

Manganese – Uses, A new Mine, and the benefits of high grade ore



Presentation Outline

- A brief overview of Manganese
- United Manganese of Kalahari – The new producer
- The benefits of using high grade Manganese ore in the production of electrolytic manganese.

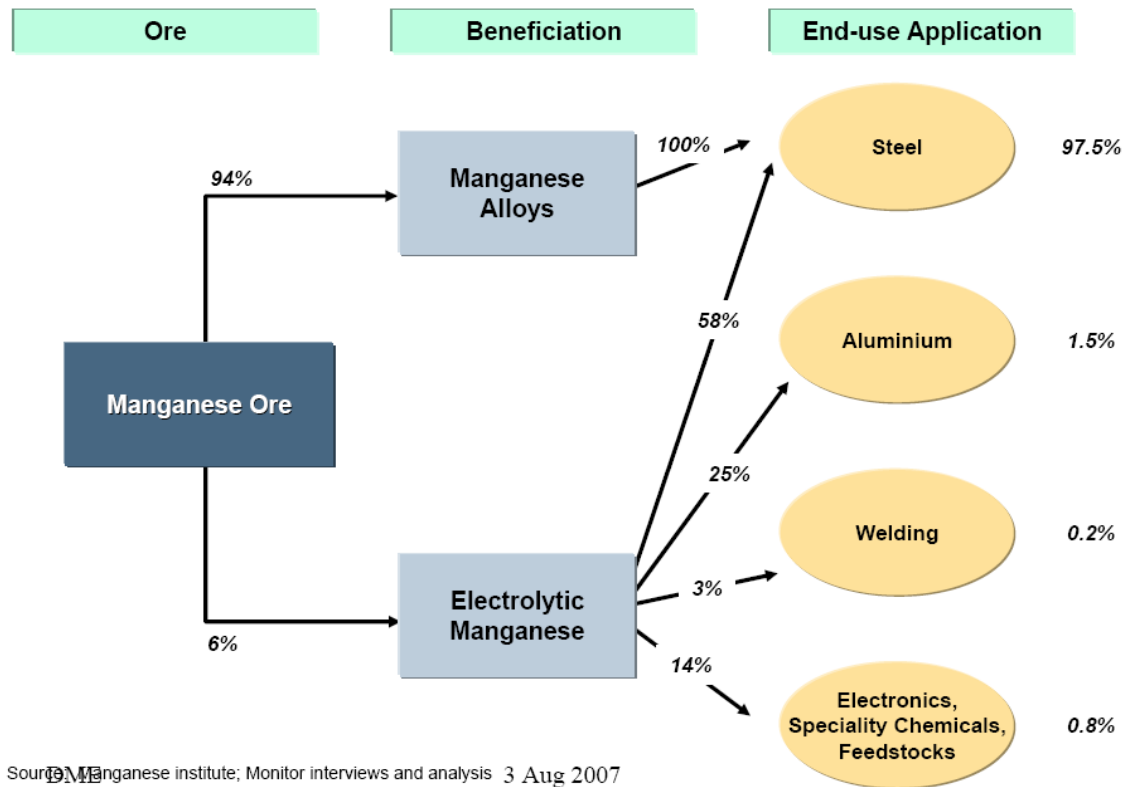
Some Interesting Facts

1. The fourth most heavily consumed metal after:
 - Iron
 - Aluminium
 - Copper
2. The Titanic sunk as a result of too little manganese in the steel used for the ship.
3. 34 million tons of Mn ore was mined in 2006.
4. 12th most abundant element on earth.
5. 92% of the world's high grade manganese is found in the Kalahari basin in South Africa.
6. The manganese deposit in the Kalahari is the biggest deposit of any mineral known to man on earth.

The use of Manganese

- Steel production without the addition of manganese alloys is not viable.
- 8kg – 10kg of Mn is used per metric ton of steel produced.
- Demand is inelastic. Demand cannot be increased, but is constrained by steel production.
- When steel output increases, the demand for manganese increases.
- Ore prices consequently linked to steel production. When steel production increase, manganese ore prices tend to increase.

The Demand for Manganese



Source: Manganese institute; Monitor interviews and analysis 3 Aug 2007

Steel industry is the main end customer of manganese (90% of its total output). China is the geographical centre of the steel industry growth

