



COMMITTEE FOR MINERAL RESERVES
INTERNATIONAL REPORTING STANDARDS

The Competent Person's Report as a means to Convey Information to the Investment Community

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Competent Persons Reports are supposed to convey material issues to the investor or his advisers in a transparent manner so that he/they can make an informed decision as to the mineral property that is the subject of the report. The Competent Person must keep this in mind as he prepares each section of the report. Are material issues being covered to a sufficient level of detail in writing, tables and figures? Which means: writing, a table or a figure conveys the message most efficiently. And importantly, does the report demonstrate the competence of the author(s)? Often the time available to prepare the report is limited. This means that materials (graphics, spreadsheets etc.) required to prepare the report must be accumulated in real time as the work is done.

- This presentation presents the views of the author
- The views represent an interpretation of the CRIRSCO family of codes
- Other Competent Persons may have differing views

What is a Competent Persons Report?

- The CRIRSCO family of “codes” define public reports to include all disclosures from press releases and website postings, to technical reports, which may be of various sizes.
- The reports should name a **Competent Person who takes responsibility for the disclosure.**
- Securities regulators can have specific requirements for disclosure in a “Technical Report” which is prepared by Qualified Persons (e.g. Canada) or Competent Persons elsewhere.
- Most large mining companies have Competent Persons Reports to support their annual declarations of Mineral Resources and Mineral Reserves. These reports sometimes take the format of strategic business plans.

General Principles

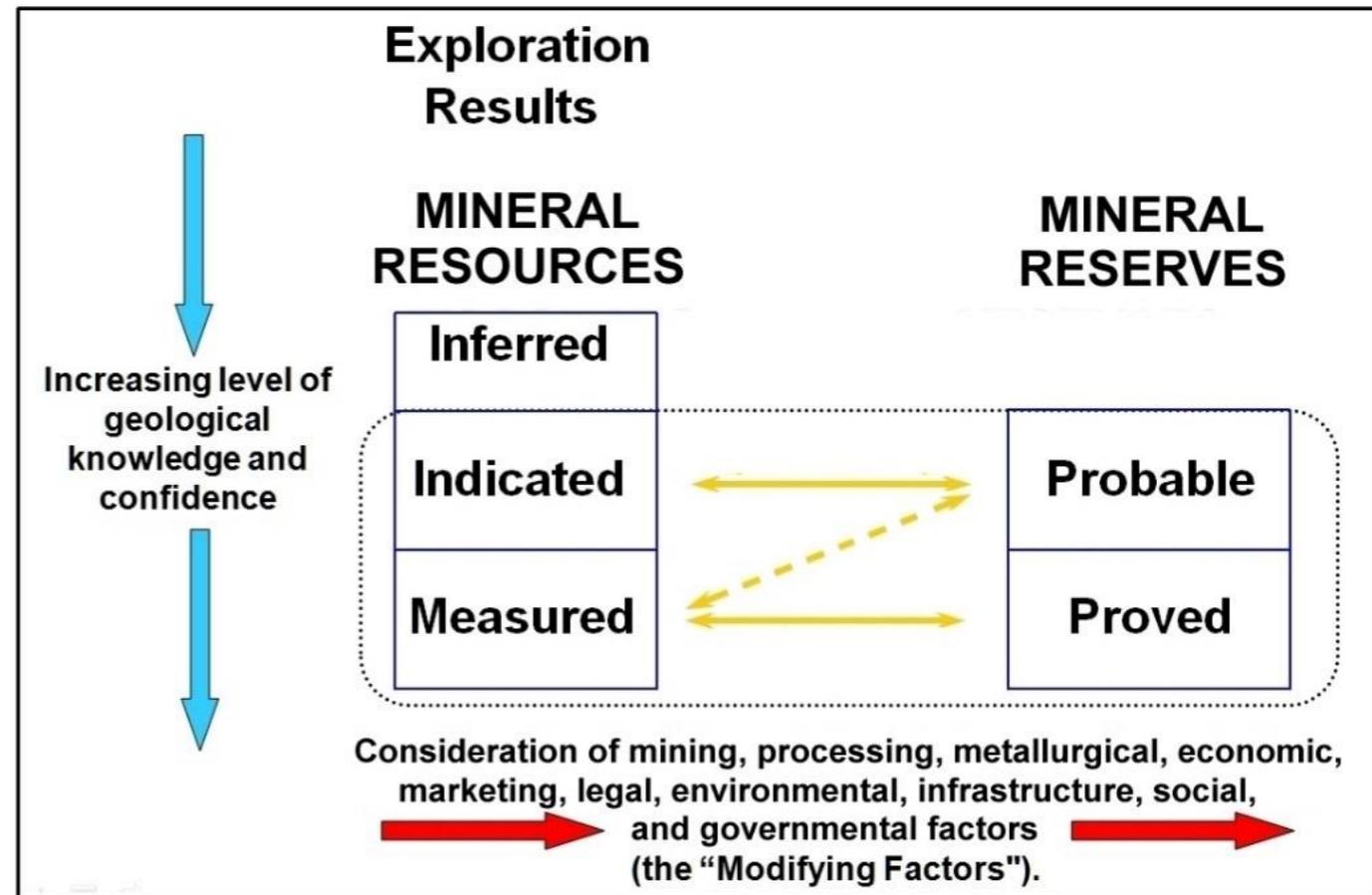
(Drawn from the CRIRSCO Template)

