

Numerical simulation of crown pillar behaviour in transition from open pit to underground mining

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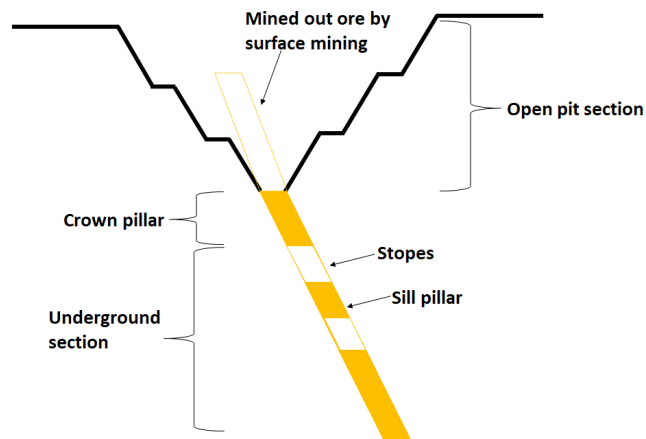
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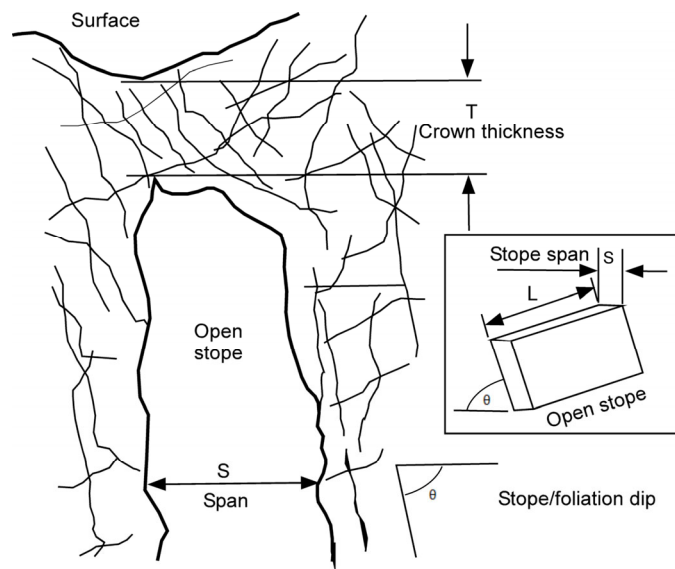


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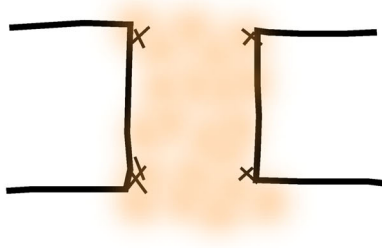
Fig. 1 Schematic of a crown pillar between an open pit and underground sections in a mine



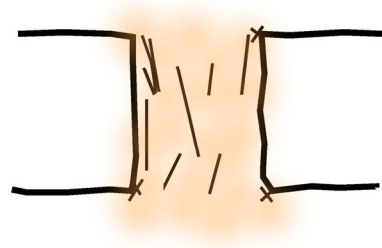
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Fig. 2. Geometry parameters of the crown pillar (modified from Carter, 2000)

