Worldwide examples of global heritage stones: an introduction

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Abstract: Heritage stones are stones that have special significance in human culture. The papers in this volume discuss a wide variety of such stones, including stones from Europe, Asia, North and South America, Africa and Australia. Igneous (basalt, porphyry and a variety of granites), sedimentary (sandstone, limestone) and metamorphic (marble, quartzite, gneiss, slate, soapstone) stones are featured. These stones have been used over long periods of time for a wide range of uses, including monuments, buildings of architectural note, columns, roofing, tiling and lithography. A number of papers in this book provide information that is essential for eventual approval of stones as a Global Heritage Stone Resource or a group of stones as a Global Heritage Stone Province.

The included papers discuss a wide variety of stones that have special significance in human culture. In many cases, the information provided may serve as a step in the Global Heritage Stone Resource (GHSR) designation of particular stones. Such designation is intended to establish a standard for designation of building and ornamental stone on an international level. Formal recognition as a GHSR or a group of stones as a Global Heritage Stone Province (GHSP) will ultimately be decided by the Heritage Stones Subcommission of the International Union of Geological Sciences (IUGS) Commission for Geoheritage (formerly the Heritage Stone Task Group of the IUGS). Details of the history and procedures of the Subcommission can be found in Cooper et al. (2013) and Cooper (2014). Procedures for designation of a GHSR can also be found in Marker (2015) as well as works posted on the website of the Subcommission (http://globalheritagestone.com/)

This book complements GSL Special Publication 407 Global Heritage Stone: Towards International Recognition of Building and Ornamental Stones (Pereira et al. 2015b). That pioneering volume consisted of 21 papers and an introduction that brought the subject of heritage stone and the GHSR designation to a general geological audience. Most of the
natural stones that were considered in the 2015 volume were European, and these included such famous stones as Carrara Marble from Italy and larvikite from Norway. However, three South American examples, Piedra Mar del Plata from Argentina and steatite and schist from Minas Gerais State in Brazil, were included. The present volume extends the geographical coverage of heritage stone of the first volume as it includes papers describing stones from all continents, excepting Antarctica: Africa, Asia, Australia, Europe, North America and South America.

Also complementing this and the previous Special Publications of the GSL on heritage stone are papers in the journal Episodes, including a collection (Pereira et al. 2015a) that discusses an additional seven potential GHSRs from Europe as well as Sydney sandstone from Australia. There are also related previous GSL Special Publications, such as volume 333 (Přikryl & Török 2010), Natural Stone Resources for Historical Monuments. (A list of related Special Publications can be found in Pereira et al. (2015c).)

The papers in this volume vary in approach and intent. All of the papers discuss geological aspects of the stone, discuss technical (physical-mechanical) properties in some way and document uses of these stones. A number of papers provide information that is essential for eventual approval of that stone as a GHSR or approval of a group of stones as a GHSP. Some papers cover one particular heritage stone; others include two or more stones. In all cases the articles bring together diverse information, in many cases providing an English-language entryway into literature published in other languages, including Dutch, Finnish, French, German, Hindi, Italian, Portuguese, Russian, Slovene, Spanish and Swedish.

The papers include articles on heritage stone from all three major groups of rock: igneous, sedimentary and metamorphic. Authors have discussed both extrusive and intrusive igneous rocks, including basalt, porphyry and granite. Cenozoic basalt quarried in Victoria, southeastern Australia, is commonly called bluestone. Walter (2018) documents its wide use in the region for a variety of important structures, many of which are listed on Australian or New Zealand historical registers and lists. She suggests Victorian bluestone as a GHSR and points out the Malmsbury Bluestone found within the province as a potential GHSR. Volcanic rocks are also represented by Lower Permian Trentino porphyry, a very durable ignimbrite from northern Italy; there is no similar dimension stone so widely used for paving across the world (Primavori & Anghelen 2020).

Granite is known as one of the most durable building stones and this is certainly true for ‘Blanco Cristal’, a leucogranite from central Spain (Freire-Lista & Fort 2019). The stone, used in Spain by various cultures for more than 2000 years, is now being used to clad the massive Jesus Tower of Sagrada Familia Basilica in Barcelona (Fig. 1), one of the most iconic ecclesiastical structures in the world. Another important granite discussed is Rapakivi granite from Finland, used for hundreds of years in Finland and in the Russian city of St Petersburg beginning in the 1700s, and more recently exported worldwide (Bulakh et al. 2020).

Sedimentary rocks discussed in this volume include Indiana Limestone from the USA (Fig. 2), famous for its use in the Pentagon and the Empire State Building (Shaffer 2019). Based on its widespread use in North America, Shaffer makes a strong case for the use of the appellation ‘America’s Building Stone’ for this stone. The Solnhofener Plattenkalk, a very fine-grained German limestone, is famous for its fossils, especially the early bird Archaeopteryx. It was also the most important stone used for lithography. Köbl-Ebert & Cooper (2019) describe these facets of the stone’s history, as well as lesser-known uses for flooring tiles and roofing. Échaillon limestone, a light-coloured bioclastic limestone quarried in France since Gallo-Roman times, has been used worldwide for monuments and other uses. This stone, documented by Dumont & Sauvegarde du Patrimoine Industriel d’Autrefois (2020), was particularly important in Beaux Arts architecture in France.

