

AfriRock International Symposium—Programme

Pre-Conference

2 October 2017

07:30–17:00 Dr Nick Barton and Prof. John Cosgrave Workshop
Meeting Room 2.64–2.66

COMMISSION MEETINGS

08:30–10:30 Design Methodology ((Meeting Suite 1.51)
10:30–12:30 Testing Methods (Meeting Suite 1.51)
08:30–10:30 Petroleum Geomechanics (Meeting Suite 1.52)
08:30–10:30 Preservation of Ancient Sites (Meeting Suite 1.53)
08:30–10:30 Radioactive Waste Disposal (Meeting Suite 1.55)
08:30–10:30 Soft Rocks (Meeting Suite 1.91)
08:30–10:30 Grouting (Meeting Suite 1.92)
10:00–12:00 Asian Council Meeting (Meeting Suite 1.71)
13:00–19:00 ISRM Council Meeting (Meeting Suite 2.44–2.46)
17:00–19:00 Welcome Network Cocktail & Conference Registration

Conference Day 1—Plenary Ballroom East

3 October 2017—Tuesday

07:30–08:30 Registration and early morning refreshments
08:30–08:35 Emergency Procedures—CTICC

OPENING CEREMONY

08:35–08:40 Opening Address

08:40–08:45 W.C. Joughin, *Conference chairperson and ISRM VP for Africa*
SANIRE President
J. Maritz
08:45–08:50 **ISRM President**
E.F. de Quadros
08:50–09:00 **SAIMM President**
S. Ndlovu
09:00–09:15 **Status of the ISRM**
L. Lamas, *Secretary General*
09:15–09:50 **Rocha Medal Award and Lecture: A combined experimental (micro-CT) and numerical (FDEM) methodology to study rock discontinuities subjected to shear**
B. Tatone
09:50–10:30 **Franklin Lecture – Numerical modelling of tabular excavations: Old problems and new solutions**
D.F. Malan
10:30–11:00 **Mid Morning Refreshments**
11:00–11:30 **Keynote Session: Rock engineering as a creator of value**
T.R. Stacey, *University of the Witwatersrand, South Africa*
11:30–12:00 **Keynote Session: Lessons learned from large failures: multiple causes include adverse design, geology, and support**
N. Barton, *Nick Barton & Associates, Norway*
12:00–12:20 **Early assessment of dynamic rupture and rockburst hazard potential in deep tunnelling**
M.S. Diederichs, *Queen's University, Canada*
12:20–12:30 **Sponsor Presentation**
New Concept Mining
12:30–13:30 **Lunch**

SUPPORT DESIGN—BALLROOM EAST

Session Chair: C. Li

13:30–13:45 **Support method for underground engineering in hard rock with high geostress: a case study of the Baihetan hydropower project, China**
Q. Jiang*, X.-T. Feng*, Q. Fan†, Y. Fan†, J. Xu†, and H. Chen†, **Institute of Rock and Soil Mechanics, Chinese Academy of Sciences and †China Three Gorges Project Corporation, China*
13:45–14:00 **Support design for tunnels with deep overburden in weak rock**
W. Schubert, *Graz University of Technology, Austria*
14:00–14:15 **Parameters required for the design of rock support in high-stress rock masses**
C.C. Li, *Norwegian University of Science and Technology (NTNU), Norway*
14:15–14:30 **Stable span re-design and support optimization for a shallow hard-rock bord-and-pillar mine on the Great Dyke: the case of Unki Mine, Zimbabwe**
O. Mandingaisa and C. Musa, *Anglo American, Unki Mines, Zimbabwe*
14:30–14:45 **Improving mining efficiencies by means of a new support design at Unisel Gold Mine, Welkom, South Africa**
P.M. Couto, *Brentley, Lucas and Associates Mining Consultants, South Africa*
14:45–15:00 **Numerical simulation of fully grouted rockbolts by considering nonlinear bond-slip behaviour**
S. Ma, Z. Zhao, and W. Nie, *Nanyang Technological University, Singapore*
15:00–15:15 **Mining with crush pillars**
M. du Plessis* and D.F. Malan†, **Lonmin Platinum, Marikana and †University of Pretoria, South Africa*
15:15–15:30 **Use of plastic composites as friction rockbolt materials**
E. Komurlu and A. Kesimal, *Karadeniz Technical University, Turkey*
15:30–15:45 **Preliminary investigation of the effect of areal shape on pillar strength**
J. Maritz, *University of Pretoria, South Africa*
15:45–16:00 **Mid Afternoon Refreshments**