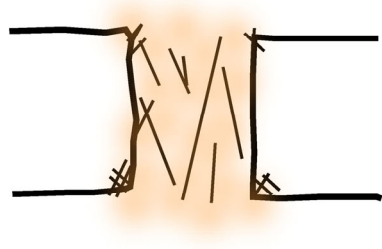
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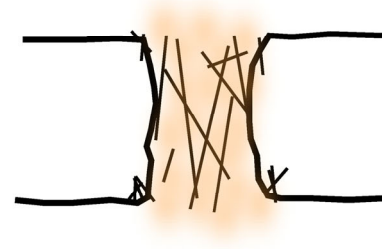
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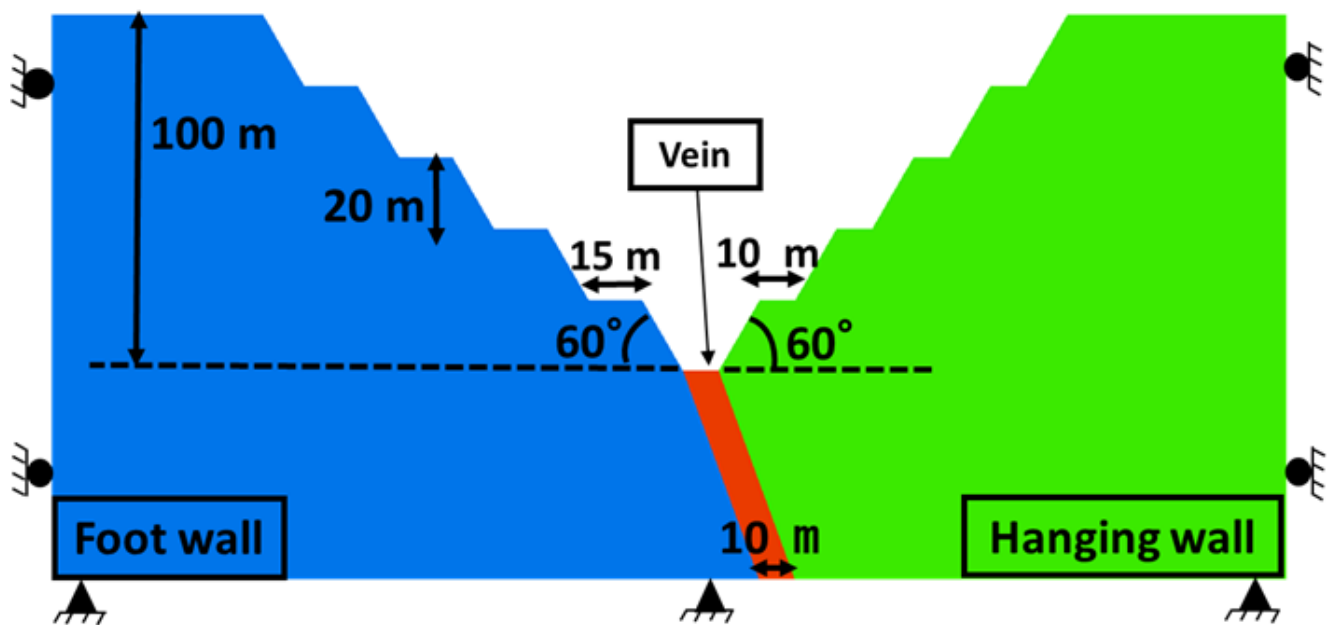
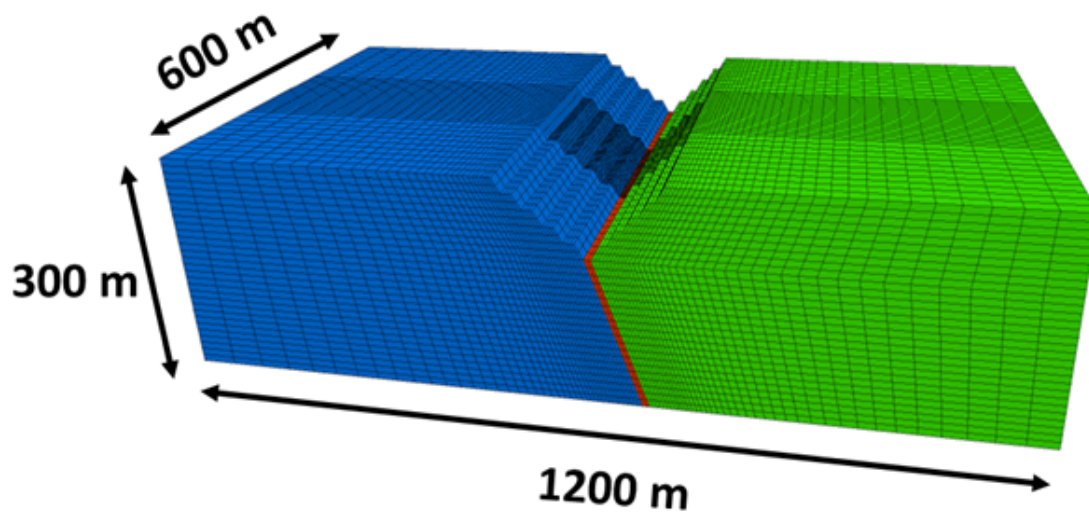


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Fig. 3 Pillar failure process



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2 **Fig. 4** Model setup and dimensions is FLAC 3D

