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Building stone databases in the UK: A practical resource for conservation

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ABSTRACT

There is a growing awareness that effective repair of historic buildings and monuments requires detailed knowledge of the component materials. In the case of repair or replacement the technical properties of the building stone are of particular importance. Macroscopic examination in isolation is not sufficient and can lead to incorrect specification of the replacement stone. Petrographic examination forms a crucial part of the repair process. Knowledge of currently available resources is equally important. The BRITPITS database contains over 17,000 sites of mineral extraction in the UK, including historical and currently active sites. Approximately 2350 entries cover active mineral workings, yet only 460 quarries are currently producing building stones. The database is used to help identify the original quarry source of a stone, and locate currently available matching stones for repairs. Research projects are underway to identify building stone resource requirements for specific areas in the UK. Detailed stone surveys of 230 buildings in Glasgow provide an assessment of the requirements and quantities of stone for the future maintenance of the stone built heritage of the city. A project with English Heritage is aimed at providing a systematic assessment of local stone sources to ensure the supply of appropriate building stones in the future.

1. Introduction

Over the past decade in the UK there has been a resurgence in the demand for building stones in the construction and conservation repair industry, partly as a result of the need for repair to high profile 'heritage' building stock and the growing appreciation that original materials are commonly the most appropriate ones to use in conservation work. Some of the initiative for this has come from the government. A recent consultation paper concerning Planning and Minerals in England (ODPM, 2005) stated that "Building and roofing stone quarries are generally much smaller than aggregate quarries and tend to be worked at a substantially slower rate. Methods of working stone quarries also tend to be less intrusive than aggregate quarrying. Consequently the scale of potential environmental impacts, including noise, vehicle movements and dust, is generally smaller. Each application needs to be considered on the basis of its specific characteristics and potential environmental impacts" (see also ODPM, 2004). This statement underlines the fact that small building stone quarries have less environmental impact (ODPM, 2005). Scottish Planning Policy 4 states that the "demand for and scarcity of consented reserves of building stone requires additional reserves to be identified and safeguarded….information held on workable reserves is important in providing future supply" (Scottish Executive, 2006).

This resurgence has led to a number of issues becoming apparent, namely how to identify the provenance of an original stone and, perhaps more importantly, where best to source an appropriate replacement.

The British Geological Survey (BGS) has been collecting data and samples from stone quarries and mines since the 1830s and is in a unique position to provide the public and professionals with information regarding building stone resources. Records held include information on historic quarries, working sites and also planning permissions for unworked sites. This information coupled with petrographic analysis of stone samples helps conservators to identify original building materials and also to determine the best available replacement stone type. In Northern Ireland an on-line stone database (www.stonedatabase.com) has been developed by Queen's University Belfast and Consarc Conservation, documenting over 2000 listed buildings and monuments and 117 quarries.

2. Petrographic analysis of building stones — BGS Building Stone Assessment GeoReports

Until recently many buildings in the UK were repaired using a stone that was considered to be a good visual match on a macroscopic scale, if aesthetic issues were considered at all. The closure of the majority of the historic building stone quarries means that in many cases there are few options for a replacement stone available and some local authorities have accepted the use of 'high quality replica block' (i.e. artificial stone) in conservation areas (McKinney, 2004).

Petrographic analysis is an integral part of stone analysis and is of value not only in identifying an aesthetic match for a building stone but also in determining any potential geotechnical incompatibility

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that might lead to accelerated decay (Hyslop, 2004). The application of this technique in the selection of a stone for repairs has been advocated for many years (e.g. Warnes, 1926; Ashurst and Kelly, 1980), and is detailed in a BS EN Standard 'Natural Stone Test Methods: Petrographic Examination' (British Standard BS EN 12407, 2000).

Petrographic analysis is part of the BGS stone matching service which, along with other building stone-related enquiries, forms part of the online BGS GeoReport system which is available through the BGS web site. The Building Stone Assessment GeoReport provides a service for users of stone ranging from repair and conservation of existing buildings to new-building requirements, and masonry and stone artefact identification in archaeological projects. One of the most regular requests is stone matching for restoration projects where a sample of the existing masonry is characterised in order to determine the most suitable replacement stone types.

If a like-for-like replacement stone is required it is important to characterise the composition and petrographic characteristics of the original stone (Hyslop, 2006). Careful sampling is necessary in order to ensure that samples are representative, and in many cases a number of samples are required to characterise variations in the stone. Thin sections taken from a series of small diameter cores are effective techniques for obtaining a representative set of samples. Different petrographic characteristics are important for different stone types, for example porosity and permeability are particularly significant factors in influencing the performance of sandstone as a building stone. The results of physical testing and factors such as durability are also important, although in some situations the use of a stronger or more durable replacement stone can lead to the accelerated decay of any remaining original stone masonry (Hyslop, 2004).

