MAKING THE MOST OF THE MENDIPS: UTILISING THE AREA FOR GEOTOURISM

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The Mendip Hills are one of the most geologically varied areas in the country with a wealth of important geological sites and a wide variety of rock types, landscapes and wildlife habitats condensed into a small area. This makes the Mendips one of the best areas in the country to appreciate the relationship between geology, landscape and biodiversity.

Large numbers of people visit the Mendip Hills each year to visit its famous caves and gorges, to participate in a range of outdoor activities, and to appreciate the landscape. The region is also an important source of aggregate, which causes a conflict of interest between conservation bodies, planners, and the quarrying industry, but which has created many superb geological exposures, some of these are now important nature reserves.

There is often a great deal of published information on the geology, geomorphology and natural history of areas of high scenic value or geological interest such as the Mendips, but there is often a significant gap between the basic geological information commonly accessible to tourists and locals, and the more specialist academic literature. The British Geological Survey is currently producing a new series of user-friendly maps and guidebooks to fill this gap and to promote geotourism in several regions across the country. For the Mendip Hills, this is being done through an Aggregates Levy funded project to create two 1:25 000 scale geological maps each accompanied by guidebook and an open access website. This more user-friendly approach to geological maps will hopefully make geology more accessible to local people and visitors alike and promote geotourism in the region.

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INTRODUCTION

The Mendip Hills have a fascinating, long and varied geological history. A wide variety of rock types, landscapes and wildlife habitats are condensed into a small area only 40 km long and generally less than 10 km wide [Figure 1]. Consequently the Mendips are one of the best areas in the UK to appreciate the relationship between geology, landscape and biodiversity. This overall diversity makes the area justifiably popular for student projects, field trips and the casual visitor, and is one of the reasons the western Mendips have been designated an Area of Outstanding Natural Beauty (AONB).

In addition, the Mendips host several sites such as Cheddar Gorge, Wookey Hole and Wells Cathedral that are popular tourist attractions, while others such as Ebbor Gorge are nature reserves and demonstrate the clear link between geology and habitat. The large number of sites for walking and sightseeing in a relatively small, easily accessible area make the

Mendips a popular place to visit. This geodiversity is reflected in the large number of geological Sites of Special Scientific Interest (SSSIs) in the region. These are tabulated in Table 1 and the locations shown in Figure 2.

However, the Mendips are also the nearest source of crushed rock aggregate to the major markets of London and south-east England (Raymond, 1994). Consequently, this comparatively small area has been extensively quarried over many years. Aggregate production currently averages 11-14 million tonnes per year (unpublished data, National Stone Centre; see also http://www.mendiphills.com/). As a result over 100 quarries dot the landscape throughout the region. Some of these quarries are now famous to geologists across the world, such as the De la Beche unconformity at Vallis Vale [Figure 3] and the Mesozoic fissure fills at Holwell. Others are important wildlife sites, and a significant number are now important nature reserves and/or Sites of Special Scientific Interest (SSSI's).

Coupled with natural exposures, the legacy of aggregate and mineral extraction has provided a network of superb opportunities to appreciate the important natural and geological heritage of the area. Many sites have been described in academic papers, memoirs and textbooks right from the earliest days of geology as a science (eg. De La Beche, 1839). Yet the majority of visitors to the region are unaware of the rich local geology except in the broadest sense, principally due to a lack of appropriate interpretative material such as display panels, geological maps, guidebooks and websites aimed both at the general public and the interested amateur. Furthermore, there is little appreciation of the benefits the aggregates industry has brought to the community in terms of creating greater local geodiversity and biodiversity in the region.

THE GEOLOGY OF THE MENDIPS

The geology of the Mendips has been well documented both in geological survey memoirs (Green and Welch, 1965; Kellaway and Welch, 1993; Whittaker and Green, 1983), local society proceedings (Simms, 1997), and in undergraduate level geological field-work guides (Savage, 1977; Duff et al., 1985). The hills consist of four en-echelon periclines [Figure 1], each with a core of Devonian sandstone, the Portishead Formation, flanked by the Carboniferous Avon and Pembroke Limestone groups (formerly known as the Lower Limestone Shale and the Carboniferous Limestone), and partially buried by younger Triassic and Jurassic rocks. The Carboniferous limestones are well exposed in many of the quarries and gorges throughout the region, and in particular at Burrington Combe which is the type section for the Burrington Oolite and Black Rock Limestone subgroups. In the easternmost Beacon Hill Pericline, a small outcrop of Silurian age volcanic strata crops out, which is quarried at Moon's Hill Quarry.

