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中国煤炭学会
CHINA COAL SOCIETY



中国矿业大学(北京)
CHINA UNIVERSITY OF MINING & TECHNOLOGY-BEIJING



第 44 届国际采矿岩层控制会议

The 44th International Conference on Ground Control in Mining

会议手册

Conference Program

2025 年 9 月 26-29 日

26-29, Sept. 2025



CATALOGUE

Conference Introduction and Topics	1
Host, Co-organizing, Organizing Institutions.....	2
Conference Academic Committee	6
Conference Organizing Committee	9
Conference Meeting Notice	11
Conference Schedule	14
Conference Agenda.....	15
Organizing Committee Introduction.....	49
Conference Contact Information	43



第 44 届国际采矿岩层控制会议

The 44th International Conference on Ground Control in Mining

Ground Control Issues in Underground Lignite Coal Mines in Türkiye

15:45-15:55 茶歇 Break

9 月 27 日下午

地点: 9 号楼多功能厅

PM of September 27

Location: Multi-functional Hall, Building No. 9

特邀报告 Keynote Speech

主持人: 张茹、Şenol Hakan Kutoğlu

15:55-16:10

李振华 教授, 河南理工大学
Li Zhenhua, Professor, Henan Polytechnic University

复杂地质条件下覆岩运移规律及工程实践
Movement Laws of Overlying Strata and Engineering Practice under Complex Geological Conditions

16:10-16:25

张呈国 教授, 新南威尔士大学
Zhang Chengguo, Professor, The University of New South Wales

Ground Support Requirements for Rock Burst Control

16:25-16:40

左建平 教授, 中国矿业大学 (北京)
Zuo Jianping, Professor, China University of Mining and Technology (Beijing)

厚顶板破断模式转变机制及岩层移动力学模型
Transition Mechanism of Fracture Modes in Thick Roof and Mechanical Model of Strata Movement

16:40-16:55

李浩荡 教授级高工, 国家能源集团新疆能源公司
Li Haodang, Professor-level Senior Engineer, National Energy Group Xinjiang Energy Company

急倾斜特厚煤层短壁综放智能无人开采关键技术
Key Technologies for Intelligent Unmanned Short-Wall Fully Mechanized Top-Coal Caving in Steeply Inclined Extra-Thick Coal Seams

16:55-17:10

Le Tién Dzung Professor, Dept. of Underground Mining

Longwall Mining Behaviours under Near-Seam Fractured Sandstone Strata in Vietnam

17:10-17:25

张农 教授, 中国矿业大学
Zhang Wong, Professot China, University of winingand Technologye

复杂条件巷道煤岩体加固与改性材料研发及应用





TRƯỜNG ĐẠI HỌC MỎ - ĐỊA CHẤT

HANOI UNIVERSITY OF MINING AND GEOLOGY

LONGWALL MINING BEHAVIOURS UNDER NEAM-SEAM FRACTURED SANDSTONE STRATA IN VIETNAM

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CONTENTS

1. Introduction
2. Vang Danh coal mine, Quang Ninh coalfield, Vietnam
3. Simulation of longwall mining under fractured strata
4. Longwall face behaviours under fractured sandstone strata
5. Longwall face behaviours in variation of strata characteristics
6. Conclusions



1. INTRODUCTION

- ❑ In Vietnam coal reserves in favourable geological conditions for longwall mining become depleted.
- ❑ The mining in less favourable conditions (i.e., under near-seam strong sandstone) is needed → face instability.
- ❑ When sandstone are embedded with pre-existing discrete structures (i.e., fault-associated fractures), strata movement breaks structures → creates potential paths for methane gas emission and water inrush.



Fig. 1 Longwall face in Vang Danh coal mine, Vietnam: stability (left, no mesh) and instability (right, with mesh)

1. INTRODUCTION

- ❑ Longwall behaviours has been well studied, but mostly under massive, bedded or uniformly jointed strata.
- ❑ The behaviours caused by strong strata embedded with discrete structures is poorly understood.
- ❑ Reasons = great number + geometric variation of pre-existing structures → insufficient consideration of fractures.



Fig. 1 Longwall face in Vang Danh coal mine, Vietnam: stability (left, no mesh) and instability (right, with mesh)

2. VANG DANH COAL MINE, QUANG NINH COALFIELD, VIETNAM

- ❑ The mine ∈ Vinacomin, located in Quang Ninh.
- ❑ 02 fault systems striking in parallel (4 faults) & meridian directions (12 faults).

