

Review of Somerset's Local Geological Sites (LGS) 2017 – 2022

Final report for the Mendips area, June 2022

This Review of Somerset's LGS is a partnership between Somerset Geology Group (SGG) and Somerset Environmental Records Centre (SERC). Please note that LGS, which may be of regional to local value, are the equivalent of the former Regionally Important Geological Sites (RIGS) and that LGS status does not imply any right of public access. The scope of our review has been to cover existing LGS only, not recommendations for new sites, although some gaps in coverage and potential for future designation have been identified in the process. See DEFRA Guidance on Local Sites published in 2006 for further information on LGS designation and SERC's web page at <https://www.somerc.com/local-geological-sites/> for the key questions that we have used in this review for assessing the four criteria (scientific, educational, historic and aesthetic). The information below is completed to the best of our ability, but there may be errors or omissions and/or more recent or more detailed information available. For our review across Somerset as a whole and other area reports see SGG's Updates at <http://wp.somerc.co.uk/specialist-groups/somerset-geology-group/>.

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Our thanks to the SERC-based graduates and members of SGG who have assisted voluntarily with preparation of site forms, site visits and desk assessments, knowledge of recent geological research on the Mendips, and Panel review of these Mendip area LGS. This report has been compiled by Wendy Lutley (SGG), based on the information gathered for the review, with Doug Robinson (SGG) acting as lead mentor for this Mendip area. Those contributing to site visits and desk assessments included: Doug Robinson and Megan Trunks and John Hicks (SERC-based graduate volunteers, summer 2019). Elliot McConnel and Simon Carpenter assisted with a few of the site visits and Wendy Lutley with some of the desk work. Expertise or knowledge on different aspects and sites has been contributed by Bob Corns, Martin Doherty, Peter Burr, Peter Hardy, Alan Holiday, Adel Avery, Vince Simmonds and Garry Dawson. Our thanks to everyone who has assisted, including to Wesley Harris (SERC's temporary LGS Project Officer) for his role in contacting owners, providing guidance to Megan and John, and carrying out the final post-Panel processing stages of the review.

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1. Introduction and sites covered

This report is intended to provide an overview of the conservation interest and requirements of the LGS in the Somerset part of the Mendips and their potential for education and interpretive use¹. It does not constitute a full geo-diversity action plan: our recommendations (which appear in summary in this section numbered R1 to R14) result only from our review of the LGS and contextual information gathered for that.

There are now 54 LGS in this area (previously 57 as three have been de-designated) – defined for this purpose as consisting of those within Mendip District and those within the Mendip Area of Outstanding Natural Beauty (AONB) in both Mendip and Sedgemoor Districts. Sixteen are within the AONB (ten within Mendip District; six in Sedgemoor District; and one de-designated). The remaining 38 are all within the non-AONB part of Mendip district, particularly the eastern part of the Mendips, between Chewton Mendip and Frome.

The Mendip area as a whole is of landscape-scale geodiversity value. This is recognised in the Mendip Hills AONB Management Plan, which includes a specific objective to recognise and celebrate geological sites and features, while the Statement of Environmental Opportunity for the Mendip Hills National Character Area Profile (No 141) - which covers the wider Mendips area - includes several opportunities specifically related to geo-diversity².

In addition to the LGS covered in this report area, there are c 35 nationally important Geological Conservation Review (GCR) sites (all earth science SSSIs or within wider biological SSSIs, see Appendix 1), while two British Geological Survey (BGS) *Walker's Guides* for the Mendips, published in 2008³ cover a wide range of other publicly accessible geology sites and geological features of interest. Several active quarries in the area were also covered by a voluntary geo-conservation

¹ It is the third of a series of final area reports covering our review. See <http://wp.somerc.co.uk/specialist-groups/somerset-geology-group/> appended PDFs. The LGS (then known as RIGS) for this Mendip area were originally identified in the late 1980s by graduate workers on a SERC-based Government 'Manpower Services Commission' scheme, with identification from secondary sources, followed by a site visit in most cases. A preliminary list was then circulated to SGG members and a few additional sites were added before a final list was put forward for the local plan in 1993.

² See <https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles> .

³ Farrant, A, 2008: *A walker's guide to the geology and landscape of western Mendip* and *A walker's guide to the geology and landscape of western Mendip*, book and map, published by the British Geological Survey. See also the BGS web site for Mendips 'localities' information: <https://www.bgs.ac.uk/mendips/home.htm> .

assessment project in the early 2000s⁴. Detailed information on the many caves and old mines can be found on the Mendip Cave Registry (<http://www.mcra.org.uk/registry/>). Then there are the LGS and GCR sites in the North Somerset and BANES parts of the Mendip Hills⁵.

A good range of educational opportunities is also currently provided in the Mendips by the Somerset Earth Science Centre (SESC < <https://www.earthsciencecentre.org.uk/>>) and these often involve visits to active quarries - while the AONB supports an annual *Mendips Rocks* festival organised in conjunction with SESC.

Museums such as those at Bristol, Radstock, Wells and Frome and the Bath Royal Literary and Scientific Institute in Bath hold specimens related to the geological interest - and may hold material relevant to specific LGS. Research is actively being carried out by Institutions such as the University of Bristol. There are also several geological groups that run visits and/or hold talks about the geology of the area, for example the West of England group of the Geologists' Association (WEGA).

A new annual internationally recognized geo-diversity day will also start this year in October 2022, and may provide opportunities to raise awareness of the geo-diversity of the Mendip area, with a new Mendips Rocks project already being developed for October, including a new art installation. We hope therefore that the evidence-base from our current LGS review will provide a useful contribution to on-going geodiversity action planning for the Mendips.

Further discussion is needed, but there may be scope, via both existing and new mechanisms, for a strengthened input on geological interest. This might include, for example, the existing Mendip Hills AONB Partnership, the AONB Land Management and Nature Recovery Working Group and the AONB Community Engagement Plan for the Nature Recovery Plan, as well as current partnership working for the Mendips Rocks Festival. There may also be scope, for example, to develop training programmes for AONB and other staff and volunteers; and for some type of overarching initiative, such as international geo-park status, that would assist in developing interpretative material and encouraging geo-tourism.

- **R1 Geo-diversity action planning** - our first recommendation is therefore that the AONB, with key partners, such as SESC, Natural England, the extractive industry, Somerset Wildlife Trust and others, explore how best to further develop partnership working to assist in co-ordinating activity and developing appropriate priorities for geo-conservation at a landscape-scale, across interests and across the Mendips as a whole.
- **R2 Liaison with Natural England and building links with academic research** - as part of R1 liaison is needed with Natural England (NE) to identify any conservation priorities for GCR sites. This is especially important as the AONB will be working with NE in the next few years to bring all SSSIs, including GCR sites, into favourable condition by 2030.

There are also many other rock outcrops, old mines and quarries, and wider landscape-scale geomorphological features in the Mendips, both within and beyond the AONB. Conservation of these remains important at the wider landscape scale and in this review some sites have been found to be of similar calibre to those currently identified as LGS.

⁴ Nicholas, C., 2004: *Geodiversity Audit of Active Aggregate Quarries: Quarries in Somerset; Project Overview Report*. David Roche Consulting in association with Somerset County Council, British Geological Survey and Mendip Quarry Producers.

⁵ Stagg, K., Stonebridge, E., Hutchinson, D.R., Corner, T. and R Barnett, 2018: *Geological sites of the Bristol Region. Bristol, England*. Bristol Regional Environmental Records Centre.

- R3 The importance of non-designated exposures and features** - we recommend that conservation of other geo-diversity interest (small rock exposures, old mines and quarried landscapes and wider landscape geomorphological features, etc) be incorporated within other wider policies, such as those to protect biological SSSIs, multiple-interest green infrastructure, industrial archaeology and the new Nature Recovery Areas, in order to achieve a landscape-scale approach to geo-conservation.

