

CAVING 2018 ACCEPTED ABSTRACTS

KEYNOTE: Optimising for success at the Grasberg Block Cave *R Campbell, PT Freeport Indonesia, USA*

KEYNOTE: Key geotechnical knowledge and practical mine planning guidelines in deep, high-stress, hard rock conditions for block and panel cave mining
D Cuello, Newcrest Mining Ltd, Australia

Automation in caving operations – the business case *M Allan, J Cronin, Resolute Mining Ltd, Australia; AM Matinlauri, Sandvik Mining, Finland; J Mowen, Resolute Mining Ltd, Australia*

Optimisation of the caving problem – a reinforcement learning approach *M Allan, Resolute Mining Ltd, Australia*

Influence of the undercutting height on the behaviour of panel-caving extraction-level pillars – a 3D numerical study *R Álvarez, D Acevedo, F Sanz, E Hormazabal, SRK Consulting (Chile) S.A, Chile*

Three-dimensional numerical analysis of pillar support on the extraction level by the convergence–confinement method in block caving mining *R Álvarez, D Acevedo, F Sanz, E Hormazabal, SRK Consulting (Chile) S.A, Chile*

Developing caving projects using CaveLogic *M Arancibia, F Soto, Maptek Chile, Chile*

Integrated simulation and optimisation tools for production scheduling using FEA caving geomechanics simulation coupled with 3D cellular automata *S Arndt, Monash University, Australia; T Bui, T Diering, Dassault Systèmes, Canada; I Austen, Newcrest Mining Ltd, Australia; R Hocking, Oz Minerals, Australia*

Determination and assessment of parameters influencing rock mass fragmentation in block caving mines using the probabilistic rock engineering system
A Azadmehr, SME Jalali, Y Shams, Shahrood University of Technology, Iran

Suggested methods for estimation of confined strength of heterogeneous rocks *N Bahrani, Dalhousie University, Canada; P Kaiser, Laurentian University, Canada; A Corkum, Dalhousie University, Canada*

Mud rush hazard in the dessert: early cave management of the Carrapateena sublevel cave *G Balog, R Hocking, T Ormerod, H Pearce, Oz Minerals, Australia*

Grasberg block cave mine: undercut planning *D Beard, C Brannon, Freeport-McMoRan Inc., USA*

A deeper understanding of the dependency of a rockbolts dynamic capacity on the magnitude of the applied impulse energy *A Berghorst, G Knox, New Concept Mining, South Africa*

Deep mill level zone undercutting behaviour – part 1: quasi-static stress fracturing and wall displacements *R Bewick, J Roy, Golder Associates Ltd., Canada; A Purba, K Simanjuntak, PT Freeport Indonesia, Indonesia; R Campbell, PT Freeport Indonesia, USA; M Sullivan, PT Freeport Indonesia, Indonesia*

Hydra-U: ground-based radar for safety critical monitoring in caving methods *N Boldrini, N Coli, M Cecchetti, M Rossi, F Coppi, IDS GeoRadar, Italy*

Understanding an unplanned rock mass cave in a deep Canadian mine *L Brown, M Hudyma, Laurentian University, Canada*

Fragmentation assessment and impact on operational performance at the Cadia East PC1 and PC2 block cave mines *I Brunton, Itasca Australia, Australia; J Lett, J Doolan, Newcrest Mining Limited, Australia*

Numerical back-analysis of caveability *I Brunton, G Sharrock, Itasca Australia, Australia; D Finn, Newcrest Mining Limited, Australia*

25 years of fragmentation experience and measurements at the El Teniente mine, Chile *A Brzovic, F Celhay, R Gonzalez, J Seguel, Codelco, Chile*

Optimising the extraction of the remaining reserves at the DOZ Mine *T Bui, Dassault Systemés, Canada; S Nugroho, PT Freeport Indonesia, Indonesia*

Full-scale experiments to measure the effect of cross-cut height on recovery in sublevel cave mines *A Campbell, Glencore, Australia*

The effect of ring burden and explosive density on fragmentation and ore recovery in sublevel caving *A Campbell, Glencore, Australia*

Hang-ups analysis and modelling for Cadia East PC1-S1 and PC2-S2 *R Castro, BCTEC Engineering and Technology, Chile; D Cuello, Newcrest Mining Limited, Australia; A Altamirano, L Araya, BCTEC Engineering and Technology, Chile*

