

The logo for SNOWDEN, consisting of the word "SNOWDEN" in white, uppercase letters inside a dark blue rectangular box with a white border.

Incorporating Mineral Resource and Ore Reserve confidence in technical reports

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Snowden

Excellence in Exploration & Mining 17-18 Oct 2005

Contents

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- Background: Inferred Resources and Feasibility Studies
- Technical reports and Feasibility Studies
 - What is a 'bankable' study?
- Types of technical risk
 - Mineral Resource and Ore Reserve confidence
- Exploration project versus mining operation
- Recommendations

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Background (1) Inferred Resources and Feasibility Studies

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Prompted by the use (misuse) and inconsistency of definitions and terminology, particularly:

- Inferred Resources
- Term 'Feasibility Study'

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Background (2) Resource confidence

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- Resource and Reserve confidence
- Hiding behind a reporting code
- No 'JORC compliant' resource or reserve estimate
- 'JORC compliant report' of resources and reserves

USE OF TERM "JORC COMPLIANT" NOT ACCEPTABLE

As stated in previous editorials, the description "JORC Compliant" or "to JORC standard" when describing the disclosed resources or reserves in a public statement is not acceptable to The AusIMM. When used in this context it is not clear to the reader if the term "JORC compliant" is meant to convey that the public statement is in accordance with the JORC Code, that it has been reported correctly, or the estimate is according to the Code.

AusIMM Bulletin

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Background (3) Inferred Resources

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Current focus by JORC on Inferred Resources:

JORC has decided to conduct its next meeting on 31 October 2005 with the single topic of:

“The practical meaning of the current (2004) JORC Code definition (and guidelines) of an Inferred Resource and consequently whether that meaning is satisfactory, or the definition requires amendment.”

“This is ... partly as a result of the apparently different applications of Inferred Resources in public reporting in Australia since the issue of the 2004 JORC Code...”

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Confidence in technical reporting

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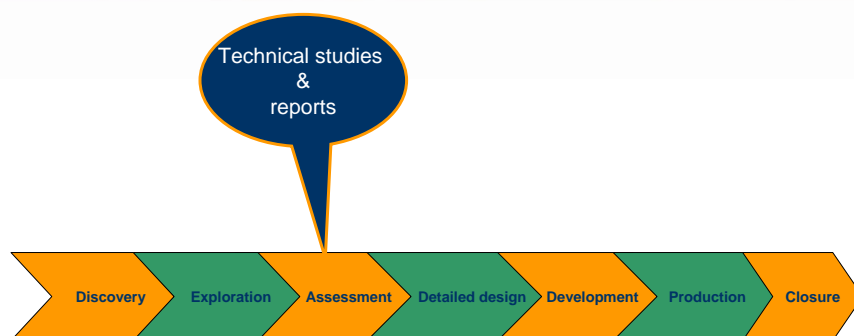
- The accuracy of the technical report should be compatible with the accuracy of its contents
- The level of confidence in a mineral study should be suitably conveyed by the study type:
 - meaningless to report a final Feasibility Study based on Inferred Resources, whereas
 - it may be acceptable to report a Scoping Study based on Inferred, Indicated and/or Measured Resources

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Life cycle of mining project

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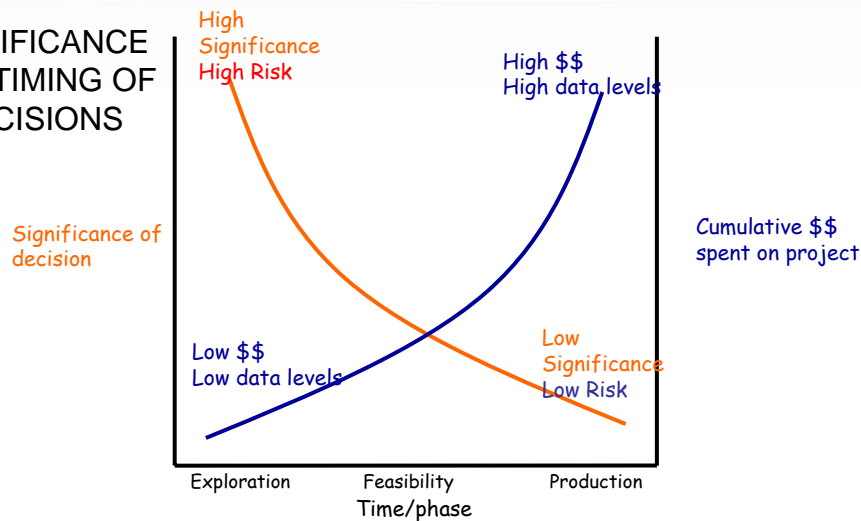
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Life cycle, investment and risk

