

Kansainvälinen Kalliomekaniikkayhdistys

INTERNATIONAL SOCIETY FOR ROCK MECHANICS

Uluslararası Kaya Mekaniği Birliği

NEWS JOURNAL

www.isrm.net

Report on the 12th ISRM Congress, New ISRM President's Message, Introduction to the 2011–2015 ISRM Board, Annual Review 2011, Regional and Commission Reports, Induction of ISRM Fellows, Müller Award Paper—Barton



The ISRM 50-Year Anniversary Logo created by Dr Ludger Suarez-Burgoa

Annual Review 2011

The Secretary-General's Report, photographs from the two ISRM Congress Banquets held in Beijing, ISRM Information

Technical Papers

2011 Rocha Medal Award PhD thesis summary by Dohyun Park, Korea, and two papers on coupled modelling

Invitation to EUROCK2012,
an ISRM International Symposium,
Stockholm, Sweden

www.eurock2012.com



Rock Engineering & Technology for Sustainable Underground Construction

The programme includes the 3rd Annual ISRM Technical and Cultural Field Trip to Northern Sweden on 24–25 May, the ISRM Board meeting on the 26 May, the ISRM Commission and Council meetings and two pre-Symposium Workshops on 27 May, with the Symposium itself on 28–30 May, followed by post-Symposium Tours.

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NEWS JOURNAL

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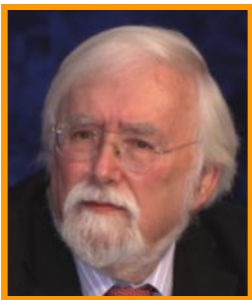
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Editor's Introduction to this Volume



John A Hudson

2011 has been an exciting ISRM year—with both the 12th ISRM Congress held in Beijing in October and the 50-year ISRM Anniversary celebrations.

The 12th ISRM Congress was a great success with its technical and social aspects. The Congress was preceded by the 2nd ISRM International Young Scholars' Symposium on "Rock Mechanics: Achievements and Ambitions" organised by Meifeng Cai—see the report on pages 26–27. The report on the Congress itself, "Harmonising Rock Engineering and the Environment", which was co-chaired by Qihu Qian and Jian Zhao, is given on pages 28–32.

Photos of the Symposium and Banquet activities are included on pages 33 and 35. The Müller Medal was awarded at the Congress to Nick Barton (see page 60). He presented the Müller Lecture "From Empiricism through Theory to Problem Solving in Rock Engineering". Eight ISRM members were inaugurated as ISRM Fellows during the Congress, see page 34. Finally, at the end of the Congress, the ISRM Presidency passed from

myself to Xia-Ting Feng (see pages 32 & 36).

The ISRM was formed in 1962 by Leopold Müller and so 2012 is our 50-year anniversary. However, because the Congress was being held in 2011, the celebrations were started at the Congress in 2011 and continue at the ISRM EUROCK Symposium to be held in Stockholm, Sweden, in May 2012, see page 2.

Two competitions have already been held to celebrate the 50-year anniversary. The first was a Young Members' competition to produce a PowerPoint presentation with the title "The Future Directions for Engineering Rock Mechanics". This was won by Ricardo Resende of Portugal and was presented at the 2nd ISRM International Young Scholars' Symposium on Rock Mechanics already mentioned. This ppt. can be viewed on the ISRM website. The second competition was to design a 50-year ISRM anniversary logo which was won by Ludger Suarez-Burgoa from Colombia and is highlighted on the cover of this Issue.

I am sure that all of you will join me in wishing Xia-Ting Feng, our new ISRM President, together with the new ISRM Board, all our best wishes for their tenure over the next four years.

*John A Hudson,
Imperial College, London, UK*

Invitations to ISRM 2012 Regional Symposia

Invitation to the 2nd South American Symposium on Rock Excavations, an ISRM Regional Symposium being held 7–9 August 2012 Ramada Plaza Herradura Hotel, San Jose, Costa Rica

www.congeocr.com



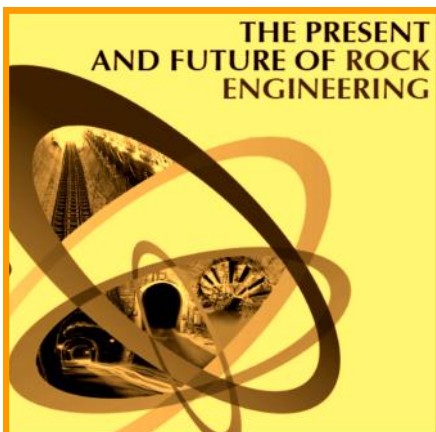
ARMS 2012

7th Asian Rock Mechanics Symposium

COEX Conference Room(South), Seoul, Korea
October 15 ~ 19, 2012



Invitation to the 7th Asian Rock Mechanics Symposium, an ISRM Regional Symposium being held 15–19 October 2012, Seoul, Korea



The venue for the Symposium is located in the heart of Seoul, Korea, with convenient access to subways, restaurants and hotels. This event will be an excellent opportunity to contemplate the present and the future of rock engineering, as well as to enjoy traditional and modern Seoul.

www.arms7.com

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The Outgoing 2007–2011 ISRM Board



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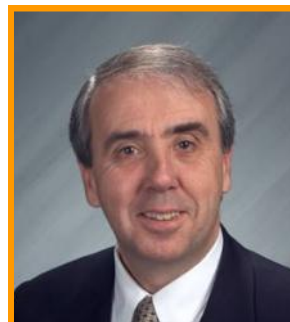
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At the 12th ISRM Congress held in Beijing, China, in October 2011,
the ISRM Presidency changed from
Professor John A. Hudson to Professor Xia-Ting Feng.
A new ISRM Board was also formed at that time.

Thus, the members of the outgoing ISRM Board
(which operated until October 2011)
are listed on these pages,
and the members of the incoming ISRM Board
(which will operate from October 2011 until May 2015)
are listed on the next two pages.

The Incoming 2011–2015 ISRM Board



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The incoming 2011–2015 ISRM Board is continuing the previous Board's 'modernisation' programme— a key element of which is enhanced communication between all ISRM Members.

The email addresses of your regional Board representatives, together with those of the President and Secretary-General, are given on these two pages.

They will welcome contact/inquiries/ suggestions from current and potential ISRM Members.

The 2011 ISRM Year

Prepared by Luis Lamas, Portugal, ISRM Secretary-General (secretariat.isrm@lnec.pt)

| 2010 | ISRM Sponsored Events | Key Events |
|-----------|--|---|
| January | | |
| February | | |
| March | | Publication of the digital <i>Newsletter No.13</i> |
| April | | |
| May | | FedIGS Board meeting in Rome |
| June | | Publication of the digital <i>Newsletter No.14</i> Selection of the winner of the 50 th anniversary logo competition |
| July | | Approval by the Board of the Guidelines: <ul style="list-style-type: none"> - for the selection of ISRM Fellows, - for the ISRM Lecture, - for the ISRM Advisory Forum, - for the Technical and Cultural Field Trips |
| August | | Publication on the website of the videos of the candidates for ISRM Regional Vice-President Selection of the winner of the 50 th anniversary slide show competition |
| September | | Publication of the digital <i>Newsletter No.15</i> |
| October | 2nd ISRM International Young Scholars' Symposium on Rock Mechanics - Beijing, China ,October 2011 12 th ISRM Congress - Harmonising Rock Mechanics and the Environment – 16 to 21 October 2011, Beijing, China | ISRM 12 th Congress in Beijing: <ul style="list-style-type: none"> • Dr Nicholas Barton presented the Müller Lecture 2011 • Dr Dohyun Park presented 2011 Rocha Medal paper • Dr Dr Maria Teresa Zandarin from Argentina selected as recipient of Rocha Medal 2012 • Election of the new ISRM Board for the tenure 2011-2015 • Wroclaw, Poland was selected as the venue of the 2013 ISRM International Symposium |
| November | | |
| December | | Implementation of the new Membership Management System has started Publication of the digital <i>Newsletter No.16</i> |

Luis Lamas, Portugal, ISRM Secretary-General (secretariat.isrm@lnec.pt)

ISRM BOARD MEETING, Beijing October 2011

Note: This was the meeting of the ‘outgoing’ 2007–2011 ISRM Board (see pages 6–7) just before the 12th ISRM Congress held in Beijing. The ‘incoming’ 2011–2015 ISRM Board (see pages 8–9) did not formally start their work until just after the Congress.

This meeting was held in conjunction with the 12th ISRM Congress *Harmonising Rock Mechanics and the Environment*, in Beijing, China, on 16th October 2011. The meeting was chaired by the President of the ISRM, Prof John A. Hudson, and was attended by the regional Vice-Presidents, the two Vice-Presidents-at-Large and the Secretary-General.

The subjects covered were as follows.

- The main decisions taken after the last Board meeting
- Presentations by the President, the Vice-Presidents and the Secretary General
- Presentation by the Secretary-General on finances and the budget for 2012
- Commissions and new Pre-Commissions
- Rocha Medal 2012: selection of the winner
- Celebrations of the 50th Anniversary of the ISRM in 2011 and 2012
- Selection of the ISRM Lecturer for Stockholm
- Issues for the Advisory Forum meeting
- FedIGS and cooperation with other Societies
- Regional Conference EUROCK2014: presentations by the applicant National Groups and selection of its venue in Vigo, Spain
- Report on the progress of the 12th ISRM Congress (Beijing, October 2011); of EUROCK2012 (Stockholm, May 2012); of the II South American Symposium on Rock Excavations (Costa Rica, August 2012); of ARMS 7 (Seoul, October 2012); and of EUROCK2013 (Wroclaw, September 2013).
- New sponsorship applications and other ISRM sponsored conferences
- Presentation on further ideas for the modernisation of the ISRM

ISRM COUNCIL MEETING, Beijing October 2011

The ISRM held its Council meeting in conjunction with the 12th ISRM Congress in Beijing, China, on 17th October 2011. 45 of the 48 National Groups were represented and two Past-Presidents were present. Representatives from the IAEG, IGS and ITA were present, and most of the ISRM Commission Chairmen attended the meeting.

Report of the President

The President mentioned that the Presidency was soon to pass to Prof. Xia-Ting Feng and sincerely thanked the very supportive Board colleagues. He stressed the initiatives taken to modernise the Society, which was the theme for his tenure, and listed the goals achieved during the past four years.

Reports of the Regional Vice-Presidents

Each Vice-President presented a report on the activities carried out in the respective geographical areas (these reports are included in this issue of the News Journal, see pages 39–52)

Report of the Secretary-General

The Secretary-General presented his report, concentrating on the evolution of membership, the National Groups’ growth, with Serbia as the newest NG of the Society, the Rocha Medal winner, the News Journal and Newsletter, the ISRM website and the Digital Library that is steadily being enlarged, and on the competitions that took place—stimulated by the Celebration of the 50-year Anniversary of the Society. This report is included in this issue of the News Journal, see pages 14–18.

Accounts of 2010 and Budget for 2012

The ISRM accounts of 2010 and the Budget for 2012 were approved.

New Guidelines approved by the Board

During 2011, the ISRM Board approved four new Guidelines for the Selection of Fellows; for the ISRM Advisory Forum; for the ISRM Field Trip and for the ISRM Lecture. The Guidelines can be downloaded from the ISRM website.

Announcement of the Rocha Medal 2012 winner

The Council was informed that the Board decided to award the Rocha Medal 2012 to Dr Maria Teresa Zandarin, from Argentina, for her thesis “*Thermo-hydro-*

mechanical Analysis of Joints—A Theoretical and Experimental Study". Dr Zandarin will receive the award at the EUROCK2012 in May 2012, in Stockholm.

The Board also awarded two runner-up certificates, Proxime Accessit, to Dr Bryan Philip Watson from South Africa, for the thesis "*Rock Behaviour of the Bushveld Merensky Reef and the Design of Crush Pillars*" and to Dr Joshua Taron, from the USA, for the thesis "*Geophysical and Geochemical Analyses of Flow and Deformation in Fractured Rock*".

ISRM Commissions

The President informed the Council of the nine existing Commissions and three Pre-Commissions and emphasised their production of significant new products. Reports on their activity were presented by the respective Chairmen or their representatives:

- Commission on Education
- Commission on Geophysics
- Commission on Mine Closure
- Commission on Preservation of Ancient Sites
- Commission on Radioactive Waste Disposal
- Commission on Rock Dynamics
- Commission on Rock Engineering Design Methodology
- Commission on Rock Spalling
- Commission on Testing Methods
- Pre-Commission on Hard Rock Excavations
- Pre-Commission on Petroleum Geomechanics
- Pre-Commission on Crustal Stress and Earthquakes

ISRM-sponsored meetings

Stockholm was reconfirmed as the venue for the 2012 ISRM annual meetings, to be held in May, in conjunction with the EUROCK 2012.

The organisers of the ISRM sponsored events presented the progress on their preparations:

- 16–21 October 2011, Beijing, China—*Harmonising Rock Mechanics and the Environment: the 12th ISRM International Congress*
- 28–30 May 2012, Stockholm, Sweden—EUROCK2012—*Rock Engineering and Technol-*

ogy for Sustainable Underground Construction, an ISRM International Symposium

- 8–10 August 2012, San José, Costa Rica—*2nd South American Symposium on Rock Excavations (II SSAER)*: an ISRM Regional Symposium.
- 21–26 September 2013, Wrocław, Poland—*EUROCK2013—Rock Mechanics for Resources, Energy and Environment*: an ISRM International Symposium
- 26–28 May 2014, Vigo, Spain—*EUROCK2014—Rock Engineering and Rock Mechanics: Structures on and in Rock Masses*: an ISRM Regional Symposium
- 29 May–6 June 2015, Montreal, Canada—*Innovations in Applied and Theoretical Rock Mechanics*: the 13th ISRM Congress

Election of the Regional Vice Presidents for 2011–2015

The candidates for ISRM Vice-President 2011–2015 made a short presentation on their intentions and aspirations for their term of office. As a result of the ISRM Council's voting, the Regional Vice-Presidents of the ISRM for the tenure 2011–2015 are:

- Africa: Mr Jacques Lucas, from South Africa, elected by acclamation;
- Asia: Dr Yingxin Zhou, from Singapore, elected by majority;
- Australasia: Dr David Beck, from Australia, elected by acclamation;
- Europe: Prof Frederic Pellet, from France, elected by majority;
- North America: Dr John Tinucci, from the USA, elected by acclamation; and
- South America: Dr Antonio Samaniego, from Peru, elected by acclamation.

Selection of the venue of the 2013 ISRM International Symposium

Only the Polish National Group applied to hold the 2013 ISRM International Symposium, i.e., at the occasion of the EUROCK2013 conference. In agreement with the ISRM regulations, the Polish application was approved by acclamation.



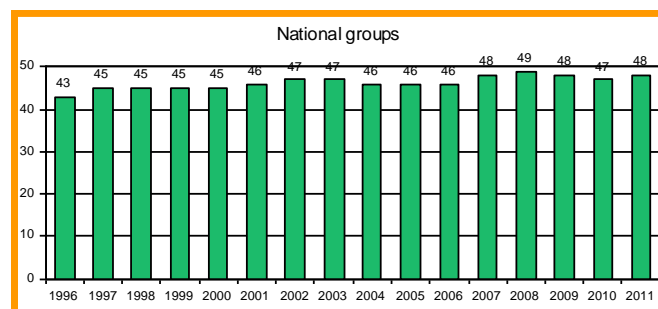
The ISRM Council Meeting, Beijing, October 2011

Report of the ISRM Secretary-General for 2011

Luis Lamas, Portugal, ISRM Secretary-General (secretariat.isrm@lnec.pt)

1. National Groups and Membership

The Board was happy to approve the Serbian Society for Rock Mechanics as a new ISRM National Group. The current number of ISRM National Groups is 48. The Table on page 11 presents the situation regarding ISRM membership, per country and per region, in October 2011. The present number of individual (ordinary and corresponding) and corporate members is as follows:

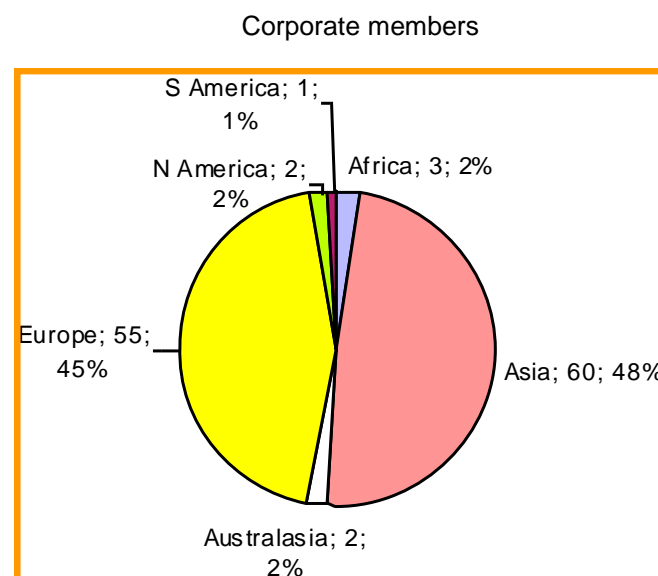
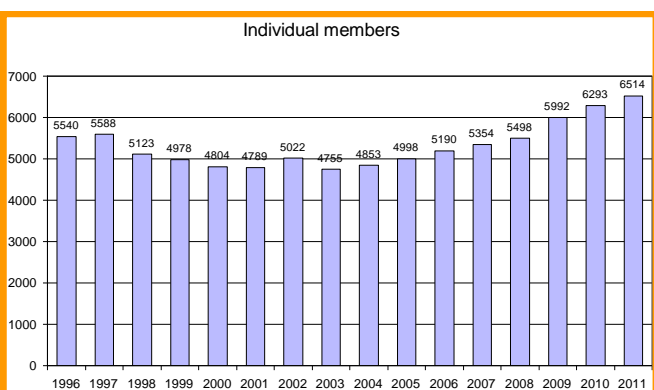
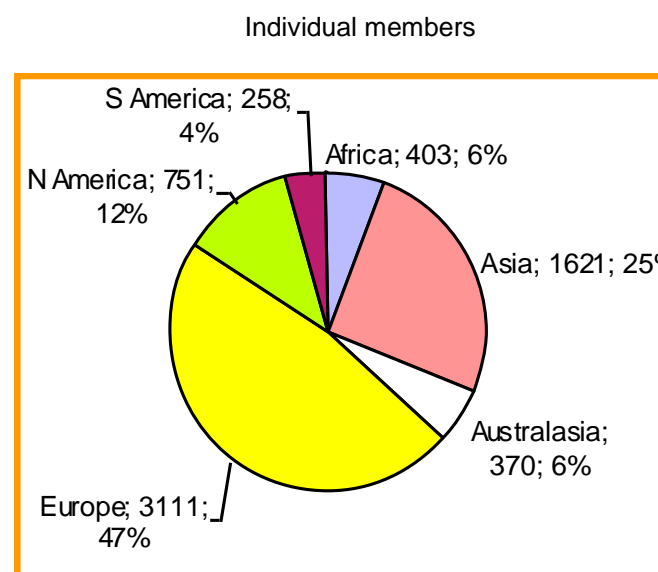


The distribution of individual and corporate members in each geographic region is shown below.

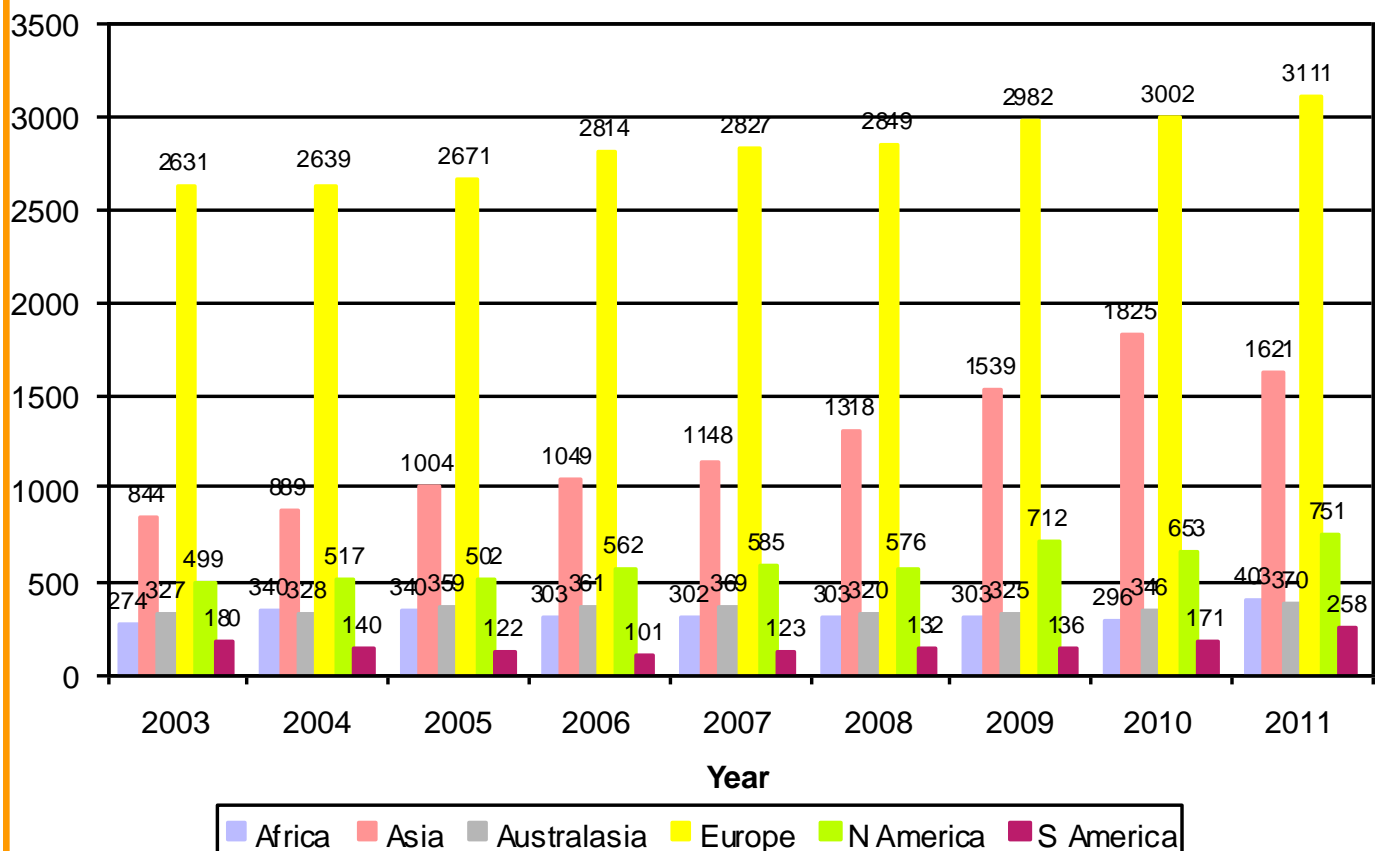
| | Individual Members | Corporate Members |
|---------------|--------------------|-------------------|
| Africa | 403 | 3 |
| Asia | 1,621 | 60 |
| Australasia | 370 | 2 |
| Europe | 3,111 | 55 |
| N America | 751 | 2 |
| S America | 258 | 1 |
| TOTALS | 6,514 | 123 |

When compared with the figures presented at the previous Council meeting, in October 2010, this corresponds to an increase of 221 individual members (3.5%). This is an all-time record for individual members of the ISRM. Major changes observed are a decrease in the Indian National Group, from 550 to 333 members, and a significant increase in the National Group of the USA, from 394 to 478. The number of corporate members decreased from 136 to 123.

The graphics below present the evolution of the number of ISRM members and National Groups in the last 16 years.



The graphic at the top of the next page shows the evolution of the number of individual members in each geographical region since 2003. In the past year,



there was an increase in the number of members from all regions, except Asia. North America was the fastest growing region in the ISRM.

2. Payment of fees

All National Groups have paid their fees for 2010. The situation of the National Groups as regards payment of the 2011 fees is as follows:

Paid 2011 fees (until 17 October): Argentina, Australia, Austria, Belgium, Bolivia, Brazil, China, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, India, Indonesia, Israel, Italy, Korea R., Middle East Asia, Netherlands, New Zealand, Norway, Paraguay, Peru, Poland, Portugal, Russia, Serbia, Singapore, South Africa, Spain, Sweden, Switzerland, UK, Venezuela.

3. Federation of International Geotechnical Societies—FedIGS

The FedIGS Board met in Rome last May. From the ISRM, it was attended by the President, the immediate Past President and the Secretary-General. The FedIGS Board voted unanimously in favour of inviting the International Geosynthetic Society (IGS) to join as a Member of the Federation, as a consequence of the

interest shown by the IGS. Prof Jorge Zornberg, the IGS President, was present and informed the meeting that he still needed the formal approval of the IGS Council.

The ISRM immediate Past-President Prof Nielen van der Merwe was appointed Chairman of the FedIGS Board until May 2014.

The items considered at the meeting dealt with the development of the FedIGS activities.

4. ISRM sponsored meetings

The Secretariat provided assistance to the Vice Presidents and National Groups in the formulation of agreements and the spreading of information regarding the different ISRM sponsored meetings.

Since the last ISRM Council meeting in New Delhi, in October 2010, two ISRM-sponsored conferences were held:

- ISRM Regional Symposium – VII South-American Rock Mechanics Congress, 2 to 4 December, 2010, in Lima, Peru.
- ISRM Specialised Conference – 2nd ISRM International Young Scholars' Symposium on Rock Mechanics, 14 to 16 October 2011, in Beijing, China.

The following ISRM sponsored conferences were approved during the same period:

- ISRM Regional Symposium—*II South American Symposium on Rock Excavations*, 7–9 August 2012, San José, Costa Rica;
- ISRM Regional Symposium—*7th Asian Rock Mechanics Symposium: The Present and Future of Rock Engineering*, 15–19 October 2012, in Seoul, Korea;
- ISRM Specialised Conference—*Effective and Sustainable Hydraulic Fracturing*, 20–22 May 2013, Brisbane, Australia;
- ISRM Specialised Conference—*6th International Symposium on In Situ Rock Stress*, 20–22 August 2013, Sendai, Japan; and
- ISRM Regional Symposium—*Eurock2014, Rock Engineering and Rock Mechanics: Structures in and on Rock Masses*, 26–28 May 2014, Vigo, Spain.

5. Müller Award

Selection of the winner took place during the 2010 Council meeting in New Delhi. From the three nominations received (Dr Nick Barton, Prof Richard Goodman and Prof Peter Kaiser) the Council selected Dr Barton as the 6th Müller Award winner. He will receive the Müller Award and deliver the Müller Lecture at the 12th ISRM Congress, in Beijing, in October 2011.

6. Rocha Medal

During the 12th ISRM Congress, the Rocha Medal Award Committee selected, as the winner of the 31st prize (Rocha Medal 2012), the thesis submitted by Dr Maria Teresa Zandarin, from Argentina, entitled “Thermo-hydro-mechanical Analysis of Joints: A Theoretical and Experimental Study”, presented to the Polytechnic University of Catalonia, Barcelona, Spain.

Two runner-up, *Proxime Accessit*, certificates were also awarded to

- Dr Bryan Philip Watson from South Africa for the thesis “Rock Behaviour of the Bushveld Merensky Reef and the Design of Crush Pillars” presented to the University of the Witwatersrand, South Africa, and to
- Dr Joshua Taron from the USA for the thesis “Geophysical and Geochemical Analyses of Flow and Deformation in Fractured Rock” presented to the Pennsylvania State University, USA.

These theses were selected from among eight short-listed theses. The awards will be conferred in May 2012, during the ISRM International Symposium in

Stockholm, Sweden, where Dr Maria Teresa Zandarin will deliver the Rocha Lecture.

7. ISRM 50th Anniversary Commemorative Logo Competition

In October 2011, the ISRM began the celebrations to commemorate its 50th anniversary, which include a number of special events and initiatives. One of the initiatives consisted of a competition, open to the ISRM Members, to create a logo to be used by the Society during the period of celebrations, from October 2011 to May 2012. Dr Ludger Suarez-Burgoa, from Bolivia, was selected as the winner of the ISRM 50th Anniversary Commemorative Logo Competition and he will receive a copy of the ISRM Blue Book, a copy of the ISRM Orange Book due for publication in 2012, and acknowledgement in the ISRM Newsletter and website.

The winning logo is on the front cover of this Issue

8. ISRM 50th Anniversary Slide Show Competition

Another initiative was a competition open to young members of the ISRM to present their vision of “The Future Directions for Engineering Rock Mechanics”. Candidates were asked to prepare a fully explanatory PowerPoint slide show explaining, illustrating and justifying their ideas. The winner was Dr. Ricardo Resende, from Portugal, and he was invited to present the slide show at the Second ISRM International Young Scholars' Symposium on Rock Mechanics, in Beijing, China, 14–16 October 2011, immediately preceding the 12th ISRM International Congress.

In addition, the winning slide show will also be published on the ISRM website. Dr Resende was formally acknowledged with a certificate during the ISRM Congress.

9. ISRM News Journal and Newsletter

One hard copy of the News Journal, prepared by the President, was published and distributed by air mail to all members of the ISRM. This 60-page Issue (Vol. 13, December 2010) contains the annual review of the Society's activity through 2010, as well as technical articles on *in situ* rock stresses. An electronic version of this Issue was posted on the website and can now be read online, without the need to download.

Since the previous Council meeting, four issues of the electronic Newsletter, prepared by the Secretary-General, were published: one in 2010 (December); and



The first page of the Powerpoint presentation

three in 2011 (March, June and September). As usual, all members registered on the website as well as all those that subscribed to the Newsletter on the website, received them by email. The Newsletters are also available for free on the website. ISRM National Groups and individual members are welcome to submit to the Secretariat contributions on Rock Mechanics topics of interest to our technical community.

10. ISRM Website

The website of the ISRM (www.isrm.net), launched on 1 April 2005, is the main means of information about the ISRM and the main channel for communication with the members. Most benefits being offered to the members are available in a password protected members' area. Statistics of the usage are summarised in the graphic at the bottom of the page, where each point represents the daily averages during each period of three months.

Following the 15 lectures on Rock Mechanics, prepared by Erik Eberhardt, a series of lectures on Introduction to Petroleum Geomechanics, prepared by Maurice Dusseault of the University of Waterloo in Canada, is now available on the ISRM website.