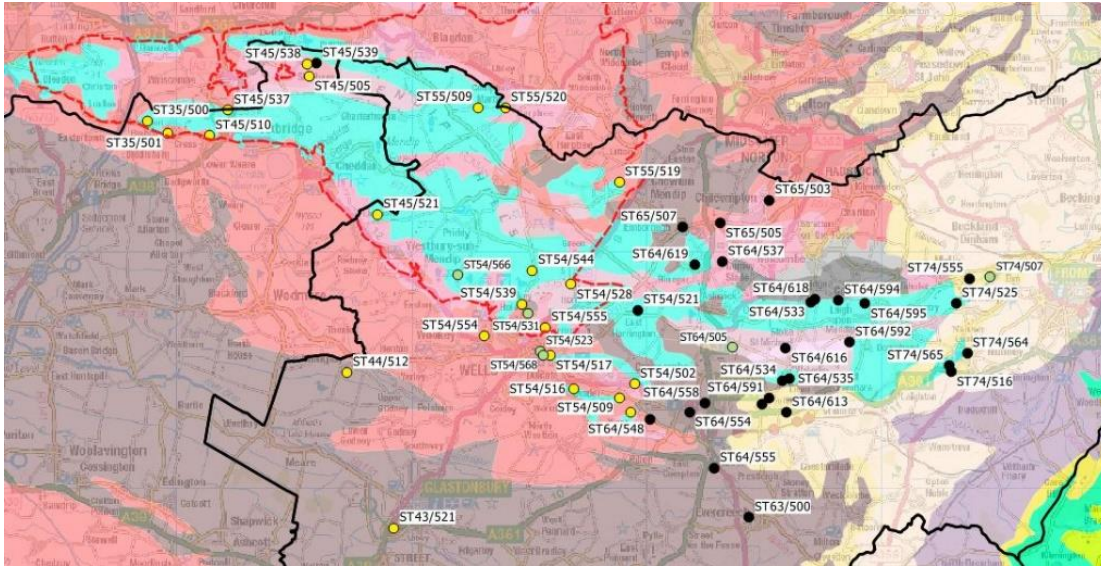


Fig 1: The general distribution of the LGS covered by this report. Red dashed line = AONB boundary; black line = district and county boundaries (Sedgemoor district to the west; Mendip to the east) LGS shown as black, yellow or green circles. NB The figures below provide more clarity on the extent of the different geological formations.

Our review in the Mendips has emerged as more complex than for other areas of Somerset. For example, five LGS overlapped with an earth science SSSI designation, where the LGS Panel needed to consider whether to remove the LGS designation; or if additional local interest still merited retention. Two old railway-cutting LGS were part infilled with waste in the late 1980s prior to original designation and the LGS Panel needed to consider whether designation should be retained or not, while other LGS were old or dormant quarry sites when originally designated, but are now part of active quarry complexes. Another c three LGS emerged with their boundaries in completely the wrong place and boundary adjustments have been made to c 30 of the 54 LGS reconfirmed⁶.

A high proportion of the Mendip sites have also needed to be desk-studies⁷. Some were straightforward candidates for reconfirmation. In other cases, additional work is ideally needed. LGS

⁶ In c 15 cases these were fairly substantial, including corrections where the previously recorded digital boundary had been developed at slightly the wrong location or as a generalised oval, but our more detailed inspection indicated a more precise area was intended; c 15 were more minor changes (to better fit SERC's master-mapping, etc).

⁷ Permission for a site visit was achieved for 27 of the original 57 LGS. The remaining 30 sites were reviewed as desk and reconnaissance studies only: 18 were where permission was sought, but no reply was received; in four cases permission was refused; in five cases ownership was identified, but not in time to arrange a site visit; and in three cases no owner was traced. The main field season was in 2019, with a few site visits carried out earlier in 2018. The ability to follow up permissions further for site visits in 2020/21 was limited by capacity, the need to progress the review for other parts of Somerset and the Coronavirus pandemic.

may be of regional or more local interest and in some more local-interest cases - especially where a site visit has not been possible - the LGS Panel has taken a precautionary approach and reconfirmed the LGS with a note indicating that further work beyond the scope of this review is ideally required.

- **R4 Priorities for further review** - the main priorities for immediate further review are a few instances where full details of ownership were not clarified until late in the review with no time to pursue a site visit; and where reclamation/infill has occurred and there are other potential sites closely adjacent. The highest priority in this respect is for the Jurassic Inferior Oolite, where there are both old and contemporary Doultong Stone quarries (see Section 4.9). An initiative to help develop local contacts with owners would also be useful, to enable site visits where no reply was received to SERC's approach for this review.

New Sites for Old (NSfo)

Twenty-two LGS (ie c 40 %) featured originally in *New Sites for Old (NSfo)*, a guide to teaching sites in the Mendips, published by the Nature Conservancy Council (NCC, now Natural England) in 1985 and now out of print. NCC had organised clearance of faces and made arrangements for access in the years preceding its publication, the project being a valuable example of a geo-conservation initiative. However, it is clear that even by time of publication in 1985 some sites were already being used for waste infill and by the time of site survey for the identification of the potential LGS (then RIGS) in the late 1980s/early 1990s there was already difficulty in obtaining access to some sites.

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Fig 2: Contents table from *New Sites for Old (1985)* annotated with those sites that are LGS (with their ref no) x = not LGS. NB Site 2 is also LGS: the grid ref in NSfo is incorrect, but the location matches the LGS. Site 3 describes a slightly different but related interest adjacent to the LGS. Site 19 has an incorrect grid ref in NSfo, corrected for the LGS, hence the reference here to it being close. Site 20 has a slightly different grid ref. Site 28 is close to a LGS but a different interest.

These NSfo LGS vary in their value, from the exceptional Site 27 Tedbury Camp Quarry, which is now considered of national value as a teaching site, to sites of more local interest. In this current review, as described above, we have taken a precautionary approach and all these NSfo site LGS have been

reconfirmed, sometimes with boundary adjustments for more accuracy. In some cases there may be scope for re-excavation of the original exposure in the longer term (where for example there is current policy in the local plan to prioritise use of old railway lines in the future as new transport corridors). In other situations, there is historic interest that might be mentioned in interpretative material for a footpath route and/or continuing potential for future research, even if cleaning the site of vegetation for use by educational groups may be impractical.

- **R5 Potential for the educational material in *NSfO* to be further developed** – there is good potential for this for some individual sites, or groups of sites: if further investigation indicates good potential for contemporary field study use and/or interpretative material; and practical proposals can be developed with the owner for face cleaning, maintenance and access. See, for example, Sections 4.7 and 4.8 for Upper Triassic and Lower Jurassic LGS in the eastern part of the Mendips.

2. Scientific interest

As mentioned above there are c 35 nationally important GCR sites in this part of the Somerset Mendips, over 50% of the c 62 GCR sites for Somerset as a whole. These are all earth science Sites of Special Scientific Interest (SSSIs) or part of wider biological interest SSSIs, but in addition to their scientific value they may also have educational value for field studies, historic interest and/or have potential for interpretation. The outstanding example in this respect is the GCR site covering the Vallis Vale unconformity near Frome, a classic location for field education where DIGS (the group that carries out practical conservation work on Dorset LGS) has been assisting with working parties to help keep the face clean for several years.

The LGS complement these nationally important GCR sites, having scientific value at a more regional or local scale - by virtue of having been documented in the scientific literature in the past, by being of contemporary research interest and/or having potential for future research. During our review, we have become aware, for example, of contemporary research being carried out by Prof Mike Benton of Bristol University and his students on Triassic fossil faunas; and of new techniques allowing a greater understanding of the climatic depositional conditions in Quaternary cave systems.

3. Opportunities for geo-conservation and geo-interpretation

- **R6 Practical conservation work** – the highest priorities for the LGS is to ensure that practical conservation work continues to take place at Tedbury Camp Quarry to maintain its wave cut unconformity surface (see Section 4.3); and to liaise with owners to consider any conservation work required at a few other LGS where features are unique in the Mendips and/or there are only a few other comparable sites nationally. Otherwise, there are several LGS which are overgrown, but requirements for clearance are best developed in tandem with opportunities to provide access and develop interpretive and educational material (as mentioned above, for example, under the *NSfO* LGS).
- **R7 The Silurian inlier** - a joint project, including the active quarry owner(s), SESC and Natural England is ideally needed in the future to further consider conservation of the oldest rocks of the Mendips and associated educational use and interpretation (see Section 4.1 below).
- **R8 Carboniferous Limestone, structural interest and the potential for parish level geo-walks and schools and community-based projects** – See Section 4.3 for examples of the wide range of opportunities that there may be in relation to the various LGS that cover the interest of the Carboniferous Limestone, including potential parish level geo-walks and for

LGS to contribute interest to local business /industrial parks in old quarries. Further review ideally requires specific expertise in the Carboniferous Limestone.

