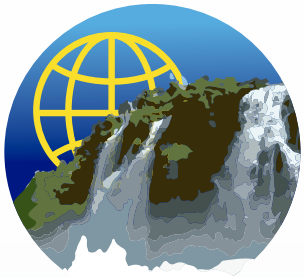
14TH INTERNATIONAL CONGRESS ON ROCK MECHANICS AND ROCK ENGINEERING

September 13 to 18, 2019 - Foz do Iguassu - Brazil

OFFICIAL PROGRAM

ISRM



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SUMMARY

WELCOME

Every four years, the International Society for Rock Mechanics and Rock Engineering, ISRM, holds its Congress, a series that started in 1966 in Lisbon, Portugal, and that it is now in its 14th edition. ISRM Council awarded in 2014 the task of organizing its 2019 International Congress to the National Groups of Brazil, Argentina and Paraguay; it is with great honor that the Chairs of the Congress welcome all delegates to the 3-countries-frontier city of Foz do Iguaçú, Brazil, the city that also represents the brotherhood of these three nations.

As in previous occasions, the Congress mobilizes researchers, professors, engineers and students around contemporaneous themes relevant to rock mechanics and rock engineering. The Technical Program contains 8 Keynote Lectures, the prestigious Rocha Award Lecture and ISRM Muller Lecture, 39 Technical Sessions (34 Oral Podium presentation sessions and 4 Oral Poster presentation sessions) covering a myriad of topics in Rock Mechanics and Rock Engineering, the 4th Early Career Forum and the 2nd International RockBowl. This program describes the schedule and location of each Technical Session.

One Congress of that importance and magnitude happens because of the actions of people in the past, people that honored our profession and the discipline of Rock Mechanics and Rock Engineering. We thank ISRM and its past Board of Directors, Past Presidents and Fellows for paving the way to our work.

At the same time, the Congress does not happen without the help of many people; we would like to express our gratitude to the Brazilian Rock Mechanics Committee, the Argentinian Society of Geotechnical Engineering, the Paraguayan Society of Geotechnics, the current ISRM Board, all ISRM National Groups, the Organizing Committee, the Congress Staff, to the sponsors and exhibitors, to the City of Foz do Iguaçú, to Itaipú Binacional for allowing the technical visits and to all delegates.

Welcome to the city of Foz do Iguaçú, the land of the once great Guarani Nation, the site of the nature wonder of Iguaçú Falls and enjoy its beauty, its National Parks, cultural and religious tradition. We proudly invite you to enjoy the 14th International Congress of Rock Mechanics and Rock Engineering.

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GENERAL INFORMATION

Please find below important information and reminders to ensure you have the most pleasant experience in the event.

REGISTRATION DESK HOURS
September 13th – 18th | 07:30 - 19:00

BADGES
Badges are mandatory to access activities and exhibition areas at all times.
Also, they are of personal use and non-transferable.

CERTIFICATE OF ATTENDANCE
Certificates will be available at the Congress website http://www.isrm2019.com/

PROCEEDINGS
Access to the Proceedings will be available at the Congress website http://www.isrm2019.com/

OFFICIAL LANGUAGE
The official language of the Congress is English. All presentations and slides will be in English only.
Simultaneous translations won't be available.

LOST AND FOUND
In case of lost and found belongings, please go to the Registration Desk. Take care of your belongings, the Congress is not responsible for their storage or compensation for their loss.

BAR-CODE READERS
Some exhibitors will have bar-code readers at their booths. By allowing your badge to be scanned, you are agreeing to be part of the company's mailing

SOCIAL EVENT
Award Dinner - September 17th
Time: 19:30 - 23:30
Ticket fee: US$ 80,00

TECHNICAL VISIT TO ITAIPU
Ticket fee R$ 80,00 per person
Vacancies: please, check at the congress accreditation about the vacancies available.
It's not allowed for under 14 years old.

- Is required to be registered to the congress to buy this activity.
- It is mandatory to wear closed shoes, without heels, and clothes with knee length during the Technical Visit.
- It is forbidden to enter with bags, backpacks, bags and the like inside the plant.
- If necessary, Itaipu has lockers for rent.
- The transfer will leave from the Hotel Bourbon Cataratas Resort parking lot punctually 1 hour before the scheduled visit time

Please, verify the full guideline about this visit on the congress website http://www.isrm2019.com/visit-itaipu.php

VENUE
Bourbon Cataratas Convention & Spa Resort

ACCOMPANYING PERSON
There is no registration fee for accompanying person, who is not associated with the technical activities of the Congress.

SPEAKERS INFORMATION

REGISTRATION

We kindly ask all the Speakers to go to the Registration Desk to collect their badge and Congress material. The use of the Badge is mandatory to enter the event. The registration desk will be located at the foyer of the Convention Center of Bourbon Cataratas Resort.

MEDIA DESK

All speakers are required to are required to submit their presentation to the Media Desk, at least 3 hours before their talk. Please consider bringing a backup copy of the presentation on flash drive in case of equipment failure.

The Media Desk will be located at the Business Center of the Convention Center of Bourbon Cataratas Resort, near the Registration Desk.

Important: If the presentation contains links to video files, it is essential that you bring not only your PowerPoint file, but also your original video files. All videos should be tested and checked in advance at the Media Desk to guarantee that they will work properly.

If your presentation is in MAC format, it is imperative to check it will run properly in PC in the Media Desk at least 24 hrs prior to your session.

The media desk will open on the following hours:

September 15th – 08:00 – 18:00
September 16th – 08:00 – 18:00
September 17th – 08:00 – 18:00
September 18th – 08:00 – 18:00

GIVING YOUR TALK

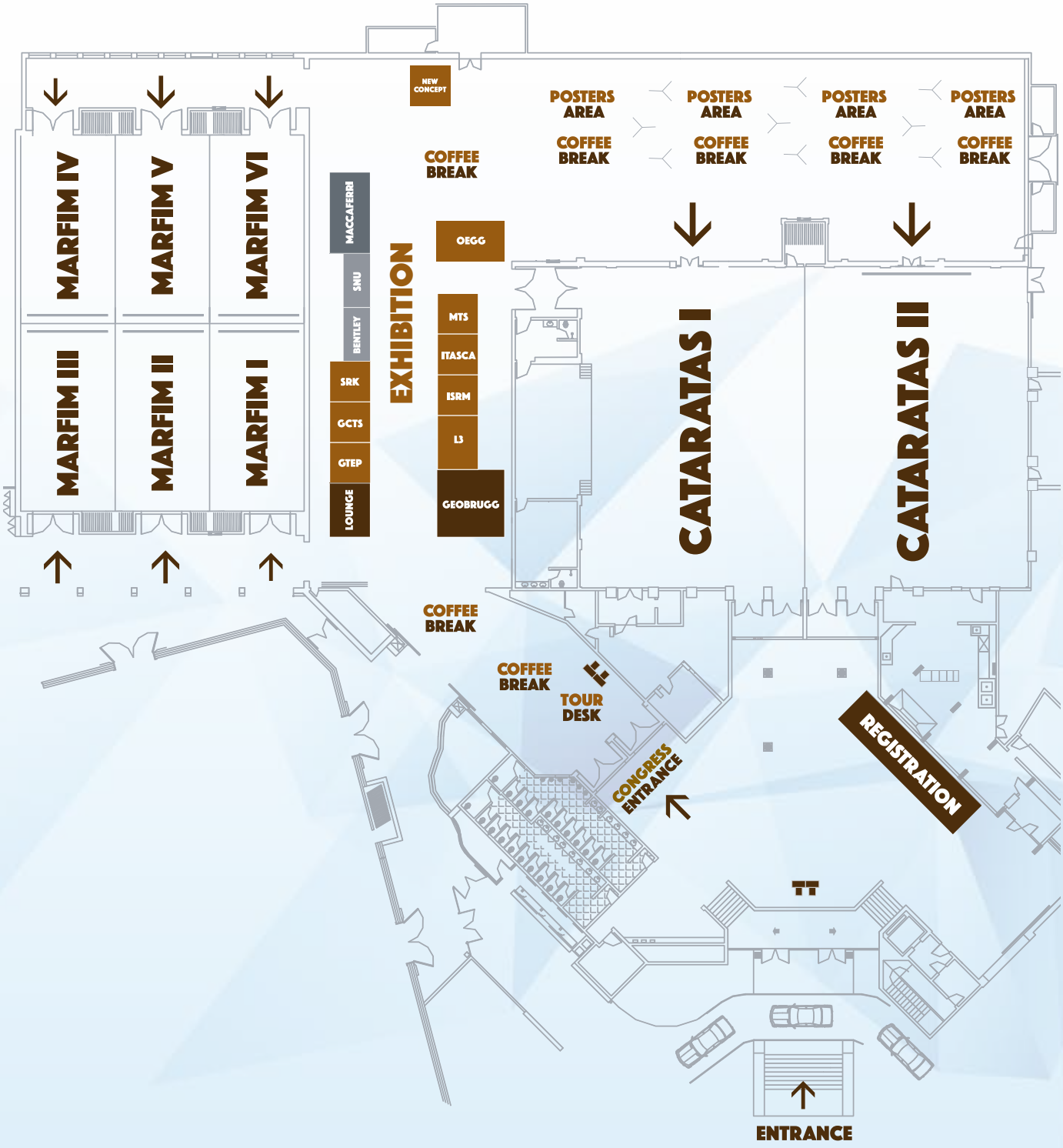
Please assemble in your session room at least 15 minutes prior to the start of the session. This will allow time for the Chairs to liaise with the speakers/presenters, explain the seating set up and arrangements for questions/discussion following the conclusion of your presentation.

POSTER PRESENTERS

The recommended poster size is 90 cm width x 120 cm height. Do not exceed the recommended size. The poster should be printed on paper, do not mount posters on fabric or heavy boards.

The posters should be displayed and removed at the date, time and place previously informed by email to the presenters. If your Poster is NOT REMOVED by the specified date and time after your session, we will not be responsible for poster containers. Any remaining posters after this time will be subject to disposal.

FLOOR PLAN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CONGRESS ENTRANCE
REGISTRATION
ENTRANCE

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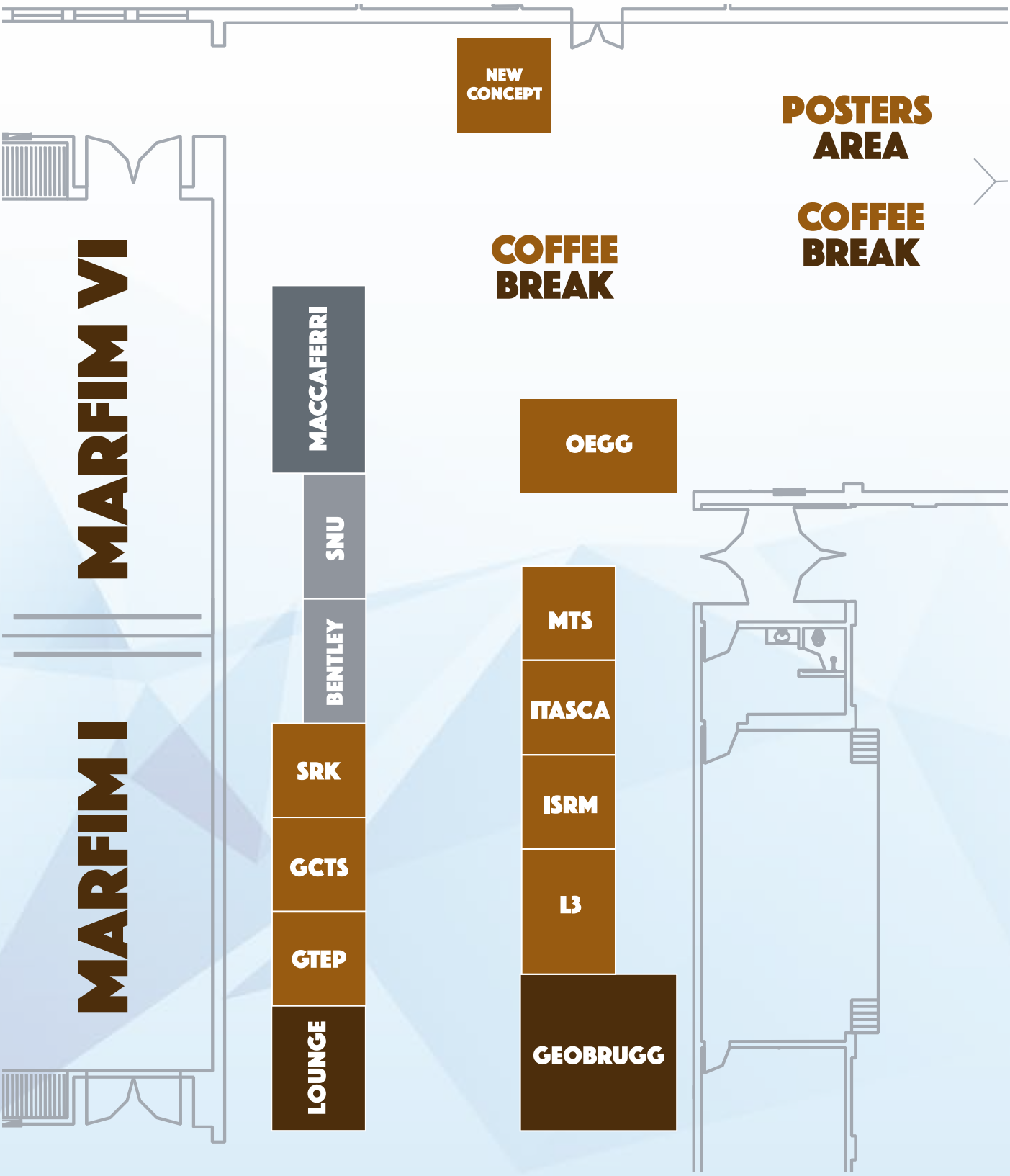
EXHIBITION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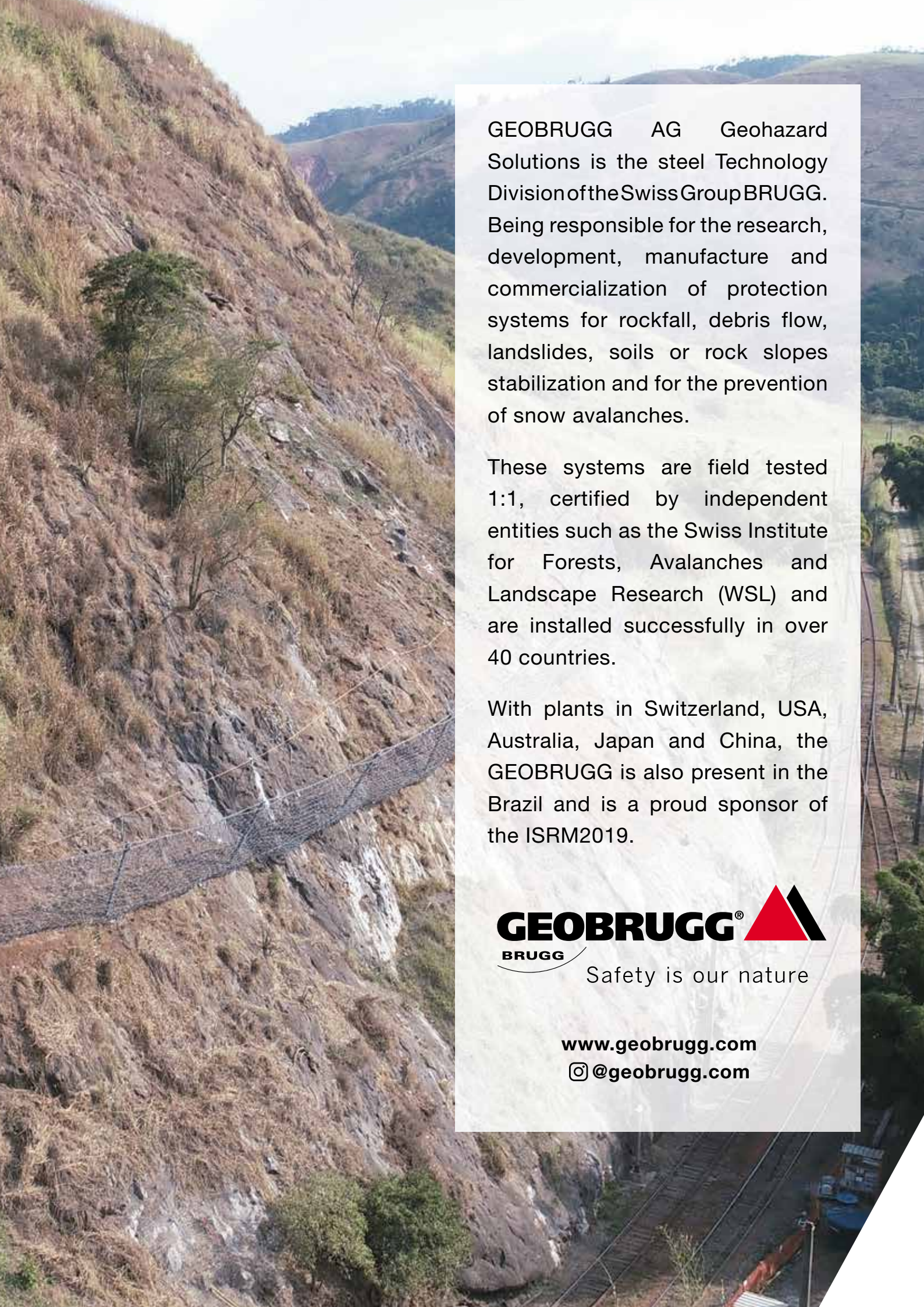

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With plants in Switzerland, USA, Australia, Japan and China, the GEOBRUGG is also present in the Brazil and is a proud sponsor of the ISRM2019.

