safe & accessible geosites & geo-resources available to schools & colleges; comprehensive site-based worked sheets & generic materials available (also on web); suitable materials for all ages & abilities
Economic regeneration	Predominantly agricultural economy dependent on development of tourism; Small market towns on borders with small	Flagship projects & ongoing work needed (Cadwyn Clwyd, Denbighshire & Flintshire CCs; AONB)	Coordination and free flow of information between funding bodies and organisation to	Additional jobs; better standard of living

	industry including 'new technology' many small rural craft industries that can be up-scaled & diversified; active existing programme of funding & regeneration; existence of rural development agency (Cadwyn Clwyd)		ensure a holistic view and prevention of repeated effort. Encouragement of geotourism with leisure industry e.g. hill walking mountain biking, climbing & caving	
Policy development	Comprehensive array of organisations in place to protect environment & promote economic regeneration	AONB Strategy; local planning policy & structure plan in place		Ensure that geosites & geo-resources are fully integrated & explicit in existing government & local government policies

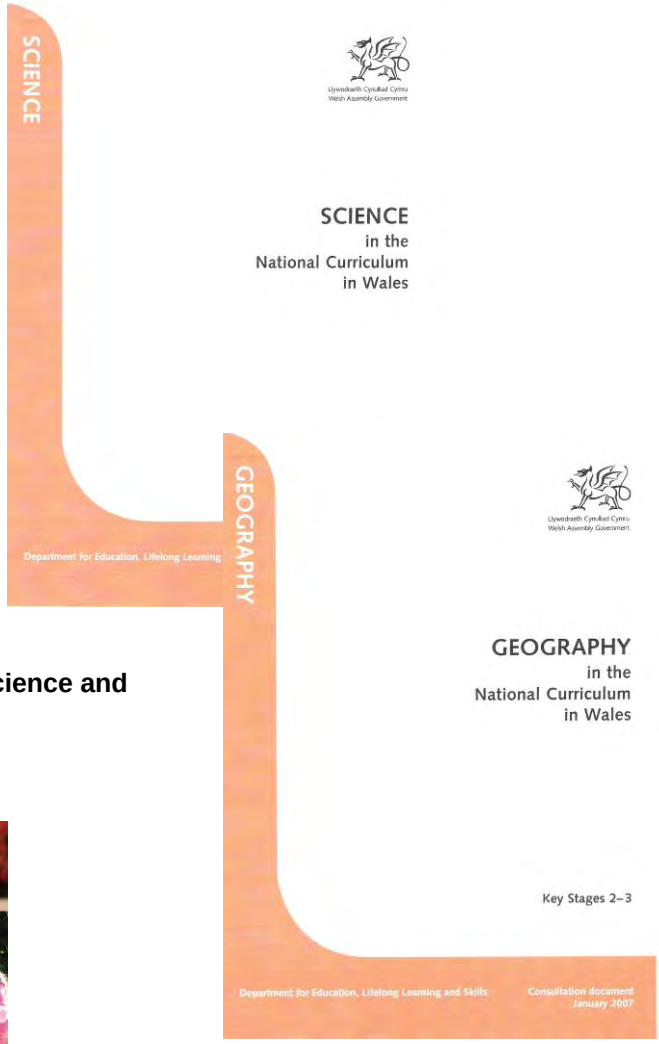

Plate 10 (above) CCW Education project report
Plate 11 (right) Welsh National Curriculum Science and geography subject orders

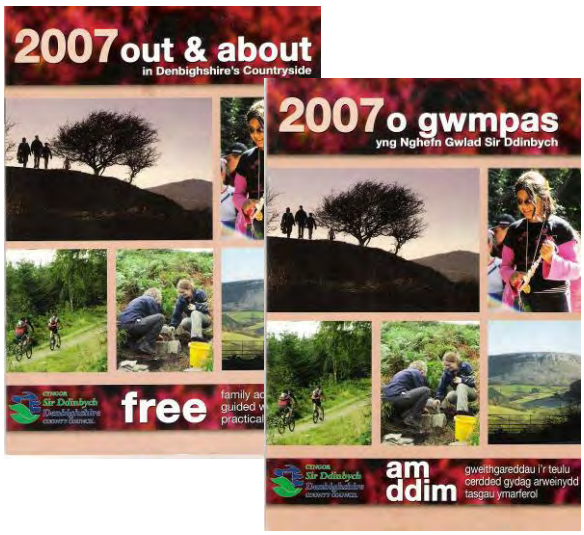

Plate 12 (left) Denbighshire out & about leaflet

Plate 12 Cilcain Church built with a wide variety of local and imported stone

Plate 13 School children learning about rocks and quarrying at Arden Early Learning, Aberduna Quarry

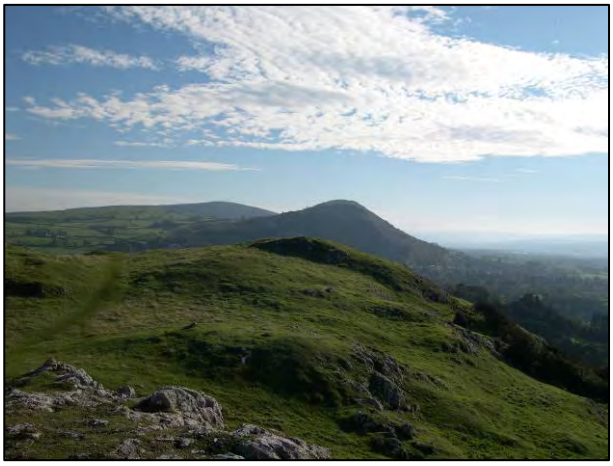

Plate 14 Moel Hiraddug, Vale of Clwyd and North Wales coast from Prestatyn Hillside

Plate 14 Capped lead mine shaft, Eryrys

Plate 15 Crumpled Silurian sediments of Penycloddiau

2. Working with partners & landowners

2.3 Site Owners

Rationale

Owners of geosites are fundamentally important in the process of geoconservation. The notification and registration of geosites is dealt with in Section 2.1, and sections 1.3 to 1.5 also involve considerable interaction with the owners of geosites. A distinction was made in Section 1.4 between the restoration of geosites and site enhancement. The latter is taken here to mean the preparation and development of a geosite for an enhanced use such as geotourism and education, and this cannot take place without the consent and detailed involvement of the site owner.

There are numerous types of site owner, from a small private landowner who may have a single geosite on their land, to large land-holding estates who may possess many geosites of different types (e.g. RIGS & SSSI). Some authorities have significant land-holdings of a particular type, for example, land held by the Crown Estate Commissioners. Such land may contain several geosites, and in such cases it may be beneficial to establish a comprehensive management plan for geodiversity features within that ownership. The same is true for quarry owners who may have geosites which are active quarries or ceased or inactive and in the process of being restored. Again, a company LGAP, such as the Hanson Company (now part of HeidelbergCement) Local Biodiversity Action Plan (LBAP) & LGAP has potential for ensuring that such geodiversity features are managed, restored, enhanced and developed in a strategic way. The same may be true for other large land-holding interests such as the National Trust, various utility companies, conservation trusts and bodies such as The Forestry Commission. With all of these the LGAP consultation process affords the means of establishing a dialogue between site owners and other interested parties, and establishing common areas of interest that can be developed.

Certainly, projects such as the Clwydian Range AONB LGAP cannot be realised without the full participation and agreement of site owners. At the same time, flagship projects such as this offer the possibility of economic regeneration as an incentive for site owners to become fully involved.

Priorities for working with site owners include completing the registration of RIGS (Section 1.2) and establishing from site owners what information and data about their geosites they require and also feel should be released to the planning authorities and general public. Similarly, it will be necessary to establish from owners which geosites can be developed for education and geotourism uses, and for explicit inclusion in publicity materials. Some sites, for example, may require improvements for improved access and safety.

The following summary table shows some of the main types of site owner with in the AONB, but is illustrative rather than totally comprehensive. All important geosites will require the same level of interaction with site owners over a similar range of issues. Many geosites (non-designated) in the countryside may indeed be identified by their owners and other local interest groups (such as Community Councils).

Summary

Site owners

Site category	Who	Work complete/in progress	Work to do	Longer term
International (e.g. World Heritage)	As below	Sites not yet identified	Sites not yet identified	Candidate sites may be identified & designated
National (e.g. SSSI/GCR sites)	Multiple geosite owners (e.g. large estates; Flintshire & Denbighshire County Councils)	Most sites notified to owners & local planning authority by CCW; Site Management Statements produced & agreed with owners; Management Agreements in place as required	Establish if owners content for site information to be released (e.g. for web); establish if site can be used for geotourism & education; negotiate arrangements (see Section 4)	Ensure that all geosites are protected & appropriately managed; ensure that all appropriate site information can be released; ensure that all suitable sites are used for geotourism & education
	Single geosite owners (e.g. farms)	As above	As above	
	Quarry companies (e.g. Tarmac, Hanson)	As above	As above; Encourage development of company LGAPs	
	Trusts (e.g. Wildlife)	As above	As above	
	Utility companies	As above	As above	
	National Trust	As above	As above	
	Crown Estate Commissioners	As above	As above	
Regional & local (e.g. RIGS)	Multiple geosite owners (e.g. large estates; Denbighshire and Flintshire County Councils)	Clwydian Range RIGS registered; completed March 2006	Establish if owners content for site information to be released (e.g. for web); establish if site can be used for geotourism & education	Ensure that all geosites are protected & appropriately managed; ensure that all appropriate site information can be released; ensure that all suitable sites are used for geotourism & education
	Single geosite owners (e.g. farms)	As above	As above	
	Quarry companies	As above	As above; Encourage development of company LGAPs	
	Trusts (e.g. Wildlife)	As above	As above	
	Utility companies	As above	As above	
	National Trust	As above	As above	
	Crown Estate Commissioners	As above	As above	
Wider countryside (non-designated geosites)	Multiple geosite owners (e.g. large estates; Crown, Grosvenor, County Council)	Extent & nature of features not yet known	Full survey required	Maximise potential use & benefit of non-designated geosites for education & geotourism
	Single geosite owners (e.g. farms)	As above	As above	
	Quarry companies	As above	As above	
	Trusts (e.g. Wildlife)	As above	As above	
	Utility companies	As above	As above	
	National Trust	As above	As above	
	Crown Estate Commissioners	As above	As above	

2. Working with partners & landowners

2.4 Other geo-resources (skills)

Rationale

Although geological and conservation skills are inevitably at the forefront of any LGAP process, they are by no means the only skills available or required. Partnership working increases the range and depth of skills available, and this is particularly true for the Clwydian Range Geodiversity Partnership (AGP) the partners of which bring an unusual diversity of skills, knowledge and experience (Section 2.1).

The geological expertise for the Clwydian Range AONB LGAP is provided primarily by members of the North East Wales RIGS (NEWRIGS) Group and by CCW Earth Science Officers who, between them, cover many important geological and geomorphological disciplines. In addition, a wide range of specialist geological expertise can be co-opted from members of the academic community, commercial consultants (e.g. Tarmac, Robertson Research & Hanson) and neighbouring RIGS groups (e.g. Gwynedd & Môn & Central Wales RIGS groups).

Other partners, including landowners, utility companies and trusts (including The National Trust) are experts in land and asset management and farming. Many landowners also have business experience and are involved in rural crafts. Denbighshire and Flintshire County Councils are the statutory planning authorities and have access to vast reserves of local information about landholdings, planning policy and plans for economic regeneration. Similarly, Community Councils have detailed local knowledge that is central to the successful development of geotourism initiatives. Cadwyn Clwyd has a proven track record of managing rural regeneration projects and procuring European and other funds. Some of the bigger organisations in the partnership can also help with the provision of IT and GIS skills.

The successful operation of the CRGP depends on this blend of skills and knowledge, and it follows that partners' roles in the CRGP stem not only from the skills and knowledge they bring, but also from what they want the partnership to deliver and achieve (see summary in Section 2.1). With this in mind, the following table summarises some of the main skills found among members of the CRGP. It is illustrative rather than comprehensive.

