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THE CITY OF EDINBURGH: LANDSCAPE AND BUILDING STONE

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THE CITY OF EDINBURGH, capital of Scotland, owes its unique character and sense of place to its spectacular geological setting, its buildings and its people. The cityscape is defined by its rocky natural landscape, moulded by glaciers, and by the fabric and varying architecture of the city's buildings which employed much indigenous building stone. The local sandstones, some of the finest in Britain, supplied the majority of buildings constructed within the World Heritage Site of the Old and New Towns. One of the challenges facing the city in the 21st century is to plan for development whilst ensuring that stone-built heritage is not neglected. Appropriate replacement stone selection and the safeguarding of indigenous resources form a vital part of good maintenance and conservation practice.

HISTORICAL BACKGROUND

The City of Edinburgh, Capital of Scotland, 'Grey Athens of the North', is characterised by stone. Spectacularly set in a hilly, glaciated landscape underlain by sedimentary and igneous rocks of Devonian and Carboniferous age, today's city embraces the Early Carboniferous (c. 345 million years old) volcano of Arthur's Seat. Although there is evidence of early human settlement in the district from about 5000 BC, the earliest mention of Din Eidyn (Fort of Eidyn) can be found in a narrative poem *Y Gododdin* of the late 6th century AD. The oldest surviving building is the 12th century, fortress-like, stone-built St Margaret's Chapel, which lies within the Castle perched on the Castle Rock, a hard volcanic basalt plug. The 'Old Town' and its High Street developed down an east-dipping ridge from this fortified position. The cliffs forming the west side of Castle Rock and the ridge to the east underlain by glacial debris form a classic example of a 'Crag and Tail' landform developed as the Quaternary ice sheets moved from west to east

(fig. 1). The durable Castle Rock was surrounded by poorly draining hollows, including the site of the Nor' Loch, formed along the line of an east-north-east trending fault in more easily eroded Carboniferous sedimentary strata.



Fig. 1. Castle Rock from the west, the 'Crag' of the 'Crag and Tail' landform. The 'Tail', formed of glacial debris, descends eastwards from Castle Rock towards the Canongate. (Photo A. A. McMillan.)

During the 17th and early 18th centuries, the Old Town population outgrew the space available within the confines of the protective 16th century Flodden and Telfer rubble walls, built of locally available stone. The Act of Union of 1707 and the suppression of the Jacobite insurgencies in 1715 and 1745 resulted in a political and economic climate which encouraged the citizens of Edinburgh and their leaders to consider expansion beyond the city walls. The topographic constraints imposed by the Nor' Loch meant that the initial expansion of the city took place to the south of the Cowgate (e.g. George Square, started in the 1760s).

In 1751 the Town Council published a pamphlet entitled *Proposals for Carrying on certain Public Works in the City of Edinburgh*. This document, endorsed by Lord Provost George Drummond,

proposed a New Town to the north connected to the Old Town by a bridge. By 1755 the population of the city stood at 57,000 and the need to expand the city was becoming an imperative. Draining of the Nor' Loch began in 1759, and the foundation stone of the North Bridge was laid in 1763. It was not until 1772 that the bridge became fully operational, owing to an earlier collapse.

The Town Council sponsored a competition to produce an overall plan for the new development in 1766. It was won by 26 year old James Craig and developed in published form as a symmetrical grid layout.<sup>1</sup> The streets were originally lined with individual town houses constructed of the finest sandstone locally available, including that from the famous quarries at Craighleith to the west of the city. This First New Town, between Charlotte and St Andrew Squares, was substantially complete by 1800. The success of the First New Town stimulated a demand for further expansion that prompted a number of schemes developed between 1800 and 1830. The demand for stone was insatiable.

Continued development of the city, to the north of the First New Town and to the south of the Old Town continued throughout the rest of the 19th century. The population of Edinburgh nearly doubled from 136,000 in 1831 to 261,000 in 1891, and many citizens were housed in rows of stone-built Victorian tenements which remain as a major legacy of today's building stock. Twentieth century expansion of the city was characterised by a programme of villa building developments and, post-Second World War, Council and private housing estates. Building in stone declined severely after the First World War although stone-clad properties continued to be constructed well into the 1930s. Modern office block developments of the 1960s onwards typically consisted of concrete or stone-clad steel structures.