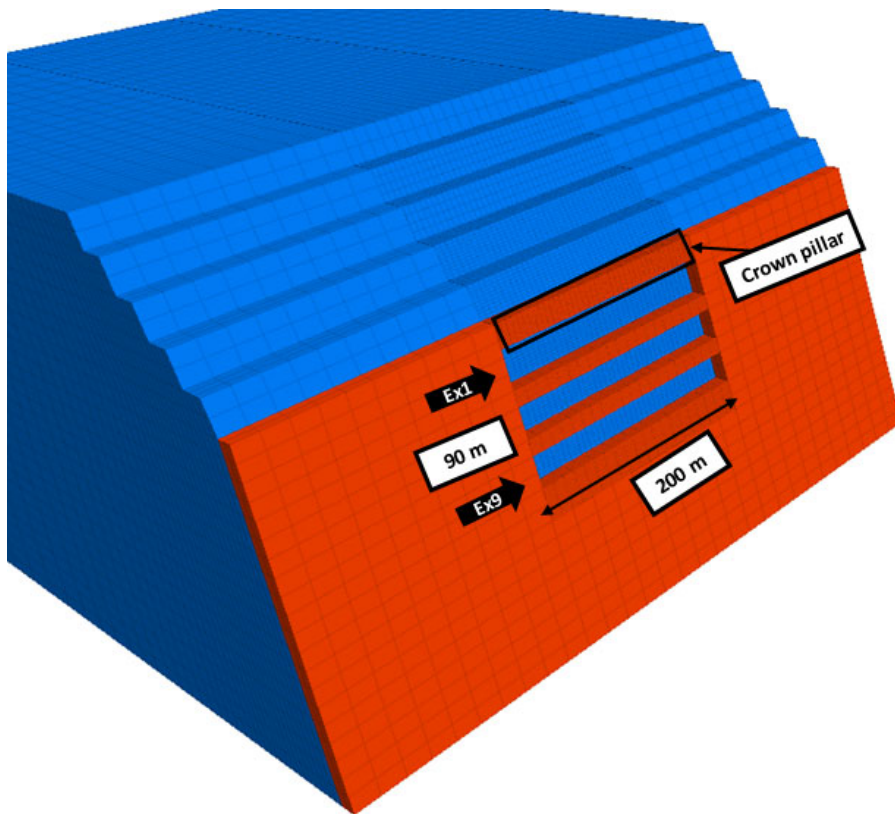
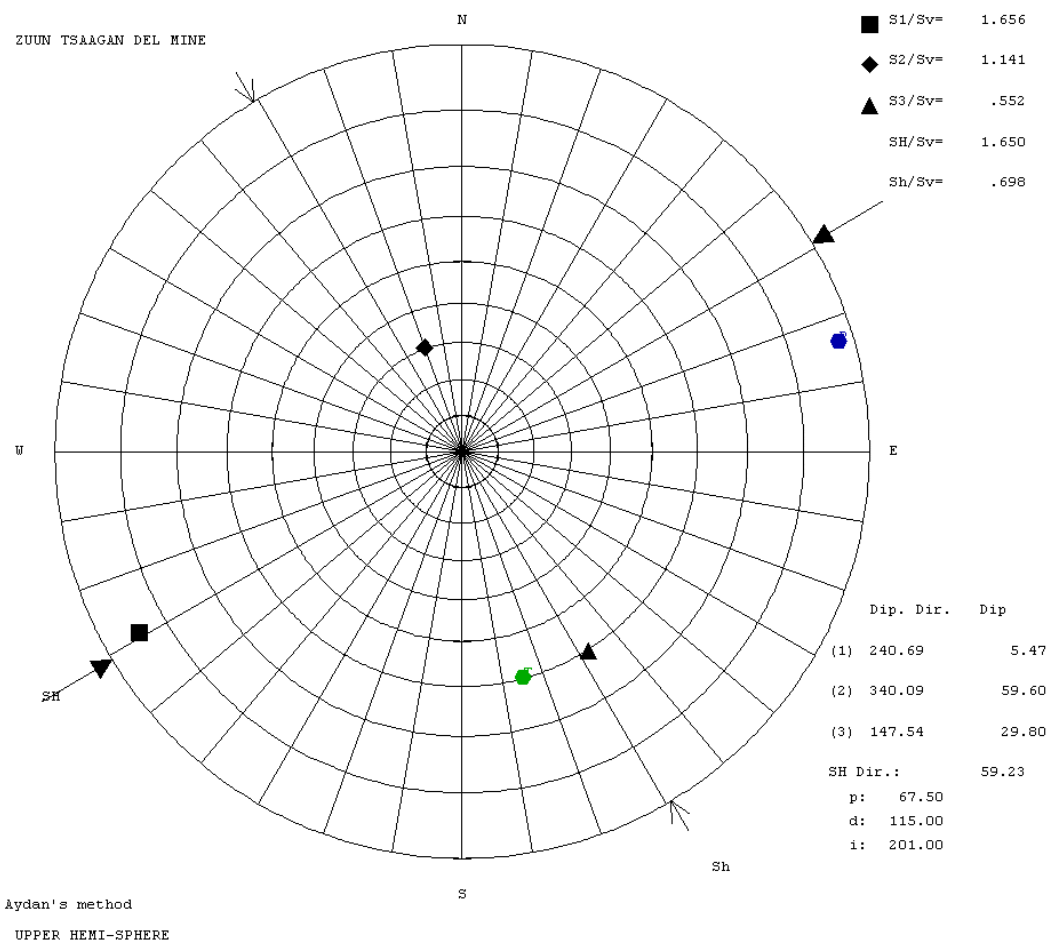