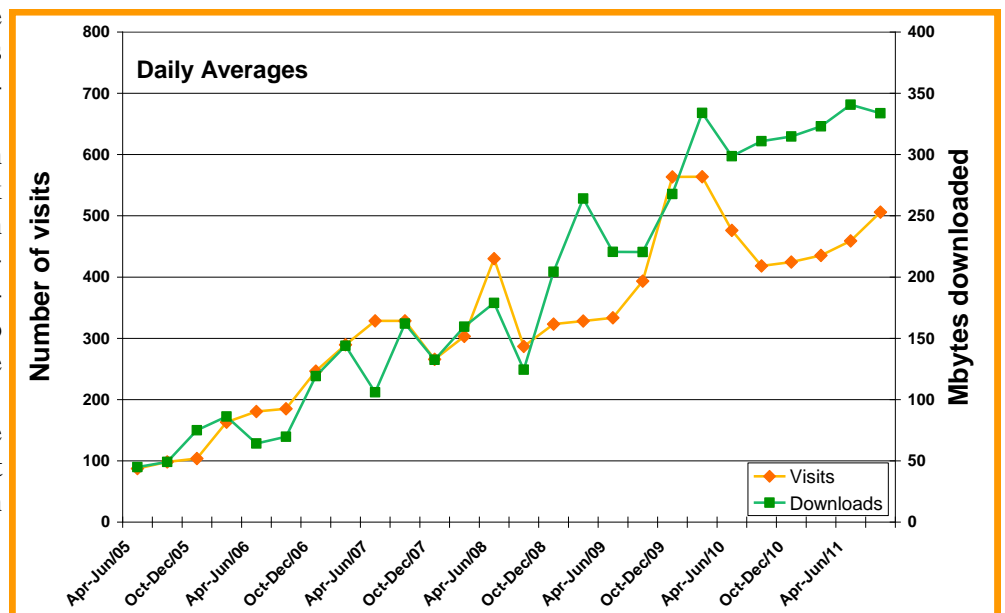
Video presentations from all the nominees to ISRM Vice-President were also uploaded and can be seen on the website.

11. Digital Library

The ISRM and the Society of Petroleum Engineers signed a contract for distribution of the papers presented in ISRM-sponsored conferences through www.onepetro.org. Launch of the ISRM digital library took place on 12 October. ISRM Individual members registered on the website are entitled to download 100 papers for free per year, while Corporate members are entitled to download 250 papers.

Papers from the ISRM Congresses and sponsored Symposia have been gradually introduced in the Library. The following are already available online.

- 2010 International Symposium, ARMS 6, New Delhi, India.
- 2009 International Symposium, SINOROCK, Hong Kong, China.
- 2008 International Symposium, ARMS 5, Tehran, Iran.
- 2007 11th ISRM Congress, Lisbon, Portugal.
- 2005 International Symposium, EUROCK 2005, Brno, Czech Republic.
- 2003 10th ISRM Congress, Sandton, South Africa.
- 2001 International Symposium, ARMS 2, Beijing, China.
- 1999 9th ISRM Congress, Paris, France.
- 1996 International Symposium, EUROCK 96, Turin, Italy.
- 1995 8th ISRM Congress, Tokyo, Japan.
- 1993 International Symposium, EUROCK 93, Lisbon, Portugal.
- 1991 7th ISRM Congress, Aachen, Germany.
- 1990 International Symposium, *Static and Dynamic Considerations in Rock Engineering*, Mbabane, Swaziland.



- 1989 International Symposium, *Rock at Great Depth*, Pau, France.
- 1988 - International Symposium, *Rock Mechanics and Power Plants*, Madrid, Spain.
- 1987 6th ISRM Congress, Montreal, Canada.
- 1983 5th ISRM Congress, Melbourne, Australia.
- 1982 International Symposium, *Rock Mechanics Related to Caverns and Pressure Shafts*, Aachen, Germany.
- 1981 International Symposium, *Weak Rock – Soft, Fractured and Weathered Rock*, Tokyo, Japan.
- 1979 ISRM 4th Congress, Montreux, Switzerland.
- 1966 1st ISRM Congress, Lisbon, Portugal.

Several other ISRM-sponsored conferences, for which the ISRM has the copyright or the right for distribution, are also ready for inclusion in the database and will also be online soon. The ISRM is still dealing with copyright issues regarding a few sponsored conferences.

12. Membership Management System

With the aim of improving management of the information regarding ISRM members, a new membership management system is being developed and is expected to be ready very soon. This system has a number of new functionalities and integrates the currently existing database of members, which has information supplied by the National Groups, with the list of members available for managing access to the members' area of the website. The new membership management system is expected to allow the Secretariat to improve communication with the members and also the management of website and digital library access.

13. Educational and promotional items

As in previous years, the ISRM educational material has been in demand, and most of it is nowadays available from the ISRM website, for free download by the ISRM members. The 'Blue Book', *The Complete ISRM Suggested Methods for Rock Characterisation, Testing and Monitoring: 1974-2006*, continued to represent, by far, the main item supplied during this period.

14. Secretariat

The work of the Secretariat staff includes all the administrative (correspondence, filing, management of members, etc.), financial (payments and receipts, accountancy), and secretarial (drafting minutes of meetings, supporting documents, etc.) tasks of the ISRM. The Secretary-General, with the help of the

Secretariat and the Webmaster, is also responsible for managing the website and, since 2008, for producing and distributing the quarterly electronic Newsletters.

15. Support afforded

As usual, the Secretariat made ample use, at no charge, of a number of facilities available at the Portuguese National Laboratory for Civil Engineering—LNEC. This included use of office rooms and of other facilities offered to the Secretariat, support in secretarial and book keeping work, telephone and fax, as well as use of LNEC's computer network, namely for internet access and e-mails. This support has long been instrumental to the well-being of the Society and is very much appreciated.

The Secretariat also thanks the Portuguese Foundation for Science and Technology, FCT, for their courtesy in providing a grant to the Society.

16. Final remarks

The life of the Society and the activity of the Secretariat during the period for this report were marked by:

- continuation of the trend of an increase in the number of individual members of the Society, with an all time record of 6514;
- Updating of the ISRM digital library;
- implementation of a new membership management system;
- implementation of the modernisation initiatives defined by the Board; and
- implementation of initiatives for the commemoration of the 50th Anniversary of the ISRM;



Luís M. N. Lamas
Secretary General, ISRM

Lisbon, October 2011



International Society for Rock Mechanics

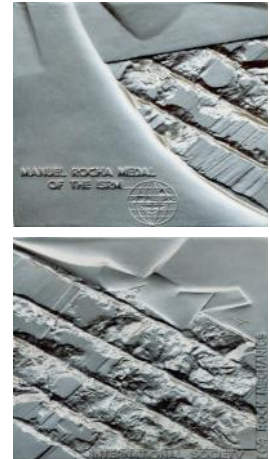
ROCHA MEDAL 2014

Since 1982 a bronze medal and a cash prize have been awarded annually by the ISRM for an outstanding doctoral thesis in rock mechanics or rock engineering, to honour the memory of Past President Manuel Rocha while stimulating young researchers.

In addition to the Rocha Medal award to the winning submission, one or two runner-up certificates may also be awarded.

An invitation is now extended to the rock mechanics community for nominations for the Rocha Medal 2014.

Full details on the Rocha Medal are provided in ISRM By-law No. 7.



Application

To be considered for an award the candidate must be nominated within two years of the date of the official doctorate degree certification.

Nominations shall be by the nominee, or by the nominee's National Group, or by some other person or organization acquainted with the nominee's work.

Nominations shall be sent electronically, addressed to the Secretary General, and shall contain:

- a one page curriculum vitae;
- a written confirmation by the candidate's National Group that he/she is a member of the ISRM;
- a thesis summary, written in English, with between 5,000 and 10,000 words, detailed enough to convey the full impact of the thesis and accompanied by selected tables and figures;
- one copy of the complete thesis and one copy of the doctorate degree certificate;
- a letter of copyright release, allowing the ISRM to copy the thesis for purposes of review and selection only;
- an undertaking by the nominee to submit an article describing the work, for publication in the ISRM News Journal.

Application Deadline

The nomination must reach the ISRM Secretary General by 31 December 2012.

Past Recipients

| | | |
|------|-----------------|---------------|
| 1982 | A.P. Cunha | PORTUGAL |
| 1983 | S. Bandis | GREECE |
| 1984 | B. Amadei | FRANCE |
| 1985 | P.M. Dight | AUSTRALIA |
| 1986 | W. Purrer | AUSTRIA |
| 1987 | D. Elsworth | UK |
| 1988 | S. Gentier | FRANCE |
| 1989 | B. Fröhlich | GERMANY |
| 1990 | R.K. Brummer | SOUTH AFRICA |
| 1991 | T.H. Kleine | AUSTRALIA |
| 1992 | A. Ghosh | INDIA |
| 1993 | O. Reyes W. | PHILIPPINES |
| 1994 | S. Akutagawa | JAPAN |
| 1995 | C. Derek Martin | CANADA |
| 1996 | M.P. Board | USA |
| 1997 | M. Brudy | GERMANY |
| 1998 | F. Mac Gregor | AUSTRALIA |
| 1999 | A. Daehnke | SOUTH AFRICA |
| 2000 | P. Cosenza | FRANCE |
| 2001 | D.F. Malan | SOUTH AFRICA |
| 2002 | M.S. Diederichs | CANADA |
| 2003 | L. M. Andersen | SOUTH AFRICA |
| 2004 | G. Grasselli | ITALY |
| 2005 | M. Hildyard | UK |
| 2006 | D. Ask | SWEDEN |
| 2007 | H. Yasuhara | JAPAN |
| 2008 | Z.Z. Liang | CHINA |
| 2009 | G. Li | CHINA |
| 2010 | J.C. Andersson | SWEDEN |
| 2011 | D. Park | REP. OF KOREA |
| 2012 | M.T. Zandarin | ARGENTINA |

All relevant information can be obtained from the ISRM website, at

www.isrm.net

ISRM Membership: Joining, Benefits and Fees and Organising

How to become an ISRM Member

Membership of the Society consists of Individual Members within the approved National Groups, Corresponding Members & Corporate Members:

For Individual Membership apply for membership of the ISRM through your National Group, this being the recommended type of membership for the development of the Society. However, because some countries do not have a National Group, or due to the preference shown by a candidate for membership directly to the Society through its Secretariat, the category of **Corresponding Members** was created, the amount of the annual membership fee to be paid, depending on the existence of an approved National Group in the respective country, as stated in the Membership Table of Fees.

For Corporate Membership (Companies or Organisations) apply directly to the Secretariat or through your National Group.

For a national organisation to be recognised as an **ISRM National Group**, it is necessary to formally apply to the President through the Secretary-General for recognition according to the ISRM statutes. This should be an organisation, such as a Society or a Committee that represents Rock Mechanics in that country, either solely concerned with Rock Mechanics, or as part of a broader field of scientific or engineering interest. Each country should have no more than one National Group.

Benefits for ISRM Members

The current benefits for **ISRM members** (Individual and Corresponding Members) are:

- Copy of the ISRM News Journal (now being sent electronically),
- ISRM Newsletter,
- Members' area access in the ISRM website (download of Suggested Methods & Reports),
- Participation in Discussion Forums, etc.,
- Ability to download up to 100 papers per year from the OnePetro website which contains all the papers from previous ISRM sponsored symposia,
- Right to participate in the ISRM Commissions and FedIGS Joint Technical Commissions
- Registration at an advantageous rate at the ISRM Congress and International and Regional ISRM Symposia,
- Personal subscription to the International Journal of Rock Mechanics and Mining Sciences at a dis-

counted price, and

- Personal subscription to Rock Mechanics and Rock Engineering at a discounted price.

The current benefits for **Corporate Members** are

- Listed in the ISRM website, with a link to the Company's website
- Listed in the ISRM News Journal
- Access to the ISRM website Members' area
- ISRM Newsletter
- Copy of the ISRM News Journal
- One registration at an advantageous rate as an ISRM member at the ISRM Congress and International and Regional Symposia.
- Free download of up to 250 papers/year from the ISRM digital library at OnePetro.org

Annual Fees

1. National Groups

National Groups shall pay to the Society a basic fee, this amount depending on the number of Members, plus a fixed amount for each Individual and Corporate Member, according to the following scale (in Euros, €).

National Group Fee:

with 10 individual members or less: €33.00;

with more than 10 and less than 40 individual members: €3 x no. of members + € 3;

with 40+ individual members: €120.00.

Individual Member Fee: €8.00

Corporate Member Fee: €160.00

2. Corresponding Members

Corresponding Members shall pay to the Society an annual fee. In order to encourage membership of individuals through the ISRM National Groups, this annual fee is different for Corresponding Members from countries with or without a National Group:

Fee for Corresponding Members from countries without a National Group: €20;

Fee for Corresponding Members from countries with a National Group: €20 in the first year; €40 in the subsequent years.

Organisation of ISRM-sponsored meetings

The Society sponsors a co-ordinated programme of National, Regional and International Symposia, and Specialised Conferences.

ISRM Symposia and ISRM Events

National Groups seeking to host a Regional or International Symposium shall submit a written proposal to the Secretariat, at least one and preferably two to three years before the date of that Symposium. The ISRM International Symposium differs from ISRM Regional Symposia in that it is the selected venue for the annual meetings of the ISRM Council, Board, and Commissions of the Society.

National Groups seeking to host a Specialised Conference sponsored by the ISRM shall submit a written proposal to the Secretariat, if possible one year before the date of that Conference, for approval by the Board. ISRM Specialised Conferences are events that may not have the format of a Symposium, are usually of a smaller nature and are focused on a specialised theme.

ISRM sponsorship shall be determined by such considerations as technical content, timing in relation to other meetings, cost and benefits to delegates and the organiser's experience in running similar meetings.

To apply for a Regional or International Symposium or for a Specialised Conference, fill in the appropriate application form available at:

<http://www.isrm.net/gca/index.php?id=195>

All publicity materials and the proceedings themselves are to make reference to ISRM sponsorship, by use of the name and logo of ISRM.

Organisation of a Congress of the Society

Every four years, the Society holds a Congress on themes of general interest to the majority of the membership. The responsibility for organising a Congress shall belong to the National Group of the country in which the Congress is to be held. National Groups wishing to host a Congress of the Society shall

submit a written proposal at the annual meeting of the Council six years before the Congress. Contact the ISRM Secretariat for further details:

secretariat.isrm@lnec.pt

ISRM Coming Events (as at publication date)

27–30 May 2012, Stockholm, Sweden – *EUROCK2012 – Rock Engineering and Technology*: an ISRM Regional Symposium.

8–10 August 2012, San José, Costa Rica – *II South American Symposium of Rock Excavations (II SSAER)*: an ISRM Regional Symposium.

20–22 May 2013, Brisbane, Australia – *Effective and Sustainable Hydraulic Fracturing*: an ISRM Specialised Conference.

20–22 August 2013, Sendai, Japan – *6th International Symposium on In Situ Rock Stress*: an ISRM Specialised Conference.

21–26 September 2013, Wroclaw, Poland – *EUROCK2013 – Rock Mechanics for Resources, Energy and Environment*: an ISRM International Symposium.

26–28 May 2014, Vigo, Spain – *EUROCK2014 – Rock Engineering and Rock Mechanics: Structures on and in Rock Masses*: an ISRM Regional Symposium.

29 April–6 May 2015, Montreal, Canada – *Innovations in Applied and Theoretical Rock Mechanics*: the 13th ISRM Congress.



Some of the attendees at the 12th ISRM Congress Welcome Banquet held in Beijing

Record of the 1st ISRM Advisory Forum Meeting

The ISRM Advisory Forum was established by the 2007–2011 ISRM Board in order to enable future Boards to gain from the knowledge of ISRM Fellows and previous ISRM Board members

The first meeting of the ISRM Advisory Forum was held in association with the 12th ISRM Congress at the China National Convention Centre (CNCC) on 20 October 2011.

Attendance

The President, Prof. John A. Hudson, opened the meeting at 16.00 with the attendance of the following ISRM Fellows and past/present/future Board Members:

Prof E.T. Brown
Dr Claus Erichsen
Prof Xia-Ting Feng
Prof John A. Hudson (President 2007–2011)
Prof Abdolhadi Ghazvinian
Prof Alvaro J. Gonzalez
Dr Nuno F. Grossmann
Prof Milton A. Kanji
Prof Peter K. Kaiser
Dr Luís Lamas
Mr Jacques Lucas
Prof Derek Martin
Dr Anthony Meyers
Prof Yuzo Ohnishi
Prof Frederic Pellet
Dr Eda F. de Quadros
Prof Shunsuke Sakurai
Dr Antonio Samaniego
Prof Dick Stacey
Prof Ove Stephansson
Mrs Sofia Meess acted as Secretary.

1. Welcome to ISRM Fellows and previous/current/future ISRM Board Members

The President welcomed all the meeting attendees.

2. Explanation of the purpose of the ISRM Forum

The President informed the meeting that the idea for the Forum had been suggested during the ISRM Board meeting in 2010 and explained the recently created Guideline for the Forum and its purpose.

The ISRM Fellowship Programme will create a group of people with expertise in rock mechanics and rock engineering. Similarly, the ISRM members who have served on previous Boards of the Society have expertise, not only in the technical fields, but also in the purpose and operations of the ISRM. The creation of the ISRM Advisory Forum will thus allow the Society to benefit from the experience and advice of these experts.

3. Discussion of current issues

3.1 Publication of the ISRM News Journal

The President mentioned this issue as a recurring one: should the Society trim costs by going for the online version of the ISRM News Journal and printing just a few hundred copies for select distribution, or should it retain the current system of distributing hard copies.

The Advisors' general opinion was that the costs of the ISRM News Journal should be reduced. The electronic version could introduce a distribution problem, as not all individual members supply their e-mail information. The meeting's recommendation was that the News Journal should go electronic.

Note that this 2011 Issue of the News Journal is the first issue to follow this recommendation and be primarily distributed electronically

Referring to accessibility, Prof. Dick Stacey questioned if the online version of the News Journal would



The first meeting of the ISRM Advisory Forum

only be free to ISRM members, and gave the example of South Africa, where in the beginning it was restricted to members but later it was offered to all website visitors in order to attract interest. The Secretary-General informed the meeting that the latest issue of the ISRM News Journal was published on the website and could be read directly on the screen, free to all visitors. A hard copy had also been distributed to all members. The President called for a vote on the subject and the free availability option was chosen.

Prof. Kanji pointed out that receiving the News Journal at home makes members feel remembered. He suggested that, in the future, both systems could exist: an informative two-page news, to be posted to all members, also reminding them to consult the Society's website; and a more technical and complete electronic publication. The President declared this to be another suggestion for the next Board to consider.

3.2 Ideas for the ISRM 50th Anniversary celebrations in 2012 in Stockholm

The President briefly explained that the ISRM was formed in 1962, so the 50th anniversary year will be 2012 but, because 2011 is the year of the ISRM Congress, the most important conference of the Society, it seemed appropriate to start the celebrations in Beijing, and continue them in 2012, in Stockholm.

The initiatives to take place during the 12th ISRM Congress include a keynote lecture by Prof. Ted Brown on "50 Years of the ISRM and Associated Progress in Rock Mechanics", a keynote lecture by Prof. John Hudson on "The Next 50 Years of the ISRM and Anticipated Future Progress in Rock Mechanics", and a Banquet formally inaugurating the 50th anniversary celebrations.

The President informed the meeting that, for 2012, a commemorative book celebrating the ISRM's 50th anniversary was being prepared by himself and the Secretary-General, to be launched in Stockholm at EUROCK2012 taking place in May. He then invited the meeting for further suggestions.

Prof. Sakurai pointed out that the young generation does not know who were the most important persons related to the Society. He suggested that a kind of exhibition with a gallery of photos

could be organised in Sweden, focussing on the Rocha and the Müller Award winners and other 'first stage' people.

Dr Eda de Quadros remembered that a similar display existed during the 11th ISRM Congress, in 2007, in Lisbon, and said that she has a good quantity of pictures, having participated in six Congresses of the Society. Prof. Gonzalez was in favour of this idea, adding that there could also be a President and Board Gallery.

Prof. Kaiser suggested that conferences could reach a higher level by asking the organisers to webcast them. Dr Grossmann advised caution in this regard as the organisation of the conference depends on the registration fees for its success. If the conference is webcast, there is the risk of less attendance. Dr Derek Martin was opposed to this comment. Dr Kaiser questioned how many people will go to Sweden and noted that young people do not have the means to travel—a reason why the conferences should be webcast.

Dr Erichsen agreed about the need to attract young people to the Society and pointed out that they look more to Facebook and Twitter than to formal websites.

Prof. Ohnishi proposed an Open Course, where each member of the Advisory Forum would submit his best lecture. Prof. Kanji seconded this idea, stating that it would be a contribution from the ISRM to the technical community. He further suggested the creation of a collection of teaching, in video files, to be shown to university students. In this context, the President commented on his surprise that, at the Young Scholars' Symposium, some participants had indicated in a discussion forum that they did not understand Prof. Eberhardt's lectures (hosted on the ISRM website) and that simpler lectures should also be prepared. The Secretary-General also commented that Prof. Franklin's



Nuno Grossmann makes a point

Record of the 1st ISRM Advisory Forum Meeting (cont.)

lectures on the ISRM website may now be out of date and could be complemented by more modern ones.

3.3 Ideas for enhancing the stature and effectiveness of the ISRM, other than the modernisation programme

The President reaffirmed his gratitude to the 2007–2011 Board for the implementation of the modernisation programme and that so many good ideas had been implemented during his 2007–2011 tenure. He then invited the Advisors to present any further suggestions that they might have.

Prof. Brown commented on the outstanding achievements of the modernisation programme and noted the need now for consolidation of the implemented initiatives. Prof. Stacey thanked the President for the introduction of the *Proxime Accessit* certificates in the Rocha Medal evaluations, and Prof. Sakurai considered that the contribution of the outgoing Board had been broad and fruitful.

Prof. Stacey also commented that rock mechanics graduates and PhD graduates have little idea of what rock is and bringing them to the field would be interesting. He affirmed that Stockholm is the ‘home of blasting’ and also that a conference in an underground room like the La Verna cavern in the Pyrenees, as an example, could be an idea. Professor Sakurai shared the same opinion, saying that young people are more interested in numerical analysis and so they should be given field experience.



Antonio Samaniego, Xia-Ting Feng, Derek Martin and Shun Sakurai

Prof. Kaiser considered it important to find a way to reach out to young people and that he senses students to be eager for supervision with experienced practitioners. He suggested the creation of *wiki*-based information focussed on assisting students in rock mechanics. Prof. Martin suggested young people representatives should have a seat at this Forum, to explain their needs. Prof. Brown pointed out that this last suggestion could fall within the themes of the Young Members’ Presidential Group, a formula already established.

Dr de Quadros informed the meeting that, at the National Congress in Brazil, there is a special session— Geo-Young—specifically for young practitioners, under 30, with an award for the best paper presented. Dr Grossmann also reminded the meeting that, at the yearly EUROCK Conferences, there is also an Award for the best young practitioner’s paper.

No further suggestions being presented, the President thanked the meeting attendees and reminded everyone that the next ISRM Advisory Forum will take place during EUROCK2013 in Wroclaw, Poland, and he invited all attendees to send Professor Feng, the 2011–2015 ISRM President any further suggestions to improve the Forum.



Prof Kaiser contributes an idea

Formation of the Young Members' Presidential Group

John A. Hudson, 2007–2011 ISRM President, UK

Objective

As part of the 2007–2011 ISRM modernisation plan, the Board formed the ISRM Young Members' Presidential Group in order to address young members' interests.

Membership

The Group is formed of eight members: one Young Member from each of the six ISRM regions (see below), the President of the Society, previously John Hudson (2007–2011), now Xia-Ting Feng (2011–2015), and Dr Luis Lamas, ISRM Secretary-General.

Each Young Member will be under 35 years of age on joining the Group.

The six main subjects to be addressed by the Group

- issues they, and younger members in general, have concerning the Society,
- initiatives for making the Society more responsive to the needs of young members,
- initiatives for addressing the objectives and purposes of the Society,
- injecting new ideas into the on-going modernisation plan,
- suggestions for promoting the Society to young rock mechanics professionals who are not members, and
- initiatives for increasing the overall membership of the Society.

The Group's Young Members

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Post-Graduate Program

Skype: ludger.suarez
ludgerito@gmail.com
Home: 55 (61) 3547.9899
Mobile: 55 (61) 819.050

Note: The ISRM 2011–2015 Board is currently expanding the membership to include a Young Member from every ISRM National Group

2nd ISRM International Young Scholars' Symposium

Meifeng Cai, China

The 2nd ISRM International Young Scholars' Symposium on Rock Mechanics (an ISRM Specialised Conference) was held on 14–16 October 2011, Beijing, immediately preceding the ISRM Congress. It was organised by Prof Meifeng Cai, President of the ISRM Commission on Education.

The aim of the Symposium

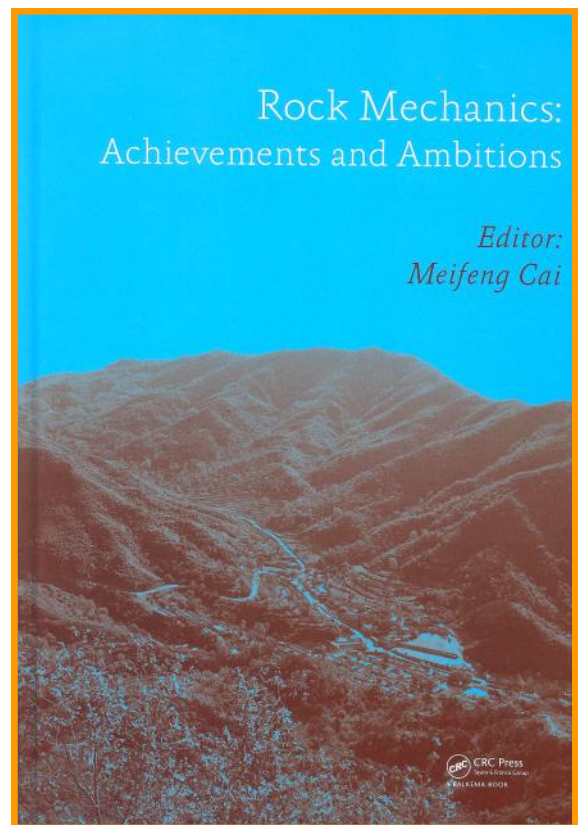
The aim was to provide an ideal platform for idea and information exchange, plus knowledge and experience sharing. To develop and improve any subject requires interaction, and so the Symposium provided extra stimulus and encouragement to the Young Scholars so that they will tackle our outstanding rock mechanics and rock engineering problems with renewed vigour.

Topics of the Symposium

- Field investigation and observation;
- Rock constitutive relations and property testing;
- Numerical and physical modelling for rock engineering;
- Information technology, artificial intelligence and other advanced techniques;
- Underground and surface excavation and reinforcement techniques;
- Dynamic rock mechanics and blasting;
- Predication and prevention of geo-environmental hazard; and
- Case studies of typical rock engineering.

Proceedings of the Symposium:

The proceedings of the Symposium, which included 193 papers and were available at the start of the Symposium, are titled “Rock Mechanics: Achievements and Ambitions” and published by Taylor and Francis/CRC Press/Balkema (see the cover illustrated in the next column). Prof John Hudson wrote a Preface for the Proceedings.



Opening Ceremony

The opening ceremony of the Symposium was held on 15 October in the Beijing International Convention Centre. Prof. John Hudson, the 2007–2011 President of ISRM, Prof. Xia-Ting Feng, the elected ISRM President for the period 2011–2015, and Prof. Peter Kaiser made presentations at the Opening Ceremony. Prof. Meifeng Cai, Chairman of the Organising Committee of the Symposium also made an opening speech.

About 250 young scholars and experts who were from 17 countries (Afghanistan, Papua New Guinea, Benin, Brazil, Canada, Chad, China, Cote D'Ivoire,



Opening Ceremony: From left to right: M. C. He (Speaker), M. F. Cai, D. B. Sun, P. K. Kaiser, J. A. Hudson, X. T. Feng, B. J. Fu, Y. D. Jiang, L. R. Jing, F. Q. Wu



The first page of Dr Resende's presentation



Part of the audience, Dr Resende, second on left

East Timor, England, Congo (Republic), Congo (Democratic Republic), Kazakhstan, Mongolia, Portugal, Rwanda and Uganda) attended the Symposium.

The Symposium was comprised of three Keynote Lectures, 50 oral presentations of the selected papers, a presentation by the winner of the ISRM Slide Show Competition (Dr Ricardo Resende), plus a Panel Discussion relating to ISRM Young Scholars' issues.

Three Keynote Lectures

The presenters and titles of the Keynote Lectures were as follows.

- Prof John A. Hudson: Rock Mechanics Research in the Modern World
- Prof Xia-Ting Feng: Dynamic Design Methods and Applications to Rock Engineering Projects in China
- Prof Jing Lanru: Modelling Coupled Processes of Stress, Flow and Transport in Fractured Crystalline Rocks.



Prof Meifeng Cai

ISRM Slide Show Competition Presentation

Dr Ricardo Resende, winner of the ISRM Slide Show Competition held to celebrate the 50th anniversary of the ISRM, presented his winning PowerPoint entry: "Future Directions for Engineering Rock Mechanics", see the title slide of the presentation on this page.

Panel Discussion: ISRM Young Scholars' Issues

Prof John Hudson (ISRM President), Dr Nuno Grossmann, European ISRM Vice-President, Prof Meifeng Cai (President of the ISRM Commission on Education), Dr Luis Lamas (ISRM Secretary-General) and Dr Ricardo Resende (ISRM Young Members' Presidential Group, formed a Panel for chairing the discussion with the audience.

Five questions were put forward for discussion.

- As Young Scholars, do you have any particular problems in finding the rock mechanics information you need for your studies or your engineering work?
- Would it be helpful if you had more access to senior people in rock mechanics, either through email, SKYPE, or arranged contact/discussion during Symposia?
- Do you ever look at the ISRM website? Have you studied the lectures available on the ISRM website?
- Is there anything that the ISRM can do to help you in your rock mechanics work?
- Are there any other points you would like to raise in connection with your rock mechanics work or the ISRM?

A lively discussion followed, with many members of the audience taking part.

The 12th ISRM Congress held in October 2011 in Beijing—

Zhongkui Li, Yan Guo, Luis Lamas, John A. Hudson



The 12th ISRM International Congress on Rock Mechanics was successfully held during 18–21 October 2011 in Beijing, China. The success of the Congress would not have been possible without the guidance of the then ISRM President Professor J.A. Hudson, the ISRM Secretary-General Dr L. Lamas and the Advisory Board Members, the joint efforts by the organising Committee Members from China and Singapore led by Professor Qihu Qian, the support from the Foreign Affairs Office of China Association of Science and Technology, plus the dedication and tireless work devoted by the Secretariat and the active participation and support of various organisations and individual members.

Review of the Congress

The 12th ISRM International Congress on Rock Mechanics (ISRM2011), the top event of the ISRM calendar, was opened on 18th October at the China National Convention Centre, Beijing, after six years of hard-working preparation by the Organising Committee. More than one thousand experts and scholars in the rock mechanics field from about 50 countries and regions participated in the Congress.

At the Opening, the Congress Chairs, Academician Qihu Qian and Professor Jian Zhao, the Deputy Minister of the Ministry of Transportation, Mr Zhenglin Feng, the Deputy Minister of the Ministry of Railways, Mr Chunfang Lu, the Party Secretary of the China Association for Science and Technology (CAST), Mr Qin Zhang, the Vice-Chairs of the Congress, Professor Xia-Ting Feng, Professor Yingxin Zhou and Professor Chung-In Lee (Korea), the then ISRM President Professor J.A. Hudson (UK), the ISRM Vice-President for Asia, Professor A. Ghazvinian (Iran), the ISRM Secretary-General, Dr L. Lamas (Portugal), the Past Presidents of the Chinese Society for Rock Mechanics and Engineering, Academicians Professors Jun Sun and Sijing Wang, and the President of the ISRM National Group for China, Professor Chun'an Tang, were seated on the podium.

