Slope Stability in Mining

ACG AUSTRALIAN CENTRE FOR GEOMECHANICS

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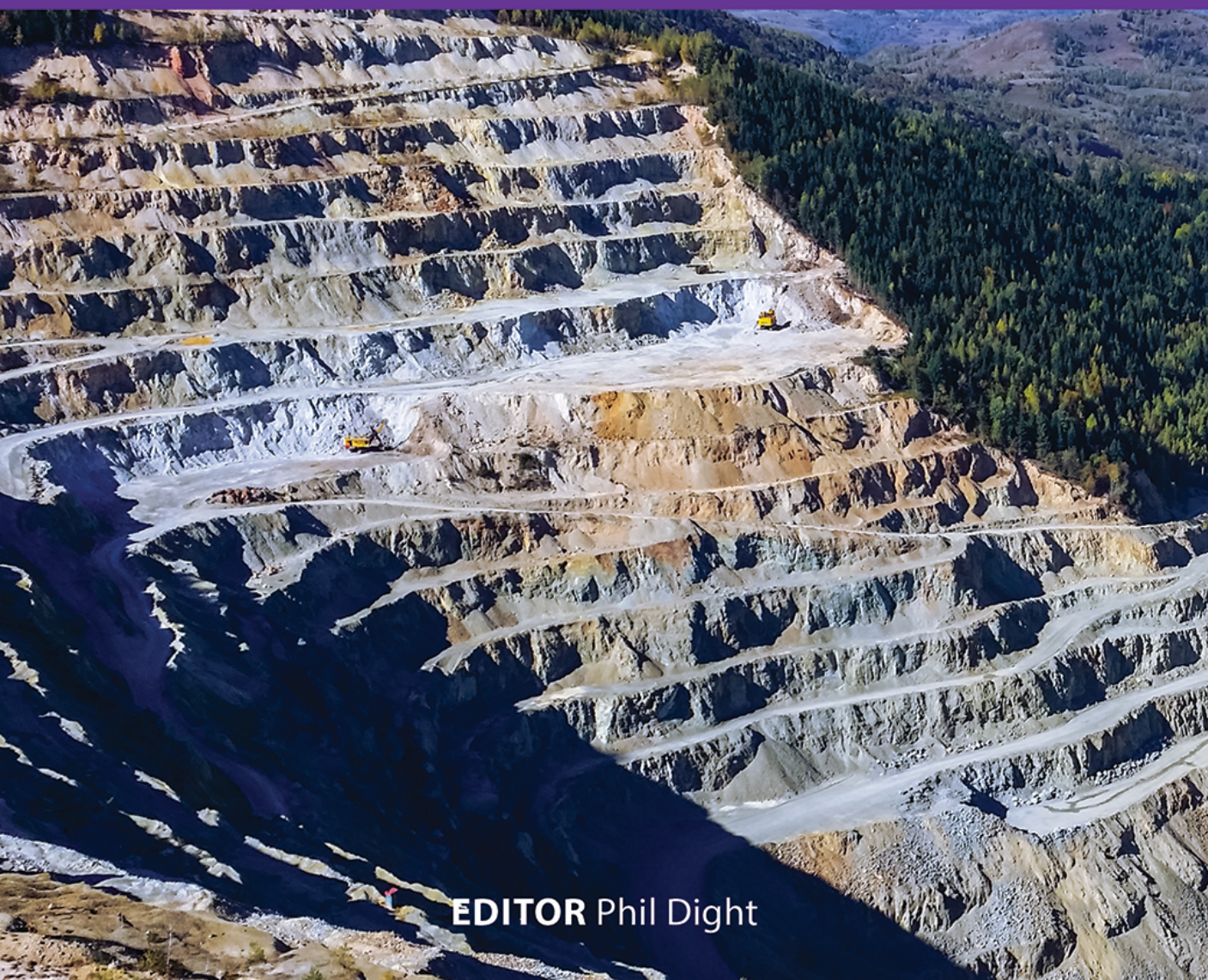
SSIM 2023

Proceedings of the Third International Slope Stability in Mining Conference

14–16 November 2023 | Perth, Australia

Volume One



EDITOR Phil Dight

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Phil Dight
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.