(Other geo-resources, not skills or geosites, are considered in Section 1.6 - for example museum and other *ex situ* collections.)

Plate 16 Investigating Ordovician sediments

Summary

Other geo-resources (skills)

Who	Business	Skills/experience	Projects & roles
Denbighshire & Flintshire County Councils (DCC & FCC)	Local government; including planning & education authority DCC has responsibility for the management of the AONB Flintshire has responsibility for mineral planning in the AONB	Extensive local knowledge; repository of local information; specialists in education, planning, tourism, economic regeneration;	Geotourism; education; planning control & policy; project management; integrating geo-resources with ongoing projects & publications
Countryside Council for Wales	Conservation; access to the countryside; government advisor; promote sustainable use, understanding & enjoyment of natural environment	Geology; geoconservation; conservation science, policy & practice; GIS; IT; publications	Geology; geoconservation; geotourism; GIS database management; geotourism; project management
Environment Agency & Welsh Water *	Environmental protection; water supply	Land & resource management	To be identified
NUW *	Farming	Local knowledge; land management	Management & development of geosites
Forestry Commission	Forestry management & economic use of forest resource	Site management; owner liaison	Geotourist development of sites within ownership
NEWRIGS Group	Geological conservation	Geology; geoconservation	Site selection; geotourism; publications; project management
Individual partners	Various	Various (e.g. IT; legal; marketing)	Production of marketing strategy; upkeep of databases; dissemination of information
Landowners	Various, including farming & economic activities	Farming; small businesses; local crafts; land management	Development of businesses & crafts supported by geotourism; management of geosites
Local Businesses	Various economic activities in including tourism, leisure, accommodation, IT	Various	Project management; marketing; event management
Cadwyn Clwyd	Rural development & project management	Project management; ecology; tourism; local regeneration; funding	Project management & co-ordination; provision of secretariat; funding applications
Tourism	Showcasing area as destination for leisure/landscape/wildlife/rural crafts/art etc	Promotion, event management, visitor management, coordination of events	Promotion, event management, visitor management, coordination of events
National Trust	Heritage conservation & management	Land, site & visitor management	Development of associated geo-resources (e.g. the geological aspects of coastal landholdings & other sites)
Community Councils *	Local issues; Community Council business; local planning	Knowledge of local conditions, issues & priorities	Identification of wider-countryside geosites; identifying & initiating local community projects; establishing local trails & walks; trail guides
Politicians	Elected representatives	Presentational & lobbying skills	Figureheads; catalysts; communicators
Quarries & mines	Extracting & processing rocks & minerals	Site management; quarry products &	Development of associated geo-resources (e.g.

		processes; aggregates; engineering geology	integrating geodiversity information with site operations; open-days; develop company LGAPs; schools resources packs)
Teachers	Education	Site users; knowledge of requirements of curriculum; potential users of products	Joint development of educational materials (e.g. worksheets, trails etc.)
Trusts (Archaeological & Wildlife)	Specialists in Conservation	Archaeology; flora & fauna; historic landscapes; cultural traditions	Development of associated geo-resources (e.g. the geological aspects of archaeological monuments & sites)
Universities & Colleges	Education & research	Geology; oceanography; soils; archaeology; biological sciences; course design; life-long learning; research programmes; marketing	Specialist research & geological advice; joint publications for higher education

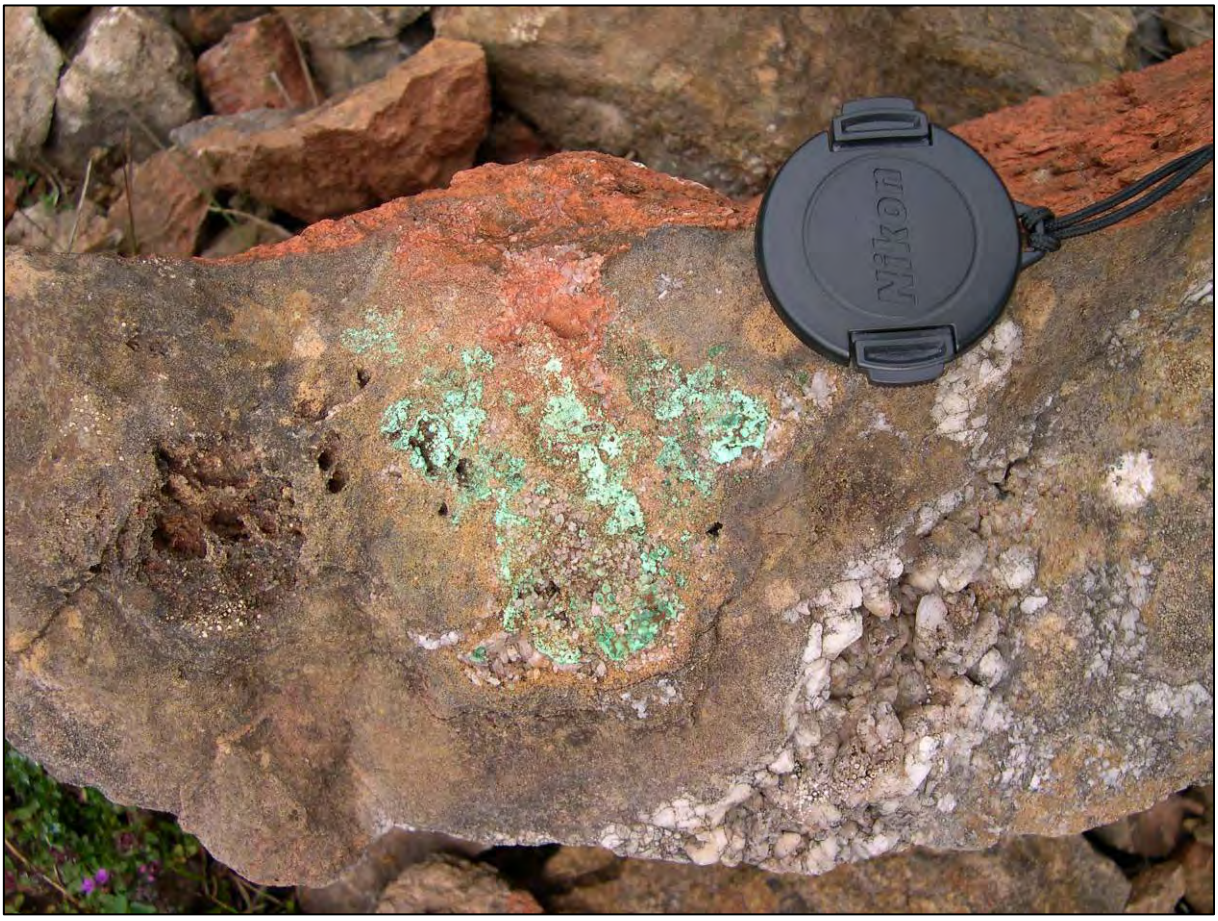

Plate 16 Copper ore, Moel Hiraddug

3. Education

3.1 Pre-school & Primary education
3.2 Transition
3.3 Secondary & Tertiary education
3.4 Higher education
3.5 Life-long learning

Rationale

Education is one of the most important elements of the Clwydian Range AONB LGAP. The teaching of geology has declined over the years to such an extent that many universities, colleges and schools no longer include geology in their courses or curricula. However, recent shortages in geologists for the economic and commercial sectors, particularly the oil and gas industry, have provided a much-needed wake-up call. Attempts to reverse the decline have started with the Earth Science Education Unit (ESEU) at Keele University developing geological INSET (In-Service Training) days to equip teachers with more effective geological teaching skills and the Earth Science Education Forum-Cymru Launched By 1st minister Rhodri Morgan in January 2006 . It is hoped that stimulating interest among teachers will herald a dramatic improvement in the numbers of students, at all ages, wishing to study geology and related disciplines. At the same time, the Clwydian Range AONB has an outstanding resource of geosites which is currently massively underused, and clear economic reasons to attract more visitors to the area. One of the chief aims of this LGAP is to promote the sustainable use of the Clwydian Range's geosites for education and geotourism. Although many educational products and methods can also be used to promote geotourism in the broadest sense, this LGAP deals with education and geotourism as separate strands. There needs to be a consideration for the needs of Welsh Language schools. To this end, published materials will be translated. Education is considered here in four formal divisions.

3.1 Pre-school & Primary education

This covers ages 3-11 years, "The Learning Country" and Key Stages 1 & 2 in the National Curriculum. Although challenging, this is one of the most important educational elements to tackle: children enthused with geology and related subjects at an early age have greater opportunity for developing their interests as their education progresses. The CCW/RIGS pilot study to find out what local schools and teachers require in the way of field and other geodiversity resources, has identified the Loggerheads Country Park and visitor centre as the principal opportunity to develop educational resources based on local geosites and materials. A 'Genius Geology' Club' akin to the already established 'Awesome Archaeologists' Club' is also proposed which will also cater for up to 16 year olds.

3.2 Transition education

This covers the transition from primary to secondary school. Teachers agree that enabling children to make a smooth learning transition between Years 6 and 7, i.e. KS2 to KS3, is desirable, but to set up useful and manageable systems can be challenging. The Welsh Assembly Government, Science in the National Curriculum in Wales programme of study across Key Stages 2 and 3 states they should ' follow the same structure with the same generic skills being relevant and integral to the whole range to create maximum choice and flexibility in a broad and balanced curriculum'.

The Skills section now includes Scientific Enquiry and teaching of Earth Sciences is an ideal subject to enhance pupil's skills of Developing thinking, Communication, Number and ICT. In addition, types of enquiry will be highlighted which differ from the traditional fair

test enquiry, for example: predictions, observations and hazards, which will guide teachers to a wider range of enquiry.

This LGAP is will develop, in conjunction with primary and secondary teachers a range of materials that will bridge the gap between KS2 and KS3. The materials will be field-based and cross-curricular. Key Stage 3 materials will build on skills developed at KS2. The section on 'Sustainable Earth' and 'Independence and interdependence of organisms' have an overarching statement or aim to enable the 'big picture' to be demonstrated with several sections that can be taught using Earth Science as the vehicle.

3.3 Secondary & Tertiary education

This covers ages 11-18 years, Key Stages 3 and 4 in the National Curriculum, and the newly introduced Welsh Baccalaureate qualification. The requirements for geosites and geodiversity materials stem both from the science and geology elements of the curriculum, and include GCSE geology and A-level geology. Initial proposals include the development of worksheets, publications and web-based materials for the Prestatyn, Loggerheads and Eglwyseg areas in conjunction with the Chief Examiner of the Welsh Joint Education Committee (WJEC). All RIGS have been assessed for their suitability as field sites for education at this level.

3.4 Higher education

The Clwydian Range and the proposed Dee Valley extension area have long been used by universities all over Britain for the teaching of geology as a field science. Although this use has declined perceptibly in recent years (with the advent of cheap flights to geological study areas abroad, precipitated by the Foot & Mouth epidemic), many geosites are still used regularly for geological teaching, and by students learning geological mapping techniques. An aim of both the LGAP is to increase this use, and encourage more university parties to stay longer. We need to find out which universities are using the AONB already, which sites they are visiting and the type of information (scientific booklets, guides & trails; details of local accommodation etc.) that would be useful to university students and lecturers. Maximising the use of geosites (particularly GCR sites/SSSI & RIGS) for scientific research and publication is also an aim of the LGAP.

3.5 Life-long learning

Life-long learning is a growing element of education provision, and encompasses a highly diverse range of ages, abilities and social backgrounds. It includes formal provision in the form of courses run from educational establishments e.g. Open University, and informal provision in the form of events, presentations, Earthcaches and publications facilitated by societies, clubs and trusts. It is one of the 'markets' targeted by the growing series of RIGS geological town-trail publications and RIGS-led field trips and events. It is important that the production of life-long learning materials is dovetailed with the strategy for geotourism products (Section 4).