SURFACE MINING SLOPE STABILITY—BALLROOM EAST

Session Chair: R. Armstrong

16:00–16:15 **Slope design considerations for shallow open pit mines: a case study at Mamatwan Mine, Northern Cape Province, South Africa**
S.N. Epiga and S.M. Rupprecht, *University of Johannesburg, South Africa*
16:15–16:30 **Identification of potential rock wedge controlled rockfalls using groundbased LiDAR Techniques: A case study in Eastern Taiwan**
M.-C. Tsao and T.-T. Wang, *National Taipei University of Technology, Taiwan*
16:30–16:45 **Optimization of slope design in saprolites at Kansanshi**
T.O. Moore, *First Quantum Minerals Limited, Zambia*
16:45–17:00 **Techniques for measuring three-dimensional displacement vector using ground-based interferometric synthetic aperture radar**
C. Thomson*, N. Coli†, and L. Leoni†, **Hexagon Mining, South Africa and †IDS GeoRadar part of Hexagon, Italy*
17:00–17:15 **Otjikoto gold mine – a case study in pit slope design**
O. Pillay, R. Armstrong, and P.J. Terbrugge, *SRK Consulting, South Africa*
17:15–17:30 **A holistic open pit mine slope stability index using artificial neural networks**
M. Fakir and M. Ferentinou, *University of Johannesburg, South Africa*
17:30–17:45 **The significance of identifying potential failure mechanisms from conceptual to design level for open pit rock slopes**
C. Romer* and M. Ferentinou†, **University of KwaZulu-Natal and †University of Johannesburg, South Africa*
17:45–18:00 **Investigation of failures associated with a major shear zone in the Main Pit Cut 3 West, at Letseng Diamond Mine, Lesotho**
N. Lefu*, E.D.C. Hingston†, and N. Lephatsoe*, **Letseng Diamonds, Lesotho and †University of KwaZulu-Natal, South Africa*
16:45–18:00 **ISRM Advisory Forum—Meeting Room 1.43 and 1.44**

