

GRADE IMPROVEMENT THROUGH MULTI-DISCIPLINARY TEAM SYNERGIES – A CASE STUDY OF UNKI MINE, GREAT DYKE OF ZIMBABWE

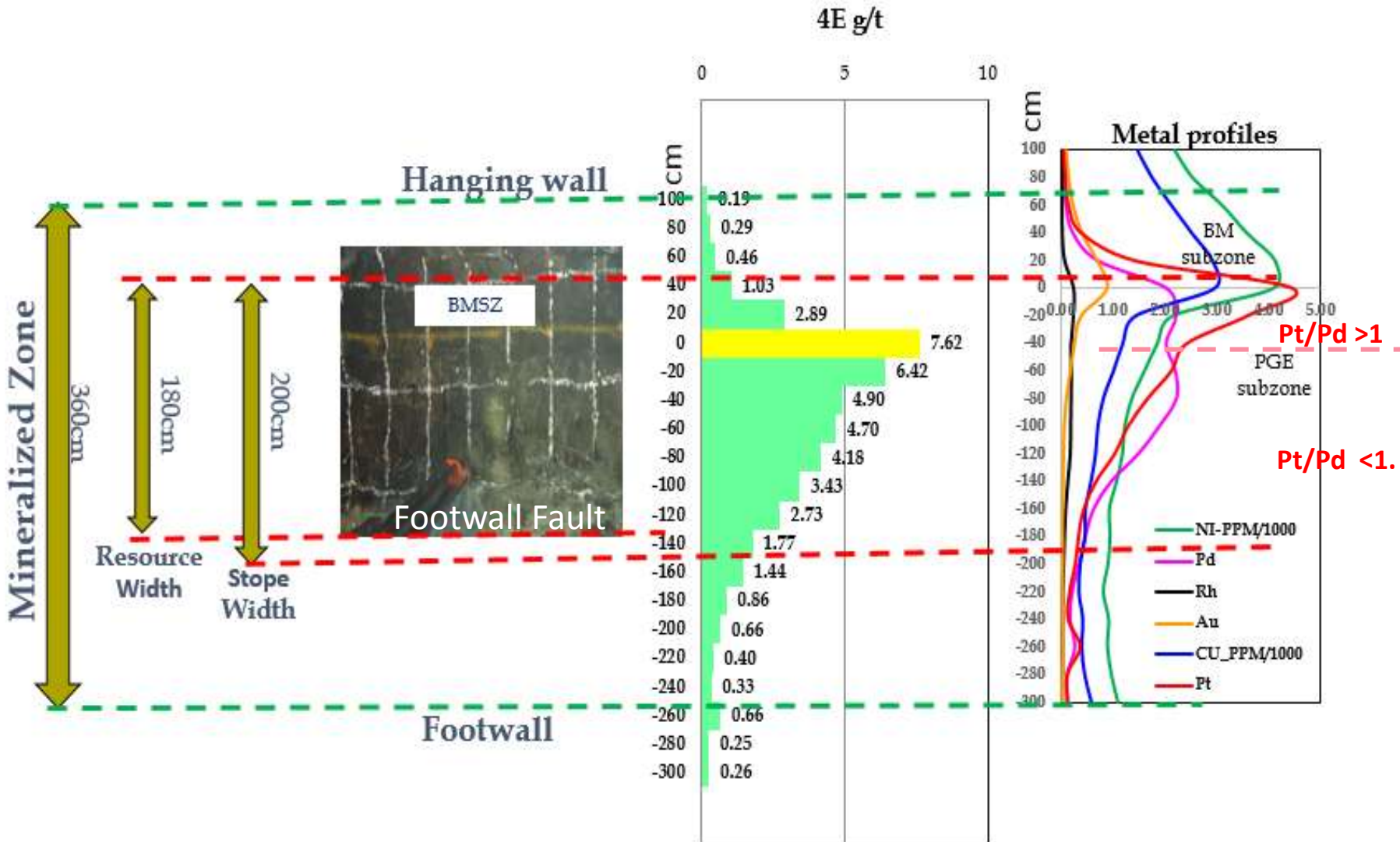
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ANGLO AMERICAN PLATINUM**

INTRODUCTION



- The operation's viability was threatened by declining metal prices and increasing production costs.
- Grades delivered to the Plant had declined from 3.40g/t in 2013 to 3.10g/t in 2014, due to unclear reasons.
- Understanding the causes and implementation of grade turn around strategies called for an integrated approach involving all disciplines and teams.