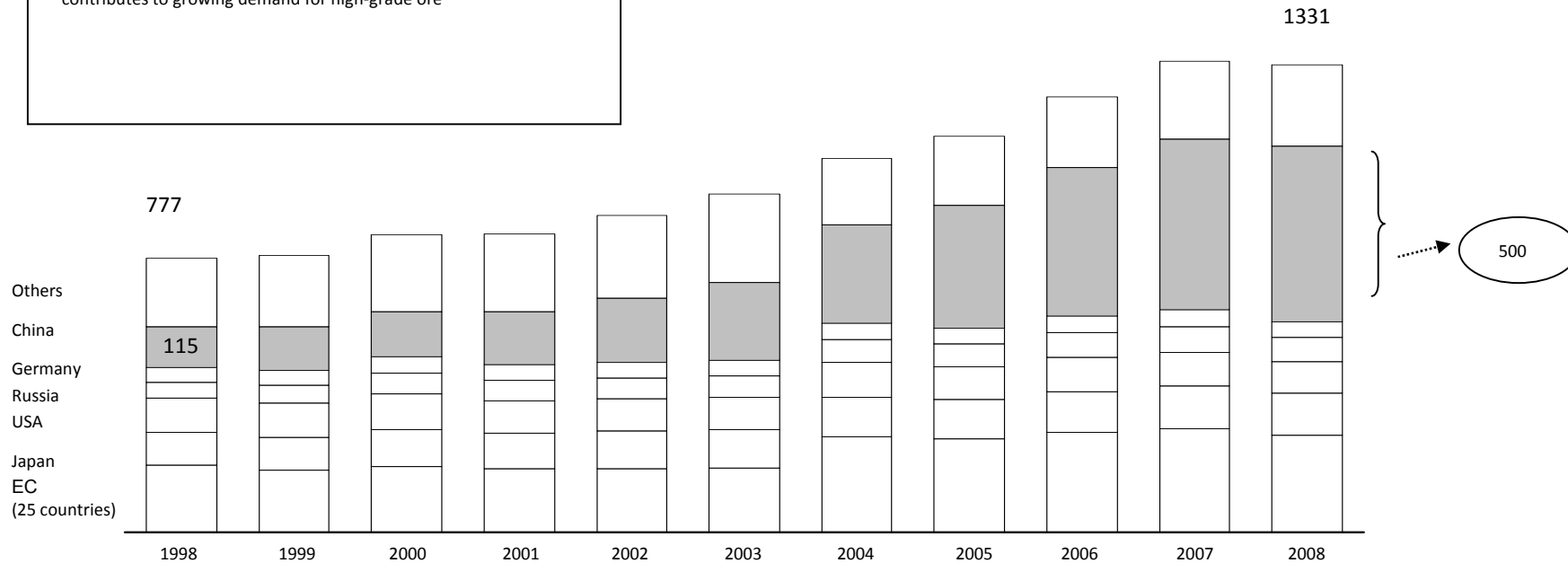
World steel production, 1998-2008

In millions of tons

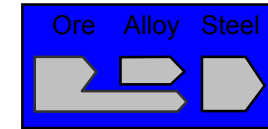
On average, 8-10 kg of manganese is required to manufacture 1 ton of steel

Note:

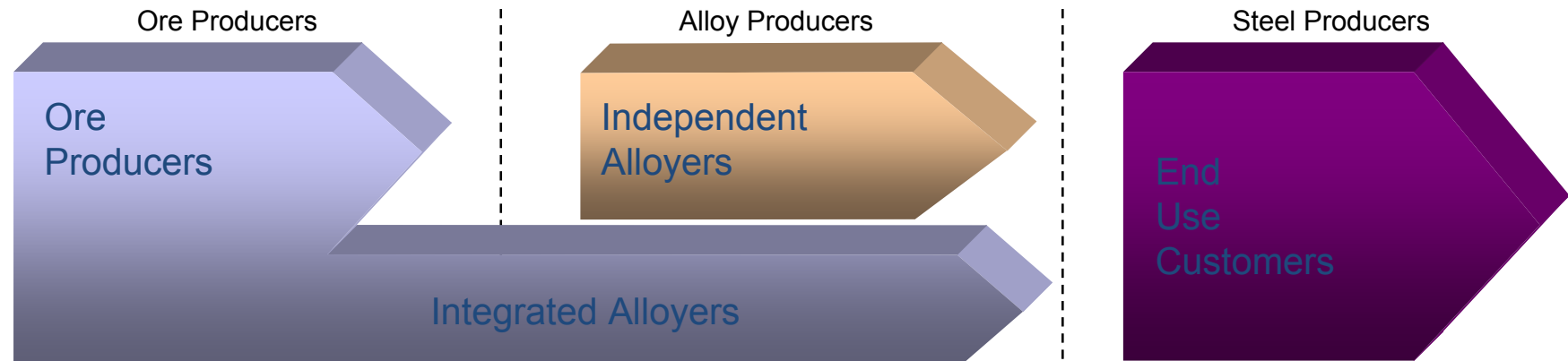
- Share of high-grade steel in total steel output is growing which contributes to growing demand for high-grade ore



Manganese Value System



The manganese industry consists of three value system components which collectively describe the structure and dynamics of the industry.



- Industry segmented by ore characteristics:
 - High grade ore (> 44% Mn) (51% of Mn units)
 - Mid grade ore (> 30%Mn and <44%Mn) (22% of Mn units)
 - Low grade ore (<30%Mn) (27% of Mn units)

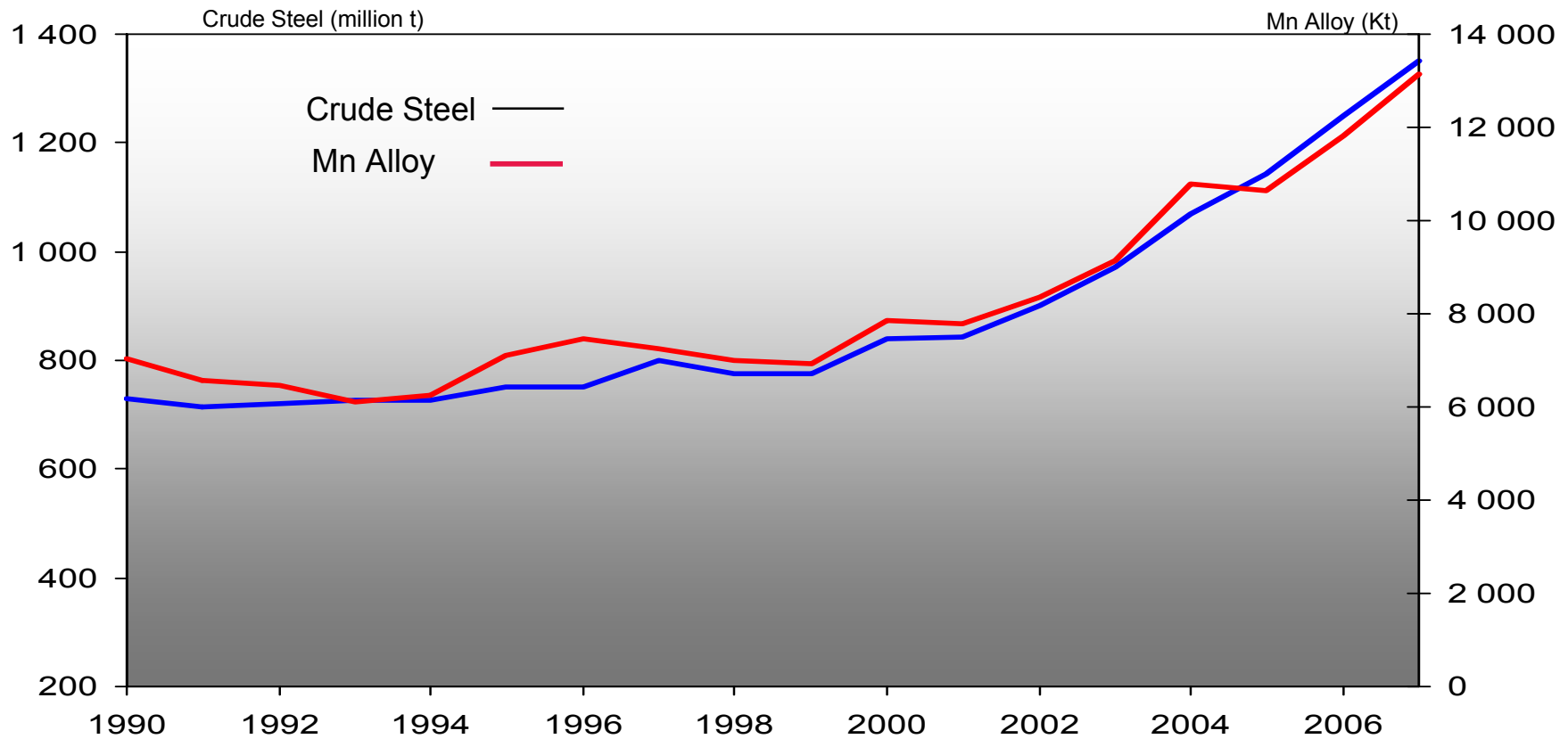
- Integrated alloy smelters
- Independent alloy smelters
- Products:
 - HCFeMn
 - MCFeMn
 - SiMn

