# A Mineral Resource Estimate on the Velikhovskoe Southern Iron Deposit

**Prepared For**
**Aktobe-Temir-VS LLP**

**The Report prepared by:**

SRK Consulting (Kazakhstan) Limited
KZ0067

| | | |
|---|---|---|
| SRK Legal Entity: | | SRK Consulting (Kazakhstan) Limited |
| SRK Address: | | 39 Gogol street, 11th floor<br>050002, Almaty, Kazakhstan |
| Date: | | June 2012 |
| **Project Number:** | | KZ0067 |
| **SRK Project Director:** | Anthony Thornton | General Director |
| **SRK Project Manager:** | Nikolai Yenshin | Business Development Director |
| **Client Legal Entity**: | | **Daughter Company Aktobe-Temir-VS LLP** |
| **Client Address:** | | **Kazakhstan 030500, Aktyubinsk Region, Kargaly District, Badamsha Village, st. Mira 56, apartment 2.** |

# Table of Contents: Executive Summary



# List of Tables: Executive Summary

SRK Consulting (Kazakhstan) Limited
39 Gogol street, 11th Floor
050002
Almaty, Kazakhstan
E-mail: info@srk.kz
URL: www.srk.kz
Tel: + 7 727 259 0118
Fax: + 7 727 259 0119

# EXECUTIVE SUMMARY
# A Mineral Resource Estimate on the Velikhovskoe Southern Iron Deposit

## 1 BACKGROUND

SRK Consulting (Kazakhstan) Limited ("SRK") is an associate company of the international group holding company, SRK Consulting (Global) Limited (the "SRK Group"). SRK has been requested by Daughter Company Aktobe-Temir-VS LLP (hereinafter also referred to as the "Company" or the "Client") to undertake a Mineral Resource Estimate ("MRE") on the Velikhovskoe Southern Iron Deposit.

The MRE is reported in accordance with the Australasian Code for the Reporting of Exploration Results, Mineral Resources and Ore reserves, The JORC Code, 2004 Edition ("JORC").

The scope of work for this document is to undertake an MRE on the Velikhovskoe Southern Iron Deposit.

This report serves as an independent report prepared by SRK with assistance from SRK Consulting (UK) Ltd (SRKUK). The Competent Person with responsibility for the Mineral Resource estimate is Dr. John Arthur (CGeol FGS, CEng MIMMM) who is a Competent Person as defined by the JORC Code. The bulk of the technical work was carried out by Denis Kovalenko (Resource Geologist SRKKZ). The Preliminary Economic Analysis was carried out Simon Law (Principal Consultant Mining Engineer) in consultation with Aktobe-Temir-VS LLP personnel. The report was reviewed by Dr. Pavel Mukhin (FAIG).

## 2 LOCATION

Velikhovskoe Southern iron deposits is located in the territory of Kargaly District of Aktyubinsk Region, Kazakhstan, in 90 km to the north-east of the regional centre Aktobe and 45 km to the north-west of Kimpersai railway station (Badamsha village) of South-Ural Railway (Russian Railways).

## 3 DATA QUALITY

SRK has completed a number of checks on the raw data supplied. These checks indicate that the QAQC procedures in place have been successful in ensuring that no major issues have been encountered during the assay procedures. SRK is confident that the data represents an accurate reflection of the in situ values (geological setting, bodies morphology and grades) and is suitable for use in an MRE for the deposit.

# 4 GEOLOGICAL MODEL

SRK has constructed a 3D wireframe geological/mineralisation model for the Velikhovskoe Southern deposit, as well as a geotectonic (structural) model and topography, which is based upon all the drilling results of the 1964, 2004, 2010 and 2011 exploration, which adequately reflects the geological understanding and continuity of the deposit. The drilling results of 1964 were used for the wireframe construction only, but were not used for the MRE.

# 5 MINERAL RESOURCE ESTIMATE

SRK has undertaken a detailed statistical and geostatistical study of the coded sample data which has validated the geological model appropriateness and which has confirmed the grade continuity within the model.

SRK has used Ordinary Kriging to interpolate grades into a block model, and has assessed the estimation quality and fully validated the model. This validation has confirmed the robustness of the parameters used and the resultant model.

# 6 MINERAL RESOURCE STATEMENT

The Velikhovskoe deposit has been explored and sampled using appropriate methodologies and at sufficient spacing to support the estimation of Indicated and Inferred Mineral Resources.

The standard adopted for the reporting of Mineral Resources in this technical report is the JORC Code (2004) and the Mineral Resource Statement presented herein has been estimated in accordance with the JORC Code (2004). Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.

The estimate is based on 14,684.3 m of drilling samples. The resource estimation work was supervised by Dr John Arthur, (CGeol FGS; C.Eng MIMMM), Principal Geologist with SRKUK who is a Competent Person according to the definition given in the JORC Code (2004). The Effective Date of the resource statement is 2 February 2012.

SRK has undertaken a preliminary cut-off grade calculation which delineates the iron mineralisation within the SRK model area.

Table ES1 shows the resulting Mineral Resource Statement for the Velikhovskoe Southern Project.

