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Guest editorial–special issue on ground control in mining in 2020

Michael M. Murphy [a,*], Ted Klemetti [a], Heather Lawson [b], Brijes Mishra [c], Kyle Perry [d]

[a] CDC NIOSH, Pittsburgh, PA 15236, USA
[b] CDC NIOSH, Spokane, WA 99207, USA
[c] Department of Mining Engineering, West Virginia University, Morgantown 26501, USA
[d] Department of Mining Engineering, Missouri University of Science and Technology, Rolla, MO 65409, USA

Ground control is the science of studying and controlling the behavior of rock strata in response to mining operations. Ground-control-related research has seen significant advancements over the last 40 years, and these accomplishments are well documented in the proceedings of the annual International Conference on Ground Control in Mining (ICGCM) [1]. The ICGCM is a forum to promote closer communication among researchers, consultants, regulators, manufacturers, and mine operators to expedite solutions to ground control problems in mining [2–7]. Fundamental research and advancements in ground control science define the central core of the conference mission. Providing information to mine operators is a priority, as the conference goal is to offer solutions-oriented information. In addition, the conference has included innovative technologies and ideas in mining-related fields such as exploration, geology, and surface and underground mining in all commodities. Many new ground control technologies and design standards adopted by the mining industry were first discussed at ICGCM. This conference is recognized as the leading international forum for introducing new ground-control-related research and products.

Professor Syd Peng (West Virginia University), on his own initiative, organized the First Conference on Ground Control in Mining in the summer of 1981. Dr. Peng recognized that in order to advance the state-of-the-art in ground control, a forum was urgently needed whereby researchers, practitioners, equipment manufacturers, and government regulators could meet regularly and exchange information in a timely manner. Since 2016, the conference has been administered by the Society for Mining, Metallurgy & Exploration (SME). Five researchers, Ted Klemetti (NIOSH, Pittsburgh Mining Research Division), Brijes Mishra (West Virginia University), Kyle Perry (Missouri University of Science and Technology), Heather Lawson (NIOSH, Spokane Mining Research Division), and Michael Murphy (NIOSH, Pittsburgh Mining Research Division), currently serve as the lead team from the conference's organizing committee to ensure that the ICGCM continues to advance the science of ground control and develop solutions for difficult problems through innovative mine design strategies, operational practices, and engineering interventions.

Due to the COVID19 pandemic, the decision was made to cancel the face-to-face component of the 39th International Conference on Ground Control in Mining (ICGCM 2020) in order to protect the health of all participants. The papers submitted to the conference received extensive peer-review and are available through proceedings. In the proceedings, 37 papers are included across 10 subject areas, including Fundamental Ground Control Studies, Dynamic Failure in Underground Coal Mines, Advancements in Geotechnical Analysis Methods, and Advances in Remote Sensing. The proceedings cover a broad range of ground control issues encompassing all commodities and mining locations. Highlights include the following articles: Dr. Essie Esterhuizen (NIOSH, Pittsburgh Mining Research Division) published "Assessing Support Alternatives for Longwall Gateroads Subject to Changing Stress" that proposes two regression equations that could be used to estimate the likely roof deformation and height of roof yield due to longwall-induced stress changes. This information was used to assess support capacity and yield requirements of standing supports. The methods highlighted in this publication concludes five years of NIOSH research on gateroad entry stability.

Dr. Khaled Mohamed (NIOSH, Pittsburgh Mining Research Division) published "Preliminary Rib Support Requirements for Solid Coal Ribs Using A Coal Pillar Rib Rating (CPRR)", which demonstrates a new, easy-to-use mapping tool to measure the bearing capacity of ribs in underground coal mines. The developed CPRR can be used as a rib quality mapping tool in underground coal mines and to determine the potential of local rib instabilities and support requirements associated with overburden depth. Two sample cases were also demonstrated that illustrate the data collection form and CPRR calculations. Future research was proposed to expand the applicability of the CPRR for conditions where thick in-seam parting and solid rock brows are encountered. Mark Van Dyke (NIOSH, Pittsburgh Mining Research Division) published "Coal Mine Entry Rating System: A Case Study", which demonstrated research to examine the relationship of the parts of a coal mine entry as a system and not as individual components. NIOSH Researchers devised this rating system to improve upon previous ideas, offering increased flexibility that can be incorporated into an overall entry condition that offers different levels of confidence based on the user's time devoted to the inspection. This new entry rating system was implemented at three different mines over vary-

* Corresponding author.
E-mail address: mmu5@cdc.gov (M.M. Murphy).

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ing periods of time to evaluate the ground response to the geology, bolt installation pattern, stress changes by mining, overburden, and time dependency.

Dr. Christopher Mark's (MSHA) publication, entitled "Protecting Miners from Coal Bursts During Development Above Historic Mine Workings in Harlan County, KY", investigates the records of past mining at an underground mine to better understand the presence of hazardous underlying remnants in order for an active operation to reach a large, untapped reserve of high-quality coal. To mitigate the burst risk, the operation adopted a strategy of stress probe drilling. A self-propelled coal drill was used to auger 38-foot-long, small diameter holes in advance of mining. As each hole was drilled, the volume of cuttings was measured to detect the presence of highly stressed coal. This case history is the first application of stress probe drilling in the United States during development mining, though the technique has a long history in Germany and elsewhere.

Adam Lines (Anglo American) published "Proactive Interburden Fracturing Using UIS Drilling with Validation Monitoring", which discusses a series of gas inrush events that occurred during development at Grosvenor Coal Mine resulting in exposure to elevated levels of methane at the production face. The solution to preventing the gas inrush events involved creating a conduit in the interburden between the mined seam and the seam in the immediate floor to allow the gas to be drained during the development of the headings, as occurred in the cut-throughs. A series of underground inseam (UIS) holes were drilled using the directional drill rig with the aim of fracturing this interburden ahead of the face and promoting floor failure to allow the gas to release consistently.

Lastly, Junwu Du's (Xi'an University of Science and Technology) publication, entitled "Study on Strata Control Based on Pillar Stress and Surface Cracks in Shallow Multi-Seam Mining", examined the effect of different coal pillar offset distances on stress concentration of coal pillars and development of stratum cracks. Based on the findings, a formula for safe mining and reducing surface damage was established, which provided a theoretical basis for safe and environmentally friendly mining in shallow multi-seams. According to the results of the study, the optimal coal pillar offset distance (the side-to-side horizontal distance of the upper and lower coal pillars) between the upper and lower coal seams was developed to reduce the stress concentration of coal pillars and surface damage.

Additional papers from the proceedings, including the ones discussed above, from the 39th International Conference on Ground Control in Mining are included in this special issue of the International Journal of Mining Science and Technology. All other papers from this year's conference (and conferences from previous years) can be purchased from SME and will ultimately be available on OneMine (http://www.onemine.org/). We hope this special issue will provide useful references for engineers worldwide and for researchers and scholars in the field of ground control.

Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC). Mention of any company name or product does not constitute endorsement by NIOSH.

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