

# AfriRock International Symposium—Preliminary Programme

## 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**  
08:35–08:40 **Opening Ceremony**  
W.C. Joughin, *Conference chairperson and ISRM VP for Africa*  
08:40–08:45 **ISRM President**  
E.F. de Quadros  
08:45–09:00 **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: Investigating the evolution of rock discontinuity asperity degradation and void space morphology under direct shear**  
B. Tatone

### SUPPORT DESIGN—BALLROOM EAST

- 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 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

- 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. Lephatoe\*, *\*Letseng Diamonds, Lesotho and †University of KwaZulu-Natal, South Africa*

### SEISMICITY (continued)—MEETING ROOM 2.41–2.46

- 15:45–16:00 **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*  
16:00–16:15 **Calibration of modelled seismicity in South African mines using a potency-based method**  
J. Gerber and S. Kohler, *Institute of Mine Seismology, South Africa*  
16:15–16:30 **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*  
16:30–16:45 **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*  
16:45–17:00 **Microseismic monitoring, warning and mitigation of rockburst in the deep tunnels of Neelum-Jhelum hydroelectric project, Pakistan**  
G.-L. Fen\*, X.-T. Feng\*, B.-R. Chen\*, Y.-X. Xiao\*, P.-X. Li†, and S. Tan\*, *Chinese Academy of Sciences and †Northeastern University, China*  
17:00–18:30 **ISRM Advisory Forum—Meeting Room 1.43 and 1.44**

- 09:50–10:30 **Franklin Lecture – Numerical modelling of tabular excavations: Old problems and new solutions**  
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*  
12:00–12:15 **Early assessment of dynamic rupture and rockburst hazard potential in deep tunnelling**  
M.S. Diederichs, *Queen's University, Canada*  
12:15–12:30 **Sponsor Presentation**  
*New Concept Mining*  
12:30–13:30 **Lunch**

### SEISMICITY—MEETING ROOM 2.41–2.46

- 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, M.S.D. Manzi, and S. Mngadi, *University of the Witwatersrand, South Africa*  
H. Ogasawara and H. Kawakata, *Ritsumeikan University, Japan*  
M. Nakatani and H. Moriya, *The University of Tokyo, Japan*  
Y. Yabe, *Tohoku University, Japan*  
M. Naoi, *Kyoto University, Japan*  
A. Cichowicz, *Council for Geoscience, South Africa*  
T. Satoh, *AIST, Japan*  
A. Milev, T. Kgarume, and V.Z. Brink, *CSIR, South Africa*  
A.K. Ward and L. Ribeiro, *Seismogen CC, South Africa*  
the SATREPS Team, *JST-JICA Science and Technology Research Partnership for Sustainable Development*  
14:00–14:15 **The effect of database integrity on the interpretation of routine seismic monitoring techniques**  
I.G. Morkel, *University of Western Australia, Australia*  
14:15–14:30 **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*  
14:30–14:45 **Microseismic events for slope stability analysis – a case study at an open pit mine**  
X. Luo\*, M. Salvoni†, P. Dight†, and J. Duan\*, *\*CSIRO Energy and †University of Western Australia, Australia*  
14:45–15:00 **Excavation-induced seismicity: mechanism and implications**  
W. Wu\*, Z. Zhao†, and K. Duan\*, *\*Nanyang Technological University, Singapore and †Tsinghua University, China*  
15:00–15:15 **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*  
15:15–15:30 **Drilling into seismogenic zones of M2.0 – M5.5 earthquakes from deep South African gold mines (DSeis): establishment of research sites**  
H. Ogasawara, A. Ishida, and H. Ogasawara, *Ritsumeikan University, Japan*  
R.J. Durrheim, S. Mngadi, and M.S.D. Manzi, *University of the Witwatersrand, South Africa*  
Y. Yabe and T. Ito, *Tohoku University, Japan*  
G. van Aswegen, *Institute of Mine Seismology Ltd South Africa*  
M. Grobbelaar, *Council for Geoscience, South Africa*  
A. Funato, *Fukada Geology Institute, Japan*  
M. Ziegler and N. Berset, *ETH, Switzerland*  
A.K. Ward, *Seismogen CC, South Africa*  
G. Hofmann, *Anglogold Ashanti, South Africa*  
P. Moyer and M. Boettcher, *University of New Hampshire, USA*  
P. Dight, *University of Western Australia, Australia*  
W. Ellsworth, *Stanford University, USA*  
B. Liebenberg, *Independent Consultant, South Africa*  
N. Wechsler, *Tel Aviv University, Israel*  
T. Onstott, *Princeton University, USA*  
the DSeis Team  
15:30–15:45 **Mid Afternoon Refreshments**

