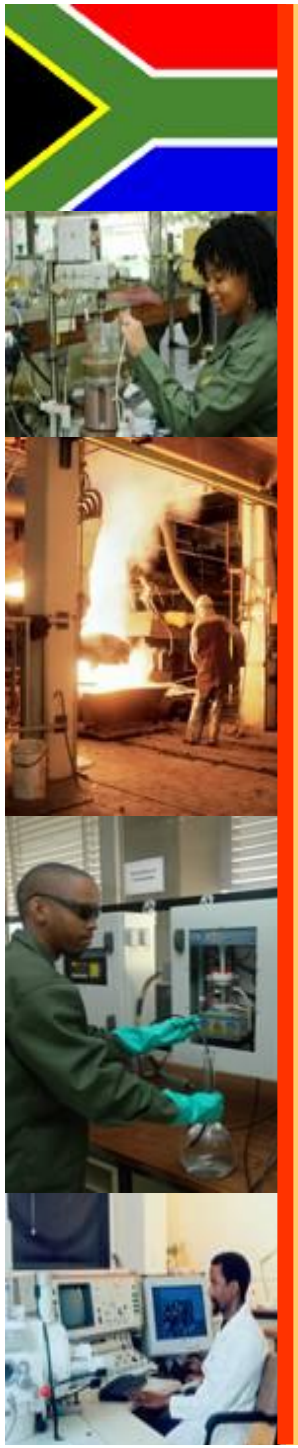

Council for Mineral Technology

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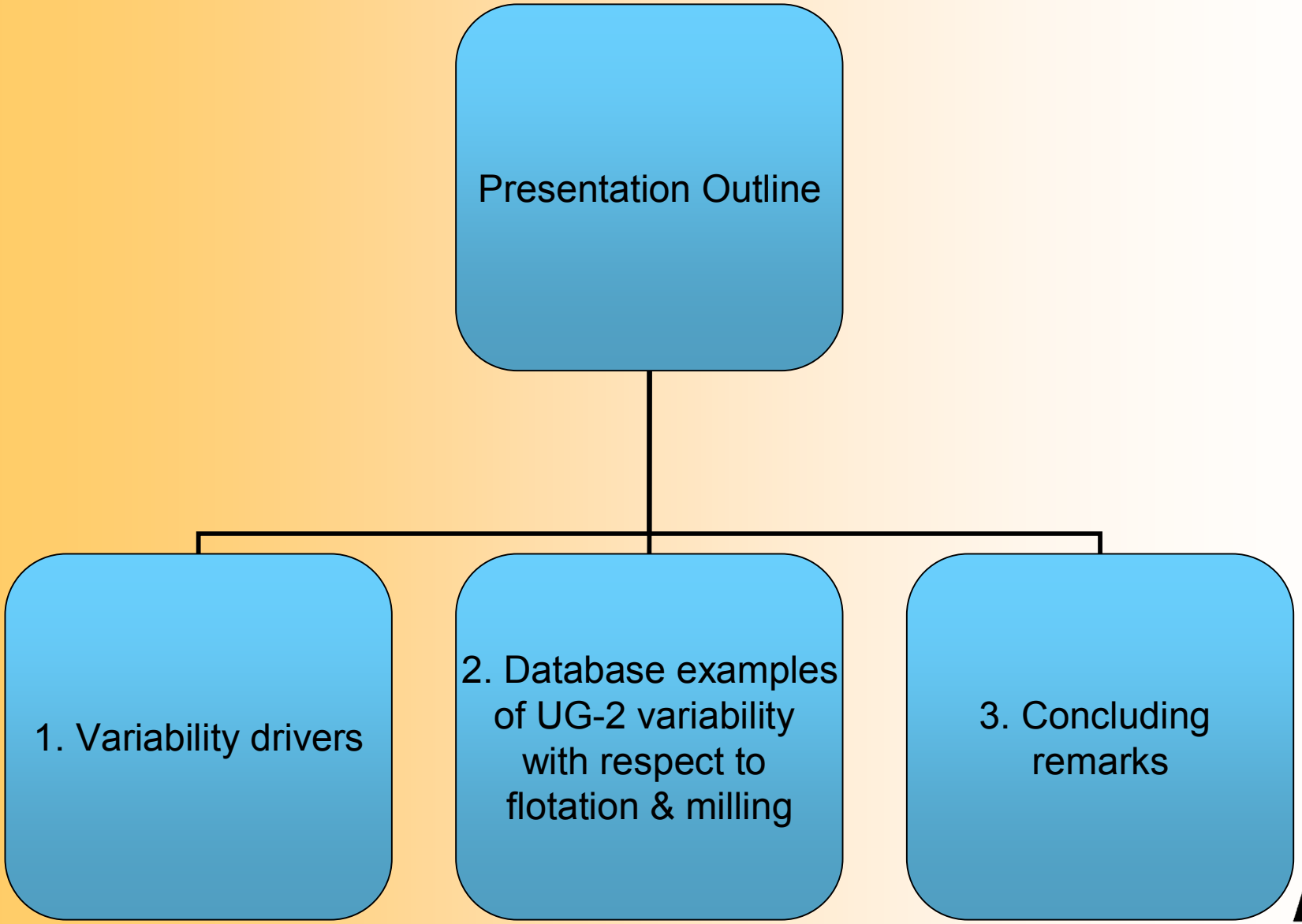
A global leader in mineral and metallurgical innovation

UG-2 ore variability

5 June 2009

Dr MAW Bryson, Mr N V Ramlall, Mr A McKenzie, Mr P Morgan (DRA)

Outline



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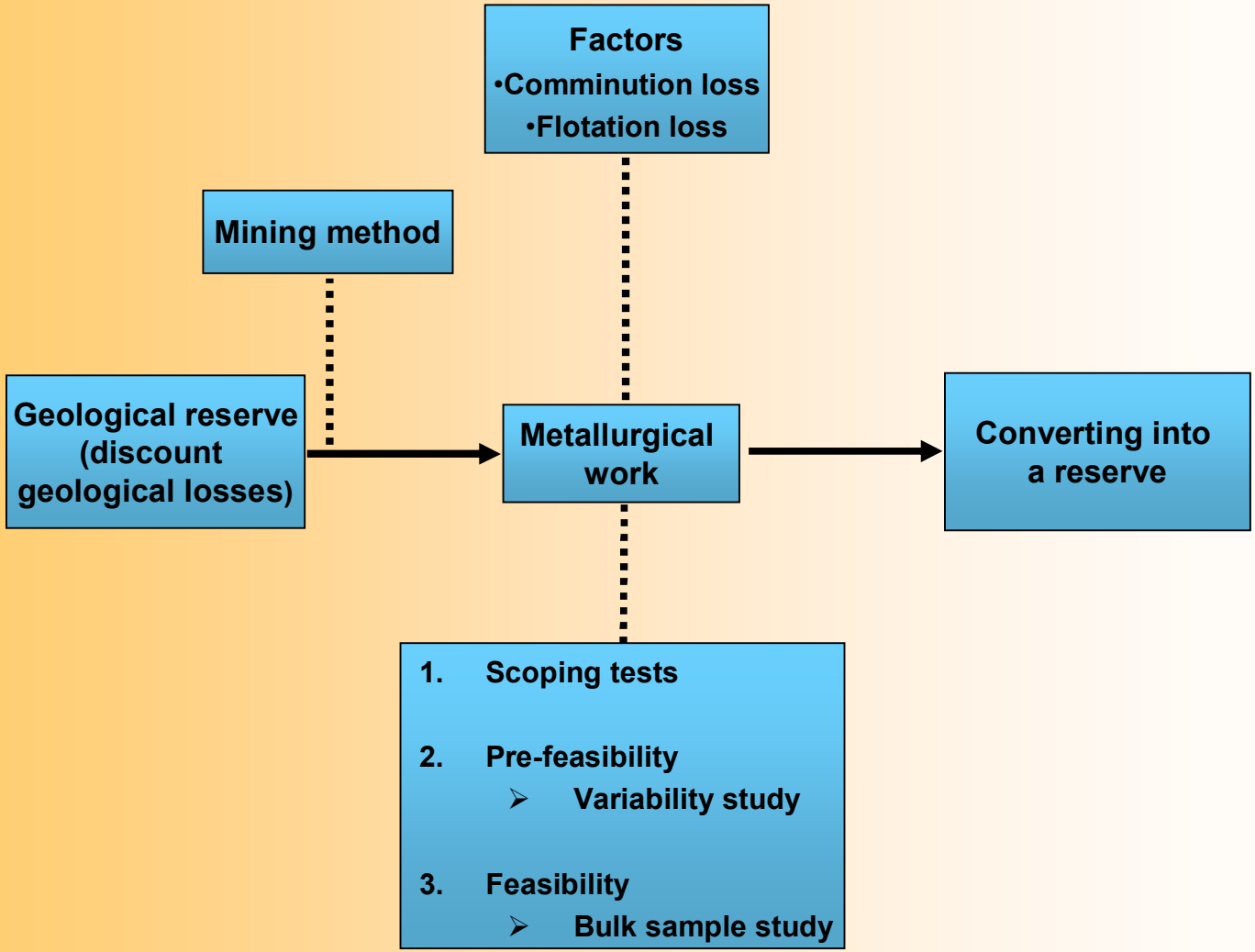
Project feasibility studies



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Drivers of variability in UG-2 ores

1. Head grade
2. Waste dilution
3. Degree of weathering
4. Degree of alteration
5. Blasting and mining methods
6. Proximity to geological features
    - Footwall rock types i.e. IRUP, PEG, PRX, ANS, etc
    - Faults
    - Intrusions
    - Lineaments
7. Geographical location i.e. Western/Eastern Limb

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Consequences of variability

- Important for determining metallurgical parameters like recovery and grade across a deposit
- Important for determining the payback period for a mine
- Milling rates for e.g. waste dilution can reduce throughput by 40 %
- Possible to identify problematic/good areas in a deposit