Summary
Education

Education	Ages	Requirements	Provision
Pre-school & Primary Education inc. Welsh language schools Foundation 3-5 KS1: 5-7 yrs KS2: 7-11 yrs	3-11 yrs	1. Use the results of CCW pilot project to establish the field-based and classroom Geodiversity resources required by schools in North Wales, particularly with respect to curriculum specifications & teachers' needs; 2. Establish requirements of schools outside North Wales; 3. Produce educational strategy for use of Geodiversity resources	1. Develop field-based Geodiversity projects with Loggerheads for schools using visitor centre: a) Web-based introductory information & CD-roms; b) Selected worksheets & experiments based on Geodiversity around visitor centre (e.g. quarries, soils, local walls etc.); 2. Establish local trails (as requested) for primary schools; 3. Develop other materials for teachers as requested. 4. Establish a 'Genius Geology' club in partnership with Rockwatch, Chester Grosvenor Museum
Transition from Primary to Secondary Education		As above Use WAG Science Subject Order Science in the National Curriculum in Wales KS 2-KS4	The materials will be field-based and cross-curricular. Key Stage 3 materials will build on skills developed at KS2. As above
Secondary & Tertiary Education KS3: 11-14 KS4: 14-16 KS5: 16-18 (6th form)	11-18 yrs	As above	1. Develop suitable sites & materials (e.g. worksheets) for WJEC Key Stage 4: Science Assessment in Geology; 2. Develop Key Stage 4 & A-level teaching materials for geology of the Clwydian Range with local A level teachers and Chief Examiner, Peter Loader; 3. Develop other materials for teachers as requested.
Higher Education	18+	Establish requirements; incorporate findings in educational strategy for use of Geodiversity resources on Clwydian Range AONB	1. Develop database of Clwydian Range geosites used by universities for teaching, student fieldwork & research through Committee of Heads of University Geosciences Departments (CHUGD); 2. Develop partnership & strategy with CHUGD & individual university geoscience departments for increasing use of Clwydian Range geosites; 3. Develop field guides, trails, web & site interpretation materials based on 1 & 2 (above).
Life-long Learning	16+	Establish requirements; incorporate findings in educational strategy for use of Geodiversity resources on Clwydian Range AONB	1. Develop publications & other materials for 'Key Skills of Life'; 2. Develop RIGS field & workshop programme to support life-long learning; 3. Develop further links with Open University for using Clwydian Range geosites; 4. Develop web & CD-rom materials advertising Clwydian Range Geodiversity; Develop geological trails and a series of Earthcaches 5. Dovetail life-long learning materials with geotourism strategy and products (Section 4).
General including outdoor education centres e.g. Colomendy	Various	Establish requirements; incorporate findings in educational strategy for use of Geodiversity resources of the Clwydian Range	Develop links with schools in NW Wales, Cheshire, Shropshire, Lancashire, Liverpool & Greater Manchester to encourage use of the Clwydian Range's geosites; Develop strategy with Liverpool C. C. and Kingswood at Colomendy Centre for improving geodiversity-based education in the Clwydian Range (local Welsh & English schools).

4. Promotion and development of the Clwydian Range's outstanding geodiversity

4.1 Geotourism
4.2 Marketing & publicity
4.3 Site interpretation & trails
4.4 Publications, the web & CD-ROMs
4.5 Events & workshops

Rationale

4.1 Geotourism

Here, geotourism is considered separately from education (Section 3), although there is a considerable overlap, and many 'geotourism' products have educational use and *vice versa*. This theme also overlaps with Section 6 – 'Managing information'.

Geotourism is nothing new. Many European countries, America, Canada, Australia and New Zealand, south and Central America among others, have a long history of using geological and geomorphological phenomena to attract visitors – for example, the Grand Canyon, Bryce & Zion and Yosemite National Parks and the waterfalls and geysers of Yellowstone National Park. The concept is of 'tourism that sustains or enhances the geographic character of a place—its environment, culture, aesthetics, heritage, and the well-being of its residents'. National Geographic has published a Geotourism Charter

Neither is geotourism new in Britain or Wales. For instance, Siccar Point, on Scotland's eastern shore, and "Hutton's Section" in Holyrood Park in Edinburgh and the Jurassic Coast of southern England. However, the potential of geosites in Wales for geotourism has not been realised. It is therefore a major aim of the Clwydian Range AONB LGAP to improve the economic health of the area and its inhabitants by attracting more visitors to its outstanding geosites. There are huge potential visitor 'markets' in Cheshire, Shropshire, Lancashire and densely populated, Liverpool and Greater Manchester. These areas furnish the Snowdonia National Park, beyond the Clwydian Range, with some of its 18 million visitors each year. It is also an aim to encourage local people to use, explore and learn from the geological heritage on their doorstep. Such development must have due regard to the conservation and protection of geosites and related features (e.g. Scheduled Ancient Monuments, historic landscape, quarries, mines and wildlife sites), must be acceptable to landowners and must be sustainable and have adequate parking facilities. Such geotourism developments need to build on existing tourism initiatives and marketing and delivery structures wherever possible. There have been two studies recently for a visitor economy strategy for the Dee Valley and the Vale of Clwyd. These studies have reviewed the current tourism performance with proposals to harness the area's resources to deepen, broaden and add value to the experience of those visiting and living in the area. It is important that this LGAP co-ordinates with and enhances other tourism initiatives within north-east Wales.

4.2 Marketing & publicity

Attempts to increase the number of visitors, maximise the use of available geosites and provide appropriate interpretative and educational materials, must be preceded by development of marketing/publicity and interpretation strategies. These will establish the different markets for geotourism (e.g. how many visitors; where from; what interpretative materials are needed). In parallel, they must consider the suitability of sites for visitor use (e.g. safety; access; impacts of visitors on sites & local services; suitability of geo-resources for interpretation; best interpretation methods etc. – see below) and the products required by potential audiences.

The recently published ‘Geodiversity of the Clwydian Range AONB’ was designed to make Geodiversity more accessible to people and to be the first of a series of complimentary material.

4.3 Site interpretation & trails

Site interpretation can take many forms. On-site boards are sometimes appropriate for explaining geological and related features. However, they can be visually obtrusive and not all geosites are suitable for interpretation by this method. A methodology for assessing the on-site interpretation potential of geosites was established by CCW Earth Science officers in 1997. It will be adapted to provide a strategy for interpreting the Clwydian Range’s geosites and to determine priorities for on-site interpretation. Describing sites and features in leaflets is another widely used technique. For example, Llanarmon yn Ial, Llandegla/Pen y Stryt, Loggerheads Discovery Trail, Moel Famau Walks, Moel Fenlli - Llanbedr Dyffryn Clwyd, Tremeirchion Although these walks are widely used they have no geological information. To broaden their appeal any new walks and leaflets could also include details of the geodiversity, local history, culture and wildlife found along the route. Discreetly located and numbered posts (waymarking) can be used when features described in a leaflet are not easy to find. There is the potential for similar leaflets to be developed for other areas of the AONB, and the possibility of using ‘audio guides’ for some trails needs to be explored. The subject matter of leaflets and trails need not, however, be restricted to rural geosites. For example, the Welsh RIGS groups have successfully established the *Walking through the past* leaflet series which describes geological materials found in historically interesting buildings in a variety of Welsh towns and cities. Such leaflets have been produced for Wrexham, Mold, Ruthin, Flint, Llangollen all possibly ‘gateways’ to the Clwydian Range AONB and the areas towns hold significant potential for attracting and engaging visitors.

4.4 Publications, the web & CD-ROMs

On-site interpretation, trails and leaflets will need to be complemented by a wide range of other interpretative products including books, booklets and posters and information disseminated through electronic media, most notably the web and CD-ROMs. Leaflets will include sister guides to the successful RIGS group publications on the geology of the towns to be based on the long distance trails that are an important component of the Clwydian Range AONB.

The potential of the web for attracting visitors and providing them with relevant information must not be underestimated. Initially, the Clwydian Range AONB website, housed at Denbighshire Countryside Services offices, will be used for marketing and publicity. However, a full website strategy will need to be developed to ensure that not only is geotourist information widely available, but that detailed geosite information can be managed and disseminated appropriately by the CRGP (see Section 6). Developing appropriate links with other websites will be paramount (e.g. links to CCW, Cadwyn Clwyd other AONBs, Welsh Tourist Board, National Museums & Galleries of Wales etc.).

4.5. Events & workshops

An active programme of events and workshops is also required to raise awareness of the Clwydian Range’s geodiversity and to attract visitors. It will include guided field trips led by NEWRIGS Group and DCS officers and wardens with other partner organisations (such as Trusts and Societies). The annual Denbighshire ‘Walking Week’ comprises a series of guided field trips and events for children. There will be a series of workshops for both officers and Wardens of the AONB as well as workshops to raise awareness amongst other users and visitors e.g. wildlife, forestry, archaeology and historical organisations. This will be modelled on the highly successful *Scottish & Welsh Geology Weeks*. A programme to train guides for running field trips (including elements of Health & Safety & First Aid) will be initiated.

Summary

Raising awareness of the Clwydian Range's outstanding geodiversity

Method	Audience	Products/projects	Objective
Marketing & publicity	Potential visitors	1. Devise comprehensive marketing strategy to include: press releases in local & national newspapers; spokesperson for local & national TV; target highly populated audiences in Lancashire, Shropshire, Cheshire, Liverpool, Greater Manchester; establish links with Anglesey and Snowdonia National Park in order to benefit from its 18 million annual visitors; use existing Denbighshire and Flintshire tourist outlets to publicise geotourism 2. Co-ordinate with Dee Valley and Vale of Clwyd visitor strategies 3. Develop international links, particularly with the large American market	1. Work with existing tourism professionals to raise the profile of the AONB 2 Publicise & market events, venues, geotourism products, attractions & initiatives
On-site interpretation	General public; local inhabitants; visitors; less-specialist audiences	Assess potential of geosites for on-site interpretation using CCW methodology; prioritise geosites for on-site interpretation; negotiate arrangements with site owners (see Section 2.3); develop on-site interpretation at suitable geosites; integrate on-site interpretation with existing facilities where possible.	Inform audiences; promote enjoyment, appreciation & understanding of the Clwydian Range's geodiversity; generate economic development
Trails & leaflets	As above	Develop leaflet series on geological topics (e.g. fossils, minerals, erratics, 'Clwydian Range in the Ice Age' etc.); Develop leaflets for themed local walks (in conjunction with Community Councils); develop a series of web-based Earthcaches	As above
Publications	More specialist audiences (e.g. geologists, societies, clubs, lay, retired & professional people; advanced amateurs)	Develop geological booklets for history of geology in the Clwydian Range Develop publications that integrate geodiversity with archaeology/history culture of the area e.g. Heather & Hillforts, Offa's Dyke long distance path	As above
Web	All	Develop 'Highlights of the Clwydian Ranges' geodiversity' for advertising (see Marketing Strategy; above); provide general information on geosites, access, accommodation, events, related attractions etc; develop geosite information service/database (see Section 6)	As for 'Marketing & publicity'; as above
CD-ROMs	Schools; specialist groups	Develop geological topics & highlights series	As above
Events & workshops	More specialist audiences (e.g. geologists, societies, clubs, informed lay, retired & professional people; advanced amateurs)	Develop RIGS field programme; develop guided walks programme; provide geological input to 'Denbighshire Walking Week'; provide geological input to other events & walks run by other clubs & societies (e.g. North Wales Wildlife Trust, local historical and conservation societies); arrange training programme for site guides	Inform audiences; promote enjoyment, appreciation & understanding of the Clwydian Range's geodiversity; generate economic development
Distribution	All	See Section 6	See Section 6

5. Developing policies

5.1 Internal
5.2 External

Rationale

A policy can be defined as a plan of action adopted by an individual, group, organisation or government. Typically, policies are taken to be guiding principles designed to influence decisions, actions and procedures. A Local Geodiversity Action Plan (LGAP) is thus, in itself, a policy or set of policies. However, within the Clwydian Range AONB's LGAP, Policy Development is identified as a separate major work area. This is because the aims of the LGAP – conserving the Clwydian Range's outstanding geodiversity, and using it sustainably for education and geotourism – will be much more easily achieved if the policies of others can be influenced and shaped. For example, different rafts of government legislation and policy, from the European Union, Westminster, National Assembly for Wales and local government, have a profound influence on geodiversity and the opportunities for geoconservation. It is thus vital to ensure that the importance of geodiversity and geoconservation is reflected in the policies of as many different relevant organisations as possible.

