

# MINERAL RESERVES AND RESOURCES

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AND RESOURCES

*Two Rivers Platinum Mine*

# Competent Person's Report on Ore Reserve and Mineral Resources



*Dwarsrivier Chrome Mine*

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# Salient features F2008



*Modikwa Platinum Mine*

- ▶ Khumani            15% increase in iron ore reserves due to higher iron ore prices  
Production started May 2007
- ▶ Beeshoek           Resources/reserves reduced
- ▶ Nchwaning        Measured resources increased by 172% with the application of more appropriate classification methods
- ▶ Nkomati            Oxidised PCR resource to be stockpiled  
MSB nickel resource depleted, MMZ currently the main nickel resource
- ▶ Two Rivers        Measured resources increased by 8% due to an additional resource classification method  
Board approval for the North Decline received
- ▶ Modikwa            Ore reserves increased by 65% with an accompanying decrease in mineral resources

# F2008 Mineral Resource/Reserve summary



Goedgevonden Coal Project

Manganese	(Measured and Indicated)			(Proved and Probable)		
	Mineral resources			Mineral reserves		
	Mt	Mn%	Fe%	Mt	Mn%	Fe%
Nchwaning						
No 1 Seam	137.7	44.7	8.83	115.3	44.7	8.83
No 2 seam	185.2	42.5	15.4	–	–	–
Gloria						
No 1 Seam	52.5	38.3	5.54	40.4	38.3	5.54
No 2 seam	29.4	29.9	10.1	–	–	–

Iron ore	(Measured and Indicated)		(Proved and Probable)	
	Mineral resources		Mineral reserves	
	Mt	Fe%	Mt	Fe%
Beeshoek	120.4	63.55	22.9	64.28
Khumani				
Bruce	265.0	64.69	215.3	64.5
King	379.7	64.49	295.6	64.52

Chromite	(Measured and Indicated)		(Proved and Probable)	
	Mineral resources		Mineral reserves	
	Mt	Cr <sub>2</sub> O <sub>3</sub> %	Mt	Cr <sub>2</sub> O <sub>3</sub> %
Dwarsrivier	44.0	39.16	35.1	39.16
Nkomati	4.6	31.04	2.9	31.0

Rounding of figures may result in computational discrepancies.



Goedgevonden Coal Project

Nickel	(Measured and Indicated)		(Proved and Probable)	
	Mineral resources		Mineral reserves	
	Mt	Ni %	Mt	Ni%
Nkomati	236.8	0.38	164.7	0.33

Platinum group metals	(Measured and Indicated)			(Proved and Probable)		
	Mineral resources			Mineral reserves		
	Mt	PGM + Au g/t	Moz	Mt	PGM + Au g/t	M oz
<b>Two Rivers</b>						
UG2	56.47	4.74 (6E)	8.60	39.51	4.02(6E)	5.11 (6E)
Merensky	18.7	3.55 (6E)	2.06			
<b>Modikwa</b>						
UG2	115.2	5.61(4E)	20.76	58.3	4.71 (4E)	8.84 (4E)
Merensky	65.5	2.67 (4E)	5.61			
Nkomati	236.8	0.93 (4E)		164.7	0.82(4E)	4.34 (4E)
Kalplats	7.12	1.7 (2E)				

2E=Pt+Pd

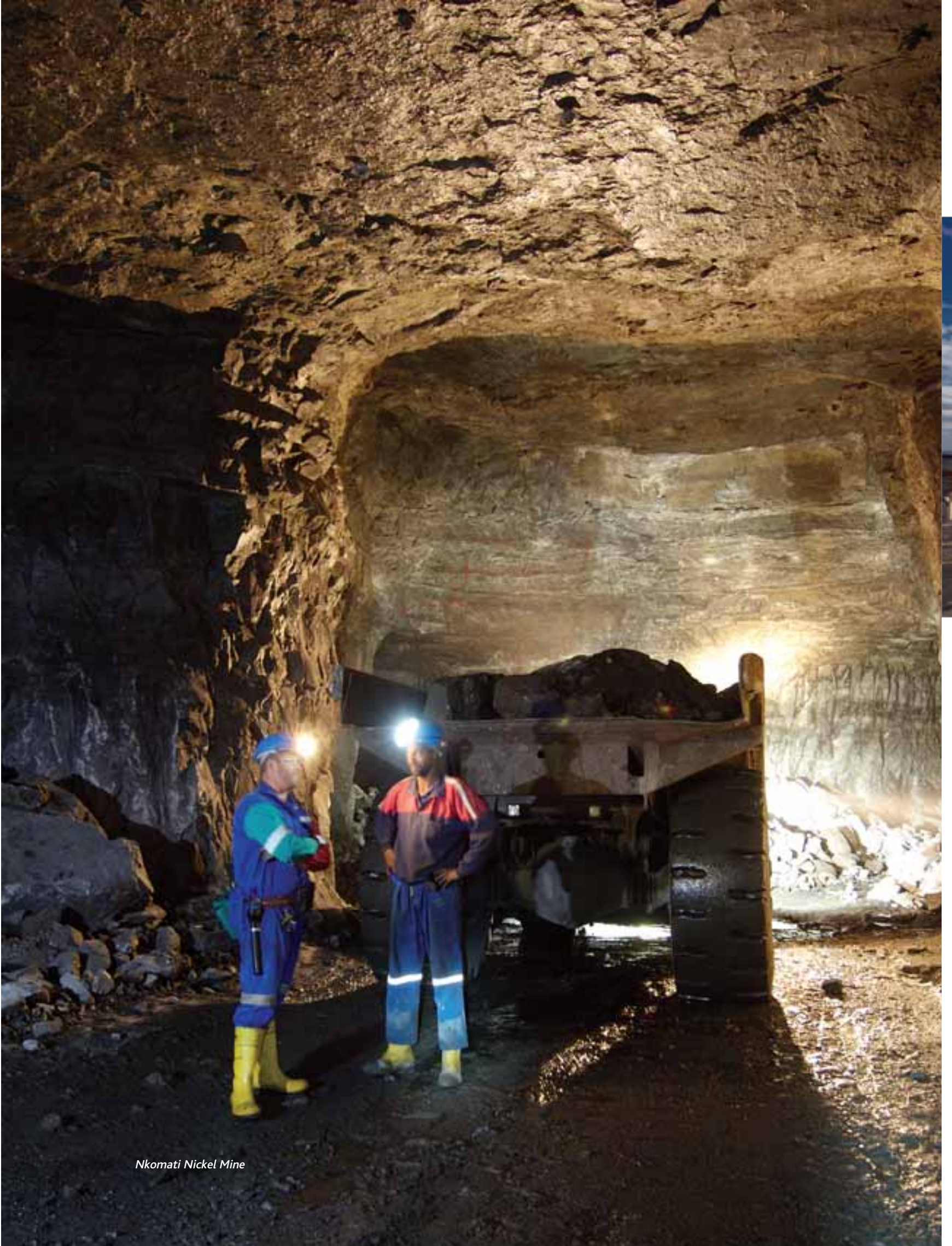
4E=Pt+Pd+Rh+Au

6E=Pt+Pd+Rh+Ir+Ru+Au

Coal	(Measured and Indicated)		(Proved and Probable)	
	Mineral resources	Mineral reserves	Saleable	
		Mt	Mt	Mt
Goedgevonden		570	357.4	194.1

Rounding of figures may result in computational discrepancies.





*Nkomati Nickel Mine*



# General statement



*Nchwaning Manganese Mine*

ARM's method of reporting Mineral Resources and Mineral Reserves conforms to the South African Code for Reporting Mineral Resources and Mineral Reserves (SAMREC Code) and the Australian Institute of Mining and Metallurgy Joint Ore Reserves Committee Code (JORC Code).

The convention adopted in this report is that Mineral Resources are reported inclusive of that portion of the total mineral resource converted to a mineral reserve. Resources and reserves are quoted as at 30 June 2008. External consulting firms audit the resources and reserves of the ARM operations on a three- to four-year cycle basis.

Underground resources are in-situ tonnages at the postulated mining width, after deductions for geological losses. Underground Mineral Reserves reflect milled tonnages while surface Mineral Reserves (dumps) are in-situ tonnages without dilution. Both are quoted at the grade fed to the plant. Open-cast Mineral Resources are quoted as in-situ tonnages and Mineral Reserves are tonnages falling within an economic pit-shell.

The evaluation method is generally Ordinary Kriging with mining block sizes ranging from 10 x 10 metres to 100 x 100 metres to 250 x 250 metres in the plan view. The blocks vary in thickness from 2.5 to 50 metres. The evaluation process is fully computerised, generally utilising the Datamine software package.

The Mineral Resources and Mineral Reserves are reported on a total basis regardless of the attributable beneficial interest that ARM has on the individual projects or mines. When the attributable beneficial interests on a mine or project is less than 100%, the actual percentage of the attributable interest is specified.

Maps, plans and reports supporting resources and reserves are available for inspection at ARM's registered office and at the relevant mines.

In order to satisfy the requirements of the Minerals and Petroleum Resources Development Act, ARM's operations will have to obtain new mining rights for all properties required to support the planned operations over the next 30 years. The act is effective from 1 May 2004 and the new rights must be obtained within five years from then. The operations are at various stages of application.

# Definitions

The definitions of resources and reserves, quoted from the SAMREC CODE, are as follows:

A **'mineral resource'** is a concentration or occurrence of material of economic interest in or on the earth's crust in such form, quality or quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, continuity and other geological characteristics of a mineral resource are known, estimated from specific geological evidence and knowledge, or interpreted from a well constrained and portrayed geological model. Mineral Resources are subdivided, in order of increasing confidence in respect of geoscientific evidence, into inferred, indicated and measured categories.

An **'inferred mineral resource'** is that part of a mineral resource for which tonnage, grade and mineral content can be estimated with a low level of confidence. It is inferred from geological evidence and assumed but not verified geological and/or grade continuity. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that may be limited or of uncertain quality and reliability.

An **'indicated mineral resource'** is that part of a mineral resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a reasonable level of confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are too widely or inappropriately spaced to confirm geological and/or grade continuity but are spaced closely enough for continuity to be assumed.

A **'measured mineral resource'** is that part of a mineral resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a high level of confidence. It is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are spaced closely enough to confirm geological and grade continuity.

A **'mineral reserve'** is the economically mineable material derived from a measured and/or indicated mineral resource. It is inclusive of diluting materials and allows for losses that may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, including consideration of, and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction is reasonably justified. Mineral Reserves are sub-divided in order of increasing confidence into probable Mineral Reserves and proved Mineral Reserves.

A **'probable mineral reserve'** is the economically mineable material derived from a measured and/or indicated mineral resource. It is estimated with a lower level of confidence than a proved mineral resource. It is inclusive of diluting materials and allows for losses that may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, including consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction is reasonably justified.

A **'proved mineral reserve'** is the economically mineable material derived from a measured mineral resource. It is estimated with a high level of confidence. It is inclusive of diluting materials and allows for losses that may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, including consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction is reasonably justified.





# Competence



Two Rivers Platinum Mine

The competent person with overall responsibility for the compilation of the Mineral Reserves and Resources is Paul J van der Merwe, PrSciNat, an ARM employee. He consents to the inclusion in this report of the matters based on this information in the form and context in which it appears.

Paul van der Merwe graduated with a BSc (Hons) in Geology from Free State University. He spent four years as an exploration geologist for FOSKOR. He then joined the Uranium Resource Evaluation Group of the then Atomic Energy Corporation of South Africa for 12 years. While employed there he studied geostatistics and spent some time at the University of Montreal, Canada. In 1991 he joined Anglovaal Mining (now ARM) in the Geostatistics Department and evaluated numerous mineral deposit types for this group in Africa. In 2001 he was appointed as Mineral Resource Manager for the group. He is registered with the South African Council for Natural Scientific Professions as a Professional Natural Scientist in the field of practice of geological science, Registration Number 400498/83, and as such is considered to be a Competent Person.

All competent persons at the operations have sufficient relevant experience in the type of deposit and in the activity for which they have taken responsibility. Details of the ARM competent persons are available from the company secretary on written request.

The following competent persons were involved in the calculation of Mineral Resources and reserves. They are employed by ARM or its subsidiaries and joint venture (JV) partners:

## Resources and Reserves

M Burger

S v Niekerk, *PrSciNat*

B Rusive

M Burger, *PrSciNat*

M Davidson, *PrSciNat*

J Vieler\*, *PrSciNat*

Iron Ore

Manganese

Chromite

Nickel

Nickel

J Woolfe, *PrSciNat*

B Knell\* *PrSciNat*

R van Rhyh *PrSciNat*

C Schlegel, *PrSciNat*

A de lange

Nickel/Platinum group metals

Platinum group metals

Platinum group metals

Gold/Copper

Nkomati Chromite

\* External consultant

P J van der Merwe

August 2008

# ARM Ferrous



*Dwarsrivier Chrome Mine*

## Assmang Limited Operations

### Manganese Mines

#### Locality

The manganese mines are situated in the Northern Cape province in South Africa, approximately 80 kilometres north-west of the town of Kuruman. Located at latitude 27°07'50"S and longitude 22°50'50"E, the site is accessed via the national N14 route between Johannesburg and Kuruman, and the provincial R31 road.

#### History

In 1940, ARM Ferrous acquired a manganese ore outcrop on a small hillock known as Black Rock. Several large properties underlain by ore were subsequently found and acquired. Today the Black Rock area is considered to be the largest and richest manganese deposit in the world. Manganese ore operations were extended and today include the Gloria and Nchwaning underground mines. Manganese ore is supplied locally to Assmang-owned smelters, but is mainly exported through Port Elizabeth to Japanese and German customers. ARM's attributable beneficial interest in Assmang Limited is 50%.

