THE MSA GROUP

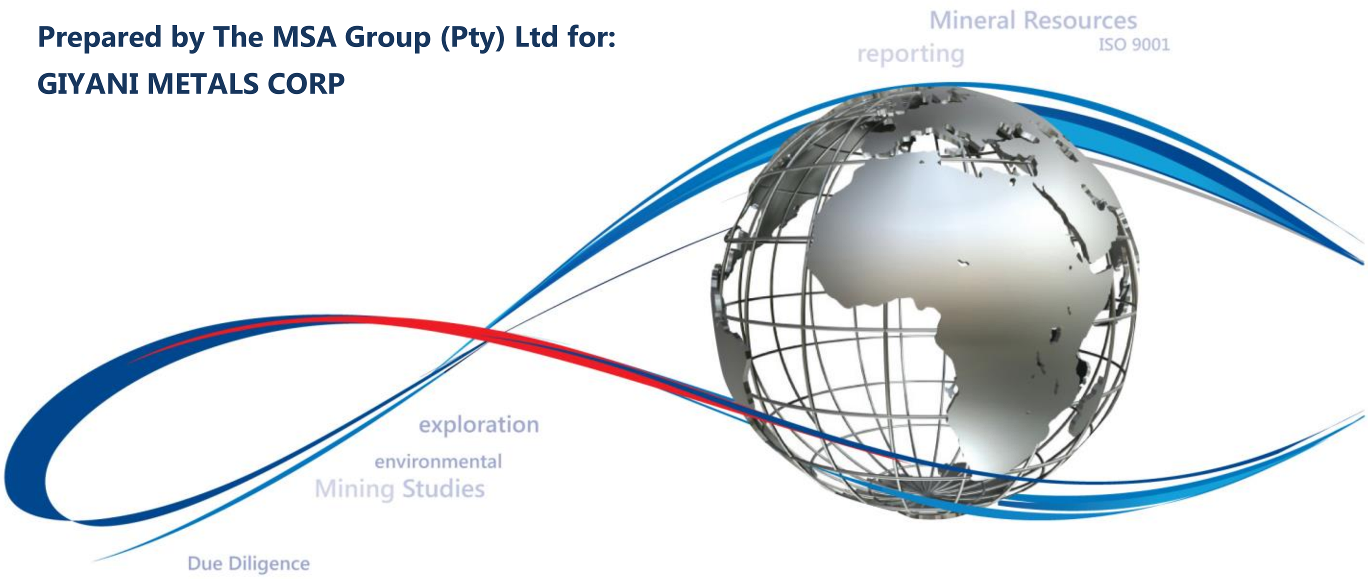
Specialist Consultants to the Mining Industry

GIYANI METALS CORP.

Mineral Resource Estimate for the K-Hill Manganese Project, Botswana

NI 43-101 Technical report

Prepared by The MSA Group (Pty) Ltd for:
GIYANI METALS CORP



Prepared By:

Edward Swindell	Pr. Sci. Nat., FGSSA
Jeremy Witley	Pr. Sci. Nat., FGSSA
Ian Flint	P. Eng.

Effective Date:	27 September 2018
Report Date:	08 November 2018
MSA Project No.:	J3839

IMPORTANT NOTICE

This report was prepared as a National Instrument NI 43-101 Technical Report for GIYANI METALS CORP. by The MSA Group (Pty) Ltd (MSA), South Africa. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in MSA's services, based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended for use by GIYANI METALS CORP. subject to the terms and conditions of its contract with MSA. Except for the purposes legislated under Canadian provincial securities law, any other uses of this report by any third party is at that party's sole risk.

The MSA Group (Pty) Ltd
Registration No: 2000/002800/07
Tel: +27 (0)11 880 4209 Fax: +27 (0)11 880 2184
email: info@msagroupservices.com
Henley House, Greenacres Office Park:
Cnr Victory and Rustenburg Roads, Victory Park, 2195
PO Box 81356, Parkhurst, 2120, South Africa
Directors: BJ Burnand, KD Scott, NN Buthelezi, SZ Majola

THE MSA GROUP

Specialist Consultants to the Mining Industry

CERTIFICATE OF QUALIFIED PERSON

I, Jeremy Charles Witley Pr. Sci. Nat. do hereby certify that:

1. I am Principal Mineral Resource Consultant of:

   The MSA Group (Pty) Ltd
   Greenacres Office Park
   Victory Road
   Victory Park, Gauteng, South Africa,
   2195

2. This certificate applies to the technical report titled "Giyani Metals Corp, Mineral Resource Estimate for the K-Hill Manganese Project, Botswana - NI 43-101 Technical Report" that has an effective date of 27 September 2018 and a report date of 08 November 2018 (the Technical Report).

3. I graduated with a degree in Mining Geology from The University of Leicester, UK in 1988. In addition, I have obtained a MSc (Eng.) from the University of Witwatersrand, South Africa in 2015.

4. I am registered with The South African Council for Natural Scientific Professions (SACNASP) and am a Fellow of the Geological Society of South Africa.

5. I have worked as a geologist for a total of 30 years during which time I have worked as a Mine Geologist, Exploration Geologist, Mineral Resource Manager and a Mineral Resource Consultant for several mining companies and mining consultancies.

6. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purposes of NI 43-101.

7. I visited the Kgwakgwe Hill property on the 7th and 8th of June 2018 for two days.

8. I am responsible for, or co-responsible for, the preparation of Items 1, 2, 3, 4 ,12, 14, 15-24, 25, 26 and 27 of the technical report.

9. I have not had prior involvement with the property that is the subject of the Technical Report.

10. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.

11. I am independent of the issuer according to the definition of independence described in section 1.5 of National Instrument 43-101.

12. I have read National Instrument 43-101 and Form 43-101F1 and, as of the date of this certificate, to the best of my knowledge, information and belief, those portions of the Technical Report for which I am responsible have been prepared in compliance with that instrument and form.

THE MSA GROUP

Specialist Consultants to the Mining Industry

The MSA Group (Pty) Ltd
Registration No: 2000/002800/07
Tel: +27 (0)11 880 4209 Fax: +27 (0)11 880 2184
email: info@msagroupservices.com
Henley House, Greenacres Office Park:
Cnr Victory and Rustenburg Roads, Victory Park, 2195
PO Box 81356, Parkhurst, 2120, South Africa
Directors: BJ Burnand, KD Scott, NN Buthelezi, SZ Majola

13. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

Dated this 08th Day of November 2018.

"signed and stamped"

Jeremy Charles Witley Pr. Sci. Nat.

THE MSA GROUP

Specialist Consultants to the Mining Industry

The MSA Group (Pty) Ltd
Registration No: 2000/002800/07
Tel: +27 (0)11 880 4209 Fax: +27 (0)11 880 2184
email: info@msagroupservices.com
Henley House, Greenacres Office Park:
Cnr Victory and Rustenburg Roads, Victory Park, 2195
PO Box 81356, Parkhurst, 2120, South Africa
Directors: BJ Burnand, KD Scott, NN Buthelezi, SZ Majola

CERTIFICATE OF QUALIFIED PERSON

I, Edward Swindell Pr. Sci. Nat. do hereby certify that:

1. I am an Associate Consultant of:

   The MSA Group (Pty) Ltd
   Greenacres Office Park
   Victory Road
   Victory Park, Gauteng, South Africa,
   2195

2. This certificate applies to the technical report titled "Giyani Metals Corp, Mineral Resource Estimate for the K-Hill Manganese Project, Botswana - NI 43-101 Technical Report" that has an effective date of 27 September 2018 and a report date of 08 November 2018 (the Technical Report).

3. I graduated with a B.Sc. (Hons) degree in Geology from the University of Cape Town in 1975. I also hold a M.Sc. (Exploration Geology) degree from Rhodes University and a B. Com. degree from the University of South Africa.

4. I am registered with The South African Council for Natural Scientific Professions (SACNASP) and am a Life Fellow of the Geological Society of South Africa.

5. I am a geologist with 42 years' experience in base and ferrous metals exploration and mining as well as Mineral Resource evaluation and reporting. This includes 28 years of experience specific to manganese mineralization.

6. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purposes of NI 43-101.

7. I visited the Kgwakgwe Hill property on the 7th and 8th of June 2018 for two days.

8. I am responsible for, or co-responsible for, the preparation of Items 1 to 12, 25, 26 and 27 of the technical report.

9. I have not had prior involvement with the property that is the subject of the Technical Report beyond a site visit on a single occasion in 1991.

10. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.

11. I am independent of the issuer according to the definition of independence described in section 1.5 of National Instrument 43-101.

12. I have read National Instrument 43-101 and Form 43-101F1 and, as of the date of this certificate, to the best of my knowledge, information and belief, those portions of the Technical Report for which I am responsible have been prepared in compliance with that instrument and form.

13. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

THE MSA GROUP

Specialist Consultants to the Mining Industry

The MSA Group (Pty) Ltd
Registration No: 2000/002800/07
Tel: +27 (0)11 880 4209 Fax: +27 (0)11 880 2184
email: info@msagroupservices.com
Henley House, Greenacres Office Park:
Cnr Victory and Rustenburg Roads, Victory Park, 2195
PO Box 81356, Parkhurst, 2120, South Africa
Directors: BJ Burnand, KD Scott, NN Buthelezi, SZ Majola

Dated this 08th Day of November 2018.

"signed and stamped"

Edward Swindell Pr. Sci. Nat.

The MSA Group (Pty) Ltd
Registration No: 2000/002800/07
Tel: +27 (0)11 880 4209 Fax: +27 (0)11 880 2184
email: info@msagroupservices.com
Henley House, Greenacres Office Park:
Cnr Victory and Rustenburg Roads, Victory Park, 2195
PO Box 81356, Parkhurst, 2120, South Africa
Directors: BJ Burnand, KD Scott, NN Buthelezi, SZ Majola

CERTIFICATE OF QUALIFIED PERSON

I, Ian Flint Ph.D., P. Eng. do hereby certify that:

1. I am a Metallurgical Consultant of:

   Lab4 Inc.,
   250-251 Windmill Road
   Dartmouth NS B3A 4P2, Canada

2. This certificate applies to the technical report titled "Giyani Metals Corp, Mineral Resource Estimate for the K-Hill Manganese Project, Botswana - NI 43-101 Technical Report" that has an effective date of 27 September 2018 and a report date of 08 November 2018 (the Technical Report).

3. I graduated with a degree in B.A.Sc., Geological Engineering, University of Toronto, Canada, in 1986, with an M.A.Sc Metallurgy and Materials Sci., University of Toronto, Canada, in 1989, and a Ph.D. in Mining and Mineral Processing, University of British Columbia in 2002.

4. I am a Registered Member of The Association of Professional Engineers and Geoscientists of British Columbia (APEGBC)

5. I have worked as a metallurgist for a total of 28 years during which time I have worked in process testing, pilot plants, circuit design, equipment design, and operations for developing mines and operating mining companies.

6. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purposes of NI 43-101.

7. I have visited the Kgwakgwe Hill property on the 7th of July 2017 for one day.

8. I am responsible for, or co-responsible for, the preparation of Items 1 and 13 of the technical report.

9. I have not had prior involvement with the property that is the subject of the Technical Report.

10. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.

11. I am independent of the issuer according to the definition of independence described in section 1.5 of National Instrument 43-101.

12. I have read National Instrument 43-101 and Form 43-101F1 and, as of the date of this certificate, to the best of my knowledge, information and belief, those portions of the Technical Report for which I am responsible have been prepared in compliance with that instrument and form.

13. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

THE MSA GROUP

Specialist Consultants to the Mining Industry

The MSA Group (Pty) Ltd
Registration No: 2000/002800/07
Tel: +27 (0)11 880 4209 Fax: +27 (0)11 880 2184
email: info@msagroupservices.com
Henley House, Greenacres Office Park:
Cnr Victory and Rustenburg Roads, Victory Park, 2195
PO Box 81356, Parkhurst, 2120, South Africa
Directors: BJ Burnand, KD Scott, NN Buthelezi, SZ Majola

Dated this 08th Day of November 2018.

"signed and stamped"

Ian Flint P. Eng.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 SUMMARY

The MSA Group (Pty) Ltd (MSA) has been commissioned by Giyani Metals Corp. (Giyani or the Company) to undertake a maiden Mineral Resource estimate and an Independent Technical Report on the Company's Kgwakgwe Hill Project (the Project or K-Hill), located in the Republic of Botswana, in which the Company has an 88% interest.

The Mineral Resource estimate has been completed under the supervision of Mr. J. C. Witley (BSc Hons, MSc (Eng.)) who is a geologist with 30 years' experience in base and precious metals exploration and mining as well as Mineral Resource evaluation and reporting. He is a Principal Mineral Resource Consultant for The MSA Group (an independent consulting company), is registered with the South African Council for Natural Scientific Professions (SACNASP) and is a Fellow of the Geological Society of South Africa (GSSA). Mr. Witley has the appropriate relevant qualifications and experience to be considered a "Qualified Person" for the style and type of mineralization and activity being undertaken as defined in National Instrument 43-101 Standards of Disclosure of Mineral Projects.

The exploration results have been reviewed by Mr. E. P. W. Swindell (BSc Hons, BCom, MSc (Exploration Geology)) who is a geologist with 42 years' experience in base and ferrous metals exploration and mining as well as Mineral Resource evaluation and reporting. This includes 28 years of experience specific to manganese mineralization. He is an Associate Consultant for The MSA Group (an independent consulting company), is registered with the South African Council for Natural Scientific Professions (SACNASP) and is a Life Fellow of the Geological Society of South Africa (GSSA). Mr. Swindell has the appropriate relevant qualifications and experience to be considered a "Qualified Person" for the style and type of mineralization and activity being undertaken as defined in National Instrument 43-101 Standards of Disclosure of Mineral Projects.

Giyani engaged Dr Ian Flint to provide Item 13 - Mineral Processing and Metallurgical Testing. Dr Flint (BASc, MASc, PhD) is a metallurgist with 28 years' experience in in process testing, pilot plants, circuit design, equipment design, and operations for developing mines and operating mining companies. Dr Flint is a Metallurgical Consultant for Lab4 Inc. (an independent consulting company), and a registered member of the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC). Dr Flint has the appropriate relevant qualifications and experience to be considered a "Qualified Person" for the style and type of mineralization and activity being undertaken as defined in National Instrument 43-101 Standards of Disclosure of Mineral Projects.

1.1 Property Description, Location and Ownership

K-Hill is located next to the town of Kanye, which is the administrative center of the Southern District of the Republic of Botswana in southern Africa. The project area is accessed by a short section of unpaved roads and tracks from a network of paved national roads, namely the A1 and A2, with the A2 highway being just a few kilometres from the project.

The mineral rights are owned by the Republic of Botswana. Giyani, through Menzi Battery Minerals, holds the exclusive right to engage in prospecting activities for "Metals" within the Project area through the issued prospecting permit in terms of Section 16 of the Mines and Minerals Act of the Republic of Botswana. The K-Hill project is located within Prospecting Licence No. 322/2016. The

K-Hill prospecting area is 878 km^2 of the total area of 8,283.30 km^2 that Menzi Battery Minerals holds prospecting rights to. The K-Hill prospecting licence (PL322/2016**)** is valid from the 1st January 2017 until the 31st of December 2019. Giyani owns an 88% stake in Menzi Battery Minerals, while the other 12% is owned by Marcell Holdings.

The surface areas at the Project are managed and owned by local authorities.

1.2 History

Historical mining in the Kanye area took place from 1957 to 1971. The first company to operate at Kgwakgwe Hill was Marble Lime and Associated Industries (Marble Lime), which also developed the asbestos mine at Moshaneng, northwest of Kgwakgwe Hill. Marble Lime mostly mined manganiferous shale, which was beneficiated before it was sold. Marble Lime ceased mining activities around 1967 (Aldiss, 1989).

Johannesburg Consolidated Investments Co. Ltd. (JCI) undertook exploration activities in the late 1960's and early 1970's and estimated that there were about 120,000 tonnes of "marketable ore" that could be extracted from the shale horizon at K-Hill. Thereafter, Rand Mines estimated approximately 1.6 Mt of manganese shale, of which 60% could be extracted (Aldiss, 1989).

In 1981, Rand London Manganese investigated the possibility of mining the manganiferous shale deposits at Kgwakgwe, Otse and Gopane (near Lobatse) together feeding a single planned processing plant at Lobatse. The Kgwakgwe deposit was considered to require further drilling for evaluation, but no further work was completed and the licence was relinquished within a year (Aldiss, 1989).

1.3 Geology and mineralization

The stratigraphy in the K-Hill area consists predominantly of late Archean to early and middle Proterozoic rocks from the Ventersdorp (meta-volcanics) and Transvaal (meta-sedimentary) Supergroups, as well as the Gaborone Granite (intrusives) and Waterberg (sedimentary) Groups (Key and Ayres, 2000).

The manganese mineralization at K-Hill occurs primarily as a supergene enriched manganiferous shale (the Mn-Shale) occurring in the upper portion of a shale horizon within the Black Reef Quartzite Formation of the Transvaal Supergroup. The quartzite package underlying the shales, rests unconformably on Archaean felsites of the Kanye Volcanic Group. The shales are overlain by chert breccias.

The K-Hill deposit is more or less kidney shaped, with a northern and a southern portion. The manganese shale outcrops along scarp slopes of the Kgwakgwe Hill. The northerly portion is elongated northwest over an area of approximately 400 m by 300 m and the average thickness of the mineralization in this area is 3.5 m. The southerly area of mineralization is elongated northeast over an area of approximately 570 m by 200 m, and has an average thickness of 2.0 m.

1.4 Drilling

Giyani carried out drilling from April to June 2018 at K-Hill. Drillholes were located within the northern and southern portion of the deposit. Holes in the northern portion were drilled along three northwest striking lines approximately 50 m and 130 m apart. The holes were drilled at approximately 100 m spacing along the lines. Holes in the southern portion of the deposit were drilled along a single north-northeast striking line with holes at approximately 100 m apart along the line.

A total of eighteen vertical holes were drilled at K-Hill; seventeen were for exploration purposes and one was for metallurgical test-work. Triple tube coring was utilised for drilling, and standard operating procedures (SOPs) were in place to guide the drilling work.

A total of 1,109.03 m was drilled, with 368 core samples assayed together with 57 quality control (QC) samples. Drilling data are stored in Microsoft Excel spreadsheets, which make up the database. Drilling recovery was poor, however statistical assessments demonstrated that there is no correlation between recovery and grade. Therefore, the QP considers the sample data to be adequate for Mineral Resource estimation, albeit at low confidence.

1.5 Sample Preparation, Analysis and Security

Sample preparation and analyses were conducted at SGS laboratory in Randfontein, South Africa. Samples were dispatched by ARAMEX couriers. A chain of custody was maintained by signature at every point the samples exchanged hands, from the core shed in Kanye, where the samples were stored, to the laboratory.

Samples were weighed and dried upon arrival at SGS. Thereafter, the samples were dried and crushed to 75% passing through a 2 mm screen. A 500 g sub-sample was collected that was then pulverized to 85% passing through a 75 µm screen.

Major element chemistry was analysed using XRF on samples subjected to borate fusion. A pulverized sub-sample between 0.2 g and 0.7 g was mixed with 10 g of flux. This mixture was fused to create a bead, which was analysed using XRF. A loss on ignition analyses was also carried out through roasting 1 g of the pulverised sample at 1000 °C.

QC samples were routinely inserted within the drillhole sample stream as part of an independent QAQC process. The type of QC samples used included certified reference material (CRM), blanks and coarse duplicates. As an additional check, 40 of the samples analysed at SGS were assayed by Intertek Genalysis laboratory in Maddington, Australia.

The CRM analyses for Al_2O_3, CaO, Fe_2O_3, MnO, MgO, P_2O_5 and SiO_2 were within three standard deviations of the certified values of AMIS0403, except for one Al_2O_3 assay that was outside the three standard deviation tolerance limits. The assays did not show significant bias, with none exceeding 4% relative difference from the certified values. This indicates acceptable accuracy in the overall analyses of the CRM samples.

Analyses of blank samples were also undertaken for Al_2O_3, CaO, Fe_2O_3, MgO, MnO and P_2O_5. The blank sample assay results indicate that the level of possible contamination within the K-Hill samples was insignificant.

The coarse duplicate assays completed by SGS demonstrate precision within expected ranges, with the correlation coefficients for all the variables at approximately 1.

The manganese assays of the AMIS0407 CRM included with the second laboratory check samples were within two standard deviations of the certified value. This demonstrates good analytical accuracy of the check assays conducted by Intertek Genalysis. The second laboratory check assays for manganese showed no bias with the primary laboratory assay, the correlation coefficient between these two assay datasets is approximately 1.

Given the results of the external QAQC measures applied at K-Hill, the QP is satisfied that the assays are of sufficient quality for use in Mineral Resource estimation.

1.6 Data verification

A site visit to K-Hill was undertaken on 07 and 08 June 2018 by the QPs, Mr Ed Swindell and Mr Jeremy Witley. The purpose of the site visit was to inspect the site, review the drilling and sampling procedures and inspect the cores. Observations made of the mineralization in the cores are consistent with the grade ranges of the assay values received from the laboratory.

Giyani carried out drilling at K-Hill in April and May 2018. The site-visit by the Qualified Persons took place shortly after the drilling was completed and the contractor had left the K-Hill site. The Qualified Persons observed the drilling sites and the marked collar positions of the completed holes during the site visit and confirmed a number of locations using a hand-held GPS.

The sample assay database was verified by comparing 10% of the values shown on the assay certificates issued by SGS with the values in the database. No errors were found.

In the opinion of the QPs, the database is adequate for the purpose of Mineral Resource estimation.

1.7 Metallurgical Testwork

Testing was carried out by Dr Ian Flint of Lab 4 Inc., the department of Geology of Dalhousie University and the Minerals Engineering Centre of Dalhousie University, all of Halifax, Nova Scotia, Canada. This work included the mineralogical characterisation and initial leaching test-work on samples taken from cores of a single drillhole at K-Hill.

The proposed process for beneficiation of the K-Hill Mineral Resource is comminution followed by leaching, solvent/liquid extraction and electrowinning. This process should be capable of taking an initial grade of Mn to produce electrolytic manganese (EMn).

Initial leaching tests were performed to suggest a chemistry for the leaching. These tests were designed to determine the overall leaching methods and not to quantify any individual sample.

In the QP’s opinion, the results of the leaching tests are promising in that manganese recovery was good. The resulting solution contained as high as 35,000 ppm Mn making it suitable for the solvent/liquid extraction process. In addition, some iron was rejected and the level of other contaminate metals were low. These results give a good probability of proper functioning of subsequent stages of the solvent/liquid extraction process.

1.8 Mineral Resource Estimates

The Mineral Resource estimate was based on geochemical analyses and density measurements of core samples obtained by diamond drilling that was undertaken by Giyani. A total of 18 vertical holes were drilled at K-Hill. Two of the drillholes were drilled outside the area underlain by manganese shale and one was drilled for metallurgical purposes. The manganese shale is not developed in one of the holes and two intersected cavities (presumably underground workings). Of the twelve that intersected manganese shale, one was not used in estimation due to very poor recovery and another did not intersect the targeted high-grade layer in the manganese shale. Therefore, ten drillhole intersections were available to estimate the high-grade layer that comprises the Mineral Resource.

The logging data from the drillholes were used to construct a three-dimensional geological model of the major stratigraphic units. The high-grade mineralization within the manganese shale was defined by a 15% MnO threshold. The major oxide grades, including MnO, and density were estimated using inverse distance squared into a three-dimensional block model based on the geological and mineralization model. An adjustment to the modelled tonnage was made to account for historical mining.

The Mineral Resource was estimated using The Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Best Practice Guidelines and is reported in accordance with the 2014 CIM Definition Standards, which have been incorporated by reference into National Instrument 43-101 – Standards of Disclosure for Mineral Projects (NI 43-101). The Mineral Resource is classified into the Inferred category as shown in Table 1-1.

The Mineral Resource is reported at a cut-off grade of 18% MnO. Given reasonably assumed high-level cost and revenue assumptions, MSA considers that mineralization at this cut-off grade will satisfy the test for reasonable prospects for eventual economic extraction (RPEEE). It should be noted that the cost and revenue assumptions are conceptual in nature and would not satisfy the requirements of a Preliminary Economic Assessment (PEA) in terms of NI 43-101. It should also be noted that Mineral Resources that are not Mineral Reserves, do not have demonstrated economic viability and the economic parameters used to assess the potential for economic extraction is not an attempt to estimate Mineral Reserves, the level of study so far carried out being insufficient with which to do so.

Table 1-1 K-Hill Mineral Resource at a cut-off grade of 18% MnO, 27 September 2018						
Category	**Tonnes (Millions)**	**MnO %**	**Al_2O_3 %**	**SiO_2 %**	**Fe_2O_3 %**	**LOI %**
Inferred	1.1	31.2	8.9	26.3	16.9	8.8

Notes:

1. *All tabulated data have been rounded and as a result minor computational errors may occur.*
2. *Mineral Resources which are not Mineral Reserves have no demonstrated economic viability.*
3. *LOI = Loss on ignition*
4. *Density determination was on undried samples and tonnages are reported as wet.*
5. *The cut-off grade calculation was based on the following assumptions:*
   EMM price of USD2,500/t (FOB)
   Mining cost of USD35/t
   Processing cost of USD75/t
   G and A cost of USD15/t
   Transport of USD50/t EMM
   Recovery of 60% Mn

1.9 Recommendations

The QPs recommend the following work programme:

- Complete a Preliminary Economic Assessment (PEA) in order to improve the understanding of the economic merits of the Project. Of particular importance is further metallurgical test-work.
    - Estimated cost of USD120,000.
- Should the PEA be encouraging, conduct further exploration to improve confidence in the Mineral Resource in order to upgrade part or all of the Inferred Mineral Resource into the Indicated category:
    - Infill drilling to complete a 100 m grid over the entire deposit, with a focus on improving sample recovery,
        - It is estimated that a further 35 diamond drillholes will be required, with an average length of 40 m. At an all-in cost of USD265 per metre, the total estimated cost will be in the order of USD329,000.
    - Complete an accurate digital terrain model through a detailed topographic survey.
        - Estimated cost of USD 2,000
    - Survey the historically mined out areas below the Kgwakgwe Hill, if safe to do so.
        - Estimated cost of USD 20,000.

The QP considers that the project warrants further exploration of expenditure in the order of that outlined above.

2 INTRODUCTION

2.1 Scope of Work

Giyani Metals Corp (Giyani or the Company) is a junior resource company trading on the Toronto Venture Exchange (TSX-V) under the stock symbol WDG, and on the Frankfurt Stock Exchange under the stock symbol KT9:GR. Giyani is focussed on the development of manganese projects in the Republic of Botswana aimed at supplying manganese to the battery industry.

The MSA Group (Pty) Ltd (MSA) has been commissioned by Giyani to undertake a maiden Mineral Resource estimate and an Independent Technical Report on the Company's Kgwakgwe Hill Project (the Project or K-Hill) located in the Republic of Botswana, in which the Company has an 88% interest. The maiden Mineral Resource estimate was announced by Giyani in a press release on 28 September 2018.

This Independent Technical Report has been prepared to comply with disclosure and reporting requirements set forth in the Toronto Venture Exchange (TSX-V) Corporate Finance Manual, Canadian National Instrument 43-101, Companion Policy 43-101CP, Form 43-101 F1, the 'Standards of Disclosure for Mineral Projects' of January 2006 (the Instrument) and the Mineral Resource and Reserve classifications adopted by CIM Council on the 10th May 2014.

2.2 Principal Sources of Information

MSA has based its review of the property on information provided by Giyani along with technical reports by government agencies and previous tenements holders, and other relevant published and unpublished data. A listing of the principal sources of information is included at the end of this Independent Technical Report. The QPs have endeavoured, by making all reasonable enquiries, to confirm the authenticity and completeness of the technical data upon which the Independent Technical Report is based. A final draft of the report was also provided to Giyani, along with a written request to identify any material errors or omissions prior to lodgement.

A personal; inspection of the Project was made on 07 and 08 June 2018 by Mr Swindell and Mr Witley, both of MSA and on 07 July 2017 by Dr Ian Flint of Lab4 Inc.

The Independent Technical Report has been prepared on information available up to and including 20 July 2018.

Giyani's K-Kill mineral property is considered to represent an exploration project which is inherently speculative in nature. However, MSA considers that the property has been acquired on the basis of sound technical merit. The property is also generally considered to be sufficiently prospective, subject to varying degrees of exploration risk, to warrant further exploration and assessment of its economic potential, consistent with the proposed programmes.

All monetary figures expressed in this report are in United States of America dollars (USD) unless otherwise stated.

2.3 Qualifications, Experience and Independence

MSA is an exploration and resource consulting and contracting firm, which has been providing services and advice to the international mineral industry and financial institutions since 1983. This report has been compiled by the QPs, Mr Ed Swindell (Associate Consultant to the MSA Group), Mr Jeremy Witley (Principal Mineral Resource Consultant, the MSA Group) and Dr Ian Flint (Metallurgy Consultant, Lab4 Inc.)

Mr. J.C. Witley (BSc Hons, MSc (Eng.)) is a geologist with 30 years' experience in base and precious metals exploration and mining as well as Mineral Resource evaluation and reporting. He is a Principal Mineral Resource Consultant for The MSA Group (an independent consulting company), is registered with the South African Council for Natural Scientific Professions (SACNASP) and is a Fellow of the Geological Society of South Africa (GSSA). Mr. Witley has the appropriate relevant qualifications and experience to be considered a "Qualified Person" for the style and type of mineralization and activity being undertaken as defined in National Instrument 43-101 Standards of Disclosure of Mineral Projects.

Mr. E. P. W. Swindell (BSc Hons, BCom, MSc (Exploration Geology)) is a geologist with 42 years' experience in base and ferrous metals exploration and mining as well as Mineral Resource evaluation and reporting. This includes 28 years of experience specific to manganese mineralization. He is an Associate Consultant for The MSA Group (an independent consulting company), is registered with the South African Council for Natural Scientific Professions (SACNASP) and is a Life Fellow of the Geological Society of South Africa (GSSA). Mr. Swindell has the appropriate relevant qualifications and experience to be considered a "Qualified Person" for the style and type of mineralization and activity being undertaken as defined in National Instrument 43-101 Standards of Disclosure of Mineral Projects.

Giyani engaged Dr Ian Flint to provide Item 13 Mineral Processing and Metallurgical Testing. Dr Flint (BASc, MASc, PhD) is a metallurgist with 28 years' experience in in process testing, pilot plants, circuit design, equipment design, and operations for developing mines and operating mining companies. Dr Flint is a Metallurgy Consultant for Lab4 Inc. (an independent consulting company), and a registered member of the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC). Dr Flint has the appropriate relevant qualifications and experience to be considered a "Qualified Person" for the style and type of mineralization and activity being undertaken as defined in National Instrument 43-101 Standards of Disclosure of Mineral Projects.

Neither MSA, nor the authors of this report, has or has had previously, any material interest in Giyani or the mineral properties in which Giyani has an interest. Our relationship with Giyani is solely one of professional association between client and independent consultant. This report is prepared in return for professional fees based upon agreed commercial rates and the payment of these fees is in no way contingent on the results of this report.

3 RELIANCE ON OTHER EXPERTS

The QPs, as authors of this report, have relied on the following sources of information in respect of mineral tenure and environmental matters pertaining to the Project.

3.1 Mineral Tenure

The mineral rights are owned by the Republic of Botswana. Giyani, through Menzi Battery Minerals, holds the exclusive right to engage in prospecting activities for "Metals" within the Project area through the issued prospecting permit in terms of Section 16 of the Mines and Minerals Act of the Republic of Botswana. The K-Hill project is located within Prospecting Licence No. 322/2016. This licence covers 878 km^2 of the total area of 8,283.30 km^2 that Menzi Battery Minerals holds prospecting rights to and is valid from the 1st January 2017 until the 31st of December 2019. Giyani owns an 88% stake in Menzi Battery Minerals, while the other 12% is owned by Marcell Holdings.

MSA has not independently verified, nor is it qualified to verify, the legal status of these concessions. The present status of tenements listed in this report is based on information and copies of documents provided by Giyani, and the report has been prepared on the assumption that the tenements will prove lawfully accessible for evaluation.

3.2 Environmental Matters

Giyani contracted the services of Loci Environmental (Pty) Ltd to undertake Environmental Screening studies for its projects in Botswana, including K-Hill, in August 2018. No fatal flaws were identified during this process.

Giyani received a request from the Department of Environmental Affairs (DEA) of Botswana to complete an Environmental Management Plan (EMP) for the K-Hill prospect area. Under this EMP Giyani will have clearance to conduct exploration and evaluation work including but not limited to geophysics and other non-invasive exploration techniques, drilling and sampling.

Giyani will be required to do a detailed Environmental Impact Assessment (EIA) before any mining and/or processing can commence.

Similarly, neither MSA nor the authors of this report are qualified to provide comment on any environmental issues associated with the K-Hill Project.