Fig. 5 Underground mining sequence



1 EQUAL ANGLE PROJECTION

2 **Fig. 6** Estimated in situ stress for the Zuun Tsagaan Del Mine

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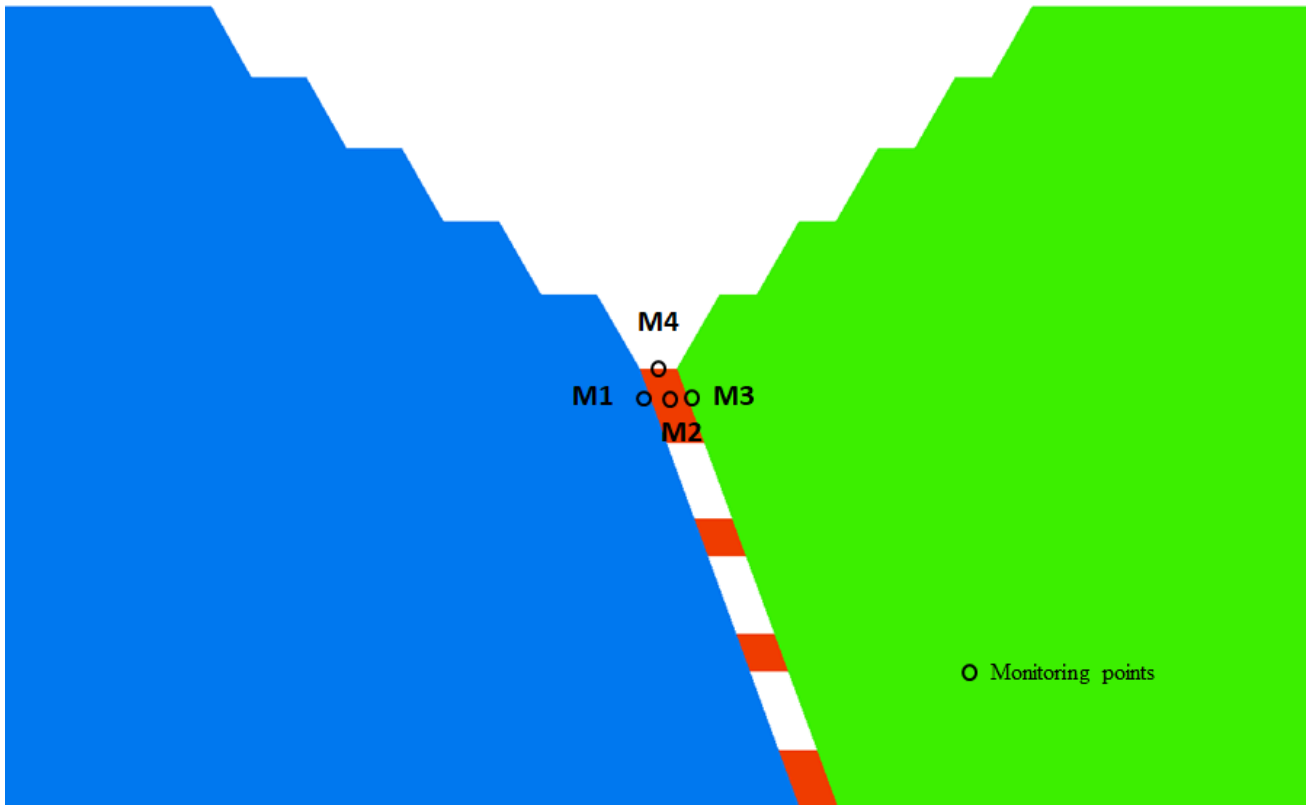