- **Transparency** requires that the reader of a public report is provided with sufficient information, the presentation of which is clear and unambiguous, so as to understand the report and not to be misled.
- **Materiality** requires that a public report contains all the relevant information which investors and their professional advisers would reasonably require, and reasonably expect to find in a public report, for the purpose of making a **reasoned and balanced judgment regarding the Exploration Results, Mineral Resources or Mineral Reserves being reported.**
- **Competence** requires that the public report be based on work that is the responsibility of **suitably qualified and experienced *Competent Persons*** who are subject to an enforceable professional code of ethics and rules of conduct.

- The Competent Person must discuss any material aspect for which the presence or absence of comment could affect the public perception or value of the mineral occurrence.
- Mineral Resources and Mineral Reserves are estimates with attendant uncertainty. The Competent Person should provide a balanced discussion of risks and opportunities accompanying statements of Mineral Resources and Mineral Reserves.
- The report should be supported adequately by text, figures, tables, sections, and maps to demonstrate competence by conveying material information in a transparent manner.
 - Figures of any type should contain appropriate explanatory information in the form of titles and/or captions. This includes legible maps and sections in the language used by the report.

Other Principles (2 of 3)

- There should be consistency between financial reports and technical studies: Financial reports take into account Mineral Resources and Mineral Reserves and are based on assumptions concerning commodity prices, exchange rates, and other parameters of significance.
 - To be clear and unambiguous, technical and financial information should be published on a comparable basis in terms of assumed parameters.
 - Disclosure should be comparable with that made by other entities, as for example resources and reserves using the CRIRSCO Template.



Other Principles (3 of 3)

- Advice from the IASB (Michael Morley, personnel communication): **The amount of disclosure should be proportional to the uncertainty of what is being disclosed.**
- Pat Stephenson (Former chairman of JORC, personal communication): **In the event of a marginal call (as for example between Inferred and Indicated Mineral Resources) the report should detail the thinking of the Competent Person that is used to make a judgment.**

Example Contents for Canada: NI 43-101 Technical Report (2011)

CONTENTS OF THE TECHNICAL REPORT

Title Page	
Date and Signature Page	
Table of Contents	
Illustrations	
Item 1: Summary	
Item 2: Introduction	
Item 3: Reliance on Other Experts	
Item 4: Property Description and Location	
Item 5: Accessibility, Climate, Local Resources, Infrastructure and Physiography	
Item 6: History	
Item 7: Geological Setting and Mineralization	
Item 8: Deposit Types	
Item 9: Exploration	
Item 10: Drilling	
Item 11: Sample Preparation, Analyses and Security	
Item 12: Data Verification	
Item 13: Mineral Processing and Metallurgical Testing	
Item 14: Mineral Resource Estimates	
Item 15: Mineral Reserve Estimates	
Item 16: Mining Methods	
Item 17: Recovery Methods	
Item 18: Project Infrastructure	
Item 19: Market Studies and Contracts	
Item 20: Environmental Studies, Permitting and Social or Community Impact	
Item 21: Capital and Operating Costs	
Item 22: Economic Analysis	
Item 23: Adjacent Properties	
Item 24: Other Relevant Data and Information	
Item 25: Interpretation and Conclusions	
Item 26: Recommendations	
Item 27: References	

Companion policy to NI 43-101, 2011

- All public reports including press releases, website postings, must be prepared by Competent Persons.
 - Best practice is that they refer to a report that supports the disclosure in the press release or website posting.
- Many entities compile lengthy Qualified or Competent Persons reports
 - That cover Preliminary Economic Assessments, Prefeasibility studies, Feasibility studies running into hundreds of pages.
 - They are designed for the institutional lenders, JV partners, and are of little use to the “retail” investor.

- On the other hand some CP reports are really only reviews of work done by others, with often limited time for substantive checks.
- Negative assurance is provided by the CP: “My review found nothing materially wrong with the estimates”. On this basis the CP takes responsibility for the reported Exploration Results, Mineral Resources and Mineral Reserves.
- In the current time of tight budgets, many companies are taking this approach; this only works if company has embedded substantive checks into its resource and reserve estimation procedures.