- **R9 The Upper Carboniferous Quartzitic Sandstone** – The Quartzitic Sandstone Formation is unique to the Mendips and we are aware of only two localities where there is a continuous sequence (potentially useful for field studies) illustrating the changing conditions from the Lower Carboniferous into the Upper Carboniferous. One is the Cook’s Wood Quarry area, which should be a high priority for further review, while the second is a proposed new LGS at Deer Leap on publicly accessible open space in the AONB, which should be a high priority for designation. See Section 4.4 for further detail.
- **R10 The Somerset Coalfield** - a project to further review the situation in this southern part of the Somerset coalfield, in conjunction with the part of that lies in BANES, and to progress any conservation requirements and potential for interpretative material should be a high priority. See Section 4.5 for further detail.
- **R11 The Mendip unconformities** - as well as the nationally important Vallis Vale GCR site and the Tedbury Camp Quarry *NSfO* site mentioned above, several other Mendip LGS illustrate renewed deposition on earlier eroded surfaces. See Section 4.6 for those involving the Triassic Dolomitic Conglomerate (unique to the Mendips). Some of these could be high priorities for practical conservation work, pending further liaison with the owner, and access arrangements. In addition, see below and Sections 4.7 and 4.8 for two *NSfO* LGS that represent marine incursion in late Triassic/early Jurassic times when the Mendips became islands and that have unique marginal marine-origin deposits lying unconformably on the older strata. Both were first described by the early Somerset geologist, Charles Moore, and although not now suitable for group field studies, have potential for off-site interpretation.
- **R12 The late Triassic and early Jurassic marine transgression** - The potential mentioned in R5 above, for the educational material in *NSfO* to be refreshed, applies in particular to the Upper Triassic and Lower Jurassic LGS described in Sections 4.7 and 4.8. These are mostly in the eastern Mendips, beyond the AONB (including a group in the Shepton Mallet area) and provide examples from a range of different depositional situations, close to and further from the Mendip shore line at that time.
- **R13 Quaternary landscapes** - there is scope for more interpretive material on the various periglacial, karstic and fluvial erosion and hydrogeology/water resources features of the Mendips and adjacent Levels, to assist with understanding more recent landscape change, with views, such as from Crook Peak and Wearyall Hill, providing good opportunities for this – see Section 4.10. One of the objectives of the AONB Management Plan is, for example, to *‘increase awareness of the Mendip Hills geology, particularly cave systems in relation to the importance they play in water management and water supply’*.
- **R14 Old mine and quarry sites** - LGS cover only a very few of the old mining sites in the Mendips and consideration is therefore needed as to whether these are adequately protected by other designations, while there is considerable potential for including information on their geology in any associated interpretative material. This might be on the mineralogy of their ores, use and on the country rock in which they occur - with scope for good visual material. There is also scope for interpretative material on geology relating to local building stone and road stone quarrying to be included in local history/community projects on the history of the quarries. See further information under Section 4.11.

4. Formations present

The Mendip Hills are formed by older rock strata (largely Devonian and the Carboniferous Limestone) that now occupy the cores and sides of four major folded and plunging periclinal structures, formed during the Variscan mountain building orogeny. These create most of the higher ground of the contemporary hills, with an area of softer Carboniferous Coal Measures strata found on the northern side of the Beacon Hill Pericline. Subsequently there was erosion and deposition of younger strata, initially non-marine in Triassic times and then a major marine transgression, when parts of the Mendips remained as islands. There are thus several localities where Triassic and later Jurassic rocks can be seen resting unconformably on the older strata and where the younger rocks illustrate sedimentary near-shore facies unique to the Mendip area⁸. Plus, there are fissure infills of this age within the Carboniferous Limestone locally. There are also features representing an interesting Quaternary history, with periglacial climatic conditions and changing sea levels, including karst and cave features where limestone is present. NB The formation and other stratigraphic names used below and for our review are largely as given by Farrant, 2008 (*op cit*).

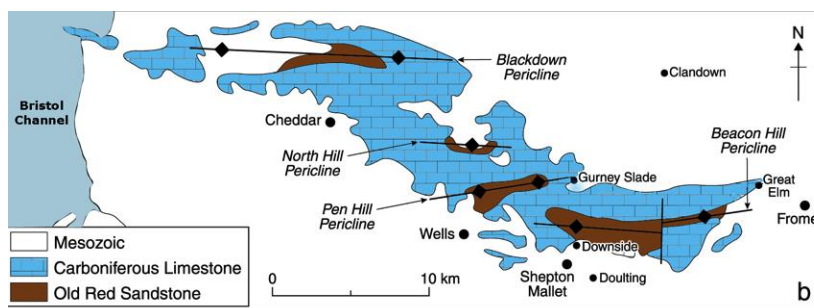


Fig 3: Simplified geological map showing the main periclinal structures that form the Mendip Hills (source unknown)

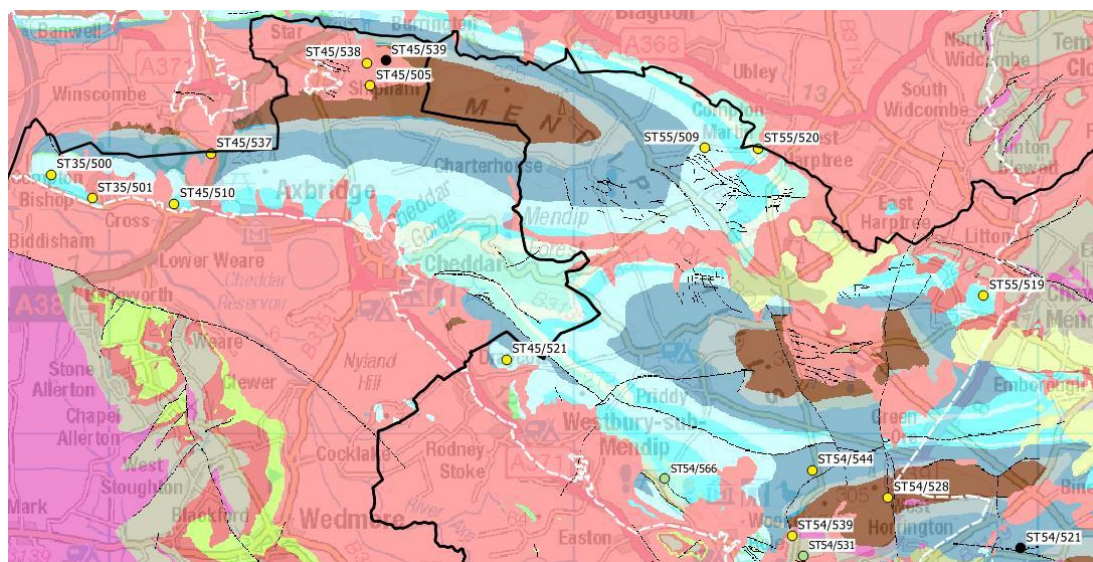


Fig 4a (above): The geology of the western part of the Mendips, showing (from the west to east) the Blackdown, North Hill and Pen Hill periclinal structures.

⁸ See Farrant, R D *et al*, 2014: *New evidence of the Cretaceous overstep of the Mendip Hills, Somerset, UK*, Proc Geol Assoc, Vol 125, 63-73 for research that has identified Upper Greensand of Cretaceous late Albian-age to also be present very locally.