#### Mining authorisation

The Nchwaning mining lease (ML10/76) comprises an area of 1 877.0587 hectares and is located on the farms Nchwaning (267), Santoy (230) and Belgravia (264). An application for the conversion to a new order mining right was submitted during the 2008 financial year.

The Gloria mining lease (ML11/83) comprises an area of 1 713.1276 hectares and is located on portion 1 of the farm Gloria (266). An application for the conversion to a new order mining right was submitted during the 2008 financial year.

#### Geology

The manganese ores of the Kalahari manganese field are contained within sediments of the Hotazel Formation of the Griqualand West Sequence, a subdivision of the Proterozoic Transvaal Supergroup. At Black Rock, Belgravia and Nchwaning, the Hotazel, Mapedi and Lucknow Formations have been duplicated by thrusting. The average thickness of the Hotazel Formation is approximately 40 metres.



The manganese orebodies exhibit a complex mineralogy and more than 200 mineral species have been identified to date. The hydrothermal upgrading has resulted in a zoning of the orebody with regard to fault positions. Distal areas exhibit more original and low-grade kutnohorite and braunite assemblages, while areas immediately adjacent to faults exhibit a very high-grade hausmannite ore. The intermediate areas exhibit a very complex mineralogy, which includes bixbyite, braunite and jacobsite amongst a host of other manganese-bearing minerals. A similar type of zoning also exists in the vertical sense. At the top and bottom contacts it is common to have high iron (Fe) and low manganese (Mn) contents while the reverse is true towards the centre of the seam. This vertical zoning has given rise to a mining practice where only the centre 3.5 metre high portion of the seam is being mined. At the Gloria mine the intensity of faulting is much less, which also explains the lower grade.

Two manganese seams are present. The No.1 seam is up to 6 metres in thickness, of which 3.5 metres are mined, using a manganese marker zone for control. There is, therefore, minimum dilution. Studies are being undertaken to evaluate the effect of increasing the mining height to 5 metres.

### Nchwaning Mineral Resources and Ore Reserves

Measured Resources at Nchwaning are based on up to two-thirds of the semivariogram sill range. Areas where the borehole spacing is greater than this distance and up to the sill range are classified as Indicated. There are no inferred resources at Nchwaning. Measured/Indicated Resources were converted to Proved/Probable Reserves by a LOM scheduling exercise by Snowden Mining Consultancy. Geological losses are built into the grade models.

The Nchwaning mine was diamond drilled from surface at 330 metre centres and the data captured in Excel spreadsheets. The core was logged and 0.5 metre-long, half-core, diamond-saw cut samples were submitted to Assmang's laboratory at Black Rock for X-ray fluorescence (XRF) analyses. Mn and Fe values were checked by wet chemical analyses. Several standards were used to calibrate XRF equipment, and results are compared with other laboratories on a regular basis.

At Nchwaning a total of 341 boreholes for the No 1 orebody and 372 holes for the No 2 orebody, as well as a total of 20 000+ face samples were considered in the grade estimation. The available data for an area was optimised over a thickness of 3.5 metres and exported into data files for computerised statistical and geostatistical manipulation to determine the average grades of Mn, Fe, silica ( $\text{SiO}_2$ ), calcium (CaO) and magnesium (MgO).

Ordinary Kriging interpolation within Datamine was used to estimate the grade of each 50 x 50 x 3.5 metre block generated within the geological model. Sub-cell splitting of the 50 x 50 metre blocks was allowed to follow the geological boundaries accurately. The relative density of Nchwaning manganese ore was taken as 4.3t/m<sup>3</sup>.

Trackless mechanised equipment is used in the bord and pillar mining method. Mining in the eastern extremity of Nchwaning occurs at a depth of 200 metres while the deepest (current) excavations can be found at a depth of 519 metres below surface. Gloria Mine is extracting manganese at depths that vary between 180 and 250 metres below surface.

Ore from Nchwaning No 2 mine is crushed underground before being hoisted to a surface stockpile via a vertical shaft. Similarly, ore from the Nchwaning No 3 mine is crushed underground before being conveyed to a surface stockpile via a declined conveyor system. Ore is withdrawn from the surface stockpile and forwarded to two stages of crushing, dry screening and wet screening to yield lumpy and fine products.

### Nchwaning year-on-year change in Mineral Resources and Ore Reserves

The 2008 Mineral Reserves for the Nchwaning No 1 orebody changed from 114.6 Mt in 2007 to 115.3 Mt. A LOM scheduling exercise by Snowden showed that the 20% loss when changing from resource to reserve previously used, proved to be very conservative, hence the increase in Reserves. The Mineral Resources at Nchwaning No 1 orebody decreased by 5.7 Mt to 137.7 Mt (143.4 Mt). The Mineral Resources at Nchwaning No 2 orebody increased slightly to 185.2 Mt from 181.9 Mt. This is the same as it was in 2006 (184.7 mt), indicating a modelling problem in 2007.

# ARM Ferrous

## Nchwaning Mine: 1 Body Manganese Resources and Reserves

Mineral Resources	Mt	Mineral Reserves	Mt	Mn%	Fe%
Measured	43.8	Proved	37.6	46.9	8.96
Indicated	93.9	Probable	77.7	43.7	8.76
<b>Total Resources 1 Body 2008</b>	<b>137.7</b>	<b>Total Reserves 1 Body</b>	<b>115.3</b>	<b>44.7</b>	<b>8.83</b>
Total Resources 1 Body 2007	143.4	Total Reserves 1 Body	114.70	44.8	8.87
Inferred		none			

## Nchwaning Mine: 2 Body Manganese Resources

Mineral Resources	Mt	Mn%	Fe%
Measured	53.9	42.1	16.1
Indicated	131.3	42.6	15.1
<b>Total Resources 2 Body 2008</b>	<b>185.2</b>	<b>42.5</b>	<b>15.4</b>
Total Resources 2 Body 2007	181.9	42.4	15.5
Inferred	none		

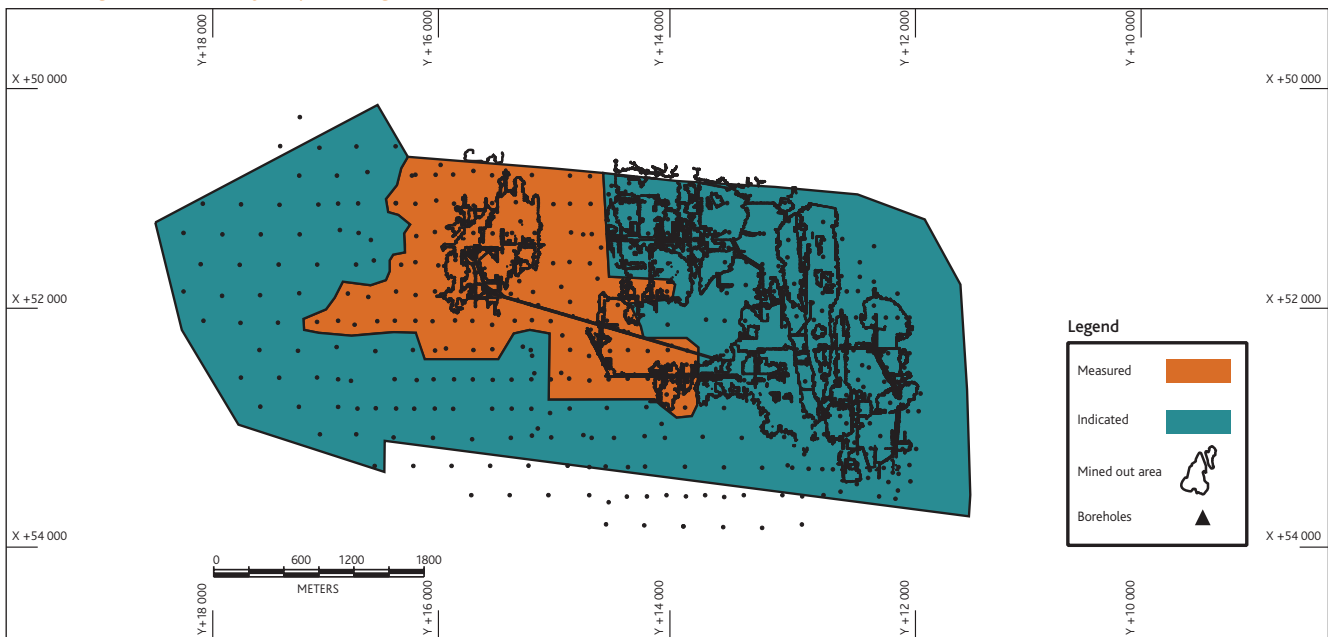
Measured resources are based on two-thirds of the semivariogram sill range rule

Areas outside this distance are classified as Indicated

Proved Reserves = Measured Resources used in LOM scheduling by Snowden

Probable Reserves = Indicated Resources used in LOM scheduled by Snowden

### Nchwaning borehole locality map showing the Mineral Reserve and Resource classification



## Gloria Mineral Resources and Ore Reserves

Measured Resources at Gloria are classified as material available up to 50 metres in front of the mining faces. Material situated further than 50 metres from the face and up to a boundary string around the dense drilled area on Gloria is classified as Indicated resources. The rest of the property



with limited drill information is classified as Inferred. In the coming year an increase in the Measured resources by in-fill drilling is anticipated. At Gloria a 23% pillar loss is accounted for in moving Measured /Indicated resources into Proved/Probable reserve.

At the Gloria mine, ore is crushed underground before being conveyed to a surface stockpile via a decline shaft. At both plants the finer fractions are stockpiled while the coarser fractions are extracted from the respective product boxes into road haulers, sampled, weighed and stored on stacks ahead of despatch. Samples from each stack are analysed for chemical content and size distribution. This ensures good quality control and enables the ore control department to blend various stacks according to customer demand.

Procedures for drilling and assaying at Gloria mine are the same as at Nchwaning. A total of 103 boreholes were considered in the evaluation of the Gloria 1 Body mine. The wide-spaced borehole interval puts some limitation on the evaluation in areas away from current mining faces. A total of 5 100+ underground sampling values were used in evaluating areas close to current mining. The boreholes were optimised over a stoping width of 3.5 metres and the relative density was taken as 3.8t/m<sup>3</sup>. The seams were evaluated by means of statistical and geostatistical methods to determine the average grades of Mn, Fe, SiO<sub>2</sub>, CaO and MgO. Ordinary Kriging interpolation within Datamine was used to estimate the grade of each 50 x 50 x 3.5 metre block generated within the geological model. Sub-cell splitting of the 50 x 50 metre blocks was allowed to follow the geological boundaries.

### Gloria year-on-year change in Mineral Resources and Ore Reserves

The 2008 Proved Reserves at Gloria No 1 Body decreased to 6.8 Mt (7.7 Mt) due to re-evaluation and production draw-down. The Probable Reserves also decreased from 67.4 Mt to 33.6 Mt as a result of a new delineation approach followed for the Indicated resources. A substantial increase of the Inferred resources is seen due to the more appropriate delineation boundary for Indicated resources. The Mineral Resources at Gloria No 2 Body were also re-classified using the new boundaries and substantial shifts in resources between categories occur. No markets currently exist for Gloria 2 Body ore.

### Gloria Mine: 1 Body Manganese Resources and Reserves

Mineral Resources	Mt	Mineral Reserves	Mt	Mn%	Fe%
Measured	8.82	Proved	6.8	38.4	4.9
Indicated	43.7	Probable	33.6	38.3	5.67
<b>Total Resources 1 Body 2008</b>	<b>52.5</b>	<b>Total Reserves 1 Body</b>	<b>40.4</b>	<b>38.3</b>	<b>5.54</b>
Total Resources 1 Body 2007	97.6	Total Reserves 1 Body	75.1	38.3	5.67
Inferred 2008	132.3				
Inferred 2007	70.3				

### Gloria Mine: 2 Body Manganese Resources

Mineral Resources	Mt	Mn%	Fe%
Measured	–	–	–
Indicated	29.4	29.9	10.1
<b>Resources 2 Body 2008</b>	<b>29.4</b>	<b>29.9</b>	<b>10.1</b>
Resources 2 Body 2007	67.9	31.9	10.9
Inferred 2008	132.3		
Inferred 2007	70.3		

Measured Resources = Immediately available tonnes up to 50 metres in front of mining faces

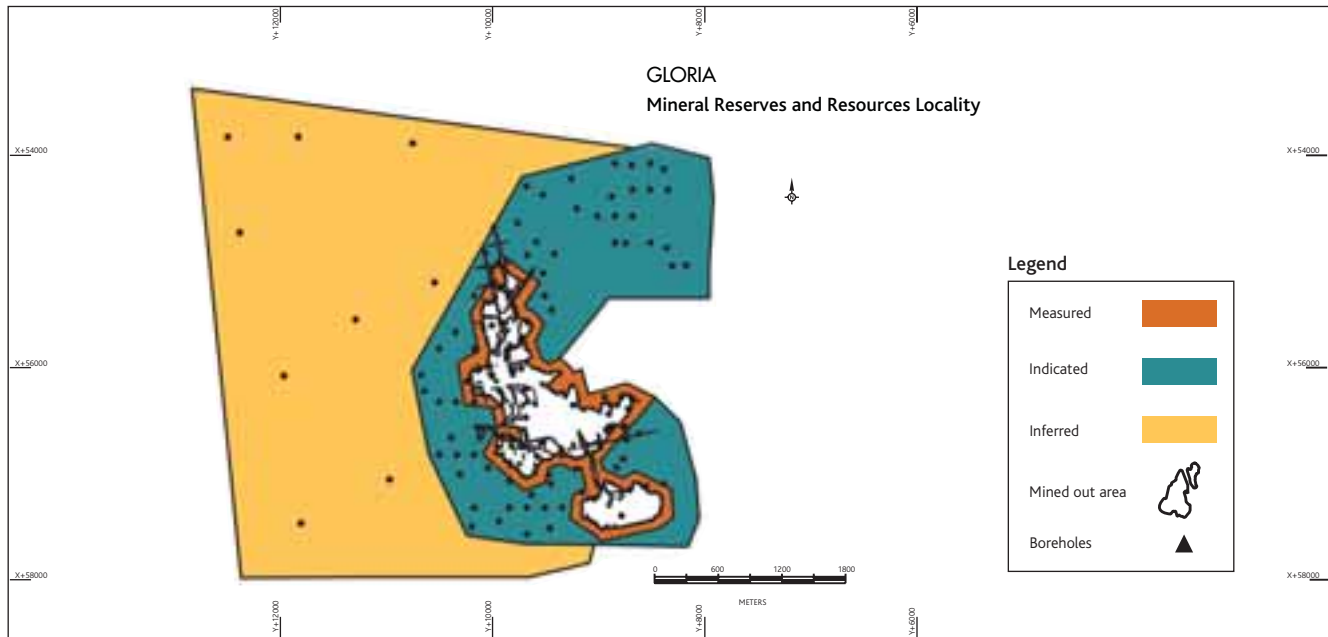
Indicated resources are as per dense drilling area (see map)