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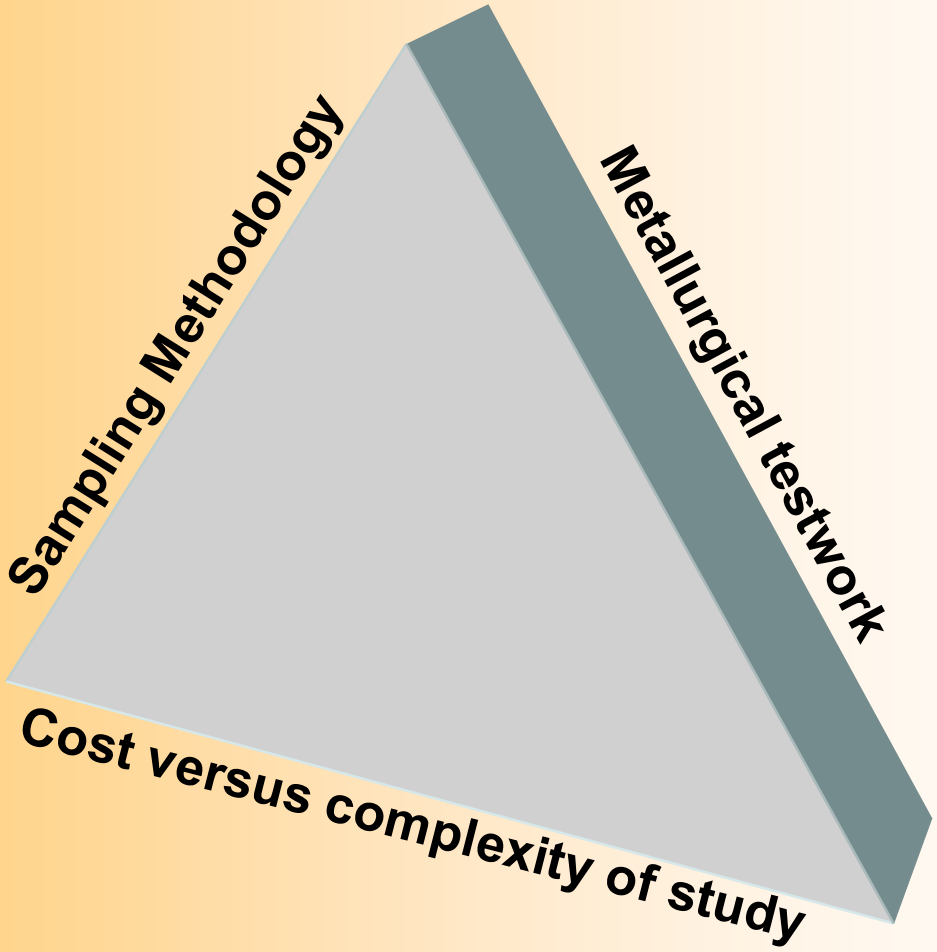
Variability methodology



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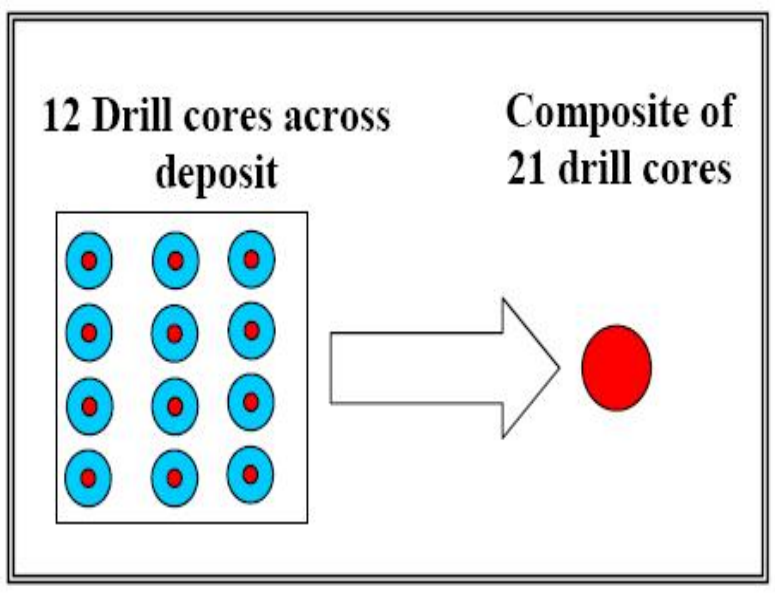
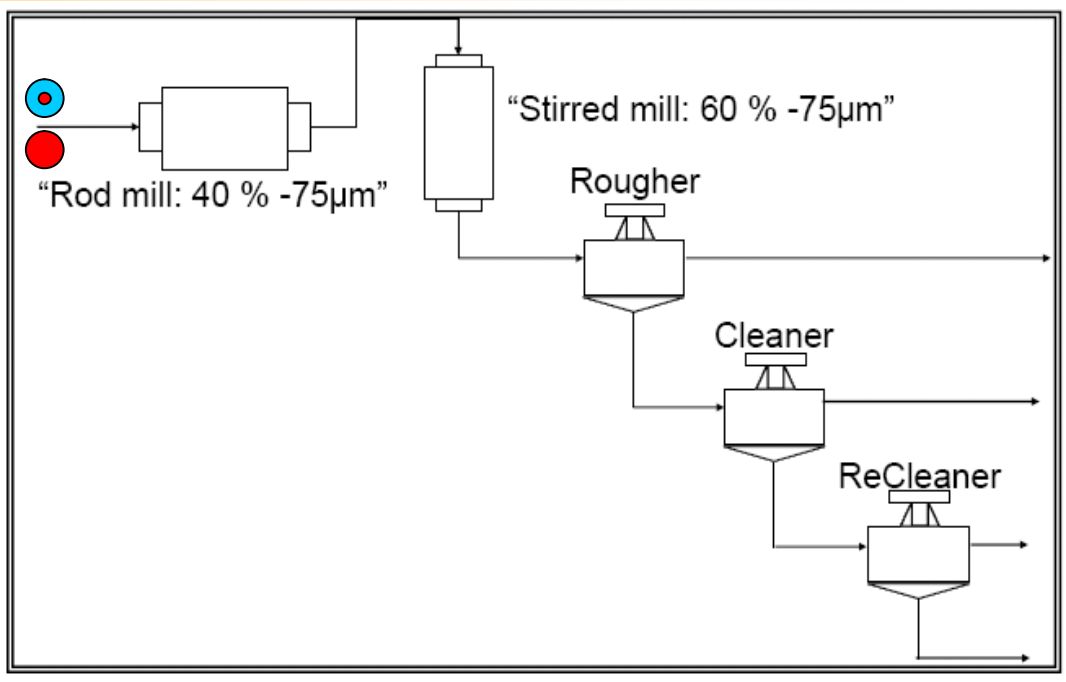
Examples

Examples of three Eastern Limb UG-2 ores

Ore No.1





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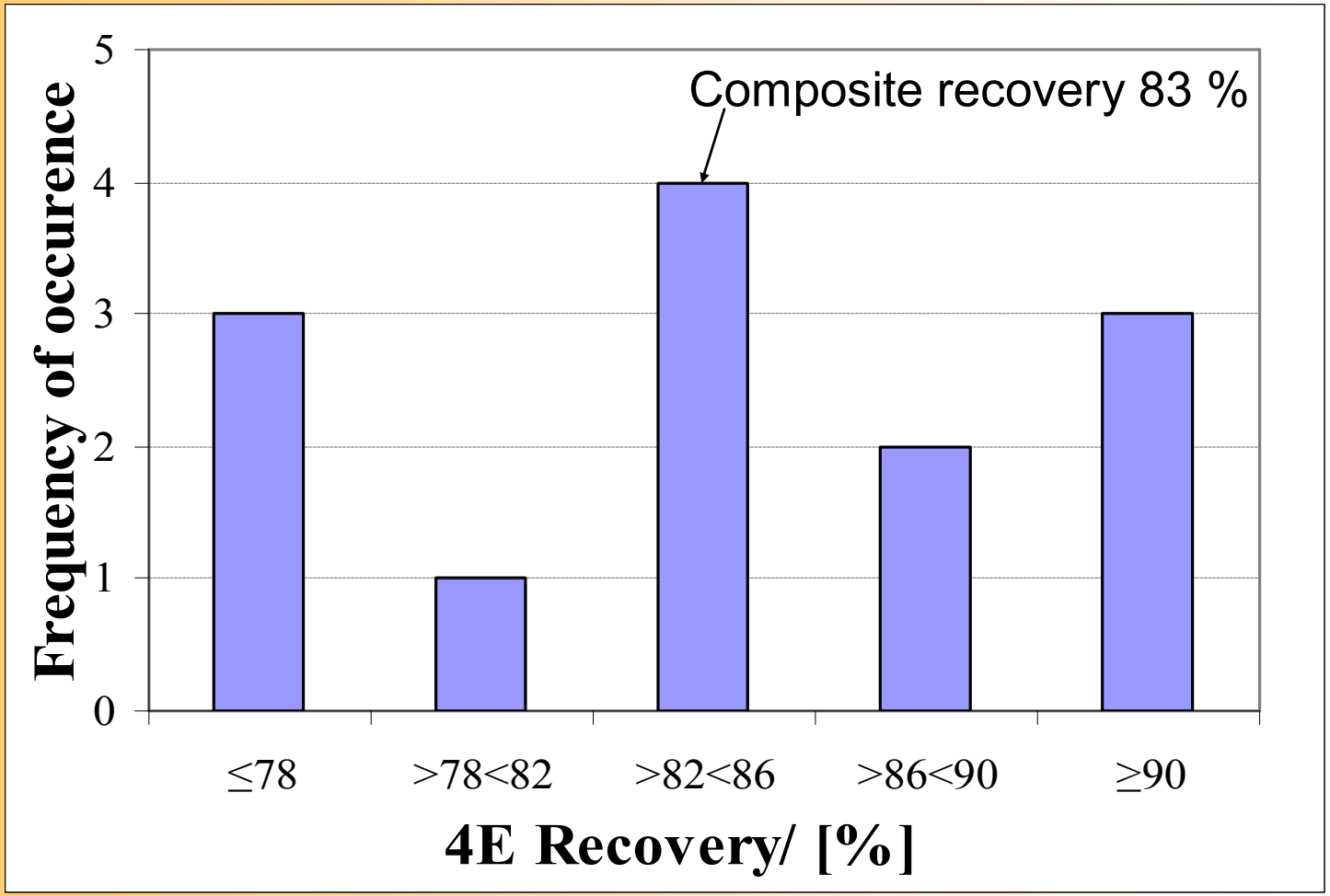
Ore No.1 cont…