- Primarily crude steel producers (94% of demand)
 - Integrated Mills
 - Minimill Flat Producers
 - Minimill Long Producers
 - Speciality Mills
- Also chemical and specialist metallurgical segments (6% of demand)

Relationship Between Steel Production and Manganese Alloy Production

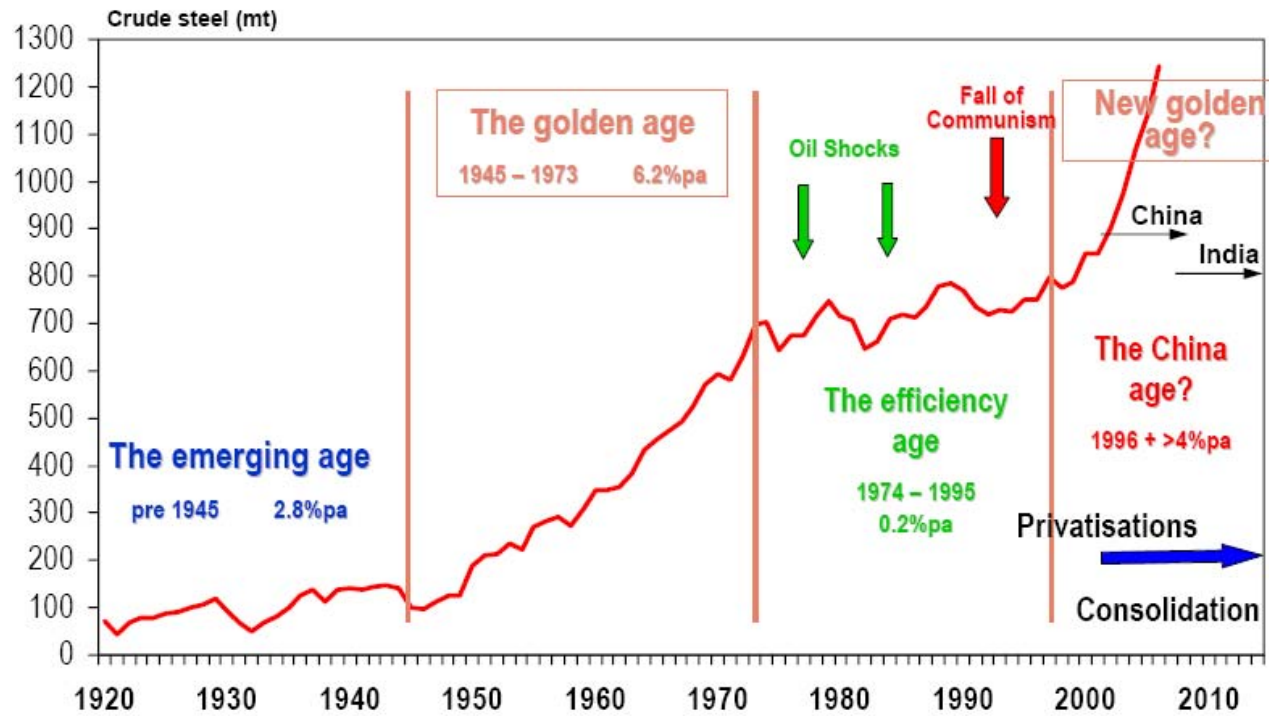
The production of manganese alloy tracks the production of crude steel.