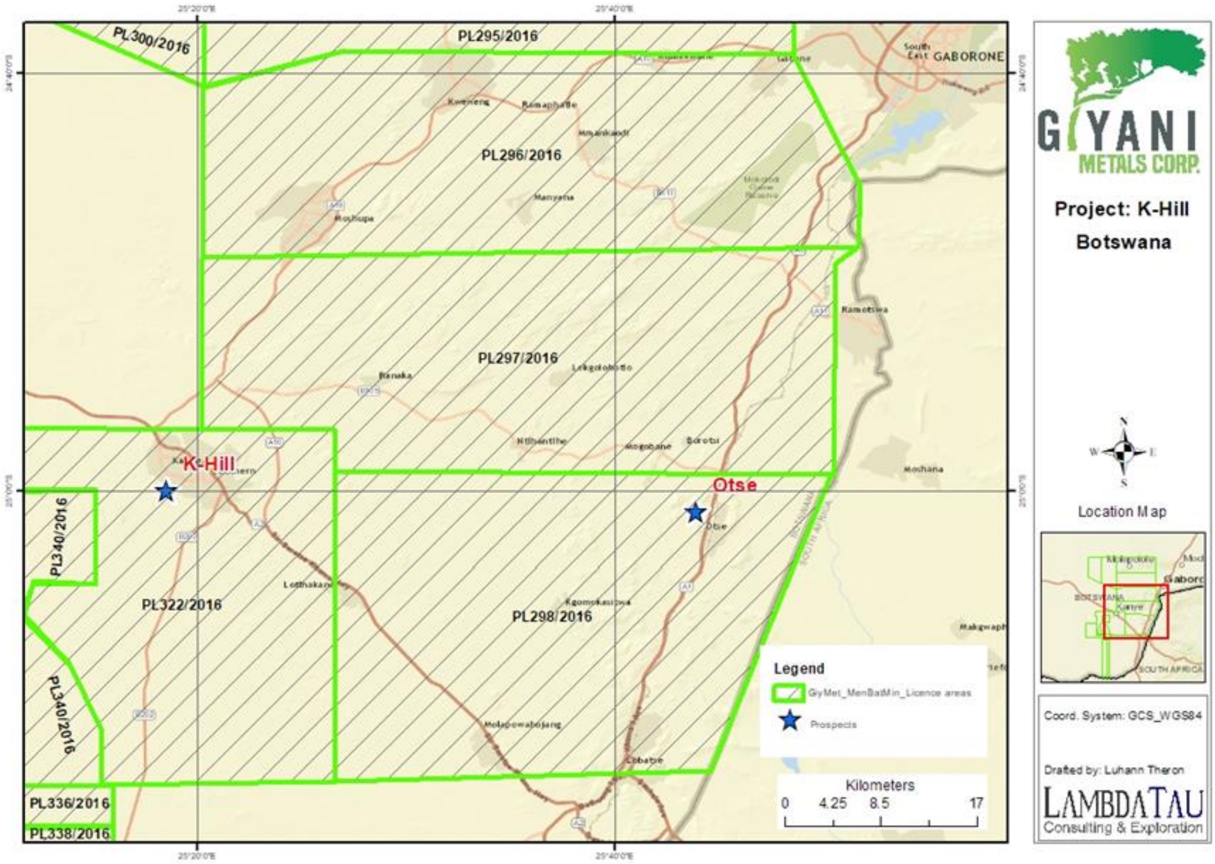
No warranty or guarantee, be it express or implied, is made by MSA with respect to the completeness or accuracy of the legal or environmental aspects of this document. MSA does not undertake or accept any responsibility or liability in any way whatsoever to any person or entity in respect of these parts of this document, or any errors in or omissions from it, whether arising from negligence or any other basis in law whatsoever.

4 PROPERTY DESCRIPTION AND LOCATION

4.1 Location

K-Hill is located next to the town of Kanye, which is the administrative center of the Southern District of the Republic of Botswana in southern Africa. K-Hill is accessed by a short section of unpaved roads and tracks from a network of paved national roads, namely the A1 and A2, with the A2 being just a few kilometres from the project. Gaborone, the governmental and economic capital city of Botswana is approximately 100 km by paved road from Kanye (Figure 4-1).

Figure 4-1
Location of the K-Hill prospect



Source: Theron, 2017

4.2 Project Ownership

The entire Giyani project area extends over 8,283.3 km^2 of tenements, with the K-Hill project in an 878 km^2 licence area, held under the Botswana registered entity, Menzi Battery Minerals. Giyani owns an 88% stake in Menzi Battery Minerals, while the other 12% is owned by Marcell Holdings.

4.3 Mineral Tenure

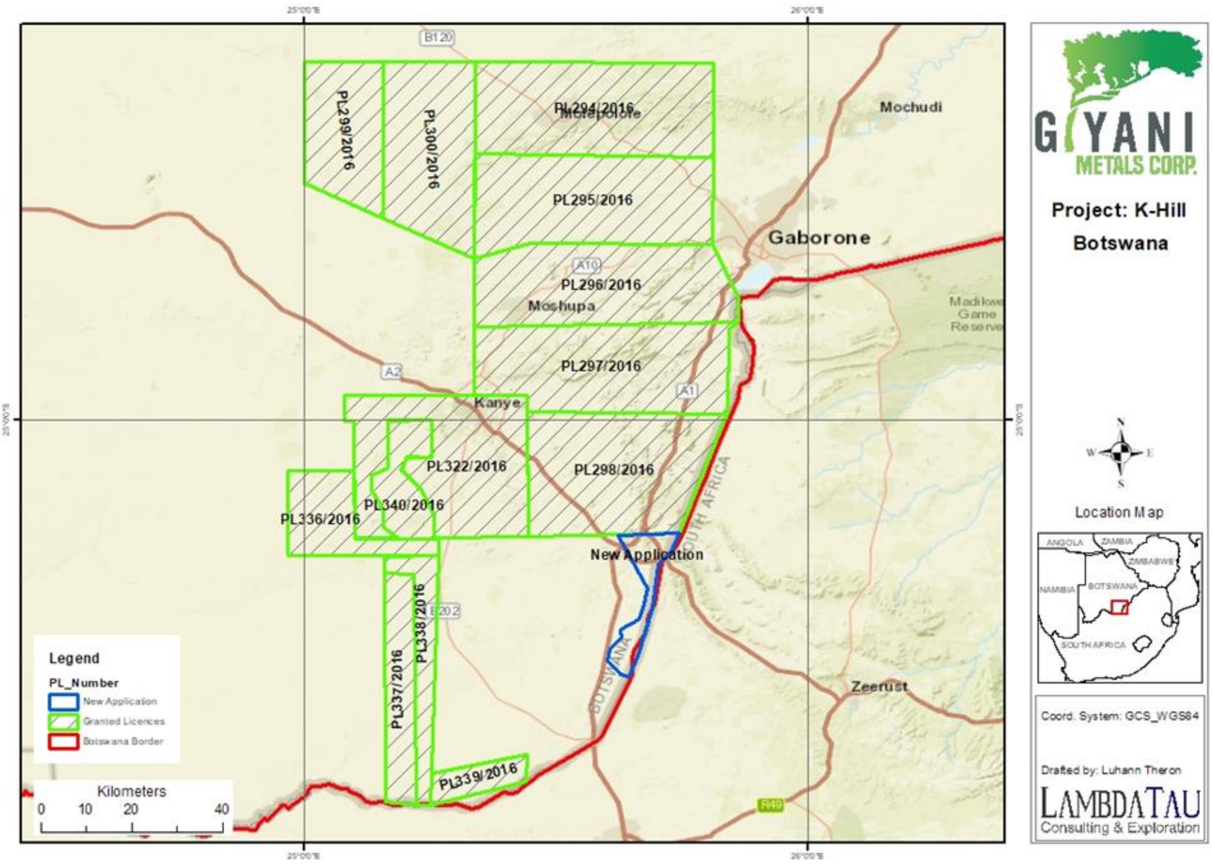
Giyani holds the exclusive right to engage in prospecting activities for "Metals" within the Project area through prospecting permits issued in terms of Section 16 of the Mines and Minerals Act of the Republic of Botswana. The K-Hill project is located within Prospecting Licence No. 322/2016. All the Giyani prospecting licenses, through Menzi Battery Minerals, are valid from the 1st of January 2017 until the 31st of December 2019 except for PL258/2017 (Table 4-1). According to the Mines and Mineral Act, the holder of a prospecting licence may, at any time not later than three months before the expiry of such licence, apply for renewal of the prospecting licence and shall be entitled to the grant of no more than two renewals thereof, each for the period applied for, which periods shall not in either case exceed two years, provided that-(a) the applicant is not in default; and (b) the proposed programme of prospecting operations is adequate.

The location of the Prospecting Licence No. 322/2016 in relation to Giyani's other permits is shown in Figure 4-2.

Table 4-1
Summary of Giyani's licence holdings in Botswana

Licence number	Licence holder	Issue date	Licence type	Expiry date	Size (km^2)
PL294/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	978.88
PL295/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	950.41
PL296/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	914.94
PL297/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	963.12
PL298/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	937.05
PL299/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	483.55
PL300/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	721.35
PL322/2016	**Menzi Battery**	**01-Jan-17**	**Prospecting**	**31-Dec-19**	**878.00**
PL336/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	308.00
PL337/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	302.00
PL338/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	237.00
PL339/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	152.00
PL340/2016	Menzi Battery	01-Jan-17	Prospecting	31-Dec-19	309.00
PL258/2017	Menzi Battery	01-Jan-18	Prospecting	31-Dec-20	148.00
				TOTAL	**8,283.30**

Figure 4-2
Location of Giyani's licence holdings in Botswana



Source: Theron, 2017

4.4 Surface Rights

The Ngwaketse Land Board granted permission to Giyani to access the land at Kgwakgwe Hill. The larger area around Kgwakgwe Hill is managed by the Ngwaketse Tribal Administration who manage the land on behalf of the community across parts of the larger area of the Project.

Water for drilling was sourced from the Mmamokhasi Dam. Permission to use the water was granted by the Mmamokhasi Dam Group. A written agreement to that effect has since expired however, no issues for utilizing this water source for future activities is envisaged.

4.5 Property Obligations and Agreements

According to Section 70 of the Mines and Minerals Act of the Republic of Botswana, the Licence Holder at the time of issue of this licence and on each anniversary thereafter is required to pay to the Office of the Director of Department of Mines, an annual charge equal to five Botswana Pula (BWP5.00) multiplied by the number of square kilometres in the Licence Area subject to a minimum annual charge of One Thousand Pula (BWP1,000.00).

Giyani, through Menzi Battery Minerals, is expected to carry out the prospecting operations set out in the prospecting licence (Table 4-2).

Table 4-2
Programme of prospecting operations for the K-Hill Prospecting Licence No. 322/2016

Programme of prospecting operations	Proposed minimum expenditure
Year 1: Desktop Study and Reconnaissance i. Compilation and interpretation of historical geological and exploration data. ii. Interpretation of all magnetic and gravity data sets. iii. Collation and interpretation of historical exploration and water drilling data. iv. Reconnaissance geophysical surveys.	Two hundred thousand Pula (BWP200,000)
Year 2: Geophysical Survey and Drilling i. High resolution geophysical surveys, data processing and interpretation. ii. Reconnaissance reverse circulation scout drilling, chip sampling and analysis.	Seven hundred and fifty thousand Pula (BWP750,000)
Year 3: Detailed Drilling and Evaluation i. Detailed grid based reverse circulation and diamond core drilling ii. Detailed geological (lithology and structure) logging of sample cores iii. Sampling and analysis of core to determine grade and presence of deleterious materials. iv. Physical tests of core to determine lump content of the rock. v. Petrographic studies to characterize mineralogical properties of ore. vi. Down-hole geophysical logging using natural gamma and density to map stratigraphy, complex structure and determine bulk density.	One million two hundred thousand Pula (BWP1,200,000)

4.6 Environmental Liabilities

Giyani contracted the services of Loci Environmental (Pty) Ltd to undertake Environmental Screening studies for its projects in Botswana, including K-Hill, in August 2018. No fatal flaws were identified during this process.

Giyani received a request from the Department of Environmental Affairs (DEA) of Botswana to complete an Environmental Management Plan (EMP) for the K-Hill prospect area. Under this EMP Giyani will have clearance to conduct exploration and evaluation work including but not limited to geophysics and other non-invasive exploration techniques, drilling and sampling.

Giyani will be required to do a detailed Environmental Impact Assessment (EIA) before any mining and/or processing can commence.

4.7 Significant Risk factors

A portion of the Mineral Resource underlies a municipal water reservoir that is under construction. Although the reservoir overlies a small portion of the Mineral Resource (<5%), the potential impact of this reservoir to the project has not been ascertained.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Accessibility

The Project area is well networked by paved national roads, namely the A1 and A2. K-Hill is within a few kilometres of the A2 highway. The A2 highway runs from Buitepos, at the Namibian border, through Jwaneng, Kanye and Lobatse to the South African border at Pioneer Gate, near Zeerust, South Africa. The A2 is a major component of the Trans-Kalahari Corridor, which is a highway corridor that provides a direct route from Maputo in Mozambique via Pretoria to central Namibia, in particular to Windhoek and the port of Walvis Bay.

Access to site from the national road is by a few kilometres of unpaved roads from Kanye. Old mining tracks are largely overgrown and degraded by erosion, and access to some areas is by foot or four-wheel drive vehicle.

Local communities own the surface areas around Kgwakgwe Hill and access is granted by notification only. The larger project area consists of a combination of privately-owned land and communal/tribal land.

5.2 Climate and Physiography

The land surface of Botswana is mostly flat or gently undulating, with the greatest topographical relief being in the southern parts of the country. Kanye is at an elevation of approximately 1,300 m amsl and Kgwakgwe Hill itself forms a district topographic high next to the town of Kanye (Figure 5-1 and Figure 5-2), with elevations reaching nearly 1500 m amsl.

Spoil heaps, stockpiled manganese mineralization and tailings occur in the K-Hill project area, which together with historical open-pit mining forming cliffs into the steep hillside have disrupted the natural topography (Figure 5-3).

Generally, Botswana can be divided into three main physiographic regions:

- The Wetland region around the delta to the north,
- The Hardeveld region with outcropping metamorphic geology in the south east, in which the Project area lies, and
- The Sandveld region which comprises of the central Kalahari sands.

Most of southern Botswana is covered in some form of savanna. In the Project area, common shrubs and small thorn trees exist and no protected or scarce trees such as the Baobab, Marula, Mopane or Fig trees have so far been observed at K-Hill (Theron, 2017).

The climate is generally considered to be warm and arid with a summer rainfall season. Operations can continue throughout the year.

Figure 5-1

View from Kgwakgwe Hill towards Kanye, taken from a drilling site

Source: MSA 2018

Figure 5-2

View of Kgwakgwe Hill, showing historical spoil heaps

Source: MSA 2018

Figure 5-3
Birds-eye view of K-Hill project area

Source: Giyani, 2018

5.3 Local Resources and Infrastructure

K-Hill is just outside the town of Kanye, which has electricity supply from the national grid. The town water supply is from the Mmamokhasi dam, which is approximately 5 km from site. Water from this source has been used for drilling activities.

Formal mining in Botswana for copper, nickel, coal, gold and diamonds has taken place from the 1900's to present, as well as historical manganese mining in the Kanye area. Both underground and open-pit mining skills are available in the country as well as skills gained from migrant labour in neighbouring South Africa. Kanye is located 70 km from Jwaneng Mine, a large open-pit diamond mine.

An historical tailings area on the site (Figure 5-3) provides a potential area for tailings storage and potential areas for waste dumps exist, assuming the required permissions can be obtained.

6 HISTORY

The discovery of manganese in the Kanye area led to mining from 1957 to 1971 (Aldiss, 1989). The first of many companies operating at Kgwakgwe Hill was Marble Lime and Associated Industries (Marble Lime), which also developed the asbestos mine at Moshaneng, northwest of Kgwakgwe Hill. Marble Lime mostly mined the bedded type ore (described as manganiferous shale during the Phase 1 mapping exercise completed by Giyani), which required beneficiation before it could be saleable (Aldiss, 1989). Marble Lime ceased mining activities around 1967.

Further exploration work was carried out by Johannesburg Consolidated Investments Co. Ltd. (JCI), during the late 1960's and early 1970's. JCI estimated that about 120,000 tonnes of "marketable ore" could be extracted from the shale horizon at K-Hill. Later on Rand Mines estimated that approximately 1.6 Mt, of which 60% could be extracted, resides within the shale-type "ore" at K-Hill (Aldiss, 1989). The reader is cautioned that these figures are provided for historical background purposes and no conclusions as to the prospectively of the project should be drawn from them. No details are known to the QPs on the basis of the estimates and the level of information available is not consistent with the definition of an "historical estimate" as defined in Section 2.4 of NI 43-101, nor are they being treated as current Mineral Resources.

In 1981, Rand London Manganese investigated the possibility of mining the manganese shale deposits at Kgwakgwe, Otse and Gopane (near Lobatse) together feeding a single planned processing plant at Lobatse. The Kgwakgwe deposit was considered to require further drilling for evaluation, but no further work was completed and the licence was relinquished within a year (Aldiss, 1989).

Historical production of "manganese ore" from Kgwakgwe was reported by Baldock *et al* (1977) to be 64,180 tonnes from 1957 to 1967, and 131,563 tonnes from 1968 to 1972 (Table 6-1). Variable prices were received for the product due to both metallurgical and high-grade battery-active products being supplied, with the latter attracting a premium at the time (Baldock et al. 1977). It is not stated how much of these tonnages were from open-pit or underground mining and these figures have not been verified by the QP's.

Table 6-1
Manganese Production from Kgwakgwe (after Baldock *et al.* 1977)

Year	Amount (Tonnes)	Value (Rand)
Total 1957-1967	64,180	798,678
1968	39,751	16,863
1969	16,732	290,433
1970	40,488	695,396
1971	34,387	140,655
1972	205	9,970
Total 1968-1972	131,563	
Grand Total	**195,743**	

7 GEOLOGICAL SETTING AND MINERALIZATION

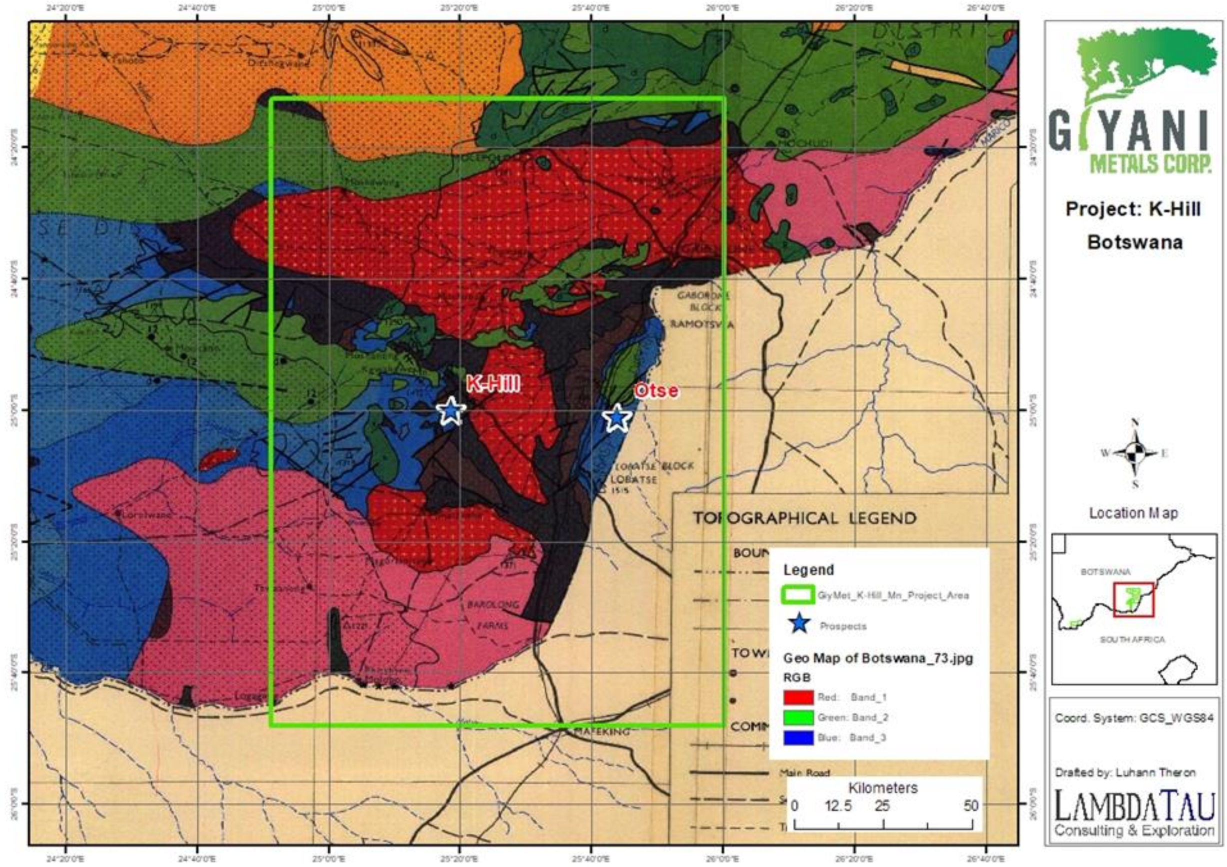
7.1 Regional Geology

The stratigraphy in the K-Hill area consists predominantly of late Archean to early and middle Proterozoic rocks from the Ventersdorp (meta-volcanics) and Transvaal (meta-sedimentary) Supergroups, as well as the early Precambrian Gaborone Granite (intrusives) and later Waterberg (sedimentary) Groups (Key and Ayres, 2000).

The location of the K-Hill prospect is shown superimposed on the 1973 regional geological map of Botswana in Figure 7-1. The Archean basement in southeast Botswana is well studied on a regional scale and maps are generally accurate. The prospect occurs within the mapped Transvaal Supergroup sediments consisting of shales, quartzites, limestones and conglomerates (blue shades in Figure 7-1) and in the vicinity of the Kanye Group (part of the Ventersdorp Supergroup) consisting of a variety of extrusive lavas and subordinate siltstones and shales (purple shades in Figure 7-1). To the east, the early Precambrian intrusive igneous units of the Gaborone Granite suite occur (red and pink shades in Figure 7-1). The youngest succession in the project area is the Waterberg Group sediments (green shades in Figure 7-1).

A subsequent regional (1:1,000,000) geological map of Botswana was published by Roger M Key and Neil Ayres in 1998, but most of the government regional mapping in the project area was completed prior to 1980 so for this area, the 1973 map is still accurate (Key and Ayres, 2000).

Figure 7-1
Location of the K-Hill prospect on the regional geological map of Botswana, 1973



Source: 1973 Regional Geological Map of Botswana

The Moshaneng-Kanye area contains outcrops of a Transvaal-age sedimentary sequence which forms part of the so-called Kanye Basin. This basin is oval in shape, with its long axis orientated northwest-southeast and extends over the Kgomodikae, Segwagwa and the Moshaneng areas. It is separated from the Transvaal sediments in the Lobatse area by Ventersdorp-age rocks which comprise the Lobatse Volcanic Group, remnants of Archaean basement rocks, and the Gaborone Granite, all of which define the north-south trending Vryburg Arch between Kanye and Lobatse. At Kanye the arch begins to swing westwards through Moshaneng towards Jwaneng. Although partially separated by a veneer of Waterberg age rocks, the Transvaal Supergroup sequence around Moshaneng forms a structural continuum with that exposed around Kanye as evidenced by the isolated ridges of chert breccia between the two. The Transvaal sediments outcrop in a poorly defined ring structure near the village of Moshaneng. The core of this structure is composed of alkaline rocks of the Moshaneng Complex.

In the Kanye area, only the lower parts of the Transvaal succession, the Black Reef Quartzite Formation and the Taupone Dolomite Group, are present. The sediments of the Black Reef Quartzite Formation constitute a sequence that fines upwards from conglomerates at the base through arenites to shales and mudstones at the top. This suggests a progressive increase in water depth consistent with a major marine transgression. The discontinuous clast-supported conglomerates are thought to have been deposited in localized stream channels within an active tidal beach environment. This conclusion is supported by the occurrence of very mature quartz arenites overlying the conglomerates.

The Black Reef unit passes gradationally through an interval of bluish grey shales and mudstones into the overlying carbonates. The carbonates are interpreted as being predominantly deposited on a tidal flat. Local sandstone lenses may occur in the upper portions of the dolomite sequence and mark the start of a regressive cycle in which terrigenous sediment was reintroduced.

The predominance of the Paupone Dolomite Group and the extensive development of chert breccias, as opposed to banded iron formation, suggests that the deposition of the Transvaal Supergroup rocks took place in a tectonically active basin. Tectonic instability is also evident during the deposition of the Black Reef, as indicated by the development of localised fault-scarp conglomerates as its base.

7.2 Local Stratigraphy

The mineralization at Kgwakgwe Hill is primarily associated with the upper shale horizon of the Black Reef Quartzite Formation. The quartzite package underlying the shales, rests unconformably on Archaean felsites of the Kanye Volcanic Group. The shales in turn are overlain by the chert breccias of the Paupone Dolomite Group (Figure 7-2), which suggests non-deposition of the intervening dolomites or a massive unconformity. The Kgwakgwe Chert Breccia Formation in the Kanye area can be subdivided into two main varieties:

- A dark brown chert breccia with milk-white angular chert fragments cemented together by brown haematitic material, and
- A reddish-brown chert breccia with abundant jaspilitic fragments and a high content of jasper in the matrix.

Figure 7-2
Chert breccia at K-Hill

Source: MSA, 2018

7.3 Property Geology

The shale horizon is of limited extent and has only been traced for a short distance to the south of Kgwakgwe Hill where it apparently terminates in the superficial deposits which constituted the most southerly of the historical mine workings. The shale also thins out rapidly to the west and to the north of the historical mine area where it appears to transgress over the quartzites and therefore, lies directly on the felsites.

The stratigraphy has been duplicated by thrusting in places. Small displacements have also been observed along steeply dipping east-northeast trending faults. The shales have been intensely folded and slumped in the vicinity of these dislocations and in addition, subparallel breccia zones and quartz veining may be evident.

The entire Transvaal package is cut out against the Waterberg sediments to the west of the Kgwakgwe Hill along what are thought to be northerly trending faults.

The manganese shale outcrops along the northerly scarp slope of the Kgwakgwe Hill and dips into the hill (Figure 7-3). The strata at K-Hill dip gently towards the northwest at an average of approximately 10° and small-scale S and Z folding is common.

Mapping delineated two broad areas of enriched mineralization within the shale separated by an area of low manganese values. The northerly portion is elongated northwest over an area of approximately 400 m by 300 m and the average thickness of the mineralization in this area is 3.5 m. The southerly area of mineralization is elongated northeast over an area of approximately 570 m by 200 m, and has an average thickness of approximately 2.0 m. The manganese shale also outcrops along the easterly scarp slope of Kgwakgwe Hill.

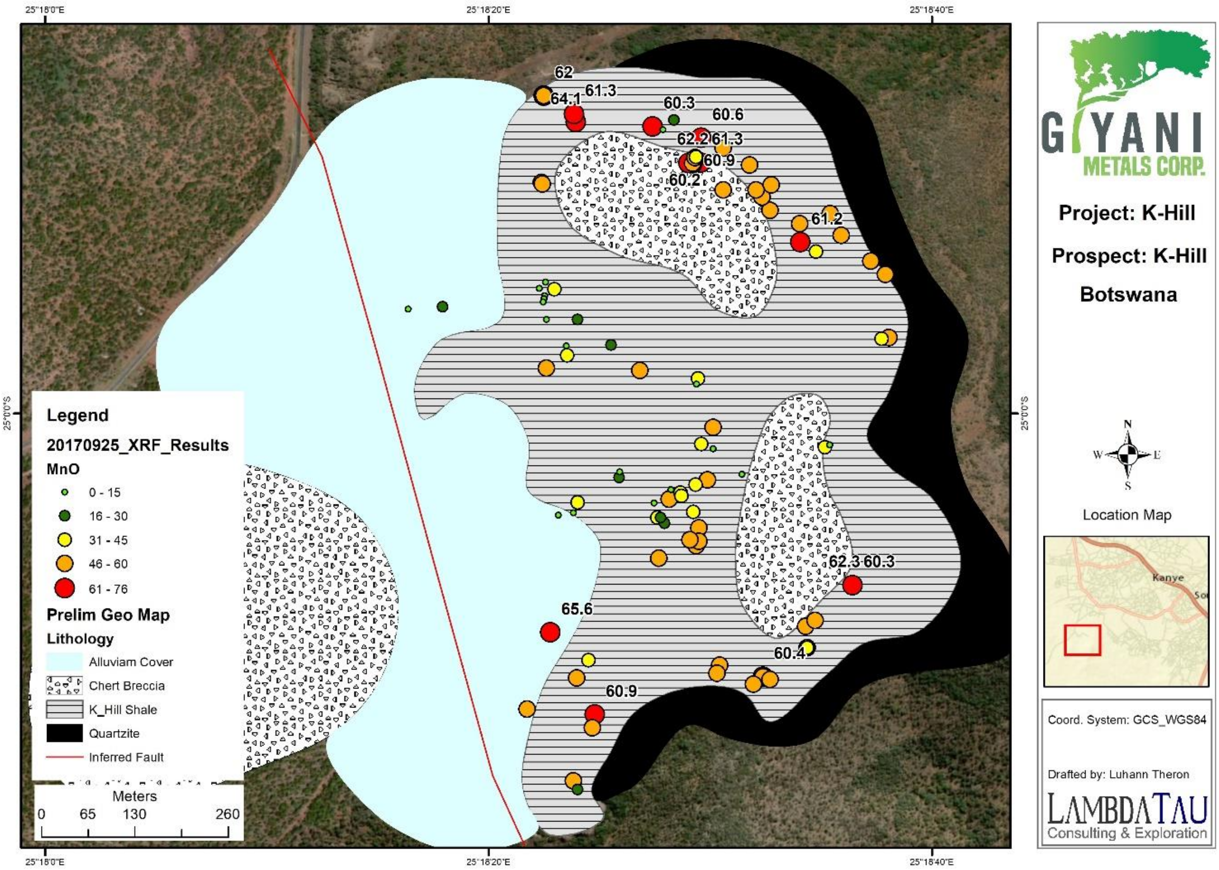
Figure 7-3
Manganese shale (black unit) and overlying shale (pale brown unit) exposed at the entrance to artisanal workings

Source: MSA, 2018

A simplified geological map of the mineralized area, including the positions of surface grab samples of manganiferous material, is shown in Figure 7-4 (refer to Item 9 of this report). The outcrop defining the limit of the manganese shale is well defined, with the areas to the west being partially covered by alluvium and/or exposed by historical surface mining into the hillside.

Figure 7-4

Simplified geological surface map of the K-Hill prospect area

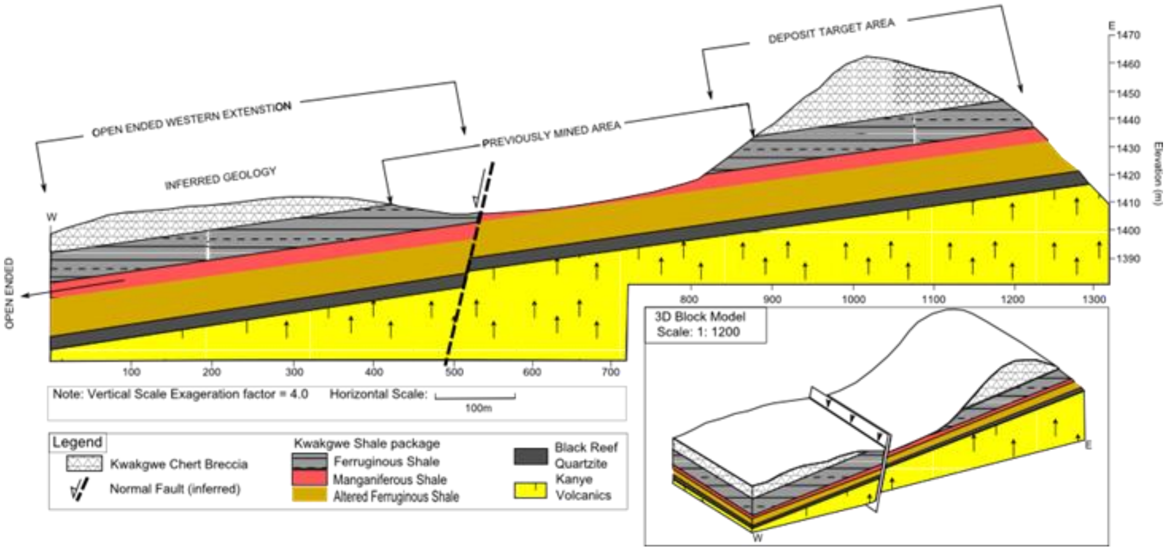


Source: Theron, 2017

A schematic section illustrating an interpretation of the geology at K-Hill is shown in Figure 7-5. This is interpreted based on the mapped mineralization outcrops and the historical open pit area. A fault has been inferred which could result in potential for additional mineralization towards the west. A single drillhole DDHKH18_0009 was drilled to test this hypothesis and no additional mineralization was found, however the potential for additional mineralization has not yet been ruled-out and further exploration may be warranted. The Kgwakgwe Hill shale has been interpreted to occur to the south based on geophysical surveys. Further exploration is required to confirm the presence of manganiferous shale in this area.

Figure 7-5

Conceptual cross section through K-Hill showing the outcropping mineralization mapped and sampled to the east, the historical mined area and potential mineralization towards the west



Source: Theron, 2017

8 DEPOSIT TYPES

The manganese mineralization occurs as a supergene enriched manganiferous shale (the Mn-Shale) within the Black Reef Quartzite Formation.

