

Review of Somerset's Local Geological Sites (LGS) 2017 – 2021 Final report for the Quantocks area, April 2020

This report is the first of a series of final reports covering our review of the c 230 LGS in Somerset. It is intended to provide an overview of the conservation interest covered by those LGS in the wider Quantocks area, and their potential for educational and interpretive use.

Please note that 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 and that LGS status does not imply any right of public access. The scope of our review is to cover existing LGSs only, not recommendations for new sites, although some gaps in coverage and potential for future designation may be identified in the process. See DEFRA Guidance on Local Sites published in 2006 and SERC's web page at <https://www.somerc.com/local-geological-sites/> for further information on LGS designation. For progress with our review across Somerset as a whole see SGG's Updates at <http://wp.somerc.co.uk/specialist-groups/somerset-geology-group/>.

Sites covered

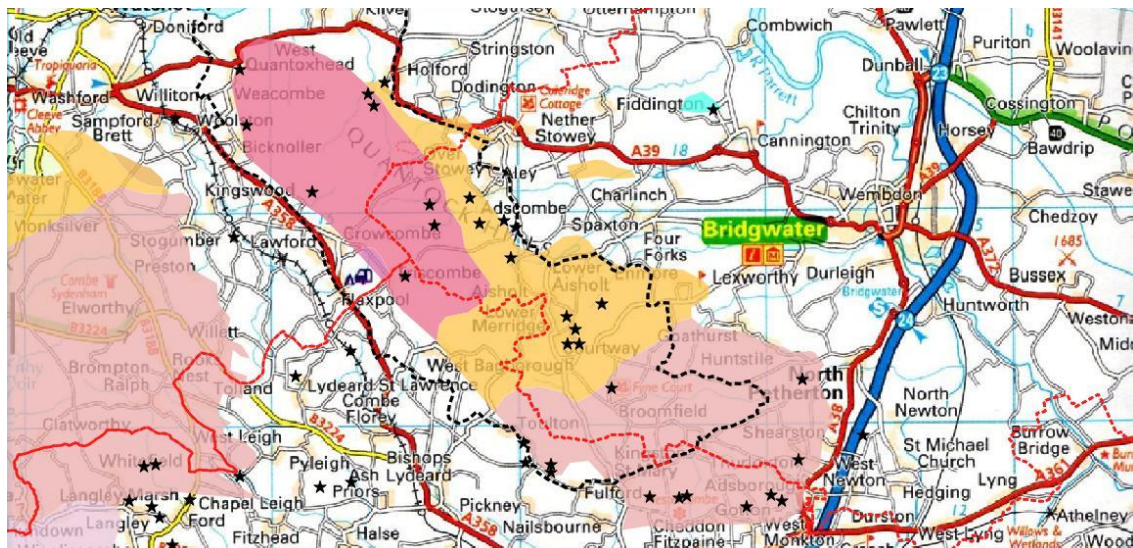
There are currently 32 LGS in the wider Quantocks (defined for this purpose as consisting of those within the Quantocks Area of Outstanding Natural Beauty (AONB) and those immediately beyond on similar Devonian strata). Twenty-five of these are within the AONB (including 1 LGS on younger Triassic strata) and 7 lie beyond.

Sixteen are within Somerset West & Taunton District and 16 within Sedgemoor District.

SERC has been able to obtain permission for visits to 21 of these LGS and all these have now received site visits. The remaining 11 (where no owner was identified or where permission was refused) have been reviewed as desk studies only.

Fig 1: Map showing geology of the Quantocks massif and distribution of the LGS (black stars)

Key: dark pink = Hangman Sandstone Formation; yellow = Ilfracombe Mudstone Formation; pale pink = Morte Mudstone Formation; black dashed line = boundary of Quantock AONB; red dashed line = boundary of districts (NB West Somerset and Taunton Deane are now combined)



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All the sites have also now been considered by SERC's LGS Panel (with the exception of the last 4 that are currently being considered)¹. All, except one, which may be recommended for de-designation, have been reconfirmed (or are likely to be), with a few relatively minor adjustments to site boundaries.

These LGSs (formerly known as RIGS²) were originally identified by a combination of: graduate workers on a Government 'Manpower Services Commission' scheme from 1988 onward; and/or subsequently in the 1990s in tandem with Hugh Prudden's research for his book *The Geology and Landscape of Taunton Deane*³.

