



Traditional and Contemporary Practices in the UK Stone Industry



Simon Brown

National ISS Institute Overseas Fellowship

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Department of Education, Employment
and Workplace Relations
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Executive Summary

The Australian stone industry, as with many other industries, is under serious threat from the continual flood of imported, mass produced Asian goods; and in the case of the stone industry, more specifically those products coming from China. Australian industry cannot compete with China's ability to turn out inexpensive articles by the billion and as such it is essential that we position ourselves cleverly to ensure our industry's survival. Survival and success depends on our ability to create items to an individual customer's taste. This may mean efficiently installing Chinese made granite bench tops after re-polishing the edges and cutting the joints to fit, or by exporting high quality Australian stone cut to accurate sizes, and delivering it within an acceptable time and budget. One of the aims of this fellowship is to investigate just how UK firms are dealing with the Asian import issue in a European context.

In Australia today there is a clear need to: 1) provide career advice for those seeking to enter working with stone in the built heritage; and 2) provide high level skills and knowledge for those working in the built environment in heritage contexts and transposing those capabilities into new works. Fundamental to the discussion is developing an appreciation and respect for materials and processes that allowed former master artisans to create such enduring fabrications.

Traditional stonemasonry skills and knowledge must be retained and integrated into modern stonemasonry practice so that a depth and breadth of expertise is maintained. Stone buildings from past times provide examples of sought-after skills that are rare, even non-existent today. Early stone working technologies support sophisticated contemporary capabilities because they are grounded in respect for the material. The Australian Stone Industry needs clever, committed skilled artisans not only to maintain our built heritage, but also to develop smart, new ways of applying conventional skills in the modern workplace. Fellowships such as those provided by ISS Institute will provide opportunities for ensuring a sound skill base for the stone industry of tomorrow.

The purpose of the Fellowship was to carry out an overseas study program of traditional and contemporary stonemason skills in the United Kingdom. The program itinerary linked short stonemasonry courses available during June 2006. The UK is an ideal destination because of its strong craft traditions, significant heritage infrastructure and parentage of Australia's craft skills. Several factors that influenced this choice were: availability of short heritage-skill courses, the wide range of skills taught, accessibility and linguistic considerations.

The Fellowship explored the roots of stonemasonry craft tradition, and examined how these techniques continue to influence the modern workplace. The primary focus of the study program was to identify and explore the development process of stone products from extraction to installation and conservation in a UK context. A series of short courses provided hands-on opportunities to explore traditional and contemporary skills.

A series of broad and more specific aims were developed for investigation.

Broad aims included:

- promoting natural stone as a material for use in the contemporary built environment, in addition to manufactured options such as concrete, glass and steel
- further developing an understanding of the ways in which natural stone can be used as a sustainable resource eg (a) promoting energy-efficient extraction and production processes (b) advocating environmental attributes such as insulating properties
- developing an understanding of stone conservation

Executive Summary

- developing resources available to skilled tradespeople, enhancing the capabilities of those working with stone, that is, those who are skilled in design, and who have high level knowledge of the physical characteristics of natural stone and its exploitation
- guiding skilled teachers to instruct the next generation of stonemasons and upskill those working in industry

Specific areas of study and skills development included:

- Masonry construction
- Masonry restoration
- Letter cutting, carving and detailing
- Sculptural design and practice

A series of short courses of formal training were undertaken to address these skills gaps.

Locations included:

- The Portland Sculpture and Quarry Trust (PSQT)
- The Orton Trust
- West Dean College
- The Winchester Lime Centre

In addition to short course skills development, the Fellowship study program provided opportunities to meet fellow stone workers, and to see stone working techniques. Considering the short time period (five weeks) and the broad range of topics, it was not possible to consider in-depth investigations; however, the proximity of teaching facilities and quarries, factories and building works allowed productive activity.

Following a detailed account of the international experience and a discussion regarding knowledge transfer, the Report concludes with a series of recommendations to Government, Industry and the Business sector, Professional Associations, Education and Training Providers, our Community and the ISS Institute.

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Abbreviations and Acronyms

BLF	Building Limes Forum
DEEWR	Department of Education, Employment and Workplace Relations
DET	Department of Education and Training
ISSI	International Specialised Skills Institute
PSQT	Portland Sculpture and Quarry Trust
SOSQ	Sculptors Queensland
SPAB	Society for the Protection of Ancient Buildings
TAFE	Technical and Further Education
TTSI	Trade and Technician Skills Institute
UNESCO	United Nations Education, Scientific and Cultural Organisation

Acknowledgments

Simon Brown would like to thank the following individuals and organisations who gave generously of their time and their expertise to assist, advise and guide him throughout the Fellowship program.

Awarding Body - International Specialised Skills Institute (ISS Institute)

We know that Australia's economic future is reliant upon high level skills and knowledge, underpinned by design and innovation.

The International Specialised Skills Institute Inc (ISS Institute) is an independent, national organisation, which has a record of nearly twenty years of working with Australian industry and commerce to gain best-in-the-world skills and experience in traditional and leading-edge technology, design, innovation and management. The Institute has worked extensively with Government and non-Government organisations, firms, industry bodies, professional associations and education and training institutions.

The Patron in Chief is Sir James Gobbo AC, CVO. The ISS Institute Board of Management is Chaired by Noel Waite AO. The Board comprises Franco Fiorentini, John Iacovangelo, Lady Primrose Potter AC and David Wittner.

Through its CEO, Carolynne Bourne AM, the ISS Institute identifies and researches skill deficiencies and then meets the deficiency needs through its *Overseas Skill Acquisition Plan (Fellowship Program)*, its education and training activities, professional development events and consultancy services.

Under the Overseas Skill Acquisition Plan (Fellowship Program) Australians travel overseas or international experts travel to Australia. Participants then pass on what they have learnt through reports, education and training activities such as workshops, conferences, lectures, forums, seminars and events, therein ensuring that for each Fellowship undertaken many benefit.

As an outcome of its work, ISS Institute has gained a deep understanding of the nature and scope of a number of issues. Four clearly defined economic forces have emerged out of our nearly twenty years of research. The drivers have arisen out of research that has been induced rather than deduced and innovative, practical solutions created - it is about thinking and working differently.

A Global Perspective. 'Skills Deficiencies' + 'Skills Shortages'

Skill deficiencies address future needs. Skill shortages replicate the past and are focused on immediate needs.

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas. This is the focus of the work of ISS Institute.

There may be individuals or firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the IP to themselves; and over time they retire and pass way. Firms likewise come and go. If Australia is to create, build and sustain Industries, knowledge/skills/understandings must be accessible trans-generationally through nationally accredited courses and not be reliant on individuals.

Our international competitors have these capabilities as well as the education and training infrastructure to underpin them.

Addressing skill shortages, however, is merely delivering more of what we already know and can do to meet current market demands. Australia needs to address the **dual** challenge – skill deficiencies and skill shortages.

Acknowledgments

Identifying and closing skills deficiencies is vital to long-term economic prospects in order to sustain sectors that are at risk of disappearing, not being developed or leaving our shores to be taken up by our competitors. The only prudent option is to achieve a high skill, high value-added economy in order to build a significant future in the local and international marketplace.

The Trades

The ISS Institute views the trades as the backbone of our economy. Yet, they are often unseen and, in the main, have no direct voice as to issues which are in their domain of expertise. The trades are equal, but different to professions.

The ISS Institute has the way forward through its 'Master Artisan Framework for Excellence. A New Model for Skilling the Trades', December 2004. The Federal Government, DEEWR commissioned ISS Institute to write an Australian Master Artisan School, Feasibility Plan.

In 2006, ISS Institute Inc. set up a new ISS advisory body, the **Trades Advisory Council**. Members are Ivan Deveson AO; Martin Ferguson AM, MP, Federal Labor Member for Batman; Geoff Masters, CEO, Australian Council of Educational Research; Simon McKeon, Executive Chairman, Macquarie Bank, Melbourne Office; Richard Pratt, Chairman, Visy Industries and Julius Roe, National President Australian Manufacturing Workers' Union.

Think and Work in an Holistic Approach along the Supply Chain - Collaboration and Communication

Our experience has shown that most perceive that lack of skills is the principal factor related to quality and productivity. We believe that attitudes are often the constraint to turning ideas into product and a successful business; the ability to think laterally, to work and communicate across disciplines and industry sectors, to be able to take risks and think outside the familiar, to share – to turn competitors into partners.

Australia needs to change to thinking and working holistically along the entire Supply Chain; to collaborate and communicate across industries and occupations - designers with master artisans, trades men and women, Government agencies, manufacturers, engineers, farmers, retailers, suppliers to name a few in the Chain.