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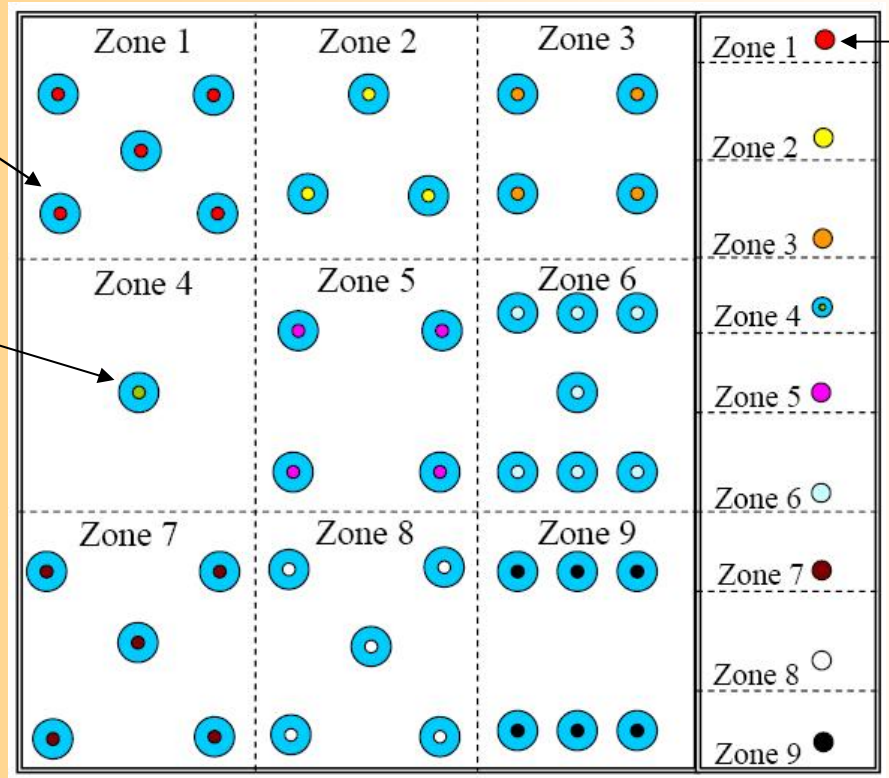
Ore No.2

Zone drill cores

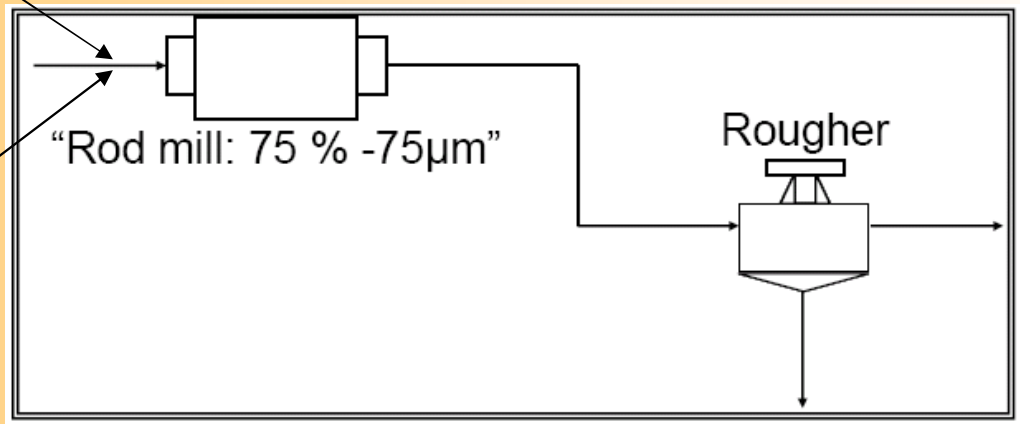
Bulk composite

Zone composites

Bulk composite



Zone composites



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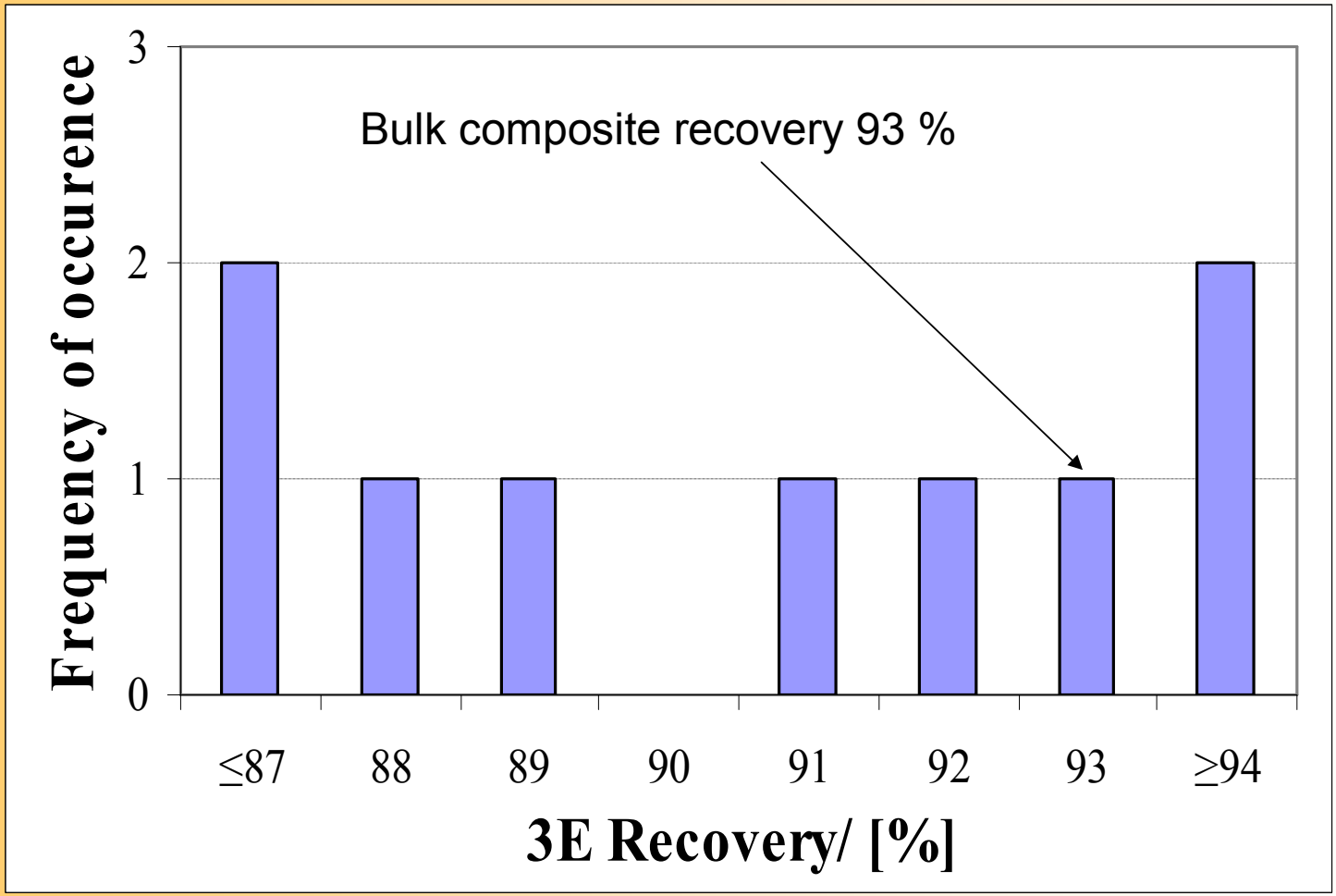
Ore No.2 cont…



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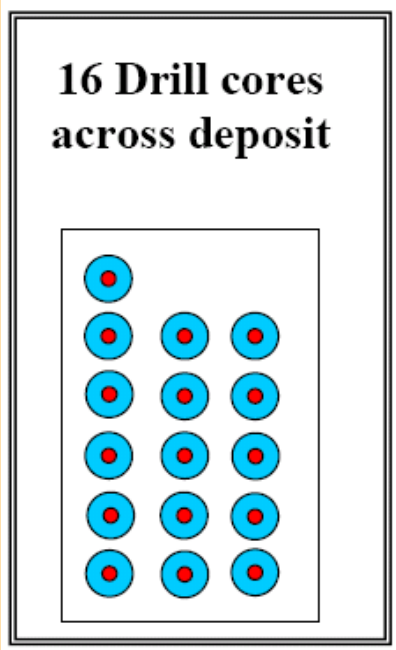
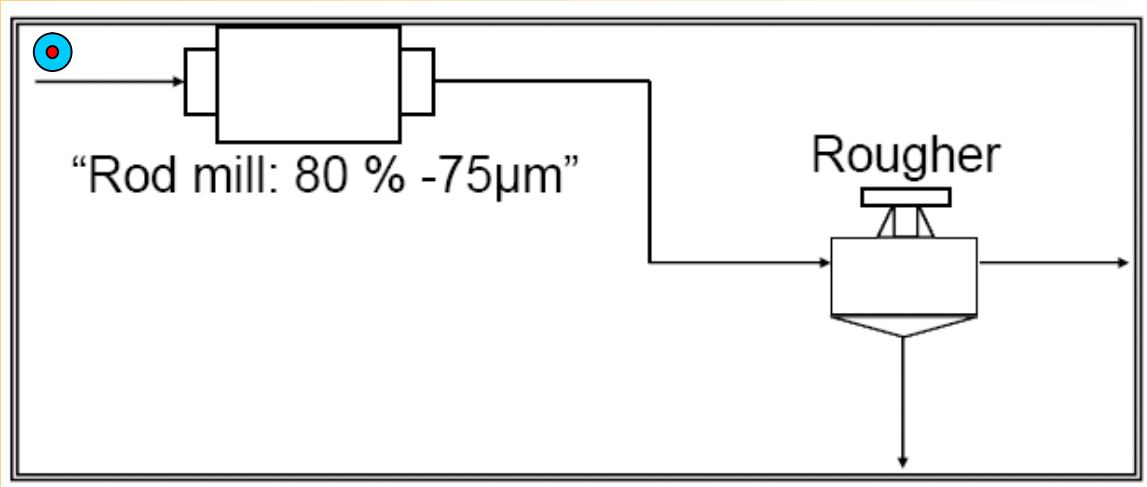
Ore No.3