SEISMICITY—MEETING ROOM 2.41–2.46

Session Chair: F. Essrich

13:30–13:45 **Relating seismic source mechanisms to damage phenomena in platinum mines of the western Bushveld Complex**
G. van Aswegen, *Consultant, Mine Seismology, South Africa*
13:45–14:00 **Observational studies in South African mines to mitigate seismic risks: challenges and achievements**
R.J. Durrheim†, H. Ogasawara‡, M. Nakatani§, Y. Yabe¶, M. Naoi¶, H. Moriya¶, A. Cichowicz¶, T. Satoh¶, H. Kawakata¶, A. Milev¶, T. Kgarume¶, V.Z. Brink¶, A.K. Ward¶, L. Ribeiro¶, M.S.D. Manzi¶, and S. Mngadi¶, the SATREPS Team, †*University of the Witwatersrand, South Africa*, ‡*Ritsumeikan University, Japan*, §*The University of Tokyo, Japan*, ¶*Tohoku University, Japan*, ¶*Kyoto University, Japan*, ¶*Council for Geoscience, South Africa*, ¶*AIST, Japan*, ¶*CSIR, South Africa*, ¶*Seismogen CC, South Africa*
14:00–14:15 **Investigations of rockburst propensity of artificial samples containing different aggregates**
A. Klammer, C. Peintner, M. Lager, M. Blümel, and W. Schubert, *Graz University of Technology, Austria*
14:15–14:30 **Microseismic events for slope stability analysis – a case study at an open pit mine**
X. Luo*, M. Salvini†, P. Dight†, and J. Duan*, **CSIRO Energy and †University of Western Australia, Australia*
14:30–14:45 **Excavation-induced seismicity: mechanism and implications**
W. Wu*, Z. Zhao†, and K. Duan*, **Nanyang Technological University, Singapore and †Tsinghua University, China*
14:45–15:00 **Early access microseismic monitoring using sensors installed in long boreholes**
T. Butler* and B. Simser†, **Engineering Seismology Group (ESG) Canada Inc., and †Sudbury Integrated Nickel Operations, A Glencore Company, Canada*
15:00–15:15 **Drilling into seismogenic zones of M2.0 – M5.5 earthquakes from deep South African gold mines (DSeis): establishment of research sites**
H. Ogasawara†, R.J. Durrheim‡, Y. Yabe§, T. Ito§, G. van Aswegen¶, M. Grobbelaar¶, A. Funato¶, A. Ishida†, H. Ogasawara†, S. Mngadi¶, M.S.D. Manzi¶, M. Ziegler¶, A.K. Ward¶, G. Hofmann¶, P. Moyer¶, M. Boettcher¶, P. Dight¶, W. Ellsworth¶, B. Liebenberg¶, N. Wechsler¶, T. Onstott¶, N. Berset†, and the DSeis Team, †*Ritsumeikan University, Japan*, ‡*University of the Witwatersrand, South Africa*, §*Tohoku University, Japan*, ¶*Institute of Mine Seismology Ltd South Africa*, ¶*Council for Geoscience, South Africa*, ¶*Fukada Geology Institute, Japan*, ¶*ETH, Switzerland*, ¶*Seismogen CC, South Africa*, ¶*Anglogold Ashanti, South Africa*, ¶*University of New Hampshire, USA*, ¶*University of Western Australia, Australia*, ¶*Stanford University, USA*, ¶*Independent Consultant* ¶*Tel Aviv University, Israel, South Africa, and †Princeton University, USA*
15:15–15:30 **Location and source mechanism of a microseismic event in a mine using a single seismogram**
R.A. Lynch*, S. Jackson†, S. Brijraj†, and S. Moolla†, **Institute of Mine Seismology, Australia*, †*University of Tasmania, Australia*, †*University of KwaZulu-Natal, South Africa*
15:30–15:45 **Calibration of modelled seismicity in South African mines using a potency-based method**
J. Gerber and S. Kohler, *Institute of Mine Seismology, South Africa*
15:45–16:00 **Mid Afternoon Refreshments**
Session Chair: T. Butler
16:00–16:15 **Technology transfer for minimizing seismic risk in South Africa's platinum mines**
F. Essrich*, J.W.L. Hanekom†, and J. Bower†, **SIM Mining Consultants, †Middindi Mining Consultants, University of Pretoria, and †Simulated Training Solutions, South Africa*
16:15–16:30 **Microseismic monitoring and stability analysis of the deep underground caverns at Lianghekou hydropower station, southwest China**
A. Li*, F. Dai*, Z. Zhou†, C. Sha†, and N. Xu*, **Sichuan University and †Powerchina Chengdu Engineering Corporation Limited, China*

AfriRock International Symposium—Programme

Conference Day 2—Plenary Ballroom East

4 October 2017—Wednesday

- 07:30–08:30 **Registration & early morning refreshments**
08:30–08:35 **Emergency Procedures - CTICC**
08:35–08:40 **Opening Address**
J. Maritz, President, SANIRE

- 08:40–09:10 **Keynote Session: Stress measurements for underground powerhouses – three recent cases**
L. Lamas*, M. Espada*, B. Figueiredo†, and J. Muralha*, *National Laboratory for Civil Engineering – LNEC, Portugal, †Uppsala University, Sweden
09:10–09:20 **Sponsor Presentation**
IDS GEORADAR SRL
09:20–09:35 **Mid Morning Refreshments**