Fig. 7 Monitoring points position around the crown pillar

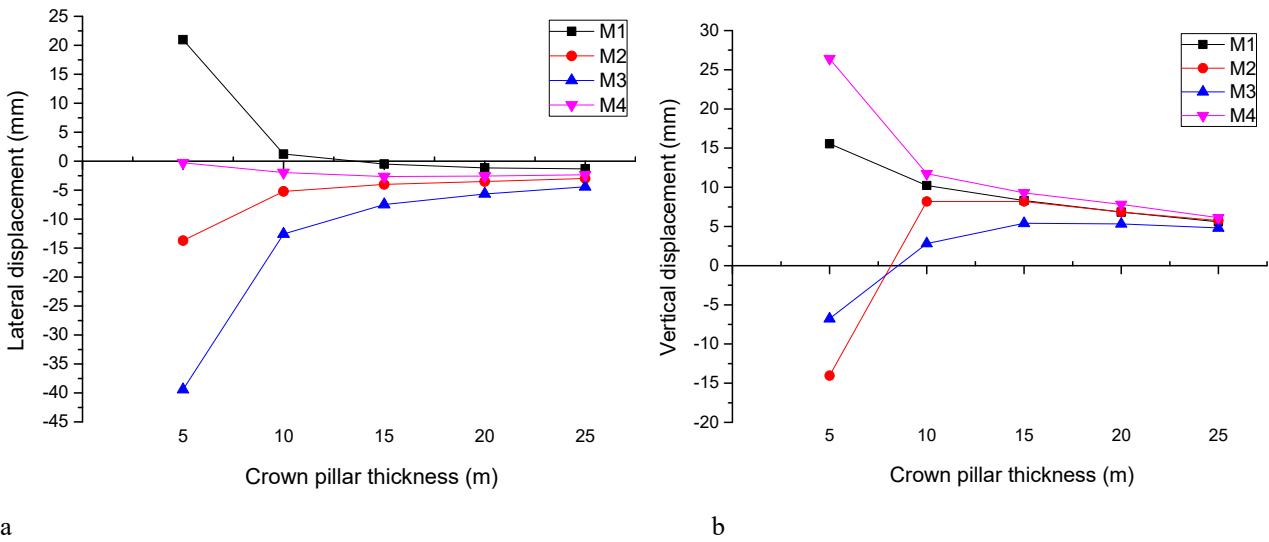


Fig. 8 Displacements around the crown pillar a) Lateral displacement b) vertical displacement

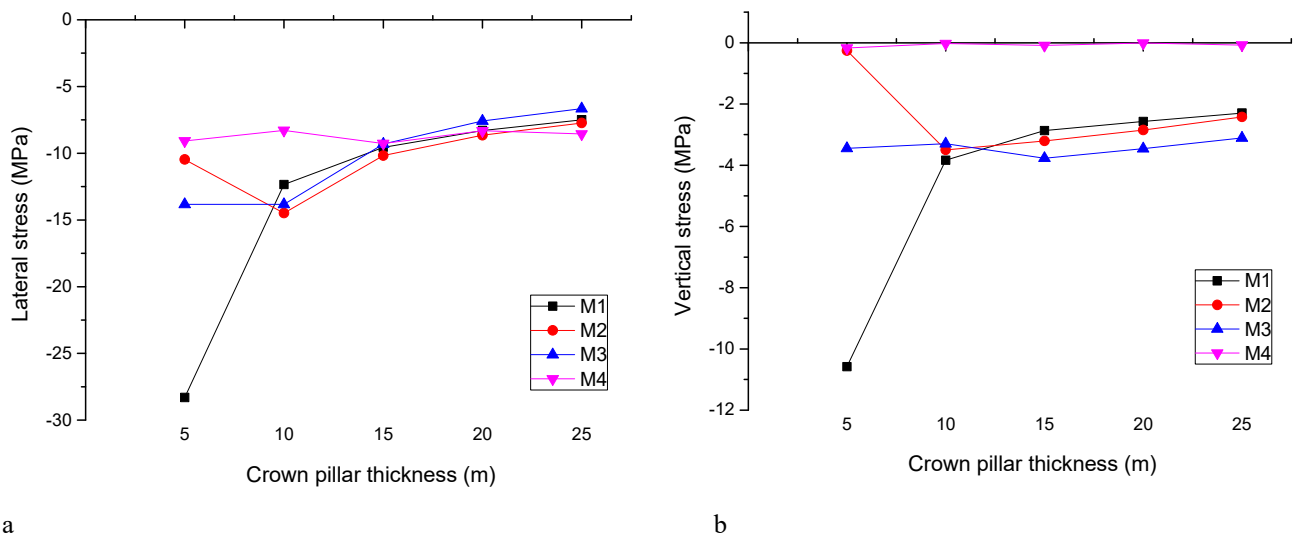


Fig. 9 Stress distribution around the crown pillar a) Lateral stress b) vertical stress

