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Identifying replacement stones for use in building repairs: an integrated system for improved stone matching

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Natural stone is a durable construction material, but stone buildings exposed to natural weathering processes eventually require repairs and suitable replacement stone must be found. However, in many cases, the quarry that originally supplied a stone is not known or is no longer accessible. In such situations, stone matching can be used to identify the source of the original stone and/or a substitute stone of similar character.

Too often, stone matching is based on appearance – in other words a replacement stone is selected simply because it looks similar to the original. Although appearance (in terms of stone colour and fabric) is clearly important, the degree to which one stone is a good match for another depends importantly on the function of the original stone (e.g. water-shedding elements, structural elements) and on additional attributes of the stone, which include: weathering performance (a good replacement stone should weather in broadly the same way as the original); permeability (a good replacement stone will not impede the flow of moisture and air through adjacent blocks of the original stone); strength (where the original stone performed a load-bearing task, the replacement stone must be at least as strong); and suitability for tooling and shaping (where the original stone has been carved, worked or sawn). We present several examples of the outcome of poor stone matches.

The importance of good stone matching (particularly in areas where a distinctive stone-built character exists) is increasingly being recognised by heritage and construction communities. However, the large number of building stones and quarries, and the great diversity of character displayed by natural stones, present significant challenges in matching a good replacement stone with an original. There is therefore a pressing need for a robust system that enables building stones to be characterised rapidly and consistently, and matched effectively with suitable replacement stones.

The British Geological Survey is developing a stone matching system for UK building stones.
The system has petrographic characterisation of stone samples at its core, based on a standard description form and supporting dictionaries designed to enable rapid, systematic, consistent description of those petrographic criteria that are relevant to stone matching. Using sandstones as an example, we describe this standardised approach and illustrate those petrographic attributes that influence the various factors that determine whether one stone is a good match for another.

The BGS system also includes: a collection of hand samples and associated thin sections for UK building stones; a database of petrographic descriptions and photomicrographs of building stones; a database of all currently active and formerly active building stone quarries; a database of stone buildings and monuments; a library of historical references linking quarries with stone buildings.

As the various collections and datasets grow, the system will become an increasingly powerful tool that will improve our ability to provide the best possible match for building stones. The growing datasets will inform policy decisions regarding the value of existing quarry resources, thereby promoting sustainable use of traditional building materials.