by Dolores Pereira

Final report of IGCP-637: a project linking researchers and heritage stones from around the world

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Introduction

The IGCP-637 project on Heritage Stone designation was approved by UNESCO and the International Union of Geological Sciences (IUGS) in 2015 and ended in 2019. The main objective was to facilitate the development of a new International Standard for building and ornamental stones. This was achieved by building an extensive international network of collaborating researchers and publications to extend knowledge on internationally important Heritage Stones. The final report is presented in this paper.

Background

An informal Working Group on Building Stones and Ornamental Stones was convened at the 33rd International Geological Congress in Oslo, Norway, in 2008, by a small group of researchers: Barry Cooper (Australia), Björn Schouenborg (Sweden), Brian R. Marker (UK) and Lola Pereira (Spain). The IUGS later granted the status as a Heritage Stone Task Group which aimed to identify the architectural and cultural important stones for which future supplies are needed for maintenance and repair of historic buildings and structures and designate them as Global Heritage Stone Resources (GHSRs). This status was upgraded by IUGS to a Sub-commission (HSS) in 2016. Subsequently, the group has achieved many goals, but probably the most important was to work on the UNESCO-IUGS IGCP-637 project. Over five years (2015-2019) we have spread knowledge on stones of important heritage significance in many countries. This will help in securing the safeguarding of, often localised, outcrops that have sometimes been concealed by careless anthropic actions or could be in danger of being sterilised by future development.

Important activities of IGCP-637 included outreach initiatives to inform non-experts about the significance of Heritage Stones and convince them of the need to safeguard resources for the continuing maintenance and repair of historic buildings and structures, including those in UNESCO World Heritage Sites. Another was to identify important stones that had previously only been described in obscure literature, sometimes in languages that are not widely understood internationally, and to publish readily accessible information on those rocks in high impact factor international journals.

The work of the HSS is disseminated through a website which was updated frequently by the HSS Secretary General: <http://globalheritagestone.com/>. It makes information available, not only on the stones that the HSS worked on but also other relevant publications, conferences and gatherings. Many researchers learned of the existence of this activity through the website and joined the Sub-commission. The website has a specific page dedicated to IGCP-637 activities and achievements. By the end of the project 121 researchers from 27 countries had actively collaborated in the work (Fig. 1); (Table 1).

Sadly, during the project, we also lost four of our most appreciated colleagues along the way: Anders Wikström, Hannu Luodes, Vladimir Gavrilenko and Don W. Byerly. As former HSS Secretary General, I want to thank them for their support and collaboration even though they are no longer with us.

Global Heritage Stone Resources: Scientific Achievements

A scientific goal of the IGCP project was to highlight stones that had been used to build monuments and historical buildings of heritage importance over the centuries. Some were already very well known internationally, but others were not. Many lacked full characterization of mineralogy, physical and mechanical properties and many other geological parameters, including the geological settings of their outcrops, in one place. Some stones had been described previously only in obscure literature. A purpose, therefore, was to make information on these widely available to the large academic and professional communities working on natural stones and/or heritage structures built with stone.

By the end of IGCP-637, 22 natural stones had been designated as Global Heritage Stone Resources (GHSRs) and ratified by the IUGS Executive following publication of details in highly recognized journals, especially Episodes, the flagship publication of IUGS. The designated stones are listed in Table 2.

Congresses, Conferences and Workshops

A general goal of IGCP-637 was to disseminate the work on Heritage Stones to interested researchers and to broaden networks. IGCP-

Table 1. Countries actively collaborating in IGCP-637

Argentina	France	Malawi	Slovenia
Australia	Germany	Malta	South Africa
Austria	Greece	Netherlands	Spain
Belgium	India	Norway	Sweden
Brazil	Ireland	Portugal	UK
Canada	Italy	Romania	USA
Finland	Japan	Russia

Figure 1. Leading members of IGCP-637 on the first year of the project, in Vienna, 2015.