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KEYNOTE SPEAKERS

PROFESSOR DANIEL FRANCOIS MALAN - SOUTH AFRICA

Innovative rock engineering solutions for deep tabular excavations

DR. ERLING FJAER - NORWAY

The role of rock mechanics in oil field development

PROFESSOR GIOVANNI BARLA - ITALY

Conventional and Advanced Monitoring of Tunnels With Selected Case Histories

DR. JOHN READ - AUSTRALIA

The Geotechnical Engineer in Metalliferous Open Pit Mines

PROFESSOR LAURA PYRAK-NOLTE - USA

Translating the Micro-scale to the Macro-scale: Signatures of Fracture Evolution

PROFESSOR LI XIAO - CHINA

In-situ Computed Tomography Technique in Geomechanical Testing

PROFESSOR TARCISIO CELESTINO - BRAZIL

Engineering for Civil Underground Works in Soft Rock

PROFESSOR YUZO OHNISHI - JAPAN

Advances in numerical approaches for coupled problems in rock mechanics and recent developments in related fields

PROGRAM | 12TH SEPTEMBER

ROOM	CATARATAS 1	CATARATAS 2	MARFIM 1	MARFIM 2	MARFIM 3
08:00 13:00					
13:00 14:00	LUNCH				
14:00 19:30					
19:30 22:30	ISRM BOARD DINNER				

PROGRAM | 13TH SEPTEMBER

ROOM	CATARATAS 1	CATARATAS 2	MARFIM 1	MARFIM 2	MARFIM 3
08:00 13:00			SHORT COURSE **Geology For Rock Engineering Projects**		SHORT COURSE **Rocscience Tools For Mining Applications**
13:00 14:00	LUNCH				
14:00 18:30			SHORT COURSE **Geology For Rock Engineering Projects**		SHORT COURSE **Rocscience Tools For Mining Applications**

	MARFIM 4	MARFIM 5	MARFIM 6	ARAUCÁRIA	IPÊ 1
	LUNCH				
				ISRM **Board Meeting**	
	ISRM BOARD DINNER				

	MARFIM 4	MARFIM 5	MARFIM 6	ARAUCÁRIA	IPÊ 1
	WORKSHOP **Rock Engineering Design Approaches And Challenges In Deep Hard Rock Mining Engineering**			ISRM **Board Meeting**	
	LUNCH				
	WORKSHOP **Rock Engineering Design Approaches And Challenges In Deep Hard Rock Mining Engineering**			ISRM **Board Meeting**	

PROGRAM | 14TH SEPTEMBER

ROOM	CATARATAS 1	CATARATAS 2	MARFIM 1	MARFIM 2	MARFIM 3	
08:00 08:30	REGISTRATION					
08:30 13:00			SHORT COURSE **2D and 3D Modelling For Underground And Slope Rock Engineering**		SHORT COURSE **Geotechnical Monitoring In Conventional Tunnelling**	
13:00 14:00	LUNCH					
14:00 18:30			SHORT COURSE **2D and 3D Modelling For Underground And Slope Rock Engineering**		SHORT COURSE **Geotechnical Monitoring In Conventional Tunnelling**	
19:30 22:30	FEDIGS BOARD DINNER					

PROGRAM | 15TH SEPTEMBER

ROOM	CATARATAS 1	CATARATAS 2	MARFIM 1	MARFIM 2	MARFIM 3	
08:00 08:30	REGISTRATION					
08:30 10:30	ROCKBOWL		ISRM Commission's Mtgs **Grouting**	ISRM **South America Council Meeting**	ISRM Commission's Mtgs **Design Methodology**	
10:30 12:30			ISRM Commission's Mtgs **Petroleum Geomechanics**	ISRM Commission's Mtgs **Evolution of Eurocode 7**	ISRM Commission's Mtgs **Rock Dynamics**	
12:30 14:00	LUNCH					
14:00 19:30		ISRM **Council Meeting**				
19:30 20:30						
19:30 22:30	OPENING OF EXHIBITION AREA AND WELCOME RECEPTION COCKTAIL					

	MARFIM 4	MARFIM 5	MARFIM 6	ARAUCÁRIA	IPÊ 1
	REGISTRATION				
	WORKSHOP **Rock Mechanics In Nuclear Waste Disposal Programs**	SHORT COURSE **The Integration Of Structural Geology And Applied Rock Mechanics**		FedIGS **Board Meeting**	
	LUNCH				
	WORKSHOP **Rock Mechanics In Nuclear Waste Disposal Programs**	SHORT COURSE **The Integration Of Structural Geology And Applied Rock Mechanics**		FedIGS **Board Meeting**	
	FEDIGS BOARD DINNER				

	MARFIM 4	MARFIM 5	MARFIM 6	ARAUCÁRIA	IPÊ 1	IPÊ 2
	REGISTRATION					
		ISRM Commission's Mtgs **Education**		ISRM **Asian Council Meeting**	ISRM Commission's Mtgs **Crustal Stress and Earthquake**	ISRM Commission's Mtgs **Preservation Of Ancient Sites**
	ISRM Commission's Mtgs **Discontinuous Deformation Analysis - DDA**	ISRM Commission's Mtgs **Testing Methods**	ISRM Commission's Mtgs **Radioactive Waste Disposal**	ISRM Commission's Mtg **Underground Nuclear Power Plant**		
	LUNCH					
				ELECTED ISRM **Board Meeting**		
	OPENING OF EXHIBITION AREA AND WELCOME RECEPTION COCKTAIL					

PROGRAM | 16TH SEPTEMBER

ROOM	CATARATAS 1	CATARATAS 2	MARFIM 1	MARFIM 2	MARFIM 3	
08:00 08:30	REGISTRATION					
08:30 09:30	OPENING SESSION					
09:30 10:15	ROCHA MEDAL **Dr. Qinghua Lei** Characterisation and Modelling of Natural Fracture Networks: Geometry, Geomechanics and Fluid Flow					
10:15 11:00	MÜLLER AWARD **Professor Peter Kaiser** From common to best practices in underground rock engineering					
11:00 11:30	COFFEE AND TEA BREAK					
11:30 12:15	KN1 **Professor Daniel Francois Malan** Innovative rock engineering solutions for deep tabular excavations					
12:15 13:00	KN2 **Dr. John Read** The Geotechnical Engineer in Metalliferous Open Pit Mines					
13:00 14:00	LUNCH + INDUSTRY MOMENT					
14:00 15:30			TS01 **Underground Rock Excavations (Mining Engineering)**		TS02 **Experimental Rock Mechanics I (Laboratory)**	
15:30 16:00	POSTERS SESSIONS + COFFEE AND TEA BREAK					
16:00 17:30			TS05 **Numerical Modelling I (Fracture Mechanics)**		TS06 **Rock Mass Characterization**	
17:30 18:30	INVITED LECTURE **Charles W.W. Ng (ISSMGE President)** Impact mechanisms between debris flows and resisting barriers including particle breakage					
18:30 19:30	ROCKBOWL **Quarter Finals**					

	MARFIM 4	MARFIM 5	MARFIM 6	ARAUCÁRIA	IPÊ 1	IPÊ 2
	REGISTRATION					
	COFFEE AND TEA BREAK					
	LUNCH + INDUSTRY MOMENT					
	TS03 **Rock Mechanics for Nuclear Waste Disposal**	TS04 **Fracture and Dynamic Behavior I**		ISRM **Advisory Board Meeting**		
	POSTERS SESSIONS + COFFEE AND TEA BREAK					
	TS07 **Seismic Behavior of Rock Masses**	TS08 **Rock Slope Engineering I**				

PROGRAM | 17TH SEPTEMBER

ROOM	CATARATAS 1	CATARATAS 2	MARFIM 1	MARFIM 2	MARFIM 3
08:00 08:30	REGISTRATION				
08:30 09:15	KN3 **Professor Laura Pyrak-Nolte** Translating the Micro-scale to the Macro-scale: Signatures of Fracture Evolution				
09:15 10:00	KN4 **Professor Li Xiao** In-situ Computed Tomography Technique in Geomechanical Testing				
10:00 11:00			SS01 **AI in Rock Mechanics**		SS02 **Rock Fracture Mechanics**
11:00 11:30	POSTERS SESSIONS + COFFEE AND TEA BREAK				
11:30 12:15	KN5 **Professor Giovanni Barla** Conventional and Advanced Monitoring of Tunnels With Selected Case Histories				
12:15 13:00	KN6 **Professor Tarcisio Celestino** Engineering for Civil Underground Works in Soft Rock				
13:00 14:00	LUNCH + INDUSTRY MOMENT				
14:00 15:30			TS09 **Underground Rock Excavations II (Tunnelling)**		TS10 **Experimental Rock Mechanics II (Laboratory)**
15:30 16:00	POSTERS SESSIONS + COFFEE AND TEA BREAK				
16:00 17:30			TS13 **Fracture and Dynamic Behavior II**		TS14 **Numerical Modelling II**
17:30 18:30	ROCKBOWL **Semi Finals & Finals**				
18:30 19:00					
19:30 23:30	BANQUET AND AWARD DINNER				

	MARFIM 4	MARFIM 5	MARFIM 6	ARAUCÁRIA	IPÊ 1
	REGISTRATION				
	SS03 **Laboratory Testing**	SS04 **Photogrammetry Application**			
	POSTERS SESSIONS + COFFEE AND TEA BREAK				
	LUNCH + INDUSTRY MOMENT				
	TS11 **Rock Mechanics for Geothermal Energy**	TS12 **Case Histories I (Mining Engineering)**		ECF **Early Career Forum**	
	POSTERS SESSIONS + COFFEE AND TEA BREAK				
	TS15 **Instrumentations and Monitoring I**	TS16 **Hard and Weak Rocks Behavior**		ECF **Early Career Forum**	
					ISRM **Europe Council Meeting**
	BANQUET AND AWARD DINNER				

PROGRAM | 18TH SEPTEMBER

ROOM	CATARATAS 1	CATARATAS 2	MARFIM 1	MARFIM 2	MARFIM 3
08:00 08:30	REGISTRATION				
08:30 09:15	KN7 **Professor Yuzo Ohnishi** Advances in numerical approaches for coupled problems in rock mechanics and recent developments in related fields				
09:15 10:00	KN8 **Dr. Erling Fjaer** The role of rock mechanics in oil field development				
10:00 11:00			SS05 **Modelling for Mining Applications**		SS06 **Rockfall**
11:00 11:30	POSTERS SESSIONS + COFFEE AND TEA BREAK				
11:30 13:00	TS21 **Rock Mechanics I (Interdisciplinary)**		TS17 **Numerical Modelling III**		TS18 **Instrumentations and Monitoring II**
13:00 14:00	LUNCH + INDUSTRY MOMENT				
14:00 15:30	TS26 **Rock Mechanics II (Interdisciplinary)**		TS22 **Underground Rock Excavations III**		TS23 **Experimental Rock Mechanics IV (Field)**
15:30 16:00	COFFEE AND TEA BREAK				
16:00 17:30	**John Hudson** Memorial Session				
17:30 18:30	**Closing Cerimony**				

	MARFIM 4	MARFIM 5	MARFIM 6	ARAUCÁRIA	IPÊ 1	IPÊ 2
	REGISTRATION					
	SS07 **Field Testing**	SS08 **Weak Rocks**				
	POSTERS SESSIONS + COFFEE AND TEA BREAK					
	TS19 **Experimental Rock Mechanics III (Laboratory)**	TS20 **Rock Slope Engineering II**		ELECTED ISRM **Board Meeting**		
	LUNCH + INDUSTRY MOMENT					
	TS24 **Petroleum Geomechanics**	TS25 **Case Histories II (Civil Engineering)**		ELECTED ISRM **Board Meeting**		
	COFFEE AND TEA BREAK					

SHORT COURSES

13TH SEPTEMBER

GEOLOGY FOR ROCK ENGINEERING PROJECTS

ROOM MARFIM 1

INSTRUCTORS

Dr. Christophe Vibert / Dr. Philippe Vaskou

DESCRIPTION

The short course deals first with a recall of basic data of structural geology, presenting the different processes of genesis and resulting characteristics of the main types of rock masses, with emphasize on fractured masses. Thereby is presented how to define a site investigation really adapted to the site conditions. Then, the methods of analysis of site geotechnical conditions of rock masses are described, including rock mass classification. Interest and limitations of these classifications will be highlighted and illustrated, based on the use of structural geology during mapping. Obtaining sound data via adapted investigation equipment, as well as the process of data validation will then be exposed, from the rock matrix scale to the rock mass of the site. Particular emphasis is put on the influence of groundwater and groundwater circulation over properties of the rock masses, including how these can be taken into consideration. The second part of the short course will focus on follow-up during construction, demonstrating the prime importance of continuous data acquisition during this phase, such as geological/geotechnical mapping of excavation faces. For this purpose, examples will be analysed from real industrial projects. How original design assumptions and design values can be validated and/or updated will also be presented on the basis of case studies. The end session will describe the monitoring instruments, and how to select the most suitable devices for the validation or updating of design parameters. A fruitful exchange with the attendees of the short course is expected at the end of the day.

ROCSCIENCE TOOLS FOR MINING APPLICATIONS

ROOM MARFIM 3

INSTRUCTORS

Thamer Yacoub

DESCRIPTION

This course aims to provide a basis for numerical modeling of rock mechanics related to mining engineering by using 2D and 3D finite elements tools

REQUIRED EQUIPMENTS

Each participant should bring their own laptops

ROCK ENGINEERING DESIGN APPROACHES AND CHALLENGES IN DEEP HARD ROCK MINING ENGINEERING

ROOM MARFIM 4

INSTRUCTORS

Dr Mostafa Sharifzadeh
Dr. Antonio Samaniego
Prof. Xia-Ting Feng

DESCRIPTION

The rapid-growing trend of resource extraction in the world, results in increases depth of underground mines. Eventually deep underground mines will face an increasing magnitude of stress, temperature, water pressure and seismicity. On the other hand, geoengineering deals with huge uncertainty in geomaterial properties, in-situ stresses, testing, and modelling, which leads to great challenges in design. Knowledge of ground, mine and operational factors and their variability leads the designer to better estimation of geomechanical behaviour and safe design optimisation. This workshop is designed to develop audience knowledge in geomechanical design of deep underground hard rock mines, which will enhance their competencies and prepares them for better and more effective contributions in their future career. This is designed to introduce from basic to advanced topics of geomechanical design aspects on deep underground mine excavation. Attendees from mining, civil and engineering geology or other related fields and professionals who work on this area would also benefit from this course.

SHORT COURSES

14TH SEPTEMBER

2D AND 3D MODELLING FOR UNDERGROUND AND SLOPE ROCK ENGINEERING

ROOM MARFIM 1

INSTRUCTORS

Dr. Giuseppe Cammarata / Marina Trevizolli

DESCRIPTION

This one-day course will combine lectures and demo sessions focused on 2D and 3D numerical modeling of tunneling and slopes by using the software PLAXIS and SVSLOPE. During the morning and the first part of the afternoon the course will cover the fundamental principles for the most suitable behavioral models for rock masses in FEM analysis and the application of FEM in 2D and 3D tunneling analysis. During the second part of the afternoon the course will present topics related to both 2D and 3D slope stability analysis and conceptual model design.

GEOTECHNICAL MONITORING IN CONVENTIONAL TUNNELLING

ROOM MARFIM 3

INSTRUCTORS

Professor Wulf Schubert

DESCRIPTION

The uncertainties in geological and geotechnical models cause a certain residual risk, which needs to be managed during construction. For a safe and economical completion of an underground project an observational approach is required. Monitoring is an essential component of the observational method. It serves several purposes, like verifying assumptions made during design, calibrating models, adjustment of excavation and support to actual ground conditions and behaviour, observe the stabilization process and assess system safety, predict conditions ahead of the face, and conserve evidence. By proper planning and executing a monitoring project the residual risk can be considerably reduced. During the last decades, monitoring methods have been further developed, as well as new methods for data evaluation and interpretation introduced. In particular, the introduction of absolute displacement monitoring has considerably increased the value of the information, allowing a much better assessment of the mechanisms associated with tunnelling. Besides assessing the stabilization process, the influence of geological features outside the visible area can be easily detected, allowing a timely adjustment of excavation and support. Thus “surprises” during excavation can be minimized, contributing to more efficient and economical completion of a project.