MSZ REEF PROFILE



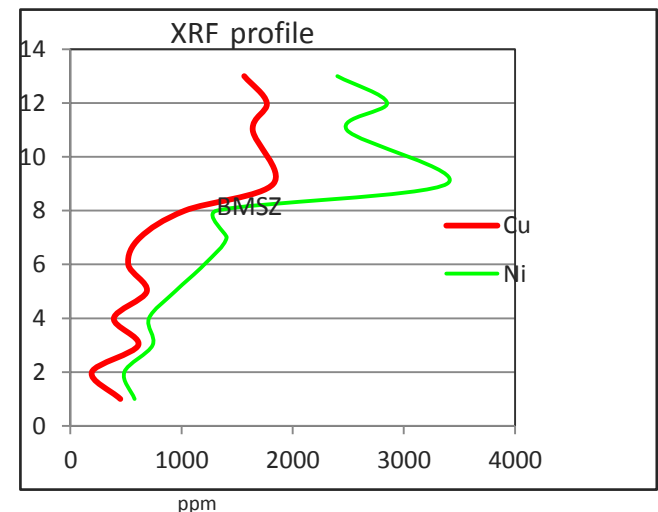
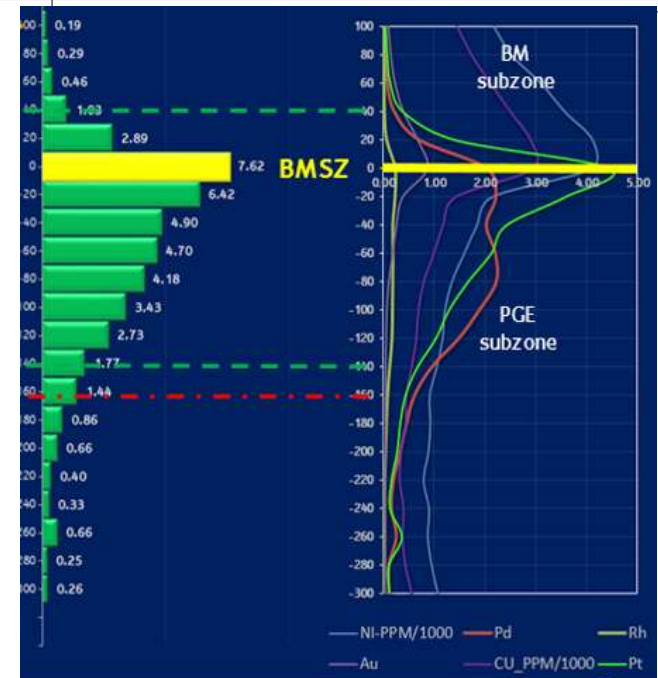
- BMSZ is the reference marker for the MSZ Reef