'Design' has to be seen as more than 'Art' discipline – it is a fundamental economic and business tool for the 21st Century

Design is crucial to the economic future of our nation. Australia needs to understand and learn the value of design, the benefits of good design and for it to become part of everyday language, decision making and choice.

Design is as important to the child exploring the possibilities of the world, as it is to the architect developing new concepts, and as it is to the electrician placing power points or the furniture designer working with a cabinet-maker and manufacturer. As such, design is vested in every member of our community and touches every aspect of our lives.

Our holistic approach takes us to working across occupations and industry sectors and building bridges along the way. The result has been highly effective in the creation of new business, the development of existing business and the return of lost skills and knowledge to our workforce, thus creating jobs - whereby individuals gain; industry and business gain; the Australian community gains economically, educationally and culturally.

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DEEWR develops and implements policies to ensure the continuing relevance of education, science and training to contemporary needs and the growing requirement for lifelong learning. DEEWR also ensures high quality and value for money in delivering Government funded programmes.

Fellowship Supporters

This paper also acknowledges Brisbane North Institute of TAFE's provision of special leave and casual backfilling during the Fellowship travel phase and Fellowship supporters in Australia and in Great Britain.

About the Fellow

Simon Brown spent twenty years working as a stonemason before joining TAFE (Queensland) as a full-time stonemasonry teacher in 2000. Brown builds on a strong skills foundation, infusing learners of all ages with his passion. After completing a stonemasonry apprenticeship at the Brisbane firm Andrew L. Petrie, Brown operated a stonemasonry sub-contractor partnership with his wife, Janet. During these years he developed an extensive understanding of the Australian stone industry. Brown was presented with an opportunity to join TAFE Queensland on a part-time basis in 1993 and in the following fifteen years since that time, he has helped young people gain skills and knowledge in the stone industry.

In 2005, the Department of Education and Training (DET) funded Brisbane North Institute of TAFE (BNIT) to develop flexible learning resources under the Learnscope Program. Simon worked in the team as content expert, developing a suite of e-learning resources.

Simon is currently developing e-learning resources under the guidance of Trade and Technician Skills Institute (TTSI) (operating as SkillsTech Australia) Product Support.

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Certificate 3 in Stonemasonry (Trade award)
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Memberships

Sculptors Queensland (SOSQ)
Building Limes Forum (BLF)

The Fellowship Program

The purpose of the Fellowship was to carry out an overseas study program of traditional and contemporary stonemason skills in the United Kingdom. The program itinerary linked short stonemasonry courses available during June 2006. The UK is an ideal destination because of its strong craft traditions, significant heritage infrastructure and parentage of Australia's craft skills. Several factors that influenced this choice were: availability of short heritage-skill courses, the wide range of skills taught, accessibility and linguistic considerations.

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The Aim of the Fellowship

A series of broad and more specific aims were developed for investigation.

Broad aims included:

- Promoting natural stone as a material for use in the contemporary built environment, in addition to manufactured options such as concrete, glass and steel
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- Developing an understanding of stone conservation
- Developing resources available to skilled tradespeople, enhancing the capabilities of those working with stone, that is, those who are skilled in design, and who have high level knowledge of the physical characteristics of natural stone and its exploitation
- Guiding skilled teachers to instruct the next generation of stonemasons and upskill those working in industry

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The Australian Context

The Australian Stone Industry, as with many other industries, is under serious threat from the continual flood of imported, mass produced Asian goods; and in the case of the stone industry, more specifically those products coming from China. Australian industry cannot compete with China's ability to turn out inexpensive articles by the billion and as such it is essential that we position ourselves cleverly to ensure our industry's survival. Survival and success depends on our ability to create items to an individual customer's taste. This may mean efficiently installing Chinese made granite bench tops after re-polishing the edges and cutting the joints to fit, or by exporting high quality Australian stone cut to accurate sizes, and delivering it within an acceptable time and budget. One of the aims of this fellowship is to investigate just how UK firms are dealing with the Asian import issue in a European context.

Also of significance is Australia's position on recognition of what constitutes a world-heritage site. Compared to Europe, Australia has relatively few World Heritage-listed cultural sites. Referencing UNESCO's World Heritage Centre, all but one of Australia's World heritage sites are natural wonders such as The Great Barrier Reef and Kakadu National Park. The European focus is very different. World heritage listings in Europe are almost all cultural sites like Stonehenge, Westminster Palace, Chartres Cathedral and the historic cities of Italy. Recognition of traditional buildings is central to any ongoing discussion regarding the survival (and recognition) of Australia's stone industry.

In Australia today there is a clear need to:

- 1) provide career advice for those seeking to enter working with stone in built heritage; and
- 2) provide high level skills and knowledge for those working in the built environment in heritage contexts and transposing those capabilities into new works. Fundamental to the discussion is developing an appreciation and respect for materials and processes that allowed former master artisans to create such enduring fabrications.

However, it is not only ancient buildings and memorials that provide examples of skilled work practices - current stone projects exploit sophisticated equipment to quarry, handle and process stone, which has remained essentially the same material. Artisans sought by the contemporary stone industry have a wide repertoire of skills, including traditional stonemasonry techniques, machine operation, and problem solving and people management abilities.

In addition, the information age has spawned a generation of smart consumers, who quicken the pace made possible by global opportunities. Today's discerning stone shopper uses the Internet to browse for good deals in overseas products, and then takes advantage of worldwide transport franchises that transport the product literally to their doorstep. This new trend is levering the local stone industry out of traditional ways of doing business, and is forcing stonemasons to re-think commercial strategies.

Ironically, the press of imported finished natural stone products has stimulated the local market. Stonemasons, who once quarried and crafted only local stone, now import a range of natural stone to supplement their product range. There is now more need than ever for skilled workers to re-work and install imported natural and manufactured stone. In the current climate, local stone products are not viable, although the increased exposure of natural stone as an alternative to fired clay and cast concrete goods may yet resurrect an interest in Australian stone.

To sustain the stonemasonry trade, masons need to be able to move between contemporary and heritage work to maintain a viable business. Accordingly, stonemasons work in contemporary settings with a few enhancing their capabilities to add heritage conservation work to their range of projects; therein they require a skill and knowledge base to meet both work environments.

The Australian Context

Successful artisans are those who artfully communicate advantages and limitations of materials from the design stage through to completion, drawing on traditional knowledge in a modern environment. With this in mind, the Overseas Fellowship itinerary has been structured to experience both time-honoured and contemporary European practices.

James Charlwood, Managing Director, Cathedral Stone, Australia has made a series of observations regarding the current state of the Australian Stone Industry. Charlwood's view is that *"the failure of training organisations to recognise the Stone Industry sectors and respond to industry needs for specialisation, particularly in the latter years of apprenticeships, is not only detrimental to the development and maintenance of high individual skill levels, but quite likely retards whole industry growth toward excellence. This factor combines with an industry which, in Australia, isn't renowned for its cohesive nature. There is very little dynamic co-operation between individual proponents of the industry"*.

Further observations by Charlwood (2007):

Throughout the 20th Century industrialisation and manufacturing replaced cottage industry. World wars depleted our traditional knowledge and skill base and modernism shunned the architectural traditions. Necessary labour reforms placed craft skills beyond the fiscal reach of ordinary Australians. This is history and as inevitable and desirable as some of these changes have been, we are left today inadequate in our capacity to provide for our contemporary building needs as follows:

- *the nation's thirst for buildings of a sustainable and culturally vibrant nature*
- *for solutions in stone that are both contemporary and innovative*
- *for a built environment cognisant of linear architectural traditions, idioms of design that are recognisable and connected to a tangible heritage*
- *and indeed for easy access at all to that archetypal building material – stone*

The draining away of skills continues, as does the dumbing-down of our once vibrant craft traditions. We are not sufficiently equipping the trade with the ability to advance into new realms of wonder in our built environment. Amongst many other factors I see:

- *The leaching away of our skilled monumental masons to cheap Chinese imports*
- *The failure of this generation to elevate [master artisan] skills on par with academic and professional career streams.*

Benefits to Australia of Developing and Retaining These Skills

Traditional stonemasonry skills and knowledge must be retained and integrated into modern Stonemasonry practice so that a depth and breadth of expertise is maintained. Stone buildings from past times provide examples of sought-after skills that are rare, even non-existent today. Early stone working technologies support sophisticated contemporary capabilities because they are grounded in respect for the material. The Australian Stone Industry needs clever, committed skilled artisans not only to maintain our built heritage, but also to develop smart, new ways of applying conventional skills in the modern workplace. As represented in the following diagram, Fellowships such as those provided by ISS Institute will provide opportunities for ensuring a sound skill base for the Stone Industry of tomorrow:

The Australian Context



In discussing the future of the Australian stone industry Charlwood (2007) observes the following:

...the future is bright indeed. Very briefly here are some of the opportunities presented to us:

Formal recognition of higher knowledge and skill levels leading to:

- *Industry and educators alike elevate the craft sector through creation of career pathways that combine with academia, business and the arts*
- *Integration of past tradition and technological advancement*
- *Support for innovation in design and application of technology at all levels*

Environmental sustainability – genuine recognition of:

- *The low carbon footprint of stone in building*
- *The high cultural value of a material group (stone) which gracefully expresses design for hundreds if not thousands of years*
- *The immense social value of teaching young people the power and vitality of their own manual dexterity*
- *The opportunity in front of us to represent stone in contemporary building in a manner that acknowledges the past whilst diving boldly into the future*

Identifying the Skills Gaps

Skills and Knowledge Gaps

As established previously, the Australian stone industry faces serious competition from Asian neighbours. While it may be that we need to ascertain the best way of working within this competitive market; whatever the outcome, it is essential that we develop and retain the necessary skills to ensure the longevity of our own industry. With regard to skills gaps it is apparent that the most significant gaps involve knowledge of traditional processes. These skills are not only apparent within traditional fields of practice, but transpose into contemporary applications.

In discussing traditional skills, we are essentially referring to those carried out expertly by hand, using hand and power tools to craft structural and decorative elements and products. Traditional knowledge consists of familiarity with natural stone and mortar materials associated with quarrying, processing and installing dimensional stone.

Within his professional practice as Stonemasonry Assessor and Workplace Trainer at Brisbane Institute of TAFE, Brown identified a need for proficiency in the following traditional fields:

- Masonry construction
- Masonry restoration
- Letter cutting, carving and detailing
- Sculptural design and practice

These skills are taught around Australia at TAFE colleges such as Brisbane Institute of TAFE. However, the skill level currently achieved is restricted to AQF Level 3, the basic requirement for trade activities. There is a requirement for higher-level Stonemasonry trade skills to be taught.

The International Context

Unlike Australia, in the UK heritage assets are part of everyday life. Building works carried out for hundreds of years in the UK have resulted in a significant built environment. Despite a severe skills' shortage workers are available to maintain historic buildings, but knowledge of traditional building techniques is becoming lost. UK Heritage funding Heritage Lottery Fund Bursaries support building maintenance projects, providing worker education. Other important sources of worker skilling include charities such as The Orton Trust and The Men of the Stones, who are committed to preserving traditional processes and practices.

There are many short stonemasonry courses available to adults in the UK. Property owners, maintenance contractors, consultants and tradespeople (as well as those who seek to further their skills for self-interest) patronise these courses. These people maintain the UK's 30,491 heritage-listed buildings.

The overseas study program did not allow exploration in all aspects of the stone industry, notably, lengthy formal training. City & Guilds stonemasonry training at Weymouth (Dorset) and Moulton (Northamptonshire) are the main centres for stonemasonry training, and although these were close to the program route, time constraints precluded contact with these institutions. At the time of itinerary planning, six-month and one-year courses were the minimum available at these centres, but short courses have subsequently been introduced.

Based on the time available and time of travel, the following destinations were selected for the overseas Fellowship study program:

- Portland Sculpture and Quarry Trust workshop
- Orton trust workshop
- West Dean College masterclass

Portland Sculpture and Quarry Trust

The Isle of Portland¹ is a small island off the southern coast of Dorset, and its quarries provided stone for many UK buildings and monuments (notably St Paul's Cathedral).

Portland is a quirky place, even by English standards. Portlanders display proud independence, boasting that there is nothing to attract them to the mainland. It is certainly a beautiful place. Architect Christopher Wren (later Sir Christopher Wren) used Portland stone to replace wooden structures destroyed in the Great Fire of London (1666), and blocks rejected by him are still visible near the eastern side shoreline (East Weares). Portland stone comprises most buildings on the island, and many buildings feature a hand-lettered name plaque. The island's prominence in the English Channel exposes it to weather extremes, necessitating distinctive sheltered doorways.²



The International Context

In 1983 the Portland Sculpture and Quarry Trust (PSQT) was set up to meet a wide range of community needs, including:

- Preserving traditional Portland stone working skills (museum display)
- Providing training in stone working (regular sculpture classes)
- Connecting Portland's cultural heritage with the Arts, Education and Earth Sciences in a quarry context (sculpture in landscape projects)
- Encouraging dialogue about environmental management (quarry regeneration)

PSQT provides an example of a successful collaboration between extractive industry, stonemasonry companies, earth scientists, stone workers, artists, landscape architects, planners, environmentalists and academics. This concept is applicable to the Australian stone industry.

Tout Quarry is the location of PSQT sculpture classes, held among the old workings.³



It is a fascinating place, a fossilised industrial wilderness area and provides a focus for loosely collaborative cultural enterprises. Paul Crabtree and Hannah Sofaer lead the teaching program with the support of an additional tutor. There were many visitors during the 6-day class, some of whom were local residents exercising dogs and horses, others were groups of London schoolchildren visiting an environment contrasting with their own. Alan J. Wolsey, called at Tout on the third day to discuss, with Hannah and Paul, designs for a Folly (tower) at Prince Charles' Poundbury village near Dorchester. Alan appears as a young apprentice in 'Heart of Stone' a 1970's BBC production featuring traditional stone extraction skills on Portland. Paul copied the movie to DVD, now catalogued in Skills Tech Australia's library at Eagle Farm.

This DVD accompanies 'Portland Stone Experience' a small locally authored book that "...explores the origins of Portland stone, how it has been used through the ages, and the dependence of communities upon it." During a Portland Bill morning walk with 'The Mermaid' (pub) owner Sue Williams, her friend, the author Rachel Barton, explained how she used many of her family photos and stories to create the book. As Community Development Officer for Weymouth Council, Rachel is reinstating historic tramways around the island, and together with the PSQT, setting up a 'Stone Experience' room.

The International Context

Paul Crabtree shared his completed assignments in HND1 Applied architectural stonework which were professionally presented, fully referenced academic publications titled:

- Production & Conservation (geology)
- Gothic Arches
- Interesting Headstones of St George's Church, Portland (pamphlet)
- Building Surveying Project: St George's Church, Portland:

Detailed photographic speech-to-text description of graves⁴⁻⁵ including:

- Condition
- Weathering
- Inscriptions
- Detailed exposition of graveyard lichens
- Geometry of Gothic arches
- Detailed photo description
- History of arches
- Types of arches
- Visitors' guide to churchyard of St George's
- St George's Church: detailed study of
- Architecture
- History
- Stonework
- Weathering



Paul, Hannah and the PSQT have diverse interests anchored in the Portland stone industry – quarry regeneration, geology teaching, landscape and interior design, sculpture, traditional quarrying techniques, and stonemasonry workshop & installation methods. The Drill Hall (PSQT headquarters) is a cultural hub on Portland.⁶

Developing sculptural experience was a personal aim in the PSQT sculpture class. To compose a crouching figure at an appropriate scale, it was necessary to select a block of Portland limestone approximately 500mm cubed.⁷⁻⁸



The International Context



Key findings:

Paul, Hannah and Mark emphasised several points to remember in anatomical work:

- Work to curves, not straight lines - the human body contains no straight lines, and to represent features in this way appears unnatural
- Work to '3-D' contour lines during shaping with hand tools, tool marks should travel directly along or across curved surfaces, not diagonally – as if these lines represent a 3-D object as sketched on paper
- Leave some original block surface records the size of the original block
- Leave some areas completely unfinished, creating an interesting variety in surface texture, and alludes to 'work in progress'
- Practise 'quick sketches' in small boulders that individually suggest form, cultivating an eye for developing natural form, rather than imposing measurements on a rough block
- Never 'join' interrupted curves ie: an arm placed over a leg breaks the leg into two separate pieces – do not make the leg appear continuous
- Compose figures as if they are 'emerging' from the block, creating a sense of unity between the finished areas and the original block.⁹

Participation in the PSQT 6-day sculpture class provided hands-on experience with Portland stone.