Proved Reserves = Measured Resources less 23% pillar loss

Probable Reserves = Indicated Resources less 23% pillar loss

# ARM Ferrous

Gloria borehole locality map showing the Mineral Reserve and Resource classification



## Historical Manganese production at Nchwaning and Gloria Mines (Mt)

	Nchwaning	Gloria
2003/2004	1.17	0,33
2004/2005	1.97	0.15
2005/2006	2.83	0.13
2006/2007	2.49	0.43
2007/2008	2.71	0.41

## Iron ore Locality

The iron ore division is made up of the Beeshoek mine located on the farms Beeshoek 448 and Olynfontein 475. The iron ore resources on the farms Bruce 544, King 561, and Mokaning 560, which were formerly known as the BKM Project, are now being developed into what is known as the Khumani iron ore mine. All properties are in the Northern Cape approximately 200 kilometres west of Kimberley. The Beeshoek open-pit operations are situated 7 kilometres west of Postmasburg and the new Khumani open pits will be adjacent to, and south-east of, the Sishen mine, which is operated by Kumba Resources. Located at latitude 28°30'00"S / longitude 23°01'00"E, and latitude 27°45'00"S / longitude 23°00'00"E respectively, these mines supply iron ore to both the local and export markets. Exports are railed to the iron ore terminal at Saldanha Bay.

## History

Mining of iron ore (mainly specularite) was undertaken as early as 40 000 BC on the farm Doornfontein which is due north of Beeshoek. The potential of iron ore in this region was discovered in 1909, but due to lack of demand and limited infrastructure, this commodity was given little attention. In 1929 the railway line was extended from Koopmansfontein (near Kimberley) to service a manganese mine at Beeshoek. In 1935 The Associated Manganese Mines of South Africa Limited (Assmang) was formed, and in 1964 the Beeshoek iron ore mine was established, with a basic hand sorting operation. In 1975 a full washing and screening plant was installed and production increased over the years to the current level of approximately 6 million tonnes a year.

## Mining authorisation

The Beeshoek mining lease (ML3/93) comprises an area of 5 685.64 hectares and is located on the farms Beeshoek (448) and Olynfontein (475). An application for the conversion to a new order mining right was submitted during the 2008 financial year.



The Khumani mining lease comprises an area of 7 388.02 hectares and is located on the farms Bruce (544), King (561), Mokaning (560) and McCarthy (559). Mining rights were granted during the 2007 financial year.

## Geology

The iron ore deposits are contained within a sequence of early Proterozoic sediments of the Transvaal Supergroup deposited between 2 500 and 2 200 million years ago. In general two ore types are present, namely laminated hematite ore forming part of the Manganore Iron Formation and conglomerate ore belonging to the Doornfontein Conglomerate Member at the base of the Gamagara Formation.

The older laminated ore types occur in the upper portion of the Manganore Iron Formation as enriched high-grade hematite bodies. The boundaries of high-grade hematite orebodies crosscut primary sedimentary bedding, indicating that secondary hematitisation of the iron formation took place. In all of these, some of the stratigraphic and sedimentological features of the original iron formation are preserved.

The conglomeratic ore is found in the Doornfontein Conglomerate Member of the Gamagara Formation and is lenticular and not persistently developed along strike. It consists of stacked, upward fining conglomerate-gritstone-shale sedimentary cycles. The lowest conglomerates and gritstones tend to be rich in sub-rounded to rounded hematite ore pebbles and granules and form the main orebodies. The amount of iron ore pebbles decreases upwards in the sequence so that upper conglomerates normally consist of poorly sorted, angular to rounded chert and banded iron formation pebbles.

The erosion of the northern Khumani deposit is less than that in the southern Beeshoek area. The result is that Khumani is characterised by larger stratiform bodies and prominent hangingwall outcrops. The down-dip portions are well preserved and developed, but in outcrop the deposits are thin and isolated. Numerous deeper extensions occur into the basins due to karst development. A prominent north-south strike of the ore is visible. The southern Beeshoek orebodies were exposed to more erosion and are more localised and smaller. Outcrops are limited to the higher topography on the eastern side of the properties. Down dip to the west, the ore is thin and deep. The strike of the orebodies is also in a north-south direction, but less continuous.

Haematite is the predominant ore mineral, but limonite and specularite also occur.

## Mineral Resources and Ore Reserves

In the iron ore operations, the following table shows how the search ellipse (i.e. the ellipsoid used by the Kriging process to determine if a sample is used in the estimation of a block) is used to classify the Mineral Resource:

	Minimum no. of samples	Maximum no. of samples	Search ellipse settings XYZ (m)
Measured	6	30	100 x 100 x 10
Indicated	5	30	200 x 200 x 20
Inferred	4	30	400 x 400 x 40

Only Measured and Indicated Resources are converted to Proved and Probable Reserves respectively. Modifying factors were applied to these resources and financially optimised. The financial outline is used to define the optimal pit by means of the Lersch-Grossman algorithm. The resources within this mining constraint are defined as reserves. These are categorised into different product types, destined for the different plant processes and scheduled for planning.

The methodology followed to identify targets is initiated with geological mapping, followed by geophysics (ground magnetics and gravity). Percussion drilling is used to pilot holes through overlying waste rock down to the iron ore bodies. Diamond drilling is the next phase, which is usually on a 200 x 200 metre grid. Further infill drilling is carried out at spacing ranging from 100 x 100 metres to 25 x 25 metres, depending on the complexity of the geological structures. Numerous exploration programmes were completed in the last 40 years. A total of 2 832 holes (1 315 holes on Khumani and 1 517 holes on Beeshoek) were drilled. Core samples were logged and split by means of a diamond saw and the half-core is sampled every 0.5 metres. Before submission for assaying, the half-cores were crushed, split and pulverised. Samples with values larger than 60% are included in the definition of the orebodies. Any lower-grade samples inside the orebody are defined as internal waste and modelled separately. Each zone is modelled per section, and then wireframed to get a three-dimensional (3D) model.

# ARM Ferrous



*Dwarsrivier Chrome Mine*

Ordinary Kriging interpolation within Datamine was used to estimate the grade of each 10 x 10 x 10 metre block generated within the geological model. Density in the resource model is calculated using a fourth degree polynomial fit applied to the estimated Fe grade. Densities range from 4.38 t/m<sup>3</sup> (60% Fe) to 5.01 t/m<sup>3</sup> (68% Fe). A default density of 3.2 is used for waste.

At Beeshoek all blast holes are sampled per metre, but composited per hole. All holes are analysed for density and blast holes in ore are sampled and analysed for Fe, potassium oxide (K<sub>2</sub>O), sodium oxide (Na<sub>2</sub>O), silica (SiO<sub>2</sub>), aluminium oxide (Al<sub>2</sub>O<sub>3</sub>), phosphorus (P), sulphur (S), CaO, MgO, Mn and barium oxide (BaO). Every fifth blast hole is geologically logged per metre, which is used to update the geological model. The chemical results of these holes are used to update the ore block model. Approximately 45 000 blast holes are drilled a year and 9 000 blast holes are used every year to update the models. The major analytical technique for elemental analyses is XRF spectroscopy. Volumetric titration is used as verification method for the determination of total iron in the ore. International standards (e.g. SARM11) and in-house iron standards are used for calibration of the XRF spectrometer. The Beeshoek laboratory participates in a round robin group that includes seven laboratories for verification of assay results.

## Historical production at Beeshoek and Khumani Mines

	Beeshoek	Khumani
Year	Mt	
2003/2004	6.3	–
2004/2005	6.0	–
2005/2006	6.2	–
2006/2007	6.7	–
2007/2008	5.3	2.0

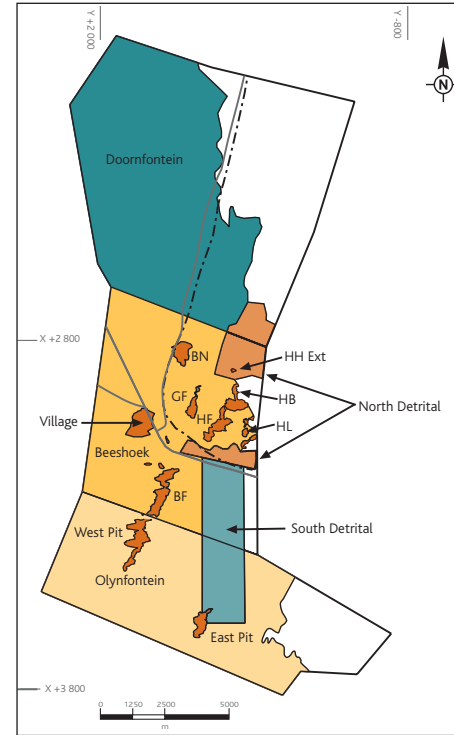
## Beeshoek year-on-year change in Mineral Resources and Ore Reserves

The 2008 Mineral Resources at Beeshoek mine decreased from 134.5 to 128.36 Mt, due to the annual production drawdown. The Mineral Reserves at Beeshoek decreased from 28.6 Mt to 22.6 Mt. The Village deposit is still not in reserve as a result of the high stripping ratio, but due to the higher iron ore prices, this deposit will be re-valued to see if its exploitation had become economic. Ore Reserves at the BN and the BF pits were drawn down heavily to meet sales requirements. The Khumani Mine will take over the Beeshoek export production in mid-2008.





Beeshoek open-pit locality plan



### Beeshoek Iron Ore: Resources and Reserves

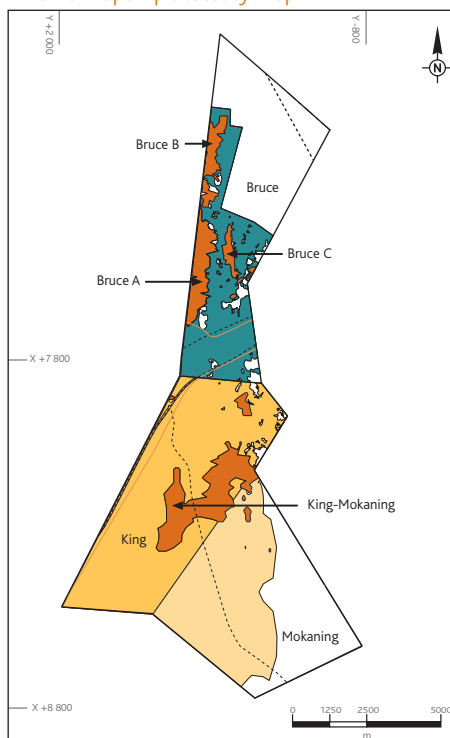
Pit/Area	Measured		Indicated		Inferred		Total Resource		Proved Reserve		Probable Reserve		Total Reserve	
	Mt	Fe%	Mt	Fe%	Mt	Fe%	Mt	Fe%	Mt	Fe%	Mt	Fe%	Mt	Fe%
Measured and Indicated														
BN	21.4	63.51	0.01	62.67	–	–	21.41	63.51	14.58	64.03	–	–	14.58	64.03
HF/HB	16.6	64.3	0.30	63.85	–	–	16.90	64.30	2.55	65.24	0.03	66.45	2.58	65.25
BF	8.57	63.35	0.23	63.54	–	–	8.80	63.36	3.54	63.72	0.01	62.58	3.55	63.72
East Pit	9.14	64.61	0.03	64.19	–	–	9.17	64.61	1.89	65.66	–	–	1.89	65.66
Village	40.79	63.56	0.09	64.64	–	–	40.89	63.57	–	–	–	–	–	–
GF	3.13	63.81	0.09	61.80	–	–	3.22	63.76	–	–	–	–	–	–
HH Ext	0.28	62.63	–	–	–	–	0.28	62.63	–	–	–	–	–	–
HL	3.57	65.09	0.05	65.23	–	–	3.62	65.1	0.27	65.96	–	–	0.27	65.96
West Pit	10.19	63.04	–	–	0.05	61.87	10.19	63.04	–	–	–	–	–	–
N Detrital	–	–	5.9	60.00	–	–	5.9	60.00	–	–	–	–	–	–
S Detrital	–	–	–	–	3.7	60.0	–	–	–	–	–	–	–	–
<b>TOTAL 2008</b>	<b>113.67</b>	<b>63.74</b>	<b>6.65</b>	<b>60.44</b>	<b>3.75</b>	<b>61.87</b>	<b>120.38</b>	<b>63.55</b>	<b>22.8</b>	<b>64.28</b>	<b>–</b>	<b>–</b>	<b>22.8</b>	<b>64.28</b>
<b>TOTAL 2007</b>	<b>120.74</b>	<b>63.67</b>	<b>6.70</b>	<b>60.07</b>	<b>0.05</b>	<b>61.87</b>	<b>127.49</b>	<b>63.31</b>	<b>28.0</b>	<b>64.16</b>	<b>0.62</b>	<b>64.03</b>	<b>28.62</b>	<b>64.16</b>

### Khumani year-on-year change in Mineral Resources and Ore Reserves

At Khumani mine the 2008 Mineral Resources remain the same when compared to 2007. The Ore Reserves increased by 15% to 510.9 million tonnes (444.7 million tonnes) due to the higher iron ore prices taken into account in the open-pit designs. It is however expected that these reserve figures will further increase due to the iron ore price increase announced in April 2008. Infrastructure construction is in progress, and production is to start mid-2008, with an estimated life-of-mine of 30 years. During the 2007/2008 financial year overburden stripping took place and in the order of 2 Mt ore was stockpiled.