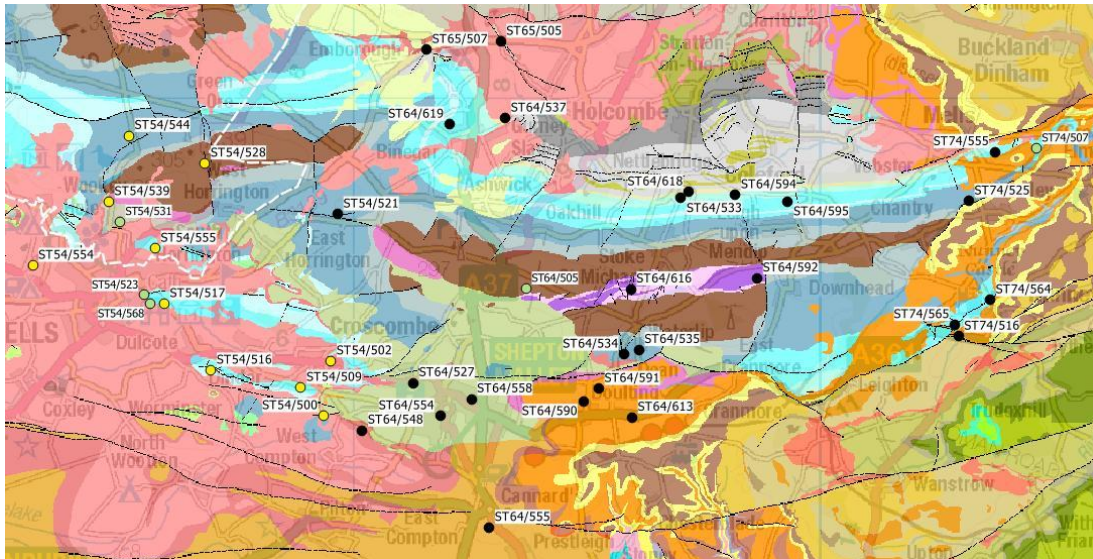


Fig 4b (above): The geology in the eastern Mendips showing (from west to east) the Pen Hill and Beacon Hill periclines.

Note for both Fig 4 a and 4b: Devonian strata in the core of the periclines = brown. Carboniferous Limestone formations = shades of grey, blue and turquoise. Geological map derived from BGS 50k data (<https://www.bgs.ac.uk/datasets/bgs-geology-50k-digmapgb/>). For full key to formations see BGS viewer at http://mapapps.bgs.ac.uk/geologyofbritain/home.html?_qa=2.138656113.371923445.1610012182-153181825.1546632697 . LGS = black, yellow and green circles.

4.1 Silurian (Wenlockian GCR conservation interest)



Fig 5: The Silurian inlier in the eastern Mendips purple (Andesite) and pale lilac (volcanic tuff) within the younger Devonian strata (beige-brown). Geological map derived from BGS 50k data (<https://www.bgs.ac.uk/datasets/bgs-geology-50k-digmapgb/>). For key to other formations see BGS viewer at http://mapapps.bgs.ac.uk/geologyofbritain/home.html?_qa=2.138656113.371923445.1610012182-153181825.1546632697 . LGS = red circles.

The oldest rocks are those of the Silurian inlier in the eastern most part of the Mendips (beyond the AONB), which form the most southerly outcrop of Silurian strata in Britain and have the additional interest of including a suite of volcanic rocks (rare in Somerset). The nationally important GCR site for this interest is Moons Hill Quarry earth science SSSI. There are two LGS, the western one has a slight overlap with the GCR site and was originally designated prior to the current active quarrying which now occupies much of its area. Both it and the GCR site are part of the same Moons Hill quarry complex, while the Somerset Earth Science Centre (SESC) is a geo-education centre based at

Moon's Hill Quarry. The other LGS, a disused and flooded quarry, provides exposure of the volcanics in the more easterly part of the inlier and has been reviewed as a desk study only, while *NSfO (op cit)* covered the additional interest of an exposure of Silurian shales in a nearby lane and Lower Limestone Shales group of the Carboniferous Limestones in an adjacent trench - both beyond the current LGS boundary. The Moons Hill complex was also covered by the voluntary geo-diversity assessment carried out on some active quarries in the Mendips in the early 2000s (Nicholas, C, 2004, *op cit*), which has not been accessed for this review.

A joint project is therefore ideally needed in the future - in conjunction with the quarry owners, Natural England and SESC - to consider in more detail the best sites for long-term conservation of local value to complement the GCR site including: looking at any boundary adjustments needed; the scope for including the Wenlock shales interest; and any face cleaning etc needed to facilitate educational use. See also below for possible extension of a nearby LGS on Devonian strata to the west to cover this interest.

4.2 Devonian (Devonian non-marine GCR conservation interest)

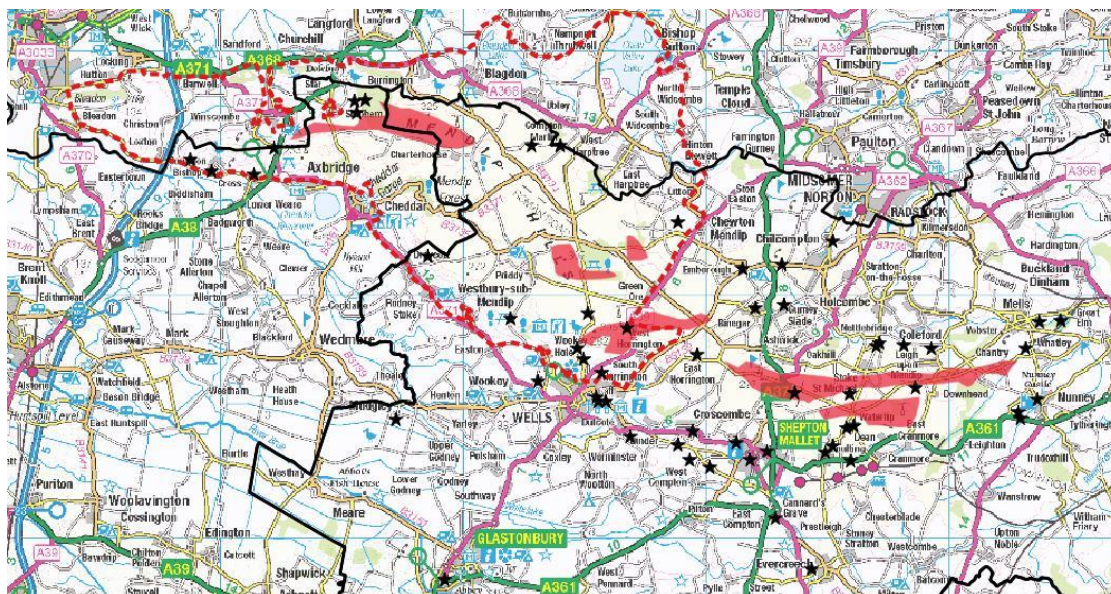


Fig 6: The extent of Devonian strata in the Mendips shown here red. LGS shown as black stars. District and county boundaries shown in black; AONB boundary red dashed. NB also shown brown in Figs 4a and 4b.

The Devonian followed, with the non-marine strata of the Portishead Formation **now** exposed in the cores of the four Mendip periclinal. Outcrop is generally more limited in the Somerset Mendips than on the nearby North Somerset coast (where the sedimentological features of the strata are reported to be better exposed), so there are no inland Mendip GCR sites covering this formation, but three LGS help to illustrate this interest in the periclinal cores of the Mendips and could be of potential research interest in considering any contrast with the coastal exposures. There is potential for educational use, with two of the sites having featured previously in *NSfO*.

From west to east the LGS include: one in the Blackdown Pericline (within the AONB, with younger Triassic Dolomitic Conglomerate overlying the formation unconformably in the Rowberrow Forest area managed by Forestry England); one in the Pen Hill pericline (in the AONB and formerly featured for educational use in *NSfO*); and one which marks the easternmost extent of the Portishead Formation in the Mendips, also featured in *NSfO* and in a woodland reserve where potential extension of the LGS boundary could include the juxtaposed Silurian rocks (see above).

