Mine Waste Rock Handling Practices and Predictions of Risk of ARD over the Long Term

Detour Gold Corporation

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All amounts are in US dollars except as noted.

Outline

1. Background, Geology and Geochemistry
2. Waste Management, Closure and ARD Risks
3. Conclusions

1. Background, Geology and Geochemistry

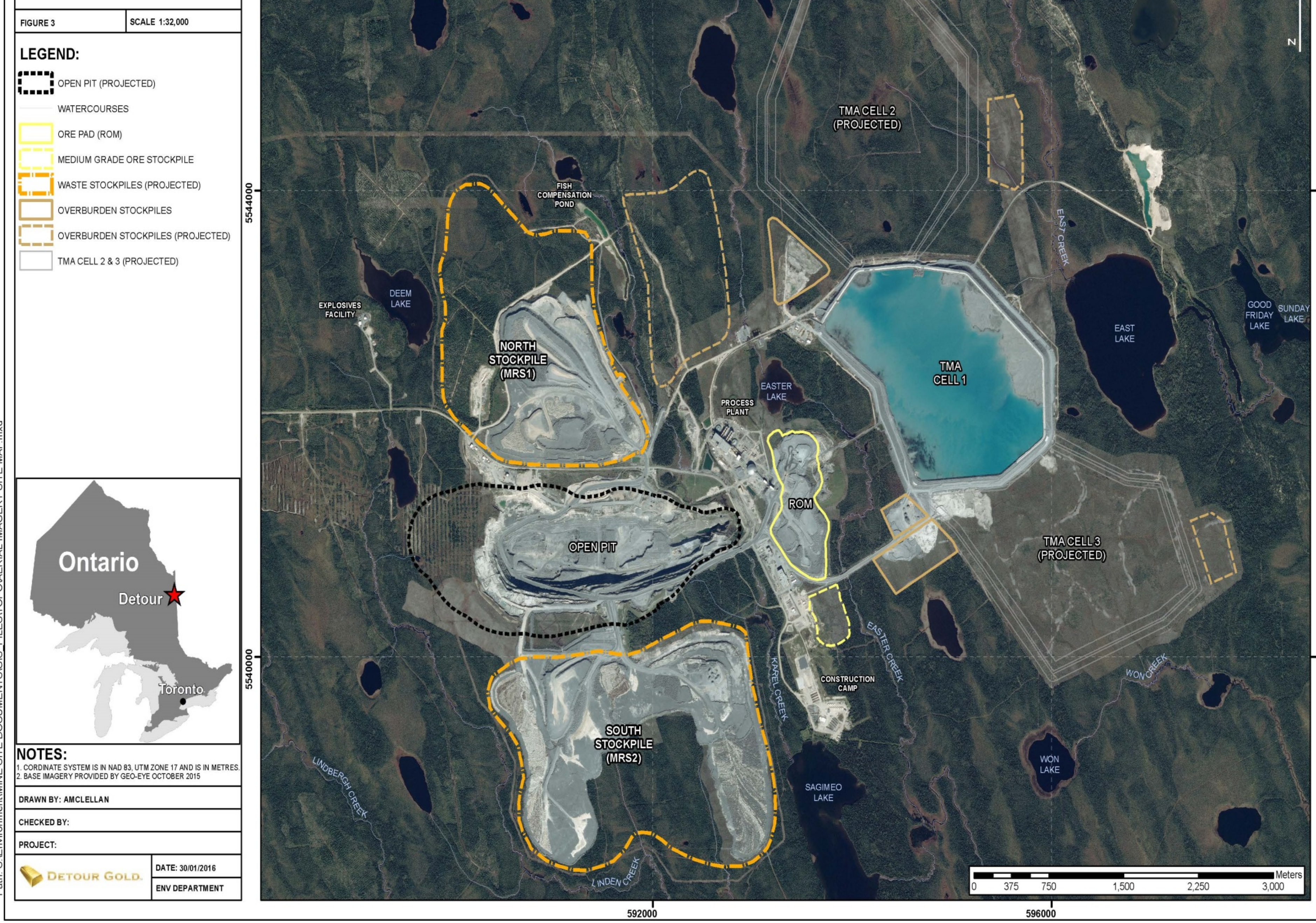


FIGURE 3
SCALE 1:32,000
LEGEND:
OPEN PIT (PROJECTED)
WATERCOURSES
ORE PAD (ROM)
MEDIUM GRADE ORE STOCKPILE
WASTE STOCKPILES (PROJECTED)
OVERBURDEN STOCKPILES
OVERBURDEN STOCKPILES (PROJECTED)
TMA CELL 2 & 3 (PROJECTED)
Ontario
Detour
Toronto
NOTES:
1. CORDINATE SYSTEM IS IN NAD 83, UTM ZONE 17 AND IS IN METRES.
2. BASE IMAGERY PROVIDED BY GEO-EYE OCTOBER 2015
DRAWN BY: AMCLELLAN
CHECKED BY:
PROJECT:
DETOUR GOLD
DATE: 30/01/2016
ENV DEPARTMENT