The Palaeozoic rocks were folded and faulted during the Variscan orogeny, creating the classic asymmetric periclines which are so well displayed on the geological maps of the area. During the Mesozoic, a suite of Triassic and Jurassic rocks were deposited over the Palaeozoic strata. For much of this time, the Mendip region was a structural high, and this allowed a distinctive suite of local near-shore and littoral sediments to be deposited across the region, in contrast to the more typical deeper-water facies in the surrounding basins (Donovan and Kellaway, 1984). Some of the Triassic, Lower and Middle Jurassic deposits are preserved in a suite of unusual sediment-filled fissures ('neptunean dykes') within the Pembroke Limestone Group. Some of these contain rare fossils including one of the earliest mammals (*Haramiya*) and a gliding reptile (*Kuehneosaurus*) (Robinson, 1957; Savage, 1993). The relative elevated relief of the Mendip area during this time also generated a suite of unconformities, including the classic mid-Jurassic De la Beche unconformity spectacularly exposed in Vallis Vale [Figure 3] and the nearby Tedbury Camp Quarry.

The Mendip Hills also display a suite of karst features, including caves, stream sinks and some of the finest limestone gorges in the UK. Indeed, the Mendip caves are often cited as the type examples for cave development in unconfined dipping limestones (Farrant and Ford, 2004).The region has been a source of mineral exploitation since Roman times (Todd, 2007).

The legacy of lead and zinc mining can be clearly seen in many places around Shipham, Charterhouse and Priddy. Many of the old spoil heaps and mine workings are now habitats for rare or endangered plants, and are now important nature reserves, as well as areas for both recreation and military training.

The combination of the diverse and interesting local geology and geomorphology and its impact on land-use, industry and the local architecture has created the distinctive Mendip landscape and generated a well-defined sense of place. It has also created a wide variety of wildlife habitats, many of them rare in southern England. This special character is further enhanced by the marked contrast with the flat low-lying, but equally distinctive Somerset Levels to the south.

THE MENDIPS AS A TOURIST DESTINATION

Figures published by the South-west Regional Tourist Board (South West Tourism, 2005) estimate that around 3.2 million people visited the Mendip Hills Area of Outstanding Natural Beauty (AONB) region (which extends from Weston-Super Mare east to the A39 Wells – Bath road) in 2003. Of these, 3.08 million were day trips and a further 106,000 included at least one overnight stay. The type of visitor to the Mendips varies widely, but can be broadly grouped into generalised three categories; 'amblers', 'ramblers' and 'scramblers'. 'Amblers' are the classic stereotypical tourist, usually a day visitor who never strays more than a few hundred metres from the car. 'Ramblers' are typified by a dog walker or walking club member and are normally people from the local area. 'Scramblers' are a more specialised type of visitor, such as cavers, climbers and horse-riders.

Identifying the type of visitor is important for planning visitor facilities and the type of interpretive material appropriate to a site. Most visitors (72%) came from the Somerset, North Somerset, Bristol and Bath & Northeast Somerset region, most of whom (70%) were day visitors. Only 2% were from overseas. Away from the tourist hot-spots of Cheddar Gorge and Wookey Hole, the vast majority of the visitors to the Mendip Hills AONB were local people, mostly 'ramblers' with some 'scramblers', who visited the area regularly. In contrast, over 75% of visitors to Cheddar Gorge, mostly 'amblers', had not visited the area in the past 12 months. Most people come to the Mendips to either visit the tourist attractions or to participate in some form of outdoor activity, be it walking or more specialised activities. When asked what they found attractive about the area, 59% said the natural scenery. However, when asked 'What have you particularly liked on your visit to this site today', the most common response however, was 'easy parking' which may reflect the location where the visitor survey took place, but also indicates that many people use particular sites for its convenience rather than the natural scenery alone. The overwhelming majority of visitors arrived by car. For people living in the surrounding areas, public transport was negligible with only 1% arriving by public transport.