Table ES 1: JORC Compliant Mineral Resource Statement for the Velikhovskoe Southern deposit effective date 2 February 2012

| Type | Class | Cut Off Grade, Fe (%) | SG, g/cm$^3$ | Volume, m$^3$ | Tonnage, t | Average grade Fe (%) | Average grade $TiO_2$ (%) |
|---|---|---|---|---|---|---|---|
| Magnetite, body - I | Indicated | 16 | 3,26 | 34 617 080,00 | 112 851 680,80 | 20,91 | 1,88 |
| Martite <30% Fe | Indicated | 16 | 3,03 | 1 470 384,00 | 4 455 263,52 | 20,86 | 1,57 |
| | Sub_total All Indicated | | | 36 087 464,00 | 117 306 944,32 | 20,91 | 1,87 |
| Magnetite, body - I | Inferred | 16 | 3,26 | 105 755 456,00 | 344 762 786,56 | 20,02 | 1,78 |
| Magnetite, body-II | Inferred | 16 | 3,26 | 3 015 272,00 | 9 829 786,72 | 20,18 | - |
| Martite <30% Fe | Inferred | 16 | 3,03 | 5 798 712,00 | 17 570 097,36 | 19,59 | 1,36 |
| Martite >30% Fe | Inferred | 20 | 3,03 | 1 647 464,00 | 4 991 815,92 | 41,00 | 3,39 |
| | Sub_total Magnetite Inferred | | | 108 770 728,00 | 354 592 573,28 | 20,03 | - |
| | Sub_total Martite Inferred | | | 7 446 176,00 | 22 561 913,28 | 24,33 | 1,81 |
| | Sub_total All Inferred | | | 116 216 904,00 | 377 154 486,56 | 20,28 | - |
| | Total | | | 152 304 368,00 | 494 461 430,88 | 20,43 | - |

# 7 EXPLORATION POTENTIAL

Further drilling is recommended by SRK for:

- revision of geological setting of the deposit;
- more precise and reliable delineation of bodies and their boundaries; and
- thickening the drilling grid (infill drilling) for revision of grades and upgrading geological resources up to higher categories.

# 8 PRELIMINARY ECONOMIC ANALYSIS

A preliminary economic analysis (PEA) was conducted on the Velikhovskoe Southern deposit. Only magnetite was included in the study, martite mineralisation zones were treated as waste. A pit optimisation was conducted and this was scheduled at 5, 10 and 20 Mtpa ore production rates.

The resource prior to the current drilling campaign was estimated to have an average weight recovery of magnetite (DTR) of 22.9%. Using the new resource grade the average weight recovery of magnetite is estimated at 23.7%.

The PEA has been conducted using the Micromine pit optimiser software to calculate an optimum pit shape. The resource inside this shape has then been scheduled and a discounted cash flow analysis of the project calculated using estimated capital costs.

Operating costs were developed by SRK for mining and processing operations, these were adjusted by the client and final operating cost concepts agreed between SRK and the client. Table ES2 shows the operating costs and assumptions used in the PEA.

Table ES 2: Operating Costs used in the PEA

| Activity | Operating cost USD | Unit | Notes |
|---|---|---|---|
| Ore mining | 3.50 | Per tonne mined | Contractor |
| Waste mining | 3.50 | Per tonne mined | Contractor |
| Crushing & Processing | 5.00 | Per tonne ore | |
| Management & Overheads | 1.50 | Per tonne ore | |
| Fixed annual costs | 3,000,000 | Total annual | |
| Rail freight | 20.00 | Per tonne concentrate | Magnitogorsk |
| Production tax | | 2.8% Per tonne concentrate | |
| Working capital | 91,000,000 | 25% operating costs | |

The model calculated NPV from the project cashflow over the life of the project. The same mining cost was used over the whole life of mine. A more detailed mine schedule and operating cost model should be developed for future evaluations.

Taxation and depreciation rates are as per the current (2012) Kazakhstan tax code. Total capital in the model is shown in Table ES3 for each production rate. A summary table, Table ES4, shows of the results for the three production cases.

Table ES 3: Total preproduction capital

| Production case | Preproduction Capital USD | Working capital USD | Annual sustaining capital USD |
|---|---|---|---|
| 5 Mtpa | 255,811,000 | 22,800,000 | 2,500,000 |
| 10 Mtpa | 377,082,000 | 45,500,000 | 5,000,000 |
| 20 Mtpa | 522,192,000 | 91,000,000 | 10,000,000 |

Table ES 4: Production scenario comparisons for 5, 10 and 20 Mtpa cases

| Case | 5 Mtpa | 10 Mtpa | 20 Mtpa | |
|---|---|---|---|---|
| NPV | 103 | 290 | 560 | USD millions |
| WACC | 10.0% | 10.0% | 10.0% | |
| IRR | 15.4% | 20.4% | 26.0% | |
| Average conc price | 140 | 140 | 140 | USD/t |
| Production life | 75 | 38 | 19 | Years |
| Operating cost | 18.87 | 18.63 | 18.60 | USD/t ore |
| Revenue per tonne ore | 30.10 | 30.10 | 30.10 | USD/t ore |
| Operating cost | 87.76 | 86.66 | 86.52 | USD/t conc |

# 9 RECOMMENDATIONS

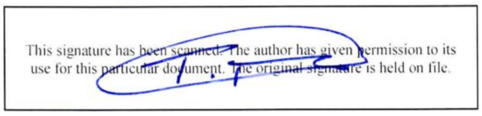
The Preliminary Economic Assessment shows that a positive NPV is attainable at the 20 Mtpa production rate. If the Company wishes to continue with the development of this project, SRK recommends that a Scoping Study is undertaken. In this study, in addition to the normal study areas for a report of this nature, work should be undertaken in the following important areas:

- All further drilling conducted on the deposit must include analysis of magnetite recovery from drill core using the Davis Tube Recovery (DTR) technique. The recovered magnetite then must be analysed for Fe and the complete set of steel making trace elements and contaminants.
- Prior to undertaking DTR assaying, there must be a programme of metallurgical sampling and testing to determine the most suitable grind size for the project. Once determined, the grind size should be replicated in all DTR testing.
- An assessment of the suitability of the coarse reject material from the 2011 drilling campaign should be made to determine its suitability for grind size analysis, DTR analysis and metallurgical testing. The sampling of this material would significantly increase the available data and should be carried out prior to any additional drilling.
- The coarse reject material from the 2011 drilling should also be sampled for vanadium grades.
- As the product is a high Ti/V concentrate there is a need for a market research study into the price and potential customer base for the final product. This study should also include investigation into the financial and marketing potential for producing a pellet from the concentrate.
- The DTR grades and trace elements need to be modelled so that production scheduling can report on contaminants as well as Fe, Ti and V.