The current and newly-elected ISRM Board Members, the past ISRM Presidents and Board Members, the International Advisory Board Members for the

Congress, the Müller Award and Rocha Award winners, the prestigious Academicians, experts and scholars from China and other countries, the Organising Committee Members and the leading Secretariat staff attended the opening ceremony and were seated in the VIP seats.

The Vice-Chair of the Congress, Professor Xia-ting Feng, hosted the Opening Ceremony.

The Congress was opened with the traditional Chinese lion dance performance, after which Academician Qihu Qian and Professor J.A. Hudson then painted the lion's eyes. Professor Xia-Ting Feng introduced the guests seated on the podium. Academician Qihu Qian and Professor J.A. Hudson made the opening addresses on behalf of the Organising Committee and the ISRM, respectively. Professor A. Ghazvinian introduced the history and development of rock mechanics in Asia. The Executive Secretary of CAST, Mr Qin Zhang addressed the Congress and wished it a great success. Professor Chun'an Tang read the list of the



Professor Qihu Qian, President of the Chinese Society for Rock Mechanics and Engineering and Co-Chair of the 12th ISRM Congress

Harmonising Rock Mechanics and the Environment



more than 30 organisations, departments and individuals who had sent congratulatory letters to the Congress, including the President of Chinese Academy of Engineering, Professor Ji Zhou, and thanked them for their congratulations.

Immediately after the Opening Ceremony, the past ISRM president, Professor Ted Brown delivered a Keynote Lecture on “50 Years of the ISRM and Associated Progress in Rock Mechanics” and reviewed the history of the ISRM and the international rock mechanics field over the last 50 years. Professor J.A. Hudson then presented a Keynote on “The Next 50 Years of the ISRM and Anticipated Future Progress in Rock Mechanics”. He predicted the future 50 years of the ISRM and the prospects for rock mechanics in the next 50 years.

Following these lectures, Professor J.A. Hudson presented the ISRM Müller Award to Professor N. Barton, after which Professor N. Barton presented the Müller lecture: “From Empiricism, Through Theory,

to Problem Solving in Rock Engineering”. See pages 60–66 for a photo of the presentation and an abridged version of the associated paper.

Academician Qihu Qian made a Keynote presentation on “New Developments of Rock Engineering and Technology in China”. In his presentation, Academician Qian reported on the splendid achievements of rock engineering and technology in large-scale rock engineering projects in China. In the afternoon, four parallel sessions were held, namely, Analysis and Design Methods, Dynamics and Blasting, Field Measurement and Site Investigation, and Laboratory Testing and Rock Properties. The delegates had extensive discussions on the presentations.



**Professor Jian Zhao, EPFL, Switzerland
Co-Chair of the 12th ISRM Congress**



**Professor Ted Brown (left) receives his
ISRM Fellowship from
John A. Hudson & Luis Lamas**

The Welcome Banquet was held in the evening of October 18. At the beginning of the banquet, the ISRM announced the induction of ISRM Fellows, a new initiative of the 2007–2011 Board. The ISRM President, Professor J.A. Hudson announced the list of the first eight ISRM Fellows and presented the certificates and medals to the previous ISRM Presidents who were present.

The 12th ISRM Congress held October 2011 in Beijing (cont.)

The ISRM National Groups for China and Singapore exchanged gifts and celebrated the successful opening of the Congress. Subsequently, a Chinese cultural show was performed during the banquet, which was enjoyed by all.

During 19–21 October, 11 speakers delivered Keynote Lectures, including the Rocha Medal Lecture. Another 20 parallel sessions were held in four meeting rooms, which demonstrated the latest achievements in the international rock mechanics and engineering field.

In recent years, a large number of rock engineering projects, for instance, the Three Gorges Project, the Jinping Hydropower Stations, the South-to-North Water Diversion Project and the Qinghai-Tibet Railway, have been constructed in China—which ranks number one in the world in terms of the large project scale, the complexity of geological conditions and the difficulty in construction. In the afternoon of 21st October, a special session “China-Afternoon” was organised. 11 experts in the rock mechanics field, including Academicians Jun Sun and Liang Yuan made presentations on the great achievements in rock mechanics theory, engineering technology and construction in China.

The ISRM 50th Anniversary Celebration Banquet was held in the evening of 20th October against the backdrop of a large image of the logo on this Issue’s front cover. Professor N. Grossmann introduced the foundation and developmental history of ISRM, the dates, country and city of previous ISRM Congresses and the past Board Members. During the Banquet, the ISRM President, Professor J.A. Hudson, the ISRM Secretary-General, Dr L. Lamas, the Congress Chair, Academician Qihu Qian and the Congress Secretary-General, Professor Zhongkui Li gave toasts to all the attending delegates. Junior and senior experts and scholars in rock mechanics got together, contemplated the present and recalled the past, and created a harmonious and celebratory atmosphere in the international rock mechanics community. Chinese and foreign-style cultural shows were performed during the Banquet. Photos of both Banquets are included on pages 33 and 35.

The Closing Ceremony was hosted by the ISRM Secretary-General, Dr L. Lamas, starting at 5 pm on 21st October. The newly-elected 2011–2015 Board members took over from the current 2007–2011 Board members. Professor Xia-Ting Feng received the ISRM staff and sash from Professor J.A. Hudson and officially became the ISRM President. He then delivered his inaugural speech and expressed his determination to expand the ISRM, to improve the benefits to Na-

tional Groups and members and to improve the effectiveness of the ISRM services, see page 36.

The ISRM2011 Congress was a grand event for the rock mechanics community. It showcased the latest advances in international progress in rock mechanics theory and engineering technology. Various new theories, new ideas and new methods struck sparks of innovation. Moreover, the ISRM2011 Congress was the largest ever in scale. In terms of the venue in China, the achievements in rock mechanics and engineering in China received attention from all over the world. In fact, the Congress has served as a link between the past and the future for rock mechanics in China.

The Congress Co-Chair, Professor Jian Zhao congratulated Academician Qihu Qian on the success of the Congress. He said that “The Congress was a success and received many appreciative comments”.

The ISRM Secretary-General, Dr L. Lamas, in his letter to Professor Qihu Qian, said that, “I would like to congratulate you, the CSRME and all the Organising Committee of the 12th ISRM International Congress for the excellent event that you organised. It was a great success from the technical and the social points of view, and the ISRM was very well served.”

The now former ISRM President, Professor J.A. Hudson, in his email to Professor Xia-Ting Feng, indicated that “The Congress went very well without any major problems...the CNCC hotel room was really



Professor Abdolhadi Ghazvinian
Tarbiat-Modares University, Iran
2007–2011 ISRM Vice-President for Asia

comfortable. The CNCC halls were also fine, and the two Banquets were excellent. We were especially impressed by the big banners across the back of the stage in each case—which came out well in the photographs. Also, the 2007–2011 ISRM Board's initiatives were implemented well, especially the ISRM Fellows' induction and the Advisory Forum. So, it was a great time and a fitting welcome to you as the new ISRM President. Good luck to you and the new Board in your work during 2011–2015. I am sure that it will be successful.”

A former ISRM Vice-President for Asia, Professor Chung-In Lee from Korea, in his email to the new ISRM Vice-President for Asia, Professor Yingxin Zhou, said that, “The 12th International Congress on Rock Mechanics is ranked as excellent in every aspect, including its high quality contents, number of participants and systematic operation during the conference.”

The President of the ISRM National Group for India, Professor K.G. Sharma, in his email to Professor Yingxin Zhou, said that, “I congratulate you and your team for organising the Congress very successfully. The venue was excellent and was within the reach of the hotels. The arrangements for the Congress were excellent. The selections of Keynotes were very good.”

Professor Yunmei Lin, one of the veterans in the Chinese Society for Rock Mechanics and Engineering, and the teacher of the new ISRM President, Professor Xia-Ting Feng, emotionally said that, “The Congress is great. The senior generation in rock mechanics is pleased and feels extremely proud of you.”

Some students, who are not yet ISRM members, were encouraged by the Congress and consulted the Organising Committee members on how to become an ISRM member and expressed their wishes to become a member. This directly reflects the attractiveness of the Congress to young students. It is gratifying to feel that we will have successors for the development of the rock mechanics and rock engineering subject.

The success of the Congress is also reflected through the fruitful academic exchanges. 15 Keynote papers were presented, including three Keynotes for the 50th anniversary of ISRM, the Müller lecture (see page 60–66), the Rocha Medal lecture, and ten invited Keynotes. 227 oral presentations in four parallel sessions and 140 poster presentations in the foyer were delivered. The papers were divided into 11 topics, covering almost all the important issues in the rock mechanics field, as follows: Analysis & Design Methods, Numerical Modelling, Laboratory Testing & Rock Properties, Field Measurements & Site Investi-



Professor J.A. Hudson presents the Rocha Medal to Dr D. Park

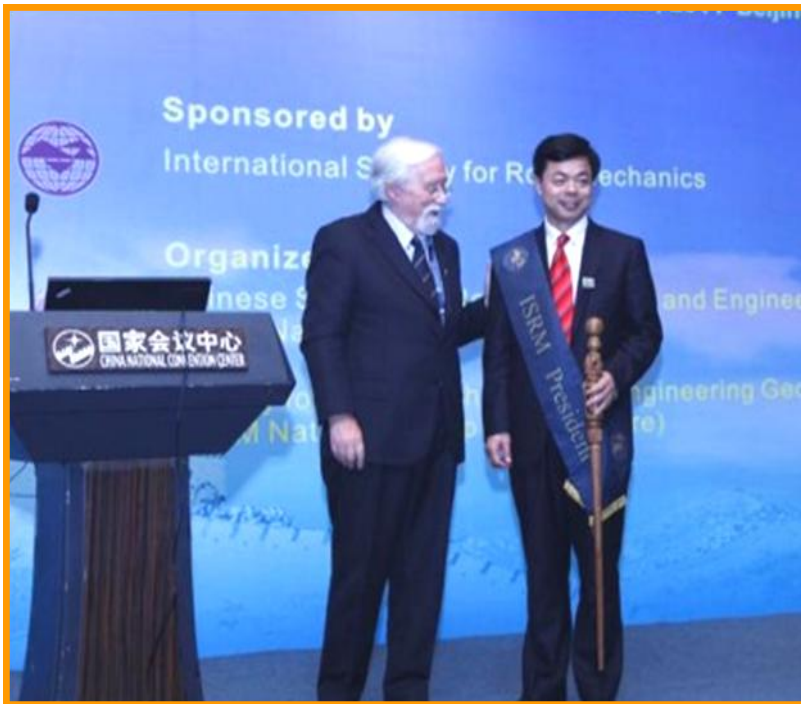
gation, Dynamics & Blasting, Fluid & Gas Flow, Risks & Hazards, Mining & Rock Support, Tunneling, Rock Caverns & Underground Space, Rock Slopes & Foundation, and Interdisciplinary.

The invited Keynote Lectures, including “Fifty Years of the ISRM and Associated Progress in Rock Mechanics” by Professor Ted Brown, “The Next 50 Years of the ISRM and Anticipated Future Progress in Rock Mechanics” by Professor J.A. Hudson and “New Development of Rock Engineering and Technology in China” by Professor Qihu Qian, were scientific, systematic and forward-looking, and typical of the academic exchanges during the Congress.

In the last day of the Congress, a special China-Afternoon session was arranged. Invited lectures were given by Academicians Jun Sun, Liang Yuan and other top scientists in Chinese rock mechanics field and technical directors of typical large-scale rock engineering projects. This special session showcased the great achievements in rock mechanics and engineering projects in China to the world.

Academician Qihu Qian in his Keynote lecture, highlighted the fact that China is No. 1 in the world in terms of rock engineering, with a large number of projects, complex geological conditions and unprecedented technical difficulties. Rich experiences have been accumulated in investigation, design, construction and monitoring. Of course, lessons were also learned. He emphasised that China is willing to share these experiences with researchers and engineers in rock mechanics and rock engineering from all over the

The 12th ISRM Congress held October 2011 in Beijing (cont.)



Prof J.A. Hudson, 2007–2011 ISRM President presents the ISRM sash and staff to Prof Xia-Ting Feng, 2011–2015 ISRM President

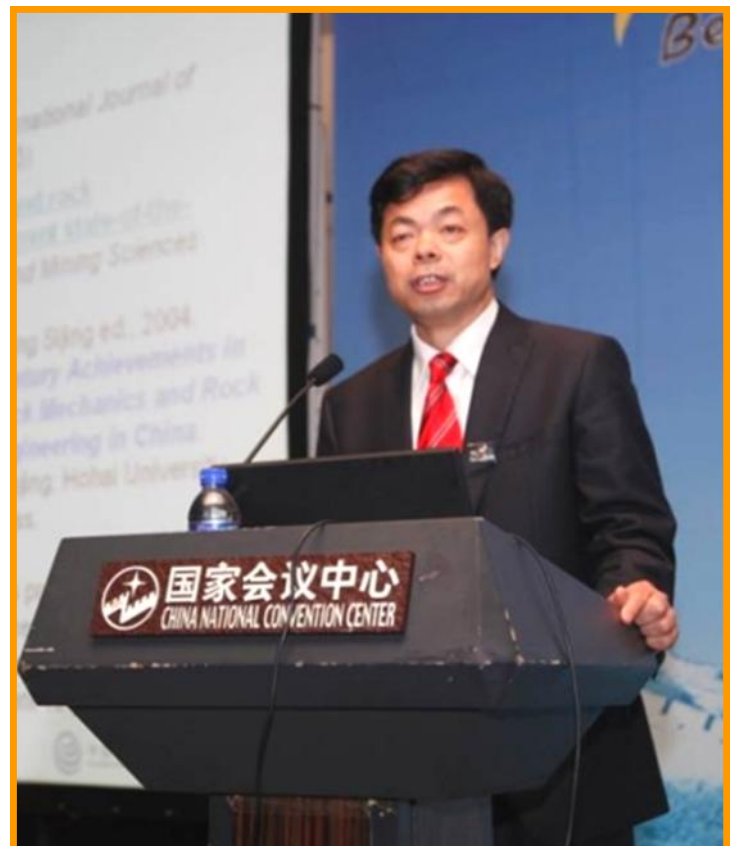
world, and to work together towards a new era in rock mechanics and engineering.

The Congress is highly valued by Chinese government departments and various sectors of society. The success of the Congress is also reflected by the great importance attached to it by the China Association for Science and Technology (CAST), the leading authority of the Chinese Society for Rock Mechanics and Engineering (CSRME), and leaders from other relevant ministries and departments. The Party Secretary of CAST, Mr Qin Zhang, the Deputy Minister of the Ministry of Transportation, Mr Zhenglin Feng, the Deputy Minister of the Ministry of Railways, Mr Chunfang Lu and leaders from other government agencies attended the Congress.

The Deputy Minister of the Chinese Ministry of Water Resources, Dr Yong Jiao, whose PhD is in rock mechanics from Imperial College in the UK, planned to participate in the Congress. However, although he was not able to attend the Congress due to business reasons, he sent a congratulatory letter to the Congress. In fact, more than 30 organisations sent congratulatory letters and mails to the Congress, including the Chinese Academy of Sciences, Chinese Academy of Engineering, Beijing Municipal Government and other large-scale state enterprises and organisations.

Mr Qin Zhang, had on behalf of the administrative department, addressed the Congress to give congratulations on the 12th ISRM International Congress, the 50th Anniversary of the ISRM, and to Professor Xia-Ting Feng on becoming the ISRM President. He stressed that CAST is a mass organisation for scientific and technical professionals and attaches great importance to such foreign exchanges. For scientific and technological exchanges, CAST has always advocated free exploration, encouraged academic contention, created an academic atmosphere and promoted original innovations, which provide common recognition among the international rock mechanics community.

In addition, the Congress also attracted attention from various media, including the Xihua News Agency, Science and Technology Daily, Science Times, Renren.com and Sina.com.



Prof Xia-Ting Feng, 2011–2015 ISRM President, gives his Inaugural Address

The 12th ISRM Congress *WELCOME* Banquet

Because of the many celebratory events associated with the 12th ISRM Congress, not one but two Banquets were held: the Welcome Banquet and the 50-Year Anniversary Banquet. The photos of these Banquets reflect the success of the Congress and the convivial atmosphere that pervaded throughout.

The photos were taken by Prof Lixing Huang and Dr Yan Guo of the Institute of Rock and Soil Mechanics.



Qihu Qian, Zhou Yingxin, Chun'an Tang



Michael King, Ted Brown, Antonio Samaniego



Nuno Grossmann and Qihu Qian



Sofia Meess and Wenli Xu



John A. Hudson, John A. Franklin, Kersty Franklin



Carol Hudson, Tony Meyers and John A. Hudson



The entertainment

Induction of the ISRM Fellows

John A. Hudson, 2007–2011 ISRM President

During the Welcome Banquet illustrated on the previous page, the first group of ISRM Fellows was inducted



The ISRM Council decided at its New Delhi meeting in October 2010, to create the status of Fellow, as the highest and most senior grade of membership of the ISRM. It is conferred on individuals, affiliated with the ISRM, who have achieved outstanding accomplishment in the field of rock mechanics and/or rock engineering and who have contributed to the professional community through the ISRM.

An ISRM Fellowship is a lifetime position. It is intended that the title of ISRM Fellow will carry a clear recognition of his or her achievements. Thus, the induction of ISRM Fellows creates a group of experts that can provide strong support and advice to the ISRM, and can be called upon as appropriate for ISRM activities, as for example through the Advisory Forum, see page 22.



Prof Shunsuke Sakurai receives his ISRM Fellow Medal from the 2007–2011 ISRM President, Prof John A. Hudson, at the 12th ISRM Congress Welcome Banquet

The first group of Fellows was inducted in Beijing, during the 12th International Congress on Rock Mechanics. They are: Ted Brown, Charles Fairhurst, John A. Franklin, Pierre Habib, Marc Panet, Shunsuke Sakurai, Nielen van der Merwe and Walter Wittke.

The ISRM Fellows booklet containing the CVs of the ISRM Fellows (see image below) is available via the ISRM website





Banqueting table, Yunmei Lin on the right



John A. Hudson, Charles Fairhurst, Qihu Qian



Nick Barton receives his Müller Award artwork



Nuno Grossmann presents the ISRM history



Ricardo Resende, the winner of the 50th Anniversary slide show presentation



Lina Wang and Xia-Ting Feng



Luis Lamas, Yan Guo, Sofia Meess, Xia-Ting Feng



Weishen Zhu, Robert Zimmerman, Quentin Yue

Message from the ISRM President



Xia-Ting Feng

As the new president of ISRM, here I would like to share some good news with you.

Thanks to your involvement and contributions, our ISRM community has expanded its dimension to over 6500 enrolled individual members. In the past year, the ISRM Fellowship has been granted to all living past Presidents, the first ISRM Advisory Forum and Young Members' Presidential Group have been very well organised, and the Commissions have delivered important outputs. The virtual library, videos, slide collections and ISRM lectures can be found on the ISRM website at www.isrm.net. Also, due to your active involvement and kind support, one of the most important ISRM events—the 12th ISRM Congress on Rock Mechanics—has been successfully held in Beijing in 16–21 October, 2011.

After the Beijing Congress, the new 2011–2015 ISRM Board has formally taken over its office. With a wide survey and many discussions among the Board, National Groups and Members, we have launched a Modernisation Program 2011–2015, which is dedicated to:

- making the ISRM even more REAP (Responsible, Effective, Attractive, and Publicly aware) through injecting proper dynamism,
- improving benefits to the ISRM members and National Groups,
- enhancing the communication and collaboration among the ISRM members and with the Sister Societies,

- attracting more members and more young people to become more involved in the activities of the ISRM,
- supporting rock mechanics and rock engineering activities in less developed countries,
- enhancing the influence and recognition of the ISRM Suggested Methods, and
- fostering the ISRM development.

The purpose of the ISRM will remain unchanged, but, to continue the successful execution of our mission, we need to adapt to evolving demands and take advantage of the opportunities, especially those presented by advances in technology. We particularly need this evolution to be towards the execution of our mission, rather than to be just change for change's sake.

So far, 13 ISRM Commissions for 2011–2015 have been set up to develop or to revise guidelines and Suggested Methods, to collect more educational materials, and to organise a series of symposia and lecture tours. In addition, some new Commissions will be established for other technical work.

In the coming year, we will have several important ISRM symposia, such as the ISRM International Symposium EUROCK2012 in Sweden, the 2nd South American Symposium on Rock Excavations in Costa Rica, and the ISRM Asian Rock Mechanics Symposium ARMS7 in Korea.

In conjunction with EUROCK2012, the ISRM Council Meeting, the Board Meeting, the Commission meetings, Workshops and Short Courses will also be held. A commemorative book on the 50 years of the ISRM will be launched. Let us meet there to share our knowledge and progress of rock mechanics and rock engineering and exchange our ideas for our future.

We always need your contribution and involvement in our ISRM activities. We would very much appreciate your time and effort in this regard.

Xia-Ting Feng
ISRM President 2011–2015

**A record of the first meeting
of the 2011–2015 ISRM Board
is presented on the next page**

NEW ISRM BOARD MEETING Beijing, October 2011

The Board elected during the Congress started its functions immediately at the end of the Beijing Congress on 21 October 2011. Thus, the first meeting of the new Board took place in Beijing and was chaired by the new President Prof Xia-Ting Feng.

The main subjects covered were as follows:

- Election of the First Vice-President and reappointment of the Secretary-General
- Appointment of Vice-Presidents at Large
- Presentation by the Vice-Presidents at Large
- Modernisation Programme 2011–2015
- Appointment of the ISRM Commissions
- News Journal
- ISRM Annual Lecture
- ISRM Fellows
- Celebration of the 50th Anniversary of the ISRM
- FedIGS (Federation of International Geo-Engineering Societies)
- ISRM Advisory Forum

The Vice President for South America, Dr Antonio Samaniego, was elected as the First Vice-President and Dr Luís Lamas was reappointed as Secretary General.

The Board appointed as Vice-Presidents at Large Dr Ivan Vrkljan from Croatia and Prof Yuzo Ohnishi from Japan. It was decided that a third Vice-President at Large would be chosen later from one of three

Asian National Groups with significant activity: India, Iran and Korea.

Aiming to continue the modernisation programme, the President presented his plan to make the ISRM more REAP: Responsible, Effective, Atractive and Publicly aware (see the previous page).

The following ISRM Commissions were appointed or re-appointed for the term 2011–2015:

- Commission on the Application of Geophysics to Rock Engineering, chaired by Prof. Toshifumi Matsuoka;
- Commission on Coupled THMC Processes in Geological Materials and Systems, chaired by Prof Jishan Liu;
- Commission on Crustal Stress and Earthquakes, chaired by Prof Furen Xie;
- Commission on Design Methodology, chaired by Prof John A. Hudson and Prof Xia-Ting Feng;
- Commission on Education, chaired by Prof Meifeng Cai;
- Commission on Hard Rock Excavation, chaired by Dr Manoj Verma;
- Commission on Petroleum Geomechanics, chaired by Prof Maurice B. Dusseault;
- Commission on Preservation of Ancient Sites, chaired by Prof Wang Xudong;
- Commission on Radioactive Waste Disposal, chaired by Prof Ju Wang;
- Commission on Soft Rocks, chaired by Prof Dr Milton Assis Kanji;
- Commission on Spalling Prediction, chaired by Dr Mark Diederichs;
- Commission on Testing Methods, chaired by Prof Resat Ulusay; and the

- Commission on Underground Research Laboratory (URL) Networking, chaired by Prof Joseph Wang

To trim expenses, the New ISRM Board approved the online publication of the Society's News Journal, free to all visitors to the ISRM website, and the printing of up to 400 copies for select distribution.



The 2011–2015 ISRM Board



John A. Hudson, 2007–2011 ISRM President

A book to celebrate the 50-year anniversary of the ISRM is being prepared and will be available in 2012

As an additional commemoration of the 50-year existence of the ISRM, an Anniversary book is being prepared and will be available in 2012. The content of the book is as follows.

ISRM 50TH ANNIVERSARY COMMÉMORATIVE BOOK 1962 – 2012

Editors: *J. A. Hudson and L. Lamas*

The following Table of Contents indicates the structure of the ISRM 50th Anniversary Commemorative Book and the associated chapter authors. The book will celebrate the 50-year history of the ISRM (1962–2012) through chapters written by key ISRM personnel, as detailed below. A hard copy version will be made available to ISRM Members and the general public at a reasonable price in the summer of 2012.

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ISRM Congresses and Sponsored Conferences

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ISRM News and ISRM News Journal

Photos from the 50 years of the ISRM

CD with the digital version of the book

This book will be available from the ISRM Secretariat in the summer of 2012

Francois Malan, S. Africa (Francois.malan@groundwork.co.za)

1. Introduction

The report below summarises the ISRM activities for the Africa region for the period of January 2011 to October 2011. With mining such an important component of the economic activity in Africa, it is expected that rock engineering activities will feature prominently on the continent. Most of the ISRM members on the continent are mainly involved in the mining sector—as relatively few large civil engineering projects are being undertaken. Occasionally some large civil engineering projects, which require significant rock engineering input, are nevertheless conducted. Examples of these are the Gautrain and the Lesotho Highlands Water scheme.

The worldwide shortage of geotechnical skills unfortunately also affects Africa detrimentally and the required rock engineering expertise in many African countries is imported on a temporary basis as required. The temporary nature of these positions implies that it is logistically very difficult to establish and maintain National Groups in many African countries. The South African National Group (SANIRE) nevertheless remains very active and is growing its membership base. The thinking for some time has been that it will be better to form larger multi-national ISRM groups in Africa. SANIRE might possibly be used as a base for a Sub-Saharan ISRM group and they have now adopted the policy that all geotechnical engineers from other African countries are welcome to join their ranks.

2. Activities of SANIRE

For a number of years, SANIRE has maintained a system of regional branches to allow participation of a larger number of its members in different parts of the country. An additional branch, the Open Pit Branch, was recently added to the list to cater for the needs of the engineers involved with open cast mining. This has increased the number of branches to seven.

A growing number of rock engineers from diverse backgrounds are joining SANIRE. The membership number has reached a record total and currently stands at 418. This includes all categories of membership, as follows: Student 2; Retired 3; Corresponding 2; Hon. Life 14; Fellows 21; Members 136; Associate 240;

TOTAL 418. Regarding African members, this has grown to seven and includes geotechnical engineers from Botswana, Zambia and Zimbabwe.

3. Communication

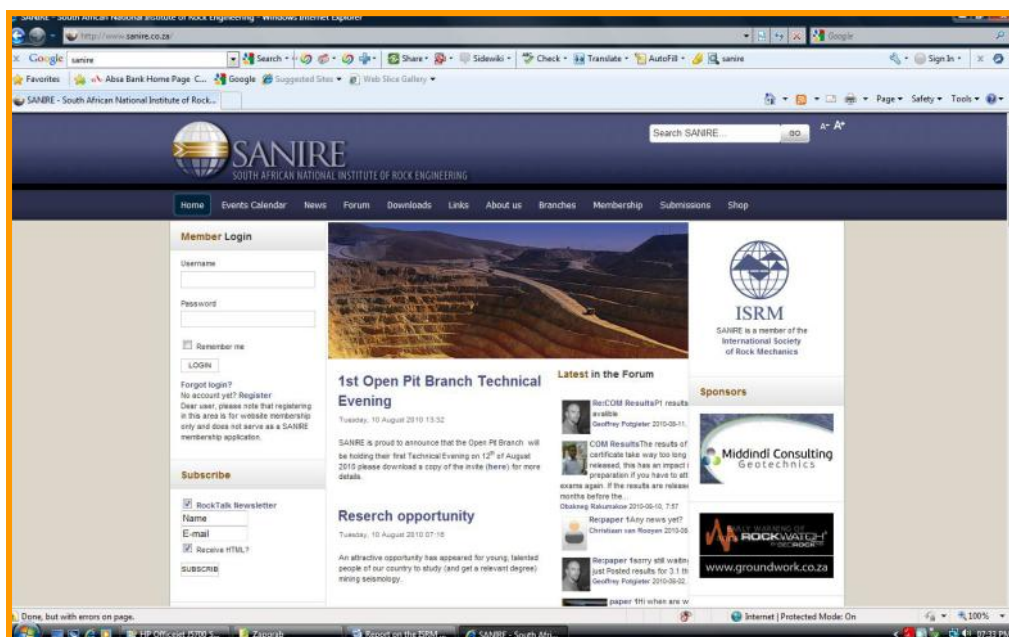
The revamped SANIRE website has become an important and frequently used communication tool during the last few years. This site is complemented by an electronic newsletter called RockTalk which contains articles of topical interest.

4. Conferences and Symposia

The tradition of holding an annual SANIRE symposium will be maintained this year as a local symposium is planned for 27 October 2011 at the Lonmin Game farm close to Rustenburg. The theme of the Symposium is “Back to Basics”.

5. SANIRE goes green

SANIRE Council supported the implementation of “green rules” to reduce the impact of the Institute’s activities on the natural environment with a green levy of R30 per member per year to be deducted from the member fees. This project was the brain child of Mr Friedemann Essrich. In 2010/11, a total of R10,920 was collected in this way. In order to put these funds to the best possible use, SANIRE approached FTFA (Food and Trees for Africa at www.trees.co.za), to identify possible projects within communities affected by mining. The funds were sufficient to purchase and plant 122 indigenous trees and three rural schools around Rustenburg were identified as beneficiaries.



Home page of the SANIRE website (www.sanire.co.za).

Abdolhadi Ghazvinian, Iran (abdolhadi@yahoo.com)

This report also includes additional historical information on the Asian ISRM activities

1. China

The Chinese Society for Rock Mechanics and Engineering (CSRME) since its inception in September 1979 has achieved great success in the field of rock mechanics and rock engineering. Being the largest of the National Groups in Asia, it now has a total individual number of 554 in the ISRM family. More than 20 International Symposia/Conferences have been so far organised by the NG of China ISRM and more than 400 domestic Symposia, including 11 National Congresses on Rock Mechanics, were successfully held in different cities all over China

Moreover, there are many other activities such as publication of the JRMGE Quarterly, organising several lecture tours, a series of international consulting activities, and the award of the Rocha Medal to Dr Z.Z. Liang from China in 2008.

The 12th Congress ISRM was held in Beijing on 18–21 October 2011, and the overwhelming achievement is that Prof Xia-Ting Feng, an outstanding scholar from the NG China, took over immediately after the Congress as the new ISRM President for the period 2011–2015.