Manganese Alloy and Crude Steel Production, 1990-2007



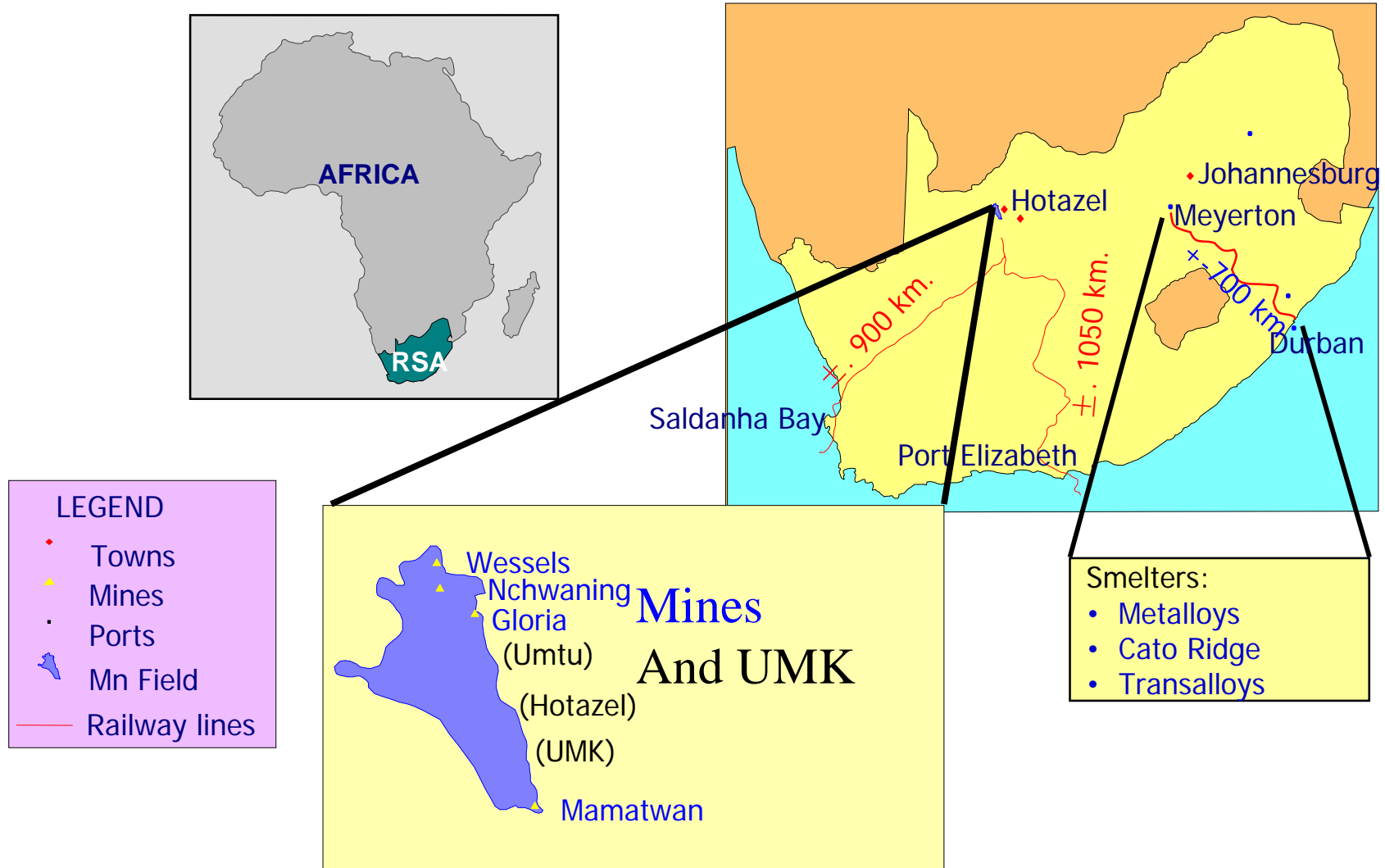
Source: IISI, IMnI

Global Steel –the new golden age?



Manganese - South African Operations

RSA Manganese operations are at a logistical disadvantage, both globally and within RSA





United Manganese of Kalahari



The New Producer – UMK

- UMK to be the first new major manganese producer in the past 25 years.
- Medium Grade ore.
- Opencastable reserves for +20 years.

Resources

- Resource of 282 million tons from 361 exploration boreholes on farms Smart, Rissik, Botha
- Farms Roldraai, Heuningdraai,to be explored

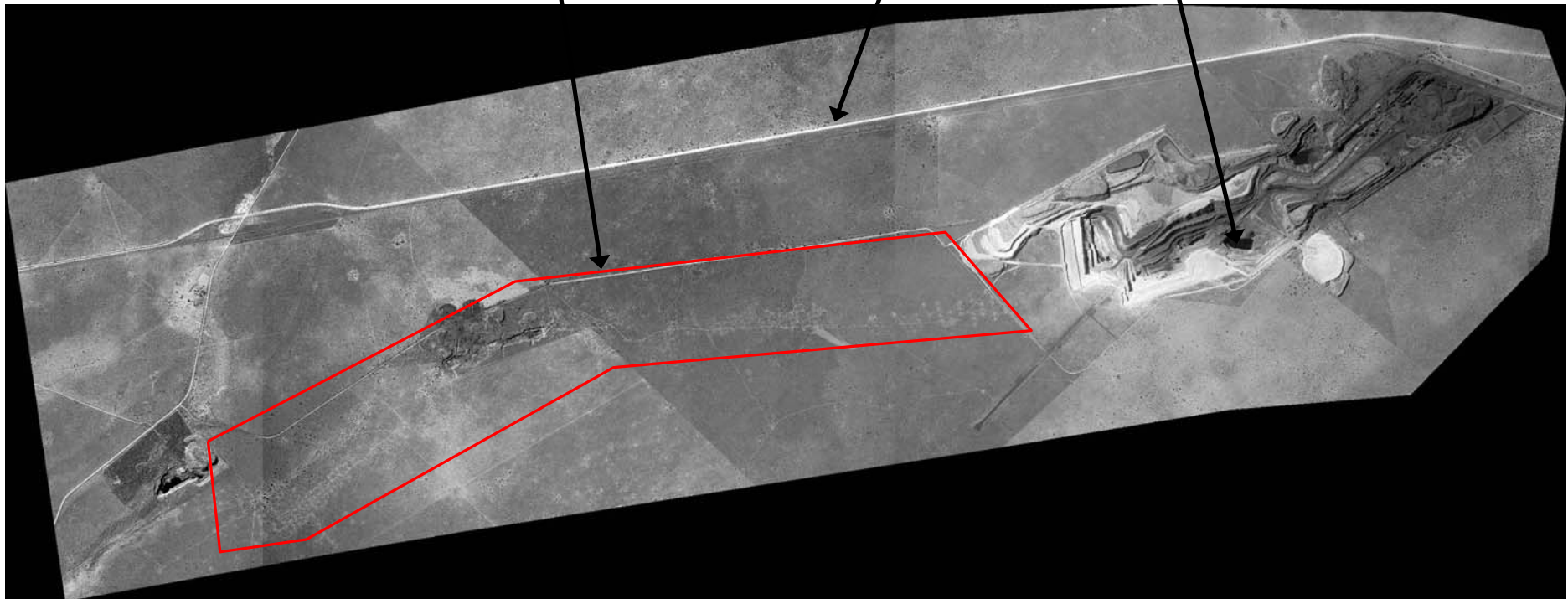
Resource Category	Tonnage (million t)	Mn %	Fe %	Si O₂ %
Measured	42.1	36.34	6.81	7.71
Indicated	140.9	34.90	6.12	6.00
Inferred	99.0	34.68	5.84	6.14
Total	282.0	35.04	6.12	6.31