637 sessions on “Natural stone research and Heritage stone designation” were organised at each annual General Assembly of the European Geoscience Union in Vienna, Austria, since 2015 (EGU-2015, EGU-2016, EGU-2017, EGU-2018, and EGU-2019).

IGCP-637 was also represented at The North Central Section meeting of the Geological Society of America held, in Madison, Wisconsin, USA, 19-20 May 2015, in a session entitled “Cultural Geology and Geo-archaeology: Millstones, Dimension Stones, Capitol Buildings, Heritage Stone, and More”.

Lola Pereira gave an invited presentation on heritage stone to the International Congress: “Geoheritage Inventories: Challenges, Achievements and Perspectives” held at the Muséum de Toulouse, 22-26 September 2015.

The first major dimension stone / heritage stone conference in North America was held as a session at the Annual Meeting of Geological

Society of America in Baltimore, Maryland, 1-4 November 2015 under the title “Dimension stone and heritage stone: Quarries, building stones, monuments, sculpture, utilitarian stones and more”. In addition, there were three field excursions including tours of Baltimore City and Washington DC, as well as a visit to an active local stone quarry in Cockeysville Marble.

IGCP-637 was also present at the 34th International Geological Congress held in Brisbane, Australia (2012) and at the 35th International Geological Congress held in Cape Town, South Africa (2016), organising symposia dedicated to “Dimension stone and building materials”.

A Global Stone Congress, linked to the international stone industry, took place in Bahia, Brazil (26-29 of April, 2018). Some IGCP-637 participants were invited as speakers and IGCP-637 funding helped some early career researchers to pay their registration fees.

In 2018 there was the first thematic workshop on Heritage Stones,

Table 2. Designated GHSR's by the end of IGCP-637. <http://globalheritagestone.com/other-projects/ghsr/designations/>

Name of the designated stone	Country of origin	Publications of reference
Portland Stone	England	Hughes et al., 2013
Larvikite	Norway	Heldal et al., 2015
Petit granit	Belgium	Pereira et al., 2015a
Hallandia gneiss	Sweden	Schouenborg et al., 2015
Podpêc limestone	Slovenia	Kramar et al., 2015
Carrara marble	Italy	Primavori, 2015
Estremoz marble	Portugal	Lopes and Martins, 2015
Villamayor stone	Spain	Garcia-Talegón et al., 2015
Lede stone	Belgium	De Kock et al., 2015
Welsh slate	United Kingdom	Hughes et al., 2016
Piedra Mar del Plata	Argentina	Cravero et al., 2015
Kolmården serpentine marble	Sweden	Pereira and Wikström, 2015
Lioz stone	Portugal	Silva, 2017
Jacobsville sandstone	USA	Rose et al., 2017
Maltese Lower Globigerina Limestone	Malta	Cassar et al., 2017
Alpedrete Granite	Spain	Freire-Lista et al., 2015
Bath Stone	United Kingdom	Marker, 2015
Macael Marble	Spain	Navarro et al., 2017
Makrana Marble	India	Garg et al., 2019
Pietra Serena	Italy	Fratini et al., 2015
Rosa Beta Granite	Italy	Careddu and Grillo, 2015
Tennessee "Marble"	United States of America	Byerly and Knowles, 2017

Figure 2. Anders Wikström presenting the Kolmården serpentine marble at EGU 2015. This stone was designated GHSR.

celebrated under the umbrella of IGCP-637: 1st Workshop on Heritage Stones (2-4 of October, 2018), Salamanca, Spain. The proceedings were published online (https://issuu.com/home/published/compilacion_ab

stract_reducido) and the IGCP-637 team issued their first poster, as a "roll-up" (Fig. 3). Because of the recent recognition by IUGS of Villamayor sandstone as a GHSR the poster was presented to the mayor of

Figure 3. Field excursion to the historical quarry of Villamayor and presentation of the poster describing the GHSR designation of Villamayor sandstone to the Mayor of the City.

the city of Villamayor and now hangs as an object of pride at the City Council building. This highlights the importance of IGCP support for heritage stone work in achieving public communication benefits.

