ASSORE

# MINERAL RESOURCES AND MINERAL RESERVES REPORT 2019

# Contents



# Report on mineral resources and mineral reserves

as at 30 June 2019

## The report is issued as the annual update of the Mineral Resources and Mineral Reserves to inform shareholders and potential investors of the mineral assets held wholly or partly by Assore Limited (Assore).

This report is a summary of Competent Person's reports or technical reports on Mineral Resources and Mineral Reserves for Assore's mining operations, which comprise Black Rock Mine, Beeshoek Mine, Khumani Mine, Dwarsrivier Chrome Mine and Wonderstone Limited.

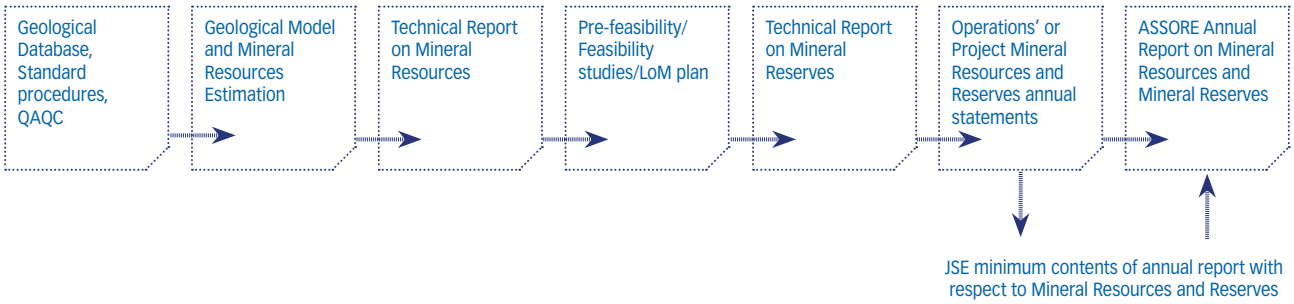
### Assore

Assore's method of reporting Mineral Resources and Mineral Reserves complies with the South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves (SAMREC Code of 2016) and the South African Code for the Reporting of Mineral Asset Valuation (SAMVAL Code of 2016). The report also complies with Section 12.13 of the Johannesburg Stock Exchange (JSE) Listing Requirements.

The SAMREC Code of 2016 sets out minimum standards, recommendations and guidelines for Public Reporting of Exploration Results, Mineral Resources and Mineral Reserves in South Africa. It was launched and adopted by the Johannesburg Stock Exchange (JSE) in May 2016. The 2019 Assore Mineral Resources and Mineral Reserves Report is based on the SAMREC Code of 2016.

The reporting of Mineral Resources and Mineral Reserves is done annually according to the following process flow chart:

**REPORTING OF MINERAL RESOURCES AND MINERAL RESERVES FLOW CHART**




**Internal and external reviews and audits**

The convention adopted in this report is that the Measured and Indicated Mineral Resources estimates are reported **inclusive** of that portion converted to Mineral Reserves. **Inferred Mineral Resources** have not been included in feasibility studies or Life of Mine Plans.

Mineral Resources and Mineral Reserves estimates are quoted as at **30 June 2019**, unless stated otherwise.

The classification into Measured, Indicated and Inferred Mineral Resources is done by consideration of geostatistical parameters, spacing of boreholes, geological structures and continuity of the mineralisation.

The Mineral Resources and Mineral Reserves are reported on a **100% basis** and the attributable interest is noted in the footnotes of the tabulations. Maps, plans and reports supporting Mineral Resources and Mineral Reserves are available for inspection at Assore's registered office and at the relevant mines.

Prospecting and Mining Rights details are provided in this report for each project and operation (refer to the relevant sections of the operations and projects). Rounding of figures may result in minor computational discrepancies on the Mineral Resources and Mineral Reserves tabulations.

### Assmang

A set of guidelines have been formulated to assist Assmang Competent Persons in the estimation, classification and reporting of Mineral Resources and Mineral Reserves and are contained in a document entitled: "Assmang Guidelines for Estimation, Classification and Reporting of Mineral Resources and Mineral Reserves".

As part of Assmang's management process of Mineral Resources and Mineral Reserves, quarterly divisional forum meetings are conducted with the following objectives:

- Skills and technical knowledge transfer in the Mineral Resources and Mineral Reserves fields.
- Ensuring that best practices through SAMREC compliant standard procedures are shared and applied.
- Facilitate internal peer reviews and audits.
- Advance professional development and registration of technical personnel.

Underground Mineral Resources are *in situ* tonnages at the postulated mining width, after deductions for geological losses. Underground Mineral Reserves reflect tonnages that will be mined and processed while surface Mineral Reserves consist of stockpiles already mined and ready for processing. Both are quoted at the grade fed to the plant. Open pit Mineral Resources are quoted as *in situ* tonnages and Mineral Reserves are tonnages falling within an economic pit-shell.

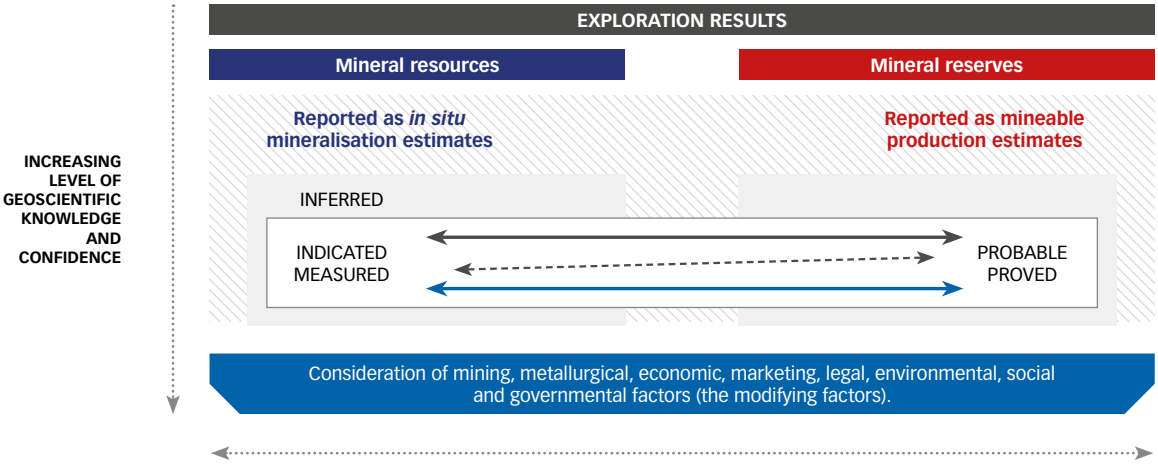
External consulting firms audit the Mineral Resources and Mineral Reserves of the Assmang operations when substantial geological borehole data has been added to the previously established database.

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

# Definitions

| | |
|---|---|
| A "Mineral Resource" | is a concentration or occurrence of material of economic interest in or on the earth's crust in such form, quality and quantity that there are reasonable and realistic prospects for eventual economic extraction. The location, quantity, grade, continuity and other geological characteristics of a Mineral Resource are known, or estimated from specific geological evidence, sampling and knowledge interpreted from an appropriately constrained and portrayed geological model. Mineral Resources are sub-divided, and must be so reported, in order of increasing confidence in respect of geoscientific evidence, into Inferred, Indicated or Measured categories. |
| An "Inferred Mineral Resource" | is that part of a Mineral Resource for which volume or tonnage, grade and mineral content can be estimated with only a low level of confidence. It is inferred from geological evidence and sampling and assumed but not verified geologically or through analysis of 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 in scope 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 information from exploration, sampling and testing of material gathered from locations such as outcrops, trenches, pits, workings and drill holes. The locations are too widely or inappropriately spaced to confirm geological 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 information from exploration, sampling and testing of material 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 or Indicated Mineral Resource or both. It includes diluting and contaminating materials and allows for losses that are expected to occur when the material is mined. Appropriate assessments to a minimum of a Pre-feasibility Study for a project and a Life-of-Mine Plan for an operation must have been completed, including consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors (the modifying factors). Such modifying factors must be disclosed. |
| A "Probable Mineral Reserve" | is the economically mineable material derived from a Measured or Indicated Mineral Resource or both. It is estimated with a lower level of confidence than a Proved Mineral Reserve. It includes diluting and contaminating materials and allows for losses that are expected to occur when the material is mined. Appropriate assessments to a minimum of a Pre-feasibility Study for a project or a Life-of-Mine Plan for an operation must have been carried out, including consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. Such modifying factors must be disclosed. |
| 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 includes diluting and contaminating materials and allows for losses that are expected to occur when the material is mined. Appropriate assessments to a minimum of a Pre-feasibility Study for a project or a Life-of-Mine Plan for an operation must have been carried out, including consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. Such modifying factors must be disclosed. |

**Relationship between exploration results, mineral resources and mineral reserves**



# Assmang competence

## The Lead Competent Person with overall responsibility for the compilation of the 2019 Mineral Resources and Mineral Reserves Report is Shepherd Kadzviti, an ARM employee. He confirms that the information in this report complies with the SAMREC Code (2016) and that it may be published in the form and context in which it was intended.

Shepherd Kadzviti graduated with a BSc in Geology and Mathematics and a MSc in Exploration Geology from the University of Zimbabwe. He later completed a Graduate Diploma in Mining Engineering (GDE) at the University of the Witwatersrand. He worked at RioZim's Renco Gold Mine for 14 years in various capacities as Geologist, Technical Services Superintendent and Mine Manager. In 2005, he joined Anglo American Platinum at Union Mine as an Evaluation Geologist with responsibilities for geological database management and Mineral Resource estimation. After two years at the mine, he was transferred to the Anglo American Platinum corporate office where he was appointed Resource Geologist. He then joined ARM as Mineral Resources Specialist in 2008, and was involved in the evaluation of various mineral deposits for the group. In 2012, he was appointed Group Mineral Resources Manager for ARM. He is registered with the South African Council for Natural Scientific Professions (SACNASP) as a Professional Natural Scientist (Pr.Sci.Nat) in the field of practice of geological science, registration number 400164/05. SACNASP is based in the Management Enterprise Building, Mark Shuttleworth Street, Innovation Hub, Pretoria, 0087, South Africa. He has a total of 29 years' experience in various aspects of Mining and Exploration Geology, database management and Mineral Resource estimation and as such is considered to be a Competent Person.

All Competent Persons at the ARM corporate office and the operations have sufficient relevant experience in the type of deposit and in the activity for which they have taken responsibility.

Details of Assmang's Competent Persons are available from the Company Secretary on written request.

The following ARM corporate office Competent Persons were involved in compiling some aspects of the Mineral Resources and Mineral Reserves report or general review of the report. They are employed by ARM.

**ARM corporate office**

| Competent Person | Professional organisation | Membership number | Qualifications | Relevant experience |
|---|---|---|---|---|
| S Kadzviti | SACNASP | 400164/05 | BSc, MSc Exploration Geology, GDE (Mining Engineering) | 29 years |
| M Mabuza | SACNASP | 400081/94 | BSc, BSc Hons (Geology), MSc (Geology), GDE (Mining Engineering) | 29 years |
| V Moyo | SACNASP | 400305/11 | BSc, BSc Hons (Geology), MSc (Project Management) | 22 years |
| R Jooste | SACNASP | 400163/05 | BSc, BSc Hons (Geology), MEng (Mining Engineering) | 18 years |

The Competent Persons consent to the inclusion of the Exploration Results, Mineral Resources and Mineral Reserves information in this report, in the form and context in which it appears.

**Shepherd Kadzviti (Pr Sci Nat)**
*Group Mineral Resources Manager*
African Rainbow Minerals
24 Impala Road, Chislehurston,
Sandton, South Africa.

9 September 2019

# Assmang competence continued

## Salient features for 2019

### Black Rock Mine

Gloria Mine Seam 1 Mineral Reserves decreased from 123,93 million tonnes (Mt) at 37,75% Mn to 115,04 Mt at 37,41% Mn mainly due to a revised Mining Plan on the eastern portion of Gloria Mine where the geological boundary of Seam 1 was updated. Nchwaning Seam 2 Mineral Reserves increased by 6% to 109,10 Mt at 42,73% Mn due to the increase in the depth to which Seam 2 could be mined based on geotechnical recommendations.

### Khumani Mine

Mineral Reserves decreased from 447,13 Mt at 62,24% Fe to 433,44 Mt at 62,10% Fe primarily due to mining depletion of 20,11 Mt (ROM). The addition of 17,92 Mt at 61,95% Fe Probable Mineral Reserves at Mokaning South, which is being reported for the first time, partially off-set the production depletion.

### Beeshoek Mine

Measured and Indicated Mineral Resources decreased marginally from 97,64 Mt at 64,14% Fe to 95,67 Mt at 64,07% Fe mainly due to mining depletion. There was however, an increase of 2,9 Mt in the Mineral Resources (Measured and Indicated) for Village Pit, before mining depletion.

Mineral Resources and Mineral Reserves estimates were undertaken during the year for the low grade jig and tailings stockpiles resulting in the declaration of a total of 15,05 Mt at 53,74% Fe of Measured and Indicated Mineral Resources and a total of 14,26 Mt at 53,74% Fe of Mineral Reserves.

# Assmang competence continued

## Mineral Resources and Mineral Reserves summary as at 30 June 2019

> *The tables below are summaries of the Assmang Mineral Resources and Mineral Reserves. The detailed information on Mineral Resources and Mineral Reserves is provided per operation from page 6 in this report.*

### Manganese

| * Mineral Resources and Mineral Reserves are reported on a 100% basis. | Mineral Resources | | | | | | | | Mineral Reserves | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Measured | | Indicated | | (Measured and Indicated) | | Inferred | | Proved | | Probable | | Total Reserves | |
| | Mt | Mn% | Mt | Mn% | Mt | Mn% | Mt | Mn% | Mt | Mn% | Mt | Mn% | Mt | Mn% |
| **Black Rock Mine (Nchwaning Mine)** | | | | | | | | | | | | | | |
| **2019 Seam 1** | **82,11** | **44,65** | **49,05** | **40,48** | **131,16** | **43,09** | | | **38,65** | **44,16** | **30,11** | **42,20** | **68,76** | **43,30** |
| 2018 Seam 1 | 75,70 | 44,61 | 52,35 | 40,78 | 128,05 | 43,04 | | | 35,31 | 44,30 | 37,87 | 42,30 | 73,17 | 43,26 |
| **2019 Seam 2** | **104,25** | **42,83** | **68,54** | **42,08** | **172,79** | **42,53** | | | **73,09** | **42,70** | **36,01** | **42,80** | **109,10** | **42,73** |
| 2018 Seam 2 | 97,38 | 42,57 | 74,86 | 42,09 | 172,24 | 42,36 | | | 69,36 | 42,52 | 33,83 | 42,62 | 103,19 | 42,55 |
| **Black Rock Mine (Koppie area)** | | | | | | | | | | | | | | |
| **2019 Seam 1** | **9,03** | **40,30** | **34,57** | **40,70** | **43,60** | **40,60** | | | | | | | | |
| 2018 Seam 1 | 9,03 | 40,30 | 34,57 | 40,70 | 43,60 | 40,60 | | | | | | | | |
| **2019 Seam 2** | **8,23** | **37,40** | **18,58** | **39,20** | **26,81** | **38,60** | | | | | | | | |
| 2018 Seam 2 | 8,23 | 37,40 | 18,58 | 39,20 | 26,81 | 38,60 | | | | | | | | |
| **Black Rock Mine (Gloria Mine)** | | | | | | | | | | | | | | |
| **2019 Seam 1** | **64,01** | **37,49** | **92,93** | **37,65** | **156,94** | **37,58** | **31,87** | **37,29** | **41,84** | **37,40** | **73,20** | **37,42** | **115,04** | **37,41** |
| 2018 Seam 1 | 64,32 | 37,45 | 92,93 | 37,69 | 157,25 | 37,59 | 31,87 | 37,11 | 49,62 | 37,51 | 74,31 | 37,91 | 123,93 | 37,75 |
| **2019 Seam 2** | | | **34,81** | **28,41** | **34,81** | **28,41** | **133,46** | **30,03** | | | | | | |
| 2018 Seam 2 | | | 34,81 | 28,41 | 34,81 | 28,41 | 133,46 | 30,03 | | | | | | |

The Mineral Resources are inclusive of those modified to produce Mineral Reserves.