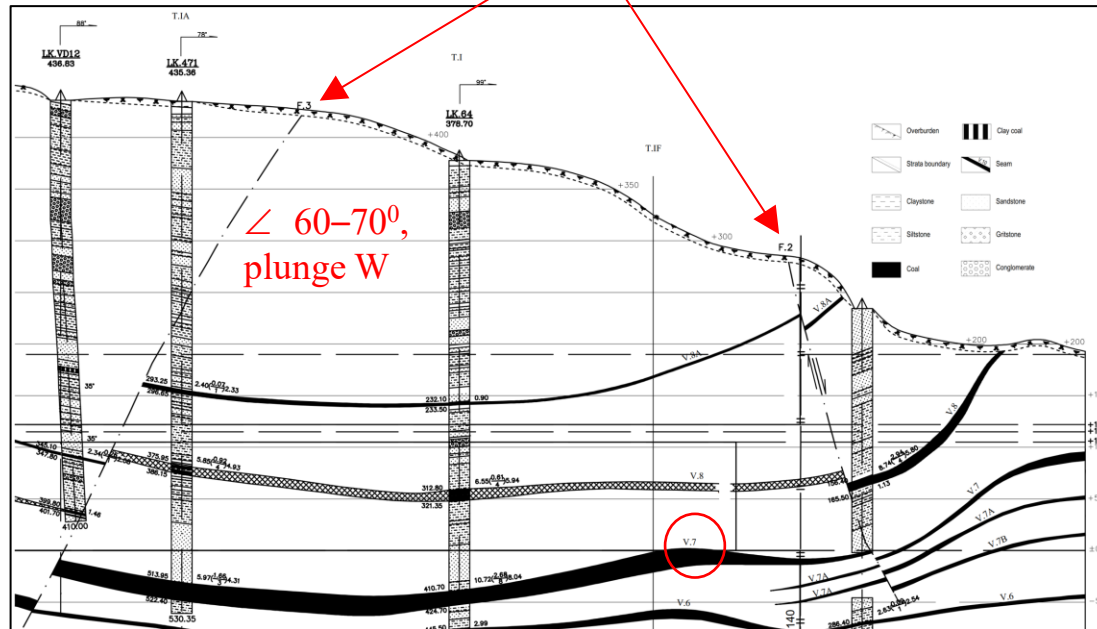
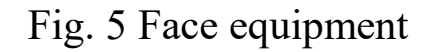


Fig. 3 Geological cross section along seam strike
(Vinacomin Mining Geology Joint Stock Company, 2016)



Fig. 2 Vang Danh coal mine, Quang Ninh coalfield, Vietnam
(Quang Ninh Portal, 2025)

❑ Panel I-7-5: layout & equipment



2. VANG DANH COAL MINE, QUANG NINH COALFIELD, VIETNAM

❑ Panel I-7-5: field measurement

- **Lack of real-time monitoring.**
- In 150 m of face retreat, shield leg pressure fluctuated in 16–25 MPa. Piston displacement was 0.7–0.9 m.
- In first 65 m, leg pressure followed cycles with increasing peaks (21 to 25 MPa). The cycles due to caving of top coal/immediate roof, sagging/rupture of main roof.
- In last 85 m, leg pressure followed steady fluctuations, indicating steady-state movements of roof strata. No noticeable decrease in piston displacement.