Comments on Best Practices – Implementing– Assessment and Reporting Criteria

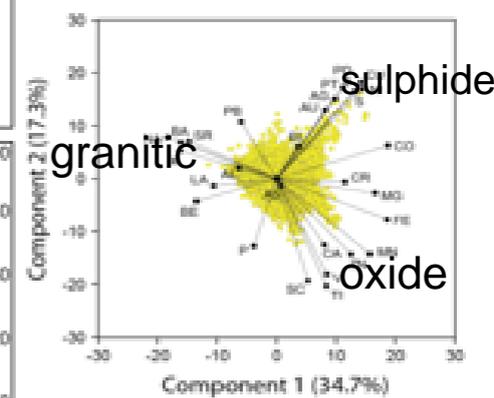
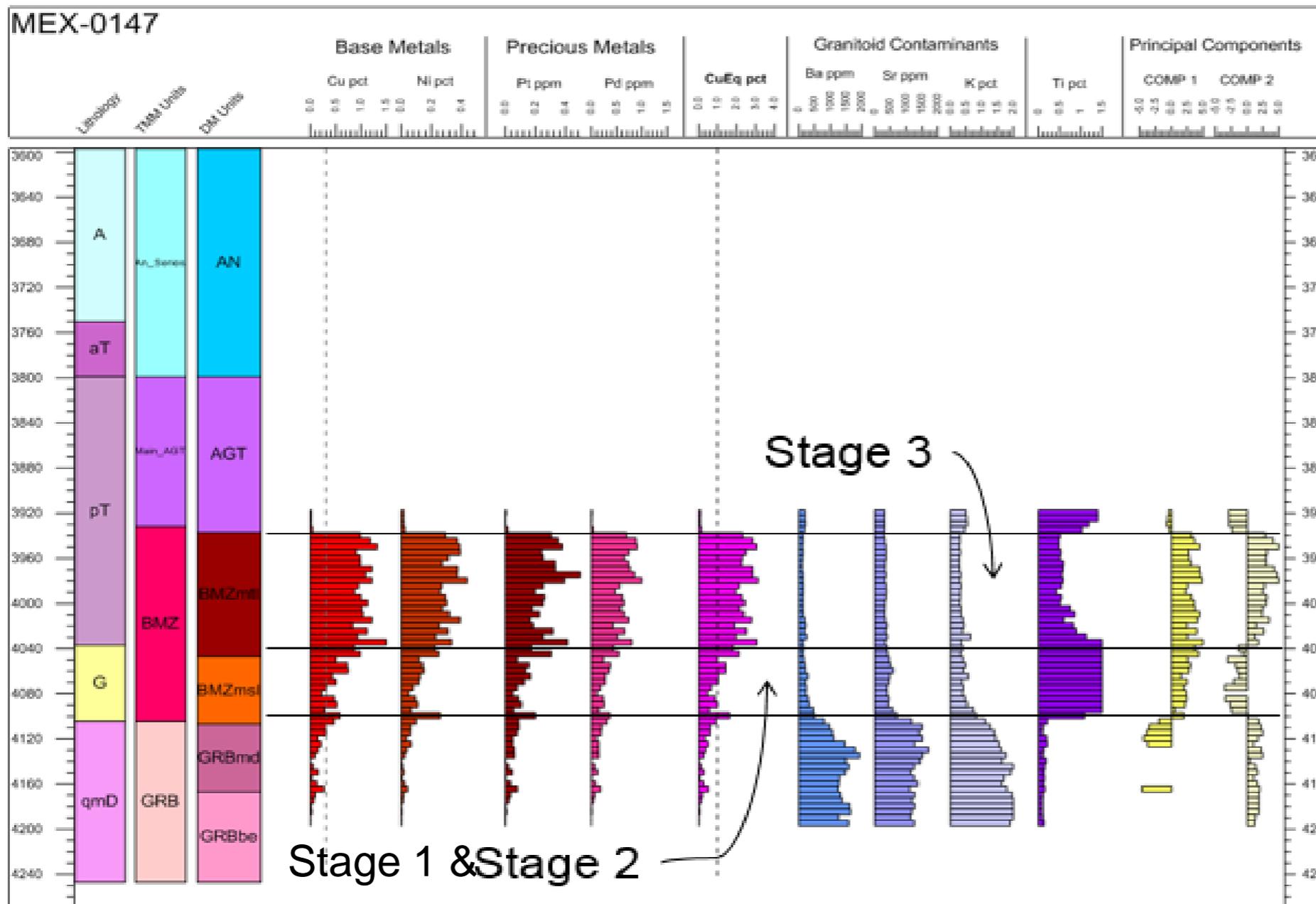
- Because of time limitations, I will discuss the CRIRSCO Template Table 1 items in **red**
 - **General**
 - **Project Data**
 - **Interpretation**
 - **Resource and Reserve Classification**
 - **Extraction**
- There is considerable diversity of practice as to the amount of description that should appear in a report. My position is that enough explanation should be presented to demonstrate the competence of the author; also to make clear material items
 - Important, but not discussed:
 - Supporting Infrastructure and G & A
 - Environmental Compliance and Reclamation
 - Social License
 - Economic Viability
 - Risk and Opportunity Analysis
 - Other Considerations
 - Qualifications of the Estimator