2. India

The Indian National Group of ISRM, the most active National Group in terms of increase in membership during the year 2009 (as pointed out by the Secretary-General of ISRM in his report) has about 438 members. This National Group has the following major international activities on its record:

- ISRM International Symposium and 6th Asian Rock Mechanics Symposium, “Advances in Rock Engineering”, 23–27 October 2010, New Delhi;
- International Conference on “Accelerated Construction of Hydropower Projects”, October 2003, Bhutan;
- ISRM Sponsored Regional Symposium on “Advancing Rock Mechanics Frontiers to Meet the Challenges of 21st Century”, 24–27 September 2002, New Delhi;
- Workshop on Rock Mechanics and Tunnelling Techniques, September 2001, Kathmandu, Nepal;
- International Symposium on Rock Slopes, 7–11 December 1992, New Delhi;
- The Indian National Group of ISRM has published a manual on Rock Mechanics for the last 20 years.

- Prof T. Rammurthy from India served the ISRM as Vice-President for Asia during the period 1987–1991;
- In 1992, Dr A. Ghosh from India was presented with the ISRM Rocha Medal for his PhD thesis.

3. Iran

The Iran National Group represented by the Iranian Society for Rock Mechanics (IRSRM) has carried out various activities and has a leading role in the Middle East/Gulf Region in the field of rock mechanics and rock engineering. The main activities are summarised below:

- Organised five national Rock Mechanics conferences and various state levels conferences;
- Organised the ISRM International Symposium 5th Asian Rock Mechanics Symposium in November, 2008;
- Organised numerous Workshops at various levels and several Lecture Tours throughout the country.
- Published a magazine in the English and Persian languages.

4. Korea

The Korean National Group (KSRM), founded in 1981, has presently over 1200 local and 50 ISRM members. The Group has been very active and its performance is summarised below:

- Every year, two national conferences are organised, in the spring and autumn;
- Publishes six issues of the KSRM Journal (also called “Tunnels and Underground Space”) each year;
- The Group hosted its first Asian Rock Mechanics Symposium (ARMS) in 1997;
- The 7th ARMS Symposium will be held in October, 2012. The Group has been very active in holding regular meetings and exchange programs with Japan and China.

5. Japan

The Japanese Committee for Rock Mechanics (JCRM) was formed in 1964 and presently has 370 ISRM individual members and 44 corporate members. A brief overview of its activities is given below:

More than four international Symposia and Conferences have been so far organised by the Japanese National Group and several domestic Symposia, including 12 National Symposia on Rock Mechanics. Since 2005, the JCRM has published electronic journals, international journals of the JCRM.



Prof Hadi Ghasvinian (fourth from the left) and the other 2007–2011 ISRM Board members receive their certificates from the 2011–2015 ISRM President, Prof Xia-Ting Feng

6. Singapore

SRMEG, the Singapore National Group, represented by the Singapore Society of Rock Mechanics and Engineering Geology (SRMGE), has now increased its membership to 85. The Singapore NG has been active in organising various activities, a summary of which is given below:

- A successful Workshop on Norwegian Tunneling Technology on 17–18 February 2009 in Singapore;
- Two Seminars on the ACI Nozzleman Certification on 6 October 2009 in Singapore;
- A two-day Short Course on Geological Investigations and Ground Characterisation for Tunnelling and Cavern Construction, held on 11–13 November, 2009, in Singapore;
- International Conference on Discontinuous Deformation Analysis 2009, held on 25–27 November 2009, in Singapore;
- SRMEG is to host the 13th International Conference of the Associated Research Centres for Urban Underground Space (ACUUS) in 2012 in Singapore;
- SRMEG was the co-organiser of the 12th ISRM Congress with China NG held in Beijing in October, 2011;
- Organised a three-day Short Course on Discontinuum Modelling in Rock Mechanics with UDEC Applications, on 30th August to 1st September 2010;
- Organised NATM Workshop on 11–12 November 2010, Singapore;

- Conducted monthly EAS-SRMEG Seminars in July, August and September 2009.

7. Israel

The Israel National Group is represented by the Israel Rock Mechanics Association (IRMA). The activities during the reporting period have not yet been reported.

8. Middle East Region

The Middle East Regional Group is represented by the Middle East Society for Rock Mechanics, based in Abu Dhabi, United Arab Emirates. This regional group was affiliated to the ISRM last year. The activities during the reporting period have not yet been reported by the Regional Group.

9. Indonesia

The Indonesian Group has furnished its short report as follows:

- Organised one geotechnical assessment course;
- Have organised a National Geotechnical Workshop.

10. Nepal

The Nepal National Group is represented by the Nepal Geotechnical Society. The activities during the reporting period have not yet been reported.

11. Southeast Asia: Thailand

The Thai National Group, represented by Thai Rock Mechanics has been active.

The Second Thailand Symposium on Rock Mechanics (Thai Rock 2009) represents a continuing mission of the Thai leading academic institutions to promote the significance and development of rock mechanics knowledge and profession in Thailand and neighbouring countries.

A one-day short course on 3D Lidar Scanner for Rock Mass Classification preceded the conference and was presented by Prof. John M. Kemeny.

12. Outlook for Asia

The upward trend of expansion and progress in the activities of the Asian National Groups is obviously perceived as the ongoing/incoming years are witnessing various international events in Asia, especially in China, India, Iran, Japan, Korea and Singapore. In addition, there are many national and local conferences and symposia planned by the ISRM National Groups and Commissions. Efforts aimed at establishing ISRM National Groups in other parts of Asia, including the Philippines, west and middle Asia, form our future strategy.

2011 Activity Report by ISRM Vice-President for Australasia

Tony Meyers, Australia (tony@rocktest.com.au)

Finances

The contribution from the Australian Geomechanics Society to the ISRM of AUD\$2959 (€2217) was transferred in June 2011.

Membership

| | |
|---------------|------------|
| Australia | 242 |
| New Zealand | 105 |
| Corresponding | 19 |
| Total | 366 |

ROCK MECHANICS EVENTS HELD BY ISRM RELATED GROUPS

| Topic | Presenter | Date | Location |
|--|---------------------|--------|------------------|
| 2010 | | | |
| National Seismic Hazard Model, NZS1170 | Mark Stirling | Sep 10 | Christchurch, NZ |
| Rock logging course | Various | Sep 17 | Perth, WA |
| Geotechnical risk | Various | Oct 12 | Brisbane, Qld |
| Influence of water on slope instability | Laurie Wesley | Oct 14 | Hamilton, NZ |
| Palmers road landslide | Mark Adams | Nov 10 | Sydney NSW |
| Earthquake experience in Christchurch | David Dobbie | Nov 23 | Auckland, NZ |
| NZGS Seismic Design Guidelines - | Various | | Auckland, NZ |
| 2011 | | | |
| 3D characterisation of Wellington fault | GNS Science | | Wellington, NZ |
| Closely jointed rock masses | Stuart Read | Feb 3 | Wellington, NZ |
| 3D models of rock strength | Peter Hatherley | Feb 9 | Sydney, NSW |
| Landslide reactivation: Utiku | Chris Massey | Feb 16 | Wellington, NZ |
| Laboratory testing of rock | Andy Fourie | Feb 18 | Perth, WA |
| Geological engineering Nakheed Tower | Chris Haberfield | Mch 8 | Perth WA |
| Development of underground space | Fiona Chow | Mch 17 | Brisbane, Qld |
| Anticipating engineering properties from geology | Alan Moon | Apr 18 | Adelaide, SA |
| Landslides in rock slopes | Bill Murphy | Apr 26 | Wellington NZ |
| Geology & geomorphology of Port Phillip Bay | N. Rosengren | May 11 | Melbourne, VIC |
| Eastlink tunnel | Tony Bennett | May 16 | Adelaide SA |
| Landslide risk management | Various | May 31 | Brisbane Qld |
| Limestone karstic terrain | Jacqui Coleman | May 31 | Auckland, NZ |
| Selecting a TBM | Tony Peach | Jun 8 | Melbourne, VIC |
| Soil and rock logging | Fred Baynes | Jun 13 | Melbourne, VIC |
| Risk management in limestone: King Park | Bruce Bulley | Jun 14 | Perth, WA |
| Martha Mine geotechnical issues | T. Matuschka | Jun 21 | Auckland, NZ |
| Geotechnical investigation of large mining project | Mark Orr | Jul 12 | Perth, WA |
| MONA underground construction | Delia Sidea | Aug 16 | Hobart, Tas |
| Managing geotechnical risk | Fred Baynes | Sep 19 | Perth, WA |

Each of these two-hour events attracted between 20 and 60 geotechnical practitioners. The events were provided at no-cost to attendees.

ROCK MECHANICS EVENTS HELD BY NON-ISRM RELATED GROUPS IN 2011

| Workshop Topics | Date | Location | Provider |
|---|------------|----------------|----------|
| New technologies in ground control | 5–6 May | Newcastle, NSW | EAGCG |
| Applications of seismology in mining | 10–13 May | Perth, WA | ACG |
| Ground support in open pit mining | 17 May | Perth, WA | ACG |
| Geotechnical engineering for open pit mines | 18–19 May | Perth, WA | ACG |
| Advanced ground support in underground mining | 26–28 Sept | Perth, WA | ACG |
| Mine backfill seminar | 29–30 Sept | Perth, WA | ACG |
| Open pit—Underground interaction workshop | 7 Nov | Perth, WA | ACG |
| Strategic vs. tactical approaches in mining geotechnics | 8–11 Nov | Perth, WA | ACG |
| Data collection and analysis | 10–11 Nov | Melbourne, Vic | EAGCG |
| Blasting for stable slopes | 16–18 Nov | Perth, WA | ACG |

ACG - Australian Centre for Geomechanics

Each of these events attracted approximately 50–150 rock mechanics practitioners. The average registration fee for these events was between €175 and €570. No discounts were provided to ISRM members.

Member communication

The VP continued to communicate with local members at every opportunity. Recent communications concerned:

- ISRM RockNotes articles for the quarterly Australian Geomechanics Journal and New Zealand Geomechanics News;
- liaison between members and the Secretariat about various issues including membership and web access;
- managing the submission of 20 papers for the 2011 ISRM Congress in Beijing; and
- Seeking nominations for the regional Vice-President 2012–2015. Nominations were sought only from Australian Members in line with a proven system. The country from which the VP will come rotates on a *pro-rata* basis according to the number of members in each country i.e., Australia two terms, New Zealand one term. This system prevents the need for the ISRM Council having to decide between alternative nominations from different countries within a region.

Rock engineering issues in the Region

In Australasia, the mining industry is the primary employer of rock mechanics professionals. There are currently a significant number of vacancies in the industry for geo-practitioners. Vacancy numbers are expected to remain constant or grow over at least the next two years.

Many companies are struggling to keep up with current demand and desperately require key personnel.

The shortage will be further exacerbated in 2012 when national regulations replace state-based regulations. These regulations place significantly greater responsibility on mine sites to have active ground control management plans.

Other issues facing rock engineering in the Region include the following.

- The necessity to address the gulf between the academic/researchers and the practitioners. Doing so requires bringing together practitioners in rock engineering from the mining and civil industries and from the research, education and training sectors in a spirit of collaboration and congeniality.
- The necessity to improve communication between the different professional societies representing rock engineers.
- The necessity to develop a uniform system of chartered professional status that can apply to all rock engineers, no matter which area (i.e., mining, civil, tunnelling, petroleum) they practise in.
- The necessity to provide all practitioners in rock engineering with the opportunity to share in the high level of expertise, and be exposed to the exciting developments taking place, in the profession both locally and overseas.
- The recent upward trend in ISRM membership numbers in the region is fragile. The trend can be just as quickly reversed in line with the general downward trend in members of all professional societies globally, the downward trend in the number of rock engineers entering the profession, the global economic downturn.

2011 Activity Report by ISRM Vice-President for Europe

Nuno Grossmann, Portugal (grossmann@Inec.pt)

Since the ISRM Council meeting held in New Delhi INDIA, on the occasion of the 6th Asian Rock Mechanics Symposium, the 2010 International Symposium of the ISRM (2010 October), no ISRM-Sponsored events took place in Europe. The European Council Meeting 2010 had taken place in conjunction with the EUROCK2010 Symposium (Lausanne SWITZERLAND, 2010 June), and the European Council Meeting 2011 took place in conjunction with the 12th ISRM International Congress on Rock Mechanics, in Beijing CHINA (2011 October).

The next European Regional Symposia of the ISRM are foreseen as follows:

- EUROCK2012, a symposium on Rock Engineering and Technology for Sustainable Underground Construction, which shall also be the 2012 International Symposium of the ISRM, will take place in Stockholm SWEDEN, 2012 May 28–30;
- EUROCK2013, a symposium on Rock Mechanics for Resources, Energy, and Environment (also the 2013 International Symposium of the ISRM), will take place in Wroclaw POLAND, 2013 September 23–26;
- EUROCK2014, was decided by the ISRM Board among three candidates (Salzburg AUSTRIA, Lyons FRANCE, and Vigo SPAIN), at their meeting in Beijing CHINA, on 2011 October 16 and Vigo was chosen.

Currently, no Specialised Events are foreseen to take place in Europe.

The vitality of the European NGs may be ascertained by the fact that there were three candidates running for the office of ISRM Vice-President for Europe 2011–2015, with Frederic Pellet being successful, see page eight.

On the other hand, my request to provide the VP Europe with a short report on their activities developed during the period 2007–2011 only received four positive replies (see the following reports).

* * * * *

ISRM NG AUSTRIA

The Austrian Society for Geomechanics (ÖGG)

ÖGG- Events

The ÖGG organises and sponsors a number of conferences and workshops. The most important are the annual Geomechanics Colloquia and the biennial Tunnel Days, which are organised in co-operation with the ITA NG Austria, in Salzburg.

| | Geomechanics Colloquium participants | Tunnel Day participants | Special Sessions participants | Excursion participants | Exhibitors |
|------|--------------------------------------|-------------------------|-------------------------------|------------------------|------------|
| 2007 | 849 from 23 Nations | | 357 from 14 Nations | 31 | 44 |
| 2008 | 998 from 23 Nations | 732 from 21 Nations | | 54 | 51 |
| 2009 | 826 from 19 Nations | | 202 from 10 Nations | 8 | 54 |
| 2010 | 985 from 23 Nations | 691 from 16 Nations | | 9 | 55 |

In 2011, the 60th Geomechanics Colloquium (the Ernest Weiss Colloquy) takes place, together with the two Workshops “Environmental impact assessment—chance or fetter for projects”, and “Methods of analysis in geotechnics—ground characterisation and failure mechanisms”.

Other events sponsored by the ÖGG

- The Annual Christian Veder Kolloquium, in Graz, with 350 to 450 participants
- The 2nd International Conference on Long Term Behaviour of Dams (2009 October 12–13), in Graz
- The 4th Colloquium “Rock Mechanics—Theory and Practice” (2007), in Vienna
- The 5th Colloquium “Rock Mechanics—Theory and Practice” (2009), in Vienna
- The IUT 2011, in Switzerland

Members

Due to increased benefits, like free subscription of the journal “Geomechanics and Tunnelling”, and substantially reduced registration fees at ÖGG conferences, the membership has continuously increased over the past years.

| | ÖGG | ISRM | Students ÖGG | Students ISRM | Sponsoring Members |
|------|-----|------|--------------|---------------|--------------------|
| 2007 | 335 | 263 | 4 | 2 | 40 |
| 2008 | 376 | 279 | 8 | 7 | 42 |
| 2009 | 416 | 301 | 17 | 14 | 41 |
| 2010 | 442 | 308 | 31 | 23 | 43 |
| 2011 | 460 | 325 | 37 | 26 | 44 |

Journal

The ÖGG is editor of the journal “Geomechanics and Tunnelling”, which is published by Ernst und Sohn, Berlin. Since 2010, the journal is published in English and German. It is also available online.

Publications

The Society is also active in producing guidelines and documents. In the past four years, the following documents have been published:

2008

- The book “100 Jahre Prof. Leopold Müller”

- The 2nd version of the “Richtlinie für die geotechnische Planung von Untertagebauten mit zyklischen Vortrieb”

2010

- The “NATM—The Austrian Practice of Conventional Tunnelling”
- The guideline for the “Geotechnical Design of Underground Structures with Conventional Tunnelling”

Sections

The Society is organised in four Sections, which coordinate Working Groups and assist in organising the Geomechanics Colloquium

- Section Rock Mechanics and Rock Engineering: *Active Working Group* – “Geomechanics of Deep Tunnels”
- Section Soil Mechanics and Foundation Engineering: *Active Working Group* – “Maintenance of Slopes”
- Section Tunnelling: *Active Working Groups* – “Conventional Tunnelling”, “Contracts”, “Monitoring”, and “Cost Estimation for Infrastructure Projects”
- Section Engineering Geology: presently has no active Working Group

Awards

The Society has two awards:

- the Leopold Müller Award for excellent doctoral theses, which is open for everyone; and
- the ÖGG award, which is dedicated to excellent diploma/master theses from Austrian Universities.

Leopold Müller Awards from 2007 to 2010

2007—no award

2008—no award

2009—Dr-Ing. *Jörg Meier* – “Parameterbestimmung mittels inverser Verfahren für geotechnische Problemstellungen”

2010—Dipl-Ing. Dr *Karl Grossauer*, “Expert System Development for the Evaluation and Interpretation of Displacement Monitoring Data in Tunnelling”

ÖGG Awards from 2007 to 2011

A variety of awards were made under this heading.

ISRM NG CROATIA Croatian Geotechnical Society

2008

- The CGS participated in the ISRM Council meeting in Tehran.

2009

- Croatian Geotechnical Society—Convention 2009: Sources of Risk in Geotechnical Works, Osijek, 2009 June 20–21.
- The CGS participated in the ISRM Council meeting in Hong Kong.
- A Regional Symposium of the International Society for Rock Mechanics (ISRM) was held on 2009 October 29–31, in Cavtat, near Dubrovnik, on “Rock Engineering in Difficult Ground Conditions—Soft Rocks and Karst”. The Symposium proceedings have been published in a single volume, and contain seven keynote lectures and 129 papers, classified in seven themes.

2010

The CGS participated in the ISRM Council meeting in New Delhi.

2011

Dr Nick Barton was interviewed by Prof. Ivan Vrkljan, during his stay in Croatia, from 2011 June 1–6 (Zagreb, 2011 June 2). This interview was reported in the 2010 Issue of this ISRM News Journal, pages 18–19.

ISRM NG CZECH R

The main activities were connected with the preparation and organisation of conferences and congresses. First of all, there is a very good collaboration of the ISRM NG CZECH R with the Czech Tunnelling Association (ITA). The ISRM NG CZECH shared the organisation of the successful World Tunnel Congress 2007 “Underground Space—the 4th Dimension of Metropolises” (Prague, 2007 May 05–10), and the 11th International Conference Underground Construction Prague 2010 (Prague, 2010 June 14–16). Members of the ISRM NG CZECH R worked in the organising committee, shared the editing of the Proceedings, took chairs of some sections during conferences, and so on.

As the centre of gravity of the ISRM NG CZECH R is in Ostrava, the NG shared also the organisation of regional conferences (with international participation), focused on mining geomechanics: the 2nd Traditional International Colloquium on Geomechanics and Geophysics (Ostrava, 2008 May 22–23), and the 3rd Traditional International Colloquium on Geomechanics and Geophysics (Ostrava, 2010 May 06-07).

Information from important ISRM events (e.g., the ISRM Congress in Lisbon 2007, and Sinorock2009) were published in the journal “Tunel”, edited by the CzTA.

In 2011, the ISRM NG CZECH R has elected a new President and Secretary. Their names, addresses

2011 Activity Report by ISRM Vice-President for Europe (cont.)

Nuno Grossmann, Portugal (grossmann@Inec.pt)

and e-mail addresses are:

President: Dr Petr Konicek , Ustav geoniky AVCR, Studentska 1768, CZ-708 00 Ostrava, CZECH R; konicek@ugn.cas.cz

Secretary: Dr Kamil Soucek, Ustav geoniky AVCR, Studentska 1768, CZ-708 00 Ostrava, CZECH R; soucek@ugn.cas.cz

ISRM NG FINLAND

As the ISRM is celebrating its 50-year anniversary during the ISRM2011 Congress, in Beijing and the EUROCK2012 Symposium in Sweden, so the ISRM NG FINLAND is also celebrating its 40-year anniversary in 2011. The Finnish Group of the ISRM (Suomen Kalliomekaniikkatoimikunta) was established on 24 May 1971, although the first annual Rock Mechanics Seminar had been arranged already in 1967.

The Finnish ISRM NG has currently 72 members, the number having stayed quite stable in 2007–2011.

In 2007–2011, the ISRM Finnish National Group has arranged/supported the following activities:

- Annual Rock Mechanics Seminar (2007 November 7), in Tikkurila, Vantaa.
- Training Seminar on Rock Support (2008 May 22), in Otaniemi, Espoo;
- Annual Rock Engineering Seminar (2008 November 27–28), in Haaga, Helsinki;
- Get Underground event, together with other Finnish Sister Societies (2009 November 4–5), in Helsinki; the event included six seminars, among them the Underground Space Seminar, the Rock Engineering Seminar, and the Nordic Grouting Seminar; 600 persons attended altogether the six seminars;
- Annual Rock Engineering Seminar (2010 October 14–15), in Haaga, Helsinki;
- World Tunnel Congress (WTC2011), together with other Finnish Sister Societies (2011 May 20–26), in Helsinki; 1,405 persons participated, from 60 countries, which made it the largest rock engineering event ever arranged in Finland.

In addition to the normal activities, the Finnish ISRM NG has also participated in a research project, with the objective of updating the guidelines for the rock bolting procedure in underground works, and participated in the national Eurocode work, for implementation in rock engineering design.

Finnish members have participated in the ISRM Commission works, as follows:

- Rock Engineering Design Methodology—Erik Johansson;
- Rock Spalling—Matti Hakala; and
- Application of Geophysics to Rock Engineering—Calin Cosma.

There has been a lot of underground activities (also in the mining sector) in Finland, some of which are:

- West Metro Project (from western Helsinki to the city of Espoo);
- Ring Rail Line (rail connection to the Helsinki-Vantaa airport);
- Radioactive Waste Disposal, the ONKALO-project in western Finland;
- P-Hämppi project (a 650 m long parking cavern, for 1,000 cars, in the city centre of Tampere); and
- Highway E18, section Muurla-Lohja, with seven tunnels (completed in 2009).

During the WTC2011, a new book by the Finnish ITA NG “Rock–Sound of countless opportunities” was published. It gives more details about these projects.



Left to right, Nuno Grossmann (2007–2011 ISRM Vice-President for Europe), John A. Hudson (2007–2011 ISRM President) and Erik Johansson (President of the ISRM NG Finland) at the “Get Underground” meeting in Helsinki, Finland

2011 Activity Report by ISRM Vice-President for N. America

Derek Martin, Canada (derek.martin@ualberta.ca)

North America has two active national groups:
(1) American Rock Mechanics Association (ARMA),
(2) the Canadian Rock Mechanics Association (CARMA)

ARMA Activities (United States)

The American Rock Mechanics Association (ARMA), the National Group belonging to ISRM, continues to grow and diversify. Currently at close to 500 members, ARMA conducts its annual US rock mechanics/geomechanics symposia. In 2009, ARMA inaugurated an ARMA Fellows programme to recognise distinguished members of the profession. ARMA's digital library, run in conjunction through SPE's OnePetro system, provides an electronic resource for all to access 55 years of US rock mechanics proceedings.

US Rock Mechanics/Geomechanics Symposia

In June 2011, ARMA organised its 45th US Rock Mechanics/Geomechanics Symposium in San Francisco. Almost 280 podium or poster presentations were delivered to over 500 participants who hailed from 37 different nations.



Lunchtime talk at the 45th US Rock Mechanics Symposium

The 46th U.S. Rock Mechanics and Geomechanics Symposium will be held in Chicago in June 2012. This international event encompasses all aspects of rock mechanics, rock engineering and geomechanics. Planned workshops (June 22–23) include *Determination of Rock Properties for Petroleum Geomechanics*, and *Geomechanics of Unconventional Reservoirs*.

A special issue of the Rock Mechanics and Rock Engineering journal will be published with selected papers from the conference. Authors of high-quality contributions will be invited to submit an expanded version of the conference paper for peer review and

possible publication in the special issue. Professional Development Hours (PDH) will also be available for symposium attendance. Abstracts of 250-500 words, in English, can be submitted online at

<http://www.armasymposium.org>

Full instructions for abstract submittal can be found on this same website.

ARMA Digital Library

ARMA was one of the first outside organisations to join SPE's OnePetro digital library. ARMA currently has about 3,500 papers included in OnePetro. ARMA members receive a discounted price for ARMA documents by providing their ARMA log-in information. OnePetro currently contains more than 106,000 documents from 12 participating organisations. During 2010, more than three million papers were downloaded from OnePetro. OnePetro will continue to grow, both through the addition of more documents from existing Societies, and as new Societies are added.

ARMA Fellows

In 2008, ARMA inaugurated its Fellows Program. To date, 17 individuals have been inducted as ARMA Fellows. The ARMA Fellows programme recognises select individuals who have achieved outstanding accomplishments in the area of rock mechanics and who have contributed to the professional community through ARMA.

The current ARMA Fellows are: Derek Elsworth (Current Fellows Chair), Pennsylvania State University; Sidney J. Green (Immediate Past Fellows Chair), Schlumberger; Bernard Amadei, University of Colorado; Charles H. Dowding, Northwestern University; Herbert H. Einstein, Massachusetts Institute of Technology; Charles Fairhurst, University of Minnesota (Ret); Richard Goodman, University of California, Berkeley (Ret); Bezalel C. Haimson, University of Wisconsin-Madison (Ret); Francois E. Heuze, Lawrence Livermore National Laboratory (Ret); Priscilla P. Nelson, New Jersey Institute of Technology; Jean-Claude Roegiers, University of Oklahoma (Ret), and

Ahmed Abou-Sayed, Advantek International; Don Banks, US Army Corps of Engineers (Ret); John A. Hudson, Imperial College, UK; Wolfgang Wawersik, Sandia National Laboratories (Ret); Michael Hardy, Agapito Associates, Inc.; and Mark D. Zoback, Stanford University.

CARMA Activities (Canada)

The Canadian Rock Mechanics Association (CARMA)

<http://www.carma-rocks.ca/>

serves as the ISRM's National Group for Canada. Members are from CARMA's two constituent groups: the Rock Mechanics Division of the Canadian Geotechnical Society (CGS); and the Society for Rock Engineering of the Canadian Institute of Mining and Metallurgy (CIM). A combined total of 269 CIM and CGS members paid for ISRM membership in 2011.

CARMA will be hosting the 13th ISRM Rock Mechanics Congress in 2015 in Montreal. This Congress will be chaired by Dr Ferri Hassani of McGill University and has the support of ARMA, Canadian industry, the Federal Government of Canada, the Provincial Government of Quebec, and academia across Canada.

Slope Stability 2011, the International Symposium on Rock Slope Stability in Open Pit Mining and Civil Engineering was held 18–21 September in Vancouver, Canada. The Conference, with over 450 in attendance, was opened by Dr Evert Hoek.

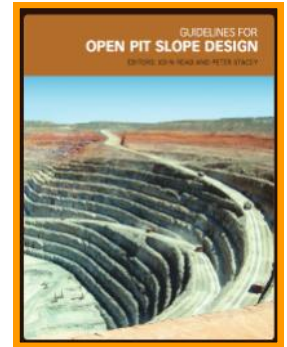
The 14th Pan-American Conference on Soil Mechanics and Geotechnical Engineering, the 64th Canadian Geotechnical Conference (CGC) and the 5th Pan-American Conference on Teaching and Learning of Geotechnical Engineering was held from 2–6 October 2011 in Toronto, Ontario, Canada. More than 700 delegates attended the conference.

In 2012, the 21st Canadian Rock Mechanics Symposium in conjunction with the CIM Annual Conference and Exhibition, will be held 5–9 May, Westin Edmonton Hotel, Edmonton, Alberta, Canada. The theme, "Rock Engineering for Natural Resources", was chosen with the objective of developing a better understanding of the rock mechanics-related challenges encountered during the development of mineral deposits, hydrocarbons, and alternative energy sources.

www.cim.org/rockeng2012

Awards

Pete Stacey (Stacey Mining Geotechnical Ltd, Vancouver) was awarded in 2011 the Canadian Geotechnical Society's Franklin Award for contributions made in the fields of rock mechanics and rock engineering. Established in 1993, the Award honours the past President of the International Society for Rock Mechanics (ISRM), John A. Franklin. Pete was recognised for his national and international contribution to rock mechanics in open pit mining; his recent contribution being co-editor of the "Guidelines for Open Pit Slope Design".



Pete Stacey, winner of the Canadian Geotechnical Society's 2010 Franklin Award. His latest contribution as co-editor (with Dr. John Read) of the Guidelines for Open Pit Slope Design was published in 2010 by CSIRO.

The Canadian Centre for Excellence in Mining Innovation (CEMI) is operated from Sudbury, Ontario. CEMI, under the leadership of Dr Peter K. Kaiser, directs and co-ordinates step-change research in the areas of exploration, deep mining, integrated mine engineering, environment and sustainability for the metal mining industry. With a seasoned team of programme directors, CEMI manages industry-focussed applied research projects. The most recent initiative by CEMI, in collaboration with Laurentian University, Queen's University and the University of Toronto, is funded by Rio Tinto, Vale, Xstrata Nickel and the Ontario Government and is called SUMIT, a \$6M programme aimed at Smart Underground Monitoring and Integrated Technology implementation for all aspects of deep mining. With respect to rock mass response, the programme focuses on monitoring and control of fault slip rockbursts. More information can be collected from the CEMI website:

<http://www.miningexcellence.ca/projects/ifscri/>

The following rock mechanics related seminars were held at CEMI since January 2011.

- August 24, Dr Steve Rogers: Applications of Discrete Fracture Network (DFN) modelling to mining geomechanics.
- August 25, Dr Willem De Beer: Geophysics for Rock Mass Characterisation.
- July 6, Dr Florian Amann: The role of brittle failure in sedimentary rocks in Swiss tunnel projects.
- March 31, Dr Erik Eberhardt: Impacts of Underground Mass Mining on Surface: Lessons Learned from the Palabora Cave-Pit Interaction Study.
- February 9, Seminars on Rock Mass Characterisation

CEMI provides access to many of these lectures and seminars as video, which can be viewed at

<http://www.miningexcellence.ca/events/lectures/>

2011 Activity Report by ISRM Vice-President for S. America

Álvaro J. González-García, Colombia (ajgon@cable.net.co)

Rock mechanics development in the South American region was in the beginning mainly associated with mining, railway, dam and roadway engineering. Due to significant reserves of gas and oil in some of the countries in the region, like Venezuela, Brazil, Ecuador, Bolivia and Colombia, rock mechanics activities as related to oil engineering have shown an increase in recent years.

1. ISRM National Groups and Members

In 2007, there were six National Groups with 109 ordinary members, seven corresponding members and one corporate member from Brazil. At present (2011), the ISRM South American Region has nine National Groups, 224 ordinary members, 34 corresponding members and one corporate member from Peru. Of the National Groups, only Chile, Peru and Bolivia do not have a website.

