

PROCEEDINGS



GLOBALSTONE CONGRESS2018

**ILHEUS (BAHIA)
BRAZIL**

April 26-29, 2018

**CONNECTING MINDS
IN THE WORLD OF STONE**

**April 26-29, 2018 / 26-29 de abril de 2018
ILHEUS (BAHIA) - BRAZIL**

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(ORG.)

CETEM/ MCTIC- ABIROCHAS
RIO DE JANEIRO, 2018

PROCEEDINGS

GLOBAL STONE CONGRESS 2018

CONNECTING MINDS IN THE WORLD OF STONE

VI CONGRESSO INTERNACIONAL DE ROCHAS ORNAMENTAIS

PROCEEDINGS ORGANIZERS: Nuria Fernández Castro & Maria Heloisa Barros de Oliveira Frascá

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FOREWORD

The city of Ilheus, Bahia, received the **Global Stone Congress 2018** (GSC), entitled **Connecting Minds in the World of Stone**, from April 26 to 29. The sixth edition of the event, organized by the Brazilian Association of the Dimension Stones Industry (ABIROCHAS) and the Centre for Mineral Technology (CETEM), brought together about 170 participants, among researchers related to the stone sector through Brazilian and foreign institutions, architects, designers, engineers, geologists, undergraduate students, as well as representatives of the productive sector, with the objective of sharing knowledge and discussing the challenges for sectoral development. Speakers from Saudi Arabia, Argentina, Brazil, Chile, Spain, Finland, England, Iran, Italy, Portugal, Czech Republic and Sweden honored the event. There were 17 lectures and 54 papers in the technical sessions and three round tables. The event was supported by Apex-Brasil, the State Government of Bahia, through the Secretariats of Economic Development and Tourism and the Baiana Mineral Research Company (CBPM), the Ilhéus City Hall and the Gestra company, a Czech industry of stone splitting machines, and the Brazilian company Apollo Logística.

The Global Stone Congress is consolidating as the main technical-scientific event in the world of natural stone. It had its first edition in 2005, in Guarapari - ES, Brazil, while it was still designated International Congress on Dimension Stones (ICDS). The event arose from a partnership between the Centre for Mineral Technology (CETEM), a research institute of the Ministry of Science, Technology, Innovation and Communication (MCTIC) and the Center for Technology of Marble and Granite (CETEMAG), with the support of the Brazilian Association of the Dimension Stone Industry (ABIROCHAS) and associates of the Brazilian Dimension Stones Technology and Quality Network (RETEQ-ROCHAS). Other editions of the event were subsequently held in Italy (2008), Spain (2010), Portugal (2012) and Turkey (2014), adopting the formal name Global Stone Congress in Spain (2010).

The lectures, workshops, technical sessions with oral presentations and posters, special topics and round tables focused on the themes of Architecture, Technology and Sustainability. At the end of the congress, the participants made a technical visit to two quarries of two types of natural stones in the State of Bahia: the blue granite (sodalite) quarry of the Somibrás company, in Potiraguá, and the pegmatite quarry of the Ouro Campo company, in Macarani. The visit allowed the participants, in addition to observing the quarrying process, to understand some of the geological context that led to the formation of those rocks in the region. Other companies made their quarries available for visitation, but for logistical and schedule reasons, this was not possible. They were: Marmífera (Blue Bahia granite), MAG-BAN & EXIDO (marble), SUS's & PRS Mining (brown syenite) and Ouro Campo (white and blue quartzite).

The architect's role as a specifier of stone products, acting as a fundamental link between the producer and the increasingly demanding consumer, was a theme widely discussed on the first day of the event, as well as the issue of teaching about natural stones in Architecture courses and the need for greater interaction between research centers, universities, architecture professionals and industry. The importance of the adequate stones conservation to ensure their durability, especially of those used in monuments and historical buildings was also discussed. It was also presented, by members of the IUGS Heritage Stone Subcommittee the concept and examples of World Heritage Stones, rocks of recognized interest for their historical use throughout the centuries and, therefore, fundamental for the restoration of buildings and monuments of global cultural importance.