# ARM Ferrous

Khumani open-pit locality map



Mining operations are all open pit, based on the conventional drill-and-blast, truck-and-shovel operations. Run-of-mine ore is crushed and stored as high or normal grade on blending stockpiles. Ore from the stockpiles is either sent to the wash-and-screen plant or, if contaminated, to the beneficiation plant. The washing and screening plant consist primarily of tertiary crushing, washing, screening, conveying and stacking equipment. The beneficiation plant consists of tertiary crushers; scrubbers; coarse and fine jigs or Larcodems; fine crushing; elutriators and upward flow classifiers; lumpy, fines and scaw product stockpiles; and a rapid load-out facility. No chemical is being used in any of the treatment plants.

## Khumani Iron Mine: Resources and Reserves

Area	Measured		Indicated		Inferred		Total		Proved Reserve		Probable Reserve		Total Reserve	
	Mt	Fe%	Mt	Fe%	Mt	Fe%	Mt	Fe%	Mt	Fe%	Mt	Fe%	Mt	Fe%
	Measured & Indicated													
Bruce A	23.5	64.91	99.0	64.54	0.8	63.37	122.5	64.60	13.9	64.47	84.2	64.43	98.1	64.44
Bruce B	21.1	65.71	77.0	64.06	8.7	64.64	98.1	64.43	20.4	65.55	64.7	63.88	85.1	64.28
Bruce C	37.2	65.45	6.9	65.95	1.6	64.80	44.1	65.45	30.4	65.27	1.66	65.55	32.1	65.28
King/	255.8	64.53	123.9	64.48	17.7	63.98	379.7	64.49	209.6	64.47	85.99	64.64	295.6	64.52
Mokaning														
Khumani					12.0	60.00	12.0	60.00						
Detrital														
<b>TOTAL 2008</b>	<b>337.9</b>	<b>64.73</b>	<b>306.8</b>	<b>64.43</b>	<b>40.8</b>	<b>62.97</b>	<b>644.7</b>	<b>64.59</b>	<b>274.3</b>	<b>64.64</b>	<b>236.6</b>	<b>64.36</b>	<b>510.9</b>	<b>64.51</b>
<b>TOTAL 2007</b>	<b>337.9</b>	<b>64.73</b>	<b>306.8</b>	<b>64.43</b>	<b>40.8</b>	<b>62.97</b>	<b>644.7</b>	<b>64.59</b>	<b>273.2</b>	<b>64.75</b>	<b>171.5</b>	<b>64.59</b>	<b>444.7</b>	<b>64.69</b>





*Khumani Iron Ore Mine*

## Chromite Locality

Chromite operations at Dwarsrivier mine form part of the chrome division of Assmang Limited. The mine is situated on the farm Dwarsrivier 372KT, approximately 30 kilometres from Steelpoort and 60 kilometres from Lydenburg, in Mpumalanga province in South Africa. Located at longitude 30°05'00"E/latitude 24°59'00"S, Assmang purchased the farm from Gold Fields Limited, together with all surface and mineral rights in October 1998.

## History

Neighbouring properties to the north and south of Dwarsrivier had existing chrome mining operations at the time of purchase. The feasibility study of the plant, tailings dam and designs for the opencast and underground mines then commenced. After the completion of the consolidated assessment, approval to proceed with the final design and construction work was given in July 1999.

Chromite was obtained from the opencast mining areas at a rate of approximately 0.9 million tonnes a year and these areas were mined out within five years. Underground mining commenced in 2005 at a rate of 1.2 million tonnes a year. Dwarsrivier mine is specifically geared to deliver high quality metallurgical grade chromite to the Machadodorp smelter. In addition, the plant has been designed to produce chemical and foundry grade products.

## Mining authorisation

An old order Mining Licence No 21/99 was granted in October 1999. It was granted for the mining of chrome and platinum group metals. An application for the conversion to a new order mining right was submitted during October 2007.

## Geology

Dwarsrivier mine is situated in the eastern limb of the Bushveld Complex, which comprises persistent layers of mafic and ultramafic rocks, containing the world's largest known resources of platinum group metals, chromium and vanadium. The mafic rocks termed the Rustenburg Layered Suite, are approximately 8 kilometres thick in the eastern lobe, and are divided formally into five zones.

# ARM Ferrous



*Dwarsrivier Chrome Mine*

The rocks of the Marginal Zone at the base of the succession consist mainly of pyroxenites with some dunites and harzburgites. Above the Marginal Zone, the Lower Zone comprises mainly pyroxenites, harzburgites and dunite, and is present only in the northern part of the Eastern Lobe, and only as far south as Steelpoort. The appearance of chromitite layers marks the start of the Critical Zone, economically the most important zone. The layers are grouped into three sets termed the Lower, Middle and Upper groups. The sixth chromitite seam in the Lower Group (LG6), is an important source of chromite ore and is the orebody being mined at Dwarsrivier mine. In the Eastern Lobe, in the vicinity of Dwarsrivier, the strike is nearly north-south, with a dip of approximately 10 degrees towards the west. Average thickness of the LG6 seam is about 1.86 metres in the Dwarsrivier area. Pipe-like dunite intrusions are evident in the area, as well as dolerite dykes that on average strike northeast-southwest. No significant grade variation is evident, especially not vertically in the ore seam. Small, insignificant regional variations do, however, exist.

## Mineral Resources and Ore Reserves

Information was obtained from boreholes with a 300 to 150 metre grid spacing. Resources were determined with a decreasing level of confidence.

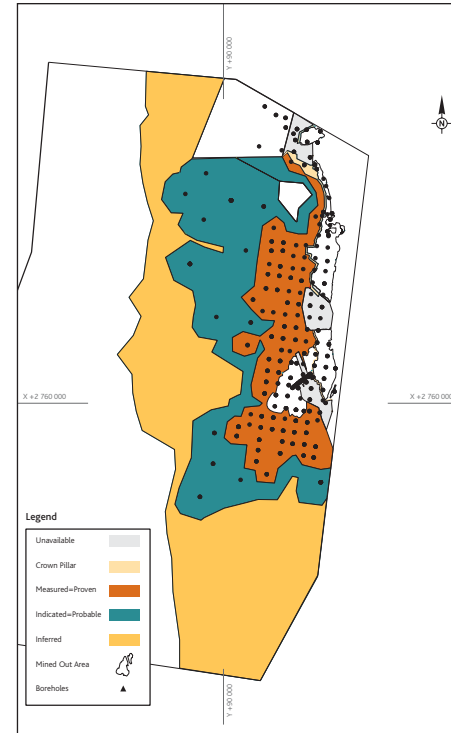
- ▶ Measured Resource (150 metres drill grid spacing);
- ▶ Indicated Resource (300 metres drill grid spacing); and
- ▶ Inferred Resource (drill grid spacing greater than 300 metres).

*All possible resources down to a mineable depth of 350 metres below ground level have been considered.*

A strategy to ensure the availability of adequate information ahead of mining activities is in place. The strategy is to ensure all mining areas falling within the first five years of the life-of-mine plan contain proved reserves. Vertical diamond drilling holes are used, except where information is needed to clarify large-scale fault planes. The Mineral Resource at Dwarsrivier mine is based on a total of 230 diamond drill holes that have been used for grade estimation and orebody modelling purposes. The drill core is NQ size and is geologically and geo-technically logged. The collar position of the drill holes is surveyed, but no down-hole surveys are done, and the holes are assumed to have minimal deflection.



Dwarsrivier Mine Mineral Reserves and Resources locality



The chromitite seam is bounded above and below by pyroxenites. As such, the ore horizon is clearly defined. The core is sampled from the top contact downwards at 0.5-metre intervals. The core is split and half is retained as reference material in the core sheds. The other half is crushed and split into representative samples, which are crushed and pulverised for chemical analysis. The samples are analysed fusion/ICP-OES for chrome oxide ( $\text{Cr}_2\text{O}_3$ ),  $\text{SiO}_2$ ,  $\text{FeO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{MgO}$  and  $\text{CaO}$ . Three laboratories, all ISO 17025 accredited for this method, are used. Every tenth sample is analysed in duplicate. SARM 8 and SARM 9 standards, as well as in-house reference material (CRI), are included every 20 to 30 samples in each batch. The density for each sample is measured using a gas pycnometer.

Datamine software is used to construct a 3-D geological model (wireframe) of the LG6 chromite seam, based on borehole and other geological data. A cut-off value of 35%  $\text{Cr}_2\text{O}_3$  was used to distinguish between ore and waste. Mineral Resources have been calculated using Ordinary Kriging, where  $\text{Cr}_2\text{O}_3$ ,  $\text{FeO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{MnO}$  and  $\text{MgO}$ -contents of the LG6 seam and densities were determined, using block sizes of 50 x 50 x 4 metres.

During mining, a slightly diluted run of mine ore is fed to the beneficiation plant. This decreases the average grade from approximately 40%  $\text{Cr}_2\text{O}_3$  to 37%  $\text{Cr}_2\text{O}_3$ . An addition of approximately 9% of waste material results in this 3%  $\text{Cr}_2\text{O}_3$  grade decrease. In the dense media separation part of the plant, the coarse fraction is upgraded to 40%  $\text{Cr}_2\text{O}_3$ , with a yield of 80%. In the spiral section of the plant the finer fraction is upgraded to 44%  $\text{Cr}_2\text{O}_3$ , and 46%  $\text{Cr}_2\text{O}_3$  respectively, for metallurgical grade fines and chemical grade fines. Foundry sand is also produced with a similar grade to that of the chemical grade fines. A 67% yield is achieved in the spiral circuit.

### Dwarsrivier year-on-year change in Mineral Resources and Ore Reserves

When compared to 2007, the 2008 Mineral Reserves decreased by 1.3 million tonnes to 35.1 million tonnes (36.4 million tonnes) and the Mineral Resources show a decrease of 1.6 million tonnes to 44.02 million tonnes (45.64 million tonnes). The reason for the change is the draw-down by the annual production.





*Dwarsrivier Chrome Mine*

### Dwarsrivier Mine: Chrome Resources and Reserves

Mineral Resources	Mt	Cr <sub>2</sub> O <sub>3</sub> %	FeO%	Reserves	Mt	Cr <sub>2</sub> O <sub>3</sub> %	FeO%
Measured	15.30	39.32	23.21	Proved	12.2	39.32	23.21
Indicated	28.72	39.06	22.55	Probable	22.9	39.06	22.55
<b>Total Measured and Indicated 2008</b>	<b>44.02</b>	<b>39.16</b>	<b>22.79</b>	<b>Total Reserves</b>	<b>35.1</b>	<b>39.16</b>	<b>22.79</b>
Total Measures and Indicated 2007	45.64	39.16	22.79	Total Reserves	36.4	39.16	22.79
Inferred	53.11	39.00	22.71				

The current life of mine of the Dwarsrivier chrome mine is more than 30 years.

Excluded from this plan are the Inferred Mineral Resources and material situated deeper than 350 metres below ground level.

### Historical Production at Dwarsrivier Chrome Mine

Year	Mt RoM
2003/2004	0.96
2004/2005	0.92
2005/2006	0.82
2006/2007	1.01
2007/2008	1.24



# ARM Platinum



*Nkomati Nickel and Chrome Mine*

## Nkomati Mine

### Locality

Nkomati mine is situated some 300 kilometres east of Johannesburg in Mpumalanga province in South Africa. Situated at latitude 25°40'S and longitude 30°30'E, the site is accessed via the national N4 highway between Johannesburg and Machadodorp, the R341 provincial road and the R351 tarred road.

### History

Nickel, copper, cobalt, PGM and chromite mineralisation is hosted by the Uitkomst Complex, a layered mafic-ultramafic, Bushveld satellite intrusion. The Uitkomst Complex outcrops on two farms, Slaaihoek 540JT and Nkomati 770 JT (a consolidation of portions of Uitkomst 541 JT and Vaalkop 608 JT). In 1929, the mineral rights on Slaaihoek were purchased by ETC, an Anglovaal subsidiary, to mine gold at the old Mamre and Slaaihoek mines. In the early 1970s, an Anglo American/INCO Joint Venture began exploring Uitkomst for nickel. In 1990, Anglo American (AAC) completed a feasibility study on an open-pit operation exploiting the large disseminated sulphide resource on Uitkomst, with negative results. Exploration on Slaaihoek by Anglovaal began in earnest in 1989, and in 1991, the first holes were drilled into the massive sulphide body (MSB). In 1995, the Nkomati JV between Anglovaal (75%) and AAC (25%) was formed and in January 1997, production of the MSB began. In 2004, Anglovaal acquired AAC's 25% interest and in 2005, a 50:50 JV was formed between ARM and LionOre, a global nickel producer and owner of the Activox technology. In February 2006, Nkomati approved an interim, Phase 1 expansion project which planned to exploit the MMZ, a disseminated sulphide body, by underground and open-pit mining. The project was completed in 2007 and the mine is currently processing MMZ ore at a rate of 112 000 tonnes per month, maintaining nickel production at approximately 5 000 tonnes a year, the MSB orebody has now been substantially mined out.

In the same year Norilsk Nickel, the Russian nickel giant, acquired LionOre in totality, resulting in Nkomati being a 50:50 JV between ARM and Norilsk Nickel.