3. BGS databases relevant to UK building stone

The BGS has a number of databases and collections relevant to building materials. Some of these include data collected 150 years ago and throughout the second half of the 19th century when building stone quarrying in the UK was at a peak. While the long term intention is to collate data into one resource, available to the public, at present there is a range of data sources. Despite this, most of the data are now held in digital format, and much have been linked to a Geographical Information System (GIS) allowing easy retrieval of information. The principal building stone databases and information sources held by BGS are outlined below.

3.1. BRITPITS

The BRITPITS database is the main repository of data on UK mines and quarries. It includes data on surface quarries and underground mines, including known active and recently inactive sites. The database is continuously updated through links with government and industry. Data on historic sites are also collected, including mines and quarries throughout the UK. The database currently holds about 2350 entries covering active mineral workings. The number of quarries currently producing building stones, however, is much smaller — approximately 460 in the UK. The number of inactive sites is much larger and in total BRITPITS contains over 17,000 entries. Many historically important building stones are not being produced at present and sourcing a matching stone for repairs can be problematic. The BRITPITS database of quarries is an invaluable tool in identifying both the probable original source for a building and the most appropriate replacement stone from currently active quarries. The database is linked through a GIS to information on environmental sensitivity, such as Areas of Outstanding Natural Beauty (England and Wales) and National Scenic Areas (Scotland). Much of the information is available digitally and in GIS format, providing a national resource for planners.

Data from BRITPITS make important contributions to studies of industrial and aggregate mineral resources and assist in regular statistical surveys carried out by the government in the UK.

3.2. Scottish building stone quarries database

This database, begun in the late 1990s by BGS, is currently being validated in a GIS with the assistance of funding from the Technical

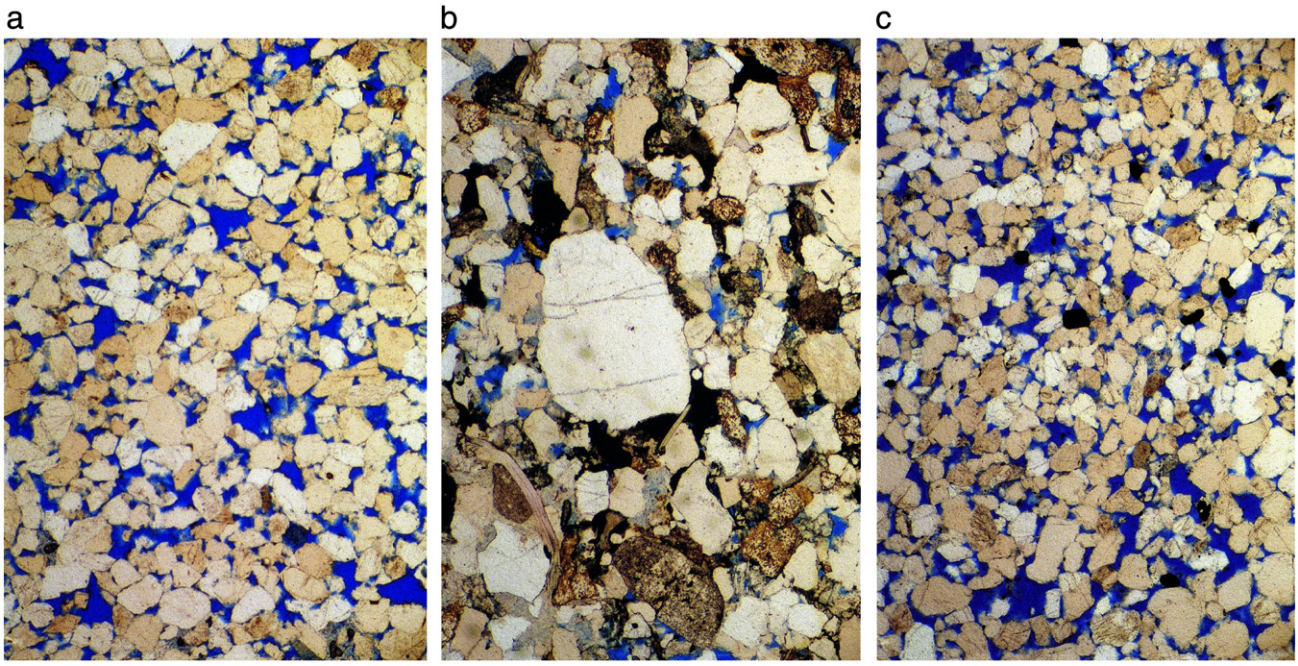

Fig. 1. Thin section photomicrographs. a) Sandstone from Craigleith Quarry in Edinburgh, typical of the stone used during the late 18th and 19th centuries as ashlar block in Edinburgh New Town. The Craigleith sandstone is no longer available as the quarry is closed and infilled. b) Sandstone from a quarry in Derbyshire currently used for stone repairs in Edinburgh New Town. c) Sandstone from Cullalo Quarry, Fife, north of Edinburgh which has similar petrographic characteristics to Craigleith sandstone. This quarry has recently been reopened to supply stone for the conservation and repair of historic buildings in Edinburgh. Images are 4 mm high.