Discussions on the second day brought conflicting opinions about the application of the Industry 4.0 model to the stone sector, which involved both the need for the natural stone industry to join this model and the difficulty, due to the characteristics of this industry and the materials worked, to adhere to model 4.0. The need for new alternatives to remain in the market was also raised, given the growing trend of international production and commercialization of artificial stones and ceramic products in detriment of natural stones. At

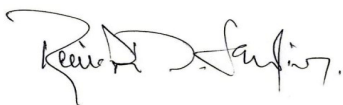
the morning workshop, latest quarrying, processing and waste-rock recycling technologies were presented, an also the Industry 4.0 model applied to the natural stones production, the Brazilian Industry 4.0 Program of the Brazilian Industrial Development Agency - ABDI and the Export Processing Zone - ZPE of Ilhéus. The technical sessions included production automation technologies, processing technologies, database softwares, robots use, as well as insights on the workforce in the stones sector, and about the world market, with emphasis on the Middle East.

Reflections on sustainability took place on the last day of the congress. A workshop on upmarket in the world of stone opened the conference, with the presentation of the International Institute of Marble - IS.I.M addressing the new technologies and solutions for the use of stone wastes and the sustainable project for small producers in Patagonia. Representatives of the Brazilian company, Petrus Mineração, showed the outstanding company's *modus operandi* of corporate social responsibility aiming at sustainability, including the use of renewable energy, controlled production to make the most of their deposits, due to the exclusivity of the exotic materials extracted from their quarries, research on wastes recycling and environmental education actions. The presentation emphasized the importance of the professionals to the better knowledge of the materials extracted, to the quarries operation planning and to the adequate processing and use of stones.

Throughout the presentations, sustainable solutions to be applied to the stones production were demonstrated, such as waste water treatment systems and alternatives for waste recycling, such as new products that use in their composition stone residues, as well as new applications for this waste in civil construction and agriculture, in the latter being used as fertilizer, among others. The issue of circular economy in the ornamental stone industry was another topic widely covered in various presentations, as well as the application of the Life Cycle Assessment (LCA) and Building Information Modeling (BIM) tools.

This event has great importance, as it brings together international research groups and promotes the worldwide diffusion of knowledge, for the benefit of the industrial sector. This edition certainly represented a milestone in the industry-research interaction, with presentations of both technical, from representatives and consultants of the industry, as well as of a more scientific nature, from representatives of research institutions, covering all aspects of current interest of the natural stones sector. From the debates and discussions generated, many new ideas and global partnerships emerged, thus living it up to the desired goals and justifying the name Global Stone Congress. Satisfied with the good results, we thank all the participants and sponsors, wishing that in the next editions of the GSC we can see results of the ideas that have emerged in Ilhéus, oriented to the academy-industry integration in favor of the natural stones sector development.

Rio de Janeiro, August, 2018



Reinaldo Dantas Sampaio
President of ABIROCHAS



Fernando A. Freitas Lins
Director of CETEM

APRESENTAÇÃO

A cidade de Ilhéus, na Bahia, recebeu o **Global Stone Congress 2018 (GSC)**, intitulado *Connecting Minds in the World of Stone*, entre os dias 26 e 29 de abril. A sexta edição do evento, organizada pela Associação Brasileira da Indústria de Rochas Ornamentais (ABIROCHAS) e pelo Centro de Tecnologia Mineral (CETEM), reuniu cerca de 170 participantes, entre pesquisadores ligados ao setor de rochas ornamentais através de instituições brasileiras e estrangeiras, arquitetos, designers, engenheiros, geólogos, estudantes universitários, além de representantes do setor produtivo, com o objetivo de compartilhar conhecimentos e discutir os desafios para o desenvolvimento setorial. Palestrantes da Arábia Saudita, Argentina, Brasil, Chile, Espanha, Finlândia, Inglaterra, Irã, Itália, Portugal, República Tcheca e Suécia prestigiaram o evento. Foram apresentadas 17 palestras e 54 trabalhos nas sessões técnicas e houve três mesas redondas. O evento contou com o apoio da Apex-Brasil, do Governo Estadual da Bahia, por meio das Secretarias de Desenvolvimento Econômico e de Turismo e da Companhia Baiana de Pesquisa Mineral (CBPM), da Prefeitura Municipal de Ilhéus e da empresa Gestra, indústria tcheca de máquinas cortadoras de pedras, e da empresa brasileira Apollo Logística.