In June 2006, following a trial mining operation, a feasibility study on mining the oxidised massive chromitite was completed and approval was given for a 60 000 tonne per month mining and processing operation. This has grown to a planned production of saleable product (lump and chips) of approximately 110 000 tonnes a month for the new financial year. Work has commenced on a Chrome Washing Plant to treat chromitite fines and chips and is anticipated to be commissioned in August 2008. Oxidised PCR, a low grade chromitite bearing ore overlying the MMZ and PCMZ is planned to be stockpiled to feed this plant in the future.



A feasibility study for a Phase 2 expansion phase was completed in 2007 and the project has been released. The project plans to build a 375 000 tonnes per month MMZ plant and to convert the current 100 000 tonnes per month MMZ plant to process 250 000 tonnes a month of PCMZ. The PCMZ, a disseminated chrome-bearing sulphide body overlying the MMZ, will be treated separately to liberate the chromitite fines. At full production in January 2011, Nkomati will produce approximately 1 600 tonnes of nickel per month.

### Mining authorisation

Old order mining licences, numbers 3/2001 and 27/2003, exist on the farms Slaaihoek and Nkomati respectively for the mining of nickel, copper, cobalt, platinum group metals (PGMs) and chromite. An application for the conversion to a new order mining right was submitted in July 2006.

### Geology

The Uitkomst Complex is a Bushveld-age layered, mafic-ultramafic body intruded into the basal sediments of the Transvaal Supergroup, which lies unconformably on an Archean granitic basement. The complex is a long linear body, which outcrops in the Slaaihoek valley for approximately 8 kilometres and dips below an escarpment where it has been drilled at depth for an additional four kilometres. The complex, which dips at approximately four degrees to the northwest, is still open-ended.

From the base to top, the stratigraphy of the Uitkomst Complex comprises the Basal Gabbro Unit (up to 15 metres thick), the Lower Pyroxenite Unit (average 35 metres), the Chromititic Peridotite Unit (30 to 60 metres), the Massive Chromitite Unit (up to 10 metres), the Peridotite Unit (330 metres), the Upper Pyroxenite Unit (65 metres), the Gabbronorite Unit (250 metres), and the Upper Gabbro Unit (50 metres). The complex and surrounding sediments are intruded by numerous diabase sills up to 30 metres in thickness.

There are five main sulphide zones in the Uitkomst Complex: the MSB, situated at and below the base of the complex, which has been the main producer for the underground mine since 1997; the BMZ within the Basal Gabbro; the MMZ, occurring within the Lower Pyroxenite, which is currently being mined from both underground and open pit; the PCMZ, which occurs with the Chromititic Peridotite (PCR) and is not currently being mined, and the PRDMZ, which occurs in the Peridotite Unit. In addition, the Massive Chromitite Unit (MCHR) is currently being mined where it is fully oxidised (weathered) in the open-pit area. The dominant sulphide minerals are pyrrhotite, pentlandite and chalcopyrite; cobalt is mostly in solid solution in the pentlandite, and the PGMs occur as separate minerals, merenskyite being dominant.

### Mineral Resources and Ore Reserves

There have been numerous diamond, percussion and RC drilling campaigns since 1972 totalling over 162 000 metres in more than 1 000 boreholes. Consequently, various sampling and assaying protocols as well as varying standards of QA/QC have been used. Core sizes have been mainly NQ and TNW. Before 1990 (Anglo American holes), half core samples over widths ranging from 1 metre to 5 metres were taken. Samples were assayed at Anglo American Research Laboratory (AARL) for total nickel, copper and cobalt using AA and for "sulphide" nickel using a peroxide leach/AA finish. Composite samples were assayed for platinum and palladium by Pb-collection fire assay/ICP, S by combustion, and a range of major elements by fusion, and RD using the Archimedes bath method. Between 1990 and 1997 (Anglovaal holes), assays were carried out at the Anglovaal Research Laboratory (AVRL), with internal standard checks. Nickel analyses were also carried out by the partial digestion methods and comparisons between AARL and AVRL to ensure that the data was compatible. In 2003, a 50 metre spaced drilling programme was carried out in the shallow open pit area. Samples from this drilling were analysed at AVRL for nickel, copper cobalt using an aqua regia partial extraction/AA finish. Platinum, palladium, rhodium and gold were analysed by Pb-collection fire-assay/AA finish. Analyses also included Cr<sub>2</sub>O<sub>3</sub>, MgO, FeO, S and RD. Duplicates and internal standards were used and a suite of referee samples were analyzed at Genalysis Laboratory in Perth.

### Nkomati Mine: Mineral Resources

	Measured Mineral Resource						Indicated Mineral Resource						
	Cut-off (Ni%)	Tonnes	Ni%	Cu%	Co%	4E g/t	Cut-off (Ni%)	000t	Ni%	Cu%	Co%	4E g/t	000t
BMZ (Underground)	0.35	30 000	0.60	0.36	0.03	1.57	0.35	200	0.47	0.33	0.02	1.20	230
MMZ (Underground)	0.35	970 000	0.54	0.19	0.03	1.07	0.30	48 450	0.48	0.21	0.03	1.03	49 420
MMZ (Open Pit) Pit 1	–	–	–	–	–	–	0.35	1 600	0.44	0.25	0.02	1.17	1 600
MMZ (Open Pit) Pit 2 & 3	–	–	–	–	–	–	0.24	82 650	0.43	0.19	0.03	1.08	82 650
PCMZ (Underground)	–	–	–	–	–	–	0.30	19 950	0.38	0.12	0.02	0.77	19 950
PCMZ (Open Pit) Pit 2 & 3	–	–	–	–	–	–	0.20	83 000	0.26	0.08	0.01	0.75	83 000
<b>Total 2008 Mineral Resources</b>		<b>1 000 000</b>	<b>0.54</b>	<b>0.20</b>	<b>0.03</b>	<b>1.09</b>		<b>235 850</b>	<b>0.38</b>	<b>0.15</b>	<b>0.02</b>	<b>0.93</b>	<b>236 850</b>
<b>Total 2007 Mineral Resources</b>		<b>1 193 000</b>	<b>0.67</b>	<b>0.30</b>	<b>0.03</b>	<b>1.45</b>		<b>236 838</b>	<b>0.38</b>	<b>0.15</b>	<b>0.02</b>	<b>0.93</b>	<b>238 031</b>

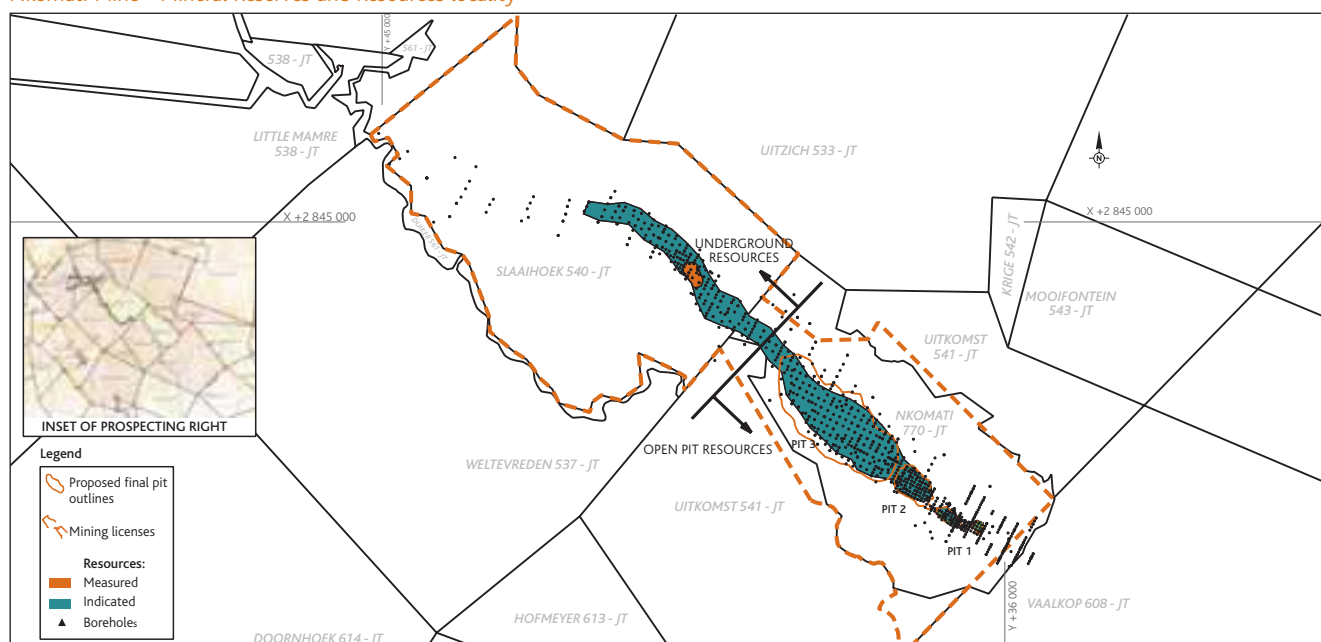
4E = Pt + Pd + Rh + Au

# ARM Platinum

## Oxidised Massive Chromitite Resource

	Indicated Mineral Resource		Inferred Resources	
	Tonnes	Cr <sub>2</sub> O <sub>3</sub> %	Tonnes	Cr <sub>2</sub> O <sub>3</sub> %
Chromitite	4 600 000	31.04	400,000	32.85

### Nkomati Mine - Mineral Reserves and Resources locality



Comparisons indicated good correlations between laboratories. In 2005, it was decided to resample many of the Anglo American drill holes to improve the sample density for PGEs in the open pit area. Drill core was resampled (quarter core) at 1 metre intervals. Assays were carried out by SGS Laboratory in Johannesburg for Pt, Pd and Au by Pb-collection fire assay/AA and for Ni, Cu and Co by aqua regia leach/AA. Blanks, duplicates and AMIS standards were included. The new data was incorporated into the borehole database.

The underground MMZ Mineral Resources are based on surface and underground diamond drilling and sidewall sampling. Underground holes are spaced 10 metres apart and the drill core is sampled at 1 metre intervals. The Nkomati mine laboratory analyzes samples for Ni, Cu and Co using aqua regia leach/ICP, while the PGE assays are carried out by SGS and Mintek Laboratories in Johannesburg. Both laboratories use blanks, standards and check assays for quality control.

The resources for the open pit MMZ and PCMZ are based on surface diamond drilling, mostly at 100 metre spacing, except in the shallow open pit area, where the drill spacing is 50 metres and occasionally 25 metres. Geological wireframe models are generated from the entire borehole database in Datamine but only diamond drill holes are used for the variography and grade estimation by ordinary kriging. Block sizes for the resource model is 50m x 50m x 2.5m.

### Nkomati Mine: Mineral Reserves

	Proved Mineral Reserve						Mineral Reserve Probable						
	Cut-off (Ni%)	Tonnes	Ni%	Cu%	Co%	4E g/t	Cut-off (Ni%)	Tonnes	Ni%	Cu%	Co%	4E g/t	Tonnes
MMZ (Underground)	0.50	200 000	0.55	0.23	0.03	1.19	0.50	9 750 000	0.55	0.21	0.02	1.04	9 950 000
MMZ (Open Pit) Pit 1	–	–	–	–	–	–	0.35	690 000	0.53	0.26	0.03	1.32	690 000
MMZ (Open Pit) Pit 2 & 3	–	–	–	–	–	–	0.24	67 900 000	0.42	0.18	0.03	1.03	67 900 000
PCMZ (Open Pit) Pit 2 & 3	–	–	–	–	–	–	0.16	86 200 000	0.22	0.06	0.01	0.62	86 200 000
<b>Total 2008</b>	–	<b>200 000</b>	<b>0.55</b>	<b>0.23</b>	<b>0.03</b>	<b>1.19</b>	–	<b>164 540 000</b>	<b>0.32</b>	<b>0.12</b>	<b>0.02</b>	<b>0.82</b>	<b>164 740 000</b>
Total 2007	–	392 000	0.79	0.36	0.04	2.03	–	165 476 000	0.32	0.12	0.02	0.82	165 868 000

4E = Pt + Pd + Rh + Au

### Oxidised Massive Chromitite Reserve (with depletion by production as at 30 June 2008)

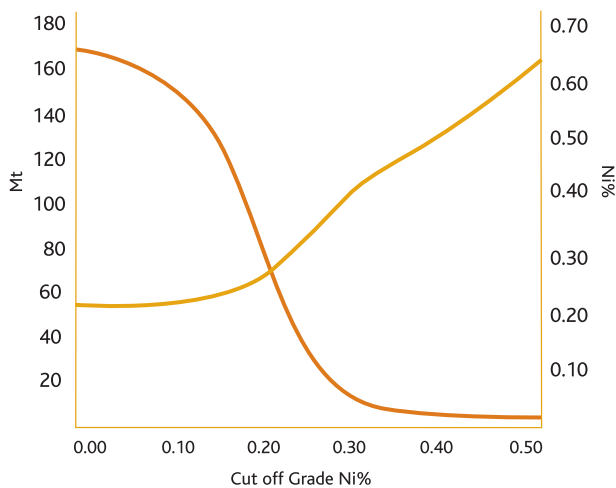
Chromitite	Tonnes	Cr <sub>2</sub> O <sub>3</sub> %
Probable Mineral Reserve	2 340 800	29.7

### Nkomati year-on-year change in Mineral Resources and Ore Reserves

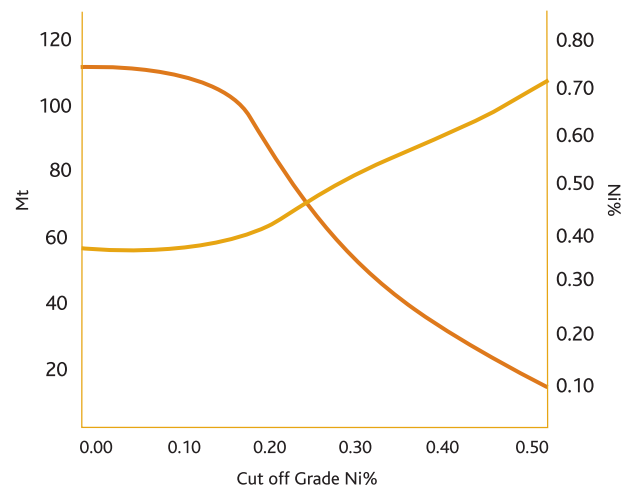
There have been minor changes in the Mineral Resource and Reserves reporting from 2007:

- ▶ The MSB resource has been substantially depleted
- ▶ An Oxidised PCR resource has been reported for the first time. The oxidised PCR is to be stockpiled as a future source of feed once the massive chromitite has been depleted. This material will be processed in the Chrome Washing Plant which is to be commissioned in August 2008.
- ▶ The Mineral Resources for the PCMZ and MMZ for Pits 2 and 3 remain the same, and are illustrated in the graphs

Grade - Tonnage Curves for PCMZ in Pits 2 & 3 Area



Grade - Tonnage Curves for MMZ in Pits 2 & 3 Area





# ARM Platinum

## Historical nickel ore production at Nkomati

Financial year	000t
2003/2004	344 000
2004/2005	346 000
2005/2006	377 000
2006/2007	359 000
2007/2008	1 069 000

Mining operations to date comprise a mechanised underground and open-pit mining operation which feeds two concentrators producing concentrate containing PGMs, nickel, copper and cobalt. Final products are transported to various third parties for toll treatment. Chrome products are sold to local and export markets.