Most ISRM NG groups in South America are

| COUNTRY | ISRM GROUP NAME | ACRONYM | MEMBERS | | E-MAIL | WEBSITE |
|----------------------------|---|---------|------------|------------|--|---------------------|
| | | | 2007 | 2011 | | |
| Argentina | Sociedad Argentina de Ingeniería Geotécnica | SAIG | 6 | 8 | rocas@saig.org.ar | www.saig.org.ar |
| Bolivia (*) | Asociación Boliviana de Geomecánica | BAG | 0 | 22 | geomecanicabolivia@gmail.com | - x - |
| Brazil | Associação Brasileira de Mecânica dos Solos e Engenharia Geotécnica | ABMS | 60 | 104 | abms@abms.com.br cbmr@abms.com.br | www.abms.com.br |
| Chile (*) | Chile ISRM National Group | - x - | 14 | 14 | zespinoza@akl.cl | - x - |
| Colombia | Sociedad Colombiana de Geotecnia | SCG | 12 | 20 | scg1@etb.net.co | www.scg.org.co |
| Costa Rica (*) | Asociación Costarricense de Geotecnia | ACG | 0 | 14 | majjcr@yahoo.com | www.civiles.org/acg |
| Paraguay | Sociedad Paraguaya de Geotecnia | SPG | 6 | 6 | presidencia@spg.org.py | www.spg.org.py |
| Peru (*) | Sociedad Peruana de Geoingeniería | SPEG | 0 | 25 | spgeoingenieria@gmail.com asamaniego@svs.com.pe | - x - |
| Venezuela | Sociedad Venezolana de Geotecnia | SVDG | 11 | 11 | civ.svdg@gmail.com | www.svdg.org.ve |
| SOUTH AMERICA TOTAL | | | 109 | 224 | | |

merged with the National Geotechnical Societies and only Brazil has a Rock Mechanics Committee (as well as a Tunnelling Committee) and Paraguay a Rock Mechanics Vice-Presidency. From the economic viewpoint, this merging is a worldwide common and somewhat desirable feature for small National Groups and does not allow to easily separate rock mechanics activities from general geotechnical activities.

Independent NG groups (*) had been recently created in Chile (2006), Perú (2009), Bolivia (2010) and

Costa Rica (2010), the three first countries with intense mining industry, and the newly formed groups from these three countries belong mainly to the mining professions. In the period 2007–2011, there was a 206% increase in the ordinary members, mainly due to the new National Groups and to an intense campaign in 2011 in Brazil by Prof Sergio Fontoura.

2. ISRM Vice-Presidents

| PERIOD | NAME | COUNTRY |
|-----------|-------------------------------------|-----------|
| 1966-1970 | Prof. A. Costa Nunes | Brasil |
| 1970-1974 | Prof. Victor F.B. de Mello | Brasil |
| 1974-1979 | Prof. Milton Kanji | Brasil |
| 1979-1983 | Prof. Oreste Moretto | Argentina |
| 1983-1987 | Prof. Fernando Tinoco | Venezuela |
| 1987-1991 | Prof. Dinis da Gama | Brasil |
| 1987-1991 | Prof. Tarcísio Celestino (at-large) | Brasil |

| PERIOD | NAME | COUNTRY |
|-----------|-----------------------------|-----------|
| 1991-1995 | Dr Oscar Vardé | Argentina |
| 1995-1999 | Prof. Michel Van Sint Jan | Chile |
| 1999-2003 | Prof. Eurípedes Vargas | Brasil |
| 2003-2007 | Dra Eda F. Quadros | Brasil |
| 2007-2011 | Prof. Alvaro J. González G. | Colombia |
| 2011-2015 | Dr. Antonio Samaniego A. | Perú |

There has not been an ISRM President from South America.

2011 Activity Report by ISRM V-P for S. America (cont)

3. ISRM-Sponsored Regional Activities

The main South American Rock Mechanics activities are the South American Rock Mechanics Congresses and the South American Rock Mechanics Symposia, of which the first versions of both type of events were held in Colombia, the Congress in 1982 and the Symposium in 2008.

South American Rock Mechanics Congresses

| No. | DATE | PLACE | No. | DATE | PLACE |
|-----|----------------|----------------------|------|-----------------|--------------------------|
| I | November, 1982 | Bogotá, COLOMBIA | V | November, 1998 | Santos, BRAZIL |
| II | October, 1986 | Porto Alegre, BRAZIL | VI | October, 2006 | Cartagena, COLOMBIA |
| III | October, 1990 | Caracas, VENEZUELA. | VII | December, 2010 | Lima, PERU. |
| IV | May, 1994 | Santiago, CHILE | VIII | September, 2015 | Buenos. Aires, ARGENTINA |

3.1 First South American Symposium on Rock Excavations (ISSAER) 2008

The Colombian ISRM NG, Colombian Geotechnical Society (SCG-Sociedad Colombiana de Geotecnia) organised the 1st South American Symposium on Rock Excavations (ISSAER), together with the XII Colombian Geotechnical Conference (XIICCG), at Universidad de los Andes in Bogota, from 1–4 September, 2008. The events were also supported by the Colombian National Mining Institute (INGEOMINAS) and the Colombian Engineers Society (SCI). The venue was at the Auditorio Mario Laserna, in the newly inaugurated building at Universidad de los Andes, sponsor and co-organiser of the events, located at the foothills of the mountains which surround Bogotá.

198 persons attended the two events, including the 8 specially invited lecturers, 50 students and 36 persons from 13 countries outside Colombia. 30 papers for ISSAER and 46 papers for XIICG were accepted and almost all presented in 16 quarter-day sessions.

3.2 ISRM Board Lecture Tour – South America 2010

The Colombian NG (Sociedad Colombiana de Geotecnia- SCG) organised the 2010 ISRM Board Interim Meeting and the ISRM Board Seminar with 10 lectures by the Board Members on Recent Advances In Rock Engineering. The event was attended by 202 professionals on 8 February, at the Auditorium of the School of Engineering of Colombia National University in Bogota. The same Board Seminar was replicated in Peru on 12 February at the Auditorium of the Institute of Mining Engineers in Lima (IIMP), as part of the 1st Peruvian Seminar on Geoengineering.

3.3 VII South American Rock Mechanics Congress-2010

The Peruvian NG (Sociedad Peruana de Geoingeniería-SPDG), in association with the Peru Mining Engineers Institute (IIMP), organised the VII South American Rock Mechanics Congress, held from 2–4 Decem-



ber 2010 in the Sheraton Hotel, Lima, as a Regional ISRM Event. Main lecturers were Prof Evert Hoek (Canada), Prof John Hudson (UK- ISRM President), Prof Xia-Ting Feng (China-ISRM President Elect), Dr Nick Barton (UK-Brazil), Dr Carlos Carranza-Torres (Argentine-USA), Prof Tarsicio Celestino (Brazil), Dr David Wood (Canada) and Dr Rimas Palkanis (Canada). There was also the oral presentation of 38 papers, mainly from Peru and South America, but also from outside the region.

The event was preceded by three short courses: Use of RocScience Codes in the Design and Analyses of Excavations in Rock (Carlos Carranza-Torres), Rock Engineering in Tunnel Excavation with Conventional and TBM Methods (Nick Barton) and Empirical Design Methods in Underground Mining (Rimas Palkanis). A post-event 3-day technical tour was organised to the Cerro Verde Mining Field near Arequipa, there was also a technical exhibition with around 20 stands and more than 450 people attended the Congress.

4. ISRM NG Activities Argentine

In 2008, the Argentinian Society of Geotechnical Engineering (SAIG), the ISRM NG group, organised from 15–17 October the 19th Congress on Soil

Mechanics and Geotechnical Engineering, in La Plata, which included the IV Argentinian Rock Mechanics Symposium. In 2009, SAIG organised the 3rd South American Young Geotechnical Engineers' Conference from 30 March to 1 April 2009 in Cordoba; a meeting which included some papers on rock mechanics. And in 2010, SAIG organised the 20th CAMSIG-2010, which was held from 6–9 October in Mendoza. This meeting included sessions on Rock Mechanics, Mining Engineering, Seismic Engineering and Geology and Geotechnics and the main lecturers were Carlos Costa (Argentina), Carlos Santamarina (Argentine-USA), I. Ortuño (Spain), Pedro Ortigosa (Chile) and Oscar Vardé (Argentine)

Bolivia

Due to its very recent formation and incorporation to ISRM, there are no events from this Group.

Brazil

Several geotechnical events are organised by the ABMS (NG-Brazil) and its branch CBMR (Brazilian Committee on Rock Mechanics).

In 2008, the Brazilian Tunnelling Committee (CBT) organised with ITA, the 2nd Brazilian Congress of Tunnels and Underground Structures (2CBT), together with the International South American Tunneling Seminar (SAT'2008) on 23–25 June in São Paulo. The ISRM Vice-President was invited to these meetings, which had 43 presentations, two round tables, more than 50 papers and gathered more than 400 professionals and 49 exhibitors. Together with the meetings, the 328-page well edited book “Tunnels of Brazil” (in Portuguese and English) was launched, which contains the description of the main 120 tunnels in this country.

In 2008, ABMS also held from 25–26 August in Buzos, near Rio de Janeiro, the XIV Brazilian Soil Mechanics and Geotechnical Engineering Conference (COBRAMSEG08), which included a session on Rock Mechanics and Mining. The CBMR produced, at the end of 2008, a CD with all the Proceedings of the Brazilian Symposia on Rock Mechanics up to 2008.

In 2010, ABMS organised COBRAMSEG 2010, the 15th version of the Brazilian Congress on Soil Mechanics and Geotechnical Engineering, which took place from during 20–22 August, 2010 in Gramado, Rio Grande do Sul. This event was preceded by a Workshop on Natural Disasters (August 17), the IV Brazilian Young Geotechnical Seminar (August 18) and the V Luso-Brazilian Geotechnical Congress (August 19). There were more than 1,200

participants and it included the V Brazilian Symposium on Rock Mechanics on 21 August. Among the main Lecturers were Dr Harry Poulos (De Mello Lecture), introduced by Prof John Burland and in the Rock Mechanics Symposium: Brazilian Engs. Arsenio Negro, Milton Assis Kanji, Luiz Jacques de Moraes and from Austria, Eng Wulf Schubert. The ISRM VP for South America attended this large event by invitation of the Brazilian Geotechnical Society.

In 2011 two Short Courses on Rock Slope Engineering (R. de Janeiro, S. Paulo, September 2011) and one Workshop on Underground Works (Rio de Janeiro, 24 November) were held. On 20–22 March, 2012, the 3rd Brazilian Congress on Tunnels and Underground Structures will be held with a Workshop on Underground Storage.

Chile

On March 2008, in Australia, Dr Antonio Karzulovic, the organiser of the Chilean NG, unfortunately passed away, and this event was a big blow for the Chilean group. However, a conference named Slope Stability 2009, devoted mainly to rock slopes, organised by Universidad de los Andes and CSIRO (Australia), was held in Santiago from 9–11 November, 2009.

In 2010, the Chilean Catholic University organised the 5th International Seminar on Deep and High Stress Mining 2010–DEEPMINING 2010—from 6–8 October, preceded by courses on Ground Control in Highly Stressed Hard Rock Mines (P.K. Kaiser, M. Cai), on Destress Blasting/Rock Preconditioning using Explosives (P. Andrieux) and on Micro-Seismicity Monitoring (R. Lynch)

Colombia

Colombian NG (SCG) organises several regular geotechnical events.

In 2007, SCG co-sponsored a 5-day course on Numerical Modelling on Rock Excavations at the National University of Colombia from 23–27 August 2007, with Professors Tarsicio Celestino (Brazil) and Carlos Carranza (Argentine-USA), the collaboration of RocScience and organised by Geol. Juan Montero O. SCG also sponsored the 2-day 2nd Academic Meeting on Rock Engineering at Colombia National University on 19–20 November, 2007. In 2008, besides organising the I South American Symposium on Rock Excavations (ISSAER), together with the XII Colombian Geotechnical Conference (XIICCG), SCG sponsored the 3rd edition of the Academic Meeting on Rock Engineering on 20–21 November.

2011 Activity Report by ISRM V-P for S. America (cont)

In 2009, SCG organised a one-day free Seminar on Mining and Environment on 30 October; a 2-day Seminar on Rockfill Dams from 12–13 November; and a 4-day internal course on Slope Stability for the Colombian Geological Institute (INGEOMINAS) from 17–20 November.

In 2010, besides organising the ISRM Board Interim Meeting and the ISRM Board Seminar, SCG, together with the National University of Colombia, organised the XIII Colombian Geotechnical Congress and the VII Colombian Geotechnical Seminar, this last one dedicated to Mining Geotechnics, from 21–25 September in the city of Manizales, located in the centre of the Colombian Coffee Belt. The main lecturers for the Mining Seminar were Antonio Samaniego (Peru), Gianfranco Perri (Venezuela), Tarsicio Celestino (Brazil) and Alvaro Correa (Colombia); and for the Congress, Laurence Wesley (New Zealand), Daniel Salcedo (Venezuela), Tarsicio Celestino (Brazil), Jaime Suarez (Colombia) and Juan Montero (Colombia). About 300 people attended the events, which, besides the main lectures, had 77 papers, a technical exhibition and a technical tour to several works located nearby Manizales.

In 2011, SCG organised the VIII Colombian Geotechnical Seminar on Urban Geotechnics on 17–18 November at the Colombia National University with 15 invited lecturers from Colombia and three special ones: Gabriel Auvinet (México), Arsenio Negro (Brazil) and Gianfranco Perri (Venezuela). 240 people attended.

Costa Rica

The Costa Rican Geotechnical Association (ACG), the ISRM NG, organises periodic local lectures and meetings on Rock Mechanics. It will hold the II South American Rock Mechanics Symposium in 2012.

<http://www.civiles.org/acg/simposio>

Paraguay

The Paraguayan NG (Sociedad Paraguaya de Geotecnica-SPG), which has a Rock Mechanics Vice-Presidency, had a Lecture Series on the Weak Rocks

The banner features the title "2nd SASORE SOUTH AMERICAN SYMPOSIUM ON ROCK EXCAVATION" in large, bold letters. Below it, the dates "August 7-9, 2012" and location "Costa Rica Ramada Plaza Herradura Hotel" are displayed. On the right, there are "WELCOME" buttons for "ENGLISH" and "BIENVENIDOS" for "ESPAÑOL". Below the title, there are four small images showing rock excavation and geotechnical work. At the bottom, the logo for "congeo" is shown, along with the title "XI CONGRESO NACIONAL DE GEOTECNIA" and dates "August 9-10, 2012" at "Costa Rica Ramada Plaza Herradura Hotel".

and Indurated Soils of Paraguay. This NG also intends to create a database for “Basaltic Rocks in Engineering Projects”, taken from the two huge binational hydroelectric projects, Itaipu (Brasil-Paraguay) and Yacyreta (Argentina-Paraguay).

Peru

The Peruvian NG (Sociedad Peruana de Geoingeniería-SPEG), in association with the Peru Mining Engineers Institute (IIMP), organise several events in Mining and Rock Mechanics. They held the Board Seminar on February, 2010 and organised the VII South American Rock Mechanics Congress at Lima in December, 2010, already reported above.

Venezuela

The Venezuelan NG (SVG) organises several geotechnical meetings.

In 2007, SVG organised the XIII Panamerican Conference on Soil Mechanics and Foundation Engineering, 16–20 July in Isla Margarita, which included some topics on rock mechanics.

In 2008, SVG organised the 50th SVDG Anniversary Conference in Honour of Gustavo Luis Perez Guerra, from 7–9 November, in Caracas, which included some papers on rock mechanics.

In 2010, SVG held the 19th Venezuelan Geotechnical Seminar, from 28–30 October in Caracas, which included some papers on rock mechanics. The main lecturers were Venezuelan Engs Nelson Rodriguez (Perez Guerra Lecture), Ivan Contreras (Lupini Lecture), Jaime Graterol, Roberto Centeno, Daniel Salcedo and Pietro De Marco.

An Overview of the 2007–2011 ISRM Commissions

John A Hudson, UK, 2007–2011 ISRM President (john.a.hudson@gmail.com)

The operational period of each ISRM Commission is for the duration of each Presidential tenure, i.e., the period 2007–2011, for those Commissions which presented the products of their work at the 12th ISRM Congress held in Beijing in October 2011. One or more of the Commissions, e.g., the Testing Methods Commission, will continue into the next Presidential period, 2011–2015 where the work is either on-going or requires more than one four-year period. Indeed, there will be an expansion of the Commissions in the period 2011–2015.

These Commissions are a crucial component of the ISRM's operation because they enable new developments to be made and, through the publications of the Commissions' reports, for the information to be disseminated to the ISRM members and the wider public. Each Commission is organised with a Commission President who is supported by Commission members, typically 5 to 10 such members, and has a task concentrating on a specific research objective or collation of information about a particular subject.

This means that each of the Commissions must have a conscientious Commission President and be well structured with appropriate milestones, so that the Commission will definitely produce a worthwhile product at the end of its lifetime. There is no value in establishing ISRM Commissions if they do not produce anything worthwhile. Accordingly, and when establishing the Commissions at the beginning of my 2007–2011 tenure, I asked all the current Commission Presidents to set out their objectives and milestones (and associated yearly presentations), and to promise me that they will do their best to achieve the objectives.

The nine ISRM Commissions that were in operation in the period 2007–2011 are as follows (in alphabetical order):

- Commission on the Application of Geophysics to Rock Engineering
President: Toshifumi Matsuoka (Japan)
Purpose: To organise international Workshops and create a rock physics database website
- Commission on Education
President: Cai Meifeng (China)
Purpose: To organise educational events
- Commission on Mine Closure
President: Christophe Didier (France)
Purpose: To produce a report and book about the state-of-the art with some well documented 'case studies'

- Commission on the Preservation of Ancient Sites
President: Li Zuixiong (China)
Purpose: To encourage exchange of ideas, teaching, research and advancement of knowledge in this field
- Commission on Radioactive Waste Disposal
President: Wang Ju (China)
Purpose: To provide a network for information exchange and to organise workshops/conferences
- Commission on Rock Dynamics
President: Zhou Yingxin (Singapore)
Purpose: To arrange meetings and to co-ordinate rock dynamics research activities within the ISRM community, produce reports and guidelines
- Commission on Rock Engineering Design Methodology
President: Feng Xia-Ting (China)
Purpose: To produce a report on modern rock engineering design with an auditing capability
- Commission on Rock Spalling
President: Mark Diederichs (Canada)
Purpose: To bring together the disparate information on rock spalling and produce an associated report
- Commission on Testing Methods
President: Resat Ulusay (Turkey)
Purpose: To prepare ISRM Suggested Methods

The work of some of these ISRM Commissions is summarised by the Commission Presidents in their reports in the following pages of this News Journal.

One of the initiatives of the 2007–2011 ISRM Board has been to introduce the concept of 'Pre-Commissions'. The idea is to set up Commissions before their period of operation so that they can 'hit the ground running'.

Three pre-Commissions were established prior to the 2011–2015 Presidential period, as follows.

- Petroleum Geomechanics
President: Maurice Dusseault (Canada)
Purpose: To promote fundamental and practical understanding of rock mechanics as applied to the engineering use of sedimentary basins at depth, accessed by boreholes
- Crustal Stress and Earthquakes
President: Xie Furen (China)
Purpose: Develop and improve the methods and techniques of borehole-based stress-strain measurements
- Commission on Hard Rock Excavation
President: Manoj Verman (India)
Purpose: Compiling case histories of hard rock excavation projects, especially those from the Himalayas, the Alps and the Andes

Geophysics Commission

Commission President: Toshifumi Matsuoka, Japan (matsuoka@earth.kumst.kyoto-u.ac.jp)

The objectives of the Commission are

- 1) to promote geophysical techniques in rock engineering,
- 2) to organise international Workshops on the application of geophysics to rock engineering, and
- 3) to establish closer relationships between ISRM members and exploration geophysicists who are interested in the academic field on the application of geophysics to rock engineering.

The Commission members in the term 2007–2011 were as follows:

- Prof T. Matsuoka (President, Japan)
- Prof E. Brueckl (Austria)
- Prof Xu Chang (China)
- Dr C. Cosma (Finland)
- Prof A. Ghazvinian (Iran)
- Prof P. Hatherly (Australia)
- Dr Jung-Ho Kim (Korea)
- Prof S. King (UK)
- Dr B. Lehmann (Germany)
- Dr S. Lüth (Germany)
- Prof C. J. de Pater (Netherlands)
- Prof L. J. Pyrak-Nolte (U.S.A.)
- Dr E. Sellers (South Africa)
- Dr S. Tanaka (Japan)
- Prof P. Young (Canada)

The Commission organised the 9th International Workshop on the Application of Geophysics to Rock Engineering in association with the 2011 ISRM Congress held in Beijing, China. This Workshop was one of the series of Workshops on the application of geophysics to rock engineering which have been held from 1990 as an activity of the Commission.

It also held a Special Session during the Congress on “Rock Physics and Geophysics for CO₂ Sequestration”. Because CCS is becoming one of the key technologies for reduction of CO₂ emission in the atmosphere, rock mechanics is expected to contribute to the procedures. Five papers by well-known experts were given at this Special Session.

Geophysics is also expected to play a central role for monitoring and verifying CO₂ movement in the ground. Although geophysics has been applied already to several CCS fields, there still remain many challenges to be solved in future.

Education Commission

Commission President: Meifeng Cai, China (caimeifeng@ustb.edu.cn)

The main activity of the Commission on Education in 2011 was organising and holding the 2nd ISRM International Young Scholars’ Symposium on Rock Mechanics (see page 26) which was held in Beijing on 14–16 October 2011, immediately prior to the ISRM Congress.

The Symposium was sponsored by the ISRM as a Specialised Conference and its aim was to promote the exchange of ideas and experiences and to share recent advances in rock mechanics and engineering among young scholars in the world. After the “First announcement and call for papers”, the Symposium received ~400 abstracts. Finally, 183 papers were included in the proceedings of the Symposium which covered the following seven subjects:

- field investigation and instrumentation
- rock properties and mechanical behaviour
- underground mining and excavation engineering
- rock slopes and landslides
- tunnels and foundations
- dynamics and blasting
- new techniques and methods.

To improve the English level of the papers, Dr M. Kwasniewski, Prof R.W. Zimmerman, Dr J.P. Harrison, Prof J.-C. Roegiers and eight Chinese professors reviewed and revised all the manuscripts of the papers. Prof J.A. Hudson wrote a Preface for the Proceedings which were published in 300 copies by Taylor & Francis/Balkema and titled “Boundaries of Rock Mechanics—Recent Advances and Challenges for the 21st Century”. All the papers in the Proceedings have been collected by ISTP (Index to Scientific and Technical Proceedings).

At the Opening Ceremony, Prof John. A. Hudson, the President of ISRM, made a speech brimming with warm feeling. In his speech, he introduced the basic tasks and obligations of the ISRM, affirmed the development and achievements in the field of rock mechanics in China and explained the current practical problems in rock engineering to the Young Scholars—which highly enlightened and inspired the attendees.

280 experts and scholars who were from 11 countries, i.e., China (including Hong Kong), Iran, Japan, Kampuchea, Korea, Mongolia, Sweden, Sudan, UK, USA and Vietnam, attended the Symposium. At the Symposium, five Keynote Lectures and two Special Reports were presented, and 50 oral presentations of the papers were made in two parallel sessions. These presentations covered the seven subjects of the Symposium listed above.

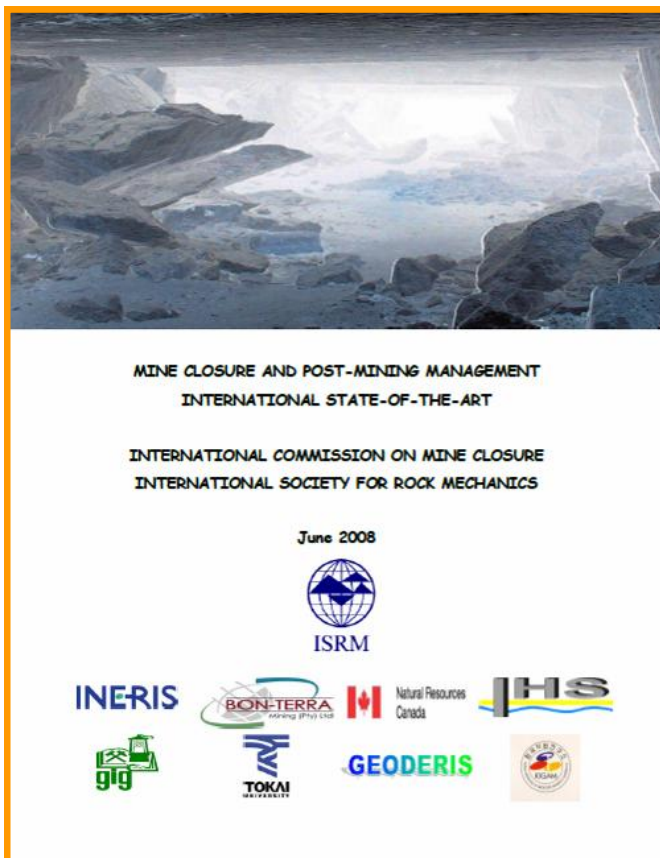
Mine Closure Commission

Christophe Didier, France
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The Mine Closure Commission aims to create links between experts in order to exchange information and experience dealing with the closure of mining works and the management of abandoned mining sites. After having published on the ISRM website an important “state-of-the-art report on mine closure and post mining management”, the main objective of the Commission is now to complete the document with a compilation of successful case studies. Some papers have been recently published on the subject by members of the Commission.

Recent contacts have been made to enlarge the existing Expert Panel and to consider several case studies representative of various countries, contexts and objectives. These examples will be introduced into the existing report to illustrate the mine closure process.

Once completed, the optimised distribution of the Final Report will be considered.



Cover of the Mine Closure report which is available for ISRM Members to download from the ISRM website: www.isrm.net

Ancient Sites Commission

Commission President: Li Zuixiong, China
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In terms of activities during the 2007–2011 Presidential period the Ancient Sites ISRM Commission has been busy. The second Commission meeting was held in association with the ISRM International Symposium for 2009 in May in Hong Kong, China. At that time, a Workshop on the new advances in the field of preservation of Ancient Sites was attended by many noted scholars from over the world.

Following that, some main tasks were accomplished as follows:

Prof Coli from the Dept. of Earth Science, University of Florence, Italy was invited to visit the Dunhuang Academy of China. After a field trip and discussion, an ‘Agreement of Cultural and Scientific Cooperation’ was established between the University of Florence (Italy) and the Chinese Society for Rock Mechanics and Engineering, via the Commission.

A field consulting activity relating to the preservation of ancient sites at the Dujiang Yan district after the Wenchuan catastrophic earthquake took place on 12 May 2008.

The Proceedings of the International Symposium on the Conservation of Ancient Sites 2008 (ISCAS-2008)—the 2008 ISRM Sponsored Regional Symposium containing 79 articles, with an important preface written by John A Hudson and Qian Qihu was formally published by the Science Press of China for international communication.

The items currently achieved and in progress are as follows.

- Hosting an international Workshop during the Commission Meeting held in New Delhi, India, during ARMS6 on 24 Oct. 2010.
- Collection of major case histories of the preservation of ancient sites worldwide.
- Listing of publications in the international community.

In accordance with the kind proposal put forward by Luis de Sousa, hosting an International Symposium on the Preservation of Historical Forts, jointly organised by the ISRM Commission on the Preservation of Ancient Sites and Portuguese colleagues will be held in Porto, Portugal in 2012. Discussion with Luis de Sousa on the organisation is well progressed.

Sincere thanks are due to John A Hudson, 2007–2011 President of the ISRM and Luis Lamas, Secretary-General of the ISRM, for their kind help and consideration.

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The purpose and products of the Commission on Radioactive Waste disposal are as follows:

- to establish a platform for rock mechanics scientific and information exchange in the field of radioactive waste disposal;
- to organise workshops/conferences related to radioactive waste disposal, independently or within the ISRM conference system;
- to establish a network for rock mechanics scientists working on radioactive waste disposal;
- to provide a scientific advisory system for radioactive waste disposal; and
- to explore scientific co-operation with sister societies and relevant organizations, such as IAEG, etc.

The Commission on Radioactive Waste Disposal (CRWD), ISRM, held its first meeting in Hong Kong, China, in conjunction with the symposium SINO-ROCK 2009 on 18 May 2009. One keynote lecture and two parallel sessions relating to nuclear waste were held during SINOROCK2009. The 3rd National Conference on Underground Waste Disposal was held in Hangzhou, China, on 14–18 September 2010. An ISRM Suggested Method for borehole televiwer measurement, which is one of the most advanced methods for determination of fractures in a borehole, is being prepared. Also, a questionnaire about key facts relating to the site selection of radioactive waste disposal and rock mechanics data from site investigation will be distributed to different countries through the members of CRWD.

An International Workshop on “Radioactive Waste Disposal: Progress and Challenges” was held in Beijing, China on 16 October (Sunday) 2011. Also, a Special Session was held during the ISRM2011 on Friday 21 October. A synopsis of the Workshop and Special Session is as follows.

- Worldwide perspectives on radioactive waste disposal, especially relating to the geological disposal of high level radioactive waste
- Coupled T-H-M-C behaviour of host rocks for geological repositories
- Numerical modelling for underground waste disposal engineering
- Performance assessment of geological repositories
- Characterisation of fractured media
- Time-dependent behaviour of excavation damaged zones
- Challenges facing radioactive waste disposal.

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The terms of reference for the ISRM Commission on Rock Dynamics include the following.

- Provide a forum for the sharing and exchange of knowledge in rock dynamics research and engineering applications. This includes organising Commission meetings as well as Workshops, Seminars and Short Courses in connection with ISRM-supported events.
- Co-ordinate rock dynamic research activities within the ISRM community, as well as with other research and professional organisations (e.g., the International Society of Explosives Engineers).
- Produce reports and guidelines on the study and engineering applications of rock dynamics, covering fundamental theories, dynamic properties of rock and rock mass, testing methods, tunnel response, and support design. The short-term goal is to produce Suggested Methods for Rock Dynamic Testing; the long-term goal is to produce a Guideline on Rock Dynamic Response and Support Design.

Following the successful Workshop held in June 2009 in EPFL at Lausanne, Switzerland, and based on the agreements at the Conclusion of the Workshop, the Commission has focused its efforts on drafting the Suggested Methods for Rock Dynamics Testing. The Commission, under the co-ordination of Kaiwen Xia, Xibing Li, and Zilong Zhou, has drafted four Suggested Methods. They are:

1. Suggested Method for determining the dynamic uniaxial compressive strength of rock materials with the Split Hopkinson pressure bar;
2. Suggested Method for determining the dynamic indirect tensile strength by the Brazilian test;
3. Suggested Method for determining the dynamic flexural strength by the Semi-Circular bend test; and
4. Suggested Method for determining the dynamic fracture toughness.

A Workshop took place for the final review and discussion of these Suggested Methods on 12–13 December 2010 at the Wuhan Institute of Rock and Soil Mechanics, China.

Also, a Workshop on Rock Dynamics, WS1, chaired by Kaiwen Xia, was held in association with the 12th ISRM Congress held in Beijing, China, on Monday, 17 October, 2011. This included presentation of the Suggested Methods plus a variety of papers on rock dynamics themes.