The Short Course will address the development of a monitoring project, introduce state of the art monitoring methods, possibilities for data evaluation and interpretation, as well as basics of geotechnical safety management on site. Site data are used to illustrate benefits of different methods. Practical examples will serve as exercises for the participants Geotechnical engineers, engineering geologists and other engineers working on underground projects are addressed. The course also may benefit clients, wanting to apply state of the monitoring methods in their projects.

ROCK MECHANICS IN NUCLEAR WASTE DISPOSAL PROGRAMS

ROOM MARFIM 4

INSTRUCTORS

Ju Wang, Eda Freitas de Quadros,
Chunliang Zhang, Gilles Armand,
Xiangling Li, Rolf Christiansson,
Jianfu Shao, Kaiwen Xia,
Hide Yasuhara, Chun’an Tang,
Ming Cai, Liang Chen,
Sandra Fahland, Xingguang Zhao,
Hongsu Ma, Zhihong Zhao,
Qizhi Zhu, Pengzhi Pan, Guibin Wang

DESCRIPTION

Safe disposal of high-level radioactive waste (HLW) is a challenging rock engineering task for the sustainable development of nuclear energy and environmental protection. Geological disposal is considered to be a feasible and safe option for the long-term management of HLW worldwide, and many countries have considered building deep geological repositories (DGRs) in which to dispose of spent fuel or vitrified HLW. This workshop aims at introducing some key rock mechanics topics for the development of DGRs. Meanwhile, the planning and the latest progress of nuclear waste disposal programs in different counties will be shared. Experience and lessons gained from nuclear waste disposal programs will also be summarized. Attendees from geology, hydrogeology, and rock mechanics or other related fields would benefit from this workshop.

SHORT COURSES

14TH SEPTEMBER

THE INTEGRATION OF STRUCTURAL GEOLOGY AND APPLIED ROCK MECHANICS

ROOM MARFIM 5/6

INSTRUCTORS

Dr. Nick Barton / Prof. John Cosgrove

DESCRIPTION

This one-day short course will cover some key elements of the lecturers' developments and work in rock mechanics, rock engineering and structural geology, respectively. The course will start with a structural geology lecture. A brief reminder is given of some fundamentals: stress, brittle failure and the factors that determine joint or fracture spacing, regularity and continuity within a set, in other words important parts of our input geometries for rock mechanics, modelling, and empiricism. The non-linear shear strength of rock, rock joints and rock masses will be covered next, as these are fundamental to many areas of rock engineering and needed for input to realistic numerical UDEC-BB and 3DEC (jointed) modelling. The second structural geology lecture will be about the the geometry of the joint or fracture network and its influence on rock mass bulk properties, such as connectivity, conductivity and strength. Fundamentals of rock mass anisotropy will follow, including the quantification of deformability, seismic velocity and permeability, to contrast with today's commonly applied isotropic modelling. The last two lectures will be empirically based, and mostly concern rock engineering in tunnelling. The Q-system is an example of observational empiricism, using rock mass classification as a basis for site-interpretation and tunnel-and-cavern design assistance, including input for numerical modelling. TBM tunnelling performance will follow, from world records to more common performance, especially the surprises, problems and big delays sometimes caused by fault zones. The QTBM prognosis method for estimating penetration rate PR and actual advance rate AR, will be described, applied and illustrated.

IMPORTANT INFORMATIONS

Pdf of all lectures (approx. 500 screens), and pdf of related keynote/plenary lectures (approx. 150-200 pages) will be provided to all participants.

REQUIRED EQUIPMENTS

Each participant should bring their own laptops

PLENARY SESSIONS
CATARATAS BALLROOM

16TH SEPTEMBER

08:30 - 09:30
OPENING SESSION

09:30 - 10:15
ROCHA MEDAL - DR. QINGHUA LEI
Characterisation and Modelling of Natural Fracture Networks: Geometry, Geomechanics and Fluid Flow

10:15 - 11:00
MÜLLER AWARD - PROFESSOR PETER KAISER
From common to best practices in underground rock engineering

11:30 - 12:15
KN1 - PROFESSOR DANIEL FRANCOIS MALAN
Innovative rock engineering solutions for deep tabular excavations

12:15 - 13:00
KN2 - DR. JOHN READ
The Geotechnical Engineer in Metalliferous Open Pit Mines

17:30 - 18:30
INVITED LECTURE - CHARLES W.W. NG (ISSMGE PRESIDENT)
Impact mechanisms between debris flows and resisting barriers including particle breakage

17TH SEPTEMBER

08:30 - 09:15
KN3 - PROFESSOR LAURA PYRAK-NOLTE
Translating the Micro-scale to the Macro-scale: Signatures of Fracture Evolution

09:15 - 10:00
KN4 - PROFESSOR LI XIAO
In-situ Computed Tomography Technique in Geomechanical Testing

11:30 - 12:15
KN5 - PROFESSOR GIOVANNI BARLA
Conventional and Advanced Monitoring of Tunnels With Selected Case Histories

12:15 - 13:00
KN6 - PROFESSOR TARCISIO CELESTINO
Engineering for Civil Underground Works in Soft Rock

18TH SEPTEMBER

08:30 - 09:15
KN7 - PROFESSOR YUZO OHNISHI
Advances in numerical approaches for coupled problems in rock mechanics and recent developments in related fields

09:15 - 10:00
KN8 - DR. ERLING FJAER
The role of rock mechanics in oil field development

16:00 - 17:30
JOHN HUDSON MEMORIAL SESSION

17:30 - 18:30
CLOSING CEREMONY

TECHNICAL SESSIONS 16TH SEPTEMBER

TS01 - UNDERGROUND ROCK EXCAVATIONS I (MINING ENGINEERING)

14:00 - 15:30 | MARFIM 1/2

14:00 - 14:15
13342 - The long-term strength of rock salt pillars as back-calculated from collapsed and stable cases. M. Mathey, S. Peysa.

14:15 - 14:30
14347 - An RMR-based stability analysis for empirical design of underground excavation spans. A. C. Adoko, A. Alipov.

14:30 - 14:45
14535 - Stress redistribution and its effects on rock failure of large underground caverns with high in-situ stress. Z. Hu, Y. Xu, B. Wu, N. Xu.

14:45 - 15:00
14687 - Impact of size excavation on time-dependent behavior of drifts excavated at the Meuse/Haute-Marne URL. L.-M. Guayacan Carrillo, G. Armand, N. Conil, R. L. Vaissiere, H. Djizanne.

15:00 - 15:15
15079 - Strategies for managing Large Deformations at CSA Underground Mine. B. Chapula, M. Sharifzadeh.

15:15 - 15:30
15083 - Semmering base tunnel: TBM excavation in a faulted rock mass with high overburden - verification and updating of geotechnical models during construction. A. Poisel, M. Brandtner, O. K. Wagner.

TS02 - EXPERIMENTAL ROCK MECHANICS I (LABORATORY)

14:00 - 15:30 | MARFIM 3

14:00 - 14:15
14291 - Statistical characterization of shale microstructures: determination of Representative Elementary Area. P. Cosenza, D. Prêt, S. Hédan, A. L. Fauchille.

14:15 - 14:30
14328 - Advanced triaxial testing of fault rocks. E. Pimentel.

14:30 - 14:45
14342 - Significance of large-scale in-situ triaxial tests for validation of sophisticated numerical models. K. Tani.

14:45 - 15:00
14460 - Shear behavior of rock mass containing non-persistent joints. S. Fereshtenejad, J.-J. Song.

15:00 - 15:15
14601 - On the selection of the most appropriate methods to characterize the shear strength of discontinuities. J. López-Molilna, V. Castellanos-Pedroza, S. Herrera-Castañeda, E. Montiel-Gutierréz.

15:15 - 15:30
14622 - Experimental study on water injection in rock fractures under critical state. Z. Dou, D. Shang, Z. Zhao, T. Gao, J. Li, Q. Yang.

TS03 - ROCK MECHANICS FOR NUCLEAR WASTE DISPOSAL

14:00 - 15:30 | MARFIM 4

14:00 - 14:15
13899 - Site characterization for the Beishan underground research laboratory for geological disposal of high-level radioactive waste in China. J. Wang, R. Su, X. Zhao, L. Chen, H. Zhao.

14:15 - 14:30
13912 - Application on technology of detecting groundwater seepage field in preselected area for high-level radioactive waste disposal. J. Fan, X. Li, G. Du, J. Wang.

14:30 - 14:45
14072 - TBM performance prediction of Underground Research Laboratory of geological disposal of high-level radioactive waste. H. Ma, J. Wang, K. Man, L. Chen, X. Zhao, Q. Gong.

14:45 - 15:00
14775 - Design implications of retrievability in HLW geological repositories. J. Stahlmann, V. Mintzlaff, R. P. L. Léon-Vargas, I. Epkenhans.

15:00 - 15:15
15071 - Investigation of the influence of different drying methods on the microstructure of bentonite. H. Sun, D. Mašín, J. Najser.

15:15 - 15:30
15116 - Cement-rock interface subjected to scCO2.
J. C. Barría, D. Manzanal, C. M. Martín, T. Piqué, J. M. Pereira.

TS04 - FRACTURE AND DYNAMIC BEHAVIOR I

14:00 - 15:30 | MARFIM 5/6

14:00 - 14:15
13680 - An experimental study on the fracability evaluation of hot dry rock: using an integrated thermo-mechanical model.
D. Wang, B. Yu, H. Qin, X. Yan, W. Cheng, Q. Liu, D. Han, L. Yang.

14:15 - 14:30
14083 - Fracturing of migmatite: influence of anisotropy. M. Petruzalek, T. Lokajicek, T. Svitek, Z. Jechumtalova, P. Kolar, J. Sileny.

14:30 - 14:45
14473 - Reactivation of major faults during strong rock bursts as realization of tectonic process. A. Batugin.

14:45 - 15:00
14480 - Characterization of dynamic behavior of NPR bolt based on stress wave theory and SHTB/weight-dropping tests.
W. L. Gong, Y. Sun, B. Lv, M. He, D. Zhu.

15:00 - 15:15
14127 - Experimental investigation on the fluid flow characteristics of 3D-printed single fractures with various fractal dimension.
J. Xie, M. Gao, R. Zhang, L. Ren, Z. Zhang, C. Li, Z. He.

15:15 - 15:30
14594 - KIC measurement of rocks using a pseudo-compact tension (pCT) test. A. Muñoz-Ibáñez, J. Delgado-Martín, M. Costas-Piñó, J. Rabuñal-Dopico, J. Alvarellos-Iglesias, J. Canal-Vila.

TS05 - NUMERICAL MODELLING I (FRACTURE MECHANICS)

16:00 - 17:30 | MARFIM 1/2

16:00 - 16:15
14111 - Simulating laboratory-scale damage in granite using Bonded Block Models (BBM). S. Sinha, G. Walton.

16:15 - 16:30
14262 - DEM modeling of hydraulic fracturing with supercritical carbon dioxide. M. Li., F. Zhang.

16:30 - 16:45
14264 - Displacement based XFEM for fractured porous media with intersecting discontinuities under dynamic load. Y. K. Gujjala, D. Deb.

16:45 - 17:00
14452 - Analysis of crack propagation for Brazilian split test based on energy entropy. C. Xu, X. Liu, E. Wang, S. Wang.

17:00 - 17:15
14499 - Coupled X-FEM approach to reproduce the mechanics due to direct fluid injection into a natural in-situ fault. A. K. Schwartzkopff, A. Sainoki.

17:15 - 17:30
14685 - Cement grout propagation in 2D fracture networks: impact of rheology. L. Zou, U. Håkansson, V. Cvetkovic.

TS06 - ROCK MASS CHARACTERIZATION
16:00 - 17:30 | MARFIM 3

16:00 - 16:15
13591 - GSI adjustments for directional Hoek-Brown strength quantified by case studies. N. Baczynski.

16:15 - 16:30
14356 - A suggested visual approach for estimating Hoek-Brown mi for different rock types. T. G. Carter.

16:30 - 16:45
14395 - Tunnelling and karst systems: a review. M. Coli, L. Piccini, M. Muscedra.

16:45 - 17:00
14400 - Application of the V-GSI system for assessments of rock mass quality and parameters. J. Sutton, P. Schlotfeldt.

17:00 - 17:15
14447 - Q-system classification applied to geotechnical-structural domain mapping. J. E. F. Ramires, G. A. P. Batista, J. H. Silva, M. P. Campos, J. Seery.

17:15 - 17:30
14830 - Correlation between geotechnical logging from borehole and mapping at Cuiabá mine. J. P. B. Amaral, R. S. Pereira, R. C. Padula.

TS07 - SEISMIC BEHAVIOR OF ROCK MASSES
16:00 - 17:30 | MARFIM 4

16:00 - 16:15
14145 - Microseismic monitoring using distributed optical fiber sensing techniques – An opportunity for coal burst risk management. X. Luo, L. Ricard, J. Duan, M. V. Werken.

16:15 - 16:30
14394 - Field monitoring seismic response of underground excavations and rock bolts at Kiirunavaara underground mine. P. Zhang, A. H. Botelho, S. Dineva, E. Nordlund, B. Woldemedhin.

16:30 - 16:45
14662 - In-situ stress constraints on the focal mechanisms of induced seismicity. Y. Mukuhira, T. Ito, M. C. Fehler, M. Naoi, H. Moriya, H. Asanuma, M. O. Häring.

16:45 - 17:00
14820 - Improving the quality and quantity of geotechnical core logging data. K. Esmaieli.

17:00 - 17:15
14898 - Seismic identification of magmatic rocks in sedimentary basin: some implication for geomechanics studies. J. N. Cruz, N. C. Ferreira, V. R. Marchesi, J. O. Peixoto, M. C. B. Machado, D. L. P. Domingues, S. A. B. Fontoura, R. Dias, C. J. C. Gonçalves.

17:15 - 17:30
14952 - Rock mechanical analyses of seismic events in a deep coal mine in Germany during flooding. M. Alber, T. Backers, R. Fritschen, T. Neuffer.

TS08 - ROCK SLOPE ENGINEERING I
16:00 - 17:30 | MARFIM 5/6

16:00 - 16:15
13879 - The Q-Slope Method for Rock Slope Engineering in Faulted Rocks and Fault Zones. N. Barton, N. Bar.

16:15 - 16:30
14101 - Stability analysis of over-tilted benches in an ornamental granite quarry. L. R. Alejano, X. Estévez-Ventosa, I. Pérez-Rey, J. González.

16:30 - 16:45
14208 - Probabilistic stability analysis of open pit rock slopes using numerical modelling. M. Abdulai, M. Sharifzadeh.

16:45 - 17:00
14217 - A new method for Predicting of rock fall from the tunnel face. H. Tobe, Y. Miyajima, S. Shirasagi, T. Yamamoto.

17:00 - 17:15
14265 - A discussion of strength reduction techniques in safety analysis with DEM models. J. Muralha, J. V. Lemos.

17:15 - 17:30
15036 - Drone imagery for the acquisition and assessment of rock fall areas. A. Gaich, M. Poetsch, B. Rieder, W. Schubert.

SPECIAL SESSIONS 17TH SEPTEMBER

SS01 - AI IN ROCK MECHANICS
10:00 - 11:00 | MARFIM 1/2

10:00 - 10:20
14599 - Comparison of Bayesian Belief Networks and Artificial Neural Networks for prediction of tunnel ground class. J. Morgenroth, E. Snieder, M. Perras, U. Khan.

10:20 - 10:40
14740 - Neural networks and virtual reality for geo-data solutions. S. Garcia, P. Trejo, J. López-Molina, V. Castellanos-Pedroza.

10:40 - 11:00
15073 - Comparison of artificial neural networks for TBM data classification.G. Erharter, T. Marcher, C. Reinhold.

SS02 - ROCK FRACTURE MECHANICS
10:00 - 11:00 | MARFIM 3

10:00 - 10:20
14220 - Fatigue hydraulic fracturing - Concept and applications in hard rock. A. Zang, S. Von Specht, P. Niemz, O. Stephansson, G. Zimmermann.

10:20 - 10:40
14338 - Dynamic shear tests on rock discontinuities and some considerations. Ö. Aydan.

10:40 - 11:00
15000 - On the significance of recognizing the 3D directionality of fracturing under polyaxial stress states for understanding and modelling the 3D directional dilation of brittle rocks. M. Rahjoo, E. Eberhardt.