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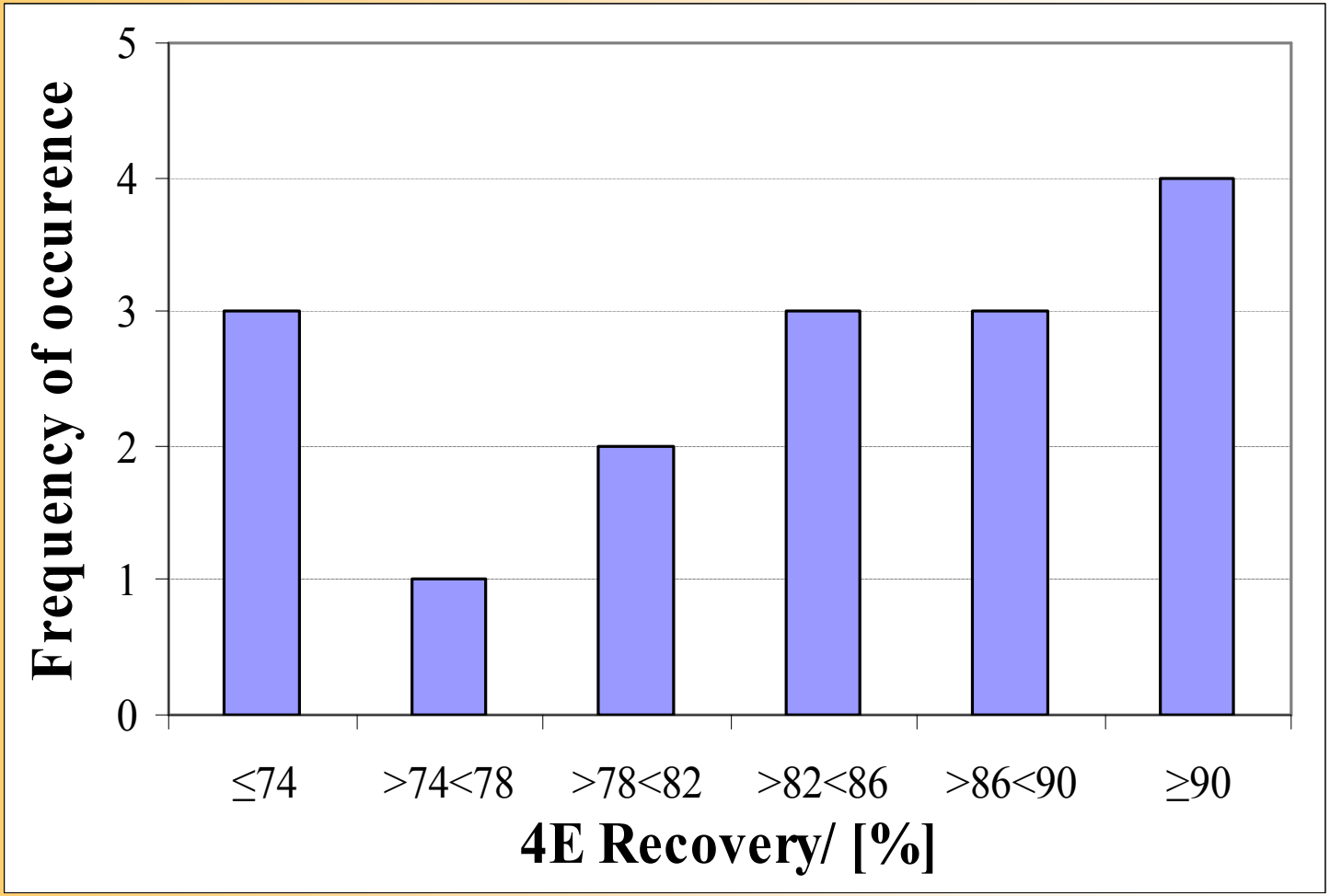
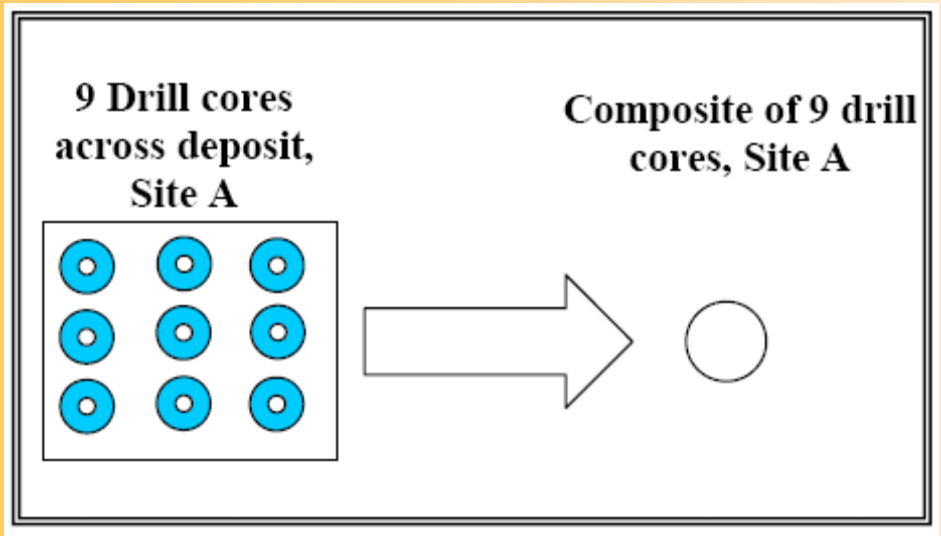
Ore No. 3 cont…

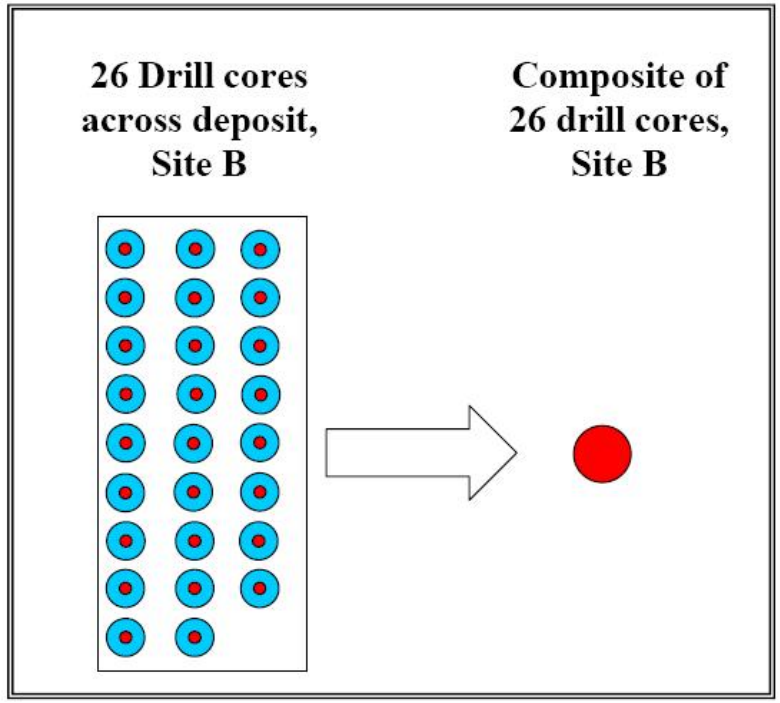

Frequency of occurence
5
4
3
2
1
0
≤74
>74<78
>78<82
>82<86
>86<90
≥90
4E Recovery/ [%]