Path: S:\Environment\MINE SITE DOCUMENTS\GIS_FILES\TOPO\AERIAL IMAGERY SITE MAP.mxd
TMA CELL 2 (PROJECTED)
FISH COMPENSATION POND
DEEM LAKE
EXPLOSIVES FACILITY
NORTH STOCKPILE (MRS1)
EASTER LAKE
PROCESS PLANT
TMA CELL 1
EAST CREEK
EAST LAKE
GOOD FRIDAY LAKE
SUNDAY LAKE
ROM
OPEN PIT
TMA CELL 3 (PROJECTED)
EASTER CREEK
KAREL CREEK
CONSTRUCTION CAMP
WON CREEK
SOUTH STOCKPILE (MRS2)
LINDBERGH CREEK
SAGIMEO LAKE
WON LAKE
LINDEN CREEK
5544000
5540000
592000
596000
N
Meters
0 375 750 1,500 2,250 3,000

Geological Context

- Disseminated low percent level sulphide mineralization, no massive sulphide. Median S: 0.2% (pre-mine), 0.4% (operational).
- Simple sulphide mineralogy – pyrite and pyrrhotite.
- Widespread carbonate, no rock lacking carbonate.
- Lack of distinctive rock types. Basaltic host rocks showing textural rather than strong geochemical variability.