SS03 - LABORATORY TESTING
10:00 - 11:00 | MARFIM 4

10:00 - 10:20
14142 - Preliminary in situ stress and fracture characterization in the Bedretto Underground Laboratory, Swiss Alps: implications on hydraulic stimulation. X. Ma, N. G. Doonechaly, M. Hertrich, V. Gischig, G. Klee.

10:20 - 10:40
15015 - Current Laboratory Techniques for Measuring Biot's Coefficient of Rock: A Review. H. A. Kasani.

10:40 - 11:00
15115 - Novel true triaxial apparatus applied to the study of sand mass production under anisotropic stress conditions. L. E. Walle, A. N. Berntsen, E. Papamichos.

SS04 - PHOTOGRAMMETRY APPLICATION
10:00 - 11:00 | MARFIM 5/6

10:00 - 10:20
14698 - Photogrammetry for recording rock surface geometry and fracture characterization. L. Uotinen, M. Janiszewski, A. Baghbanan, E. C. Hernández, J. Oraskari, H. Munukka, M. Szydłowska, M. Rinne.

10:20 - 10:40
14749 - Discontinuity analysis at different scales using DEMs and photogrammetry. M. Brugger, H. Käsling, K. Thuro.

10:40 - 11:00
15043 - Automatic determination of discontinuity areas from photogrammetric 3D models. M. Poetsch, P. Hergan, A. Gaich.

TECHNICAL SESSIONS 17TH SEPTEMBER

TS09 - UNDERGROUND ROCK EXCAVATIONS II (TUNNELLING)
14:00 - 15:30 | MARFIM 1/2

14:00 - 14:15
13618 - Influence of foliation orientation on tunnel behavior. W. Schubert.

14:15 - 14:30
13660 - The gap between lining and ground on pressure tunnels excavated in anisotropic rock mass: Effect on the stress distribution. J. M. Robles, M. M. Menéndez.

14:30 - 14:45
14358 - Leakage potential through a shotcrete lined high pressure headrace tunnel - An analysis on a case from Nepal. K. Panthi, C. B. Basnet.

14:45 - 15:00
14602 - Flexible support intersection between two perpendicular experimental drifts excavated in the Callovo-Oxfordian claystone. H. Djizanne, L.-M. Guayancan-Carrillo, A. Arnould, N. Conil, G. Armand.

15:00 - 15:15
14641 - Consideration of proneness of rocks to strain-bursting through an assessment of elastic parameters. B.-A. Sainsbury, N. Kurucuk.

15:15 - 15:30
14730 - Investigation, design and construction of 5 NATM highway tunnels – Serra do Mar, Brazil. M. A. Cunha, M. S. Paula, C. A. Campanhã, L. F. M. C. Rocha, B. P. Goulart, J. L. Demartini, L. C. Vicente, W. S. Iyomasa, F. S. Santos.

TS10 - EXPERIMENTAL ROCK MECHANICS II (LABORATORY)
14:00 - 15:30 | MARFIM 3

14:00 - 14:15
14649 - Development of an apparatus to track rock fragment trajectory in 3D. D. E. Guccione, K. Thoeni, O. Buzzi, S. Fityus, A. Giacomini.

14:15 - 14:30
14697 - Experiment of true triaxial hydraulic fracturing of deep shale using varying pumping rates. J. Zhou, Y. Guo, X. Chang, L. Wang, H. Wang, L. Hou, L. Zuo, T. Jiang, G. Zhong.

14:30 - 14:45
14704 - Wave velocity measurements in three directions on axially loaded water-saturated granite and gneiss core specimens. L. Jacobsson, G. Kjell, R. Kiuru, J. Suikkanen.

14:45 - 15:00
14809 - An experimental study of dynamic fracture toughness of rocks subjected to hydrostatic. confinement. W. Yao, K. Xia.

15:00 - 15:15
15027 - Innovative and alternative rock mechanics testing methods. T. Stoxreiter, P. Gehwolf, R. Galler.

15:15 - 15:30
15084 - Brittle characteristics of hard rocks and temperature effect on rockbursts under thermo-mechanical coupling. T. B. Li, M. B. Gao, G. Q. Chen, C. Ma, H. S. Pan.

TS11 - ROCK MECHANICS FOR GEOTHERMAL ENERGY
14:00 - 15:30 | MARFIM 4

14:00 - 14:15
14736 - 3D rotation applied to in situ stress fields for 2D numerical modelling, borehole stability and drill core recovery in deep geothermal wells. G. Stockinger, H. Käsling, K. Thuro, F. Menschik.

14:15 - 14:30
14088 - Cyclic hydraulic stimulation design to develop Enhanced Geothermal Systems. G. Zimmermann, H. Hofmann, A. Zang, O. Stephansson, M. Farkas, J. S. Yoon, L. Zhuang, K. Y. Kim, K.-B. Min.

14:30 - 14:45
14137 - Characteristics of altered volcanic rocks in geothermal reservoirs. M. Villeneuve, B. Kennedy, D. Gravley, S. Mordensky, M. Heap, P. Siratovich, L. Wyering, J. Cant.

14:45 - 15:00
14677 - A 3D numerical study of the heating capability loss of reservoir in enhanced geothermal system. Y. Zhang, G. Zhao.

15:00 - 15:15
14733 - Geomechanical investigation of a geothermal aquifer in the South German Molasse Basin. D. Bohnsack, K. Zosseder, M. Potten, H. Käsling, K. Thuro.

15:15 - 15:30
15032 - 3D numerical analysis using a coupled geomechanics and fluid-heat flow model for heat extraction from enhanced geothermal reservoirs. S. Li, X.-T. Feng, Z. Pan.

TS12 - CASE HISTORIES I (MINING ENGINEERING)
14:00 - 15:30 | MARFIM 5/6

14:00 - 14:15
13848 - Draw point behavior in LKAB's SLC mines. A. Gustafson, H. Schunnesson, K. Jonsson.

14:15 - 14:30
14307 - Seismic hazard assessment at Cuiabá Mine. C. Dominoni, S. A. B. Fontoura, D. C.-Potvin, R. F. Cota.

14:30 - 14:45
14644 - Risk analysis of limestone open pit mine slope stability in rembang district, Central Java, Indonesia. M. A. Azizi, I. Marwanza, N. A. Hartanti, A. Anugrahadi.

14:45 - 15:00
14646 - Assessment of surface subsidence hazard using strength reduction method: A case study of a limestone mine. B. K. Jeon, H. Y. Jeong, S. D. Lee, S. W. Jeon, W.-K. Song.

15:00 - 15:15
14709 - Deep shaft sinking through limestone, mudstone, and halite. S. Pollak, T. Mahoney, G. Capes.

15:15 - 15:30
14788 - Consequences of leaving large pillars at depth and in a high stress environment. S. Singh, D. Nokane, W. J. Gouws.

TS13 - FRACTURE AND DYNAMIC BEHAVIOR II
16:00 - 17:30 | MARFIM 1/2

16:00 - 16:15
14132 - Failure mechanisms under triaxial non-proportional loading of rocks on the basis of acoustic emission measurements. V. Karev, Y. Kovalenko, K. Ustinov, I. Panteleev, A. Zaitsev.

16:15 - 16:30
14178 - Fracture potential-based multi-staged hydraulic fracturing design in tight oil reservoirs. K. Zhang, Y. Su, W. Wang, L. Fan, J. Xu.

16:30 - 16:45
14234 - Forecasting hydraulic fracture geometry using an artificial neural network. B. T. Silveira, E. C. M. Sanchez, R. G. Escobar, D. Roehl.

16:45 - 17:00
14282 - Damage evolution characteristics of rock under confining pressure and repeated blasting. C. He, J. Yangjun.

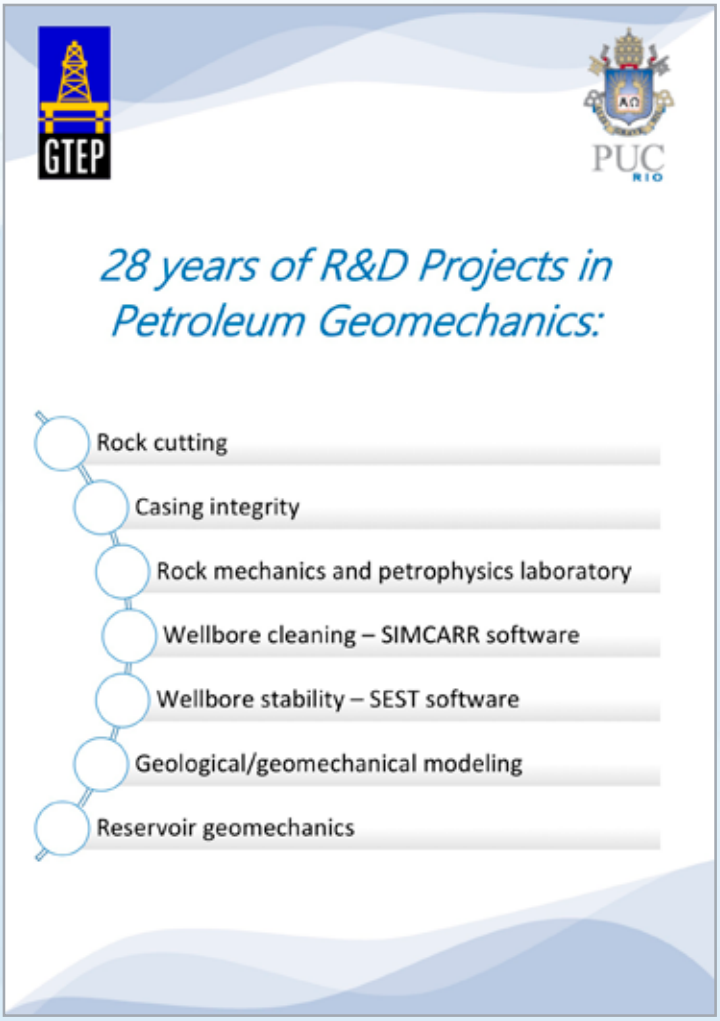
17:00 - 17:15
14448 - The relationship between fracture toughness and confining pressure. G. Gao, C. Wang, P. Wang, R. Yang.

17:15 - 17:30
15102 - Connectivity and permeability for rock fracture network in both radial and unidirectional flow configurations. Z. Wang, W. Li, L. Qiao.

TS14 - NUMERICAL MODELLING II
16:00 - 17:30 | MARFIM 3

16:00 - 16:15
15113 - Effect of crushing on rock avalanches: constitutive approach. D. Manzanal, M. Pastor, M. Martin Stickle, A. Longo, S. Sanavia.

16:15 - 16:30
14850 - CFD-DEM simulation of solids production in unconsolidated reservoirs. G. W. C. Branco, R. Q. Velloso, A. Zhemchuzhnikov.



16:30 - 16:45
14859 - Application of the node-centric indirect boundary element method to 3D multi-material rock problems. S. Moallemi, T. Yacoub, J. Curran.

16:45 - 17:00
14923 - The importance of geometric dilation in response to brittle rock failure for support design in high stress environments. E. Eberhardt, T. Lavoie, M. Rahjoo.

17:00 - 17:15
14944 - The brittle to ductile behavior of “hard soil and soft rock” – experimental review and challenges for constitutive modelling. S. Stauder, T. Marcher.

17:15 - 17:30
14422 - Modeling the Japan Trench fault instability by FEA with cohesive joint elements. K. Ahn, A. Pouya.

TS15 - INSTRUMENTATIONS AND MONITORING I
16:00 - 17:30 | MARFIM 4

16:00 - 16:15
13326 - The use of open-source hardware and software in low-cost geotechnical sensors: a strain-gauge logger and a tilt-test machine. M. M. Menéndez, I. P. Rey, L. R. Alejano.

16:15 - 16:30
14112 - Prediction of tunnel crown settlement by means of inclination monitoring. K. Sakai, T. Tani, T. Aoki, H. Ohtsu.

16:30 - 16:45
14121 - Precision evaluation for convergence and settlement measures in tunnels. M. Hamze-Guilart, L. A. A. Silva, A. L. M. A. Silva.

16:45 - 17:00
14152 - Rock mass behavior in deep mines: in situ monitoring and numerical modelling. F. De Santis, V. Renaud, Y. Gunzburger, I. Contrucci, P. Bernard.

17:00 - 17:15
14280 - Method for monitoring of pore pressure in jointed rock mass of an unlined headrace tunnel subjected to varying power plant operation: A case study. B. Neupane, K. Panthi, K. Vereide.

17:15 - 17:30
14916 - Quality control of support system in hard rock mines. P. F. S. Resende, G. A. P. Batista, A. S. Carvalho, J. H. Silva, J. E. F. Ramires, B. R. F. Araújo, G. R. Ribeiro, A. A. Gontijo, A. R. Matos.

TS16 - HARD AND WEAK ROCKS BEHAVIOR
16:00 - 17:30 | MARFIM 5/6

16:00 - 16:15
14094 - Anisotropic deformation characteristics of soft mudstone via measuring full strain tensor components during triaxial compression. Y. Togashi, M. Kikumoto, K. Tani, K. Hosoda, K. Ogawa.

16:15 - 16:30
14272 - The importance of barrier pillars in controlling load transfer and seismicity in us burst-prone mines. H. Maleki, B. Jaramillo.

16:30 - 16:45
14361 - Long-term and short-term uniaxial strength of the Belencito claystone in unsaturated conditions. M. Espitia, B. Caicedo, L. Vallejo.

16:45 - 17:00
14370 - Importance of structural geology in weak rocks failure mechanisms comprehension - 3 open pit mine case studies. L. A. Sala, M. P. P. Melo, E. A. G. Marques.

17:00 - 17:15
14608 - Progressive failure due to tunnel misalignment with geostatic principal stresses. O. P. M. Vitali, T. B. Celestino, A. Bobet.

17:15 - 17:30
15068 - Highest mountains suggest strong curvature of shear strength envelopes for rock. M. Singh, N. Barton.

SPECIAL SESSIONS 18TH SEPTEMBER

SS05 - MODELLING FOR MINING APPLICATIONS
10:00 - 11:00 | MARFIM 1/2

10:00 - 10:20
14107 - Simplified methods of geomechanical analysis for small-scale underground mining. A. D. Lorenzo, A. Pasqua, M. Cardu, A. Godio, J. Seccatore.

10:20 - 10:40
14267 - A limit equilibrium model to simulate the effect of pillar geometry. J. Maritz, D. F. Malan.

10:40 - 11:00
14331 - The Effect of Rock Mass Damage on Strength Degradation in Large Open Pits. D. Potyondy, L. Lorig, M. Purvance.

SS06 - ROCKFALL
10:00 - 11:00 | MARFIM 3

10:00 - 10:20
14263 - Discrete element simulations of punch tests for the mechanical characterization of cortical meshes. F. Gabrieli, A. Pol, N. Mazzon, M. Deana.

10:20 - 10:40
14449 - Experimental study of reinforced soil bunds subjected to horizontal impact. O. Korini, M. Bost, J.-P. Rajot, Y. B. Braouli, N. Freitag.

10:40 - 11:00
14994 - New rockfall testing method of flexible rockfall barriers. C. Wendeler, A. Lanter, G. Lu, A. Caviezel, A. Ringenbach, P. Bartelt.

SS07 - FIELD TESTING
10:00 - 11:00 | MARFIM 4

10:00 - 10:20
14080 - Updated in situ rock stresses in Norway based on recent estimations and measurements. A. Simonsen, C. Li.

10:20 - 10:40
14453 - Potential applications of multi-sensor remote sensing in rock mass characterisation. D. Donati, D. Stead.

10:40 - 11:00
14547 - Distribution of structural planes and its influence on brittle failure in China Jinping Underground Laboratory Phase II. H. Xu, X.-T. Feng.

SS08 - WEAK ROCKS
10:00 - 11:00 | MARFIM 5/6

10:00 - 10:30
Latest progress on weak rocks. He Manchao

10:30 - 11:00
Properties and characteristics of weak rocks. Milton Kanji

TECHNICAL SESSIONS 18TH SEPTEMBER

TS17 NUMERICAL MODELLING III
11:30 - 13:00 | MARFIM 1/2

11:30 - 11:45
14159 - Understanding the instability mechanisms of chalk mines in presence of water (France). V. Renaud, A. Cherkaoui, J.-M. Watelet, P. Gombert, C. Kreziak.

11:45 - 12:00
14335 - Prediction of grout take in rock grouting using data mining. Q. Liu, Z. Zhao, F. Xiao.

12:00 - 12:15
14366 - Numerical modelling of thermal drilling of rock by heating-cooling cycle. M. Pressacco, T. Saksala.

12:15 - 12:30
14476 - Establishing a stepwise verification and upscaling process for modelling brittle failure in rock using the fdem method. S. Markus, M. Diederichs, I. Vazaios.

