



4th International Heritage Stone Workshop

**Heritage stone: from quarries
to craft practitioners and buildings**

Trinity College Dublin, Ireland

14 – 17 July 2025

PROGRAMME

14 July

Lectures: Haughton Lecture Theatre, Museum Building, Trinity College Dublin.

- 8:30-9:05 **Registration** – Hallway, Museum Building
- Session 1 Chair: Patrick Wyse Jackson**
- 9:05-9:10 Opening welcome
- 9:10-9:20 Gurmeet Kaur: Subcommission on Heritage Stones: Key Achievements and Ongoing Challenges
- 9:20-9:40 Heiner Siedel: Traditions of sandstone quarrying in Saxony, Germany
- 9:40-10:00 Tom Heldal, Anette Kelany and K. Laskarides: Reflections around Egyptian and Greek Heritage stones
- 10:00-10:20 David Martín Freire-Lista: From Stone to Status: Linking Heritage Stones to UNESCO World Heritage Nominations. Three European Case Studies
- 10:20-10:40 Grazia Signori: Sanpietrini: The Iconic Paving Stone of Rome
- 10:40-11:00 Anette Granseth, Tom Heldal and Bjørn Schouenborg: Renaissance for structural stone: an ecological approach to natural stone in the age of sustainability
- 11:00-11:05 Questions for all session presentations
- 11:05-11:40 **Coffee and Posters** Museum Building – Seminar Room A
- Session 2 Chair: Louise Caulfield**
- 11:40-12:00 Antônio Gilberto Costa: Marbles from Minas Gerais: characteristics and applications in Brazil's cultural heritage
- 12:00-12:20 Oliviero Baietto, R. Bellopede, F. Gambino, G. Kaur, Paola Marini and Camila Mori de Oliveira: Communication and Education on Heritage Stones
- 12:20-12:40 Ana Maričić, Marija Horvat and Karmen Fio Firi: Lithothamnium limestone as autochthonous natural building stone in the city of Zagreb, Croatia
- 12:40-1:00 Ingrid Urban, E. Bridi, C. Mazzoli and N. Preto: Towards a new Heritage Stone: the Karst Rudist Limestone of Italy and Slovenia
- 1:00-1:05 Questions for all session presentations
- 1:05-2:00 **Lunch** Museum Building – Seminar Room A
- Session 3 Chair: Patrick Wyse Jackson**
- 2:00-2:20 Raymond A. Duraiswami: The Geoheritage of Springs from the Western Ghats
- 2:20-2:40 Maria Heloisa Barros Oliveira Frascá and Eliane Aparecida Del Lama: Cinza Mauá Granite in the history of Sao Paulo city, Brazil
- 2:40-3:00 Marija Horvat, Ana Maričić, Daria Fricki and Uroš Barudžija: The stone cultural heritage buildings of Lumbarda, island of Korčula (Croatia)
- 3:00-3:20 Elena Storta, Alessandro Borghi, Antonella Dino Giovanna, Daniele Castelli and Anna d'Atri: Proposal for the nomination of Balma Syenite (NW Italy) as an IUGS Heritage Stone
- 3:20-3:40 Stephany de Paula Miranda, Patrícia Duffles and Nuria Fernández Castro: Além Paraíba Mylonite, the Heritage Stone of the Coffee Valley – Rio de Janeiro, Brazil
- 3:40-3:45 Questions for all session presentations
- 3:45-4:20 **Coffee and Posters** Museum Building – Seminar Room A

Session 4 Chair: Gurmeet Kaur

- 4:20-4:40 Ruth Siddall: Use of fossil trees used in the urban environment in the later 19th and early 20th Century
- 4:40-5:00 Louise Caulfield, Úna Farrell and Patrick Wyse Jackson: The STONEBUILT Ireland project
- 5:00-5:05 Questions for all session presentations

Closing Remarks

- 5:05 Patrick Wyse Jackson: arrangements for dinner and field excursions
Gurmeet Kaur

Posters: viewing during coffee and lunch breaks

- Nicola Careddu, G. Cardia, A. Dessena and P. Meloni: An innovative app for geo-urban itineraries in Cagliari based on the “Pietra Forte”
- Nuria Fernández Castro, Edilene Capanema, Manuella L. Ribeiro, Kátia L. Mansur and Rosana E.C. Silva: The Tropical Belle Epoque: Decorative Stones of Teatro Municipal, Rio de Janeiro, Brazil (+ video show during poster session)
- Angela Ehling: Status of the Heritage Stone collection.
- Joseph T. Hannibal: Heritage Stones of the United States.
- C. Sreejith, M. Nithya and Gurmeet Kaur: Peninsular gneiss: A common heritage stone resource from the oldest continental crustal segment of India
- O. Baietto, I. Balzani, A. Berruto, R. Bellopede, P. Marini and C. Mori de Oliveira: Valentino Castle roof, Turin Italy -The roofing slates history
- Pratheesh Prabhakaran Nair: Architectural Heritage Carved in Western Ghats Laterite: The Forts of North Malabar, Kerala

Dinner

- 8.00 Diwali [Indian & Nepalese Restaurant], 1 Castle House, South Great Georges Street, Dublin 2 (www.diwali.ie)



15 July

Excursion to the granite quarrying district of west Wicklow

- Morning: Ballyknockan, Co. Wicklow: Visit to a Leinster Granite quarry and two granite-working workshops run by McEvoy and Sons and O’Flaherty Stone. Ballyknockan is known across Ireland as the ‘Granite Village’ and many of its vernacular buildings are granite gems, which will be the focus of a tour. The granite, quarried here since the 1850s, has given Dublin its geological feel.
- Afternoon: Russborough House (www.russborough.ie). The group will be split into two groups, and while one is having lunch the other will participate on a tour of the interior of this important 18th century country house. It is constructed of Leinster Granite with internal decoration and chimneypieces of native and imported marbles.
- 13:30 First group go on house tour with Patrick and Russborough Guide, while the second group have lunch in the café.
- 14:30 Second group go on house tour with Louise and Russborough Guide, while the first group have lunch in the café.

Lunch: Lunch is covered by your Registration Fee, as is the Entrance Fee to the house.
Lunch menu: Gourmet sandwich, Cup of Soup, Tea or Coffee.

15:30 Both groups meet at the South Front to look at stonework, led by Patrick and Louise.

16 July

Excursion to the limestone quarrying area of central Ireland

Morning: Visit to Threecastles Quarry, Kilkenny and McKeon Stone Works, Stradbally, Co. Laois.

Lunch: Generously supplied by McKeon Stone, Stradbally.

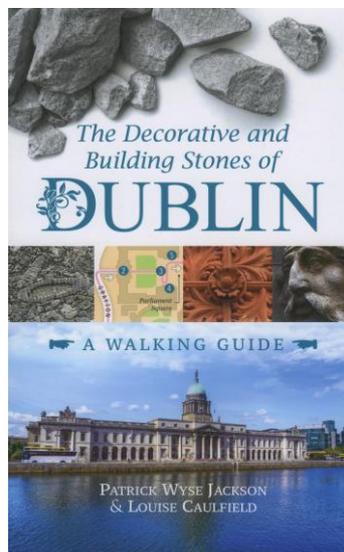


Afternoon: Emo Court (<https://heritageireland.ie/places-to-visit/emo-court-and-estate/>)
This is another fine 18th century country house, which features Leinster granite, Irish limestone, Portland Stone and Coade Stone on its exterior, and native and imported marbles in its interior decoration.