Tools and techniques are similar to those used to fashion Helidon sandstone, except that tungsten carbide tipped tools more ably work Helidon sandstone because of its quartz component. There is less risk of lung-damage working Portland stone for this reason; however, precautions such as dust-masks and wet cutting are still important. Portland stone is finer and softer than any similar stone in Australia, making for easy working and high-definition detailing, yet it is a durable building material.

Future networking opportunities were presented with other participants,¹⁰ notably:

- Keith Windynook and Peter Parnell, builders from Hull who regularly attend the summer sculpture class
- Frank Bibby, Northamptonshire sculptor, and
- Peter Wilson, Australian sculptor (an already established friend)



The International Context

Albion Stone Quarries Site Visit (Part of PSQT Program)

Paul Crabtree and Hannah Sofaer work intimately with local Portland stone companies, and Crabtree arranged to visit a stone quarry and production facility close by.¹¹



Albion Stone Quarries is a modern stone mill, processing local Portland stone into products for ashlar, paving, headstones and restoration. Their primary breaking equipment is a Benedetti block saw. It has a single, vertically mounted diamond wire, with the wire guided along one edge of a horizontal bar similar to a chainsaw.¹²⁻¹³ After cutting the stone, the diamond-threaded wire loop passes around a drive wheel and then returns over the top of the machine back along a guide wheel. The bar provides stability for the wire as it cuts the stone. In Australia, similar diamond wire saws do not have this horizontal guide bar.



Albion stone also have a large tile line and mason's workshop. Their storage and dispatch area is at the front entry of the workshop, and the plant gives the impression of smooth efficiency. Their cooling water is recycled on site; the water and silt separated by osmosis and the press-dried silt collected for removal. Close to the entrance, there are large display panels featuring product lines. This is important because Portland limestone is many different stones, even within the same quarry workings.

The difference between stones depends on the 'bed' in which it was laid down, with stone

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at the bottom of the deposit most sought after. Upper stones have various proportions of voids and oyster shell, which, although useful as a decorative effect, makes the stone more porous, hence less durable.¹⁴



A network of vertical cracks and gullies interlace Portland Island's stone deposits, affecting the extraction orientation. Consumable steel air bags inserted into trenches (dug parallel to and perpendicular to the gullies) push the stone laterally from its bed as the bags are inflated.¹⁵⁻¹⁶

The Portland stone quarries have limited dimension stone capabilities because the most sought-after stone lies only in a narrow band beneath metres of overburden. Below the base bed lies stone that is only useful for aggregate products for roads and concrete. Residential encroachment also limits quarrying activities to a degree, and so Albion Stone have recently completed underground extraction trials in horizontal mineshafts at Bower's Quarry.¹⁷⁻¹⁸



Although other parts of the UK also mine stone, mine manager Mark Godden explained that the network of experimental shafts at Bower's Mine introduce an innovative way to extract stone close to the extraction lease boundaries. Rock bolts hold the shaft roof stable during mining operations, conducted with minimal noise and vibration. Albion Stone's Fantini GU 50 mine saw cuts the shafts, using diamond wire mounted on variable angle bars. It is a quiet, dustless operation, despite cutting dry. Movement sensors continuously monitor rock fall hazards.¹⁹

Spaces left by the mining operation are stable thermally and structurally, and suggest future development into archival storage, public meeting spaces or even residential dwellings.²⁰



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Conversations with local stonemasons reveal pride in stone craft skills: 'Mermaid' regular and stonemason Paul Brown²¹ shared his City & Guilds (Weymouth College) portfolio.

Paul Brown assembled his portfolio during a refresher course he undertook in 2003, after initially completing his training in 1986-88. Paul's portfolio featured many examples of banker masonry, worked in Portland limestone to exacting specifications. Compared to Australian stonemasonry training, in the UK there is greater emphasis on banker masonry detailing. This is understandable in the context of vast numbers of UK buildings requiring skilled maintenance and restoration.

Comments from other stonemasons revealed a certain lack of respect for 'college' training, with preference for 'on-the-job' training. The 'paperwork' required for instruction and assessment appeared to be a contentious issue, possibly employers would prefer more applied training techniques than theoretical.

The Orton Trust

The Orton Trust²² is supported by the Men of the Stones. The Orton Trust offers supplementary training in stonemasonry skills to those who have no formal training in stonemasonry. Much of the Orton Trust expenses are dedicated to insurance premiums; however, 'Men of the Stones' financial grants render the Orton Trust course fees affordable.



The overseas fellowship program allowed attendance at two Orton Trust courses: *Basic Masonry Skills* and *Lime Mortars*. Tutors Neville Slack and Rory Young are very experienced practitioners and teachers. During the first day, tutors Rory Young and Shaun Bradley unveiled a plaque honouring retiring tutor John Green, Orton Trust instructor for 35 years since 1969. Like Neville, Rory is an Orton past student.²³

Basic Masonry Skills

Although intended for those with few banker masonry skills, *Basic Masonry Skills* included advanced students as well as beginners. Neville Slack ensured that drawing and practical projects suited students' skill levels, assigning appropriate projects. Brown received instruction in making a moulded arch voussoir from Ancaster 'hard' limestone. This was very 'flaky' stone, unlike anything Brown had carved before. Following his lesson from the beginning, was 'boning' the rough block with hand tools just like the rest of the class, Brown then used an existing template to set out moulded profiles on the radiating stone bed. Some class time was also spent observing other students completing their projects and talking with them about their experiences in the stone industry.²⁴

Fellow participants included Dave Willey from South Wales. Willey attended the class to gain hands-on experience in banker masonry. Self-taught, he is teaching stonemasonry

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skills in his hometown, and networking in the Welsh Stone Forum (Fforwm Cerrig Cymru). In addition, he is compiling a database of Welsh building stones. Australian Lyle Closs was another participant, augmenting his stone carving skills. A British Public Servant, Closs had recently spent a week at Guedelon in France assisting with a medieval castle project. He later emailed some of his Guedelon photos. James, an apprentice stonemason from Northampton, was building his stone working skills prior to attending formal training at Moulton College.



Also in attendance were Edward Garrett, a sculptor who was investigating stone as a sculpture medium, Daniel Denault, a teacher, who was adding skills to his manual arts training repertoire and Brendan, a stonemason from Newcastle, who had brought a tracery restoration project to the class, completing it under Neville's guidance.²⁵

Neville extended an invitation to visit his home in Sheffield. Built in the historic Rivelin Glen stone quarry, Neville and Penelope operate a B&B and sculpture studio and lease their quarry to a stone company. The stone company workers were slabbing, sawing and tooling Derbyshire stone (hard, gritty sandstone), making replacement walling stones. They used Neville's mobile yard crane to shift product and remove waste. Neville had, at some time, bought an old stone planer and was slowly restoring it. Working equipment included a small block saw, slab saw and guillotine and tumbler (fashioned from a concrete mixer bowl).²⁶



The supervisor at Neville's yard, Shaun Collins, had recently assisted stonemason John Nicholson at Sheffield Peace Park, a city redevelopment. Handrail balusters surrounding the park featured unusual field and ground effects.²⁷

Nearby, workers re-pointed Sheffield Town Hall black basalt stairs with commercially prepared lime mortar. The workers noted that they were just following the spec and did not

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have any faith in the mortar being suitable because it was "... *weak and light coloured.*" They preferred cement, being "... *strong, and you know it will last.*" Indent repairs to Sheffield Town Hall's columns repaired shrapnel damage from WWII.²⁸⁻²⁹



Neville showed his work in progress (Pitsmoor Toll Bar, owned by the Duke of Norfolk), as well as some of his completed projects in the Sheffield General Cemetery. Neville had earlier cleaned the Pitsmoor Toll Bar, and was in the final stage of replacing stones, and re-pointing mortar.³⁰



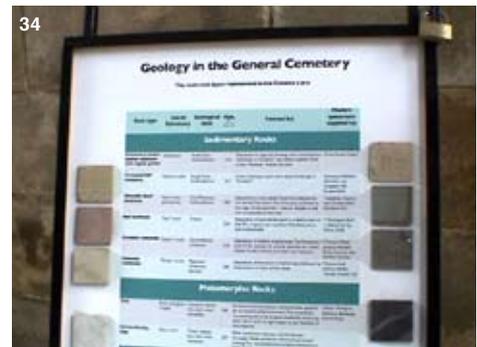
Pollution had blackened the Toll Bar's stones, as well as bitumen DPC applied after deterioration had advanced. Neville steam cleaned the stonework at 1500 psi. Tooling on new stones had to match original imperial sizes and he had adapted oversized metric chisels to achieve this. Additionally the original 'black ash' lime mortar was matched with a mixture of crushed stone, hydraulic lime and black iron oxide. Immediately after filling the joints, 'hazing' with a hand water spray exposed the mortar aggregate as in the