The first true national and comprehensive set of policies for delivering geoconservation in Great Britain was, arguably, *Earth Science Conservation in Great Britain – a strategy*, published by the Nature Conservancy Council (NCC) in 1990. This document set out a vision and broad action plan for protecting nationally important geosites, stimulating the formation of RIGS groups and establishing RIGS, forging international geoconservation links and working with partner organisations and landowners. Many of its themes have since been elaborated in other policies and strategies, and indeed the LGAP process inherits some of its principles and premises, developing them for use at the local and regional level. Since 1990, advice from the national conservation agencies (including CCW) and the UKRIGS movement, among others, has been successful in raising the profile of geodiversity still further, to the extent that 'geodiversity' and 'geosites' are now incorporated in many national and regional planning policies. In Wales, the need for local planning authorities to consider RIGS and other geosites is now explicit in many of the Technical Advice Notes (TANs) issued by the Welsh Assembly Government (WAG). Although this marks considerable progress, there is still much more that can be done, particularly at the European and local levels. Steady pressure is required to ensure that geodiversity issues are represented comprehensively in planning policy and that they are periodically revised to reflect current thinking and best practice.

The CRGP comprises numerous groups and organisations who themselves develop internal policies and try to influence the policies of others. Through this expertise it is hoped that geodiversity issues can be pushed still farther up the agenda of government, local government, the quarrying and mining industry and other sectors of business and society who have a profound influence on geoconservation.

This LGAP also considers the policies required by the CRGP project to comply with legislation and establish efficient internal procedures and protocols.

Summary
Developing policies

Type	Policy	Legislation, Guidance & Opportunities	Objectives & actions
Internal	Welsh Language	Welsh Language Act 1993 Government of Wales Act 1998 Welsh Language Scheme	CRGP to ensure equality of Welsh & English languages in all published materials (books, booklets, leaflets, posters, web & CD-ROM materials) and to comply with legislation
	Charging for information & use of Local Record centres	Develop a 'Charging for information' policy cf. North East Wales RIGS Group; develop policy for disseminating information through Local Record Centres (see Section 6)	CRGP and NEWRIGS to cover costs of administering, accessing & preparing information for release to consultancies & commercial organisations, especially in providing baseline information on geosites for Strategic Environmental Assessment
	Freedom of Information	Freedom of Information Act 2000 Freedom of Information (Scotland) Act 2002	Develop policy for providing information on request & comply with legislation (see Section 6)
	Data Protection	Data Protection Act 1998	Develop policy to comply with legislation & protect personal & private data (e.g. details of landownership)
External	International	Strategic Environmental Assessment Directives *(references to soils, landscapes & geodiversity)*	CRGP (through appropriate partners – e.g. CCW, RIGS etc.) to try to ensure that geosites and geo-heritage conservation are given appropriate emphasis & weight in emerging European policies & legislation (through UNESCO, EGN, JNCC, ProGeo & Geo Conservation Commission of Geological Society of London etc.)
		Other policies & legislation with an impact on geosites & geo-heritage conservation (e.g. emerging spatial plans)	As above
	National	Environment Strategy Wales	CRGP to try to ensure that geosites and geo-heritage conservation are considered
		Wales Spatial Plan *(NAW travel plan)*	As above, with particular respect to geotourism and emerging transport policies; develop protocol with Highways Agency (Dept Transport) for accessing, protecting & maintaining road-cutting geosites – trunk roads & motorways [A55, 494 & 541] (jointly with local Highways Authority).
		Planning Policy Wales 2002 *(provides the strategic policy framework for the effective preparation of local planning authorities' development plans – via TANs)*	CRGP to seek to strengthen guidance for geo-heritage conservation when TANs are reviewed/updated
		Technical Advice Notes (Wales) TAN 1 *Joint housing and land availability* para 64 *Preserving quarries and mine tips*	CRGP to strengthen guidance for geo-heritage conservation when TAN is reviewed/updated (TAN already contains some provision for geosites at all levels)
		Technical Advice Notes (Wales) TAN 5 *Nature Conservation & Planning 1996*	CRGP to strengthen guidance for geo-heritage conservation when TAN is reviewed/updated (TAN already contains some provision for geosites at all levels)
		Technical Advice Notes (Wales) TAN 6 *Agricultural & Rural Development 2000*	As above

		Technical Advice Notes (Wales) TAN 9 *Enforcement of Planning Control 1997*	As above
		Technical Advice Notes (Wales) TAN14 *Coastal Planning 1998*	As above
		Technical Advice Notes (Wales) TAN 21 *Waste 2001*	As above
		Technical Advice Notes (Wales) *Others (e.g. TAN 13 Tourism; TAN 15 Flood-risk)*	As above, where appropriate
		Technical Advice Notes (Wales) MTAN (Wales) *1 - Aggregates 2004*	As above, particularly with respect to RIGS, site restoration & aftercare
		Welsh Office Circular 60/96, 'Planning and the Historic Environment: Archaeology and Planning'	**CRGP to seek to strengthen guidance for geo-heritage conservation when Welsh Office Circulars are reviewed/updated**
		Utility Companies; national Quarry operators (e.g. Hanson) & other major land-holders	CRGP to develop protocols with utility companies for protection of geosites & consultations over proposed developments; promote Utility Company & Quarry Company LGAPs
	Regional & local	Unitary Development Plans	CRGP to ensure that geosites and geo-heritage conservation are considered; ensure that Denbighshire and Flintshire County Councils (DCC/FCC) has all known geosites, including RIGS, on a GIS-based constraints register for development control; ensure DCC/FCC structure plan & constraints register take adequate account of non-notified GCR sites; develop protocol with Mineral Planning Authority to ensure that quarry restoration & development procedures always include an assessment of geodiversity features
		Local development Plans	As above;
		Community Strategies	CRGP to try to ensure that geosites and geo-heritage conservation are considered, especially through liaison with Community Councils
		Highways Authority	CRGP to develop protocol with local Highways Authority (part of local authority) for accessing, protecting & maintaining road-cutting geosites – A & B roads (jointly with national Highways Agency)

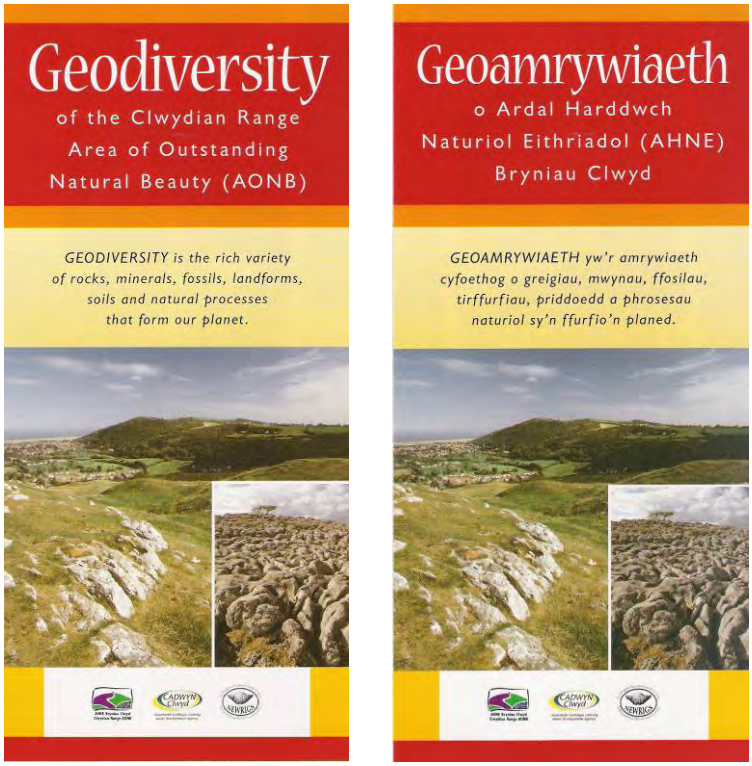

Plate 17 Clwydian Range AONB Geodiversity/Geoamrywiaeth leaflet

6. Managing information

6.1 Websites
6.2 Data & record management

Rationale
A fundamental aim of this LGAP is to raise awareness of the Clwydian Range's outstanding geodiversity, thereby attracting visitors to the area and stimulating the local economy. Consequently, most information and data produced by the CRGP will be available on the World Wide Web.

6.1 Websites

A web-based approach is the most economical and efficient way to generate interest from potential visitors. Web materials on the Clwydian Range AONB's website will include 'geological highlights of the Clwydian Range', details of events and activities, places to see and stay, and details of leaflets, booklets, trails and other sources of information. Web-based information may also contribute significantly to satisfying the majority of more detailed enquiries and requests for information. For example, data for geological SSSI and GCR sites will be available from the CCW and JNCC websites; the latter provides full details of all GCR sites in Britain. RIGS data will be available from the NEWRIGS website and Earthcaches from the Geocaching website, potentially, from Cofnod, the North Wales Local Record Centre. Such an approach will contribute to ensuring compliance with the Freedom of Information Act 2000. Private and personal data, particularly regarding the ownership of geosites, will not be released without explicit permission, in order to safeguard the rights and sensitivities of individuals and to comply with the Data Protection Act 1998 (see Section 5).

6.2 Data & record management

Management of information via the web will be complemented by distribution of materials (leaflets, booklets etc.) through a series of strategically located centres in and around the Clwydian Range. The initial 'hub' for CRGP activities will be the Loggerheads near Mold which is already a popular and well used destination as well as the start of many walks on the Clwydian Range. Loggerheads will house interpretative and guide material (e.g. leaflets, booklets, posters & trail guides) as well as reference materials (Ordnance Survey maps, geological books & rock, fossil and mineral samples). Satellite information centres will be established near other key geological/visitor areas – for example, at Llangollen TIC and Denbighshire Countryside Services offices at Llangollen and Prestatyn among others localities. Where possible, agreements with existing facilities such as TICs and libraries will allow CRGP materials to be displayed and distributed. Out of the area, a similar arrangement will be made with visitor 'honeypots' such as the Snowdonia National Park (SNP), the World Heritage sites of Caernarfon and Conwy and the Bronze Age Copper Mines at the Great Orme, Llandudno and Chester . Using such important 'gateways' will allow reciprocal arrangements for distribution and information exchange. The establishment of an efficient distribution service for moving materials around and replenishing stocks will be vital.