Operating Information

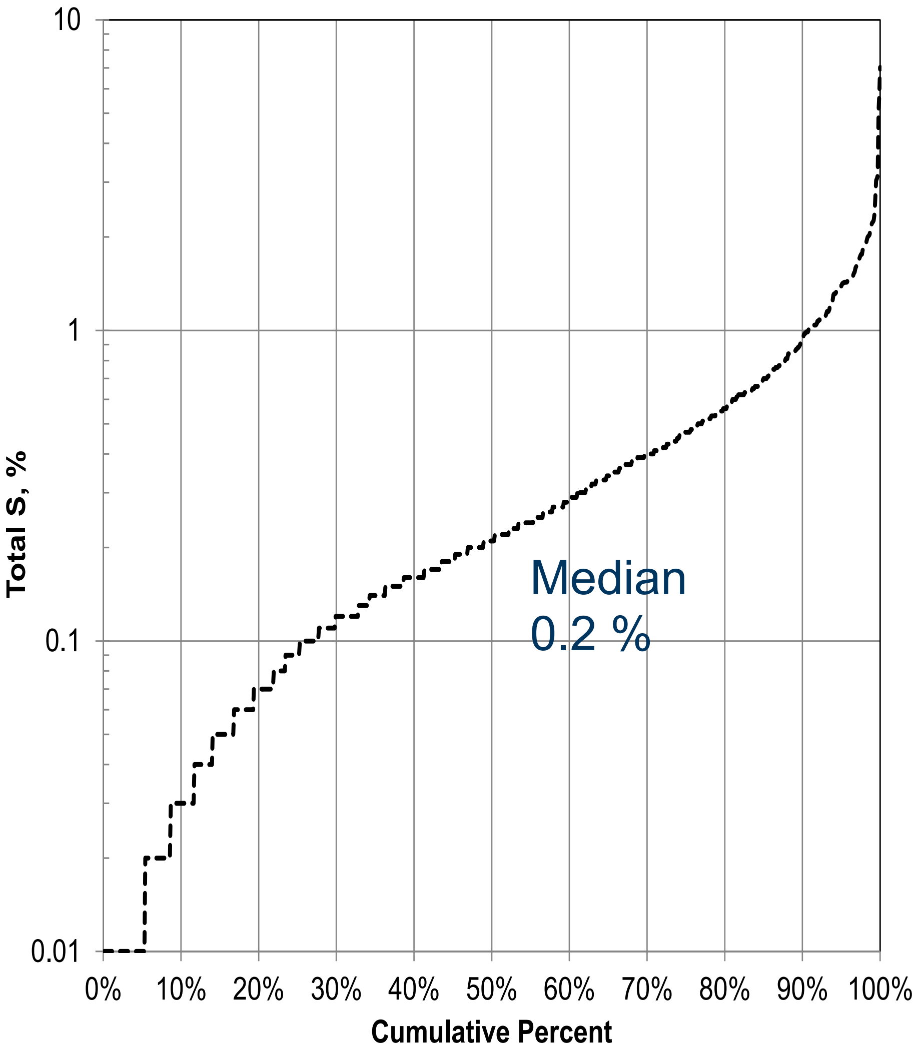
- Started production in January 2013.
- Ore processed – 55,000 to 75,000 tonnes per day
- Average gold grade – 0.9 g/t
- Ore processed by gravity and cyanidation achieving 91 % gold recovery
- Waste rock strip ratio – 2.5 waste rock/ore
- Projected mine life is 23 years, Main Pit - 16.4 M oz

Other Exploration Potential.

- West Detour ; small pit to west – EA process – 2 Moz
- South Detour 58 N zone – active exploration 5 km south of plant
- Total Detour mineral claim and lease is 625 km^2
- New Abitibi Greenstone Belt south of Detour Mine
    - Claims staked in summer 2016 – 494 km^2


Ore is hosted by basaltic volcanic rocks

Waste Rock has Low Sulphide Content



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- Cumulative histogram of sulphide content of rock tested for EA.
- Median NP/AP = 3.2
- Lack of trace element enrichment correlates with simple sulphide mineralogy.

2. Waste Management, Closure and ARD Risks

Waste Rock Management Concepts

- 17 to 20% PAG rock.
- Segregated by ARD potential.
- Separate PAG and non-PAG stockpiles.
- PAG rock stockpile closure considering oxygen entry and infiltration reduction measures.
- PAG rock drains towards open pit.
- Non-PAG rock also used as fill for infrastructure construction.

Waste Rock Geochemical Management

Essential considerations for geochemical segregation:

1. Mineralogically-based segregation parameters
2. Site specific segregation criterion
3. Feasibility of segregation
4. Practical operational implementation
5. Segregation risk factors
6. Long term water quality

1. Mineralogically-Based Segregation Parameters

NP/AP used for segregation

- NP determined from total carbon which was demonstrated as a proxy for carbonate.
- The carbonate mineral at DLM is dominantly calcite.
- Use of carbonate to measure NP eliminates reliance on less reactive silicates.

- AP determined from total sulphur which quantifies pyrite and pyrrhotite.
- No sulphate minerals.