Today's modern city, with a population exceeding 460,000 (2006), embraces the Old Town and the New Town, together with the Port of Leith on the Firth of Forth and suburbs. Edinburgh's Old and New Town World Heritage Site was inscribed on UNESCO's World Heritage Sites list in 1995 in recognition of the outstanding architectural, historical and cultural importance of the Old and New Towns of Edinburgh.

In *Modern Athens Displayed in a Series of Views* (1829) Thomas Shepherd commented that 'for situation, and for the durability of its building-materials, few cities have equal advantages to Edinburgh; and there is, perhaps, no town, of which the general and distant effects are more picturesque and striking'.<sup>2</sup> A common thread running through Edinburgh's history of development is stone. Its natural heritage and landscape is determined by the variations in hardness of sedimentary and igneous lithologies and their resistance to weathering. Its buildings are dominated by locally quarried sandstone so that the stone-built heritage literally grows out of the bedrock foundations of the city. Robert Louis Stevenson in his *Picturesque Notes* described the city in the 19th century as 'this dream in masonry and living rock'.<sup>3</sup> As with so many Scottish towns and cities, the character of Edinburgh, defined by local stone and its use, imparts a sense of place and confirms the uniqueness of location which the citizens and visitors alike may take for granted.

The early sandstone quarries were often temporary features situated around the houses and lands within or immediately outside the town walls. Permission to open quarries was usually granted on condition that they were filled in later. The first houses were built on the ridge descending to the east of the Castle and were seldom more than two storeys high. They were constructed of timber obtained from nearby forests and thatched with straw. The fire risks were so great that, in 1425, the third Parliament of James I introduced laws with the result that henceforth most building was to be in stone.<sup>4</sup> Early sources of stone included the pink, coarse-grained sandstone of Early Carboniferous age from the outlying village of Craigmillar and blonde sandstones close by and within the town. Igneous rocks were also used in early construction (e.g. for parts of the Castle). At Salisbury Crags in Holyrood Park some of Edinburgh's oldest quarries worked a dolerite sill. This durable rock, colloquially known as whinstone, was used extensively as 'calsey stanes' (setts) for the streets of Edinburgh and as a source of rubble for buildings on the south side of the city. These workings ceased in the 1830s because of public concerns about damage to the landscape character.<sup>5</sup>



Fig. 2. Formal masonry finishes in Craigeleith sandstone, Abercromby Place. (Photo A. A. McMillan.)

Edinburgh's New Town employed formal designs in stone from the late 18th century.<sup>6</sup> Except for the grandest buildings early buildings were constructed of harled rubble. Over time the fronts of the finest town houses showed off a range of unharled masonry styles, from rock-faced in the basement to broached ashlar or V-rusticated polished ashlar in ground floor elevations and polished ashlar above (fig. 2). Side walls consisted of coursed rubblework. As the pace of building accelerated, the old quarries within the expanding city could not produce the block sizes, quality and quantities of stone demanded by New Town architects and developers. New quarries developed on the west side of the city. The most famous were those of Craigeleith, Ravelston, Redhall and Hailes which supplied exceptionally durable, thickly bedded quartz arenite sandstone of Early Carboniferous age.<sup>7</sup> The continuity of bed allowed the winning of long sections suitable for columnar and monumental work. Several of these quarries (e.g. Hailes) also supplied laminated sandstone capable of being split by hand into thin slab for pavement, platts and steps.

The development of the canal and railway networks allowed stone to be transported from further afield.<sup>8</sup> From the mid 19th century, the sandstone quarries of West Lothian and Angus supplied stone both for public buildings and tenements. As local sources of pale coloured Carboniferous sandstones dwindled, supplies for masonry were imported from northern England, particularly Northumberland. By the end of the 1800s Permian to Triassic red sandstones from the south of

Scotland were also reaching the Scottish cities.<sup>9</sup> Notable examples in Edinburgh included the National Portrait Gallery, Queen Street (1890), constructed of the fluvial St Bees Sandstone from Corsehill and Moat quarries near Annan, and the Caledonian Hotel (1903), constructed of aeolian sandstones from Locharbriggs, Dumfries and Corncockle, Lochmaben, the latter building being described much later as 'a wonderfully blousy intrusion into West End Edinburgh'.<sup>10</sup> Roofing slates were transported from the Argyllshire slate belt and flagstones (laminated, fine-grained sandstones suitable for paving) of excellent quality were brought from Caithness and Angus to supplement local supply.