The Mn-Shale itself appears to represent primary manganese deposition (proto-ore) in a shallow marine basin as per the Canon and Force model referred to in Figure 8-1. However, as is typical for most manganese deposits, there is clear evidence of upgrading by means of supergene enrichment. This evidence includes:

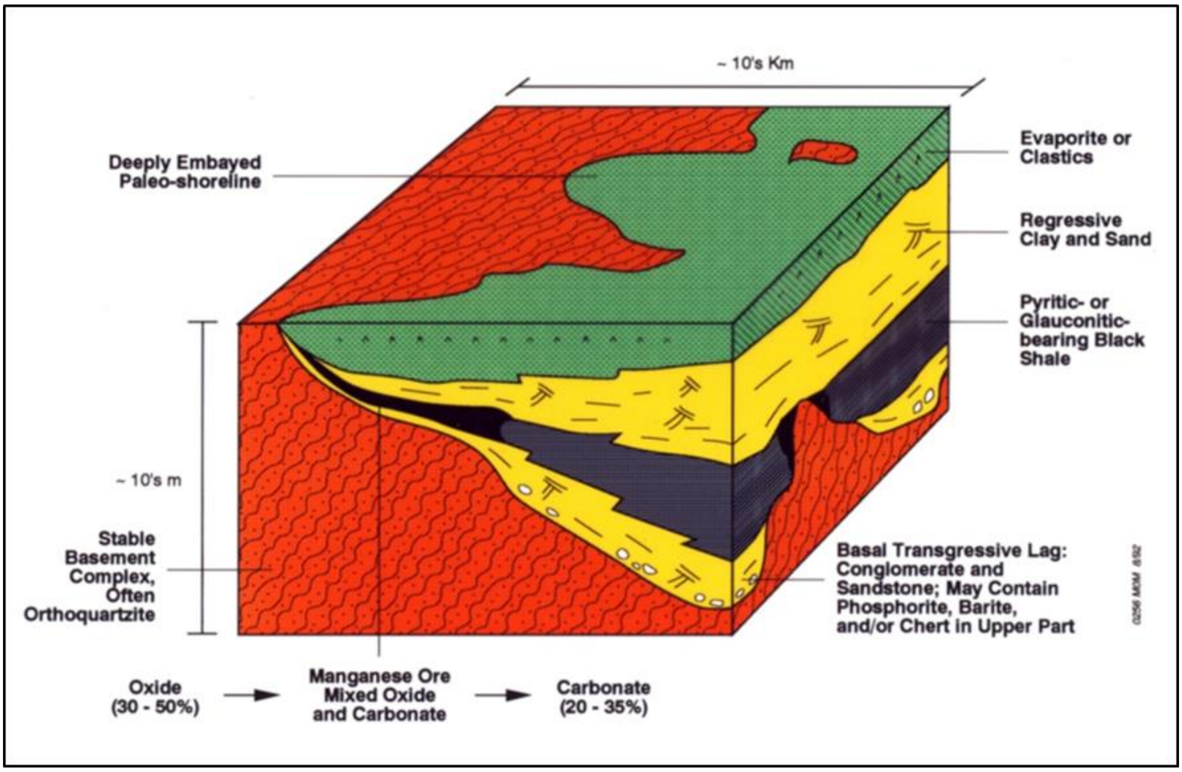
- Only manganese oxide mineralogy has been noted to date,
- Observed manganese mineral textures are consistent with secondary precipitation,
- The presence of fine manganese wad and the presence of cavities and vugs intersected in the drill holes in the Mn-Shale.

There are two possible time intervals during which weathering and supergene enrichment could have occurred, these being the recent period of exposure as well as the ancient period of exposure associated with the unconformity at the base of the Chert Breccia. If supergene enrichment is only related to the current exposure then the enrichment could be limited in extent by the current geomorphology and may only extend under the hill to the limit of weathering. However, if there was supergene enrichment during the period associated with the unconformity, then more extensive supergene enrichment may have occurred. The latter possibility appears to be supported by the drillhole intersections. Two mineralising processes are evident, namely an initial phase of mineralization by precipitation and diagenesis during sedimentation (forming the Mn-Shale or proto-ore) followed by one (and possibly two) phases of redistribution and concentration during weathering and supergene enrichment.

Interpretation of the gravity map allows the recognition of a very clear marine basin embayment paleogeography of the type typically recognised in the Cannon and Force (1988) model. The Archaean floor to the basin seems to be well described by the gravity anomalies. Interpretation of the gravity map indicates the possible presence of two shallow marine embayments with a north-south running paleo-shoreline shoaling to the east and deepening westward. This data is very useful from a prospectivity mapping point of view.

Figure 8-1

Illustration of the Cannon and Force (1988) model for sedimentary manganese mineralization



Source: Cannon and Force (1988)

8.1 Mineralization style

Key elements of the Canon and Force model and this mineralization style may be summarised as follows:

- The Cannon and Force model is a depositional model for a large number of sedimentary manganese deposits that apparently have their formation during times of high sea level stand and stratified sea columns in common. Manganese precipitation occurs at intersections of horizontal oxidation-reduction interfaces with shallow marine substrates within shallow marine embayments.
- The manganese occurs in typically thin flat lying stratiform and stratabound layer(s), often of enormous lateral extent. They are stratiform marine basin-margin deposits, which may be present in oxide and (or) carbonate facies, tend to be in condensed stratigraphic sequences, result from low energy deposition, and have little clastic dilution. Characteristically the manganese horizon is a thin but laterally extensive stratigraphic condensed sequence type interval
- Basin analysis has shown that these types of deposits typically occur in settings characterised by deposition in localised basins or shallow marine embayments around littoral paleo-islands, peninsulas and shoals. It is important to delineate barrier island, embayments and shoal settings because of the role of basin sills in isolating anoxic seas and favouring black shale

formation. The relationship to the basin's basement and floor is critical. Major deposits usually formed close to the basin margin. Deposits are often less than 100 m above the basement.

- The host rocks are typically sandstone (or orthoquartzite), siltstone and claystone, shales and black shale. Subordinate poorly consolidated limey sediments (marls) occur. Diatomaceous clays, radiolarian sediments and shell beds are common. Black organic- and pyrite-rich-shales and glauconitic sands are common in footwall rocks.
- Mineralogically they typically include an oxide facies; an oxide–carbonate facies; and a carbonate facies. Currently there is only evidence of oxide facies in the K-Hill deposit.
  - The oxide-facies manganese mineralization most commonly includes cryptomelane-group minerals and pyrolusite and over forty oxide minerals are potential ore constituents. Less-oxic deposits contain manganite, braunite, and kutnohorite. Psilomelane and wad (primary and supergene iron and manganese oxide mineral intergrowths) are commonly listed in older literature. Gangue typically includes clay minerals (commonly montmorillonite), carbonate minerals, glauconite, quartz, chert, and biogenic silica.
  - If developed, the oxide-carbonate facies include psilomelane, manganite, manganoan calcite and rhodochrosite.
  - Carbonate facies mineralization typically includes rhodochrosite, kutnohorite, and manganoan calcite, siderite, mixed manganese and iron carbonate minerals, pyrite and wad. Gangue typically includes clay, calcium and calcium-magnesium carbonate minerals, glauconite, organic matter, pyrite, quartz, and biogenic silica.
- Secondary superimposed weathering and supergene processes are common. In situ weathering and oxidation enhance both the oxide and carbonate primary ores. Manganese carbonates may weather to a brown non-descript rock. Black secondary oxides are common. Penecontemporaneous erosion, oxidation and sedimentary reworking (tidal lag) of oxide and oxidized carbonate ores can give rise to premium quality ores. Contacts between primary and supergene-enriched zones are typically sharp.

This ore type typically presents manganese grades as follows:

- Primary ores: 20% to 40% Mn, low Fe
- Secondary ores: 30% to 50% Mn, low Fe
- Fe content - Host rocks are low in Fe.

Examples of this ore-type include:

- Groote Eylandt, Australia,
- Nikopol & Bolshoi Tokmakskoe, Ukraine,
- Chiatura, Georgia,
- Obrochischte – Bulgaria

8.2 Exploration techniques and methodologies

The principal exploration technique used is diamond drilling, which is essential to provide material for accurate lithological logging. Mapping of all available surface outcrops should take place with a focus on basin analysis and the development of facies models. It must however be borne in mind that because of the flat-lying and stratabound nature of the target deposit, the surface expression is often extremely limited.

From a geochemistry point of view, the target horizons are manganese-enriched beds. The manganese/iron ratio is a good local indicator of the basin morphology. The exploration target is a condensed sequence and may be anomalous in respect of some base (and precious) metals.

Generally, geophysics is not effective for direct detection of these thin, flat lying and laterally extensive mineralised layers. However, battery-active deposits are electrochemically active, and the associated self-potential field may on rare occasion be distinctive. All manganese minerals except psilomelane (manganite) are conductive. Thus, massive manganese deposits may have low associated resistivity that can be detected by direct current resistivity methods. Gravity and magnetic surveys are useful for regional mapping purposes.

9 EXPLORATION

9.1 Mapping and Sampling

Early exploration at K-Hill was designed to geologically map and geochemically sample the prospect area. Geologists equipped with a Garmin GPSMAP 64S GPS, Brunton Compro Pocket Transit compass as well as RockLogger Android software, spent a total of 13 days mapping and sampling in and around the main prospect area.

A preliminary stratigraphic column was interpreted from the field observations. It is important to note that the Mn-Shale and the K-Hill shale are not the same unit. The K-Hill shale, as shown in Figure 9-1, refers to the entire shale unit. This unit varies in composition and character but represents the same geological event. The Mn-Shale refers to a specific horizon within the K-Hill shale that contains enhanced levels of manganese mineralization.

The focus of historical mining efforts was towards the inner area, with unmined outcropping mineralization towards the outer northern and north-western edges. Adits from artisanal mining around this outcropping area are common.

Outcropping mineralization as well exposed mineralization in the historical mining pits were sampled. Various mineralization styles were observed and sampled. Grab samples were taken from the K-Hill Shale within and away from the Mn-Shale outcrop. These were taken where outcrop existed and access allowed. A total of 97 grab samples were collected from the K-Hill prospect and additionally 25 samples were submitted as duplicates to test variability in sampling technique and analyses. All samples were taken from surface and within old open-pit faces except for two samples that were taken from artisanal adits. Sampling was focussed on mineralized units, although some samples were also collected from the non-mineralized footwall and hangingwall units. Rock units sampled included manganiferous shale, ferruginous shale, quartzite, chert breccia and siliceous/silicified shale.

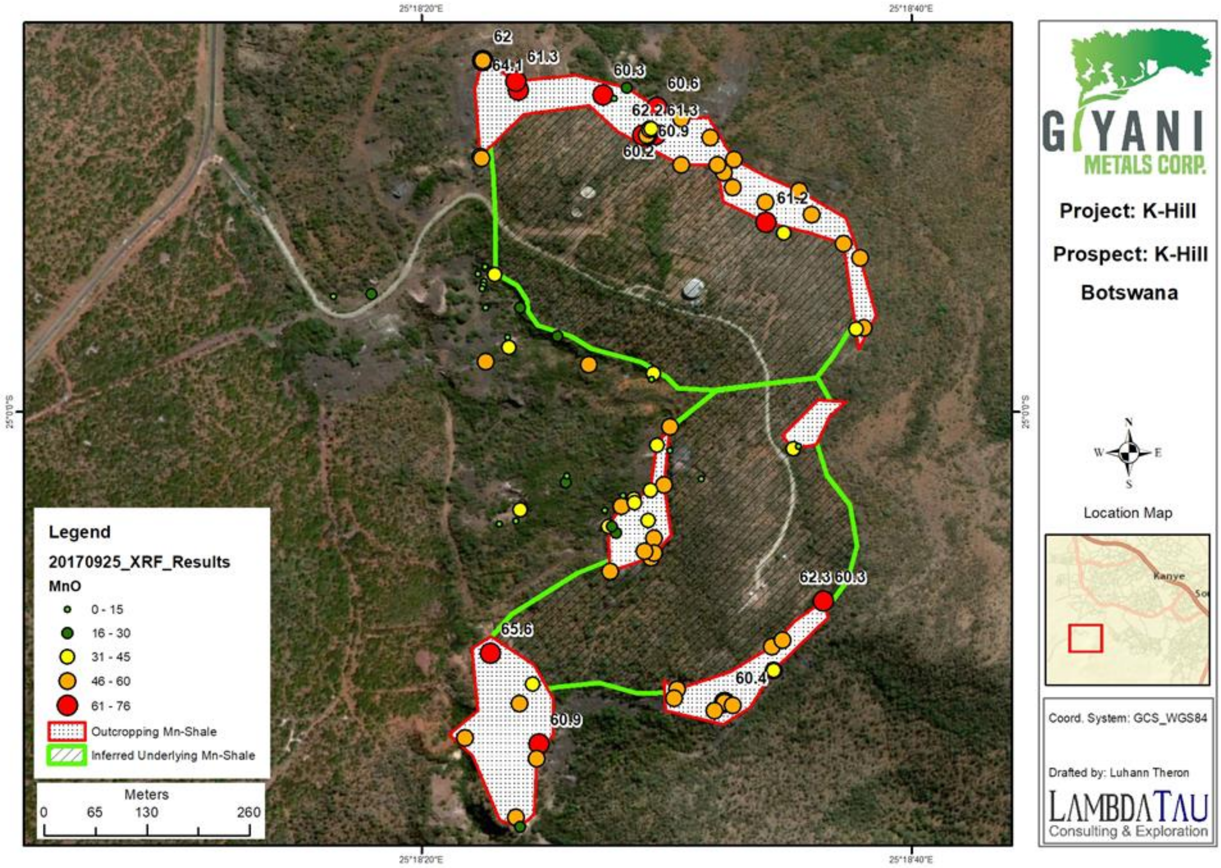
Analysis of the grab samples was by borate fusion followed by XRF and was performed by SGS laboratories in Randfontein, Johannesburg, South Africa.

It should be noted that the grab sampling had the sole purpose of identifying the location and nature of the mineralization. Samples of this nature are not suitable for estimating the grade of the deposit. The grab samples are not representative of the grade of the complete mineralised unit and sampling of this nature is inherently biased, generally towards a higher grade.

Samples collected from outcropping Mn-Shale units yielded the highest manganese grade, as can be expected. Lower grade and non-mineralized footwall and hangingwall units were sampled where exposed by historical workings. Instances of high grade MnO (>50% MnO) occur along the entire approximate 1.25 km of Mn-Shale outcrop. Due to the biased nature of the grab sampling this should not be misconstrued as the in-situ grade of the Mn-Shale unit but does illustrate that occurrences of high-grade manganese mineralization do occur within the outcrop.

Figure 9-1

Location of outcropping Mn-Shale as well as the area of Mn-Shale inferred to underly Kgwakgwe Hill.

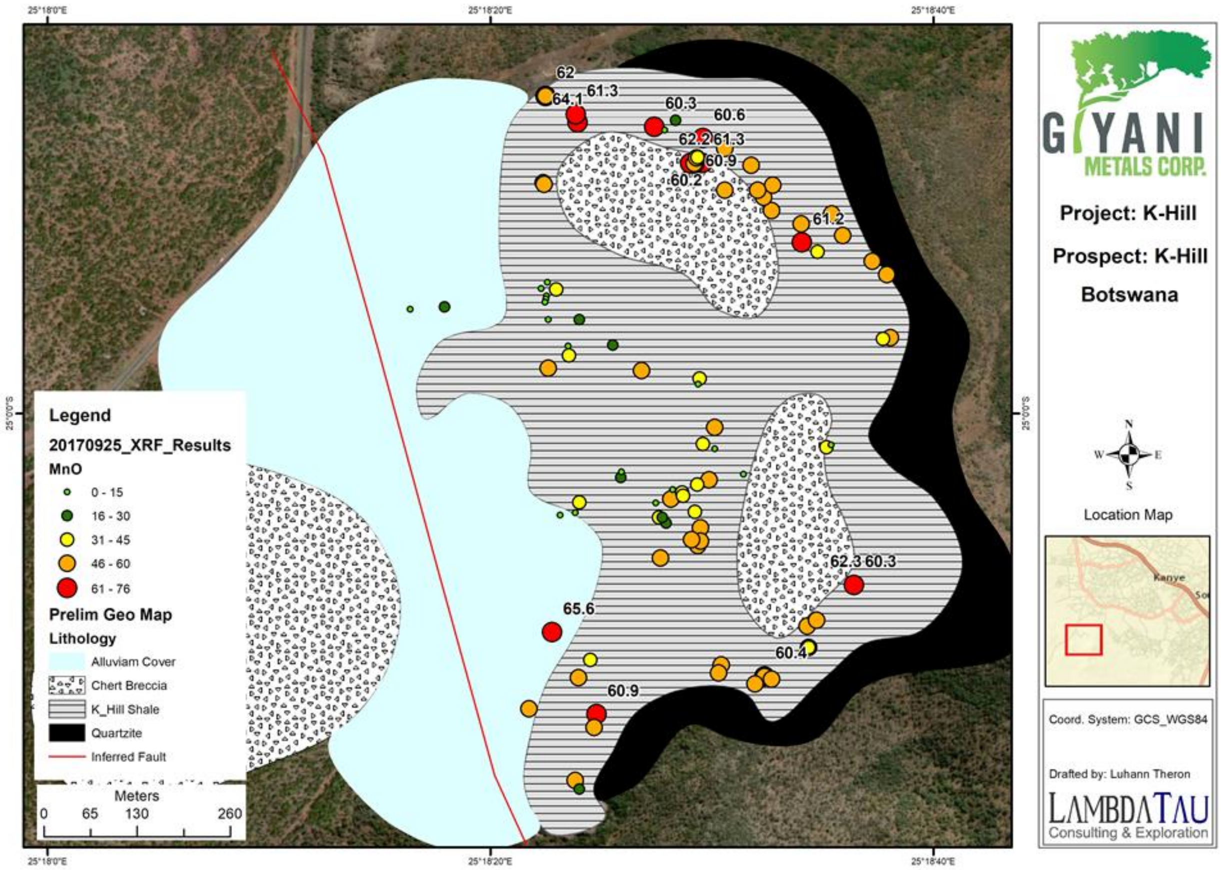


Source: Theron, 2017

A preliminary geological map is shown in Figure 9-2. More detailed work is required to refine this surface map.

Figure 9-2

Preliminary geological surface map of the K-Hill prospect are showing the grab sample locations and grades as ranges.



Source: Theron, 2017

Table 9-1 summarises the average MnO values of the units sampled by the grab sampling programme at the K-Hill prospect. It should be noted that the figures shown in Table 9-1 are the average results of a grab sampling exercise focussed on identifying the location of enhanced manganese mineralization and the potential of different units to contain elevated levels of manganese. These figures are not intended to represent an estimate of the grade of the units.

Table 9-1
Summary of analytical results from the K-Hill grab sampling programme

Unit	Number of samples	Maximum MnO (%)	Minimum MnO (%)	Average MnO (%)	Comments
Manganiferous Shale	74	64.1	1.7	44.5	Main mineralised unit
Ferruginous Shale	9	0.08	0.04	0.05	
Chert Breccia	4	0.04	0.03	0.04	Hanging Wall
Silicified Shale	5	0.04	0.03	0.03	Hanging Wall
Quartzite	1	32.3	32.3	32.3	Footwall: Sample probably contaminated

9.1.1 Chip Channel Sampling Programme

Channel chip sampling was conducted at K-Hill at two locations. The aim was to collect representative samples from the Mn-Shale without any loss in material. The intended use of the samples is for future metallurgical test-work.

Two outcrops were identified for sampling, KH18CC_0001 and KH18CC_0002 (Figure 9-3). Site preparation included excavation at the bottom of the face to a depth of 1 m to achieve a full 3 m of exposed face. The exposed face was cleaned by removing the outer 5 cm of weathered material. Sampling was conducted over a 3 m intersection of the Mn-Shale unit in intervals of 1 m. A fourth sample consisting of a complete channel chip sample through the entire 3 m interval was also collected at each location.

Figure 9-3
Locations where the two channel chip samples were taken (shown as red asterixes)

Source: Theron, 2017

9.2 Geophysics (Gravity, IP and Magnetics) Programme

Remote Exploration Services (Pty) Ltd (RES) was engaged by Giyani to complete high-resolution ground gravity and ground magnetic surveys over K-Hill. RES describes the geophysical surveys as follows (Remote Exploration Services, 2018):

- The K-Hill ground gravity grid comprised 1,987 planned gravity stations. All gravity grids were planned with 50 x 50 m spaced stations. Ground magnetic data were collected on the same survey lines as the gravity grids along north-northeast to south-southwest oriented lines at K-Hill. All data were collected in continuous surveying (Walkmag) mode which translates to a reading every 1 to 2 m on 50 m spaced survey lines. In total 101.3 km of magnetic data were collected over K Hill. Three 1 km IP/DC traverses were undertaken based on the results from the gravity and magnetic data.
- Ground gravity station positions were measured using a Trimble R6 RTK DGPS. Coordinates for the beacons were provided by the Botswana Land Board in Cape LO25 format with orthometric heights. These coordinates were transformed to WGS 84 UTM 35S. Gravity station positions were marked and measured by walking a pattern which included approximately 5%

internal repeats as well as approximately 5% external repeats. Following RTK surveying, gravity readings were taken over all stations. A Scintrex CG-5 Autograv gravity meter was used to complete the gravity survey.

- Magnetic data were collected using a GEM Systems GSM19 Overhauser magnetometer in Walkmag at a 1 second sampling interval. A GEM proton precession magnetometer was used to monitor and correct for diurnal variations. Location data were collected with handheld GPS which was time synchronised with both Walkmag and base station magnetometers.
- As regards IP/DC data collection and in order to evaluate the effectiveness of IP/DC techniques, three approximately 1 km lines of IP/DC were collected. IP/DC traverses were designed to extend from felsic volcanic basement, (Kanye Volcanic Formation), over the basal unit of the Transvaal quartzites (Black Reef Quartzite Formation), into Lower Transvaal shales (Kgwakgwe Shale Formation) and into upper Transvaal chert breccia (Kgwakgwe Chert Breccia Formation). The results of the ground gravity data were used to assist with the survey design. IP/DC data were collected in dipole-dipole configuration with a = 50 m and n = 1 – 7. A Zonge GDP32 receiver, GGT10 10 kVA transmitter and ZMG 7.5 kVA Generator were employed.
- Various filters and processes were applied.

9.2.1 Interpretation of geophysical data

Bouguer Anomaly and Total Magnetic Intensity images are provided in Figure 9-4 and Figure 9-5. The following broad geophysical characteristics can be ascribed to the geological units:

- Both gravity and magnetic datasets are dominated by the response of the felsic volcanics in the northeast and eastern portion of the survey area. These units produce significant gravity and magnetic anomalies;
- The sedimentary units of the overlying Transvaal Supergroup are clearly mapped as distinct, structurally controlled, gravity lows;
- A subtle contrast exists between the Lower and Upper Transvaal sedimentary units with Upper Transvaal rocks appearing to be denser and producing small gravity highs;
- Thicker portions of the target Lower Transvaal units have been interpreted to correlate with more prominent associated gravity lows as a result;
- No direct gravity response appears to be associated with the manganese oxides;
- No clear magnetic contrasts have been mapped within the Transvaal sedimentary units although there is some evidence of subtle structure in the magnetic data.

Figure 9-4

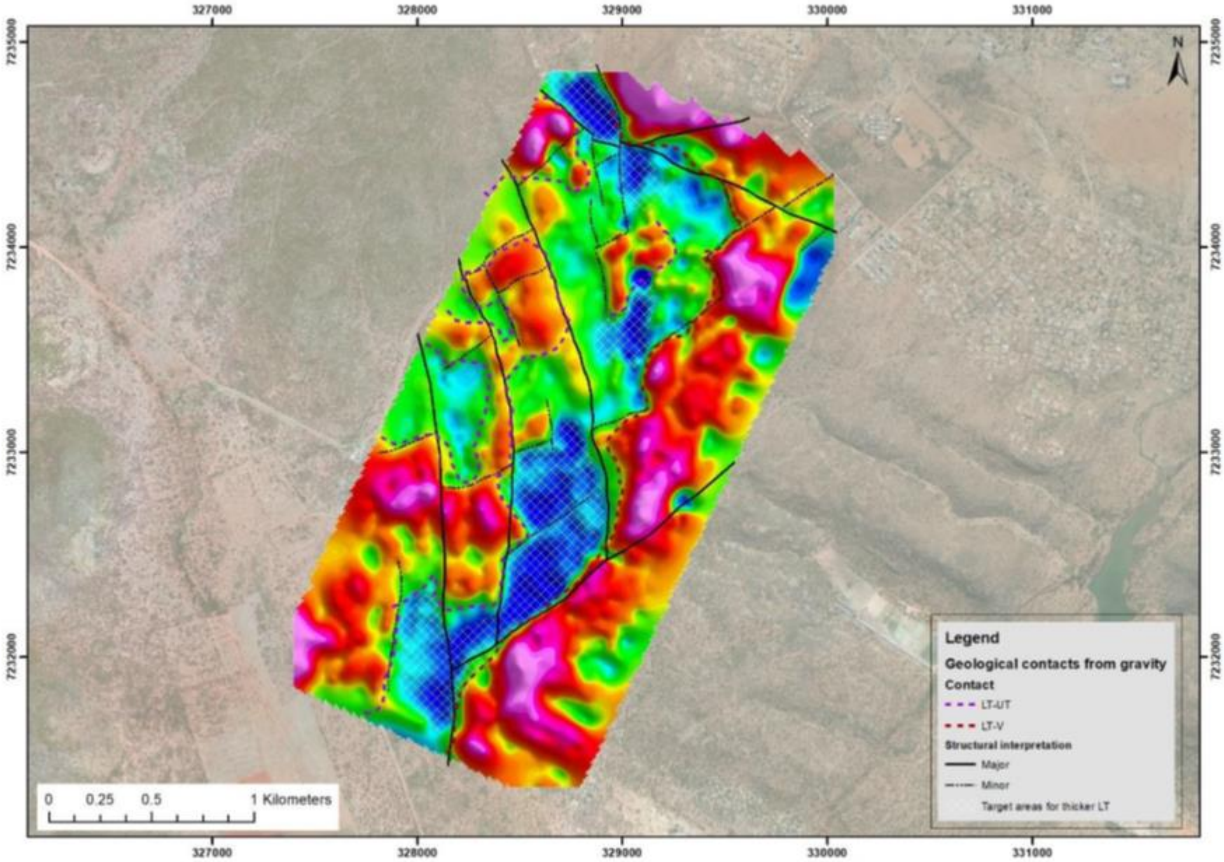
1:125,000 scale geology with survey stations and features of interest highlighted

Source: Remote Exploration Services, 2018

Using a number of different filter and image products as well as depth slices through the unconstrained density volume, the relationships described above were used to map basin controlling structures, contacts with the target Lower Transvaal and areas where the Lower Transvaal units appear to thicken. The interpreted contacts and target areas for thicker Lower Transvaal correlate well with known geology and sample results. Additional prospective target areas have been identified under recent cover.

Figure 9-5

Residual filtered Bouguer Anomaly image with structure, Lower Transvaal contacts and prospective areas for thicker Lower Transvaal units highlighted



LT= Lower Transvaal, UT = Upper Transvaal, V = Ventersdorp

Hatched areas are the target areas for thicker Lower Transvaal

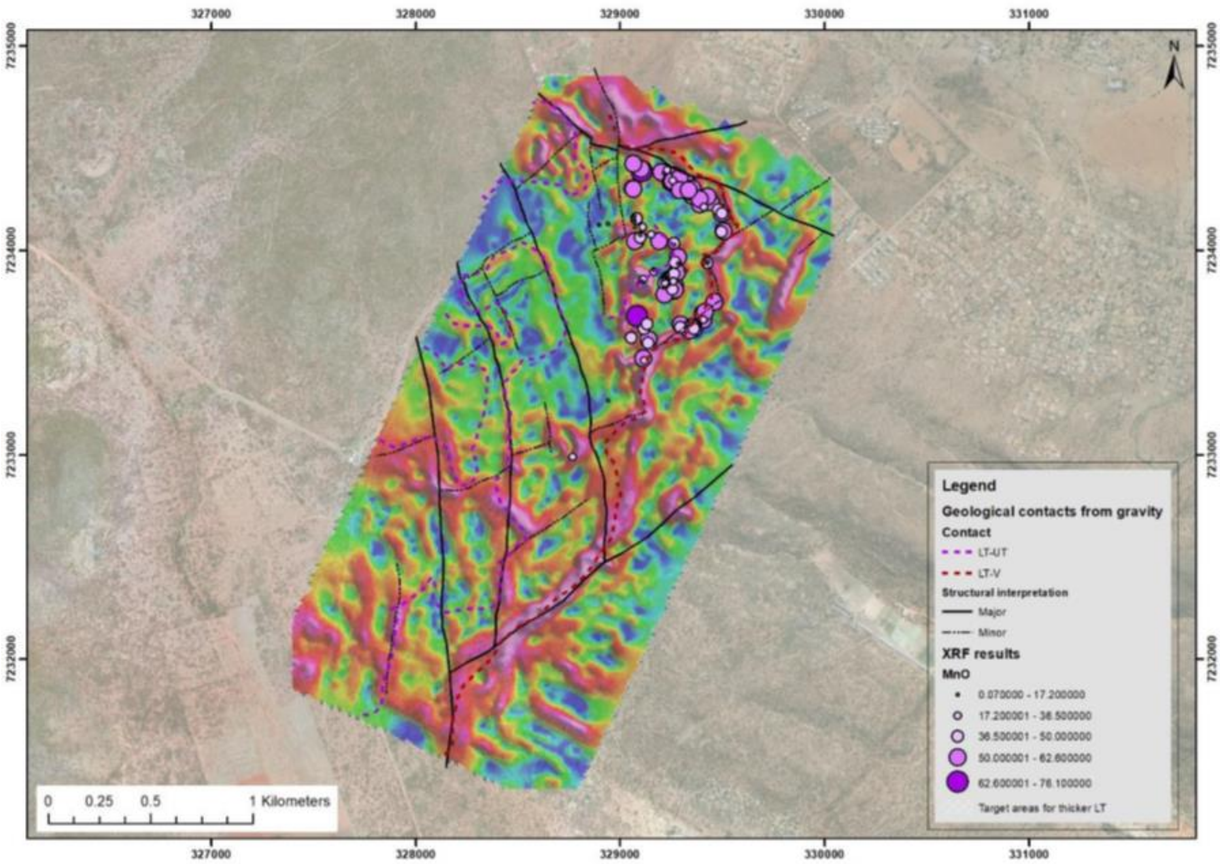
Source: Remote Exploration Services, 2018

Ground gravity surveying proved to be an effective method for mapping out the extent and possible structural controls for manganese mineralization in the Lower Transvaal host rocks. Basement felsic volcanics are clearly delineated in both magnetic and gravity data where they are manifest as anomalous highs. IP/DC proved to be an effective means of mapping conductive Lower Transvaal host rocks over resistive Upper Transvaal and basement volcanics, as well as potentially higher chargeability manganese mineralization (RES,2018).

The IP/DC traverses results demonstrate high correlation with the gravity inversion and interpretation. As expected, the Lower Transvaal shale units are more conductive (lower resistivity) than underlying volcanics and overlying chert breccias correlate well with low density portions of the inverted density volume. Distinct IP chargeability anomalies coincide with the anticipated position of Mn-Shale. Significant cultural noise in the northern IP/DC traverse across the known mineralization has made direct comparison with the known mineralization somewhat ambiguous (RES, 2018).

Figure 9-6

Total horizontal derivative of the Bouguer Anomaly with structure, Lower Transvaal contacts and prospective areas for thicker Lower Transvaal units highlighted. XRF MnO grab sample results are illustrated as scaled symbols.



LT= Lower Transvaal, UT = Upper Transvaal, V = Ventersdorp

Source: Remote Exploration Services, 2018

9.3 Mineralogical Investigation

A mineralogical analysis was performed on the K-Hill manganese oxide bearing rocks by Dr Flint at the Dalhousie Minerals Engineering Centre in Halifax Nova Scotia Canada (Theron, 2018). Four samples were tested to determine the mineralogical composition of the manganese minerals. Haematite, other iron oxides, some pyrite along with silica, and kaolin in one horizon of the shales, are evident as well as manganese oxides. This study is described in more detail in Item 13 of this report.

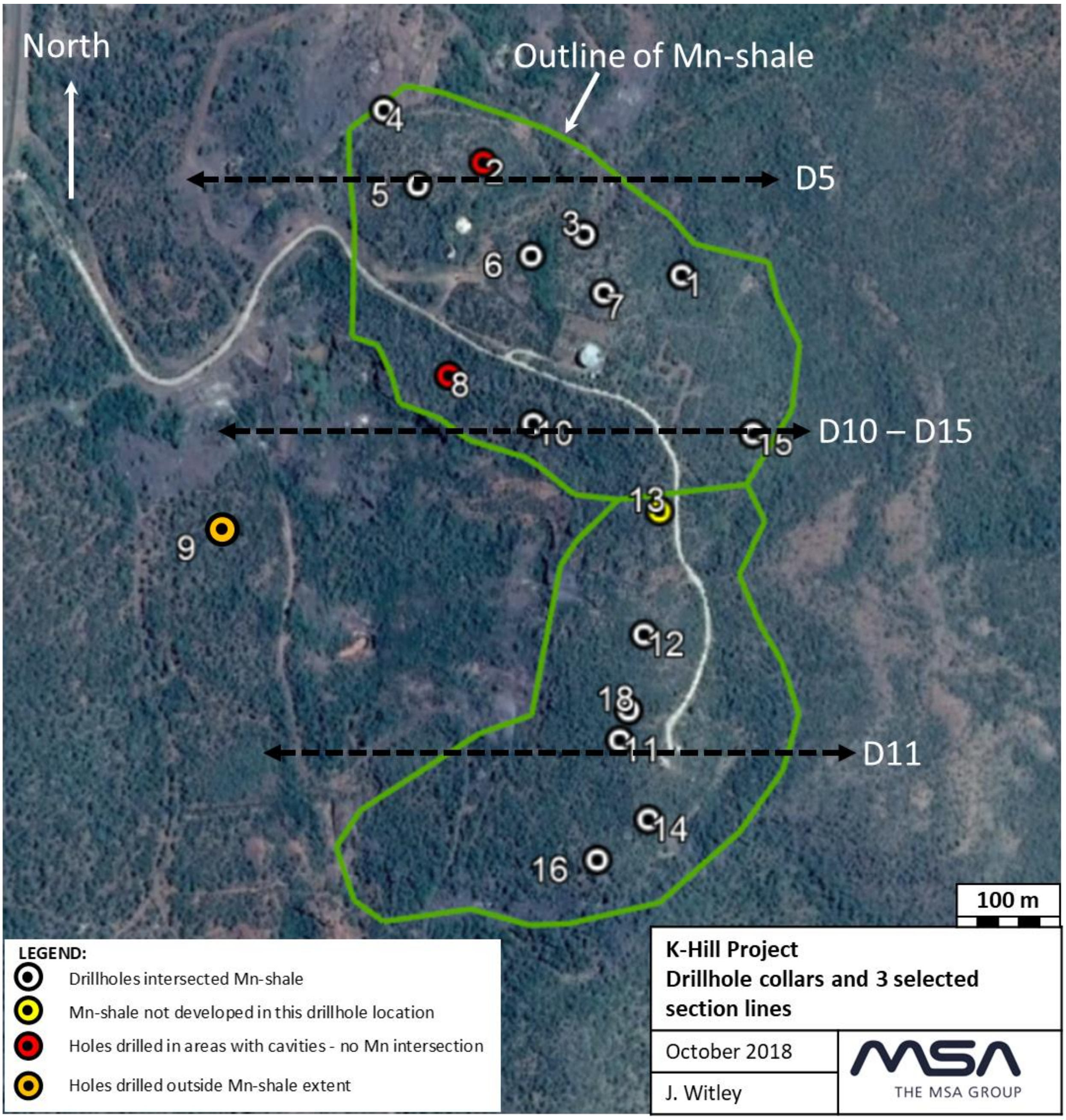
10 DRILLING

10.1 Drillhole locations

Drillholes were located within the northern and southern portion of the deposit. Holes in the northern portion were drilled along three northwest striking lines approximately 50 m and 130 m apart. The holes were drilled at approximately 100 m spacing along the lines. Holes in the southern portion of the deposit were drilled along a single north-northeast striking line with holes at approximately 100 m apart along the line (Figure 10-1). Drillholes were collared vertically.