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SIGNIFICANCE AND TIMING OF DECISIONS



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Types of studies

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Goal: To determine the best use of futures \$

- Scoping Study or Preliminary Assessment – ‘broad brush, back of the envelope’
 - do not use term ‘Feasibility’, generally no Reserve
- Pre-feasibility Study – firming up on the numbers, evaluating options, identify preferred option
- Feasibility Study – decision to develop
 - do not use term ‘bankable’ - assumes the study will be automatically accepted (bank will decide!)

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A Feasibility Study...

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Comprehensive study to determine economic feasibility

- Undertaken to justify continued investment in a project and project implementation
- Provides technical, commercial and financial recommendations
- Identifies and quantifies risk
- Identifies areas for additional investigation

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Study types, accuracy & contingency

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	Scoping study	Pre-feasibility	Feasibility
Financial analysis	yes	Yes	Yes
Accuracy range (cost)	+/- 30%	+/- 15% to 25%	+/- 10% to 15%
Contingency considerations	≤50%	30%	≤15%
Key risk	May discard viable project	Numbers "locked in" 'Best' option not chosen	Key parameters poorly defined (eg geotech, resource, recovery, throughput, revenue assumptions)

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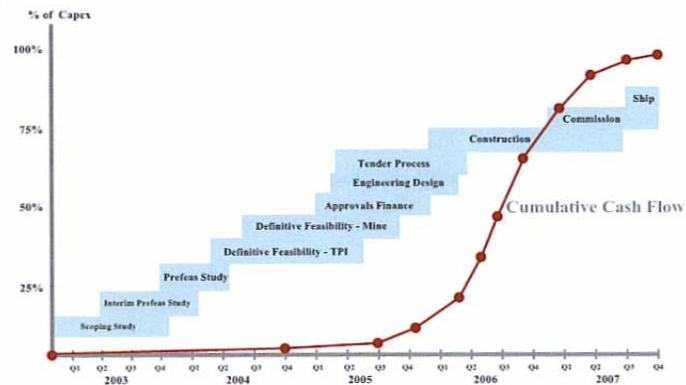
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FMG example

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Timeline to Production 2007



Diggers & Dealers 2005

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Successful Feasibility Studies

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- Project development
- 3rd parties' review
- Independent Engineer

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The final stage in Feasibility Studies

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Due Diligence and Audits

- 3rd Parties' review and analysis
- Clarity of documentation
- References & backup readily available
- Clear audit trail of work
- Transparency regarding options and decisions

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Risk factors in mining projects

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- Human Nature Risk
 - Socio-Economic
- Mother Nature Risk
 - Geographical
 - Geological (resource grade, tonnage, mineralogy, mining and processing recoverability)

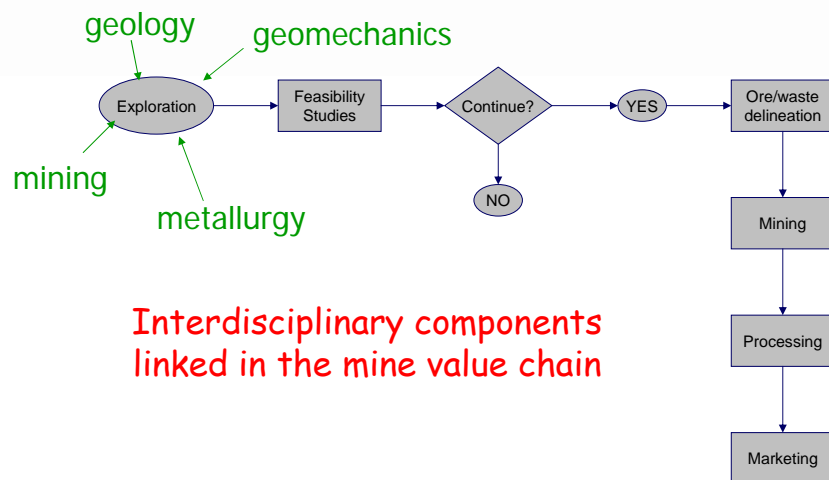
Most bankers report that 'Reserve Risk' is their major concern – you can do nothing if it is not there!