17 July

Excursion to examine some decorative and building stones of Dublin

10.00-12.00: Meet at the Museum Building at 10.00am



The Heritage Stone Workshop is generously supported by McKeon Stone, Stradbally, C. McEvoy & Sons, Ballyknockan, and O'Flaherty Stone, Ballyknockan.



Communication and Education on Heritage Stones

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Correct communication on geosciences is becoming important in order to bring an ever-increasing number of people towards a knowledge based on a scientific approach, that provides the tools to correctly interpret the infinite avalanche of true or fake information that comes from social media.

Nowadays tourism lead great quantities of people to visit monuments all around the world but in the most cases there is not a connection between the Heritage and the stone present in the monument itself. Building a connection between stones and monuments involves understanding the integral role that stones play in preserving history and culture. The Heritage Stone Subcommittee of IUGS, also by means of lots of seminars and webinars, is leading the way forward to establish this connection by designating stones used in monuments which have preserved the cultural heritage. By identifying and designating these stones, the subcommittee ensures that future generations can appreciate both their geological and cultural value. In this contest we remember the book on the first 55 IUGS Heritage Stones together with the table calendar published by IUGS, to spread awareness of the importance of stones.

To enhance the proper knowledge of heritage stones and the relation with the monuments and sites where they are used, several communication and education projects were carried out by experts in this sector, also involved in the works of Heritage Stone Subcommittee (recognized by IUGS International Commission on Geoheritage). In particular in Turin, for students of university and high school, TOURinSTONES project (by University) and field trip for students in Environmental Engineering (by Politecnico) were developed. For the citizens the participation to European initiative as UNIGHT, in presence in Turin, had the aim to show the results of research on Heritage stones designations and to reach high impact inspirational goals on society. On a correlated topic, the webinar organized by Tasmania University at the beginning of 2025 and carried out among expert in this sector, is now on line (<https://www.youtube.com/watch?v=rIRQTnIM0jE>.)

The TOURinSTONES project offers an interactive educational experience that guides students on a geohistorical tour through the discover of ornamental stones of the city of Turin, in North-West Italy. Thanks to the dedicated app, each stop can be explored with detailed geological descriptions, providing insights into the origin of the stones, their mineralogical characteristics, and historical quarry sites. The aim is to promote multidisciplinary learning that connects Earth sciences, art history, and local culture. It's an innovative way to understand the deep connection between building materials and cultural identity, transforming the city itself into a dynamic educational resource.

The Turin field trip offered to the future environmental engineer inside the course "Raw Material and Waste Engineering" on the technical properties of raw materials and their process. Inside the course 10 hours are related to the ornamental stones: in this

context the field trip in Turin with the student has the goal to explain the relation between the kind of stone , the use in the monuments and their degree of weathering.

Within the UNIGHT initiative in Turin, that reached hundreds of people of different ages, the HerSTONES project (IGCP 637), for the third year , in September 2024 aimed to broaden and deepen the technicalscientific recognition of stones of cultural heritage, tangible traces of the history of very ancient civilizations. Thanks to a board game you can discover which are the 55 stones currently recognized by the Stone Heritage Subcommittee (recognized by IUGS UNESCO).

The Webinar “Heritage Stone Communication Handout” has the aim to clarify the classification of term in the communication of Heritage stones, deepening the concept of taxonomy relates to the stones, establishes the scenarios most likely used to describe modified geodiversity, with an explanation of each category, a list of examples, and the count and percentage count of their occurrences in the publications.

Valentino Castle roof, Turin Italy - The roofing slates history

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Valentino Castle, where the II workshop on Heritage stones of Turin 1997 was hosted, Since 1906 it was the first seat of Politecnico di Torino, founded by the union of the "Scuola di applicazione" (Application School) with the "Regio Museo Industriale" (Royal Industrial Museum) in 1906. It is listed as a UNESCO World Heritage Site (WHC Nomination Documentation File name: 823.pdf UNESCO Region EUROPE- Residences of the Royal House of Savoy.

In 1621, a first part of the works commissioned by Christina of France, wife of Victor Amadeus I of Savoy, was completed. She decided to transform, based on a design by Charles of Castellamonte, a pre-existing building into a castle with the characteristics of a typical French construction, and therefore with a slate roof. Since, at the time of the construction of the Castle, slate roofing was not used in Piedmont, the construction of the roof was entrusted to specialized workers, specifically called by Savoy in 1621. The slates used for the roofing also came from Savoy.

In the second half of the nineteenth century, there was a total renovation of the roofing, covered with slates from Saint Michel de Maurienne (Savoy). This mantle, although requiring periodic maintenance, as witnessed by SACCO (1905), remained in good working order until the 1940s.

During the Second World War, the building suffered considerable damage due to the bombings of 1942 and 1943, with detachments of the ceilings and frescoed plasterwork of some internal rooms. Then in 1960 there was another total renovation of the mantle, but since the slates of Saint Michel de Maurienne were no longer available, it was decided to use the Ligurian carbonatic slates which were known (SACCO 1905) to be less durable and in thin slabs (4-5 mm). In 1978 a further renovation of the mantle was carried out, limited to the courtly body and the two turrets that flank it. Unfortunately, Ligurian slate was still used in this case, although in thicker elements (8-10 mm). In this case too, the roofing quickly deteriorated.

Therefore, in 1987, a new total renovation of the roofing was decided. During the design phase, samples of slates from different sources were subjected to durability tests. Based on the results of these tests the new roofing was created with a with a carbonate content Welsh slate (< 1%), which, in 2003, sixteen years after the intervention, was in a good state of conservation.

Until 2 August 2024, when Turin and in particular the western area along the Po river was affected by an extraordinary atmospheric event with the fall of hailstones that reached a diameter of 10 cm. The slate roof, especially on the slope towards the river, suffered considerable damage with thousands of slates breaking and moving out of place, falling to the ground or getting stuck in the gutters and downpipes.

Now Politecnico technicians are proceeding in the evaluation of the residual mechanical resistance of the slabs in the roof remaining in order to evaluate if they can be still left in place, and in the choice of new slates. This choice will be done taking into account mechanical strength, mineralogical composition, availability and homogeneity of the supply.

An innovative app for geo-urban itineraries in Cagliari based on the “Pietra Forte”

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The study is built upon the research presented at the 3rd workshop held in Jaipur-Agra. Cagliari, the capital of Sardinia (Italy), stands on a succession of Miocene limestones, which have been exploited since the Neolithic time by the various civilizations throughout history. More specifically, the so-called “Pietra Forte” lithotype, due to its strength and durability, has been used in works that still exist today and that are worthy of attention. As part of the E.Ins-Spoke2 project, supported by PNRR fund, it has been possible to map the sites made in Pietra Forte in Cagliari such as quarries, necropolis, churches, towers, monuments, etc. In the second step, the app PiForte has been developed in order to enable each visitor to customise his/her own urban itinerary depending on their personal or professional interests (geological, archaeological, historical or architectural). The app will be available to the public by the end of the year. The study will explain the methodology used for implementing an innovative geotourism project in Cagliari and its benefits in terms of replicability and sustainability.