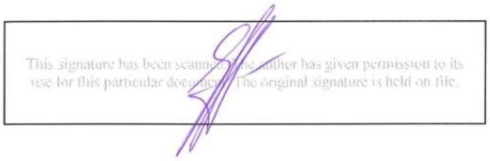
- Mineralised material outside the wireframe needs to be modelled as the higher grade mineralisation outside the wireframe may be profitable to process at the end of the mine life if stockpiled into low grade waste dumps.
- Waste modelling needs to be included in the block model.
- A detailed topographical survey to accurately locate all the drilling data should be carried out over the drilled areas. This will further enhance the accuracy of the present Digital Terrain Model (DTM) and will be required for further project development.
- Replacing the previously-used standard Certified Reference Materials (CRM) GIOP-34 with more applicable CRM (standards) which should match the expected grades in the deposit mineralisation and be of similar mineralisation type, colour and mineral composition.
- If the initial DTR and marketing studies are positive, then an infill campaign of drilling over selected areas of the deposit (principally between lines 4400 and 4700) could be carried out to determine whether the grade variability is of a suitable level to allow the categorisation of Measured Mineral Resources. SRK would recommend a maximum spacing of 50 m along strike in order to determine possible Measured Resources, however, it should be made clear that drill spacing alone does not allow a Measured category to be applied to individual blocks of ground.
- The need for geotechnical and hydrological drilling and testing needs to be assessed as part of the next phase of work, especially given the water problems encountered in the early stages of drilling during the 2011 campaign.
- Any future drilling and testwork should be concentrated in the areas of the conceptual pits derived from this current phase of work.

As part of the scope of the recommended Scoping Study, a preliminary Environmental and Social Impact Assessment should be undertaken to identify any sensitive receptors or related issues that could constrain project development.

**For and on behalf of SRK Consulting (Kazakhstan) Limited**




A Thornton
Director
SRK Consulting (Kazakhstan) Limited




N Yenshin
Project Manager
SRK Consulting (Kazakhstan) Limited

# Table of Contents

# List of Tables

# List of Figures

## List of Appendices

SRK Consulting (Kazakhstan) Limited
39 Gogol street, 11th Floor
050002
Almaty, Kazakhstan
E-mail: info@srk.kz
URL: www.srk.kz
Tel: + 7 727 259 0118
Fax: + 7 727 259 0119

# A Mineral Resource Estimate on the Velikhovskoe Southern Iron Deposit

## 1 INTRODUCTION

### 1.1 Background

SRK Consulting (Kazakhstan) Limited ("SRK") is an associate company of the international group holding company, SRK Consulting (Global) Limited (the "SRK Group"). SRK has been requested by Daughter Company Aktobe-Temir-VS LLP (hereinafter also referred to as the "Company" or the "Client") to undertake a Mineral Resource Estimate ("MRE") on the Velikhovskoe Southern Iron Deposit.

The MRE is reported in accordance with the Australasian Code for the Reporting of Exploration Results, Mineral Resources and Ore reserves, The JORC Code, 2004 Edition ("JORC").

### 1.2 Terms of Reference/Scope of Work

The terms of reference for the proposal included the following:

- Topographic Modelling:
  - compilation of the surface topography survey data;
  - preparation of a validated three-dimensional wireframe surface/dtm.
- Lithological Interpretation and Modelling:
  - generation of three-dimensional wireframe models of the main lithological types (domains) using the drillhole data as well as any mapping or topographic data.
- Statistical and Geostatistical Assessment:
  - statistical and geostatistical analysis of the datasets within each modelled domain.
- Data Transformation:
  - compositing and grade capping, if necessary.
- Quality Control Assessment:
  - assessment of Quality Assurance / Quality Control (both internal and external) (QAQC) data/procedures.
- Model Framework:
  - generation of a suitable block model to represent the deposit and domains.
- Grade Estimation:
  - selection of an appropriate estimation method for all relevant grade information: for the key valuable component (Fe) and accompanying components ($TiO_2$);
  - derivation of appropriate estimation parameters;
  - grade estimation for each block in the model; and
  - resource estimation parameter sensitivity analysis (QKNA).
- Model Validation:

  - validation of resultant grade model;
  - local and Global validation (to include validation plots and statistical analysis); and
  - comparison by domain of block model grade and mean de-clustered sample grade.

- Mineral Resource Classification and Reporting:
  - classification of the Mineral Resource model following JORC Guidelines.
- Study Reporting:
  - report describing all aspects of the Mineral Resource estimation study; and
  - include description of regional and local geology as well as the data acquisition programmes.

In addition to the scope of work provided, SRK recommends adding the following:

- Review of any Mineralogical information in order to assess any relevant deleterious minerals.
- Undertake a preliminary economic assessment in order to calculate appropriate cut-off grades and open-pit mining limits in order for Mineral Resource Reporting.
- Provide recommendations for further exploration to develop the confidence categories of the Mineral Resource.

