Target & Prospect Evaluation

Brisbane, Queensland
16th May, 2017
The progress of studies for mineral projects (Source: AusIMM Cost Estimation Handbook, 2nd ed.)

Pre-Concept/Scoping-Study Evaluation

TARGET GENERATION

WHAT ARE WE LOOKING FOR?

DISCOVERY

HOW DOES IT MEASURE UP?

Company-specific practices

Multidisciplinary Project Evaluation

Established Processes and Guidelines

WHAT ARE WE LOOKING FOR?

HOW DOES IT MEASURE UP?

WHAT COULD IT BE?

WHAT SHOULD IT BE?

WHAT WILL IT BE?

Preparation and the Investment Decision

Deliver the Project

Extract the Value

Start-up

Production

The progress of studies for mineral projects (Source: AusIMM Cost Estimation Handbook, 2nd ed.)
0.50% Cu * 90% recovery (mining & met) = 0.45% Cu
= $27/tonne contained value
@$6,000/tonne for Cu
O/C mining cost = ~$29/tonne
All-in operating cost = ~$70/tonne

“...infill drilling...”  “...open-cut potential...”  “...skarns...associated with Grasberg...”
Some nice intersections reported…..

Any contenders?

As explorers, how do we know when we have something with potential?

What is the effect of exploring deeper?
Introduction to PEET-UG

Interactive, spread-sheet based tool, for prospect/target evaluation (Pre-
’Concept level’ analysis) in relative terms.

3 key purposes:

1. Where should I be exploring? .....mining constraints on prospectivity utilized
   in exploration strategy development.

2. Amongst my portfolio of targets/prospects, which of these has the
   potential to sustain a mining operation? Tool for ranking geological targets
   in terms of potential viability.

3. Tool for stage-gating the exploration process: is the prospect worth
   continued effort/expenditure?

The evaluative tool has been constructed to determine relative value of
deposits amenable to underground mining, and as a standalone operation.
Venturing off the outcrop

Mt Isa Inlier
Greenfields Potential

>70% is under cover and virtually unexplored

(Hutton, 2015)
What do we need to find at 500m depth in order to establish a viable mining operation?

Is this reasonable in the context of known deposits in the area we are exploring?
In-ground Value of a Selection of Metalliferous Deposit Types (Metal Prices as at 14/3/2017)

Value (USD) of Contained Metal per Tonne

Total Resource Tonnage (million tonnes)

Bubble Size Indicates Relative Value of Deposits Using the Product of Unit Value and Resource Tonnage
Extraction Options at Depth – Operating Costs

- OC 8.1 (Najafizad et al., 2014)
- OC 4.1 (Najafizad et al., 2014)
- OC 1.1 (Najafizad et al., 2014)
- OC 1.1 (Wood et al., 2015)
- BC (Najafizad et al., 2014)
- BC (Kajpa Newco Ltd, 2012)
- BC (Carapintina-02, 2014)
- BC (Crada East-Smith, 2012)
- BC (Wood et al., 2015)
- BC (ElTennente-Brown, 2003)
- BC (Bedwinka Brown, 2003)
- BC (Friesport Brown, 2003)
- BC (HillParkers Brown, 2009)
- BC (Salvador Brown, 2009)
- BC (M3 Consultants, 2013)
- BC (Phelps-NBV INC, 2015)
- BC (Iron Cap-Ridder Ass, 2012)
- SLC (DeFever et al., 2014)
- SLC (Wood et al., 2011)
- SLC (Syama Rec Min Ltd, 2015)
- SLC (Ph政府ic Newco Ltd, 2007)
- SLC (Amax-Buyana Southfields, 2013)
- SLC (Jama-ChileGold Inc., 2012)
- SLC (Buma-Balla River Res, 2015)
- SLC (Grindic-Catal Re, Inc, 2013)
- SLC (Low Goliath-Mimano, 2015)
- SLOS (Wood et al., 2011)
- SLOS (M3 Consultants, 2012)
- SLOS (Bravura European Goldfields, 2013)
- SLOS (Woodham-Min Res Ltd, 2013)
- SLOS (Rukjeek-Chief Cobalt Met. Corp, 2014)
- SLOS (Aurora Fortune Min Ltd, 2014)
- SLOS (Selphant-Selepyn Res Ltd, 2012)
- SLOS (Beachor Lake-Metanor Res, Inc, 2013)
- SLOS (Fried-VMS Vent Inc, 2012)
- SLOS (Comino-GEO Goldinc, 2009)
- SLOS (Cerro Blanco-RRAlcan, 2015)
- SLOS (Palagoyo-F&P Ltd, 2015)
- SLOS (Sorores-PanAm Silver Corp, 2014)
- SLOS (Chalipench-Dundee Inc-Met, 2005)
- ISL (Equinor Thorns (Florence-M) Cons, 2015)
- ISL (Equinor Thorns (Gunnison-M & w/o acre plan)-M3 Cons, 2014)
Extraction Options at Depth – Operating Costs