Marbles from Minas Gerais: characteristics and applications in Brazil's cultural heritage

Antônio Gilberto Costa

Labtecrochas – CPMTC/IGC-UFMG; ag.costa@uol.com.br

Over the past 305 years, stone materials extracted in the state of Minas Gerais, located in the southeast region of Brazil, have been used in buildings and monuments that are part of the country's cultural heritage. The oldest extractions involved quartzite, schists and soapstone, and it was only from the beginning of the 20th century that different types of marble began to be extracted and used. Formed under low-grade metamorphic conditions, they are part of a set with unique chromatic and textural patterns. From this set are considered: Aurora Pérola Marble, Verde Jaspe Marble, Sete Lagoas Marble and two types from a region called Gandarela. The Aurora Pérola marble, which is extracted in the Cumbi region, in Ouro Preto, is part of the Fecho do Funil Formation. With dolomitic composition, it is around 2.1 Ga old and is characterized by the presence of columnar stromatolites. Chromatic variations involving shades of beige and reddish pink to greenish white allow the identification of subtypes commercially known as: Aurora Pérola, Vermelho Jacarandá, Aurora Pink, Aurora Veiado and Pink Pele de Onça. But of the set, it is Aurora Pérola that has an important history of national and international applications. In the municipality of Campos Altos, in the western region of Minas Gerais, there is an outcrop of the marble known as Verde Jaspe, which is calcitic, belongs to the Canastra Group and is of Neoproterozoic age. It occurs in the form of lenses, showing intercalations or levels made up of materials that present mineralogical and chromatic variations between white, grayish and green. The greenish levels have some sericite content. Signs of deformation of the rock are evident, involving folding on different scales, which gives it very special patterns. The Sete Lagoas marble is from the region of the same name, belongs to the Sete Lagoas Formation (Bambuí Group), has a calcitic composition and is also of Neoproterozoic age. It is characterized by alternating layers of laminated microsparites of beige to pinkish color with layers of dark gray limestone with the presence of acicular calcite crystals perpendicular to the bedding and generated from the transformation of aragonite. The marbles identified as Gandarela belong to the Gandarela Formation (Itabira Group), with depositional ages around 2.4 Ga. The first subtype has a reddish coloration and is a dolomitic marble rich in iron. Standing out against the red background are thin whitish veins, sometimes interrupted and also of dolomitic composition. The presence of numerous fissures in the rock, filled or not, and resulting from the action of tectonic deformation processes, compromises its utilization rate. The second subtype is calcitic. Banded, it presents a repetition of gray and white sheets. Associated with these sheets, the presence of stromatolites and oncolites can be observed with their typical shapes and structures, either forming mats of hemispheroids stromatolites, or by the presence of isolated spheroidal forms, not constituting mats, identified as oncolites.

Status of the IUGS Heritage Stone collection

Angela Ehling

BGR, Germany

Within the last 10 years 55 IUGS Heritage Stones had been designated. The stones are presented both on the website of the IUGS Geoheritage Commission and in the form of a book.

Given the global origin of the stones, this is the best way to make them known to the general public. Anyone who has anything to do with stones knows that pictures are only a substitute for seeing and touching stones directly. This led to the idea of an IUGS Heritage Stone collection in Berlin at the BGR. The future location will be in the Museum of Natural History in the centre of Berlin. The plates will be mounted on mobile stand boards so that they can also be shown at other locations.

All authors of a successful stone proposal have been asked to send a 15x15 cm plate to Berlin. So far the plates of 31 stones have arrived, some with several varieties. They are currently housed provisionally within the building stone collection of the BGR and they can be researched online with a photo (<http://gewis.bgr.de>).

The mobile stand boards are in the planning stage. Construction will take place in the autumn, as we, as a state institution, will not have an approved budget until September following the new government elections in Germany. Hopefully the missing plates will also be available by autumn.



Current and planned presentation of the IUGS Heritage Stone collection

Cinza Mauá Granite in the history of São Paulo city, Brazil

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The city of São Paulo, founded in 1554, is the capital of the state of São Paulo, located in the southeastern region of Brazil. It is mainly built over the Cenozoic sedimentary rocks of the São Paulo and Resende formations in the São Paulo Basin, which in turn are laid on the Precambrian crystalline basement with rare outcrops.

This is one of the reasons for the scarcity of stone-built heritage, since in the beginning São Paulo was just a small village, where the main building material was rammed earth, a local material made of clay and gravel, gradually replaced with bricks, and later with concrete. It was only with the wealth arising from the so-called "coffee cycle" in the mid-19th century that the use of stone began in the city's buildings and monuments.

Just to illustrate, the oldest stone monument in the city, the Obelisco da Memória (Memory Obelisk), built with the nearby Itaquera Granite, dates back to 1814.

Together with Itaquera, Cinza Mauá (Mauá Grey) Granite is one of the most common stones found in older buildings and monuments of São Paulo, mostly as flooring or cladding, sometimes as masonry (mainly at the base of buildings).

Cinza Mauá is a structurally homogeneous Neoproterozoic porphyritic biotite monzogranite (dated circa 750 Ma) that occurs in the vicinity of the São Paulo city (near the municipalities of Mauá, Suzano and Ribeirão Pires) included in the metasedimentary Embu Complex. It is constituted by quartz (30%), oligoclase (30%), perthitic microcline, usually as phenocrysts up to 3 cm (25%), biotite (15%), with titanite, opaque minerals, apatite, zircon and allanite as accessory minerals. Chlorite, carbonate and sericite are secondary minerals.



Closer view of Monument to Bandeiras in which the felspar megacrysts are visible



Main aspect of Cinza Mauá

Cinza Mauá was used in the construction of several important monuments, notably those to the Bandeiras (expeditions that left São Paulo to discover the Brazilian hinterland) (1920-1953), Faun (1942), and the huge pedestal of the Duque de Caxias (Duke of Caxias) statue (1960), all by the Italian Brazilian sculptor Victor Brecheret, responsible for

introducing modernism into Brazilian culture and sculpture. Apparently, this stone was his favourite.

Remarkably, the Monument to Bandeiras took 33 years from its conception (1920) to completion (1953). It is colossal measuring about 11 m high by 8.40 m wide and 44 m deep. In addition, it was sculpted using around 240 granite blocks, weighing 50 tons each.

This granite also appears on the pavement of Pátio do Colégio, the site where the city was founded in 1554, and in Mário de Andrade Municipal Library cladding. A more contemporary use was on the flooring of the pedestrian area in the old town and in metro stations.

The exploitation of Cinza Mauá Granite reached its peak in the second half of the 20th century, with a decline from the beginning of the 21st century, both due to environmental issues and competition with similar, relatively cheaper materials.

As exposed, Cinza Mauá Granite is a relevant stone to the history of the city and state of São Paulo and is still available for restoration and conservation work.

The Tropical Belle Epoque: Decorative Stones of Theatro Municipal, Rio de Janeiro, Brazil

Nuria Fernández Castro, Kátia Leite Mansur, Edilene Cassia Capanema de Vianna,
 Manuella Lima Ribeiro, Rosana Elisa Coppedê Silva

The Theatro Municipal of Rio de Janeiro is one of the leading performance venues in Brazil. It was built at the beginning of the 20th century during the administration of Mayor Pereira Passos. He was committed by the President of the Republic to an extensive renovation of the country's capital at that time, following the example of Paris, which awarded him the nickname of "Tropical Housmann". The urban tissue was entirely altered by a network of connecting roads to improve goods transport and widening the streets to reduce the spread of diseases. The culminating reform consisted of the demolition of more than 700 old buildings in the city centre to open a large avenue, now known as Rio Branco Avenue, with sumptuous and modern edifices inspired by European architectural trends, selected through a public competition. The avenue was inaugurated in 1905, less than two years after the demolitions began, and significantly contributed to the improvement of building techniques and the use of noble materials, mostly imported, representing the culmination of Brazilian modernisation from the end of the Imperial period (1822-1889) to the 1920s. This period is known as the "Belle Epoque". The Theatro Municipal stands at the end of the Rio Branco Av., fronting the main square. It was built in the dominant eclectic style of the time, and the project is similar to that of the Paris Opera House, albeit on a smaller scale.