O Global Stone Congress está se consolidando como o principal evento técnico-científico mundial do setor de rochas ornamentais. Teve sua primeira edição em 2005, em Guarapari - ES, quando ainda era designado International Congress on Dimension Stones (ICDS). Na ocasião, o evento resultou de uma parceria entre o Centro de Tecnologia Mineral (CETEM), instituição de pesquisa integrante do Ministério da Ciência, Tecnologia, Inovações e Comunicações (MCTIC), e o Centro Tecnológico do Mármore e Granito (CETEMAG), com apoio da Associação Brasileira da Indústria de Rochas Ornamentais (ABIROCHAS), e de outras instituições filiadas à Rede Brasileira de Tecnologia e Qualidade em Rochas Ornamentais (RETEQ-ROCHAS). Outras edições do evento foram subsequentemente realizadas na Itália (2008), Espanha (2010), Portugal (2012) e Turquia (2014), adotando-se, a partir da Espanha, a designação formal Global Stone Congress.

As palestras, workshops, sessões técnicas com apresentações orais e de pôsteres, tópicos especiais e mesas redondas focaram nas temáticas Arquitetura, Tecnologia e Sustentabilidade. Ao término do congresso, os participantes realizaram visita técnica a duas pedreiras de extração de dois tipos de rocha ornamental no Estado da Bahia: o Granito Azul (sodalita) da empresa Somibrás, em Potiraguá, e o pegmatito da empresa Ouro Campo, em Macarani. A visita permitiu aos participantes, além de acompanhar o processo de extração, compreender um pouco do contexto geológico que levou à formação das rochas na região. Outras empresas disponibilizaram suas pedreiras para visitação, mas por motivos logísticos e de tempo, não foi possível. Foram estas: Marmífera (granito Azul Bahia), MAG-BAN & EXIDO (mármore), SUS's & PRS Mineração (sienito marrom) e Ouro Campo (quartzito branco e azul).

O papel do arquiteto como especificador dos produtos de rochas, atuando como elo fundamental entre o fabricante e o consumidor final cada vez mais exigente, foi um tema amplamente discutido no primeiro dia do evento, assim como a questão do ensino de rochas ornamentais em cursos de arquitetura e a necessidade de maior interação entre centros de pesquisa, universidades, profissionais de arquitetura e a indústria. Foi também discutida a importância da correta conservação das rochas para garantir sua durabilidade, especialmente, daquelas utilizadas em monumentos e edificações históricas e apresentado o conceito de Rochas do Patrimônio Mundial (*Global Heritage Stone*), rochas de reconhecido interesse pelo seu uso histórico ao longo dos séculos e, portanto, fundamentais para a restauração de edifícios e monumentos de importância cultural global.

