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Church of St. Mary Magdalene, Stockland Bristol

Decorative and other dressed stonework of tower

Building Stone Assessment:

The BGS Building Stone Assessment service combines geological expertise and building conservation expertise to provide authoritative advice to clients wishing to specify natural stone for repairing or building stone structures. Samples of stone supplied by clients are compared with samples from active quarries held in the BGS Collection of UK Building Stones to identify the closest-matching currently available stone(s). Using the closest-matching stone type in repairs to stone structures maximises the likelihood that the replacement stone will co-exist harmoniously with the 'original' stone and will weather sympathetically.

GeoReport ID: BGS_340675/57525

BGS sample number: ENQ20095

Client reference: St. Mary Magdalene, Stockland Bristol

Date of report: 19/11/2024

Executive Summary

Site name: Church of St Mary Magdalene, Stockland Bristol, Somerset¹.

Architectural/structural element(s) sampled: High-level cornice associated with tower; presumably original C19th (c. 1865) stonework and representative of the dressings of the tower more generally. The sample supplied for analysis was collected during a roped access survey.

Nature of planned repairs: Repairs (indent and/or full-block replacement) to stonework of the type represented by the supplied sample, focusing on the high-level cornice and quoins of tower.

¹ See List Entry Number: 1059049 (<https://historicengland.org.uk/listing/the-list/list-entry/1059049>).

The sample(s) of building stone supplied to BGS comprise(s):

Decorative and other dressed stonework of tower (BGS sample number ENQ20095)

A single partially fragmented and generally rather friable piece² of an off-white cum beige coloured³, essentially medium-grained⁴, ooidal, peloidal and bioclastic **limestone** which shows evidence of significant diagenetic compaction. An intergranular (moderately ferroan) calcite spar and microspar cement is present, although the extent of its development is typically limited (owing to compaction of the allochems, and associated reduction in the intergranular void space, ahead of calcite cementation).

There is little doubt that this limestone is a variety of '**Bath Stone**', originating from within the Middle Jurassic **Great Oolite Group** succession of the Bath–Bradford-on-Avon–Corsham area. Detailed provenancing of 'Bath Stone' samples is always hampered by the variability (both vertically and laterally) of the source limestone beds, and consequent variation in character through time of the stone originating from particular workings, but comparison with historical BGS-held reference specimens suggests that the source of this 'Bath Stone' was one of the underground quarries in the Corsham area of Wiltshire (where the beds of the **Chalfield Oolite Formation**⁵ were, and still are, worked). Stone such as this was marketed historically under a number of different names, typically linked to the specific quarry/mine of origin and also more generally as 'Corsham Down Stone'. The exact origins of this particular 'Corsham Down Stone' are indeterminable petrographically.

² With approximate maximum dimensions of 115 x 30 x 20 mm and evidently corresponding to the rounded nose of a moulding. A thin section was prepared from the sample to enable petrographic analysis of the stone. The section was cut perpendicular to the inferred direction of the sedimentary bedding.

³ Most similar to shades of 'very pale brown' (10YR) on a Munsell® Soil Color Chart.

⁴ Denotes a grain size of 0.25–2 mm. A subordinate amount of *fine-grained* material (< 0.25 mm) is present.

⁵ See relevant BGS Lexicon entry at: <https://www.bgs.ac.uk/lexicon/lexicon.cfm?pub=CFDO>.

The closest-matching currently available stone is:

Amongst the limited range of 'Bath Stone' varieties in active production, '**Hartham Park Stone**' (ideally in its 'Top Bed' guise) should be pursued in the first instance. Contact details for the relevant producer-supplier are as follows:

Lovell Stone Group

Hartham Park Quarry, Park Lane, CORSHAM, Wiltshire

Tel. 01929 439255

Email: sales@lovellstone.com

Website: <https://www.lovellstonegroup.com/> (also <https://www.harthambathstone.com/>)

We urge you to approach Lovell Stone Group and discuss your requirements, requesting samples of their most recent production for the purposes of conducting an on-site comparison exercise with the existing masonry (to confirm colour and textural suitability). Note that the 'T2 Basebed' variety would not be appropriate in this case.

Other possible replacement stones are:

In the event that an alternative to 'Hartham Park Stone' has to be pursued, then '**Park Lane Bath Stone**' should be regarded as the 'next-best' alternative. The 'Base Bed' and 'Top Bed' varieties will need to be considered, with the final decision being based on which one of the two offers the better gross textural match for the existing 'Bath Stone' of the church (impossible to determine from small *ex situ* samples) and the specific structural locations of the planned repairs. Comparison of the supplied sample with reference specimens of 'Park Lane Bath Stone' held by BGS suggests that the 'Top Bed' will offer the more satisfactory match, but an on-site comparison exercise will still be necessary. It should be borne in mind that the colour of the replacement stone is liable to 'warm' to a degree over time as it weathers. The relevant producer-supplier contact details are as follows:

Blockstone Ltd.

Park Lane Mine, Park Lane, The Ridge, CORSHAM, Wiltshire

Tel. 01246 927100 (main Blockstone contact number) or 01277 568050

Email: sales@blockstone.com or sales@parklanebathstone.com

Website: <https://blockstone.com/> and <https://parklanebathstone.com/>

Other remarks:

Prior to specification, representative samples of each replacement stone under consideration should always be obtained and examined alongside the existing stonework. The blocks of stone ultimately used should ideally be selected at the quarry by the stonemason undertaking the repairs.