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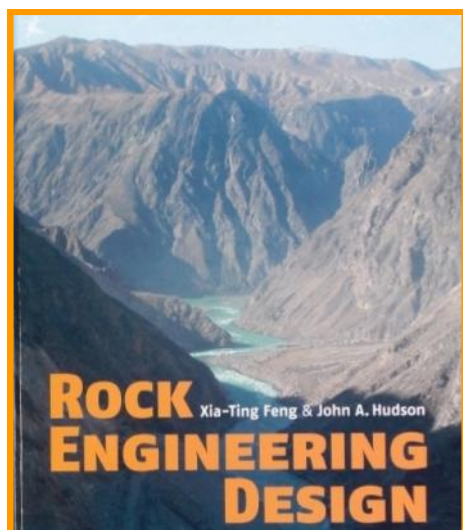
The purpose of the Commission has been to progress rock engineering design methods using both general experience and specific experience from large projects in China, outlining:

- methods of design for underground structures in rock masses;
- the types of information required to support such rock engineering design;
- methods for auditing design procedures, both concurrently with the design process and subsequently; and
- illustrative case examples of design and auditing based on major projects in China.

The work has been undertaken via an Overseeing Committee, Task Force Committee and the ISRM Commission itself. Task Force Meetings were held on these dates and at these locations: 11 July 2007, Lisbon; 15 August 2007, Beijing; 19 September 2008, Beijing; 29 March 2009, Wuhan; 15 May 2010, Wuhan, 23 August 2010, Beijing.

The main work was completed towards the end of 2010 through the completion of a book, "Rock Engineering Design" by X.T. Feng and J.A. Hudson. The contents of the book were presented at a Special Session of the ISRM Congress held in Beijing on Friday 21 October, 2011 which was complemented by a talk by Rolf Christiansson from Sweden.

Xia-Ting Feng and John A. Hudson are extremely grateful to the Commission members for their reviewing contributions: Cai Meifeng, Claus Erichsen, Erik Johansson, Li Zhongkui, Wulf Schubert, Alexandros Sofianos, Ove Stephansson, Tang Chun'an, George Tham, Resat Ulusay and Thierry You.



Published book produced by the ISRM Commission on Rock Engineering Design Methodology (available from www.crcpress.com)

Mark Diederichs, Canada
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The Commission on Rock Spall Prediction was initiated in May, 2009, at the SINOROCK conference in Hong Kong. The mandate of the Commission is to develop Suggested Methods for the determination, from laboratory tests, of key parameters for spalling prediction and to provide guidance for the determination of spalling potential for different rock types and rock mass characteristics. Secondary goals include the evaluation of predictive tools for spalling around excavations that are currently available to the practising engineer and to encourage further development of more sophisticated numerical techniques.

The current members of the Commission include: Mark Diederichs (Leading Co-President of Commission), Derek Martin (Co-President of Commission), Lars Jacobsson (Sweden), Bernie Gorski (Canada), Matti Hakala (Finland), Dick Stacey (South Africa), Ming Cai (Canada), Christer Andersson (Sweden), Erik Eberhardt (Canada), Florian Amman (Switzerland), Marc Panet (France), and Giovanni Grasselli (Canada).

The first definitive act of the Commission was to standardise terminology. The Commission has met in national and regional groups. The Scandinavian and Canadian members met at the BEFO (Swedish Rock Mechanics Society) Workshop in March 2010 to discuss rock testing for spall prediction, as well as key spalling issues associated with nuclear waste repository engineering, and the effects of damage, anisotropy, moisture and/or pore pressure, temperature and intermediate principal stress on CI (crack initiation).

Over the duration of the Commission's work, a rigorous testing programme has been undertaken and was completed. This testing program involved sending 4 sets of 10 samples (Smaland Granite) to 4 independent labs for CI, CD (crack damage) and UCS measurement using their state-of-practice techniques, including various strain measurement and calculation procedures, as well as acoustic emissions. These test results have been compared and analysed by separate teams directed by Derek Martin (University of Alberta, Canada) and Mark Diederichs (Queen's University, Canada).

A meeting of the Spalling Commission took place in association with the 2011 Beijing Congress held in October 2011.

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The 2011 annual meeting of the ISRM Commission on Testing Methods was held on 17 October 2011 at the China National Convention Centre in Beijing, China, before the 12th ISRM International Congress on Rock Mechanics. Prof John A. Hudson, Prof Xia-Ting Feng, Prof Sergio Fontoura, Prof Yuzo Obara, Dr Nuno Grossmann, Dr Chulwhan Park, Dr Eda de Quadros, Prof Ove Stephansson and Dr Don Banks participated in the meeting as the members of the Commission. The other two members of the Commission, Dr Robert J. Fowell and Prof Hasan Gercek, who could not participate in the meeting, sent their comments to the Commission President. In addition, Prof Yves Guglielmi (France, Chairman of the most recently established Working Group (WG) for “*In Situ* Hydromechanical Testing of Fractured Rock Masses with the High Pulse Poroelasticity Protocol, HPPP), Prof Giovanni Grasselli (Canada; WG member of the SM for Shear Strength) and Prof Norikazu Shimizu (Japan; Chairman of the WG for Standard Practice for Displacement Measurements Using Global Positioning System) also attended the Commission meeting.

All issues given in the meeting agenda were discussed and decisions were taken by the Commission. Also, Prof Guglielmi gave a brief talk on the proposal for HPPP and Prof Grasselli informed the Commission about the recent progress on the SM for shear strength, which is under preparation. Prof Grasselli also declared that he was able to chair the WG for “Upgraded SMs for Quantitative Description of Discontinuities in Rock Masses”. This was accepted by the Commission.

The annual report of the Commission was also presented at the ISRM Council Meeting on October 17, 2011. In this 2011 period, in addition to the current WGs, some new WGs were also established to develop new ISRM Suggested Methods. The following four SMs under preparation were reviewed by experts, and finally accepted and approved by the Commission and ISRM Board as ISRM SMs. They will be published in *Int. J. Rock Mech. Min. Sci. (IJRMMS)*:

- (1) “SMs for Determining the Dynamic Strength Parameters and Mode I Fracture Toughness of Rock Materials” (*Y. Zhou, K. Xia, X. Li, H.B. Li, G.W. Ma, J. Zhao, Z.L. Zhou, and F. Dai*). These SMs were written by the ISRM Commission on Rock Dynamics and evaluated by the ISRM Commission on Testing Methods. The SMs were accepted for publication as ISRM SMs and will appear in the journal *IJRMMS* very soon.
- (2) “SM for the Determination of Mode II Fracture Toughness” (*Tobias Backers and Ove Stephansson*).

This SM will be submitted to *IJRMMS* for publication.

- (3) “SM for Rock Stress Estimation—Part 5: Establishing a Model for the *In Situ* Stress at a Given Site” (*Ove Stephansson and Arno Zang*). This SM will be submitted to *IJRMMS* for publication.
- (4) “SMs for Rock Failure Criteria” (*Bezalel Haimson and Antonio Bobet (WG Co-Chairmen), Chandong Chang, Sergio Fontoura, Erik Eberhardt, Joseph F. Labuz, Arno Zang, Stephen Priest, Leandro R. Alejano*). The SM includes six failure criteria and will be submitted to *IJRMMS*.

The following SMs, which are under preparation, will be submitted to the Commission to be reviewed very soon and also published in the *IJRMMS*.

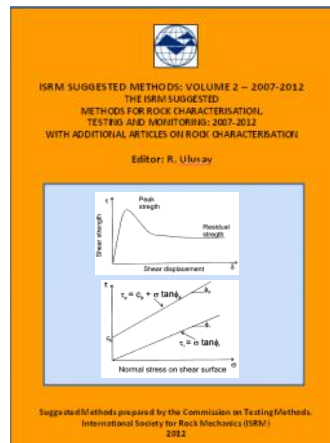
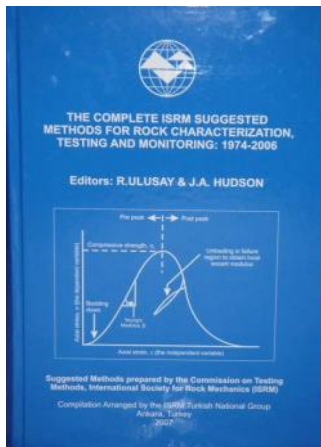
- (5) “SMs for Creep Test” (*WG Chairman: Prof Omer Aydan; Japan*). The final document was submitted to the Commission for review in November 2011
- (6) “SM for Standard Practice for Displacement Measurements Using Global Positioning System” (*WG Chairman: Prof Norikazu Shimizu; Japan*) The final document was submitted to the Commission for review at the end of 2011.
- (7) “SM for Determination of Thermal Properties of Rock” (*WG Chairman: Dr Bijan Adl-Zarrabi; Sweeden*). The final document was also submitted to the Commission for review at the end of 2011.
- (8) “Upgraded SMs for Shear Strength and Stiffness of Discontinuities” (*WG Chairman: Dr Jose Muralha; Portugal*). Similarly, the final document was submitted to the Commission for review at the end of 2011.
- (9) “Upgraded SM for Sonic Velocity Test” (*WG Chairman: Assoc. Prof Adnan Aydin; USA*). The final document will be submitted to the Commission for review in January or February of 2012.

The Commission also organised a Special Session on 21 October 2011 during the 12th ISRM International Congress on Rock Mechanics in Beijing, China, and it was chaired by the Commission President Prof. Resat Ulusay. In this Session, the WG Chairmen and/or WG members presented seven new SMs. Approximately 150 delegates attended this Session and the methods were discussed. The Session was a useful forum to discuss the SMs before their publication.

See the next page for information about the ISRM Orange Book which is a successor to the ISRM Blue Book and which will contain all the ISRM SMs produced since 2007

The ISRM 'Orange Book'

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The ISRM 'Blue Book' & the ISRM 'Orange Book'

Readers will be familiar with the ISRM 'Blue Book' which contains all the ISRM Suggested Methods (SMs) generated by the Testing Methods Commission during the period 1974–2006. (Copies can be obtained at a reasonable price from the ISRM Secretariat.)

A follow-on book, the ISRM 'Orange Book', is currently being prepared which will contain all the recent SMs generated in the period 2007–2012.

In addition to these SMs, the book will contain articles relating to rock characterisation.

Due out in 2012: the ISRM 'Orange Book'

ISRM Suggested Methods Volume 2: 2007–2012

The ISRM Suggested Methods for Rock Characterisation, Testing and Monitoring: 2007–2012. with Additional Articles on Rock Characterisation

The expected contents of the 'Orange Book' are given below.

- Preface (by Profs Hudson and Feng)
- Introduction (by the Editor, Prof R. Ulusay)

New and Upgraded Suggested Methods

- ISRM Suggested Method for Determination of the Schmidt Hammer Rebound Hardness: Revised Version
- ISRM Suggested Methods for Determining the Dynamic Strength Parameters and Mode-I Fracture Toughness of Rock Materials

- ISRM Suggested Methods for Rock Stress Estimation – Part 5: Establishing a Model for the *In Situ* Stress at a Given Site
- ISRM Suggested Method for the Determination of Mode II Fracture Toughness
- ISRM Suggested Methods for Failure Criteria
- Upgraded ISRM Suggested Method for Determining Shear Strength of Rock Joints, both in the Field and Laboratory, and Shear Testing Including Stiffness Controlled Tests and Possible Determination of Normal and Shear Stiffness
- ISRM Suggested Methods for Creep Tests
- ISRM Suggested Methods for Displacement Measurements Using a Global Positioning System
- Upgraded ISRM Suggested Method for the Sonic Velocity Test
- ISRM Suggested Methods for Thermal Properties of Rocks
- ISRM Suggested Methods for *In Situ* Borehole Measurements in a Rock Mass
- ISRM Suggested Method for the Abrasivity Test
- Upgraded ISRM Suggested Methods for the Quantitative Description of Discontinuities in Rock Masses
- ISRM Suggested Method for *In Situ* Hydromechanical Testing of Fractured Rock Masses with the High Pulse Poroelasticity Protocol (HPPP)
- ISRM Suggested Method for Measuring Static Fracture Toughness of Rock Using the Semi-Circular Bend (SCB) Specimen.

Supplementary Documents

- Geo-engineering Data
- 3-D Terrestrial Laser Scanning Techniques for Rock Mechanics Applications
- Pocket Cards to Aid Description of Carbonate Rocks as Core or at Outcrops
- Rock Properties and Their Role in Rock Characterisation, Modelling and Design
- What is an ISRM Suggested Method and what is the Purpose of ISRM Suggested Methods? Guideline for Developing and Submitting ISRM Suggested Methods, Procedure for Application, Developing and approval of New ISRM Suggested Methods and How ISRM Suggested Methods should be Referenced.

Note that these contents are subject to change, depending on successful receipt of the individual items before going to press.

The 6th Müller Lecture (abridged by the author)

Nick Barton, NB&A, Oslo, Norway

The Müller Medal for 2011 was awarded to Nick Barton at the 12th ISRM Congress held in Beijing China in October 2011.



Nick Barton receives the 2011 Müller Medal

**From Empiricism, Through Theory, To Problem Solving in Rock Engineering:
an abridged version of the 6th Müller Lecture**

Nick Barton

ABSTRACT

The behaviour of the jointed-and-faulted-anisotropic-water-bearing media that we call rock masses, was an abiding pre-occupation of Leopold Müller. The author has been similarly pre-occupied. So starting with modest developments from tension-fractured physical models, and progressing to the real jointed and three-dimensional world in due course, a few of the numerous lessons learned and subsequently applied in rock engineering practice will be described. These include non-linear and block-size dependent shear strength, no actual cohesion, and the possibility of thermal overclosure if rock joints are rough. A six orders of magnitude rock quality Q-scale has proved essential. Discontinuous behaviour provides rich experiences for those who value reality, even when reality has to be simplified by some empiricism.

1. INTRODUCTION



Figure 1. Confronted with this potentially unstable jointed rock slope, multiple reasons for the overbreak and instability suggest themselves. There are clearly adverse values of JRC, JCS, and ϕ_r , and there are also adverse ratings of Jn, Jr, Ja (and Jw on occasion).

The lessons learned during the development of the empirical parameters in the caption to Figure 1 on the previous page, which are now widely used in many countries, will be summarised in the following pages. Their application has been in widely diverse projects.

2. TWO-DIMENSIONAL ROCK MASSES SIMULATED WITH PHYSICAL AND NUMERICAL MODELS

The desire to model the behaviour of jointed rock slopes in late nineteen sixties Ph.D. studies at Imperial College led to tension-fracture models by the writer, and numerical modelling developments (pre- μ DEC) in the case of a student colleague Peter Cundall. The relative *inflexibility* and *flexibility* of the two approaches is readily imagined from Figure 2. The single numerical slope model demonstrates the influence of changed friction angles, and was reported some years later, in Cundall *et al.*, 1977 (1975 conference).

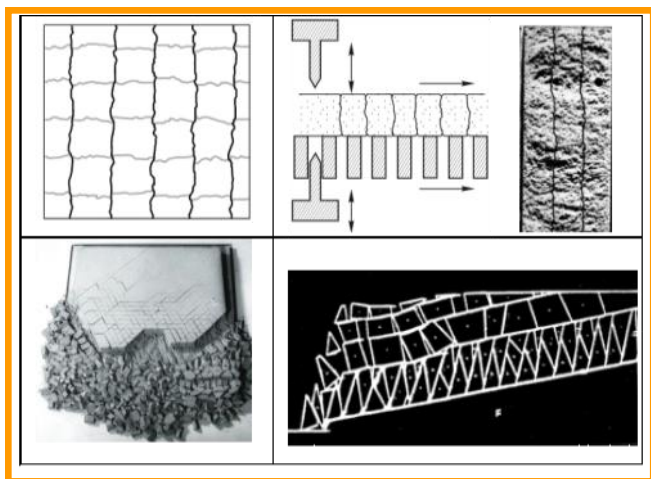


Figure 2. A study in contrasts: physical modelling using tension-fracture generation, and numerical modelling using μ DEC: this example demonstrates a friction angle for the joints of $\phi = 20^\circ$.

Despite the shortcomings of physical tension-fracture models, the writer nevertheless discovered that the peak shear strength of these rough and clearly unweathered tension fractures could be described by a simple relation involving the *uniaxial compression strength* (σ_c) of the model material (Barton, 1971). This was to prove useful.

$$\tau = \sigma_n \tan [20 \log (\sigma_c / \sigma_n) + 30^\circ] \quad (1)$$

This equation, and simple links to peak dilation angle, proved to be the unweathered and roughest ‘end

-member’ of the Barton and Choubey, 1977 equation for the peak shear strength of rock joints, which followed some years after the testing of tension fractures.

$$\tau = \sigma_n \tan [JRC \log (JCS / \sigma_n) + \phi_r^0] \quad (2)$$

Here the *joint roughness coefficient* (JRC), the *joint wall compression strength* (JCS) and the *residual friction angle* (ϕ_r) can each assume lower magnitudes, caused by roughness $JRC < 20$, and variable weathering ($JCS < \sigma_c$, and $\phi_r < \phi_b$). The first equation was based on *direct shear tests* of more than 200 artificial tension fracture samples, while the second equation was based on DST of 130 rock joint samples, some of them slightly weathered.

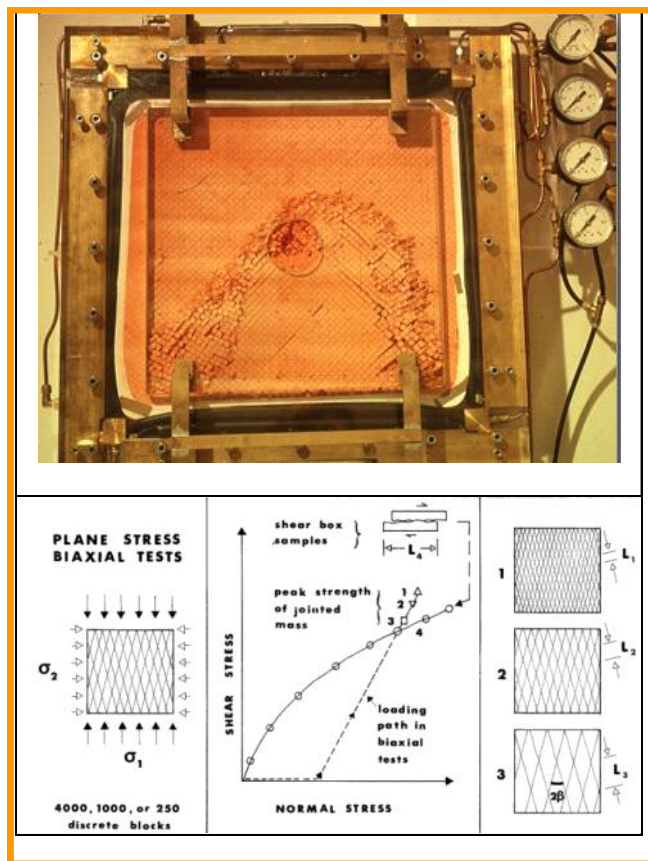


Figure 3. Biaxially loaded two-dimensional physical models with respectively 250, 1000 or 4000 discrete blocks helped to give clues about scale effects caused by different block sizes. These physical models were described by Barton and Hansteen, 1979, therefore pre-dating UDEC-BB. It was noted that linear ‘stress-strain’ curves resulted when loading 4000-blocks models in biaxial shear. Convex curves were registered with larger block sizes.

The 6th Müller Lecture (cont.)

Physical models, each of 40,000 blocks, created for the rock slope stability studies by Barton, 1971, were followed some years later (Figure 4), by model studies of caverns for underground nuclear power plants, studying the generic effect of joint-set (fracture) orientation, anisotropy due to one dominant joint set, and horizontal stress variation in models with 20,000 blocks. This research was performed in NGI, Oslo. Barton and Hansteen, 1979 also compared the physical 'jointed' models with FEM continuum analyses.

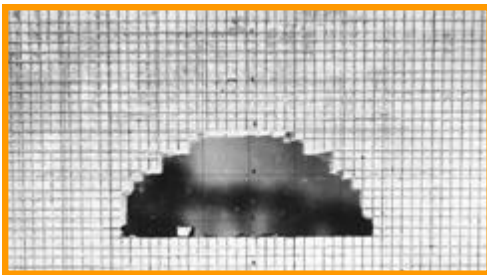


Figure 4. Tension-fracture models consisting of 20,000 blocks, with three different joint patterns, and two different levels of applied horizontal stress, demonstrated that excavation of large caverns near the surface could cause upward (heave) or downward (subsidence) of the overlying 'rock mass'. Joint orientation effects and horizontal stress effects were coupled.

Some ten years later, this physical model experience was put to the test in the modelling of the planned Gjøvik cavern of 62 m span, using UDEC-BB. Figure 5 shows the input data, including BB parameters, the joint geometry from observations in surrounding caverns, and application of a high horizontal stress based on local stress measurements.

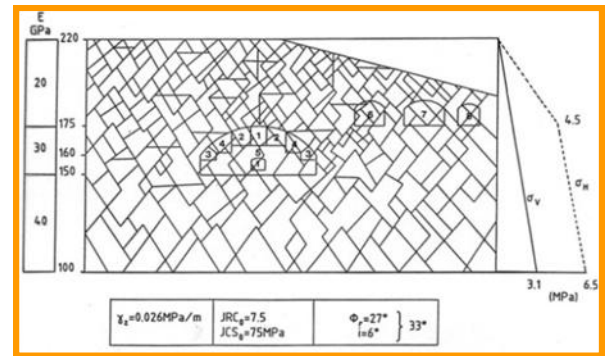


Figure 5. The UDEC-BB model shown above, gave a good (Class A) prediction of 7 to 9 mm downward movement. (Barton *et al.*, 1994). A view of the huge (stages 1 to 4) top-heading is shown.

3. SHEAR FAILURE AROUND MODEL OPENINGS

Joint oil-industry borehole stability studies performed at NGI in the late eighties, provided consistent evidence of shear failure development in the form of log-spiral surfaces, with physically measured shear displacements. The model studies involved drilling into anisotropically loaded model sandstones in a 0.5 x 0.5 x 0.5 m polyaxial cell. Drilling could be performed in various directions in relation to the three independent principal stress directions, by drilling through pre-welded holes in the flatjacks.

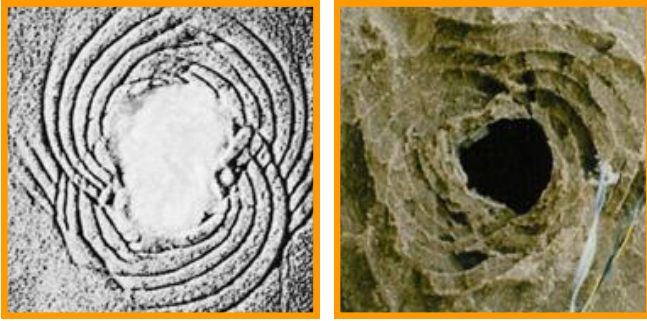


Figure 6. Log-spiral shearing with a 45° inclined hole drilled in the direction of σ_H into a stressed block of model sandstone, with principal stress ratios $\sigma_v = 1$, $\sigma_H = 0.8$, $\sigma_h = 0.4$. Addis *et al.*, 1990.

The log-spiral form of failure, Figure 6, has been seen when inspecting TBM headrace tunnels in massive sections of marble, and also in schists, where the estimated theoretical maximum tangential stress ($\sigma_\theta = 3\sigma_1 - \sigma_3$) was presumably reaching the 'limit' of 0.4–0.5 x UCS, i.e., increased SRF in the Q-system. The onset of stress-slabbing and even rock bursting is seen if the ratio of UCS/ σ_θ continues to rise with depth of cover exceeding 1 and even 2 km. Norwegian road tunnels have exceeded 1 km depth several times, but reached 1.4 km at the Lærdal Tunnel of 24.5 km length, with three caverns of 30 m span at almost this depth. Stress failure may be extensional when in hard dilatant rocks.

4. MODELLING FAILURE IN A ROCK MASS

The tunnel break-out that developed when excavating the Canadian URL mine-by experimental tunnel by line-drilling, was in response to obliquely acting, high and strongly anisotropic stresses. It is shown in Figure 7. The accompanying shortcomings of continuum modelling with '*c plus $\sigma_n \tan \varphi$* ' shear strength assumptions, as partially illustrated in the same Figure, should have alerted our profession for change already ten years ago.

Attempts to model 'break-out' phenomena such as those illustrated are not realistic with standard Mohr Coulomb or Hoek Brown failure criteria, because the *actual failure* mode is not following our long-standing expectation of '*c plus $\sigma_n \tan \varphi$* ' for the strength of rock masses. In fact Müller indirectly pointed this out already in 1966.

The intact rock fails at small strain (in tension if hard and dilatant), in shear (if less dilatant), followed by the mobilisation of friction along the new failure

surfaces (if not ejected), followed by mobilisation of surrounding joint surfaces. This of course is a complicated test of our present numerical modelling capabilities, and complex-algebra input data for '*c*' and ' *φ* ' as in Table 1, cannot by any stretch of the imagination, solve this challenging problem.

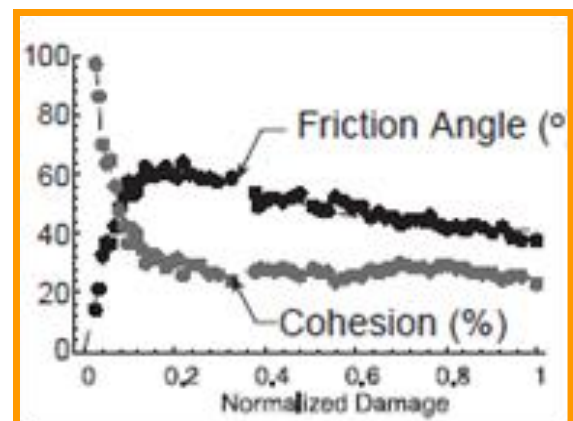
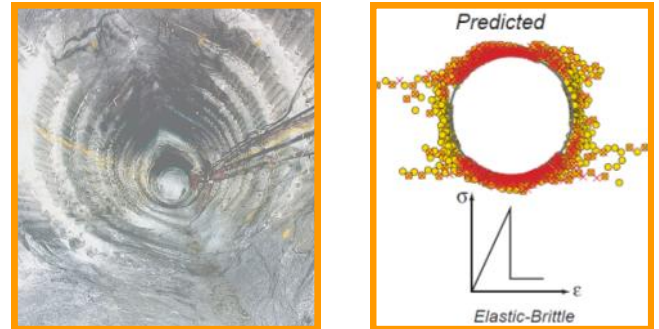


Figure 7. An important demonstration of unsuccessful modelling by 'current methods', as given by Hajiabdolmajid *et al.*, 2000. This is followed by their own more realistic degradation of cohesion and mobilisation of friction, which was applied in FLAC.

Table 1. The remarkable complexity of the algebra for estimating c' and ϕ' with Hoek-Brown based formulations (equations 4 and 6) are contrasted with the simplicity of equations 3 and 5, derived by 'splitting' the existing Q_c formula into two parts, as described in Barton, 2002. ($Q_c = Q \cdot \sigma_c / 100$, with σ_{ci} expressed in MPa).

| | | |
|----|---|-----|
| FC | $\phi \approx \tan^{-1} \left(\frac{J_r}{J_a} \times \frac{J_w}{1} \right)$ | (3) |
| | $\phi' = a \sin \left[\frac{6am_b (s + m_b \sigma'_{3n})^{a-1}}{2(1+a)(2+a) + 6am_b (s + m_b \sigma'_{3n})^{a-1}} \right]$ | (4) |
| CC | $c'' \approx \left(\frac{RQD}{J_n} \times \frac{1}{SRF} \times \frac{\sigma_c}{100} \right)$ | (5) |
| | $c' = \frac{\sigma_{ci} \left[(1+2a)s + (1-a)m_b \sigma'_{3n} \right] (s + m_b \sigma'_{3n})^{a-1}}{(1+u)(2+a) \sqrt{1 + \left(\frac{6am_b (s + m_b \sigma'_{3n})^{a-1}}{(1+a)(2+a)} \right)}}$ | (6) |

Rock masses actually follow an even more complex progression to failure, as suggested in Barton and Pandey, 2011, who recently demonstrated the application of a similar 'c then tan ϕ ' modelling approach, but applied it in FLAC 3D, for investigating the behaviour of multiple mine-stopes in India. A further break with convention was the application of peak 'c' and peak ' ϕ ' estimates that were derived directly from mine-logged Q-parameters, using the CC and FC parameters suggested in Barton, 2002. For this method, an estimate of UCS is also required. CC (cohesive component) and FC (frictional component), Table 2, are derived from separate 'halves' of the formula for $Q_c = Q \times \sigma_c / 100$.

Table 2. Illustration of parameters CC (seems to be MPa ?) and FC^o (friction angle), for a declining sequence of rock mass qualities, with simultaneously reducing σ_c (MPa). $V_p \approx 3.5 + \log Q_c$ (km/s), and $E_m \approx 10 Q_c^{1/3}$ (GPa) were suggested in Barton, 2002.

| RQD | J _n | J _r | J _a | J _w | SRF | Q | σ_c | Q_c | FC ^o | CC | V_p | E_m |
|-----|----------------|----------------|----------------|----------------|-----|-----|------------|-------|-----------------|-----|-------|-------|
| 100 | 2 | 2 | 1 | 1 | 1 | 100 | 100 | 100 | 63 | 50 | 5.5 | 46 |
| 90 | 9 | 1 | 1 | 1 | 1 | 10 | 100 | 10 | 45 | 10 | 4.5 | 22 |
| 60 | 12 | 1.5 | 2 | 0.66 | 1 | 2.5 | 50 | 1.25 | 26 | 2.5 | 3.6 | 11 |
| 30 | 15 | 1 | 4 | 0.66 | 2.5 | 0.1 | 33 | 0.04 | 9 | 0.3 | 2.1 | 3.5 |

The pairs of parameters RQD/J_n and J_r/J_a are already being logged at a lot of tunnels and caverns, and also in mines, following the Potvin and Matthews method, and the subsequent Modified Stability Graph,

now in common use for preliminary slope dimensioning in many countries. Relations between rock properties are shown in Figure 8.

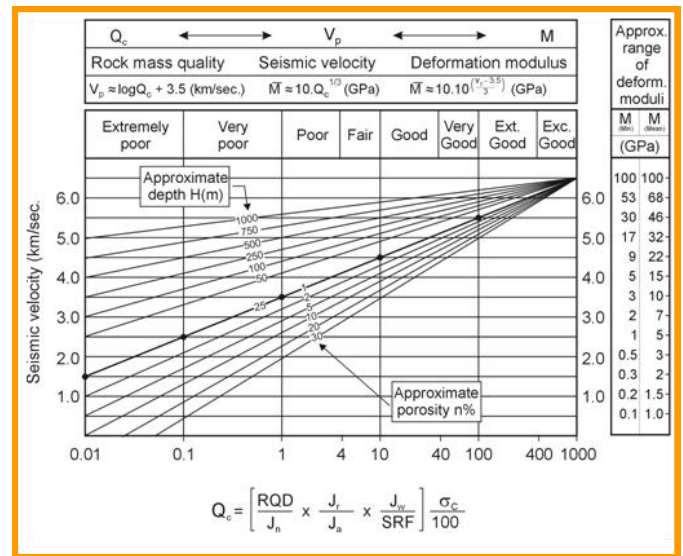


Figure 8. The integration of rock mass quality and seismic velocity, with adjustment (+ve) for depth (or stress level) and porosity (-ve), and rock strength. Estimates of static deformation modulus (right-hand column) should also be depth dependent. Barton, 1995.