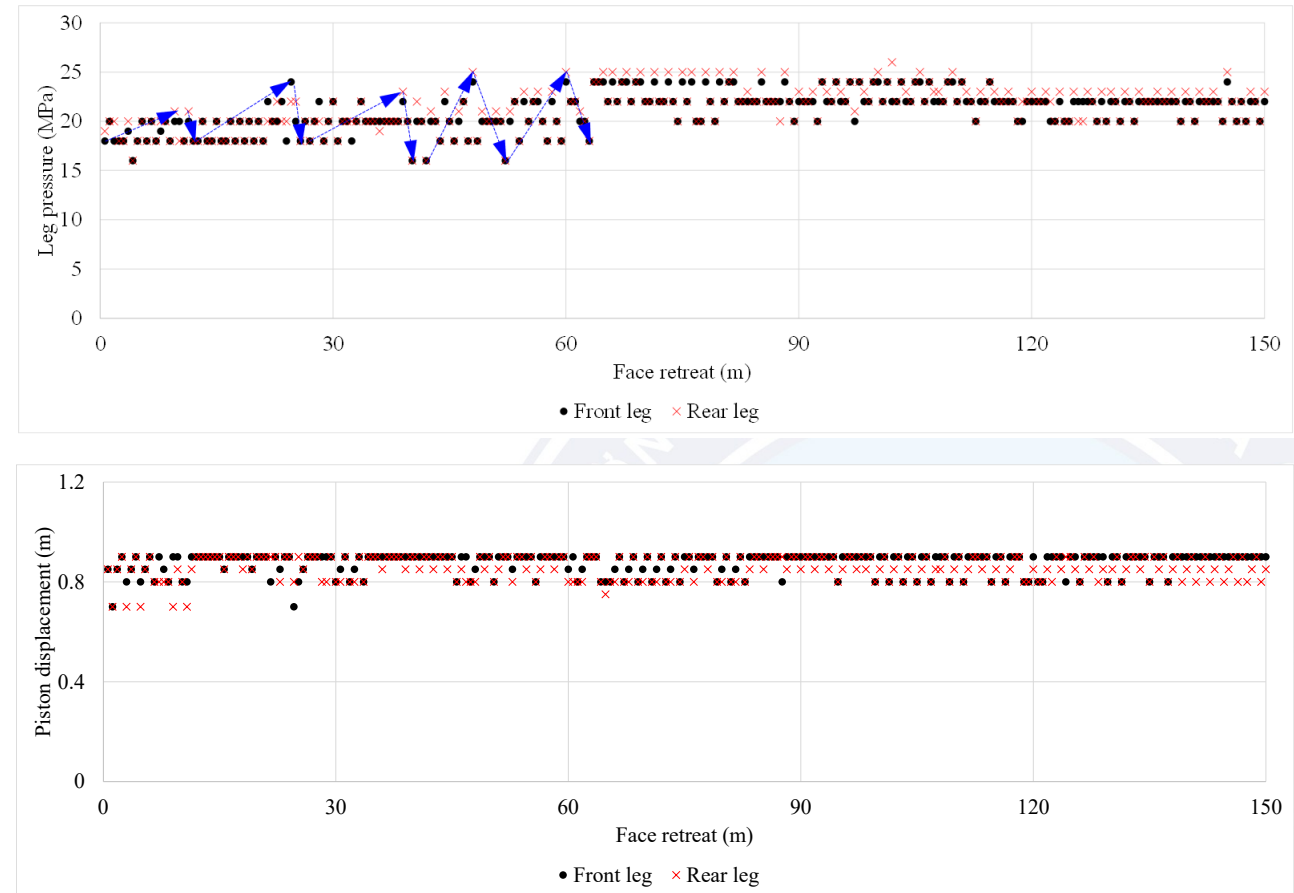


Fig. 6 Leg pressure & piston displacement

2. VANG DANH COAL MINE, QUANG NINH COALFIELD, VIETNAM

❑ Panel I-7-5: field measurement

- Face instability was quantified via retreat interval between 2 consecutive events and number of intervals.
- Face instability occurred after a minimum span of 1 web (0.6 m, 2 events), maximum span of 17 webs (10.2 m, 2 events), frequent span of 3 webs (1.8 m, 12 events) due to cyclic caving of top coal and immediate roof.
- The instability also occurred in varied intervals due to hanging and rupture of main roof layers (due to discrete fractures).

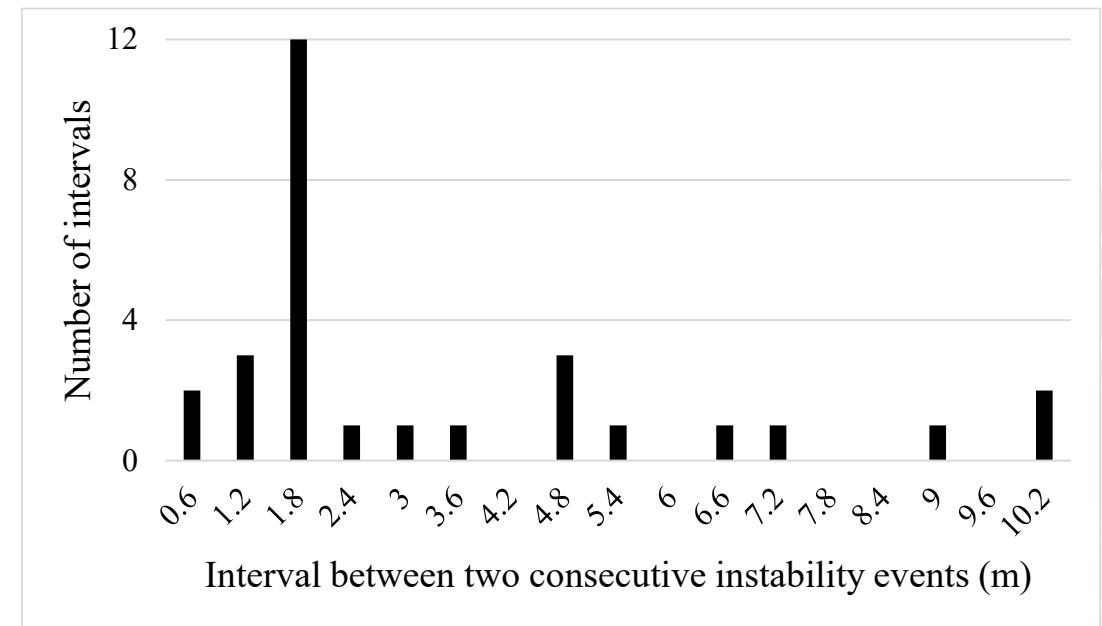


Fig. 7 Frequency of instability events

3. SIMULATION OF LONGWALL MINING UNDER FRACTURED STRATA

□ Geometry:

(Le and Oh, 2022)