** Black Rock Manganese Mine attributable interests (ARM 50%; Assore 50%).*

### Iron ore

| * Mineral Resources and Mineral Reserves are reported on a 100% basis. | Mineral Resources | | | | | | | | Mineral Reserves | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Measured | | Indicated | | (Measured and Indicated) | | Inferred | | Proved | | Probable | | Total Reserves | |
| | Mt | Fe% | Mt | Fe% | Mt | Fe% | Mt | Fe% | Mt | Fe% | Mt | Fe% | Mt | Fe% |
| **Beeshoek Mine** | | | | | | | | | | | | | | |
| **2019 All pits** | **90,56** | **64,11** | **5,11** | **63,44** | **95,67** | **64,07** | **5,35** | **62,58** | **29,71** | **64,70** | **0,13** | **63,35** | **29,84** | **64,69** |
| 2018 All pits | 95,10 | 64,16 | 2,54 | 63,22 | 97,64 | 64,14 | 3,55 | 60,80 | 35,13 | 64,85 | 0,01 | 63,18 | 35,14 | 64,85 |
| **2019 Stockpiles** | | | | | | | | | | | **0,77** | **58,52** | **0,77** | **58,52** |
| 2018 Stockpiles | | | | | | | | | | | 2,83 | 55,58 | 2,83 | 55,58 |
| **2019 Low Grade Stockpiles** | **2,41** | **56,46** | **12,64** | **53,22** | **15,05** | **53,74** | | | **2,29** | **56,46** | **11,97** | **53,22** | **14,26** | **53,74** |
| **Khumani Mine** | | | | | | | | | | | | | | |
| **2019 Bruce and King/Mokaning** | **418,99** | **63,01** | **137,30** | **63,22** | **556,29** | **63,06** | **36,10** | **61,13** | **340,19** | **61,97** | **93,25** | **62,58** | **433,44** | **62,10** |
| 2018 Bruce and King/Mokaning | 442,99 | 62,95 | 108,00 | 63,23 | 550,99 | 63,00 | 59,49 | 61,73 | 369,16 | 62,12 | 77,97 | 62,79 | 447,13 | 62,24 |
| **2019 Stockpiles** | | | | | | | | | | | **6,04** | **55,08** | **6,04** | **55,08** |
| 2018 Stockpiles | | | | | | | | | | | 5,01 | 55,08 | 5,01 | 55,08 |

The Mineral Resources are inclusive of those modified to produce Mineral Reserves.

** Iron ore operations attributable interests (ARM 50%; Assore 50%).*

# Assmang operations

## Assmang operations comprise Black Rock Manganese Mines as well as Khumani and Beeshoek Iron Ore mines.

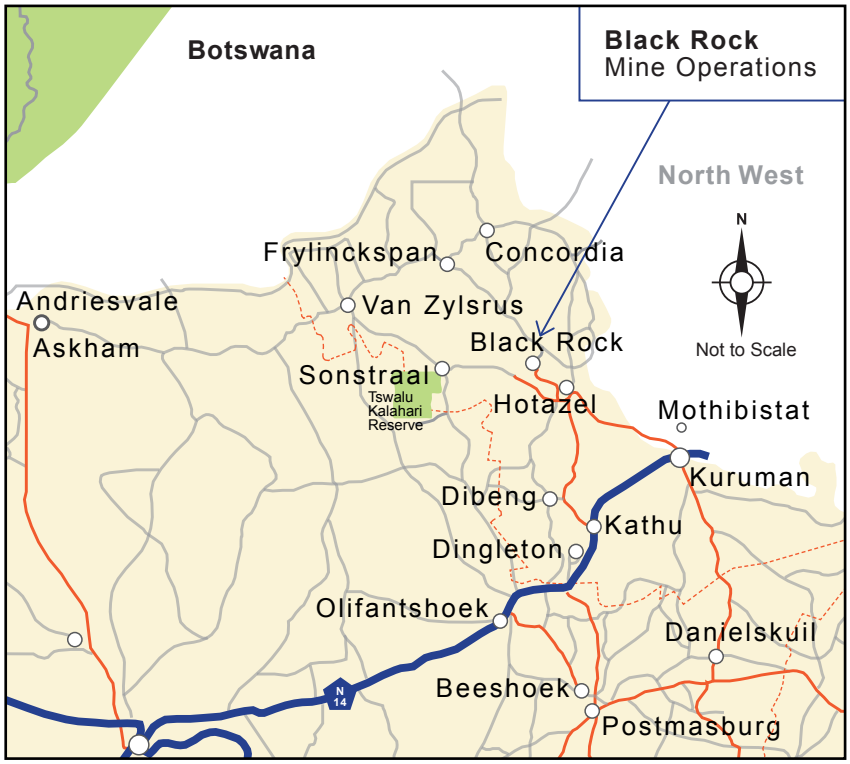
## Manganese mines

### Locality

Black Rock Manganese Mines includes Nchwaning and Gloria mines which are situated approximately 80 kilometres north-west of the town of Kuruman in the Northern Cape province of South Africa. Located at latitude 27°07'50"S longitude 22°50'50"E, the mines are accessed via the national N14 route between Johannesburg and Kuruman, and the provincial R31 road.

Nchwaning 3 and Nchwaning 2 (including Graben area) shafts are situated on portions of Nchwaning 267, Belgravia 264 and Santoy 230 farms while Gloria Mine is on Portion 1 of Gloria 266. The Nchwaning and the adjoining Gloria Mining Rights are bounded by the farms Wessels 227, Dibiaghomo 226 and Dikgathlong 268 in the north, Rhodes 269, East 270 and Kipling 271 in the east, Umtu 281 and Mukulu 265 to the south.

**Locality of Black Rock Manganese Operation**




### History

In 1940, Assmang 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 one of the largest and richest manganese deposits in the world. Manganese mining operations were extended and today include the Gloria and Nchwaning underground mines. Manganese ore is supplied locally to the Assmang-owned Cato Ridge Smelter, and is exported through Port Elizabeth, Durban and Richards Bay.

# Assmang operations continued

## Manganese mines

### Competence

The following Competent Persons were involved in the estimation of Black Rock Mineral Resources and Mineral Reserves. They are employed by Assmang.

| Competent Person | Professional organisation | Membership number | Qualifications | Relevant experience |
|---|---|---|---|---|
| B Ruzive (Mineral Resources) | SACNASP | 400238/07 | BSc, BSc Hons (Geology), MSc (Exploration Geology), MBA | 19 years |
| J Smuts (Mineral Reserves) | ECSA | 201270097 | B-Tech (Mining Engineering) | 8 years |

### Mining authorisation

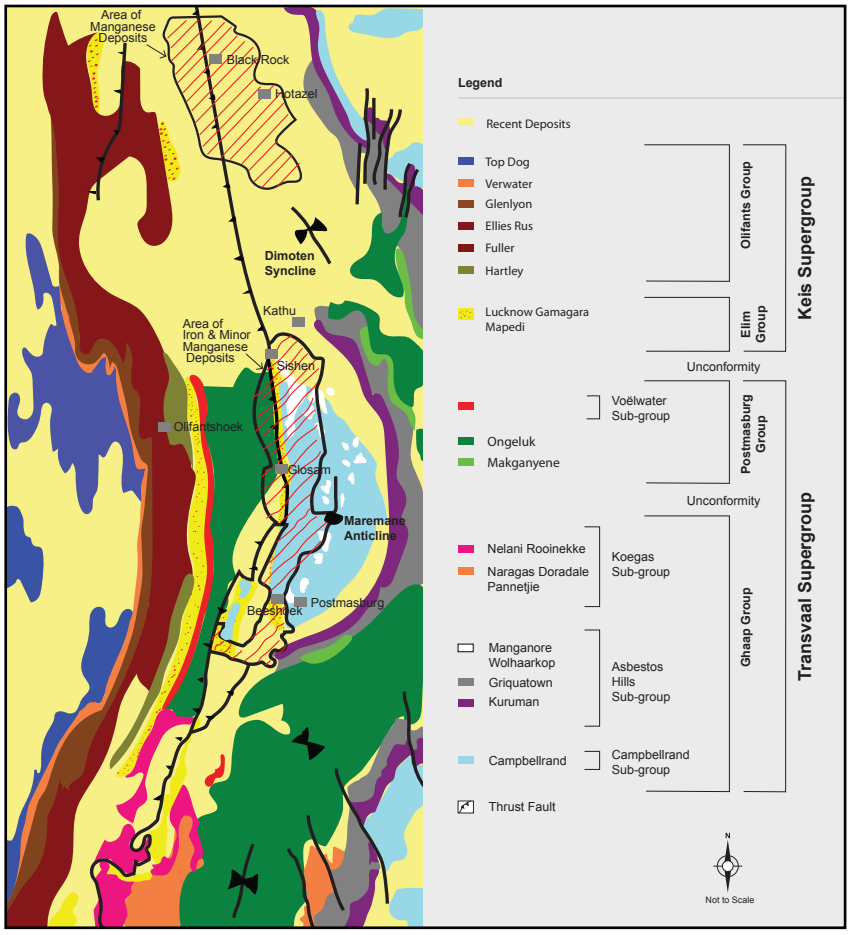
| Legal entitlement | Minerals covered by Mining Right | Comment | Period of Mining Right (years) | Known Impediments on legal entitlement |
|---|---|---|---|---|
| Mining Right NC 30/5/1/2/2/203 MRC | Manganese ore | None | 30 years: 13 July 2011 to 12 July 2041 | None |

### Geology

The manganese ores of the Kalahari Manganese Field are contained within sediments of the Hotazel Formation in the Postmasburg Group of the Griqualand West Sequence, a sub-division of the Proterozoic Transvaal Supergroup. The Griqualand West Sequence comprises a basal dolomite and banded ironstones dominating the Ghaap, Postmasburg and the Olifantshoek Groups. The Postmasburg Group consists of basal basaltic andesites of the Ongeluk lava and banded ironstone and manganese of the Hotazel Formation.

On Belgravia, Santoy and Nchwaning farms the Hotazel Formation and overlying Mapedi shales and Lucknow quartzite sequences have been duplicated by thrusting. The thrusted ore-bodies were mined from surface at the Kalahari Manganese Field discovery outcrop – the Black Rock Koppie and at two other down dip interconnected Belgravia 1 and Belgravia 2 shafts. Mining reached depths of approximately 200 metres. The manganese resources hosted in the thrusted orebodies are reported, collectively, under Black Rock (Koppie Area) ore bodies. The average thickness of the Hotazel Formation is approximately 40 metres, with the banded iron formation (BIF) hosted manganese ore bodies occurring as three stratabound and stratiform units of variable thickness. The lowermost ore body (Seam 1) is higher grade in comparison to the topmost ore body (Seam 2). Seam 3, which occurs in between Seams 1 and 2, is thin and uneconomic.

**Regional geological map**



# Assmang operations continued

## Manganese mines

### Generalised stratigraphy of manganese units in the hotazel formation

- Banded Ironstone
- Top Mn Seam (Mn2): lower Mn, higher Fe, up to 10 m thick
- Marker Mn thin (1 m – 1.5 m), carbonaceous, uneconomic
- Lower Mn Seam (Mn1): higher Mn, lower Fe, most mined, up to 40 m thick*
- Lava

** Mn seams tend to be thicker in lower-grade Mamatwan/Gloria type ore compared to the higher-grade Wessels/Nchwaning type ore.*

The manganese orebodies exhibit a complex mineralogy and more than 200 ore and gangue mineral species have been identified. Hydrothermal upgrading has resulted in zoning of the ore body adjacent to fault positions. Distal areas exhibit more original and low-grade kutnohorite and braunite assemblages, while areas immediately adjacent to faults exhibit high-grade hausmannite rich ore. The intermediate areas exhibit mineralogy which includes bixbyite, braunite and jacobsite among a host of other manganese-bearing minerals. Similar zonation also exists in the vertical sense.

At the top and bottom contact, 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 4,0 to 5,0 metre-high centre portion of the seam is being mined.

### Exploration activities

A total of 12 boreholes were planned for the 2018/2019 Nchwaning drilling project. The project started in March 2019. Drilling takes place in two stages, percussion drilling of the unconsolidated formation followed by diamond drilling. Percussion drilling was completed on all planned Nchwaning boreholes. Diamond drilling was completed on three boreholes (BEL8, BEL8A and BEL8B) by year-end. The completed boreholes have all intersected the Hotazel Formation and the seam positions in the boreholes correlate well with the current geological model. Drilling is planned to commence on SA1J, SA1L and SA2H during the first quarter of 2020. An additional eleven boreholes will be drilled at Nchwaning and Gloria during the 2020 financial year. The exploration expenditure for 2019 was R3,6 million.

### Mining methods and infrastructure

Trackless mechanised equipment is used in the Bord and Pillar mining method. Two manganese seams are mined. The lowermost (Seam 1) at Nchwaning 3 is up to 6 metres thick, of which up to 5 metres is mined. There is, therefore, minimum dilution. Mining of Nchwaning Seam 2 has also been done on an optimum cut of 4,0 metres. Gloria Seam 1 is approximately 14 metres thick, but only an optimum cut of 4,0 metres is mined. No mining has been undertaken to date on Gloria Seam 2.

### Nchwaning Mine Mineral Resources

Nchwaning Mine was diamond drilled from surface at 330 metre grid centres and the data is captured in a Geological Database Management System (GDMS) developed by Datamine. The core is logged and 0,5 metre-long, half-core, diamond-saw cut samples are submitted to Assmang's laboratory at Black Rock for X-ray fluorescence (XRF) analyses. Mn and Fe values are checked by Wet Chemical analyses. Several standards are used to calibrate the XRF equipment, and results are compared with other laboratories on a regular basis.

At Nchwaning, boreholes and underground sample sections were considered in the geological modelling and grade estimation for Nchwaning Seams 1 and 2. The geological modelling and the grade estimation was undertaken using Datamine Studio 3 and Datamine Strat 3D software. The resource models were built on 50 metre x 50 metre x optimal minable cut. The optimal mineable cuts were 4 to 5 metres for Nchwaning Seams 1, 2, and 3 and Graben. The blocks were sub-split in the X and Y directions to accurately follow the geological boundaries.