Scientific conservation interest

The LGS form an important suite of sites covering the geo-conservation interests of the inland Quantocks, particularly as the only nationally important Geological Conservation Review (GCR) sites in the Quantocks (all earth science SSSIs or within wider SSSIs) are on younger strata along the coast.

Some of the LGS are close to the fault-bound western side of the Quantocks; others are on the eastern side, where the formations represented are at their eastern most extent within Britain. Equivalent aged strata in South Wales and the Mendips, although superficially similar in some respects, are now thought to come from a different source, with the two brought together by later tectonic movements.

These Devonian rocks are now regarded (along with strata further west in Devon and Cornwall) as belonging to the *Rhenohercynian zone* and having more in common with the

rocks in Germany, than the rest of Britain. They are thought to have been brought into close proximity to the Mendips and South Wales by earth movements after the closure of the *Rheic Ocean* as part of the Variscan Orogeny, a period of mountain building resulting from plate tectonic movements.

This updated geological understanding is described for South West England as a whole by Leveridge and Hartley, 2006 (<http://nora.nerc.ac.uk/1518/1/GEWChapter10.pdf> and http://nora.nerc.ac.uk/7135/1/Shail_Leveridge_revised.pdf). A second useful reference is Whittaker, A and Leveridge, B, 2011: *The North Devon Basin: a Devonian passive margin shelf succession*, Proceedings of the Geologists' Association, v 122, pp 718–744.

Much of this updated geological understanding is based on more detailed research further to the west - there has been little recent research on the Quantocks strata. So the LGS here form an important potential resource for future research, both on their sedimentology and their structural deformation during the Variscan mountain-building period.

Similarly, there is little in the way of a detailed technical field guide to the inland part of the Quantocks. A former Bristol University field guide⁴ with a section on the Quantocks is both out of print and out of date. There is therefore scope for a Geologists' Association field guide or similar. We understand that a book on the geology of the Brendon and Quantock Hills is in preparation by Dave Green, a Gloucestershire-based geologist, who leads geological field trips and runs courses.

Formations present

The Devonian sedimentary sandstones and slates included are in some cases of terrestrial and in others of marine origin. They illustrate

¹ NB Final adjustments and other 'post-panel processing' (including sending finalised forms to landowners where permission was granted for site visit) is still to be carried out for several sites.

² Regionally Important Geological Sites. NB LGS may be of local to regional interest.

³ 2001, Taunton Deane Borough Council.

⁴ R J G Savage 1977: *Geological Excursions in the Bristol District*: University of Bristol

a range of different former environmental conditions from extensive river systems with primitive land plants to mud with volcanic ash, and fossiliferous limestones deposited in seas on a continental shelf. These sediments were then buried, deformed and affected by low grade metamorphism to create hard rocks deep beneath a mountain chain.

There are also a few sites of interest for their igneous rocks. There was then erosion of the Variscan mountain chain, while more recent Quaternary periglacial weathering in tundra conditions has resulted in a superficial cover of 'head' deposits locally and has sometimes 'bent' the underlying strata with hill creep where it is near the surface.

Devonian - Hangman Sandstone Formation

There are 8 LGS on the Hangman Sandstone Formation (which underlies the northern part of the Quantock Hills and is shown in dark pink on Fig 1), 4 in the west and 4 in the east. They provide exposure of a range of different lithologies and features within these non-marine sediments, for example conglomeratic bands and cross bedding. This Formation has locally differentiated horizons within it (including the Trentishoe Sandstone, Rawn's and Little Hangman Sandstone Members) although it is not always possible to distinguish these easily⁵.

Devonian - Ilfracombe Mudstone Formation

This overlying formation (yellow on Fig 1 above) represents a change to marine sedimentary conditions and consists largely of

⁵ NB The most recent description of the Formation for Exmoor describes a number of different sedimentary *facies* (from the greater detail provided by the coastal exposures there) rather than these former 'Members'. See Edwards, R A and Evans, C D R, 1999: *The Minehead district: a concise account of the geology*, British Geological Survey Memoir.

slates, with variations in lithology both vertically and laterally, including a tuff horizon (volcanic ash) and beds of fossil-bearing limestone. There are 11 LGS on this formation: 1 of slate only; 2 that are slate with tuff; and 8 that are slate with limestone.