Location

UMK mine site

Rail,Road and
water access

Mamatwan



Desired Strategic Position & Objectives

**RESERVES AND
SCALE OF
OPERATION**

Substantial.....become one of the top 5
producers

GRADE OF ORE

High/medium-grade

**COST OF
PRODUCTION**

low-cost ore reserves

MARKET

strategic imperative ...to become
the first major new entrant to the market

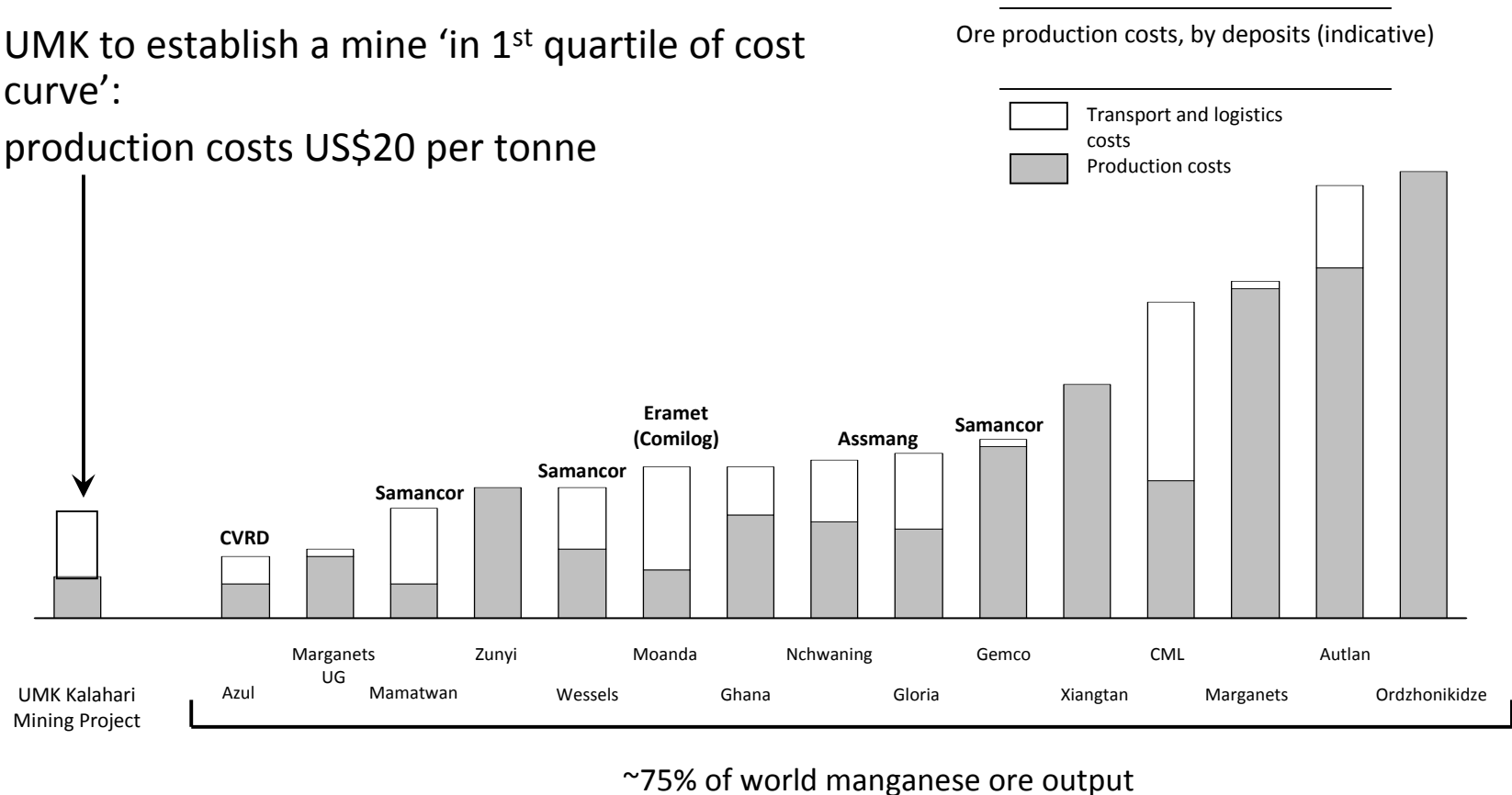
Ore Quality

	ROM
Manganese content	38%
Fe (iron) content	Typically 5-7%
SiO ₂ (silicon dioxide)	Typically 6-11%
Phosphorus content	<0,01%
Sulphur	<0.02%
CaO (calcium oxide)	Typically 6-14%

Cost Of Production

FIRST QUARTILE

UMK to establish a mine 'in 1st quartile of cost curve':
production costs US\$20 per tonne