# Assmang operations continued

## Manganese mines

Statistical and geostatistical analysis was done on the following variables: Mn, Fe, $Al_2O_3$, BaO, CaO, $K_2O$, MgO, $Na_2O$, P, S and $SiO_2$. Ordinary Kriging interpolation within Datamine Studio 3 was used to estimate the grade of each block. Borehole and/or underground sample data composited to the optimal mineable cut was used in the estimation of grades. The relative density of the Nchwaning manganese Seams 1 and 2 was determined as 4,3 t/m³. Mineral Resource classification at Nchwaning Mine is based on a number of parameters: Kriging variance, Kriging efficiency, regression slope, geological continuity of the manganese seams, geological structures and quality of assay data. Each of these parameters contributes to the overall classification. Measured and Indicated Resources have been declared for Nchwaning.

### Nchwaning Mine Mineral Reserves

Conversion of the Mineral Resources to Mineral Reserves is done for the Measured and Indicated Mineral Resources. The main modifying factors for the conversion are: plant recovery factor, manganese prices and mining extraction factors. Details of these factors are listed below the Mineral Reserves tables.

Mining in the eastern extremity of Nchwaning occurs at a depth of 200 metres, while the deepest (current) excavations are 519 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 undergoes two stages of crushing, dry screening and wet screening to yield lumpy and fine products.

At the plant, 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 requirements.

**Nchwaning Mine: Seam 1 Manganese Mineral Resources and Mineral Reserves estimates as at 30 June 2019**

| Mineral Resources | | | | Mineral Reserves | | | |
|---|---|---|---|---|---|---|---|
| ** Mineral Resources and Mineral Reserves are reported on a 100% basis.* | **Mt** | **Mn%** | **Fe%** | | **Mt** | **Mn%** | **Fe%** |
| Measured | 82,11 | 44,65 | 9,08 | Proved | 38,65 | 44,16 | 9,00 |
| Indicated | 49,05 | 40,48 | 7,83 | Probable | 30,11 | 42,20 | 8,23 |
| **Total Resources (Seam 1) 2019** | **131,16** | **43,09** | **8,61** | **Total Reserves (Seam 1) 2019** | **68,76** | **43,30** | **8,66** |
| Total Resources (Seam 1) 2018 | 128,05 | 43,04 | 8,76 | Total Reserves (Seam 1) 2018 | 73,17 | 43,26 | 8,85 |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*

**Key assumptions for Mineral Resources:**
- True thickness cut-off: 4,0 metres to 5,0 metres.
- Density: 4,3 t/m³.

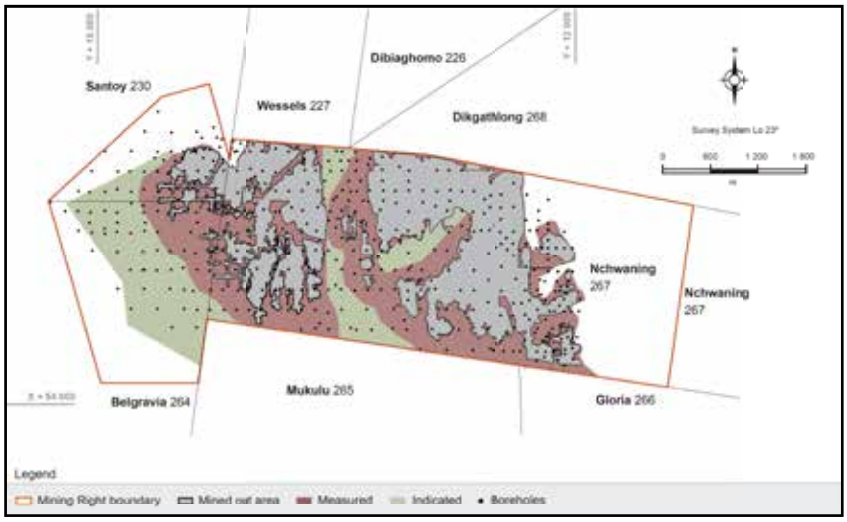
**Modifying factors for the conversion of Mineral Resources to Mineral Reserves include:**
- Cut-off grade: 35% Mn.
- Tramming loss factor: 1%.
- Plant recovery: 91%.
- Mine extraction factor: 72% to 78%.
- Price ranges: Based on market-related long-term view.
- Exchange rate used: Market-related.
- Life of Mine: 30 years

** Black Rock Manganese Mine attributable interests (ARM 50%; Assore 50%).*

# Assmang operations continued

## Manganese mines

### Nchwaning Manganese Seam 1 Mineral Resources classification




**Nchwaning Mine: Seam 2 Manganese Mineral Resources and Mineral Reserves estimates as at 30 June 2019**

| Mineral Resources | | | | Mineral Reserves | | | |
|---|---|---|---|---|---|---|---|
| ** Mineral Resources and Mineral Reserves are reported on a 100% basis.* | **Mt** | **Mn%** | **Fe%** | | **Mt** | **Mn%** | **Fe%** |
| Measured | 104,25 | 42,83 | 15,86 | Proved | 73,09 | 42,70 | 15,91 |
| Indicated | 68,54 | 42,08 | 15,25 | Probable | 36,01 | 42,80 | 15,46 |
| **Total Resources (Seam 2) 2019** | **172,79** | **42,53** | **15,62** | **Total Reserves (Seam 2) 2019** | **109,10** | **42,73** | **15,76** |
| Total Resources (Seam 2) 2018 | 172,24 | 42,36 | 15,65 | Total Reserves (Seam 2) 2018 | 103,19 | 42,55 | 15,85 |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*

**Key assumptions for Mineral Resources:**
- True thickness cut-off: 4,0 metres.
- Density: 4,3 t/m$^3$.

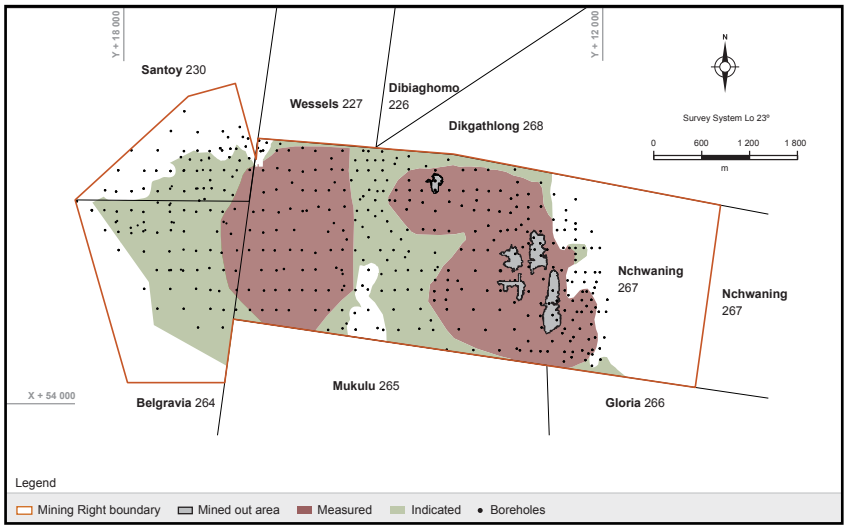
**Modifying factors for the conversion of Mineral Resources to Mineral Reserves include:**
- Cut-off grade: 38% Mn.
- Tramming loss factor: 1%.
- Plant recovery: 91%.
- Mine extraction factor: 72 – 78%.
- Price ranges: Based on market-related long term view.
- Exchange rate used: Market-related.
- Life of Mine: 30 years

** Black Rock Manganese Mine attributable interests (ARM 50%; Assore 50%).*

# Assmang operations continued

## Manganese mines

### Nchwaning Manganese Seam 2 Mineral Resources classification




### Nchwaning year-on-year change

Measured and Indicated Mineral Resources for Nchwaning Seam 1 increased from 128,05 Mt to 131,16 Mt largely as a result of changes and re-interpretation of geological structures incorporated in the modelling process. Mining depletions were masked by the global increase in Mineral Resources.

Nchwaning Seam 2 Mineral Reserves increased by 6% to 109,10 Mt at 42,73% Mn due to the increase in the depth to which Seam 2 could be mined based on geotechnical recommendations.

### Historical manganese production at Nchwaning Mine

| Financial year | ROM Mt | Saleable Mt |
|---|---|---|
| 2014/2015 | 3,05 | 2,48 |
| 2015/2016 | 2,91 | 2,39 |
| 2016/2017 | 3,00 | 2,35 |
| 2017/2018 | 3,59 | 3,00 |
| 2018/2019 | 3,34 | 2,99 |

### Black Rock "Koppie" Mineral Resources

The Black Rock ore-bodies occur in the Black Rock Koppie, Belgravia 1 and Belgravia 2 areas. They are all part of a large thrust complex. Modelling of these ore-bodies was undertaken using 151 Nchwaning boreholes that intersected the thrust complex and 174 Black Rock in-fill boreholes. A 38% Mn cut-off was used in the modelling. Seams 1 and 2 were modelled at variable thicknesses. No mining is currently being done at Black Rock Koppie.

**Black Rock (Koppie Area): Seam 1 Manganese Mineral Resources estimates as at 30 June 2019**

| ** Mineral Resources and Mineral Reserves are reported on a 100% basis.* | Mineral Resources Mt | Mn% | Fe% |
|---|---|---|---|
| Measured | 9,03 | 40,3 | 18,1 |
| Indicated | 34,57 | 40,7 | 18,1 |
| **Total Resources (Seam 1) 2019** | **43,60** | **40,6** | **18,1** |
| Total Resources (Seam 1) 2018 | 43,60 | 40,6 | 18,1 |

*Totals are rounded off.*

**Key Resources assumptions:**

- Density: 4,0 t/m$^3$.

** Black Rock Manganese Mine attributable interests (ARM 50%; Assore 50%).*

# Assmang operations continued

## Manganese mines

**Black Rock (Koppie Area): Seam 2 Manganese Mineral Resources estimates as at 30 June 2019**

| | Mineral Resources | | |
|---|---|---|---|
| ** Mineral Resources are reported on a 100% basis.* | **Mt** | **Mn%** | **Fe%** |
| Measured | 8,23 | 37,4 | 19,8 |
| Indicated | 18,58 | 39,2 | 19,8 |
| **Total Resources (Seam 2) 2019** | **26,81** | **38,6** | **19,8** |
| Total Resources (Seam 2) 2018 | 26,81 | 38,6 | 19,8 |

*Totals are rounded off.*

**Key Resources assumptions:**
- Density: 4,0 t/m$^3$.

** Black Rock Manganese Mine attributable interests (ARM 50%; Assore 50%).*

### Gloria Mine Mineral Resources

Procedures for drilling and assaying at Gloria Mine are the same as at Nchwaning. Both boreholes and underground sample sections were considered in the evaluation of Gloria Seam 1. Gloria was modelled similarly to Nchwaning using Datamine Studio 3 and Datamine Strat 3D software for the geological modelling and for the grade estimation. The geological block model was created for an optimum cut of 4 metres for Seams 1 and 2. Block sizes in the X and Y directions were 50 x 50 metres allowing for sub-splitting. A relative density was determined as 3,8 t/m$^3$. The full vertical extent of both Seams 1 and 2 were modelled respectively.

Statistical and geostatistical analysis for the following variables: Mn, Fe, $Al_2O_3$, BaO, CaO, $K_2O$, MgO, $Na_2O$, P, S and $SiO_2$ was undertaken. Ordinary Kriging interpolation within Studio 3 was used to estimate the grade in the 50 x 50 x 4 metre blocks using borehole and/or underground sample data. Mineral Resource classification methods were similar to those applied at Nchwaning Mine.

### Gloria Mine Mineral Reserves

Conversion of the Mineral Resources to Mineral Reserves is done for Measured and Indicated Mineral Resources. The main modifying factors for the conversion are: plant recovery factor, manganese prices and mining extraction factors. Details of these factors are listed below the Mineral Reserves tables.

Manganese is extracted at depths that vary between 180 to 250 metres. Ore is crushed underground before being conveyed to a surface stockpile via a decline shaft. 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. At the plant, the ore is processed similarly to Nchwaning run-of-mine ore.

**Gloria Mine: Seam 1 Manganese Mineral Resources and Mineral Reserves estimates as at 30 June 2019**

| Mineral Resources | | | | Mineral Reserves | | | |
|---|---|---|---|---|---|---|---|
| ** Mineral Resources and Mineral Reserves are reported on a 100% basis.* | **Mt** | **Mn%** | **Fe%** | | **Mt** | **Mn%** | **Fe%** |
| Measured | 64,01 | 37,49 | 4,90 | Proved | 41,84 | 37,40 | 4,89 |
| Indicated | 92,93 | 37,65 | 4,88 | Probable | 73,20 | 37,42 | 4,79 |
| **Total Measured and Indicated (Seam 1) 2019** | **156,94** | **37,58** | **4,89** | **Total Reserves (Seam 1) 2019** | **115,04** | **37,41** | **4,83** |
| Total Measured and Indicated (Seam 1) 2018 | 157,25 | 37,59 | 4,86 | Total Reserves (Seam 1) 2018 | 123,93 | 37,75 | 4,86 |
| **Inferred 2019** | **31,87** | **37,29** | **5,43** | | | | |
| Inferred 2018 | 31,87 | 37,11 | 5,46 | | | | |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*

**Key assumptions for Mineral Resources:**
- True thickness cut-off: 4 metres.
- Density: 3,8 t/m$^3$.

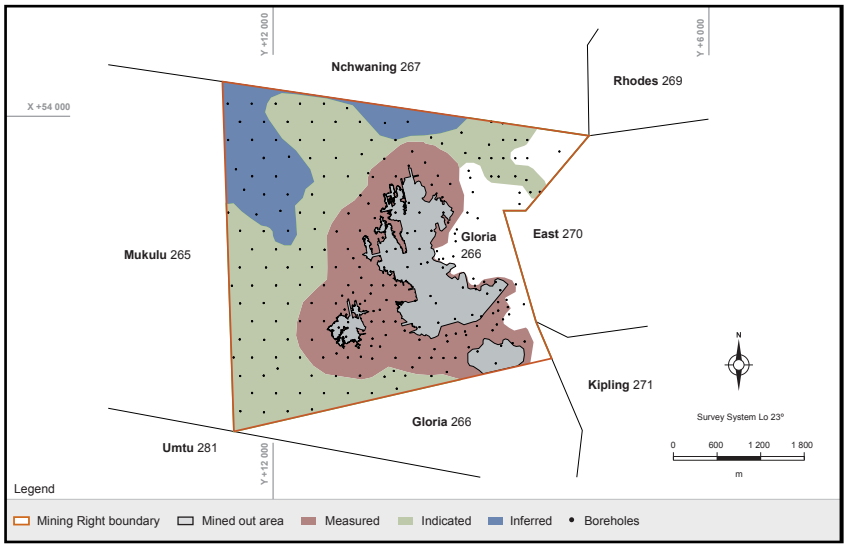
**Modifying factors for the conversion of Mineral Resources to Mineral Reserves include:**
- Cut-off grade: 35% Mn.
- Tramming loss factor: 1%.
- Plant recovery: 91%.
- Mine extraction factor: 82%.
- Price ranges: Based on market related long-term view.
- Exchange rate used: Market-related.
- Life of Mine: 30 years