As discussões do segundo dia trouxeram à tona opiniões contraditórias acerca da aplicação do modelo de Indústria 4.0 ao setor de rochas ornamentais, que envolveram tanto a necessidade da adesão da indústria de rochas ornamentais a este modelo quanto a dificuldade, em virtude das características próprias dessa indústria e dos materiais trabalhados, para aderir ao modelo 4.0. Também se aventou a necessidade de

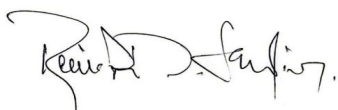
buscar novas alternativas para se manter no mercado, diante da tendência crescente de produção e comercialização internacional de rochas artificiais e produtos cerâmicos em detrimento das rochas naturais. No workshop matinal, foram apresentadas tecnologias de aproveitamento de estéreis de pedreiras, a Indústria 4.0 aplicada à produção de rochas ornamentais, o programa brasileiro Indústria 4.0 da Agência Brasileira de Desenvolvimento Industrial - ABDI e a Zona de Processamento de Exportação - ZPE de Ilhéus. Nas sessões técnicas foram apresentadas, ainda, tecnologias de automação da produção, tecnologias de processos, softwares de bancos de dados, uso de robôs, além de reflexões sobre a força de trabalho no setor de rochas ornamentais, e o mercado mundial, com destaque para o Oriente Médio.

Reflexões sobre sustentabilidade tiveram espaço no último dia do congresso. Um workshop sobre a exclusividade no mundo das rochas ornamentais abriu os trabalhos, com a apresentação do Instituto Internacional do Mármore – IS.I.M abordando as novas tecnologias e soluções para o aproveitamento de resíduos de rochas ornamentais e o projeto sustentável para pequenos produtores na Patagônia. Destacou-se a apresentação de representantes da empresa brasileira de extração e beneficiamento de rochas, Petrus Mineração, que expuseram o *modus operandi* de responsabilidade social corporativa da empresa visando à sustentabilidade, incluindo o uso de energia renovável, a produção controlada para o máximo aproveitamento dos maciços, dada a exclusividade dos materiais exóticos extraídos das suas minas, os estudos para aproveitamento de resíduos e ações de educação ambiental. A apresentação ressaltou a importância dos profissionais no conhecimento dos materiais extraídos, no planejamento de lavra e seu melhor beneficiamento e utilização.

Ao longo das apresentações, foram demonstradas soluções sustentáveis a serem aplicadas no processamento das rochas, como, por exemplo, sistemas de tratamento de águas residuais do processo e alternativas para reaproveitamento dos resíduos gerados, tais como novos produtos que utilizam em sua composição resíduos de rochas, assim como novas aplicações para este resíduo na construção civil e na agricultura, nesta última podendo ser utilizados como fertilizante, entre outros. A questão da economia circular na indústria de rochas ornamentais foi outro tema amplamente abordado em diversas apresentações, assim como a aplicação das ferramentas de Avaliação de Ciclo de Vida (ACV) e Modelagem de Informações de Construção (BIM – *Building Information Modelling*).

A realização deste evento é de grande importância, por aproximar grupos de pesquisa internacionais e por promover a difusão mundial de conhecimentos, em benefício do setor industrial. Esta edição, certamente, representou um marco na interação indústria-pesquisa, com apresentações tanto de cunho técnico, de representantes e consultores da indústria, quanto de cunho mais científico, de representantes das instituições de pesquisa, abrangendo todos os aspectos de interesse atual do setor de rochas ornamentais. Dos debates e discussões gerados, surgiram muitas novas ideias e parcerias globais, atingindo-se assim os objetivos desejados e fazendo-se jus ao nome Global Stone Congress. Satisfeitos com os bons resultados, agradecemos a todos os participantes e patrocinadores, desejando que nas próximas edições do GSC possamos ver resultados das ideias surgidas em Ilhéus, orientadas para a integração academia-indústria em prol do setor.

Rio de Janeiro, agosto de 2018



Reinaldo Dantas Sampaio
Presidente da ABIROCHAS



Fernando A. Freitas Lins
Diretor do CETEM

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Synopsis

In this presentation, we seek to disseminate a study in the field of Social and Human Sciences on the Heritage and History of the Marble Industry (PHIM), whit news approaches on the use of marbles in the identified architectural elements, in cities and towns of Portugal, in particular at Alentejo province.