12:30 - 12:45
14669 - 3D numerical modeling of rock cutting experiments under confining pressure through discrete element method. N. Gonze, F. Descamps, J.-P. Tshibangu.

12:45 - 13:00
14948 - Geomechanical modeling of mudrock stress-level dependency and application to a salt-sediment system. M. Nikolinakou, M. Heidari, P. Flemings, M. Hudec.

TS18 - INSTRUMENTATIONS AND MONITORING II
11:30 - 13:00 | MARFIM 3

11:30 - 11:45
13883 - Managing the Deforming of Ground Support and Reinforcement. E. Jones, E. Hancock.

11:45 - 12:00
14336 - Creation of rock mass monitoring deformations systems on rock burst hazardous mineral deposits. K. Morozov.

12:00 - 12:15
14357 - In-situ assessment of distributed strain and curvature characteristics in shotcrete tunnel linings based on fiber optic strain sensing. C. M. Monsberger, W. Lienhart, A. Kluckner, W. Schubert.

12:15 - 12:30
14367 - On-site applications of innovative tools for deformation monitoring in underground excavations. A. Carri, A. Valletta, A. Segalini, R. Savi.

12:30 - 12:45
14411 - Long-term stability monitoring of underground cavern using geotechnical instrumentation - A case study. K. Sudhakar, S. R. Naik.

12:45 - 13:00
14575 - Velocity amplification of obliquely incident S-wave through parallel fractures near a free-surface. A. H. Botelho, P. Zhang, S. Dineva, E. Nordlund.

TS19 - EXPERIMENTAL ROCK MECHANICS III (LABORATORY)
11:30 - 13:00 | MARFIM 4

11:30 - 11:45
14929 - On extraction-induced microcracking in aggregates. E. Hamdi, S. Ezzeiri, S. Omrani, Z. Lafhaj, K. Jeridi.

11:45 - 12:00
13898 - Thermal conductivity characteristics of thermally treated Beishan granite under uniaxial compression condition. X. Zhao, J. Wang, P. F. Li, Z. Zhao, H. R. Xu, M. Cai.

12:00 - 12:15
14084 - A new approach of the Cerchar abrasiveness test to predict the wear of TBM's disc cutter. G. R. Piazzetta, G. Pintaude.

12:15 - 12:30
14141 - Correlations between geomechanical and physical properties for amphibolites and schists from south of Minas Gerais state, Brazil. K. S. Rezende, E. A. G. Marques.

12:30 - 12:45
14158 - Geometrical and mechanical characterization of 3D-printed rock joints. J. Jaber, M. Conin, O. Deck, C. Grandclaude, M. Moumni, C. Auvray, O. Godard, S. Kenzari.

12:45 - 13:00
14279 - Combination of various laboratory tests to investigate rock burst. L. Gottsbacher, A. Klammer, W. Schubert, R. Marschallinger, P. Hofmann, F. Zobl, R. Ketcham, D. Edey.

TS20 - ROCK SLOPE ENGINEERING II
11:30 - 13:00 | MARFIM 5/6

11:30 - 11:45
14273 - Effect of pH on the geomechanical properties in slopes in open pit mine – A case study in the Peruvian Andes. C. J. Barriga, E. L. Pereira, H. M. Lima.

11:45 - 12:00
14355 - Global characterization of high rock slopes using the Hoek-Brown mb parameter as controlling index. T. G. Carter, C. Carranza-Torres.

12:00 - 12:15
14782 - Slope stability in heterogeneous rock masses with a block-in-matrix fabric. M. L. Napoli, M. Barbero, C. S. C. Scavia.

12:15 - 12:30
14947 - Q-Slope and RHRS for the evaluation of highway rock slopes – Serra do Mar, Brazil. M. S. Paula, A. V. Maion, G. A. Campanha, L. M. N. Castilho, M. A. Cunha.

12:30 - 12:45
15064 - Slope stability assessment and slope optimization at Letseng Diamond Mine, Lesotho. N. Lefu, L. Lorig.

12:45 - 13:00
15069 - Dynamic Stability of Mine Slopes due to Bench Blasting. S. H. Prassetyo, G. M. Simangunsong, A. Sadikin.

TS21 - ROCK MECHANICS I (INTERDISCIPLINARY)
11:30 - 13:00 | CATARATAS 1

11:30 - 11:45
14144 - Methodology to Predict and Reduce the Unplanned Dilution in Narrow Vein Underground Mines. Case Study: Córrego do Sítio Mine - Santa Bárbara - MG, Brazil. L. C. B. Costa, R. P. Figueiredo.

11:45 - 12:00
14470 - Analysis of propagation and attenuation characteristics of stress wave in sandstone with small shock disturbance. Z. Song, Y. Cheng, J. Jin.

12:00 - 12:15
14590 - Experimental investigation on the size effects of KIC in selected rock types. A. Muñoz-Ibáñez, J. Delgado-Martín.

12:15 - 12:30
14287 - In situ application of Schmidt hammer test on a coal face with large-scale. M. Mesutoğlu, I. Ozkan.

12:30 - 12:45
14192 - Visco-elastic-plastic solutions for tunneling and corresponding support measures in squeezing rock with different rheological constitutive models. C.-C. Xia, C. Xu, Y.-P. Liu, C.-L. Han.

12:45 - 13:00
14562 - Assessment of coal pillar behaviour at great depth using field monitoring and numerical models. S. Ram, P. Waclawik, J. Nemcik, A. Kumar, R. Kukutsch, V. Kajzar.

TS22 - UNDERGROUND ROCK EXCAVATIONS III
14:00 - 15:30 | MARFIM 1/2

14:00 - 14:15
13614 - Deformation measurements of Basal Reef stopes with cemented backfill in South Africa. P. Couto, D. F. Malan.

14:15 - 14:30
14167 - Underground gas production and migration induced by mining subsidence. S. Lafortune, Z. Pokryszka, A. Charmoille.

14:30 - 14:45
14324 - Failure mechanisms developed in rock masses under shallow foundations. A. T. S. Alencar, R. Galindo, S. Melentijevic.

14:45 - 15:00
14585 - Leakage remediation of the right abutment of a concrete face rockfill dam and behavior after five years. J. A. Valencia-Quintanar, J. A. López-Molina, V. Castellanos-Pedroza, J. Alemán-Velásquez.

15:00 - 15:15
14689 - Stability evaluation and safe designing of barriers against rivers in an opencast working - A case study. P. K. Mandal, A. J. Das, S. Tewari, R. Bhattacharjee, L. Kumar, P. K. Singh.

15:15 - 15:30
14931 - Geomechanical substantiation of measures of safety in the process of development of the Southern Hingansk deposit. M. I. Rasskazov, A. V. Rasskazova, M. I. Potapchuk, A. A. Teryoshkin.

TS23 - EXPERIMENTAL ROCK MECHANICS IV (FIELD)
14:00 - 15:30 | MARFIM 3

14:00 - 14:15
13619 - Field testing of weak rock deformation in water tunnels: A practical review of the flatjack test. L. Selen, K. Panthi, L. Tunbridge, T. Schönborn.

14:15 - 14:30
14201 - In-situ swelling pressures in sulphate bearing rocks: findings from field observations. W. Steiner, M. Schwalt.

14:30 - 14:45
14437 - Uncertainty quantification of in situ stress estimations: a Bayesian approach. Y. Feng, J. P. Harrison, N. Bozorgzadeh.

14:45 - 15:00
14559 - Theoretical bandwidth for the measurement of strain waves in borehole tensor strainmeters. J. Tian, K. Zhang, Z. Hu.

15:00 - 15:15
14702 - Long-term experience with stress state determination using CCBO probe in various rock mass. P. Waclawik, L. Stas, K. Soucek, M. Vavro, V. Zajicova.

15:15 - 15:30
15037 - 3D imaging on a hard rock TBM. A. Gaich, M. Poetsch, W. Schubert.

TS24 - PETROLEUM GEOMECHANICS
14:00 - 15:30 | MARFIM 4

14:00 - 14:15
14221 - Near-wellbore geomechanical damage of naturally fractured system due to production-induced stresses. X. A. Rodriguéz, J. G. Osorio.

14:15 - 14:30
14261 - Numerical simulation of slot-shaped breakout in high-porosity sandstone. T. Wang, F. Zhang, Y. Han.

14:30 - 14:45
14318 - A coupled SPH-PD numerical procedure for the analysis of fluid flow through deformable porous media. S. Das, D. Deb, R. Pramanik.

14:45 - 15:00
14799 - Numerical simulations of cascade casing collapse in oil wells due to events in the production stage. J. D. V. Uribe, D. D. E. F. Melo, B. G. Souza Jr, S. A. B. Fontoura, J. L. R. Anjos, L. F. M. Almeida, C. J. C. Gonçalves.

15:00 - 15:15
15075 - Numerical modeling of pore collapse in hydrocarbon reservoirs using the cap plasticity constitutive model. M. Sanei, O. Duran, P. R. Devloo.

15:15 - 15:30
15091 - Effects of Crustal Stress on the Hydraulic Stimulation of Shale Gas Reservoirs. Z. Zhang, X. Li, J. He, G.-F. Li, P. He.

TS25 - CASE HISTORIES II (CIVIL ENGINEERING)
14:00 - 15:30 | MARFIM 5/6

14:00 - 14:15
14664 - Influence of an open-pit quarry on the stability of an underground cavity. F. Descamps, D. Danis, J.-P. Tshibangu, K. Meessen.

14:15 - 14:30
14577 - Geological and hydrogeological characterization for modelling and rock engineering purposes: Case studies from the Äspö Hard Rock Laboratory, Sweden. Å. Fransson, G. Viola.

14:30 - 14:45
14604 - Research on risk of metro foundation pit construction by nonlinear fuzzy comprehensive evaluation model. T. Xu, Z. Song, G. Zhou.

14:45 - 15:00
14663 - The remediation of a rock fall and a landslide at karst edge. V. Jovičić, B. Merhar, S. P. Medved.

15:00 - 15:15
14344 - Long-time monitoring of rock-hewn rock structures in Cappadocia (Turkey) and some environmental effects. R. Ulusay, Ö. Aydan, H. Tano.

15:15 - 15:30
14742 - Neuro-construction of a landslide susceptibility simulator. S. Garcia, P. Trejo, J. López-Molina, A. Valencia-Quintanar, V. Castellanos-Pedroza, V. Paez-Juarez, L. Borjar-Hernández.

TS26 - ROCK MECHANICS II (INTERDISCIPLINARY)
14:00 - 15:30 | CATARATAS 1

14:00 - 14:15
14288 - Estimation of concrete lining thickness for stability of circular mine shafts in different rock masses. İ. Özkan, S. S. Hussaini.

14:15 - 14:30
13627 - On the mechanism of pillar rockbursts induced by dynamic disturbances from blasting. J. Deng, Y. Gong, T. Elsheikh, B. Patel.

14:30 - 14:45
14606 - Application of the Theory of Critical Distances for the fracture prediction of rocks at different temperatures and containing U-shaped notches. J. Justo, J. Castro.

14:45 - 15:00
14722 - Experimental study on energy dissipation of red sandstone soil with different dry densities by SHPB. T. Wang, Z. Song, J. Yang, R. Huo.

15:00 - 15:15
14516 - Failure mechanism and Acoustic Emission characteristic of Beishan granite under true triaxial compression. Y. Zhang, X.-T. Feng, Q. Han, C.-X. Yang, R. Kong, Y. Gao.

15:15 - 15:30
15081 - Study on the blasting perforation process of blast holes in single row under different. confining pressures. X. Zhang, Y. Ji, H. Li, D. Li, H. Wang, H. Zhou.

POSTER SESSIONS
16TH SEPTEMBER | 15:30 - 16:00 | EXHIBITION AREA

CASE HISTORIES AND RISK ASSESSMENT IN ROCK ENGINEERING		
P001	A methodology for semi-quantitative analysis of rockfall hazards and cost-benefit-based mitigation design	R. Ortiz, L. Castro, S. Marambio.
P002	A review study about spatial correlation measurement in rock mass	S. Shokri, M. Shademan, M. Rezvani, B. Cami, T. Yacoub, S. Javankhoshdel.
P003	An accessible implementation of Bayesian data analysis for rock engineering applications	N. Bozorgzadeh, J. P. Harrison.
P004	Application of Quantitative Hazard Assessment System (HAS-Q) in rock mine slopes	T. B. Santos, A. E. M. Santos, M. S. Lana.
P005	Design of foundations on rock of arch type reinforcement in Antahuacana bridge	C. B. C. Peña, C. J. G. Rocha, M. A. Camacho, V. H. A. Iriarte.
P006	Displacement analysis of shallow tunnels by considering spatial variability	H. Mohammdi, E. Mohammadi, S. Moallemi, T. Yacoub, S. Javankhoshdel.
P007	Evaluation of behavior of a longwall entry subjected to the entire process of mining-induced stresses	H. Kang, L. Wu, F. Gao, H. Lv..
P008	Geotechnical Characterization of Methadiabase from Quadrilátero Ferrífero - MG, Brazil	L. C. Marcellino, J. R. F. Galindo, E. A. G. Marques, A. C. N. B. Arêdes, M. F. Leão, C. C. S. Lemos, E. P. S. Ferreira, P. H. F. Duque, D. S. Jaques.
P009	Influence of nearby structures in the design of a road tunnel	O. A. Varde, R. J. Rocca, M. E. Zeballos, R. E. Terzariol.
P010	Investigation of the impact of geodynamic risk on the financial and economic activities of mining enterprises	V. Noskov, S. Tsirel, P. Korchak.
P011	Investigation on the settlement of Yangtze River levee caused by the shield tunneling: a case study in Sutong GIL	Y. Xue, X. Li, F. Kong, D. Qiu, Xianfengtan, Hongshuaizhen, Y. Tao.
P012	Method to Execute Damage Mapping in the Support and Reinforcement of Underground Mines. Case Study: Cuiabá Mine – Sabará, MG/Brazil.	R. C. Padula, L. C. B. Costa, J. P. B. Amaral.
P013	Rockfall risks along highways - A case study in the Serra do Mar mountain range (São Paulo, Brazil)	L. M. N. Castilho, M. S. Paula, G. A. Campanha, M. A. Cunha.
P014	Rockfall Susceptibility: An Estimation Of The Main Factors Using Multivariate Statistics	L. R. C. Silveira, M. S. Lana, T. B. Santos.
P015	Strata Control Problems Encountered and Support Designing in one of the Incline Tunnel while driven in Coal Measure Rocks: A Case Study	M. N. Bagde, A. G. Sangode, J. C. Jhanwar, J. Buragohain, A. Kumar.
P016	Study of a collapse occurred during the reinforcement work of a vault in a chalk quarry located in the north of Paris (France).	A. Hosni, B. Meire, D. Pennequin, N. Gildas.
P017	Tibetan Plateau rock tunnels in permafrost	D. Zhang, J. Harrison.
CHARACTERIZATION OF ROCK MASSES		
P018	Anisotropic Deformation Model of Jointed Rock Mass with Dilatancy	A. Vlasov, D. Vlasov, M. Zertsalov.
P019	Application of geomechanical classification systems in a Brazilian gold mine for estimation of rock mass strength parameters	T. B. Santos, C. O. Rodrigues.
P020	Assessment of the rock mass using the georesistivity method – A case study of the Kovire Tunnel	C. J. Barriga, J. P. Barriga, E. L. Pereira.
P021	Definition of discontinuity sets by cluster analysis: a case study	M. S. Lana, M. A. Silva, J. M. P. Alves, A. M. Klen.