** Black Rock Manganese Mine attributable interests (ARM 50%; Assore 50%).*

# Assmang operations continued

## Manganese mines

### Gloria Manganese Seam 1 Mineral Resources classification




### Gloria Mine: Seam 2 Manganese Mineral Resources estimates as at 30 June 2019

| | Mineral Resources | | |
|---|---|---|---|
| ** Mineral Resources and Mineral Reserves are reported on a 100% basis.* | **Mt** | **Mn%** | **Fe%** |
| Measured | | | |
| Indicated | 34,81 | 28,41 | 9,39 |
| **Total Measured and Indicated (Seam 2) 2019** | 34,81 | 28,41 | 9,39 |
| Total Measured and Indicated (Seam 2) 2018 | 34,81 | 28,41 | 9,39 |
| **Inferred 2019** | 133,46 | 30,03 | 9,67 |
| Inferred 2018 | 133,46 | 30,03 | 9,67 |

*Totals are rounded off.*

**Key assumptions for Mineral Resources:**

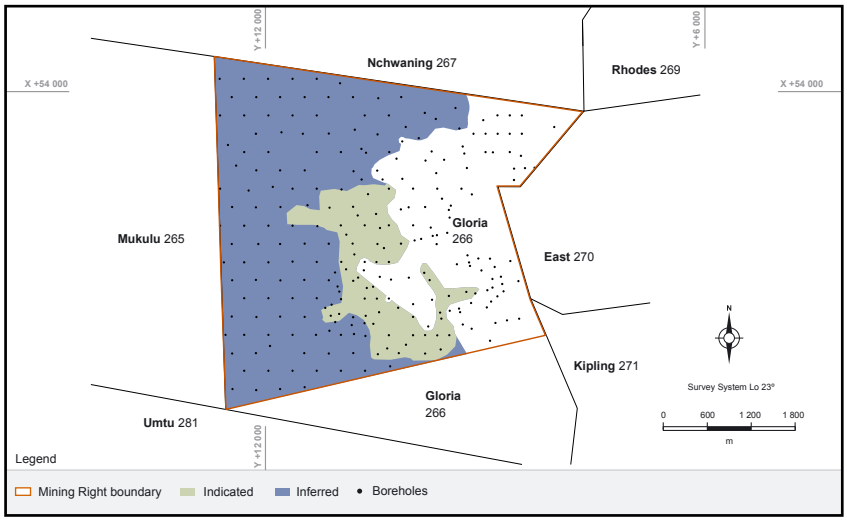
- True thickness cut-off: 4,0 metres.
- Density: 3,8 t/m$^3$.

** Black Rock Manganese Mine attributable interests (ARM 50%; Assore 50%).*

# Assmang operations continued

## Manganese mines

### Gloria Manganese Seam 2 Mineral Resources classification




### Gloria year-on-year change

Gloria Mine Seam 1 Measured and Indicated Mineral Resources decreased marginally from 157,25 Mt to 156,94 Mt due mining depletion.

The Mineral Reserves decreased from 123,93 Mt at 37,75% Mn to 115,04 Mt at 37,41% Mn mainly due to a revised Mining Plan on the eastern portion of Gloria Mine where the geological boundary of Seam 1 was updated.

### Historical manganese production at Gloria Mine

| Financial year | ROM Mt | Saleable Mt |
|---|---|---|
| 2014/2015 | 0,74 | 0,61 |
| 2015/2016 | 0,56 | 0,55 |
| 2016/2017 | 0,72 | 0,72 |
| 2017/2018 | 0,69 | 0,71 |
| 2018/2019 | 0,51 | 0,42 |

# Assmang operations continued

## Iron ore mines

### Locality

The Iron Ore Division is made up of Beeshoek Mine located on the farms Beeshoek 448 and Olyn Fontein 475 and Khumani Mine situated on farms Bruce 544, King 561 and Mokaning 560. All properties are approximately 200 kilometres west of Kimberley in the Northern Cape. The Beeshoek open-pit operations are situated 7 kilometres west of Postmasburg and the Khumani open pits are adjacent to, and south-east of Kumba Iron Ore's Sishen Mine. Beeshoek and Khumani Mines are located at latitude 28°30'00"S/longitude 23°01'00"E, and latitude 27°45'00"S/longitude 23°00'00"E respectively.

### 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, Beeshoek Iron Ore Mine was established, with a basic hand-sorting operation. In 1975, a full washing and screening plant was installed at Beeshoek Mine. The Khumani Iron Ore Mine was commissioned in 2007.

### Competence

The following Competent Persons were involved in the estimation of Mineral Resources and Mineral Reserves for the Iron Ore operations. S Kadzviti and R Jooste are employed by ARM while the rest are employed by Assmang.

| Mining operation | Competent Person | Professional organisation | Membership number | Qualifications | Relevant experience |
|---|---|---|---|---|---|
| Beeshoek Mine | S Kadzviti (Mineral Resources) | SACNASP | 400164/05 | BSc (Geology and Mathematics), MSc (Exploration Geology), GDE (Mining Engineering) | 29 years |
| | R Jooste (Mineral Resources) | SACNASP | 400163/05 | BSc, BSc Hons (Geology), MEng (Mining Engineering) | 18 years |
| | A Burger (Mineral Reserves) | SACNASP | 400233/08 | BSc (Geology), BSc Hons (Geology), GDE (Mining Engineering) | 18 years |
| Khumani Mine | M Burger (Mineral Resources and Mineral Reserves) | SACNASP | 400086/03 | BSc (Geochemistry), BSc Hons (Geochemistry), GDE (Mining Engineering) | 36 years |
| | I van Niekerk (Mineral Resources) | SACNASP | 400006/94 | BSc Hons (Geology) | 29 years |

### Mining authorisation

| Mining operation | Legal entitlement | Minerals Covered by Mining Right | Comment | Period of Mining Right (years) | Known Impediments on Legal entitlement |
|---|---|---|---|---|---|
| Beeshoek Mine | Mining Right NC 30/5/1/2/2/223 MRC | Iron ore | None | 30 years: 16 March 2012 to 15 March 2042 | None |
| Khumani Mine | Mining Right NC 50/5/1/2/5/2/70 MR | Iron ore | None | 30 years: 25 January 2007 to 24 January 2037 | None |

# Assmang operations continued

## Iron ore mines

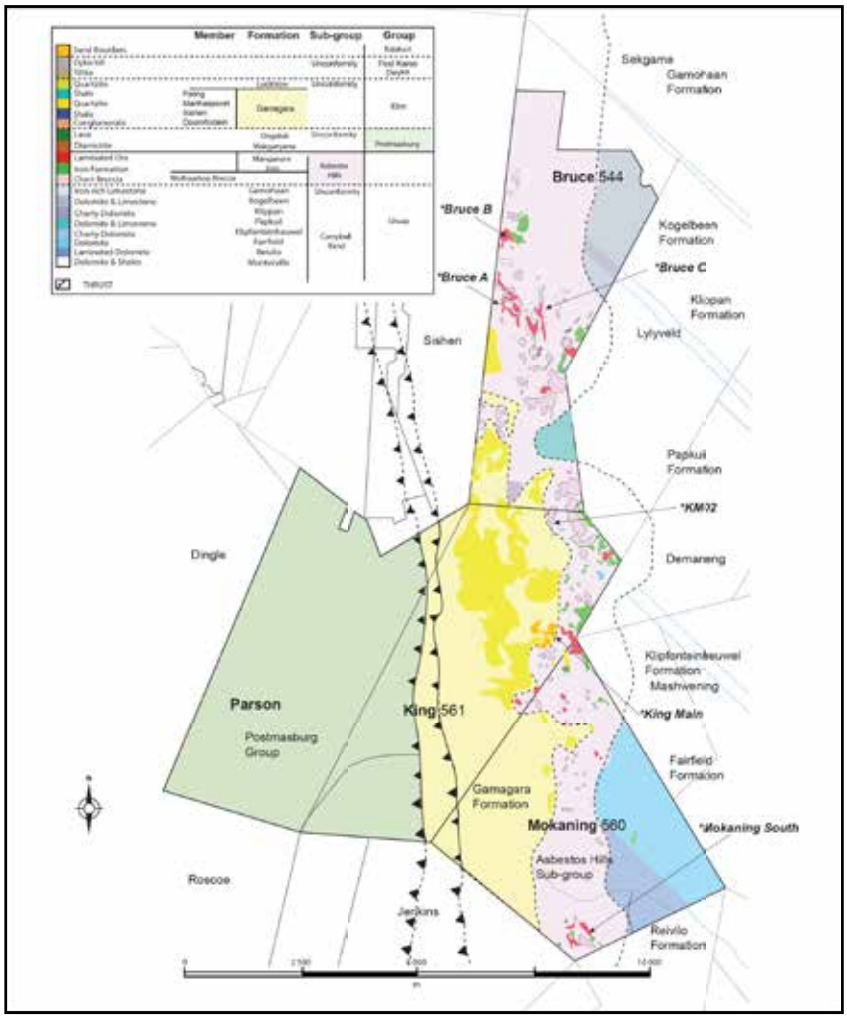
### Geology

Beeshoek and Khumani mines are situated within a sequence of early Proterozoic sediments of the Transvaal Supergroup. Both mines are symmetrically located on the Maremane Anticline in the Griqualand West Sequence of the Transvaal Supergroup, as well as the Elim Group of the Keis Supergroup.

In general, two ore types are present: 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 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 ore bodies cross-cut primary sedimentary bedding, indicating that secondary hematisation 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 found in the Doornfontein Conglomerate Member of the Gamagara Formation, is lenticular but not consistently developed along strike. It consists of stacked, upward fining conglomerate-gritstone-shale sedimentary cycles. The lowest conglomerates and gritstones tend to be rich in subrounded to rounded hematite ore pebbles and granules and form the largest part of the resource. 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. Hematite is the predominant ore mineral, but limonite and specularite also occur.

Erosion in the Khumani deposit is less than in the Beeshoek area. This results in Khumani being characterised by larger stratiform bodies and prominent hanging-wall outcrops. The down-dip portions are well preserved and developed, but in the outcrop the deposits are thin and isolated. Numerous deeper iron ore extensions occur into the basins due to karst development. A prominent north-south strike of the ore bodies dipping to the west is notable. The southern Beeshoek ore bodies were exposed to more erosion and hence 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 ore bodies is also in a north-south direction dipping to the west, but less continuous.

**Khumani surface geology map**




** Khumani Mine consists of Bruce A, Bruce B, Bruce C, King and Mokaning areas.*

# Assmang operations continued

## Iron ore mines

### Exploration activities

The exploration work at Khumani Mine for the past year concentrated on the southern part as well as the south-eastern part of Mokaning. The former realised additional Mineral Resources after drilling, while the latter target was mainly reconnaissance. The drilling cost for 2018/2019 was R16,99 million excluding sampling costs. A total of 16 003 metres were drilled comprising percussion and diamond drilling. Exploration work is planned continue in the Mokaning area as well as the western part of King.

Exploration activities at Beeshoek Mine carried out over the past year included drilling of Village Pit on the south-west and north-west as well as to the south of BN pit. The total amount of boreholes added to the database were 142 with 16 507 assay samples. The total number of metres drilled for the period July 2018 to June 2019 was 10 974 metres. The cost of the drilling work for the year was R17,36 million. Plans for next year are to drill additional boreholes to the west of Village Pit and the Oppikoppie areas.

Drilling and estimation was undertaken for the low grade tailings stockpile resulting in the definition of Mineral Resources reported in the table on page 19. The tailings stockpile Mineral Resources occur within a larger tailings exploration target. The exploration target is estimated to have a tonnage range of between 6 Mt and 10 Mt with grade range of between 50% and 60% Fe and further work will be required to define additional Mineral Resources for this target area.

### Mining methods and infrastructure

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 “on-” or “off-grade” on blending stockpiles. Ore from the stockpiles is either sent to the wash-and- screen plants or, if “off-grade”, to the beneficiation plants. The washing and screening plants consist primarily of tertiary crushing, washing, screening, conveying and stacking equipment. The beneficiation plants consist of tertiary crushers; scrubbers; coarse and fine jigs; lumpy and fines product stockpiles; and a rapid load-out facility. No chemicals are being used in any of the treatment plants.

### Mineral resources

The methodology followed to identify exploration targets is initiated with geological mapping, followed by geophysics (ground magnetics and gravity). Numerous exploration programmes have been completed in the past. 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 in-fill 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. Core samples are logged and split by means of a diamond saw and the half-core is sampled at 0,5 metre intervals. The half-cores are crushed, split and pulverised and submitted to the owner-managed laboratory for assaying. All holes and blast holes in mineralisation are sampled and analysed for Fe, $K_2O$, $Na_2O$, $SiO_2$, $Al_2O_3$, P, S, CaO, MgO, Mn and BaO. The 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 (eg SARM11) and in-house iron standards are used for the calibration of the XRF spectrometer. The Khumani laboratory undertakes stringent quality control and assurance methods, including “round robin” analysis with 11 laboratories for verification of assay results. A Datamine “Fusion” database with all the borehole data has been established.

At Khumani the geological model is built with Datamine’s Strat 3D modelling functionality to create a 3D representation of the stratigraphy using all validated borehole information. The stratigraphy is modelled from the surface geology to the stratigraphic unit below the lowest mineralised zone. Within the host stratigraphic units, Doornfontein (conglomeritic mineralisation) and Manganore (laminated mineralisation) outlines for mineralisation above a cut-off of 55% Fe are interpreted and solid wireframes created. Any lower-grade samples inside the ore body are defined as internal waste and modelled separately. Ordinary Kriging interpolation is used to estimate the grade of each 25 x 25 x 10 metre block generated within the geological model for the following separate units: mineralised envelopes (Fe>=55%), internal shales and banded iron stone, Doornfontein and Manganore units outside the Fe>=55% envelope. Densities in the resource model are calculated using a fourth degree polynomial fit applied to the estimated Fe grade. Mineral Resource classification is based on both geostatistical parameters as well as the geological continuity of the mineralisation. The geostatistical parameters that are considered are: Kriging efficiency, Kriging variance, number of samples, search volume and regression slope. The final assessment of the classification is done by the lead Competent Person who may make adjustments as necessary. The geological modelling of the ore body at Beeshoek is similar to Khumani, although the cut-off grade used is 60% Fe.

### Mineral reserves

Only Measured and Indicated Mineral Resources are converted to Proved and Probable Mineral Reserves respectively. Modifying factors are applied to these Mineral Resources and are financially optimised. The financial parameters are used to define the optimal pit outline. The pit designs are based on geotechnical parameters, mining fleet and selective mining unit (SMU). The combined waste and mineralisation models are reblocked at 6,25 x 6,25 x 10 metre blocks. The Resources within this mining constraint (optimised pit-shell) with grades of greater than 54% Fe (Khumani) and greater than 60% Fe (Beeshoek), are defined as Reserves. These are categorised into different product types, destined for the different plant processes and then scheduled for mining. The average Fe, $K_2O$, $Al_2O_3$ and $SiO_2$ Grades of the SMUs are used to define “on-Grade” (wash and screen) feed as well as “off-Grade” (Jig) feed.