Unfortunately, the project session organised for the 36th IGC in Delhi had to be cancelled due to COVID-19. We had intended to present the final achievements of IGCP-637 in a poster which is presented here instead (Fig. 4).

Networking

Extending the international Heritage Stones network was one of the most useful outcomes of IGCP-637 funding. We were able to extend the network, both in numbers of correspondents and geographical extent, bringing in the participation of scientists from developing countries, and in particular young and women scientists. Several female researchers and young researchers from developing countries had their expenses partially covered to attend the international meetings organized under the umbrella of IGCP-637. Those countries were Malawi, Algeria, India, Brazil, Morocco, Argentina, and Malta (Table 3).

Publications and Outreach

More than 70 articles have been published from IGCP-637 activities; some in books and others as individual papers or in Special Issues of highly cited journals. The first major publication from the IGCP project was a Special Publication of the Geological Society, London (Pereira et al., 2015b). It contained 22 papers in 275 pages. Two more books containing papers have been published subsequently (Kato et al.,

2016 and Pereira et al., 2018). Others are planned. In addition a book was published on stones of Salamanca, Spain (Pereira et al., 2018). An important new departure was the initiation of a series of books under the general title “Natural Stone and World Heritage” by Taylor and Francis. The first considered the World Heritage Site of Salamanca (Pereira, 2018) and the second considered stones of Delhi and Agra, India (Kaur et al., 2020).

There have been five special issues of journals (Pereira and Pratt, 2016; Pereira et al., 2015c, Pereira et al., 2019; Pereira and Cárdenes, 2019 and Kaur et al. (in press)).

A review of Heritage Stone activities was requested by the journal *Geosciences* (Pereira and Marker, 2016). This paper has been downloaded from the journal page 2,423 times and has been cited 18 times, helping to promote general awareness of the working group and also the aims of IGCP.

Outreach activities through social media (Face book, Twitter and YouTube) have been a useful tool for dissemination of project achievements. Other media have also been used e.g. the online Global Magazine for Architecture, Art and Design with Natural Stone published an article summarising the achievements of the project.

<https://www.stone-ideas.com/64790/global-heritage-stone-resource-ghsr/>

Conclusions

During the five years that IGCP-637 was active, many achievements have been made while also promoting IUGS Heritage Stones Sub-

IGCP-637 Heritage Stone Designation: A successful UNESCO and IUGS project on natural stones.

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IGCP Project 637 was approved in 2015 to facilitate establishment of a new international geological standard for building and ornamental stones. Formal international recognition of those natural stone types that have achieved widespread utilisation in human culture is now underway and the term "Global Heritage Stone Resource" (GHSR) has been proposed for this designation. Where appropriate a "Global Heritage Stone Province" (GHSP) embracing several heritage stones may also be defined. Stones that have been used in heritage construction, sculptural masterpieces, as well as in utilitarian (yet culturally important) applications are obvious GHSR candidates. In furthering these aims, the project has promoted the adoption and use of the GHSR designation. Consequently an interim list of potential GHSRs is maintained and a register of GHSR approved stones has been created. IGCP-637 ends in 2019, with the following achievements:

Achievements:

22 well known stones have gone through the whole evaluation procedure and are now officially designated:

- Portland Stone from UK
- Lavikite from Norway
- Petit granit from Belgium
- Podpeč Limestone from Slovenia
- Carrara Marble, from Italy
- Halland Gneiss, from Sweden
- Villamayor Stone from Spain
- Estremoz Marble from Portugal
- Lede Stone from Belgium
- Piedra del Plata from Argentina
- Welsh Slate from UK
- Lloz Limestone from Portugal
- Kolmarden Serpentine Marble from Sweden
- Jacobsville Sandstone from USA
- Maltese Globigerina Limestone
- Makrana marble from India
- Rosa Beta Granite from Italy
- Alpedrete granite from Spain
- Tenesse "marble" from USA
- Bath Stone from UK
- White Macael from Spain
- Pietra Serena from Italy

Publications supported by IGCP-637:

- Pereira, D. et al. 2015. Global Heritage Stone: Towards International Recognition of Building and Ornamental Stones Geological Society of London, Special Publication 407, 275pp.
- Pereira, D. et al. 2015. Special Issue: Global Heritage Stone Resource: An Update. Episodes 38 (2).
- Pereira, D. & Pratt, B. (Editors) 2016 Special Issue: Heritage Stones of the World. Geoscience Canada 43: 3-88.
- Pereira, D. & Cárdenas, V. (Editors) 2019 Special Issue: Heritage Stones and Geoheritage. Geoheritage, 11-1
- Pereira, D. 2019. Natural Stone and World Heritage: Salamanca, Spain. CRC Press, Taylor & Francis Group.
- Pereira, D. et al. 2019. Natural Stone and architectural heritage. Sustainability, MDPI.
- Kaur, G. et al. 2020. Natural Stone and World Heritage: Delhi-Agra, India. CRC Press, Taylor & Francis Group.

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 Authors contributing to our publications with description of potential GHSR candidates are appreciated.

The procedure to achieve the GHSR can be found at www.globalheritagestone.com

IUGS Ratification letters: final step for designation

The last publication initiative has to do with a Book Series on Heritage Stone and World Heritage. This is a series of short books on specialized topics that fall under the overarching theme of geological and cultural heritage of stone, the built environment, and the geological and engineering characteristics of the dimension and ornamental stones. The books deal with well documented case studies of construction and restoration works at one or more specific sites and/or monuments related to World Heritage, providing detailed overviews of construction techniques, documentation of the materials utilized during the historical period in which the monuments were built, and specific conservation/preservation works that have been carried out. The books highlight the importance of natural stone in the preservation of cultural heritage in a sustainable way: moreover, natural stones (heritage stones) often represent the tangible trace of culture development in specific areas, including important activities like quarrying.

The books are closely linked to UNESCO World Heritage sites around the world. After Salamanca and Delhi, another 10 books will follow: Rio de Janeiro, Edinburgh, Germany, Ljubljana, Slovenia, Madrid, Florence, Apulia region, Philippines, North Wales and Western Alps, Italy

Figure 4. Poster summarising final IGCP-637 achievements.

Table 3. Numbers of scientists attending the four events (years 2016, 2017, 2018 and 2019) organized within IGCP-637. Most scientists from developing countries attending (bottom row) were partly funded by the project

	Total number of scientists	Number of male scientists	Number of female scientists
Numbers of participating scientists	35+27+49+19=130	22+17+25+8=72	13+10+24+11=58
Numbers of young scientists/students (<35 years old)	5+6+11+8=31	2+3+6+5=16	3+3+5+3=14
Numbers of scientists from developing countries	5+3+7+8=23	2+1+3+4=10	3+2+4+4=13

commission. Natural stones that were previously described in obscure publications are now reflected in widely available international literature. Many researchers, including young researchers, female researchers and researchers from low-income countries are now part of the natural stone community, thanks to the IGCP program. Stones that have played an important part in architectural and cultural heritage have started to be recognized by IUGS as a geological standard, the Global Heritage Stone Resource.

With this project we have also provided the information of the need of proper characterization of stones to promote their use in construction and restoration. Comprehensive information is now stored in the HSS web page, but also in the journals that published the outputs, mainly those related to IUGS: the journal Episodes and the Geological

Society of London Special Publications. Also proceedings and media reports are now uploaded in the IGCP-637 section of the HSS webpage.

Many articles have been generated for technical journals and local papers. Leaders of the project have been interviewed about heritage stones and related projects by local newspapers and academic media aiming a wider diffusion. A video was recorded at the University of Salamanca with information about the IGCP-637: <https://www.facebook.com/watch/?v=409940296094718>. The HSS planned a workshop on Heritage Stones to be held in March 2020 at the 36th IGC but, due to COVID-19, this and other IGCP activities have been postponed. However the information from the intended session will be published in different media.

The future

IGCP-637 has been a very successful initiative and will now continue: an extension was approved in 2020: <http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/international-geoscience-programme/igcp-projects/earth-resources/igcp-637/>.

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