4.3 Carboniferous Limestone (Dinantian) and including Variscan structural interest

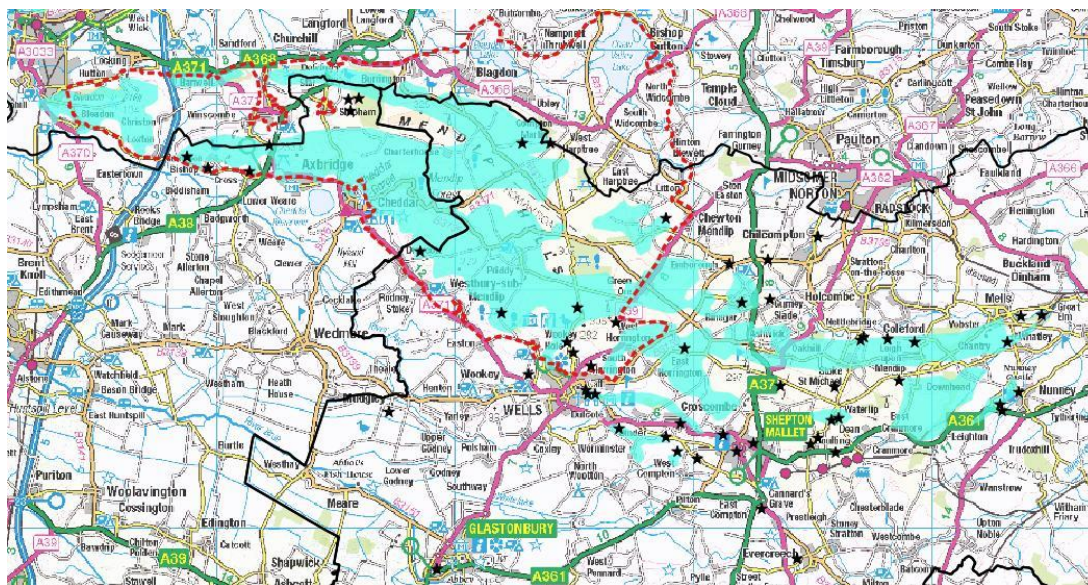


Fig 7: The extent of the Carboniferous Limestone in the Mendips all formations = turquoise. LGS shown as black stars. District and county boundaries shown in black; AONB boundary red dashed. NB The different formations can be seen in Figs 4a and 4b.

Deposition of the marine Carboniferous Limestone followed the Devonian with a number of different formations present. The main formations are (youngest at the top):

- Oxwich Head Limestone Formation
- Clifton Down Limestone Formation
- Burrington Oolite Formation (Vallis Limestone Formation in the east Mendips only);
- Black Rock Limestone
- Avon Group/Lower Limestone Shale (succeeding the Devonian and poorly represented).

These strata were deformed by folding in the subsequent Variscan mountain-building period, so that they surround the cores of the four main periclines. The latter are from west to east:

- Blackdown pericline - in the AONB
- North Hill pericline - in the AONB
- Pen Hill /Dulcote pericline
- Beacon Hill pericline in the east.

See Figs 4a and 4b and the link to the BGS viewer there for more detail on the distribution of the individual formations and their structural arrangement in these periclines.

There are c 25 LGS which complement three nationally important GCR sites for this Dinantian stratigraphical interest in the Somerset Mendips, while other GCR sites are on the Carboniferous Limestone, but are designated for their karst, cave and fissure infill interest (see Appendix 1).

In total the LGS provide examples of: the different formations; different types of limestone within them (deposited in different sedimentological conditions); different fossil faunas; structural interest, due to their location at different situations on the periclines; unconformable relationships with other

strata; and/or they are of interest for their mineralogy, fissure infill, karst or cave interest. Many are exposures in old quarries.

For example, within the AONB, Crook Peak (NT-owned and the most westerly of the LGS) and Draycott Sleights (also an open access area) provide accessible sequences through the Burrington Oolite Formation on the southern limb of the Blackdown and North Hill periclinal structures respectively, with contemporary limestone-pavement type weathering of the strata. A more modest LGS, also within the Burrington Oolite and AONB, provides steeply NNE dipping strata on the 'nose' of the Blackdown Pericline within a Local Wildlife Site with a permissive footpath. Another LGS in an old quarry at the eastern end of the AONB is in a locally complex area geologically on the northern side of the North Hill Pericline with several footpaths, including some that link to Chewton Mendip village. There may thus be potential for the development of a parish level geo-walk, although the junction between the Clifton Down and Oxwich Head Limestone Formations in the LGS itself may not now be exposed. An old quarry near Wells, illustrates ancient erosion surfaces and stromatolitic (algal mat) beds within the Clifton Down Limestone and may have potential for local school use, subject to safety considerations and if the owner were to be willing. One former LGS, now an infilled old quarry has also been de-designated.

Beyond the AONB, examples include the now disused Dulcote Quarry, a *NSfO* site within the Clifton Down Limestone Formation. It has good exposure, plus the additional mineralogical interest of the former quarrying producing many beautiful geodes, some of which are now in museums. Nearby, an old quarry is currently used for farm storage, but is close to Roundabout Hill, where the local landscape value is a result of varied geology, with scope for interpretative material or a geo-walk.

Further east again, Maesbury Quarry, a *NSfO* site, is at the western end of the ridge forming the Beacon Hill Pericline and exposes the older Black Rock Limestone, but its main interest is for mineralization (see Section 4.10 below). LGS in the Cooks Wood Quarry area on the northern side of provide potential for a continuous sequence from the Clifton Down Limestone Formation, through younger formations, with a public footpath through the area, used previously for a Mendip Rocks festival geological walk.

Disused Barnclose Quarry provides exposure further east along the same pericline with potential to study lateral variation in the same formations. It is an example where potential business park use in the future could provide opportunities for site cleaning, interpretive interest and occasional small field group use. A *NSfO* site in the Oxwich Head Limestone Formation nearby, although privately owned, is a high priority for assessment of any practical conservation needed to ensure tree bole impressions within a bedding plane, a feature unique in the Mendips, within a cyclic sedimentary sequence, is not lost.

Tedbury Camp Quarry in the east, is the most outstanding of Somerset's LGS in the Mendips, with an extensive marine erosion surface developed over the Clifton Down Limestone Formation, including fossils of burrowing organisms, with later Jurassic limestone lying unconformably above it. The erosion surface is exposed in an old quarry floor cleared by the former NCC in advance of publication of *NSfO* in the 1980s, with more recent published educational resources available on-line (see for example <https://geohubliverpool.org.uk/tedbury/index.htm>). It is periodically cleaned by volunteers and is regularly used for field studies, with access arranged via SESC.

Several of these LGS have been reviewed as desk exercises with a precautionary approach taken in reconfirming them. Further review is desirable if and when opportunities for access and/or more specialist expertise becomes available, including consideration in conjunction with any LGS of in North Somerset and BANES.

There is only one other LGS covering Carboniferous Limestone in Somerset, near Cannington, in the former Sedgemoor district. It is the most westerly exposure of the Carboniferous Limestone in Somerset (and South West England) and occurs there, with carboniferous-aged siltstones, as a small isolated inlier within younger Permian-Triassic strata.

4.4 Upper Carboniferous - Quartzitic Sandstone Formation (Namurian interest)

This formation occurs as a relatively thin band of quartzitic sandstone (as its name implies) above the Carboniferous Limestone and underlying the Coal Measures in a few localities only. It is unique to the Mendips with an interesting history relating to its geological interpretation. The **few** LGS covering it are therefore very important, especially as there are apparently no nationally important GCR sites covering this interest.

A new LGS is proposed on open space in the Deer Leap area of the AONB on the southern side of the central periclinal folds to provide better educational potential than the current LGS in that area. It and LGS in the Cook's Wood area, on the northern side of the eastern pericline, are the only localities that we are aware of where there is a continuous sequence (both potentially useful for educational use) from the underlying Carboniferous Limestone.

A third location is Shores Hill Farm Quartzite Quarry *NSfO* site (on the north side of the periclinal folds and assessed as a desk exercise), which also includes an unconformity with the overlying Triassic Dolomitic Conglomerate. Assessment of the current condition is desirable, if permission can be obtained from the owner in the future, to explore site cleaning to re-expose the interest, including whether any removal of farm waste infill needed could be achieved reasonably easily.