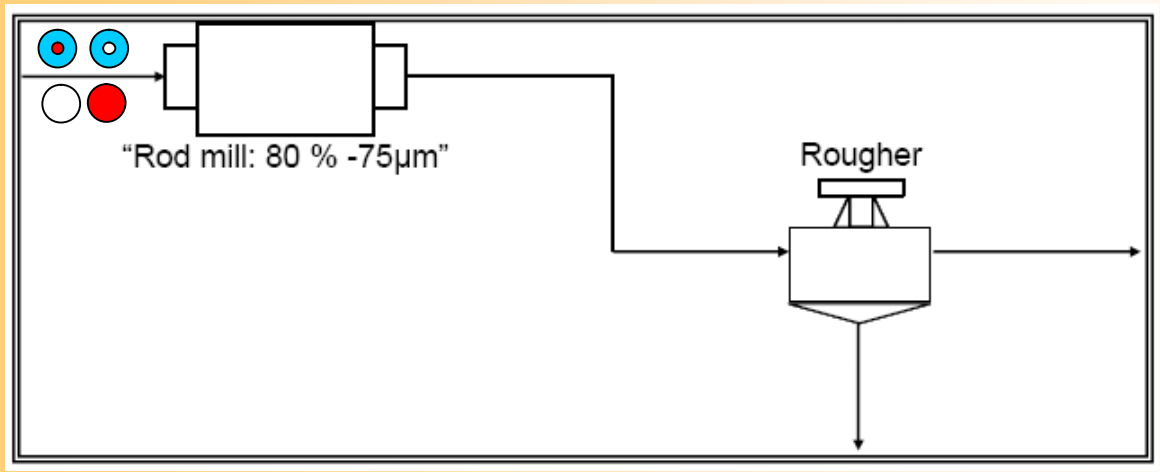
Examples

Examples of two Western Limb UG-2 ores

Ore No.4







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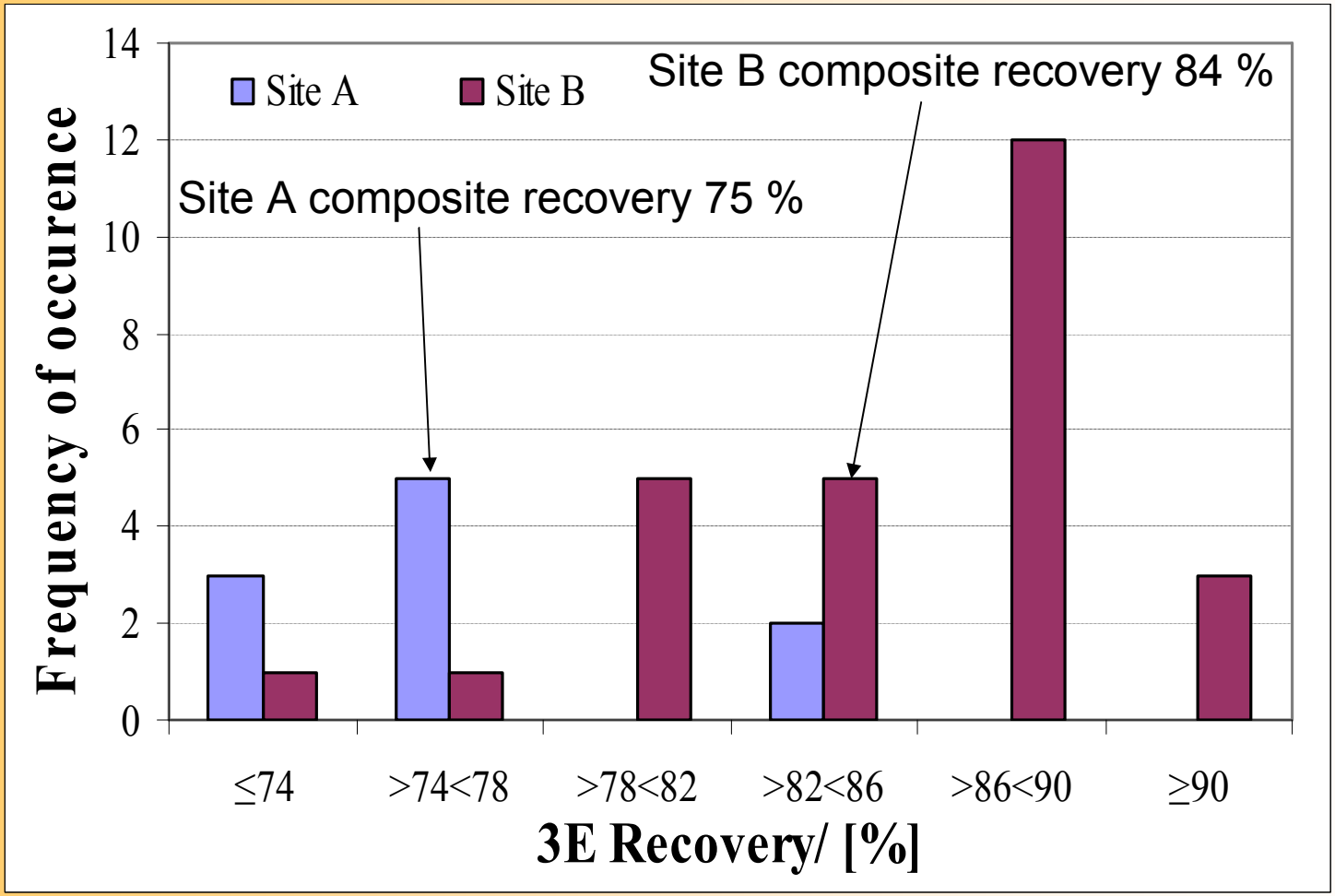
Ore No.4 cont…



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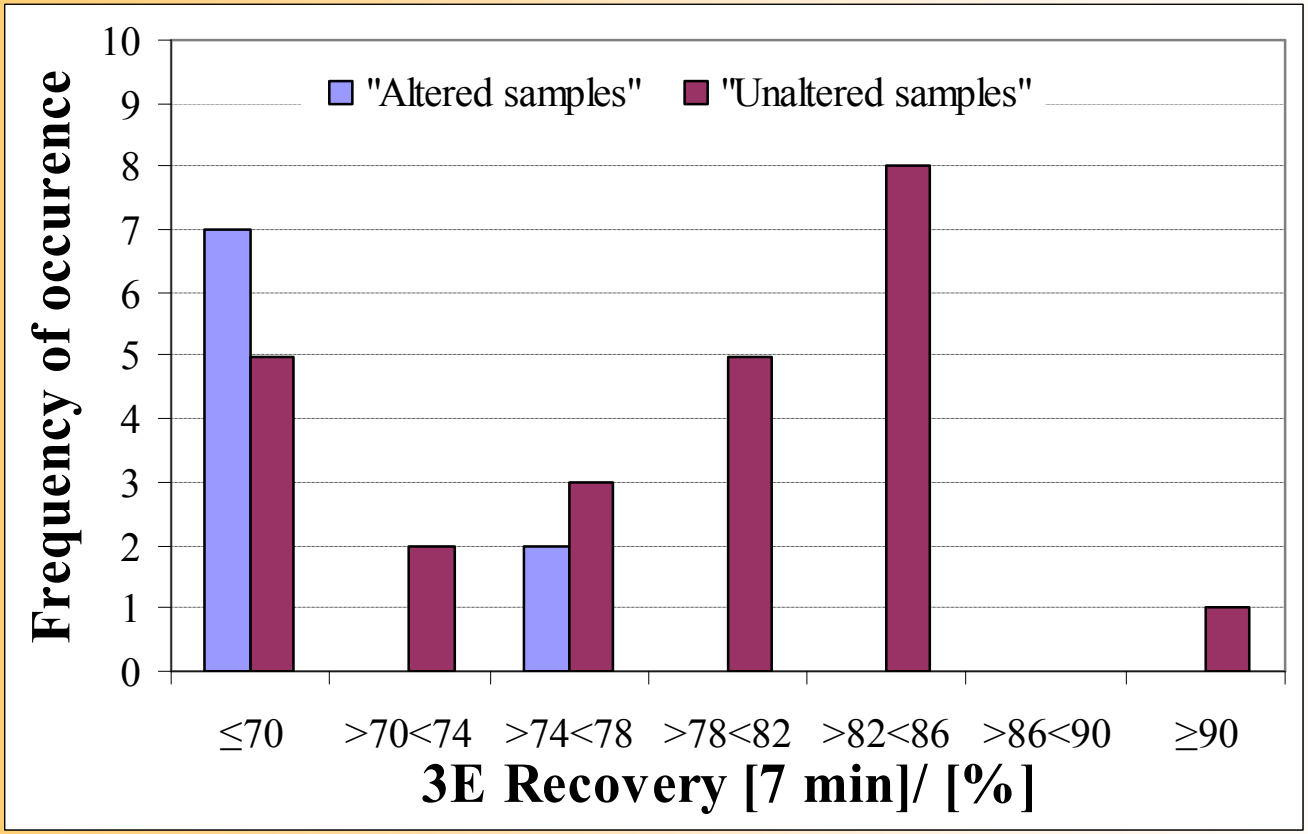
Ore No.4 cont…

- Site A and Site B were characterised into altered an unaltered samples
- The presence of large amounts of talc, chlorite, serpentine, amphibole and mica indicate some degree of alteration



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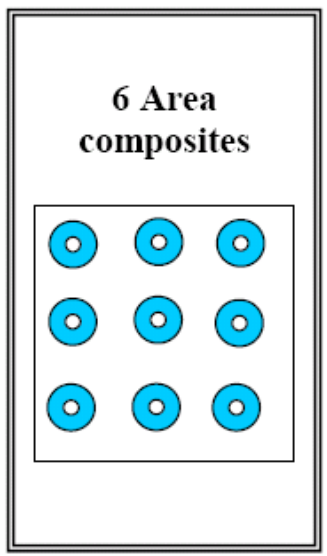
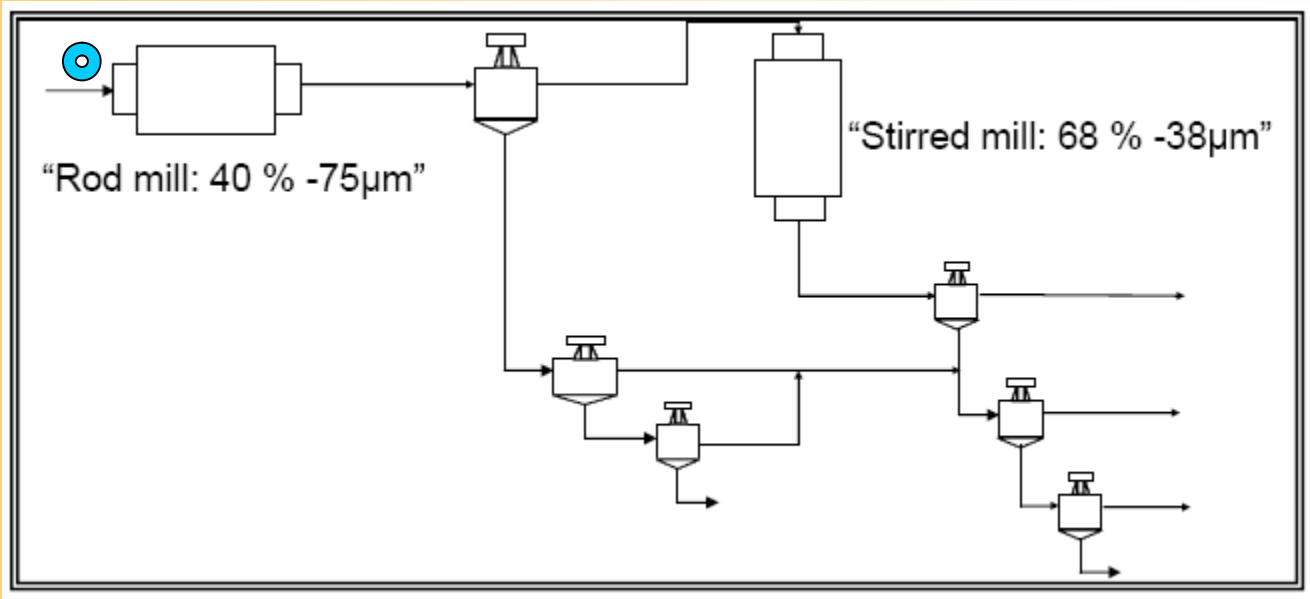
Ore No. 5 – Area composite