CALIBRATION OF CORRECT REEF SLICE POSITIONING PROCESS

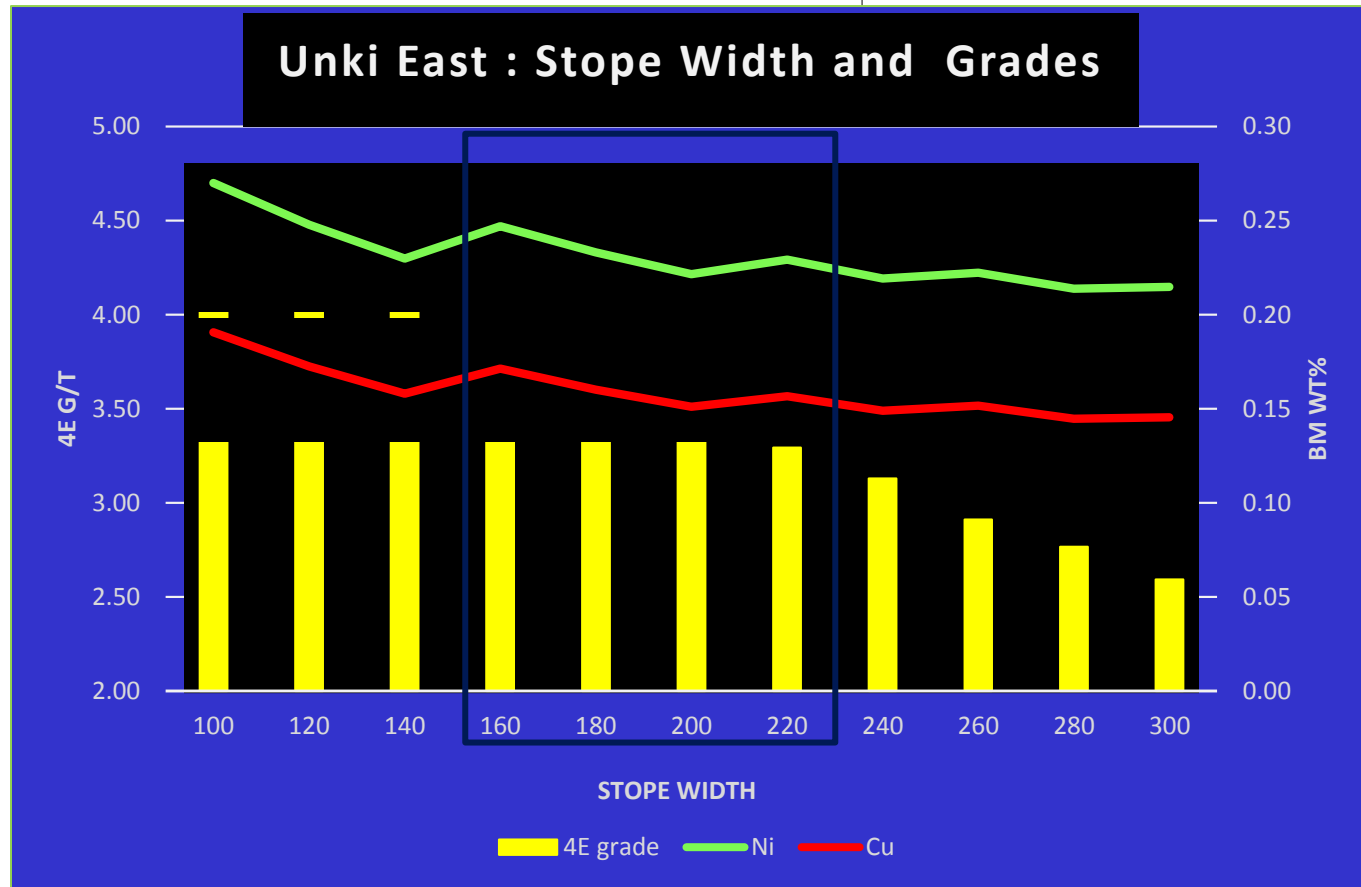
Assay Database

Pt Peak Coincident with BMSZ	75%
Pt Peak within 20cm of BMSZ	20%
Pt Peak outside 20cm	5%

- Visual determination of the position of the Base of Base Metals Subzone (BMSZ) by assessment of sulphides concentration.
- Worst case : Leave Pt Peak in HW - dilution increases from 4 to 22%
- SOR after every 3 blasts to mitigate dilution: Ni and Cu. Added Pt and Pd assays using AAS with TAT of 24hrs.
- ***Pt Pd from AAS, Ni and Cu from XRF.***