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With the recent addition of the SSIM 2023 papers, 108 SSIM conference papers are now freely available. Setting a high standard for technology transfer and accessibility, this valuable online resource will continue to develop and grow with future conferences.

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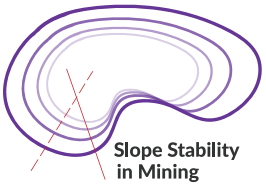

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Preface

This conference proceedings has an emphasis on specific issues associated with our industry with respect to safety, risk management, detailed monitoring, groundwater issues, data collection, numerical modelling and interpretation.

Ensuring the safety of personnel is the most important task we have. Our industry upholds the highest standards to minimise injury from instability in pit walls and access to the mines. However, we are also fully cognisant of the fact we are dealing with natural materials – the properties of which vary with orientation and are often affected by alteration resulting from the mineralising process, local tectonics and weathering. We need to recognise these challenges and deal with the risks involved.

Why monitoring? It is an essential key along with observational techniques to manage project performance – if you cannot *measure it* you cannot *manage it*.

There are some great advances in slope monitoring primarily based on measuring surface deformation and interpreting mechanisms. Indeed, we see many more operations taking advantage of LiDAR, radar and satellite interferometry. Now we appear constrained by the models used to interpret the deformation. Why?

As an industry, we are still focused on strength, not deformation; although deformation is the only parameter we can measure, whether it is in the laboratory or the field. For instance, the strength we measure in the laboratory comes from strain gauges in a load cell using elastic theory to convert to strength. Limit equilibrium analysis techniques still dominate our design process; however, these do not examine deformation.

Indeed, a significant issue in our design process is that deformation is seldom used to evaluate a design. Yet this is the only measure we have during development and closure that we can use to infer stability. This is a major challenge for our engineers and geologists.

So, without precedent at a new site when we experience deformation in the field which appears anomalous, we do not have the data to better undertake the numerical modelling to initially interpret what this means.

The challenges are compounded when consideration is given to the material properties used in our analysis. Unless we are dealing with known or visible anisotropy, we rarely investigate whether it is a possibility. This has arisen over the last 60 or so years by undertaking laboratory testing largely in the axis of the core, irrespective of the purpose for which the core was originally required. Until we can change the paradigm that the test results obtained in the laboratory are 'isotropic', we will continue to only be doing part of our job. The rock does not know that it is meant to behave this way.

Groundwater and surface water affect stability and impose constraints on blasting. The difficulty experienced when removing water has significant implications on successful mining.

Mine closure is something that is left to last. It raises issues of what is behind the wall, in terms of geology/structure, which is often not explored in detail before or during mining, where our focus is on what we can see. More attention is needed in this area. We will be faced with legacy issues (blast damage, weathering, continuing deformation etc.) long after the mine has ceased operation; but long-term monitoring will be necessary after closure.

This conference addresses many of these issues. The majority of keynote presentations were selected from papers submitted and deemed noteworthy by the committee and reviewers.

A conference such as this could not have taken place without the support of the Principal Sponsor PSM and our sponsors and exhibitors. Thank you to all sponsors for your involvement in and your support of the conference series.

These proceedings are freely available from the Australian Centre for Geomechanics' Online Repository of Conference Proceedings, courtesy of Open Access Sponsors Equilibrium Mining and SRK Consulting. The papers can be accessed from papers.acg.uwa.edu.au/ssim2023

All the people supporting this conference are gratefully acknowledged for their time and efforts.

Professor Phil Dight
Australian Centre for Geomechanics
SSIM 2023 Editor and Conference Chair

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The Australian Centre for Geomechanics proudly acknowledges the generous contribution by the Principal and Major Sponsors of the Third International Slope Stability in Mining Conference.

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Table of Contents

Keynote addresses

Slope optimisation

Weak rocks

Constructing models

Structural data