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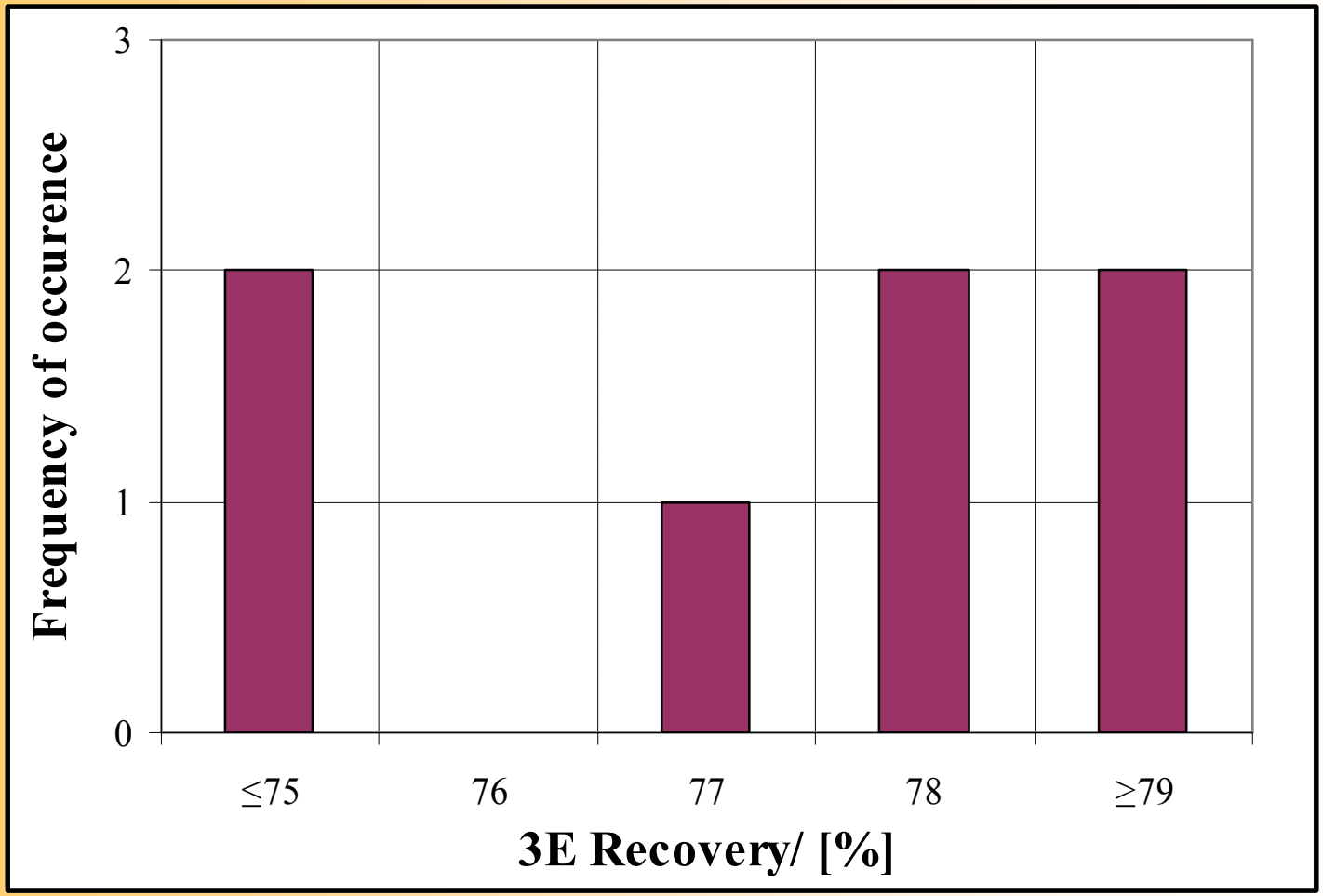
Ore No. 5 – Area composite cont…



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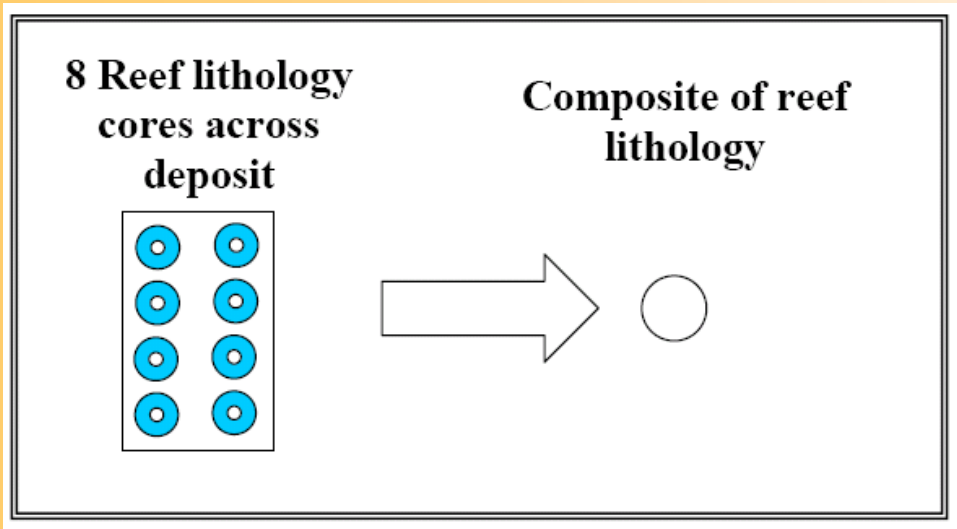
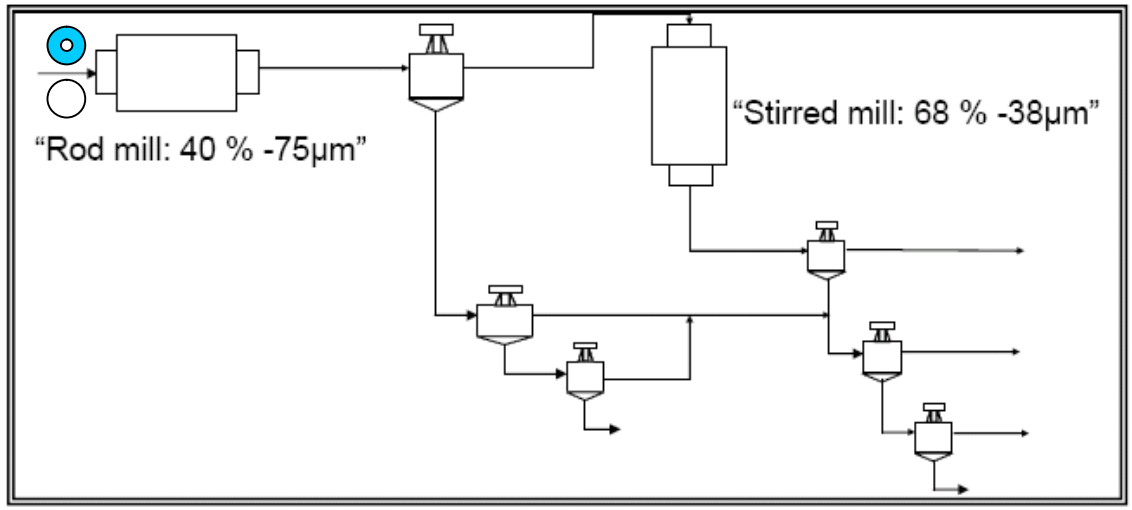
Ore No. 5 - Lithologies



- 4 Central zone reef samples differentiated into Pyroxenite, Anorthosite, Iron-rich upper pyroxenite & Pegmatoidal pyroxenite
- 4 Eastern zone reef samples differentiated into Pyroxenite, Anorthosite, Iron-rich upper pyroxenite & Pegmatoidal pyroxenite



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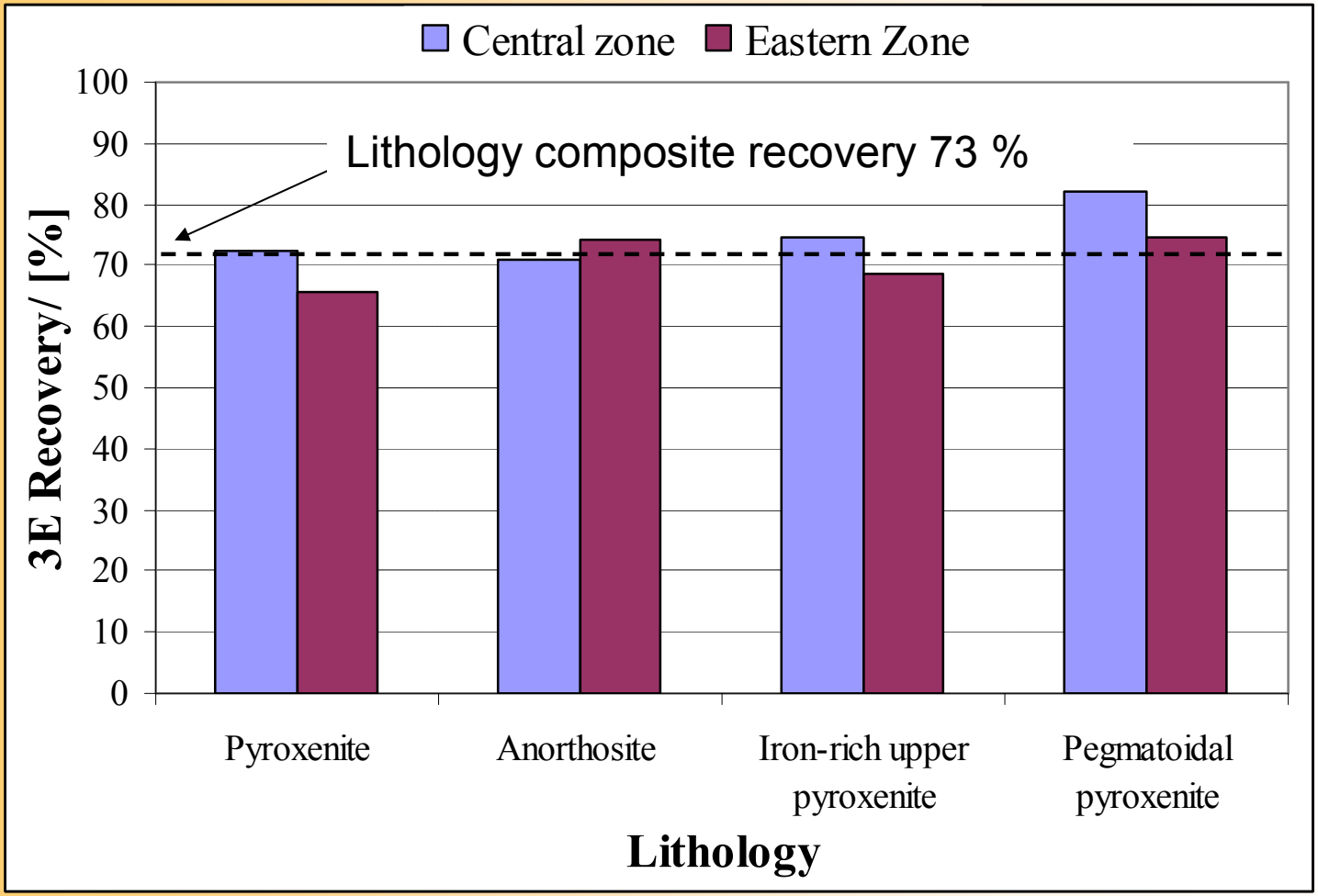
Ore No. 5 – Lithologies cont…