Summary

Data management & handling

Method	What	How
World Wide Web	General non-private/ non-personal information about geosites; details of projects, events, products (leaflets, books, booklets; trails etc.); links with key partners & other organisations (e.g. accommodation, other events, venues & attractions); links with other geotourism sites worldwide	Establish CRGP website in conjunction with the Clwydian Range AONB website. establish formal links with NAAONB, CCW, UKRIGS, Gwynedd & Môn RIGS, Central Wales RIGS, NMGW 'Minerals Online' websites; establish links with EGN, BGS
Local Records Centres (Cofnod – North Wales Environmental Information Service)	Details of Clwydian Range (& other North Wales) RIGS, including site name, location, brief summary of geological features & justification for selection	1. Develop comprehensive site documentation proforma for RIGS (to include a comprehensive justification for site selection; details of site location, access, safety etc; management & geoconservation requirements; details of site potential for geotourism & education); 2. Establish GIS database of site boundaries (with CCW); 3. Establish protocol with COFNOD for RIGS record management & release (see Section 5)
Distribution service	A repository for CRGP leaflets, posters, booklets & other publications for their distribution in conjunction with other AONB publications e.g. Out & About; links with existing & proposed tourist information services	Establish a suitable service for storing & distributing products
Local offices & centres	A series of sites (hub & satellite) distributed across north-east Wales to contain information, displays, offices & other facilities for CRGP	1. Establish an CRGP office at Loggerheads and the Millennium Eco Centre Borras, Wrexham - office, stores, meeting room, reference facilities (books, maps etc.) 2. Establish links with 'satellite' centres at Llangollen & Prestatyn
Gateway links	A series of centres outside Clwydian Range AONB with major visitor attractions & large visitor numbers; suitable for distributing CRGP products & keen to enter reciprocal arrangements	Establish links with Snowdonia National Park, Caernarfon & Conwy (World Heritage sites), Bangor, Great Orme's Head Bronze Age Mines, Anglesey for reciprocal distribution arrangements

7. Sustainability of the Clwydian Range AONB's LGAP

7.1 Funding
7.2 Monitoring actions and the review process

Rationale

The first aim of the Clwydian Range LGAP is to promote collective action to conserve and enhance the Clwydian Range AONB's outstanding geological heritage. This is a long-term aim and will be embedded into the statutory Management Plan which is under review. The Geodiversity Action Plan will then have the same legal basis as the Biodiversity Action Plan. In order for this to be achieved it is imperative that there is a Geodiversity Officer responsible for overseeing the LGAP and to ensure that the objectives and actions are carried out.

To ensure that the LGAP progresses, it is important that the aims, objectives, targets and actions are reviewed by the Clwydian Range LGAP Partnership. The LGAP must remain relevant to the Clwydian Range AONB and enhance its work.

7.1 Funding

Funding is vital to the sustainability of the Clwydian Range AONB. The post of Geodiversity Officer is vital. The Geodiversity Officer monitors the progress of the LGAP and is key to its success. This post should ideally be funded in a similar way as the Biodiversity Officer or, if this is not possible, funding must be sought from other sources at both national and local levels. Funding should be sought both from European, national, local and commercial sources.

Currently, the Geodiversity Officer is funded by the Aggregates Levy Sustainability Fund for Wales, Clwydian Range AONB sustainability Fund, Countryside Council for Wales (CCW) and Tarmac Ltd. This post is fully funded for 3 years ending September 2009.

Towards the end of this period it is essential to explore further funding to ensure the future of the LGAP.

7.2 LGAP publications

LGAP document

A major part of the LGAP is the production of the LGAP document. The intension is to publish online in .pdf format with only the minimum number of hard copies produced. This is to reduce the amount of paper used and also to reduce costs. The LGAP will also be available on the Clwydian Range AONB website

Educational materials

Education materials will also be produced as .pdfs and are intended for use by teachers and others involved in education. The materials are part funded by the LGAP project and also by the Clwydian Range AONB Sustainability Fund through Arden Early learning. They will be available from the website.

Further funding will need to be explored to ensure the updating of this material.

Walks leaflets

Walks leaflets will be published in conjunction with Denbighshire Countryside Services and the Clwydian Range AONB. Funding for leaflets should be sought from outside organisations and be part of the Sustainable Tourism Strategy.

In the past funding had been awarded by a variety of organisations including statutory bodies e.g. CCW; rural development agency, Cadwyn Clwyd; Geologists' Association, and

several quarrying companies e.g. Tarmac Ltd and Hanson Aggregates (now HeidlebergCement).

It is important that a variety of funding sources is explored to ensure wide interest and acceptance of any material produced.

Website

Material produced by the LGAP will be available on the Clwydian Range AONB's website. This will enable world-wide availability.

7.3 Monitoring actions and the review process

The drawing up of an LGAP is the start of a process and is not an end in itself. For an LGAP to be effective the actions must be monitored and reviewed at regular intervals. This should take the form of regular monitoring of actions by the Geodiversity Officer and reviews by the steering group. There should be al review at the end of the 1st year, September 2008 and major review near the end of the Clwydian Range LGAP project which finishes September 2009 .

During the life of the Action Plan indicators will be developed to monitor the effectiveness of the actions and their continued relevance to the action plan.

Plate 17 Loggerheads

Summary

Sustainability of the LGAP

Funding	Who	How
European	Sustainable Tourism Strategy, Quarrying companies e.g. HeidlebergCement	Establish and maintain links with organisations to understand; suitability; funding criteria and amounts available
UK	Awards for All, Geologists' Association, Lottery funding, Quarrying companies e.g. Tarmac Ltd. Lafarge Aggregates, Castle Cement,	Establish and maintain links with organisations to understand; suitability; funding criteria and amounts available
Wales	Aggregates Levy Sustainability Fund for Wales, CCW, Denbighshire CC & Flintshire CC tourism, environment, leisure and education departments	Establish and maintain links with organisations to understand; suitability; funding criteria and amounts available
Local	AONB Sustainability Fund, Cadwyn Clwyd, local businesses with an interest in AONB visitors.	Establish and maintain links with organisations to understand; suitability; funding criteria and amounts available

Plate 18 Castell Dinas Bran, Eglwyseg Mountain and Horseshoe Pass

Acknowledgements

The Clwydian Range LGAP partnership would like to thank the many organisations and individuals that have contributed to this project. We would like to thank the Aggregates Levy Sustainability Fund for Wales, the Clwydian Range AONB Sustainable Development Fund, Countryside Council for Wales and Tarmac Ltd for the financial support that has made this project possible.

We are particularly grateful to Raymond Roberts, CCW; David Shiel, Clwydian Range AONB, Howard Sutcliffe, Denbighshire Countryside Services and the AONB Joint Advisory Committee for their enthusiasm and support for the project. This LGAP is grateful to Stewart Campbell for allowing his LGAP template to be used for this document.

This project would be much the poorer without the generous and enthusiastic help and support of the AONB wardens, Denbighshire Countryside Services, Heather and Hillforts project, Denbighshire and Flintshire Biodiversity partnerships.

The Clwydian Range LGAP would like to thank all those who have contributed to this LGAP including Castle Cement, Arden Early Learning, Flintshire Planning Department and British Geological Survey and Clwyd Powys Archaeological Trust.

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Appendix 1

Areas of Outstanding Natural Beauty (AONB)

Areas of Outstanding Natural Beauty fall within a worldwide category of protected landscapes along with National Parks. These are known as 'Protected Landscapes' which was devised by the International Union for the Conservation of Nature. Throughout the world, areas of special countryside and landscape have been given protection of various kinds so their unique qualities may be enjoyed by all both now and in the future. The Parc Naturels in France and the National Parks of Spain and Portugal are protected landscapes in a similar scheme.

Areas of Outstanding Natural Beauty are unique and irreplaceable national assets and together with National Parks represent the finest countryside and landscapes in Wales. There are **five AONBs in Wales** covering a total area of 844 sq. kms or 4% of the land area of Wales. Of these, four are wholly in Wales - Anglesey, Clwydian Range, Gower and Llŷn - and one, the Wye Valley, is partly in England.

The primary statutory purpose of designating a tract of countryside as an AONB is to conserve and enhance the natural beauty of the area. The concept of natural beauty includes the protection of flora, fauna and geological as well as landscape features.

However, it is very important that the cultural dimension of the landscape, including the historical, intellectual and spiritual elements, as well as the physical human shaping of the land are fully recognised. **In Wales there is the added dimension of the language** that also needs to be recognised.

In Wales, the statutory requirement for the National Assembly to pursue sustainable development serves to give heightened importance to the interaction between the conservation of AONBs and the needs of recreation and tourism, the local economy and local communities

The idea of designating landscapes on account of their natural beauty emerged as part of national plans for post-war reconstruction in the 1940s. At the same time that a comprehensive town and country planning system was being introduced, certain aspects of use and conservation of the countryside was also given some thought.

The approach was spearheaded by John Dower and Sir Arthur Hobhouse. Their reports - respectively *National Parks in England & Wales* and *Report of the National Parks Committee (England & Wales)* - led to the passing of the **National Parks and Access to the Countryside Act in 1949**. This Act provided for the designation of National Parks and Areas of Outstanding Natural Beauty in England and Wales

The **inter-relationships that exist between communities and their landscapes**, and the environment and the economy are brought together and discussed within this planning process. An assessment of the resource and the forces that act upon, them is the only way to truly inform decision making within the context of sustainable development.

It is not just the scenery of AONBs that is important; all also have very significant historical, language and cultural resources.

A full understanding of these resources, plus an understanding of the relationship between culture, the landscape, and the Welsh language is paramount to devising a sustainable approach to the management of the Welsh AONB's special qualities.

Following on it is now considered that the geodiversity of the Clwydian Range has been underrepresented in the AONB management planning process in Wales and this Local Geodiversity Action Plan seeks to develop this thinking and address this omission.

The Purpose of AONB Designation

Because of their fragile natural beauty, the **primary purpose of AONB designation**, as derived from the 1949 National Parks and Access to the Countryside Act, is to **conserve and enhance natural beauty of the landscape**.

This primary purpose was reaffirmed in a 1991 Policy Statement on AONBs (*Areas of Outstanding Natural Beauty: A Policy Statement. 1991, CCP356*).

The statement also identifies subsidiary purposes which should be taken into account in pursuing the primary purpose. These include:

- a **socio-economic** purpose:
  'account should be taken of the needs of agriculture, forestry, other rural industries, and the economic and social needs of local communities'.
- a purpose to have regard to the principles of **sustainable development**:
  'Particular regard should be paid to promoting sustainable forms of social and economic development that in themselves conserve and enhance the environment'.
- To meet the need for quiet enjoyment of the countryside
- To have regard for the interests of those who live and work there.

In achieving these aims each AONB relies on

- Planning controls
- Practical countryside management

Why do we need AONBs?

We assume that our countryside will always stay the same, but often this is not true. Perhaps the most vulnerable areas are not the wild, open, high places but the gentle, smaller-scale landscapes of England and Wales. These include hedgerows, spinneys and bluebell woods; heath, marsh, meadow, rivers, quarries and mining remains. Under pressure for change, much of this traditional countryside has already vanished. AONB status protects the finest examples which remain. AONBs work, with due care for the rural way of life, to conserve the landscape's outstanding natural beauty and ensure its survival for future generations.

As a nation, we believe that the rich green image of our traditional countryside belongs to us all. In a sense, AONBs do belong to us all: the Government confers their status and our planning laws protect them. But the nation neither owns nor administers the land, some is owned by public bodies such as the Forestry Commission, or by conservation organisations such as the National Trust and County Wildlife Trusts. Other areas are owned by local authorities and government departments, like the Ministry of Defence. But much of the land within AONBs remains in the hands of the farmers and landowners who, over the generations, have shaped its rich and familiar patterns. Most AONBs continue to function as traditional, but well-farmed landscapes; it is accepted that the countryside is not a museum and supports a distinct and traditional rural way of life.

Designation of AONBs:

The Countryside Council for Wales (CCW) is responsible for formally designating AONBs and advising on policies for their protection. A function of CCW is to operate as national ‘watchdogs’ over AONBs, to ensure the successful conservation and enhancement of the landscape. Designation seeks to protect and enhance natural beauty whilst recognising the needs of the local community and economy. This includes the protection of flora, fauna and geological as well as landscape features. The conservation of archaeological,

architectural and vernacular features in the landscape is also important. Responsibility of care is assumed by local authorities and the rural community. AONB status provides a context for low key, long-term action, which relies upon partnership with local people.

As a result of this local basis, the planning and management approach in each individual AONB can vary considerably. Overall responsibility of care lies with the relevant local authorities. However, most AONBs fall within more than one local authority area (city, district and/or county). To encourage consistent policies and positive coordination, AONBs have undertaken the following actions:

- The formation of Joint Advisory Committees. These include representatives of not only the different local authorities, but also of landowners, farmers, residents and conservation and informal recreation interests.
- The appointment of AONB officers to coordinate local management operation.
- The preparation of Statements of Intent (or Commitment) and Management Plans.