# Assmang operations continued

## Iron ore mines

### Beeshoek Mine

**Beeshoek Iron Ore Mine: Mineral Resources and Mineral Reserves as at 30 June 2019**

| | Measured Resources | | Indicated Resources | | Measured and Indicated Resources | | Inferred Resources | | Proved Reserves | | Probable Reserves | | Total Reserves | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ** Mineral Resources and Mineral Reserves are reported on a 100% basis.* **Pit/Area** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** |
| BN Pit | 6,93 | 63,02 | | | 6,93 | 63,02 | | | 2,39 | 63,06 | | | 2,39 | 63,06 |
| HF/HB Pit | 15,47 | 64,57 | | | 15,47 | 64,57 | | | 4,73 | 64,96 | | | 4,73 | 64,96 |
| BF Pit | 7,50 | 63,51 | 0,23 | 63,54 | 7,73 | 63,51 | 0,00 | 65,24 | 0,60 | 61,59 | | | 0,60 | 61,59 |
| East Pit | 2,86 | 64,99 | 0,02 | 64,52 | 2,88 | 64,98 | | | 0,59 | 65,05 | | | 0,59 | 65,05 |
| Village Area | 42,96 | 64,36 | 4,75 | 63,45 | 47,71 | 64,27 | 2,80 | 64,89 | 21,40 | 64,90 | 0,13 | 63,35 | 21,53 | 64,89 |
| GF Pit | 3,13 | 63,81 | 0,09 | 61,80 | 3,22 | 63,75 | | | | | | | | |
| HH Ext Pit | 0,28 | 62,63 | | | 0,28 | 62,63 | | | | | | | | |
| HL Pit | 1,98 | 64,82 | 0,02 | 65,21 | 2,00 | 64,82 | | | | | | | | |
| West Pit | 9,45 | 63,19 | | | 9,45 | 63,19 | 0,05 | 61,88 | | | | | | |
| Detrital** | | | | | | | 2,50 | 60,00 | | | | | | |
| **Total 2019** | **90,56** | **64,11** | **5,11** | **63,44** | **95,67** | **64,07** | **5,35** | **62,58** | **29,71** | **64,70** | **0,13** | **63,35** | **29,84** | **64,69** |
| Total 2018 | 95,10 | 64,16 | 2,54 | 63,22 | 97,64 | 64,14 | 3,55 | 60,80 | 35,13 | 64,85 | 0,01 | 63,18 | 35,14 | 64,85 |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*
*** Detrital is loose fragmented material occurring in various areas at Beeshoek Mine.*

**Key assumptions for Mineral Resources:**

- Grade cut-off: 60% Fe.

**Modifying factors for the conversion of Mineral Resources to Mineral Reserves include:**

- Grade cut-off: 60% Fe.
- Plant yield: On-grade (84%); Off-grade (28% to 45% depending on material type).
- Price used for iron ore (US$/t): Based on market-related long-term view and customer contracts.
- Exchange rate used: Market-related.
- Life of Mine: 7 years

** Beeshoek Iron Ore Mine attributable interests (ARM 50%; Assore 50%).*

**Beeshoek stockpiles Mineral Reserves estimates as at 30 June 2019**

| | Proved Reserves | | Probable Reserves | | Total Reserves | |
|---|---|---|---|---|---|---|
| ** Mineral Reserves are reported on a 100% basis.* **Area** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** |
| North Mine (ROM On-Grade) | | | 0,01 | 64,00 | 0,01 | 64,00 |
| North Mine (B ROM Off-Grade**) | | | 0,23 | 55,00 | 0,23 | 55,00 |
| North Mine (C Off-Grade) | | | | | | |
| South Mine Village Pit (Off-Grade) | | | 0,08 | 55,00 | 0,08 | 55,00 |
| South Mine Village Pit (On-Grade) | | | 0,16 | 64,00 | 0,16 | 64,00 |
| South Mine East Pit (ROM On-Grade) | | | 0,13 | 64,00 | 0,13 | 64,00 |
| South Mine East Pit (B ROM Off-Grade) | | | 0,16 | 55,00 | 0,16 | 55,00 |
| South Mine (C Off-Grade) | | | | | | |
| **Total 2019 Stockpiles** | | | **0,77** | **58,52** | **0,77** | **58,52** |
| Total 2018 Stockpiles | | | 2,83 | 55,58 | 2,83 | 55,58 |

*Totals are rounded off.*
*** ROM Off-Grade ore is beneficiated to produce a saleable product.*
** Beeshoek Iron Ore Mine attributable interests (ARM 50%; Assore 50%).*

# Assmang operations continued

## Iron ore mines

### Beeshoek low grade stockpile: Mineral Resources estimates as at 30 June 2019

**Mineral Resources and Mineral Reserves are reported on a 100% basis.*

| Pit/Area | Measured Resources | | Indicated Resources | | Measured and Indicated Resources | | Inferred Resources | | Proved Reserves | | Probable Reserves | | Total Reserves | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mt | Fe% | Mt | Fe% | Mt | Fe% | Mt | Fe% | Mt | Fe% | Mt | Fe% | Mt | Fe% |
| Tailings Stockpile | 2,41 | 56,46 | 0,04 | 54,52 | 2,45 | 56,43 | | | 2,29 | 56,46 | | | 2,29 | 56,46 |
| JIG Stockpile | | | 12,60 | 53,22 | 12,60 | 53,22 | | | | | 11,97 | 53,22 | 11,97 | 53,22 |
| **Total 2019** | **2,41** | **56,46** | **12,64** | **53,22** | **15,05** | **53,74** | | | **2,29** | **56,46** | **11,97** | **53,22** | **14,26** | **53,74** |
| Total 2018 | | | | | | | | | | | | | | |

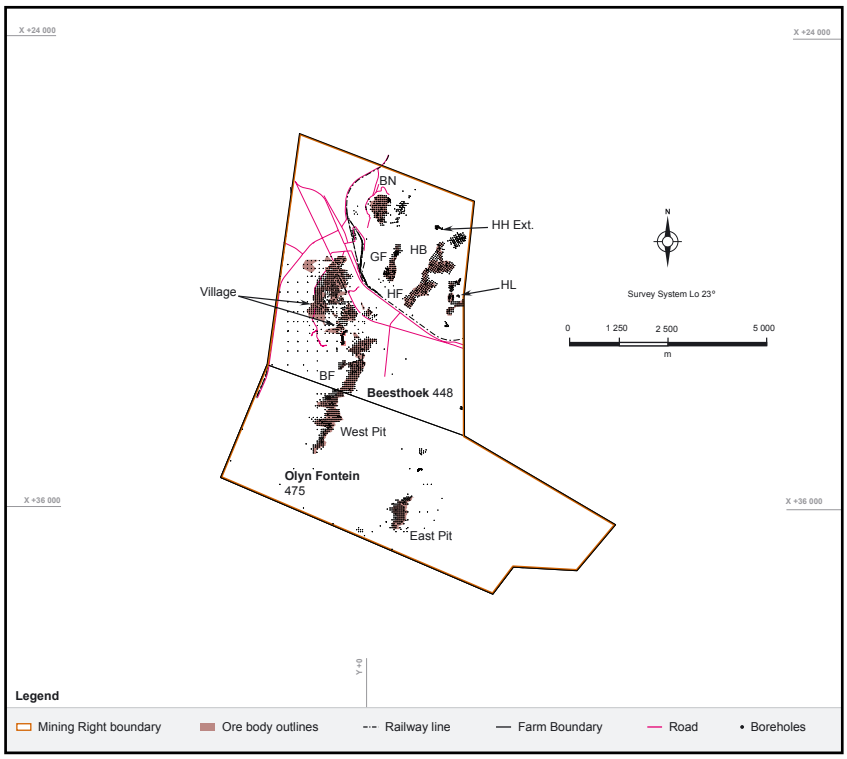
*Mineral Resources are inclusive of Mineral Reserves.*
*Totals are rounded off.*

**Modifying factors for the conversion of Mineral Resources to Mineral Reserves include:**

- Tailings Stockpile Yield: 55% (Saleable Product 1,26 Mt @ 63,5% Fe).
- Jig Stockpile Yield: 49% (Saleable Product 5,86 Mt @ 63% Fe).
- Mining loss: 5%

**Beeshoek Iron Ore Mine attributable interests (ARM 50%; Assore 50%).*

### Beeshoek deposits map




### Beeshoek year-on-year change

Measured and Indicated Mineral Resources were virtually unchanged, from 97,64 Mt in 2018 to 95,67 Mt in 2019. This is mainly due to mining depletions in 2018 being offset by an increase in the Mineral Resources for Village Pit.

Mineral Reserves decreased from 35,14 to 29,84 Mt mainly due to mining depletions.

Stockpile Mineral Reserves decreased from 2,83 Mt at 55,58% Fe to 0,77 Mt at 58,52% Fe mainly due to processing of the material.

Mineral Resource estimates were undertaken during the year for the Low Grade Jig and Tailings stockpiles resulting in the declaration of a total of 15,05 Mt at 53,74% Fe of Measured and Indicated Mineral Resources. A total of 14,26 Mt at 53,74% Fe of Mineral Reserves was reported.

# Assmang operations continued

## Iron ore mines

### Historical production at Beeshoek Mine

| Financial year | ROM Mt | Saleable Mt |
|---|---|---|
| 2014/2015 | 3,35 | 3,43 |
| 2015/2016 | 3,05 | 3,11 |
| 2016/2017 | 3,39 | 3,15 |
| 2017/2018 | 4,17 | 3,88 |
| 2018/2019 | 4,44 | 3,64 |

### Khumani Mine

**Khumani Iron Mine: Mineral Resources And Mineral Reserves estimates as at 30 June 2019**

| ** Mineral Resources and Mineral Reserves are reported on a 100% basis* | Measured Resources | | Indicated Resources | | Measured and Indicated Resources | | Inferred Resources | | Proved Reserves | | Probable Reserves | | Total Reserves | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pit/Area** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** | **Mt** | **Fe%** |
| Bruce A | 54,83 | 63,38 | 64,20 | 63,99 | 119,03 | 63,71 | | | 47,56 | 61,92 | 55,67 | 63,31 | 103,23 | 62,67 |
| Bruce B | 67,05 | 62,10 | 11,60 | 62,11 | 78,65 | 62,10 | 3,74 | 59,36 | 51,14 | 61,20 | 11,15 | 60,24 | 62,29 | 61,03 |
| Bruce C | 11,87 | 62,77 | | | 11,87 | 62,77 | | | 4,26 | 62,00 | | | 4,26 | 62,00 |
| **Total for Bruce Pits** | 133,75 | 62,68 | 75,80 | 63,70 | 209,55 | 63,05 | 3,74 | 59,36 | 102,96 | 61,57 | 66,82 | 62,80 | 169,78 | 62,05 |
| King Main | 285,24 | 63,16 | 35,53 | 62,59 | 320,77 | 63,10 | 30,01 | 61,23 | 237,23 | 62,14 | 8,51 | 62,18 | 245,74 | 62,14 |
| Mokaning South | | | 25,97 | 62,69 | 25,97 | 62,69 | 2,35 | 62,62 | | | 17,92 | 61,95 | 17,92 | 61,95 |
| Total King/Mokaning | 285,24 | 63,16 | 61,50 | 62,63 | 346,74 | 63,07 | 32,36 | 61,33 | 237,23 | 62,14 | 26,43 | 62,02 | 263,66 | 62,13 |
| **Total 2019** | 418,99 | 63,01 | 137,30 | 63,22 | 556,29 | 63,06 | 36,10 | 61,13 | 340,19 | 61,97 | 93,25 | 62,58 | 433,44 | 62,10 |
| Total 2018 | 442,99 | 62,95 | 108,00 | 63,23 | 550,99 | 63,00 | 59,49 | 61,73 | 369,16 | 62,12 | 77,97 | 62,79 | 447,13 | 62,24 |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*

**Key assumptions for Mineral Resources:**
- Grade cut-off: 55% Fe.

**Modifying factors for the conversion of Mineral Resources to Mineral Reserves include:**
- Mining loss factor: 2%.
- Mining dilution: 3%.
- Strip ratio (LoM: 2,42).
- Wash and screen recovery: 87% (on-grade).
- Jig recovery: 72% (off-grade).
- Grade cut-off: 54% Fe.
- Price used for iron ore (US$/t): Based on market-related long-term view and customer contracts.
- Exchange rate used: Market-related.
- Life of Mine: 23 years

** Khumani Iron Mine attributable interests (ARM 50%; Assore 50%).*

# Assmang operations continued

## Iron ore mines

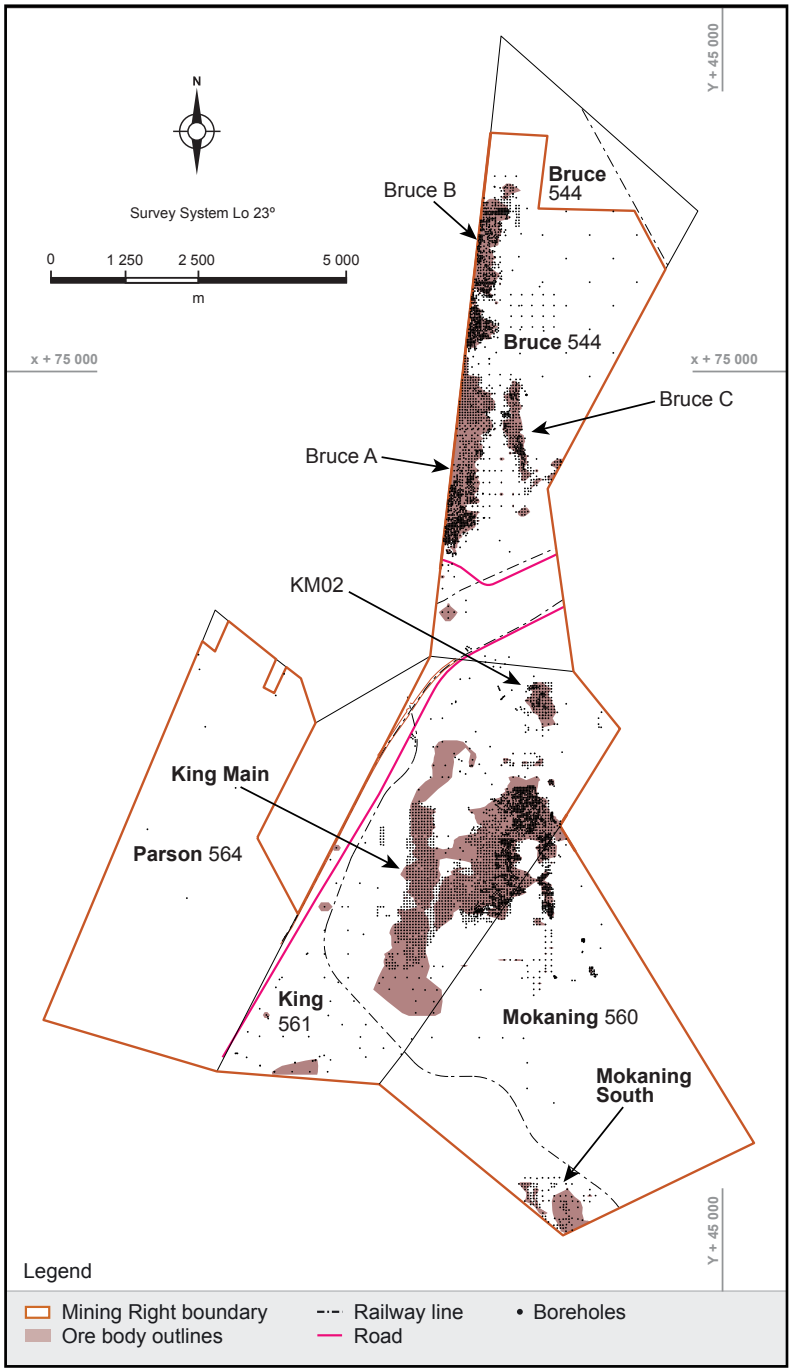
### Khumani stockpiles Mineral Reserves estimates as at 30 June 2019

** Mineral Reserves are reported on a 100% basis.*

| Area | Proved Reserves Mt | Proved Reserves Fe% | Probable Reserves Mt | Probable Reserves Fe% | Total Reserves Mt | Total Reserves Fe% |
|---|---|---|---|---|---|---|
| Bruce | | | 3,56 | 55,00 | 3,56 | 55,00 |
| King | | | 2,48 | 55,20 | 2,48 | 55,20 |
| **Total 2019 Stockpiles**** | | | **6,04** | **55,08** | **6,04** | **55,08** |
| Total 2018 Stockpiles | | | 5,01 | 55,08 | 5,01 | 55,08 |

*Totals are rounded off.*
*** Stockpiles are beneficiated to produce a saleable product.*
** Khumani Iron Mine attributable interests (ARM 50%; Assore 50%).*

### Khumani deposits map




### Khumani year-on-year change

The Measured and Indicated Mineral Resources increased from 550,99 Mt at 63,00% Fe to 556,29 Mt at 63,06% Fe after mining depletion mainly due to the upgrade of most of the Mokaning South Inferred Mineral Resources to Indicated Mineral Resources after completion of additional drilling and re-estimation of the Mineral Resource.