P022	Determination of RQD using GSI applied to Isotropic Igneous Rocks for Bieniawski's RMR	C. Franco, S. S. Salgado, A. F. Amaral Junior, E. A. G. Marques.
P023	Geomechanical Classification weak rocks masses: Application of a modified RMR System to an Open Pit mine	P. R. C. Cella, L. G. Almeida, L. Castro.
P024	Geomechanics Core Logging Validation – Study Case Córrego do Sítio Mine	F. C. Pereira, Y. C. Vilca, T. C. A. Lima, S. S. Chaves, S. V. O. Ribeiro, R. L. P. Canabrava.
P025	Improvement of Rock Mass Basic Quality (BQ) Classification Method	W. Zhao, P. Jia, Y. Chen, C. Li, H. Yang.
P026	Mine Overburden Geomaterial Characterisation Using Digital Image Processing Technique	R. Koner, V. S. Kurre, S. Bose.
P027	Natural caves empirical stability assessments – four empirical methods application to caves in iron-rich lithologies	A. Q. Paula, T. R. Corrêa, C. S. Sebastião, I. V. Brandi, H. M. Lima, R. P. Figueiredo.
P028	Rock fracture characterization and the influence of blasting parameters	A. O. B. F. Magalhães, R. A. Cunha, O. A. Quaglio.
P029	Selection of quasi-homogenous units of rock mass due to engineers classification systems (URF Bukov, Czech Republic)	P. Konicek, K. Soucek, M. Vavro, L. Stas, P. Waclawik, L. Vondrovic, L. Vavro.
P030	SfM-MVS digital models applied to rock surface roughness	C. D. Viana, A. Endlein, C. H. Grohmann, G. A. Campanha, J. P. Monticelli.
P031	Step-Path Method an opportunity to better understand rock masses	N. Baczynski.
FRACTURE AND DYNAMIC BEHAVIOR OF ROCKS		
P032	Analysis of progressive failure process of layered gneiss based on digital speckle correlation method	X. Liu, Y. Zhou, F. Wang, W. Zhang, C. Wang, X. Feng.
P033	Analysis of the influencing factors on b-value of rock acoustic emission	X. Liu, M. Han, X. Li, Z. Liu, T. Ming, W. He.
P034	Brittleness Effect on Acoustic Emission Response of Rocks under Uniaxial Compression Loading	H. R. Nejati, A. Ghazvinian, A. Nazerigivi.
P035	Characteristics of AE quite period of red sandstone under uniaxial compression	K. Zhao, Y. Zhuo, P. Zeng, Q. Li, C. Gong, Z. Huang.
P036	Characterization Of Fracture Toughness And Propagation On Intrusive Basic Rocks From Tamanduá Mine, Minas Gerais State, Brazil	S. A. R. Cerrato, A. C. C. Perim, E. A. G. Marques.
P037	Coupling THMC of Fracture Conductivity of Hydro-Shearing stimulation in Enhanced Geothermal System Development	Y. Xiao, H. Wang, J. Guo, M. Chen.
P038	Cracking across a smooth interface in a rock-model material	D. M. Moura, A. Bobet.
P039	Cracking behaviors of rock-like specimens containing a flaw subjected to dynamic loading: a quantitative analysis	B. Wu, P. Dong, Q. Wang.
P040	Defining the damage variable of sandstone from electrical impedance spectroscopy measurements	X. Qianjun, Y. Duohao.
P041	Determination of effective surface energy of coal samples using methods of uniaxial deformation and small-angle neutron scattering	Vasilenko, A. Kirillov.
P042	Development of a true triaxial device for hydraulic fracturing experiments	J. Delgado-Martín, A. Muñoz-Ibáñez, R. J. Rivera, L. Romera-Rodríguez, L. R. A. Monge, J. Canal-Vila, N. González-Molano, J. Alvarellos-Iglesias, E. López-Puiggene, M. Lakshmikantha.
P043	Effect of microwave irradiation on the dynamic compressive behavior of Fangshan granite	K. Xia, S. Wang, Y. Xu, X. Li, G. Lu, Y. Xu.
P044	Estimating the fracture density in a Cox-Boolean discrete fracture network model	A. Hekmatnejad.
P045	Experimental characterization of dynamic elastic properties of a transversely isotropic clayrock in partially saturated range	D. Grgic, A. Giraud, L. Schoumacker.

P046	Influence of interface inclination on hollow cylinder based on hydro-mechanical coupling	Y. Zhu, X. Liu, E. Wang, J. Zhong.
P047	Influence of strain resolution on experimental correlation between ultrasonic amplitude and surface strains	D. Shirole, G. Walton, A. Hedayat.
P048	Investigation of directional hydraulic fracturing based on deformation reinforcement theory	J. Deng, Q. Yang, Y. Liu, W. Cui, Y. Zhu.
P049	Microcosmic failure features of rock under combined tension-shear stress	S. Li, J. Guo, X. Li, J. He.
P050	Observation of Failure Processes of Rock Containing Elliptical Holes under Compression Based on DIC	D. Li, Q. Zhu, Z. Han, X. Li.
P051	Shock Tests and Some considerations	Ö. Aydan, T. Ito, N. Tokashiki, S. Kodate.
P052	Study on prediction method of shale fracture toughness in southern Sichuan by logging data	C. Shi, X. Liu, L. Liang, X. Wei, J. Xiong.
P053	Study on the attenuation law of blasting pressure and blasting vibration in extra thick coal	X. Wu, F. Cui.
P054	Study on the damage and failure characteristics of shale using micro-focus X-ray computed tomography (μ-CT)	Y. Duan, X. Li, J. He, R. P. Gamage.
P055	The electromagnetic radiation model of rock fracture	L. Peng, W. Pengcheng, W. Cheng, L. Ming.
MECHANICS OF HARD AND WEAK ROCKS		
P056	AE Characteristics on the Energy Dissipation and Liberation of Coal-Rock Mass Failure	P. Shan, X. Lai, X. Chen.
P057	Back analysis (BEM) in hard rock and the implications in further mining layouts	G. A. P. Batista, J. H. Silva, J. E. F. Ramires, M. P. Campos, K. D. Plooy.
P058	Deformation and failure characteristics of hard rocks under true triaxial compression	X.-T. Feng, R. Kong, J. Zhao, H. Xu, Z. Zheng, Y. Gao, W. Zhaofeng.
P059	Diamond wire cutting – Sense of Rock Strength	L. Seppo.
P060	Impact of faults and their mechanical properties on the regional stress field	J. Maury, T. Guillon, A. Blaisonneau.
P061	Influence of Anisotropy on the Swelling Properties of Alentejo Flysch Rocks (Portugal)	A. B. Pinho, I. M. R. Duarte.
P062	Investigation of the mechanical properties of dry, saturated and frozen highly porous limestone	B. Vasarhelyi, M. Davarpanah, A. Török, M. H. Ahmadi.
P063	Modelling the 3D Directional Dilation of Brittle Rocks	D. M. A. Oliveira, M. S. Lana, J. M. P. Alves.
P064	Modification of structural properties of filled soil by the “Geocomposite” method in the base of foundation slab	D. Chunyuk, A. Vlasov, V. Znamensky, E. Morozov.
P065	Role of joint material properties on the apparent cohesion of a gravity dam foundation	A. Rulliere, P. Rivard, L. Peyras, P. Breul.
P066	Roman travertine geomechanical properties	M. G. Benedicto Junior, A. F. Borges, J. H. F. Gaona, E. A. Vargas Júnior, R. Q. Velloso.
P067	The effect of alteration layers on UG2 pillar behaviour in the Bushveld Complex	A. G. Hartzenberg, M. Plessis, D. F. Malan.

POSTER SESSIONS
17TH SEPTEMBER | 11:00 - 11:30 | EXHIBITION AREA

LABORATORY AND FIELD TESTING		
P068	Oedometer testing of swelling gouge materials at different water contents	A. H. Høien, B. Nilsen, R. Olsson.
P069	Analysis Of The Alterability Of Quarry Rock Used In The Alcorlo Rock Fill Dam (Guadalajara, Spain)	J. A. D. Torres.
P070	The estimation of rockburst hazard for hard rocks by the test results below and beyond the compressive strength	N. Kuznetcov, A. Kozyrev, I. Fedotova, A. Shokov.
P071	The Transfer and Lose of Grains with Water Flow in Broken Rock	H. Kong, L. Wang, G. Xu, B. Xu, C. Qiu, D. Zhang.
P072	Small-scale model preliminary testing on the interaction between paste backfills and waste rock barricades	M. Nujaim, T. Belem, C. Auvray.
P073	Distinctions between the failure mechanisms of intact and jointed rocks under compression by acoustic emission technique	Z. Zhang, J. Deng, J. Zhu.
P074	Borehole Geophysics Applied to the Geomechanical Characterization of Fractured Rock Masses	W. Pereira, R. P. Figueiredo.
P075	Laboratory measurements and numerical investigations of thermally-induced and gas-pressure driven fractures in rock salt	L. Siemann, B. Leuger, D. Zapf.
P076	Influence of shear velocity on induced micro-seismicity and permeability	A. Giwelli, J. Sarout, J. Dautriat, M. Nogueira Kiewiet, L. Esteban, M. B. Clennell, D. Nguyen, Y. Kovalyshen, S. Banks, D. N. Dewhurst, L. Kiewiet, 0. Kear.
P077	Static and dynamic elastic moduli of Limestone: comparison of results	M. P. Figueiredo, J. C. R. Justen, G. F. Vasquez, M. J. Morschbacher.
P078	Elastic properties of thermally heated Westerly granite under hydrostatic pressure	T. Lokajicek.
P079	ASR study of accelerated mortar bars by ultrasonics and acoustic emission	T. Lokajicek.
P080	Study on the Interaction of 'Rock-Machine' Based on the Newly Developed Whole Process Cerchar Test	S. Li, W. Hou, X. Li, Z. Zhou.
P081	Microbiologically influenced stress corrosion cracking of cable bolts in underground mines	S. Saydam, H. L. Ramandi, H. Chen, S. Wu, A. Crosky, O. Kimyon, M. Manfield.
P082	Multichannel method of reliable precursors of failure define	V. V. Makarov, M. A. Guzev, A. M. Golosov.
P083	Experimental study of gneiss elastic anisotropy	T. Lokajicek.
P084	Abrasive WJ cutting: Effect of rock properties on kerf production energy	P. B. Arab, T. B. Celestino.
P085	Contribution to the knowledge of the alterability of the ardosifer schists of the Poio quarries, Foz Côa, Portugal	L. M. F. Gomes, C. R. V. Batalha, L. J. A. Pais.
P086	Performance analysis between drilling machines- models CAT MD6420 (rotatory drill) and ATLAS COPCO T4BH (Rotary-percussion drill) – in different lithology.	F. G. Costa.
P087	Long term behavior of a chalk: effect of relative humidity and flooding	M. Souley, C. Auvray, N. Lafrance, J.-M. Watelet, R. Vincent.
P088	Form study of coarse aggregates of geological domains using distinct tests	A. H. Back, E. Z. Porto, R. J. B. Pinheiro, A. V. Nummer, T. R. Sanguebuche, A. V. Sagrilo, P. T. Pascoal.
P089	Pull-out creep lab test for rock bolts embedded in soft rock-like material	N. Montero, R. A. G. Aires, C. O. Marañón, M. M. Menéndez.
P090	Ageing of cement grouted joint by water and acidic flows for assesing dam foundation quality	N. Néron, P. Rivard, M. Quirion.

P091	Shear strength of rock-concrete interface via direct shear test – a data compile	V. O. S. Vizini, M. M. Futai.
P092	Cover systems analysis in decommissioned gold mines to reduce acid drainage	T. S. C. Souza, C. A. Lima, L. E. Assis, E. A. G. Marques, S. J. M. C. Menezes.
P093	Hydraulic fracturing and In Situ Stress in the Cachoeira Mine, Caetité-BA, Brazil.	L. A. Rocha, R. P. Figueiredo, F. S. Magalhães, A. F. Amaral.
P094	Compaction banding in triaxial experiments on a high porosity limestone	Y. Abdallah, J. Sulem, M. Bornert, S. Ghabezloo, I. Stefanou.
P095	Investigation on the influence of the acid on the rock mechanical parameters of carbonate reservoir	G. Kepan, L. Xiang-Jun, L. Li-Xi.
P096	Energy characteristics of sandstone failure process under true triaxial loads	D. Li.
P097	Failure characteristics and mechanisms of Jinping marble under true triaxial compression under low σ3	Z. Zheng, X.-T. Feng, S. Li, C.-X. Yang.
P098	Parametric studies of cable bolts using a modified Short Encapsulation Pull-out Test	D. Li, S. Saydam, P. Hagan, H. Masoumi.
P099	Experimental study on the effects of large single-joints on Oya tuff pillar strength	T. K. M. Dintwe, T. Seiki, O. Aydan, N. Tokashiki, H. Shimada.
P100	Pressure dependent dynamic elastic properties of anisotropic rocks	W. Li, X.-J. Liu, L.-X. Liang.
P101	Stress Level Dependence of Brittleness in Marbles	Z. Wang, X.-T. Feng, Y. Zhou, Y. Gao.
P102	Tensile mechanical properties of the flexible bent rockbolt and its application in the deep roadway	B. Wang, Z. Guo, T. Feng, W. Wang, Y. Ning.
P103	Abrasion tests combined with accelerated alteration cycles in different rock materials for railway ballast	R. S. Santos, R. P. Ribeiro, A. B. Paraguassu, J. A. C. Neto, G. C. Xavier, M. J. Remedio.
P104	Experimental study on flexible supporting high-stress broken roadway and micro-seismic monitoring	S. Huayou, Y. Ning, C. Haiyan, S. Li.
P105	Experimental investigation and field application of deep hard rock fragmentation using conical pick	S. Wang, H. Linqi, J. Du, X. Li.
P106	Investigation of the Mechanisms of Stick-Slip Behaviour in Smooth Granite Joints	M. T. A. Labeid, W. Dossett, M. Diederichs, J. J. Day.
P107	In-situ tracer experiment at underground research laboratory in Japan	Y. Tanaka, T. Uda, S. Nohara, S. Okamoto.
P108	Point load test database of the Republic of Macedonia, statistical overview and regression analyses	I. Peshevski, M. Jovanovski, D. Velinov.
P109	Inter relationship between shear parameter & resistivity for different rock matrix's using artificial neural network (ANN)	S. Manish, P. Sudani.
P110	Experimental Study of the Shear Behaviour of a Rough Discontinuity Infilled by Different Minerals	M. Jeffery, S. Fityus, J. Delahunty, A. Giacomini.
P111	Analysis of rock mechanical strength tests of deposits in Rio Grande do Sul	T. R. Sanguebuche, A. H. Back, R. J. B. Pinheiro, A. V. Nummer.
P112	Experimental investigation of the grout-bolt interface behavior by optical fiber	M. Bost, D.-A. Ho, A. Khadour.
P113	Mechanic Characterization of Gneiss Weathering Materials from Southeast Brazil.	L. C. Marcellino, E. A. G. Marques, J. R. F. Galindo, D. S. Jaques, M. F. Leão, C. C. S. Lemos, E. P. S. Ferreira, P. H. F. Duque, R. R. Baggieri.
P114	Rational design of waste rock (muck) barricades (WRBs) as paste backfill-retaining structures	T. Belem, M. Mbonimpa, L.-P. Gélinas, J. Alcott, D. Dallaire.
P115	Evaluation procedure of rock degradation by wet and dry cycles.	H. B. Justi, J. L. E. D. Filho, P. C. A. Maia.
P116	Comparative analysis between capping types used in the cylindrical test specimens of shotcrete at the Cuiabá Mine.	R. S. Pereira, D. T. Peterle, J. P. B. Amaral.
P117	Comparative analysis of reinforcing fibers from the shotcrete used in the Cuiabá Mine	R. S. Pereira, J. P. B. Amaral, D. T. Peterle.

P118	Iron ore mines blast optimization based on geomechanical information.	L. A. Silva, R. C. Candia, T. A. V. Costa, A. Lubene, D. Mazzinghy, G. V. Gouveia, T. Resende.
P119	Mechanical behavior of clay-rich shale under lateral decompression test with constant mean stress	Z. Liu, C. Zhang, J. Feng, X. Chen, J. Shao.
P120	Statistical validation of dip an d dip direction of discontinuity planes of rock masses, obtained from point clouds acquired with DRONE.	J. Mancera-Alejándrez, E. Villareal-Rubio, S. Marcías-Medrano, A. Hernández-Espriu, J. López-Molina.
P121	In situ pull out test results of double corrosion protected fully grouted rock bolts and analytical predictions	M. H. Aghchai, P. Moarefvand, H. S. Rad.
P122	Grinding or not grinding, that is the question	J. Arzua, J. González, I. E. Varas, L. R. A. Monge, M. C. Vidal.
P123	Research on the influence of Confining Pressure on Nonlinear Dilatancy of Rock	W. Bin, Y. Jianmin, W. Aiqing.
P124	Fracturing under Polyaxial Stress States for Understanding and	I. Buocz, N. Rozgonyi-Boissinot, Á. Török.
P125	Joint orientation measurement application with two advanced systems	Y. Wang.
P126	Modelling the behaviour of oil well cement paste: a challenge spanning from the early age to the hardened state	S. Ghabezloo, M. Samudio, J. Sulem.
P127	Seismic characteristics of micro-tremors of rock block and related slope revealed by physical model experiment	T.-T. Wang, T.-T. Lee, K.-L. Wang, M.-C. Tsao.
P128	Process Management in Brazilian University Laboratories - Autonomy and Competitiveness	M. F. Leão, E. A. G. Marques.
P129	Experimental investigation of the optimum sample geometry for the Luong core tension test	W. Chenghu, G. Gao.