Source: BHP Billiton, CRU, Renova Manganese Investments Technical Team

UMK

STRONG STRATEGIC POSITION

**RESERVES and SCALE
OF OPERATION**

**Largest resource in the world
5th largest producer – current project**

GRADE OF ORE

raw material of choice

COST OF PRODUCTION

**first quartile of the cost curve
(~US\$20/t)**

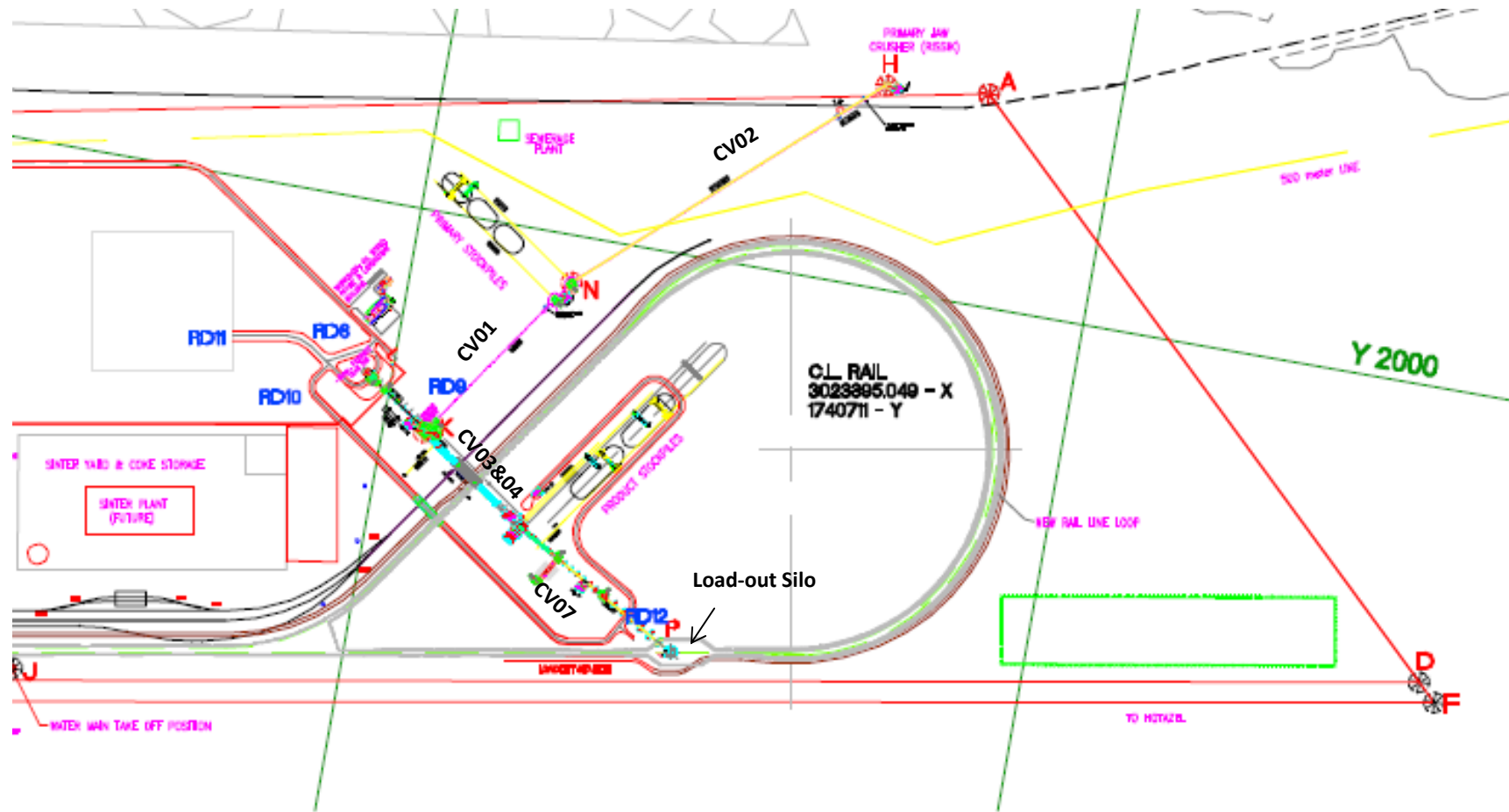
LOGISTICS

Well positioned