The tuff is important as it is the only indicator of a period of volcanic activity in the region during Devonian times. It has also been quarried as a unique local building stone.

The limestone beds act as "marker horizons": their mapped distribution helps in understanding the folding of the Devonian strata in the Quantocks during the Variscan Orogeny (see Fig 2 below).

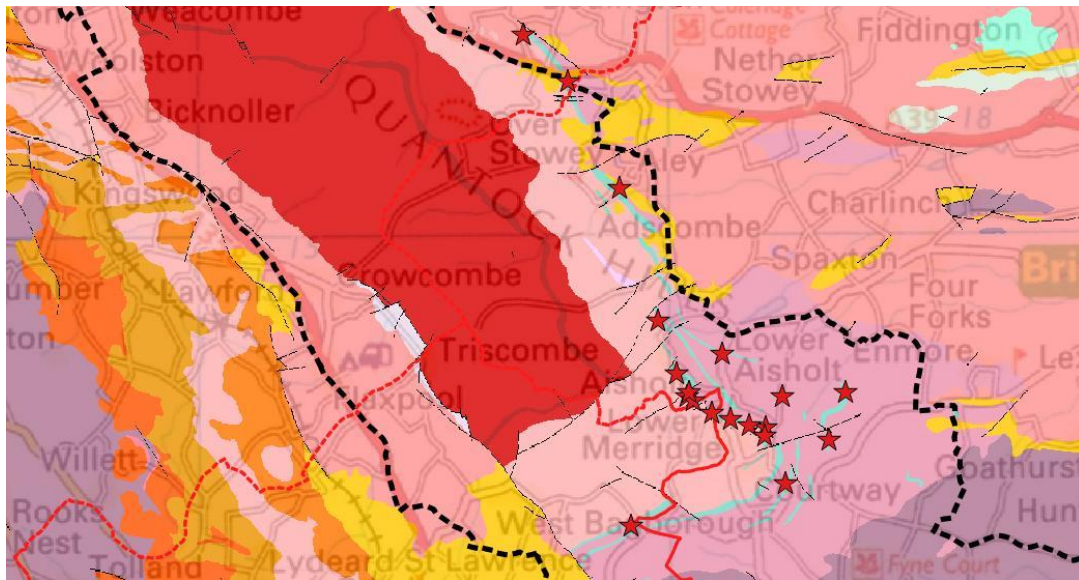
The limestones, although now extensively worked, were abundantly fossiliferous, including fossil corals, and are the only strata with significant fossils faunas in the area. The LGS include a few localities where there are fossils still *in situ* - and there are other exposures of the limestone not currently designated as LGS.

The extent of the beds are well illustrated by the remains of lime kilns - as the beds were once the basis of a thriving lime extraction trade - a fact reflected in the limestone being marked in a similar location on William Smith's first geological map in the early 1800s. See below for the potential for geo-interpretative material on this geology, and its associated industrial archaeology.

Devonian - Morte Mudstone Formation

The southern part of the Quantocks is underlain by the marine beds of the Morte Mudstone Formation (light pink on Fig 1 and succeeding the Ilfracombe Mudstone Formation) - the nationally important GCR exposures are in the Morte Point area of the North Devon AONB further west. There are 10 LGS, including 3 which also have Permian intrusive rocks (see paragraph below).

Figure 2: More detailed geological map showing the limestone beds (turquoise) within the Ilfracombe Mudstone Formation (here in different shades of pink) and the distribution of lime kilns (red stars) - lime kilns courtesy of Somerset Historic Environment Record



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Permo-Triassic strata

Within the Quantock AONB there is 1 LGS on the younger Triassic strata surrounding the older Devonian rocks and 2, which include both Triassic and Devonian strata. The latter sites provide important clues about the geological history of the Quantock Hills. The other LGS on strata of this age across the wider Vale of Taunton Deane will be covered in a separate overview report.

Permian-aged intrusive rocks

There are 3 LGS, including 2 at Hestercombe, illustrating the unique igneous intrusions in the southern Quantock Hills of lamprophyre dykes, with associated chilled margins and altered Morte Mudstone Formation slate country rock. Volcanic and related igneous rock types are rare in the Devonian sedimentary strata covering North Devon, Exmoor and the Quantocks and within this region are particularly well represented in the Quantocks. These LGSs were already

recognised to be a particular local interest and, during 2018, research was published (<https://www.nature.com/articles/s41467-018-06253-7>) which suggested that they may have regional significance.