POSTER SESSIONS
17TH SEPTEMBER | 15:30 - 16:00 | EXHIBITION AREA

FOUNDATIONS AND UNDERGROUND EXCAVATIONS		
P130	Effect of bolt configuration on the rock bolt-grout interface behaviour	Y. Yokota, Z. Zhao, W. Nie, J. Shang, K. Date, K. Iwano, Y. Koizumi, Y. Okada.
P131	A new method for cover depth threshold of tunnels in soft rock mass	Z. Hu, J. Lai, C. Wang, H. Lai, Y. Xie, K. Hua, Y. Wang.
P132	Geotechnical solutions depending on the changes of soil parameters	M. Uljarević, B. Grujic, S. Zekan, D. Biorac, L. Palikuća.
P133	The use of fiber reinforced shotcrete as rock support at the Cuiabá mine excavation	V. Monteiro, F. A. Silva, F. B. Pereira, A. R. Silva.
P134	A methodology for assessing rock mass damage in underground mining	A. C. Adoko, M. Zhalel.
P135	Soil-structure Interaction Study of a Building in Reinforced Concrete with Foundation in Rocky Mass in Caruaru, Pernambuco, Brazil	Y. R. P. Santos, M. I. M. C. Bello, A. D. Gusmão.
P136	Effect of boulder blasting on nearby structures of a tunnel being excavated by a TBM	Q. Zhang, Z. Zhang, J. Yang, Y. Liang, S. Bai.
P137	Theoretical and Technological Study Progress of Preventing Dynamic Disasters in Mines	Q. Qi, L. Shu, W. Zheng, H. Li, Y. Li, Y. Pan, S. Liu.
P138	Prediction of Tunnel Closure in Time-Dependent Rock Mass using Grey Verhulst Model	H. U. Chol, I. Y. Kang, K. U. Hong.
P139	Stability Analysis of Free Span in Excavations with Diameter greater than 10 meters – Study Case in the Córrego do Sítio Mine	F. C. Pereira, Y. C. Vilca, T. C. A. Lima, R. L. P. Canabrava, S. S. Chaves.

P140	Analysis Of The Support Of The Incahuasi Tunnel (Bolivia), Despite A Bad Prognostic Of The Geological Profile And The Influence Of The Water On A Soft Rock (Sandstone)	C. C. Martinez.
P141	Landslide triggers of coastal cliff and the influence on highway tunnel – investigations through combined 3D models of slope and tunnel	C. Y. Chu, P. C. Lo, T.-T. Wang.
P142	Poroelastic analysis of tunnel face advance in low permeability anisotropic ground	G. C. L. Maria, J. Sulem, S. Ghabezloo, I. Stefanou.
P143	The influence of the discontinuities on the mining performance	J. H. Silva, G. A. P. Batista, J. E. F. Ramires, A. S. Carvalho, G. R. Ribeiro, P. F. S. Resende, K. D. Plooy.
P144	Behavior of gravity dams built on sedimentary rocks: deformation analysis of Dona Francisca HPP foundation	V. O. Santos, L. A. Bressani, C. S. D. Smirdele, L. F. Tomasi.
P145	Heave of a sports centre on anhydritic claystone formation	A. Ramon, E. Alonso.
P146	Effect of gas flow rate on gas fracturing in Callovo Oxfordian claystone	A. Gilles, R. L. Vaissiere, M. N. Vu, J. Talandier, F. Cornet.
MODELLING AND COMPUTATIONAL ROCK ENGINEERING		
P147	Sobol Sensitivity Analysis Based on the Extended RBSN	L. L. Rasmussen, A. P. Assis, M. M. Farias.
P148	Rock Physics Modeling of Anisotropic Shale and its Application to Geomechanics	S. Vorobiev, B. Cuesta, R. Sonwa.
P149	A Quick Rock Mass Classification Method of NATM Tunnel During Construction Based on Mask R-CNN	Y. Xue, S. Zhang, Y. Cao, H. Shao.
P150	A FEM Study on Bearing Capacity and Safety of Shallow Footings on Slopes for Garhwal Himalayan Region in India	K. Pandit, S. Sarkar, A. Godayal, M. Shazan.
P151	Probabilistic numerical evaluation of the open stope compression failure at the Niobec Mine, Quebec (Canada)	S. Heidarzadeh, A. Saeidi, A. Rouleau.
P152	Numerical tests on the shear behavior of asymmetric single triangular rock joints	M. Huang, C. Xia, C. Ma, D. Zhang, Q. Xu.
P153	On anisotropy of deformational and ultimate properties of poro-elasto-plastic rocks	K. Ustinov, V. Karev.
P154	Thermomechanical numerical analysis of bowing in marble slabs	W. H. Ito, A. M. Ferrero, F. Vagnon, M. R. Migliazza, P. I. B. Queiroz.
P155	A Numerical Study on the Optimization of Rockbolt Support for Flat-Roofed Excavations in Laminated Ground	G. Walton, R. Abousleiman, S. Sinha, A. Crockford.
P156	Cosserat's effect (microstruture) coupled to Biot's poroelasticity in stability of circular openings in rocks	D. M. S. Lopes, R. P. Figueiredo.
P157	Study of pipe jacking method for roadway excavation in deep and complex coal mine environment	X. Ding, Y. Tan, H. Mo, J. Chen.
P158	Side Friction of large diameter steel cylinder simulated using DEM	Y. Shi, X. Ding, R. Chen.
P159	Mechanical Mechanism and Test Verification of Deformation and Failure of Surrounding Rock Caused by Rock Subway Tunnel Construction	X. Zeng, Y. Guangming, Z. Yanhua, Q. Ju, Y. Yingnian, L. Tengchao, C. Cunji.
P160	Numerical Geological Modeling of the Karst System from Lajedo Arapuá, Jandaíra Formation, Potiguar Basin	F. B. Quadros, E. A. Vargas Júnior, F. O. L. Falcão.
P161	Study on the shear behaviour of rock joints using different models of artificial neural networks	A. R. S. Leite, S. A. D. Neto, K. Polemis Júnior, C. M. S. Oliveira.
P162	Computational simulation using solid finite elements with high aspect ratio	B. Maciel, L. L. Alvarez, I. F. Gomes, L. J. N. Guimarães.
P163	Circular Tunnel In A Gradient Elastoplastic Rock Mass	G. Efremidis, H. Chen, C. Qi, E. C. Aifantis, I. Tsagrakis.
P164	Three dimensional numerical modelling of a large cavity formed in an underground complex in a hydropower plant in the Himalayas	R. Bhasin.
P165	Excavation damage zone prediction for deep tunneling based on distinct element approach	N. Dadashzadeh, M. Diederichs.

P166	Methodology to assess rockburst potential and dynamic support design in tunnels by numerical modelling	F. Villalobos, S. Villalobos, L. Aguilera.
P167	Design of shotcrete barricade for paste filled stopes using numerical modelling approach	J. L. Porathur, S. Sekhar, A. K. Mandal, M. Jose, C. P. Verma.
P168	Study on Horizontal and Vertical Seismic Response of Single-Arch and Large-Span Prefabricated Subway Station	P. Ding, T. Lianjin, C. Shi, W. Xiao-Wa, S. Wu, S. Li.
P169	Improved contact model of discrete element method for simulating strain rate effect of rock materials	Z. Yuan, J. Zhou, Z. Guoyan.
P170	Constitutive behavior of rock mass anchored with constant-resistance-large-deformation bolt/cable incorporated with a NPR structure	M. He, W. Gong, Y. Sun.
P171	Study of thermal and mechanical stresses variations on rock caused by laser drilling in high confining pressure with Finite Element Method	M. Ahmadi, A. Dini.
P172	Analysis of backfill stability using the beam theory with the method of numerical simulation	F. Ma, F. Liu, R. Lu, J. Guo.
P173	Insitu blocks and yield dimension stone block size distributions assessment by using 3DEC	R. Bhusan, S. R. Naik, R. Kumar, S. S. Falke, R. V. Gireesh .
P174	Numerical study of the effect of delay timing on blast induced rock damage	A. S. Hashemi, P. Katsabanis.
P175	Using Numerical Model as Tool to Predict the Stability Behavior of a Stope	D. Santana, A. R. Rati, P. L. Oliveira, F. C. Melo.
P176	Simplified method for the Identification of geologic osmotic pressure based on pore pressure and porewater composition	M. Takeda, M. Manaka, K. Ito.
P177	Sill pillars and hangingwall stability charts based on numerical modelling for Cuiabá Mine	L. Pimenta, L. C. B. Costa, R. S. Guzman, L. Lorig, D. Toro.
P178	Thermo-Hydro-Mechanical characterization of Soft Rock from Sillar Zone km 137	D. B. T. Arispe, C. B. C. Peña, G. R. Roca, D. R. Sandoval.
P179	A simplified analytical method to estimate long term concrete lining stress in deep underground galleries	V. Martyniak, F. Emeriault, R. Plassart, F. Laigle.
P180	Three-Dimensional Trajectory Reconstruction of Induced Single Block Rockfall Experiments	A. Ringenbach, A. Caviezel, L. Meier, S. E. Demmel, G. Lu, Y. Bühler, M. Christen, P. Bartelt.
P181	Numerical investigation of massive roof failure in an Underground Coal Mine in Pittsburgh Seam	B. Mishra, R. Sebastian.
P182	Fluid flow simulation in naturally fractured media using interface solid finite elements with high aspect ratio	P. R. Cleto, O. L. Manzoli, H. Fabbri, E. A. Rodrigues, L. A. G. Bitencourt Jr., A. T. Gaiotto Jr..
P183	Parametric analysis for support definition during construction of road tunnels to overcome subjective decisions	A. J. C. Caicedo, J. Carrillo, F. Nanclares.
P184	Geostatistical analyzes applied to estimating geotechnical parameters – Case Study: Córrego do Sítio Mine	Y. C. Vilca, C. E. A. Ortiz, R. L. P. Canabrava, F. C. Pereira, S. S. Chaves, T. C. A. Lima, M. S. Lana.
P185	A simple and efficient 3D clumped particle strategy to model brittle rocks	Y. Ye, K. Thoeni, Y. Zeng, O. Buzzi, A. Giacomini.
P186	Variants of the shear strength reduction method and their impact on the assessment of complex slopes	K. P. Lawrence, M. Yetisir , K. M. Moffitt, J. L. Carvalho.
P187	Excavation simulation and support time study of deep buried double-shield TBM tunnel	Y. Liu, S. K. Hou, Q. Yang, F. Jin, C. Y. Li, P. X. Qin, H. W. Zhou.
P188	A method for applying a variable disturbance factor to Hoek-Brown properties in large open pits	K. Gallant, E. Tasse, P. Matlashewski, K. Lawrence, J. Carvalho.
P189	The Groundwater Impacts of Rock Tunneling Analysis Based on Stochastic Modeling	Y. Li, X. Li, Z. Chen, C.-F. Chang, Y. Rubin.
P190	Subsidence Analysis of Waste Dumps Located inside an Active Caving Crater	C. Cancino, C. Alvarez, P. Gomez, P. Cavieres, R. Jara, C. F. Badilla, J. Millan.
P191	Microplane Damage Model for Rocks and Its Application	X. Chen, Y. Fu, Z. Feng.

POSTER SESSIONS
18TH SEPTEMBER | 11:00 - 11:30 | EXHIBITION AREA

INSTRUMENTATIONS, MONITORING AND SEISMIC BEHAVIOR OF ROCK MASSES		
P192	Analysis of Microseismic Parameters for the Safety of Underground Structures	D.-S. Cheon, K. Jin, C.-O. Kim.
P193	Budgeting for Deformation	E. Hancock, E. Jones.
P194	Dependence of the distribution of seismic events on the location of geological faults	D. Kotikov, S. Tsirel.
P195	Complex approach to the allocation of hazardous areas within the mine field	Y. Zamorkina, M. Belova, A. Popov, A. Shabarov, F. Pellet.
P196	Empirical analysis for ground vibration induced by air decking blasting in a copper mine	R. Cheng, Z. Zhou, X. Cai, D. Ma.
P197	Implementation of "GTSism V1.0" didactic computer program for seismic refraction survey interpretation at Geotechnical Laboratory of Universidad Mayor de San Simón (Bolivia)	C. J. Geronimo, C. B. Camacho, M. A. Camacho.
P198	Study on warping structure of overlying strata and roof comovement effect between two coal bump mines	L. Y. Zhe, Z. S. Kun, P. P. Zhi, W. X. Zhi.
P199	Analysis of rock blasting at an open pit and its influence in the community	A. S. Carvalho, G. A. P. Batista, J. H. Silva, P. F. S. Resende, G. R. Ribeiro.
P200	The Use of Mechanofacies to Characterize the Evaporite Section of Brazilian Basins	D. L. P. Domingues, J. P. Oliveira, N. C. Ferreira, V. R. Marchesi, S. A. B. Fontoura, R. Dias, C. J. C. Gonçalves.
P201	Use of GEM4D in evaluating operational geometry in Open Pit Mining – Case Study: Córrego do Sítio Mine	R. L. P. Canabrava, Y. C. Vilca, S. S. Chaves, T. C. A. Lima, F. C. Pereira.
P202	Slope monitoring by vector of prism displacement	Y. C. Vilca, R. L. P. Canabrava, F. C. Pereira, S. S. Chaves, T. C. A. Lima.
P203	A low-cost terrestrial photogrammetric system for rockfall monitoring and hazard assessment in open-pit mines	A. Giacomini, K. Thoeni, M. Santise, S. Fityus, S. W. Sloan, R. Roncella.
P204	Seismic Analysis of Vibration Induced by Rock Blasting in Underground Mining	A. R. Matos, A. A. Gontijo, L. R. Fonseca, F. B. Pereira, B. B. Frontini, A. R. Rati, L. C. Costa, G. A. Costa.
PETROLEUM AND ENERGY APPLICATIONS		
P205	Developing a rock mechanical coupling study over drilling through hydrate bearing sediments.	Y. Cheng, U. Ansari, Q. Li, Z. Han.
P206	Hydro-geomechanical fields in borehole vicinity and stress-dependent permeability	L. Nazarova, L. Nazarov, N. Golikov.
P207	Acoustic and Mechanics Characteristics Research on Conglomerate	Z. Bao-Wei, L. Xiang-Jun, L. Li-Xi, Z. Wen.
P208	Simulating the effects of transient pore pressure envelop on rock mechanical stresses around horizontal wellbore	Y. Cheng, U. Ansari, Q. Li , Z. Han.
P209	Static versus dynamic elastic moduli of carbonate reservoir rocks during stress cycles	A. Giwelli, J. Sarout, L. Esteban, M. B. Clennell, C. D. Piane, D. N. Dewhurst, L. Kiewiet, S. Firns, S. Kager, F. Falcao, M. N. Kiewiet, 0. Soares.
P210	Geomechanical and flow characterization of deep coal with continued generation of biogenic gas	S. Saurabh, S. Harpalani, R. Pandey.
P211	A Fully Coupled 3D Simulation of Hydraulic Fracture Networks from the Horizontal Wells	D. Kumar, A. Ghassemi.
P212	Heat Transfer with Phase Transition in Geomaterials	L. Wang, Z. Liu.
P213	Modelling of Coal Matrix Deformation and Swelling of Coal Induced by Gas Adsorption	J. Feng, N. Zhao.
P214	Geomechanical Analysis Directed at Basin and Petroleum System Modeling	P. Miranda, E. A. Vargas Júnior, A. Moraes.
P215	On the empirical correlations for pre-salt carbonates – a numerical modeling approach	M. A. M. C. C. Fernandes, G. L. Righetto, S. A. B. Fontoura.