Figure 10-1

Surface map depicting the outline of the area underlain by the Manganese Shale, drillhole sites and location of selected profiles



Source: MSA, 2018

10.2 Drilling

Drilling was undertaken by a drilling contractor, RotsDrill Botswana (RotsDrill). RotsDrill used an Atlas Copco CS14 diamond drilling machine. The drilling programme was managed by Lambda Tau (a consultant to Giyani appointed to manage its exploration activities in Botswana).

The standard operating procedure provides for a geologist to be assigned to the drill-rig to manage the drilling, stake collars, align and communicate with the drilling team. The drilling supervisor reported to the responsible geologist on the progress of drilling twice a day at the change of each shift.

The designated geologist was also the responsible safety and environmental officer. The drill-rig, drill site preparation and setup were audited at the start and during the drilling programme. The responsible geologist also ensured that all sites were rehabilitated according to the Environmental Management Standards set forward by Giyani, prior to the drilling team leaving a site.

Casing was left in the hole once a hole was completed. This was to ensure that the hole remained intact for any future down-hole geophysical surveys that might be required. A concrete plinth was constructed around the drillhole collar, such that 50 cm of casing protrudes above the concrete block to permanently mark the collar. The drillhole casing was sealed at the collar and a plate was inserted with the drillhole ID (Figure 10-2).

Figure 10-2

Drillhole collar and site for DDKH18_0005

Source: MSA 2018

10.3 Storage

Drilled cores were placed in core trays. The trays were labelled with drillhole ID at the top right corner of the box, as well as on the side. The drilling contractor was responsible for inserting core blocks to mark the drilled depths at the end of each run. Mechanical breaks in the core were marked with two small stripes on both sides of the break to enable appropriate fitting of the core later.

The drill contractor was responsible for all the core handling at the drill site and transportation of the core to the core shed, located in Kanye. The core was transported in core boxes, stacked to a maximum of five boxes, with a lid on the top core box. The stacked boxes were strapped together using a ratchet strap and further secured to the sides of the vehicle. The delivered core was accepted at the designated core shed by the on-site geologist or manager.

10.4 Logging

Geotechnical and geological logging and other data were recorded at the core shed. Standard logging codes were created to ensure that logging was standardized and to reduce errors in rock identification.

10.5 Sampling

The cores were cut longitudinally in half using a rotating diamond saw blade. Half core samples were collected continually through the mineralised units at a 1 m nominal length, which was adjusted to smaller intervals in order to honour the lithological contacts. Half core samples were collected between core blocks where the recovery was less than 50%. This resulted in samples with drilled lengths longer than 1 m in some instances.

10.6 Density measurements

Density measurements were carried out through the Archimedean water immersion method. This method involves weighing dry core in air, and then weighing the same core while immersed in water. Density is then calculated using the following equation:

$$\frac{\text{Dry mass}}{\text{Dry mass} - \text{Wet mass}}$$

The core samples used to carry out density measurements at K-Hill were air dry but were not dried in an oven to ensure that there is no interstitial moisture in the sample. Thus, the calculated densities were considered to be wet, and not dry.

10.7 Recovery

The Mn-Shale is soft and weathered, within which harder layers of manganese oxide (MnO) mineralization on a centimetre scale occur. Recovery was calculated through dividing the drilled length by the recovered length. Poor core recoveries were observed in most of the intersections of the Mn-Shale, averaging approximately 50% in the high-grade mineralization. Hole DDKH18_0006 was excluded for grade estimation as a result of poor recovery as well as a down-hole grade distribution that is inconsistent with the surrounding drillhole intersections.

Statistical analysis was carried out to determine if there is a relationship between recovery and MnO grade (Refer to paragraph 14.2.5). This demonstrated that the sample intersection grade was not artificially elevated by poor recovery and it appears that poorer recovery results in lower MnO grade. Therefore, it is unlikely that the poor core recovery will result in an over-estimation of the MnO grade. The poor recovery is not ideal and local grade biases may occur as a result.

10.8 Other captured data

On completion of each hole, collar surveys were completed using a handheld global positioning system (GPS). Downhole surveying was not necessary because the drilled holes were short and vertical, with end of hole depths ranging from 30.22 m to 85.78 m. The following information was recorded in the database:

- Hole number, with collar location, length, inclination and direction;
- Drilled lengths and recovered lengths;
- Geological and mineralogical descriptions;
- Assay results; and
- Quality assurance and quality control (QAQC) samples.

Because the collar positions were not accurately located with a differential GPS (DGPS), there are differences between the collar elevations and the topography. Collars were therefore projected vertically to the topography, which maintained the hand-held GPS X and Y coordinates and adjusted the elevation.

10.9 Drillhole Database

Drilling information was captured into Microsoft Excel spreadsheets. The data were checked by Luhann Theron, from Lambda Tau, after entry. All the data is backed up on storage servers and accessible on request. The Microsoft Excel sheets were combined to create a drillhole database.

The K-Hill drillhole database consist of 18 holes with a total length of 1,109.03 m and 425 assays, which includes 368 samples and 57 quality control (QC) samples (19 blanks, 19 certified reference material samples and 19 duplicates).

10.10 QP Comment

In the opinion of the QP, the quantity and quality of data collected in the K-Hill drilling programme, including lithology, mineralization and collar, is sufficient to support Mineral Resource estimation to a low level of confidence. The drilling method used and the means in which data has been collected is appropriate for Mineral Resource estimation. Though recoveries are low, they do not show a definitive relationship with the manganese content, and thus the assayed grades are acceptable for a Mineral Resource estimation.

10.11 Drilling Results

A series of east-west sections of the geological model describe the geology (refer to Figure 10-1 for the location of the sections). Each section relates to a detailed lithology log depicting the manganese grade distribution down the hole. Gangue mineralogy reflects in the Al_2O_3 and SiO_2 values.

Drillhole DDKH18_0005 (Figure 10-3 and Figure 10-7) intersected the Mn-Shale unit underlying the chert breccia beds with the highest-grade mineralization tending to be towards the base. This is typical at K-Hill and allowed for the Mn-Shale to be divided into a low-grade layer overlying a high-grade layer. The log also depicts an elevated level of manganese mineralization in the footwall of the Mn-Shale. In the field, a network of manganese oxide veins filling a joint set was observed and the elevated manganese grades in the shale below the Mn-Shale observed in DDKH18_0005 can be attributed to that. The localised extent and relatively low grade indicate that this mineralization is of no significant economic interest.

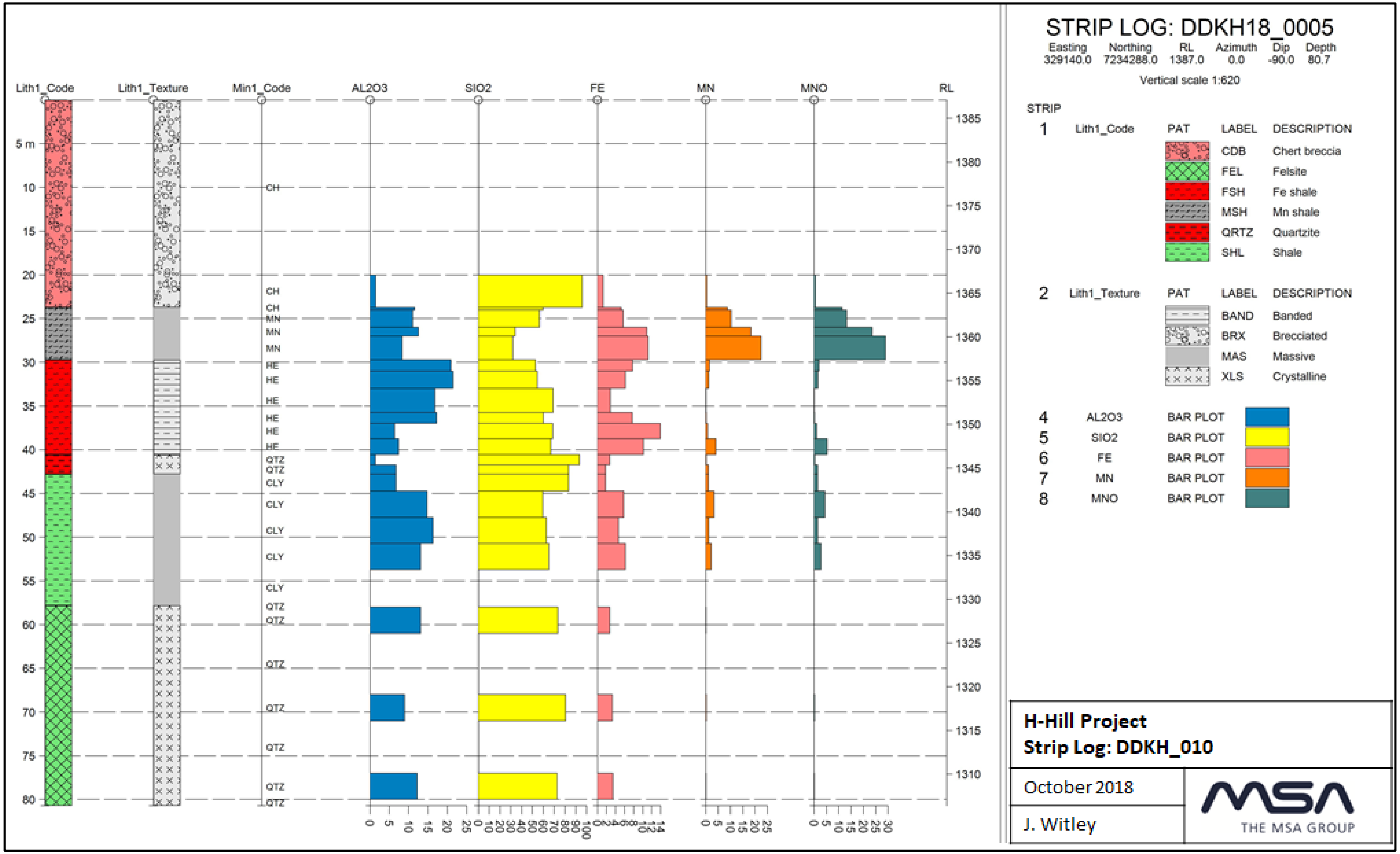
Drillhole intersections DDKH18_0010 and DDKH18_0015 (Figure 10-4, Figure 10-5 and Figure 10-8) also demonstrate that the Mn-Shale underlies the chert breccia unit. DDKH18_0010 shows a tendency to have higher manganese grades towards the top of the unit, although the high-grade zone is overlain by a thin layer of low-grade manganese mineralization. Sub-economic manganese values are again evident in the footwall shale underlying the Mn-Shale.

Drillhole DDKH18_0013 lies to the south of profile D10-15. It intersected the stratigraphic sequence from the chert breccia, down through the shale beds to the underlying felsite, but it did not intersect a manganiferous shale unit. It is thus apparent that the manganese mineralization is discontinuous in this area despite the existence of the chert breccia and ferruginous shale.

Further south, the manganese mineralization reappears again within the shale beds. DDKH18_0011, shown on profile D11, is well mineralized and, as with the profiles discussed above, it provides evidence of an upper lower-grade manganese layer overlying an enriched manganese layer (Figure 10-6 and Figure 10-9). A second zone of enhanced manganese mineralization was intersected by this drillhole at the base of the shale unit in a coarse-grit (logged as a conglomerate) lying directly on the footwall felsites. This is sub-economic and is of academic interest only and has been included in the geology model for completion. This is also well developed in DDKH18_0014 and may be a feature of the southern areas.

Figure 10-3

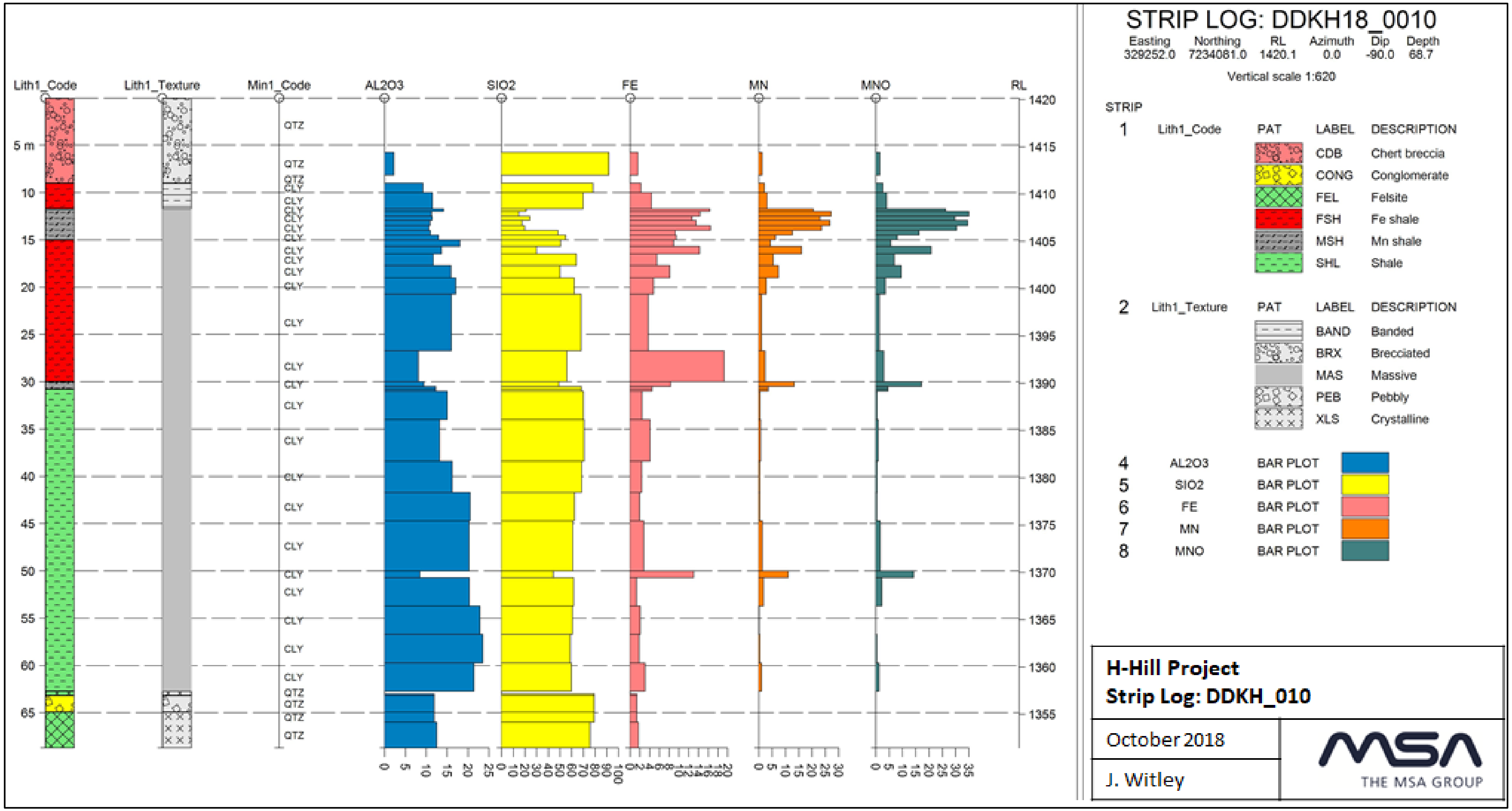
Detailed lithology log and selected assay values of DDKH18_0005



Source: MSA, 2018

Figure 10-4

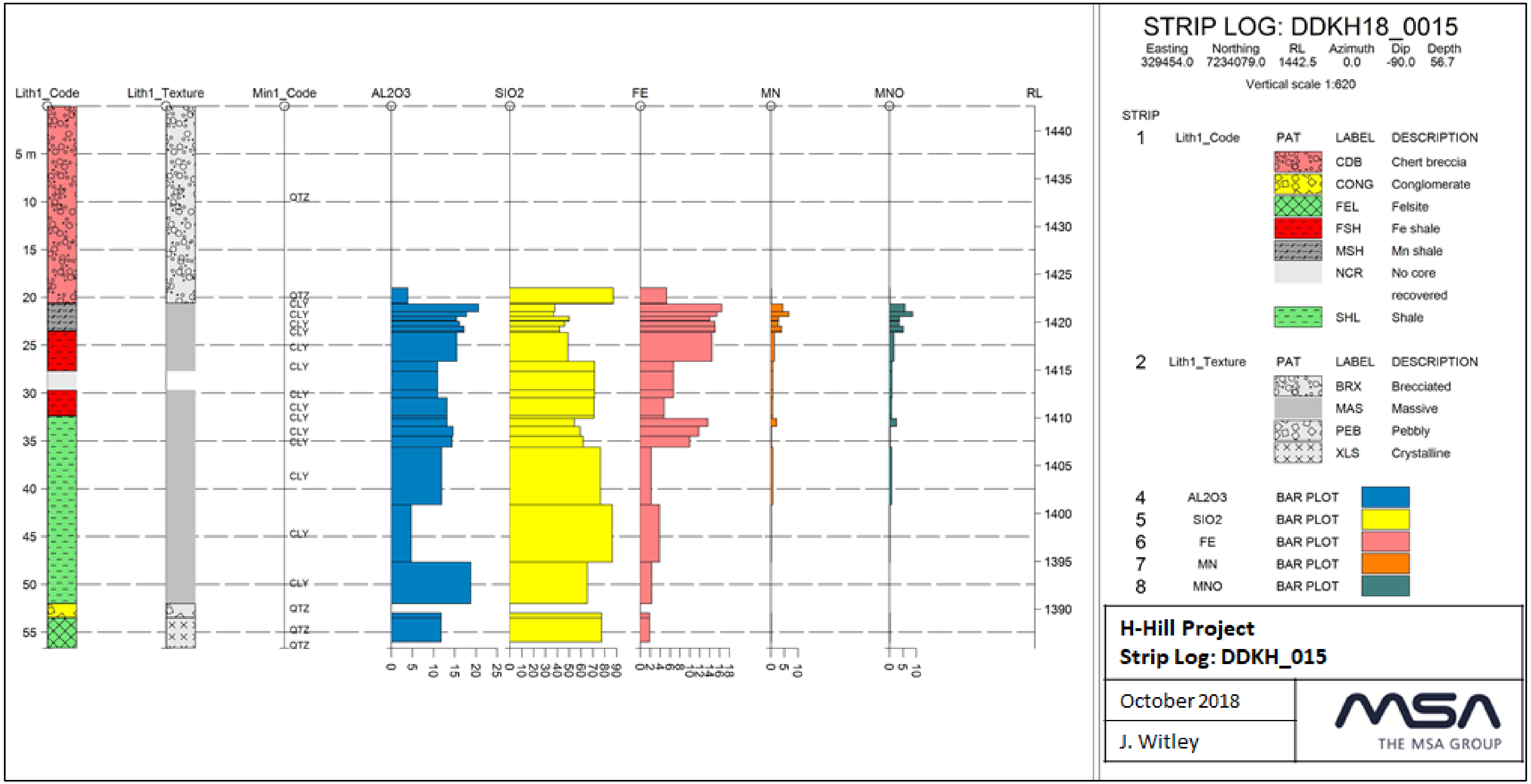
Detailed lithology log and selected assay values of DDKH18_0010



Source: MSA, 2018

Figure 10-5

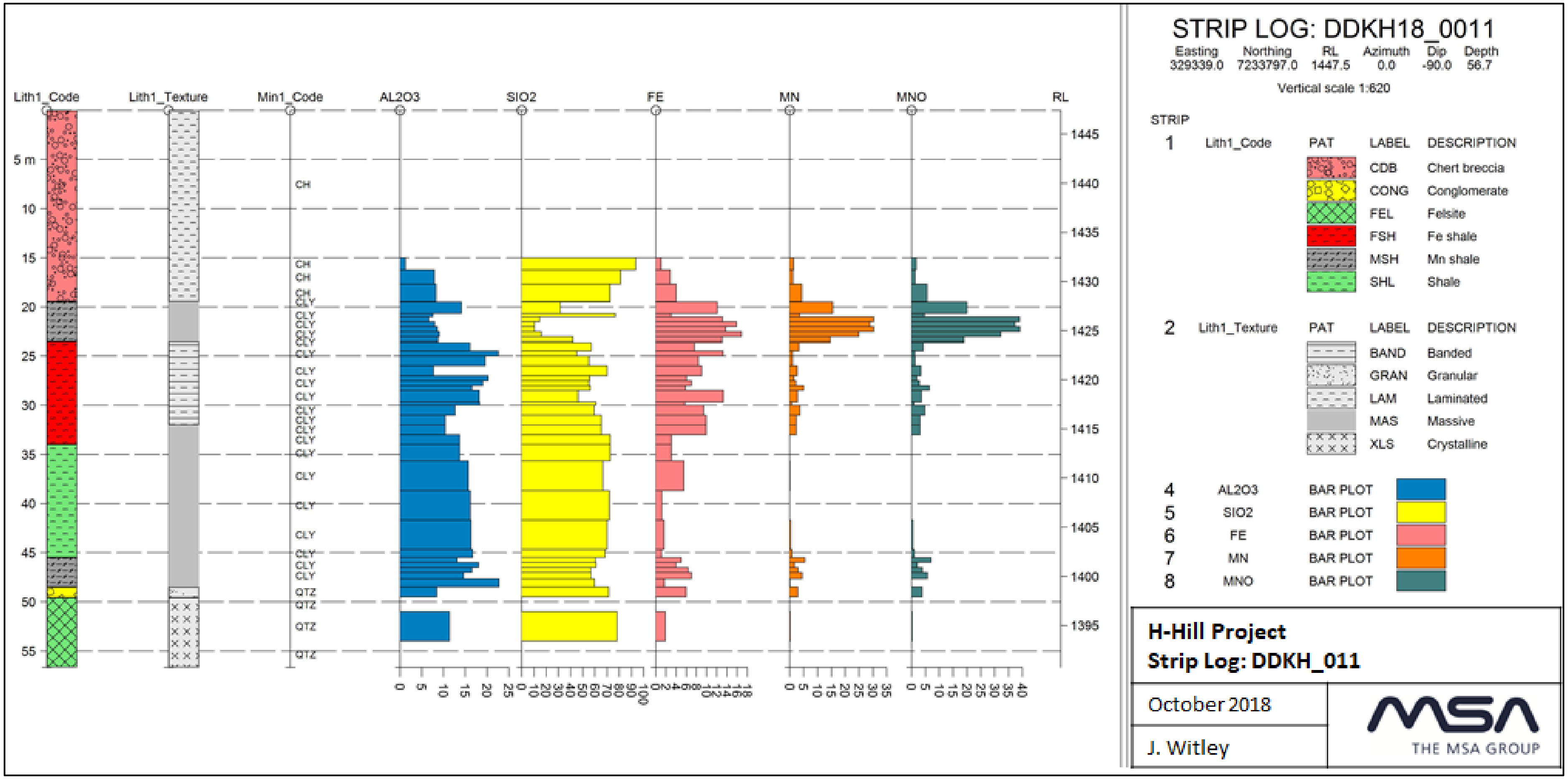
Detailed lithology log and selected assay values of DDKH18_0015



Source: MSA, 2018

Figure 10-6

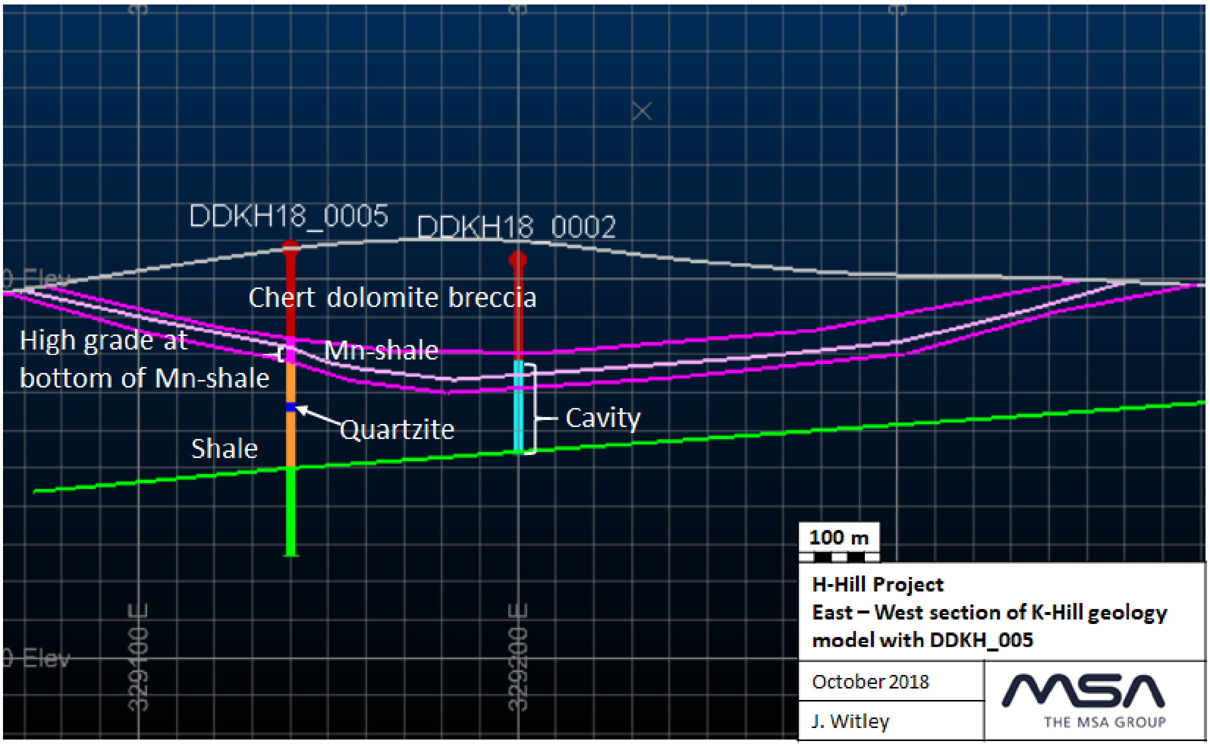
Detailed lithology log and selected assay values of DDKH18_0011



Source: MSA, 2018

Figure 10-7

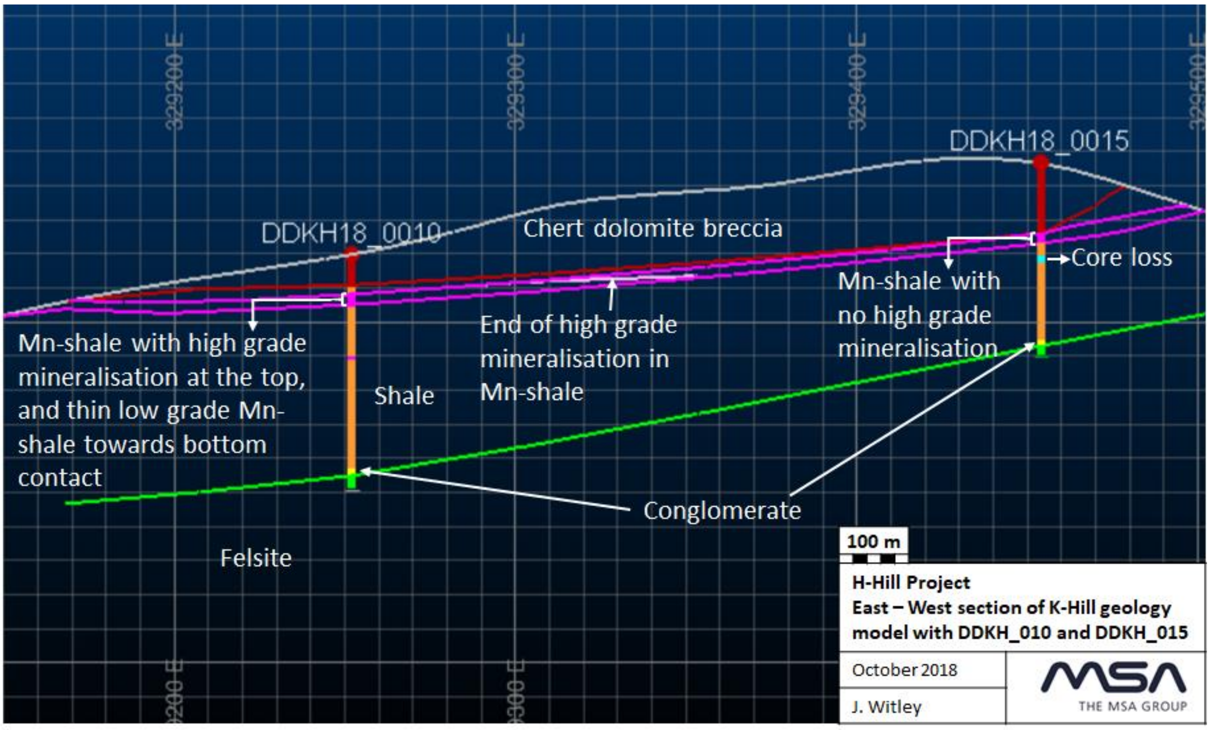
East-west section D5 of K-Hill model with DDKH18_0005 (the log is shown in Figure 10-3)



Source: MSA, 2018

Figure 10-8

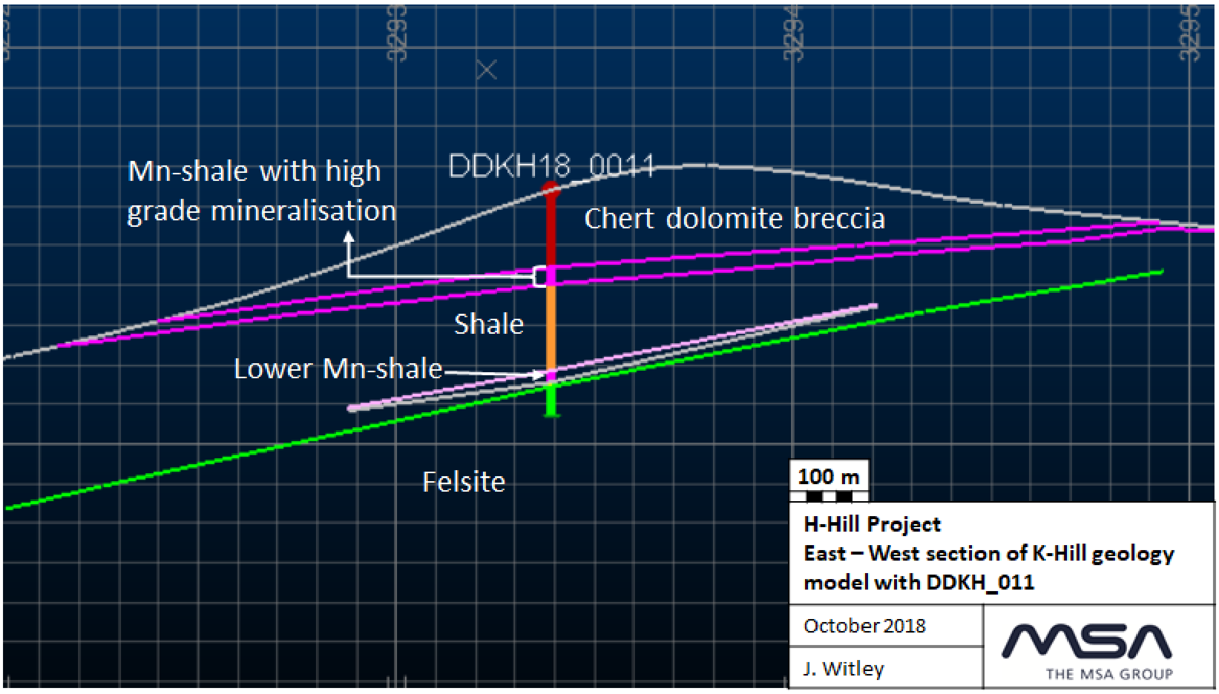
East-west section D10 – D15 of K-Hill model with DDKH18_0010 and DDKH18_0015 (the logs are shown in Figure 10-4 and Figure 10-5)



Source: MSA, 2018

Figure 10-9

East-west section D11 of K-Hill model with DDKH18_0011 (the log is shown in Figure 10-6)

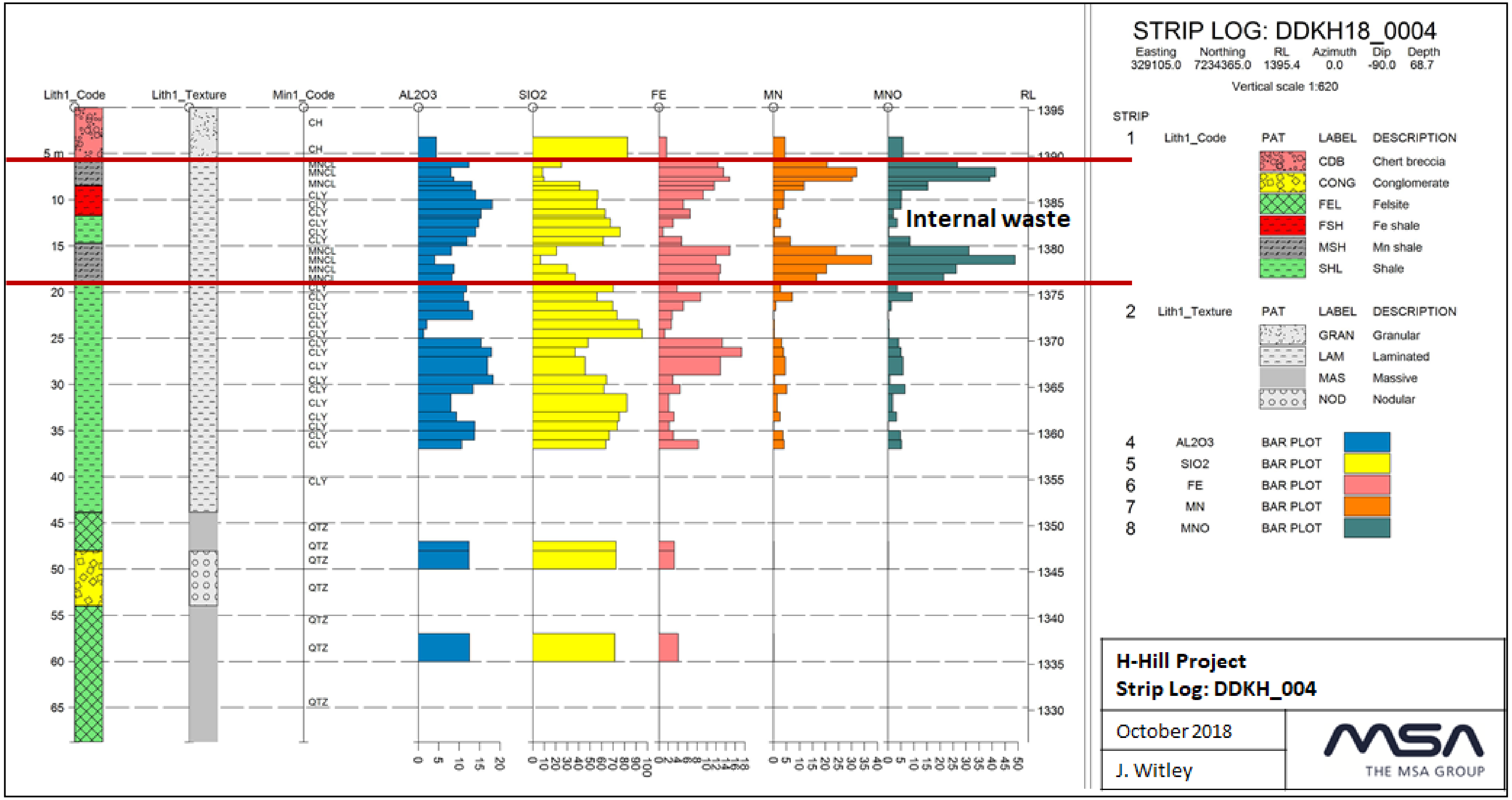


Source: MSA, 2018

DDKH18_0004 is located in the extreme north of the deposit. This hole intersected two layers of manganese mineralization separated by an internal waste parting. A thickening of the Mn-Shale package in the northern area is interpreted, related to a possible facies change with the development of a sandy (as indicated by relatively high SiO_2 values) internal waste parting within the Mn-Shale bed (Figure 10-10).