# AfriRock International Symposium—Preliminary 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 Ceremony**  
W.C. Joughin, *Conference chairperson and ISRM VP for Africa*

### UNDERGROUND MINING—BALLROOM EAST

- 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 <sup>†</sup>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<sup>†</sup>, \*Institute of Geonics of the CAS, Czech Republic, <sup>†</sup>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<sup>†</sup>, \*Sibanye Gold and <sup>†</sup>University of Pretoria, South Africa
- 10:35–10:50 **A tool for the evaluation of departmental effectiveness**  
K. Balt\* and T.R. Stacey<sup>†</sup>, \*Advisian, Worley Parsons Group, Sub-Sahara Africa and <sup>†</sup>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<sup>†</sup>, \*University of the Witwatersrand, <sup>†</sup>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<sup>†</sup>, and N.L. Ayres\*, \*Impala Platinum Limited and <sup>†</sup>Marula Platinum Mine, South Africa
- 11:20–11:35 **Discrete element modelling of rock-cutting experiments under confining pressure**  
N. Gonze and J-P. Tshibangu, *University of Mons, Belgium*
- 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*
- 11:50–12:05 **A remote sensing approach workflow for the derivation of numerical modelling input data: insights from the Hope Slide, Canada**  
D. Donati\*, D. Stead\*, M-A. Brideau<sup>†</sup>, and M. Ghirotti<sup>‡</sup>, \*Simon Fraser University, Canada, <sup>†</sup>BGC Engineering, Canada, <sup>‡</sup>University of Ferrara, Italy
- 12:05–13:00 **Lunch**

### TUNNELS AND CAVERNS—BALLROOM EAST

- 13:00–13:15 **Microseismicity-based feedback analysis of the stability of deep underground caverns at the Houziyan hydropower station, China**  
B. Li\*, Z. Zhou<sup>†</sup>, C. Sha<sup>†</sup>, N. Xu\*, and F. Dai\* \*College of Water Resources and Hydropower, Sichuan University, China and <sup>†</sup>Powerchina Chengdu Engineering Corporation Limited, P.R. China
- 13:15–13:30 **Dam foundation curtain grouting management based on 3D geological model and monitoring system**  
K. Fan\*, Y. Wang\*, Q. Fan\*, Bingyu Ren<sup>†</sup>, \*China Three Gorges Corporation and <sup>†</sup>Tianjin University, China
- 13:30–13:45 **Cautious blast design and practice in close proximity to a railway tunnel and residential buildings**  
H.A. Bilgin\*, Y. Daganan<sup>†</sup>, and B. Unluturk\*, \*Middle East Technical University, Turkey, <sup>†</sup>Curtin University, Australia and <sup>‡</sup>Polyak Energy Coal Mine, Turkey
- 13:45–14:00 **Issues related to the long-term stability of unlined water tunnels of Norwegian Hydropower – a review of a case**  
K.K. Panthi, *Norwegian University of Science and Technology (NTNU), Norway*
- 14:00–14:15 **Failure mechanism of karst cave wall during tunnelling**  
J. Wang\*, Y. Deng\*, L. nbo Wu\*, X. Liu\*, Y. o Yin\*, and W. Liu\*, \*Tongji University, China
- 14:15–14:30 **Afternoon Refreshments**
- 14:30–14:45 **Geotechnical design refinement in parallel with construction - Boschkop Abstraction Works, South Africa**  
A.T.M. Morgan, *Geoid Geotechnical Engineers, South Africa*
- 14:45–15:00 **Feedback analysis and real-time supporting method for large underground hydraulic caverns under high geo-stress condition: A case study of Chinese Baihetan underground powerhouse**  
Q. Fan\*, Q. Jiang<sup>†</sup>, and X. Duan<sup>\*\*</sup>, \*China Three Gorges Corporation, <sup>†</sup>Institute of Rock and Soil Mechanics, Chinese Academy of Sciences and <sup>\*\*</sup>China Three Gorges Projects Development Co., Ltd, China