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Milling variability

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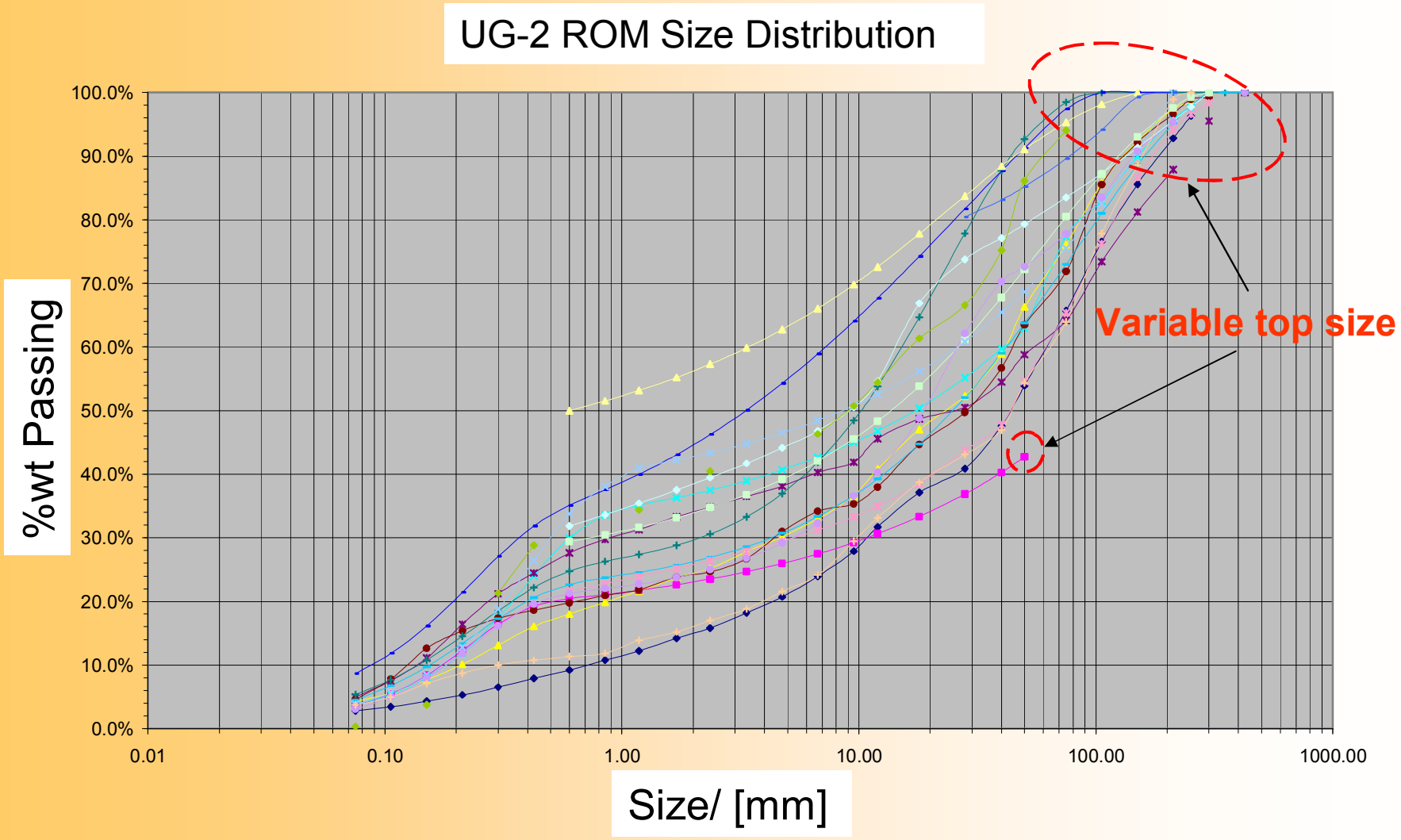
Milling Variability cont…



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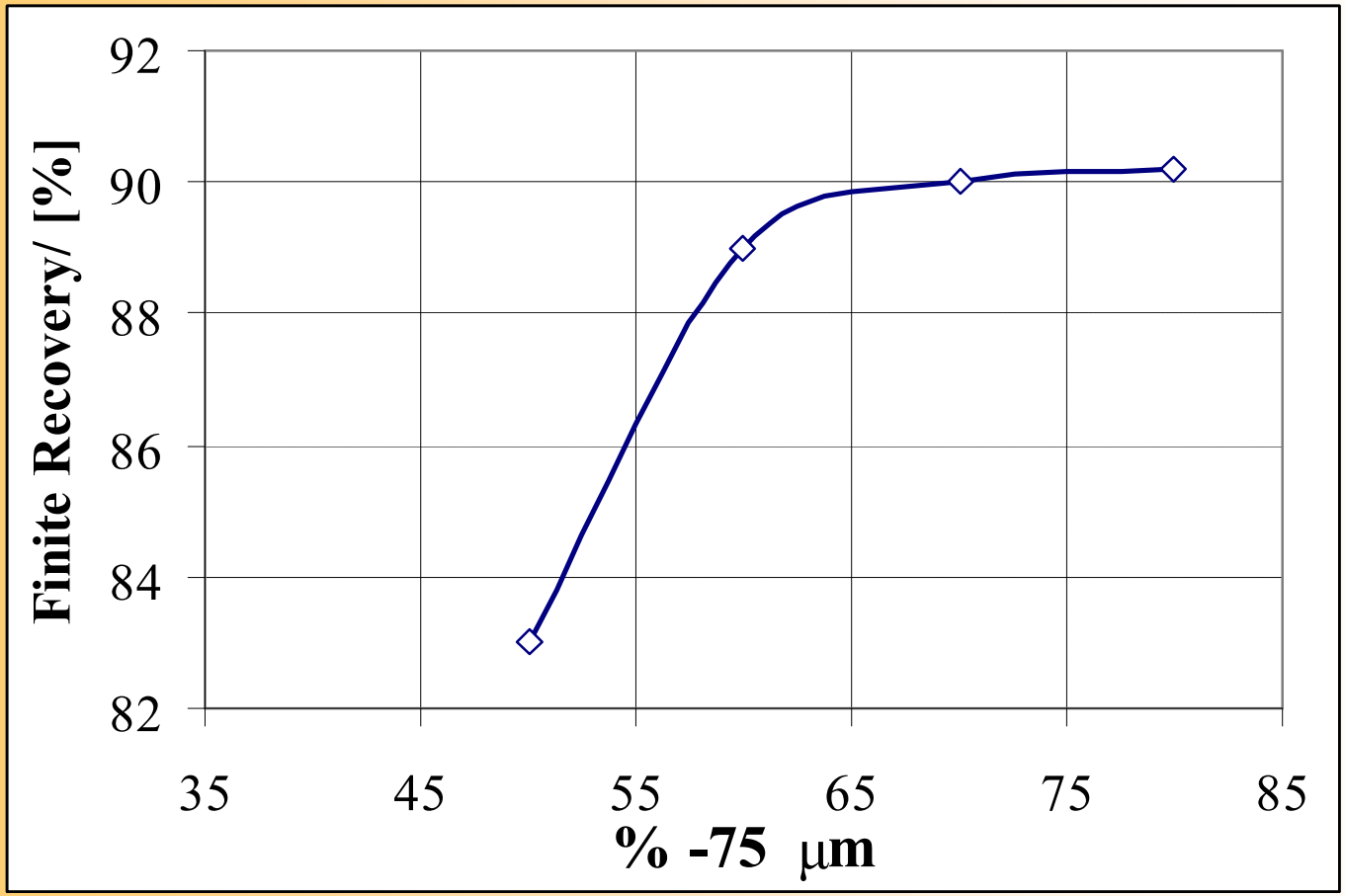
Western Limb

- Ore body Variability affects grind and therefore recovery
- Example- Typical finite recovery-grind curve