- Specify type of CP report and time available for preparation
- Describe dates for site visits by CPs and their activities on site
 - If no site visit, state why not needed or not made and risk to conclusions
- Describe sections for which each CP is responsible
- Describe ownership; vet ownership by third party legal opinion
- Obtain opinion(s) that payments due surface and mineral rights holders and other stakeholders have been made
- Specify risk of change in legal regime
- Ensure maps are up to date and legible (at least with 200% “zoom”)

- Field check 5 to 10% of hole collars with GPS
- 100% Check of collars in primary survey documents versus database
- Check 5-10% of downhole surveys versus database
- Check for unreasonable kinks ($>5^\circ/30$ m)
- Check collars of holes versus topography
- Check logging for 5 to 10% of holes; concentrate on features used for domaining
- Check transfer of logs to database for 5 to 10% of holes (higher percentage if logging into tablet PCs)
- Check sampling, preparation and assaying protocols; check transfer of assays to database for at least 5%, more if directly available from laboratory
- Check chain of custody, security
- Check adequacy of QAQC (blanks, crushed and pulp duplicates, certified or standard reference materials, check assays at external laboratories) typically 10 to 20 % of sample load
- Check real-time graphing of QAQC results

- What are key mineralization guides, trends to grade and size (thickness)?
- What are key geological features that control grade and thickness: lithology, alteration, proximity to contacts and/or structure?
- How well defined are faults? Do faults disrupt favorable units?
- Define domains that are continuous; separate the deposit into areas with mutually low coefficients of variation (standard deviation/mean)
- What are risks to the interpretation; are multiple interpretations possible? Are risks related to orientation of drill holes oblique to mineralization domains?
- Are there analogue deposits?

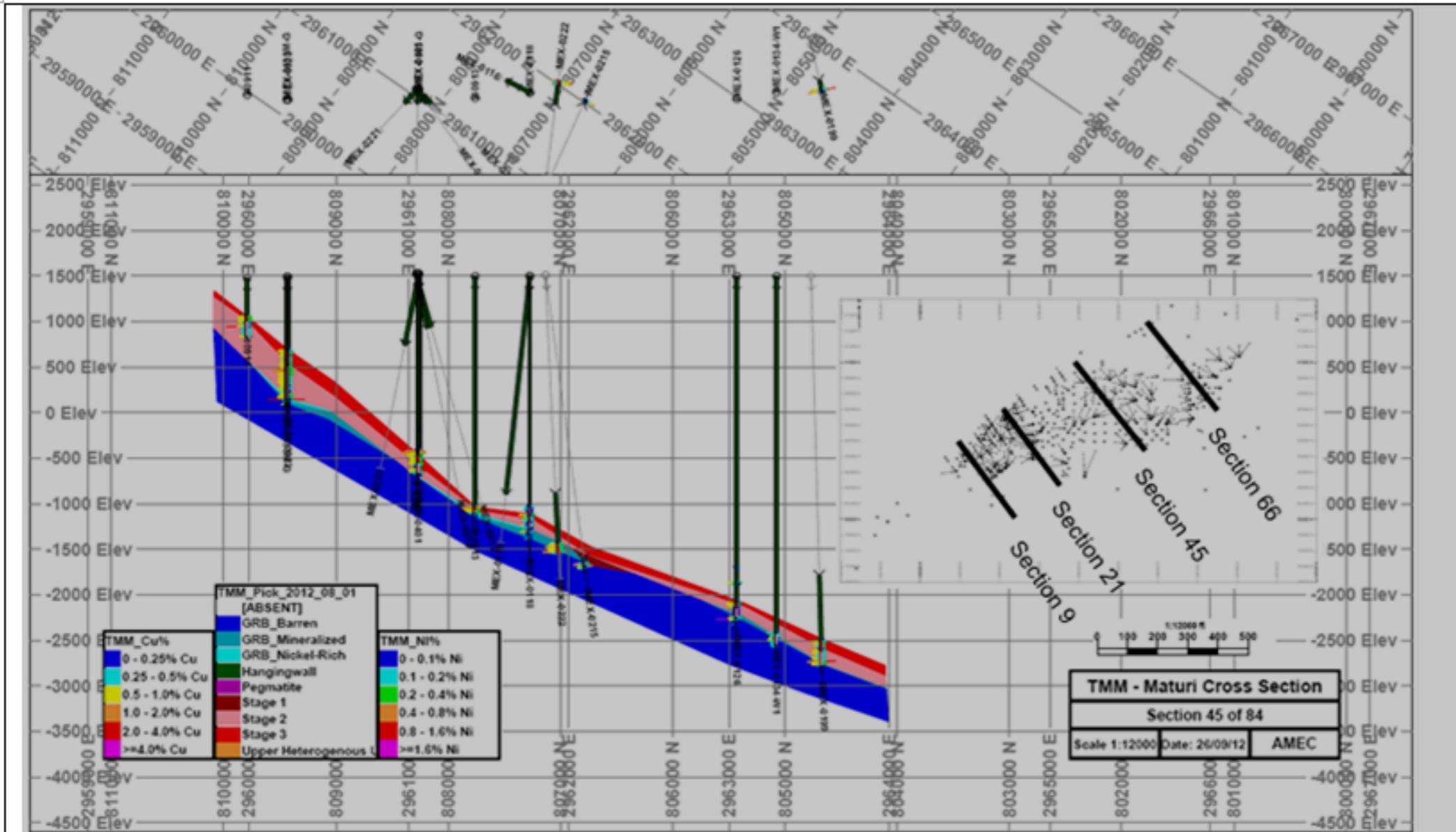
Use of Multivariate Geochemistry to Define Magma Stages – Maturi Deposit, MN