## 1.3 Main Objectives

The main objectives of the commission were as follows:

JORC Compliance Mineral Resource Estimate and Report covering:

- geology;
- data quantity and quality;
- geological modelling/domaining;
- classical statistical study;
- geostatistical study and quantitative Kriging Neighbourhood Analysis ("QKNA");
- grade/quality interpolation and validation;
- Mineral Resource Classification and reporting criteria, and;
- Mineral Resource Estimation report.

## 1.4 Requirement, Structure and Compliance

All the initial data used in the Mineral Resource Estimate on the deposit were provided by the Client. The collection of the sample data during 2011 has been undertaken by the client under the supervision of SRK, and SRK has undertaken the subsequent Mineral Resource Estimate, all of which are considered to be in Compliance with the JORC Code.

## 1.5 Limitations, Reliance on SRK, Declaration, Consent, Copyright and Cautionary Statements

SRK's opinion, effective date as 2 February 2012, is based on information provided to SRK by the Company throughout the course of SRK's investigations as described below, which in turn reflect various technical and economic conditions at the time of writing. Given the nature of the mining business, these conditions can change significantly over relatively short periods of time.

This report includes technical information, which requires subsequent calculations to derive sub-totals, totals and weighted averages. Such calculations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, SRK does not consider them to be material.

### 1.5.1 Declaration

SRK is not an insider, associate or affiliate of the Company, and neither SRK nor any affiliate has acted as advisor to the Company or its affiliates in connection with the Velikhovskoe Southern Deposit Project. The result of the work undertaken by SRK is not dependent on any prior agreements concerning the conclusions to be reached, nor are there any undisclosed understandings concerning any future business dealings.

While SRK reviewed a limited amount of pertinent maps and agreements to assess the validity and ownership of the mining concessions, SRK has not conducted an in-depth review of mineral title and ownership.

### 1.5.2 Copyright

Copyright of all text and other matter in this document, including the manner of presentation, is the exclusive property of SRK. It is an offence to publish this document or any part of the document under a different cover, or to reproduce and/or use, without written consent, any technical procedure and/or technique contained in this document. The intellectual property reflected in the contents resides with SRK and shall not be used for any activity that does not involve SRK, without the written consent of SRK.

This report is dependent upon technical, financial and legal input. In respect of the technical information and fundamental base data (geological information, assay information) as provided to and taken in good faith by SRK, and other than where expressly stated, this has not been independently verified.

### 1.5.3 Legal Reliance

SRK have not undertaken any legal-related studies on the company, the licence holder or the licence, and therefore all statements are made on the assumption that everything is legal and compliant.

## 1.6 Qualifications of Consultants

### 1.6.1 General Introduction

SRK Consulting (Kazakhstan) Limited (SRK) is an associate company of the international group holding company SRK Consulting (Global) Limited. The SRK Group comprises over 1,400 staff, offering expertise in a wide range of resource engineering disciplines with 45 offices located on six continents. The SRK Group's independence is ensured by the fact that it holds no equity in any project. This permits the SRK Group to provide its clients with conflict-free and objective recommendations on crucial judgement issues.

The SRK Group has a demonstrated track record in undertaking independent assessments of resources and reserves, project evaluations and audits, Mineral Experts' Reports, Competent Persons' Reports, Mineral Resource and Ore Reserve Compliance Audits, Independent Valuation Reports and independent feasibility evaluations to bankable standards on behalf of exploration and mining companies and financial institutions worldwide.

The SRK Group has also worked with a large number of major international mining companies and their projects, providing mining industry consultancy service inputs. SRK also has specific experience in commissions of this nature.

### 1.6.2 Specific Experience

SRK's experience in such commissions is exemplified by its mandates as a Mineral

Expert/Competent Person in support of various transactions requiring regulatory approval: IPOs, GDRs, ADRs and other secondary filings: on the following international exchanges: London Stock Exchange, JSE Securities Exchange, Toronto Stock Exchange, New York Stock Exchange and the Alternative Investment Market. Since SRK has been directly mandated in respect of a variety of transactions with 2000 the combined value of the listed companies has exceeded USD50 billion.

### 1.6.3 Report Responsibility

The QAQC Section of the report was prepared by Tatyana Sokhonchuk. The visit to the Stewart Geochemical and Assay Laboratory LLC, Moscow (Stewart Geochemical and Assay) and inspection of the analytical surveys procedures was performed by Pavel Mukhin. The Mineral Resource Estimate and report have been completed by Sergey Volkov, Denis Kovalenko and John Arthur. The mine optimization study and preliminary economic assessment was performed by Simon Law.

Neither SRK nor any of its employees and associates employed in the preparation of this report has any beneficial interest in the Company or in the assets of the Company. SRK will be paid a fee for this work in accordance with normal professional consulting practice.

The above-listed experts, responsible for the report preparation, have extensive experience in the mining industry and are members in good standing of appropriate professional institutions.

### 1.6.4 Sources of Information

SRK's report is based upon information provided by the Company as detailed below:

- Information from site visits undertaken by SRK and SRK sub-contracted associates.
- A sample and analytical results database provided by the Company (Daughter Company Aktobe-Temir-VS LLP).
- Access to key personnel of the Company at the exploration site and during meetings, for discussion and enquiry.
- A review of the Client's data collection procedures and protocols, including the methodologies applied by the Company in determining such assays and measurements that were subsequently used by SRK in estimating the Mineral Resource.
- Technical reports and data as follows:
    - Project for exploration of Velikhovskoe Southern and Velikhovskoe Northern iron deposits in Kargaly district of Aktyubinsk Region. Prepared by Alaigyr LLP. Director of Alaigyr LLP Kh. O. Zhagyparov, Chief Geologist V. P. Ermakov, Coordinator Yu. A. Antonov. Semei, 2008.
    - Report on exploration of Velikhovskoe Southern magnetite deposit with reserve estimate as 1 April 2005. Prepared in 2004 according to Contract № 248 of 08.10.1998 (registration № 939), Supplement to the Contract № 1 of 23.05.2002 registration № 939 and №2 of 11.12.2003 (registration № 1278). Authors: Dubovsky A. G., Zyabkin V. F., Tishkov V.N. and other, Tekeli, 2005.
    - Information reports on SRK visits to Velikhovskoe Southern deposit in 2011.
    - Information reports on SRK visits to Stewart Geochemical and Assay in 2011.