## Two Rivers Platinum Mine

### Locality

The Two Rivers platinum mine is located within the southern sector of the eastern limb of the Bushveld complex, on the farm Dwarsrivier 372KT. Situated at longitude 30°07'00E and latitude 24° 59'00S, the UG2 and Merensky Reefs are present on the farm.

### History

Exploration, development and production history in the area dates from the early 1920s. During 1929, Lydenburg Platinum Areas Limited started mining activity. No records are available, however. Following the acquisition by Gold Fields Mining and Development Limited, exploration started up again in 1987 and was mainly directed at the Merensky Reef. Assmang acquired the farm in September 1998 primarily to exploit the LG6 Chromitite. During 2001, Avmin acquired the PGE rights on the Dwarsrivier farm from Assmang and targeted the UG2 Reef.

In June 2005, following a full feasibility study and a period of trial underground mining, the joint venture announced the release of a 220 000 ounce-per-year PGM mine. As a result an underground mine was established. The plant was commissioned in July 2006. The project is a joint venture between ARM (55%) and Impala Platinum Holdings Limited (Implats) (45%).

### Mining authorisation

Two Rivers holds an old order mining licence no. 4/2003 on Dwarsrivier 372KT relating only to the PGEs contained in the Merensky and UG2 reefs. An application for a new order conversion of the mining licence was submitted in July 2007. This application is still pending.

### Geology

The UG2 Reef outcrops in the Klein Dwarsrivier valley over a north-south strike length of 7.5 kilometres, dipping to the west at between 7 degrees and 10 degrees. The extreme topography results in the UG2 occurring at a depth of 935 metres on the western boundary.

The following reef facies have been defined for the UG2 at Two Rivers:

- ▶ 'Normal' UG2 with an average thickness of 120 centimetres. This is overlain by up to three chromitite 'leaders' collectively termed the UG2A chromitites;
- ▶ 'Split Reef' in the southern, west-central and north-eastern parts, characterised by a pyroxenite or norite lens up to 6 metres thick which is developed within the UG2 and typically resulted in a lower chromitite layer that is thicker than the upper chromitite layer; and
- ▶ 'Southern facies' comprising a second pyroxenite/norite lens situated approximately one-third from the base of the UG2. This facies has been intersected in seven drill holes in the extreme south-western area.

The UG2 is usually bottom loaded with peak PGM values occurring in the basal 10 centimetre sample.

The Merensky Reef consists mainly of orthopyroxene with lesser amounts of plagioclase and clinopyroxene. Thin chromitite layers, usually 1 to 4 millimetres thick generally, occur near the upper and lower contacts of the reef.

## Mineral Resources and Ore Reserves

The majority of resources at Two Rivers are classified as Indicated Mineral Resources, and it is only the open-pit area in the north and the area around the underground mine that are classified as Measured Resources due to the more closely spaced drilling in this area.

A total of 218 surface diamond boreholes had intersected the UG2, of which 35 were drilled by Gold Fields of South Africa and 18 by Assmang. This provided a total of 409 individual UG2 reef intersections, with an average spacing grid of 500 metres over the whole property and 250 metre grid spacing over the area planned for the first five years of mining. The drill hole spacing in the area of the open pit is 50 metres on dip and 100 metres on strike. It was standard for Two Rivers to drill three non-directional deflections off each mother hole.

The holes were halved by diamond saw and the half-core sampled at 20 centimetres. Samples were crushed and split and submitted for assaying. All samples were assayed by Ni-sulphide collection fire-assay with an ICP-MS finish to determine Pt, Pd, Rh, Ru, iridium (Ir) and Au values. Base metals (Ni, Cu, Co) were also assayed by aqua regia digestion/OES finish. Duplicate samples and check analyses were carried out. The earlier Gold Fields and Assmang samples were assayed by Pb-collector fire-assay with gravimetric finish. In order to combine the data, some of the original core samples were re-assayed by means of Ni-sulphide collection fire-assay and a regression equation was derived at to re-cast the original Pb-collection data as Ni-sulphide assay 'equivalents'. The Merensky Reef resource is based on a total of 81 surface diamond drill holes. The same sampling protocol was used as for the UG2, but assays were carried out by Pb-collection fire-assay with ICP-MS finish for Pt, Pd Rh and Au.

Ordinary Kriging interpolation within Datamine was used to estimate the grade of each 50 x 50 x 1 metre block generated within the geological model. The UG2 was wireframed and estimated as two units based on the Pt:Pd ratio as observed in the drill hole database. Sub-cell splitting of blocks was allowed to follow the geological boundaries accurately. Relative density was calculated for each sample and determined by Kriging in the resource model.

Total in-situ resources were decreased by 30% to account for geological losses due to potholes, faults, dykes and replacement pegmatoids.

The resource to reserve conversion was done using the Mine2-4D optimisation software package to select the optimum economic cut subject to the geological, geotechnical and trackless mining constraints. Unplanned and off-reef dilution factors, followed by a 95% mine call factor, have been applied to the output from the optimiser to provide the fully diluted mill head grade of the reserves.

### Two Rivers year-on-year change in Mineral Resources and Ore Reserves

Overall the 2008 UG2 Resources decreased from 57.8 Mt to 56.5 Mt. This 1.3 Mt reduction is the result of depletion by mining.

The Measured Resources were increased by 1.1 Mt when compared to the previous year. This was due to the additional classification criteria that were brought into play. Based on the two-thirds of the range of the semivariogram rule, all areas up to 250 metres in front of the mining faces were brought into the Measured resource category. The Indicated Resources decreased by 2.4 Mt, this is due to the re-arrangement of the Measured area.

The Mine2-4D model was re-visited and simplified, this exercise increased the Ore Reserves by 0.3 Mt from 40.3 to 40.6 Mt. The 1 Mt reserves on the stockpile were depleted and re-established to 0.1 Mt.

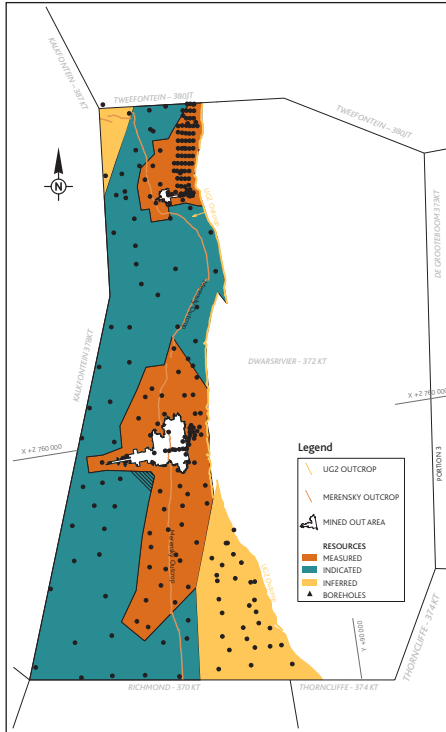
### Two Rivers Platinum Mine: Mineral Resources UG2

(UG2 + Internal Pyroxenite)									
Grade									
	Mt	Pt g/t	Pd g/t	Rh g/t	Au g/t	(3PGE+Au) g/t	(5PGE+Au) g/t	Pt Moz	6E Moz
Measured	14.78	2.54	1.56	0.47	0.05	4.62	5.52	1.21	2.62
Indicated	41.69	2.05	1.23	0.38	0.04	3.70	4.46	2.75	5.98
<b>Total 2008</b>	<b>56.47</b>	<b>2.18</b>	<b>1.31</b>	<b>0.41</b>	<b>0.04</b>	<b>3.94</b>	<b>4.74</b>	<b>3.96</b>	<b>8.60</b>
Total 2007	57.81	2.19	1.34	0.41	0.04	3.98	4.79	4.07	8.89
Inferred	8.1	2.17	1.29	0.39	0.05	3.90	4.68	0.57	1.22

3PGE = Pt + Pd + Rh; 5PGE = Pt + Pd + Rh + Ir + Ru; 6E = 5PGE + Au

# ARM Platinum

Two Rivers Platinum (Pty) Ltd – Dwarsrivier  
372 KT UG2 Mineral Resources Classification



## Two Rivers Platinum Mine: Mineral Reserves UG2

(UG2 + Internal Pyroxenite)

	Mt				Grade				
	Pt g/t	Pd g/t	Rh g/t	Au g/t	(3PGE+Au) g/t	(5PGE+Au) g/t	Pt M oz	6E Moz	
Stockpile	0.10	1.89	1.27	0.35	0.04	3.55	4.10	0.006	0.013
Proved	10.56	2.04	1.23	0.37	0.04	3.68	4.46	0.693	1.514
Probable	28.85	1.78	1.05	0.34	0.03	3.20	3.86	1.651	3.580
<b>Total 2008</b>	<b>39.51</b>	<b>1.85</b>	<b>1.10</b>	<b>0.35</b>	<b>0.03</b>	<b>3.33</b>	<b>4.02</b>	<b>2.35</b>	<b>5.11</b>
Total 2007	40.59	1.88	1.17	0.36	0.03	3.44	4.13	2.45	5.39

## Two Rivers Platinum Mine: Mineral Resources Merensky Reef

Top zone	Mt	(3PGE+Au) g/t	6E g/t	Pt g/t	Pt M oz	6E Moz
Measured	–	–	–	–	–	–
Indicated	18.7	3.34	3.55	2.06	1.20	2.06
Inferred	3.9	3.16	3.36	1.95	0.24	0.41

## Historical production at Two Rivers Platinum Mine

Financial year	Mt
2005/2006	1.00
2006/2007	1.28
2007/2008	2.33





*Nkomati Nickel and Chrome Mine*

## Modikwa Platinum Mine

### Locality

Modikwa platinum underground mine is situated some 15 kilometres north of Burgersfort and 15 kilometres east of Steelpoort, along the border between the Mpumalanga and Limpopo Provinces in South Africa. Located at longitude 30°10'E and latitude 24°40'S, the site is accessed via the R37 road between Polokwane and Burgersfort.

### History

Exploration in the area started in the mid 1920s with the discovery of the Merensky Reef. During the late 1980s further drilling was completed on the UG2 and Merensky Reefs. In the late 1990s a feasibility study was completed on the exploitation of the UG2. During 2001 a 50:50 JV agreement was signed between Rustenburg Platinum Mines and ARM Mining Consortium Limited. ARM's effective stake in Modikwa is 41.5%, through its 83% ownership of ARM Mining Consortium. The other 8.5% is held by the Mampudima and Matimatjatji community companies through their 17% shareholding in ARM Mining Consortium.

### Mining authorisation

During June 2001, an old order mining licence was issued to ARM Mining Consortium and Rustenburg Platinum Mines over the properties Onverwacht 292KT, Portion 1 and R/E Winterveldt 293KT, Driekop 253KT, Maandagshoek 254KT and Hendriksplaats 281KT. An application for new order rights is being prepared and will be submitted in the 2008/2009 financial year.

### Geology

The igneous layering at Modikwa mine is north-northwest striking with an average dip of 10 degrees to the west. Both the UG2 and Merensky reefs are present. The UG2 occurs as a chromitite layer with average thickness of approximately 60 centimetres. Three leader chromitites occur above the main seam. Gentle undulations of the UG2 with amplitudes of less than 2 metres are pervasively developed across the mine area. Potholes of varying size appear to be randomly distributed within the North shaft area. Potholes are less abundant in the South shaft area, which is more disturbed by faulting. The Onverwacht Hill area is characterised by the presence of several large ultramafic pegmatoid intrusions that disrupt and locally replace the UG2.

# ARM Platinum

## Mineral Resources and Ore Reserves

The Mineral Resource and Reserve classification is based primarily on the proximity to drilling and underground sampling data and uses the semivariogram range, and the number of samples used, to estimate a block to determine the category. Measured Mineral Resources are classified if a block is within 66% of the range of the semivariogram from the nearest sample and six to 30 samples are used in the estimation process. Indicated Mineral Resources are classified when a block is within the range of the semivariogram and 6 to 30 samples are used in the estimation process. Inferred Mineral Resources are classified if a block falls outside the range of the semivariogram and 30 to 100 samples are used to estimate a block.