Figure 10-10

Detailed lithology log and selected assay values of DDKH18_0004



Source: MSA, 2018

Table 10-1 shows the coordinates of each drillhole collar and the depth and grade of the high-grade portion of the Mn-Shale that forms the Mineral Resource. The Mn-Shale dips at an average of approximately 10° to the east and drilled intervals will represent the true thickness intervals with a correction of less than 2%.

Table 10-1
K-Hill drillhole collar location, orientation, depth of hole and significant intersections

Drillhole ID	X Collar	Y Collar	Z Collar	Azimuth	Dip	EOH	Significant intersections		
							From (m)	To (m)	MnO (%)
DDKH18_0001	329,391	7,2342,14	1,420	0	90	85.78	6.00	10.00	40
DDKH18_0002	329,200	7,234,312	1,408	0	90	50.72	Drilling stopped in chert breccia due to interception of cavity		
DDKH18_0003	329,298	7,234,245	1,246	0	90	83.29	38.50	41.50	18
DDKH18_0004	329,105	7,234,365	1,397	0	90	68.73	5.73	19.00	31
DDKH18_0005	329,140	7,234,288	1,397	0	90	80.72	26.00	29.72	28
DDKH18_0006	329,243	7,234,228	1,415	0	90	78.00	Poor Core Recovery		
DDKH18_0007	329,316	7,234,198	1,429	0	90	83.70	25.00	29.00	40
DDKH18_0008	329,170	7,234,114	1,412	0	90	30.22	Drilled through two cavities – no Mn-Shale intersected		
DDKH18_0009	328,966	7,233,972	1,377	0	90	56.82	No Intersection – west of resource area		
DDKH18_0010	329,252	7,234,081	1,423	0	90	68.72	11.73	14.50	29
DDKH18_0011	329,339	7,233,797	1,455	0	90	56.68	19.48	23.68	27
DDKH18_0012	329,362	7,233,895	1,452	0	90	56.73	17.35	19.50	31
DDKH18_0013	329,369	7,234,007	1,451	0	90	53.88	No Mn-Shale developed in hole location		
DDKH18_0014	329,366	7,233,732	1,463	0	90	59.72	15.00	19.00	31
DDKH18_0015	329,454	7,234,079	1,452	0	90	56.68	Only low-grade mineralization intersected		
DDKH18_0016	329,318	7,233,695	1,464	0	90	47.72	14.11	14.73	22
DDKH18_0017	328,804	7,233,020	1,423	0	90	35.72	No Intersection – south of resource area		
DDKH18_0018	329,348	7,233,819	1,485	0	90	54.94	Drilled for metallurgical test-work		

11 SAMPLE PREPARATION, ANALYSES AND SECURITY

11.1 Sample Dispatch

Samples were dispatched in batches of approximately 100 samples. The sample batches were exported by Aramex to SGS laboratory in Randfontein, South Africa, for geochemical analysis.

A chain-of-custody was maintained by signature at every point that the samples exchanged hands, from the core shed in Kanye, where the samples were stored, to the laboratory. As part of the laboratory procedure, all samples were weighed. All the persons involved in the chain-of-custody were required to submit a copy of their receipt of handover of the samples to the project manager for record keeping on site.

11.2 Sample Preparation

Samples were prepared and analysed at SGS Laboratories in Randfontein, South Africa (SGS). This is an independent commercial laboratory, which is ISO17025 accredited by SANAS for chemical analysis. The sample preparation method code used is PRP87, which entails the following procedure:

- Samples are weighed on arrival.
- The samples are dried and then crushed using a jaw crusher to 80% passing through a 2 mm screen.
- A 500 g sub-sample is collected from a riffle splitter.
- The 500 g sub-sample is pulverized using a carbon steel ring and puck to 85 % passing through a 75-micron screen.
- Pulps are logged against sample numbers and submitted for analysis.

All pulverized reject samples are stored at SGS.

11.3 Analytical Technique

The samples were assayed at SGS by method XRF76V, which assays major element oxides by x-ray fluorescence (XRF) using borate fusion. The oxides assayed included Al_2O_3, CaO, Cr_2O_3, Fe_2O_3, MgO, MnO, Na_2O, P_2O5, K_2O, SiO_2, TiO_2 and V_2O_5 reported in percent, as well as loss on ignition.

The analytical procedure involves the following procedure:

- A pulverised sample between 0.2 g and 0.7 g is required for analyses.
- The samples are mixed with 10 g of flux, which is made up of equal amounts of lithium tetraborate-metaborate and a non-wetting agent.
- The sample is fused to create a bead.
- X-ray fluorescence is carried out on the fused bead.
- Loss on ignition is determined separately by roasting approximately 1g of the pulverized sample at 1,000 degree Celsius for 1 hour in a furnace.

11.4 QAQC

Quality control (QC) samples were inserted to test analytical accuracy, laboratory contamination and repeatability on a hole by hole basis. Certified reference material (CRM) samples and blank samples were inserted with the core samples by the geologist on-site. Duplicate samples were inserted at the laboratory. Empty bags with sample labels were submitted to the sample preparation laboratory with an instruction to make a duplicate of a specified sample and insert into the sample sequence. One standard, one blank and one duplicate sample were inserted into the sample stream for every 20 core samples.

11.4.1 Blanks

A total of 19 blank samples were inserted within the field sample stream in order to detect contamination, especially in the preparation stage. The number of blank samples inserted equals a 5% insertion rate, which is in line with industry practice. Giyani used blank silica chips from African Mineral Standards (AMIS; Table 11-1).

Table 11-1
AMIS0439 blank silica chips certified mean grades and two standard deviation values

Variable	Certified value (%)	Two standard deviations (%)
Al_2O_3	0.99	0.13
CaO	0.02	0.01
Cr_2O_3	0.01	0.002
Fe_2O_3	1.53	0.23
K_2O	0.21	0.04
MgO	0.03	0.01
MnO	0.01	0.01
Na_2O	0.02	0.01
P_2O_5	0.01	0.003
SiO_2	96.9	0.4
TiO_2	0.06	0.01

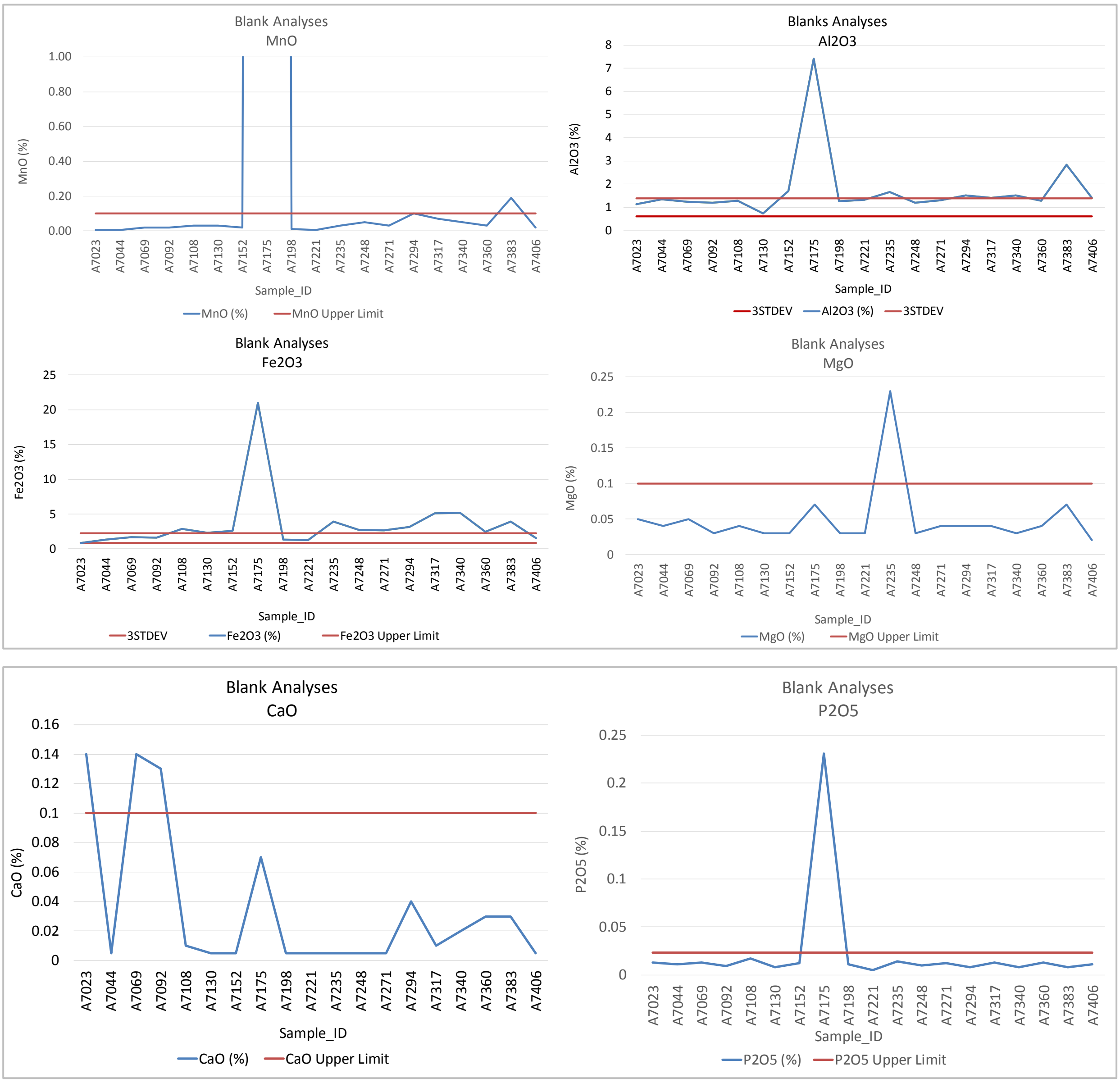
All the MnO assays of the blank samples, except two, are below the upper limit. The upper limit is the upper threshold below which the blank assays are expected to be when there is no contamination and is generally taken at ten times the lower detection limit for the method used for each analyte. The blank assays that returned values beyond the upper limit had assays of 0.19% and 42.5% MnO.

An assay of 42.5% MnO is considered to be too high to result from contamination. It is therefore concluded that this sample was swapped with a field sample. The other blank failure, with an assayed grade of 0.19%, could have been due to contamination as it follows a CRM, which has an assayed grade of 60.1% MnO. Contamination should not have taken place during the sample preparation phase as CRMs are inserted as pulverised material, so they do not require any crushing where most contamination takes place. Overall, the blank sample assay grades for MnO show that there may have been some contamination at the laboratory, but this was low and would not have any significant impact on the MnO grade of the drillhole core samples (Figure 11-1).

Analyses of blank samples were also undertaken for Al_2O_3, CaO, Fe_2O_3, MgO and P_2O_5. The Al_2O_3 and Fe_2O_3 grades were judged in reference to three standard deviations of the certified values. The average assayed grade of the blank sample for Al_2O_3 and Fe_2O_3 is 1.4% and 2.6%, respectively. Out of 19 samples, one was interpreted to be a sample swap, 11 Fe_2O_3 assays are outside three standard deviations of the certified value, and five Al_2O_3 assays are outside three standard deviations of the certified value.

It is thus the QP's opinion that the level of possible contamination within the K-Hill samples is low. The reason for the elevated Fe_2O_3 values is uncertain as the sample cannot be contaminated for only one analyte. This is more likely an accuracy issue but will not negatively affect the confidence of the Mineral Resource estimates at this stage of the project's development.

Figure 11-1
Results of blank sample assays



Source: MSA, 2018

11.4.2 CRMs

Samples of a single CRM (AMIS0403) were inserted within the K-Hill drillhole core sample stream. This CRM was made from manganese ore from the Wessels Mine in the Kalahari Manganese Field in South Africa (Table 11-2).

Table 11-2 AMIS0403 certified value and two standard deviation value		
Variable	**Certified value (%)**	**Two standard deviations (%)**
MnO	60.42	0.64
Al_2O_3	0.37	0.02
CaO	5.12	0.14
Fe_2O_3	18.52	0.36
MgO	0.66	0.06
P_2O_5	0.08	0.008
SiO_2	5.25	0.18
LOI	4.27	0.48

Source: MSA, 2018

The number of CRMs inserted was 19, equating to a 5% insertion rate within the K-Hill samples, which is in line with acceptable industry practice. The MnO grade of the CRM was high relative to the K-Hill samples and more than one CRM is generally recommended.

Out of 19 samples, only one sample returned a value outside three standard deviations of the certified MnO value. This sample had a grade of 0.02% MnO and is considered to be a sample swap. The average grade of the CRM assays, excluding the sample swap, is 60.51% MnO, which compares favourably with the CRM certified value of 60.42% MnO (Figure 11-2).

The CRM samples were also assayed for Al_2O_3, CaO, Fe_2O_3, MgO, P_2O_5 and SiO_2. The CRM assays for these variables are within three standard deviations of the certified value of the respective variables, except for one Al_2O_3 assay that returned a value above the limit. None of the variables showed significant bias, and none exceeded 4% relative difference from the certified values (Figure 11-2).

It is the QP's opinion that the assayed grades of the CRM samples indicate acceptable analytical accuracy at the grade of the CRM. However, the single CRM used does not fully confirm the accuracy of assays at the ranges of MnO grades at K-Hill, since the K-Hill drillhole core samples have lower MnO grades than the certified value of the CRM.

Figure 11-2

Results of AMIS0403 CRM sample assays

Source: MSA, 2018

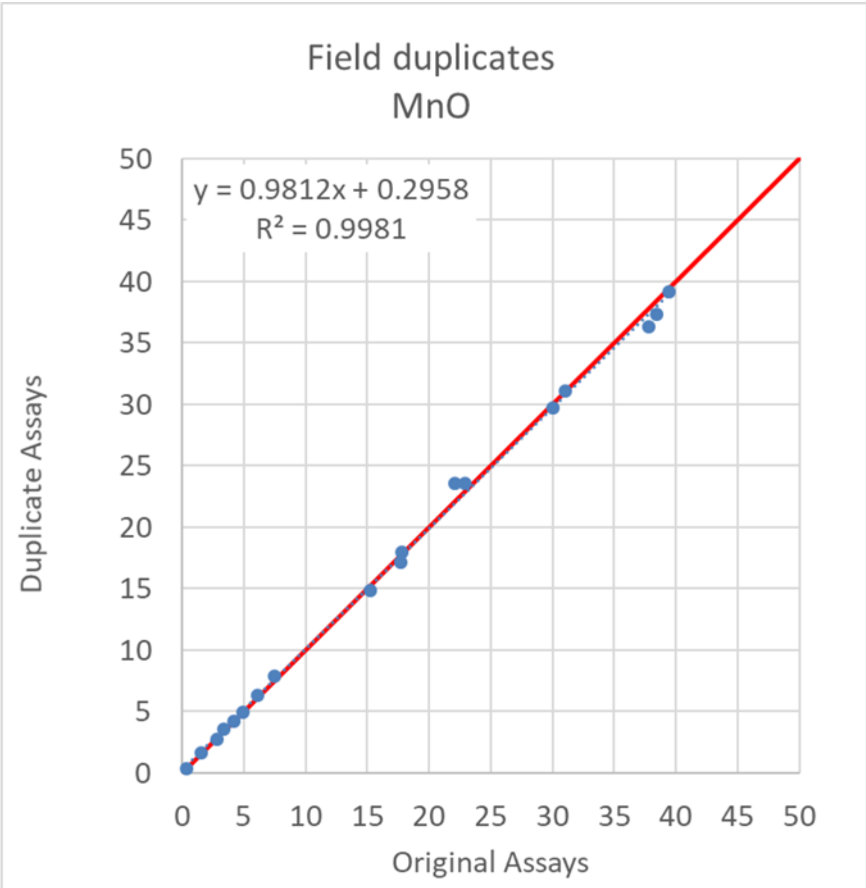
11.4.3 Coarse duplicates

Coarse duplicates are inserted to assess the adequacy of the sub-sampling process after crushing and the repeatability of the analytical process. As per the laboratory sample preparation standard operating procedure, a sub-sample of 500 g was collected using a riffle splitter after crushing. At this point, a second sub-sample was collected as a coarse duplicate and assigned a different sample number.

The duplicate assays of MnO, Al_2O_3, CaO, Fe_2O_3, MgO, P_2O_5 and SiO_2 show good precision (or repeatability) with linear correlation coefficients of greater than 0.9 (Figure 11-3 and Figure 11-4).

It is therefore the QP's opinion that the sub-sampling process and the analytical processes are repeatable and the results thereof are appropriate for Mineral Resource estimation.

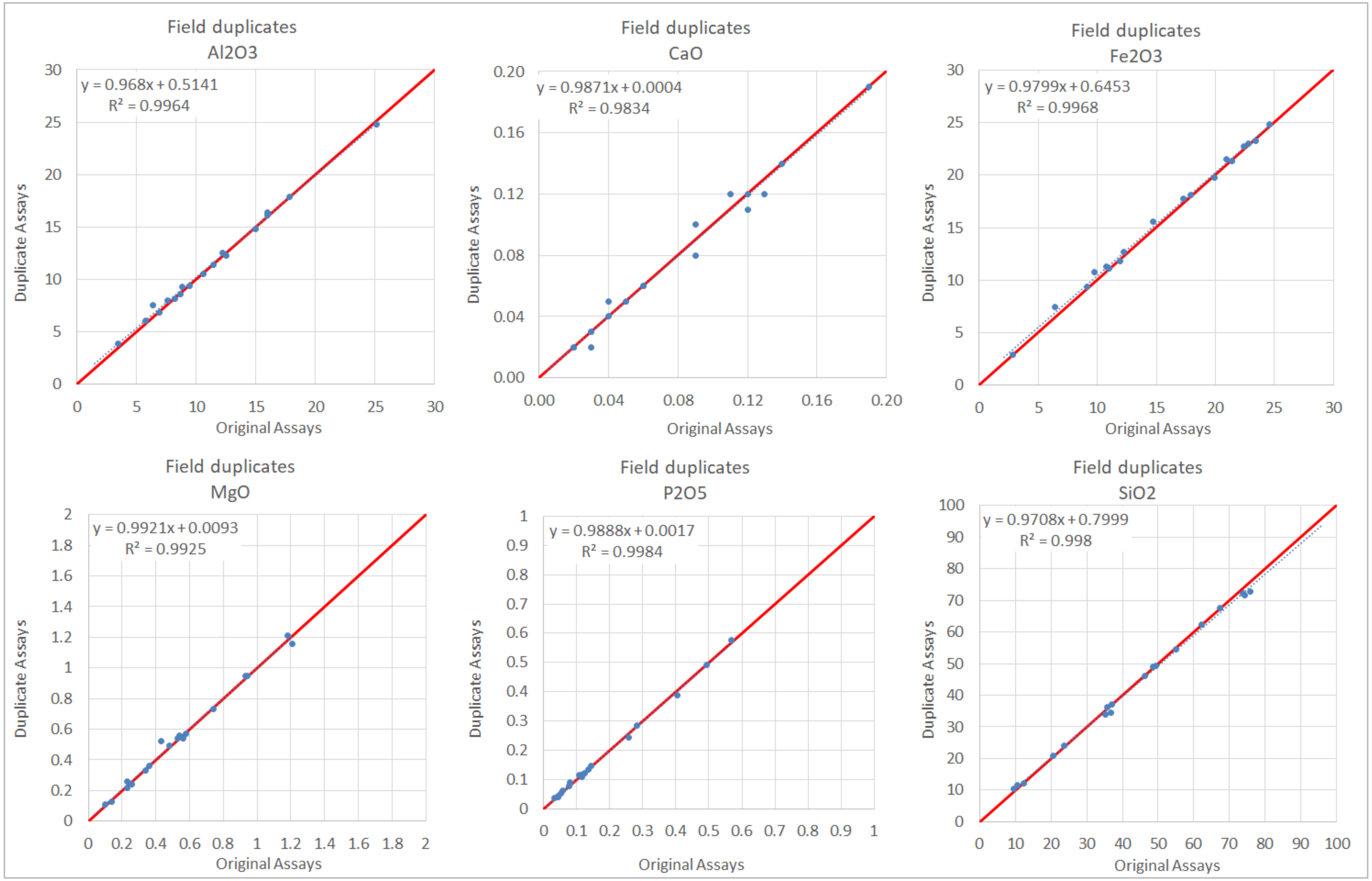
Figure 11-3
Scatterplot of MnO assay pairs (in percent) of duplicate samples



Source: MSA, 2018

Figure 11-4

Scatterplots of duplicate sample assay pairs (in percent)



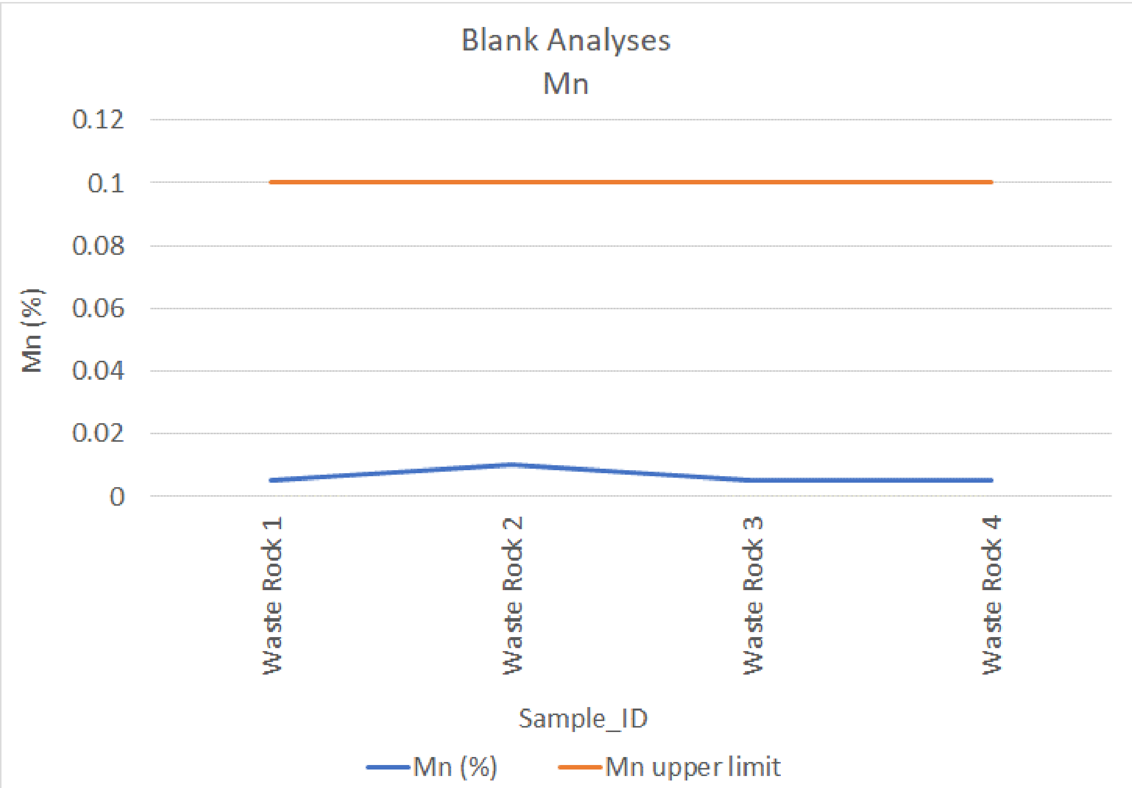
Source: MSA, 2018

11.4.4 Check Assays

Reject material from 40 samples that had previously been assayed by SGS were submitted to Intertek Genalysis laboratory in Maddington, Australia. This is an independent commercial laboratory, which is ISO17025 accredited by the National Association of Testing Authorities, Australia (NATA) for chemical testing. The duplicate samples were accompanied by 4 CRM and 4 blank samples. The assay method undertaken on these samples was x-ray fluorescence (XRF), similar to the primary laboratory (SGS) assay method. The insertion rate was 10%, which is higher than the industry standard 5%, because of the limited number of samples in the data set.

The blank samples accompanying the check assays returned grades close to the detection limit for all variables, including MnO (Figure 11-5). This indicates that there was limited, if any, contamination at the laboratory, during the assaying of these samples.

Figure 11-5
Assays of MnO in blank samples accompanying the check assays

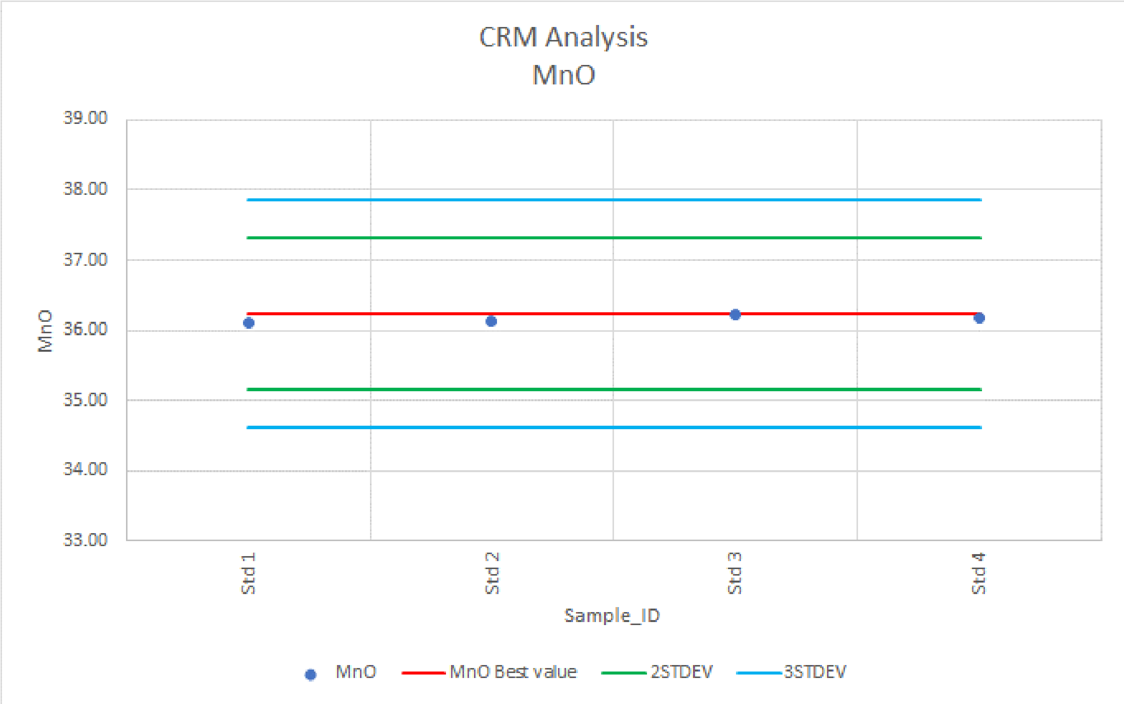


Source: MSA, 2018

The CRM samples inserted with the check assay batch were sourced from AMIS0407. The assays that were returned are within two standard deviations of the certified MnO value for this method (Figure 11-6).

Figure 11-6

MnO assays (in percent) of AMIS0407 samples by the check laboratory



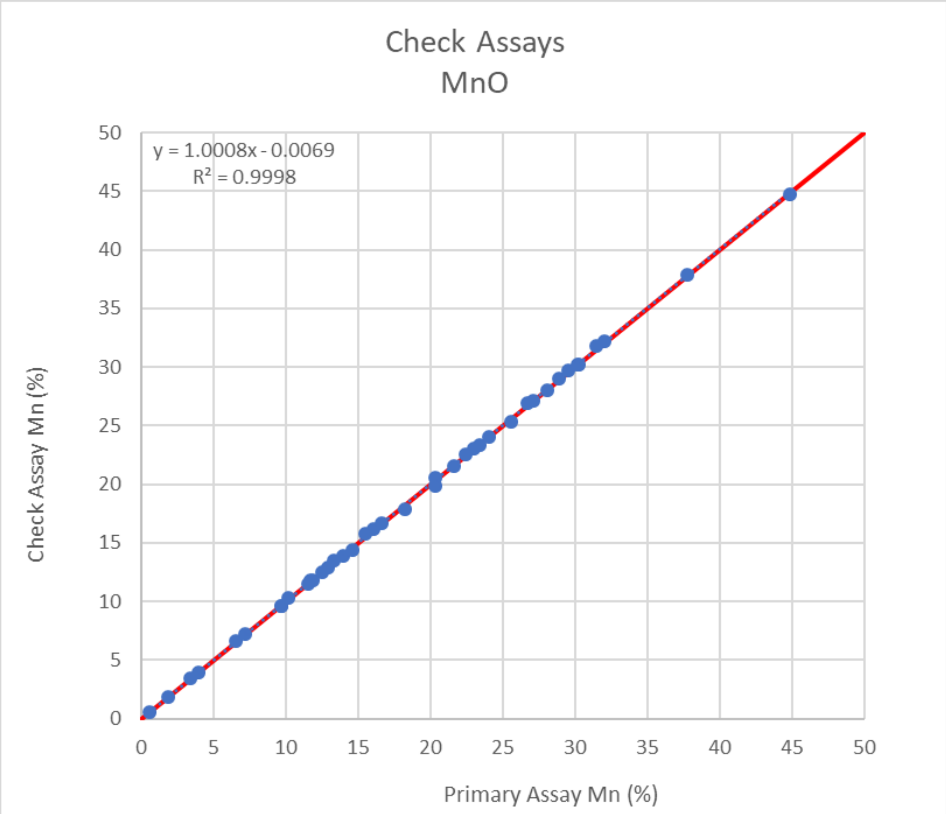
Source: MSA, 2018

A scatterplot comparing the MnO assays from the primary and the secondary laboratory shows very good correlation, with a linear correlation coefficient of approximately 1 (Figure 11-7).

The original samples were not analysed for base metals at SGS. Assays for lead and copper were only carried out on the check assays. The statistics thereof are reported in Item 14.