Analyses of other lamprophyre occurrences in Devon and Cornwall were used as evidence for a Variscan plate boundary underlying the county of Devon. Time precluded inclusion of the Hestercombe rocks in the study but they are expected to be included in the future (*pers comm* Dr Arjan H. Dijkstra, 2019).

Overall, because of the relative scarcity of igneous rocks within the county, these rocks make a valuable contribution to representing the geo-diversity of Somerset more widely. Again, the history of the interpretation of these volcanic rocks and their former quarrying has interpretative potential - with a picture of the old quarry already featuring on a Hestercombe brochure.

Quaternary periglacial deposits and fluvial erosion

A few LGS also illustrate: the superficial cover of Quaternary head deposits and associated features of periglacial erosion and deposition in the Quantocks; and the fluvial erosion of steep sided valleys and associated springs (the latter, for example, apparently associated with more easily eroded horizons such as the Rawn's Member and/or faulting etc).

Opportunities for geo-conservation and geo-interpretation

The review of the LGS in the Quantocks has highlighted the opportunities for geo-conservation and geo-interpretation that these LGS and other sites provide. As the review has progressed we have maintained contacts with the Quantock AONB, Forestry England and the National Trust in the Quantocks to disseminate and discuss our findings, including the potential for face-cleaning activity and educational use, and the other management considerations that land owners/managers may need to consider.

The latter can include Health and Safety issues, such as the need to avoid inadvertently encouraging inappropriate public access to loose rock faces, or beneath over-mature trees, by clearing scrub that currently acts as a deterrent.

Partial clearance may be more appropriate in some situations. An access route across an adjacent owner's land may be held only for management purposes, while felling work being carried out by contractors is another example of the constraints that may need to be considered.

Any conservation work or use for field studies therefore requires the agreement of the land owner/manager - and they may need to consider how it fits in with other uses, and any implications, for example, for their public liability insurance.

We have also discussed how to develop geo-interpretive material for a range of different audiences to encourage better public understanding of the geology. This could, for example, include: the upgrade of individual on-site information; reviving a formerly available geology trail leaflet; and/or incorporating geology into updated wider or new interpretive material (which may not need to mention or encourage access inappropriately to a specific LGS).

For example, the National Trust's *Science and Scenery* leaflet currently mentions the scientist Andrew Crosse, who was the owner of the former mansion at Fyne Court, but he also had an interest in geology as a mineralogist, as well as carrying out early experiments with electricity. Material could also provide geo-interpretation for the different local building stones used throughout the Quantocks.

We have discussed too how the target audience needs to be considered to develop interpretive material appropriate to it. The general public will probably read very little and visual material is helpful, while we still need to ensure that the information is scientifically appropriate and accurate.

Very few of the public currently appear to make the connection between landscape and the underlying geology, while in fact, in the Quantocks there is a potentially interesting story covering hundreds of millions of years which finishes very recently (in geological terms) with tundra-type weathering conditions.

We have also flagged up the potential for the Quantocks AONB to incorporate geology within its proposed archaeological project on lime kilns (within its successful Lottery bid). This provides good potential for geo-interpretation as the lime kilns are, as noted above, situated in or near several of the limestone quarries located within the Ilfracombe Mudstone Formation. These help to envisage a former industrial era of limestone extraction for the manufacture of

lime (for use in both agriculture and buildings), while there is also potential - in the same interpretative material - to illustrate the fossils corals that lived within the seas when the limestone was first deposited.

Finally, in addition to the existing LGS, there are some potential new LGS and other sites beyond the boundaries of current LGS that have as good or better potential for education and/or the provision of interpretative material, because they are more easily accessible, being on publicly owned land, than some privately owned LGS in old quarries (where access may be more difficult to secure

because of either permissions and/or H&S considerations).

Compiled by Garry Dawson and Wendy Lutley, Co-coordinators for SGG, April 2020, drawing on the evidence base assembled for the LGS in the Quantocks area during the LGS review process and with thanks to all those from the SGG network, SERC, SERC-based graduate volunteers and others who have contributed to this information and thinking, including discussion at the September 2019 SGG meeting held in the Quantocks.

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