4.5 Upper Carboniferous - Coal Measures Group (Westphalian interest)

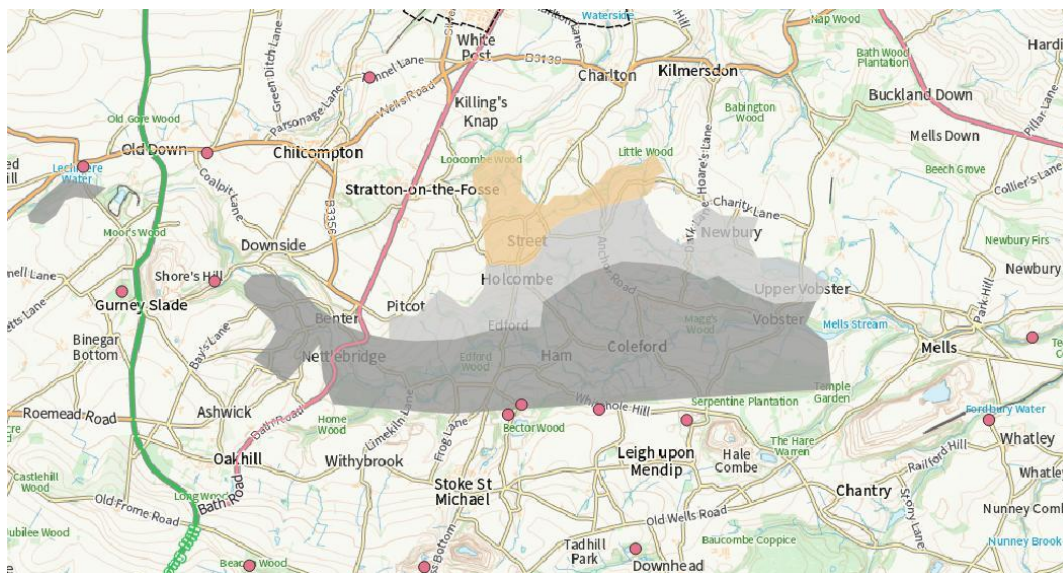


Fig 8: The Coal Measures in the eastern part of the Mendips dark grey = Lower Coal Measures; light grey = Middle; and beige = Upper Coal Measures. NB The underlying Quartzitic Sandstone is here a very narrow band along the southern margin of the main extent of the Lower Coal Measures. LGS in the area shown as red circles, with the Emborough Dam *NSfO* site in the separate area of Lower Coal Measures to the north east.

There is only one LGS reported to have exposure of *in situ* strata (the Emborough Dam *NSfO* site) and no nationally important GCR sites for this southern part of the Somerset Coalfield, while another LGS has no exposure and waste infill only. The *NSfO* site was reviewed by desk assessment only. It is currently not apparently accessible for teaching use, but could potentially be restored in the future if the owners were willing. It is therefore a high priority for exploring possible future access, site cleaning and interpretation. NB It exposed Coal Measures Group strata - not coal itself.

The Cooks Wood Quarry area also includes an area underlain by the Coal Measures (again desk assessment only possible), but the Coal Measures here are reported from the past to not be well exposed, although there are reported to be exposures in the banks of the Mells River to the north, while both pits and waste heaps are reported in Edford Wood. Further assessment of this area is therefore also desirable.

Most of the Coal Measures material available for study is reportedly in waste heaps associated with old pits, rather than *in situ*. However, the one LGS with infill of this type is not known to have been of particular interest for its plant and insect fossils and it may now be heavily weathered and vegetated. The strata is also often friable and frost action can cause blocks to shatter into small pieces. It is therefore reported to be unlikely to produce good fossil specimens.

Given the historic interest, a high priority should therefore be given to further review and assessment of this southern part of the Somerset coalfield, in conjunction with the part of the coalfield within BANES, to ensure that there is adequate conservation of the geological features in the field and geological interpretative material available - to complement industrial archaeological remains, local history interest, museum specimens and artefacts.

We understand, for example, that there are bell pits related to coal mining that are Scheduled Ancient Monuments in Somerset Wildlife Trust's Harridge Woods and Cockles Fields Nature Reserves (with the Perrink coal seam of the Lower Coal Measures near vertical at the latter near Nettlebridge). Part of the Somerset Coal Canal (dug but never completed) can also still be seen in the woods at Harridge and Edford, where there is coal exposure near the surface.

Further north, in the Radstock area of the BANES unitary authority, there is the Writhlington SSSI, which is a GCR site for its Farrington Beds, while an old tip at Kilmersdon, featured in *NSfO* and is also designated LGS/RIGS (see Stagg *et al*, 2018, *op cit*). SESC also reports that it has taken fossil foray & school groups to a site formerly used by fossil collectors in the Writhlington area, with permission of the landowner, although ownership has changed recently. It has a fact sheet on the fossils present, while the dragonfly species *Boltonites radstockensis* was discovered there. The material was deliberately deposited there after coal mining ceased at nearby sites.

Large slabs of spoil could be split into smaller sheets, with good preservation of many insects and plants and fossil arthropods described by Ed Jarzembowski and Peter Austen and are reported to be preserved at the British Museum of Natural History. SESC holds a collection of plant fossils collected by Alan Bentley, but Peter Hardy's material, loaned to Radstock Museum, may have been lost. We are also aware that mining artifacts are held in, for example, the Radstock Museum, and community arts activities have included, for example, the revival in the 1990s of an annual 'miners gala' involving local primary schools in traditional dance and song activities including creative work such as song writing.

4.6 Triassic strata (Triassic GCR conservation interest)

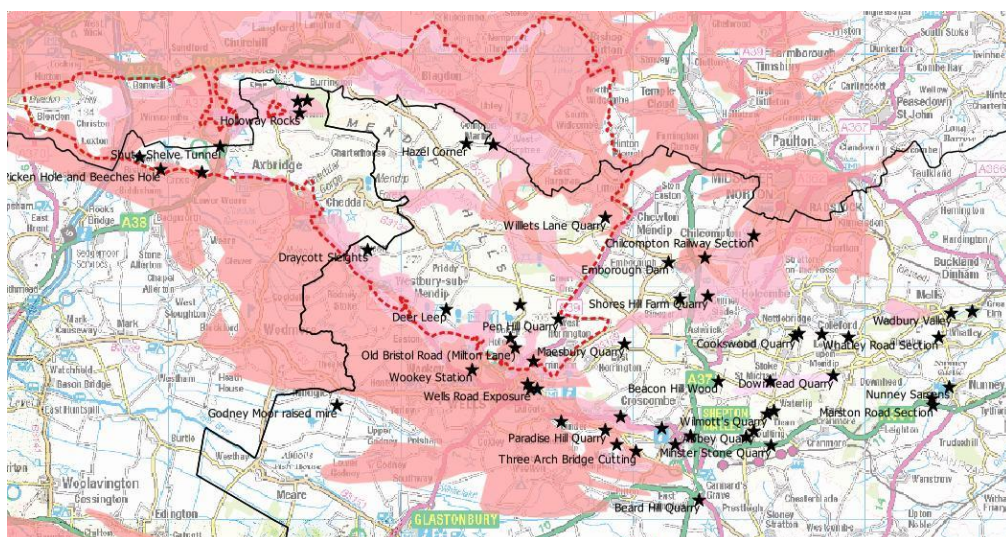


Fig 9: The Triassic strata of the Mendips shown red with the marginal facies (which includes both the Dolomitic Conglomerate and the late Triassic Penarth Group ie former Rhaetic) shown pink. LGS shown as black stars. District and county boundaries shown in black; AONB boundary red dashed.

The main part of the Triassic (excluding the Late Triassic Penarth Group for which see Section 4.7 below) is represented in the Mendips by the Mercia Mudstone Group. Within this there is the particular interest of the Dolomitic Conglomerate facies, which (like the Carboniferous Quartzitic Sandstone) is unique to the Mendips. There is only one nationally important GCR site in the Mendip area for this age strata (Emborough Quarry SSSI, of interest for its fossil fauna) so the LGS are of importance for the Dolomitic Conglomerate facies *per se* and also its unconformable relationships with older or younger strata.

Within the AONB there are c four LGS covering this interest. Three are within the Rowberrow Forestry England managed area, one with Dolomitic Conglomerate lying unconformably on older Devonian strata, while the other two are primarily of Quaternary interest for swallet and cave features, but developed in the Dolomitic Conglomerate. An LGS in the Draycott Sleights area has also been extended across the road to cover Dolomitic Conglomerate interest on publicly accessible land.

Beyond the AONB there are another four LGS, all featured previously in *NSfO*. One is part of the Wells area *NSfO* site (with both Dolomitic Conglomerate and Mercia Mudstone present and a further nearby LGS covering the unconformity with the Carboniferous Limestone). See also Section 4.4 above for Shores Hill Farm Quarry and Section 4.7 below for Stump Cross railway cutting and Chilcompton Old Down Cutting. All three are reported to include Dolomitic Conglomerate.