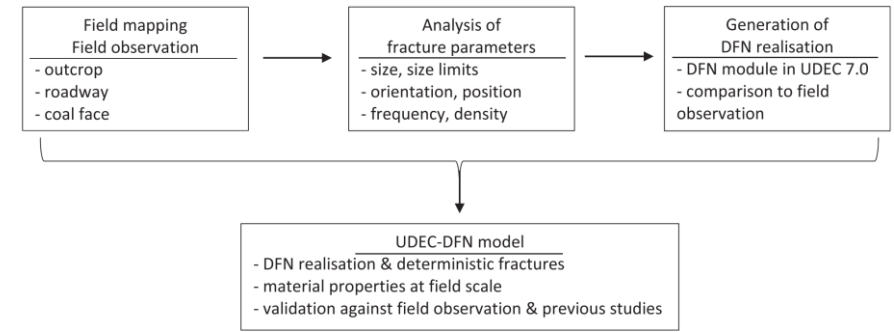
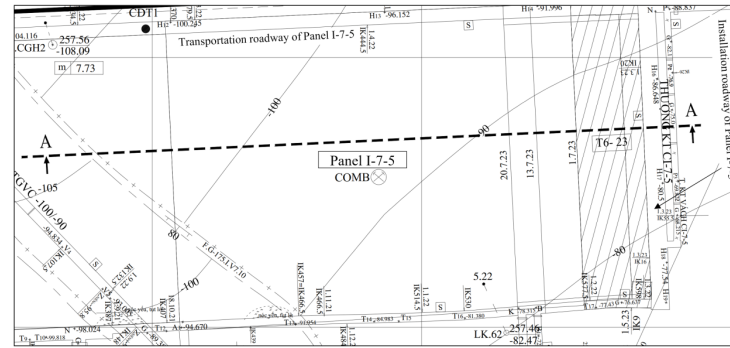
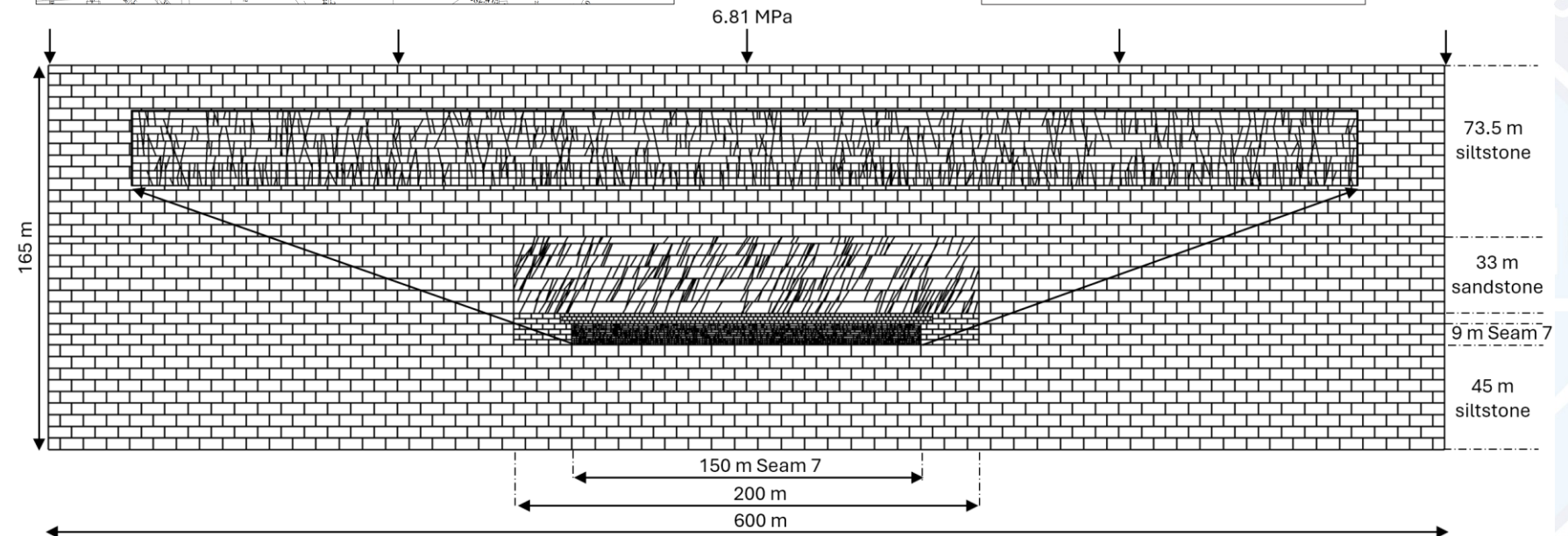


Fig. 8 Simulation of Panel I-7-5



3. SIMULATION OF LONGWALL MINING UNDER FRACTURED STRATA

□ Monitoring & calibration:

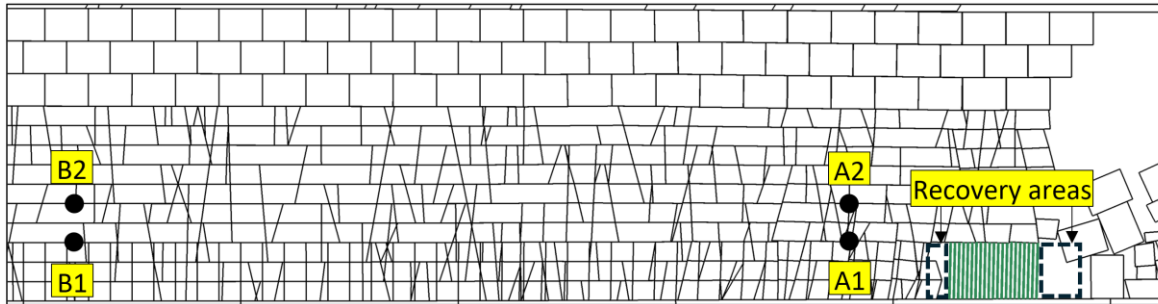


Fig. 9 Model monitoring

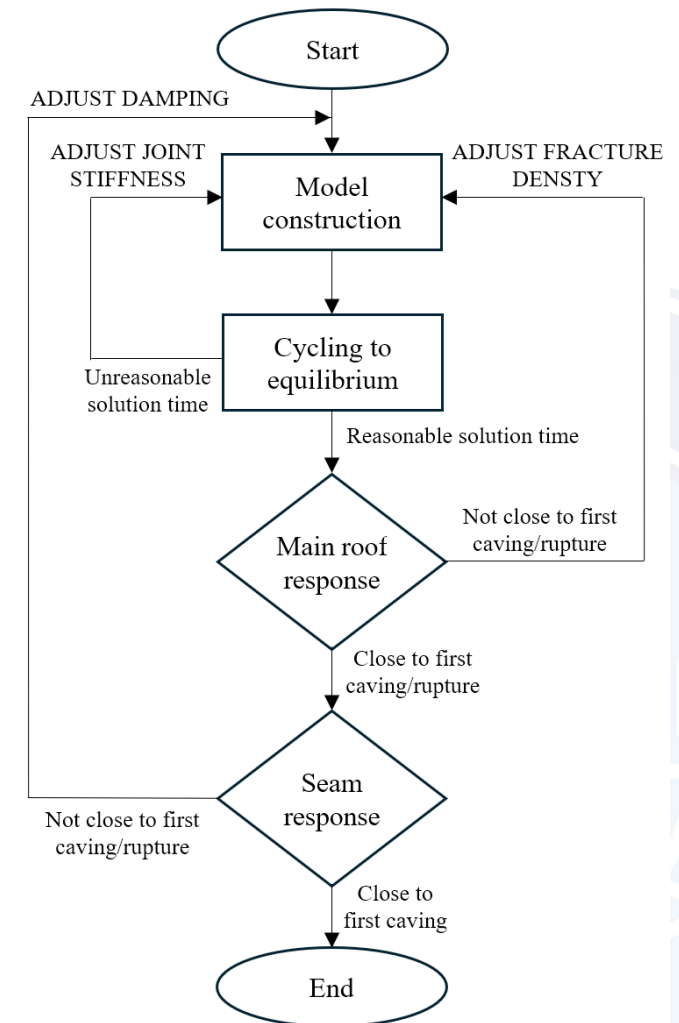


Fig. 10 Calibration procedure

4. LONGWALL FACE BEHAVIOURS UNDER FRACTURED SANDSTONE STRATA

□ Stress distribution: tensor

- Release of stress tensor initially formed “elliptical” zone → gradually turned to “pear” zone when hanging roof caved/ruptured.
- Inside stress release zone, compressive stress gradually re-develop in rocks, reaching its pre-mining value after a certain face retreat.
- Outside stress release zone, mining formed horizontal stress concentration in roof. When roof caved/ruptured, the concentration transferred to upper rock layers.