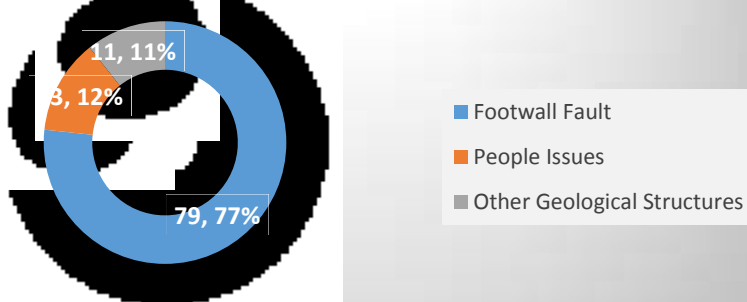
STOPE WIDTH REDUCTION



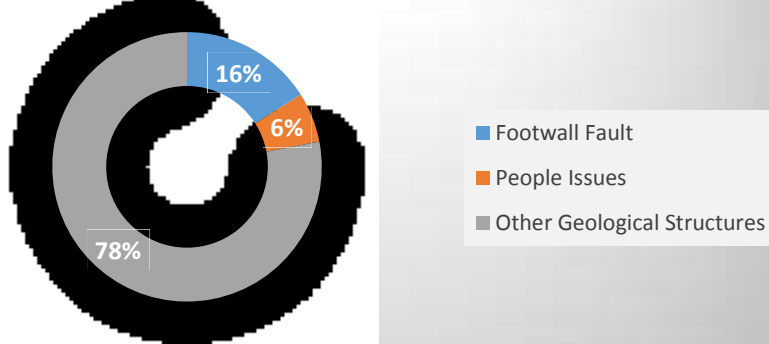
- 4E grade highly sensitive to broken Stope widths.
- Focus on reducing Stope widths for all teams from an average of 2.19m to below 2.04m

OVERBREAK ANALYSIS

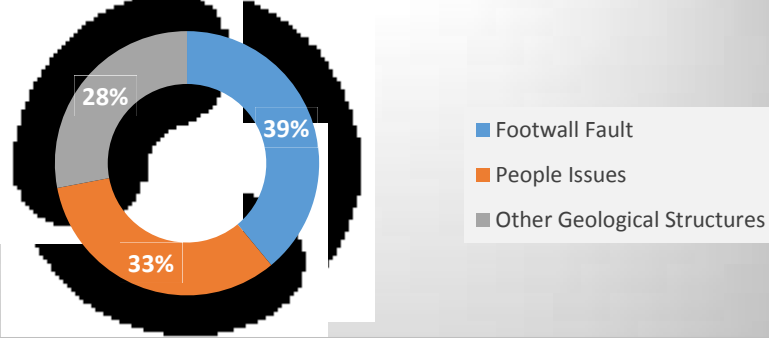
South Section : Levels 1 - 4



North Section : Levels 1 - 7



South Section : Levels 5 - 8



- Footwall Fault impact significant in the Upper Levels as well as the South Section.
- Low angle Joints, Domes & mainly E-W trending faults, dykes had significant impact in the North Section : Also contributing to Poor Ground Conditions in this Section.
- People Issues: Poor marking, drill and blast.

MINE DESIGN CHANGES

- Detailed mapping & stability analysis in the North Section resulted in mine design changes being effected in this section of the mine.
- Hangingwall overbreaks due to unstable HW significantly introduced dilution whilst sidewalls failure compromised regional support.
- Mine design change from 12m to 6m panels
 - ✓ Ensured bord span was smaller than dimensions of domes and fault frequency spacing
 - ✓ Improved extraction rate from 62% to 69%
 - ✓ Mitigated large Falls of Ground