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original. Researching 'black ash mortar' indicates that it included ashes as aggregate, not ideal because of potential sulfate attack, although another possible source could be locally produced lime. Locally produced lime often includes wood ash because of unsophisticated lime burning techniques.³¹⁻³²



Another project had involved the repair of the gateway at Sheffield General Cemetery, replacing stone, cleaning and re-pointing. After years of neglect, the cemetery was undergoing refurbishment. There were many visitors wandering around its green space, admiring the Victorian funerary symbols.³⁵ Geological and historical information featured on display boards at the cemetery entrance.³³⁻³⁴ Beside the walking track, old headstones laid flat formed a raised platform.³⁶



Neville had also carried out extensive stone restoration work at the Abbeydale Industrial Hamlet. Abbeydale is the last remaining water mill in the area. There were scores of mills operating from the 17th century until the 1930's, producing Sheffield steel cutlery and tools. The museum is an interesting conjunction of traditional trades in steel, timber and stone. Old grindstones split in halves formed lintels above windows, and a large collection of worn grindstones formed retaining walls.³⁷

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Lime Mortars

The second workshop, *Lime Mortars*, held on the weekend following Basic Masonry Skills involved hands-on restoration at the decommissioned Orton church.³⁸ It could be wondered what lime information could possibly occupy three days, but tutor Rory Young had not enough time to expound his knowledge. Five of the six stonemasons employed by the Commonwealth War Graves Commission attended this class. Alun Walker set up an Orton Students guest book shortly after the class ended.

Also attending were:

- Anke Few, German conservation expert
- Alun Walker, blacksmith and stonemason
- An Environmental Protection Services Officer – working part time with Neville Slack
- A local bricklayer and property owner (in France)
- A local stonemason



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Giles gave directions to Lyveden New Bield,³⁹⁻⁴¹ an unfinished Elizabethan lodge and moated garden not far from Orton. Sir Thomas Tresham had begun Lyveden New Bield shortly before his death in 1605. Other Tresham buildings include Rushton Hall, Rushton Triangular Lodge (a folly) and The Market House at Rothwell.

All of these buildings appear to be made from the same limestone, (similar in appearance to Portland stone) and show little weathering after 400 years. The joints are incredibly fine (less than 2mm wide), filled flush with lime mortar. The buildings have an attractive multi-coloured lichen patina overlaying a finely furrowed, slightly dissolved surface, reminiscent of a very old person's face.

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Rory opened Lime Mortars in the Orton church hall with a brief talk about lime and presented a slide-show featuring recent masonry restoration projects. His latest sculptural work, commissioned by the Society for the Protection of Ancient Buildings (SPAB) had a cyclical 'decay/restoration' theme. In the Orton church building, Rory demonstrated cutting out wall joints, and preparing lime mortar 24 hours in advance of its use. Rory listened to an idea for a Murgon lime workshop (collaborating with Unimin Australia).

The importance of lime as a traditional mortar binder commonly used until the early 1900's was established. The use of cement to replace lime in traditional buildings work was condemned, comparing the outer surface of a masonry building to tree bark, ie, subject to regular sacrificial peeling in order to protect the fabric beneath. Lime, being semi porous, repels water molecules (rain) while allowing water vapour (damp) to escape from the structure. Impermeable cement mortar initially repels water, but traps moisture within the masonry structure. When cement mortar invariably cracks water penetrates the masonry, causing worsening damp problems. Stone decay soon follows at the repair boundary. Lime mortar effectively 'flexes' with building movement because of the lime crystals dissolving and re-crystallising across cracks (autogeneity).⁴²



Transcript of Text on Plaque: "A SEPTARIAN CONCRETION found in the Oxford Clay at Bicester, Oxfordshire, 1984. This limestone concretion was formed in the soft organic-rich mud at the bottom of the sea which covered the South Midlands of England in Callovian times, some 165 million years ago. The calcite and pyrite cementing the clay sediments were probably generated by local bacterial activity. Early chemical changes and dehydration took place a few metres below the sea floor, resulting in a polygonal pattern of shrinkage cracks. Calcite crystals have since grown to fill the cracks".



One of the earliest hydraulic limes, termed Roman Cement, was made from septarian nodules found in the Thames Valley at Oxfordshire.⁴³⁻⁴⁴

Contemporary UK lime mortar re-pointing visually unifies stones and mortar, contrasting Australian cement mortar practices. In Australia, it is usual to brush joints to a shallow depth, exposing stone faces. Traditional masonry buildings were described as being flush-jointed, lime plastered and then lime washed; protecting the stone surface, not exposing it.⁴⁵

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A three stage lime cycle was explained:

- **Calcination**

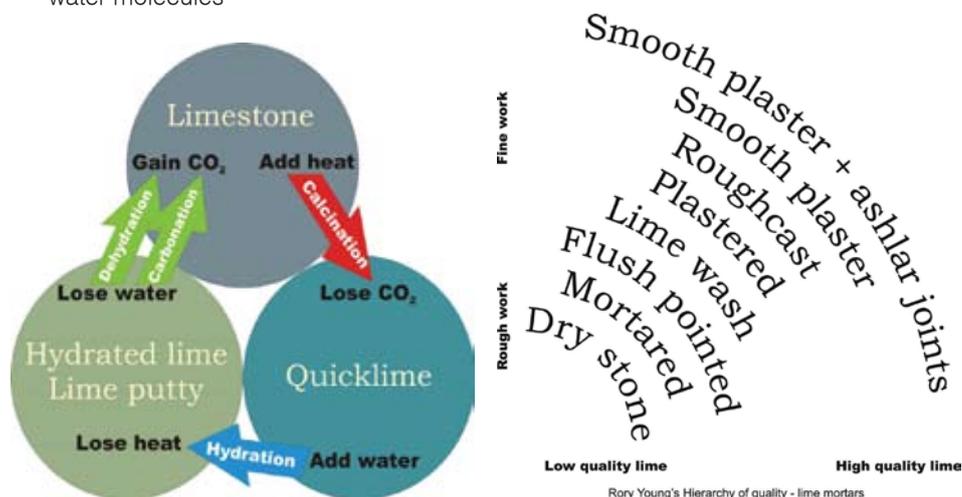
Heating limestone rock drives off water and carbon dioxide, and produces quicklime

- **Hydration**

Adding water to quicklime (slaking) makes hydrated lime (just enough water) and lime putty (excess water)

- **Dehydration & Carbonation**

When lime mortar slowly dries out, it reverts to limestone as carbon dioxide replaces water molecules



The Lime Cycle

An overview was then provided regarding how lime has different grades dependent on source materials and their treatment. To achieve efficiency, it is important to distinguish between grades.

Various grades of lime have their place in building lime mortars, ranging from rough work to fine work. Fine work requires high quality lime. Carefully selected, competently calcined limestone is slaked and aged to avoid 'pitting and popping' caused by dolomitic impurities. 'Pitting and popping' is not an issue in rough work, and so lower quality limes are suitable. The class had several projects to work on:

- Lime mortar re-pointing internal and external wall joints, removing earlier cement repairs
- Lime plastering interior walls
- Lime mortar plastic repair

Lime Mortar Re-pointing⁴⁶ – The twelfth century Orton church building walls provided a restoration medium for lime mortar repairs, using 3:1 lime mortar (prepared from stone similar to that used in the original church) in a ratio of 3:2:1:2 crushed stone (2mm - 5mm): fine sand (0.5mm - 2mm): stone dust (0.1mm - 0.5mm): lime putty. 3:2:1:2 crushed fine stone: lime stone: sand dust: putty.



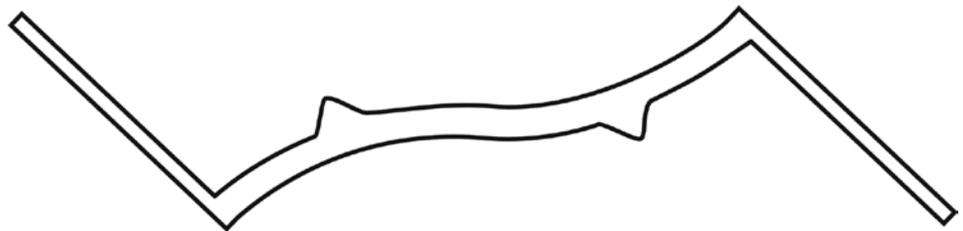
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Lime Mortar Proportions

Zeolite (a mineral with microporous properties) stone dust absorbs moisture from mortar and then releases it gradually, slowing mortar curing. The mix contained no added water; however, adjusting the mix ratio attained workability.⁴⁷



A demonstration was provided identifying the process for cutting out cement mortar joints, replacing previous harmful repairs with lime mortar. The importance of creating clean, suitably recessed wall joint 'floors' and 'ceilings' rather than 'V' cutting, giving the soft mortar a firm seating was stressed.⁴⁸



Bronze Pointing Iron

The repair surface was pre-damped, hazing water from a garden sprayer. Frequent dampening continued as the work progressed, ensuring that no water ran down the wall face. Lime putty and fine aggregate primed the clean, damp, repair surfaces. Freshly mixed mortar, pressed in, over-filled the damp joints. Pre-washed and dampened wedge-shaped spalls (plums, or pinnings) filled voids one cubic inch and greater.