UNDERGROUND MINING—BALLROOM EAST

Session Chair: P. Couto

- 09:35–09:50 **An empirical and numerical approach to quantifying raisebore-hole stability**
Y. Rajpal* and J.W.L. Hanekom†*, *Middindi Consulting (Pty) Ltd and †University of Pretoria, South Africa
09:50–10:05 **Reassessing continuous stope closure data using a limit equilibrium displacement discontinuity model**
D.F. Malan and J.A.L. Napier, University of Pretoria, South Africa
10:05–10:20 **Rockburst prevention via destress blasting of competent roof rocks in hard coal longwall mining**
P. Konicek* and J. Schreiber†, *Institute of Geonics of the CAS and †GreenGas, Inc., Czech Republic
10:20–10:35 **A study of multi-reef pillar extraction in the Ventersdorp Contact Reef**
J.C. Esterhuysen* and D.F. Malan†, *Sibanye Gold and †University of Pretoria, South Africa
10:35–10:50 **A tool for the evaluation of departmental effectiveness**
K. Balt* and T.R. Stacey†, *Advisian, Worley Parsons Group, Sub-Sahara Africa and †University of the Witwatersrand, South Africa
10:50–11:05 **Estimation of closure by the timber pack assessment method, and comparison to modelled elastic convergence**
H. Yilmaz* and O. Rakumakoe†, *University of the Witwatersrand, †Mponeng Gold Mine, AngloGold Ashanti, South Africa
11:05–11:20 **Optimizing stope panel spans at an eastern Bushveld Platinum Mine by probabilistic analysis**
L.J. Gardner*, L. Bronkhorst†, and N.L. Ayres*, *Impala Platinum Limited and †Marula Platinum Mine, South Africa
11:20–11:35 **Evaluation of crack displacement in underground excavations using wireless technology crack meters**
M. Lekhuleni and T. Zvarivadza, University of the Witwatersrand, South Africa
11:35–11:50 **Time-dependent failure of open stopes at Target Mine**
P.J. Le Roux and K.R. Brentley, Brentley, Lucas and Associates, South Africa
11:50–12:00 **Sponsor Presentation: Sandvik**
12:00–13:20 **Lunch**

TUNNELS, CAVERNS and DAMS—BALLROOM EAST

Session Chair: L. Lamas

- 13:20–13:35 **Microseismicity-based feedback analysis of the stability of deep underground caverns at the Houziyan hydropower station, China**
B. Li*, Z. Zhou†, C. Sha†, N. Xu*, and F. Dai* *College of Water Resources and Hydropower, Sichuan University and †Powerchina Chengdu Engineering Corporation Limited, P.R. China
13:35–13:50 **Cautious blast design and practice in close proximity to a railway tunnel and residential buildings**
H.A. Bilgin*, Y. Dagan†, and B. Unluturk*, *Middle East Technical University, Turkey, †Curtin University, Australia and †Polyak Energy Coal Mine, Turkey
13:50–14:05 **Geotechnical design refinement in parallel with construction - Boschkop Abstraction Works, South Africa**
A.T.M. Morgan, Geoid Geotechnical Engineers, South Africa
14:05–14:20 **Afternoon Refreshments**

- 18:00–18:30 **Transport from CTICC to the Castle**
19:00–22:00 **Conference Dinner**
22:00–22:30 **Transport to CTICC**

INVESTIGATION TECHNOLOGY—MEETING ROOM 2.41–2.46

Session Chair: S. Read

- 09:35–09:50 **The determination of crustal stress orientation based on the borehole geometric shape using panoramic stereopair imaging technology**
C. Wang, X. Zou, and Z. Han, Chinese Academy of Sciences, China
09:50–10:05 **The Sub Surface Profiler: a giant leap for ground penetrating radar**
A. Pienaar, Reutech Mining, South Africa
10:05–10:20 **Rock failure modes under uniaxial compression and indirect tension**
A. Basu, Indian Institute of Technology Kharagpur, India
10:20–10:35 **Innovative technologies for monitoring underground excavations during construction and usage**
A. Carri, L. Chiapponi, R. Savi, and A. Segalini, University of Parma, Italy
10:35–10:50 **An acoustic approach to the estimation of rock mass state and prediction of induced seismicity parameters: theory, laboratory experiments, and case study**
L.A. Nazarova, L.A. Nazarov, V.L. Shkuratnik, M.I. Protasov, and P.V. Nikolenko, Russian Academy of Science, Russia
10:50–11:05 **Experimental studies of variably saturated flow from a horizontal discontinuity to the vertical with and without an intersection**
B.R. Jones*, L.B. Brouwers†, M.A. Dippenaar†, and J.L. Van Rooy†, *GaGe Consulting (Pty) Ltd, South Africa, †Fugro Middle East, United Arab Emirates, and †University of Pretoria, South Africa
11:05–11:20 **Design of an *in situ* testing device for the backfill of mechanized driven tunnels in hard rock**
M. Lagger, M.R. Henzinger, and W. Schubert, Graz University of Technology, Austria
11:20–11:35 **Analytical and experimental investigation of the hard rock indentation process**
S. Souissi and E. Hamdi, Université de Tunis El Manar, Tunisia
11:35–11:50 **Characterizing microtremor signals of a slope with deep-seated gravitational deformation**
Y.C. Chiu, P.C. Lo, and T.T. Wang, National Taipei University of Technology, Taiwan
11:50–12:05 **Progress of brittle microfracturing in crystalline rocks under cyclic loading conditions**
E. Ghazvinian* and M.S. Diederichs†, *Mine Design Engineering, and †Queen's University, Canada
12:05–12:20 **InSAR monitoring for mines: an integrated approach**
D. Colombo*, F. Bellotti*, P. Farina*, A. Jonson†, and I. du Toit†, *Tre Altamira, Italy and †Opron (Pty) Ltd, South Africa
12:20–13:20 **Lunch**