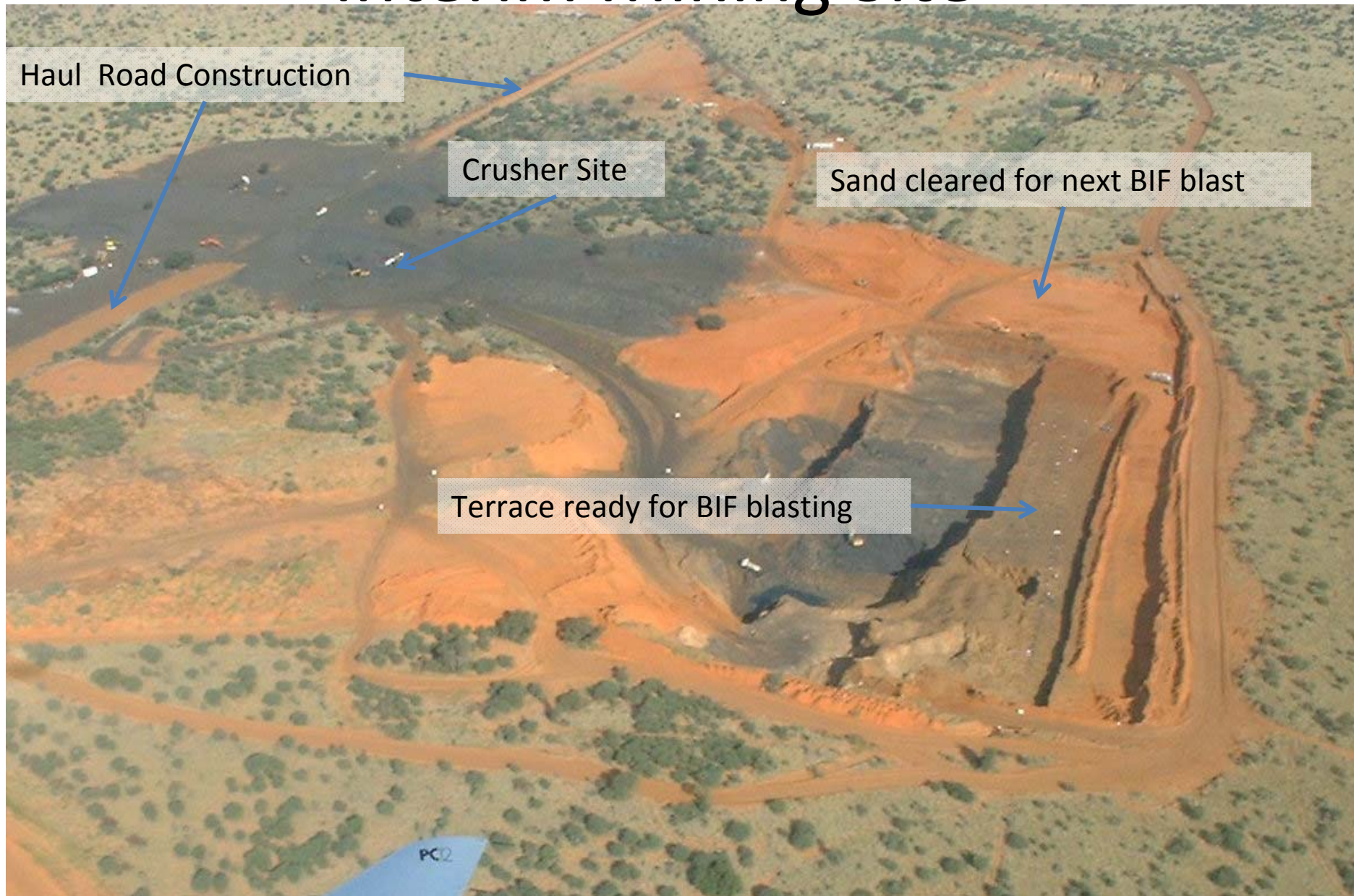
MARKET

Strong strategic position

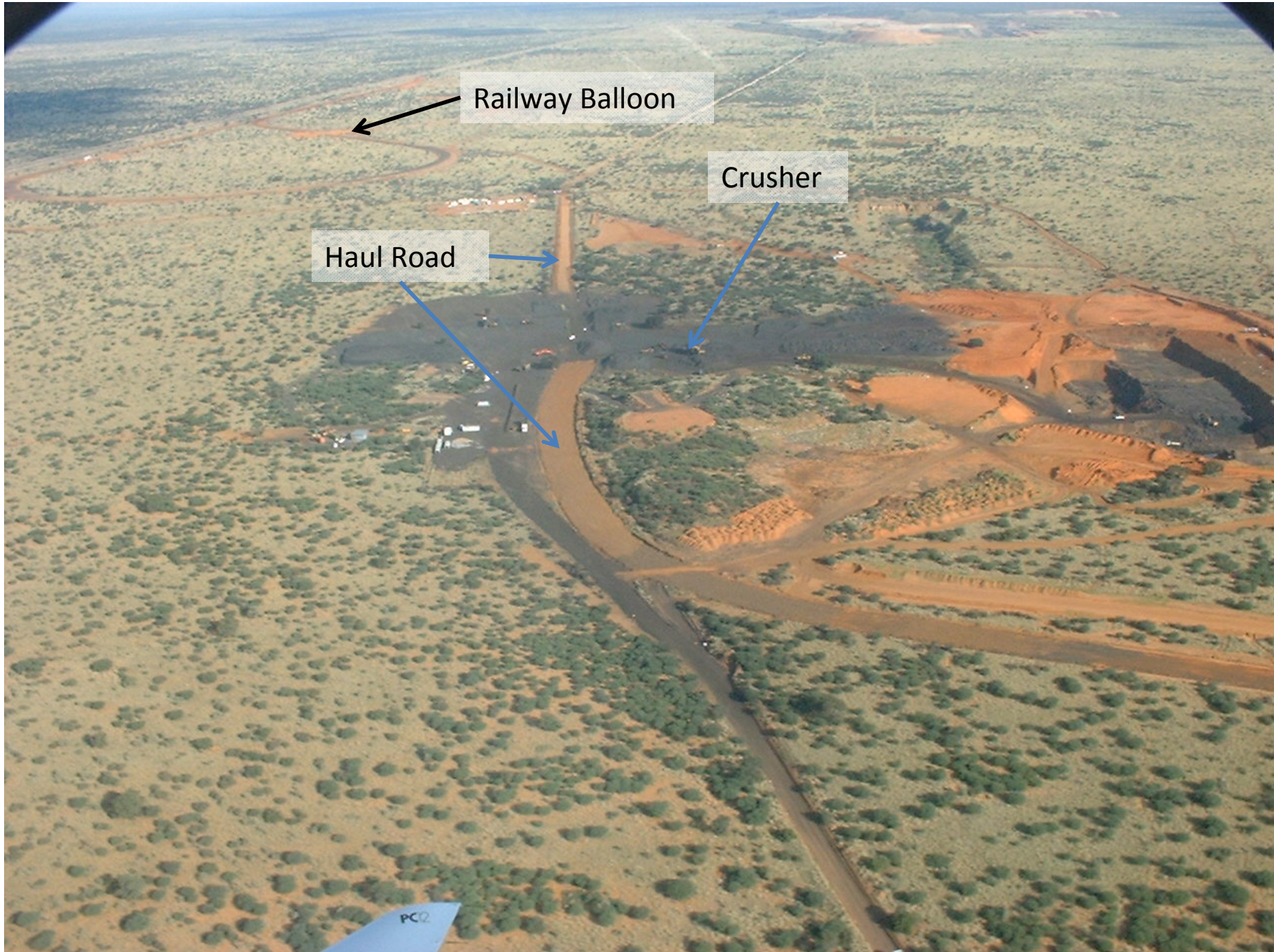
Main Plant Area and Future Sinter Plant



Interim Mining Site







Railway Balloon

Crusher

Haul Road

PCQ

Project Progress



Silo Under Construction

The benefits of using high grade
ore in the production of EMM

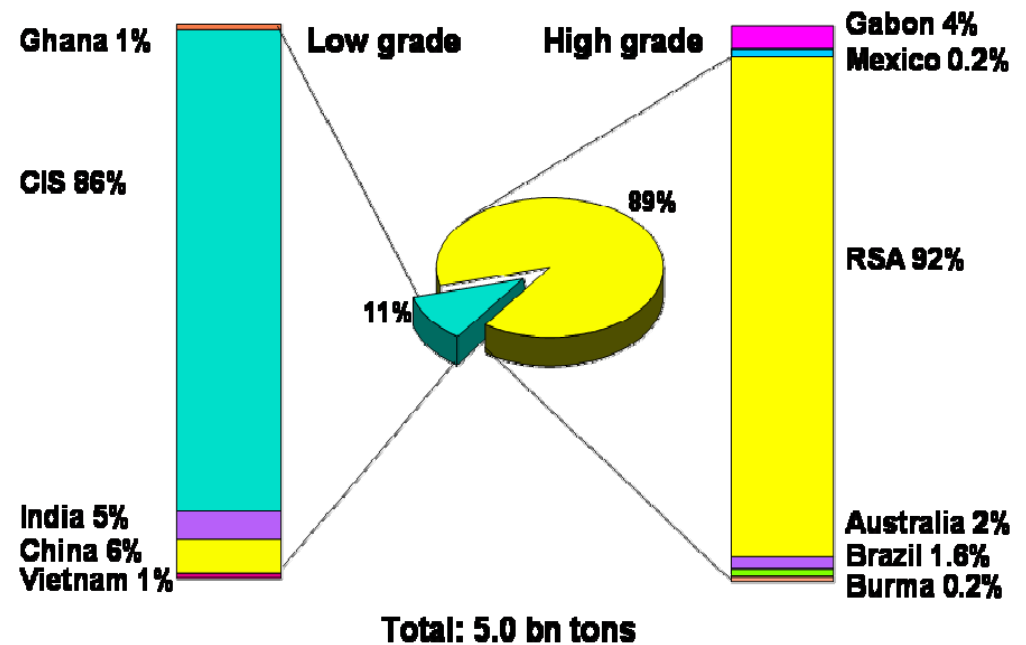
High grade Mn ore - RSA:

- 44% to 48% Mn content
- At 85% recovery require 2.6 to 2.8 ton ore per ton EMM
- Typically oxide mineralogy
- Requires reduction before leaching
- Needs 0.2t acid per ton EMM

Low grade Mn ore - China:

- 14% to 18% Mn content
- At 75% recovery require 6.9 to 8.9 ton ore per ton EMM
- Typically carbonate mineralogy
- Needs no reduction before leaching
- Needs 2.2t acid per ton EMM

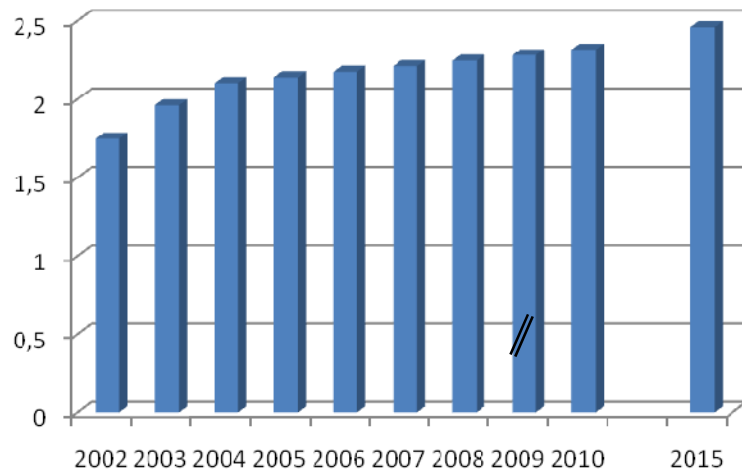
World Mn Reserves
(Roskill, The Economics of Manganese, 2000)



Source: Roskill

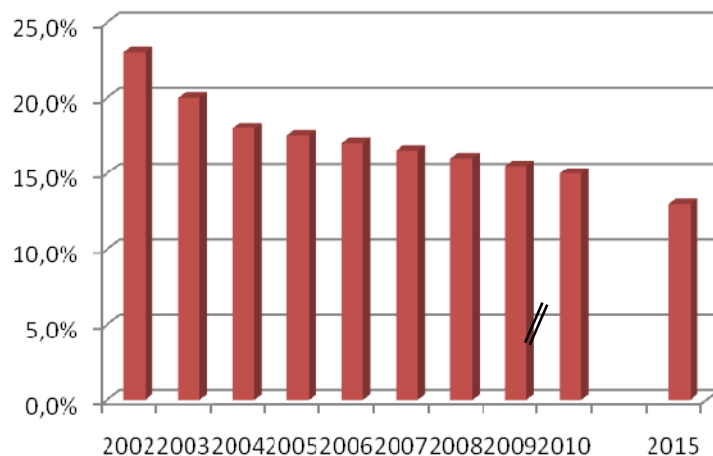
China's domestic MnCO₃ ore grade is declining

Acid Consumption



- Currently consuming 7-8 t ore/t EMM due to 30% decrease in grade since 2002
- Rate of decrease is in the order of 0.5% Mn per year
- Currently in the order of 15-16% Mn
- Acid consumption could increase by similar rate as grade decreases
- Transport and milling cost will also increase as will the requirement for waste disposal space

Grade %Mn



High grade Mn ore - Process Aspects

- Advantages:
 - Lower acid consumption (price of acid volatile)
 - Higher Mn recovery can be achieved (up to 87% in RSA)
 - Lower waste production/handling – lower capital for filter banks
- Disadvantages:
 - Require ore reduction
 - Additional process step and associated CAPEX and OPEX

Compare different Mn ore types

Example for EMM industry	Low grade ore	Hig grade ore	Unit
Mn content	15	44	%
Ore price (powder, DEL)	750	2910	RMB/t ore
Overall factory efficiency	72	85	%
Ore consumption	9.26	2.67	t/t EMM
Ore reduction cost	0	400	RMB/t ore
Acid consumption	1.96	0.25	t/t EMM
Acid price	450	450	RMB/t acid
Waste generation (dry basis)	8.26	1.67	t/t EMM
Cost to dispose waste	50	50	RMB/t waste
Cost of ore	6,944	8,850	RMB/t EMM
Cost of acid	882	113	RMB/t EMM
Cost of disposal of waste	413	84	RMB/t EMM
Total cost of above	8,239	9,046	RMB/t EMM
For 10,000tpa EMM factory:			
Volume of waste to landfill	82,593	16,738	t waste
<i>Cost saving to the EMM factory when using low grade:</i>			9%
<i>Cost increase to the Chinese environment for landfill space:</i>			393%
This table uses imported ore price of RMB55/mtu CIF China port after clearing			
This table is estimate for situation in August 2009			

Landfill Rates and Costs

Landfill	Opex (US\$/t)	Capex (US\$/m ²)
RSA, Nelspruit	18-22	4.80-6.00
USA, Washington State	?	?
China example	?	?

Assuming a 10 000t/a EMM Factory		
Mn Ore Grade	Waste (t/a)	Landfill Space (m ² /a)
Low Grade – China	76 806 (1)	4 500 (3)
High Grade - RSA	16 738 (2)	990 (3)

1. Assume 16%Mn ore and factory efficiency of 72%
2. Assume 44%Mn ore and factory efficiency of 85%
3. Assume 10m high Mn waste disposal facility

How much landfill space is available in China?

At 900 000t/a EMM: require 405 000m²/a (40.5 ha/a) waste disposal footprint growth

Conclusion

- Steel demand growth robust
- Healthy demand for manganese
- UMK well positioned to capitalize on demand growth
- Product well accepted in the market

- Thank you