The tourism industry has a substantive local economic impact (South West Tourism, 2005). In 2003 it has been estimated that the 3.2 million trips to the region, contributed some £47.6 million total spend (£27.8 million from day visitors and £18.5 million by staying visitors). The tourism industry supports an estimated 831 related jobs and an additional 593 full time equivalent posts. Over the last 10-15 years, a thriving outdoor pursuits industry has become established in the region and forms an integral and important part of the tourism industry in the area. It has been estimated that in 2006 around 450,000 people participate in some form of 'organised activity that takes place outdoors, that requires instruction or supervision, for which payment has been made' (Ingram, 2006). This has a direct economic impact of around £5.72 million per year, with further induced and indirect benefits of around £3.27 million, and provides employment for 181 full time and 129 full time equivalent posts (Ingram, 2006).

The visitor and economic surveys suggest that although many people come to the region for the scenic value of the landscape, or participate in activities that use the landscape such as caving or climbing, relatively few know much about the geology or geomorphology of the

region. As the Mendips have some classic geological and geomorphological sites, one of the ways the tourist industry could be boosted is through the active promotion of geotourism.

GEOTOURISM

Geotourism has been defined as: “The provision of interpretive facilities and services to promote the value and societal benefit of geologic and geomorphologic sites and their materials, and ensure their conservation, for the use of students, tourists and other recreationists.” (Hose, 2000).

Geotourism can offer new opportunities for amblers, ramblers and scramblers alike and has the potential to make geology more accessible to the public. Investment in geotourism can also improve facilities for specialised user groups such as school and university field trips. Perhaps one of the most important benefits is the improved understanding of the surrounding environment, and a raised awareness of the link between geodiversity, biodiversity and cultural history. It can also help raise awareness of conservation issues such as the role of the aggregates industry in enhancing geodiversity. Furthermore, it involves local people, groups and businesses, can add value to the local economy and has the potential to extend the tourist season.

Geotourism on the Mendip Hills is not generally well established except at a few specific sites where interpretive facilities exist. The best examples occur at the tourist hotspots of Cheddar Gorge and Wookey Hole. Both Cheddar Caves and Wookey Hole Caves host small museums with some information on the basic geology, geomorphology and archaeology of the region. The best available resource is in the Wells and Mendip Museum (see http://www.wellsmuseum.org.uk/), but this gets relatively few visitors per year. Display boards and information boards are mostly confined to Somerset Wildlife Trust and National Trust reserves. These generally have some excellent information about the wildlife, but generally very little about the underlying geology.

The 1997 visitor survey suggested that most people thought that either the amount of information was about right, or had no opinion on the matter. However, at some sites such as Burrington Combe and Charterhouse there was a noticeable demand for more information, particularly on ‘Rights of Way’, ‘the history of a site’ and ‘plants and animals’.

Many of the outdoor pursuits providers such as Cheddar Caves, Black Rock Outdoor Pursuits and Rocksport utilise geological sites for their activities such as the crags in Cheddar Gorge and caves in Burrington Combe. In doing so, some of the more rock-based providers, for example caving and climbing instructors, provide a limited form of geotourism, in that they impart some basic information about the geology and geomorphology of the area. Caving and climbing are also forms of geotourism. Both sports attract both local and more distant visitors. As caves and crags are inherently geological features, many cavers and climbers have at least a basic understanding of the geology and geomorphology of the region.

AVAILABLE INFORMATION

The Mendips have been studied by geologists ever since the world’s first geological memoir was published in 1839 by Henry De la Beche, and the region continues to attract field parties today. However, the current British Geological Survey 1:50 000 scale geological maps, sheets 280 (Wells) and 281 (Frome) are unsuitable for many outdoor pursuits. This is because the maps were not designed for this purpose, but have been produced for users with prior geological knowledge, and not for geotourism use by the general public as they do not show footpaths or rights of way. The memoir for the Wells sheet was published in 1965 (Green and Welch, 1965), and although still packed with much useful information, it is not an easy read for the general public. A memoir for the Frome sheet has yet to be published.

Nevertheless, there are some excellent guides to the geology of the Mendips, for example Duff et al., (1985) and Savage (1977). However, these are now either out of date or do not cover all of the Mendips. Indeed, many of the sites mentioned in Duff et al., (1985) are now

completely overgrown, on private land, infilled or no longer accessible. Many of the sites need permission to be obtained in advance, fine for pre-arranged dedicated geological fieldtrips, but not perhaps appropriate for casual visitors who are often deterred by having to organise trips in advance. Furthermore, both these guides were aimed at undergraduate level student field trips.

The recently released Somerset County Council Geodiversity Audit, produced by David Roche Associates (2004) is an account of the geodiversity of the major aggregate quarries in the region. It is also, however, aimed at the geologist rather than the general public. It has fulfilled its remit to document the geodiversity of the major quarries, but not the Mendip Hills as a whole.