5. MODELLING A COMPACTING RESERVOIR

Seabed subsidence above the Ekofisk reservoir resulted in the raising of all platforms by 6 m, and provision of a 100 m diameter protective wall, and final re-location of operations away from the centre of the 9 x 14 km field. Since 1986 compaction has at least doubled, despite extensive sea-water injection for pressure maintenance that also caused inevitable weakening of the chalk (Figures 9).

The down-dip shearing that can occur despite one-dimensional strain, is a fundamental necessity for the continued conductivity of the dipping joints, as the matrix is of low permeability, and cannot otherwise be well drained (Figures 10 & 11).

During exploration, slickensided joints in the chalk were not observed. According to Philip's geologist (H. Farrell, pers. comm.), slickensiding was observed in some much later cored holes connected with the water-injection operations, after 1985. Production was causing joint shearing, and is presently a seemingly ignored part of 4D interpretation, by those focusing only on 'continuum based' phenomena in producing reservoirs (Barton 2006).



Figure 9. A view of the Ekofisk reservoir in the North Sea, where compaction of the jointed-chalk reservoir of 300 m thickness at 3 km depth caused increasing sea-bed subsidence that amounted to about 4 m when investigations began in 1985-1987. Now it is 10m.

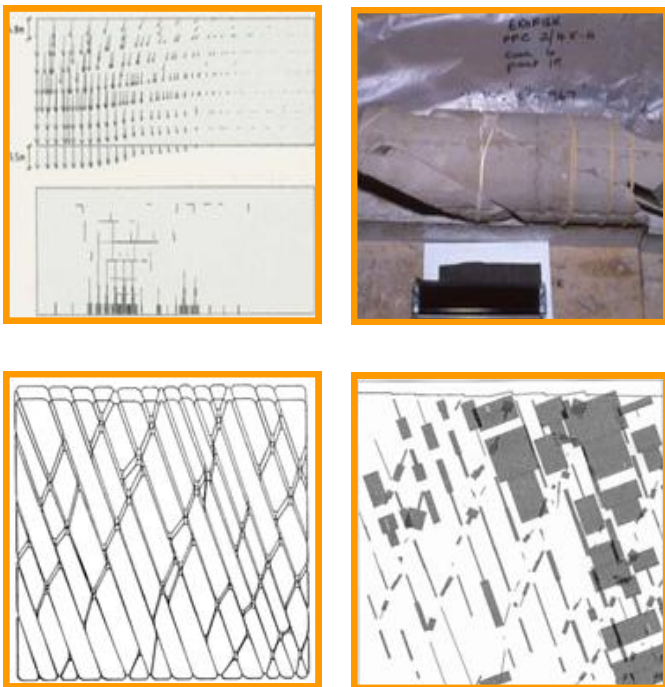


Figure 10. Top: Axi-symmetric UDEC-MC modeling of the ratio of subsidence/compaction (S/C) and two of the tested joint samples from Ekofisk. Bottom: UDEC-BB 'uniaxial-strain' M-H modelling of a vertical 1.5x1.5 m 2D-element of jointed Ekofisk chalk, which had a porosity of 40%. Input data were obtained from JRC and JCS characterisation of numerous joint samples. Barton *et al.*, 1986.

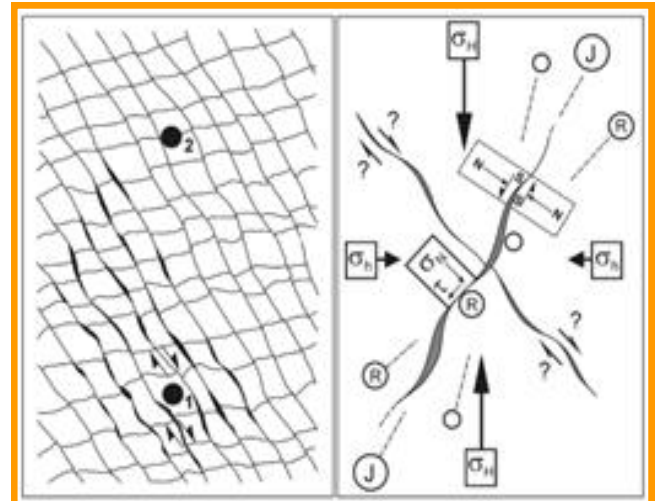


Figure 11. A scenario (exaggerated here) involving maintenance of permeability through shearing and slight dilation is also consistent with analysis of deep-well conductors and non-conductors, and should be relevant to continued production from weak reservoir rocks. Note the possibility of bypassing fluid with incorrect interpretation, as also in numerous geothermal projects.

6. SHEAR STRENGTH AT EXTREME STRESS LEVELS

In 1976, the author proposed a 'critical state' concept for the shear strength of intact rock at high stress, which involved both the expectation and the actual *horizontal orientation* of the Mohr strength envelope. Recently, this concept has been applied to better define the curvature of intact rock strength envelopes. A few tests at low confining pressures provide all the data needed for extrapolation to high levels of confinement. The elegant Singh *et al.*, 2011 shear strength criterion heralds a new era in rock mechanics understanding.

Since a blend of theory and empiricism has been promised in the title, with possible application to problem solving in rock engineering, the final figure to be presented will be of the tilt testing concept. This is at the other end of an extreme stress range, and has been widely applied (Figure 12 on the next page).

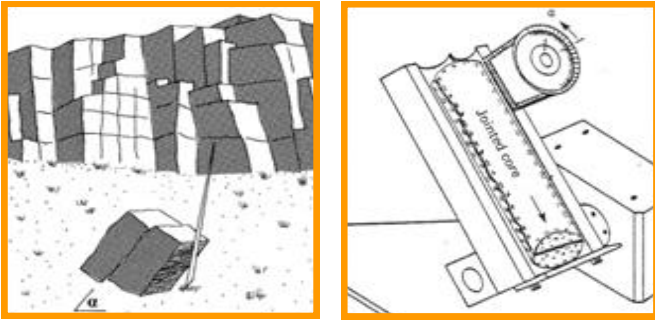


Figure 12. The tilt test result can be extrapolated from 0.001 to 10 MPa, and can be performed on samples of 10 cm to 1 m in size. The same method has also been used on 5m long as-built rockfills.

7. CONCLUSIONS

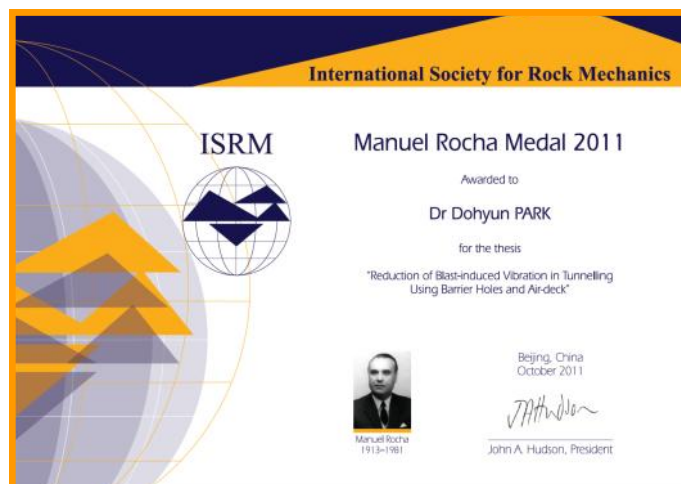
Those who restrict their rock mechanics experience to GSI-based isotropic continuum modelling, inevitably miss many exciting insights in the rewarding field of rock engineering, which is mostly executed in jointed, anisotropic, water-bearing rock masses, which usually vary from location to location. Complex algebra and multiple decimal places are irrelevant in such a variable medium.

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Dr Dohyun Park was the winner of the 2011 Manuel Rocha Medal which was presented to him (see page 31) during the 12th ISRM Congress held in October 2011 in Beijing, China

Below is a summary of the PhD thesis prepared by Dr Park of Korea



Summary of PhD Thesis

Since a tunnel is excavated in one direction, it is important to reduce blast vibration considering the location of nearby structures. For example, structures can be located in front of and in the back of a vertical plane including the tunnel face, as shown in Figure 1 (a). Also, at a point in time, the structure in Figure 1 (b) is located in front of the S-1 plane but, as we excavate the tunnel, the structure is located at the back of the S-2 plane. Therefore, when we are going to reduce blast vibration in tunnelling, we need to consider the location of nearby structures. This study proposed line-drilling and bottom-air-deck methods (Figure 2) for reducing blast vibration at the back of a vertical plane including the tunnel face and in front of the vertical plane, respectively.

A quantitative assessment of the effectiveness of both methods was numerically and experimentally carried out. The parameters of line-drilling were the spacing and diameter of drill holes, the distance between blasthole and line-drilling, and the number of rows of drill holes, including their arrangement, with the parameter of bottom-air-deck being the air-deck ratio at the bottoms of blastholes.

In the numerical investigations, a non-linear hydrocode, AUTODYN, which can numerically model explosives, was used to realistically simulate blasting problems. From the numerical investigations of both methods, correlation equations (Equations below) of their vibration-reduction effects, which give quantitative information on the drilling of barrier holes and on the bottom-air-deck ratio, were derived.

$$ARF = \left[60.796 \cdot \ln \left(\frac{D^2}{S-D} \right) - 103.190 \right] (D_{LD-BH})^{-0.244}$$

$$ARF = 56.69(R_a)^{0.68}$$

where ARF (%) = amplitude reduction factor; D (mm) = diameter of drill holes; S (mm) = spacing of drill holes; D_{LD-BH} (mm) = distance between line-drilling and blasthole; and R_a = bottom-air-deck ratio.

In order to verify the numerical results, a series of single-hole and full-scale experiments were carried out in the field, as shown in Figures 3 & 4, and then good agreement was found from a comparison between the numerical and experimental results. The conditions for field application were designed by using the information obtained from the numerical analysis considering the practice and the difficulty of blasting work, and then the concept of ‘factor of safety’ was introduced to consider uncertainties of the numerical analysis.

In conclusion, the numerical investigations and the field observations suggested that both methods reduce blast vibration in tunneling according to the location of nearby structures, and then they can be used as alternatives to reducing blast vibration in tunneling. Finally, further field evaluations and more detailed numerical examinations will be needed to update the results of this study and to extend the engineering application. [See Figures 1b–4 on the next page.](#)

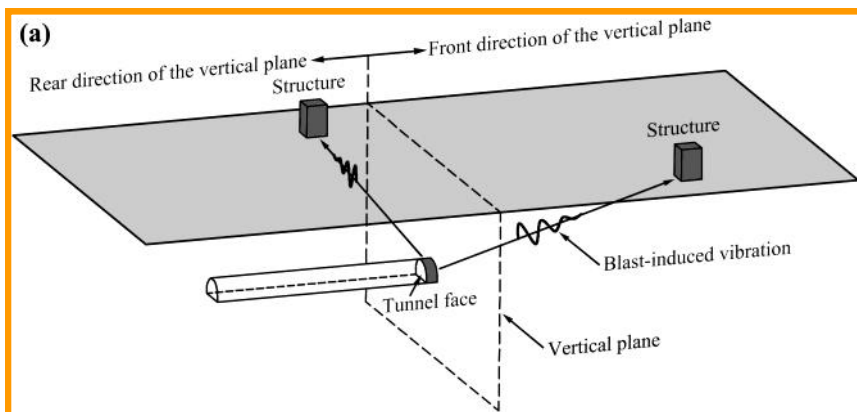


Figure 1a. Reduction of blast vibration in tunnelling

Reduction of Blast-Induced Vibration in Tunnelling (cont.)

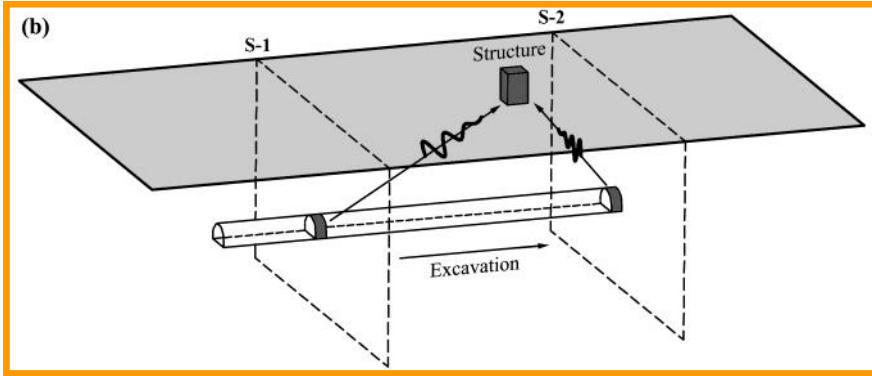


Figure 1b. Reduction of blast vibration in tunnelling

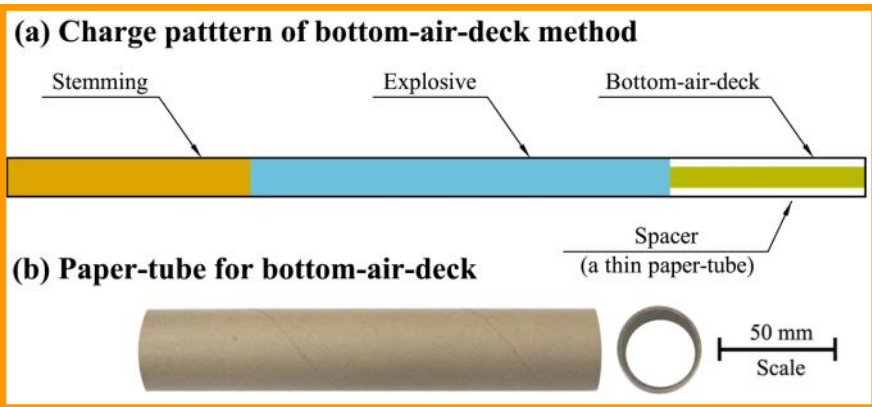


Figure 2. Bottom-air-deck method

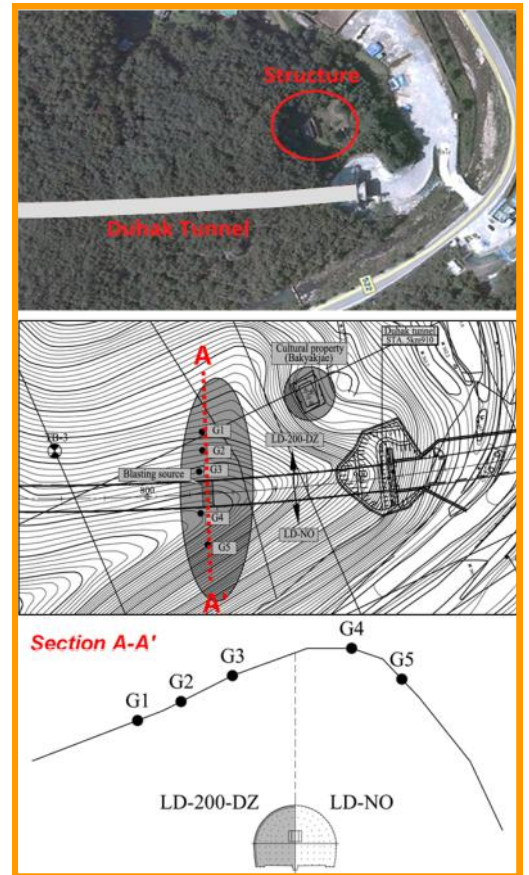


Figure 3. Full-scale experiment of line drilling

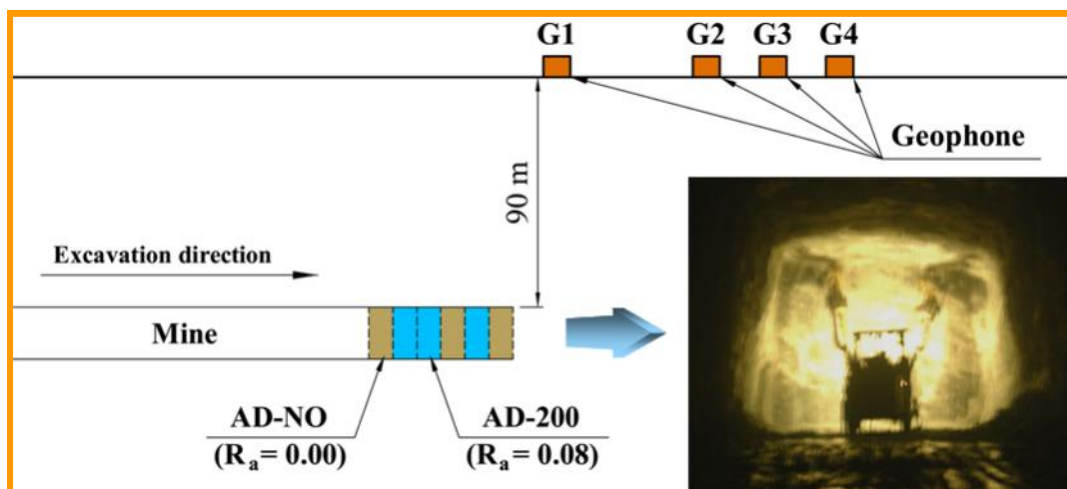


Figure 4. Full-scale experiment of bottom-air-deck

A Fully Coupled Coal Damage Mechanics and Gas Flow Model

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Summary

Coal and gas outbursts have created serious problems for the coal mining industry around the world. In this study, a fully-coupled coal damage mechanics and gas flow model has been developed to evaluate different mitigation techniques, such as gas drainage. In this model, the development of the mining-induced damage zone and the gas flow in damaged coal seam are considered as a coupled process. A porosity-evolution relation, which incorporates the effect of the combined influence of gas pressure, thermally-induced solid deformation, thermally-induced gas adsorption change, and gas desorption-induced solid deformation, is implemented into the fully-coupled coal deformation, gas transport, and thermal transport model. The potential of its applications is demonstrated through a numerical example that shows the enhancement of gas drainage by blasting in a coal seam. Model results demonstrate that the blasting by loosening the coal seam, as a coupled coal-gas interaction process, may enhance the gas drainage significantly and reduce the risk for the potential of coal and gas outbursts.

Key words: coal damage, gas drainage, coal-gas interaction, numerical simulation

1. Introduction

Gas transport in coal seams is one of the most important factors that affects coal and gas outbursts. Evaluation of gas emission and design of the most suitable panel and pre-drainage systems are necessary to predict and prevent the coal and gas outbursts. Gas migration in coal seams is a process associated with coal seam deformation, gas seepage, absorption-induced matrix shrinkage of coal, as well as thermal transfer. This problem is complex because all the effects of the above physical processes are at PVT (pressure, volume and temperature) states, and the coal seam properties, such as permeability, vary with these states. More importantly, the gas flow in a coal seam is also affected by the mining activities, which usually trigger the unstable failure of a coal seam, leading to the coal and gas outbursts.

Because so many factors relating to the geological conditions and drainage operations are involved during gas drainage, numerical modelling is normally employed based on the characterisation of all these

related factors, the constitutive laws and coupled relations linking all major processes. Up to now, most of the models for coal seam gas mitigation did not take the thermal process into account, which may lead to serious discrepancies if the thermal effect is significant, especially when it is considered for coal mining at depth. Another important issue that must be taken into account for the coal gas mitigation is the effect of mining-induced damage of the coal seam, which may alter the gas flow and the coupled coal-gas interactions during underground mining.

In this study, a coupled gas flow, incorporating coal seam damage, thermal conduction and convection processes during the drainage of gas in a coal seam is developed. In this model, the cross couplings among these three processes, in particular, the influences of coal seam damage and thermal gradient on gas flow, are taken into account. The model is developed based on our previous work (Zhu *et al.*, 2011).

2. Methodology

This work is focused primarily on a coupled gas flow, coal seam damage and thermal conduction and convection processes during the drainage of gas in coal seam, in which the cross coupling among these three processes, in particular, the influences of coal seam damage and thermal gradient on gas flow, are taken into account.

Formulation of Fully-Coupled Processes

As shown in Figure 1, in order to consider the effect of damage of the coal seam on the typically coupled coal-gas interaction, the damage of the solid (i.e., the coal seam), as shown in the red circle at the centre of Figure 1, is incorporated into the typical coupled coal-gas interaction model. In this regard, the coal may be damaged as judged according to the damage thresholds defined based on stress and strain, and the damage may dominate the gas flow and thermal transfer, at least by altering the porosity, permeability and thermal conductivity. Also, the damage may degrade the Young's modulus of the coal, thus leading to the further development of the damage zone.

Within this theoretical framework, the porosity for gas flow in the coal seam is affected by gas pressure, the thermally induced solid deformation, thermal

A Fully Coupled Coal Damage Mechanics Gas Flow Model (cont.)

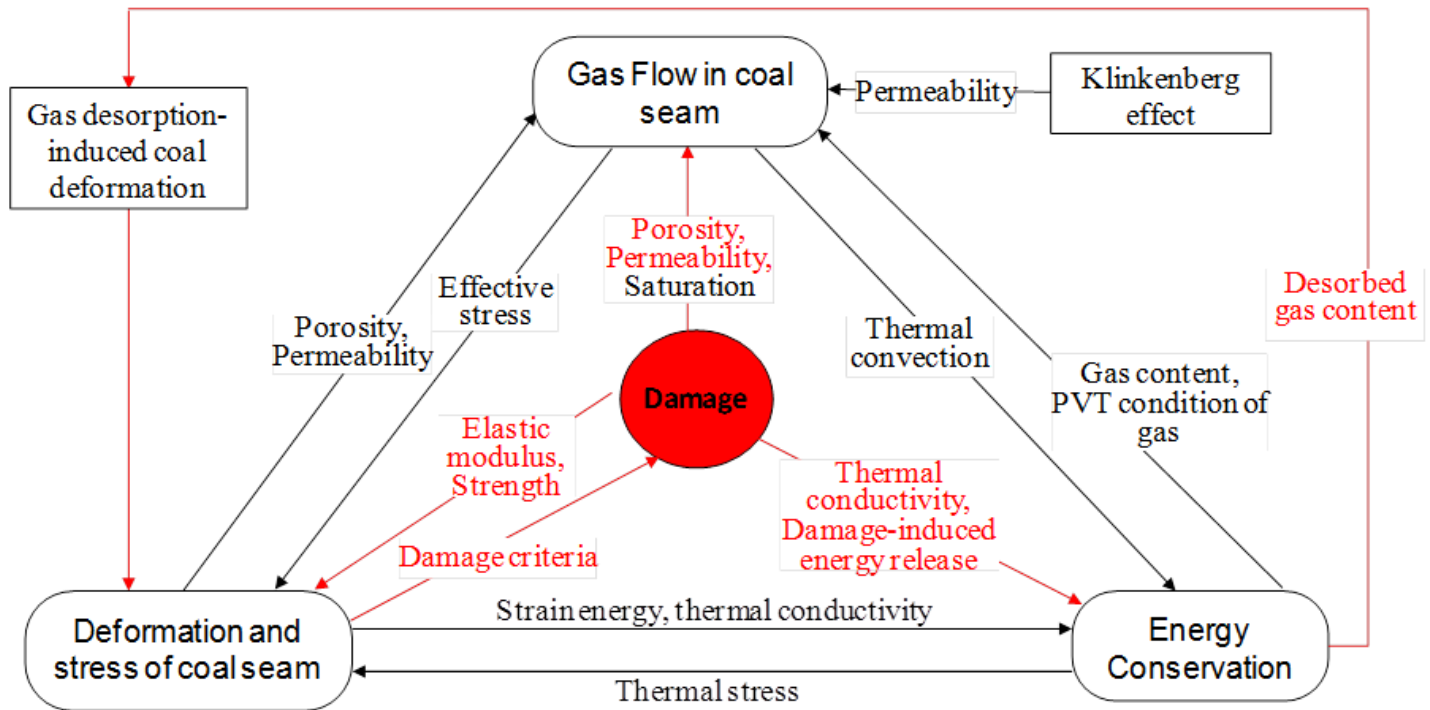


Figure 1. Illustration of fully-coupled damage coal mechanics and gas transport processes

induced gas desorption, gas desorption-induced matrix deformation, and coal damage as well. Based on the energy conservation equation, the impacts of the thermal expansion of the solid medium, thermal dilation of the fluid medium and thermal convection on the thermal transport are formulated.

Numerical Implementation

The coupled multiphysical model for gas flow, coal seam damage and thermal processes during gas flow in the coal seam is implemented into and solved by using COMSOL Multiphysics, a powerful PDE-based multiphysics modelling environment, where the boundary and initial conditions are specified. An example is numerically simulated in order to clarify gas drainage enhanced by blasting damage in a coal seam.

3. Demonstration of the Potential Applications

As shown in Figure 2, the numerical model is established based on the *in situ* conditions at a colliery. The simulation domain is 10 m long, 5 m wide and 7 m high, in which the coal seams are 3 m in thickness and the working face is 3 m high with a roof of sandstone and a floor of mudstone. There are two blasting boreholes with depth of 5 m and distance apart of 1.4 m that are charged and detonated, while another one is used only for measurement, being termed the ‘controlling borehole’.

The denotation of two blasting boreholes results in two types of loading applied on the borehole wall: namely a stress wave and a quasi-static gas pressure with a longer duration. Because the transient analysis of the response of coal to such a blasting stress wave is too time-consuming and so cannot easily be simulated with a PC, in this case study example we mainly focus on the high blasting-induced gas pressure and its impact on coalbed damage and gas flow. This pressure is applied as a radial quasi-static load on the inner boundary of the blasting borehole in order to simulate the gas pressure.

Figure 3 shows the damage zone distribution around the working face after blasting. In this Figure, the different colours are used to denote the different damage states, i.e., the white for shear damage and black for tensile damage. The damage variable (D) is varied continuously from -1.0 (for tensile damage) to 0 (for the elastic state) and from 0 to 1.0 (for shear damage). As shown in Figure 3, damage zones appear around the blast borehole and at the roof in front of the working face which should be noticed during operation. A broken zone with radius of 1.0 m and a loosening zone with radius of 1.2 m are induced around the blasting borehole. Similarly, the increase of the permeability within and around the damage zone is also predicted. Thus it can be concluded that loosening blasting can have notable effects on increasing the coalbed permeability and enhancing gas drainage, especially within the damage zone.

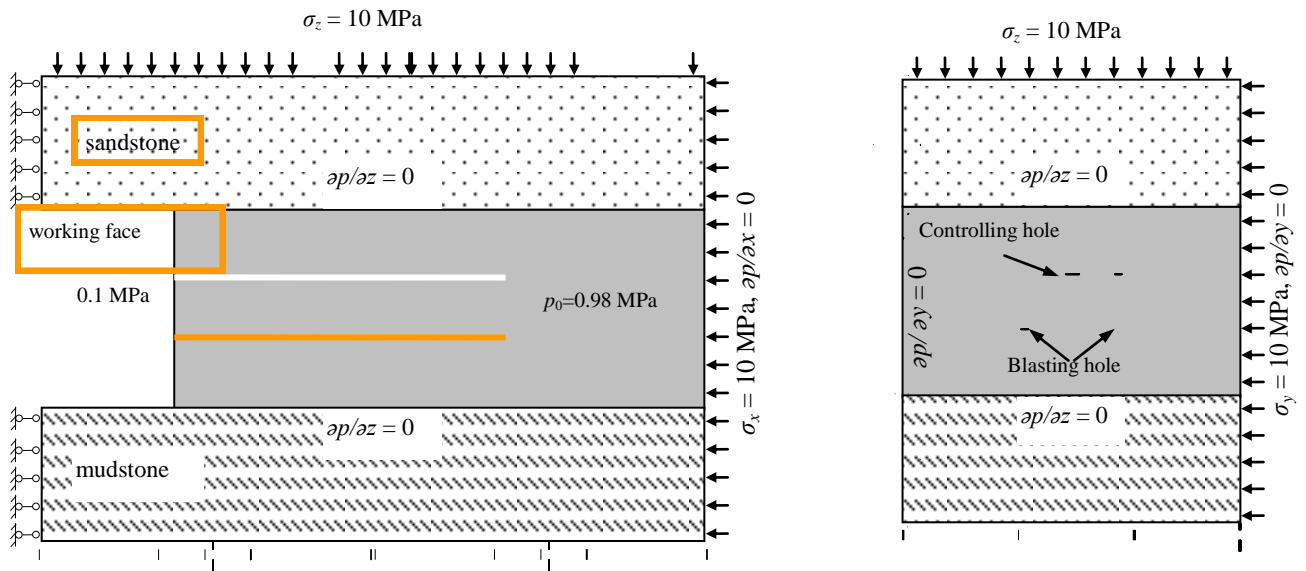


Figure 2. Three-dimensional model and the boundary conditions for the case study.

4. Conclusions

It is of vital importance to understand the mechanism of gas drainage in order to pre-drain methane effectively. In this work, a fully-coupled coal damage mechanics and gas flow model, which takes the effect of variable temperature and mining-induced damage in the coal seam into account, is introduced. The model is used to simulate gas drainage under variable temperature and as enhanced by loosening blasting. Based on the numerical simulation in the case study, a blasting-induced damage zone is formed around the borehole, leading to increased coal permeability and enhanced gas drainage. The coupled coal seam damage and gas flow model is capable of characterising the effectiveness of loosening blasting for increasing coal permeability and enhancing gas extraction.

Acknowledgements

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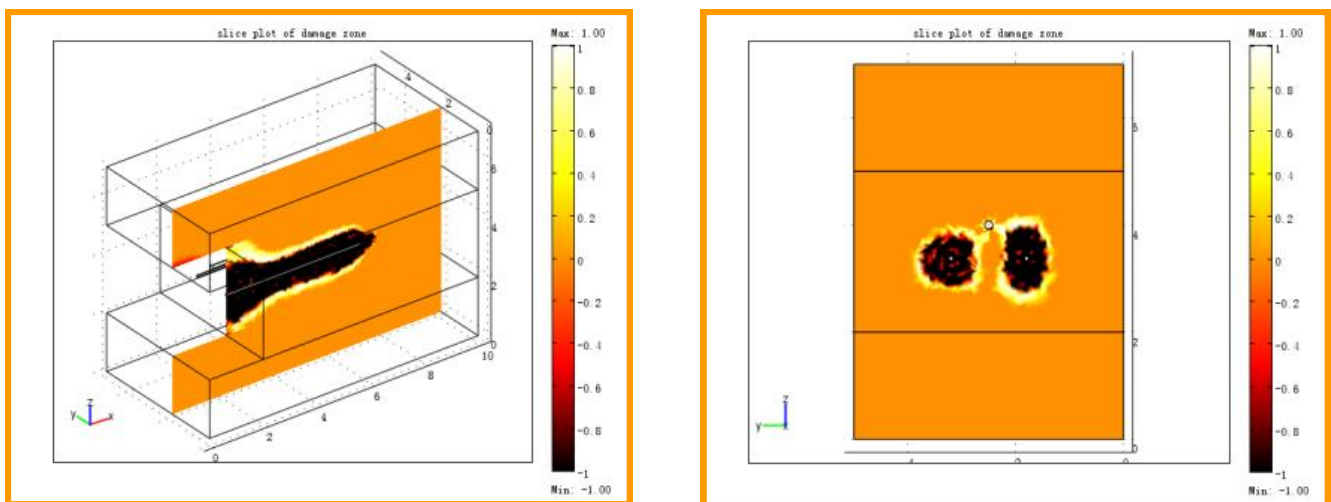


Figure 3. Damage zone distribution after loosening blasting.