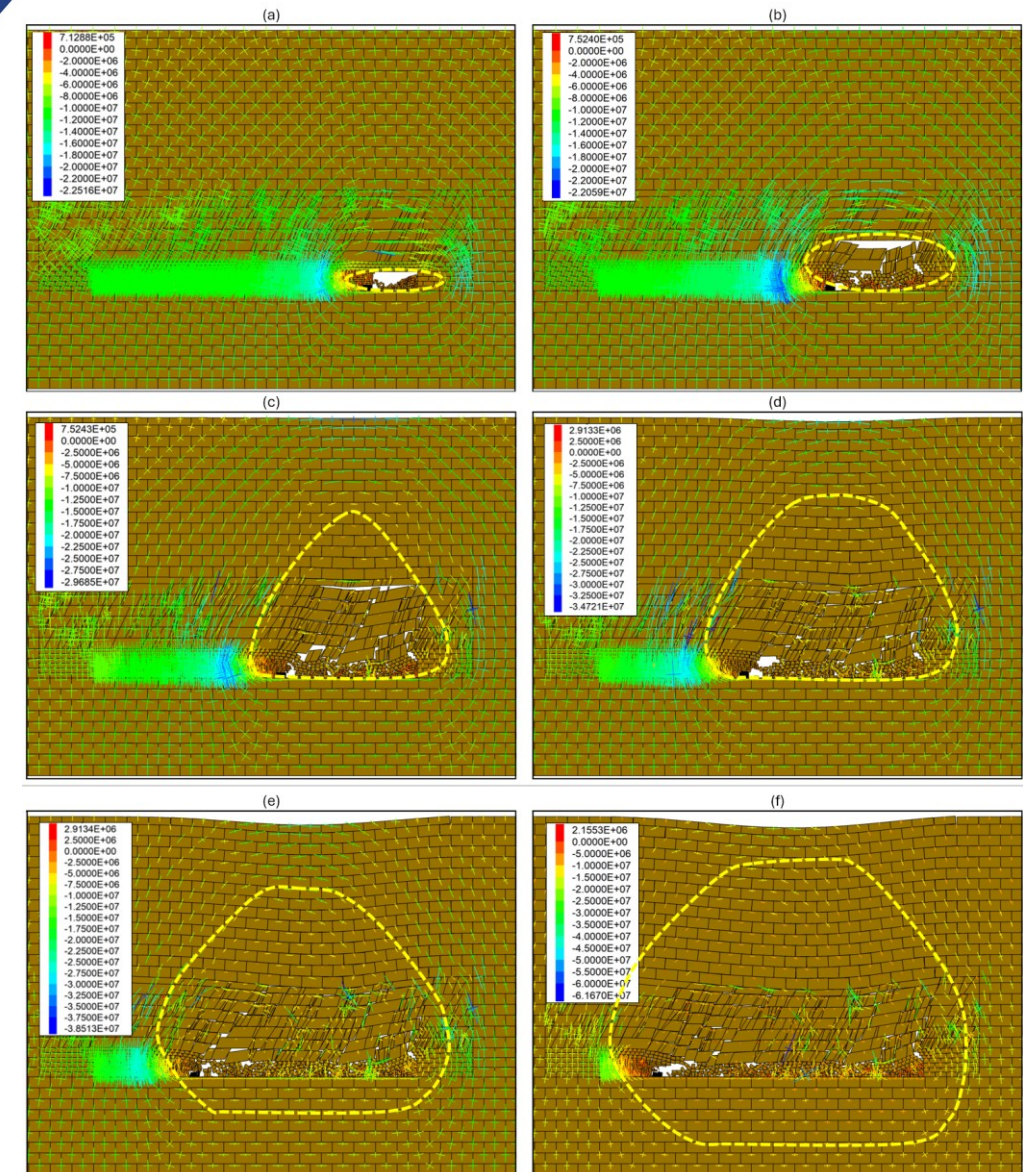


Fig. 11 Stress tensor at each 20 m face

4. LONGWALL FACE BEHAVIOURS UNDER FRACTURED SANDSTONE STRATA

□ Stress distribution: at fixed points

- At A1 & A2 (and also B1 & B2), the change in vertical stress followed similar trends: increased and reached peak value of 15–16 MPa at 20–22 m ahead of coal face → then rapidly decreased → fluctuated around 0.
- As the face retreated 85 m, stress at A1 increased again. It recovered its pre-mining value after 110 m and reached a peak value (13 MPa) after 118 m. The results confirmed the stress re-development in mined-out area.
- Caved rock recovered pre-mining stress at distance = $0.2 \times$ overburden thickness, which is $< 0.3\text{--}0.4$ times in literature → the presence of pre-existing discrete fractures facilitates strata caving and reconsolidation of caved rocks.

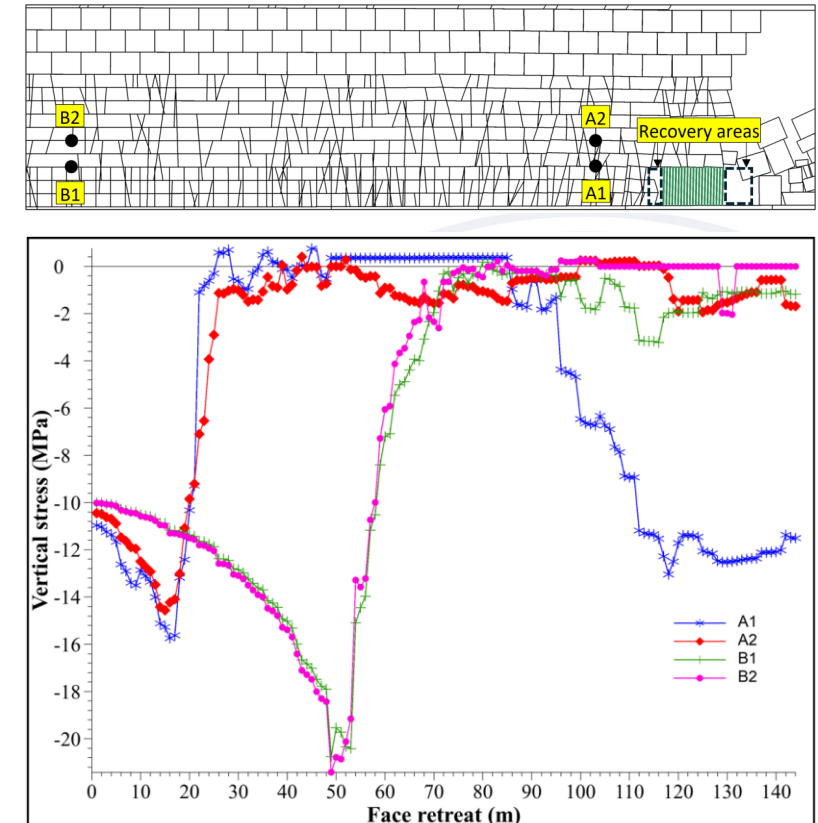


Fig. 12 Vertical stress at fixed locations during face retreat

4. LONGWALL FACE BEHAVIOURS UNDER FRACTURED SANDSTONE STRATA

□ Face stability:

- In total 144 cuts, coal face remained stable in 64 cuts without any face spall/top coal fall (44%).
- Coal face showed major instability in 33 cuts where both face spall and top coal fall occurred (23%). The frequencies agreed with on-site engineer's experience.
- Amongst the major face instability events, severe events (> 3 spalled + fallen blocks) occurred in relation to roof strata stability.
- As mining progressed further, the event became more severe because a greater number of roof layers hung up and ruptured.

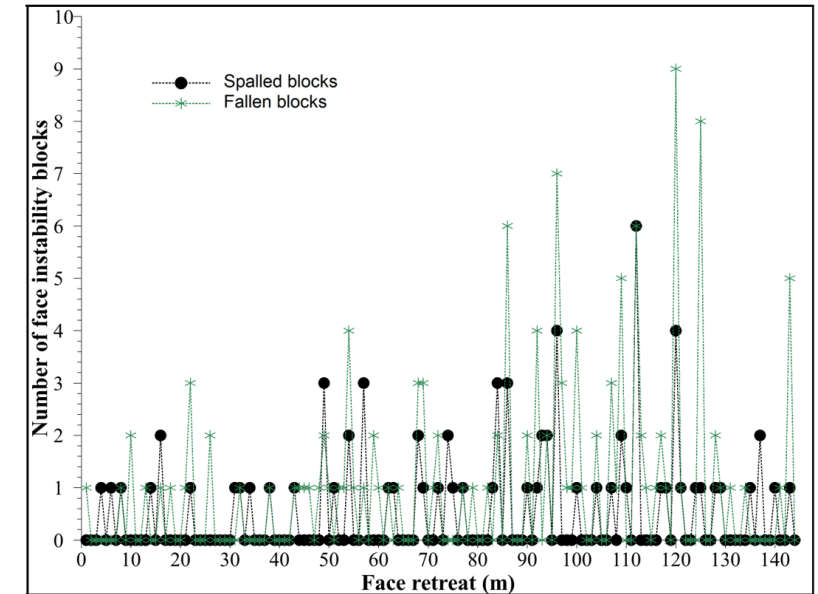


Fig. 13 Number of face instability blocks in each face retreat

5. LONGWALL FACE BEHAVIOURS IN VARIATION OF STRATA CHARACTERISTICS

❑ Rock strength and elastic modulus:

- When main roof rock strength increased, coal face and top coal became **more** stable.
- When main roof rock elastic modulus increased, coal face became **more** stable, while top coal not much impacted.