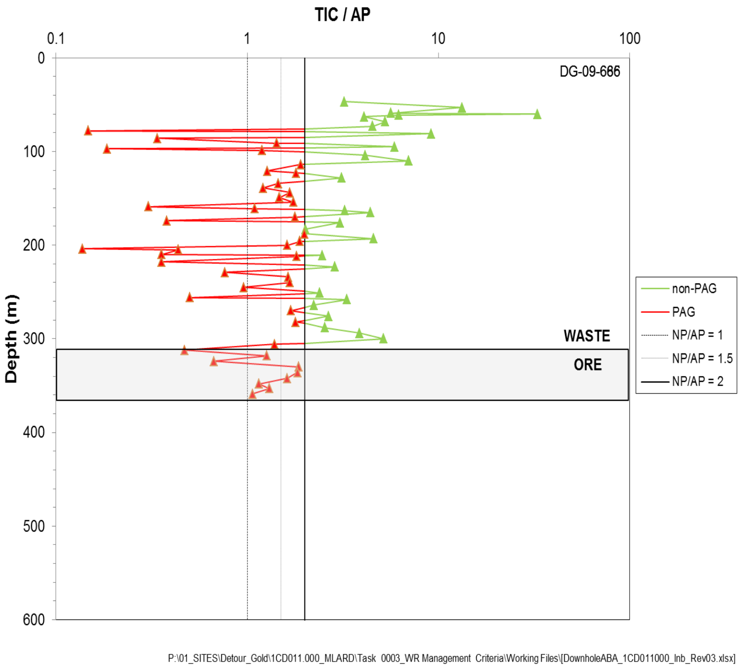
2. Site Specific Segregation Criterion

- Determined based on interpretation of relative rates of weathering and dissolution of sulphide and carbonate minerals in humidity cells.
- The selected site specific criterion to define PAG rock is:

$$NP/AP \leq 1.5$$

- Due to lack of trace element enrichment, segregation by trace element content is not needed.

3. Feasibility of Segregation



- Considered scale of downhole variability in PAG/non-PAG.
- Determined that PAG and non-PAG rock occur at scales that can practically be segregated using the mine equipment.

4. Practical Operational Implementation

- Total carbon and total sulphur determined on reverse circulation drill hole cuttings two benches ahead of mining.
- Analysis by induction furnace at dedicated laboratory operated by SGS in nearby Cochrane.
- Results transferred to geology department and used to define dig limits.
- Auditing of placed rock.

5. Segregation Risk Factors

- Does NP/AP≤1.5 increase risk that non-PAG rock will generate ARD? Compared to say NP/AP≤2.0

- Types of minerals contributing to NP and AP.
  - NP is Ca and Mg carbonate – most reactive acid neutralizers.
  - AP is iron sulphide.
  - Minimal other sulphur forms and mineral types.
- Physical availability of minerals.
  - AP and NP minerals exposed the same way by blasting

(see also Day, Forsyth and DesJardins 2015)