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After the initial application, joints were twice reworked, being firmly compressed with a trowel and then finally scraped flush with the stonework. This countered shrinkage during drying, opening the joint surface texture and created an almost imperceptible boundary between stone and mortar. It was explained that a rough texture not only provided porosity at the mortar surface, allowing moisture to escape, but it also gave a larger surface area from which this could happen: smoothly finishing the surface creates unwanted 'impermeability'.⁴⁹

Lime Plastering – The Orton church walls regularly receive the benefit of lime plastering demonstrations that contribute to the building fabric maintenance. So that plastering could be done in a controlled way, the class first prepared materials, and then the wall surface. A small sample-board recorded mix details.⁵⁰

Fine sand and lime putty (mixed 3:1, by volume) comprised the mortar. Before the wall surface was prepared, the mortar was mixed, covered and left to stand. The mortar was 'knocked up' (re-liquefied by vigorous re-mixing) immediately before use, and goat's hair reinforcement added.⁵¹



Cleaning and dampening (as previously described) preceded a primary slurry coat application. The primer (1:2 fine sand: lime putty), brushed and into cracks and voids, created a sticky bond. Lime mortar and pinnings plugged holes after the primer had slightly dried and carbonated. When lime mortar dries (hydration), it loses plasticity and begins to absorb carbon dioxide from the air (carbonation). As the carbonation happens only 10-12mm in from the surface, applying several thin coats allows the calcium hydroxide to harden (indurate) in the presence of moisture into a firm calcium carbonate matrix.⁵²

Lime slurry brushed onto the dampened wall surface paved the way for the first lime mortar coat. After the primer coat reached a cheesy texture, 'coarse stuff' (3:1 sand: lime

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+ goat hair) was then applied, filling slacks (hollows). Left overnight to dry, the wall then received a second plaster coat, without goat hair added. It was then ready for shelter coating (three coats of 1:2 sand: lime slurry).⁵³

Lime Mortar Plastic Repair – Rory Young instructed the Orton class in decorative stonework repair, developing concepts introduced in the initial sessions, mixing similar lime mortar mixtures for priming, building out and finishing. Small-scale ceramic armatures (Nim T's) are used to support the mortar while it is drying out and carbonating. Students were allowed access to Young's own fourteenth-century decorative limestone pieces to practise repairs. Lime mortar, tinted to match the stone colour, is a reversible, low-tech, environmentally friendly, almost undetectable and easily shaped repair technique.⁵⁴

West Dean College

English Heritage accredits West Dean College's⁵⁵ Building Conservation Masterclasses, and the short courses count as Continuing Professional Development towards a Professional Development Diploma. Completing ten short courses and a final essay submission satisfy Diploma requirements.



*Cleaning Masonry Buildings*⁵⁶ is a masterclass that accompanies the new BS Code of Practice for Cleaning and Surface Repair of Buildings, Parts I and II. Not just about cleaning buildings, it was a chance to develop authority to pass on knowledge about the subject. Attending the course also provided opportunities to meet masonry experts and develop professional relationships. West Dean College, being self-contained, allowed socialising after class with like-minded people, reinforcing existing knowledge, sharing experiences and gaining new perspectives.

European building-management professionals, designers and architects attended the three-day class. The workshop's conservation theme provided a philosophical basis for cleaning masonry⁵⁷, and practical demonstration reinforced technical instructions. Specialist presenters inspired discussion around real work examples, both positive and negative.

SPAB Technical Secretary Alan Gardner convened the masterclass in place of John Ashurst. Gardner is a natural teacher, passionate and knowledgeable about his subject and he varied both media and presentation technique to communicate his message. His engaging manner drew comment from each participant, and intelligent discussion flowed because of the way in which he structured lessons and introduced topics. Gardner made himself available outside lecture times, taking advantage of conservationists attending similar courses. One memorable late-night debate united Ian Constantinides (St Astier proprietor) and Gardner on the topic of cleaning delicate statuary.

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UK stone conservation supplies company Stonehealth proprietors Brian Crowe and Jamie Fairchild addressed the class. Crowe and Fairchild emphasised the importance of training masonry cleaning operators – 80% of cleaning can be achieved without damage so it is important to know when to stop. When a building must be cleaned; decisions about cleaning processes should include selecting operators (with an emphasis on appropriate qualifications), drawn from an approved list. Crowe and Fairchild demonstrated Stonehealth's cleaning systems JOS/TORC and DOFF.⁵⁸



Site Visit: Cathedral Works

The course included a site visit to Chichester masonry firm Cathedral Works Organisation (CWO). Supervisor Brian Kleland demonstrated CWO's stone mill and banker masonry workshop, as well as their JOS/TORC and DOFF cleaning systems.⁵⁹

David Odgers, Nimbus Conservation founder, presented information about cleaning St Paul's, both past and present projects, and spoke of damage caused by untrained and unsupervised workers. During 1962-66 contractors used high volume water-soaking, high-pressure steam cleaning and phosphor bronze scrubbing, scraping and stone reworking to thoroughly clean St Paul's exterior. Although the building certainly became clean, excess water caused structural damage similar to York Minster's West Front. Consequently, a gentler method was specified when Nimbus cleaned St Paul's interior in 2003.

Before undertaking site works at St Paul's, Odgers' team had to consider what effects cleaning would have on a building. Issues considered included:



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- How cleaning would affect the building's future behaviour
- If cleaning would disturb the surrounding equilibrium
- What other factors would be affected by the cleaning operation

Diesel fumes now produce more pollution than coal fires ever did, and England's historic buildings remain subject to attack. Atmospheric pollution (sulfur dioxide + carbonaceous particles) reacts with calcium carbonate (limestone), producing calcium sulfate (gypsum), carbon particles and PAH's (polycyclic aromatic hydrocarbons) in a hard black mineralised outer layer called 'black crust'.⁶⁰

Pre-wetting softens the crust, assisting gentle removal. Water soaking is most effective if used over long periods; however water levels must be minimised. Nimbus developed an exterior cleaning system, combining nebular water sprayers with moisture sensors and timer. The registered degree of wall dampness activated or shut off water sprays, maintaining correct moisture levels without excess water.

Nebular systems are not used in isolation, but with other cleaning methods such as gentle scrubbing and scraping. De-ionised water and non-ionic soap are necessary for delicate materials like gold leaf and mosaics. Localised staining requires poultice application, made from paper pulp and sepiolite clay, mixed with water and ammonium carbonate.

An interesting exchange took place regarding clients' motivations for cleaning buildings. Issues included:

- Aesthetics
- Does the building look grimy?
- Does the patina contribute to appearance?
- Decay
- Will soiling accelerate decay?
- Does soiling obscure structural faults?
- Will soiling prevent protective coatings being applied?

Site Visit: Weald and Downland Open Air Museum

The course included a visit to Weald and Downland Open Air Museum. This is a collection of historic buildings from fourteenth to nineteenth centuries. Professionally presented rare trade displays are on view at the museum entry.⁶¹⁻⁶⁸



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Site Visit: Gotherington Village

Wally Peart, is a Queensland Central Highlands grazier who co-organised Injune Public Space Art Group stone walling workshops. His grandfather, Joseph Peart built many fine stone buildings in Gotherington, a hamlet near Bishop's Cleeve in Gloucestershire.⁶⁹⁻⁷²



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Site Visit: Ashmolean Museum: Oxford

Site works Oxford University Properties Manager David Holt (a Cleaning Masonry Buildings participant) invited all class members to visit conservation works in progress at the Ashmolean Museum in Oxford. Brown was able to take up his offer on his last day in England, and Holt spent a few hours explaining his past and present building maintenance projects.⁷³⁻⁷⁴



The West wing had previously been cleaned, and the East wing was then in progress. David had specified the JOS/TORC abrasive system to remove black crust from delicate statuary.⁷⁵⁻⁷⁶



Holt showed the cupola above the Sheldonian Theatre ceiling that he had removed for repair. Designed by Christopher Wren, it was built from 1664-68 for the University of Oxford. An endoscope was used to reveal that the ceiling fixings were in danger of failing, and Holt carried out immediate remedial work.⁷⁷

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The Lime Centre, Winchester

After working on the conservation of historic buildings for many years, Bob Bennett MBE, Director, The Lime Centre, became increasingly aware that while there was an abundance of academic material available, there was little or no practical training for those involved in the industry.