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Sources of technical risk (1)

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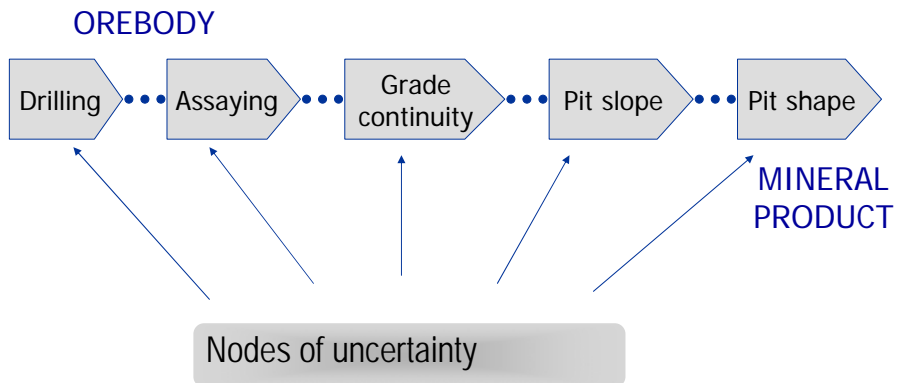


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Sources of technical risk (2)

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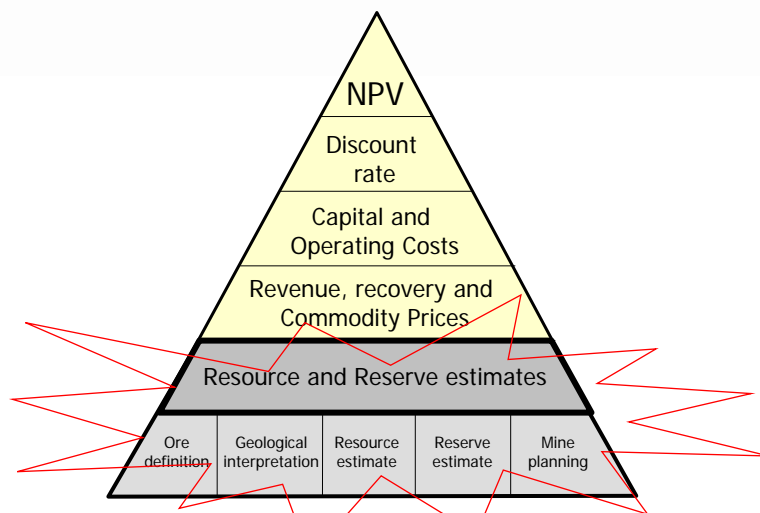


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Sources of technical risk (3)

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Iterative study process

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- Exploration and Geology
- Resource evaluation and definition
- Mining (selectivity, recovery, ore loss)
- Process
- Infrastructure and Services
- Commercial and Financial

Cashflow model

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Reporting Resource and Reserve risk (1)