Raising awareness and informed support

By raising awareness of the importance of AONBs among local communities, local authorities and visitors, we seek to foster a commitment to the AONBs, encourage local partnerships and generate informed support from visitors.

The beauty of AONB landscapes naturally attracts visitors. Millions visit the less remote areas - perhaps on holiday in Wales, on day trips to the Wye Valley, or simply strolling in the Clwydian Hills. Managing visitor numbers is a growing challenge in AONBs. Control measures to avoid damage, ranging from parking restrictions to steering people away from sensitive sites, are only part of the answer. Leaflets, trails and ranger services in AONBs can help to show visitors why the landscape is precious and how to protect, as well as quietly enjoy, the fragile natural beauty. Public awareness and understanding of the special quality of AONB landscapes has been helped in recent years by the publication of landscape assessments for AONBs.

Over four decades have passed since the designation of the first AONBs. But, during these years, few major urban or industrial developments have scarred any of these areas. This is a clear vindication of what is, essentially, a policy of trust, which has left the nation's landscape treasures in capable local hands.

For more information about the AONB system in England and Wales, visit the National Association of AONB’s website. You can also view an online version of the interactive CD-based presentation ‘An Introduction to AONBs’, produced by the Association, Natural England and the Countryside Council for Wales. The presentation can be viewed in either English or Welsh.

Appendix 2

Legal framework

The **National Parks and Access to the Countryside Act 1949** was the first piece of relevant legislation which provided for the designation of AONBs. This legislation provided for planning protection of AONBs and gave local authorities the power to take action to conserve them. But no statutory duties were placed on local authorities or any other body.

Since then, however, the pressures on the landscape of our protected areas have increased dramatically and the provisions of the 1949 Act were considered inadequate.

The **Environment Act 1995** brought in new measures for the protection of National Parks. The **Countryside and Rights Of Way (CRoW) Act 2000** has now placed AONBs on a more secure footing and significantly increased their importance as nationally designated landscapes.

Part IV of the CRoW Act 2000 significantly raised the profile of AONBs by placing new responsibilities on the local authorities and conservation boards who are responsible for their management, including a statutory duty to produce and regularly review AONB Management Plans for their areas, and a duty on all 'relevant authorities' to have regard for AONB purposes.

In summary, the CRoW Act 2000:

consolidates and strengthens earlier legislation concerning AONBs, reaffirming the purposes of designation, and confirming the powers of local authorities to take appropriate action to conserve or enhance the natural beauty of AONBs.

In addition:

- **Section 85** of the Act places a duty on all public bodies and statutory undertakers (commonly referred to as 'Section 85 bodies') to have regard to the purposes of AONBs.
- **Section 86** establishes a process for creating AONB conservation boards.
- **Section 89** creates a statutory responsibility for local authorities and conservation boards to produce and regularly to review AONB Management Plans.

The Countryside and Rights of Way Act 2000 (**CRoW Act 2000**) applies to England and Wales only, received Royal Assent on 30 November 2000, with the provisions it contains being brought into force in incremental steps over subsequent years. Containing five Parts and 16 Schedules, the Act provides for public access on foot to certain types of land, amends the law relating to public rights of way, increases protection for Sites of Special Scientific Interest (SSSI) and strengthens wildlife enforcement legislation, and provides for better management of Areas of Outstanding Natural Beauty (AONB). The Act is compliant with the provisions of the European Convention on Human Rights, requiring consultation where the rights of the individual may be affected by these measures.

Access to the Countryside

The Act provides a new right of public access on foot to areas of open land comprising mountain, moor, heath, down, and registered common land, and contains provisions for extending the right to coastal land. The Act also provides safeguards which take into account the needs of landowners and occupiers, and of other interests, including wildlife.

Public Rights of Way and Road Traffic

The Act improves the rights of way legislation by encouraging the creation of new routes and clarifying uncertainties about existing rights. Of particular relevance to nature conservation, the Act introduces powers enabling the diversion of rights of way to protect SSSIs.

Nature Conservation and Wildlife Protection

The Act places a duty on Government Departments and the National Assembly for Wales to have regard for the conservation of biodiversity and maintain lists of species and habitats for which conservation steps should be taken or promoted, in accordance with the Convention on Biological Diversity.

Schedule 9 of the Act changes the Wildlife and Countryside Act 1981, amending SSSI notification procedures and providing increased powers for the protection and management of SSSIs. The provisions extend powers for entering into management agreements, place a duty on public bodies to further the conservation and enhancement of SSSIs, and increase penalties on conviction where the provision are breached, with a new offence whereby third parties can be convicted for damaging SSSIs. To ensure compliance with the Human Rights Act 1998, appeal processes are introduced with regards to the notification, management and protection of SSSIs.

Schedule 12 of the Act amends the Wildlife and Countryside Act 1981, strengthening the legal protection for threatened species. The provisions make certain offences 'arrestable', create a new offence of reckless disturbance, confer greater powers to police and wildlife inspectors for entering premises and obtaining wildlife tissue samples for DNA analysis, and enable heavier penalties on conviction of wildlife offences.

Areas of Outstanding Natural Beauty

The Act clarifies the procedure and purpose of designating AONBs, and consolidates the provisions of previous legislation. It requires local authorities to produce management plans for each AONB, and enables the creation of Conservation Boards in order to assume responsibility for AONBs, particularly where the land designated crosses several local authority jurisdictions. The Act also requires all relevant authorities to have regard to the purpose of conserving and enhancing the natural beauty of AONBs when performing their functions.

The Natural Environment and Rural Communities Act (NERC) 2006

The NERC Act is deigned to help to achieve a rich and diverse natural environment and thriving rural communities through modernised and simplified arrangements for delivering Government policy.

Part 3 Section 40 states that ’Every public authority must in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity’ replaces and extends a pre-existing duty to have regard to the purpose of conserving biodiversity, which was set out in section 74 of the CRoW Act. This amendment is key and reinforces the importance of conserving Geodiversity as **Geodiversity underpins Biodiversity.**

Appendix 3

The Geodiversity of the Clwydian Range AONB

The geology of the Clwydian Range AONB and the proposed Dee Valley Extension area

The geodiversity of the Clwydian Range rocks, their composition, structures, fossils, minerals soils, geomorphology and the continued processes acting upon them are evidence of a story that Earth scientists have been endeavouring to unravel for over 200 years. The story of the Clwydian Range can be traced back over 400 million years (Fig. 4). However, the story has several chapters missing. The introduction to the story, the oldest rock records, the Precambrian and Cambrian and Devonian Periods are not present in the Clwydian Range. These rocks are well represented on Anglesey and have evidence of past events during these times.

Over geological time the land that is now Wales has moved over the globe from low latitudes in the southern hemisphere to its present position in the northern hemisphere and is still moving northwards at about the same rate our fingernails grow. The rocks of the Clwydian Range reflect these changes in environment.

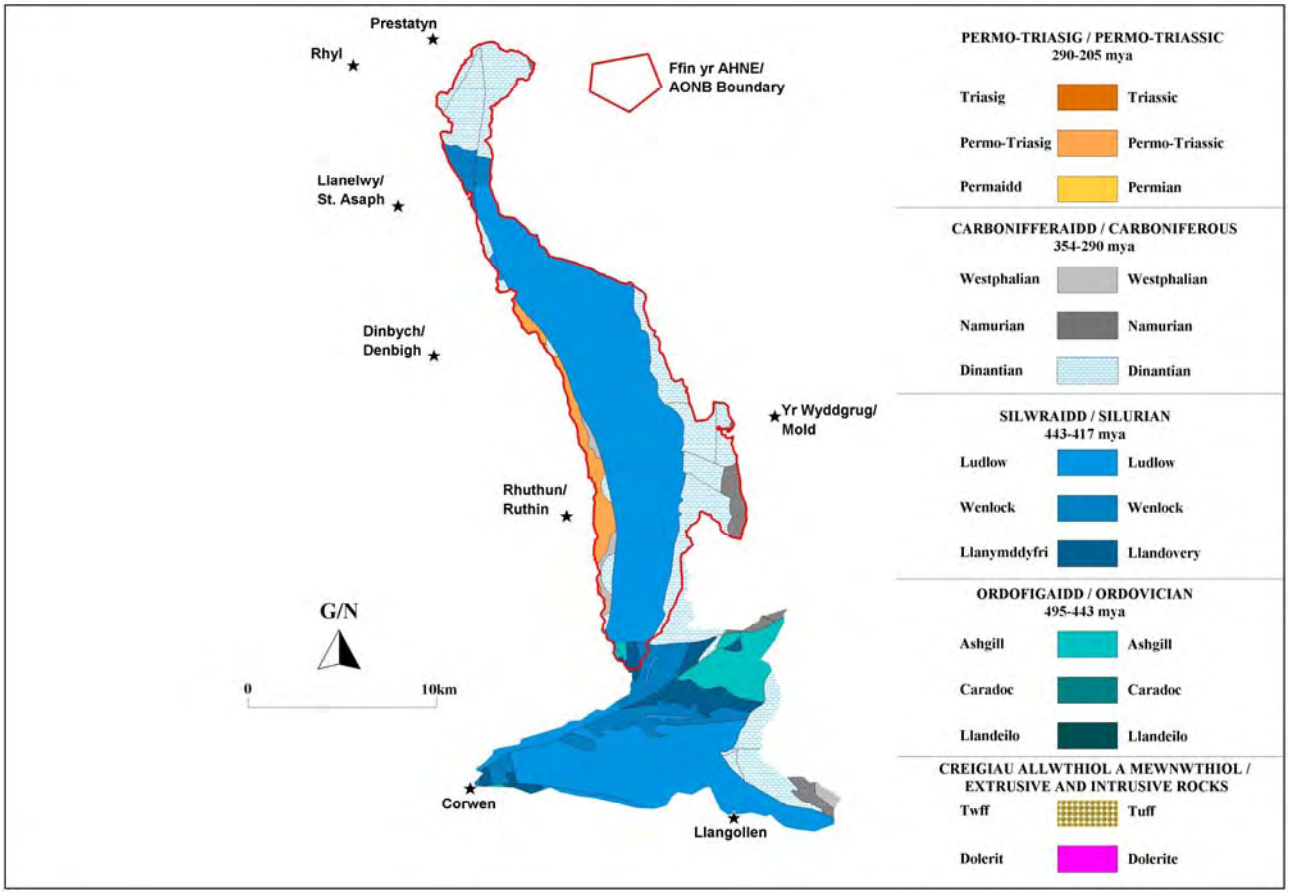

Figure 4 Solid geology of the Clwydian Range AONB and surrounding area

The Ordovician Period, 490–443 million years (Ma)

The oldest rocks in the area are of Ordovician age and are only present in the south of the project area. They are mainly found in the Cryn y Brain area south of Llandegla and the A525, and a small inlier (an area of older rocks completely surrounded by younger rocks, usually the result of folding or faulting) at Mynydd Cricor, both on the northern limb of a structure known as the Llangollen syncline. A syncline is formed during mountain-building events when the rocks are folded into a trough-shape. In this large, U-shaped fold, the

younger rocks are in the centre of the fold and the older rocks on the outer edges. Ordovician rocks are also present in a small area south of Carrog on the southern limb of the syncline (Fig. 5).