Quantifying the role of gravity flow in caving mines through FlowSim *R Castro, A Altamirano, D Guzman, BCTEC Engineering and Technology, Chile*

Development of a monitoring network for surface subsidence at New Gold's New Afton block cave operation *A Clayton, M Dugie, C McKane, BGC Engineering Inc., Canada; A Davies, New Gold Inc., Canada*

Seismic monitoring using mixed sensor types and the benefits to rock mass behaviour interpretation *DS Collins, I Pinnock, T Butler, Z Anderson, ESG Solutions, Canada*

Maximising resource utilisation in scheduling of underground mining works of multiple faces *D Cortés, YM Fernández, MS Balocchi, Codelco, Chile*

The application of sequential spatial clustering and fractal dimension of caving seismic event parameters of time, distance and intensity *D Cortolezzis, M Hudyma, Laurentian University, Canada*

Application of telepresence systems for accelerated re-entry and inspection after seismic events *J Cronin, Australian Droid and Robot, Australia; D Gilbreath, Rajant Corporation, USA*

Oyu Tolgoi cave mine development planning *K Crook, F Prince, Rio Tinto, Australia*

An extended conceptual model of caving mechanics *D Cumming-Potvin, J Wesseloo, Australian Centre for Geomechanics, Australia; SW Jacobsz, E Kearsley, University of Pretoria, South Africa*

Physical and numerical models of cavity growth through undercutting *D Cumming-Potvin, Australian Centre for Geomechanics, Australia*

Understanding and managing surface subsidence at New Gold's New Afton block cave operation *A Davies, D Hamilton, New Gold Inc., Canada; A Clayton, BGC Engineering Inc., Canada*

Applications of passive seismic tomography to hazard assessment *W de Beer, ESG Solutions, Australia; G Viegas, K Bosman, D Angus, L Smith-Boughner, T Urbancic, ESG Solutions, Canada*

Footprint finder tool for sublevel caving *T Diering, Dassault Systèmes Canada, Canada; F Breed, The De Beers Group of Companies, Canada; T Pillay, Dassault Systèmes Canada, Canada*

Palabora Lift 1 block cave: understanding the grade behaviour *T Diering, Dassault Systèmes Canada, Canada; S Ngidi, J Bezuidenhout, Palabora Mining Company, South Africa*

Influence of veining in blocks on secondary fragmentation during block caving *L Dorador, Advanced Earth Sciences Inc., USA; E Eberhardt, D Elmo, University of British Columbia, Canada*