- Stage 1 – Low sulphide, Ti oxide enriched
- Stage 2 – Ti oxide enriched
- Stage 3 – Sulphide enriched, low oxide

Modified from Eggleston, et al., 2014

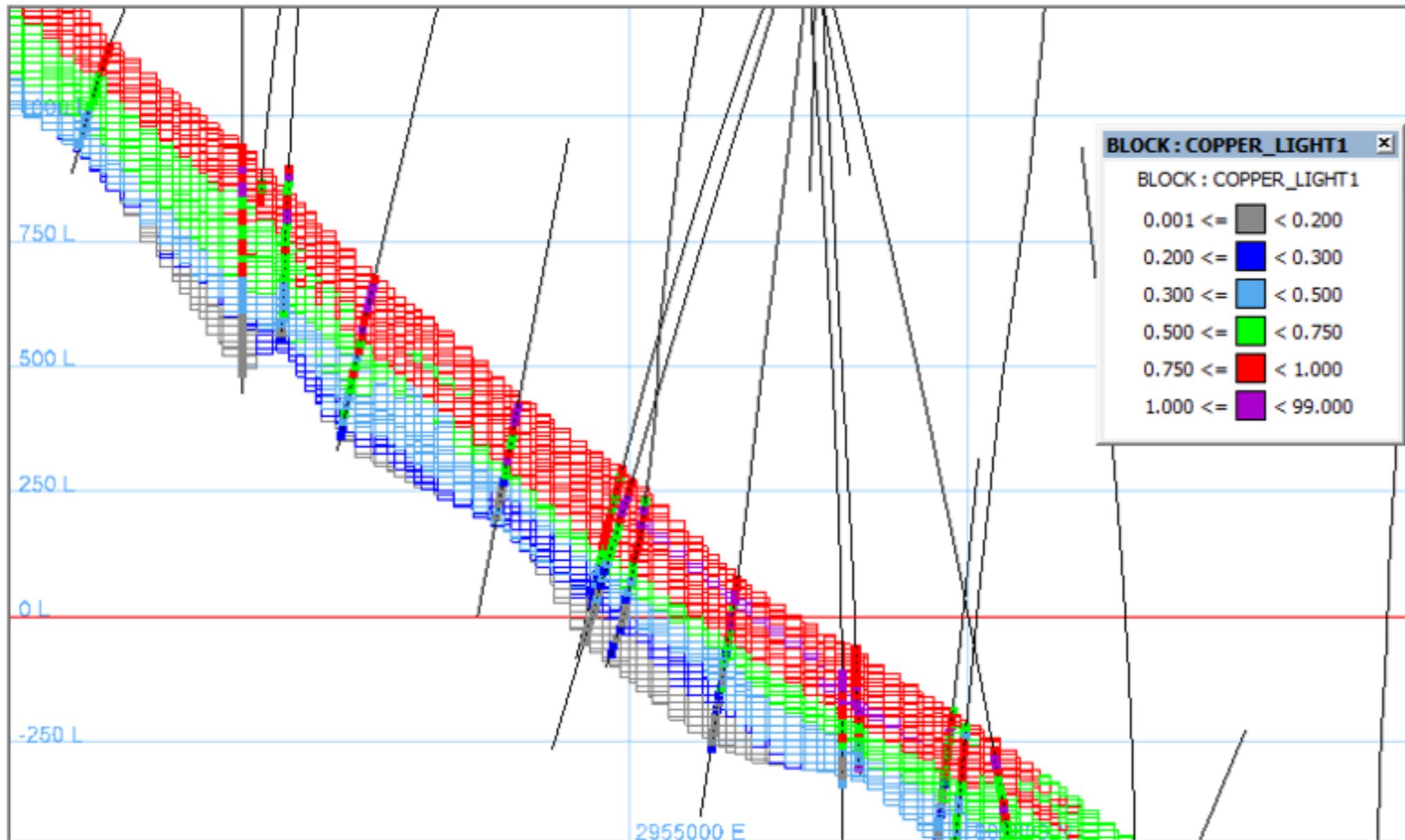
Principal components were used to define the magma stages