# 2 PROPERTY DESCRIPTION, LOCATION AND HISTORY

## 2.1 Licence Location

The Velikhovskoe deposits of martite-magnetite are located in the Kargaly district of Aktyubinsk Region, Kazakhstan, 90 km to the north-east of the Regional centre Aktobe and 36 km to the north-west of Kimpersai railway station (Badamsha village) of South-Ural Railway (Russian Railways), in the territory of sheet M-40-45-B (Figure 2.1).

The license area of Velikhovskoe Southern deposit is located within the contract area defined by license MG № 1200 of 11.10.1996, Contract № 248 of 08.10.1998 (registration № 939), Supplement to the Contract № 1 of 23.05.2002 registration № 939 and №2 of 11.12.2003 (registration № 1278).

The contract area (geological allotment) covers 36.12 $km^2$ with 7 land corners, as shown in Table 2-1.

Subsurface use right on the geological allotment is owned by Daughter Company Aktobe-Temir-VS LLP (Act of state registration of the Contract on mining of iron ores № 2067 of 14 June 2006).

The mining allotment at the Velikhovskoe Southern deposit is 3.4 $km^2$ with 8 land corners, as shown in Table 2-2.

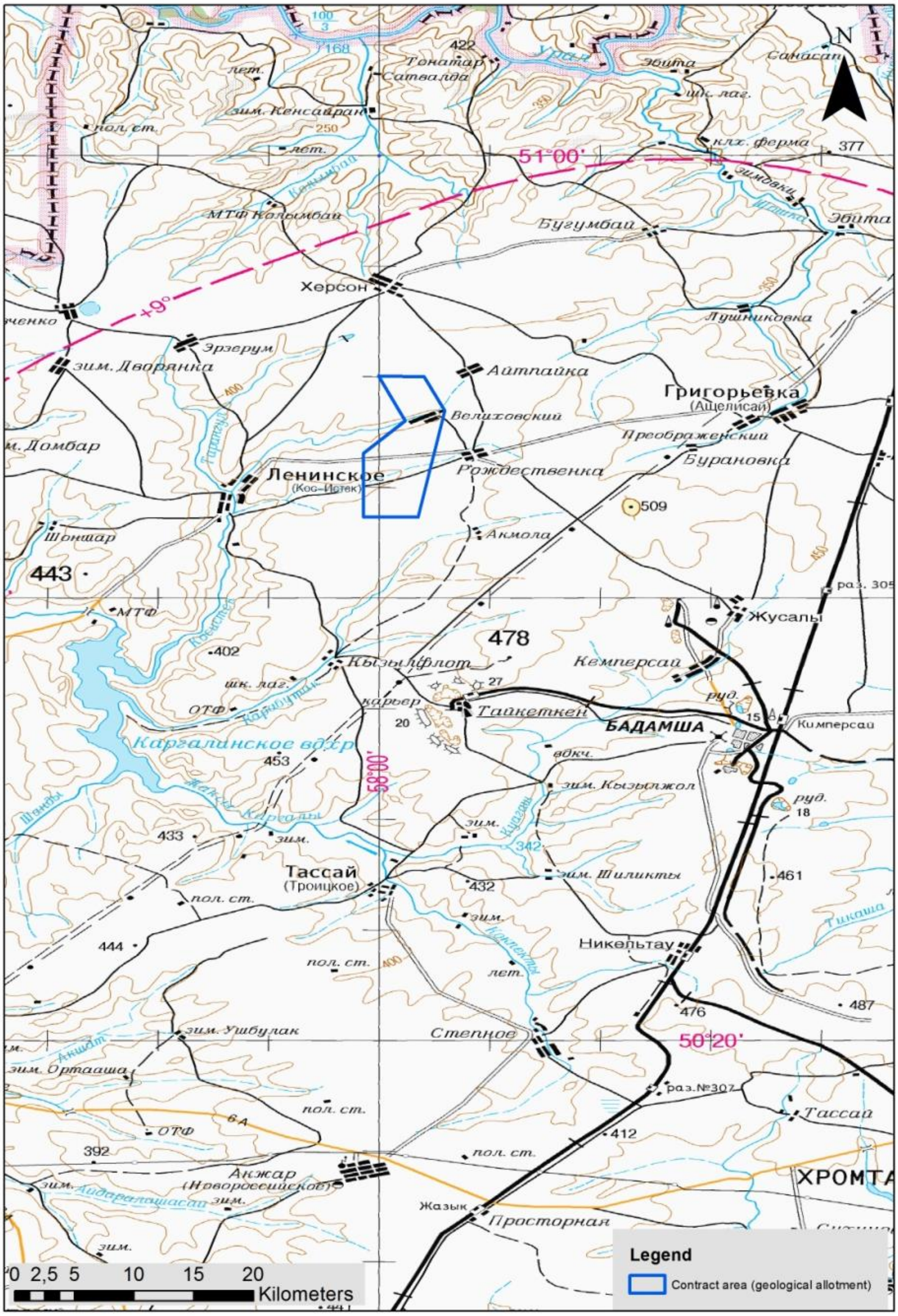



**Figure 2-1: Location Map of the Contract area (geological allotment)**

**Table 2-1: Coordinates of geological allotment**

| Land corners | Land corners coordinates | |
|---|---|---|
| | North latitude | East longitude |
| 1 | 50˚43′40″ | 57˚59′20″ |
| 2 | 50˚46′30″ | 57˚59′20″ |
| 3 | 50˚48′00″ | 58˚01′10″ |
| 4 | 50˚50′00″ | 58˚00′00″ |
| 5 | 50˚50′00″ | 58˚02′00″ |
| 6 | 50˚48′30″ | 58˚03′00″ |
| 7 | 50˚43′40″ | 58˚01′45″ |