In the original construction, more than six thousand square meters of local gneiss and 1.5 million square meters of varied marbles, almost all imported, were used. In the 1934 reforms, new marble flooring and panels were installed in the first- and second-floor corridors. Only the Leptinito Gneiss from Rio de Janeiro (external stonework) and some decorative stones are publicised as Algerian (onyx of internal balustrades and wall

coverings), Italian (Carrara Marble of the main columns of the façade and foyer staircase and Rosso Verona Marble, misidentified in the main hall columns) and Belgian origin (other façade columns and internal decoration).



Having observed various materials in this national heritage building, this work in progress aims to identify them and elaborate a tour through its stones for visitors, thereby contributing to its conservation. The methodology comprises macroscopic observations, an extensive review of the literature and documentation, and consultation with heritage stone specialists. So far, it has been possible to identify four different types of onyx (Algerian, del Carso and two other types: one green and one whitish-cream coloured), several Campan marble varieties from France (Vert, Rose Vert, Grand Melange, and Griotte), Carrara white, Calacatta and Rosso Verona marbles from Italy, Rouge de Rance marble from Belgium, Estremoz marble and Yellow Lioz Limestone from Portugal, Red Gandarela marble from Brazil, and Emperador and Red Alicante from Spain (2015 pedestal). The great hall columns are made of brecciated orange-to-pink marble with a red matrix, resembling the Rose de Brignoles marble (France), and are supported by dark green serpentine bases similar to the Verde Alpi type. The external balconies are composed of an unidentified brecciated, fossiliferous, whitish-pinkish limestone with a red-purple matrix, believed to be of Belgian origin, as the Société des Merbes Le Château, the company responsible for the internal decoration of the Teatro, provided it.

From Stone to Status: Linking Heritage Stones to UNESCO World Heritage Nominations. Three European Case Studies

David Martín Freire-Lista

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Natural stone has played a pivotal role in shaping cultural identities and built heritage across Europe. This study explores the significance of three emblematic heritage stones and their contribution to the Outstanding Universal Value of the associated UNESCO World Heritage Sites.

The first case study focuses on the leucogranite of Penaboa in A Coruña, Spain, whose unique geological and aesthetic qualities were integral to the construction of the Tower of Hercules and its enduring legacy. The Tower of Hercules was declared a World Heritage Site by UNESCO in 2009.

The second case study analyses the Ançã limestone (Cantanhede, Portugal), which is also an IUGS Heritage Stone. It highlights the stone's integral role in the architectural heritage of Coimbra, Portugal, particularly in the University and Alta-Sofia area, which is listed by UNESCO. It was declared a World Heritage Site by UNESCO in 2013.

The third case study focuses on Alpedrete granite (Alpedrete Pluto, Madrid, Spain), recognised as an IUGS Heritage Stone, and its historical use in Madrid's urban fabric, particularly within the core of the UNESCO-listed 'Paseo del Prado and Buen Retiro, a Landscape of Arts and Sciences'. This landscape, which includes the Paseo del Prado, the Jerónimos neighbourhood, and Retiro Park, was nominated by Spain for UNESCO in 2019. Its inclusion on the UNESCO World Heritage List was approved in 2021.

These case studies demonstrate the importance of geodiversity and heritage stones in supporting cultural value, strengthening World Heritage nominations, and promoting interdisciplinary approaches to heritage conservation and recognition.

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Renaissance for structural stone: an ecological approach to natural stone in the age of sustainability

A. Granseth, T. Heldal and B. Schouenborg

During the last 100 years, natural stone in fine architecture has largely been applied as panels, covering other, structural materials in buildings. Hence, the visual appearance of a stone counts more (in the market) than its technical properties. The recent recognition of natural stone having a large potential as a construction material with low carbon footprint is, however, increasing among builders and architects. This leads to a focus on new, innovative ways of using natural stone in architecture, also structurally, as load-bearing elements. The rationale is that an increase of the percentage of stone in a construction compared with high-emission materials such as steel, concrete and bricks, will lower the total emission of the building. Moreover, stone is, through history, proven to be a material with high longevity and re-usability, proper for a more circular society.

Through a series of workshops run by the Aarhus School of Architecture, Denmark, architects, geologists and engineers got together exploring examples and cases of load-bearing structural stone in modern architecture. These included: use of quarry waste material for structural constructions, Norway; prefabricated, load-bearing stone elements, UK; high-rise buildings with exo-skeleton of load-bearing stone, UK; load bearing ashlar stone masonry in social housing, Spain. The presentation shares aspects from these examples and discusses how history and geology can provide knowledge to such an evolution. It also discusses what type of quality criteria that is relevant to place on such products.

Heritage Stones of the United States

Joseph T. Hannibal

University of Akron, Akron Ohio, 44325-4101, and Cleveland Museum of Natural History,
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Due to its diverse geology and long quarrying history, the United States has many stones that may be considered heritage stones on some level. However only two stones in the United States, Jacobsville Sandstone and Tennessee Marble, have been formally recognized to date as heritage stones by the IUGS. Supporting data for Berea sandstone from Ohio, Seneca sandstone from Maryland, Indiana Limestone from Indiana, and Cockeysville marble from Maryland has been published but these have yet to be formally proposed. Berea sandstone is the most international of these as it has been used in both the United States and Canada for more than 200 years, and is still quarried today. Indiana Limestone has been used for a similar time span and continues to be used in the United States and Canada. Cockeysville marble was quarried even earlier than Berea sandstone and Indiana Limestone but has not been quarried for building stone for decades.

In addition to these, candidates for international designation include Georgia marble and Vermont marble, both of which have a two-century or more history of quarrying for building stone. Both have been widely used in the United States for important buildings including public libraries and state capitols. Georgia marble is still actively quarried, but the great Vermont quarries are quiescent. Arguments can also be made for the inclusion of Morton Gneiss from Minnesota, Barre granite from Vermont, Quincy granite from Massachusetts, Texas pink granite, Kasota stone (a dolomitic limestone) from Minnesota, and Columbus Limestone from Ohio as heritage stones at an international level. Conversely, the use of various stones from Europe, Canada, and Africa in the United States support the designation—or can support the potential designation—of international heritage stones.

Reflections around Egyptian and Greek Heritage stones

T. Heldal, A. Kelany and K. Laskarides

The Subcommittee on Heritage Stones is encouraging and collecting nominations of stones from all over the world, aiming at establishing a global “canon” of natural stones of particular importance to our cultural and architectural heritage. So far, 55 Heritage Stones have been approved, most of them occurring in countries having representation among voting members and delegates to the Subcommittee. However, a representative coverage is still lacking, both globally and within Europe. The presentation reflects around some of Greek and Egyptian stones, so far not included in the list, and discusses similarities and differences related to the assessment of heritage aspects of these stones and why it is important to get a representative selection of stones from these countries as IUGS Heritage Stones. The Penteli, Thassian and Karystian marbles will be used as examples from Greece, and Chephren Gneiss, Aswan Granite, Faiyum Basalt and Mons Pophyrates porphyry from Egypt.