Columns are, from left to right, Cu, Lithology, Ni as indicated in the legends. The interpreted lithology is indicated on the section and corresponds to the central legend.

From Eggleston et al., 2014

Cross Section Showing Block Model Grades Honor Drill Composite Grades – Maturi Deposit MN



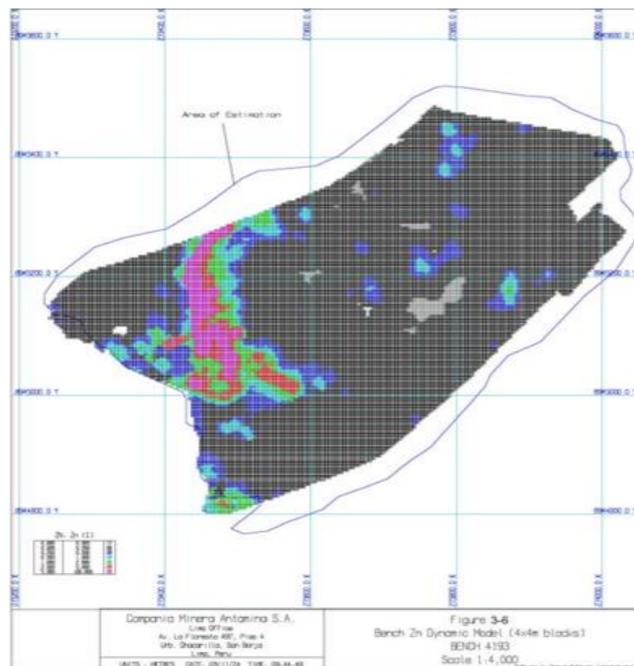
Composites projected 250 ft from section

From Eggleston et al., 2014

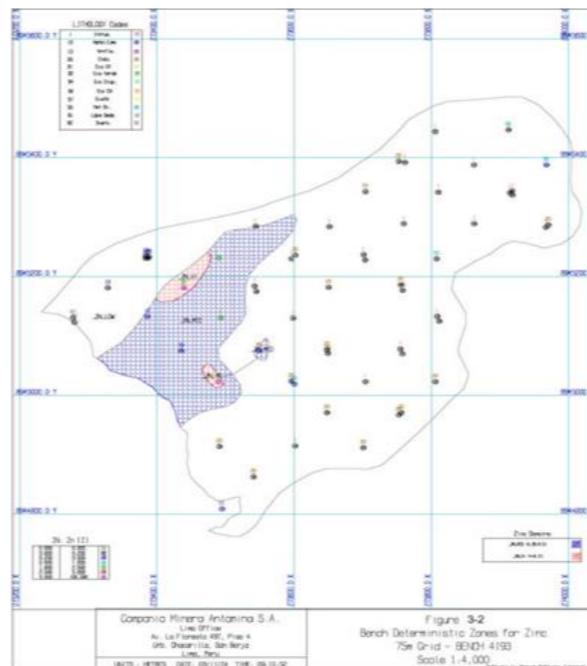
- Check volumes of domains versus a nearest neighbor model
- How smooth is the resource model? Should a non linear estimation method be used?
- Does the resource model honor the drill hole composites?
- Has the model been validated on swath plots; does its mean grade give similar results to a nearest neighbor model?