**Table 2-2: Coordinates of mining allotment**

| Land corners | Land corners coordinates | |
|---|---|---|
| | North latitude | North latitude |
| 1 | 50˚45′40″ | 58˚00′20″ |
| 2 | 50˚45′47″ | 58˚01′00″ |
| 3 | 50˚45′27″ | 58˚01′15″ |
| 4 | 50˚44′45″ | 58˚01′35″ |
| 5 | 50˚44′05″ | 58˚01′35″ |
| 6 | 50˚43′57″ | 58˚00′47″ |
| 7 | 50˚44′15″ | 58˚00′35″ |
| 8 | 50˚45′20″ | 58˚00′30″ |

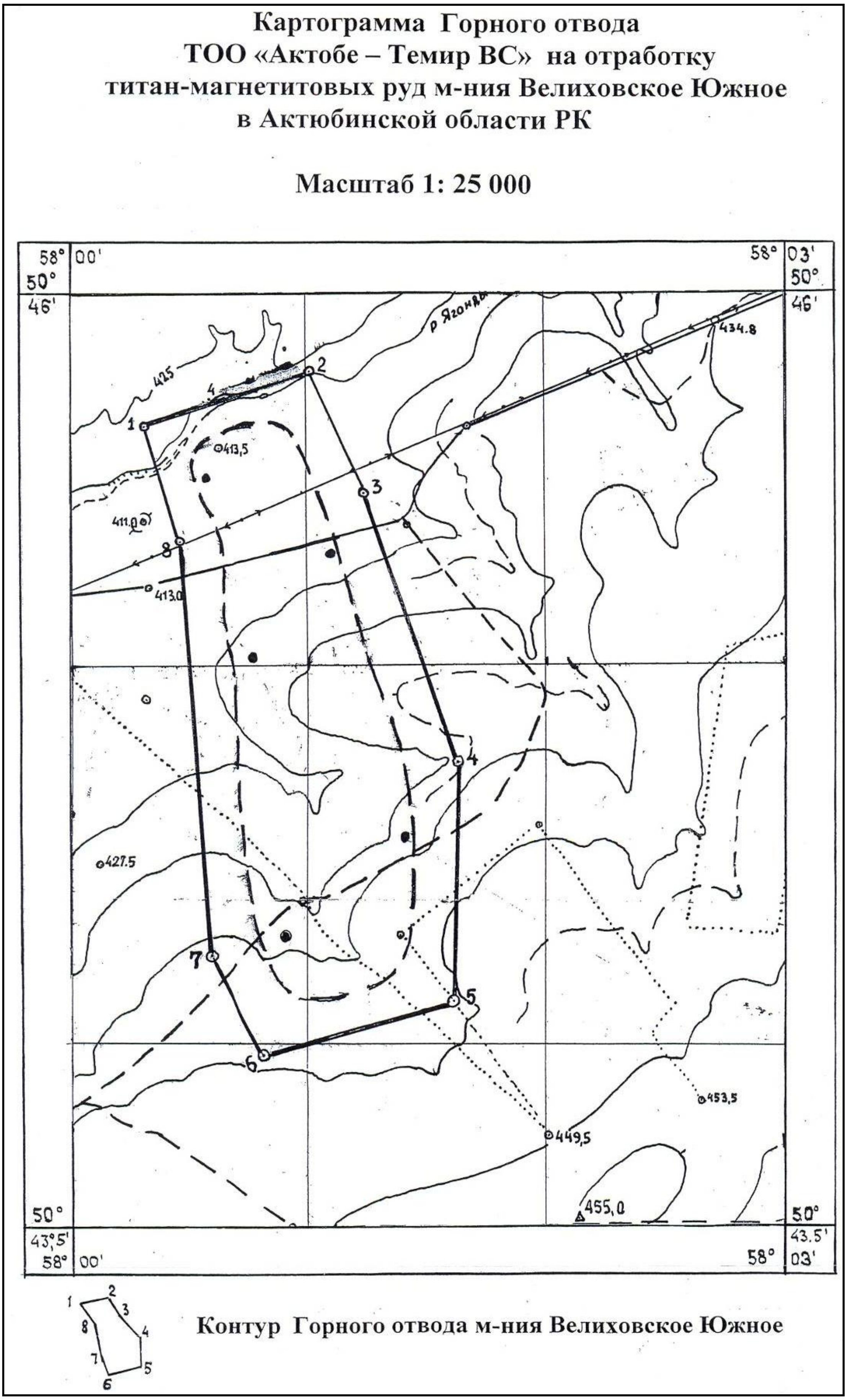



**Figure 2-2: Outline of Mining Allotment for Velikhovskoe Southern deposit**

## 2.2 Climate

The regional climate is continental with large temperature amplitudes both within a year and a day. Maximal temperature of +43°C is reached in July, and minimal of -48°C in January. Average annual temperature is +4.2°C.

