

# Underground Mining Technology

## UMT 2020

Proceedings of the Second International Conference on  
Underground Mining Technology

3–4 November 2020 | Online and Perth, Australia



**EDITOR** Johan Wesseloo

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*Editor*

**Johan Wesseloo**

Australian Centre for Geomechanics, Australia

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# Australian Centre for Geomechanics

The Australian Centre for Geomechanics (ACG) was formally established in 1992 as a University of Western Australia not-for-profit research centre in order to promote research excellence and continuing education in geomechanics, with particular emphasis on its application to the mineral and energy extraction sections of Australia's resources industry.

The Australian Centre for Geomechanics is an unincorporated Joint Venture involving:

- CSIRO Mineral Resources
- The University of Western Australia — Civil, Environmental and Mining Engineering

The ACG draws together staff knowledge, experiences and expertise from within the two groups forming the Centre and facilitates a multi-disciplinary approach to research and education in geomechanics. Research undertaken by the ACG attracts both national and global support and the outcomes of the projects are utilised to promote safer mining and environmental geomechanics practices, operating efficiencies and to meeting community expectations for sustainable mining practices.

With the guidance of strong industry representation on the Board of Management, and close collaboration with senior representatives of the mining industry, research, training and further education activities are tailored directly to the needs of industry. The ACG Board expects the Australian Centre for Geomechanics to be the focal point for industry on geomechanics issues and to address the needs of industry through a collaborative interdisciplinary approach.

## Online Repository of Conference Proceedings



*Accessing geomechanical excellence*

Since 2005, the ACG has published conference papers across the geotechnical mining spectrum, including: underground and open pit mining, paste and thickened tailings and mine closure. To make many of these papers more accessible for industry and academia, the ACG launched the Online Repository of Conference Proceedings in 2017. This repository aims to provide the mining geomechanics fraternity with open access, peer-reviewed conference papers that may assist readers to maintain and develop their skills, knowledge and capabilities.

Aside from allowing users to freely download many past and current conference papers, the site features many useful functions. This highly interactive and searchable repository provides importable citation information in various formats, links to the paper authors' profiles on ORCID, ResearchGate and LinkedIn, as well as the ability to share papers on social media.

The Second International Conference on Underground Mining Technology papers are available on the repository.

Setting a high standard for technology transfer and accessibility, this valuable online resource will continue to develop and grow with future ACG geomechanical mining events.

**[papers.acg.uwa.edu.au](http://papers.acg.uwa.edu.au)**



# Technical Reviewers

The dedicated efforts of the peer reviewers have resulted in the high quality of the technical programme and the papers compiled for this publication. The editor thanks the following people who contributed their time and expertise as reviewers of manuscripts for the proceedings of the Second International Conference on Underground Mining Technology. A technical and critical review of each paper was undertaken by a minimum of two reviewers for the production of these proceedings.

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# Preface

The Underground Mining Technology Conference series provides a forum to discuss new technologies and explore practical ways of implementing and expanding these new technologies to maximise their value within the underground mining environment. Shortcomings in current and new technologies need to be identified which will drive further development and better solutions.

Ongoing research and innovations in underground mining technologies continually assist operations to significantly improve their productivity, cost efficiency and, most importantly, their health and safety records, whilst reducing their environmental impact. This continual drive to improve mining safety and productivity requires new and innovative technology in rock mass characterisation, design, ground support, instrumentation, monitoring and data interpretation, as well as management and integration.

In recent years, a vast amount of technology development has changed the landscape of the mining geomechanics discipline. Photogrammetric methods and laser measurement technology allow geotechnical engineers to gather data not possible before, and the development in drone technology allows them to gather this data in areas previously not accessible. Advances in processing technology allow faster processing of large datasets, and integrated underground communications systems allow for real-time monitoring and real-time integration. Geotechnical engineers now have data at higher resolution with wider coverage and in shorter times than possible before, and a wider range of products to provide a solution. Effective decisions can only be made if data is turned into information, and knowledge derived from it.

The conference featured 25 presentations, including four keynotes. The peer-reviewed conference proceedings are freely available from the ACG Online Repository of Conference Proceedings, made possible by the Open Access sponsorship of DSI Underground. The papers can be accessed by scanning the QR code or from [papers.acg.uwa.edu.au/umt2020](http://papers.acg.uwa.edu.au/umt2020)

I sincerely thank everyone who contributed to the technical review of the papers and the ACG team for their hard work to realise this conference.

Finally, an event like this could not have taken place without the support and encouragement of our industry sponsors. We trust you have found your involvement in this conference rewarding, and the continuing contribution of new and improving technologies to safe and cost-effective underground mining will benefit from this involvement.

Associate Professor Johan Wesseloo, Australian Centre for Geomechanics, Australia  
Editor and Conference Chair







## Conference Sponsors

The Australian Centre for Geomechanics proudly acknowledges the generous contribution by the Principal and Major Sponsors of the Second International Conference on Underground Mining Technology.