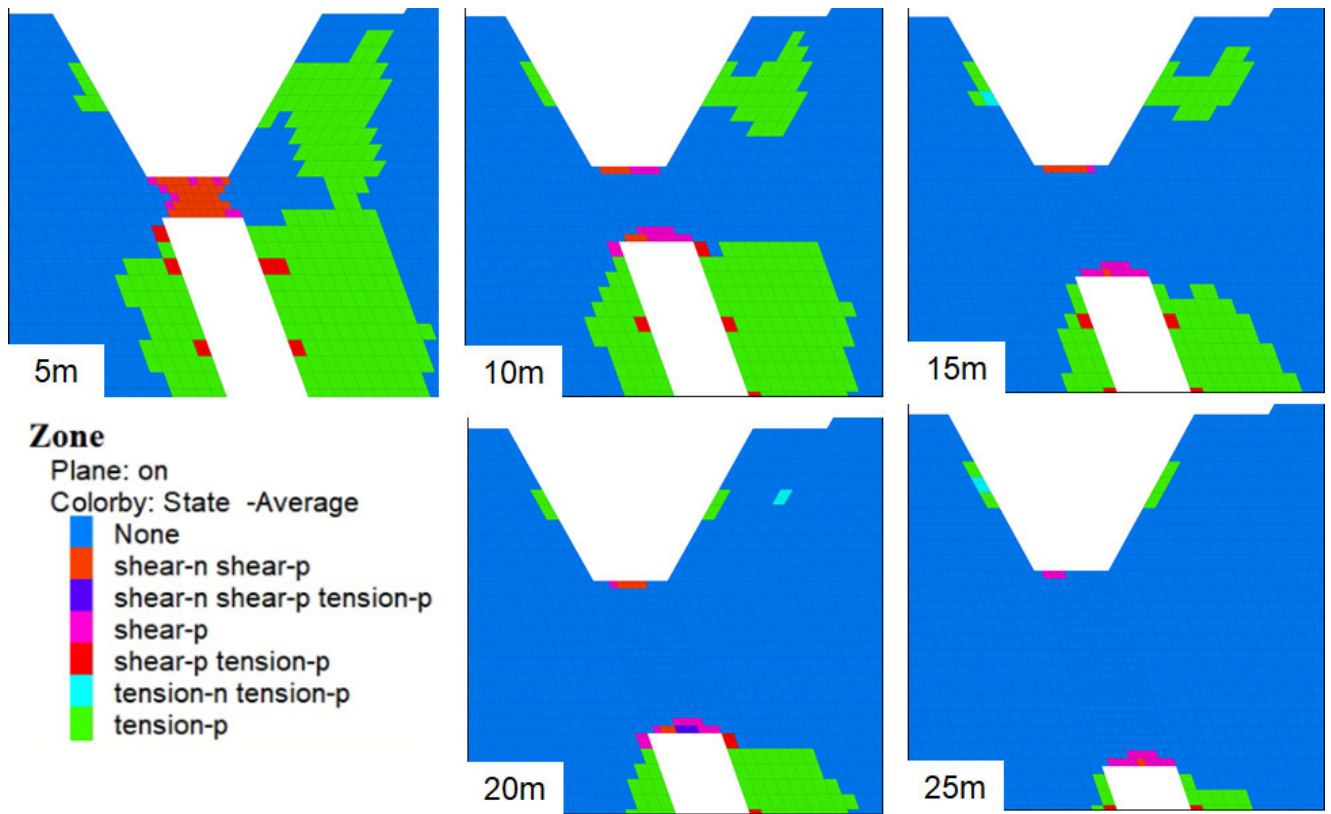


Fig. 10 Yielding zones around the crown pillar at different thickness

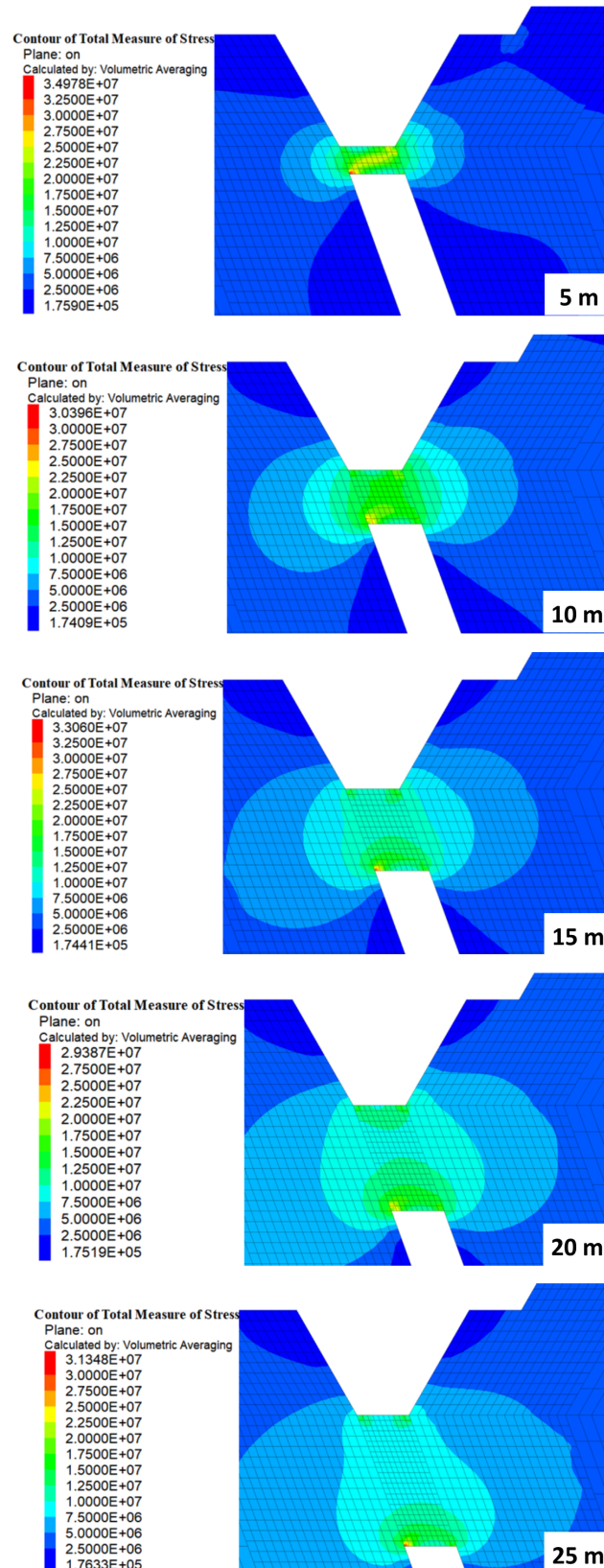


Fig. 11 Total stress (Pa) distribution around the crown pillar at different thickness