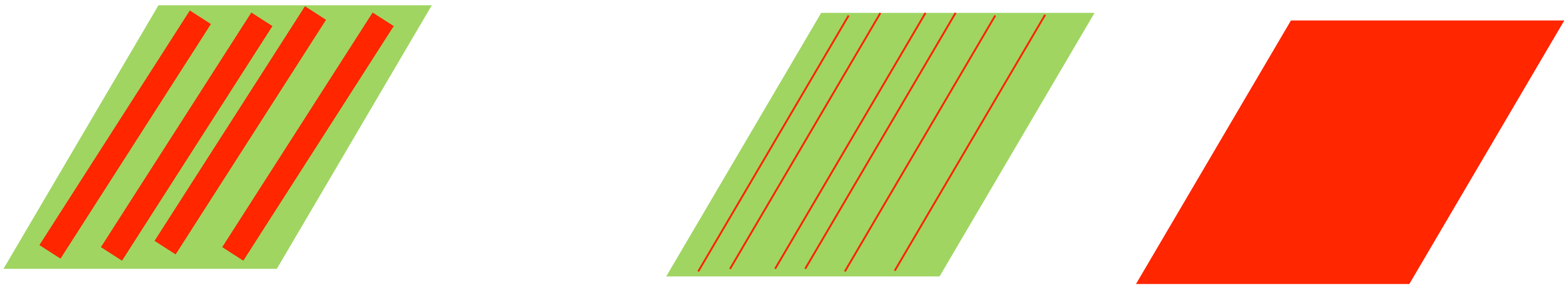
5. Segregation Risk Factors

Blending vs segregation

Blended Pile
NP/AP<Criterion

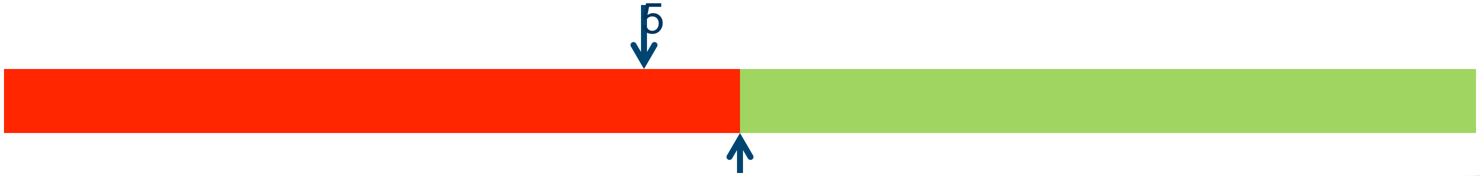
Segregated Non-PAG Pile
NP/AP>>Criterion

Segregated PAG Pile



Segregation absorbs uncertainty in the criterion

NP/AP=1.5



NP/AP>1.5

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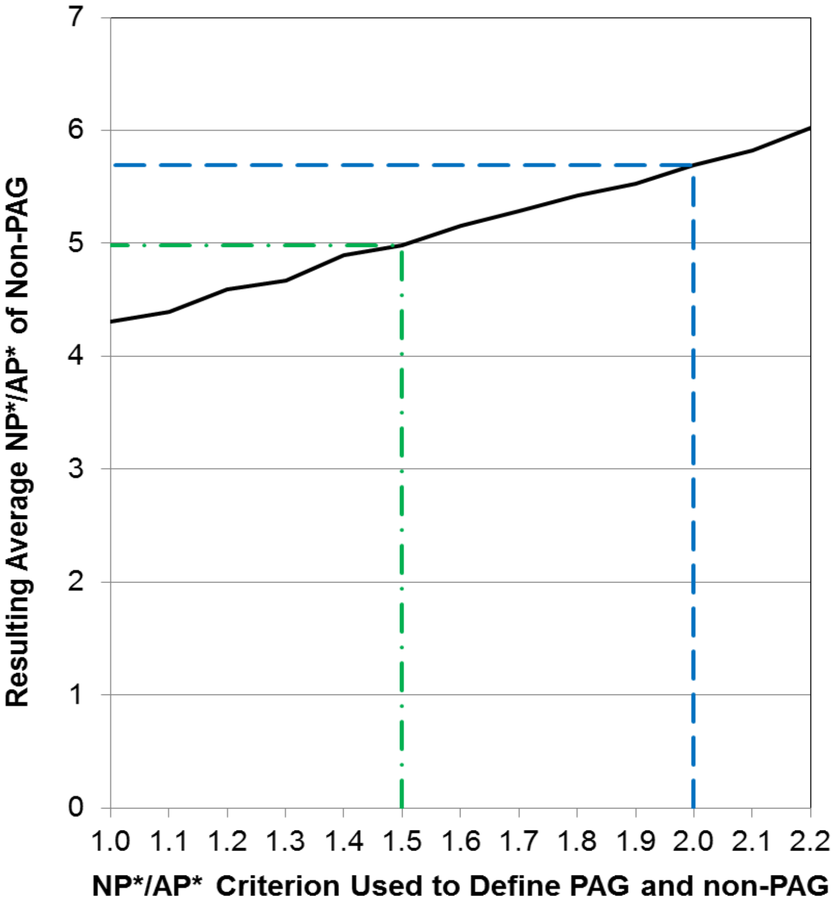
5. Segregation Risk Factors