The paper is divided into two parts: firstly, is about the objectives of the project and their methodologies used throughout the research and the reasons that led to the study of the relationship between the Marbles of Estremoz and the urban architecture buildings from the 16th century. The second reason, are rehearsing some parallels with applications abroad from the internalization of this economic activity, identifying destinations for the export of Portuguese marble.

Keywords

Marble, Portugal, Alentejo, History, Architecture

Introduction

The study about marble has been developed since 2012, at the Center of Studies – CECHAP, by a group of researchers in the fields of History, Archaeology and Digital Humanities, whit the scientific coordination of the research academic centers of Universidade de Évora, Faculdade de Letras of Universidade de Lisboa, the Universidade Nova de Lisboa and ISCTE-Instituto Universitário de Lisboa.

The goals of the project are the study of the ornamental stone industry, in particular the marble of Estremoz Anticline, through history, industrial archaeology, the processes of technical and technological evolution, social issues and the economic relation whit the territory, including the counties of Borba, Estremoz and Vila Viçosa. The research project has also sought to establish the relationship between the natural resource and the evolution of architecture and urbanism.

It is in the context of this research, which seemed pertinent to us, to make known the progress of this study, seeking to highlight the importance of the application of this natural resource, paying particular attention to aesthetic concepts and the artistic tendency, by typologies and uses in architecture. [1]

We sought to establish chronological targets and specific areas of research for the execution of this project. The first phase of the study took place between 2012 and 2015, cover the chronological period from 1850 to 1986. It allowed to identify and gather, through a database, many unpublished sources in archives, bibliographic documents and other in public and private libraries of Portugal, about industrial licensing of divers activity linked whit marble industry like quarries, factory's and others industrial unit's, for the 19th and 20th centuries. Preferential areas where established, such as legislation, the evolution of techniques and technologies used in extraction and landscape changes caused by the intensity of new explorations in the geography of the Anticline.

The uses of Portuguese marbles in architecture and heritage

As far as fieldwork is concerned, the space of the marble industry was crossed and visited, and between quarries and transformation units we tried to identify the evidence of technological evolution in the field of industrial archaeology. At the same time, a set of oral history, whit interviews of the various actors (engineers, industrialists, trade unionists, quarry masters, masonry workers and other technicians).

The second phase of PHIM project began in 2017, whit new areas of study: Art History and Roman Archaeology, distributed by speciality teams, each chronological period. It is in this context that Art History, conducting a systematized research and inventory of sources for the sixteenth and nineteenth centuries, contemplating the Renaissance, Mannerism, Baroco and Classicism periods, whit a collection of testimonies of the use of marble in architecture and urbanism in the region of Alentejo.

Today it is possible to determine the economic moments of greater dynamism in the marble sector, between the 16th and 20th centuries, confirmed by the diversity of orders and the availability of the endogenous resource.

Whit this presentation, we also sought to frame the process of late industrial development of this activity in Portugal [2] and their influence in the internationalization of the Portuguese marble at the beginning of the twentieth century. Their trade had some meaning in supplying the urban expansion of cities in important markets like Brazil and United States of America. [3]

For this productive growth, as not indifferent, in the nineteenth century, the presence of Portuguese marbles at the Universal Exhibitions like London and Paris, where, from 1851, they would be appreciated and raised the interest of use then in domestic furniture and also in decorative elements inside houses. It was, whit this reality that several quarrymen become, at the same time, businessmen in the extraction, processing and exportation of marbles. To this scenario would add in the early of twentieth century, the large foreign investments in the sector, destined to supply the orders based in the news architectural trends. [4]

Finally, whit regard the outputs of the project, it was possible so far to gather in a database the treated information, making it available to the community in general, through the project portal available at: (<http://phim.cechap.com/en/project>), complemented whit a cultural itinerary and smart-phone application, both about marble, such as, a publication about this thematic, published and available for download at the site of the project. [5]

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