The use of the web as an educational resource is a medium which is being increasingly exploited. An example of this medium is the UKRIGS group Earth Science On-site web-site (http://www.ukrigs.org.uk/html/esos.php). This group, made up of the membership of RIGS (Regionally Important Geological and Geomorphological Sites) groups across the British Isles offers a good source of information, albeit specific to individual sites, only one of which is in the Mendips. They have also produced a CD-Rom of various sites around the country to be used by schools, in particular at Key Stages 2, 3 and 4. Tedbury Camp Quarry and Vallis Vale, near Frome with its spectacular Jurassic unconformity is one of the sites that has been show-cased. However, some of the geological information available on some websites is either taken from existing published sources (and often not credited), may be misleading, and in some cases can be plain wrong.

A wealth of detailed information is contained within the Geological Conservation Review volumes published by the Joint Nature Conservation Committee (for example: Waltham et al, 1997; Campbell et al., 1998; Palmer et al., 2000; Cleal et al., 2001; Benton et al., 2002; Cox and Sumbler, 2002; Cossey et al., 2004; Simms et al., 2004). The sites selected – GCR sites – form the basis of statutory geological and geomorphological site conservation in Britain. Although the GCR programme was managed through public funds, with much time given in kind by the authors, the books are only available for purchase in hard copy form at prices of approximately £50-100 per volume, although the introductory chapter of each volume is available on the web. There is a GCR site database available on the internet (www.jncc.gov.uk) containing information on the location of the 3000 GCR sites already selected and the reasons for their citation are available on the Natural England website (www.english-nature.org.uk). The database has no detail of the geodiversity at each site, and it is not put in context, only basic geological information being given. Furthermore, these volumes are aimed at a specialist audience with prior knowledge of geology.

Outdoor Education Centres such as that run by Somerset County Council at Charterhouse, and the Hanson East Mendip Study Centre at Whatley Quarry also help provide some geological information. However, although they provide an education service for school, college and corporate groups, they do little to cater for the individual casual visitor to the Mendips.

The lack of geological information presented in a format suitable for the interested, educated lay-person is a niche that is currently not exploited. There are several ways that this information gap can be addressed. One is by the use of more on-site interpretation boards, but these are often subject to vandalism and are limited to particular sites. The local museums have a role to play, for example in the type of displays they produce, but visitor numbers are often quite low, and often only reach a small segment of the target audience. There is scope here for greater use of their resource, for example by hosting a ‘Rocky Road-show’, which has been successful in other parts of the county, for example Bristol City Museum, in increasing geological awareness.

The British Geological Survey (BGS) has addressed this need for intermediate level information by creating a new series of geological maps and guidebooks, at various scales, of particular areas aimed at the geotourism market. As part of this series, two 1:25 000 scale

geological maps, one for eastern Mendip and one for western Mendip have been produced (Farrant, 2008a, 2008b), funded by the Aggregates Levy Sustainability Fund (ALSF). Each map accompanied by a guidebook and sold together as a single entity in a plastic wallet. In addition, the maps and guides are complimented by a web site, www.mendiphills.com with 3D geological models and additional information on the role of the aggregates industry, geology, natural history as well as links to other information sources. Similar maps and guide books have been produced for the Assynt area in north-west Scotland (Goodenough *et al*., 2004) and Charnwood Forest (Ambrose *et al*., 2007), and one is in production for the Abberley and Malvern Hills Geopark.

The two new maps of the Mendips differ from standard BGS geological maps in that they incorporate an Ordnance Survey 1:25 000 scale topographic base, on which is overlain slightly simplified existing geological line-work with suitably muted colours. Public rights of way have been obtained from the relevant local authorities and are shown on the map face. An example of part of the Western Mendip map-face is shown on Figure 4.

Central to these two new guides are a series of numbered localities shown on the map-face and described in the guidebook. These sites were selected for their geological, geomorphological, archaeological or ecological interest, and include natural exposures, quarries, nature reserves and wildlife sites, caves, gorges, old mining areas and sites with industrial archaeology. Many sites actually have a combination of features, demonstrating the close link between biodiversity, industrial archaeology, geomorphology and geology. With the exception of the two largest active quarries where permission needs to be sought in advance, the sites mentioned in the guidebooks are all accessible from public footpaths or roads, or are on open access land. The sites are not focussed on a series of walks, but instead are described so the user can choose their own itinerary, be it on foot or by car.