Mineral Reserves decreased from 447,13 Mt at 62,24% Fe to 433,44 Mt at 62,10% Fe primarily due to mining depletion of 20,11 Mt. The addition of 17,92 Mt at 61,95% Fe Probable Mineral Reserves at Mokaning South, which is being reported for the first time, partially off-set the production depletion.

Stockpile Mineral Reserves increased from 5,01 Mt at 55,08% Fe to 6,04 Mt at 55,08% Fe as a result of production from the pits.

### Historical production at Khumani Mine

| Financial year | ROM Mt | Saleable Mt |
|---|---|---|
| 2014/2015 | 19,06 | 12,65 |
| 2015/2016 | 21,38 | 13,62 |
| 2016/2017 | 20,35 | 14,07 |
| 2017/2018 | 22,00 | 14,69 |
| 2018/2019 | 20,11 | 14,15 |

# Assore subsidiary companies competence

The Competent Person with overall responsibility for the compilation of the Mineral Resources and Reserves for the subsidiary companies' report is Ms C van der Merwe, an employee of African Mining and Trust Company Limited since January 2013. She confirmed in writing that the information in this report complies with the SAMREC 2016 Code and that it may be published in the form and context in which it was intended.

Ms Van der Merwe graduated from the University of Johannesburg with a BSc Geology and Environmental Management and a BSc Honours degree in Geology. She also completed a Management Advancement Programme certificate at the University of the Witwatersrand as well as an Iron and Steelmaking certificate.

She is considered a Competent Person who is registered with the South African Council for Natural Scientific Professionals (Pr Sci Nat No 114059). She has sufficient experience that is relevant to the style of mineralisation and type of deposits under consideration and to the activity being undertaken to qualify as a Competent person as defined in the 2016 Edition of the "South African Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves".

SACNASP is based in Suite B 313, Geoscience Building, 280 Pretoria Road, Silverton, Pretoria, 0184, South Africa.

Ms Van der Merwe is also a member of the Geological Society of South Africa (No 967480) and the Australian Institute of Mining and Metallurgy (No 329991).

**Christelle van der Merwe Pr Sci Nat**
*Senior Geologist*
Assore limited.
15 Fricker Road
Illovo Boulevard
Illovo,
2195
South Africa

16 September 2019 (as per the letter supplied in writing)

All Competent Persons at the ASSORE corporate office and the operations have sufficient relevant experience in the type of deposit and in the activity for which they have taken responsibility. Details of Assore's competent Persons are available from the Company Secretary on written request.

The following Assore corporate office, and Dwarsrivier Competent Persons were involved in compiling some parts of the Mineral Resources and Mineral Reserves report:

| Competent Person | Professional organisation | Membership number | Qualifications | Relevant experience | Employed |
|---|---|---|---|---|---|
| C Moffatt | IMSSA | 2071 | NHD (Mine Surveying), MSCC (No 1839) | 31 years | Assore |
| L Maluleke | SACNASP | 400076/16 | BSc Geology, BSc (Honours) Geology | 11 years | Dwarsrivier Chrome Mine |

# Assore subsidiary companies continued

## Salient features for 2019

| Dwarsrivier Chrome Mine | Wonderstone Limited | Rustenburg Minerals Development Company Limited (RMDC) | Zeerust Chromite Mines Limited (ZCM) |
|---|---|---|---|
| Measured and Indicated Resources decreased slightly by 4,2% to 78,08 Mt at 37,09% $Cr_2O_3$. Total Reserves have decreased with 5,8% to 58,89 Mt at 32,82% $Cr_2O_3$. The decrease is mainly as a result of mining depletion.<br><br>At the time of the compilation of this report, the Dwarsrivier directors are not aware of any legal proceedings or material conditions that will inhibit the planned Dwarsrivier mining or exploration activities. | 151 477 t was mined and processed for the FY2018/2019 (as opposed to the 87 275 t for the FY2017/2018). This is an increase of 73,6%. The stockpile was depleted with 33 672 t.<br><br>At the time of the compilation of this report, the Wonderstone directors are not aware of any legal proceedings or material conditions that will inhibit the planned Wonderstone mining or exploration activities. | RMDC was sold to Thutse Mining Proprietary Limited during the FY2018/2019. | ZCM was sold to ZCM Holdco One Proprietary Limited during the FY2018/2019. |

# Assore subsidiary companies continued

**Assore subsidiary companies Mineral Resources and Mineral Reserves summary as at 30 June 2019**

*> The tables below are summaries of the Assore Mineral Resources and Mineral Reserves. The detailed information on Mineral Resources and Mineral Reserves is provided per operation later in this report.*

## Mineral Resources

### Chrome Mines

** Mineral Resources are reported on a 100% basis.*

| | Inferred | | Measured | | Indicated | | Measured and indicated | |
|---|---|---|---|---|---|---|---|---|
| | Mt | $Cr_2O_3$% | Mt | $Cr_2O_3$% | Mt | $Cr_2O_3$% | Mt | $Cr_2O_3$% |
| **2019 Dwarsrivier Chrome Mine** | **42,97** | **35,18** | **48,92** | **37,39** | **29,16** | **36,60** | **78,08** | **37,09** |
| 2018 Dwarsrivier Chrome Mine | 42,97 | 35,18 | 52,72 | 37,31 | 28,80 | 36,79 | 81,52 | 37,13 |
| 2018 Rustenburg Minerals (LG6) | 9,78 | 44,04 | 3,60 | 44,04 | 1,70 | 44,04 | 5,30 | 44,04 |
| 2018 Zeerust Chrome (LG1 to LG3) | 6,57 | 45,44 | 0,30 | 45,44 | 1,10 | 45,44 | 1,40 | 45,44 |

### Wonderstone (Pyrophyllite) Mine

** Mineral Resources are reported on a 100% basis.*

| | Average grade across ore body | | Inferred | Measured | Indicated | Measured and indicated |
|---|---|---|---|---|---|---|
| | $SiO_2$% | $Al_2O_3$% | Mt | Mt | Mt | Mt |
| **2019** | **58,8** | **29,9** | **107,20** | **7,54** | **9,90** | **17,44** |
| 2018 | 58,8 | 29,9 | 107,20 | 7,69 | 9,90 | 17,59 |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*
** Dwarsrivier Chrome Mine and Wonderstone Mine attributable interests (Assore 100%).*

## Mineral Reserves

### Chrome Mine

** Mineral Reserves are reported on a 100% basis.*

| | Proved | | Probable | | Probable and proved | |
|---|---|---|---|---|---|---|
| | Mt | $Cr_2O_3$% | Mt | $Cr_2O_3$% | Mt | $Cr_2O_3$% |
| **2019 Dwarsrivier Chrome Mine** | **34,57** | **33,51** | **24,32** | **31,83** | **58,89** | **32,82** |
| 2018 Dwarsrivier Chrome Mine | 37,39 | 33,27 | 25,15 | 31,84 | 62,54 | 32,69 |

### Wonderstone (Pyrophyllite) Mine

** Mineral Reserves are reported on a 100% basis.*

| | Average grade across ore body | | Proved | Probable | Proved and probable |
|---|---|---|---|---|---|
| | $SiO_2$% | $Al_2O_3$% | Mt | Mt | Mt |
| **2019** | **58,8** | **29,9** | 7,16 | 9,40 | **16,56** |
| 2018 | 58,8 | 29,9 | 7,30 | 9,40 | 16,70 |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*
** Dwarsrivier Chrome Mine and Wonderstone Mine attributable interests (Assore 100%).*

# Assore subsidiary companies continued

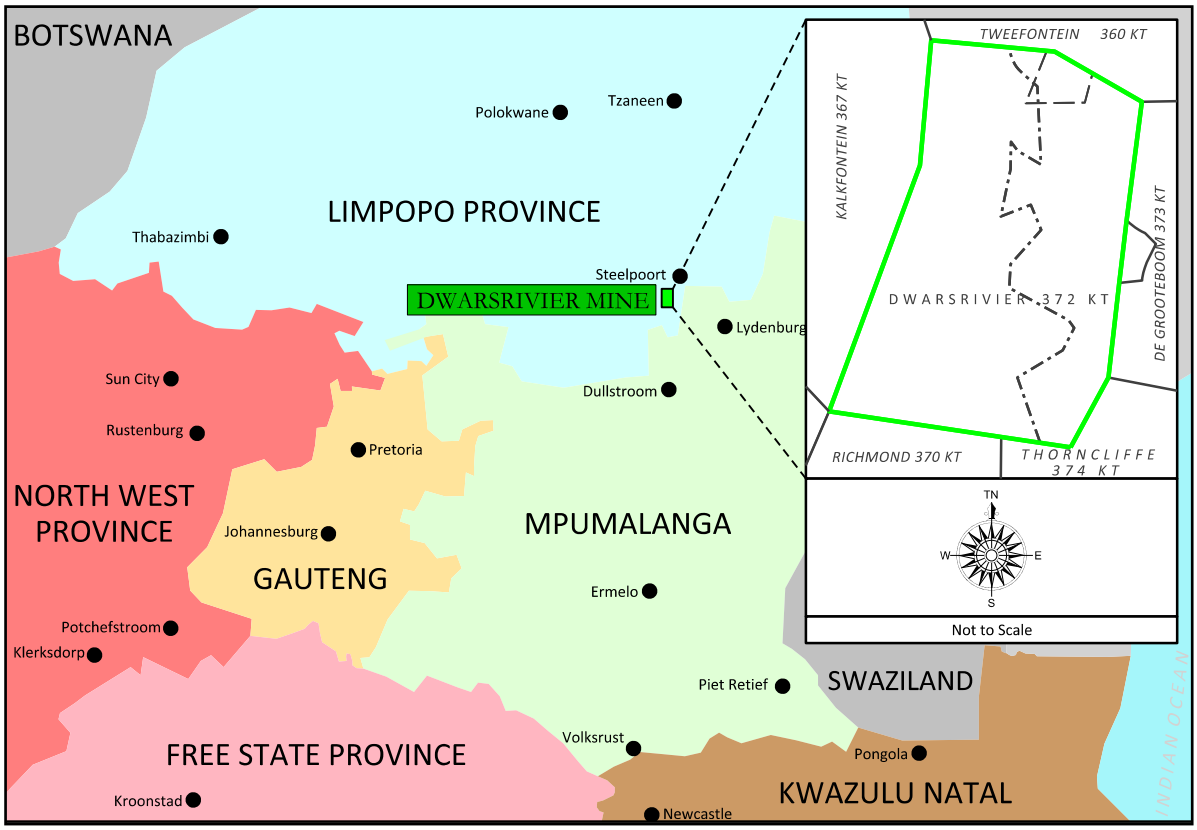
## Assore Chrome mine

### Dwarsrivier Chrome Mine

### Locality

Dwarsrivier Chromite Mine (Dwarsrivier) is situated on the "Remaining Extent of Portion 1" and the "Remaining Extent" of the Farm Dwarsrivier 372 KT. Dwarsrivier is approximately 30 kilometres by road from Steelpoort and 60 kilometres by road from Lydenburg, Limpopo province, South Africa. Dwarsrivier is located at latitude 24°56'12.95"S/longitude 30°07'39.32"E.

**Dwarsrivier locality map**




### History

Assmang Proprietary Limited (Assmang) bought the farm Dwarsrivier 372KT, together with all surface and Mineral Rights, from Gold Fields Limited in October 1998. Following a thorough feasibility study, final design and construction of the chrome mine commenced in July 1999. Construction of the infrastructure, plant and open-cast mine was completed by September 2000.

The mine was previously owned by Assmang, which is jointly owned by African Rainbow Minerals Limited (ARM) (50%) and Assore Limited (Assore) (50%). In July 2016, Assore purchased the ARM interest as well, making Assore the 100% owner of Dwarsrivier. FY2018/2019 was the third year under Assore management and the operations are still performing well.

### Current operations

Currently, all the chromite production from Dwarsrivier is extracted from the underground operations as the open-cast reserves were exhausted in 2005. The operations are focused on delivering high grade metallurgical, chemical and foundry grade products to the export market.

### Mining authorisation

| Farm | Legal entitlement | Mineral covered by Mining Right | Comment | Licence validity/ expiry date | Period of Mining Right (years) |
|---|---|---|---|---|---|
| Dwarsrivier 372 KS | LP179 MRC | Chrome ore inclusive of Platinum Group Minerals (PGM) | The Converted Mining Right was executed on 15 May 2013 | 14 May 2043 | 30 |

Surface rights have been purchased from Assmang and are in the process of being transferred to Dwarsrivier.

# Assore subsidiary companies continued

## Dwarsrivier Chrome mine

### Geology

Dwarsrivier is situated in the Bushveld Complex (BC), the World's largest source of PGM's and chromite. It has an aerial extent over 65 000 km$^2$ and an average thickness of 7 km (Cawthorn, 1999) with an age of approximately 2,06 Ga (Kinnard, 2010). The BC is exposed in three portions, the Eastern and Western limbs and the Northern portion (Kinnard, 2010). Dwarsrivier is situated in the Eastern limb of the BC.

The economically significant portion is the Rustenburg Layered Suite (RLS) and is sub-divided into several zones. The economically important units at Dwarsrivier are situated within the Critical Zone (CZ) of the RLS. The CZ is made up of cyclic units that include pyroxenite, norite and anorthosite. Three chromitite groups are hosted within the CZ, namely the Upper Group (UG), the Middle Group (MG) and the Lower Group (LG). Most of the lease area is underlain by these units.