Mortar plays an important role with respect to the free movement of moisture and air through stonework. It will be important, therefore, to use a permeable mortar (e.g. lime mortar, which ideally should be at least as permeable as the 'original' stone), as well as a compatible replacement stone, in any repair, to increase the chances of a long-lasting, successful outcome. Portland cement, which is essentially impermeable, should not be used as mortar in stonework.

Do not hesitate to contact us for further advice if required.

Dr. Stephen F. Parry

British Geological Survey, Keyworth, Nottingham, UK.

21 November 2024

Information about this Report

Introduction:

This report is designed for use by qualified professionals involved in building repair and/or conservation.

Limitations of the report:

- This report is based on an analysis of the sample or samples provided and cannot be assumed to be applicable to all materials in a building or structure unless an on-site assessment has been carried out by BGS or a suitably qualified professional.
- The mention of a specific stone type(s) should not be taken as an endorsement, or otherwise, of the quality of a particular product. Equally, recommendations made with respect to a replacement stone do not constitute a repair specification. All aspects of the building (location, detailing, other materials) must be considered in competent repair work.
- The report is based on petrographic analysis. This does not guarantee that a replacement stone is suitable for a particular purpose (e.g. carved detail), nor does it guarantee specific properties of a stone such as strength.
- The characteristics of stone from a quarry source can vary over time and from place to place within the quarry; there is therefore no guarantee that a sample of quarried stone held by BGS is representative of the stone being supplied by the quarry at any particular point in time. One or more samples of stone should be obtained from a quarry operator prior to stone specification, to confirm the appearance and character of the stone currently being supplied.
- Recommendations made with respect to a replacement stone are based on and limited to an interpretation of the records in the possession of BGS at the time the analysis is carried out.

BGS Building Stone Assessment

A BGS Building Stone Assessment is usually performed in three stages.

(i) The sample of 'original' stone (usually supplied by the client) is first subjected to a detailed petrographic examination, to establish the range and character of its intrinsic properties.

(ii) The range of properties is then compared with those of stone samples held in the BGS Petrological Collections, to constrain the source of the stone. Historical records and other forms of documentary evidence, if available, and the likelihood that the stone was sourced locally or 'imported', are also taken into account.

(iii) Finally, the closest-matching currently available stone(s) are identified. If the quarry from which the stone was sourced originally has been identified and is still open, it will usually provide the closest-matching stone.

If the quarry from which the stone was sourced originally has not been identified, or is closed, the closest-matching currently available stones are identified by comparing the properties of the 'original' stone with those of samples of currently available stones held in the BGS Collection of UK Building Stones.

Comparing stone properties to identify the source and/or the closest-matching stones is known as stone matching.

Stone matching

Where possible, the source (quarry and bedrock unit) of the 'original' stone is determined by comparing it with samples held in the BGS Petrological Collections; historical records and other forms of documentary evidence, if available, and the likelihood that the stone was sourced locally or 'imported', are also taken into account, if appropriate. Many thousands of quarries in the UK have supplied building stone in the past, and in many instances it is not possible to relate a stone sample back to one particular quarry or bedrock unit.

Where the source cannot be identified unambiguously, the closest-matching currently available stone(s) are identified by comparing the intrinsic properties of the 'original' stone with those of similar stones that are currently being supplied by quarries in the UK.

The following factors are taken into account when comparing an 'original' stone with a potential replacement stone.

- 1) *Mineral and textural features* – ideally, these should be as similar as possible in the replacement stone and 'original' stone, to increase the likelihood that the two stones will respond in similar ways and at similar rates to the various physical and chemical processes associated with weathering, and will therefore co-exist harmoniously. Replacement stones are selected to match the 'original' stone in its fresh (rather than weathered/decayed) state, unless otherwise requested.
- 2) *Permeability* – ideally, the replacement stone and 'original' stone should have similar permeability characteristics, thereby minimising the degree to which fluid (water and air) migration between adjacent blocks of 'original' and replacement stone might be impeded. Accelerated stone decay can occur where fluid migration is impeded.
- 3) *Appearance* – for aesthetic reasons, the replacement stone and 'original' stone ideally should look similar to the unaided eye in terms of colour and stone fabric at the time the repair is made. However, the closest-matching stones in terms of the properties that govern weathering performance (mineral-textural features and permeability) are not necessarily the closest match in terms of appearance. A repair using stone selected primarily because it is the closest match in terms of appearance may look good initially but could quickly show signs of decay or of being incompatible with the 'original' stone. For that reason, priority is generally given to the properties that govern weathering performance, thereby maximising the likelihood of long-term compatibility of the 'original' stone and replacement stone.

A degree of compromise may in some cases be desirable and acceptable if the closest-matching stones in terms of 'weathering properties' are not a close match in terms of appearance. Immediately following repair, the fresh surfaces of a stone insert or indent will usually contrast in appearance with the soiled or discoloured surfaces of adjacent 'original' masonry, but if the 'weathering properties' of the two stones are a good match the new stone should blend in over time and the contrast should become less obvious.

- 4) *Functional and performance requirements* – specific functional and performance requirements of a replacement stone are taken into account if requested. For example, if the 'original' stone performed a load-bearing role, the choice of matching stones should include only those that are at least as strong; and if the 'original' stone was carved or shaped in a particular way, the choice of matching stones ideally should include only those that can be carved or shaped in a similar way, with a similar level of detail and quality of finish.

One or more replacement stone types are proposed taking these factors into account.

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