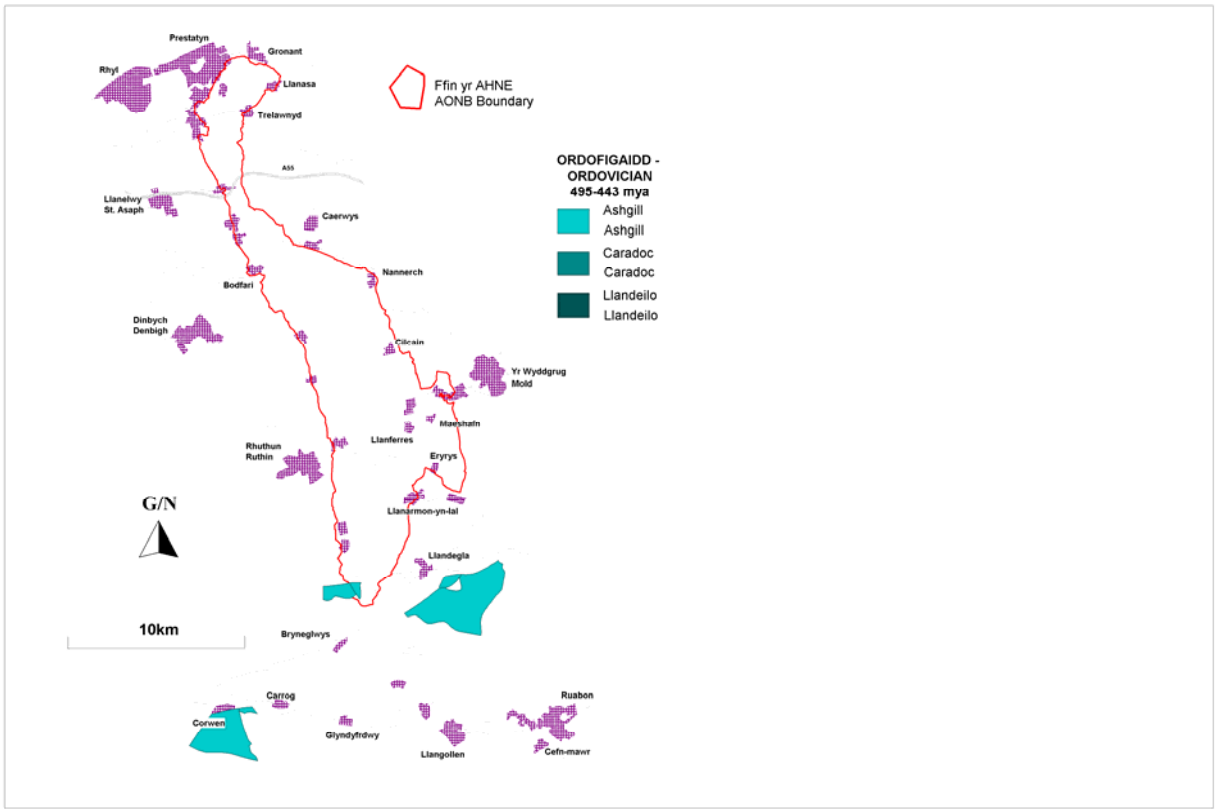

Figure 5 Ordovician rocks of the Clwydian Range AONB and surrounding area

The Ordovician rocks are sedimentary and comprise mainly siltstones and mudstones with subsidiary sandstone and limestone bands. There is a limestone and fissile mudstone at the base of the Ordovician succession, which blanketed the sea-floor at that time. The sediments were deposited in a deep-sea with land (the Midland Platform) to the south and west. During the Ordovician, Wales was positioned deep in the southern hemisphere, close to the South Pole. The land was defined by two large faults; the Pontesford-Linley and Church Stretton Faults. There are also layers of volcanic ash recording periodic eruptions of volcanoes in Snowdonia and the Berwyns.

During most of the Ordovician and Silurian Periods, Wales was covered by a narrowing ocean basin. Scotland was joined to part of North America and separated from Wales by the Iapetus Ocean. The continents on either side of this ocean had been gradually moving together and met during the latter part of the Ordovician Period. This resulted in the formation of very active volcanoes, similar to the Andes today.

The mudstones, sandstones and limestones, typical of deep marine environments, contain many fossils of marine animals including crinoids (sea lilies), brachiopods (marine animals with two shells), trilobites and graptolites (tiny marine creatures that lived in colonies, the fossilised remains of these colonies often look like tiny hack-saw blades) (Pl. 19).

Plate 19 Ordovician graptolite (Central Wales RIGS)

The Silurian Period, 443–417 Ma

The next geological period represented in the AONB is the Silurian Period. These rocks are present as the central spine of the Clwydian Range themselves and the central part of the Llangollen syncline (Fig.6).

Roderick Impey Murchison, a geologist who studied intensively the rocks of Wales, was the first to use the term Silurian in 1835. He named his 'Silurian System' in 1839, after the ancient British tribe, the Silures, which inhabited the southern Welsh borders.

During most of the Silurian Period, the Iapetus Ocean was still closing and two continents were colliding. The closure of the ancient ocean basin, late in the Silurian, created mountain ranges, river systems and coastal plains that provided ideal environments for the emergence and diversification of terrestrial land plants, the remains of which are found in a few classic localities in mid Wales and the Berwyns.

At this time, the Earth's crust under Wales was also undergoing subsidence in an north-east to south-west trending, elongated basin and sediment was accumulating in the area now known as the Welsh Basin with land, the Midland Platform, to the south.

The rocks, which represent the sediment that filled the basin, consist of vast thicknesses; up to 3000 m, of deep-water mudstones and sandstones. In some areas, for example Penycloddiau, there is evidence of water flowing over the sea-floor with beautifully preserved scours and ripples.

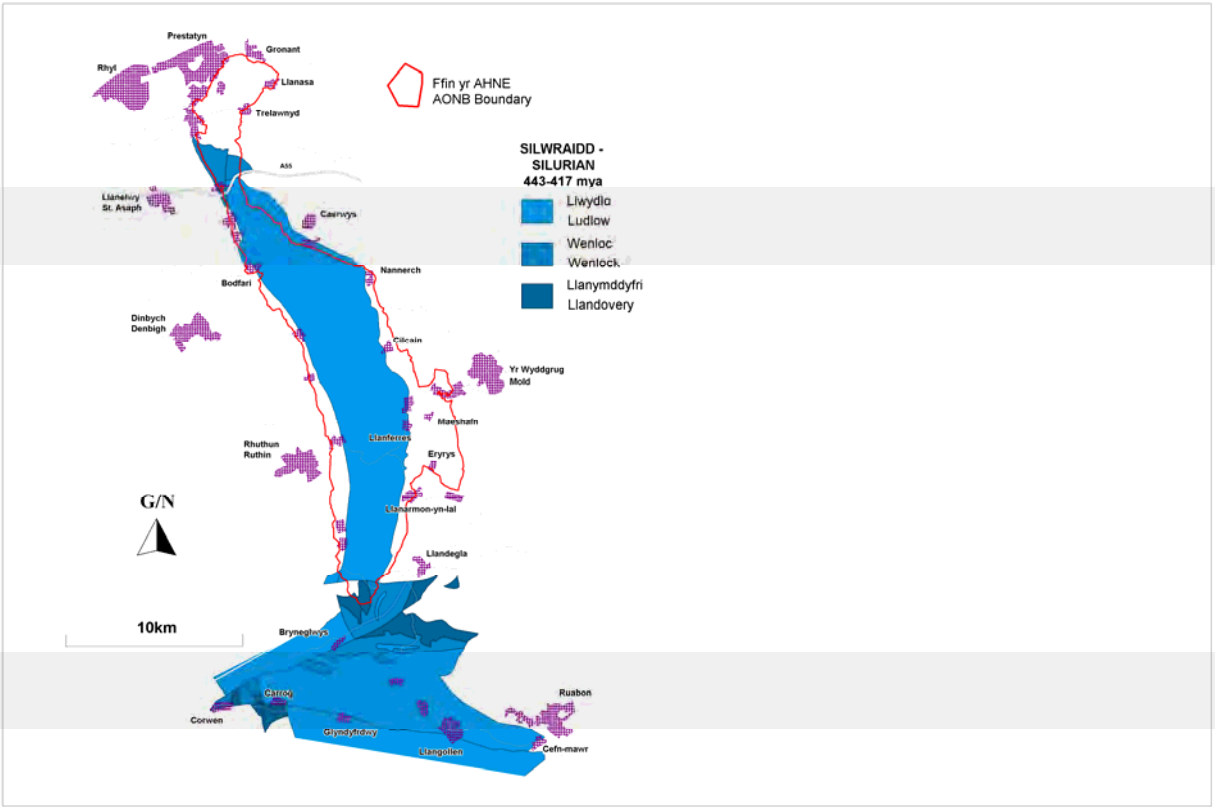

Figure 6 Silurian geology of the Clwydian Range AONB and surrounding area

The rocks also contain the abundant fossilised remains of the marine animals. They include orthocones (similar to squid), crinoids and many new forms of trilobites, brachiopods and graptolites. Graptolites evolved very rapidly and some graptolites are only present in particular ages of rocks. The graptolites were studied by pioneering female geologists based at the University of Cambridge in the late 19th and early 20th centuries.

Using the graptolites they undertook the first systematic survey of the Silurian rocks of the central Clwydian Range and used the results to work out the relative ages of the rocks.

After deposition, the sediments were buried and compacted, which removed the water and then compressed by movements of Earth's tectonic plates to form the slates that typify Horseshoe Pass and the Berwyn Mountains. The rocks were also folded by these events and a fold can be seen in the A55 road cutting at Rhuallt.

There is some mineralization of the Silurian strata. The Pennant Mine, about 5 km east of St Asaph, worked galena and zinc in a vein cutting the mudstones. This mine also worked baryte and barium ore, which are commonly associated with lead-zinc mineralization.

The Carboniferous Period, 354–290 Ma

The Carboniferous rocks are the next Period represented in the AONB. The Carboniferous Limestone is present in the north of the area forming Prestatyn Hillside, Graig Fawr and Moel Hiraddug, in the central area around Eryrys and in the south, limestone forms the spectacular escarpment at Eglwyseg, above Llangollen, the Limestone Pavements at Bryn Alyn, Loggerheads, Moel Hiraddug and Graig Fawr.

Deposition of the Carboniferous rocks took place over 73 million years, when Wales lay close to the equator. Initially the area was land and there is evidence of rivers with up to 100m of red, purple and green mudstones with many beds containing pebbles, fossilised river beds. As sea-levels rose in the early part of the Carboniferous, warm, shallow tropical seas covered much of the area and a great thickness of limestone, up to1000m, was deposited. The limestones were deposited in warm tropical seas with abundant marine life including, corals, crinoids (sea lilies), brachiopods, trilobites, fish, goniatites (early ammonites) and other animals. There are also bands of volcanic ash, but at this time the volcanoes were in the Derbyshire area. The ash fell into the sea and blanketed the sea-floor smothering the marine life.