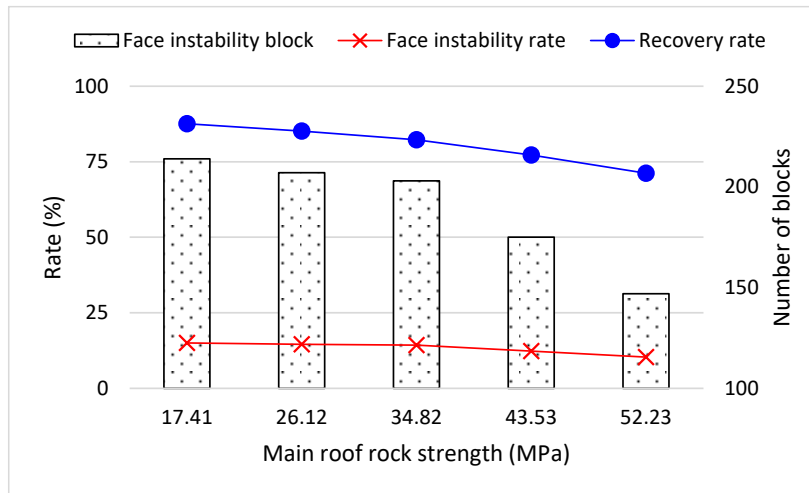


Fig. 14 Impact of MR rock strength

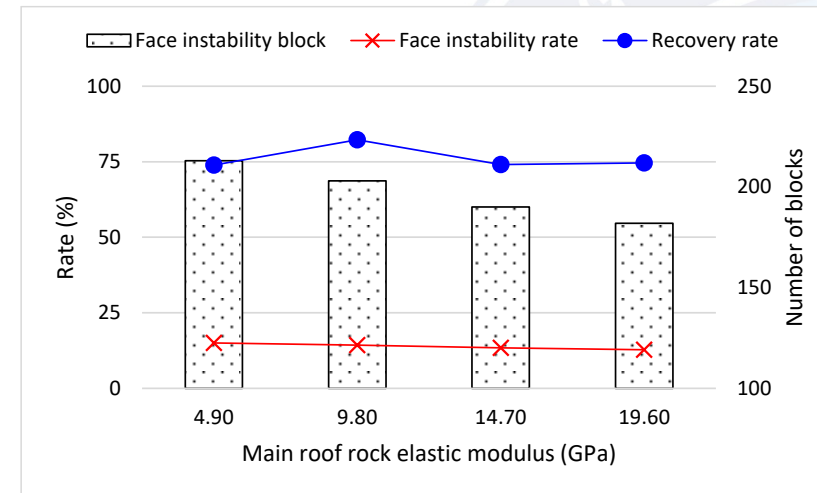


Fig. 15 Impact of MR rock elastic modulus

5. LONGWALL FACE BEHAVIOURS IN VARIATION OF STRATA CHARACTERISTICS

❑ Roof and bedding thickness:

- When main roof thickness increased, coal face and top coal became **less** stable.
- Impact of bedding thickness: not clear as DFN realisation also changed, needs improve modelling technique.