Average annual rainfall amounts to 275 mm, with very irregular rainfall distribution throughout a year.

Average wind speed is 3.9-5.1 m/s, with often strong winds, snow storms in winter and dry hot winds in summer.

Spring is rather short, snow is melted by April. Summer is dry and hot. Autumn is dry with warm days and frost in the night. Snow cover occurs mainly in November, its thickness in low.

## 2.3 Infrastructure and Local Resources

The region has a well-developed industry, including several established mining operations, being a core of industrial potential of the region.

The deposit is also located near ferrous metallurgy enterprises of Russian Urals: 80 km from Ural Steel and 500 km from Magnitogorsk Integrated Iron and Steel Works. The region has a well-developed infrastructure, largely established by Yuzhuralnickel in the Soviet era. Since 1940, several deposits of silicate-nickel ores have been mined in the Kimpersai region and current economic trends make the iron mineralisation of Velikhovskoe deposits attractive.

The rural population is mainly involved in cattle breeding and agriculture. The population is mainly concentrated in central villages of collective farms and, seasonally, at cattle breeding farms.

## 2.4 Topography, Elevation, Physiography and Terrain

The Velikhovskoe deposit area is typical of the steppes of Kazakhstan, being slightly elevated plain, cut by river valleys (rivers Aitpaika, Egendy, Karabutak and others).

Elevations in the deposit territory range from 300-500 m. Minimal elevations are in the Zharsy-Kargaly river valley, where the Kargaly water reservoir, with a capacity of 186 $Mm^3$, is located. Maximal elevations (450-500 m) are located in the watershed, dividing drainage systems of Kosistek river and Ebita river (Urals river tributary).

Elevations of the Velikhovskoe Southern deposit area range from 405 to 445 m.

## 2.5 The Project Development History

### 2.5.1 Introduction

Geological survey of the Velikhovskoe deposits region began in 1930s: in 1931-1939, small-scale prospecting-mapping works were conducted in Aktyubinsk region to provide initial systematic understanding of geological setting and metallogeny of the territory (Tsibulchik M. A., 1931; Agakhano N.D., Baranova E.I., 1939).

In 1950s, systematic geological mapping of the region began H.S.Rozman, R.A.Segedin, N.I.Leonenok, P.I.Klimov, N.I.Nikolaev and other, 1950-1951). More detailed geological-geophysical surveys began later (H.S.Rozman, R.A.Segedin, 1952; Kim L.A.,Korotkov, V.P., 1959-1961).

The iron mineralization was discovered in the course of aero-magnetic mapping at a scale of 1:25000, implemented by Bachin A.P. and Komissarov B.I. (1958-1959 ).

By 1960, the area was covered with aero-magnetic survey (mapping) (Bachin A.P. and Komissarov B.I.), which allowed delineation of magnetic anomaly of the Velikhovskoe Southern deposit.

In 1959-1964, exploration works to estimate size of the Velikhovskoe Southern deposit were conducted (L.A.Kim, V.P.Korotkov, V.V.Prokopev).

In 1983, geological survey of Kimpersai district at a scale of 1: 50000 was completed (V.F.Korobkov, V.Sanin and others).

The next exploration was carried out in 1985-1989 (Ulukpanov K.T., Bogach I.I., Kukushkin M.V. and others).

### 2.5.2 Brief review of the historical works

The Velikhovskoe Southern deposit was discovered in the course of aero-magnetic mapping at a scale of 1 : 25000, implemented by Bachin A.P. and Komissarov B.I. (1959). The magnetic anomaly of the Velikhovskoe Southern deposit was estimated as prospective for magnetite iron mineralisation.

Based on the aero-magnetic mapping results, in 1960-64, Velikhovskoe Crew of Kimpersai GRE, from recommendation of Berchogursky GGFE (Bachin A.P.), conducted exploration of the deposit (L.A.Kim, V.P.Korotkov, S.I.Danchenko, L.V.Yashin, V.V.Prokopev and others).

*1961-1964 Exploration*

132 drillholes (4666 m) were drilled in that period (the hole depths were 40-50 m) and 18 exploration drillholes (5386 m) were drilled with spacing between the latitudinal lines of 800 m and hole spacing in a line of 100 m. (№№ 1-8, 12-14, 5195-5201). The exploration holes were drilled inclined at an angle of 75-76º predominantly eastwards. Some holes (1 and 3) were drilled inclined westwards. The holes depth ranged 113 to 434.9 m, averaging 299.2 m. Core recovery that period averaged around 90%. 3344 core samples (6608 run. m) and 209 composite samples from core were collected. The sampling control was 5%. From drillholes № 3 and №4, technological (metallurgical) samples weighting 500 and 300 kg, respectively, were collected, which then were surveyed in the laboratory of Sibelectrosteel plant, Krasnoyarsk.

In all drillholes, combination logging was carried out, comprising GR, resistivity log and SP. Directional survey was carried out in exploration drillholes.

Basing on the survey feedback (1964), the deposit was estimated as large with reserves to depth 300 m of 575 Mt at mean $Fe_{tot}$ grade of 17%, 2.03% $TiO_2$, and 0.23% $V_2O_5$ .

*Exploration 2004*

In 2004 exploration of the deposit was carried out by Aktobe-Temir VS LLP, comprising drilling with core sampling, surface geophysical survey (magnetic and electric logging) were implemented).

Basic volumes of exploration works at Velikhovskoe Southern deposit, carried out in 2004, are presented in Table 2-3.