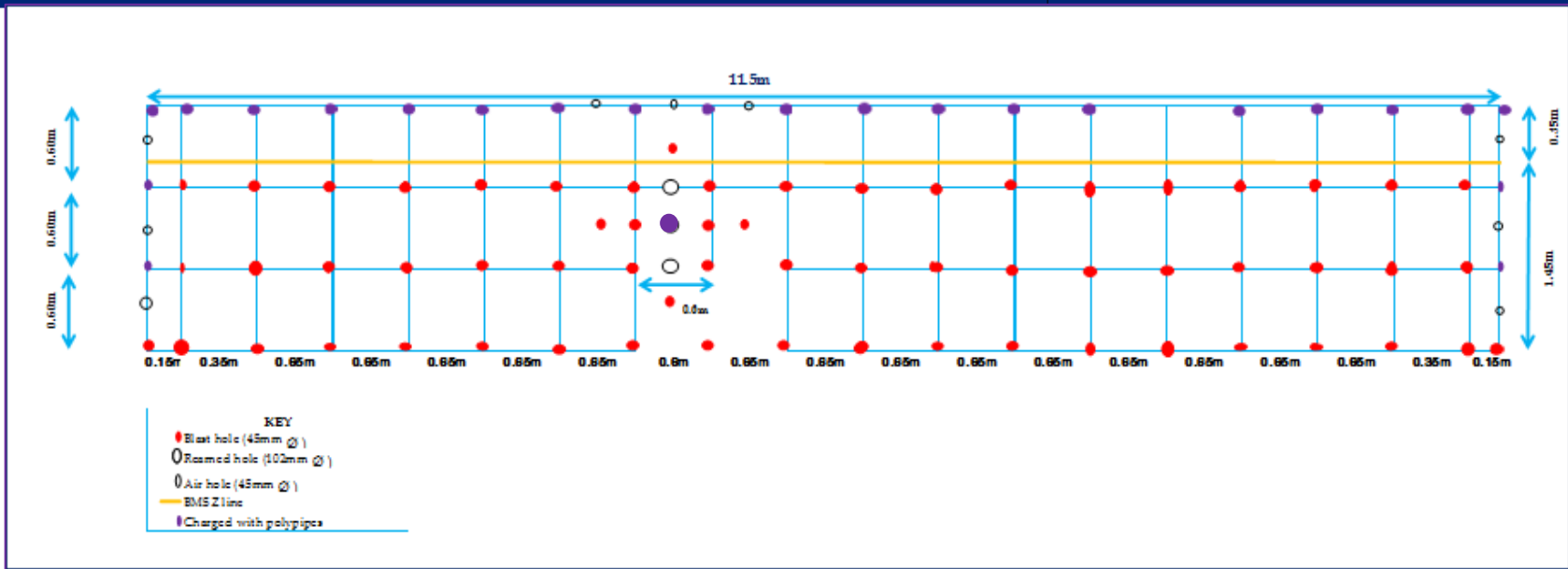
TMM PAIRING AND RE-DEPLOYMENT

- Benchmark Mining Cut for sections based on Fleet Pairing and Deployment.

LHD	MACHINE HEIGHT (m)	PAIRING MACHINE	DESIRED SW (m)
GHH 4.4	1.55	4.4	1.95
SANDVIK 208L	1.60	4.4	1.98
GHH 7.4	1.65	4.4	2.05

- GHH 7.4 machines had more impact on the footwall dilution during cleaning and tramming, exacerbated by presence of footwall fault.
- Plan was to re-deploy 7.4s in areas with higher than average in-situ grades to accommodate the dilution.