- Inferred
 - Data are wide-spaced; it is difficult to observe continuity between points of observation, but well-drilled analogue deposits show continuity
 - Multiple interpretations possible for domains
 - Probability of conversion to Indicated > 50% with more drilling
 - May have legacy holes with limited/no QAQC
- Indicated
 - Can assume continuity between points of observation
 - Can support mine planning
 - Annual production increments within relative $\pm 15\%$ at 90% confidence
 - QAQC validates sampling and assaying
- Measured
 - Can confirm continuity between points of observation
 - Can support detailed mine planning
 - Quarterly production increments within relative $\pm 15\%$ at 90% confidence
 - QAQC validates sampling and assaying

Continuity for Zinc at Antamina; blue is [0.25, 2.5%), pink is $\geq 2.5\%$

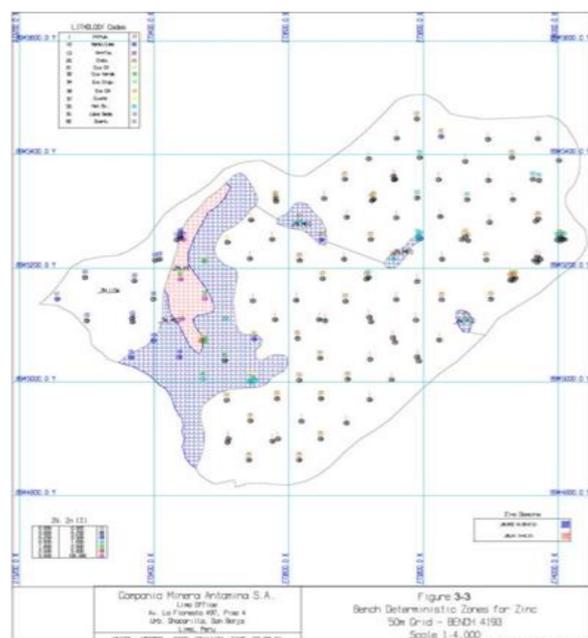


Ground-truth
Based on Blast
Holes
(7 X 7 m
Spacing)



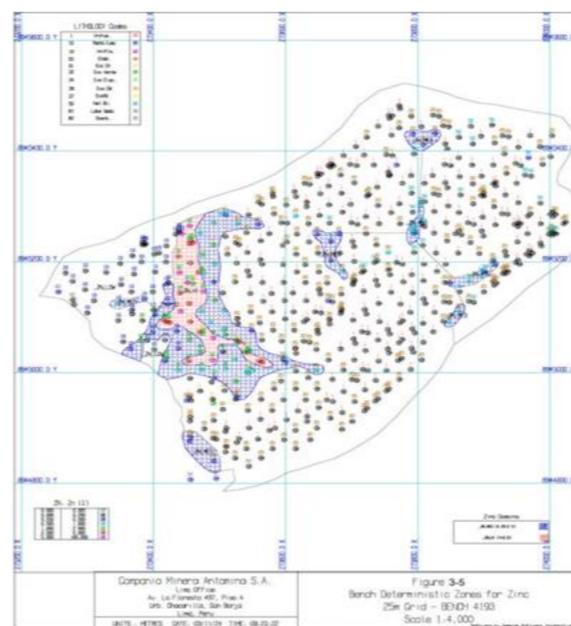
75 X 75 m
Spacing; High-
grade is under
represented

Inferred



50 X 50 m
Spacing; High-
grade is still
under
represented

Indicated



25 x 25 m
Spacing (High-
grade is fairly
well
represented)

Measured

Reconciliation of Resource Model to Grade Control for Type A Ore at Fort Knox, AK – Highest Grade Category and Sent to Mill

Year	Resource Model Depletions			Grade Control Depletions			F1 = Grade Control/Res. Model		
	Mst	Opt Au	Contained Moz	Mst	Opt Au	Contained Moz	Tonnage	Grade	Metal
1996	1.0	0.031	0.03	1.0	0.036	0.04	1.00	1.16	1.16
1997	13.7	0.033	0.45	13.3	0.035	0.47	0.97	1.07	1.03
1998	14.2	0.030	0.42	13.7	0.031	0.43	0.97	1.07	1.03
1999	14.0	0.028	0.39	13.6	0.031	0.42	0.98	1.10	1.07
2000	16.0	0.027	0.42	15.5	0.029	0.44	0.97	1.08	1.04
2001	13.1	0.027	0.35	11.8	0.028	0.33	0.91	1.03	0.93
2002	11.4	0.026	0.30	11.8	0.027	0.32	1.04	1.04	1.08
2003	9.6	0.027	0.26	10.8	0.028	0.30	1.12	1.03	1.16
2004	11.5	0.029	0.33	10.6	0.029	0.31	0.92	1.00	0.92
2005	12.7	0.028	0.36	12.7	0.029	0.36	1.00	1.02	1.01
2006	13.8	0.027	0.37	12.3	0.030	0.37	0.89	1.10	0.98
2007	10.6	0.029	0.30	11.2	0.031	0.35	1.06	1.08	1.14
2008	11.7	0.029	0.33	12.2	0.028	0.34	1.04	0.99	1.03
2009	12.6	0.025	0.31	11.8	0.024	0.28	0.94	0.97	0.91
2010	11.1	0.025	0.28	11.5	0.024	0.28	1.03	0.97	1.00
2011	1.6	0.021	0.03	3.7	0.018	0.07	2.34	0.88	2.06
2012	8.9	0.024	0.22	10.1	0.026	0.26	1.15	1.06	1.22
2013	8.7	0.027	0.24	9.4	0.028	0.27	1.08	1.03	1.11
2014	5.4	0.027	0.15	6.8	0.028	0.19	1.26	1.03	1.31
Total	201.5	0.028	5.56	204.0	0.029	5.83	1.01	1.04	1.05