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

### INVESTIGATION TECHNOLOGY—MEETING ROOM 2.41–2.46

- 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<sup>†</sup>, M.A. Dippenaar<sup>‡</sup>, and J. Louis Van Rooy<sup>‡</sup>, \*GaGE Consulting (Pty) Ltd, South Africa, <sup>†</sup>Fugro Middle East, United Arab Emirates and <sup>‡</sup>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<sup>†</sup>, \*Mine Design Engineering, and <sup>†</sup>Queen's University, Canada
- 12:05–12:20 **InSAR monitoring for mines: an integrated approach**  
D. Colombo\*, F. Bellotti\*, P. Farina\*, A. Jonson<sup>†</sup>, and I. du Toit<sup>‡</sup>, \*Tre AlTamira, Italy and <sup>†</sup>Optron (Pty) Ltd, South Africa
- 12:20–13:20 **Lunch**

### EARLY CAREER FORUM—MEETING ROOM 2.41–2.46

- 13:20–14:15 **Early Career Forum**  
14:15–14:30 **Afternoon Refreshments**  
14:30–15:30 **Early Career Forum**

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

# AfriRock International Symposium—Preliminary 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**  
W.C. Joughin, *Conference chairperson and ISRM VP for Africa*

### NUMERICAL MODELLING—BALLROOM EAST

- 09:45–10:00 **A multi-objective hybrid prediction model of slope deformation based on fuzzy optimization algorithm**  
J.B. Zhu and C. Li, *Yangtze River Scientific Research Institute, China*
- 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<sup>1</sup>, and J. Xiang<sup>1</sup>, \**University of Turin, Italy*, <sup>1</sup>*Imperial College of London, United Kingdom*
- 10:15–10:30 **Numerical model calibration: process or luck?**  
J.W.L. Hanekom\*<sup>†</sup> and B.C. Okhuis<sup>†</sup>, *Middindi Consulting (Pty) Ltd, †University of Pretoria, South Africa*
- 10:30–10:45 **Modelling rock salt dissolution in the foundation of a large dam**  
C. Vibert<sup>†</sup>, J. Schittekat<sup>†</sup>, and V. Libaud\*, \**Tractebel-Coyne et Bellier, France*, <sup>†</sup>*University of Leuven, Belgium*
- 10:45–11:00 **Calibration of a numerical model for bore-and-fill mining**  
D.P. Roberts, *CSIR/Anglogold Ashanti, South Africa*
- 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<sup>†</sup>, \**University of Vigo and †Itasca Consulting Group, Spain*
- 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<sup>†</sup>, \**University of Vigo, Spain* and <sup>†</sup>*Universidad Católica del Norte, Chile*
- 11:30–11:45 **Numerical simulation of hydraulic fracturing process in mixed ground**  
J. Wang\*<sup>††</sup>, Y. Deng\*, X. Liu\*, H. Peng\*, Y. Yin\*, L. Wu\*, Z. Wu<sup>§</sup>, \**Tongji University*, <sup>†</sup>*State Key Laboratory for Geo Mechanics and Deep Underground Engineering*, <sup>‡</sup>*CCCC Key Laboratory of Environment Protection & Safety in Foundation Engineering of Transportation* and <sup>§</sup>*East China Architectural Design & Research Institute, China*
- 11:45–12:00 **Geotechnical characterization and revision of the pillar design for a hard-rock bord and pillar mine**  
J. Walls\*<sup>†</sup> and P. Mponzi\*, \**SRK Consulting and †JeWal Geotechnical (Pty) Ltd, South Africa*
- 12:00–12:15 **A comparison between LEM and FEM based sensitivity analysis for a soil slope**  
A. Singh\*, T. Singh\*, and K.S. Rao\*, *Indian Institute of Technology Bombay and †Indian Institute of Technology Delhi, New Delhi*