The mineral resource is based on over 700 surface diamond drill holes and over 600 underground channel samples. These logs and values are kept in separate electronic databases and combined for estimation purposes after rigorous data validation. The 4E grades are capped at 13 grams per tonne based on statistical analyses.

Samples are submitted to Anglo Platinum Research Centre and analysed at Anglo American Research Laboratories. Analyses are completed using two fire-assay techniques to provide individual assay grades for Pt, Pd, Rh and Au, while wet-chemical techniques are used to determine Ni and Cu grades.

The UG2 mining cut is divided into three units comprising the UG2 chromitite layer, the hangingwall and the footwall. Estimation of the three sub-units in the mining cut is carried out separately and independently. Two-dimensional block models with block sizes of 250 x 250 metres and 500 x 500 metres, depending on the drill hole spacing, are created. Pt, Pd, Rh, Au, Ni and Cu grades are interpolated using Ordinary Kriging for the UG2 and inverse distance squared for the hanging and footwall units. The width of the chromitite and the density are also interpolated into the block models. The average density at Modikwa mine is 3.72t/m<sup>3</sup>. Discount factors are applied to tonnages ranging from 10% (for measured Mineral Resources) and up to 30% to account for loss of ore due to pegmatoidal intrusions, faults, dykes and potholes.

## Modikwa year-on-year change in Mineral Resources and Ore Reserves

The Mineral Reserves at Modikwa increased to 58.3 Mt (35.2 Mt) when compared with the 2007 statement. The Measured and Indicated Mineral Resources decreased from 131.2 to 115.2 Mt due to conversion of resources (Measured and Indicated) to reserves and re-evaluation. Resources and Reserves were adjusted to reflect June 2008 status.

A minimum mining cut of 102 centimetres is used to calculate the amount of footwall waste that is included in the mining cut. Where the hangingwall and the main seam thickness are greater than 102 centimetres, an additional 5 centimetres of footwall waste is included. The basal contact of the UG2 layer is typically high-grade and it is important that this contact is not left in the footwall during mining. The UG2 is accessed via two primary declines from surface – and a fleet of mechanised equipment is used for the mining operations. Run-of-mine tonnage is processed at the Modikwa concentrator and the PGE rich concentrate is transported to Anglo Platinum's Polokwane smelter and refining facilities.

## Modikwa: Mineral Resources and Reserves UG2

Mineral Resources	Mt	3PGE+Au g/t	M oz	Mineral Reserves	Mt	3PGE+Au g/t	Moz
Measured	50.73	5.54	9.04	Proved	18.09	4.71	2.74
Indicated	64.43	5.66	11.72	Probable	40.21	4.72	6.10
<b>Total 2008</b>	<b>115.16</b>	<b>5.61</b>	<b>20.76</b>	<b>Total</b>	<b>58.30</b>	<b>4.71</b>	<b>8.84</b>
Total 2007	131.2	5.62	23.7		35.17	4.82	5.45
Inferred	89.64	6.23	17.97				

3PGE = Pt + Pd + Rh

## Modikwa: Mineral Resources Merensky Reef

	Mt	3PGE+Au g/t	Moz
Measured	18.68	2.96	1.77
Indicated	46.78	2.55	3.84
<b>Total</b>	<b>65.46</b>	<b>2.67</b>	<b>5.61</b>
Inferred	152.01	2.80	13.66

### Modikwa Resources classification and borehole locality plan



### Historical production at Modikwa Platinum Mine

Financial year	Mt
2003/2004	2.54
2004/2005	2.46
2005/2006	2.51
2006/2007	2.32
2007/2008	2.26

### Kalplats Platinum Projects

#### Locality

The Kalplats platinum projects are situated 330 kilometres west of Johannesburg and some 90 kilometres southwest of Mafikeng in the North West Province of South Africa. Situated at latitude 26°30'S and longitude 24°50'E, the project area is accessed from Stella on the N14 national road linking Mafikeng and Vryburg.

#### History

Anglo American discovered the Kalplats platinum deposits in the early 1990s and Harmony Gold Mining Company Limited acquired the project from Anglo in 1999. Subsequently ARM acquired the project as part of the merger of the Avmin, ARM and Harmony assets in 2004. Pre-2004, exploration comprised a combination of rotary air blast (RAB), reverse circulation (RC) and diamond drilling. Anglo drilled a total of 6 000 metres in 133 holes, while Harmony drilled a total of 40 000 metres in 862 holes. Harmony commissioned a feasibility study in 2003 and excavated a 500 tonne bulk sample for metallurgical test work. The study assessed the viability of both an open pit and underground mining operation. The feasibility study was completed early in 2004.

In 2005, ARM Platinum entered into two joint venture agreements with Platinum Australia Limited (PLA), one over the "Kalplats Project" in which ARM Platinum has a 90% share and which provides for PLA to earn up to 49% by completing a bankable feasibility study and making the Pantom metallurgical process available at no cost. The other joint venture agreement covers the "Kalplats Extended Project" (Extended Project) in which ARM Platinum and PLA each has a 50% share and contributes equally to the exploration expenditure. Both projects are managed by PLA.



# ARM Platinum



*Two Rivers Platinum Mine*

## Prospecting rights

In September 2006, ARM Platinum was granted a new order prospecting right (PR492 of 2006) over the Kalplats Project covering portions of the farms Groot Gewaagd 270, Gemsbok Pan 309, Koodoos Rand 321 and Papiessvlakte 323 (approximately 3,810 hectares). In April 2007, a new order prospecting right (DME1056) (approximately 62,985 hectares) was granted to ARM Platinum over the Extended Project area which covers an additional 20 kilometres of strike to the north and 18 kilometres to the south of the Kalplats Project area.

## Geology

PGE mineralisation is hosted mainly by magnetite-rich gabbros within the Stella Layered Intrusion (SLI), a 3.0 billion year old layered complex intruded into the Kraaipan Greenstone Belt. Mineralisation is contained in seven separate, subvertically dipping zones known as Crater, Orion, Vela, Sirius, Crux, Serpens North and Serpens South, each with strike lengths of between approximately 500 and 1 000 metres and widths of between 15 and 45 metres. In addition more recent drilling has outlined at least five additional deposits known as Scorpio, Tucana, Pointer, Mira and Crux Gap.

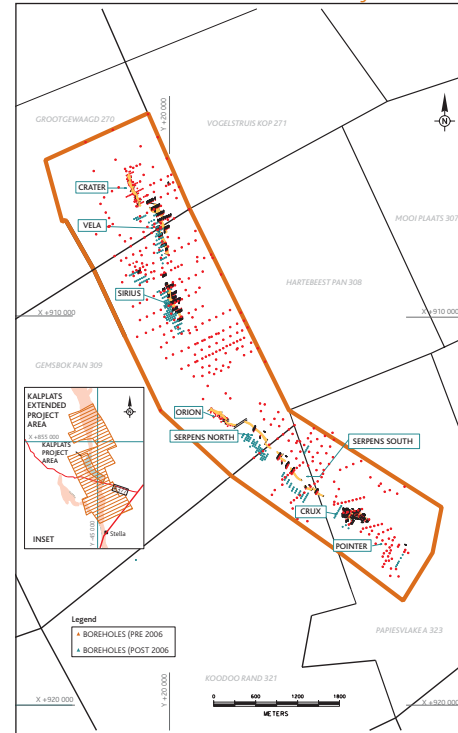
Three main sub-parallel reef packages within each zone have been recognised. They are the Main Reef (the highest grade reef), Mid Reef and LG Reef. The area is structurally complex, and thrusting has caused duplication of reefs in some cases.

## Mineral Resources and Ore Reserves

PLA drilled a total of 48 390 metres of diamond and reverse circulation drilling during the 2008 financial year. Since September 2006, when PLA started work on the Kalplats Project, almost 76 000 metres of drilling have been completed. An aeromagnetic survey was also carried out over the whole of the Kalplats Project area as well as part of the southern Extended Project area covering approximately 5.5 kilometres of strike length.

PLA's work is aimed at completing a bankable feasibility study (BFS) and as such drilling aims both to increase the resource base of the project and to upgrade the classification of the resource. In May 2008, PLA released updated mineral resource estimates for the Crater, Orion and Crux deposits. The geological modelling and evaluation of the deposits was carried out by Snowden Mining Industry Consultants. Drilling, however, is continuing and final resource estimates for all the deposits will become available with the completion of the BFS. In the light of the likely upgrading of the

Kalplats Platinum Projects –  
Mineral Reserves and Resources locality



resource in the near future, ARM Platinum’s 2008 mineral resource statement remains the same as 2007, that is the same as the 2004 Harmony feasibility study.

**Kalplats: Mineral Resources**

	Mt	2PGM+Au g/t	Moz
Measured	–	–	–
Indicated	7.12	1.7	0.38
Inferred	68.11	1.15	2.44

2PGM = Pt + Pd

# ARM Coal



*Goedgevonden Coal Project*

## Goedgevonden Coal Project

### Locality

The Goedgevonden Coal Project is situated in the Witbank Coalfield about 7 kilometres south of the town of Ogies in Mpumalanga province in South Africa. Snowden (in October 2005) audited a feasibility study carried out by Murray and Roberts in September 2005, and ARM expects the work carried out by these two organisations to be accurate and manifesting a high degree of confidence. No additional work on resources and reserves was carried out by ARM.

### History

A total of 548 surface diamond boreholes were drilled during 1964 to 2004 by Duiker Mining and Xstrata SA. Anglo Coal supplied an additional 102 boreholes for the Zaaiwater area. Most boreholes were drilled down to basement to define the seam locality and basement topography. Owing to the different campaigns, the database had to be validated to produce a consistent set of data.

### Mining authorisation

New order mining rights were granted during the year under review.

### Geology

The stratigraphy of the Witbank Coalfield consists of five seams numbered from oldest to youngest: No 5 to No 1 seam. The seams vary in thickness from less than 0.5 metres to over 6 metres and do not exceed 300 metres in depth from surface. The coal seams dip at less than 5 degrees. However, coal seam morphology and qualities may be locally influenced by basement topography, surface weathering and intrusion of dolerite dykes and sills. The coal qualities vary both within and between individual coal seams. Low quality coals, suitable for the local steam coal market, have a calorific value of between 18 to 22Mj/kg, whereas the high quality export steam coal has a calorific value of greater than 27Mj/kg. The proposed Goedgevonden open-cut mine is expected to produce an additional 3.2 Mt annually for export and 3.4 Mt a year for domestic thermal generation coal by 2009. The planned stripping ratio is between 3.35:1 and 1.85:1 in the early years of production. Using a mining contractor, Xstrata SA started mining on the Goedgevonden property at a rate of 1 mtpa (run-of-mine), gaining knowledge of the geology and mining conditions.



All five coal seams are developed on Goedgevonden (see figure). The No 1 seam is of low quality, thin and only developed in paleo-low areas. The No 2 seam is extensively developed and is of good quality and is, on average, 5.5 metres thick. The No 3 seam at Goedgevonden is of good quality but, with an average thickness of only 0.3 metres, is uneconomic. The No 4 seam, being closer to surface and although of the same thickness as the No 2 seam, is influenced by weathering and is not as extensively developed. The No 5 seam is of good quality, but is preserved as erosional remnants on the high ground only and thus not extensively developed over the area. No major faults, structural disturbances or intrusives were observed in the boreholes drilled to date.

Wireframes for the seam composites for the No 2, 4 and 5 seams were generated in Datamine. Two-dimensional blockmodels were generated with block sizes of 50 x 50 metres. All estimations of the individual blocks were done using inverse distance cubed with an isotropic search. Other software packages used in the evaluation are 'Washproduct' and 'Xpac'.

### Stratigraphic column at Goedgevonden



The following table with regard to Goedgevonden coal resources and reserves was obtained from Snowden, reflecting the status as at June 2005. Mineral Resources and Reserves of the Xstrata mines are the responsibility of the Xstrata SA resources and reserves team. No ARM employee is involved in the compilation of Xstrata Coal South Africa's Mineral Resources and Reserves.