4.7 Late Triassic – Penarth Group (Rhaetic GCR conservation interest)

The Somerset Mendips include important exposures of the late Triassic Penarth Group (former Rhaetic, see Fig 9 above for general extent). These strata often rest unconformably on older rocks and represent the start of a major marine transgression that continued into Jurassic times. The higher ground of the Mendips formed islands at that time, with nearshore sediments adjacent. At the same time deposition was also occurring in fissures within the Carboniferous Limestone, sometimes with valuable fossil content, and this continued into the Jurassic.

Hapsford Bridge in Vallis Vale (within a wider differently named SSSI) is the main nationally important GCR site for this stratigraphic horizon in the Somerset Mendips. The LGS complement this national interest with additional sites, both north and south of the higher ground of the hills.

Several of these LGS are old railway cuttings and virtually all featured in *NSfO*, although even then the exposures were being adversely affected, in some cases by waste infill, and/or access arrangements have subsequently lapsed. Some of these sites are of historic interest for their investigation by early geologists and/or remain of contemporary interest for research for their vertebrate fossil remains. Several have been assessed for this review as desk and/or reconnaissance surveys only. A project is therefore desirable (as for the Lower Jurassic LGS below) to identify those where site clearance, re-establishing access and updated resource material would be most practical and useful for future educational use and/or public interpretation. Other LGS should be retained even where infilled or scrubbed over, in case longer term opportunities arise.

Old Bristol Road *NSfO* site is the only one of these LGS within the AONB – the rest are further east and include the Three Arch Bridge Cutting, Chilcompton Railway Section, Chilcompton Old Down Cutting and Stump Cross Railway Cutting *NSfO* sites (the latter two also mentioned above and/or below, for other interest). Holwell Car Park and Marston Road Section *NSfO* sites were both included for fissure infill interest, but Penarth Group sediments also lie unconformably over the Carboniferous Limestone at Marston Road Section, which was described originally by the early Somerset geologist, Charles Moore and has been the subject of more recent research. A further LGS reported to be of interest for fissure infill is in an old quarry now a business/industrial site.

4.8 Lower Jurassic (Hettangian, Sinemurian & Pliensbachian interest)

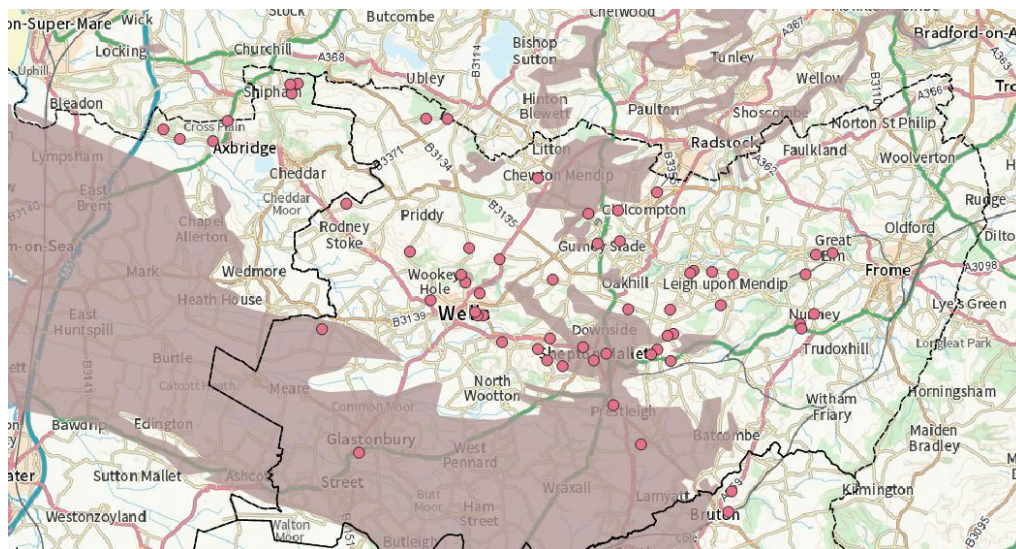


Fig 10: The extent of Lower Jurassic strata in the Mendips shown beige-grey. LGS shown as red circles. District boundaries shown in black; county boundaries dashed black. AONB boundary not shown.

Marine transgression continued in Lower Jurassic times, with sediments typical of near-shore conditions being deposited in the Somerset Mendips. There are c eight LGS representing this interest (all beyond the AONB) and all but one are *NSfO* sites. They complement two GCR sites (Hobbs Quarry and Viaduct Quarry SSSIs), which cover marginal facies on the south side of the Mendips in the Shepton Mallet area. NB Other nationally important GCR sites of this age cover fissure deposits within the Carboniferous Limestone - see Appendix 1.

Six of these LGS are in the Shepton Mallet area and help to illustrate the different facies present (ie variation in the nearshore sediments), including the ‘Bowlish facies’ described by Bristow and

Donavan⁹. Five featured in *NSfO* and included site clearance and access arrangements at that time. Several are now in need of clearance and a project is desirable to further assess them in terms of those most suitable for clearance and future use (in tandem with that recommended for the Penarth Group LGS). Shepton Mallet Railway Cutting is possibly amongst the best for any potential conservation work, as it is within the ownership of Mendip District Council. Whatley Road Section is now covered with vegetation and is on a busy road, so is less suitable for work to re-expose the strata. However, it is crossed by the East Mendip Way and provides a potentially interesting story for off-site interpretation as it was first documented by the early Somerset geologist, Charles Moore.

The two other LGS, Old Bristol Road and Chilcompton Old Down Cutting *NSfO* sites, also cover this interest in addition to their Penarth Group interest (see Section 4.7). A swallet within the AONB also provides an example of karst geomorphology developed where Lower Jurassic clays overlies Carboniferous Limestone, while Wearyall Hill in Glastonbury, illustrates mass movement over Lower Jurassic clays - and provides views from its summit footpath from which to consider the Quaternary history of the Somerset Levels. NB There are no LGS in the Somerset Mendips for Lower Jurassic Toarcian interest, which is represented by Maes Down SSSI/GCR site.

4.9 Middle Jurassic Inferior Oolite (Aalenian-Bajocian GCR conservation interest)

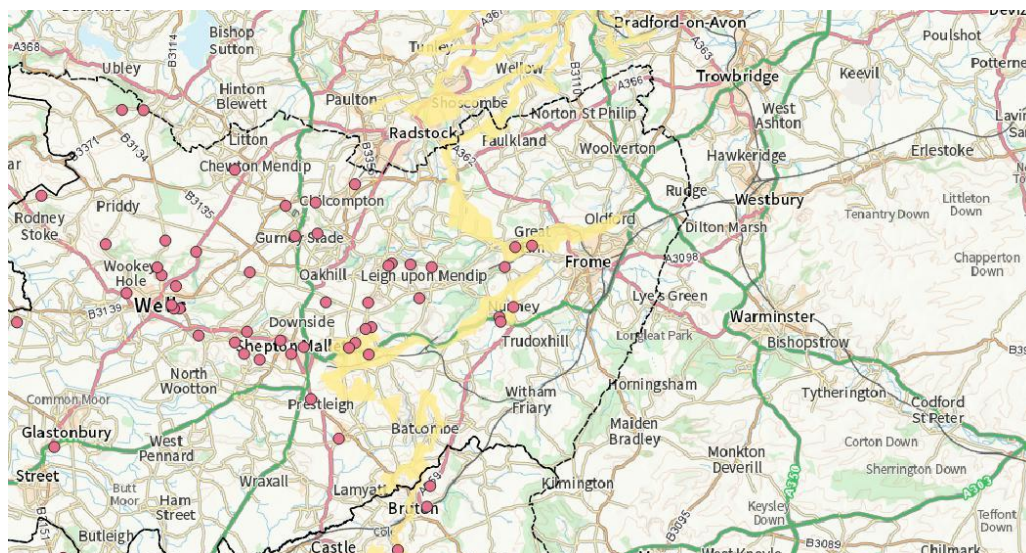


Fig 11: The extent of Mid Jurassic Inferior Oolite in the Mendips shown yellow. LGS shown as red circles. District boundary shown in black; county boundaries dashed black. AONB boundary not shown.

