

# EUROCK 2014



## Rock Engineering and Rock Mechanics: Structures in and on Rock Masses

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# Rock Engineering and Rock Mechanics: Structures in and on Rock Masses

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ROCK ENGINEERING AND ROCK MECHANICS:  
STRUCTURES IN AND ON ROCK MASSES

## Preface

This book is a peer-reviewed and edited volume that contains keynote lectures and extended abstracts of papers that were received for EUROCK 2014 – The 2014 ISRM European Symposium, which will be held in the city of Vigo SPAIN on 27–29 May, 2014. The Symposium was organized by the Spanish Society for Rock Mechanics (SEMR) and the School of Mining Engineering of the University of Vigo with the main aim of providing a forum for engineers, practitioners, researchers and students to meet, to integrate industry professionals and scientific research communities, to share experiences and create opportunities to update and improve knowledge and to present the most recent contributions in the field of rock mass engineering.

EUROCK 2014 is the latest symposium in the series of annual European rock mechanics symposia that started in 1992 with the symposium “Rock Characterization” that was held in Chester UK. It was preceded last year by EUROCK 2013, which was held in Wroclaw POLAND, and will be followed next year by EUROCK 2015, which will be held in Salzburg AUSTRIA.

EUROCK 2014 is the first of this series of Symposia to be held in Spain. However, previous specialized conferences like ‘Rock Mechanics and Power Plants’ held in Madrid in 1988 and ‘Volcanic Rock Mechanics’ held in Tenerife in 2010 have preceded this Symposium in our country. Additionally, workshops on ‘Preservation of Natural Stone and Rock Weathering’ and ‘Underground works under special conditions’ were also held in Merida and Madrid within the framework of the 11th International ISRM congress that took place in 2007 in Lisbon, capital of Portugal and home of the secretariat of the ISRM.

We are honored and pleased that the Spanish community of rock mechanics has been given the opportunity to host for the first time a EUROCK symposium and receive colleagues from Europe and other parts of the world.

EUROCK 2014 was planned to focus on recent developments in the field of rock mechanics with an emphasis on structures on and in rock masses. Twenty thousand years ago our forerunners dwelt in caves and painted in Altamira the so called Sistine Chapel of Paleolithic art. Still our rocky country makes an extensive use of rock masses to locate on them buildings and large civil engineering structures and in them mines, caverns, tunnels and a number of different excavations for varied purposes.

Purposely, six keynote lectures will be presented by leading international experts on shear strength of rock, rock joints and rock masses (N. Barton from Norway), rock mass characterization by means of advanced survey methods (A.M. Ferrero from Italy), impact of brittle behavior of rocks on excavation design (D. Martin from Canada), case histories of rock engineering projects in China (X.-T. Feng from China), foundations on rock masses (C. Olalla from Spain) and representation of rock discontinuities in safety analysis of large dams (J. Lemos from Portugal). This covers a wide spectrum of rock mechanics traditional but still unresolved concerns as well as a number of advanced applications and relevant case studies.

More than 350 abstracts were received for EUROCK 2014 from consulting firms, industrial enterprises, universities and research institutes from 45 countries. The full papers that arrived in fewer numbers were reviewed by members of the Scientific and Review Committees in order to determine their eligibility for publication in the Symposium Proceedings and subsequent presentation during the Symposium. Finally, 249 papers from 39 countries were accepted. These include contributions from Asia (43), Australia (10), New Zealand (1), Europe (171), North America (18), South America (4) and South Africa (2), with the greatest number of papers coming from Spain (69).

These Symposium proceedings have been published in a book containing the full version of the above mentioned keynote lectures and the extended abstracts of the accepted papers. In conjunction with this book a USB pen drive is provided including the full version of the 6 keynotes and all accepted papers. Technical papers are classified under the following 10 themes: Rock properties and testing methods, Rock mass characterization, Rock mechanics for infrastructures, Mining and quarrying rock mechanics, Design methods and analysis, Monitoring and back analysis, Excavation and support, Case histories and Preservation of natural stone, Petroleum engineering, hydro-fracking and CO<sub>2</sub> storage and Applicability of EUROCODE-7 in rock engineering.

We would like to thank everyone who contributed to the organization of EUROCK 2014 and the publishing of this volume. Our thanks and words of gratitude go to the Board of the International Society for Rock Mechanics, members of the International Advisory Committee with particular gratitude to Prof. Xia-Ting Feng, the present president of the ISRM, Prof. Frederic Pellet, the present vice-president of the ISRM for Europe, to Dr. Luís N. Lamas, Secretary-General of the ISRM and to Ms. Sofia Meess, Executive Secretary of the ISRM. We equally warmly thank the members of the Scientific and Review Committees who so generously contributed their expertise and time to review the abstracts and the full papers that were received for the Symposium. We also

gratefully acknowledge Mr. Léon Bijnsdorp, the Editor 'Conference Proceedings', and Mr. Lukas Goosen, the Production Manager at CRC Press/Balkema – Taylor & Francis Group for their cooperation and commitment during the entire editorial and publishing process. Last, but not least, we wish to express our appreciation all the members of the Organizing Committee with special emphasis on the staff of the School of Mining Engineering in Vigo and the staff of CEDEX in Madrid.

Finally, we would like to extend our sincere thanks and wish our best wishes to all of the participants of EUROCK 2014. Thank you for attending and we hope that you will enjoy the Symposium. We wish you a pleasant stay in Vigo!

Leandro R. Alejano  
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*Editors of this volume*

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