BLAST DESIGN CHANGES

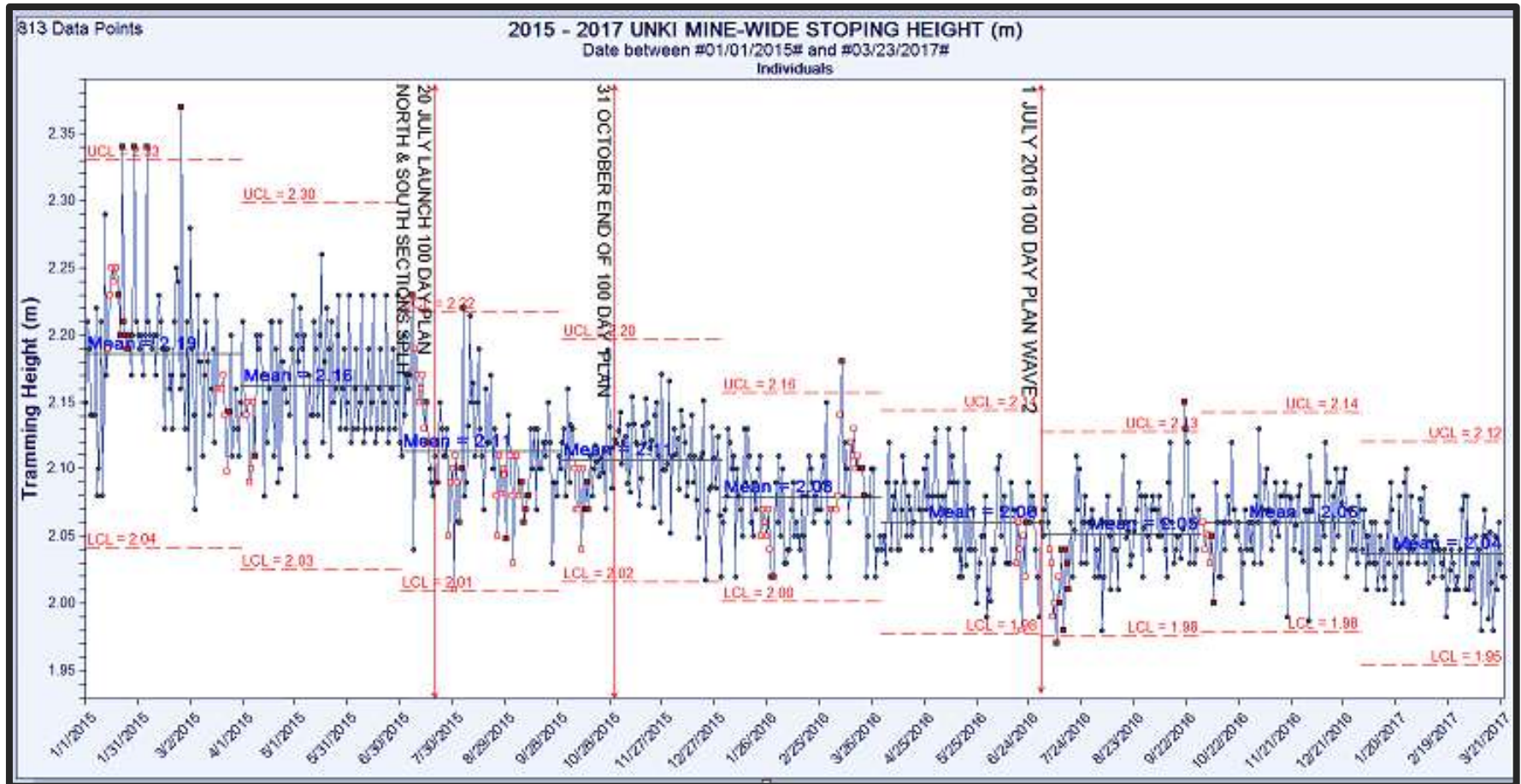


- Practical & well-balanced changes to the blast design by multi-disciplinary team introduced to ensure smooth perimeter control blasting for all types of ground at Unki Mine.
- Introduction of air holes between perimeter holes induce stress line which triggers a pre-splitting of the hangingwall and sidewalls, less damage.
- Reduction of burden and additional line of holes 15cm from sidewalls.