Figure 11-7

Scatterplot of MnO assays (in percent) of the primary laboratory versus the secondary laboratory



Source: MSA, 2018

11.4.5 Overall Opinion of Sample Preparation, Analyses and Security at K-Hill

The results of the QAQC measures applied for K-Hill do not indicate significant contamination and demonstrate a high degree of accuracy and precision. The second laboratory assays confirm the primary laboratory assays within close limits.

It is the QP's opinion that the sample preparation, security and analytical procedures are adequate for the style of mineralization evident at K-Hill. The use of a single CRM as a measure of analytical accuracy is not optimal and three CRMs that cover the expected range of grades at K-Hill are recommended in any future exploration drilling.

12 DATA VERIFICATION

A site visit to K-Hill was undertaken on the 07th and 08th of June 2018 by the QPs, Mr Ed Swindell and Mr Jeremy Witley. The purpose of the site visit was to inspect the site, review the drilling and sampling procedures and inspect the cores. Observations made of the MnO mineralization in the cores are consistent with the grade ranges of the assay values received from the laboratory.

Giyani carried out drilling at K-Hill in April and May 2018. The site-visit by the Qualified Persons took place shortly after the drilling was completed and the contractor had left the K-Hill site and so the actual drilling activities were not observed. The Qualified Persons observed the rehabilitated drilling sites and the marked collar positions of the completed holes during the site visit and confirmed a number of their locations using a hand-held GPS.

The sample assay database was verified by comparing 10% of the values shown on the assay certificates issued by SGS with the values in the database. No errors were found.

In the opinion of the QPs, the database is adequate for the purpose of Mineral Resource estimation.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

The purpose of this section of the report is to present the chemistry background to manganese leaching within the context of the hydrometallurgical processing as it pertains to the K-Hill Project. This test-work concentrates on the leaching of manganese from the minerals but also places it in context of the overall circuit.

Dr Ian Flint of Lab 4 Inc. (Canada) was engaged by Giyani to provide metallurgical consulting services. Lab 4 has more than 30 years of experience in mineral processing including physical separations and hydrometallurgy. This includes laboratory, pilot plant and industrial operations as well as circuit and equipment design.

Testing was carried out by Lab 4 Inc., the department of Geology of Dalhousie University and the Minerals Engineering Centre of Dalhousie University, all of Halifax, Nova Scotia, Canada.

- Stage 1 was performed by Lab 4 and the department of Geology of Dalhousie University. This included optical and electron probe work that identified the valuable and waste minerals, the particle sizes, and the approximate grind sizes required for liberation to exposure.
- Stage 2 was performed by Lab 4 and the Minerals Engineering Centre of Dalhousie University. This included tests on the leaching of various samples to determine the chemistry, and residence times required to dissolve the manganese as the first stage of a hydrometallurgical process. The grind size was based on the results of Stage 1.

13.1 Mineralogy Summary

A mineralogical analysis was performed on a selection of manganese oxide bearing rocks taken as grab samples from K-Hill. Four samples were tested to determine the mineralogical composition of the manganese minerals. These samples and the resulting determinations are found in Table 13-1. haematite, other iron oxides and some pyrite along with silica and in one horizon of the shales; kaolin, are found throughout.

Table 13-1
Identified and possible manganese minerals in the K-Hill samples. All samples also contain silica and iron oxides

Sample	Description	Mineral	Formula
KH17MT01	Dump Material	Cryptomelane Hausmannite Hollandite Psilomelane Pyrolusite	$K(Mn_7^{4+}Mn^{3+})O_{16}$ $Mn^{2+}Mn_2^{3+}O_4$ $Ba(Mn^{4+}{}_6Mn^{3+}{}_2)O_{16}$ $BaMn^{2+}Mn_8^{4+}O_{16}(OH)_4$ MnO_2
KH17MT02	Altered Shale	Jacobsite	$Mn^{2+}Fe^{3+}{}_2O_4$
KH17MT03 KH17MT05	Shale with Kaolin	Coronadite Cryptomelane Hausmannite Hollandite Psilomelane	$Pb(Mn^{4+}{}_6Mn^{3+}{}_2)O_{16}$ $K(Mn_7^{4+}Mn^{3+})O_{16}$ $Mn^{2+}Mn_2^{3+}O_4$ $Ba(Mn^{4+}{}_6Mn^{3+}{}_2)O_{16}$ $BaMn^{2+}Mn_8^{4+}O_{16}(OH)_4$
KH17MT04	Silicified Shale	Hausmannite Psilomelane group	$Mn^{2+}Mn_2^{3+}O_4$ $BaMn^{2+}Mn_8^{4+}O_{16}(OH)_4$

In terms of presentation, the manganese minerals occur in three forms:

- As staining on the silicates, iron oxides and themselves.
- As small veins where manganese oxides have been deposited on each other particularly within the well fissured portions.
- As nodules where the manganese has built-up into botryoidal masses that may contain other minerals within them. This study did not investigate the nodules as this would involve a significant sample to determine their mass percent and size distribution at various locations.

This supergene mineralogy is complex as there are many oxidation states of manganese and a variety of other metals present.

The results of the assays from these samples, converted to the standard oxide form, are shown in Table 13-2. These assays were taken on gram sized samples and not on individual crystals thus represent a number of different minerals as found within the entire rock sampled.

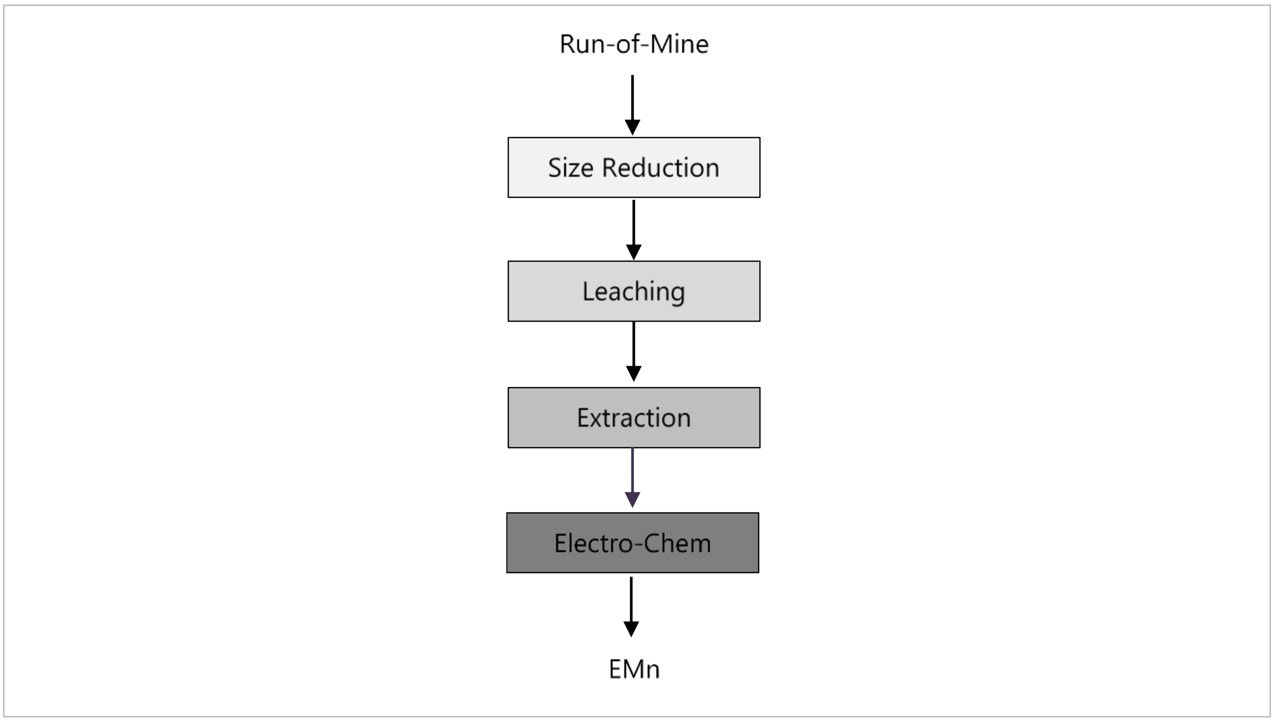
Table 13-2
Assay results for various samples taken at K-Hill, (Converted from Fe and Mn values determined by Dalhousie MEC)

Sample	Description	Weight Percent	
		FeO	MnO
KH17MT01	Dump material	39.7	48.7
KH17MT02	Altered shale	27.3	48.8
KH17MT04	Silicified shale	4.5	4.3
KH17MT03, KH17MT05	Shale with kaolin	23.2	60.8

13.2 Postulated Processing Circuit

The overall manganese product circuit postulated for the Project is illustrated in Figure 13-1 wherein the feed to the circuit is the mined materials. The minerals are reduced in size to expose the surfaces, leached by acid dissolution, and the manganese is then extracted from the mixed ion system and concentrated in a solvent/liquid extraction system. Finally, the manganese gets removed from the solution as electrolytic manganese (EMn) by electro-chemistry.

Figure 13-1
Overall manganese processing circuit



Source: Flint 2018

13.3 Grinding

No grinding tests have been carried out. The required grind size for leaching was estimated from the thin sections to be approximately 200 µm based on breakage occurring along existing fractures, manganese deposited preferentially on surfaces and within the fractions, and liberation to leaching liquid exposure. Leaching tests was conducted on a d_{80} of this target size.

13.4 Leaching

Core samples from drillhole DDKH18_0018 were subjected to leaching tests. A description of these samples is provided in Table 13-3. The samples used for the test-work encompassed a variety of mineralization styles from a single drillhole the position of which is shown in Figure 10-1. Given the that the samples were sourced from a single location they are not representative of the various types and styles of mineralization and the mineral deposit as a whole.

Table 13-3

Description of the samples from DDKH18_0018 used for leaching tests

Sample	Description	Photograph
KH18MT010	Mn-Shale High density Metallic Luster Interval 23.73-27 m Drilled thickness 3.27 m Recovery 1 m Sample type – core/chips/rubble Specific Gravity 3.05	
KH18MT011	Fe Shale Massive Mn Oxide mineralization within bands Interval 27-30.85 m Drilled thickness 3.85 m Recovery 3.7 m Sample type – core Specific Gravity 2.54	
KH18MT012	Mn-conglomerate Massive Mn Oxide mineralization Granular texture Finer grained conglomerate unit Interval 48-50.73 m Drilled thickness 2.73 m Recovery – 0.56 m Sample type – core Specific gravity 2.62	

The acid strength used for the leaching was 18.9M diluted at a ratio of 1:6. The leach was maintained at a temperature of 80°C and stirred at 300 rpm.

Within a typical circuit, the leaching is done after physical processing and before solvent liquid extractions. The physical processing reduces the particle size to dimensions suitable for the leaching and may remove non-manganese minerals. Leaching is then used to dissolve the manganese from the ore into solution. This solution is then sent to the solvent/liquid extraction stage where the manganese is removed from the solution. The now barren solution is regenerated and recycled, and the manganese Is passed to the electrowinning stage.

Each stage of the solvent/liquid extraction process cannot work without the others. These are leaching, extraction, electrowinning and regeneration and recycling of solutions. As such, leaching is a critical stage. It is a complex stage as many different minerals could be dissolved; including many manganese oxides, iron species and other metallic oxides. The leaching stage is critical to the manganese recovery in that manganese not dissolved is lost. The ions in the final leaching solution are those that must be both separated in the extraction phase and removed in the recycle stage; and the consumption of acid dictates the replacement and regenerations required. As such, the leaching stage performance must be known before the other stages can be properly assessed. The results of the leaching tests are promising in that manganese recovery was good and resulted in a loaded solution of up to 35,000 ppm. In addition, some iron was rejected and the level of other contaminate metals were low.

The recoveries of acid leaching with reductant ranged from 62% to 94% based on a one-hour residence increasing to 88% to 100% for an infinite residence time (Table 13-4). As similar minerals are found in each sample, the differences in recovery are attributed to different grind size requirements and not to chemistry. Final recovery will be an economic balance between manganese recovery and the costs of grinding and iron removal.

Table 13-4
Example recoveries using both low and high values

Sample	Mn recovery 1hr/infinite	Fe recovery 1 hr
KH18MT010	62%/88%	49%
KH18MT012	77%/100%	72%
KH18MT011	94%/98%	68%

Initial leaching tests were performed to suggest a chemistry for the leaching. These tests were designed to determine the overall leaching methods and not to quantify any individual sample. Some problems were encountered with the presence of small amount of rare earth metals as well as scandium and yttrium. Cerium and lanthanum were tested and are elevated. Examples of the results that show the minor dissolved metals, are shown in Table 13-5.

Table 13-5

Multi element analysis of the loaded leach solution resulting from the preliminary leach tests

Sample ID	mg/L							
	Ag	Al	As	Ba	Be	Bi	Ca	Cd
EPH (Water Std.)	<0.2	29.8	14.2	82	4.4	<0.2	1246	4.9
Mn Fe Sucrose	<1	938	<0.1	<0.1	0.3	<0.5	132	<0.1
Mn Silici	<1	1236	<0.1	<0.1	<0.1	<0.5	55	<0.1
Mn Fe	<1	915	<0.1	<0.1	0.3	<0.5	134	<0.1
Mn Fe 2Hr	<1	896	<0.1	<0.1	0.3	<0.5	130	<0.1
Mn Kaolin 2Hr	<1	2082	<0.1	<0.1	0.1	<0.5	77	<0.1

Sample ID	mg/L							
	Ce	Co	Cr	Cu	Fe	Ga	Ge	In
EPH (Water Std.)	<0.2	3.5	23	48	48	<0.2	<0.2	<1
Mn Fe Sucrose	20	138	1.5	29	6589	<0.5	<5	<1
Mn Silici	<1	1.3	1.5	0.1	2232	<0.5	<5	<1
Mn Fe	95	61	3.2	32	10730	<0.5	<5	<1
Mn Fe 2Hr	95	57	2.6	32	10492	<0.5	<5	<1
Mn Kaolin 2Hr	28	19	3.8	4.0	11396	<0.5	<5	<1

Sample ID	mg/L							
	K	La	Li	Mg	Mn	Mo	Na	Nb
EPH (Water Std.)	725	<0.2	35	379	9.6	22.5	728	<0.2
Mn Fe Sucrose	641	<2	3.1	206	26470	<0.1	111	<1
Mn Silici	129	<2	2.0	42	719	<0.1	12	<1
Mn Fe	238	<2	5.4	177	2388	<0.1	185	<1
Mn Fe 2Hr	238	<2	3.9	177	2350	<0.1	184	<1
Mn Kaolin 2Hr	451	<2	2.5	90	2749	<0.1	59	<1

Sample ID	mg/kg							
	Ni	P	Pb	S	Sb	Se	Si	Sn
EPH (Water Std.)	23	23	20		7	15	2.1	<1
Mn Fe Sucrose	38	19	2.2	78634	<1	7.5	217	<1
Mn Silici	0.9	7.5	<0.5	218216	<1	<0.5	9.3	<1
Mn Fe	18	11	0.9	169268	<1	<0.5	50	<1
Mn Fe 2Hr	19	18	0.9	163402	<1	<0.5	51	<1
Mn Kaolin 2Hr	8.2	12	0.8	213483	<1	<0.5	10	<1

Sample ID	mg/kg							
	Sr	Ta	Te	Ti	Tl	V	Zn	Zr
EPH (Water Std.)	39	2	<1	<0.2	7.1	33.1	254	<0.2
Mn Fe Sucrose	2.4	28	<1	21	<10	21.2	18	1.1
Mn Silici	0.3	<1	<1	55	<10	3.0	5.2	0.7
Mn Fe	2.5	<1	<1	27	<10	7.9	18	1.5
Mn Fe 2Hr	2.4	<1	<1	27	<10	7.7	17	1.4
Mn Kaolin 2Hr	3.5	<1	<1	55	<10	7.7	8.9	2.3

These tests were conducted to determine the leach conditions and approximate residence times. In Table 13-5, EPH is the base conditions with only a water dissolution. Mn-Fe Sucrose is the leach tests done using sucrose as a reductant. Mn-Silica is a test performed on silica rock with veinlets of manganese minerals. The remainder of the tests were done on manganese enriched rocks that were the primary rock or that covered silica rocks. The Mn-Fe test had a resident time of one hour. The kaolin tests were performed on rocks with manganese mineralization containing appreciable amounts of kaolin.

- The silica sample was from the hard cap rock that has manganese minerals veins. Mn rock tests were done on material more unconsolidated material that was black in colour from manganese surfaces. This includes the Mn Fe, Mn Fe 2hr and Mn Kaolin tests. The Mn Fe Sucrose test was on the Mn Fe material using different chemistry.
- EPH Water Standard was the baseline leach using only water. Only a small amount of Ca and Na were dissolved. All tests, with the exception of the EPH used sulphuric acid.
- The Silica test shows minimal dissolution of Fe and Mn that occurred over an hour residence time. This indicates that grind size may have to be reduced on this particular ore type or that longer residence times are needed if this rock is to be processed.
- The Mn Fe, and Mn Fe 2hr test are similar leaches with one- and two-hour residence times. These show appreciably higher dissolution of manganese compared to the Silica tests resulting from the higher surface areas of manganese minerals. The similar dissolution of the one- and two-hour tests indicates that a one-hour residence is sufficient at this grind size.
- Mn Kaolin 2hr tested the unconsolidated kaolin bearing materials. There were essentially no differences in the leach products between the prior two Mn tests. The exception is the elevated levels of Al.
- The Mn Fe Sucrose test used sucrose as the reductant. This test showed a slight elevation of Al and Co compared to the baseline, and very large increase in both Fe and Mn. The Mn obtained was significantly higher than in the other treatment methods. The reactions occurring in the Mn Fe Sucrose tests are as follows:

  $$24MnO_2 + C_{12}H_{22}O_{11} + 24H_2SO_4 \rightarrow 24MnSO_4 + 12CO_2\uparrow + 35H_2O$$

- The chemical reactions, acid, reductant requirements, and the residence times, all change with mineral type and grind size.

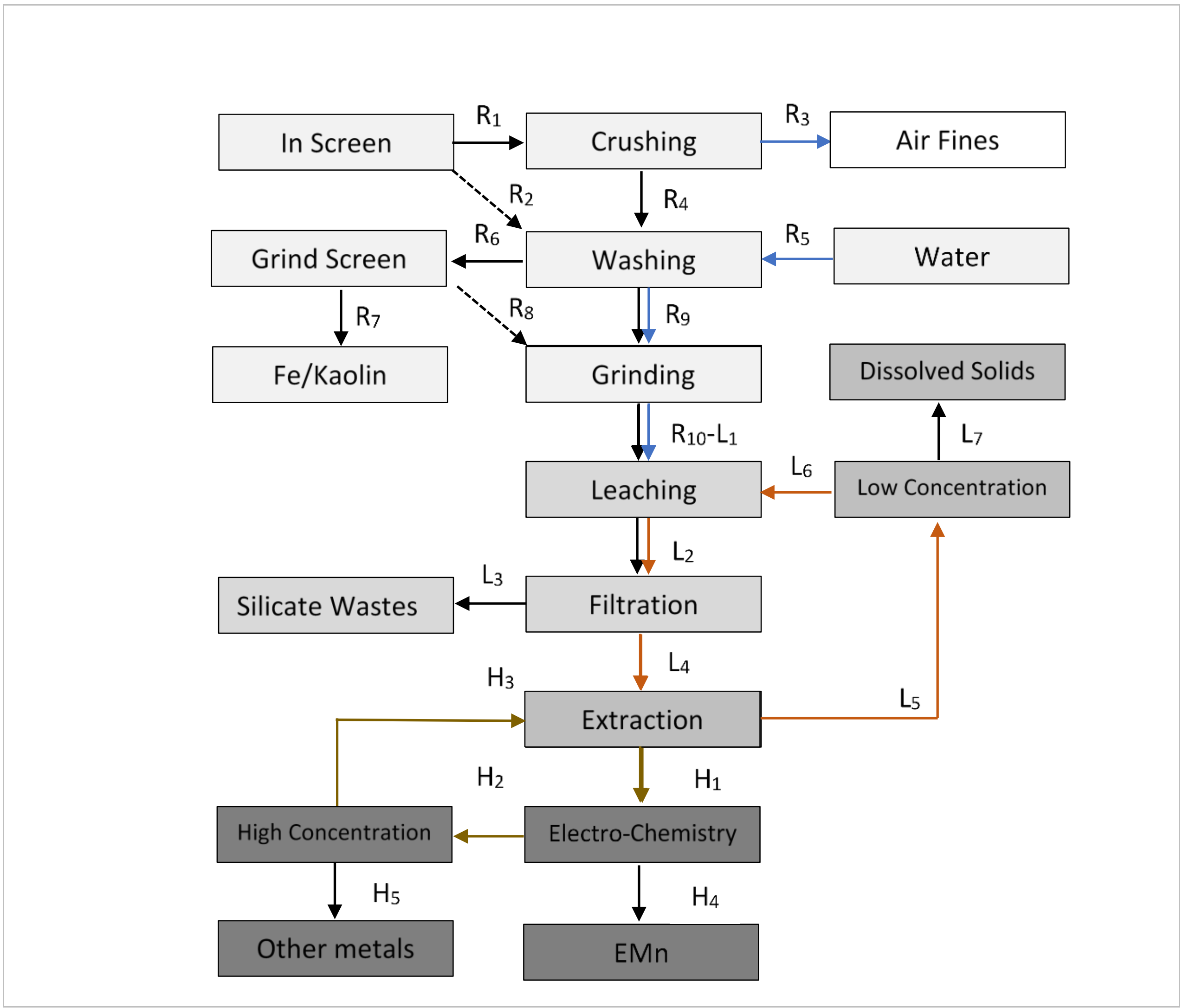
13.5 Hydrometallurgical Processing of Manganese

Hydrometallurgical test-work was not performed on the K-Hill samples. A description of the general hydrometallurgical process to extract manganese from solution is as follows:

The hydrometallurgical processing of manganese from its various oxide forms is existing technology. This takes manganese from silicate rocks, mudstones and similar ores and upgrades it electrolytic manganese (EMn). The general circuit for this process is found in Figure 13-1. This is comminution followed by leaching, solvent/liquid extraction and electrowinning. This process should be capable of taking an initial grade of Mn to produce EMn.

The first stage of the process is size reduction, shown in Figure 13-2 in light grey. In this stage the run-of-mine ore particles are reduced to the point where the manganese is exposed at the surface. This stage results in three products, collected dust is the Air Fines (R_3) the washing removes some of the surface iron minerals and kaolin as the Fe/Kaolin product (R_7), and the remainder is the remaining rock with exposed manganese (R_{10}).

Figure 13-2
High level block diagram of an initial Mn hydrometallurgy separations circuit. Each block could contain many pieces of equipment or sub-circuits.



The grinding product (R_{10}) is the feed to leaching stage (L_1). Acid and a reductant are recycled and refreshed to dissolve the manganese. Two products result; the filtered solids (L_3) which is mostly silicates and other undissolved minerals, and the loaded liquid (L_4) that will contain manganese ions, iron ions and a suite of other metal ions dissolved from the rock. Consumables are any acid that is consumed by stray carbonates or other alkaline materials, and the reductant. Acid consumption will vary within depending on the source rock. Leaching can be in stirred tanks or as a heap leach depending on capital costs and environmental concerns.

The loaded leach liquid (L_4) goes to a solvent/liquid extraction process. In this circuit the manganese is transferred to a purified high concentrate solution (H_1) and the L_4, minus the manganese, is recycled using a classical circuit and conditioning of the recycle.

The concentrated product of the purification is then electroplated to form EMn.

13.6 Operating Cost Estimate

A high-level estimate of the operating cost for producing manganese metal from run-of-mine ore is given in Table 13-6.

Table 13-6
A high-level operating cost of producing manganese metal from run-of-mine ore

Component	Cost/tonne ore (USD/t)	Cost/tonne of manganese (USD/t)
Grinding	15	
Leaching Reductant	5	100
Leaching Acids	10	450
Organics		10
Electricity	5	30
Total	**35**	**590**

Crushing, milling and screening costs are estimated at approximately USD15/t; however, this is highly dependent on the type of mineralization.

The hydrometallurgy cost is estimated at approximately USD590/t of manganese and an additional cost of about USD20/t of ore. Thus, the cost per tonne of ore depends on the grade of that ore.

The costs presented are high level estimates and are not based on any detailed work.

It is important to note that the envisaged product is EMn, which is electrolytic manganese as opposed to manganese ore that is unrefined ore used in steel making. Recently, the price of EMn has been upwards of USD2500 per metric tonne (FOB China) (Source: www.metal.com).

13.7 QP Opinion of the Suitability of the K-Hill Manganese Mineralisation to the Postulated Process

In the QP's opinion the results of the leaching tests are promising in that manganese recovery was good. The resulting solution contained as high as 35,000 ppm Mn making it suitable for the solvent/liquid extraction process. In addition, some iron was rejected and the level of other contaminate metals were low. These results give a good probability of proper functioning of subsequent stages of the solvent/liquid extraction process.

14 MINERAL RESOURCE ESTIMATES

On behalf of Giyani, MSA completed a Mineral Resource estimate for the Kgwakgwe Hill Manganese Project (K-Hill).

To the best of the Qualified Person's knowledge there are currently no title, legal, taxation, marketing, permitting, socio-economic or other relevant issues that may materially affect the Mineral Resource other than those described in this Technical Report.

The Mineral Resource estimate incorporates drilling data collected by Giyani from 16 April to 02 July 2018 inclusive, which, in the Qualified Person's opinion is adequate for the purpose of Mineral Resource estimation.

The Mineral Resource was estimated using the 2003 CIM "Best Practice Guidelines for Estimation of Mineral Resources and Mineral Reserves" and classified in accordance with the "2014 CIM Definition Standards". It should be noted that Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.

The Mineral Resource estimate was conducted using Datamine Studio 3 software, together with Microsoft Excel and Snowden Supervisor for data analysis. The Mineral Resource estimate was completed by Mrs Ipelo Gasela (Pr. Sci. Nat.) under the supervision of Mr Jeremy Witley (Pr. Sci. Nat.), the Qualified Person for the Mineral Resource.

14.1 Database

The estimate was based on geochemical analyses and density measurements obtained from the cores of diamond drillholes. The cut-off date for the data used for this estimation was 20 July 2018. As at the cut-off-date, there were no outstanding data of relevance to this estimate and the database was complete.

A total of eighteen vertical holes were drilled at K-Hill. Two of the drillholes were collared outside the Mineral Resource area, one was drilled for metallurgical purposes and twelve of the exploration drillholes intersected the Mn-Shale. Out of these, eleven holes intersected the high-grade mineralization in the Mn-Shale, but only ten were used for estimation due to very poor recovery observed in DDKH18_0006. Drillholes not included in the grade estimate were used in defining the extent of the mineralization and for estimating the low-grade Mn-Shale and surrounding un-mineralised lithologies.

The drillhole data are stored in Microsoft Excel spreadsheets that were managed by Lambda Tau. The information contained in these Microsoft Excel spreadsheets is comprehensive, including collar surveys, lithology, sample assays and density. Where the assays returned a value of "below detection limit", the lower detection limit was assigned for estimation purposes.

As the project develops further and more drillhole data are obtained, a relational database is recommended as a more secure and managed way of storing the drillhole data.

14.2 Exploratory Analysis of Raw Data

14.2.1 Validation of the data

MSA undertook a high-level validation process which included the following checks:

- Examining the sample assay, collar information, and geology data to ensure that the data were complete for all drillholes.
- Examining the de-surveyed data in three dimensions to check for gross spatial errors and their position relative to mineralization.
- Examination of the assay and density data in order to ascertain whether they are within expected ranges.
- Checks for "FROM-TO" errors, to ensure that the sample data do not overlap one another or that there are no unexplained gaps in the sampling.
- Checks for excessive mineralized sample lengths, especially within the manganese shales.

The data validation process revealed the following:

- No missing information was found, except in intervals where no core was recovered, which is expected.
- Three drillholes, DDKH18_0002, DDKH18_0006 and DDKH18_00013, intersected voids, which are interpreted as being the result of historical small-scale mining activities. Small scale mining is largely observed in the eastern part of the deposit, but not limited to this area.
- No overlaps or unexplained gaps were found in the sampling.
- Two excessive sample lengths were identified (4.68 m and 4.28 m) in the poorly mineralised shale towards the top of the felsite basement. These are related to low recoveries and were retained in the database.
- Three density values exceeding 4.00 t/m^3 were observed; these were set to absent values for estimation purposes, as they were considered to be outside acceptable limits. Otherwise, the density and assay values were regarded to be within expected limits for the style of mineralization at K-Hill.

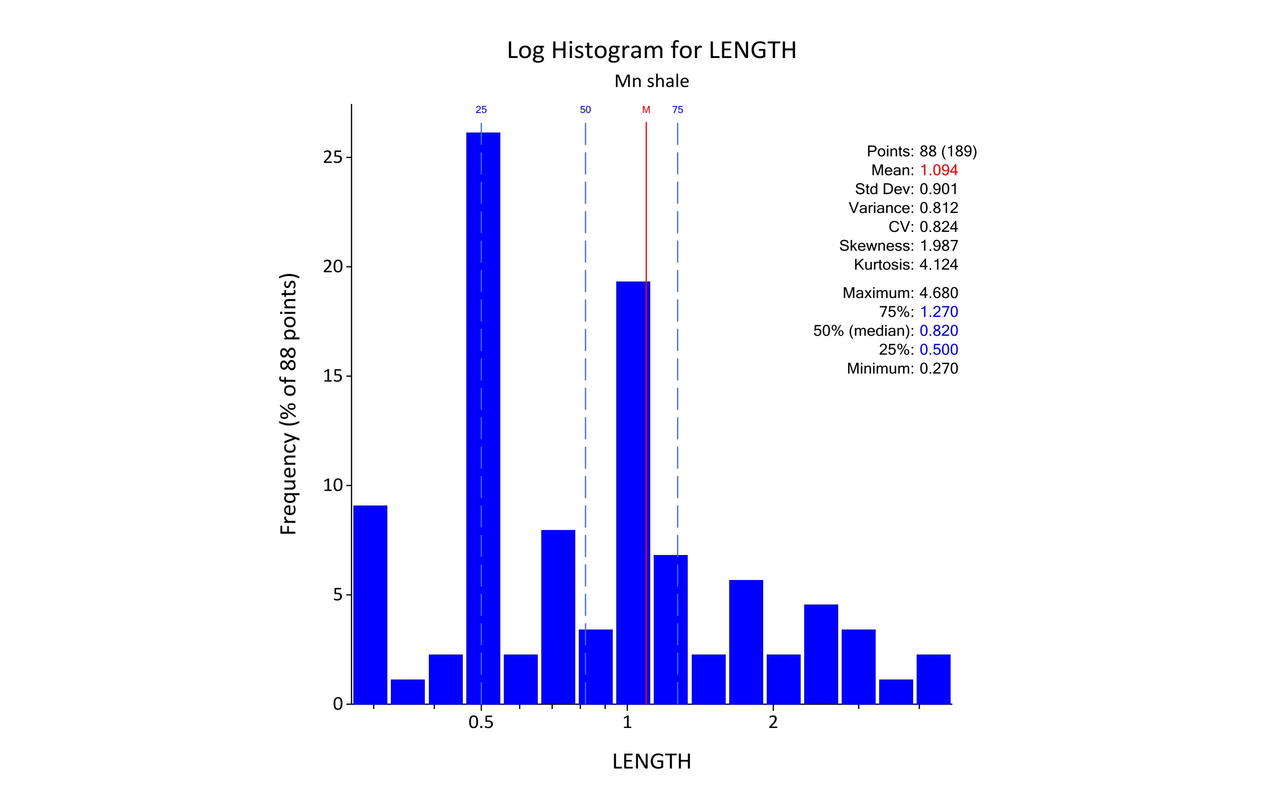
The validated data was considered acceptable for Mineral Resource estimation.

14.2.2 Statistics of sample length

Sample lengths are between 0.27 m and 6.00 m. Long samples were observed in intersections of poor recovery. Sample lengths of the Mn-Shale are between 0.27 m and 4.68 m, with the most common sample length being 0.50 m although there are a significant number of samples with a length of 1 m (Figure 14-1).

Figure 14-1

Histogram and statistics of K-Hill sample length (m) for Mn-Shale intersections



Source: MSA, 2018

14.2.3 Statistics of Assay Data

The univariate statistics of the un-composited sample assays are presented in Table 14-1. The K-Hill assay grades are from 0.01% to 57.90% MnO, while the density values are between 1.37 t/m^3 and 6.4 t/m^3. SiO_2 is the largest chemical component of the samples. The statistics presented in Table 14-1 are for all samples taken from the different lithologies at K-Hill.

Table 14-1
Un-composited sample assay statistics (in percent)

Variable	Number of samples	Minimum	Maximum	Mean	Variance	Standard Deviation
MnO	368	0.01	57.9	5.79	97.35	9.87
Al_2O_3	368	0.91	29.6	13.00	28.72	5.36
CaO	368	0.01	0.25	0.04	0.00	0.03
Cr_2O_3	368	0.01	0.63	0.04	0.00	0.04
Fe_2O_3	368	0.91	61.1	9.29	51.13	7.15
K_2O	368	0.06	9.29	3.89	4.05	2.01
MgO	368	0.01	2.03	0.88	0.23	0.48
Na_2O	368	0.01	0.78	0.04	0.01	0.08
P_2O_5	368	0.01	0.58	0.10	0.01	0.10
SiO_2	368	5.75	95.8	61.26	322.91	17.97
TiO_2	368	0.03	2.01	0.43	0.06	0.24
V_2O_5	368	0.01	0.25	0.04	0.00	0.04
LOI	368	0.0	14.42	4.13	6.21	2.49
SG g/cm^3	368	1.37	6.4	2.32	0.18	0.43

Base metals assays were only carried out on second laboratory check assay samples. The mean grade of the copper and lead assays of the check sample are 0.017% Cu and 0.638% Pb, respectively (Table 14-2).

