

PREFACE

The editors, organizing committee, and SME staff extend a warm welcome to all the authors, students, and attendees of the *38th International Conference on Ground Control in Mining* (ICGCM 2019) in Morgantown, West Virginia.

The conference was initially conceived in 1981 by Dr. Syd Peng to bring together members of the mining community in a forum where diverse ground control experience and research can be shared. The conference has been held annually since that time, and has established a rich history of advancing ground control techniques to its current stage. It has provided a unique platform for researchers, regulators, and operators to present, exchange, and discuss topics that are unique, challenging, and/or require immediate solutions. The conference has covered every aspect of ground control in mining. The conference has been attended by researchers from all the mining countries around the world. The papers presented at the conference are accessible online at no cost and represent an exquisite collection of technical papers.

This year we are pleased to announce two special sessions, one focusing on underground limestone mining held on Tuesday afternoon from 2:50 PM to 4:30 PM, and the second on the interaction between longwall mining and gas wells between 4:45 PM and 5:45 PM. We hope that these sessions peak new interest as well as stimulate our audiences. Finally, we encourage anyone with ideas for special session(s) for future meetings to submit them to one of us as we plan. We look forward to a very exciting ICGCM 2020.

We thank all the primary technical reviewers, peer reviewers, chairs, co-chairs, and authors for their contributions and dedication to this conference. In addition, the editors extend appreciation to the SME staff for their hard work, patience, and enthusiastic support. We also thank our sponsors for their continued support in the success of this conference. Lastly, we thank all the participants for joining us and making this conference a success that will drive forward the science of mine ground control for the benefit of all.

Ted Klemetti
Brijes Mishra
Heather Lawson
Michael Murphy
Kyle Perry

PROCEEDINGS OF THE 38th
International
Conference
ON GROUND CONTROL IN MINING

ICGCM 2019

Edited by

Ted Klemetti | Brijes Mishra | Heather Lawson | Michael Murphy | Kyle Perry

Published by the
Society for Mining, Metallurgy & Exploration

Society for Mining, Metallurgy & Exploration (SME)

12999 E. Adam Aircraft Circle
Englewood, Colorado, USA 80112
(303) 948-4200 / (800) 763-3132
www.smenet.org

The Society for Mining, Metallurgy & Exploration (SME) is a professional society whose more than 15,000 members represents all professionals serving the minerals industry in more than 100 countries. SME members include engineers, geologists, metallurgists, educators, students and researchers. SME advances the worldwide mining and underground construction community through information exchange and professional development.

Information contained in this work has been obtained by SME from sources believed to be reliable. However, neither SME nor its authors and editors guarantee the accuracy or completeness of any information published herein, and neither SME nor its authors and editors shall be responsible for any errors, omissions, or damages arising out of use of this information. This work is published with the understanding that SME and its authors and editors are supplying information but are not attempting to render engineering or other professional services. Any statement or views presented herein are those of individual authors and editors and are not necessarily those of SME. Authors assumed the responsibility to obtain permission to include a work or portion of work that is copyrighted. The mention of trade names for commercial products does not imply the approval or endorsement of SME.

ISBN 978-0-87335-472-1