#### CONSERVATION POLICIES AND PRACTICES – THE RELEVANCE OF GEOLOGY

Today's city embodies the rich stone-built heritage of earlier generations together with stone-clad concrete buildings of the 20th and early 21st centuries. Safeguarding this early tangible heritage and many other less tangible (e.g. historical) heritage assets of the city is a matter of concern for everyone. For the Old and New Towns, the World Heritage Site Management Plan (2005) outlines a series of elements of significance that make up the Outstanding Universal Value of the World Heritage Site and identifies the risks that these might face (see table).<sup>11</sup> It is obvious that both the natural geological heritage and the employment of stone in a variety of constructions and townscapes can profoundly influence many of these elements.

A balance always needs to be made between strong conservation and heritage policies and those policies to maintain the City Centre as a viable economic entity. The recently ratified City of Edinburgh Local Plan recognises this requirement and chapter 4 of the Plan sets out four objectives to care for the environment:<sup>12</sup>

- To ensure that the unique qualities of the city, its built heritage and the character of its urban areas are safeguarded for the future.
- To protect important landscape and natural features of the environment, including the city's Green Belt setting.
- To protect and enhance the nature conservation and biodiversity interest of the city.
- To protect natural resources.

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Table. Elements of significance defining Outstanding Universal Value  
(Edinburgh World Heritage 2005)

|                          |                                                                                                                                                                                                                                                                                                                                              |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Landscape Setting        | <p>Topography of Hills and Valleys (its geological setting).<br/>                 Juxtaposition of the Old and New Towns (the architectural contrasts and the influence of the natural landscape).<br/>                 Valley of the Water of Leith (a small but significant river which flows through the city to the Firth of Forth).</p> |
| Urban Form and Landscape | <p>Contrasting characteristics of the Site.<br/>                 Outstanding Townscape.<br/>                 Historic Buildings (the majority of which are stone-constructed).<br/>                 Historic Interiors.<br/>                 Statues and Monuments.<br/>                 Parks, Gardens and Graveyards.</p>                  |
| History and Heritage     | <p>Historic City and Capital of Scotland.<br/>                 Communities.<br/>                 Intellectual Tradition, Education and Law.<br/>                 Edinburgh – Festival City.</p>                                                                                                                                              |

The Plan makes specific mention of geodiversity and planning authorities are encouraged to identify additional sites of geodiversity interest including quarry faces, exposed rock features and interesting land forms. Such sites also serve to remind us all of the former local building stone industry and make the link between natural resources which supplied builders with construction materials and the city's buildings. A good example of such a site is Craighleith Quarry, now the location of a supermarket complex, and also designated as a Regionally Important Geological Site.<sup>13</sup>

More widely across the city, the City of Edinburgh Council's Cultural Policy states under Objective 8 that the aim is 'to preserve and interpret Edinburgh's heritage' and emphasises that 'Edinburgh has an important built and natural heritage'.<sup>14</sup> The Council believes it is important to foster the public interest in the City's heritage and states that this can be achieved through:

- Preserving and enhancing the City's built heritage.
- Arranging displays on aspects of the City's history.
- Carrying out archaeological and social history research.
- Developing close links between the City's schools and its museums and galleries.
- Maintaining and encouraging the enjoyment of the City's natural heritage of parks and open spaces.

- Interpreting the City's architectural and historical background and identifying ways of making it more accessible to the public.
- Collecting and preserving artefacts relating to the City's heritage.

The City Council aims to ensure that new development within the area is of the highest design quality. New development should:

- Fit within and complement the urban grain and massing characteristics of the area in which they are located.
- Make use of the existing historic palette of building materials, particularly natural stone.
- Retain and reinforce the standard plot widths and height of street elevations, avoiding long single elevations, even where larger land packages have been assembled.
- Include wherever possible the planting of native deciduous trees.
- Retain the character of the New Town Gardens.