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# Table of Contents

iii	Australian Centre for Geomechanics
v	Technical Reviewers
vii	Preface
ix	Conference Sponsors

## Keynote Addresses

3	<b>Mobile LiDAR for underground geomechanics: learnings from the teens and directions for the twenties</b> <i>EW Jones, Curtin University and BHP, Australia</i>
27	<b>Solving rock mechanics issues through modelling: then, now, and in the future?</b> <i>J Sjöberg, Itasca Consultants AB, Sweden</i>
47	<b>Breaking new ground: challenges and opportunities for maximising value from underground blasting</b> <i>EJ Sellers, EF Salmi, CSIRO, and Mining3, Australia</i>
77	<b>Recovery and flow in cave mining: current knowledge gaps and the role of technology in the future</b> <i>AD Campbell, Beck Engineering, Australia</i>

## Machine Learning

107	<b>Can new technologies shake the empirical foundations of rock engineering?</b> <i>D Elmo, University of British Columbia, Canada; D Stead, Simon Fraser University, Canada; B Yang, R Tsai, Y Fogel, University of British Columbia, Canada</i>
117	<b>Rock forecast tool: new tool for rock mass quality prediction in tunnelling</b> <i>A Tapia, University of Concepción, and Concessionaire Tunnel El Melón, Chile; A Farías, Pontifical Catholic University of Valparaíso, and Aura Ingeniería, Chile</i>
137	<b>Artificial intelligence assisted technology for ground support construction</b> <i>B Chen, GroundProbe Pty Ltd, Australia; T Harrington, BHP, Australia; P Ayres, Orica Hong Kong Ltd, Hong Kong; L-P Gélinas, Agnico Eagle Mines Limited, Canada</i>

## Seismicity

155	<b>Reliable automatic processing of seismic events: solving the Swiss cheese problem</b> <i>W Törnman, J Martinsson, Luleå University of Technology, and LKAB, Sweden</i>
-----	--

- 173 Advances in seismic monitoring technologies**  
*G Goldswain, Institute of Mine Seismology, Australia*
- 189 Large seismic events ( $M > 0$ ) in the Lappberget orebody, Garpenberg, Sweden: blast or non-blast-related?**  
*İ Erguncu Güçlü, Luleå University of Technology, Sweden; S Dineva, Luleå University of Technology, and Luossavaara-Kiirunavaara Aktiebolag (LKAB), Sweden; S Mozaffari, Luossavaara-Kiirunavaara Aktiebolag (LKAB), Sweden; A Nyström, Boliden Mines, Sweden*

## Paste

- 207 Efficient paste mix designs using new generation backfill admixtures: perception versus reality**  
*F Erismann, Sika, Switzerland; M Hansson, Sika, Sweden*
- 217 Crown pillar extraction with paste underhand stoping**  
*A Shiels, Glencore, Australia; D Sainsbury, Geotechnica Pty Ltd, Australia*

## Monitoring

- 233 Small-scale variations in mining-induced stresses, monitored in a seismically active underground mine**  
*C Dahnér, S Dineva, Luleå University of Technology, and Luossavaara-Kiirunavaara Aktiebolag (LKAB), Sweden*
- 247 Rapid automated processing of structural orientation from time-of-flight LiDAR mapping**  
*JW Smith, S Yee, RockMass Technologies Inc., Canada*
- 261 Fundamentals for cave back and in-ground monitoring using wireless technology**  
*A Aguirre, J Lloyd, Elexon Mining, Australia*
- 273 Ground support loading monitored with Rock Bolt Sensor (RBS™) and relationship to nearby production and seismicity**  
*L Smith-Boughner, Z Anderson, ESG Solutions, Canada; Z Sun, D Levesque, S Kruger, Y Quenneville, National Research Council of Canada, Energy, Mining and Environment Research Centre, Canada; A Jalbout, IAMGOLD Corporation, Canada; J Szirti, Newmont Corporation, Canada; R Royer, R Lacroix, National Resources Canada, Canada*
- 285 Ground support and strata monitoring: what is needed?**  
*O Vallati, W Roach, S Weaver, Sandvik Mining and Rock Technology, Australia*

## Stope Design

- 299 Benchmarking of stope design and reconciliation practices**  
*Y Potvin, KR Woodward, Australian Centre for Geomechanics, Australia; B McFadyen, Université Laval, Canada; I Thin, KSCA Geomechanics Pty Ltd, Australia; D Grant, BHP, Australia*

- 309      Assisted geotechnical design for sublevel open stoping using MineRoc® software**  
*JA Vallejos, R Miranda, E Marambio, L Burgos, G Sanhueza, University of Chile, Chile*
- 325      Mobile drone LiDAR structural data collection and analysis**  
*CNC Baylis, DR Kewe, EW Jones, BHP, Australia*
- 335      A new stope reconciliation approach**  
*B McFadyen, Université Laval, Canada; KR Woodward, Y Potvin, Australian Centre for Geomechanics, The University of Western Australia, Australia; M Grenon, Université Laval, Canada*

## **Ground Support**

- 353      Development of the mesh clamp and its evaluation**  
*W Roach, M Rataj, B Darlington, Sandvik Mining and Rock Technology, Australia*
- 367      Ground support strategy for optimisation of time schedule, Oyu Tolgoi Underground Mine**  
*B Batkhuu, LA Johnson, Oyu Tolgoi, Rio Tinto Copper and Diamonds, Mongolia*

## **Fundamental Rock Mechanics**

- 379      Rock property determination**  
*I Gray, Sibra Pty Ltd, Australia*
- 401      On the accurate strain measurements for the crack initiation determination**  
*E Mutaz, M Serati, DJ Williams, VT Nguyen, The University of Queensland, Australia*
- 413      Author Index**