**Operating Costs**

- **SLOS**
- **SLC**
- **ISL**
- **BC**

**Not PEET Option**

**PEET Options**

- **BC**
- **ISL**

Source: Atlas Copco, 2007

Source: DMQ Project, 2015

Source: M3 Consultants, 2013
Key workings of PEET-UG

1. Inputs & Assumptions
   - Grade Distribution
   - Depth of Cover
   - Down-dip Extent
   - Length of new road required
   - Grade
   - Dip
   - Width
   - Strike-length
   - Discount rate
   - Metal prices
   - Distance to transport hubs
   - S.G.
   - Mining & Met. recovery
   - Exchange rate

2. Derived Quantities
   - Tonnage
   - In-ground value
   - Tonnes/vertical metre
   - Mine capex estimates
   - Contained metal
   - Mining rate potential
   - Haulage distances
   - Mining advance rate
   - Opex estimates (Mining + Geology + Processing + Admin)

3. Mining Method Selection
   - Potential mining block height
   - SLOS vs SLC vs BC determined by deposit geometry, dip, min. block height, in-ground ‘ore’ value
   - Truck vs Conveyor test (determined by depth below surface and production rate)

4. Project & Prodtn. Schedule
   - Mine development by year
   - Schedule of ore processed and recovered metal
   - Production by year
   - Schedule of concentrate produced (tonnes and grade)
Key workings of PEET-UG (cont’d)

5. Revenue Schedule
- Payable metal by year
- Realisation costs by year
- Refining charges per year
- Total Gross Revenue by year

6. Capex Estimate Models
- Declines
- Vertical development
- Fixed plant and Infrastructure
- Processing Plant
- Lateral development
- Mobile equipment
- Infrastructure and services
- Total capex
- Tax deduction for capex
- Sustaining capex

7. Opex Estimate Models
- Mining costs assuming steady state production
- Processing costs
- General & Admin costs by year

8. Evaluation Model
- Collated revenue, capex, opex
- IRR calculation
- Maximum negative cash position
- NPV calculation
- EBITDA
- Time to payback
- Net Cashflow
Results: comparison with peer projects

Not intended for critical financial or feasibility analysis
PEET-UG used in anger.....on simulated data
Copper Equivalence

Cu Equivalence Curves (using Cu: USD$5,500/t & Au: USD$1,200/oz)

CuEq (%) = ($value contributed from both Cu and Au) / Cu price.
**Financial measures vs grade/-tonnage/geometry (mining method)**

Above, Internal rate of return (IRR) vs grade. Bubble colour corresponds with geometry/mining-block (see image in top RH corner of slide). Bubble size is proportional to NPV, some annotated. Bigger target = more tonnes = higher value. Dashed line represents the 25% IRR ‘target’ outcome (AP pers. comms, 2016).

Parameters:
- 300m depth to top of deposit
- 80 degree dip
- CuEq calculation assumed Cu at USD$5500/t, and Au at USD$1200/oz, and a 20k:1 ratio of Cu:Au, as broadly observed in IOCG systems.