(The different colours are used to denote the different damage states.)

A Chemo–Thermo–Mechanically Coupled Analysis Method of

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Introduction

Methane hydrates are viewed as a potential energy resource since a large amount of gas is trapped within ocean sediments and regions of permafrost. In Japan, an industry-government-academia collaboration research group, known as, Research Consortium for Methane Hydrate Resources (MH 21 Research Consortium), was established in order to undertake research associated with gas hydrates, such as, exploration, production method, and environmental impact. They have discovered turbidite sand and mud alternation layers in the eastern Nankai Trough area, which were considered viable and prosperous for developing methane hydrates resources.

There are three possible methods to produce methane gas from hydrates, these are depressurising method, heating method, and inhibitor injection method. In the production process, hydrates dissociate into water and gas, which will result in changes of pore water and pore gas pressures and the effective stress in soil sediments. Also, temperature changes with dissociation occur since the dissociation is an

endothermic reaction. Hence, the dissociation process can be treated as a chemo-thermo-mechanically coupled process as shown in Figure 1.

Hydrate bearing sediments are composed of soil particles, hydrates, water, and gas during the dissociation process. In the present study, the behaviour of multiphase materials can be described within the framework of a macroscopic continuum approach through the use of the theory of porous media. The theory is considered to be a generalisation of Biot's two-phase mixture theory for saturated soil (Biot, 1955).

Proceeding from the general geometrically non-linear formulation, the governing balance relations for multiphase materials can be obtained (e.g., Boer, 1998; Loret & Khalili, 2000; Ehlers *et al.*, 2004). Mass conservation laws for the gas phase as well as for the liquid phase are considered in those analyses. In the field of geotechnics, air pressure is frequently assumed to be zero in many research works (e.g., Sheng *et al.*, 2003) since geomaterials usually exist in

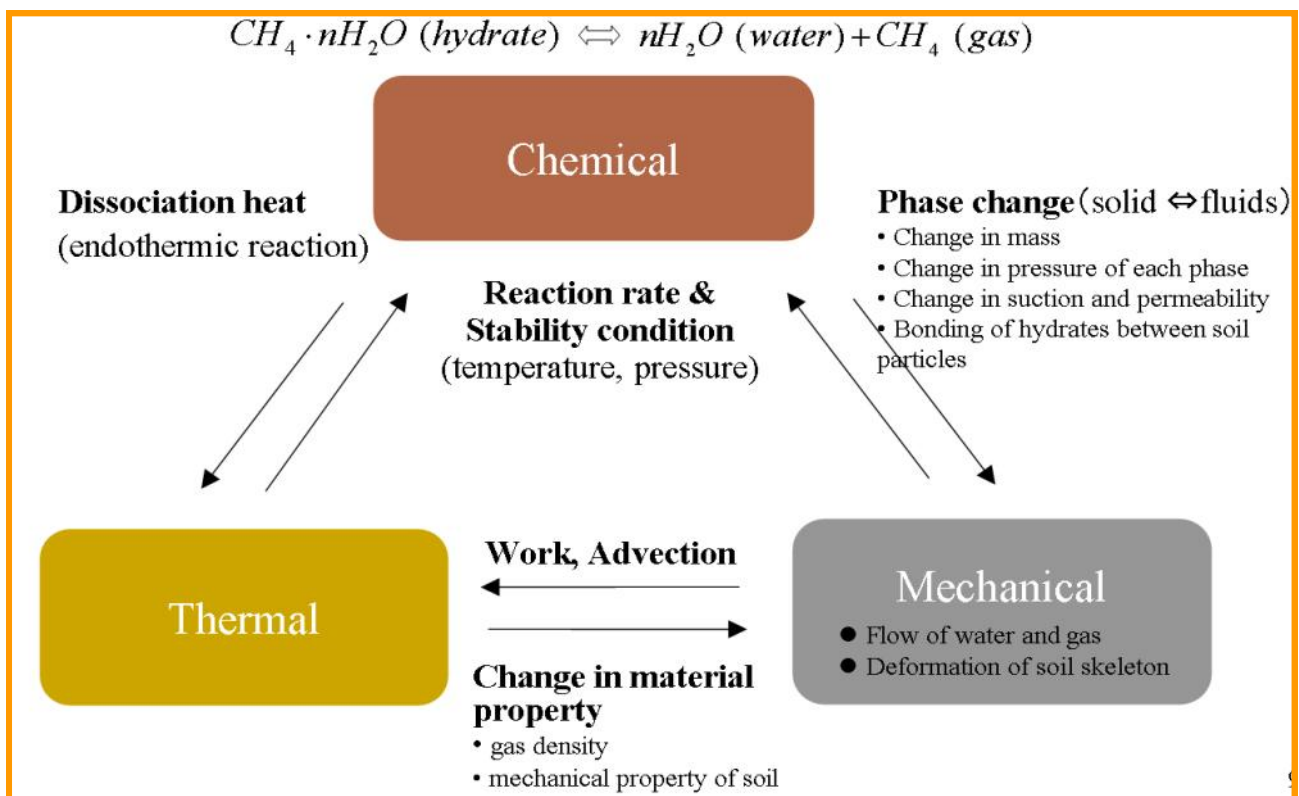


Figure 1. Chemo-thermo-mechanically coupled behaviour

Ground Deformation Induced by Gas Hydrate Dissociation

an unsaturated state near the surface of the ground. Considering hydrate dissociation, however, we have to deal with the high level of gas pressure that exists deep in the ground; this means that the mass balance for both phases must be considered. Oka *et al.* (2006, 2009, 2010) proposed an air-water-soil coupled finite element model in which the skeleton stress is used as a stress variable with the effect of suction through the parameters in the constitutive equation for soil, and the simulated compression behaviour for unsaturated soils is under impermeable conditions for both water and gas flow.

The conservation of energy is required when there is a considerable change in temperature during the deformation process. Oka *et al.* (2005) and Kimoto *et al.* (2007) numerically simulated the thermal consolidation process using a thermo-hydro-mechanically coupled finite analysis method with a thermo-elasto-viscoplastic model. Since hydrate dissociation is an endothermic reaction, heat transfer plays an important role in both the gas production and the ground deformation.

In the following section, we present a numerical analysis example of gas hydrate dissociation in hydrate-bearing sediments in the seabed. The proposed simulation method has been developed based on the chemo-thermo-mechanically coupled analysis, taking into account the phase changes from solids to fluids, that is, water and gas, the flow of water and gas, heat transfer, and the ground deformation (Kimoto *et al.* 2010). The following assumptions are adopted in the formulation.

- 1) Soil particles and water are incompressible.
- 2) Methane is treated as an ideal gas and the effect of dissolution into water is disregarded.
- 3) The flows of gas and water are independent and they follow Darcy's law.
- 4) The soil and hydrates behave as solid mass, so that the velocity of hydrates is equal to the velocity of soil.
- 5) The acceleration term is disregarded in the equation of motion.

Numerical Simulation Examples

Weak forms of conservation of the mass for water and gas, conservation of momentum, conservation of energy are discretised in space and solved by the finite

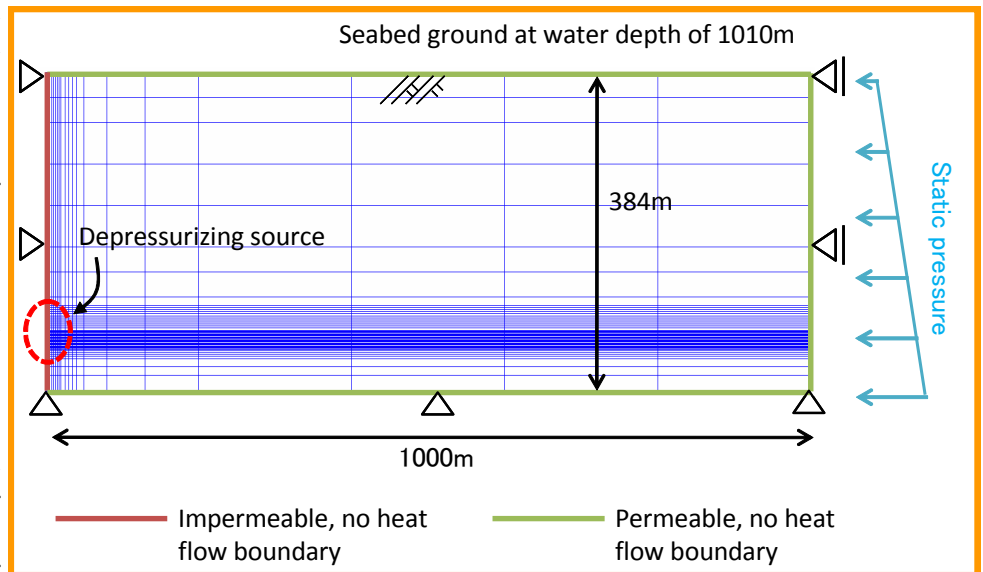


Figure 2. Finite element meshes

element method. For the finite element method, an updated Lagrangian method with the objective Jaumann rate of Cauchy stress is used (Kimoto *et al.*, 2004, Oka *et al.*, 2006, Kimoto *et al.*, 2010).

Numerical simulation examples of the production process by depressurising in the seabed at a water depth of around 1,010 m will be shown. The finite element mesh and the boundary conditions for the simulation are shown in Figure 2, in which a plane strain condition is assumed. The ground is assumed to consist of silty soil and hydrate-bearing sediment existing at a ground depth of 288–332 m. The production well is assumed to exist on the left side of the model. The elements for the production well are modelled as elastic materials. The pressure is depressurised from 13 to 6 MPa in 25 hours.

Figure 3 shows the distribution of the hydrate saturation ratio around the depressurising source. The hydrate saturation ratio is determined as the remaining hydrate moles divided by the initial hydrate moles in each element. The dissociation progresses around the depressurising source. Figure 4 shows the decrease in temperature due to the endothermic reaction. Figure 5 shows distributions of pore gas pressure around the depressurising source. The pore gas pressure is generated in the dissociated area and the value is around 6 MPa. Figure 6 shows the distribution of volumetric strain around the source. The volumetric compression occurs around the source and the maximum value is about 8%.

A Chemo–Thermo–Mechanically Coupled Analysis Method of

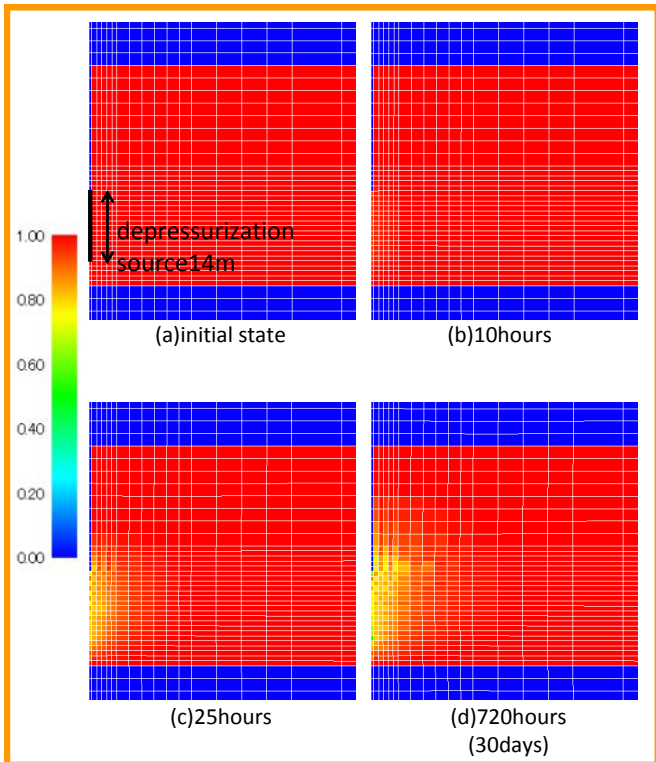


Figure 3. Distributions of hydrate saturation ratio

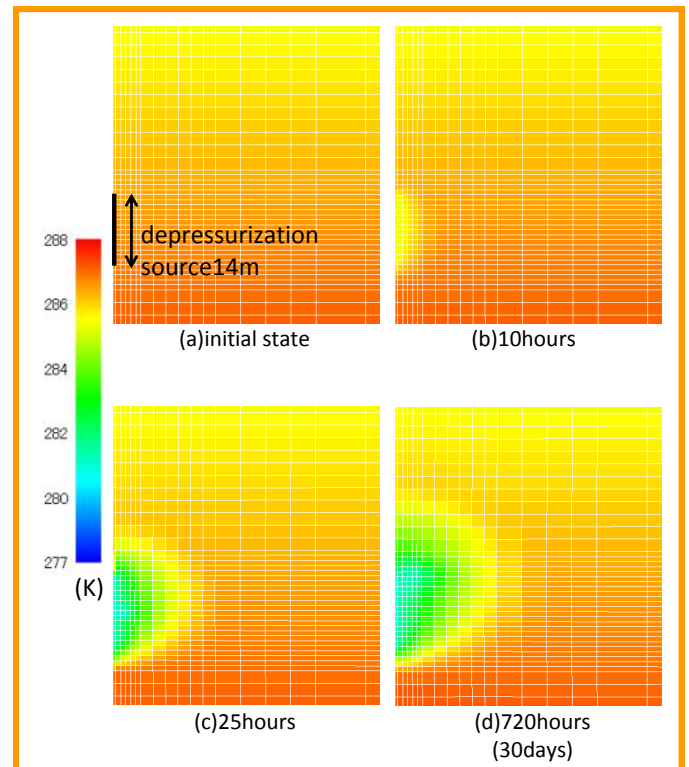


Figure 4. Distributions of temperature

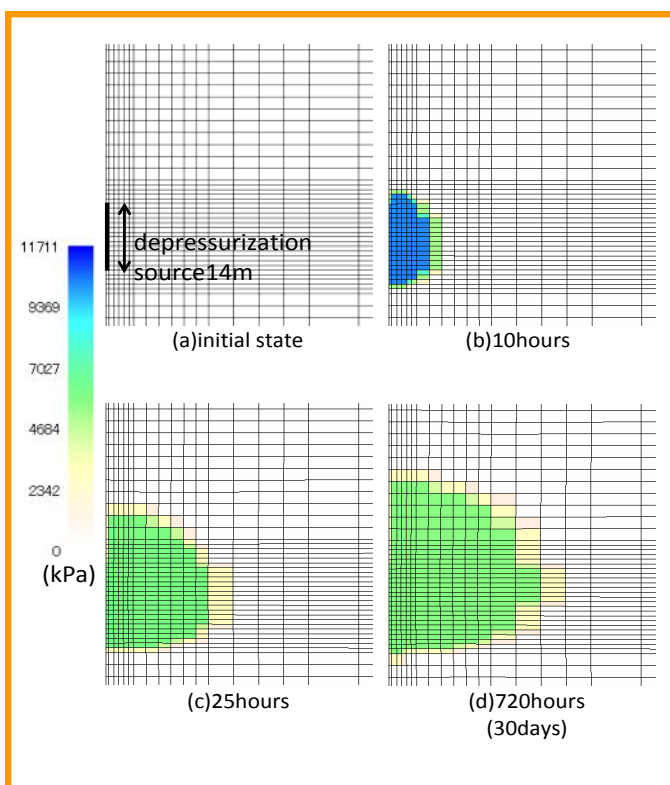


Figure 5. Distributions of pore gas pressure

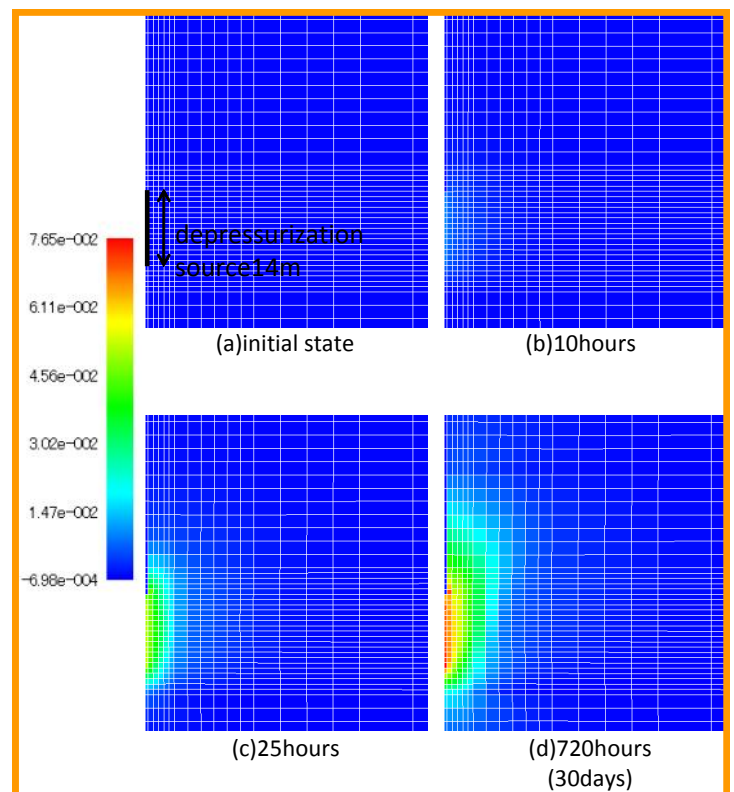


Figure 6. Distributions of volumetric strain

Conclusions

We have developed a chemo-thermo-mechanically coupled analysis method to predict the ground deformation caused by the dissociation of gas hydrates. The method has been developed based on coupled analysis, taking into account phase changes from solids to fluids, that is, water and gas, the flow of fluids, heat transfer, and the ground deformation. A two-dimensional dissociation analysis of the seabed with hydrate-bearing sediments has been conducted using the proposed method. The results show that deformation occurs around the depressurising source during the dissociation process.

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EDP - Energias de Portugal, Lisbon, Portugal
Elletipi S.R.L., Ferrara, Italy
Geomecon GmbH, Potsdam, Germany
GMI S.A. Ingenieros Consultores, Lima, Peru
Golder Associates, Sweden
Golder Associates, Ltd., Burton on Trent, United Kingdom
Guangdong Hongda Blasting Engineering Co. Ltd., China
Hazama Corporation, Ibaraki, Japan
Heesong Geotek Co.,Ltd., Gyeonggi-do, Korea
Hydrochina Guiyang Engineering Corporation, Guiyang City, Guizhou Province, China
Hydrochina Kunming Engineering Corporation, Kun'ming, China
Ingenieursozietät Prof. Dr.-Ing. Katzenbach GmbH, Frankfurt am Main, Germany
Itasca Consulting China Ltd., China
Itasca Consulting Group Inc., Minneapolis, USA
ITOCHU Techno – Solutions Corporation, Tokyo, Japan
Kawasaki Geological Engng. Co., Tokyo, Japan
KDC Engineering, Tokyo, Japan
Kiso-Jiban Consultants Co., Ltd., Tokyo, Japan
Lahmeyer International GmbH, Bad Vilbel, Germany
LCW Consult , S.A., Algés, Portugal
Lehrstuhl für Ingenieurgeologie und Hydrogeologie, Aachen, Germany
Lombardi Engineering Ltd., Minusio, Switzerland
Multiconsult SA., Oslo, Norway
Newjec Inc., Osaka, apan
Nitro Consult AB., Stockholm, Sweden

Norwest Holst - Soil Engineering Division, Leeds, United Kingdom
Prof. Dipl.-Ing. H. Quick, Darmstadt, Germany
Ramboll UK Ltd., London, United Kingdom
SEA Consulting s.r.l., Turin, Italy
Shinnikken Consultants Co., Ltd., Tokyo, Japan
Solexperts Ag., Mönchaltorf, Switzerland
SSANGYONG Engineering & Construction Co., Ltd., Seoul, Korea
Stable Strata Consulting (Pty) Ltd., Mondeor, South Africa
Sumiko Consult. Co Ltd., Tokyo, Japan
Suncoh Consultants Co., Ltd., Tokyo, Japan
Sweco VBB AB, Stockholm, Sweden
Three Gorges Geotechnical Consultants Co., Ltd., Wuhan, China
Tyréns Infrakonsult Ab., Stockholm, Sweden
Vattenfall Power Consultant, Stockholm, Sweden
West Japan Engineering Consultant, Inc., Fukuoka, Japan
WSP Finland Ltd., Helsinki, Finland
Yachiyo Engineering Co., Ltd., Tokyo, Japan

D - CONTRACTORS

Betongsprutnings AB Besab, Göteborg, Sweden
China Three Gorges Project Corporation, Yichang, China
Eiffage Construction g.d., Velizy-Villacoublay, France
GEO Lab Testing Ltd., Llanelli, United Kingdom
Geoscience Ltd., Falmouth, United Kingdom
Immeuble Eurostade – SNCF, La Plaine St. Denis, France
Japan Underground Oil Storage Comp., Tokyo, Japan
Kajima Co., Tokyo, Japan
Nishimatsu Const. Co., Tokyo, Japan
Obayashi Corporation, Tokyo, Japan
Shanghai Tunnel Engineering Co., Ltd., China
Shimizu Corporation, Tokyo, Japan
Skanska Project Support AB, Solna, Sweden
Solexperts Ag., Mönchaltorf, Switzerland
Taisei Corporation, Tokyo, Japan
Tekken Corporation, Tokyo, Japan
Tobishima Corp., Chiba, Japan
Toda Corporation, Tokyo, Japan
WSP Finland Ltd., Helsinki, Finland

E - ELECTRICITY SUPPLY COMPANIES

China Three Gorges Project Corporation, Yichang, China
Chugoku Electric Power Co., Inc., Hiroshima, Japan
EDP - Energias de Portugal, Lisbon, Portugal
Electric Power Dev. Co., Ltd., Tokyo, Japan
Hokkaido Electric Power Co. Inc., Sapporo, Japan
Hokuriku Electric Power Co., Toyama City, Japan
Kansai Electric Power Co. Inc., Osaka, Japan
Kyushu Electric Power Company, Fukuoka, Japan
Shikoku Electric Power Co., Kagawa, Japan
Tohoku Electric Power Co., Sendai, Japan

F - MINING COMPANIES

China Coal Research Institute, China
CSIR Mining Technology, Auckland Park, South Africa
LKAB, Luleå, Sweden
Nittetsu Mining Company, Ltd., Tokyo, Japan
Sominor - Sociedade Mineira de Neves Corvo, S.A., Castro Verde, Portugal

G - RESEARCH ORGANISATIONS

ÅF, Stockholm, Sweden
BRGM, Orleans, France
Central Research Institute of Electric Power Industry, Chiba, Japan
Cetu (Centre d' Études des Tunnels), Lyon, France
Chalmers Tekniska Högskola, Göteborg, Sweden
China Coal Research Institute, China
Geoscience Research Laboratory, Co. Ltd, Yamato, Japan
Heesong Geotek Co.,Ltd., Gyeonggi-do, Korea
Institute of Rock and Soil Mechanics, The Chinese Academy of Science, China
Japan Atomic Energy Agency, Ibaraki, Japan
Laboratoire Central des Ponts et Chaussées (LCPC), Paris, France
Laboratório de Engenharia Civil de Macau, Macau, China
Laboratório Nacional de Engenharia Civil, Lisbon, Portugal
Lehrstuhl für Ingenieurgeologie und Hydrogeologie, Aachen, Germany
Luleå University of Technology – LTU, Luleå, Sweden
Nottingham Centre for Geomechanics, Nottingham, United Kingdom
Rock Engineering Research – BeFo, Stockholm, Sweden
Solexperts Ag., Mönchaltorf, Switzerland
Swedish Nuclear Fuel and Waste Management Co. – SKB, Stockholm, Sweden

H - GOVERNMENT DEPARTMENTS

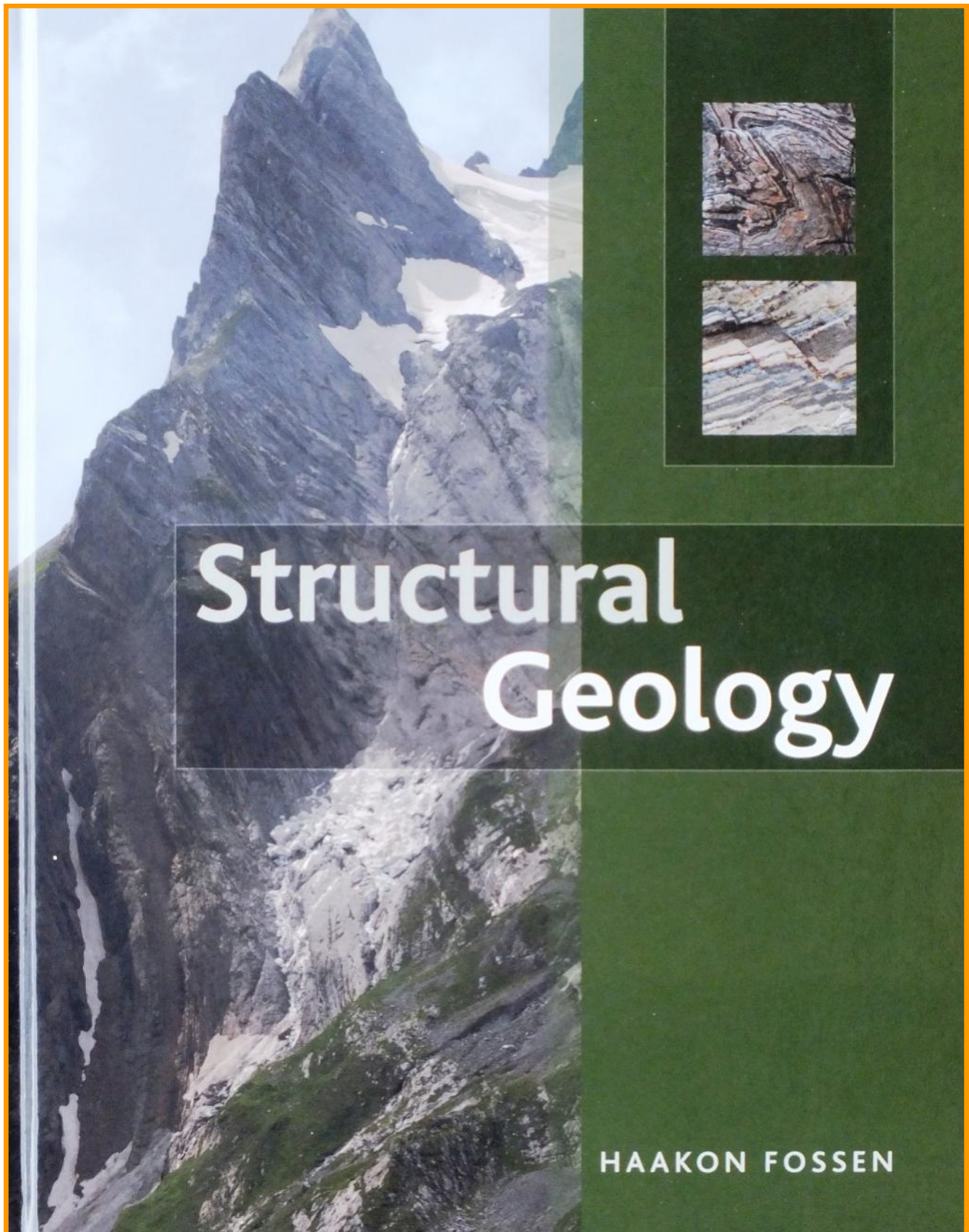
CEDD Civil Engineering and Development Department, Hong Kong, China
Ineris, Verneuil en Halatte, France
Japan Atomic Energy Agency, Ibaraki, Japan
Japan Railway Construction, Transport and Technology Agency, Kanagawa, Japan
Laboratório de Engenharia Civil de Macau, Macau, China
Laboratório Nacional de Engenharia Civil, Lisbon, Portugal
Luleå University of Technology – LTU, Luleå, Sweden
Norwegian Public Roads Administration, Oslo, Norway
Royal Institute of Technology – KTH, Stockholm, Sweden
Skanska Project Support AB, Solna, Sweden
Swedish Nuclear Fuel and Waste Management Co. – SKB, Stockholm, Sweden
Universidade de Aveiro, Aveiro, Portugal

I - OTHER CORPORATE MEMBERS

Geosigma Ab., Uppsala, Sweden
ITOCHU Techno – Solutions Corporation, Tokyo, Japan
Kokusai Kogyo Co., Tokyo, Japan
Kumagai Gumi Co., Ltd., Tokyo, Japan
Okumura Corporation, Osaka, Japan
WSP Sverige AB, Stockholm, Sweden WSP AB; Stockholm, Sweden

Recently Published Books

The recently published books illustrated on these two pages are recommended by the Editors. In terms of content and presentation, they both 'raise the bar' by several notches.



Cambridge University Press: ISBN 978-0-521-51664-8 (Hardback), 2010

Geological Engineering



Luis I. González de Vallejo
Mercedes Ferrer

 CRC Press
Taylor & Francis Group
A BALKEMA BOOK

CRC Press, Taylor & Francis Group: ISBN 978-0-415-41352-7 (Hardback) 2011

EUROCK2013

An ISRM International Symposium “Rock Mechanics for Resources, Energy and Environment”



Wroclaw, Poland
21–26 September 2013
Convention Centre, Wroclaw University of Technology

With its history of more than 1000 years, Wroclaw is a beautiful city of monuments of the past, an opera house, a philharmonic hall, several theatres and numerous museums and art galleries



Important dates

- ✓ Call for papers: March 2012
- ✓ Abstract submission deadline: October 15, 2012
- ✓ Notification of acceptance: January 15, 2013
- ✓ Deadline for full paper submission: March 15, 2013

| 21 September (Sat) | 22 September (Sun) | 23 September (Mon) | 24 September (Tue) | 25 September (Wed) | 26 September (Thu) | |
|--------------------------|---|--|---|--|--------------------------|--|
| ISRM Board Meeting | Commission meetings Workshops Short courses | Opening session Plenary session #1 | Plenary session #2 Parallel sessions S5 & S6 | Plenary session #3 Parallel sessions S11 & S12 | Technical visits | |
| Lunch break | | | | | | |
| ISRM Board Meeting | ISRM Council Meeting | Parallel sessions S1 & S2 Parallel sessions S3 & S4 | Parallel sessions S7 & S8 Parallel sessions S9 & S10 | Parallel sessions S13 & S14 Parallel sessions S15 & S16 | | |
| Board dinner | Council dinner | Welcome reception | Cultural programme | Symposium banquet | | |

Organised by the Polish Society for Rock Mechanics

Chairmen: Dariusz Lydzba, Organising Committee; Marek Kwasniewski, Scientific Committee