- Use of polypipes in sidewall and hanging wall
- Improvement of drill and blast practice by multi-disciplinary team through continuous monitoring

REDUCTION OF WASTE GENERATION

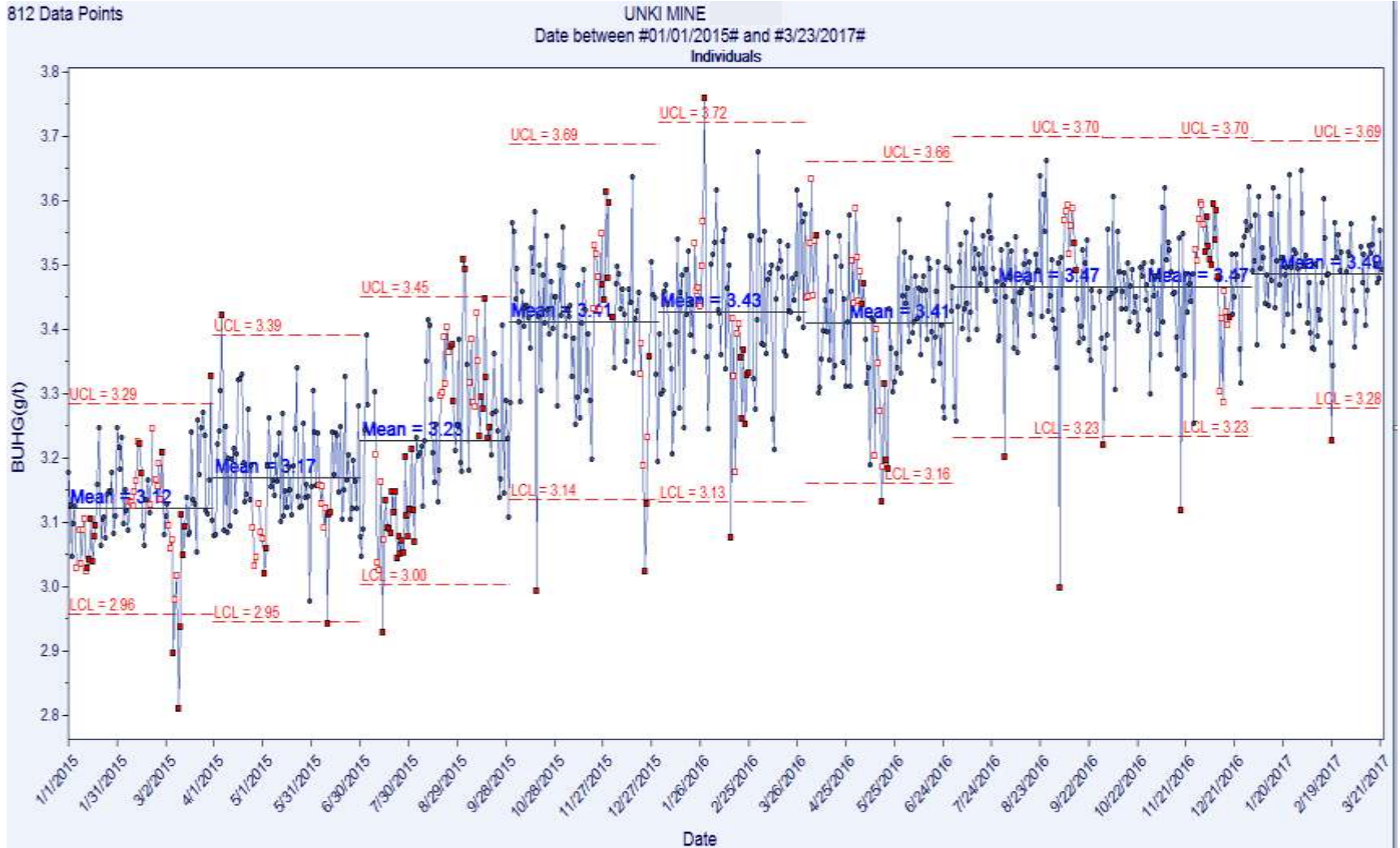
- Post blast analysis: Spotting of waste (IRUPS and Xenoliths).
- Bord narrowing & re-establishments to avoid waste generation
- Painting and Insertion of magnetic washers to track waste and ore movement.