Table 14-2
Un-composited sample base metal assay statistics for check assays

Variable	Number of samples	Minimum (%)	Maximum (%)	Mean (%)	Variance ($\%^2$)	Standard Deviation (%)
Cu	32	0.005	0.048	0.017	0.000	0.010
Pb	40	0.024	3.646	0.638	0.827	0.909

14.2.4 Bivariate Statistics

Bivariate statistics of the un-composited sample assay grades were calculated in order to assess if there is correlation between any of the variables. Strong relationships between variables should be considered in the choice of estimation parameters applied. A correlation matrix shows the linear correlation coefficient for all the variables (Table 14-3).

MnO has a strong correlation with CaO, SiO_2 and LOI. The correlation between SiO_2 and MnO is negative, while the correlation with LOI and CaO is positive. The strong linear correlations suggest that the estimation parameters of these variables should be aligned to maintain this correlation.

Table 14-3
Correlation matrix of un-composited sample assays

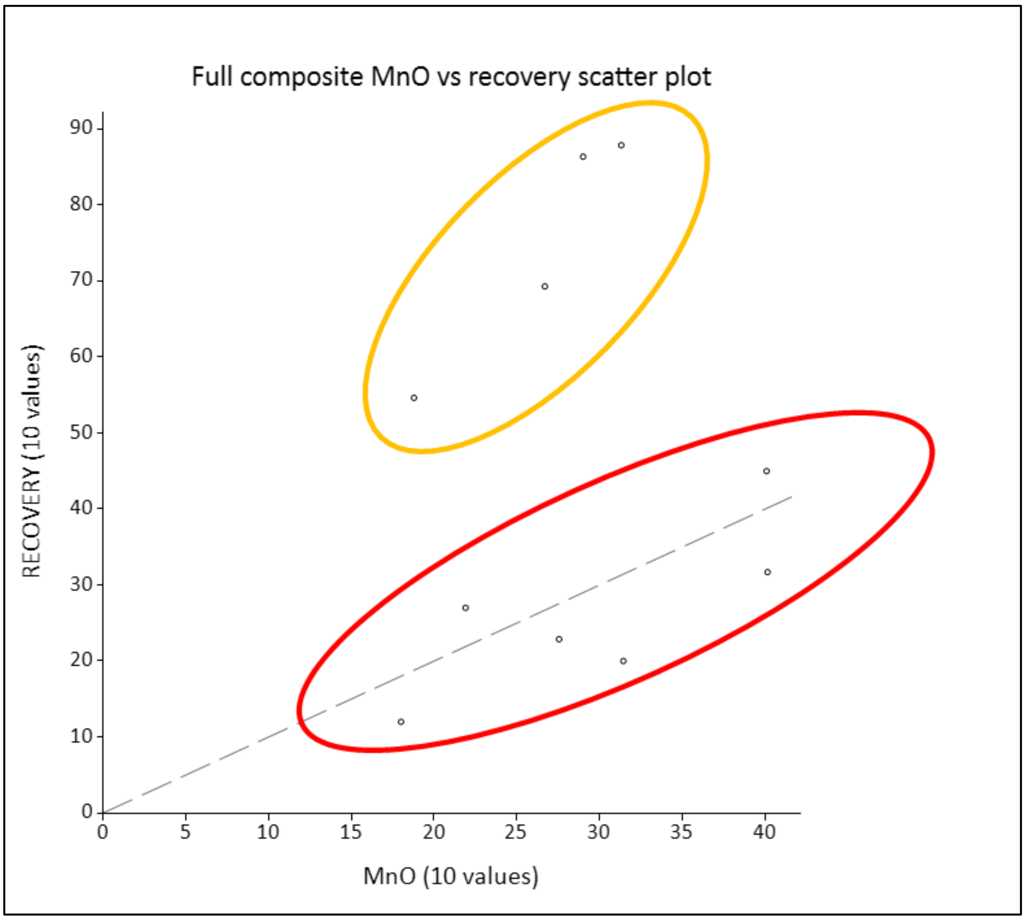
	Al_2O_3	CaO	Cr_2O_3	Fe_2O_3	K_2O	MgO	MnO	Na_2O	P_2O_5	SiO_2	TiO_2	V_2O_5	LOI
Al_2O_3	-	-0.25	0.09	-0.13	0.88	0.81	-0.3	0.06	-0.14	-0.21	0.59	-0.13	0.1
CaO	-0.25	-	0.02	0.51	-0.31	-0.37	0.74	0.44	0.58	-0.64	-0.03	0.35	0.66
Cr_2O_3	0.09	0.02	-	0.02	0.09	0.01	-0.1	0.03	-0.06	0.02	0.14	-0.09	-0.06
Fe_2O_3	-0.13	0.51	0.02	-	-0.3	-0.32	0.53	0.15	0.49	-0.74	0.13	0.5	0.57
K_2O	0.88	-0.31	0.09	-0.3	-	0.86	-0.38	0.15	-0.31	-0.03	0.43	-0.29	-0.15
MgO	0.81	-0.37	0.01	-0.32	0.86	-	-0.41	-0.1	-0.24	0.03	0.34	-0.23	-0.1
MnO	-0.3	0.74	-0.1	0.53	-0.38	-0.41	-	0.22	0.58	-0.81	-0.16	0.56	0.83
Na_2O	0.06	0.44	0.03	0.15	0.15	-0.1	0.22	-	0.07	-0.26	0.08	0.04	0.14
P_2O_5	-0.14	0.58	-0.06	0.49	-0.31	-0.24	0.58	0.07	-	-0.59	-0.07	0.58	0.73
SiO_2	-0.21	-0.64	0.02	-0.74	-0.03	0.03	-0.81	-0.26	-0.59	-	-0.22	-0.57	-0.9
TiO_2	0.59	-0.03	0.14	0.13	0.43	0.34	-0.16	0.08	-0.07	-0.22	-	0.02	0.1
V_2O_5	-0.13	0.35	-0.09	0.5	-0.29	-0.23	0.56	0.04	0.58	-0.57	0.02	-	0.64
LOI	0.1	0.66	-0.06	0.57	-0.15	-0.1	0.83	0.14	0.73	-0.9	0.1	0.64	-

14.2.5 Core Recovery

The average core recovery is approximately 50%. The MnO grade was compared with recovery for full thickness composites of the high-grade layer within the Mn-Shale (Figure 14-2).

There appears to be two populations, which both indicate higher MnO grade with increased recovery. Therefore, the risk of the poor recovery resulting in over-estimation of MnO grade is low and the data indicate that it is more likely that an under-estimation of MnO grade will occur.

Figure 14-2
Scatter plot between core recovery and MnO grade (in percent)



Source: MSA, 2018

The distribution of MnO grade within each intersection was examined for consistency between the holes. DDKH18_0006, has a grade distribution down the hole that is inconsistent with the surrounding holes and, given the particular low core-recovery, it was rejected from the grade estimation data.

14.2.6 Summary of exploratory analysis of the raw dataset

- The drilling information is stored in several spreadsheets. The current data management solution is considered adequate for a project at such an early stage, but MSA recommends that the data should to be transferred to a more suitable relational database as the project progresses.
- The validation process did not reveal any overlaps, duplicates or gaps in the sampling data.
- Assays below the analytical detection limit were assigned the lower detection limit value.
- Intervals of core that were not sampled due to no core recovered were left absent. These intervals had a loss of core caused by the soft and friable nature of the rock.
- Drillhole intersections into historical small-scale mining voids were left with absent values in the database.
- All recovered Mn-Shale intersections were sampled and sent for geochemical analyses, except for hole DDKH18_0018 that was drilled for metallurgical purposes. This drillhole was logged and the information was used in the geology modelling.
- The assay grade of a Mn-Shale intersection in DDKH18_0006 was disregarded for estimation because it had very poor recovery and a down-hole grade distribution that is inconsistent with the surrounding drillholes.
- Density values that exceeded 4.00 t/m^3 in the Mn-Shale were assigned an absent value.

14.3 Topography

A topographic model was supplied by Lambda Tau. It was constructed from gravity survey data points obtained using a differential global positioning system (DGPS), with measurements taken at approximately 50 m spacing. The relatively wide data spacing resulted in a topographic surface that is smother than the irregular topography at K-Hill and does not model the cliffs and historical open-pit faces into the hillside.

The drillhole collars were surveyed using a handheld GPS, and discrepancies between the topography and the drillhole collars were observed. The collar positions were projected vertically to the topography, since the elevations from the DGPS topography surface are considered more accurate than the handheld GPS.

It is the opinion of the QP that the resolution of the topographic surface is poor but acceptable for this level of project study. A detailed topographic surface will be required when the project progresses to the next phase of exploration or a Preliminary Economic Assessment (PEA).

14.4 Geological Modelling

The lithological logging was examined with respect to the assay data and adjustments were made as shown in Table 14-4.

Table 14-4
Adjustments made to lithological logging based on the assay data

BHID	From (m)	To (m)	Logged lithology and code	Re-assigned lithology and code
DDKH18_0001	10.00	10.10	Mn-Shale (MSH)	Footwall Shale (FSH)
DDKH18_0011	19.46	19.48	Mn-Shale (MSH)	Chert Breccia (CDB)
DDKH18_0011	23.50	23.68	Footwall Shale (FSH)	Mn-Shale (MSH)
DDKH18_0012	17.20	17.35	Mn-Shale (MSH)	Footwall Shale (FSH)
DDKH18_0015	20.60	20.68	Mn-Shale (MSH)	Chert Breccia (CDB)

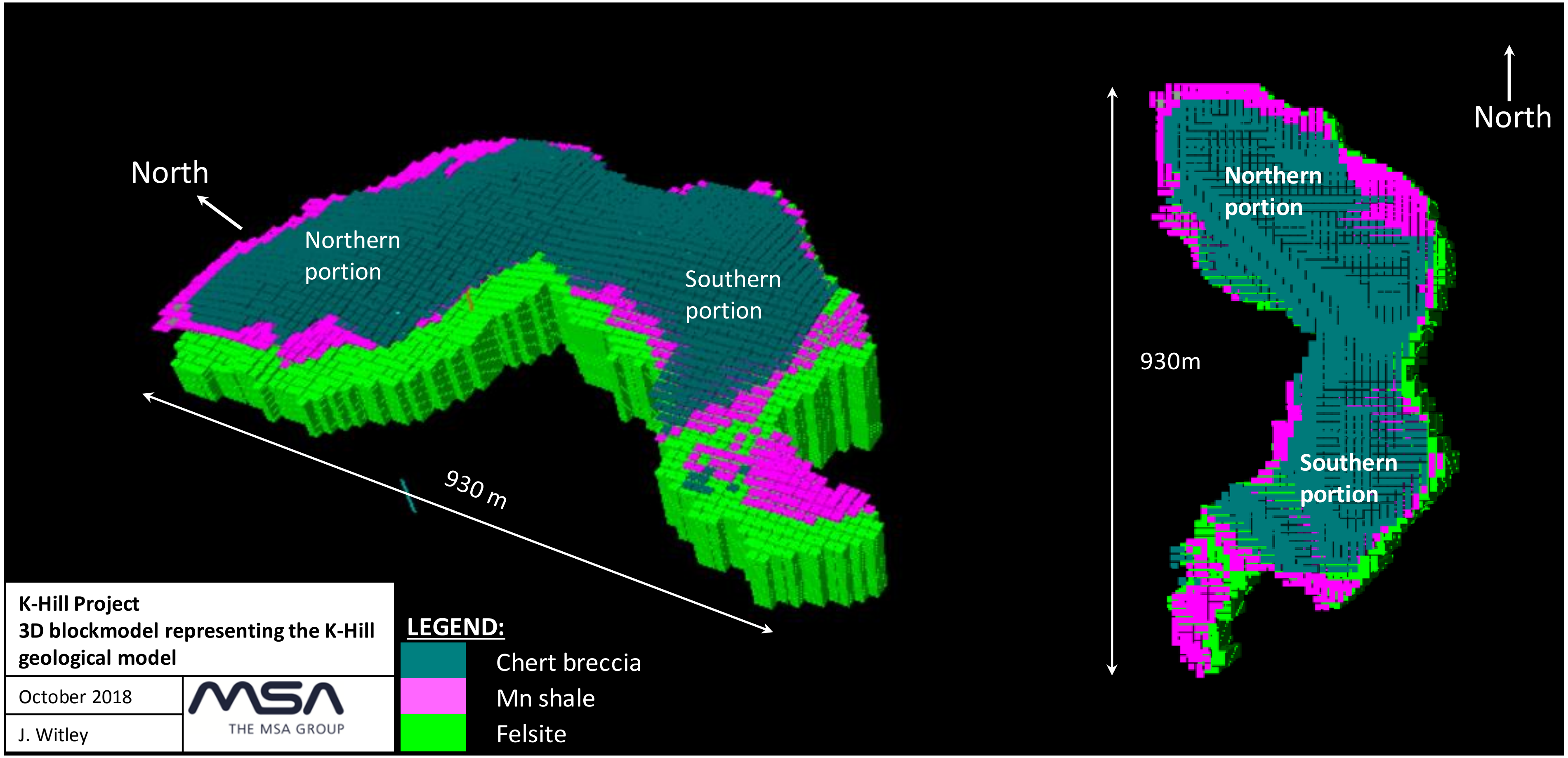
Wireframe surfaces of the lithological contacts were constructed using drillhole data and mapping. The wireframes were constructed using Datamine Studio 3 and filled with blocks to represent the position and volumes of the main lithologies (Figure 14-3) as follows:

- Base of Chert Breccia,
- Upper Mn-Shale,
- A combined unit of Fe shale, shale and conglomerate,
- Lower discontinuous Mn-Shale,
- Top of Felsite,

Internal waste was modelled in the upper and lower Mn-Shale horizons in some areas.

Figure 14-3

Oblique view (left) and plan view (right) of 3D geology block model of K-Hill

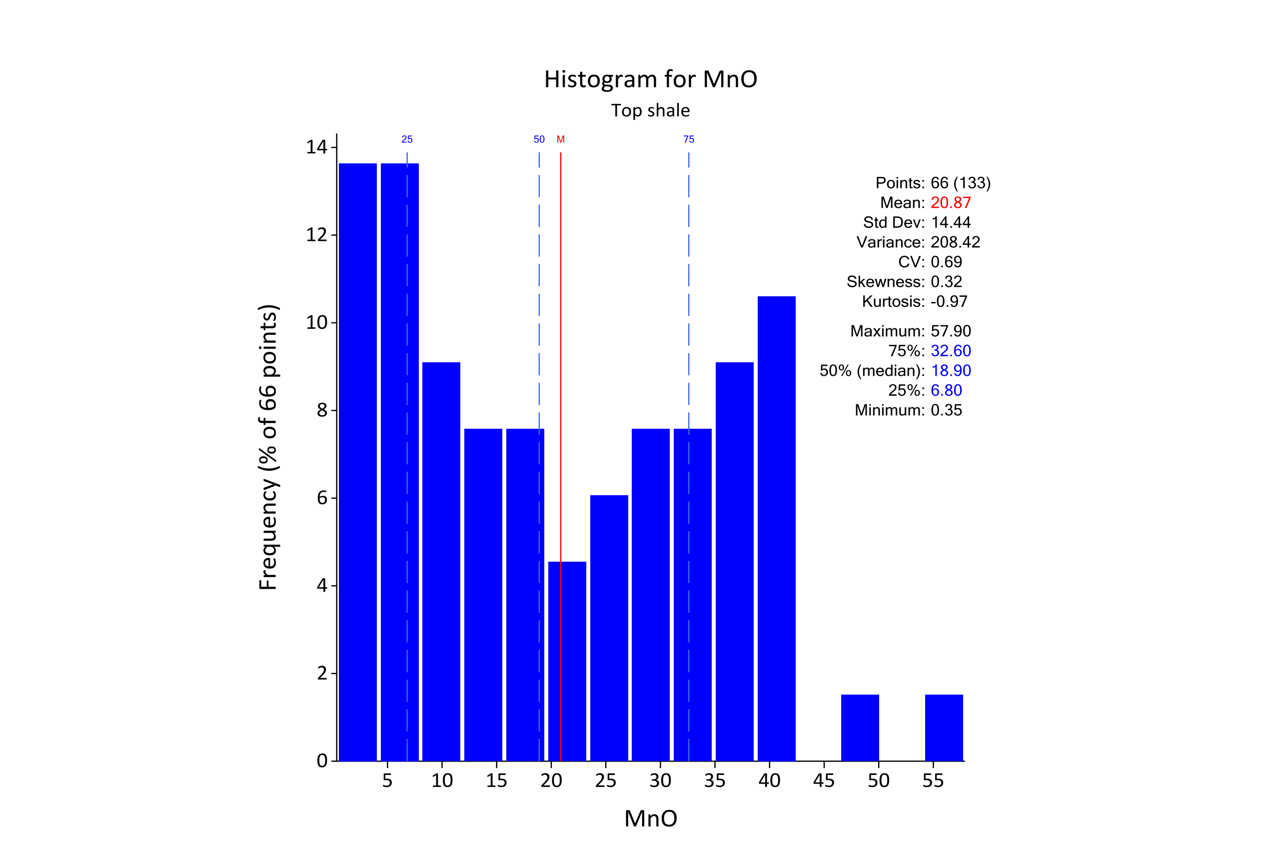


Source: MSA, 2018

The MnO grade of samples within the upper Mn-Shale were extracted using the wireframes. A histogram of the data revealed a high- and a lower-grade population (Figure 14-4). This prompted a decision to create a second surface defining a high-grade domain within the upper Mn-Shale. A threshold of 15% MnO was chosen to discriminate high-grade based on the histogram and a visual assessment of spatial continuity. The lower grades tend to occur towards the top of the Mn-Shale and higher MnO grades occur towards the base.

Figure 14-4

Histogram and statistics of K-Hill un-composited sample MnO grade (in percent) for the upper Mn-Shale

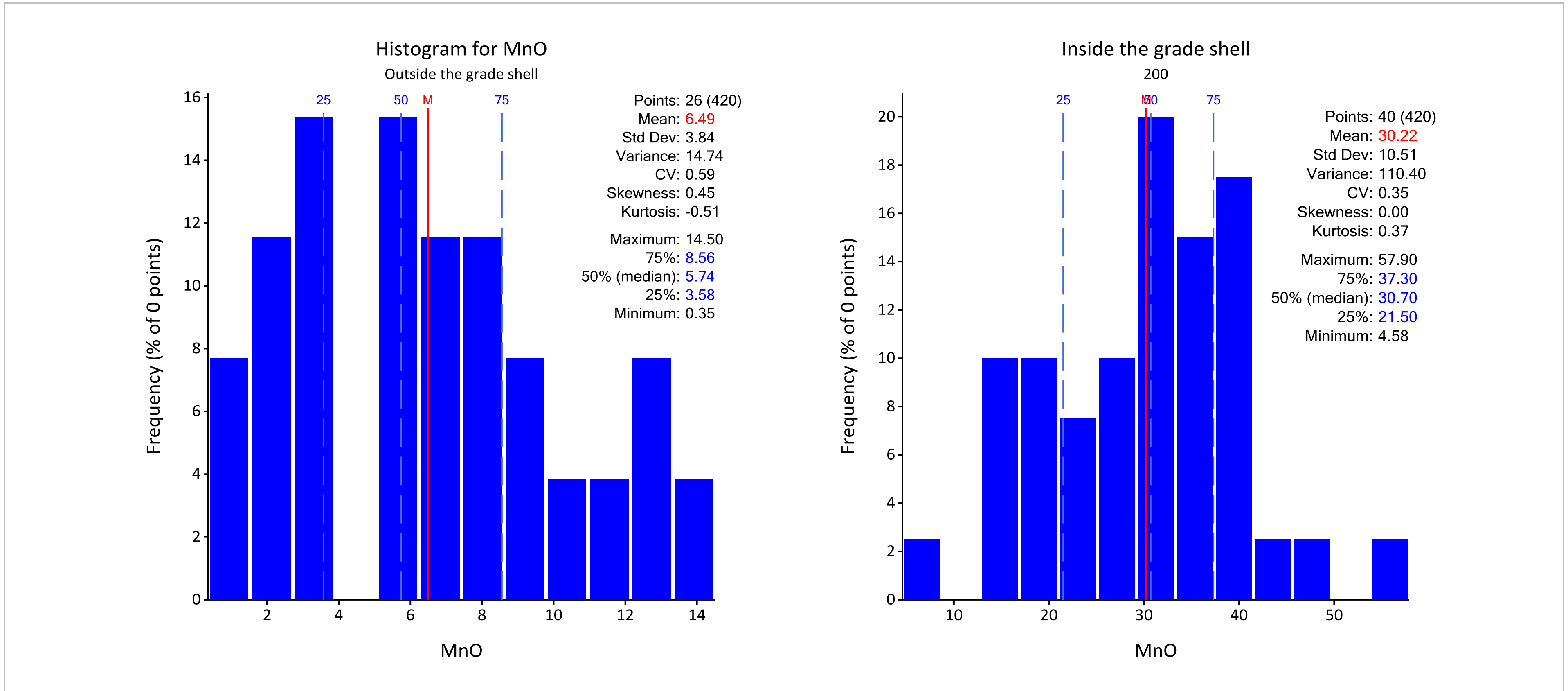


Source: MSA, 2018

Figure 14-5 shows histograms of the un-composited sample MnO grade inside and outside of the 15% MnO grade shell. The histograms are informed by a limited number of samples and are not robust. The samples outside the grade shell are between 0.35% and 14.5% MnO, and average 6.49% MnO, whereas those inside the high-grade shell are between 4.58% and 57.9% MnO and average 30.22% MnO (Figure 14-5).

Figure 14-5

Histogram and statistics of un-composited sample MnO grade (in percent) in and out of the grade shell in the upper Mn-Shale horizon



Source: MSA, 2018

The lower Mn-Shale horizon does not display multiple populations and therefore did not require further sub-domaining. The sample grades of the lower Mn-Shale horizon were from 0.04% to 17.2% MnO, with an average of 5.57% MnO. This horizon is generally of low MnO grade with only one sample above 15% MnO. Internal waste zones were also modelled in the lower Mn-Shale layer, based on logged information.

14.5 Estimation Domains

Estimation domains are based on the geological domains as shown in Table 14-5.

Table 14-5
Estimation domains

Geological domain	Estimation domains
Chert dolomite breccia	100
High grade upper Mn-Shale	200
Low grade upper Mn-Shale	201
Internal waste of top Mn-Shale	202
A combined unit of Fe shale, shale and conglomerate	400
Lower Mn-Shale	300
Internal waste of lower Mn-Shale	301
Felsite	500

14.6 Compositing

The samples were composited to 1 m lengths, this being the longest nominal sample length used. The minimum composite length allowed was 0.50 m. Composites were calculated using length weighting.

14.6.1 Composite statistics

The means and coefficients of variation (CV) of the assays for each domain are shown in Table 14-6. The histograms for Domain 200 and Domain 201 (the high- and low-grade portions of the Mn-Shale respectively) are presented in Figure 14-6. The distributions of MnO grades for both domains show a slight positive skewness, with low coefficient of variation of 0.29 and 0.45 for Domain 200 and Domain 201 respectively, demonstrating the variability within the individual domains is low.

Outliers were identified in the Fe_2O_3 grade distributions of Domain 201 and Domain 301. Top-caps were applied to the Fe_2O_3 composite grades of Domain 201 and Domain 301 at 13.5% and 3.2% respectively.

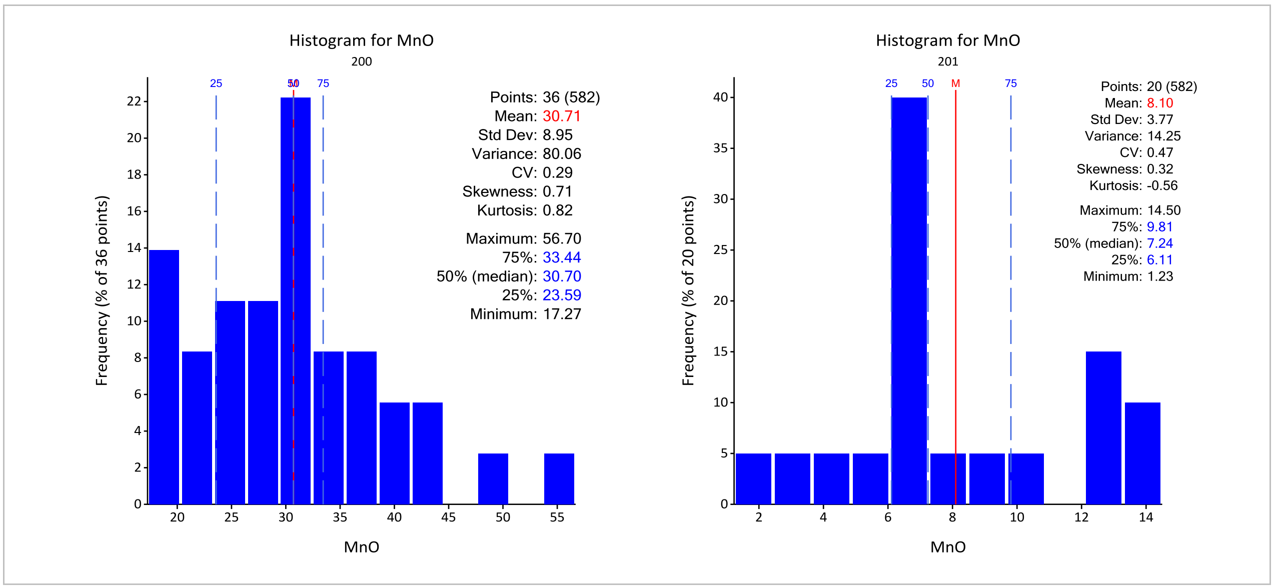
Table 14-6
Composite statistics by domain

Domain	Variable	Number of Composites	Mean	CV
100	Al_2O_3	33	3.79	0.55
	Fe_2O_3	33	3.22	0.51
	MnO	33	2.07	0.83
	P_2O_5	33	0.04	0.75
	SiO_2	33	87.83	0.07
	SG	33	2.51	0.10
200	Al_2O_3	36	8.78	0.28
	Fe_2O_3	36	16.53	0.31
	MnO	36	30.71	0.29
	P_2O_5	36	0.23	0.54
	SiO_2	36	27.53	0.51
	SG	36	2.45	0.16
201	Al_2O_3	20	11.16	0.34
	Fe_2O_3	20	12.10	0.39
	MnO	20	8.10	0.45
	P_2O_5	20	0.09	0.47
	SiO_2	20	58.94	0.17
	SG	20	2.30	0.09
202	Al_2O_3	6	14.70	0.13
	Fe_2O_3	6	7.09	0.53
	MnO	6	4.13	0.63
	P_2O_5	6	0.07	0.52
	SiO_2	6	63.57	0.11
	SG	6	1.98	0.09
300	Al_2O_3	23	13.25	0.27
	Fe_2O_3	23	10.43	0.71
	MnO	23	4.87	0.70
	P_2O_5	23	0.18	0.70
	SiO_2	23	59.69	0.14
	SG	19	1.88	0.15
301	Al_2O_3	8	14.60	0.09
	Fe_2O_3	8	2.72	0.56
	MnO	8	0.40	1.97
	P_2O_5	8	0.07	0.44
	SiO_2	8	72.95	0.05
	SG	8	2.09	0.04
400	Al_2O_3	396	13.98	0.37
	Fe_2O_3	396	7.91	0.87
	MnO	396	2.07	1.36
	P_2O_5	396	0.07	0.83
	SiO_2	396	66.13	0.17
	SG	393	2.27	0.13
500	Al_2O_3	393	12.30	0.10
	Fe_2O_3	393	3.26	0.44
	MnO	393	0.09	0.78
	P_2O_5	393	0.07	0.26
	SiO_2	393	75.97	0.04
	SG	393	2.73	0.02

Note: refer to Table 14-5 for geological domain

Figure 14-6

Histogram and statistics of composited sample MnO grades (in percent) of the upper Mn-Shale



Source: MSA, 2018

14.7 Geostatistical Analysis

Variograms were calculated in a horizontal plane using the 1 m composite data. The experimental variograms were not robust and did not show any structure due to limited data.

14.8 Block model

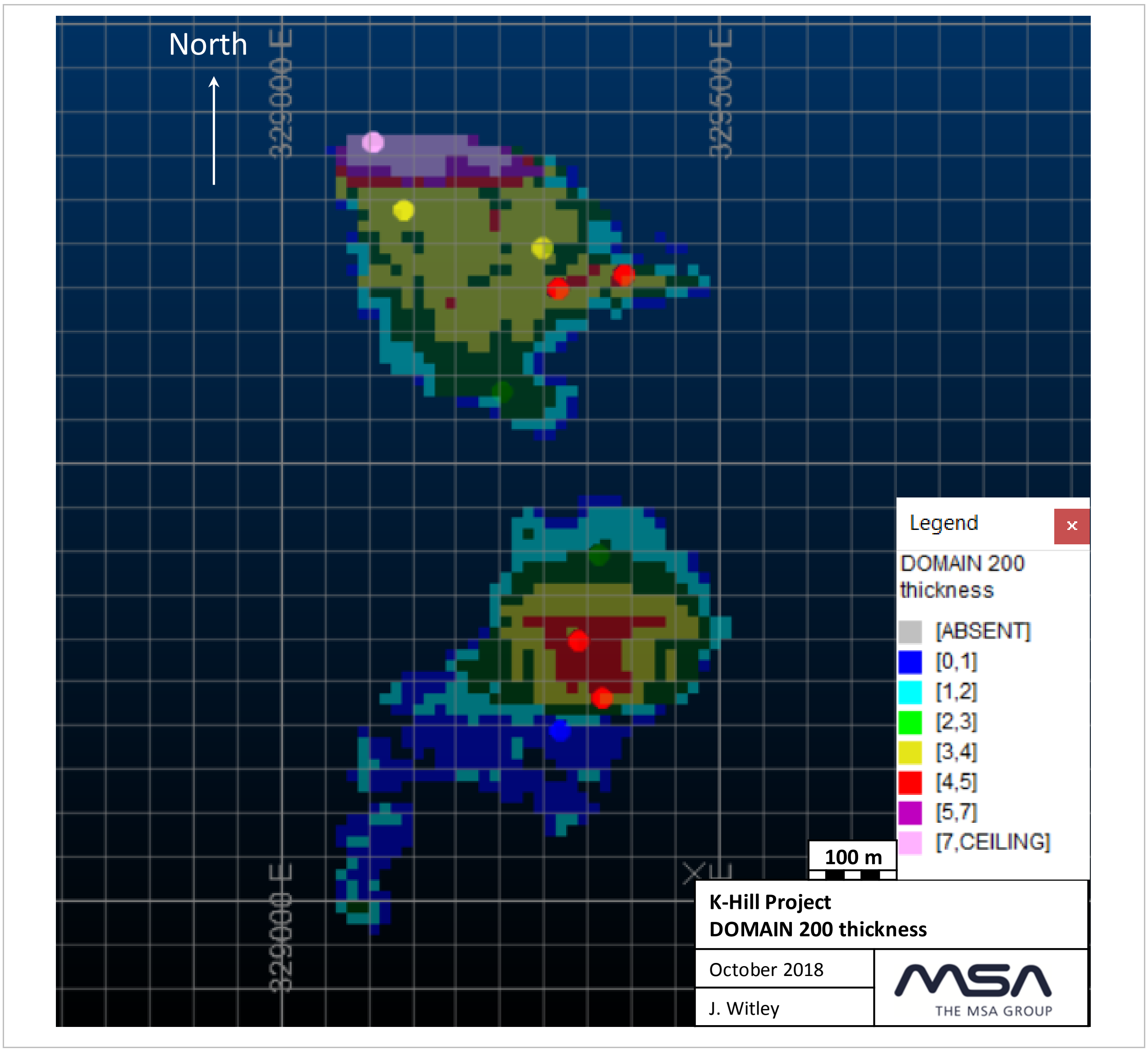
A block model was constructed with cell dimensions of 50 mX by 50 mY by 5 mZ. The block size was chosen based on the drillhole spacing, which is a minimum of approximately 50 m between the drilling sections in the northern portion. The wireframes representing surfaces of lithological contacts were filled with cells to a minimum sub-cell size of 12.5 mX by 12.5 mY by 1 mZ in order to best fill the spaces between the surfaces.

The blocks were coded with the respective domain codes as shown in Table 14-5.

In order to validate the wireframe surfaces, the high-grade Mn-Shale unit was filled with cells with a single variable height and the height of the cells was compared with the drilled (vertical) thickness (Figure 14-7). The modelled thicknesses are comparable to the input drillhole thicknesses, indicating that the modelling of the high-grade Mn-Shale domain is valid.

Figure 14-7

Plan view of model thickness vs drillhole thickness for Domain 200 (High grade upper Mn-Shale)



Source: MSA, 2018

14.9 Estimation

Since variograms could not be modelled, but an assumption of spatial grade relationships was made, all the assayed variables and density were estimated using inverse distance weighting to the power of two. Variables were estimated into parent cells. The minimum number of composites required to estimate a cell was four and the maximum was restricted to twelve.

The same search parameters were used to estimate all the grade variables and density as shown in Table 14-7. A three-pass search strategy was used for estimation, with the first search range set at 150 mX by 150 mY by 5 mZ in order to include the closest surrounding drillholes in all directions. The second search was twice the first search range, and the third was ten times the first search in order to estimate the majority of the cells in the model. The search ellipse was orientated horizontally in order to be aligned with the sub-horizontal layering.

Estimation of assayed variables was carried out separately for the Mn-Shale domains. The rest of the lithologies were estimated together as the these lithologies are not significantly mineralised. Density, however, was estimated independently for each lithological unit since density is influenced by lithology.