EARLY CAREER FORUM—MEETING ROOM 2.41–2.46

Session Chairs: E. Quadro and M. He

EARLY CAREER FORUM

- 13:20–14:05 **Early Career Forum Presentations**
14:05–14:20 **Afternoon Refreshments**
14:20–17:00 **Early Career Forum Presentations**

AfriRock International Symposium—Programme

Conference Day 3—Plenary Ballroom East

5 October 2017—Thursday

07:30–08:30	Registration & early morning refreshments
08:30–08:35	Emergency Procedures - CTICC
08:35–08:40	Opening Ceremony

NUMERICAL MODELLING—BALLROOM EAST

Session Chair: F. Malan

09:45–10:00	A multi-objective hybrid prediction model of slope deformation based on fuzzy optimization algorithm J.B. Zhu and C. Li, <i>Yangtze River Scientific Research Institute, China</i>
10:00–10:15	Benchmarking of debris flow experimental tests using combined finite-discrete element method, FEMDEM F. Vagnon*, A.M. Ferrero*, J.P. Latham ¹ , and J. Xiang ¹ , * <i>University of Turin, Italy</i> and ¹ <i>Imperial College of London, United Kingdom</i>
10:15–10:30	Numerical model calibration: process or luck? J.W.L. Hanekom* ¹ and B.C. Okhuis ² , * <i>Middindi Consulting (Pty) Ltd and ¹University of Pretoria, South Africa</i>
10:30–10:45	Modelling salt rock dissolution in the foundation of a large dam C. Vibert*, J. Schittekat ¹ , and V. Libaud*, * <i>Tractebel-Coyne et Bellier, France</i> and ¹ <i>University of Leuven, Belgium</i>
10:45–11:00	Calibration of a numerical model for bore-and-fill mining D.P. Roberts, <i>CSIR/AngloGold Ashanti, South Africa</i>
11:00–11:15	Comparison of observational, empirical and 3D discrete numerical methods to estimate subsidence over longwall coal faces I. Pérez-Rey*, L.R. Alejano*, and P. Velasco ¹ , * <i>University of Vigo and ¹Itasca Consulting Group, Spain</i>
11:15–11:30	Characterization and numerical modelling of standard and cabled-strapped pillars in a haematite mine L.R. Alejano*, U. Castro-Figueira*, I. Pérez-Rey*, F. García-Bastante*, and J. Arzúa ¹ , * <i>University of Vigo, Spain</i> and ¹ <i>Universidad Católica del Norte, Chile</i>
11:30–11:45	Geotechnical characterization and revision of the pillar design for a hard-rock bord and pillar mine J. Walls* and P. Mpunzi ¹ , * <i>SRK Consulting and ¹JeWal Geotechnical (Pty) Ltd, South Africa</i>
11:45–12:00	A remote sensing approach for the derivation of numerical modelling input data: insights from the Hope Slide, Canada D. Donati*, D. Stead*, M-A. Brideau ¹ , and M. Ghirrotti ² , * <i>Simon Fraser University, Canada</i> , ¹ <i>BGC Engineering, Canada</i> and ² <i>University of Ferrara, Italy</i>
12:00–12:15	Discrete element modelling of rock-cutting experiments under confining pressure N. Gonze and J-P. Tshibangu, <i>University of Mons, Belgium</i>
12:15–13:30	Lunch