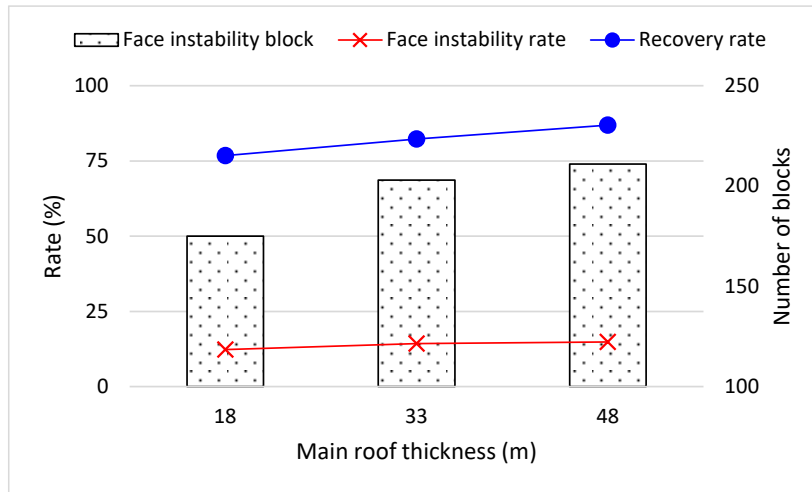


Fig. 16 Impact of MR thickness

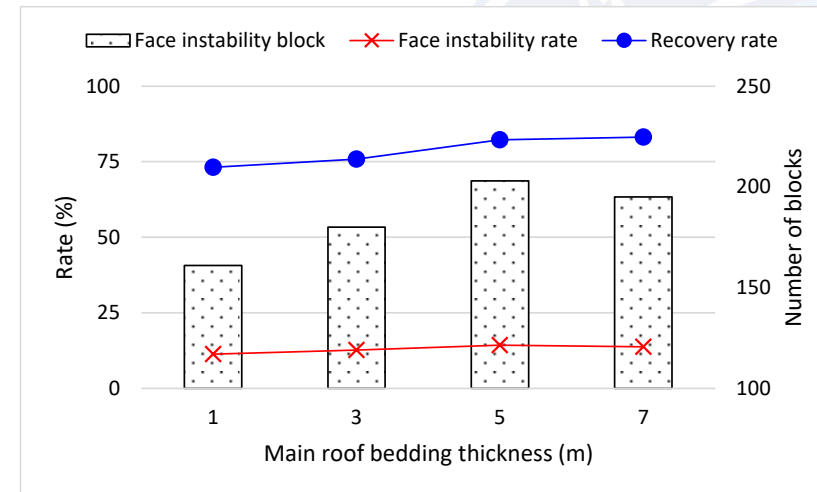


Fig. 17 Impact of MR bedding thickness

5. LONGWALL FACE BEHAVIOURS IN VARIATION OF STRATA CHARACTERISTICS

❑ Fracture density and strata location:

- When fracture density in main roof increased, coal face and top coal became **less** stable.
- When main roof was further above coal seam, coal face and top coal became **more** stable.

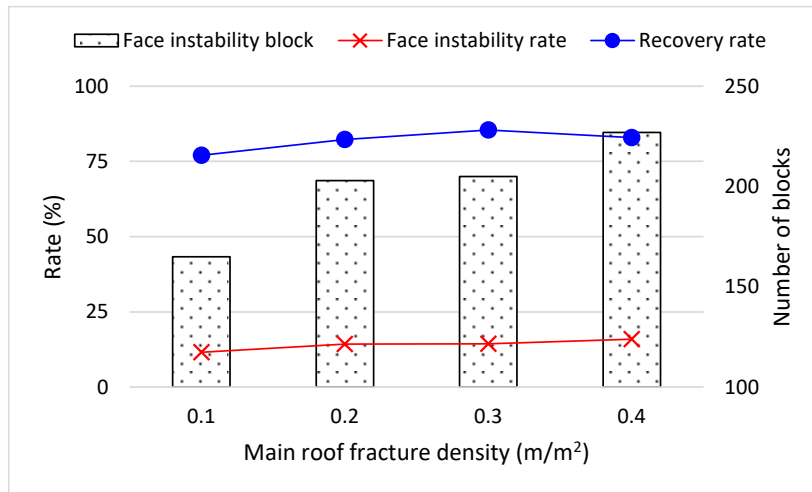


Fig. 17 Impact of fracture density

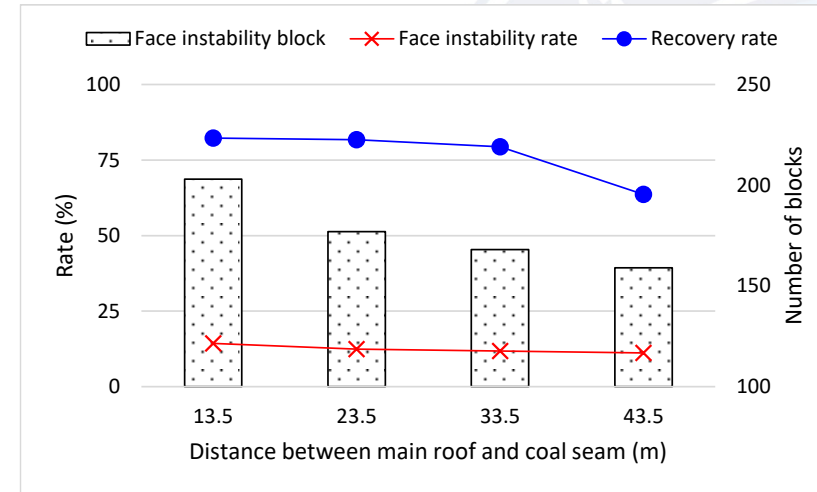


Fig. 18 Impact of MR location

6. CONCLUSIONS

- ❑ Vietnam has large coal reserves for longwall mining under near-seam fractured sandstone strata.
- ❑ The study demonstrates that the shape of stress release zone is in “pear” shape.
- ❑ Inside stress release zone, the steady-state movement of roof strata causes the compressive stress to re-develop in reconsolidated rocks in mined-out area.
- ❑ The coal face behaviour is demonstrated to closely relate to roof strata stability.
- ❑ When main roof (MR) characteristics vary, coal face is more stable when the strength and elastic modulus of MR rock increase. Similar behaviour is manifested when distance between coal seam and MR increases.
- ❑ In contrast, face is found to be less stable when the thickness and fracture density of MR increase.
- ❑ Behind shield support, top coal shows clear relationships with main roof rock strength, main roof strata thickness, and distance between coal seam and main roof.
- ❑ Deeper understanding helps engineers in better controlling geotechnical hazards associated with varied rock characteristics → safe and environmentally sustainable coal mining can be better maintained.

THANK YOU!



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4. Vinacomin Mining Geology Joint Stock Company, *Report on results of supplemental exploration for mechanization of Vang Danh coal mine - Uong Bi - Quang Ninh*, 2016.