The recognition through Council and World Heritage statements of the importance of both the geological and geomorphological heritage of the city (in other words its geodiversity), and its building stone serves to emphasise that sources and properties of stone, both for the present building stock and for new build, need to be well understood. The process of safeguarding the city's heritage and that of other Scottish towns and cities includes the assessment of locally available stone resources which may provide the best geological match for repair.<sup>15</sup>

SOURCING OF STONE FOR REPAIR  
AND CONSERVATION

In the mid to late 19th century Scotland had over 700 working quarries supplying local, national and, in some cases, international needs, yet by the end of the 20th century the country was left with approximately 20 quarries supplying exclusively building and pavement stone of which 15 were producing sandstone.<sup>16</sup> Today some 12 Scottish quarries are producing sandstone in the form of dimension stone, block stone and building stone, and an additional three producing flagstone.<sup>17</sup>

The careful sourcing of stone is not new. To meet the demand for stone in the 19th century architects and builders searched for new material which matched the colour and physical properties of stone in existing buildings. The first detailed published account of Edinburgh's building sandstones was written by George Craig (*c.*1852–1928), architect to the Leith School Board. His paper (1893) showed that, even then, when natural stone was much more widely used, it was difficult to ascertain the source of many of the stones used in older buildings.<sup>18</sup> Craig hoped that his work would be a useful 'first contribution to a branch of practical local geology that has been but little investigated, though full of both economic and scientific interest'. Much knowledge was lost as a result of the huge decline in the use of natural stone following the First World War as concrete started to gain the ascendancy. Strategic interest in stone resources was revived in the 1930s and resulted in several publications by the Geological Survey of Great Britain over the period 1930–49.<sup>19</sup> However today few detailed records are kept of modern uses of stone or markets and reference is usually in the form of reports in trade journals or in published national statistics.

The rapid growth of Edinburgh in the 19th century and the sourcing of building stone from other parts of southern Scotland and northern England meant that not all the stone was of the best quality. Some sandstones used in Edinburgh tenements and other buildings are prone to weathering, and inappropriate cleaning has sometimes exacerbated this. One of the most common problems in such stone is case hardening, where minerals in the stone dissolve and re-deposit near the surface forming a hardened crust over a weak interior. This will not be obvious until the crust

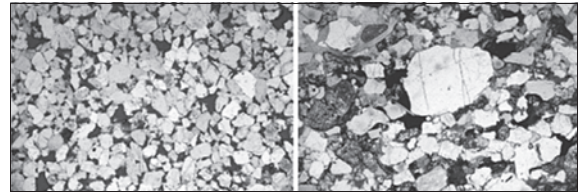


Fig. 3. Comparative thin sections of two sandstone types which have superficially similar colour in hand specimen: a) typically employed in the construction of New Town buildings – a well sorted (uniform grain-size) quartz arenite with interconnected porosity; b) frequently specified for repair work – a more poorly sorted arenite with significant iron oxide content (black grains) and lower porosity. Thin sections are 4 mm high. (*Photos British Geological Survey, © NERC.*)

is broken (e.g. through cleaning) and the interior becomes subject to rapid decay.

During the last decades of the 20th century the selection of stone for repair of buildings in the New Town commonly failed to take into account the varying petrographical properties of replacement sandstone (fig. 3).<sup>20</sup> Whilst colour matches between original masonry and replacement stone may have been satisfactory, there are many instances where differences in grain size, mineralogy and porosity have resulted in aesthetic degradation (fig. 4). Accelerated physical decay can take place in the original masonry when replacement stones of different mineralogy and lower porosity are introduced. Accelerated decay can also be effected

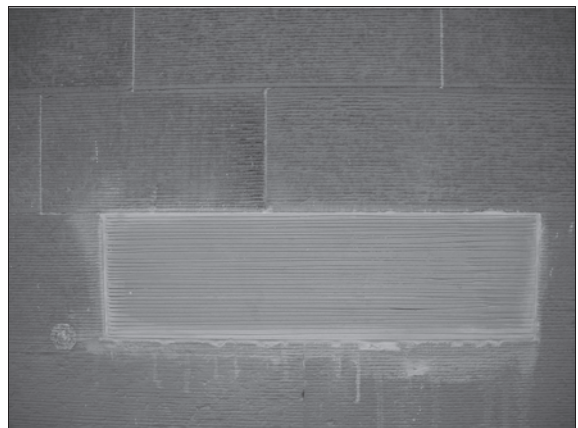


Fig. 4. Example of the effect of grain-size differences between the original sandstone showing a hand-chiselled, fine horizontal broached finish and recently replaced stone, with different petrographical characteristics, showing a machined coarse finish. (*Photo A. A. McMillan.*)

by poor maintenance, for example when water is concentrated on sandstone masonry from blocked gutters and downpipes or from poorly positioned signs or other fixings (fig. 5). Inappropriate chemical cleaning processes when applied to porous and permeable sandstones can result in colour changes and penetration of chemicals with the result that some accelerated decay and surface efflorescences can develop.<sup>21</sup>