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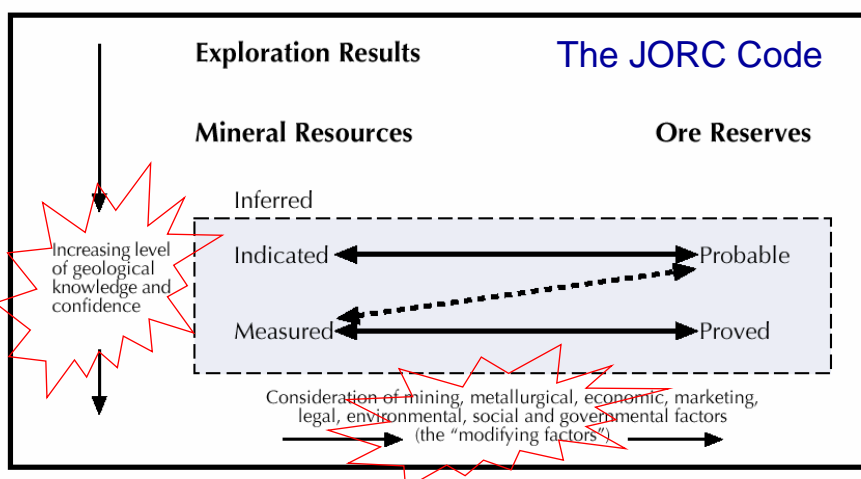


Figure 1. General relationship between Exploration Results, Mineral Resources and Ore Reserves

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Reporting Resource and Reserve risk (2)

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JORC Resource and Reserve classification ... "so many variables and so few hard benchmarks"

- Transparency ✓
- Materiality ✓
- Competence ✓
- Consistency ✗

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Study types, accuracy & Resource/Reserve categories

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Resource	Global (Inferred +)	Indicated +	Measured + Indicated +
Reserve	None	Probable +	Proved + Probable
Mine design	None or conceptual	Conceptual	Detailed

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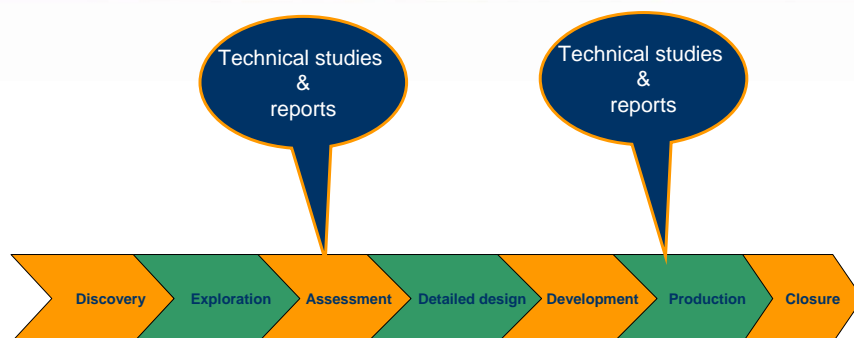
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Life cycle of mining project

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What about mining operations?

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- Measured Resources and Proved Reserves represent the ultimate level of mineral asset accuracy in a Feasibility Study
- This is not sufficient for mining operations
 - these require short-term, mining-scale ore control
- Grade Control and further technical studies continuously improve mine Resource and Reserve estimates
- Reconciliation assesses the reliability of the Resource, Reserve, orebody delineation and extraction

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Recommendations (1)

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Firm up definition of Resources categories and study types

- Remember for Inferred Resources (JORC 2004):
 - The Inferred Mineral Resource is that portion of the deposit with *'reasonable prospects for eventual economic extraction'*
 - Outline economic assumptions
 - Discuss confidence in cut-off grades and scale of selectivity for reported tonnage and grade
 - It should *'be reasonable to expect that the majority of Inferred Mineral Resources would upgrade to Indicated Mineral Resources with continued exploration'*
 - Extrapolation is not enough

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Recommendations (2)

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Consider other codes

- SEC
 - No reporting of Resources
 - Reserve requires completion of a Feasibility Study
- CIM, NI 43-101
 - Technical report required to support public reporting
 - Clearer definition of study types and use of Resource & Reserve categories
 - Must not use term 'Feasibility' when relying on Inferred Resources or if no Reserves are reported
 - Consistent report format for a technical report

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Conclusion

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*"The JORC Code sets out **minimum** standards, recommendations and guidelines for Public Reporting in Australasia of Exploration Results, Mineral Resources and Ore Reserves"*

We should strive to achieve consistency and best practice in technical reporting within the global exploration, mining and investment community

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