The stone cultural heritage buildings of Lumbarda, island of Korčula (Croatia)

Marija Horvat, Ana Maričić, Daria Fricki and Uroš Barudžija

Stonemasonry and stone carving have been developed on the area of today's Croatia during the Greco-Illyrian (Illyrian burial mounds and Greek colonies walls) and Roman periods as exhibited by sarcophagi, columns and capitals, and old tools. The European Standard establishes the criteria for the designation of natural stone from raw material to finished products. According to the denomination criteria (HRN EN 12440), 44 variety of natural stones is being exploited in Croatia.

Natural stone deposits in Croatia are located in the areas of Istria peninsula, Adriatic coast (Dalmatia) and the islands of Brač and Korčula, and only one variety is in the continental part of Croatia. The island of Korčula is one of the largest islands in the Adriatic Sea, located about 1200 m away from the mainland. It is a part of the Outer Dinarides belt, and it is built of limestones and dolomites deposited from the Lower to the Upper Cretaceous period, which are in places covered with terra rossa and clastic sediments of Quaternary age.

Lumbarda is a small village on the east end of the island of Korčula, which cherishes long tradition of decorative stone exploitation and stonemasonry. Apart from the island itself, the stone was excavated on the nearby islets located in the Pelješac Channel. There are several significant old buildings or building remains in Lumbarda area that represent stone cultural heritage from the different historical periods (especially in the period from 15th to 18th century). They are: Villae Rusticae, the St. Križ Church, the Venetian Tower and the Bishops Summer House and on the islet of Sutvara is the St. Barbara Church.

The possible origin of the stone used for the construction of five old cultural heritage buildings, or their remains was determined. According to the mutual comparison of petrographic characteristics of limestone samples (macroscopic and microscopic analysis) determined that the stone for the construction of these buildings was quarried in the vicinity from two quarries. First is Brendana Quarry on the island of Korčula and the second one is Gornja Špilja Quarry on the nearby islet of Sutvara. Although the quarries are no longer active, the small amounts of stone could be used for the restoration purposes. In addition, it should be noted, that the dry-stone walls, built by stacking stones one on top of the other, without the use of binding material, could find on Korčula but also on other islands and along the Adriatic coast were inscribed on the UNESCO Intangible Heritage List in 2018.

It could be concluded, as the island of Korčula is famous for its long tradition of quarrying and stonemasonry, this is an opportunity for geological and quarrying heritage, together with related cultural heritage, to be presented for (geo)tourism purposes.

Subcommission on Heritage Stones: Key Achievements and Ongoing Challenges

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The Heritage Stone Subcommission (HSS) of the International Union of Geological Sciences (IUGS) is dedicated to the identification and designation of stones used in significant monuments and buildings and are of great cultural importance. One of its key achievements is the development of a standardized framework for designation of a heritage stone as an IUGS Heritage Stones. With lot of input and discussions with the ICG EC and voting members a robust framework has been devised for designation of an IUGS Heritage Stone. This initiative has received international recognition and finally the first 55 IUGS Heritage stones from 24 nations have been designated. A book on the first 55 IUGS Heritage Stones representing diversity in stone types has been the biggest achievement for the Heritage Stone Subcommission as it has popularized the concept, process and relevance of designation. Additionally, through workshops, seminars, and publications, the HSS has helped educate masses and professionals about the significance of stone and its geology in heritage conservation. The faces significant challenges with one of the most pressing being the difficulty in engaging geologists from developing nations to nominate stones renowned for their exceptional architectural value and cultural significance. Another challenge lies in the ongoing effort to urge UNESCO to incorporate the criterion of stone when designating World Heritage Sites, a critical step in recognizing the integral role stone plays in preserving global heritage.

Lithothamnium limestone as autochthonous natural building stone in the City of Zagreb, Croatia

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In the capital of Croatia – Zagreb, many historical buildings and monuments are built of autochthonous natural building stones – lithothamnium limestone and litavac (Fio Firi and Maričić, 2020; Maričić et al., 2023). Besides these yellowish limestones, other natural building stone varieties of Miocene age are also present, mainly calcareous sandstones. These carbonate varieties were often used in constructions in the same manner, even though they have specific macro and micropetrographic characteristics and show different resistivity to the weathering conditions. All three varieties were exploited in the vicinity of Zagreb from several old, today abandoned, quarries – Bizek, Vrapče potok and Markuševac, which are situated in the southwestern part of the Medvednica Mt. The main reasons for using these local stone types, beside vicinity of the quarries, were their decorative value, softness and ease of processing and shaping into different decorative elements and sculptures. Due to their high values of open porosity and water absorption these stones revealed low resistivity to atmospheric conditions, especially in urban area. Over the time many stone elements made of such varieties started to deteriorate, which lead to degradation of historical objects.

Among the most famous buildings in Zagreb that were built from these varieties are the Zagreb Cathedral, St. Mark's Church, Croatsians Natural Theatre, Postal Palace and arcades of Zagreb city cemetery Mirogoj. Lithothamnium limestone and associated two varieties were the main building material for building and subsequent restorations of the Zagreb Cathedral. Other mentioned buildings are only partially built with these varieties, and stones were mostly used in the basal parts of the objects as building foundations, as slabs for floors and for façade covering.

It is worth to be noted that usage of the lithothamnium limestone throughout history has not only been common in Croatia, but also in the surrounding countries, as Slovenia, Austria, Czech Republic and Hungary where Miocene (Badenian) deposits are common. Nowadays, these stone varieties are no longer exploited in Croatia. Regardless, they represent valuable (geo)heritage of the City of Zagreb, as well as of other areas where they are used.

References

- Fio Firi, K. and Maričić, A. (2020): Usage of Natural Stones in the City of Zagreb (Croatia) and its Geotouristical Aspect. *Geoheritage*, 12, 62, 1–18. <https://doi.org/10.1007/s12371-020-00488-x>
- Maričić, A., Briševac, Z., Hrženjak, P. and Jezidžić, H. (2023): Natural building stone in the construction and renovation of the Zagreb Cathedral. *Rudarsko-geološko-naftni zbornik*, 38/3, 29–42, DOI: 10.17794/rgn.2023.3.3

Além Paraíba Mylonite, the Heritage Stone of the Coffee Valley – Rio de Janeiro, Brazil

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The Coffee Valley (*Vale do Café*) is the touristic name of a region encompassing 15 Paraíba Valley municipalities in Rio de Janeiro. In the 19th century, it produced 75% of the world's coffee. Geologically, this area is installed in a 200 km long and 5 km wide shear zone, resulting from the amalgamation of the paleocontinent Gondwana during the Neoproterozoic, giving rise to a NE-SW sub-vertical structure, an elongated body of mylonitic rocks, that controls the course of the Paraíba do Sul River in that region.

The Além Paraíba Mylonite is a heterogeneous, partially molten rock of paragneissic, orthogneissic, and mafic granulitic composition. It exhibits the typical mylonitic foliation, with centimetric to decametric light and dark bands and deformed amphibolite and calc-silicate rocks insertions parallel to foliation. It is a grey and white striped rock, sometimes with folding, and more yellowish in the case of the mylonitic paragneisses.



This work aims to demonstrate the historical importance of the Além Paraíba Mylonite as a building material and to publicise its educational, cultural and scientific values. Through bibliographic research and field trips throughout the valley, it was possible to record the extensive use of various facies in pavements, bridges, and urban elements, as well as bases, stairways, lintels, jambs, pilasters and columns of religious, administrative and vernacular constructions, especially of old mansions from the 19th century.