The marine transgression continued into the Mid Jurassic in the Somerset Mendips. The outstanding Vallis Vale GCR site covers this Aalenian-Bajocian interest at the nationally important level, with the strata lying unconformably on the older Carboniferous Limestone. Doultong Railway Cutting GCR site, near the boundary between Mendip and South Somerset districts also provides a late Bajocian sequence continuing into the succeeding Bathonian, including the only complete section for Doultong Stone and the junction of the Inferior Oolite with the overlying Great Oolite Group.

The LGS for this interest include Tedbury Camp Quarry, which exposes the same unconformity as at the Vallis Vale GCR site and provides an alternative teaching site to it. As mentioned in Section 4.3, it is one of the best geological teaching sites in Somerset, and a range of teaching resources on it are

⁹ See Bristow, C R and Donovan, D T, 2015: *The litho- and biostratigraphy of the Lias group of the Glastonbury-Shepton Mallet area, Somerset*. *Geoscience in South-West England*, 13, 377-391.2019.

currently available. The presence of the Inferior Oolite in the Mendips was also first recognised by the early Somerset geologist Charles Moore at the Whatley Road Section *NSfO* site (see Section 4.8 for its Lower Jurassic interest, but as explained there, it is currently vegetated).

Further to the south there are three LGS representing Doultong Stone, an important building stone within the Inferior Oolite Formation, used for many centuries, including in Wells Cathedral. There have been changes since these three LGS were originally designated, with the area originally designated as Doultong LGS now being reclaimed farmland. Unfortunately, time precluded achieving permissions for site visit to the wider area of interest, so that all three of these LGS have been assessed as desk and reconnaissance exercises only at this stage. A further project is a high priority: to provide a more detailed assessment of both the old and currently quarried areas; and to bring forward recommendations for future conservation, including potentially revised LGS boundaries. The main active Doultong Quarry has been regularly welcoming to those organising group field studies in recent years. The adjoining Abbey Quarry area is under separate ownership/management, while the Minster Stone Quarry is a separate area nearby. NB There are several more LGS for the Inferior Oolite in South Somerset covering a wider range of its zones – see the South Somerset area report for more background.

4.10 Quaternary conservation interest including karst and cave features

The Quaternary interest of the Somerset Mendips includes: outstanding karst landscapes, caves and cave deposits (some of the latter including vertebrate fossil faunas) and deposits on the adjacent Somerset Levels. Nationally important GCR sites in the Somerset Mendips include five [earth science](#) SSSIs for karst, five for cave interest, and five for vertebrate remains, plus Wookey Station and Grey Lake for deposits (see Appendix 1).

There are in contrast relatively few LGS. Within the AONB, the LGS include Crook Peak (NT owned) which provides an accessible example of an eroded limestone surface (see Section 4.4), with nearby caves of local interest. The Rowberrow Forestry area, managed by Forestry England, provides an example of both a swallet and cave on the Dolomitic Conglomerate (see Section 4.6) and there is a swallet developed on Lower Jurassic clays in the AONB (see Section 4.8).

Beyond the AONB, one LGS is adjacent to and complements the Wookey Station GCR site for fan gravels (illustrating erosion of the Mendips in periglacial conditions). Another covers a research site that has revealed deposits of clay on the Levels, thought to illustrate marine incursion from the north through a previous drainage route, with polygonal patterns on the ground surface representing a subsequent raised mire. The view of the Levels from the public footpath on Wearyall Hill is mentioned above (see Section 4.8). In addition, a footpath along the Wadbury Valley, provides a good view of a river valley cut in Carboniferous Limestone in the eastern Mendips. There are also geologically interesting records of sarsen stones in the Nunney area of the east Mendips, but none were identified in reconnaissance survey of the LGS area formerly designated for this interest and it was thus de-designated.

NB Another twelve, largely karst-interest, localities featured in *NSfO*, all in the Somerset Mendips (in an area running east-west from Chilcompton to Priddy and north-south from Wookey Hole to immediately south of Litton). None are LGS, but several are within areas covered by biological SSSI designation.

4.11 Mineralogy, building and construction stone and other geo-diversity interest

The Mendips are of interest for their old mines, with information on them included on the Mendips Cave Registry web site. The mineralisation is comprehensively described in Burr, P: 2015: *Mines and Minerals of the Mendip Hills*, Vols 1 and 2, with Vol 3 currently in preparation (Burr *pers comm*, 2020). There are three nationally important GCR sites for this mineralogical interest in the Somerset Mendips (see Appendix 1), but only one LGS. This is Maesbury Quarry *NSfO* site, where a zinc-galena- barytes vein occurs within the Carboniferous Limestone. This is an important locality for understanding the mineralization - as the nearby Maesbury Fault is unmineralized – but the vein is not currently exposed. Specimens are held in the Wells Museum. Dulcote Quarry is also well known for its geodes (see Section 4.3). There are no LGS covering the old ochre pits on the Mendips, which Farrant, 2008 (*op cit*) indicates were worked into the 1920s.

The Somerset Mendips are of course also of wider interest for the history of their quarrying, for local building stone and for aggregate for road construction. For example, Doultong Stone has been used for many hundreds of years, while the Dolomitic Conglomerate is referred to locally as the ‘Draycott Marble’ and was used by Brunel for Bristol’s Temple Meads railway station. Both limestone and the Silurian strata of volcanic origin have been and are still actively quarried for aggregate, with an interesting industrial history, while the limestones also provide an important aquifer, with potential for interpretation to assist in wider understanding of water resources.

Appendix 1: Table of GCR Sites in Mendip District and the Sedgemoor part of the Mendips AONB

The information below has been extracted from the GCR web site (list for Somerset accessed 2019) and a column has been added to indicate whether the SSSI name is the same as, or different to the GCR name. In most cases, but not all, the SSSI name is the same. NB *Many sites are on private land and the designation does not imply any right of public access.*

GCR site name	SSSI: same name or different	GCR conservation interest ‘block’	Other notes
Badger Hole & Rhinoceros Hole	different	Pleistocene Vertebrata	
Ben Knowle	same	Mineralogy of the Mendips	
Brean Down	same	Pleistocene Vertebrata Quaternary of Somerset	
Bridged Pot, Savory’s Hole	different	Pleistocene Vertebrata	
Brimble Pit and Cross Swallet	same	Karst	
Charterhouse Caves	different	Caves	
Charterhouse Lead Orefield	different	Mineralogy of the Mendips	
Cheddar Caves	different?	Caves	
Cheddar Gorge	different?	Karst	
Cloford Quarry	same	Hettangian, Sinemurian & Pliensbachian	
Cook’s Wood Quarry	same	Dinantian of Southern England & South Wales	Slight overlap with a LGS
Doultong Railway Cutting	same	Aalenian - Bajocian Bathonian	
Emborough Quarry	same	Permian - Triassic Reptilia	
Grey lake	same	Quaternary of Somerset	In Sedgemoor beyond AONB

Hapsford Bridge	different	Mesozoic Palaeobotany	
Hapsford Bridge, Vallis Vale	different	Rhaetian	
Hobbs Quarry	same	Hettangian, Sinemurian & Pliensbachian	
Holwell Quarries	same	Hettangian, Sinemurian and Pliensbachian and Mesozoic Mammalia	
Lamb Leer Cavern	same	Caves	
Leighton Road Cutting	same	Hettangian, Sinemurian and Pliensbachian	
Maes Down	same	Toarcian	
Maesbury Railway Cutting	same	Dinantian of Southern England & South Wales	
Moons Hill Quarry	same	Wenlock	LGS overlap to be considered in the future
Picken`s Hole & Beeche`s Hole	different	Pleistocene Vertebrata	LGS overlap retained for local interest
Priddy Caves	same	Caves	
Sandpit Hole & Bishop`s Lot	same	Karst	
St Dunstons Well Catchment	same	Caves	Slight overlap with LGS
Sun Hole	different	Pleistocene Vertebrata	
Thrupe Lane Swallet	same	Caves	
Vallis Vale	same	Aalenian - Bajocian and Dinantian of Southern England & South Wales	
Viaduct Quarry	same	Hettangian, Sinemurian & Pliensbachian	
Windsor Hill	same	Mesozoic - Tertiary Fish/Amphibia and Mesozoic Mammalia	
Wookey Hole	same	Caves and Karst	
Wookey Station	same	Quaternary of Somerset	Slight overlap with LGS
Wurt Pit & Devil's Punchbowl	same	Karst	
Wurt Pit	within above	Mineralogy of the Mendips	