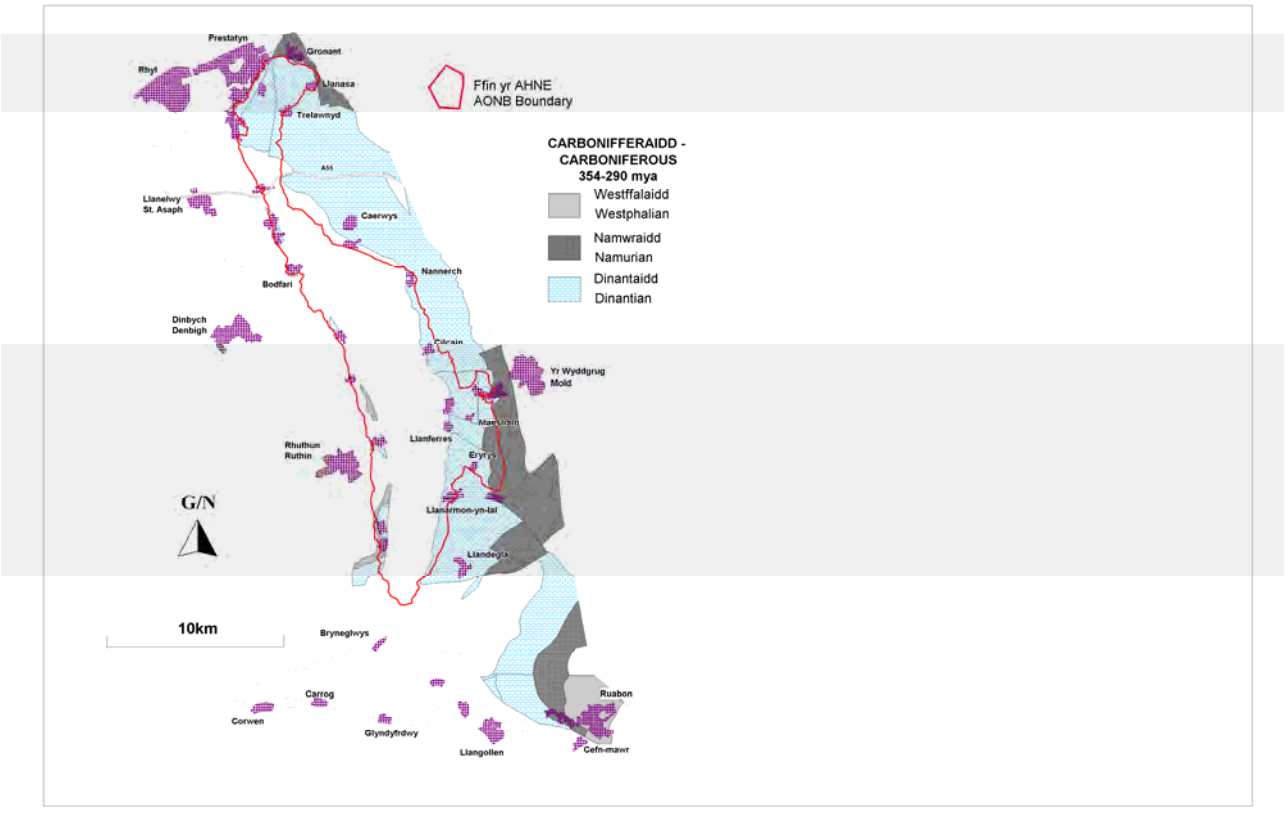

Figure 7 Carboniferous geology of the Clwydian Range AONB and surrounding area

Over time, sea-level fell and vast rivers formed mud and sand deltas along the coast. These deposits built up to form the Ruabon Marl, Cefn y Fedw, Holywell Shale and Gwespyr Sandstone Formations of Gwespyr, Moel Garegog, Graianrhyd, Moel Findeg and Ruabon Mountain. Later in the Carboniferous, swamps and vast forests developed on the deltas which ultimately led to the formation of coal deposits of the Flintshire and Denbighshire Coalfields.

Following the formation of the Coal Measures, the environment changed to one of low-gradient alluvial plain (environment and processes associated with rivers and streams) with high ground to the south. These rocks consist of thick clays, mudstones and sandstones with some fossil non-marine bivalves, fish fragments and some plants. There is also some evidence of freshwater lakes, fossil soils and some thin coals.

By the end of the Carboniferous the area was undergoing desertification.

The Carboniferous limestone is a valuable resource and is currently extensively quarried for road stone and is an important economic resource for the area. There is also abundant evidence of past mining and quarrying in the district. This is generally confined to the Carboniferous strata and is known as the North Wales Orefield Lead and zinc mineralization occurs along fault planes in 'veins'. The mineralization is almost exclusively in the upper part of the Carboniferous Limestone in the Loggerheads and Cefn Mawr Limestone Formation which occur in the Loggerheads, Eryrys and Llanarmon-yn-Ial areas. The principal ore minerals are galena (lead), which is can also be silver-bearing, sphalerite (zinc) and chalcopyrite (copper). Fluorite is a minor component of the mineralization as a whole, but is locally common the south of the around Llanarmon yn Ial. There is also significant and important mineralization in the Prestatyn, Dyserth area with copper, lead, zinc, iron (haematite), nickel, manganese and cobalt have all been mined. These ores are again associated with the upper part of the Carboniferous Limestone, which in this area is called the Dyserth Limestone.

The Permian-Triassic Periods, 290–199 Ma

By about 290 million years ago Wales had moved over the Earth to the same latitudes as North Africa. The rocks are the only ones in the area to have been deposited on land as opposed to under water. The rocks are dominated by up to 800m of red sandstones and are present in the Vale of Clwyd and on the western side of the Clwydian Range, east of Ruthin (Fig. 8).

The climate at this time was very hot and arid resulting in huge deserts. The area was covered by sand with huge sand dunes that were up to 10 meters high. There was very little animal or plant life in the harsh environment in the centre of a large continent, Pangaea, and there are no fossils in these rocks. There were also violent storms and flash floods which left pebble-lined channels, evidence of short-lived rivers and streams.

The rocks are found at the margins of major Permian-Triassic basins which were part of a linked post-Carboniferous rift basins extending from Scotland to Paris. The Vale of Clwyd is the southern extension of the East Irish Sea Basin which is now separated from the other Permian-Triassic outcrops by faulting and erosion. The development of the faults was during east-west extension and crustal thinning associated with break-up of the huge continent of Pangaea and the opening of the Atlantic Ocean towards the end of the Triassic Period.

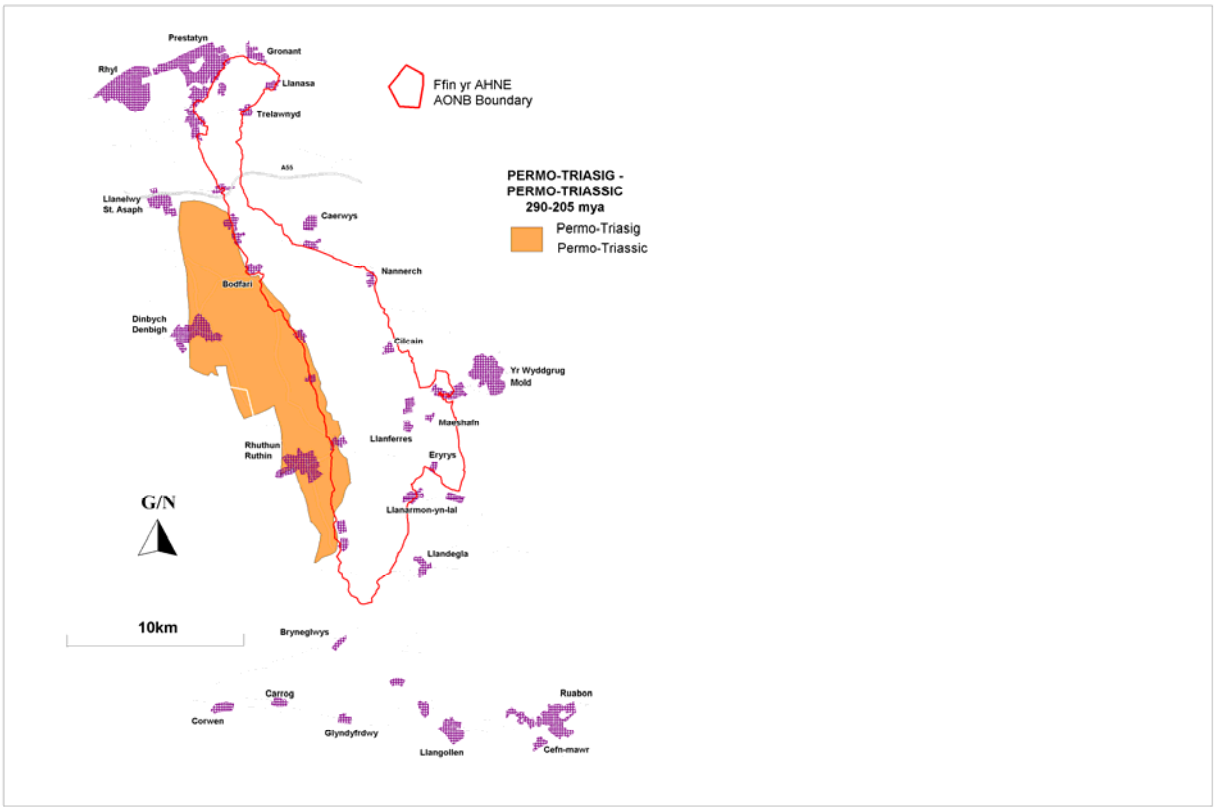

Figure 8 Permian geology of the Clwydian Range AONB (to be supplied)

The Quaternary Period, 2 Ma–present

The next important phase in the evolution of the landscape of the AONB, was the Quaternary Period which has seen numerous glaciations, the most recent of which ended around 14,000 years ago.

Significant parts of the project area are overlain by Quaternary deposits. Only the exposed parts of the Carboniferous limestone in the north and east of the area and Eglwyseg Escarpment together with the Silurian spine of the Clwydian Range, Dinas Bran and Llantysilio and Maesyrychen Mountains, are largely free of glacial sediments.

The Quaternary deposits fall into two main groups; glacial deposits including till (boulder clay), and water-lain sand and gravel, which were all deposited during the last major glaciation and post-glacial deposits, including screes (rock debris at the bottom of an inland cliff) and head (poorly-sorted angular rock fragments) but mainly alluvial deposits originating from rivers and streams, which have accumulated since the retreat of the ice sheets.

There have been several episodes of glacial and interglacial periods. Deposits in some caves in the district have been recorded as interglacial. Bone and human Palaeolithic implement-bearing deposits were found in Tremerchion Cave beneath glacial sediments which were laid down in the last major cold period. The 'cold' mammal fauna of mammoth, woolly rhinoceros, lion and reindeer have been dated to about 18,000 BP, just before the last glacial period.

During the last glaciation, a thick ice sheet covered the area, smoothing the hills and gouging cwms and valleys. When the ice melted it left behind sands, gravels and clays. The ice also left behind many large glacial erratics. These are ice-transported boulders,

carried from the source of the ice and dropped by retreating ice. The most conspicuous of these erratics in the district are of Ordovician volcanic rocks derived from Snowdonia and Arenig areas. The best examples are Moel y Parc, Moel Arthur and Eryrys.

The landscape of the Dee Valley west of Llangollen, Dinas Bran, Eglwyseg, Llantysilio and Maesyrychen Mountains has all been sculpted by ice. The Dee valley is a classic U-shaped glacial valley, while the screes of Eglwyseg are the result of peri-glacial frost shattering.

In the northern margin of the Clwydian Range to Halkyn Mountain and Mold there is evidence of a second, Irish Sea Ice Sheet. This ice sheet met and interacted with the Welsh Ice Sheet. The sediments form this ice sheet contains marine shells and rocks from the Lake District and Scotland.

During deglaciation, both ice sheets released large volumes of water and left many blocks of ices stranded. When these melted they left behind kettle holes and a hummocky landscape typified by the Nannerch area. The meltwater eroded channels both in the glacial sediments and in the bedrock. There is also evidence of rivers, lakes, deltas and tundra-like periglacial conditions which established as the ice retreated.

There were several episodes of erosion and deposition that established the present-day landscape. The valleys of the Clwyd, Wheeler and Alyn rivers are thought to have been initiated and developed under the ice sheet.

Thus the shape of the present-day landscape throughout the Clwydian Range is the result of the underlying geology which had been moulded by ice and water. These processes, although much modified are occurring today.

Plate 19 The Great Immovable Stone, Eryrys

Appendix 4

List of Consultees

David Shiel, Denbighshire Countryside Services

Raymond Roberts, Regional Geologist, Countryside Council for Wales

Simon McCurdy, Geological Manager, Tarmac Central Ltd

Noel Williams, Quarry Manager, Cefn Mawr Quarry, Castle Cement

Adrian Humpage, British Geological Survey, Head of Station, Wales

Keith Ambrose, British Geological Survey

Gary Nancarrow, Head of Minerals, Planning Flintshire County Council

Fiona Gale, County Archaeologist, Denbighshire County Council

Cath Wright, Arden Early Learning

Gail Bale, Arden Early Learning

Jeremy Knibbs, Economic Development, Denbighshire County Council

Bill Britnell, Clwyd Powys Archaeological Trust

Tony King; Joint Advisory Committee, Clwydian Range AONB