### Goedgevonden Coal Resources and Reserves

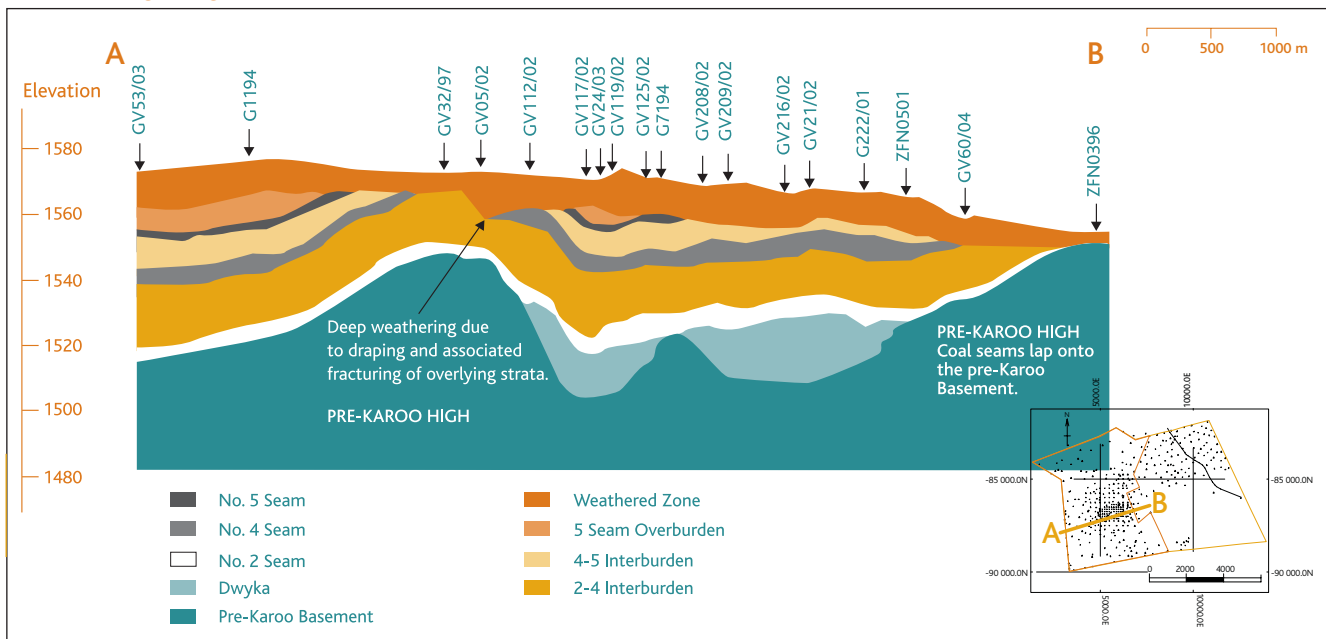
Seam no	Mineral Resources within mine plan			Reserves		
	Measured	Indicated	Inferred	Proved	Probable	Saleable
2	58.3	30	–	–	–	–
4	44.2	13	58	–	–	–
5	14.7	1	8	–	–	–
<b>Total</b>	<b>117.2</b>	<b>44</b>	<b>67</b>	<b>–</b>	<b>–</b>	<b>–</b>
Mineral Resources outside of mine plan						
2	177.9	–	–	–	–	–
4	189.3	–	–	–	–	–
5	41.8	–	–	–	–	–
<b>Total</b>	<b>409</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Overall</b>	<b>526.2</b>	<b>44</b>	<b>67</b>	<b>329.8</b>	<b>27.6</b>	<b>194.1</b>

# ARM Coal

## Historical Production at Goedgevonden

Financial year	Mt RoM
2006/2007	2.00
2007/2008	1.96

Section showing Goedgevonden Coal seams



# TEAL Exploration & Mining Inc.



*TEAL Konkola North*

## Exploration and evaluation

African Rainbow Minerals Limited (ARM) owns 64.9% of TSX and JSE listed company TEAL Exploration & Mining Incorporated (TEAL). TEAL is currently finalising feasibility studies and further drilling on its copper projects in Zambia and in the Democratic Republic of Congo (DRC) and on its gold project in Namibia. TEAL is also undertaking further exploration for base metals, gold and uranium, in the DRC, Zambia, Namibia and Mozambique. The mineral resources and reserve estimations by TEAL are compliant with the relevant Canadian National Instrument 43-101 (NI 43-101) regulations governing the reporting of such Mineral Resource estimates.

## Otjikoto Gold Project

The Otjikoto Gold Project is an evaluation and exploration project situated in the Otavi region in Namibia, and the project is covered by an exclusive prospecting licence (EPL 2410). The company has four additional exclusive prospecting licences comprising 3 667 km<sup>2</sup> surrounding the Otjikoto Gold Project on which exploration work is being undertaken.

The gold mineralisation at Otjikoto occurs within the Northern Zone of the Damara Orogen. The mineralisation occurs as shallow-dipping, sheeted vein systems hosted within a package of marbles, albitites and biotite schists of the Karibib Formation. The individual veins range from 1 to 10 centimetres in thickness and contain pyrrhotite, magnetite, pyrite and free, often coarse grained, gold. The package of mineralised sheeted veins is approximately 25 metres thick, with an average dip of 25 degrees, presently defined along a strike of approximately 1.9 kilometres.

The Mineral Resource is based on RC and diamond drill holes totalling 129 boreholes, equating to a total of 15 435 metres (11 410 metres of diamond drilling and 4 025 metres of RC drilling). The drill holes were drilled initially on a 100-metre strike spacing and a 50-metre dip separation. Further infill drilling in the north-western portion of the orebody was undertaken on 50 x 25 metre and 25 x 25 metre grids during the 2007/2008 financial year, which increased the confidence in geological and grade continuity substantially. The gold mineralisation is open-ended along strike and down-dip.

In the case of RC drilling, sample collection takes place every 1 metre and each sample is logged and assayed. The samples are weighed, then split using a riffler before four sub-samples are derived for assay and quality control reference purposes. Diamond drill core is geologically logged



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and halved with a saw. Half-core samples are taken every 1 metre for screen fire assaying by laboratories in South Africa and Australia. The project involves the use of stringent sampling protocols, and sample duplicates and certified reference material is used to monitor the quality of assay results.

Three-dimensional wireframe models using a cut-off of 0.4 g/t Au were produced in Datamine from the drill hole intersections. Drill hole samples are composited over a 1.0 metre interval within the orebody wireframes. The data population is positively skewed and closely approximates a lognormal distribution. The wireframes were used to constrain 50 x 50 x 2.5 metres block models and gold grade was interpolated into the block model using ordinary kriging in the normal space. High nugget-effect spherical-structured semivariograms were generated along- and across-strike from the log-normal data and then converted to the normal space. Clear anisotropy can be recognised along and across strike. SRK Consulting (South Africa) (Pty) Limited ('SRK') are appointed as the Independent Qualified Persons for this project.

## Otjikoto – Mineral Resources at a 0.4 G/T Au Cut-Off Grade as at June 2008

	Mt	g/t Au	Moz
Measured	–	–	–
Indicated	23.3	1.4	1.05
Inferred	19.4	1.41	0.88

## Konkola North Copper Project

The Konkola North Copper Project is situated on the Zambian Copperbelt with the economic mineralisation being generally confined to a dark-grey siltstone within the OS 1 Member (Ore Shale) of the Nchanga Formation. The true thickness of the OS 1 Member varies from 3 to 12 metres. The mineralisation is transgressive at a low angle and the ore zone is not defined by a geological hangingwall and footwall. The deposit occurs at a depth of 50 to 1 300 metres below surface with a dip range of -40 to +55 degrees. The thickness of the deposit increases towards the south where it averages over 10 metres.

A total of 125 diamond holes were drilled in a number of exploration phases. The core was split with a diamond saw, logged and sampled in approximately 0.5 metre lengths. Samples were assayed by two laboratories in South Africa. Total copper and cobalt analysis was carried out by a two-acid digest (HCl and HF) with a flame AAS finish. Acid soluble copper was determined by a sulphuric acid leach and a flame AAS finish. 10% of all samples in a batch were repeated as duplicate samples to check repeatability.

The orebody was divided into three zones – East Limb, South Limb and Area A – for estimation purposes. Wireframes were defined by using a 1% Total Cu cut-off in Datamine and a density of 2.75 t/m<sup>3</sup> was used. GijimaAst used the "UNFOLD" process in Datamine to do the Ordinary Kriging estimation in 2-D. The block size is 500 x 500m in the horizontal plane with sub-cell splitting down to 250 x 250m at the edges of the wireframe hull. SRK are appointed as the Independent Qualified Persons for this project.

## Konkola North – Mineral Resources at a 1% Total Copper Cut-Off Grade as of April 2008

	Mt	%TotCu	%AsCu
Measured South Limb	10.00	2.23	0.60
Indicated South Limb	22.20	2.13	0.26
Total South Limb	32.20	2.16	0.49
Inferred South Limb	16.20	2.22	0.25
Measured East Limb	7.10	2.34	1.07
Indicated East Limb	11.70	2.87	0.39
Total East Limb	18.80	2.67	0.54
Inferred East Limb	10.70	2.83	0.41
Total Measured + Indicated	51.00	2.35	0.47
Inferred (mainly Area A)	219.50	2.64	1.09

The above-mentioned resource estimation was carried out by GijimaAst in December 2006. GijimaAst assigned SAMREC categories according to the Kriging Efficiency (KE). The KE measures the improvement in estimate from more samples per estimate, closer sample distances to the block and samples spread evenly rather than clustered one-sidedly. The criteria adopted for the classifications, after consideration of the literature, are as follows:

- ▶ Inferred KE (copper accumulation) <0%
- ▶ Indicated KE (copper accumulation) 0-50%
- ▶ Measured KE (copper accumulation) >50%

SRK reviewed, audited and signed-off of the re-estimated resources for Konkola North during March 2008.

An underground mine with a shaft to 423 metres in depth and related infrastructure are in place at Konkola North's South Limb orebody. The shaft was on care and maintenance from 1959 onwards. A feasibility study has been completed, and parts of the mineral resource have been converted to a mining reserve through detailed mine design and scheduling.

### Mwambashi Copper Project

The Mambwashi Copper Project lies in the Zambian Copperbelt on the western edge of the Chambishi Basin. The orebody is wedge-shaped, being up to 30 metres thick in the shallower portions and tapering down to less than 1 metre at a depth of 450 metres. The orebody has a strike extent of 500 metres and extends down-dip for approximately 450 metres, with an average thickness of 15 metres. The orebody dips range from 25 degrees in the south to 35 degrees in the north. Most of the copper mineralisation occurs as disseminated to massive mineralisation in the argillaceous quartzite and conglomerate of the Mindola Clastics Formation.

From 1951 to 2007 nine drilling campaigns were completed. During 2001 an evaluation was carried out by Avmin to determine the mineral resource potential at a 1% total copper cut-off grade. 33 boreholes composited to 1 metre intervals were used in that estimation. An Indicated Mineral Resource of 8.6 Mt at an average grade of 2.43% total copper was estimated to be present.

During 2006, a database validation exercise was performed by external consultants GeoLogix Mineral Resource Consultants (Pty) Limited. All available drill core was re-logged and lithologies validated. 57 boreholes were used in the re-evaluation. Assays were available for percentages of total copper and acid soluble copper and cobalt, and this data was captured in a SABLE database and coded according to rock type. The drill holes were composited to 2 metre intervals, respecting lithological boundaries. Wireframed sections were constructed in Datamine and block models were generated, using a 0.3% total copper and 0.5% total copper cut-off grade. Lower cut-off grades were used due to the dramatic increase in the copper price. GSLIB was used to do ordinary kriging estimates into the block models with block sizes of 5 x 30 x 1 metres, and then imported back into Datamine and regularised into block sizes of 30 x 30 x 10 metres. Relative densities are based on the weathering profile: overburden = 1.8 t/m<sup>3</sup>, < 30 metre depth = 2.1 t/m<sup>3</sup>, 30 to 40-metre depth = 2.2 t/m<sup>3</sup>, 40 to 50-metre depth = 2.3 t/m<sup>3</sup> and >50-metre depth = 2.5 t/m<sup>3</sup>.

During September 2007 the mineral resource at Mwambashi was re-evaluated. The range of the semivariogram was used to classify Mineral Resources into the SAMREC defined Measured, Indicated and Inferred Resources categories:

- ▶ Measured = Estimating data closer than first range of semivariogram (60 metres) from block being estimated;
- ▶ Indicated = Estimating data between first range (60 metres) and Sill range (240 metres) from block being estimated; and
- ▶ Inferred = Estimating data further than 240 metres from block being estimated.

### Mwambashi – Mineral Resources at 0.5% Total Copper Cut-Off Grade

	Mt	%TCu	%AsCu
Measured	10.54	1.84	0.74
Indicated	1.896	1.17	0.42
<b>Total</b>	<b>12.44</b>	<b>1.74</b>	<b>0.69</b>
Inferred	1.77	2.10	0.26

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## Democratic Republic of Congo (DRC)

Kasonta-Lupoto Mines sprl (Kalumines) holds the rights to TEAL's 60% interest in Kalumines which is situated 30 kilometres to the north-west of Lubumbashi. The mining licence, P.E. 2590, covers an area of 77 km<sup>2</sup> and hosts various near surface exposures of rich oxide copper and cobalt mineralisation, all within a few kilometres of each other. Kalumines is a 60:40 joint venture with Gécamines.

TEAL has undertaken extensive drilling on the Lupoto Copper Project within the Kalumines licence area and has completed an initial drilling programme of 189 boreholes in addition to the 73 boreholes previously drilled by Union Minière du Haut Katanga (UMHK) and Gécamines. Drill centers were on 50 metres line spacing and boreholes were spaced 50 metres apart. The copper/cobalt mineralization is transgressive over several units within the Series des Mines and has an average thickness of 25 metres, dipping between 90 and 65 degrees. An initial, first phase, mineral resource with a 0.5% total copper cut-off to a vertical average depth of 80 metres has been completed. Further drilling is in progress to define the remainder of the strike extension of 1 360 meters presently not in this model and to undertake further infill drilling. SRK have been appointed as the Independent Qualified Persons for the resource estimation of the Lupoto Copper Project.

## Lupoto – Mineral Resources at 0,5% Total Copper Cut-Off Grade

	Mt	% TCu	% AsCu
Measured			
Indicated	15.1	2.32	1.83
Inferred	9.13	2.09	1.73

Kalumines has started a small open-pit mining operation, exploiting about 110 000 m<sup>3</sup> per month. A small screening plant is operational to sort the copper material into various size categories for on-sale to customers with in the DRC.

## Exploration

TEAL has an extensive portfolio of exploration rights on the Zambian Copperbelt and in Central Zambia, where TEAL undertakes exploration work to discover copper, zinc, nickel mineralisation. In the DRC on the Kalumines licence area, TEAL is undertaking extensive drilling and exploration work, and an extensive zone of copper mineralisation has been discovered between the prospects Kasonta and Niamumenda with a strike extend in excess of 2.4 kilometres. In Namibia, extensive exploration is being carried out for additional gold and base metal mineralisation.

TEAL has commenced with an exploration programme on six prospecting licences in Mozambique, following a regional airborne geophysical survey. The aim of this programme is to outline areas of uranium mineralisation.

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ARM holds a 16% stake in Harmony Gold. Harmony, South Africa's third largest gold producer is separately run by its own management team. Resources and reserves of the Harmony mines are the responsibility of the Harmony team and are published in Harmony's annual report.

ARM holds a 20.2% stake in Xstrata Coal South Africa's operations other than Goedgevonden. Resources and reserves of the Xstrata Coal South Africa mines are the responsibility of the Xstrata SA team and are published in their annual report.