Some sites have been highlighted to illustrate the relationships and impacts of the aggregate industry on the geodiversity, landscape evolution and biodiversity, particularly in East Mendip where the impact of aggregate extraction has been the greatest. Many of the localities shown on the maps are sites already promoted by the Mendip Hills AONB Service. Unlike traditional geological maps, the maps have been designed with outdoor leisure and fieldwork in mind. The maps are designed to be used by the local community and visitors as a guide to sites of interest and to be of use for navigation purposes. The geological maps and guides also compliment the AONB Service Visitor and Heritage guides.

WEBSITE

To complement the maps and booklet, the BGS has developed an open-access web-site. The heart of the web-site comprises two three-dimensional landscape models of the eastern and western parts of the Mendip Hills. These virtual landscapes are fully interactive, allowing the user to ‘fly’ over the area. They complement the paper map by showing a 3D terrain overlain with aerial photographic imagery and sites of interest. By flying over the models or using an interactive static map, information on the sites of interest can be viewed. In addition, some more specialised information on the various aspects of geology, geomorphology, biodiversity and archaeology, and particularly on the history of aggregate extraction, is available for download. This increasingly detailed approach to the provision of information allows the user to explore the web-site as far as they wish, thus filling the gap between the basic information that is readily available to the wider public (for example, imparted by tour guides at Cheddar Caves and Wookey Hole) and the more specialised data available in academic journals and textbooks.

CONCLUSIONS

The Mendip Hills caters for large number of visitors who participate in a wide variety of activities. The majority of the visitors come to appreciate the landscape or participate in some form of outdoor activity, many of which utilise geological features such as the caves, cliffs and quarries. The provision of geological information for the typical visitor to the region has

been limited and patchy in the past, mainly centred around the tourist hotspots of Cheddar Gorge and Wookey Hole, and through the Wells and Mendip Museum. There is a significant gap between this basic geological information, and the more specialised academic papers, BGS maps, memoirs and undergraduate-level guidebooks such as Duff et al. (1975) and the Geological Conservation Review volumes. To fill this niche, the British Geological Survey has produced a series of new maps aimed at geotourists for specific areas of particular interest, including the Mendip Hills. The aim of these new maps and guidebooks is to explain the geology in a more user-friendly way, and to explore the links between geology, biodiversity and the landscape. By doing this, we hope to promote the demand for geotourism in the region, and improve the public understanding of areas special landscape.

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Figure captions

Figure 1. Simplified bedrock geology of the Mendip Hills.

Figure 2. Location of Geological SSSI locations in the Mendip Hills. The numbers refer to those listed in Table 1.

Figure 3. The De la Beche unconformity at Vallis Vale, with Jurassic Inferior Oolite resting on dipping grey Carboniferous Limestone. Photo: A.R. Farrant, BGS © NERC

Figure 4. Geological map of Burrington Combe, part of the new 1:25 000 scale geological map that accompanies the Western Mendip guidebook (Farrant, 2008a). The numbers relate to locations described in the guidebook. The red circles are stream sinks, the blue circles springs and the purple triangles known caves.

Table 1. Geological Sites of Special Scientific Interest (SSSIs) on the Mendip Hills. Sites marked with an * are associated with either quarrying or mining activities. The location of these sites are shown in Figure 2.