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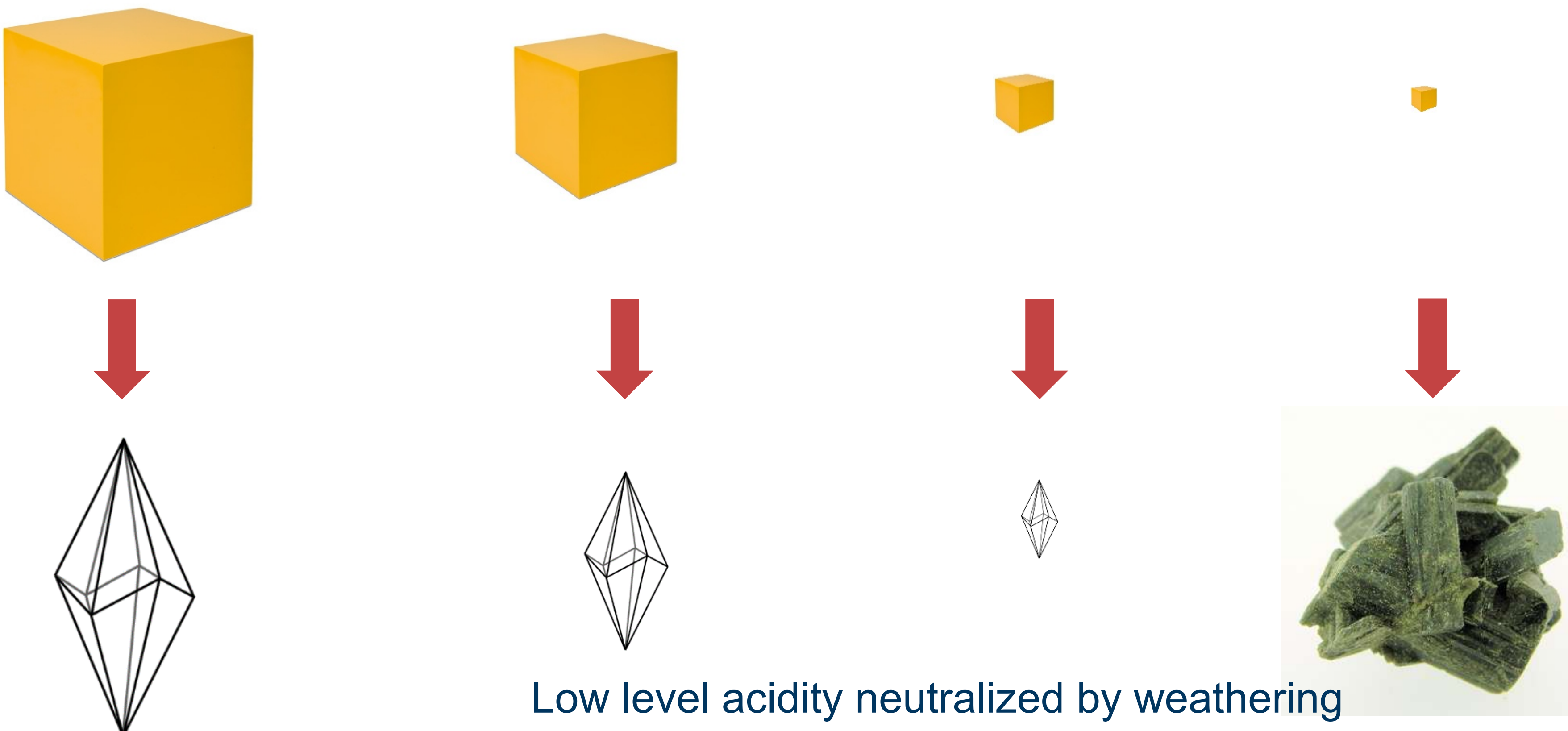
- Segregation absorbs uncertainty in the criterion, pit rock heterogeneity, and operational upsets

5. Segregation Risk Factors

With time, sulphide and calcite deplete in parallel



Low level acidity neutralized by weathering silicates

(see also Day and Kennedy 2015)

6. Long Term Water Quality

Non PAG waste rock

- pH basic drainage, sulphate constrained by gypsum solubility, trace element concentrations controlled by pH.