P216	Evaluation of THM long-term behavior in HLW near-field: Gain reliability of future prediction by centrifugal time-accelerated physical model testing	S. Nishimoto.
P217	Numerical simulation of multiple stage hydraulic stimulation in Enhanced Geothermal System	L. Xie, K.-B. Min.
P218	Numerical Investigation of the Hydraulic Fracture Propagation Using the Distinct Element Method	P. He, X. Li, B. Zhang, J. He, Z. Zhabin, T.-Q. Mao, G.-F. Li.
P219	The effect of natural fractures on the hysteresis of stress-dependent permeability in Keshen tight gas reservoirs	H. Qu, F. Zhou, J. Hu, Y. Peng, Y. Zhong, Z. Pan.
P220	Sealing property of the compacted block joint with bentonite particles/powder mixture	H. Zhang, Y. Wang, S. Han, R. Yu, G. Zhou.
P221	Assessment of thermal performance of engineered barrier system made up of Barmer bentonite, India	M. K. Jha, P. K. Gautam, A. K. Verma.
P222	Monitoring and numerical modeling of long-term geothermal heat pump operation	K. Sosna, M. Cerný, H. Semíková, T. Pluhar.
P223	Sensitivity analysis of hydraulic properties of naturally fractured reservoirs	H. B. Assis, P. R. Cleto, R. A. Rodrigues, O. L. Manzoli, C. G. Nogueira.
P224	Characterization of the transversely isotropic behaviour of the Callovo-Oxfordian claystone in thermo-hydro-mechanical experiments	P. Braun, S. Ghabezloo, P. Delage, J. Sulem, N. Conil.
P225	Numerical methodology for mechanical analysis of casing integrity across salt dissolved caverns	D. D. E. F. Melo, S. A. B. Fontoura, J. D. V. Uribe, J. L. R. Anjos, L. F. M. Almeida, C. J. C. Gonçalves.
P226	Simulation of Mixed Mode Hydraulic Fracture Propagation in Shale Gas Reservoirs	Y. Suo, Z. Chen, S. Rahman, H. Yan.
P227	Deformation visualization in oil sand under water injection by using continuous photographic and DIC technique	H. Pang, Y. Jin, J. Dong, Y. Gao, S. Wang, J. Guo.
P228	Fault reactivation and seismicity associated with geologic carbon storage, shale-gas fracturing and geothermal stimulation – Observations from recent modeling studies	J. Rutqvist, A. P. Rinaldi.
ROCK SLOPE ENGINEERING		
P229	Effect of natural thermal cycles on rock slopes stability- study of 2 French sites	M. Gasc-Barbier, V. Merrien-Soukatchoff.
P230	Estimations of Swellex's life of time at Lamego Mine - Sabará/MG	D. R. Lima.
P231	Integration of 3D limit equilibrium models with live deformation monitoring from interferometric radar to identify and manage slope hazards	N. Bar, T. Yacoub, N. Coli, N. Harries, J. Bu, S. Rea, A. Mcquillan, K. Pano, L. Leoni, C. Ryan.
P232	Preliminary analysis of rock slope stability by SMR in Canguçu, RS, Brazil	P. B. Arab, L. Vieira.
P233	Stability Assessment of a Road Cut Slope Using 3D Numerical Simulation – A Case Study	S. Sardana, R. K. Sinha, M. Jaswal, A. K. Verma, T. N. Singh.
P234	Method to determine the Stability of Rock Mass in front of Piles Based on Deep Excavation	Z. Dapeng, H. Lei, Y. Bo, L. Xue.
P235	Development of a dimensioning concept for the flexible rockfall protection solution Attenuator.	H. Hofmann, D. J. Glover, D. D. Wyllie.
P236	Kinematic Analysis of a Kimberlite Slope in the East of the Main Pit at Letšeng Diamond Mine, Lesotho	N. Lefu, E. Hingston.
P237	From creep to rapid sliding: back analysis of the Vajont landslide with the numerical DDA method	J. P. Ibanez, Y. H. Hatzor.
P238	Kinematic Analysis Applied to a Study of Stability from a Brazilian Slope Located at the "Serra do Mar"	M. A. Silva, I. C. Salah, A. M. G. Acevedo, L. B. Passini, A. C. M. Kormann.
P239	Analysis of slope stability in clay mine for industrial purposes	B. G. Duz, A. O. B. F. Magalhães, É. P. Freire.
P240	The use of hig-tensile wire mesh in order to promote active stress field in a Rockmass	F. Gobbi, A. Pereira, N. Stein, B. Denardin, M. Strauss, S. Asakawa, A. Savarius, P. H. Dias, E. França, V. Teles.
P241	Slope stability assessment based on a Digital Outcrop Model: a case-study at Jardim Garcia quarry	C. D. Viana, J. P. Monticelli, C. H. G. Carvalho, M. M. Futai, G. P. B. Garcia, R. W. Albuquerque, P. P. Cacciari.

P242	Using Intelligent Systems for Evaluating the Rock Slope Stability Defined by Unfilled Discontinuities	S. A. D. Neto, G. A. Barreto, Y. M. P. Matos.
P243	Slope stability assessment by using the finite element method: the case study of the Riacho dos Machados Gold Mine, Minas Gerais State, Southern Brazil	D. T. Peterle, M. E. Hartwig, L. R. Lima.
P244	Definition of geological-geotechnical models in slope stability studies applied to road projects in complex geological zones	A. Balbis, J. Cerutti.
P245	Study on Dynamic Soil Pressure Response and Spectrum Characteristics of Micro-piles in Slope	W. Zhixin, W. Honggang, W. Fei, L. Hao, P. Lifang, Z. Jin, X. Xianlong.
P246	Risk analysis based on geotechnical slope behavior in Rio Piracicaba (MG), Brazil	L. E. Assis, C. A. Lima, E. A. G. Marques, S. J. M. C. Menezes.
P247	Numerical analysis of thermomechanical processes in slope stability problems of fractured rock masses	R. N. Almeida, E. A. Vargas Júnior, R. Q. Velloso.
P248	Alto Parana basaltic rock slope stability	J. P. Mendoza, R. C. Alvarez.
P249	Prediction of Failure Mode in Weak Rock Slopes Using Fuzzy Slope Mass Rating	A. G. Yardimci, C. Karpuz.
P250	Effects of Discontinuities and Groundwater on Rock Slope Stability	R. C. Silva, M. Ehrlich, D. P. Costa.
P251	Slope kinematic analysis in mining pits: case-study in São Jorge quarry, Balsa Nova/PR	M. Lima, A. M. G. Acevedo, J. C. Leite, E. Salamuni.
P252	Stability analysis considering water effect for reservoir bank slope based on deformation reinforcement theory	Y. Liu, Z. Wu, O. Yang, W. Wang, Z. He.
P253	Slope stability evaluation in weak rock masses using sensitivity analyses and multivariate statistical techniques	D. A. Menezes, T. B. Santos, M. S. Lana, S. R. C. Carneiro.
P254	Assessment of mine rock slope stability using classification trees	T. B. Santos, M. S. Lana.
P255	On the Estimation of GSI for Weak Rock Masses in Large Pit Slopes	P. R. C. Cella, F. A. Padovani, F. N. Santos.
P256	Amount of fracturing inside rock slopes due to strength variation	A. Alzo'Ubi.

PARALLEL MEETINGS

DATE	TIME	ROOM	COMMITTEE
Sunday 15, 2019	08:30 - 10:30	Marfim 1	Grouting
Sunday 15, 2019	10:30 - 12:30	Marfim 6	Radioactive Waste Disposal
Sunday 15, 2019	08:30 - 10:30	Marfim 2	ISRM South America Council Meeting
Sunday 15, 2019	08:30 - 12:30	Ipê 1	Crustal Stress and Earthquake
Sunday 15, 2019	08:30 - 10:30	Marfim 3	Design Methodology
Sunday 15, 2019	08:30 - 10:30	Araucária	ISRM Asian Council Meeting
Sunday 15, 2019	10:30 - 12:30	Marfim 3	Rock Dynamics
Sunday 15, 2019	08:30 - 12:30	Ipê 2	Preservation of Ancient Sites
Sunday 15, 2019	08:30 - 10:30	Marfim 5	Education
Sunday 15, 2019	10:30 - 12:30	Marfim 5	Testing Methods
Sunday 15, 2019	10:30 - 12:30	Marfim 2	Evolution of Eurocode 7
Sunday 15, 2019	10:30 - 12:30	Araucária	Underground Nuclear Power Plant
Sunday 15, 2019	10:30 - 12:30	Marfim 4	Discontinuous Deformation Analysis - DDA
Sunday 15, 2019	10:30 - 12:30	Marfim 1	Petroleum Geomechanics
Sunday 15, 2019	18:00 - 19:00	Araucária	Elected ISRM Board Meeting
Sunday 15, 2019	08:30 - 10:30	Marfim 2	ISRM South America Council
Monday 16, 2019	14:00 - 17:30	Araucária	ISRM Advisory Board Meeting
Tuesday 17, 2019	17:30 - 18:30	Ipê I	ISRM Europe Council
Wednesday 18, 2019	11:30 - 15:30	Araucária	Elected ISRM Board Meeting

4TH EARLY CAREER FORUM
ISRM EDUCATION FUND

1ST BLOCK - 14:00 - 15:30	ROOM ARAUCÁRIA
14:00 - 14:05	4th ECF Opening Eda Quadros - ISRM President - Brazil
14:00 - 14:30	Rock burst and its control Prof. Manchao He - Chair of the ISRM Education Fund and Vice President of ISRM - China
14:30 - 14:40	A criterion for damage extension around excavated brittle hard rock masses in terms of its convergence in time. Rodolfo Enrique Cabezas González - Chile
14:40 - 14:50	Numerical modeling of rock behavior considering hydromechanical coupling: application in well and reservoir geomechanics Carlos Emmanuel Ribeiro Lautenschläger - Brazil
14:50 - 15:00	The difficulties and solutions of roads under construction in the Bolivian state Omar Andrés Velarde Soruco - Bolivia
15:00 - 15:10	Modelling the behaviour of oil well cement paste: a challenge spanning from the early age to the hardened state Marcos Samudio - Paraguay
15:10 - 15:20	3D Modeling of Potential Risk Zones for Well Drilling Purposes Using Seismic Data Naira Coutinho Ferreira - Brazil
15:20 - 15:30	Questions
15:30 - 16:00	Coffee break

2ND BLOCK - 16:00 - 17:30	ROOM ARAUCÁRIA
16:00 - 16:25	Karl Terzaghi's activity in Croatian karst, rock mechanics and engineering geology. Ivan Vrkljan - Professor of Faculty of Civil Engineering, University of Rijeka – Croatia
16:25 - 16:35	Evaluation of the Seismic Response of the Rock Mass Using a Model of Seismic Aftershocks of the Epidemic Type Fedilberto José Gonzalez Arias - Colombia
16:35 - 16:45	Understanding the behavior of anisotropic rock masses; Numerical evaluation of pillars and caverns roofs by discrete technics Jonathan Jair Soberanis Bello - Mexico
16:45 - 16:55	Determination of alarm levels for an in-pit removal – Open Pit Central Peru Victor Miguel Vergara Lovera - Peru
16:55 - 17:05	Basaltic rock slope stabilization: A case study in the city of Puerto Presidente Franco, Alto Paraná - Paraguay Tatiana Stanichevsky - Paraguay
17:05 - 17:15	Integrating terrestrial laser scanning and discrete fracture networks for tunnel modeling in fractured rock masses - Case study: Monte Seco Tunnel, Brazil. Pedro Pazzoto Cacciari - Brazil
17:15 - 17:25	Questions
17:25 - 17:30	4th ECF closure

ROCKBOWL

WHAT IS ROCKBOWL?

It is a game of questions and answers, in which competing student teams are challenged to answer technical and non-technical questions about rock mechanics.

AWARDS

Each student of the winning team will receive the amount of US$ 1,000. The best player will be awarded a DRONE.

WHO CAN PARTICIPATE?

The competition is open to undergraduate and graduate (MSc and PhD) students from any university, but team members cannot be more than 35 years old.

FUNDING

The RockBowl has an exclusive sponsorship, Geobrugg. As part of the sponsorship, the student teams will be funded with the registration on the ISRM Congress 2019, accommodation during the congress and a food voucher.

QUALIFIERS AND ROUND OF 16s - 15th, September - 20:30 - 00:30, Cataratas 1
QUARTERS OF FINAL - 16th, September - 18:30 - 19:30, Balroom Cataratas
SEMIFINALS AND FINAL - 17th, September, 17:30 - 19:00, Balroom Cataratas

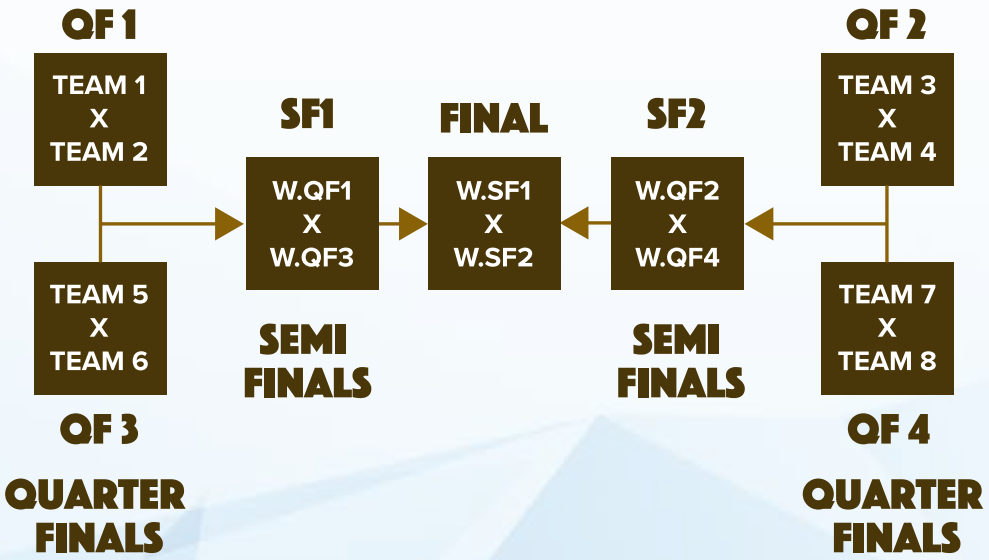
TEAM	UNIVERSITY	COUNTRY	PROFESSOR TUTOR	FULL NAME
EESC-USP	Universidade de São Paulo	Brazil	Tarcisio B. Celestino	Tayra Müller Silva Lopes, Gabriel Ferrara Bilesky, João Gabriel Mercio Xavier Zacarin
The Flysch Team	SEMR	Spain	Mauro M.Menéndez	Ignacio Pérez-Rey, Ana Teresa Santos de Alencar, Andrea Muñoz Ibáñez
University of Cuenca	University of Cuenca	Ecuador	Karla Santacruz	Josseline Vanessa Contreras Duchimaza, María Mercedes Ojeda Muñoz, Diego Andrés Alvarez León
Rock-thu	Tsinghua university	China	Zhihong Zhao	Zihao Dou, Shaokang Hou, Duohao Yin
Rock Rocket	Escuela Militar de Ingenieria	Bolivia	Jaime R. T. Aguilar	Horacio Argote Salinas, Marco A. Schmidt Aliaga, Stephanie Marisol Unzueta Echalar
Team RSA	University of Pretoria	South Africa	Jannie Maritz	Paul Couto, Alida Hartzenberg, Prenolan Naidoo
Andes and rocks	Universidad Nacional de Colombia	Colombia	Alvaro Castro-Caicedo	Simon Acevedo, Luisa Naranjo, Alejandro Arroyave Henao
Queen's Geomechanics	Queen's	Canada	Mark S. Diederichs	Neda Dadashzadeh, Mariem Tahra Ahmed Labeid, Simone Ariela Law Markus
TUM GeoRockz	Technical University of Munich	Germany	Kurosch Thuro	Georg Stockinger, Daniel Bohnsack, Matthias Brugge
Respeita o Grão	Universidade do Vale do Rio dos Sinos	Brazil	Mirtes Caron Peres Ramires	Caroline Nicol, Nicolas Oliveira da Fonseca
Tongji Rockers	Tongji University	China	Wei Wu	Mengli Li, Sen Zhang, Uddin Mohammad Mahtab
The Flintstones	Escuela Militar de Ingenieria	Bolivia	Jaime Rodrigo Tamayo Aguilar	Alexis Adolfo Romero Calle, Valeria Jazmin Gomez, Alcoreza Luis Becerra Suarez
Under Pressure	Federal University of Santa Catarina	Brazil	Murilo da Silva Espíndola	Wellington Sutil de Oliveira, Mateus Zanini Broetto, Vinícius Freire Hickel
PUC - CRACKS	PUC-RIO	Brazil	Professor Pedricto Rocha Filho	Rodman Raul Cordova Rodriguez, Erland Gonzalez Leano, Vitor Guerra Lopes
GeoLed UENF	Univ. Estadual do Norte Fluminense	Brazil	Paulo César de Almeida Maia	Ana Caroline de Assis, Maria Carollina Cordeiro Soares da Silva, André Luiz Marques Junior
UFRJ Rocks	Universidade Federal do Rio de Janeiro	Brazil	Maria do Carmo Reis Cavalcanti	Thiago Cezar Oliveira, Rodrigo Costa de Jesus, Alfredo Affonso Monteiro
CerradoROCK	Federal University of Goiás, UFG	Brazil	Carlos Alberto Lauro Vargas	Emílio Farias Vaz, Marcela Leão Domiciano, Jaqueline Costa De Souza
Rockbowl UFRGS	Universidade Federal do Rio Grande do Sul	Brazil	Nilo Cesar Consoli	Lucas Eduardo Dornelles, Laís Veríssimo do Nascimento, Brenda Rielli Spier Correa

QUALIFYING

QUAL1	QUAL2	QUAL3
TEAM 1 X TEAM 2	TEAM 3 X TEAM 4	TEAM 5 X TEAM 6

R1	R2	R3	R4	R5	R6	R7	R8
TEAM 1 X TEAM 2	TEAM 3 X TEAM 4	TEAM 5 X TEAM 6	TEAM 7 X TEAM 8	TEAM 9 X TEAM 10	TEAM 11 X TEAM 12	TEAM 13 X TEAM 14	TEAM 15 X TEAM 16

ROUND OF 16



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