The importance of undertaking petrographical analysis according to recognised British and European standards, e.g. those published by the British Standards Institution, is highlighted and today there is a better appreciation by conservation architects of this requirement.<sup>22</sup>

To satisfy the increasing need for sandstones of similar petrographical properties to those used in the past, efforts have been made in recent years to

encourage the opening of new quarries or the re-opening of long abandoned workings. An example is Cullalo Quarry, Fife, across the Firth of Forth from Edinburgh, where Carboniferous sandstone was recognised by the early 19th century architects as an alternative to Craigeith sandstone. Modern petrographical research demonstrates the similarity of the two sandstones.<sup>23</sup> With the ready cooperation of the landowner and through the support of the Scottish Stone Liaison Group (SSLG), this quarry was reopened in 2003 and it is now being used for repair work in Edinburgh. SSLG projects are ongoing to undertake building stone audits in various parts of Scotland and, in collaboration with the British Geological Survey, to develop a National Stone Database which will help to inform planners, architects and specifiers about indigenous stone.



Fig. 5. Accelerated decay in original masonry with removal of the horizontal broached work effected by excess water run-off from the plastic sign. (Photo A. A. McMillan.)

## CONCLUSIONS

The longer term value to the city's built heritage of applying geological knowledge to the sourcing and characterisation of indigenous stone can be measured in terms of both aesthetics and technical performance. A 'like for like' petrographical selection policy for replacement stone conforms with national and international conservation criteria and offers a sustainable approach towards safeguarding the historic built environment. The revival of an indigenous stone industry also offers the opportunity to maintain skills in the traditional uses of stone as well as providing an alternative source of materials for new-build projects.

Both citizens and visitors are aware of the special character of the City of Edinburgh. The degree to which individuals are conscious of this 'Sense of Place' will vary according to their own life experience and also their willingness to explore and appreciate the history which surrounds them. A fundamental influence on that heritage is the geological foundation which provides a unique backdrop to the city's buildings and varied architecture. Many of the buildings themselves are constructed of the very stone which underlies the City. It is clear that robust strategies and policies for safeguarding the stone-built heritage, supported by the public, are necessary for the benefit of present and future generations.