Black limestones are featured in two papers: Tourneur (2018) reviews geological and historical information on the famous Belgian black limestones, long known as black ‘marbles’, bringing together much information previously available in French or Dutch; Kramar et al. (2019) have brought together information on Drenov Grič limestone, a black limestone from Slovenia whose main use has been in Slovenia and surrounding countries. The most important use of this stone, notable for its white calcite veins and fossils, was during the Baroque period.

Sandstones are the topic of several articles. They include a paper (Grissom et al. 2018) on Seneca sandstone, an arkosic sandstone quarried along the Potomac River in the eastern USA. This is one of the better-known red sandstones quarried from the Newark Supergroup, and most famously used for the Smithsonian Castle building in Washington, DC. Berea sandstone, described by Hannibal (2020), is one of the historically most important sandstones in North America. It has been quarried in Ohio for more than 200 years and used over a wide area of the USA and Canada for a large number of structures now on the US National Register of Historic Places and the Canadian Register of Historic Places. Ehling’s (2018) paper features a number of sandstones from the Cretaceous of northern Germany, some with a quarrying history of more than a thousand years and a history of use over a wide area of
Europe. Her paper can serve as an entry point into more extensive German literature on such sandstones.

Metamorphic rocks represented include marbles, gneiss, soapstone and quartzite. Accounts of the modernistic buildings designed for Brasília, capital of Brazil, in the 1950s by Oscar Niemeyer typically laud his innovative use of reinforced concrete, but his use of marble cladding and flooring has been generally neglected. Frascà et al. (2020) focus their attention on this marble, tracing the origin of most of it to the Itálva region of Brazil. Their account references many sources in Portuguese.

Cockeysville marble quarried in Maryland, USA, is best known for the white stone used for the Washington Monument in Washington, DC, but other more colourful Cockeysville marble has been used as well. Hannibal & Schnabel (2020) review the various commercial names, including Texas marble and Mar Villa marble, used for this stone over time. Connemara Marble is a complex ophicarbonate composed of a number of different minerals. Its occurrence and colouration has resulted in its being closely identified with Ireland, and used for attractive green columns and a variety of other products including small souvenirs (Wyse Jackson et al. 2019).

The use of gneiss in the NW of Italy dates back many centuries to the Roman conquest of the region. Cavallo et al. (2019) provide a detailed geological history and petrography of the Serizzo and Beoloa orthogneisses. Soapstone quarried in Finland was particularly important in Jugend (Art Nouveau)
architecture in northern European cities; its ease of carving led to its use for sculptural decoration characteristic of this style. Bulakh et al. (2019) review the use of this stone in Finnish cities and St Petersburg. The sarcophagus of Napoleon in the Dôme des Invalides in Paris is widely, and wrongly, said to be made of porphyry. Bulakh & Touret (2019) show that it is instead made of Shoksa Quartzite, a stone quarried in Russia, noting that sedimentary features can be seen in the tomb from the surrounding galleries.

Two papers in this volume discuss multiple rock types. Cole (2018) discusses Malmesbury Group slate, Cape and Paarl Grey granites, and Table Mountain sandstone, all quarried in the Cape Town region of South Africa and used in construction in Cape Town. Sharma (2019) discusses a wide variety of heritage stones across India within four potential GHSPs. These include basalts from the Deccan Traps which have historic sculptures carved directly into them, sandstones from the Vindhyan Supergroup used for the Lion Capital of Ashoka, and Makrana Marble, a stone best known for its use in the Taj Mahal, as well as charnockite and khondalite.

The paper by Cooper (2018) explores the limits of GHSR designation given the use of natural stone in utilitarian applications, and as implements used by prehistoric humans, as well as its ongoing use as decorative stones and even gemstones.

We expect that the papers in this book will serve as a gateway into further investigation and documentation of heritage stones worldwide. The papers should also stimulate the continued study of these and other heritage stones in quarries and natural outcrops, and their utilization in human culture.