UNDERGROUND MINING—BALLROOM EAST

Session Chair: O. Mandingaisa

13:30–13:45	Assessment of the potential to extract hard rock strike pillars to improve overall extraction ratio K.B. Le Bron*, P.S. Piper ¹ and G. Judeel ² , * <i>MLB Consulting, ¹Groundwork Consulting and ²Geosindile, South Africa</i>
13:45–14:00	Coal pillar stooping – assessing the stability of snooks S.Z. Pethö*, K.B. Le Bron ¹ and C.Selai ² , * <i>Glencore Coal and ¹MLB Consulting, South Africa</i>
14:00–14:15	Review of remnant mining practices in South African gold mines T. Rangasamy* and H. Yilmaz ¹ , * <i>Middindi Consulting and ¹University of the Witwatersrand, South Africa</i>
14:15–14:30	Geotechnical input into shaft sinking on the Platreef Project A. Cooper, A. Brits, A. Mbongonya, F. Fredericks, and T. Hudson, <i>Ivanplats (Pty) Ltd, South Africa</i>
14:30–14:45	Fundamental understanding of underground pillar design processes and methods J.W.L. Hanekom* ¹ , * <i>Middindi Consulting (Pty) Ltd and ¹University of Pretoria, South Africa</i>
14:45–15:00	Performance evaluation of the Paboase crown pillar at Chirano Gold Mines in Ghana E.O. Mensah* and J.J. Ran ¹ , * <i>Kinross Chirano Gold Mines Ltd, Ghana</i> , ¹ <i>Kinross Gold Corporations, Canada</i>
15:00–15:15	Stope performance assessment at the Goldcorp Eleonore mine using bivariate analysis S. Guido* ¹ , M. Grenon ¹ , and P. Germain*, * <i>Goldcorp-Eleonore Mine and, ¹Université Laval, Canada</i>
15:15–15:30	Design of a stoping sequence at deeper horizons for a lead-zinc mine in a sheared rock mass J.L. Porathur*, C.P. Verma ¹ , S. Dutta ¹ , and A. Jha ¹ , * <i>CSIR-Central Institute of Mining Fuel Research and ¹Hindustan Zinc Limited, India</i>
15:30–15:45	Coal pillar stooping – partial extraction of coal pillars ensuring panel stability K.B. Le Bron*, L. Sekwele ¹ , and D. Snyman ¹ , * <i>MLB Consulting and ¹Exxaro, South Africa</i>
15:45–16:00	Afternoon Refreshments

PLENARY CLOSING CEREMONY

16:00–16:15	Best paper and Young Participant's Awards
16:15–16:30	Closing Address W.C. Joughin, <i>Conference chairperson and ISRM VP for Africa</i>
16:30–16:45	The ISRM VP for Africa 2018 ISRM International Symposium in Singapore

08:40–09:10	M. du Plessis Keynote Session: How rock mechanics can help oil well drilling – Latest developments S. Fontoura, <i>PUC-Rio, Brazil</i>
09:10–09:20	Sponsor Presentation: Reutech
09:20–09:30	Sponsor Presentation: Optron
09:30–09:45	Mid Morning Refreshments