In the city of Vassouras, the most representative of the coffee production heyday and a national heritage property since 1958, there are many examples of this mylonite's uses. Amongst them, a former baron mansion, the current City Council building, stands out, with its monolithic neoclassic columns featuring partial melt texture. In this city, it is also possible to observe a mylonite outcrop.



Beautiful features of the Além Paraíba Mylonite are also exhibited in various applications throughout Paraíba do Sul, a city in the middle of the way of the road opened for the transport from Minas Gerais to the port of Rio de Janeiro of precious stones destined for Portugal. In 1857, the city inaugurated Brazil's first cast iron bridge, supported by massive pillars of mylonite masonry, for crossing the Paraíba River, charging a toll for the first time in the country too. This city is also known for the therapeutic properties of its mineral waters due to the minerals leached from mylonite. Três Rios, another important city in the Coffee Valley, features the Casa de Pedra (House of Stone), an old railroad engine house made of perfectly fitted ashlar of Além Paraíba Mylonite, as well as an inactive quarry of that stone.

The Além Paraíba Mylonite connects the natural and cultural heritage of the Coffee Valley. Its geological characteristics reveal the Earth's processes that shaped the morphology of the region, provided esteemed mineral waters and stones to build cities that showcased the wealth of the 19th-century coffee barons and, today, are recognised as Brazilian cultural heritage. Moreover, it is paramount to remember that all that richness and construction were achieved through the work of enslaved people, Africans and their descendants, which is an embarrassing heritage but needs to be acknowledged.

Architectural Heritage Carved in Western Ghats Laterite: The Forts of North Malabar, Kerala

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Kerala, a narrow coastal strip in southern India, has a rich cultural and architectural heritage shaped by centuries of historical influences. From the Chera dynasty to colonial rule, the state's architectural landscape showcases a fusion of indigenous, Persian, Arabic, Chinese, and European styles. The presence of 54 forts along its 590 km coastline highlights its strategic importance in maritime history. These forts, along with palaces and temples, stand as testaments to Kerala's historical legacy.

The rock forts of Kerala, particularly in North Malabar, reflect a blend of indigenous and colonial influences. Of the 13 identified forts in the region (Fig.1), only a few remain well-preserved, while the majority have significantly deteriorated or exist only as remnants. Once-majestic strongholds, which played key roles in trade and military defence, now require urgent conservation efforts.

The forts of North Kerala, particularly Bekal Fort, Kannur Fort, and Thalassery Fort, exhibit distinct architectural patterns and construction styles that reflect their strategic applications and historical purposes. Bekal Fort, the largest in Kerala, features massive laterite walls, a well-planned water storage system, and an observation tower, indicating its primary role as a military defense outpost. The fort's circular structure and high ramparts provided a clear vantage point to monitor enemy movements along the coastline. Kannur Fort, also known as St. Angelo's Fort, built by the Portuguese in 1505, showcases Indo-European architectural influences, with bastions, underground tunnels, and sea-facing ramparts designed for maritime defence and colonial administration. The later addition of Dutch and British modifications, such as gun emplacements and magazine stores, reflects its evolving military function. Thalassery Fort, constructed by the British East India Company, differs from the other two as it was more of a trade and administrative centre than a purely military structure. Its rectangular layout, large inner courtyard, and interconnected secret tunnels highlight its use for commercial storage, governance, and regional control.

Likewise, the inland forts of North Kerala, such as Kundamkuzhi, Kumbala, and Povval, functioned as essential military and trade strongholds while also serving a vital role in safeguarding temples. Their strategic placements were instrumental in protecting settlements and religious sites from potential invasions.

One striking feature of these forts is the predominant use of laterite, despite the availability of harder rocks like charnockite and granite. The preference for laterite can be attributed to its abundance, ease of extraction, and workability. Colonial builders, in particular, favored laterite due to its proximity to their settlements, reducing transportation challenges and ease of construction. However, the varying composition of laterite across Kerala influenced the durability of these structures, with North Malabar laterite proving to be more resilient due to its higher iron and aluminum content.

The deterioration of these historical structures can be attributed to multiple factors, including Kerala's tropical humid climate, which accelerates laterite erosion. Additionally, a lack of maintenance and awareness about the geological variations in laterite has

contributed to the ruins. Many forts, once used as military and trade centres, have been abandoned, leaving them vulnerable to natural decay and uncontrolled human encroachment.

To safeguard these historical sites, urgent conservation measures are needed. A multidisciplinary approach, integrating geological and archaeological studies, is essential to understanding the materials used in construction and their weathering patterns. Strategic conservation efforts, including controlled restoration and public awareness initiatives, will be crucial in preserving Kerala's architectural heritage for future generations.

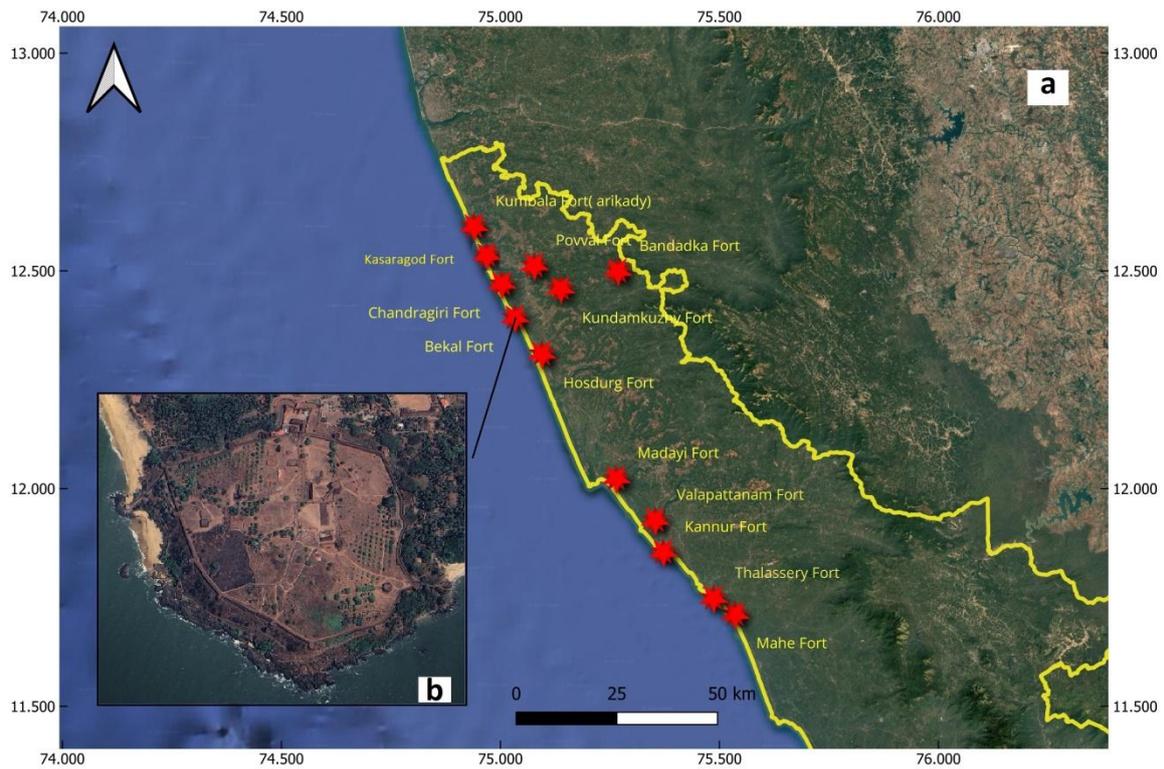


Fig. 1 (a) Map illustrating the concentration of laterite forts in North Malabar, highlighting their predominant spatial distribution along the coastal fringe. (b) Google Earth view of Bekal Fort, the largest fort in Kerala.