12:15–13:30 **Lunch**

### UNDERGROUND MINING—BALLROOM EAST

- 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<sup>†</sup> and G. Judeel<sup>‡</sup>, \**MLB Consulting*, <sup>†</sup>*Groundwork Consulting* and <sup>‡</sup>*Geosindile, South Africa*
- 13:45–14:00 **Coal pillar stooping – assessing the stability of snooks**  
S.Z. Pethö\*, K.B. Le Bron<sup>†</sup> and C. Selai\*, \**Glencore Coal and †MLB Consulting, South Africa*
- 14:00–14:15 **Review of remnant mining practices in South African gold mines**  
T. Rangasamy\* and H. Yilmaz<sup>†</sup>, \**Middindi Consulting and †University of the Witwatersrand, South Africa*
- 14:15–14:30 **Geotechnical input into shaft sinking on the Platreef Project**  
A. Cooper, A. Brits, A. Mbongonya, F. Fredericks, and T. Hudson, *Ivanplats (Pty) Ltd, South Africa*
- 14:30–14:45 **Fundamental understanding of underground pillar design processes and methods**  
J.W.L. Hanekom\*<sup>†</sup>, *Middindi Consulting (Pty) Ltd and †University of Pretoria, South Africa*
- 14:45–15:00 **Performance evaluation of the Paboase crown pillar at Chirano Gold Mines in Ghana**  
E.O. Mensah\* and J.J. Rant\*, \**Kinross Chirano Gold Mines Ltd, Ghana*, <sup>†</sup>*Kinross Gold Corporations, Canada*
- 15:00–15:15 **Stope performance assessment at the Goldcorp Eleonore Mine using bivariate analysis**  
S. Guido\*<sup>†</sup>, M. Grenon<sup>†</sup>, and P. Germain\*, \**Goldcorp-Eleonore Mine and, †Université Laval, Canada*
- 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\*, S. Dutta\*, and A. Jha<sup>†</sup>, \**CSIR-Central Institute of Mining & Fuel Research and †Hindustan Zinc Limited, India*
- 15:30–15:45 **Coal pillar stooping – partial extraction of coal pillars ensuring panel stability**  
K.B. Le Bron\*, L. Sekwele<sup>†</sup>, and D. Snyman<sup>†</sup>, \**MLB Consulting and †Exxaro, South Africa*
- 15:45–16:00 **Afternoon Refreshments**
- 16:00–16:15 **Best paper and Young Participant's Awards**
- 16:15–16:30 **Closing Ceremony**  
W.C. Joughin, *Conference chairperson and ISRM VP for Africa*
- 16:30–16:45 **The ISRM VP for Africa 2018 ISRM International Symposium in Singapore (10-15 min)**

- 08:40–09:10 **Keynote Session: How rock mechanics can help oil well drilling – Latest developments**  
S. Fontoura, *PUC-Rio, Brazil*