GEOTECHNICAL INVESTIGATIONS—MEETING ROOM 2.41–2.46

Session Chair: M. Cawood

09:45–10:00	Geomechanical evaluation-enabled stimulation optimization of a tight gas reservoir in Egypt M. Salah*, A. Abdel-Meguid ¹ , B. Crane ² , S. Squires ³ , and L. Matzar ⁴ , * <i>Khalda Petroleum, Egypt</i> , ¹ <i>Halliburton, Egypt</i> and ² ³ ⁴ <i>Halliburton, United States</i>
10:00–10:15	Experience gained from <i>in situ</i> stress measurements conducted in Southern Africa during the past ten years M.F. Handley*, P.S. Piper ¹ , H. Kato ² and T. Clements*, * <i>Consultant, Groundwork Consulting, ¹Groundwork Consulting, South Africa, and ²3D-Geoscience, Japan</i>
10:15–10:30	Advanced information on rock mass properties in large open pits by analysing production drill rig parameters in real time P.S. Piper*, K. Bro ¹ , and P. Martensson ¹ , * <i>Groundwork Consulting, South Africa</i> and ¹ <i>Rockma Systems, Sweden</i>
10:30–10:45	Unravelling the structural mysteries of the 'Bermuda Triangle' at Lonmin's Saffy Shaft A.G. Hartzberg*, M. du Plessis*, and A.E.W. Friese*, * <i>Lonmin Platinum, Marikana and ¹Terra Explora, South Africa</i>
10:45–11:00	The influence of geological structures – an often-overlooked but important aspect affecting the stability of operating mines G.C. More O'Ferrall* and M. du Plessis ¹ , * <i>First Quantum Minerals Limited, Zambia</i> and ¹ <i>Lonmin Platinum, Marikana, South Africa</i>
11:00–11:15	Development of a rock mass quality model for an open pit mine M. Morales*, K.K. Panthi ¹ , and K. Botsialas ¹ , * <i>Norwegian University of Science and Technology (NTNU)</i> and ¹ <i>The Mining Company, Norway</i>
11:15–11:30	Experimental study on hydraulic conductivity of a rock joint S.-B. Choi, H.-Y. Jeong, S. Lee, and S. Jeon, <i>Seoul National University, Korea</i>
11:30–11:45	Geological and hydrogeological reference conditions for rock engineering: an example for grouting design at Äspö Hard Rock Laboratory, Sweden Å. Fransson* and J. Petersson ¹ , * <i>Chalmers University of Technology and Consulting Geologist, Gothenburg, Sweden</i>
11:45–12:00	Active ultrasonic imaging and interfacial characterization of stationary and evolving fractures in rock F. Pourahmadian* and B.G. Guzina ¹ , * <i>University of Colorado Boulder and ¹University of Minnesota, USA</i>
12:00–12:15	Application of rock mass classification and blastability index for improving wall control at a hard-rock mine in Botswana G. Segaeatsho and T. Zvarivadza, <i>University of the Witwatersrand, South Africa</i>
12:15–13:30	Lunch
	Session Chair: J. Walls
13:30–13:45	Keyblock stability analysis of longhole stopes D. Sewnun*, W.C. Joughin ¹ , R. Armstrong*, and A. Cooper ¹ , * <i>SRK, Consulting and ¹Ivanplats (Pty) Ltd, South Africa</i>
13:45–14:00	An investigation on the relationships between the petrographic, physical and mechanical characteristics of sandstones from Newspaper Member of the Natal Group using self-organizing maps M. Ferentinou, <i>University of Johannesburg, South Africa</i>
14:00–14:15	Collection and processing of geotechnical data as part of a stoping panel span optimization study at an eastern Bushveld Complex platinum mine L.J. Gardner*, L.U. Bronkhorst ¹ , and N.L. Ayres*, * <i>Impala Platinum Limited and ¹Marula Platinum Mine, South Africa</i>
14:15–14:30	A petrographic and geotechnical investigation of the sandstone parting between the Alfred seam and the Gus seam in the Magdalena Colliery, Dundee, South Africa T. Keman*, E.D.C. Hingston*, and S. Mtshali ¹ , * <i>University of KwaZulu-Natal and ¹Buffalo Coal, South Africa</i>
14:30–14:45	A case study: Remediation of abandoned mines for residential development I.S. Oweis*, G. Gartenberg ¹ , and L. Oweis*, * <i>Oweis Engineering Inc and ¹The Falcon Group, United States</i>
	Session Chair: S. Fontoura
14:45–15:00	Hydraulic fracturing in plastic-deformed low-permeability reservoirs Y. Wang* and F. Karaoulanis ¹ , <i>Petro-, Geotech Inc., Canada and ¹Petro-, Geotech Inc., Greece</i>
15:00–15:15	Simulating fractured reservoirs by a coupled two phase dual porosity model Y. Wang, <i>Petro-, Geotech Inc., Canada</i>
15:15–15:30	Stability of large underground rock caverns for crude oil storage operated below atmospheric pressure N. Gatelier and H.D. Nguyen, <i>Geostock-Entrepose, France</i>
15:30–15:45	Borehole stability and sand production in gas reservoirs E. Papamichos* ¹ , * <i>Aristotle University of Thessalonik, Greece</i> and <i>SINTEF Petroleum Research, Greece, Norway</i>
15:45–16:00	Afternoon Refreshments