Sticks and Stones: Fossil Trees in British Parks and Gardens

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Across the world, fossil trees and fossil forests are large-scale geological remains that have always stirred public interest and globally, many examples are preserved *in situ* as national parks and have become well-known destinations for geotourism and geoheritage. In Britain in the second half of the 19th Century, large tree-trunk and tree-root fossils began to be recognised as objects of interest by both scientists and quarry workers and they were carefully excavated and preserved when discovered during quarrying and engineering activities. Fossil trees were derived from two major geological sources; the Upper Carboniferous Coal Measures of northern England, Scotland and Wales and the Lower Purbeck Group which form the uppermost Jurassic strata in southern England. The Lower Purbeck Group immediately overlies the Portland Stone and trees were frequently discovered during the removal of overburden prior to stone quarrying. Many of these finds were recorded in the local and national press and subsequently went on public display. A number of these large plant fossils still remain, often forgotten, in Britain's municipal parks and gardens. These urban fossil trees represent significant items of geological and cultural heritage and were important in early public engagement initiatives in the Earth sciences. This paper will present a public science initiative to record the locations and origins of fossil trees displayed in Britain's towns and cities and their importance to geoheritage studies.

Traditions of Sandstone Quarrying in Saxony, Germany

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In the German federal state of Saxony, situated in the southeast of the country, sandstone quarrying in the Elbe Valley goes back at least to the 13th century. There were different historic techniques of stone extraction according to the geological setting. In some profile sections the sandstones are layered, with layer joints spaced a maximum of a few metres apart. In other profile sections, layer joints do not occur at all or only at large distances of a few tens of metres. Getting sandstone blocks of appropriate dimensions for the production of building stones was easier for the massively bedded profiles. In these quarries, single sandstone layers were extracted in a certain area of the quarry bank by bank from top to bottom. In German, this was called “Abbau vom Stock” (extraction from the massive). The other, somewhat peculiar technique was called “Wandfällen” (wall felling). It was very typical for the quarry region at least since the 16th century and applied for the profiles with mighty sandstone walls (higher than 10 m) without distinct stratification. The quarry wall was undermined stepwise across a width of up to some 10 metres and into the depth until a vertical joint surface was encountered. This was the case normally in 5-10 m, in rare cases up to 15-20 m. Columns made of stone or wood supported the resulting, steadily growing overhang. It took the workers a few weeks to undermine a smaller wall, but a few months up to some years in case of bigger walls. Since the work in the quarries was suspended in winter due to the frost, hollowing a wall was a good way for the quarrymen to earn some money during this period. When the next vertical joint in the direction of undermining was reached, the undermined wall began to settle on the columns under its own weight. This was the time to remove some supports at the front edge of the undercut. In the past, this was done by chipping away supports with an axe (and then quickly running). In later times, the columns were blasted away with gunpowder. At a certain point, the wall tilted and fell over. Broken into pieces, it was then further crushed into blocks and those were formatted into building stones for months or even years. Initially, officials of the stoneworkers’ guilds supervised the work themselves. After 1860, the Saxon state took over legal regulation and approval as well as the supervision. Only particularly qualified persons were allowed to carry out this work in the quarry at any time. At the end of the 19th century, more than 100 walls were felled per year. The number decreased rapidly until WW I. Although it was very dangerous, this technique was still used occasionally until 1963. In a few cases, it was also applied in Silesia and Franconia in the first half of the 20th century.

Sanpietrini: The Iconic Paving Stone of Rome

Grazia Signori

Sanpietrini represent one of the most iconic historic paving of Rome, forming an essential part of the city's identity and its deep connection with local stone. These small cubic basalt blocks, generally measuring 12 × 12 × 10 to 20 cm, owe their name to the large-scale paving of St. Peter's Square in the 16th century. Since then, they have become a distinctive feature of Rome's urban fabric, valued for their durability, resistance, and ability to adapt to ground movements.

The basalt used for sanpietrini comes from the lava flows of the volcanic districts of Lazio, particularly from the Monti Sabatini and Colli Albani complexes. This effusive rock, a leucitite basalt characterized by its compact structure and exceptional wear resistance, grants sanpietrini outstanding longevity, making them ideal for urban traffic and mechanical stresses. Additionally, the traditional herringbone arrangement of the blocks enhances stability and facilitates rainwater drainage.

Beyond their technical qualities, sanpietrini are an integral part of Rome's historical and cultural heritage, shaping the aesthetic perception of the city and the collective memory of its inhabitants. Their characteristic dark appearance and the irregular texture of the streets they pave contribute to Rome's unique and globally recognized charm. However, in recent decades, their use has been progressively reduced on high-traffic roads, often replaced with asphalt for maintenance and safety reasons. This shift has sparked debate on their conservation and valorization as an urban heritage material.

Analyzing sanpietrini as a paving material offers an opportunity to reflect on sustainable management of historic centers, balancing preservation, functionality, and innovation. Their presence remains a symbol of the enduring relationship between Rome and its geology, the century long "geological wisdom" developed by locals bearing witness to centuries of history, urban transformations, and the city's unique identity.

Peninsular gneiss: A common heritage stone resource from the oldest continental crustal segment of India

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The grey gneisses of southern India regionally known as “Peninsular Gneiss” is composed of a suite of granites and granodioritic-tonalitic gneisses, and represents the primordial sialic basement crust of Indian subcontinent. Apart from its geological significance as the oldest known segment of the continent’s crust, dating back over 3.5 billion years, its high resilience makes it a valuable building material. With its high-grade metamorphic mineral assemblages, the Peninsular Gneiss is well-known for its durability and distinctive appearance and is considered as the prime construction material, especially for buildings that designed for long-lasting architecture. Thus, the Peninsular Gneiss has been an integral part of the cultural and architectural heritage of Indian subcontinent. The ancient usage of Peninsular Gneiss dates back to the 16th Century during Kempegowda’s rule, the founder of Bengaluru city, which is represented by the installation of Kempegowda’s Mantapa, an iconic structure in Bengaluru. Historical structures using this stone as a fundamental building material include: Bangalore Palace (built in 1862), St. Francis Xavier’s Cathedral (1851), the iconic main building of the Indian Institute of Science (1909), with a silver-grey granite structure crowned by an imposing 150-ft tower, and contemporary structures such as Bengaluru’s Vidhana Soudha (1952). Most of these heritage buildings follow neo-Dravidian architecture, which includes elements of styles from various dynasties such as Chalukyas, Hoysalas and Vijayanagara. Though, much information is not recorded, there are reports of worldwide supply of Peninsular Gneiss, especially to northern Europe and other British colonies. Given its cultural importance, widespread usage and availability, the Peninsular Gneiss serves as a “common heritage stone,” deeply embedded in the architectonic history of India.

Proposal for the nomination of the Balma Syenite (NW Italy) as an IUGS Heritage Stone

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The Balma Syenite is an important ornamental stone for the past economy of Piemonte region (NW Italy). It was exploited in the Canavese-Biellese quarry district in the Cervo Valley Basin (Biella province), where a medium-sized Alpine synorogenic magmatic body of Oligocene age crops out, intruded into the polymetamorphic basement of Sesia-Lanzo Zone, a geological unit of Austroalpine Domain.