The Lime Centre at Morestead near Winchester, Hampshire, was set up to offer consultancy, practical training and a ready supply of materials, which are not generally available from the builders merchants. The Lime Centre is now recognised as a centre of excellence with course participants coming from throughout the United Kingdom, USA, Sweden, Canada, India and Australia.

Apart from producing a wide range of ready mixed lime mortars, plasters, renders and washes, Bennett has also advised and worked upon a number of interesting and challenging projects, a few of which are detailed below.

- Windsor Castle. Five major projects, including the Henry VIII entrance, the Norman Arch, the Guardroom, the Royal Dairy.
- The Statue of Liberty, New York. Refurbishment.
- Stonehenge. Removal of graffiti.
- Highclere Castle. Repair and conservation of the stone masonry to north, south and east elevations.
- Shakespeare's Globe Theatre. Design and manufacture lime mortar for the foundations.

Bennett⁷⁸ is an ISS Fellow. He was awarded the David Mitchell P/L Fellowship in 1997 and The Pratt Foundation Fellowship in 2007.

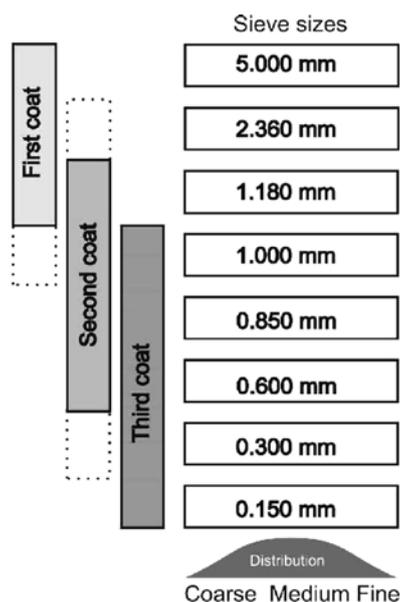


Bennett spoke about types of lime and their uses, and both he and Holt demonstrated practical application of the Lime Centre's product range. Lime Day participants got their hands dirty laying bricks, plastering, pointing, making mortar and slaking lime.⁷⁹

Holt demonstrated how mixing quicklime, sand and water makes a 'hot mix'. The steaming caustic primary lime mortar then cools, and 'ages' in a covered container until ready for application. It was explained that slaking hot, alkaline lime and sand together etches aggregate particles, enhancing binder action. Aging the mortar lessens the likelihood of 'pitting' and 'popping'.⁸⁰

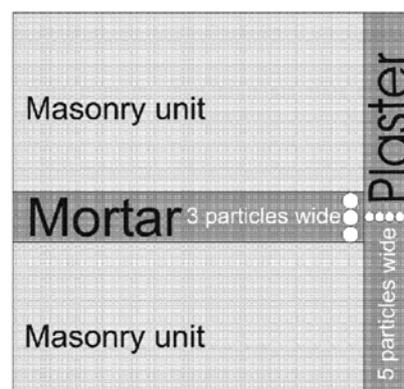
The Lime Centre held several different types of local sands, selected and blended for different applications. Bennett explained how mortar application dictated sand sieving size selection⁸¹, indicated in the following diagrams.

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Sand must be clean, sharp and well graded.

To achieve workability, bedding mortar thickness should be three times the average aggregate particle diameter, and plaster thickness five times the average particle size.



Internal plaster: Aggregate size analysis Mortar thickness: Maximum aggregate sizes

Using phenolphthalein (pH indicator), Bennett revealed the lime carbonation process. Breaking open a dried lime mortar pat, he applied phenolphthalein to the freshly broken edge. Purple staining indicated active lime (pH >10.0) in the pat's centre, and unstained white mortar around the outer crust showed indurated calcium carbonate (pH <8.2).⁸²



An explanation of how to gauge the best aggregate was offered: binder ratio for any sand. Taking a small sample of sand, add water until the sand is saturated. The volume of water consumed is equal to the volume of binder required for that sample. The binder volume, expressed proportionately to the sand volume, permits the total volume to be calculated.

Details were provided about the Building Limes Forum and their lime education program. Lime burning is one of their yearly activities, and during a three-day workshop, the kiln is built, fired and emptied, and the lime used for wall building. A recently made stone-built kiln replaced single use lime clamps. Alternating layers of seasoned timber and limestone the clamp burnt at >900°C overnight. The next morning, course participants picked quicklime rocks from the ashes and slaked them in metal tubs before mixing with aggregate to make lime mortar.

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Supplementary Activities

In between formal training sessions, there were opportunities to make site visits and experience local culture.

'House in Time' was a 1998 Countryside Education Trust project supported by the Lime Centre. According to a local tradition, a peasant could own a house begun at dawn and built in a day on common land, as long as smoke came from the chimney by dusk on that day. A group of people who were passionate about traditional building achieved this, creating a New Forest c.1686 cob house in one day.

Neasden Hindu Temple - from 1992-95, 1,526 skilled artisans hand carved 5,000 tonnes of Carrara marble and Bulgarian limestone into 26,300 pieces to create the marble Mandir.⁸³⁻⁸⁸



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Additional Sites of Interest

- York Minster
- Chichester Cathedral
- Durham Cathedral
- Windsor Castle
- Buckfast Abbey
- Stonehenge
- Neasden Hindu Temple (Mandir)
- Kelso Tool Company, Tool Manufacturer (Kelso, Borders)
- G. Gibson & Co, Tool Manufacturer (Leeds, Yorkshire)
- Weald & Downland Open Air Museum (Sussex)
- Gotherington Historic Village (Gloucestershire)
- Lyveden New Bield, (Northamptonshire)
- Triangular Lodge (Northamptonshire)
- Stamford Village (Northamptonshire)
- Abbeydale Industrial Hamlet (Sheffield, Yorkshire)
- Rivelin Masonry Company (Sheffield, Yorkshire)
- Sheffield General Cemetery
- Albion Stone (Portland, Dorset)
- Bowers Quarry and Mine (Portland, Dorset)
- Independent Quarry (Portland, Dorset)
- Derwent Dam (Derbyshire)
- Oxford University - buildings under restoration
- Ancestral Home and Cemetery Plot (Aspatria, Cumbria)
- Ancestral Home and Cemetery Plot (Longworth, Oxfordshire)
- London sights (St Paul's, Westminster, Houses of Parliament, Portobello Rd, London Eye, Thames cruise, Greenwich)

Outcomes and Observations

The overseas fellowship was an opportunity to get a new perspective from which to view the Australian stone industry.

The spread of topics during the five weeks followed stone products from quarry to buildings and monuments, including conservation treatments.

The UK has such a collection of historic buildings that are continually being maintained, conserved and refurbished for new uses, so that building workers are exposed to traditional building techniques from early on in their careers. Australian stonemasons do not have the same level of exposure, but develop skills in new building work.

European traditions brought to Australia continue to be subtly shaped by local demand. In Australia, there is more flexibility to explore new architectural treatment in stone (such as feature walling and lightweight panelling). Weighty tradition and lack of space impede new ideas in England.

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In Australia, high labour costs keep local stone in the ground while imported materials are preferred.

The European stone industry shares similarities with Australia, but there are some major differences:

	Australia	Europe (UK)
Living space	Australia is still expanding within livable areas	England has no more space to build
Architectural styles	Builders have more scope to develop local styles	Builders must follow established regional styles
Population numbers	Relatively lower population numbers means that the market for natural stone is not as great as in other countries, although Asian markets may become more accessible	The UK has access to European markets
Climate	Warm, dry climate favours outdoor working. Houses are built to accommodate air circulation: large windows, overhanging eaves, under floor venting, high ceilings	Cool, wet climate limits outdoor work. Traditional houses built with thick walls, low ceilings and small windows to suit damp climate.
Distance	Freight costs are very high	Freight costs are relatively lower
Quarry infrastructure	Road and rail are still being developed	Excellent road and rail services
Skills shortage	Shortage of skilled workers	Shortage of skilled workers
Stonemasonry skills	Hand skills are valued less than machine operation skills	Hand skills are highly valued
Stone varieties	Many stone varieties remain undeveloped	While there are no new stone varieties being discovered, sometimes quarries are reworked for heritage projects

Knowledge Transfer

Brown's passion for the industry is demonstrated by his long-term commitment to developing his own Stonemasonry and teaching skills. As a trade skills trainer employed by TAFE Qld, he is strategically placed to share his industry knowledge. The opportunity to undertake this international fellowship in an advanced Stonemasonry qualification will help Brown to support his students in expanding their practical and creative experience.