PAG waste rock

- Acidic drainage if it occurs will be many decades in the future (due to carbonate buffering),
    - severity of ARD is expected to be limited by low residual sulphide content
    - reactive silicates may moderate pH depression.

6. Long Term Water Quality – cont.

- Operational monitoring over mine life allows any corrective actions:
  - Geochemical analysis of waste rock.
  - Collection ditches around waste rock piles
  - 45 surface water sites for operating permit
  - Over 100 groundwater wells for operating permit
  - Fully integrated Earth FX surface and ground water model
- Ongoing research on old and new waste rock piles
  - **$ 1.14 M total 2012 to 2021** – with NSERC matchings grant with Universities of Waterloo/Alberta/Carleton
  - 3 masters theses completed & 2 masters and 2 PhD planned
  - Numerous co-op students in past and future.

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Conclusions

- Waste management approach at DLM tailored to specific characteristics
  - Non-distinctive rock types.
  - Relatively low sulphide concentration in all waste rock.
  - Widespread carbonate.
  - Lack of enrichment of trace elements.
  - Together these result in relatively low reactivity.
- Due to these features, an NP/AP segregation criterion of 1.5 is appropriate:
  - Segregated non-PAG rock maintains NP/AP near 5.
  - Small amounts of PAG rock can be included at low risk.
  - Reduces need for management of PAG waste rock.

Thanks for Listening!