TRACKING STOPE WIDTHS

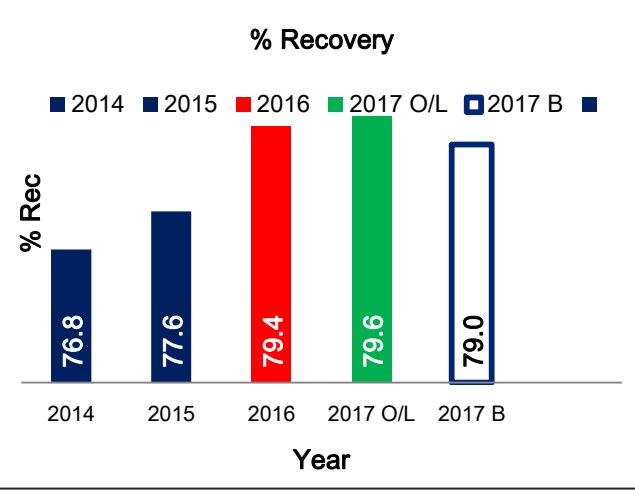
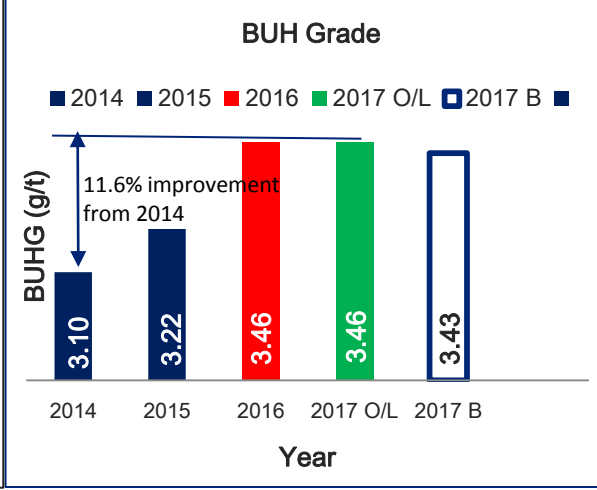
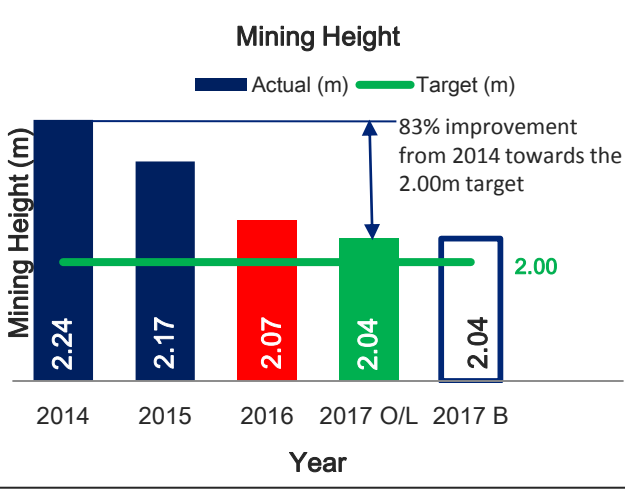
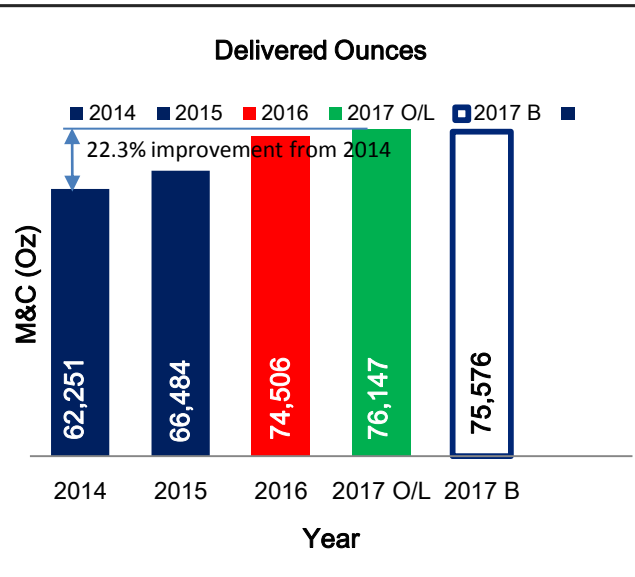
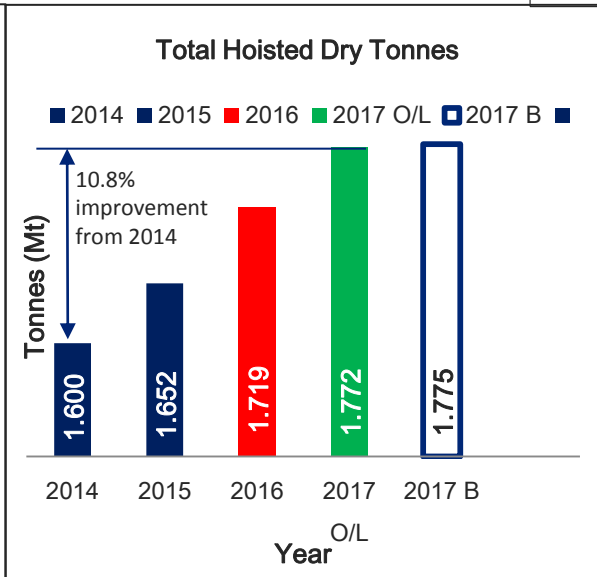
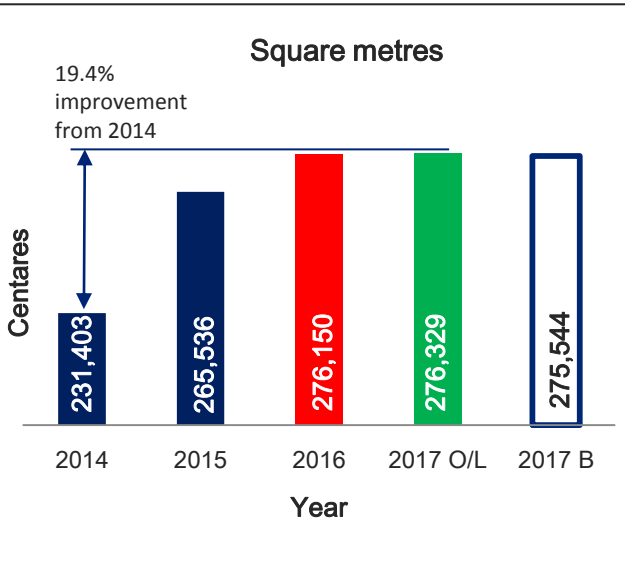


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Rejuvenation of grade improvement through 100 Day Projects

TRACKING GRADE



UNKI MINE PERFORMANCE BEFORE AND AFTER INTERVENTIONS



THANK YOU

QUESTIONS?