- 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

- 09:45–10:00 **Geomechanical evaluation-enabled stimulation optimization of a tight gas reservoir in Egypt**  
M. Salah\*, A. Abdel-Meguid<sup>†</sup>, B. Crane<sup>‡</sup>, S. Squires<sup>‡</sup>, and L. Matzar<sup>‡</sup>, \**Khalda Petroleum, Egypt*, <sup>†</sup>*Halliburton, Egypt* and <sup>‡</sup>*Halliburton, United States*
- 10:00–10:15 **Experience gained from *in situ* stress measurements conducted in Southern Africa during the past ten years**  
M.F. Handley\*, P.S. Piper\*, H. Kato<sup>†</sup>, and T. Clements\*, <sup>†</sup>*Groundwork Consulting, South Africa*, <sup>‡</sup>*3D-Geoscience, Japan*
- 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<sup>†</sup>, and P. Martensson<sup>†</sup>, \**Groundwork Consulting, South Africa*, <sup>†</sup>*Rockma Systems, Sweden*
- 10:30–10:45 **Unravelling the structural mysteries of the 'Bermuda Triangle' at Lonmin's Saffy Shaft**  
A.G. Hartzenberg\*, M. du Plessis<sup>†</sup>, and A.E.W. Friese<sup>†</sup>, \**Lonmin Platinum, Marikana and †Terra Explora, South Africa*
- 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<sup>†</sup>, \**First Quantum Minerals Limited, Zambia* and <sup>†</sup>*Lonmin Platinum, Marikana, South Africa*
- 11:00–11:15 **Development of a rock mass quality model for an open pit mine**  
M. Morales\*, K.K. Panthi<sup>†</sup>, and K. Botsialas<sup>†</sup>, \**Norwegian University of Science and Technology (NTNU)* and <sup>†</sup>*The Mining Company, Norway*
- 11:15–11:30 **Experimental study on hydraulic conductivity of a rock joint**  
S.-B. Choi, H.-Y. Jeong, S. Lee, and S. Jeon, *Seoul National University, Korea*
- 11:30–11:45 **Geological and hydrogeological reference conditions for rock engineering: an example for grouting design at Åspö Hard Rock Laboratory, Sweden**  
Å. Fransson\* and J. Petersson<sup>†</sup>, \**Chalmers University of Technology, Consulting Geologist, Gothenburg, Sweden*
- 11:45–12:00 **Active ultrasonic imaging and interfacial characterization of stationary and evolving fractures in rock**  
F. Pourahmadian\* and B.G. Guzina<sup>†</sup>, \**University of Colorado Boulder and †University of Minnesota, USA*
- 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, *University of the Witwatersrand, South Africa*
- 12:15–13:30 **Lunch**
- 13:30–13:45 **Keyblock stability analysis of longhole stopes**  
D. Sewnun\*, W.C. Joughin<sup>†</sup>, R. Armstrong<sup>†</sup>, and A. Cooper<sup>†</sup>, \**SRK, Consulting and †Ivanplats (Pty) Ltd, South Africa*
- 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, *University of Johannesburg, South Africa*
- 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<sup>†</sup>, and N.L. Ayres\*, \**Impala Platinum Limited and †Marula Platinum Mine, South Africa*
- 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<sup>†</sup>, and S. Mtshali<sup>†</sup>, \**University of KwaZulu-Natal and †Buffalo Coal, South Africa*
- 14:30–14:45 **A case study: Remediation of abandoned mines for residential development**  
I.S. Oweis\*, G. Gartenberg<sup>†</sup>, and L. Oweis\*, \**Oweis Engineering Inc and †The Falcon Group, United States*

### PETROLEUM—MEETING ROOM 2.41–2.46

- 14:45–15:00 **Hydraulic fracturing in plastic deformed low-permeability reservoirs**  
Y. Wang\* and F. Karaoulanis<sup>†</sup>, *Petro-, Geotech Inc., Canada and †Petro-, Geotech Inc., Greece*
- 15:00–15:15 **Simulating fractured reservoirs by a coupled two phase dual porosity model**  
Y. Wang, *Petro-, Geotech Inc., Canada*
- 15:15–15:30 **Stability of large underground rock caverns for crude oil storage operated below atmospheric pressure**  
N. Gatelier and H.D. Nguyen, *Geostock-Entrepose, France*
- 15:30–15:45 **Borehole stability and sand production in gas reservoirs**  
E. Papamichos\*<sup>†</sup>, \**Aristotle University of Thessalonik, Greece and SINTEF Petroleum Research, Greece, Norway*
- 15:45–16:00 **Afternoon Refreshments**