Geological strike is north-south on the farm with an average of 10º dip towards the west. The Steelpoort Chromitite Seam (SCS), is on average 1,8 m thick and is the main seam currently being exploited by Dwarsrivier. Both the hangingwall and footwall lithologies of the seam are pyroxenitic, that generally allows for very competent ground conditions.

Measuring approximately 40 cm above the SCS, there is a disseminated Chromitite-Pyroxenite stringer, referred to as the false hanging wall disseminated zone (FHW-DZ). The entire unit from the SCS contact to the FHW-DZ is referred to as the False Hangingwall (FHW) unit. The SCS and FHW unit form the economically mineable unit at Dwarsrivier and is considered as such for the Reserve Estimate.

Dwarsrivier falls within the so called Tweefontein section of the RLS Eastern Limb, South of the Steelpoort fault. The northern part of the eastern limb is known as the Clapham-Winterveld section, and between these blocks, the chromitite seams are known to have distinct lateral variations. In the central part of these blocks, various thin chromitite seams are developed which to date has had little to no work done in terms of correlation (Schürmann, 1985; Hatton and Von Gruenewaldt, 1987), as well as its behaviour along strike.

As previously reported, Dwarsrivier has commenced with some extensive work in and around the seam properties, within the lease area, based on the need to better understand the viability of mining the MG2 and MG3 seams in the upper lithologies. Together with this, there has also been an initiative to improve the Steelpoort Chromitite Seam (SCS) extraction from a safety and economic perspective.

From the initial work conducted in the FY2017/2018, six (6) distinct facies had been identified. It has since been refined and limited to three (3) facies during the FY2018/2019, based mainly on the lithological thickness and the Chromitite seam convergence. The motivation for this was the practicality of mining the individual zones to different specifications.

### Exploration activities

A new drilling campaign commenced before the end of the FY2018/2019. The information obtained from it will only be included into the resource and reserve estimation of the next financial year. The total exploration budget is R29,25 million for an estimated 21 000 m of diamond drilling. The bore holes will be drilled at 150 m spacing to fit into the existing drilling grid.

### Mining method and infrastructure

Dwarsrivier is a shallow mining operation that employs a fully mechanised Bords and Pillar mining method.

For both the North and South Shaft complexes, the underground workings are accessed through on-reef declines. For each mining area, a five-barrel decline system is advanced on reef at an apparent dip of 8°. These serve as the main arteries for the underground workings, supplying ventilation, material, personnel and ore transport means for the operations.

Bords are mined on an apparent dip in a roughly northern and southern direction, respectively. With a direction of advance in a northern and southern direction, there is up and down dip mining in Easterly and Westerly directions to create the necessary ventilation holing. The bords are mined at widths of 10 m with the ventilation holings at 8 m wide. The pillars sizes increase with depth due to the increase in the overburden weight.

The total LoM is in excess of 30 years. Steady state production for the operations is planned at approximately 200 kt Run of Mine (RoM) per month (2,4 Mt RoM per annum) for the Dwarsrivier operations. The steady state target can be maintained by upgrading Inferred Resources to Reserves. All development is done on reef and therefore all the RoM is trammed to the plant.

### Mineral Resources

The estimation and blockmodelling work are done in Leapfrog Geo. Resource tonnes were extracted from Datamine Studio RM, defined by the resource classification perimeter strings (Measured-, Indicated- and Inferred Resource 2018/2019), which is in line with the previous year's resource estimation process.

The same total of 457 boreholes, as per the previous year, were used for FY2018/2019 geostatistical modelling and resource estimation.

The Mineral Resource classification was based on consideration of geological and geostatistical aspects. The geological continuity of the Steelpoort Chromitite Seam and the geological structures such as faults and dykes that affect it, were considered. Geostatistical parameters ie Kriging efficiency (KEF), Kriging variance (KVAR), number of samples, search volume (SVOL), and regression slope (RS) were considered in the resource classification. The following was applied for the classification categories:

Measured Resources based on geostatistical parameters: KVAR<=0,15 and RS>=0,9, SVOL=1, KEF>=0,8.

Inferred Resources based on geostatistical parameters: KVAR<=0,4 and RS>=0,65, SVOL<=2, KEF>=0,55.

Any resources between the above parameters were classified as Indicated Resources.

Geological losses of 12% were applied. An additional 5% (unknown geological losses) was further depleted from the estimated inferred resources. Major structures, except faults, and the associated affected ground were depleted from the blockmodel. Actual tonnes estimated for the geological losses were based on the geological model interpretation. Fault losses are accounted for in the mine design to replicate actual mining practice.

# Assore subsidiary companies continued

## Dwarsrivier Chrome mine

### Mineral Resources for Dwarsrivier Chrome Mine as at end of June 2019

| Resource classification<br>** Mineral Resources are reported on a 100% basis.* | Mt | $Cr_2O_3$ (%) | FeO (%) | $SiO_2$ (%) | MgO (%) | $Al_2O_3$ (%) | Density (g/cm³) |
|---|---|---|---|---|---|---|---|
| Measured | 48,92 | 37,39 | 22,31 | 10,59 | 11,91 | 13,38 | 4,18 |
| Indicated | 29,16 | 36,60 | 22,09 | 10,50 | 12,35 | 13,06 | 4,22 |
| **Total (Measured and Indicated) 2019** | **78,08** | **37,09** | **22,23** | **10,56** | **12,07** | **13,26** | **4,19** |
| Total (Measured and Indicated) 2018 | 81,52 | 37,13 | 22,30 | 10,52 | 12,04 | 13,31 | 4,19 |
| **Inferred (2019)** | **42,97** | **35,18** | **20,64** | **11,82** | **14,00** | **11,91** | **4,33** |
| Inferred (2018) | 42,97 | 35,18 | 20,64 | 11,82 | 14,00 | 11,91 | 4,33 |

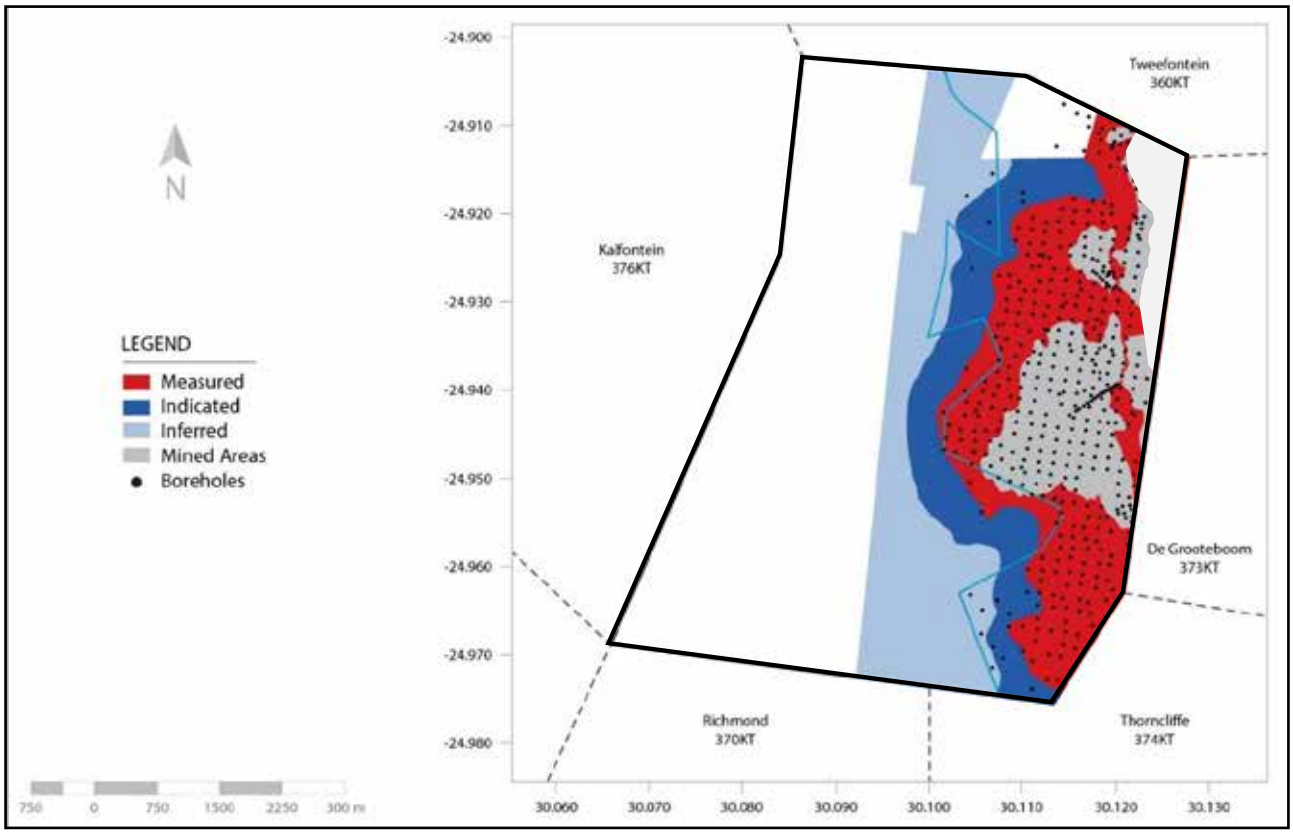
*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*

**Key assumptions for Mineral Resources:**

- Geological loss factor applied losses to be encountered when mining through all known geological structures (except Faults) depleted from the model. The loss amounted to 12%. An additional 5% (unknown geological losses) was further depleted from the estimated inferred resources.
- Density is estimated for each resource block.
- No grade or thickness cut-offs applied to Resource due to consistency of the Steelpoort Chromitite Seam layer with grade above 30% $Cr_2O_3$ and thickness of over 1 m.

** Dwarsrivier Chrome Mine attributable interests (Assore 100%).*

### Dwarsrivier Chrome Mine Resource classification



# Assore subsidiary companies continued

## Dwarsrivier Chrome mine

### Mineral Reserves

The reserves are classified into Proven and Probable reserves with the areas adhering to the boundaries as per the Measured and Indicated categories determined in the resource modelling. The Resource to Reserve conversion for Dwarsrivier was based on the mineable resources which were derived from Studio 5D Planner. The design process is based on a true three-dimensional design layout as per the previous year. This ensures a relatively accurate reflection of the actual mining practices at Dwarsrivier.

The Reserve Model tonnage was determined by utilising the actual SCS bottom contact to the actual SCC top contact and adding 0,4 m to the top contact to account for the mining of the FHW-DZ. The applied modifying factors to convert the resources to the reserves include a 5% geological loss for unknowns, a 2% mining loss and mining extraction ranging from 66% to 84% (depending on the pillar size/mining depth).

**Mineral Reserves for Dwarsrivier Chrome Mine at the FY ending 2018**
**Reserve classification**

| ** Mineral Reserves are reported on a 100% basis.* | Mt | $Cr_2O_3$ (%) | FeO (%) | $SiO_2$ (%) | MgO (%) | $Al_2O_3$ (%) |
|---|---|---|---|---|---|---|
| **Proven** | 34,57 | 33,51 | 20,97 | 14,67 | 13,08 | 12,35 |
| **Probable** | 24,32 | 31,83 | 20,21 | 14,29 | 13,06 | 11,77 |
| **Total Reserves (2019)** | **58,89** | **32,82** | **20,66** | **14,52** | **13,07** | **12,11** |
| Total Reserves (2018) | 62,54 | 32,69 | 20,30 | 12,76 | 12,24 | 11,97 |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*

**Applied modifying factors for Mineral Reserves:**

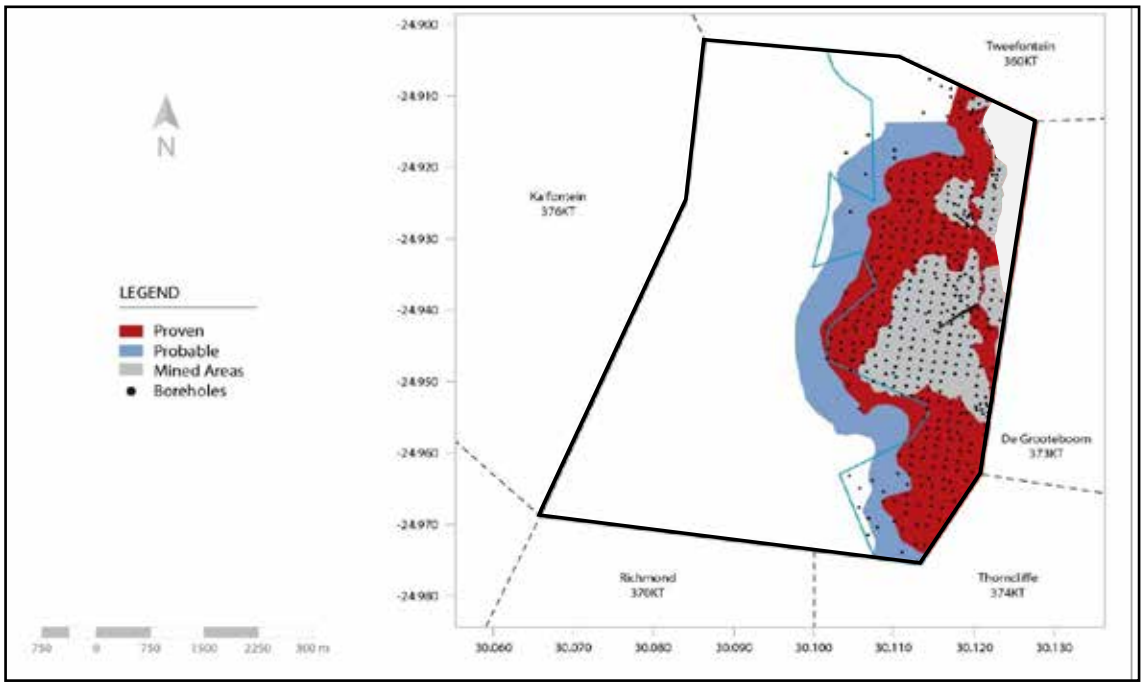
- 5% Geological loss applied for unknowns
- 2% Mining loss (Sweepings being done)
- 66% to 84% Extraction achieved

** Dwarsrivier Chrome Mine attributable interests (Assore 100%).*

# Assore subsidiary companies continued

## Dwarsrivier Chrome mine

### Dwarsrivier Chrome Mine Reserve classification




### Year-on-year change

**Year-on-year change 2018 to 2019 for declared Dwarsrivier Resources and Reserves**

| Resource classification | Mineral Resources Mt | $Cr_2O_3$% | FeO% | Reserve classification | Mineral Reserves Mt | $Cr_2O_3$% | FeO% |
|---|---|---|---|---|---|---|---|
| **Total Measured and Indicated 2019** | **78,08** | **37,09** | **22,23** | **Total reserves 2019** | **58,89** | **32,82** | **20,66** |
| Total Measured and Indicated 2018 | 81,52 | 37,13 | 22,30 | Total Reserves 2018 | 62,54 | 32,69 | 20,30 |
| **Inferred 2019** | **42,97** | **35,18** | **20,68** | | | | |
| Inferred 2018 | 42,97 | 35,18 | 20,64 | | | | |

The 2018/2019 mine design was conducted similarly to the previous year. The actual bottom contact of the SCS is still used to guide the design, with a consistent 0,40 m applied from the top contact of the SCS. The FHW undercutting sections have not yet been applied to the design as the project is ongoing. It will be rolled out as standard practice when the necessary rock-engineering and related supporting work is in place.