A total of nine cells were not estimated for density and these were assigned the domain average values.

Table 14-7
K-Hill Estimation search parameters

Search Distance			Number of Composites		Second search multiplier	Number of Composites		Third Search Multiplier	Number of Composites	
X	Y	Z	Min	Max		Min	Max		Min	Max
150	150	5	4	12	2	4	12	10	2	10

14.10 Model validation

Validation of estimated grades and densities was undertaken using the following methods:

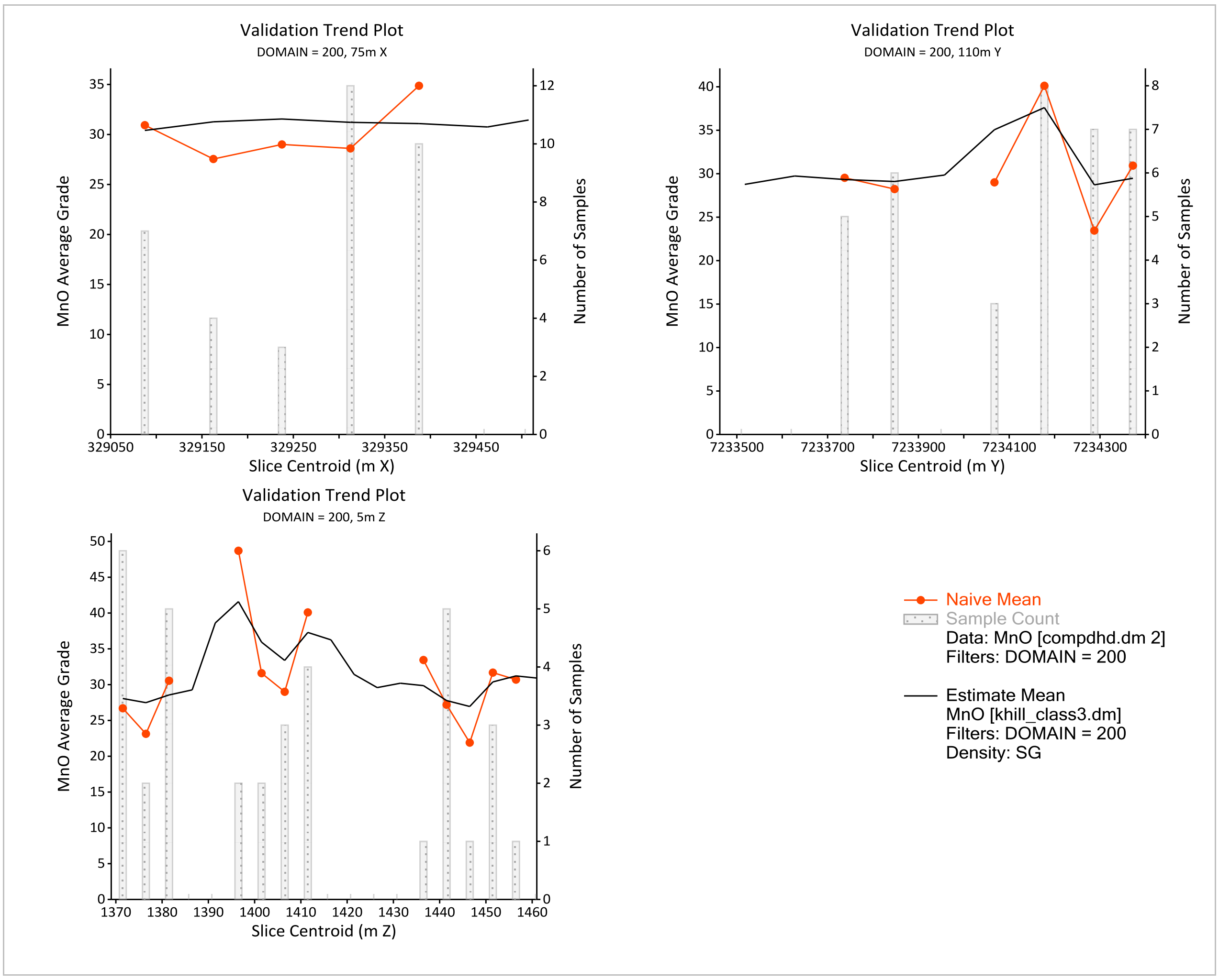
- Visual examination of the input data against the block model estimates,
- Swath plots, that compare the average grades of the block model against the input data along a number of corridors in various directions through the deposit.
- Comparison of the input data statistics against the model statistics.

The block model was examined visually in sections to ensure that the drillhole grades were locally well represented by the model and it was found that the model validated reasonably well against the data.

Swath plots were constructed for MnO grade of the upper Mn-Shale domains. These show that the estimates were representative of the grade trends of the composites across the deposit and illustrate the paucity of data with which to estimate the grade (Figure 14-8 and Figure 14-9).

Figure 14-8

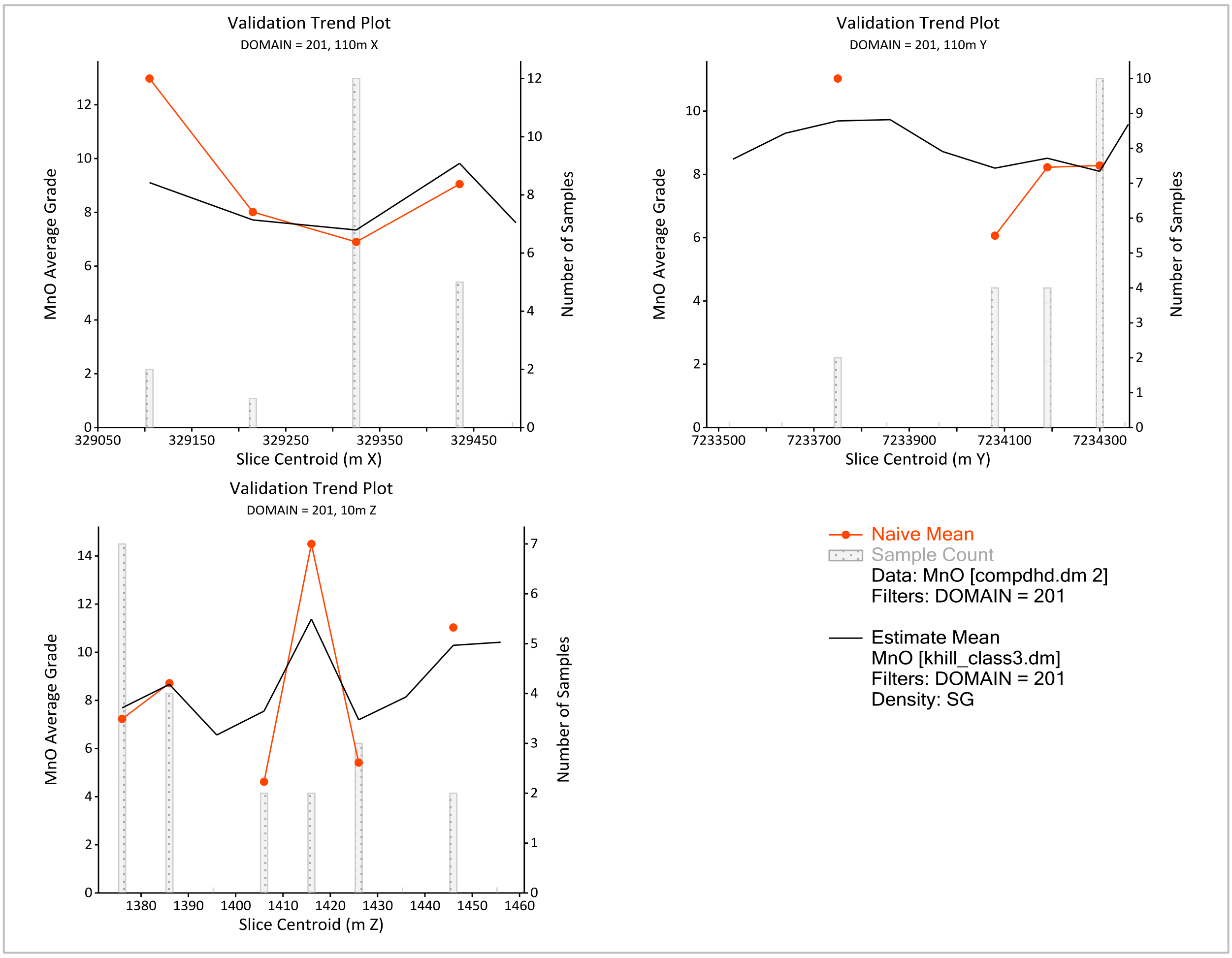
Swath plots for MnO in Domain 200.



Source: MSA, 2018

Figure 14-9

Swath plots for MnO in Domain 201.



Source: MSA, 2018

The average grades of the model compare well to the average grade of the de-clustered sample composites (de-clustered to 50 mX by 50 mY by 5 mZ) for each domain. Relative differences between the model grade and input data grade for the main mineralised layer are generally less than 5% (Table 14-8). Larger relative percent differences in the less significant layers are due to the spatial arrangement and paucity of the data.

Table 14-8

Comparison of mean of the composite data with the mean of the model data

Domain	De-clustered composite sample mean						Model mean						Percentage difference					
	MnO (%)	Al_2O_3 (%)	Fe_2O_3 (%)	P_2O_5 (%)	SiO_2 (%)	SG (g/cm^3)	MnO (%)	Al_2O_3 (%)	Fe_2O_3 (%)	P_2O_5 (%)	SiO_2 (%)	SG (g/cm^3)	MnO	Al_2O_3	Fe_2O_3	P_2O_5	SiO_2	SG
200	30.82	8.76	16.55	0.23	27.39	2.46	31.16	8.94	16.96	0.23	26.22	2.54	1	2	2	1	-4	3
201	8.61	10.88	12.07	0.09	58.80	2.33	8.40	10.26	10.00	0.07	61.13	2.37	-2	-6	-17	-16	4	2
202	4.14	14.71	7.12	0.07	63.49	1.98	4.20	15.09	8.36	0.06	61.52	2.04	1	3	17	-9	-3	3
300	4.81	13.36	10.32	0.18	59.72	1.88	4.51	13.70	9.61	0.17	60.27	1.90	-6	3	-7	-8	1	1
301	0.42	14.62	2.76	0.07	72.84	2.09	0.58	14.81	2.17	0.08	71.93	2.07	38	1	-21	9	-1	-1

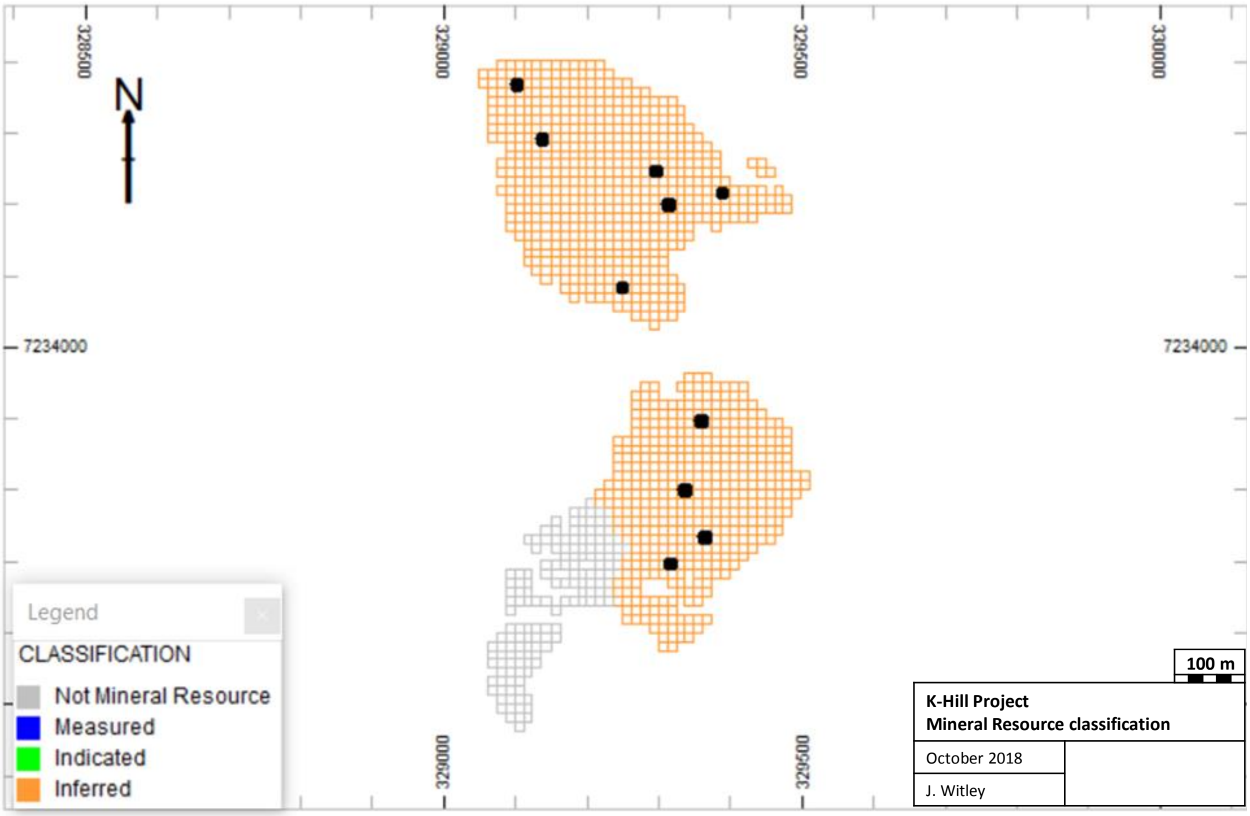
14.11 Classification

Classification of the K-Hill Mineral Resource was based on confidence in the data, confidence in the geological model, grade continuity and variability and the frequency of the drilling data. The main considerations in the classification of the Mineral Resource are as follows:

- There is acceptable confidence in the accuracy and precision of the assay data.
- The variability of the grades is low.
- The extent of the mineralization was based on mapped outcrops around the hill and therefore geological confidence in the extent of the mineralization is good.
- The drillhole spacing is too wide to provide local estimates and therefore the estimate should be considered as global in nature.
- The drilling recoveries are poor due to the friable nature of the near surface material.
- The topographic data points were measured at approximately 50 m spacing and the resolution of the survey is considered to be poor.
- The extent of underground workings is unknown.
- The drillhole collars were measured using a handheld GPS and their location is less accurate than is optimal.

Given the nature and spacing of the data, the Mineral Resource was classified as Inferred. An area of modelled mineralization where the Mn-Shale daylights on a flat erosional surface was not included in the Mineral Resource as the thickness and grade are uncertain in this area (Figure 14-10).

Figure 14-10
Mineral Resource classification of upper Mn-Shale at K-Hill



Source: MSA, 2018

14.12 Depletion of Mineral Resource

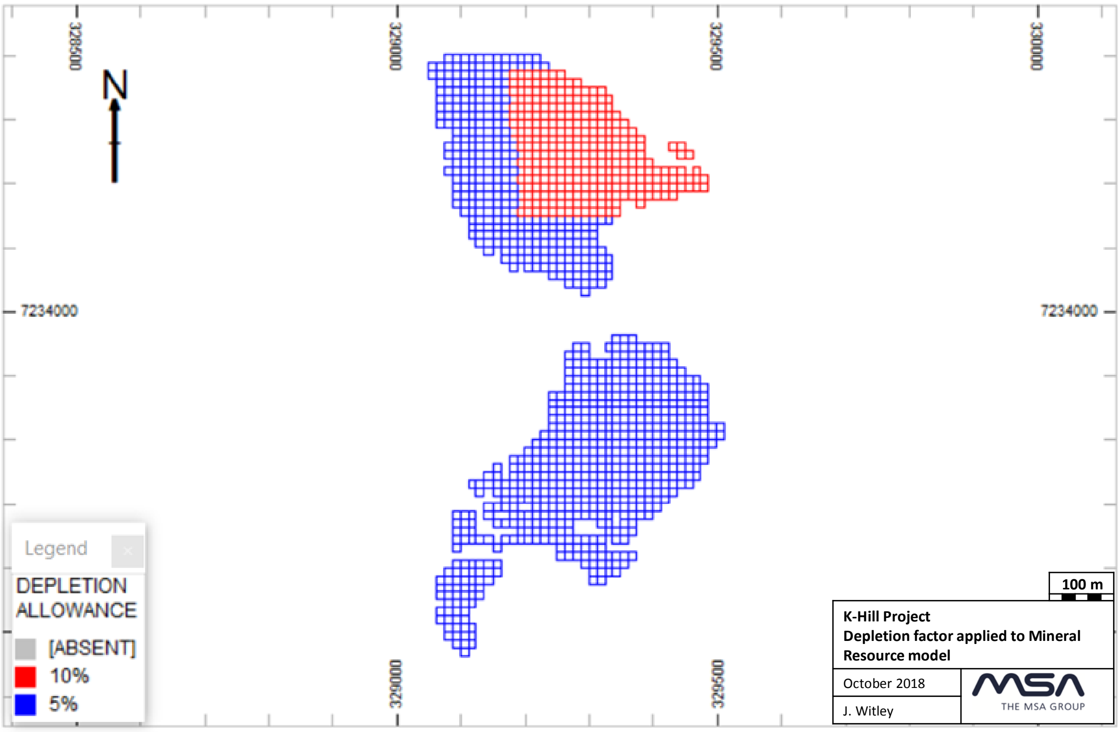
The Mineral Resource was cut to the modelled topographic surface where it outcrops. The steep cuts on the sides of the hill are not apparent in the topographic model due to widely spaced data points and local errors in Mineral Resource volume will occur.

Historical open-pit mining took place in the area. The Mineral Resource area excludes areas mined by the open pit, although the accuracy is limited by the resolution of the topographic surface.

Underground workings were observed to be more frequent in the north-eastern part of the Mineral Resource area than the rest of the Mineral Resource area. Therefore, a deduction of 10% was applied to the Mineral Resource model in the north eastern part of the Mineral Resource and a lesser amount of 5% was applied to the rest of the area (Figure 14-11). These deductions attempt to allow for historical mining depletion, but are high-level estimates not based on any data such as surveying of the historical workings, that are inaccessible, and should not be considered reliable.

Figure 14-11

Depletion factor applied at K-Hill to allow for historical underground mining



Source: MSA, 2018

14.13 Mineral Resource Statement

The Mineral Resource was estimated using The Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Best Practice Guidelines and is reported in accordance with the 2014 CIM Definition Standards, which have been incorporated by reference into National Instrument 43-101 – Standards of Disclosure for Mineral Projects (NI 43-101). The Mineral Resource is classified into the Inferred category as shown in Table 14-9.

The Mineral Resource is reported at a cut-off grade of 18% MnO, which is the lowest grade block estimate within the mineralization model. Given reasonably assumed high-level cost and revenue assumptions, the QP considers that mineralization at this cut-off grade will satisfy the test for reasonable prospects for eventual economic extraction (RPEEE). It should be noted that the cost and revenue assumptions are conceptual in nature and would not satisfy the requirements of a Preliminary Economic Assessment (PEA) in terms of NI 43-101.

It should be noted that Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability and the application of economic parameters used to assess the potential for economic extraction is not an attempt to estimate Mineral Reserves, the level of study so far carried out being insufficient with which to do so.

Table 14-9
K-Hill Mineral Resource at a cut-off grade of 18% MnO, 27 September 2018

Category	Tonnes (Millions)	MnO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	LOI %
Inferred	1.1	31.2	8.9	26.3	16.9	8.8

Notes:

1. *All tabulated data have been rounded and as a result minor computational errors may occur.*
2. *Mineral Resources which are not Mineral Reserves have no demonstrated economic viability.*
3. *LOI = Loss on ignition*
4. *Density determination was on undried samples and tonnages are reported as wet.*
5. *The cut-off grade calculation was based on the following assumptions:*
   EMM price of USD2,500/t (FOB)
   Mining cost of USD35/t
   Processing cost of USD75/t
   G and A cost of USD15/t
   Transport of USD50/t EMM
   Recovery of 60% Mn

The Mineral Resource estimate was completed by Mrs Ipelo Gasela (Pr. Sci Nat.), who is a Senior Mineral Resource Consultant with The MSA Group. The Mineral Resource estimate was carried out under the supervision of Mr. J.C. Witley (Pr. Sci Nat.). Mr Witley (BSc Hons, MSc (Eng.)) is a geologist with 30 years' experience in base and precious metals exploration and mining as well as Mineral Resource evaluation and reporting. He is a Principal Resource Consultant for The MSA Group (an independent consulting company), is registered with the South African Council for Natural Scientific Professions (SACNASP) and is a Fellow of the Geological Society of South Africa (GSSA). Mr. Witley has the appropriate relevant qualifications and experience to be considered a "Qualified Person" for the style and type of mineralization and activity being undertaken as defined in National Instrument 43-101 Standards of Disclosure of Mineral Projects.

15 MINERAL RESERVE ESTIMATES

Not applicable.

16 MINING METHODS

Not applicable.

17 RECOVERY METHODS

Not applicable.

18 PROJECT INFRASTRUCTURE

Not applicable.

19 MARKET STUDIES AND CONTRACTS

Not applicable.

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

Not applicable.

21 CAPITAL AND OPERATING COSTS

Not applicable.

22 ECONOMIC ANALYSIS

Not applicable.

23 ADJACENT PROPERTIES

Not applicable.

24 OTHER RELEVANT DATA AND INFORMATION

No additional information or explanation is necessary to make the technical report understandable and not misleading.

25 INTERPRETATION AND CONCLUSIONS

The manganese mineralization at K-Hill occurs primarily as a supergene enriched manganiferous shale (the Mn-Shale) occurring in the upper portion of a shale horizon within the Black Reef Quartzite Formation of the Transvaal Supergroup.

The K-Hill deposit is more or less kidney shaped, with a northern and a southern portion. The manganese shale outcrops along the northerly scarp slope of the Kgwakgwe Hill and dips into the hill. The northerly portion is elongated northwest over an area of approximately 400 m by 300 m and the average thickness of the targeted mineralization (the high-grade portion of the Mn-Shale) in this area is 3.5 m. The southerly area of mineralization is elongated northeast over an area of approximately 570 m by 200 m, and has an average thickness of 2.0 m. The manganese shale outcrops along the easterly scarp slope of the hill.

A total of eighteen vertical holes were drilled at K-Hill. Two of the drillholes were collared outside the Mineral Resource area, one was drilled for metallurgical purposes and twelve of the exploration drillholes intersected the Mn-Shale. Out of these, eleven holes intersected the high-grade mineralization in the Mn-Shale, but only ten were used for estimation due to very poor recovery observed in DDKH18_0006. Drillholes not included in the grade estimate were used in defining the extent of the mineralization and for estimating the low-grade Mn-Shale and surrounding un-mineralised lithologies.

A Mineral Resource for the high-grade layer of the Mn-Shale has been reported in accordance with NI 43-101 as shown in Table 25-1.

Table 25-1
K-Hill Mineral Resource at a cut-off grade of 18% MnO, 27 September 2018

Category	Tonnes (Millions)	MnO %	Al_2O_3 %	SiO_2 %	Fe_2O_3 %	LOI %
Inferred	1.1	31.2	8.9	26.3	16.9	8.8

Notes:

1. *All tabulated data have been rounded and as a result minor computational errors may occur.*
2. *Mineral Resources which are not Mineral Reserves have no demonstrated economic viability.*
3. *LOI = Loss on ignition*
4. *Density determination was on undried samples and tonnages are reported as wet.*
5. *The cut-off grade calculation was based on the following assumptions:*
   EMM price of USD2,500/t (FOB)
   Mining cost of USD35/t
   Processing cost of USD75/t
   G and A cost of USD15/t
   Transport of USD50/t EMM
   Recovery of 60% Mn

The Mineral Resource is reported at a cut-off grade of 18% MnO, which is the lowest grade block estimate within the mineralization model. Given reasonably assumed high-level cost and revenue assumptions, the QP considers that mineralization at this cut-off grade will satisfy the test for reasonable prospects for eventual economic extraction (RPEEE). It should be noted that the cost and revenue assumptions are conceptual in nature and would not satisfy the requirements of a Preliminary Economic Assessment (PEA) in terms of NI 43-101.

Th results of preliminary metallurgical test-work suggest that the manganese mineralization at K-Hill may be amenable to processing to produce manganese metal that may be suitable for the battery market.

A number of significant risks have been identified for the project.

- Market risk.
    - This project is predicated upon marketing manganese from the K-Hill Mineral Resource to the electrolytic manganese metal (EMM) or electrolytic manganese dioxide (EMD) market. Although initial test-work is encouraging, the recoverability and saleability of manganese for these products has not been demonstrated.
- Resource Risk.
    - The currently defined Mineral Resource is limited to the K-Hill topographic high. It is a small deposit and bears uncertain upside potential.
    - The recovery of sample material is poor. Although comparisons between MnO grade and recovery that samples with higher recovery tend to have higher grade, this may not necessarily be the case.
    - The extent of historical underground mining excavations is unknown. Although an allowance has been made in the Mineral Resource estimate to cater for historical mining depletion this is a high-level assumption and may significantly over- or under-estimate the actual depletion.
- Future Mining Risk.
    - A portion of the Mineral Resource underlies a municipal water reservoir that is under construction. Although the reservoir overlies a small portion of the Mineral Resource (<5%), the potential impact of this reservoir to the project has not been ascertained.

26 RECOMMENDATIONS

The QPs recommend the following work programme:

- Complete a Preliminary Economic Assessment (PEA) in order to improve the understanding of the economic merits of the Project. Of particular importance is further metallurgical test-work.
        - Estimated cost of USD120,000.
- Should the PEA be encouraging, conduct further exploration to improve confidence in the Mineral Resource in order to upgrade part or all of the Inferred Mineral Resource into the Indicated category:
    - Infill drilling to complete a 100 m grid over the entire deposit, with a focus on improving sample recovery,
        - It is estimated that a further 35 diamond drillholes will be required, with an average length of 40 m. At an all-in cost of USD265 per metre, the total estimated cost will be in the order of USD329,000.
    - Complete an accurate digital terrain model through a detailed topographic survey.
        - Estimated cost of USD 2,000
    - Survey the historically mined out areas below the Kgwakgwe Hill, if safe to do so.
        - Estimated cost of USD 20,000.

The QP considers that the project warrants further exploration of expenditure in the order of that outlined above.

27 REFERENCES

Aldiss, D.T. (ed.) (1989). The geology of the Kanye area: an explanation of quarter degree sheet 2425C. Lobatse, Geological Survey Dep, 170pp.

Baldock, J.W., Hepworth, J.V. and Marengwa, B.S.I. (1977). Resources inventory of Botswana: metallic minerals, mineral Fuels and diamonds. Mineral Resources Report No. 4, Geological Survey of Botswana, 69pp.

Cannon WF and Force ER, (1983), Potential for High Grade Shallow- Marine Manganese Deposits in North America. Am. Inst. Mining Metall. Petroleum Engineers, pp: 175-190, Cameron volume on unconventional mineral deposits

Cannon, W.F., and Force, E.R. (1986), Descriptive model of sedimentary Mn: U.S. Geological Survey Bulletin 1693, p. 231.

Ekosse, G. and Vink, B. (1998). The Kgwakgwe manganese oxides in the Kanye area, southeastern Botswana-evidence for a shallow aqueous palaeo-environment. Botswana Notes and Records, 30, 147–156.

Eriksson, P.G., Bartman, R., Catuneanu, O., Mazumder, R. and Lenhardt, N. (2012). A case study of microbial mat-related features in coastal epeiric sandstones from the Paleoproterozoic Pretoria Group (Transvaal Supergroup, Kaapvaal craton, South Africa); The effect of preservation (reflecting sequence stratigraphic models) on the relationship between mat features and inferred paleoenvironment. Sedimentary Geology, 263–264, 67–75.

Force WF and Canon ER. (1988), Depositional Model for Shallow-Marine Manganese Deposits around Black Shale Basins. Econ Geol. vol. 83, pp. 93-117

Force Eric R., Cannon William F., and Klein Douglas P, (1986), USGS Sedimentary Mn Deposits (Model 34b; Cannon and Force, 1986)

Johnson, M., Anhaeusser, C. and Thomas, R. (2006). The geology of South Africa. Pretoria: Council for Geoscience; Johannesburg: Geological Society of South Africa and Council for Geoscience, 2006.

Key, R.M. (1983). The Geology of the area around Gaborone and Lobatse, Kweneng, Kgatleng, Southern and South East Districts. Geological Survey Department Ministry of Mineral Resources & Water Affairs

Key, R.M. and Ayres, N. (2000). The 1998 edition of the national geological map of Botswana. Journal of African Earth Sciences, 30, 427–451.

Theron L. (2017), K-Hill, Botswana Property Report, Report prepared for: Giyani Metals Corp.

Lambda Tau Consulting and Exploration, (2018) K-Hill Channel Chip sampling. Feedback Report., Prepared for Giyani Metals Corp.

Varentsov, IM, (1996). Manganese Ores of Supergene Zone; Geochemistry of Formation, Kluwer Academic Publishing, Dordrecht 356pp.

Remote Exploration Services (Pty) Ltd (2018) Report on Ground Geophysical Data Collection, Processing and Interpretation Over the K-Hill and Otse Prospect Areas for Giyani Metals Ltd.

APPENDIX 1: Glossary of Technical Terms

Glossary of Technical Terms

Adit	An entrance to an underground mine which is horizontal or nearly horizontal.
amsl	Above mean sea level.
alkaline rocks	Rocks containing an excess of sodium and or potassium.
Archaean	The oldest rocks of the Precambrian era, older than about 2,500 million years.
basement	The igneous and metamorphic crust of the earth, underlying sedimentary deposits.
breccia	An intensely fractured rock.
braunite	a brown or black mineral that consists of manganese oxide and silicate and is a source of manganese.
carbonate	A rock, usually of sedimentary origin, composed primarily of calcium, magnesium or iron and CO_3. Essential component of limestones and marbles.
Certified Reference Material	Standards used to validate analytical measurement methods and calibration of instruments.
chip channel sampling	This method is used to take samples from an outcrop. The tools are used hammer and chisel.
conglomerate	A rock type composed predominantly of rounded pebbles, cobbles or boulders deposited by the action of water.
diamond drilling	Method of obtaining cylindrical core of rock by drilling with a hollow diamond set or diamond impregnated bit.
dolomite	A calcium magnesium carbonate with a chemical composition of $CaMg(CO_3)_2$.
facies	A rock or sediment unit that reflects its environment of deposition and allows it to be distinguished from rock or sediment deposited in an adjacent environment.
fault	A fracture or fracture zone, along which displacement of opposing sides has occurred.
felsic	Light coloured rocks containing an abundance of feldspars and quartz.
felsite	A fine grained volcanic extrusive rock, generally light in colour, composed mainly of feldspar and quartz.
ferruginous	Contains a substantial proportion of an iron compound.
fold	A planar sequence of rocks or a feature bent about an axis.
glauconite	An iron potassium phyllosilicate (mica group) mineral of characteristic green colour with very low weathering resistance and very friable.

granite	A light-coloured igneous rock composed mainly of quartz and feldspar with minor amounts of mica, amphiboles, and other minerals.
gravity survey	Recording the specific gravity of rock masses in order to determine their distribution.
ground magnetic surveys	Surveys carried out on the ground using a handheld device to measure the magnetic susceptibility of rocks at or near the earth's surface.
induced polarization surveys	A geophysical imaging technique used to identify the electrical chargeability of subsurface materials.
intrusive	An igneous rock formed from magma forced into older rocks at depths within the Earth's crust, which then slowly solidifies below the Earth's surface.
IP/DC	Induced polarization performed with a direct current resistivity.
Joint set	A regular planar set of fractures set in massive rocks along which no relative displacement has occurred.
kutnohorite	A rare calcium manganese carbonate mineral with magnesium and iron that is a member of the dolomite group.
limestone	A sedimentary rock containing at least 50% calcium carbonates.
littoral	Beach or shoreline environment.
Ma	Million years.
manganese	The chemical element of atomic number 25, a hard, grey metal of the transition series.
manganite	A metallic grey to black mineral MnO(OH) that is a hydroxide and minor ore of manganese.
meta-	Used to denote change, transformation, or metamorphism.
metallurgical test-work	Metallurgical response of an ore indicated by laboratory tests on samples, often from drill cores or bulk samples.
MnO	Manganese oxide
montmorillonite	A very soft phyllosilicate group of minerals that form when they precipitate from water solution.
Precambrian	Pertaining to all rocks formed before Cambrian time (older than 545 million years).
Proterozoic	An era of geological time spanning the period from 2,500 to 545 million years before present.
psilomelane	Barium-manganese hydroxides that do not form in visible crystals.
quartzite	A non-foliated metamorphic rock composed almost entirely of quartz. It forms when a quartz-rich sandstone is altered by the heat, pressure and chemical activity of metamorphism.

sandstone	A sedimentary rock composed of cemented or compacted detrital minerals, principally quartz grains.
satellite positioning system (global positioning system GPS)	An instrument used to locate or navigate, which relies on three or more satellites of known position to identify the operators location.
shale	A laminated, fine-grained, clastic sedimentary rock composed that is a mix of flakes of clay minerals and tiny fragments (silt-sized particles) of other minerals.
silicified	The introduction of, or replacement by, silica, generally resulting in the formation of fine-grained quartz, chalcedony, or opal, which may fill pores and replace existing minerals.
siltstone	A rock intermediate in character between a shale and a sandstone. Composed of silt sized grains.
tectonic	Pertaining to the forces involved in, or the resulting structures of, movement in the earth's crust.
unconformably	Consisting of a series of younger strata that do not succeed the underlying older rocks in age or in parallel position, as a result of a long period of erosion or non-deposition.
wad	A general term for any black manganese oxide or hydroxide mineral-rich rock in the oxidized zone of various ore deposits.