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References

BULAKH, A. & TOURET, J. 2019. Shoksha quartzite, a heritage stone of international importance from Russia. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2017-303

BULAKH, A., SELONEN, O. & PRINEN, H. 2019. Soapstone in Jugend (Art Nouveau) architecture of northern European cities (1890s–1910s). In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2017-158

BULAKH, A., HÄRMÄ, P., PANOVA, E. & ELONEN, O. 2020. Rapakivi granite in the architecture of St Petersburg: a potential Global Heritage Stone from Finland and Russia. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2018-5

CAVALLO, A., DINO, G.A. & PRIMAVORI, P. 2019. Gneisses (Serizzo and Beola) of the Verbano–Cusio–Ossola District (Piedmont, northern Italy): possible candidates for designation as Global Heritage Stone Resources. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2018-8

COLE, D. 2018. Heritage stone in Cape Town, South Africa. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486.3

COOPER, B.J. 2014. The ‘Global Heritage Stone Resource’ designation: past, present and future. In: PEREIRA, D., MARKER, B.R., KRAMAR, S., COOPER, B.J. & SCHOUENBORG, B.E. (eds) Global Heritage Stone: Towards International Recognition of Building and Ornamental Stones. Geological Society, London, Special Publications, 407, 11–20, https://doi.org/10.1144/SP407.5

COOPER, B.J. 2018. The limits of heritage-stone designation. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486.2

COOPER, B.J., MARKER, B.R., PEREIRA, D. & SCHOUENBORG, B. 2013. Establishment of the ‘Heritage Stone Task Group’ (HSTG). Episodes, 36, 8–10, https://doi.org/10.18841/epi2013/3/v361/002

DUMONT, T. & SAUVÉGARDE DU PATRIMOINE INDUSTRIEL D’AUTREFOIS 2020. Echaillon stone from France: a Global Heritage Stone Resource proposal. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2019-92

EHLING, A. 2018. Cretaceous building sandstones in northern Germany. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2018-31

FRASCÁ, M.H.Barros de Oliveira, NEVES, R. & CASTRO, N.F. 2020. The White Marbles of Brasilia, a World Heritage site and capital of Brazil. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2018-31

FRIEBE-LISTA, D.M. & FORT, R. 2019. Cadalso de los Vidrios leucogranite ‘Banco Cristal’: a widely used heritage stone from Spain. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2017-189

GRISSOM, C.A., ALOIZ, E.M., VICENZI, E.P. & LIVINGSTON, R.A. 2018. Seneca sandstone: a heritage stone from the USA. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486.4

HANNIBAL, J.T. 2020. Berea sandstone: a heritage stone of international significance from Ohio, USA. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2019-33

HANNIBAL, J.T. & SCHNAIBEL, L. 2020. Cockeysville marble: a heritage stone from Maryland, USA. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2019-1

KOLBE-EIBERT, M. & COOPER, B.J. 2019. Solnhofener Plattenkalk: a heritage stone of international significance from Germany. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2017-324

KRAMAR, S., ŽBONA, N., BLEDIČIĆ, M., MLADENOVIC, A. & ROŽIČ, B. 2019. Drenov Grič black limestone: a heritage stone from Slovenia. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2017-188

MARKER, B.R. 2015. Procedures and criteria for the designation of Global Heritage Stone Resources. In: PEREIRA, D., MARKER, B.R., KRAMAR, S., COOPER, B.J. & SCHOUENBORG, B.E. (eds) Global Heritage Stone: Towards International Recognition of Building and Ornamental Stones. Geological Society, London, Special Publications, 407, 5–10, https://doi.org/10.1144/SP407.3

PEREIRA, D., KRAMAR, S. & COOPER, B.J. (eds) 2015a. Global Heritage Stone Resource: an update. Episodes, 38, 78–131.

PEREIRA, D., MARKER, B.R., KRAMAR, S. & COOPER, B.J. & SCHOUENBORG, B.E. (eds) 2015b. Global Heritage Stone: Towards International Recognition of Building and Ornamental Stones. Geological Society, London,
PEREIRA, D., MARKER, B.R., KRAMAR, S., COOPER, B.J. & SCHOUENBORG, B.E. 2015c. Introduction. In: PEREIRA, D., MARKER, B.R., KRAMAR, S., COOPER, B.J. & SCHOUENBORG, B.E. (eds) Global Heritage Stone: Towards International Recognition of Building and Ornamental Stones. Geological Society, London, Special Publications, 407, 1–4, https://doi.org/10.1144/SP407.18

PRÍKRYL, R. & TÖRÖK, A. (eds) 2010. Natural Stone Resources for Historical Monuments. Geological Society, London, Special Publications, 333, https://doi.org/10.1144/SP333.0

PRIMAVORI, P. & ANGHEBEN, A. 2020. Trentino Porphyry, Italy. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2020-20

SHaffer, N.R. 2019. Indiana Limestone: America’s building stone. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2018-58

SHARMA, V.K. 2019. Heritage stones in India. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486-2017-151

TOURNEUR, F. 2018. Global Heritage Stone: Belgian black ‘marbles’. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486.5

WALTER, S.M. 2018. Victorian Bluestone: a proposed Global Heritage Stone Province from Australia. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486.1

WYSE JACKSON, P.N., CAULFIELD, L., FEELY, M., JOYCE, A. & PARKES, M.A. 2019. Connemara Marble, Co. Galway, Ireland: a Global Heritage Stone Resource proposal. In: HANNIBAL, J.T., KRAMAR, S. & COOPER, B.J. (eds) Global Heritage Stone: Worldwide Examples of Heritage Stones. Geological Society, London, Special Publications, 486, https://doi.org/10.1144/SP486.6