	F1: [0.9, 1.10]
	F1: [0.85, 0.90), (1.10, 1.15]
	F1: <0.85, > 1.15

Mostly within
±10% on an
annual basis

From Parker et al., 2015

Reconciliation of Mine to Mill (Type A, Fort Knox, AK)

Year	Crusher Feed (Delivered to Mill)			Received at Mill (RAM)			F2 = RAM/Delivered to Mill			F3= F1 X F2		
	Mst	Opt Au	Contained Moz	Mst	Opt Au	Contained Moz	Tonnage	Grade	Metal	Tonnage	Grade	Metal
2003	15.3	0.032	0.49	15.1	0.031	0.47	0.98	0.99	0.97	1.10	1.02	1.13
2004	Not Available											
2005	14.1	0.027	0.37	14.3	0.026	0.38	1.01	0.99	1.01	1.01	1.01	1.02
2006	14.2	0.026	0.37	14.8	0.026	0.39	1.05	1.00	1.04	0.93	1.10	1.03
2007	13.4	0.027	0.37	14.0	0.028	0.39	1.05	1.02	1.07	1.11	1.10	1.22
2008	14.8	0.025	0.36	15.1	0.026	0.39	1.02	1.04	1.06	1.07	1.02	1.09
2009	13.9	0.021	0.29	14.1	0.022	0.32	1.02	1.05	1.07	0.96	1.02	0.98
2010	14.2	0.021	0.29	14.6	0.023	0.33	1.03	1.11	1.14	1.06	1.08	1.15
2011	14.4	0.016	0.23	14.9	0.016	0.24	1.03	1.03	1.07			
2012	14.3	0.021	0.30	14.6	0.020	0.29	1.02	0.97	0.99	1.17	1.03	1.21
2013	13.7	0.023	0.31	14.0	0.024	0.33	1.02	1.05	1.07	1.10	1.08	1.19
2014	14.7	0.019	0.28	16.1	0.020	0.32	1.10	1.05	1.16			
Total	156.9	0.023	3.66	161.6	0.024	3.86	1.03	1.02	1.05	1.04	1.06	1.11

F2 or F3: [0.9, 110]
F2 or F3: [0.85, 0.90), (1.10,1.15]
F2 or F3: <0.85, > 1.15

From, Parker et al. 2015

Overall the reconciliation is positive for tonnage, grade, metal

- There must be reasonable prospects for eventual economic extraction to declare Mineral Resources.
- Open Pit Mineral Resources:
 - Declare open-pitiable Mineral Resources within pit shells (may use optimistic slopes, prices, recoveries, costs)
 - Cut-off to declare Mineral Resources should consider processing, G&A
- Underground Mineable Mineral Resources
 - Declare underground Mineral Resources within wireframes representing stope blocks
 - Cut-off to declare Mineral Resources should consider secondary development, mining, tramming, hoisting, processing G&A

- There are a large amount of topics to cover
- We have only dealt with about one third of the topics in this talk
- The key is to determine which subject areas add value
- Where are the opportunities? Where is there leverage?
- Where are the risks?

% Cu	% Change	Cash Flow Year 2 (M\$)	% Change	NPV@8%	% Change	Payback Years
0.66%	10%	218.9	30%	886.5	60%	4
0.63%	5%	193.9	15%	720.4	30%	4
0.60%	0%	169.0	0%	554.3	0%	5
0.57%	-5%	144.0	-15%	388.1	-30%	6
0.54%	-10%	119.1	-30%	222.0	-60%	7

Small Changes in Grade can have large impacts on Cash flow, NPV

- Design the report with the audience in mind
- High on the list of priorities is demonstration of competence

Thank You

Eggleston, T., Reid, D., Kuhl, T., Wakefield, T., Long, S, 2014, Mineral resource report for the prefeasibility study of Maturi, Maturi Southwest, Birch Lake and Spruce Road deposits, Ely, Minnesota, AMEC report for Twin Metals Minnesota, 501 pp.

Parker, H., Hill, E., Morgan, R., 2015, Comparison of Fort Knox gold deposit resources from pre-feasibility study (1991) to production (1997 to 2015), 37th International Symposium on the Application of Computers and Operations Research in the Mineral Industry, PowerPoint presentation, 46 slides.