

UDEC Modelling of the Gunpowder Mine, Mt Isa

Damien L Keys, Gustav S Nortje, John G McLellan

Introduction

The Gunpowder copper deposits, Mammoth and Esperanza are located 115km north of Mt Isa. Mineralisation is hosted in Proterozoic sediments and is structurally controlled.

A substantial body of work has been completed on the structural regime of the Gunpowder deposits, yet discrepancies remain over the direction of the maximum principal stress at the time of mineralisation (mainly due to an earthy hematite overprint on faulting). Documented thoughts on the stress regime include:

- **Askew, 1992** – overall kinematics of the mine area during D3 are transpressional with maximum principle compressive stress orientated ENE-WSW
- **ERA Maptec, 1994** – copper mineralisation occurred during a steeply inclined EW compression event resulting in NS extension
- **Connors, 1997** – copper mineralisation occurred during NE-SW transpression

All of the authors of the conflicting structural theories, agree that mineralisation was syn to post D3.

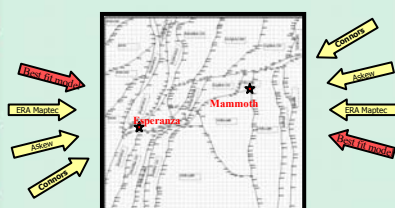


Fig. 3. Previous structural theory with best fit model being oriented 101°-281°.

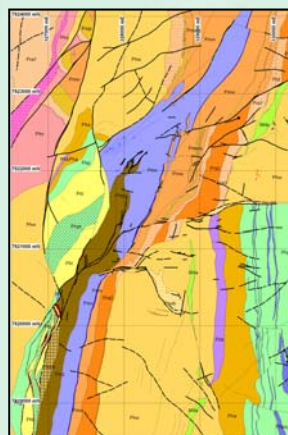


Fig. 1. Gunpowder Regional Mapping – J. Crossing (04)

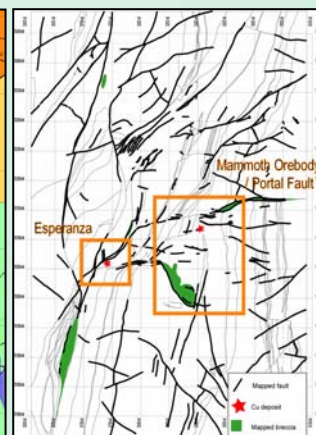


Fig. 2. Focus areas

UDEC – What is it and why use it?

UDEC is a distinct element modelling code that is optimised for dealing with faults and fractures. The rock mass is represented as an assembly of discrete blocks that may be internally deformable, where the contacts or faults can have a wide range of properties assigned.

UDEC is more than just “stress mapping” software. Several recent software improvements including calculations for Pff (pore fluid pressure for failure) and visualisation of fluid flow vectors through faults, now make it ideal for systems where faults dominate flow architecture.

The 2D package is extremely useful for plan modelling when faults are steep and have a dominant strike-slip component of movement.

It is ideally suited to many of the Mt Isa Inlier copper deposits for the following reasons – fault controlled deposits, steeply dipping faults, dominantly strike-slip movement during D3.

Mammoth Orebody / Portal Fault Zone

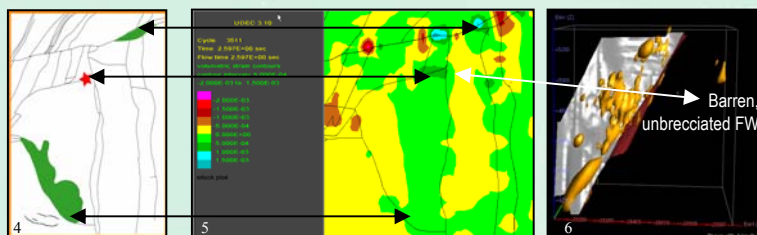


Fig. 4. Mammoth focus area

Fig. 5. Volumetric strain map. Positive values (greens/blues) are dilational sites, while negative values (yellows/red) are contractional. The modelling shows the FW of the system is contractional and dilation occurs in the Mammoth ore zone and along the Mammoth Extended Fault – as seen within the deposit.

Fig. 6. Leapfrog modelling of the Mammoth orebody, looking north. The Mammoth Fault is in grey, the pink represents the Portal Fault and the 1% Cu contour is in orange. Note the barren FW to the Portal Fault as reflected in the UDEC modelling.

Esperanza Orebody Zone

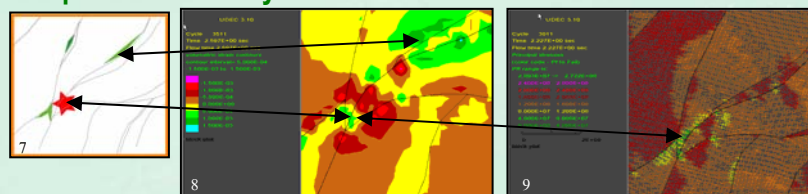


Fig. 7. Esperanza focus area

Fig. 8. Volumetric strain map. The modelled dilation again reflects the field mapped breccias. The focus of dilation is along the Mammoth Extended Fault and in the intersection of the Mammoth, Mammoth Extended and Esperanza Fault Zones (Esperanza ore zone).

Fig. 9. Pore fluid pressure required for failure. Red requires high pore fluid pressures for failure and these aren't conducive to mineralisation. The browns/greens however, require lower pf pressures for failure and are ideal sites for dilation, hydrothermal brecciation and in this case mineralisation. The Esperanza deposit is easily identified.

The UDEC modelling has worked for the Gunpowder deposits. The match of dilantant sites with known deposits is great providing confidence for exploration.

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Future work ...

Validation of numerical modelling through underground mapping of mineralised extension veins in the Mammoth Deposit.

Collaboration with J. Miller's Isa Cu work. Both Gunpowder and Isa are showing ESE – WNW shortening at mineralisation. Interestingly this has never been documented at either mine.

Synthesis of Gunpowder modelling and mapping with:

- other Western Succession deposits (i.e. Mt Kelly and Mt Isa)
- larger regional scale UDEC modelling being conducted by J. McLellan and G. Nortje.
- Eastern Succession deposits and regional modelling.

Damien Keys, Gustav Nortje, John McLellan
pmd*^{CRC}, School of Earth Sciences
James Cook University
Townsville, QLD, 4811.

Phone: (07) 4781 6397
Fax: (07) 4725 1501
Email: damien.keys@jcu.edu.au
gustav.nortje@jcu.edu.au
john.mclellan@jcu.edu.au
www.pmdcrc.com.au