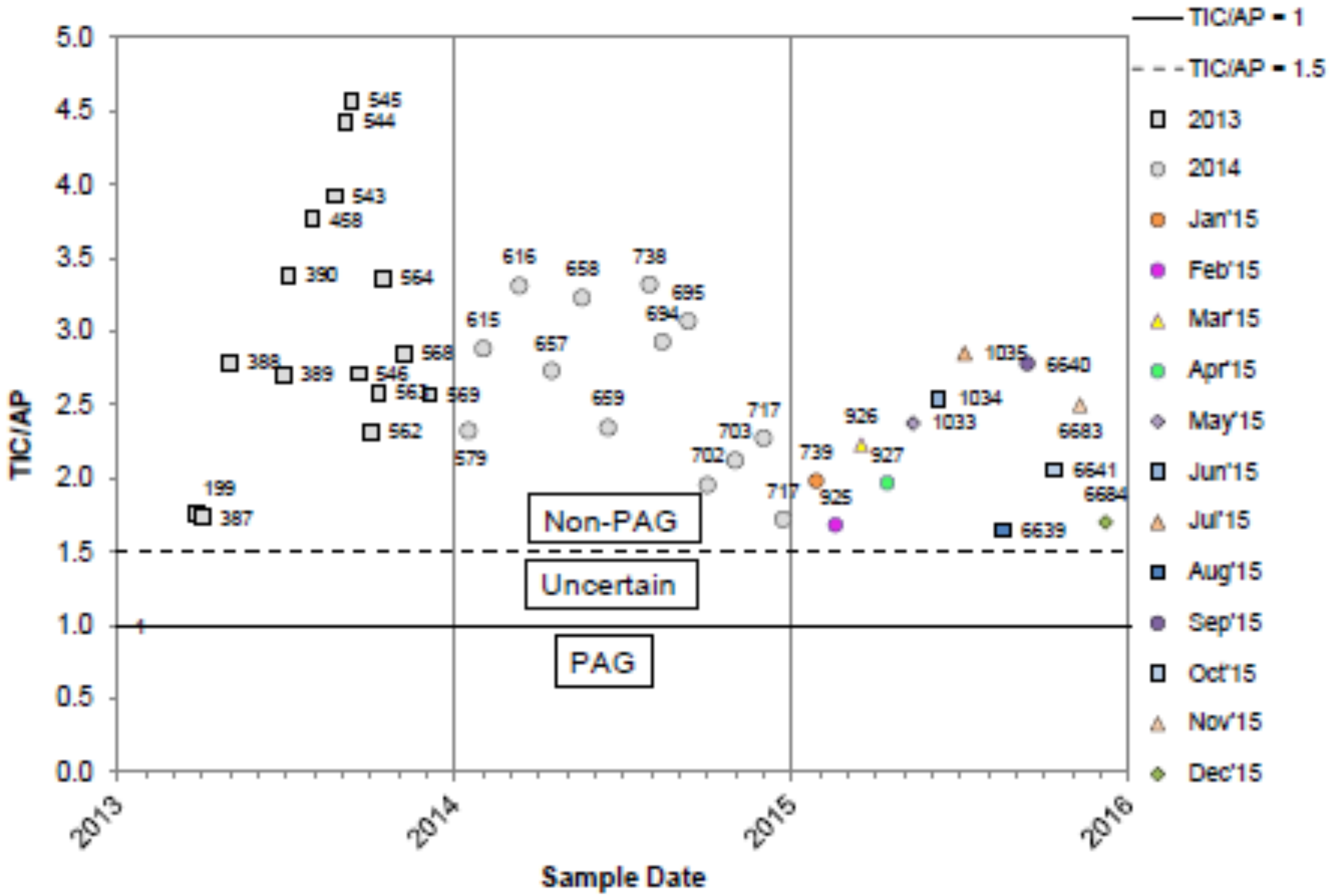
Supporting Material

References

Day, S.J., Forsyth, B.A. and DesJardins, M. 2015. Influence of Size-Fraction Partitioning of Sulphide and Carbonate Minerals in Blasted Rock on ARD Potential Classification, Copper Mountain Mine. Presented at 22nd Annual British Columbia-MEND ML/ARD Workshop December 2 and 3, 2015.

Day, S.J. and Kennedy, C.B. 2015. Setting ARD management criteria for mine wastes with low sulfide content. Proceedings of the 10th International Conference on Acid Rock Drainage, Santiago, Chile, April 20 to 25, 2015.

Production Monitoring Tailings ABA



Production Statistics for Four Years (in tonnes x1000)

` Material Category	2012	2013	2014	2015	Total to Date
Ore					
Ore Processed	2,129	12,239	17,725	19,800	51,893
Mineralized Waste (NAG)	547	5,740	6,930	3,123	16,340
Mineralized Waste (PAG)	-	-	-	836	836
Total Ore and Mineralized Waste	2,676	17,979	24,655	23,759	69,069
Waste Rock					
NAG Waste Rock	6,573	23,637	30,237	39,253	99,700
PAG Waste Rock	1,042	891	6,151	17,433	25,517
Total Waste Rock	7,615	24,528	36,388	56,686	125,217
Strip Ratio	3.8	2.4	2.5	3.4	2.8
% PAG vs all Waste rock	14%	4%	17%	31%	20%

Summary of RC Core Analysis – 4 years (All Ore and Waste Rock Samples)

Statistic	Total C %	Total S %	NP (Total C) kg $CaCO_3$/t	AP (Total S) kg $CaCO_3$/t	NPR
Number of Samples	160,416	160,391	160,416	160,391	**160,391**
Average	0.64	0.61	52.9	19	4.6
25th Percentile	0.32	0.241	26.7	7.5	1.8
Median	0.49	0.48	40.4	15.0	3.2
75th Percentile	0.87	0.84	72.2	26.3	5.1
Number of Non PAG					80,350
Median	0.50	0.39			3.8