Below, net-cashflow (total) vs grade. Dashed line = 0 cashflow. SLOS methods achieve negative cashflows at grades where caving methods are profitable.
Impact of Orebody Dip and Geometry on Mining (& Financial) performance

Parameters:
- 300m depth to top of deposit
- Cu grade of 1.0% and Au grade of 0.5g/t
- 500m mining block height

Above, orebody dip erodes NPV through reduction of footprint (access for extraction) and reducing metal content in the 500m vertical high mining block. An 80deg imposed threshold on Block Caving limits its application, but arrests the reduction in NPV and production rate. An interesting phenomenon from the above chart is that NPV is maximised where these mining methods are at their technical limit, i.e. the lowest dip achievable.

Below, the effect of dip on horizontal area (‘footprint’) available for extraction. Production rate is higher at gentler dips. Other technical challenges relating to flow of material and stresses impact on mineability, but are deposit-specific and not dealt with at this early stage assessment.
NPV=0 does not mean that the project has no value, but implies that it offers no greater realisation of value than other investment options, or benefits outweighing the cost of capital.

At NPV=0, project risk would be a determining factor in investment choice.
Parameters:
- 500m mining block height only
- 80 degree dip
- CuEq calculation assumed a 20k:1 ratio of Cu:Au, as broadly observed in IOCG systems.
Indicative ‘cut-off’ grades by mining method/orebody geometry

Key observations:

- Depth insensitivity of Block and Sub-level Caving scenarios.

- SWAN occurs left of its corresponding geometry curve (orange) and is uneconomic in the assumed price environment.

- Eloise, despite being significantly higher grade, would likely be sub-economic if the top of the ore-reserve was 250m below surface.

- The more selective and development intensive (per tonne of mined ore) stoping methods have a shallower gradient to their CuEq vs Depth curve. Extensions to these mines with depth, carries additional costs; and these costs are amortised across fewer tonnes mined and metal produced.

- Kulthor is well to the left of its corresponding geometry curve (purple) and was economically extracted as it was an incremental expansion of an existing mine and utilized existing processing facility. Discovery of a Kulthor-analogue away from this infrastructure would likely be sub-economic.
15m @ 3.0% CuEq....woohoo!!....what next?

- Draft the ASX release?
- Plan another five holes to follow-up?
- Plan downhole geophysics programme to assess size/ extents?
- Mothball & rank against other prospects?
- Consider the target tested .....and move on?
CuEq grade vs Depth vs Geometry (& Mining Method)

Cu Equivalent grade (Cu: USD 5,500/t, Au: USD 1,200/oz) at NPV=0

Parameters:
• 500m mining block height only
• 80 degree dip
• CuEq calculation assumed a 20k:1 ratio of Cu:Au, as broadly observed in IOCG systems.
Are some Cloncurry Cu-Au deposits more prospective than others?

- The average value per tonne for Cloncurry Cu-Au deposits is $161, with larger deposits (>10Mt) averaging $85/t.
- The smaller deposits have average contained value of $236/t.
- This equates to CuEq of 1.5% for the >10Mt deposits and 4.1% for the remainder of deposits, which are generally <5Mt.

It is apparent that the successful mining of Cloncurry Cu-Au deposits as underground mines has largely been possible due to precursor open-cut mines at the same operation. In other words, the initial extraction method was via open-cut mining and this has covered costs of site access and infrastructure (processing plant, power, water, offices, camp, and tailings storage facility).
DMQ Summary

Aiming to reduce the risk profile of exploring at depth in the Cloncurry district by identifying tracts of ground which are:

- prospective for large, mass-mineable mineral deposits, i.e. *fertility*

- comprise geotechnical, geothermal, geographical conditions which are technically amenable to mass-mining methods, i.e. *mineability*, and

- comprise all of the above, but with the prospect of positive financial outcomes....subject to internal & external factors, i.e. *viability*. 