The quarried rock is unique in Italy in terms of textural, chromatic, aesthetic and commercial characteristics. Its violet color combines well with other shade; the material is easy to work, sculpt, resistant to mechanical stress and almost unalterable even when used outdoors. It has excellent physical-mechanical properties; for these reasons, it has been among the most sought-after materials as ornamental stone in the past, exploited since Roman times. In the past centuries, the working of Syenite has allowed the sustenance of many families in the area and has made the craftsmen of the Cervo Valley famous throughout the world. The traditional trade of stonemason-bricklayer has provided an alternative to the only pastoral activity. The industrial extraction began in 1830, expanding significantly after 1891 with the construction of the Biella-Balma railway, which facilitated nationwide and international distribution.

From a petrographic point of view the Balma Syenite is a magmatic intrusive rock (quartz-syeno-monzonite), with a typical gray to violet in color due to hematite dispersion in K-feldspar. The rock shows medium homogeneous grain size and weak anisotropic texture defined by the well-developed magmatic flow fabric. Plagioclase, rare quartz, biotite, hornblende and relict clinopyroxene complete the paragenesis.

Currently there are no active quarries, but over ten abandoned quarries are located among the villages of the Cervo Valley. The last quarrying activity, dating back to the early 2000s, involved two main quarries: the average annual production estimated for the two quarries was about 2000 m³ of "workable stone". The quarries gradually stopped their activity due to objective environmental difficulties and economic reasons such as high processing and transport costs.

The rock has been used in many iconic monuments and buildings. In Piemonte region it is possible to recognize the Balma Syenite in several infrastructures, including bridges, road pavements, coverings, steps, columns, funerary art. For example, it was used in the Olivetti buildings in Ivrea (industrial city of the 20th century, registered since 2018 in the UNESCO World Heritage List), and in the historic city centre of Torino (capital of the Piemonte region). Not only in NW Italy, but throughout the world this stone has been used for fountains, churches, monuments and palaces: Milan, Naples, Rome, New York, Lyon etc.

Nowadays some of the abandoned quarries have been valorised from a geotouristic point of view for the preservation of cultural, social and scientific heritage site. For example, in 2009, in the spaces that were previously used as quarries, the "Parco delle Cave" (Quarries Park) was born, featuring climbing walls and geotouristic routes.

For all these and others characteristics, the Balma Syenite could be a good candidate as an IUGS Heritage Stone.

Towards a new Heritage Stone: the Karst Rudist Limestone of Italy and Slovenia

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The Classical Karst Region (Kras-Carso) is a cross-border area shared by Italy and Slovenia, from which the international scientific term “karst” was derived. The geodiversity of this region is linked to the evolution of the former Adriatic-Dinaric Carbonate Platform (Jurkovšek *et al.*, 2016; Bensi *et al.*, 2022). On this platform, an Upper Cretaceous, rudist-rich shallow-water limestone was deposited, which includes the Italian “Aurisina Limestone” and the Slovenian Repen, Sežana and Lipica formations (Bensi *et al.*, 2022). These limestones are at present commercially exploited on both sides of the border. More importantly, they have played a significant role in the cultural heritage of the Karst region, and several historical quarries are preserved in the area. Due to its geotechnical and ornamental attributes, the stone has been used since Roman times and throughout the centuries for construction purposes. Its use is witnessed also in important UNESCO World Heritage Sites, such as the Roman city of Aquileia and the Mausoleum of Theodoric in Ravenna. Particularly in the 19th century, the quarrying of this limestone experienced significant growth and development. From this period onwards, it has been traded not only on a regional scale but also on a broader, extra-regional level. This is evidenced, for instance, by the numerous monuments in Vienna and Budapest that were constructed using this stone.

Within the framework of the Interreg project Kras-Carso II (2023–2026), a study of the Karst Rudist Limestone across Italy and Slovenia was undertaken to assess the suitability of Karst Rudist Limestones as an IUGS Heritage Stone. For this purpose, we have worked in several directions: (1) describing the petrography of the many commercial varieties of Rudist-bearing limestone that have been quarried in the Karst; (2) identifying whether objective differences exist between commercial varieties of different ages and provenance; (3) documenting the use of stone throughout historical periods and across a wide geographic region; and (4) mapping and studying both active and inactive quarries.

The data acquired qualify the Karst Rudist Limestone as a potential Heritage Stone, in accordance with IUGS standards. This contribution displays an overview of our dataset and results, which will form part of our proposal to the IUGS Subcommittee on Heritage Stones.

Bensi S. *et al.* (2022) - The Classical Karst geopark. Geological Survey - Central Directorate for Environmental Protection, Energy and Sustainable Development of the Autonomous Region of Friuli Venezia Giulia, 164 pp., <https://hdl.handle.net/11368/3053480>.

Jurkovšek B. *et al.* (2016) - Geology of the classical karst region (SW Slovenia–NE Italy). *J. Maps*, 12(sup1), 352-362, <https://doi.org/10.1080/17445647.2016.1215941>.

STONEBUILT Ireland

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STONEBUILT Ireland is a research collaboration between Trinity College Dublin, Geological Survey Ireland and the Office of Public Works (OPW), which aims to enhance the understanding and conservation of Ireland's architectural and geological heritage. These goals are achieved through the identification and documentation of Irish stone resources - including dimension stone, decorative stone and aggregates - and by promoting and building awareness of these resources through hands-on displays, publications and events. This initiative also includes the provision of a publicly accessible database that connects historical building and decorative stones to their source quarries, the stone works where they were fabricated, and the buildings and monuments in which they were used.

In revealing the hidden journey of stone from quarry to building, the wider communities involved in the 'making' of buildings are recognised. The well documented history of architectural design and patronage can be balanced, and built upon, by alternative chronicles of materials, workmanship and craftsmanship. By diversifying the narratives surrounding buildings, this book invites new ways for people to identify with their heritage. Stone has a visceral quality to which people – of any background – can respond, and stories of stone anchor structures in the surrounding geological landscape.

STONEBUILT Ireland has been ongoing since 2019 and it is currently in its 3rd phase. Phases 1 and 2 laid strong foundations in terms of data collection and presentation. A relational database has been set up, which enables flexible searching and improves data integrity and security. Data collated thus far has been made available through the STONEBUILT Ireland website, <https://stonebuiltireland.com/>. Stakeholders and the public can explore the geological context of selected building stones and details of stone use in Irish buildings, accompanied by maps and images. Phase 3 is building on these foundations to provide a more extensive and comprehensive coverage of quarries, materials and heritage sites across Ireland. Data regarding the stone works, along with the people involved in the extraction, fabrication and application processes, will also be revealed.

Furthermore, Phase 3 aims to build links with other existing resources, and to add supplemental information that will directly align with key national and organisational strategic goals. In particular, it will facilitate the implementation of EU climate action plans with regard to primary and secondary raw materials. Understanding Ireland's domestic stone resources is the first step towards securing sustainable supply chains of stone within Ireland and in the Single Market. Baseline quarry data from the STONEBUILT Ireland database will inform Ireland's capacity for extraction of primary raw materials in the form of natural stone.

Additionally, STONEBUILT Ireland's comprehensive dataset of building stone use and provenance will significantly aid in the appropriate and sympathetic restoration and conservation of Ireland's built heritage. Specifically, STONEBUILT Ireland will assist the OPW, conservation architects, other firms and individuals in making judgements as to the most suitable stone types required for restoration purposes, with an emphasis on local supply chains. The sourcing of correct materials maintains the durability, authenticity and character of our towns and villages. The decline of local stone quarrying, as well as lack of information and awareness within rural communities, has led to significant degradation of fabric.