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- Rapid mine development using efficient in-cycle shotcrete *F Erismann, B Lindlar, Sika Services AG, Switzerland; M Corner, Sika Canada, Canada*
- The influence of stress and seismicity on the performance of a sublevel caving operation *H Esterhuizen, Ernest Henry Mine, Australia*
- InSAR monitoring of subsidence induced by underground mining operations *G Falorni, TRE Altamira Inc, Canada; F Bellotti, D Colombo, TRE Altamira SRL, Italy; N Toro, TRE Altamira Inc, Canada*
- Application of smaller blastholes in Malmberget mine *H Falksund, Luossavaara - Kiirunavaara, Sweden*
- Strategy for mining research and development in the cave mining industry *G Ferguson, Seltrust Associates Limited, United Kingdom; Y Potvin, Australian Centre for Geomechanics, Australia; D Cuello, Newcrest Mining Limited, Australia, E Rojas, Codelco, Chile*
- Overview of mine planning process for Oyu Tolgoi underground project *S Fowke, B Groeneveld, Rio Tinto, Australia*
- Review and simulation of passive seismic tomography in block cave mining *S Ghaychi Afrouz, EC Westman, Virginia Tech, USA*
- Characterising the behaviour of rockbolts based on in situ pull tests *J Hadjigeorgiou, P Tomasone, University of Toronto, Canada*
- Factors influencing cave initiation, propagation and breakthrough in deep hard rock mining operations *E Hancock, D Cuello, Newcrest Mining Ltd, Australia*
- Controlling hydraulic fracture propagation by prescribed hydraulic fracturing *Q He, J Xu, China University of Mining and Technology, China*
- Three-dimensional simulation of cave initiation, propagation and surface subsidence using a coupled finite difference – cellular automata solution *Y Hebert, G Sharrock, Itasca Australia Pty Ltd, Australia*
- Grade control and segregation at New Gold's New Afton block cave operation *M Henning, New Gold Inc., Canada*
- Leinster cave seismic risk management: a block cave solution *M Hopkins, R Rimmelin, BHP, Australia*
- Ground subsidence due to sublevel caving mining in Gushfil lead and zinc mine, Isfahan, Iran *AS Hosseini, A Kia, Shahin Alborz Lead & Zinc LLC., Iran*
- Evaluating the effect on seismicity of a hydraulic fracturing trial using Bayesian data analysis *K Jonsson, J Martinsson, Luossavaara - Kiirunavaara, Sweden*
- Rehabilitation of an extraction level drawpoint at the New Gold New Afton mine *C Kamp, New Gold Inc., Canada*
- Utilising a comprehensive instrumentation system for cave monitoring at the new gold New Afton mine, west cave *C Kamp, New Gold Inc., Canada*
- Discrete element modelling of a laboratory static test on welded wire mesh *E Karampinos, B Baek, J Hadjigeorgiou, University of Toronto, Canada*
- Application of mathematical modelling for draw control under material flow uncertainty *F Khodayari, Y Pourrahimian, University of Alberta, Canada; E Ben-Awuah, Laurentian University, Canada*
- Bulk sorting: the key to grade control for caving operations *B Klein, A Moss, S Nadolski, University of British Columbia, Canada*
- A comparison between the laboratory-based, sample tube configurations for dynamic testing *G Knox, New Concept Mining, South Africa*
- Data collection for block cave mine design *R Lachenicht, Newcrest Mining Limited, Australia; D Tyler, C Scott, pitt&sherry, Australia; I Brunton, Itasca Australia Pty Ltd, Australia*
- A new approach to modeling cave growth *T Lavoie, Itasca Consulting Canada Inc., Canada; A Davies, C Kamp, New Gold, Canada*
- Factors influencing brittle failure mechanisms for extraction levels in high-stress environments and means to improve support design *T Lavoie, Itasca Consulting Canada inc., Canada; E Eberhardt, University of British Columbia, Canada*
- A Monte Carlo flow solver for caving mines *C Lilley, Beck Engineering, Australia*
- Sublevel retreat mining in the subarctic: a case study of the Diavik Diamond Mine *P Lewis, L Clark, S Rowles, C Auld, C Petryshen, A Elderkin, Diavik Diamond Mines (2012) Inc., Canada*
- Geotechnical data collection and approach to modelling for Cukaru Peki deposit *K Llewelyn, SRK Consulting (UK) Limited, UK; J Jakubec, SRK Consulting (Canada) Inc., Canada; R Goddard, SRK Consulting (UK) Limited, UK; P Stenhouse, Polyphase Consulting Limited, New Zealand*
- Determining an optimal footprint for a block cave by improving certainty and mitigating risks *C Ludwicki, C Villa, Dassault Systèmes, Canada*
- Tracking cave shape development with microseismic data *R Lynch, S Meyer, E Lotter, Institute of Mine Seismology, Australia; J Lett, Newcrest Mining Limited, Australia*
- InSAR as a practical tool to monitor and understand large-scale mining-induced ground deformations in a caving environment *K Mäkitäavola, B-M Stöckel, T Savilahti, Luossavaara-Kiirunavaara AB, Sweden; J Sjöberg, Itasca Consultants AB, Sweden; J Dudley, MA McParland, R Morin, MDA Geospatial Services, Canada*
- Analysis of damaging seismic event on 24 December 2011 in the Pilar Norte sector of El Teniente mine *D Malovichko, Institute of Mine Seismology, Australia; D Cuello, Newcrest Mining Limited, Australia; E Rojas, Codelco, Chile*
- Numerical modelling of dynamic testing for rock reinforcement used in underground excavations *E Marambio, JA Vallejos, L Burgos, Advanced Mining Technology Centre, Chile; L Castro, JP Saure, Compañía Siderúrgica Huachipato, Chile; J Urzúa, Teiko Ingeniería Ltda., Chile*
- Cave mining research *S McKinnon, Queen's University, Canada; G Ferguson, Seltrust Associates Ltd., Scotland*
- Microseismic monitoring of the Oyu Tolgoi Hugo North Lift 1 *JP Mercier, Oyu Tolgoi Mine, Mongolia; A van As, Rio Tinto Copper and Diamond, Australia; C Carlson, B Tumur-Ochir, Oyu Tolgoi Mine, Mongolia; P Dales, University of Ottawa, Canada; P Friberg, ISTI, USA; M Metz, Major Drilling, Mongolia; G Tubridy, Avalon Sciences, England*
- Rapid assessment of the spatial extent of strong ground motion in mines – ShakeMap approach *S Meyer, Institute of Mine Seismology, Australia; J Doolan, C Chester, Newcrest Mining Limited, Australia; G Basson, Institute of Mine Seismology, Australia*
- Using a structured data management system to improve mine development efficiencies *T Moorcroft, E Savage, Oyu Tolgoi LLC, Mongolia*
- A systems approach to mining innovation *D Morrison, V Drylie, P Labreque, Centre for Excellence in Mining Innovation, Canada*
- Reducing geotechnical problems in block caving by increasing productive capacity *D Morrison, P Labreque, K Shelswell, Centre for Excellence in Mining Innovation, Canada*
- Presence of natural fracture as an indicator of operational difficulty for future cave operations *M Munkhchuluun, Oyu Tolgoi, Mongolia; D Elmo, S Nadolski, Institute of Mining Engineering, Canada; A Moss, Sonal Mining Technology, Canada; B Klein, Institute of Mining Engineering, Canada*
- Assessing the impact of sensor-based sorting systems on cave project value *S Nadolski, University of British Columbia, Canada; M Samuels, New Gold, Canada; B Klein, C Hart, University of British Columbia, Canada; A Moss, SONAL Consulting, Canada; D Elmo, University of British Columbia, Canada*