Measured and Indicated Resources decreased slightly by 4,2% to 78,08 Mt at 37,09% $Cr_2O_3$. Total Reserves have decreased with 5,8% to 58,89 Mt at 32,82% $Cr_2O_3$. The decrease is as a result of mining depletion.

A total of 2 196 436 t (of which 1 551 112 t is product tonnes) were mined during the FY2018/2019.

### Historical production at Dwarsrivier Chrome Mine

Production at Dwarsrivier has shown a slight decrease for FY2018/2019. The main contributing factor was social-related strikes in the area surrounding Dwarsrivier, to the extent that it prevented employees and material from reaching Dwarsrivier.

| Financial year | ROM Mt | Saleable Mt |
|---|---|---|
| 2013/2014 | 1,61 | 1,07 |
| 2014/2015 | 1,77 | 1,11 |
| 2015/2016 | 1,96 | 1,20 |
| 2016/2017 | 2,04 | 1,31 |
| 2017/2018 | 2,52 | 1,89 |
| 2018/2019 | 2,20 | 1,55 |

Dwarsrivier will continue at a planned steady state of 2,4 Mtpa but with sufficient flexibility to increase production should market demand increase.

# Assore subsidiary companies continued

## Wonderstone Pyrophyllite mine

### Wonderstone Limited (Wonderstone)

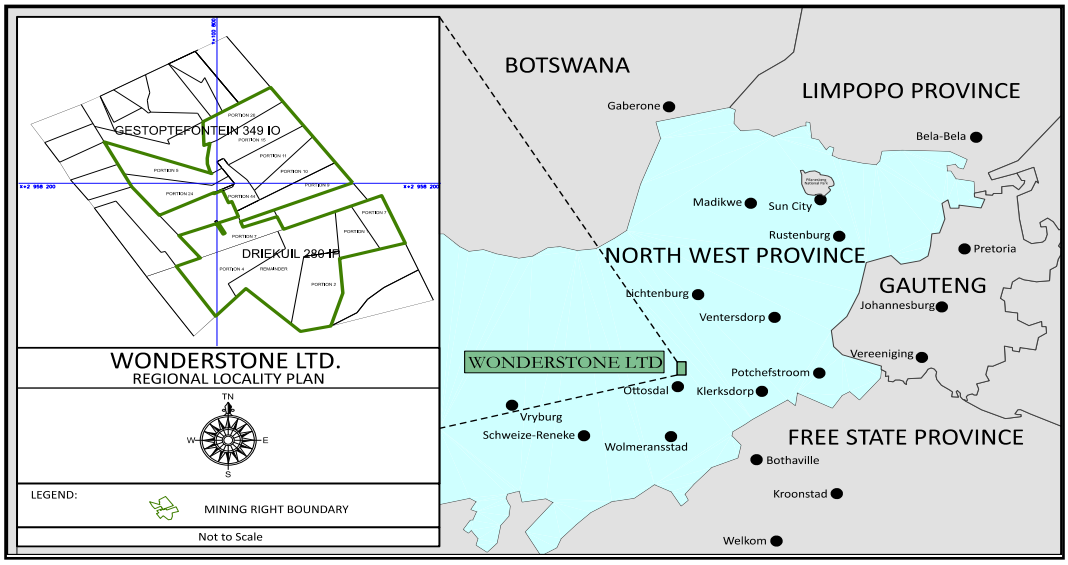
Assore owns 100% of Wonderstone.

### Locality

The Wonderstone pyrophyllite outcrop extends from the main deposit on Portion 44 of the farm Gestoptefontein 349 IO, south-east (as the twin layered deposit) for a distance of 5,5 km to the main Hartbeesfontein/Ottosdal road. To the north-west it extends another 400 m beyond the current mining area to the boundary of Portion 15 of the farm Gestoptefontein 349 IO (north-west boundary of the prospecting area).

Wonderstone is in the North West Province and situated approximately 12 km north of Ottosdal at latitude 26°44'7"S/longitude 25°59'49".

**Wonderstone locality map**




### History

Wonderstone mines a type of pyrophyllite which, for trade purposes, has been referred to as Wonderstone.

Mining commenced at the Wonderstone Mine in 1935.

A range of customised wear and acid-resistant tiles and ceramic products produced, are mainly used for chute wear liners in the local mining industry. Wonderstone is also used in the manufacture of industrial filtration solutions. The main wonderstone market areas are based in the United States of America, the United Kingdom and the Far East.

### Mining authorisation

| Farm | Legal entitlement | Mineral covered by Mining Right | Comment | Licence validity/ expiry date | Period of Mining Right (years) |
|---|---|---|---|---|---|
| Portion 44 of Gestoptefontein 349 IO | ML: ML1-97 to Converted MR: NW 30/1/2/2/398 MR | Pyrophyllite | The Converted Mining Right was executed on 24 April 2013 | 23 April 2043 | 30 |
| Re of and portions 5,7,9,10,11 24 RE of 15, 20 and 40 of Gestoptefontein 394 and portions 2,4, Re of 1, 7 and RE of Driekuil 280 | NW 30/5/1/2/239 7 MR | Pyrophyllite | New Order Mining Right as executed on 20 March 2019 | 19 March 2049 | 30 |

# Assore subsidiary companies continued

## Wonderstone Pyrophyllite mine

### Geology

Wonderstone is a non-fibrous type of pyrophyllite, an aluminium silicate of the phyllosilicate family, with the chemical formula $Al_2 Si_4 O_{10} (OH)_2$. It constitutes a very fine-grained compact mica of uniform texture and composition, the result of greenschist metamorphism of felsic tuff. It has a melting temperature of approximately 1 630°C.

The pyrophyllite forms part of the Syferfontein Formation of the Dominion Group and occurs as bands within a thick package of inclined felsic volcanics. The thickness of the main band is approximately 190 metres with the thinner tuff bands up to 20 metres thick. The outcropping formation has a north-westerly to south-easterly strike and dips in a south-westerly direction at angles of between 25° and 48° from the horizontal.

Wonderstone occurs in two shades of grey, dark and light. The lighter colour wonderstone is a result of some dehydration and oxidation, and is typically found at the surface, while the darker grey wonderstone occurs beneath it in the less weathered regions. The product is mined and sold based on customer colour demand, and grade is therefore not important. Flaws such as joints and minor felsic inclusions are avoided through the selective surface open-cast mining method.

Resistance to the destructive influences of weathering and corrosive agents, superior workability, strength and other useful qualities, are distinct in the commercial exploitation of this mineral.

### Exploration activities

The FY2018/2019 exploration expenditure for 830 m diamond drilled boreholes was R1,6 million. The boreholes were drilled on the western contact of the wonderstone, perpendicular to the ore body. The bore hole spacing was 200 m with average depths of 83 m. This exercise confirmed ore body continuity.

### Mining method and infrastructure

The open-cast operation mainly comprises hydraulic hammering and excavator loading with no drilling and blasting being necessary. About two to 10 percent of the material is cut and sold in its natural state as solid blocks and involves no beneficiation. The bulk of the material, is crushed, milled and reconstituted to produce high-precision components and powders to customers' specification.

### Mineral resources estimate

The market selection of wonderstone is based on the ore's visual and natural characteristics, ie colour and consistency in hardness, and it can therefore be classified as an industrial mineral.

The ore body outcrops across the farm. The Resource classification was done by considering geological parameters such as the continuity and overall behaviour of the Wonderstone obtained through mining, the outcropping material as well as borehole information. The boreholes were drilled at maximum 200 m spacing perpendicular to the dip angle. The purpose of the boreholes was to test for continuity and homogeneity. The collar positions of the drill holes were surveyed. Down-hole surveys were only done for the 10 most recent boreholes drilled during the FY2018/2019. Negligible deflection was detected on a few boreholes since all boreholes were drilled to a depth below surface not exceeding 80 m, which is relatively shallow. As a result of this, negligible deflection is also assumed to the previously drilled boreholes at similar depths. The exploration expenditure for 2019 was R1,6 million.

The resources consist of stockpiles and *in situ* tonnages. The classification into Measured, Indicated and Inferred Mineral Resources relates to the open-cast development and borehole spacing. The pit cut extent and stockpile tonnes are determined through surveying and the determined *in situ* and stockpile SG values. These mining depletion figures are deducted from the Resources and Reserves estimated in Microstation in 2D and 3D.

The Wonderstone Measured Resources are estimated below the natural ground level (NGL) and pit surface perimeter extend down to the current mining floor and includes stockpile tonnes. The Indicated Resources are estimated from the current mining floor down to 30 metres below NGL and vertically below the open-pit's extend (excluding the Measured Resources); whereas the Inferred Resources are estimated over the remaining drilled lease area to a depth of 30 m below NGL (excluding the Measured and Indicated Resources). Inferred Mineral Resources have not been included into feasibility studies or the Life of Mine Plan.

### Mineral Reserves

The Measured Resources are converted to the Proved Mineral Reserves, and the Indicated Resources to the Probable Resources, both with a 5% geological loss.

The SG of the *in situ* pyrophyllite is 2,64 t/m$^3$ whereas the SG of the stockpiles has been determined at 1,96 t/m$^3$.

# Assore subsidiary companies continued

## Wonderstone Pyrophyllite mine

### Wonderstone Mine: Mineral Resources and Reserves

| * Mineral Resources and Mineral Reserves are reported on a 100% basis. | WS | | | | |
|---|---|---|---|---|---|
| | Mineral Resources | | | Mineral Reserves | |
| | Measured (Mt) | Indicated (Mt) | Inferred (Mt) | Proved (Mt) | Probable (Mt) |
| NGL outcrop to current mining floor | 1,72 | | | 1,63 | |
| Stockpile | 5,82 | | | 5,53 | |
| Mining floor down to 30 m below NGL | | 9,90 | | | 9,40 |
| 30 m below NGL across prospecting area | | | 107,20 | | |
| **Total Wonderstone 2019** | **7,54** | **9,90** | **107,20** | **7,16** | **9,40** |
| Total Wonderstone 2018 | 7,69 | 9,90 | 107,20 | 7,30 | 9,40 |
| **Total 2019** | **17,44** | | | **16,56** | |
| Total 2018 | 17,59 | | | 16,70 | |

*The Measured and Indicated Mineral Resources are inclusive of those modified to produce Mineral Reserves.*
*Totals are rounded off.*

**Key assumptions for Resources and Reserves:**

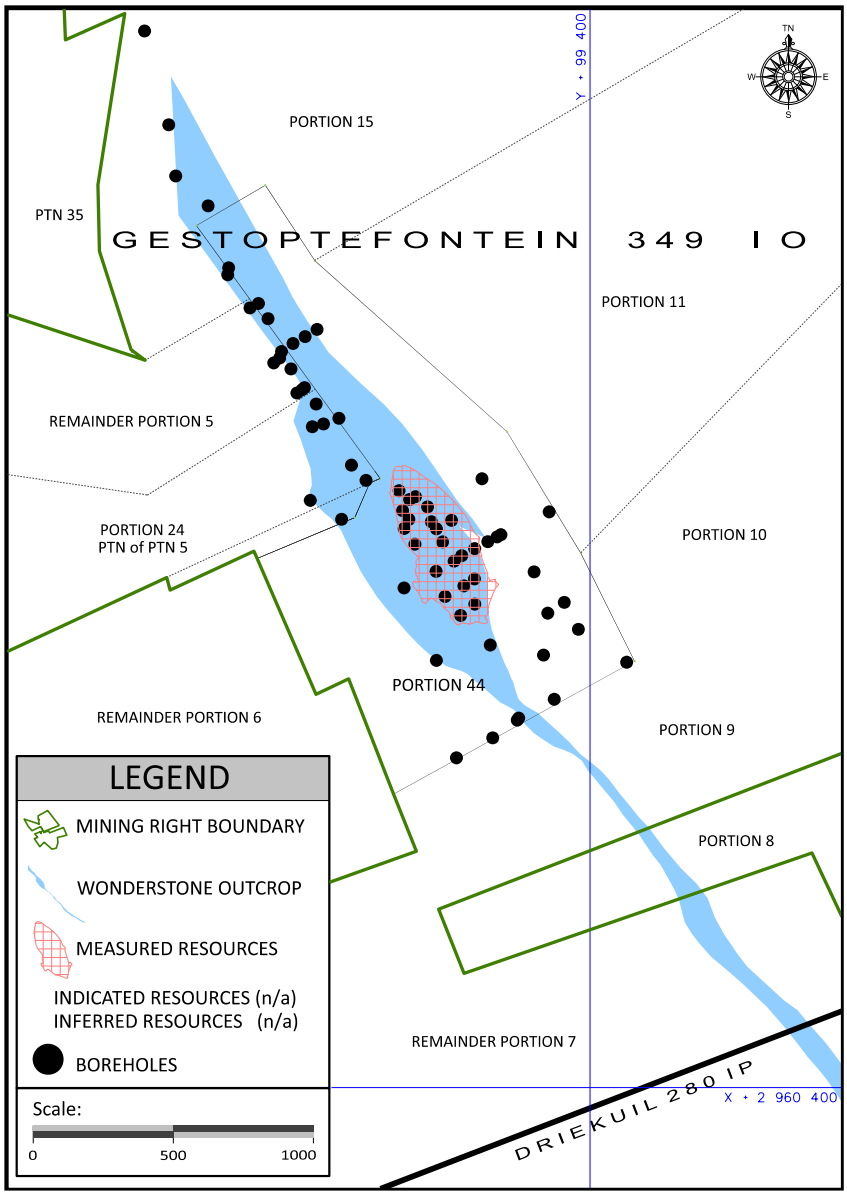
- Grade is relatively consistent across the Resources and Reserves at about 58,8% $SiO_2$ and 29,9% $Al_2O_3$.
- *In-situ* default density: 2,64 t/m³
- Stockpile default density: 1,96 t/m³

Modifying factors for the conversion of Mineral Resources to Reserves include:

- Geological loss: ~5%.

** Wonderstone Mine attributable interests (Assore 100%).*

### Wonderstone Resource classification




### Year-on-year change

151 477 t was mined and processed for the FY2018/2019 (as opposed to the 87 275 t for the FY2017/2018). This is an increase of 73,6%. The stockpile was depleted with 33 672 t.

# Glossary of terms

## Mass units

| | |
|---|---|
| **tonnes** | metric system unit of mass equal to 1 000 kilograms |
| **Mt** | million tonnes; metric system unit of mass equal to 1 000 000 metric tonnes |

## Grade units

| | |
|---|---|
| **% $Al_2O_3$** | weight percent Aluminium oxide |
| **% $Cr_2O_3$** | weight percent Chromium (III) oxide |
| **% Fe** | weight percent Iron |
| **% MgO** | weight percent Magnesium oxide |
| **% Mn** | weight percent Manganese |
| **% $SiO_2$** | weight percent Silicon dioxide |

## Professional organisations

| | |
|---|---|
| **ECSA** | Engineering Council of South Africa |
| **IMSSA** | Institute of Mine Surveyors of South Africa |
| **SACNASP** | South African Council for Natural Scientific Professions |

## Other abbreviations within the report

| | |
|---|---|
| **ARM** | African Rainbow Minerals Limited |
| **IAR** | Integrated Annual Report |
| **JSE** | Johannesburg Stock Exchange |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