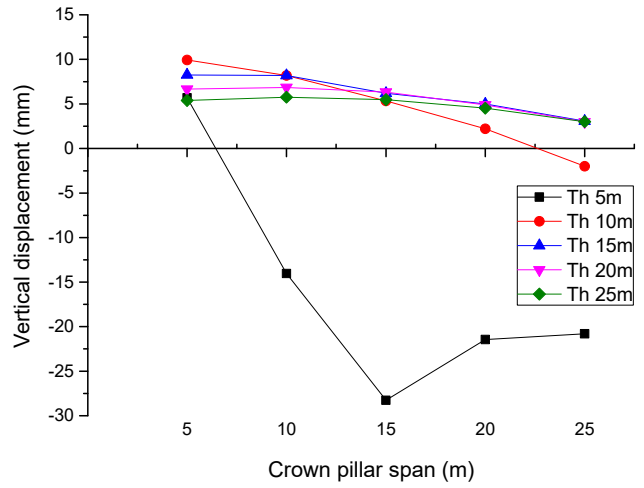
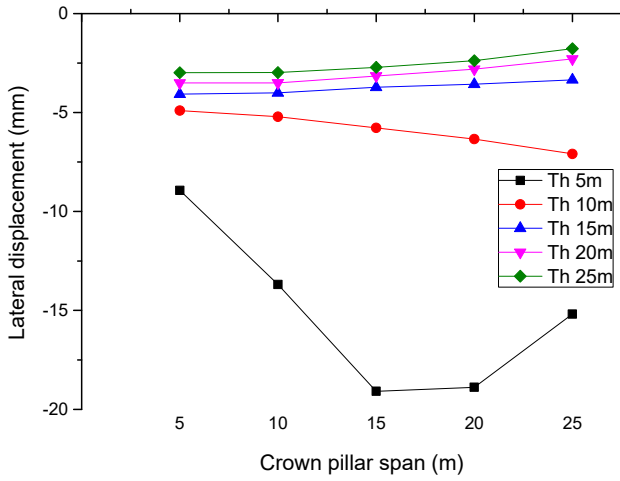


Fig. 12 Relationship between the crown pillar span and thickness a) Lateral displacement b) Vertical displacement

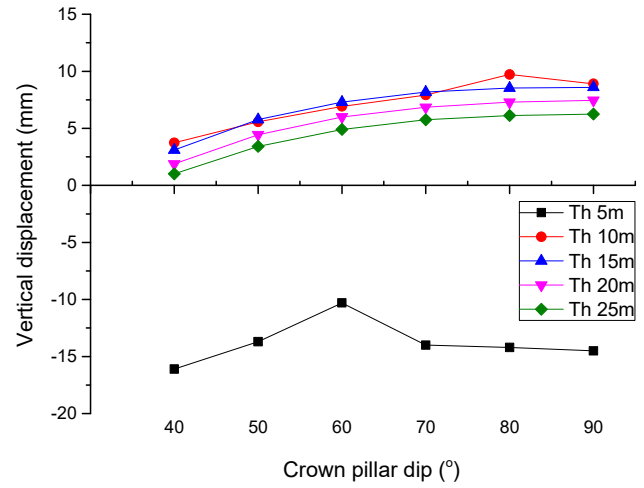
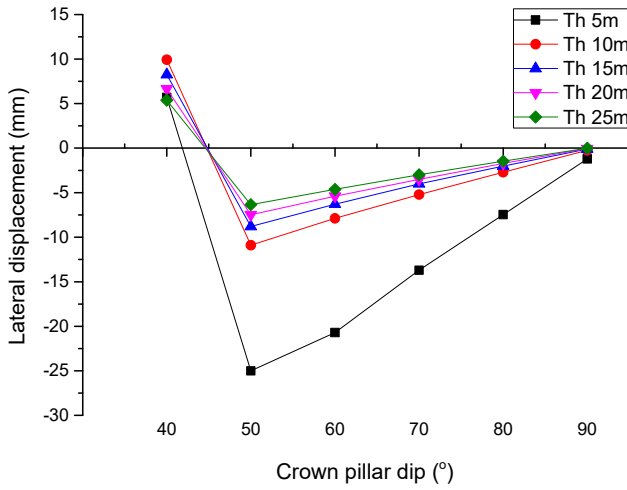