	Geological SSSI	Grid Reference	Reason for designation
1	Brimble Pit And Cross Swallet Basins	ST 512505	*Cave and karst features*
2	Banwell Caves	ST 383588	*Cave and karst features*
3	Banwell Ochre Caves*	ST 407593	*Mineralogy*
4	Bleadon Hill	ST 351574	*Quaternary stratigraphy*
5	Bourne	ST 484600	*Quaternary stratigraphy*
6	Bowlditch Quarry*	ST 668558	*Jurassic stratigraphy*
7	Burrington Combe*	ST 478583	*Cave and karst features*
8	Cook's Wood Quarry*	ST 669479	*Carboniferous limestone*
9	Crook Peak to Shute Shelve	ST 385555 to ST 430560	*Biodiversity and geology*
10	Doulting Railway Cutting	ST 645424 to ST 652425	*Middle Jurassic stratigraphy*
11	Ebbor Gorge	ST 525485	*Limestone gorge and woodland*
12	Emborough Quarries*	ST 623505	*Neptunian dykes and palaeontology*
13	Holwell Quarries*	ST 726450	*Neptunian dykes and palaeontology*
14	Lamb Leer	ST 544550	*Cave and karst features*
15	Leighton Road Cutting	ST 702437	*Neptunian dykes and palaeontology*
16	Maesbury Railway Cutting	ST 606475	*Lower Carboniferous stratigraphy*
17	Moon's Hill Quarry*	ST 665460	*Silurian stratigraphy*
18	Priddy Caves	ST 540505 to ST 549500	*Cave and karst features*
19	Sandpit Hole And Bishop's Lot	ST 531498 & ST 549494	*Cave and karst features*
20	St. Dunstan's Well Catchment*	ST 668475 to ST 655475	*Cave and karst features*
21	The Cheddar Complex	ST 465538-ST 505560-ST 470563-ST 477563	*Cave and karst features*
22	Thrupe Lane Swallet	ST 603458	*Cave and karst features*
23	Vallis Vale*	ST 755490	*Unconformity and geology*
24	Viaduct Quarry*	ST 621443	*Jurassic stratigraphy*
25	Windsor Hill Quarry*	ST 615451	*Neptunian dykes and palaeontology*
26	Wookey Hole	ST 535485	*Cave and Karst features*
27	Wookey Station	ST 53154640	*Quaternary stratigraphy*
28	Writhlington*	ST 558539	*Upper Carboniferous palaeontology*
29	Wurt Pit And Devil's Punchbowl	ST 543537	*Cave and karst features*

Table 1. Geological Sites of Special Scientific Interest (SSSI) on the Mendip Hills. Sites marked with an * are associated with either quarrying or mining activities. The location of these sites are shown in Figure 2.

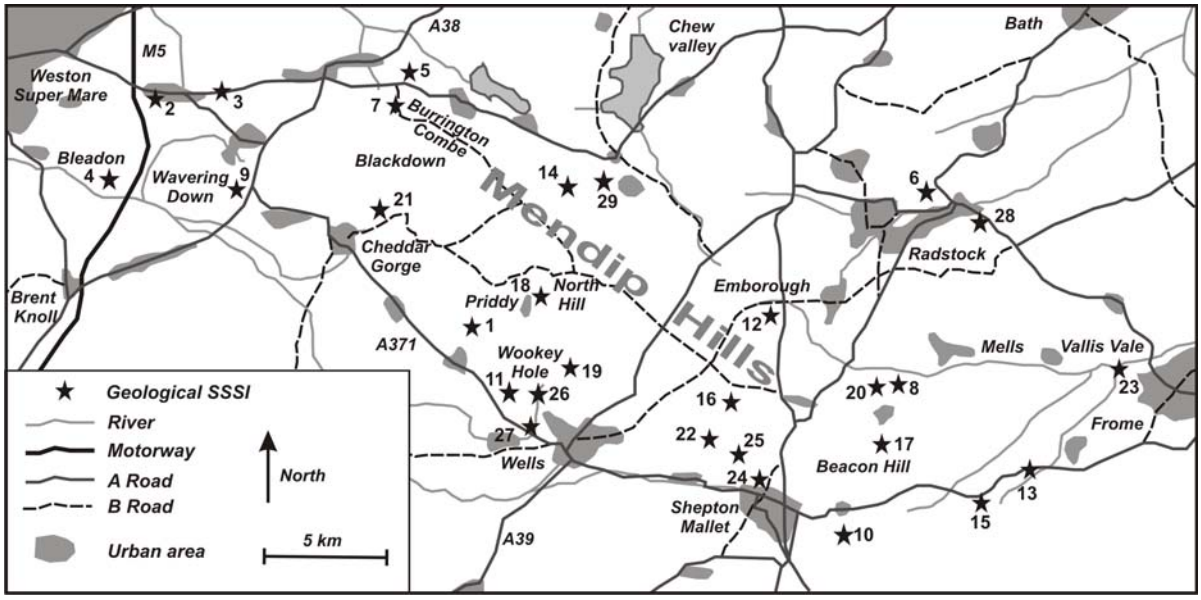

Figure 2. Location of Geological SSSI locations in the Mendip Hills. The numbers refer to the sites listed in Table 1.

Figure 3. The De la Beche unconformity at Vallis Vale, with Jurassic Inferior Oolite resting on dipping grey Carboniferous Limestone. Photograph: A.R. Farrant, BGS © NERC