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Gravity flow at the Kiruna sublevel caving mine *A Nordqvist, M Wimmer, Luossavaara - Kiirunavaara, Sweden*

Optimisation of the undercut level elevation in block caving mines using a mathematical programming framework *R Noriega, Y Pourrahimian, WL Victor, University of Alberta, Canada*

Integrated planning – development and production scheduling at the Lac des Iles Mine *S Olson, North American Palladium, Canada; A Isabel, S O'Connor, Deswick, USA; G Power, Power Geotechnical, Australia*

Strategic management and tactical approach of drawpoint re-opening at the Argyle Diamond Mine *J Ooi, M Ario, M Wilson, L Pryce, G van Hout, A van As, Rio Tinto, Australia*

Grasberg open pit to Grasberg block cave transition *P Paredes, T Leaño, L Jauriat, Codelco, Chile*

Chuquicamata underground mine design: the simplification of the ore handling system of Lift 1 *ND Pascoe, AP Ginting, PT Freeport Indonesia, Indonesia*

Chuquicamata underground mine development: main challenges and lessons learned *P Paredes, C Herrera, M Olganier, Codelco, Chile*

Non-vertical cave and dilution modelling at New Gold's New Afton Mine *J Parsons, D Hamilton, New Gold Inc., Canada; C Ludwicki, Dassault Systèmes, Canada*

REBOP-FLAC3D hybrid approach to cave modelling *M Pierce, Pierce Engineering LLC, USA; M Fuenzalida, Itasca Consulting Group Inc., USA*

Artificial Intelligence-powered caving *R Puscasu, CSIRO Mineral Resources, Mining3, University of Queensland, Australia*

Design of a new layout for sublevel caving at dept *C Quinteiro, Luossavaara - Kiirunavaara AB, Sweden*

Numerical caving simulations under simultaneous open pit and underground mining at Chuquicamata mine *V Rivero, C Alvarez, Itasca S.A., Chile; S Lopez, G Barindelli, Codelco, Chile*

Validation of the Itasca caving algorithm incorporated in the 3DEC discontinuum code *V Rivero, E Widzyk-Capehart, R Castro, University of Chile, Chile; C Alvarez, Itasca S.A, Chile*

Benchmarking and its application for caving projects *I Ross, CaveConsult Pty Ltd, Australia*

DMLZ undercutting behaviour – part 2: dynamic response *J Roy, R Bewick, Golder Associates Ltd., Canada; A Purba, K Simanjuntak, PT Freeport Indonesia, Indonesia; R Campbell, PT Freeport Indonesia, USA; M Sullivan, PT Freeport Indonesia, Indonesia; P Kaiser, GeoK Inc., Canada*