Fig. 13 Relationship between the crown pillar thickness and dip displacements a) Lateral displacement b) vertical displacement

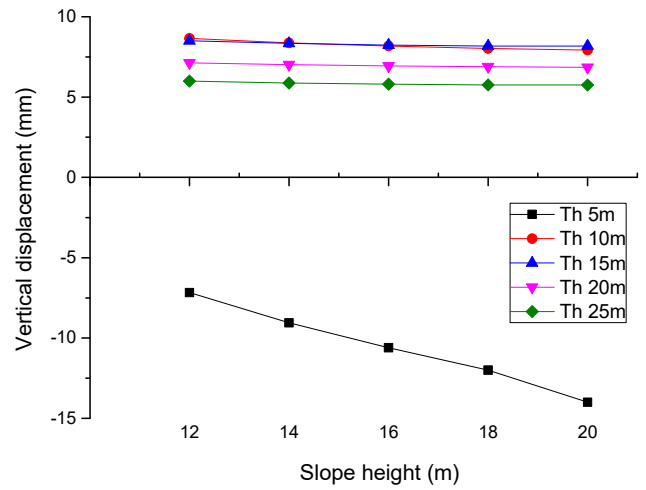
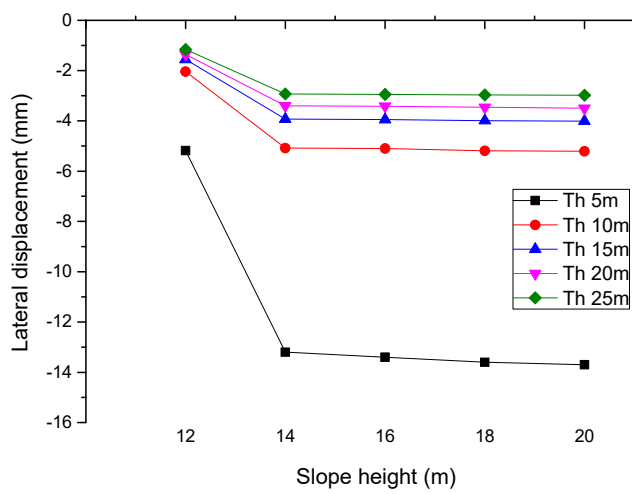


Fig. 14 Bench height displacement a) Lateral displacements b) Vertical displacements

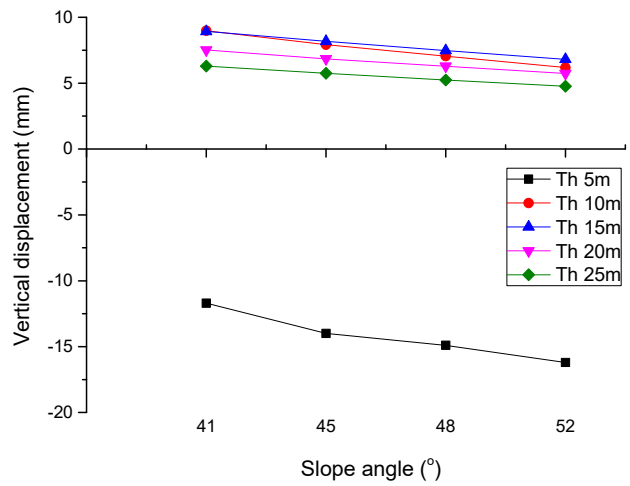
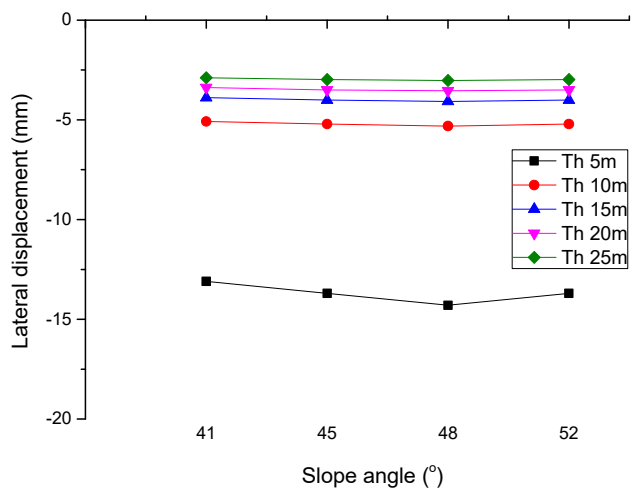


Fig. 15 Slope angle displacement a) Lateral displacements b) vertical displacements