Brown believes that participation in expertly run theory and practical classes sharpens insights into teaching practice, and consequently the learning experience is improved for all students. He believes that a well-run training program will attract apprentices to the trade who are genuinely focused on improving themselves, and, in turn, to be a resource to the Australian Stone Industry and related sectors such as contemporary architecture, monumental stonemasonry and heritage.

The craft of Stonemasonry deserves the best in learning substance.

Brown plans to use the skills he has acquired at the three workshops listed previously not only in his current apprenticeship classes, but is keen to make these skills available to other stonemasonry industry personnel and members of the public by providing weekend and evening workshops at various locations throughout Queensland and northern New South Wales.

Benefits to Fellow's Professional and Personal Development

Brown will actively seek opportunities to widen the range of professional contacts with whom he collaborates. A successful outcome of this study will be the invaluable networking opportunities among stone industry personnel, educational institutions and professional associations abroad.

The Fellowship program has provided Brown with the tools to help build a sound skill base for the stone industry of tomorrow. He is currently a member of several workgroups. These groups have been formed to meet a number of concerns in Vocational Training:

- Revising the existing Certificate 3 Stonemasonry qualification (Construction and Property Skills Industry Skills Council)
- Providing input into development of AQF Level 4-6 (Construction Training Queensland)
- Developing professional partnerships among private and public vocational training providers (Department of Employment and Training).

Recommendations

The following are recommendations to Government, Industry and the Business sector, Professional Associations, Education and Training Providers, the ISS Institute.

Government

If Australia is to develop and sustain a successful Stone Industry, Brown believes that it is essential that responsibility for training is placed *within* the Stone Industry. Brown identifies that a review of training may identify that stonemasonry training is better suited to an enterprise-specific arrangement, assessed against a national standard. It may become apparent that resource allocation (in the form of government assistance) could be addressed to ensure that it is being targeted to effectively achieve maximum benefit. Funding may be better spent on further developing an understanding of the ways in which natural stone can be used as a sustainable resource eg (a) promoting energy-efficient extraction and production processes (b) advocating environmental attributes such as insulating properties.

Also of significance is Australia's position on recognition of what constitutes a world-heritage site. Compared to Europe, Australia has relatively few World Heritage-listed cultural sites. Referencing UNESCO's World Heritage Centre, all but one of Australia's World heritage sites are natural wonders such as The Great Barrier Reef and Kakadu National Park. The European focus is very different. World heritage listings in Europe are almost all cultural sites like Stonehenge, Westminster Palace, Chartres Cathedral and the historic cities of Italy. Recognition of traditional buildings is central to any ongoing discussion regarding the survival (and recognition) of Australia's stone industry.

It is recommended that with regard to the Queensland Government (and other resource rich states such as Western Australia) that steps are taken to:

- Conserve resources such as iconic places
- Promote sustainable building and construction techniques, and with respect to Queensland
- Carry out the 24 Actions of the Queensland Skills Plan

Industry

The Australian Stone Industry is repositioning itself in the face of global competition for stone products. Each enterprise has its own specialities with which it operates. Customers do not discriminate on the material's place of origin, but demand professional service during fabrication and installation of products. Recent change in the stone industry means that the few traditionally skilled workers who are in great demand for heritage conservation work are training their own workforce, and operators from allied trades such as tiling, bricklaying and plastering are taking advantage of the increasing market for stone kitchen bench tops.

To sustain the stonemasonry trade, masons need to be able to move between contemporary and heritage work to maintain a viable business. Accordingly, stonemasons work in contemporary settings with a few enhancing their capabilities to add heritage conservation work to their range of projects; therein they require a skill and knowledge base to meet both work environments. This requires skilled labour; hence demand for specific training within each enterprise.

Recommendations

Industry Skills Councils

The Construction and Property Services Industry Skills Council (CPSISC) is revising the national training package for the Building and Construction Industry. The stonemasonry qualification, currently under the Off-Site Construction sector is to be absorbed into the mainstream General Construction sector. This means that changes to allied trades such as tiling, plastering, bricklaying and concreting, and the broader building and construction field can be integrated more easily into the training specifications.

However, as with many industries, the Stone Industry is diversified and 'speaks with many voices'. It must be recognised that while there can never be complete agreement on broad recommendations for change that are proposed by the Industry Skills Council, that all voices have a place in which to be heard.

Business

Business has an integral role to play with regard to ensuring the ongoing sustainability of the stone industry. Business is well placed to promote stone as a sustainable, naturally-formed product. It is essential that natural stone is endorsed as a material for use in the contemporary built environment, in addition to manufactured options such as concrete, glass and steel.

A further consideration would be to provide training opportunities for workers to learn skills in allied trades such as concreting, tiling, plastering and bricklaying, so that using mass-produced manufactured products (clay bricks and tiles, concrete and reconstituted stone) is almost as familiar as using natural stone products.

Professional Associations

There are no stonemasonry guilds apart from small Monumental Masons' associations in NSW and Victoria. The CFMEU plays an important role in skills development, focused on improving workplace conditions.

Education and Training Institutions

Brown's passion for the industry is demonstrated by his long term commitment to developing his own Stonemasonry and teaching skills. As a trade skills trainer employed by TAFE Qld, he is strategically placed to share his industry knowledge. Brown believes that participation in expertly-run theory and practical classes sharpens insights into teaching practice, and consequently the learning experience is improved for all students; the craft of stonemasonry deserves the best in learning substance. He further believes that a well-run training program will attract apprentices to the trade who are genuinely focused on improving themselves.

There is a need for a Level 2 traineeship qualification in the stone industry, providing a pathway to the current Level 3 trade qualification. Workers currently employed as labourers would undergo training and assessment to recognise existing skills and address skills gaps.

The Fellowship program has provided Brown with an opportunity to:

- Revise the existing Certificate 3 Stonemasonry qualification (Construction and Property Skills Industry Skills Council)
- Provide input into development of AQF Level 4-6 (Construction Training Queensland)
- Develop professional partnerships among private and public vocational training providers (Department of Employment and Training).

Recommendations

With regard to teaching practices, Brown notes that his role as a 'teaching stonemason' would be more effective in a workplace environment, working directly with small teams in project-based training activities. His TAFE experience has been invaluable for his personal skills development, and notes that the simulated training environment can never replace real-work activities in terms of validity. However, safety considerations mean that novices be trained in a strictly supervised fashion, thus some authenticity must be traded considering the interests of the worker.

Within the context of teaching and teaching practice, Brown further notes the importance of developing resources available to skilled tradespeople; enhancing the capabilities of those working with stone, that is, those who are skilled in design, and who have high level knowledge of the physical characteristics of natural stone and its exploitation.

ISS Institute

ISS Institute has a long-standing commitment to the Australian Stone Industry, awarding its first fellowship in this area in 1992. Since then it has awarded fellowships in both the professions and trades and worked to build links along the Supply Chain through its conferences and workshops. The Institute will continue to identify skill deficiencies and assist, where possible, in building a highly skilled, knowledgeable and sustainable Australian Stone Industry.

ISS Institute is seeking funding for a project it has developed in collaboration with professional and trades practitioners in Australia, France and the UK. The project is aimed rebuilding disappearing or lost capabilities to preserve our heritage and to transpose those capabilities to contemporary applications in the built environment.

The focus is to recover the skills, knowledge and insights (capabilities) in traditional stonemasonry, through the collection of the knowledge held by the remaining Master Stonemasons in Australia, and with the technical assistance and guidance of European Master Stonemasons.

Each of the following disciplines is to be represented:

1. Monumental
2. Sculptural
3. Banker

A range of building types will also be represented: a) Ecclesiastical b) Commercial

4. Residential
5. Institutional
6. Memorial

Mortars and renders applicable to stonework will be also be investigated.

The project is divided in four major phases :

- Methodology building, identification of resources
- Collection of the data
- Analysis, writing and preparation of the documents
- Dissemination of the findings through practical training tools (CD and websites) and technology transfer through education/training activities.

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