Back-analysis of PC1 propagation behaviour at the Cadia East Mine *B Sainsbury, Deakin University, Australia; D Sainsbury, Noma Consulting, Australia; D Carroll, Newcrest Mining Limited, Australia*

Maximising volumetric efficiency for ventilation systems in temporarily reduced flow environments of block cave mines *G Schult, B Prosser, SRK Consulting (U.S.) Inc., USA; J Wolgram, D Brown, Rio Tinto, Australia*

Fines migration in block and sublevel caving *G Sharrock, I Brunton, Itasca Australia Pty Ltd, Australia; R Hocking, OZ Minerals Ltd, Australia*

Assessing excavation stability in block caving *G Sharrock, Itasca Australia, Australia; R Lachenicht, Newcrest Mining Limited, Australia*

Simulating gravity flow and caveability with cellular automata *G Sharrock, Itasca Australia, Australia; C Chester, D Caroll, Newcrest Mining Limited, Australia*

Safely reopening a collapsed extraction level drive in a resource limited environment *N Shea, RW Sinclair, TM Welsh, Climax Molybdenum, USA*

The evolution and performance of the Henderson Mine's C-arch shotcrete drawpoint support *N Shea, Climax Molybdenum, USA*

Analysis of minimum extraction ratio to be loaded from sublevel caving rings *G Shekhar, A Gustafson, J Martinsson, H Schunnesson, Luleå University of Technology, Sweden*

Development of method for economic control of loading in sublevel caving mines *G Shekhar, A Gustafson, A Hersinger, H Schunnesson, Luleå University of Technology, Sweden*

Bolt trials at Northparkes Mines *L Snyman, B Li, CMOC - Northparkes Mines, Australia*

Investigating and assessment of effecting parameters on rock mass cavability in block caving mines using the DEMATEL technique *F Sotoudeh, R Rafiee, M Ataei, RN Masir, Shahrood University of Technology, Iran*

2D discontinuum modelling of large-scale footwall stability at the Luossavaara-Kiirunavaara AB Kiirunavaara sublevel cave mine *M Svartsjaern, Itasca Consultants AB, Sweden; D Saiang, Luleå University of Technology, Sweden; K Mäkitaavola, Luossavaara-Kiirunavaara AB*

Case study – Ernest Henry Mine: designing step-out zones in an inclined sublevel cave *C te Kloot, A Harrison, P Nichols, Glencore, Australia*

Cave extensions – geotechnical challenges at Northparkes *R Teet, L Snyman, CMOC Northparkes Mines, Australia*

Underground roadway design considerations for efficient autonomous hauling *R Thompson, WA School of Mines, Australia; H Malekzhehtab, Curtin University, Australia*

Evaluation of caving as mining method for the Udachnaya underground diamond mine project *M Tishkov, Yakutniiproalmaz Institute of ALROSA PJS, Russia*

Comprehensive 3D numerical model with stress measurement and monitoring for a sublevel caving mine in Norway *N Trinh, SINTEF, Norway*

Draw strategies for wet muck control at El Teniente *M Valencia-Vera, R Castro, University of Chile, Chile*

Mapping cave front growth utilising the collective behavior of seismicity and velocity fields *G Viegas, K Bosman, D Angus, ESG Solutions, Canada; W de Beer, ESG Solutions, Australia; T Urbancic, ESG Solutions, Canada*

Implications of measured stress regime on the planned orientation of undercut extraction for the Palabora Lift II block cave *J Walls, Jewal Geotechnical (Pty) Ltd, South Africa; P Lourens, Palabora Mining Company, South Africa*

Cave extensions Northparkes Mines – designs, results and lessons learnt *S Webster, E Samosir, S Manurung, CMOC Northparkes Mines, Australia*

Northparkes E48 block cave – mid mine life recalibration for predicting future fragmentation with emphasis on fines *S Webster, S Manuang, E Samosir, CMOC Northparkes Mines, Australia; N Burgio, Stratavision, Australia*

Testing the suitability of RFID cattle tags for tracking block cave progression *M Wilson, G van Hout, F Dean, Rio Tinto, Australia*

Progression of seismic hazard and its management through the life of Telfer gold mine sublevel cave *M Woods, R King, M Poulter, Newcrest Mining Limited, Australia*