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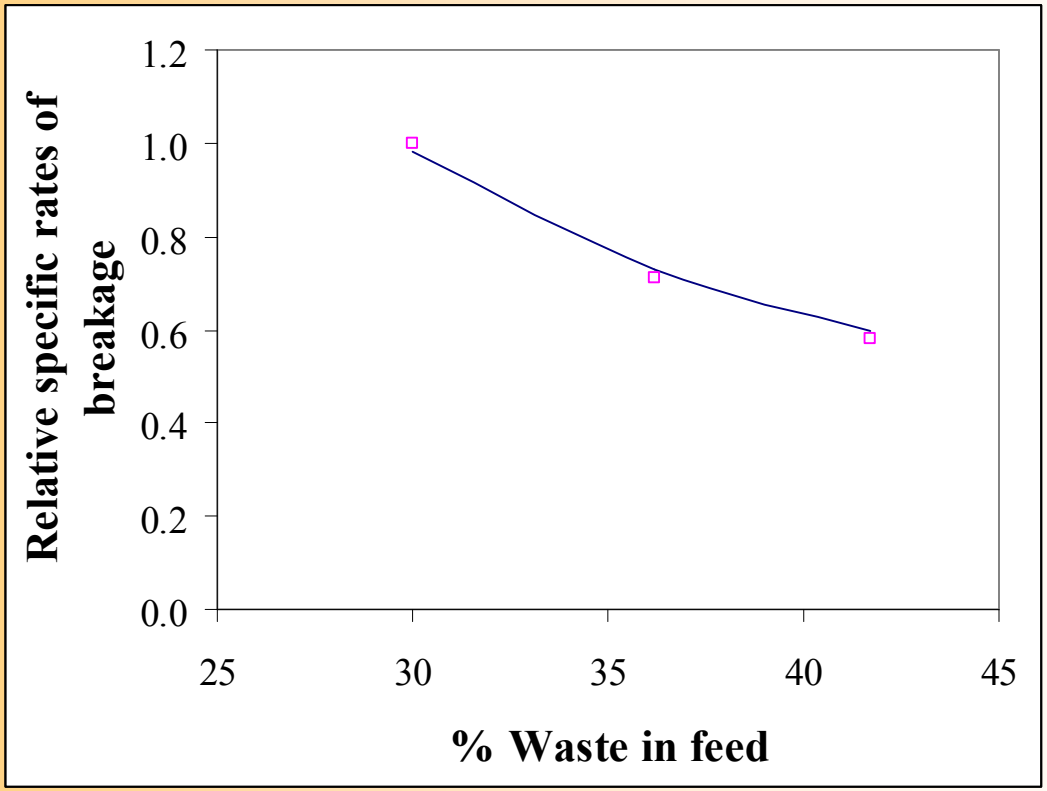
Eastern Limb

- Waste rock generally harder than on Western Limb; and higher variability encountered
- Example- Eastern Limb ‘waste fraction’ effect on ROMB grinding efficiency



- Indicates 40 % slowdown in breakage at high waste levels!

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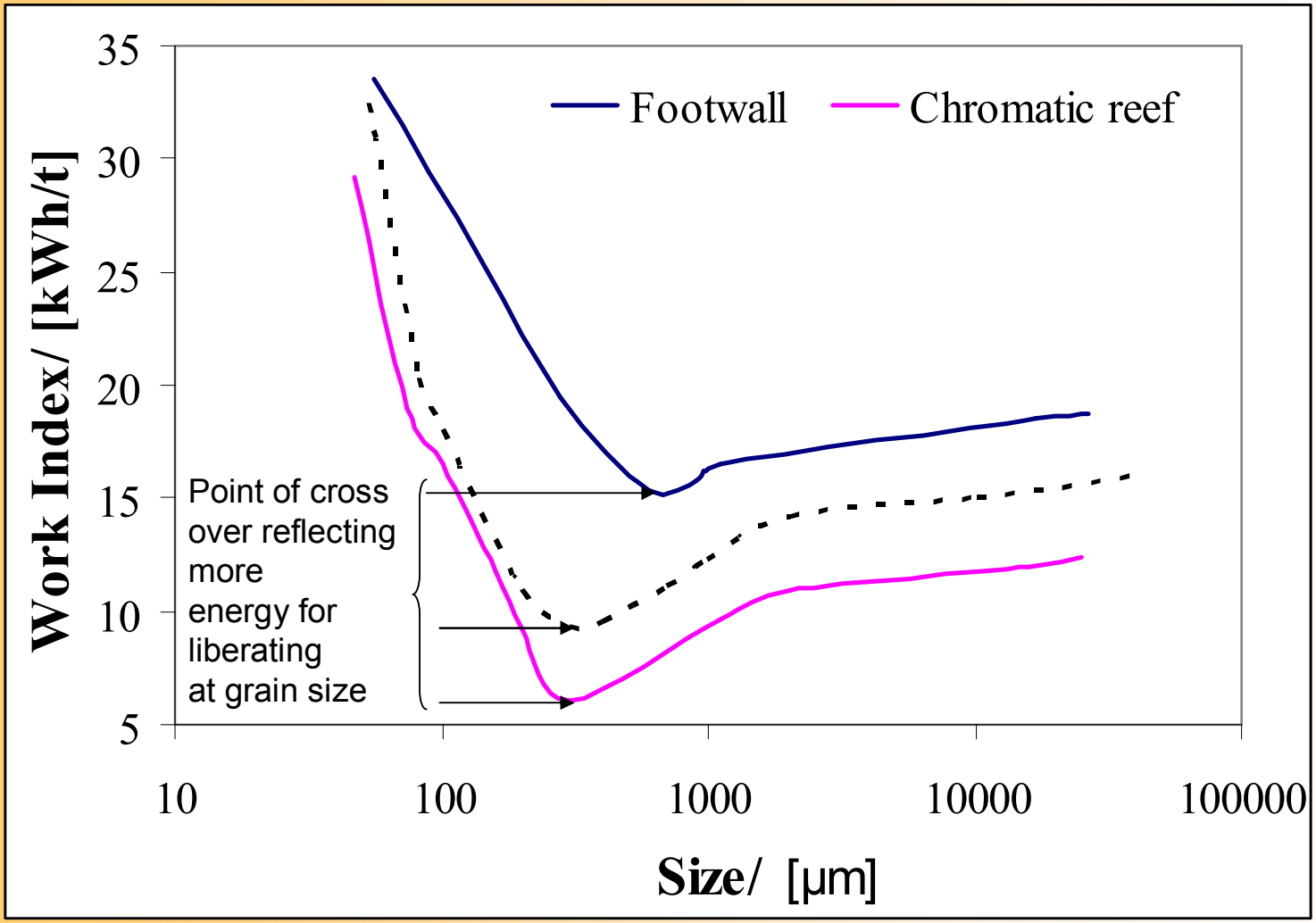
UG2 Grinding cont…

•Bi-modal nature of ore is significantly affected by variations in ‘waste’ dilution



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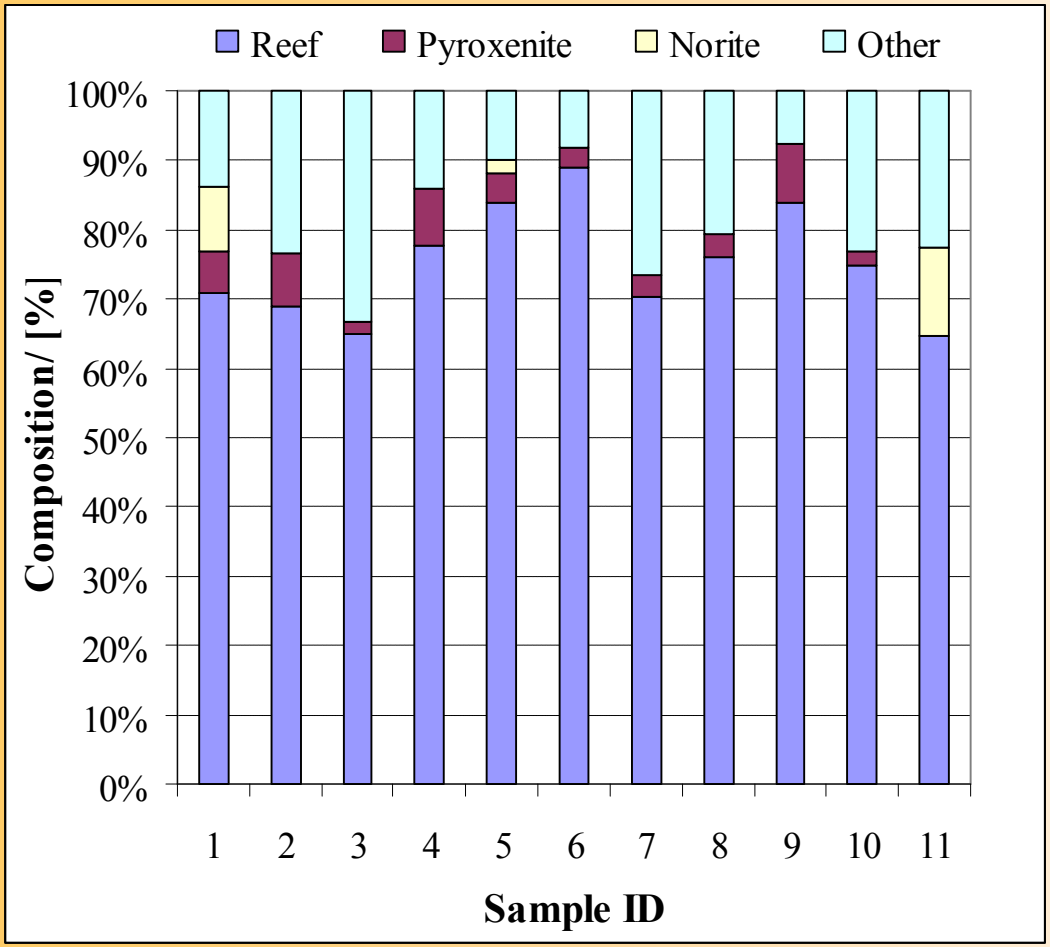
Grind Variation- Typical Western Limb UG2



Sample №	Relative Grind $\kappa_n/\kappa_{control\_avg}$	Actual % -75 µm
10 (Control)	1.019	75.3
	0.981	73.5
1	1.081	71.8
2	1.283	77.2
3	1.030	69.4
4	1.078	71.4
5	1.070	70.7
6	0.957	67.4
7	1.088	77.0
8	1.053	76.3
9	1.145	78.6
11	0.912	71.9
Composite	1.026	73.9

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Concluding remarks

- Allocate more resources to understand the inherent variability in a deposit
- Formulate a standard metallurgical variability methodology
- Use the methodology to understand what factors control variability within a deposit

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Thank you

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