# EDINBURGH LANDSCAPE AND BUILDING STONE

## NOTES AND REFERENCES

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- 1 Kitty Craft, 'James Craig, 1739–1795: Correction of his Date of Birth', *Book of the Old Edinburgh Club*, New Series 5 (2002), pp. 103–105.
- 2 Thomas H. Shepherd, *Modern Athens! Displayed in a Series of Views: or Edinburgh in the Nineteenth Century* (London 1829), p. 26.
- 3 Robert Louis Stevenson, *Edinburgh: Picturesque Notes* (London 1878), chapter 1, 'Introductory', p. 15.
- 4 James Grant, *Old and New Edinburgh*, 3 vols (London 1880–83), I, p. 27.
- 5 Andrew A. McMillan, Richard J. Gillanders and John A. Fairhurst, *Building Stones of Edinburgh*, 2nd edn (Edinburgh, Edinburgh Geological Society, 1999), p. 117.
- 6 A. J. Youngson, *The Making of Classical Edinburgh, 1750–1840* (Edinburgh 1966).
- 7 McMillan *et al.*, *Building Stones of Edinburgh*, chapters 3 and 7; Ewan K. Hyslop, *The Performance of Replacement Sandstone in the New Town of Edinburgh* (Edinburgh, Historic Scotland Research Report, 2004).
- 8 McMillan *et al.*, *Building Stones of Edinburgh*, pp. 105–109.
- 9 Robert Boyle, 'The economic and petrographic Geology of the New Red Sandstones of the south and west of Scotland', *Transactions of the Geological Society of Glasgow*, 13 (1909), pp. 344–383; Malcolm Macnicol and Mike Devlin, *Red Sandstone Buildings of Edinburgh* (Edinburgh 2009).
- 10 Charles McKean, *Edinburgh, An Illustrated Architectural Guide*, 1st edn (Edinburgh 1982), p. 51.
- 11 Edinburgh World Heritage, *The Old and New Towns of Edinburgh World Heritage Site Management Plan*, July 2005. The second Mangement Plan 2011–16 can be downloaded from <http://www.ewht.org.uk/publications>.
- 12 The Council adopted the Edinburgh City Local Plan on 28 January 2010. The Plan covers the whole of the urban area, and part of its rural Green Belt fringe. It can be downloaded from [http://www.edinburgh.gov.uk/info/178/local\\_and\\_strategic\\_development\\_plans/1005/edinburgh\\_city\\_local\\_plan](http://www.edinburgh.gov.uk/info/178/local_and_strategic_development_plans/1005/edinburgh_city_local_plan).
- 13 Lothian and Borders GeoConservation Publications, Edinburgh Geological Society, *Craigleith Quarry* leaflet. This and other leaflets can be downloaded from [http://www.edinburghgeolsoc.org/r\\_download.html](http://www.edinburghgeolsoc.org/r_download.html).
- 14 City of Edinburgh Council, *Towards the New Enlightenment – A Cultural Policy for the City of Edinburgh* (1999). Available via the Arts Development Team of the Edinburgh Cultural Partnership. See [http://www.edinburgh.gov.uk/info/486/arts\\_development423.edinburgh\\_cultural\\_partnership/CEC\\_cultural\\_policy\\_and\\_art\\_strategies](http://www.edinburgh.gov.uk/info/486/arts_development423.edinburgh_cultural_partnership/CEC_cultural_policy_and_art_strategies).
- 15 Ewan Hyslop and Andrew McMillan, 'Replacement Sandstone in the Edinburgh World Heritage Site: Problems of Source and Supply', in Daniel Kwiatkowski and Runo Löfvendahl (eds), *Proceedings of the 10th International Congress on Deterioration and Conservation of Stone* (Stockholm: ICOMOS, Sweden, 2004), vol. 2, pp. 777–784; Ewan Hyslop, Andrew McMillan and Ingvall Maxwell, *Stone in Scotland* (Earth Science Series, Paris: UNESCO Publishing, International Association of Engineering Geology, Queen's Printer for Scotland, British Geological Survey, 2006); Andrew McMillan and Ewan Hyslop, 'Development of Sustainable Georesources for the Built Environment in the United Kingdom', *Estonian Journal of Earth Sciences*, 57 (2008), pp. 94–103.
- 16 Robert Hunt, *Mineral Statistics of the United Kingdom of Great Britain and Ireland (for the year 1858)*, Part 1 (Memoir of the Geological Survey of Great Britain, London 1859); Andrew A. McMillan, *Quarries of Scotland*, Historic Scotland Technical Advice Note, No. 12 (Historic Scotland, Edinburgh 1997).
- 17 Donald G. Cameron, N. E. Idoine, P. M. McDonnell, E. K. Hyslop, T. J. Brown and A. J. Hill, *Directory of Mines and Quarries 2008*, 8th edn (British Geological Survey, Keyworth, Nottingham 2008).
- 18 George Craig, 'On the Building Stones used in Edinburgh: Their geological Sources, relative Durability, and other Characteristics', *Transactions of the Edinburgh Geological Society*, 6 (1893), pp. 254–273.
- 19 McMillan and Hyslop, 'Sustainable Georesources' (note 15).
- 20 Hyslop, *Performance of Replacement Sandstone* (note 7); Hyslop and McMillan, 'Replacement Sandstone' (note 15).
- 21 Christopher Andrew, Maureen Young and Kenneth Tonge, Masonry Conservation Research Group of the Robert Gordon University, in association with the Technical Conservation, Research and Education Division of Historic Scotland, *Stone Cleaning – A Guide for Practitioners* (1994).
- 22 British Standards Institution, *Natural Stone Test Methods – Petrographic Examination*, BS EN 12407: 2000 (London 2000).
- 23 Hyslop and McMillan, 'Replacement Sandstone' (note 15).