**Table 2-3: The Exploration Program Implemented in 2004**

| № cons. | Title of surveys | Units | Amount |
|---|---|---|---|
| 1 | Exploration drilling, | Run. m/drillholes | 8314.4/50 |
| | including hydrogeological | | 255/4 |
| 2 | Core sampling | Run. m/ samples | 7805.6/3934 |
| 3 | Magnetic mapping at grid spacing 100x10 m | $km^2$ | 20 |
| 4 | Electric survey by lines | Run. km | 23.3 |
| 5 | Topographic mapping<br>Including in the mineralised field | $km^2$ | 4.0<br>3.6 |
| 6 | Metallurgical sampling | sample | 161 |
| 7 | Hole geophysical logging | | |
| | GK | Run. m | 8289 |
| | Resistivity log | " | 8289 |
| | Electro-magnetic survey | " | 6726.1 |
| | Directional survey | points | 860 |

Based on feedback of two exploration campaigns (1960-64, 2004), the deposit was explored to depth of 200 m, with some holes dug to 300 m and 400 m. The exploration was implemented for justification of open-cut mining to a depth of 200 m, so the electric log was restricted by these depths.

*Confirmatory Exploration Drilling of 2010 (Daughter Company Aktobe-Temir-VS LLP).*

The 2010 holes are designated for validation of historical data and for tracing the mineralization to depth (300 m).

In 2010, the Company drilled three confirmatory (validation-and-verification) holes (holes 1049, 1046 and 1043) along exploration lines 4, 5 and 7. The hole depths were 530, 545 and 540m, respectively.

*2011 Exploration*

SRK Exploration Services Ltd and SRK Consulting (Kazakhstan) Ltd in collaboration with management of Aktobe-Temir-VS LLP, planned and executed a drilling program for estimation of the most promising blocks of the Velikhovskoe Southern deposit in accordance with JORC Code.

As a result, in 2011 contractor GRK Topaz LLP for Aktobe-Temir-VS LLP drilled 25 exploration holes of total length of 5,306.5m, completely geologically logged with collection of 2,767 samples.

# 3 GEOLOGY

## 3.1 Geological Setting of the Deposit

Velikhovskoe Southern deposit is located in western limb of Kimpersai anticline, in the belt of early oceanic Ordovician basalt formation Both structurally and genetically the deposit is connected with Ordovician magmatism, namely, Kimpersai complex. Effect of Devonian intrusive magmatism on the deposit is limited by hydrothermal-metasomatic alteration of the mineralised zones and host rocks.

Structurally the deposit is a stratified sill-like intrusive mass, subconcordant to enclosing Lower-Medium Ordovician strata, with steep dip (same to the strata dip, around 70º) westwards, at submeridianal strike.

The intrusive massive is composed by 2/3 of plagioclase pyroxenites, by 1/3 magnetite pyroxenites, being impregnated magnetite mineralisation of the Kachkanar type. Pyroxene anorthosites are of minor abundance.

The monocline pyroxenites have been broken by longitudinal and diagonal faults of NE strike and transpressional faults. The strike becomes NW at the dominating submeridional strike of contacts and bodies in northern part of the mineralised field, in the south, and beyond the southern border of the field.

Except for the Southern Valley site, practically everywhere the pyroxenites are covered with Upper Cretaceous clayey sands, the thickness of which in northern part of the mineralised field reaches 7-8 m, and in the southern part 10-15 m.

In most of the mineralised field, the Cretaceous sands overlie weathering crust. The upper part of the weathering crust column is of significantly clayey composition. The lower part of the weathering crust is presented by weathered (to a different extent) pyroxenites, gradually changing to fresh rocks and mineralised zones.

The pyroxenite mass is composed of three rock lithologies: magnetite pyroxenites, plagioclase pyroxenites and pyroxene anorthosites in volumetric ratio of around 33:65:2 (%).

At that, magnetite pyroxenites correspond to $Fe_{tot}$ grade of around 18.3%, plagiopyroxenites around 13%, and pyroxene anorthosites below 8%.

## 3.2 Bodies Morphology

The deposit bodies are presented by lenticular magnetite pyroxenite bodies, occurring within a plagioclase pyroxenite intrusive. In mineralised field of the Velikhovskoe Southern deposit, four magnetite pyroxenite bodies (I,II,III,IV) have been revealed.

The principal exploration target, body I (being properly the exploration target), is a flattened lenticular body (both along and across the body axis).

Body I is the largest and has been traced along the strike from line I to line XII (around 2.7 km). The interstratal type faults define southern and northern contacts of the body. The body shows submeridianal strike at a generally western dip with the 65-70º angle (in axial part).

Body II, detected by exploration line IV, is a separate lens occurring to the west of body I, similar in morphology and spatial attitude to the body I.

## 3.3 Material and Mineralogical Composition

In the Velikhovskoe Southern deposit, the impregnated magnetite prevails, whereas martite, in the hypergenesis zone, is of minor abundance.

*Magnetite* refers to magmatogene impregnation type having a genetic link with the gabbroids (pyroxenites). The mineralisation present Kachkanar commercial-genetic type. The major mineral is magnetite, forming impregnation textures, and very rarely – stringer-porphyry mineralization textures in massive or indistinctly stratified pyroxenites.

The magnetite crystals have prevailing size of around 0.2 mm, and also thinner magnetite impregnation in pyroxene occurs (0.01-0.05 mm). Intergrowths of magnetite crystals reach size of 1-2 mm, rarely 5 mm. As rule, magnetite forms integrowths with similar in size, but more frequently thinner ilmenite, rarely ulvospinel. Close association of magnetite with ilmenite owing to mutual intergrowths allows to call the former titanian magnetite. Average content of the titanian magnetite is 17.05% at the ratio of standard ilmenite and magnetite of 1:5.

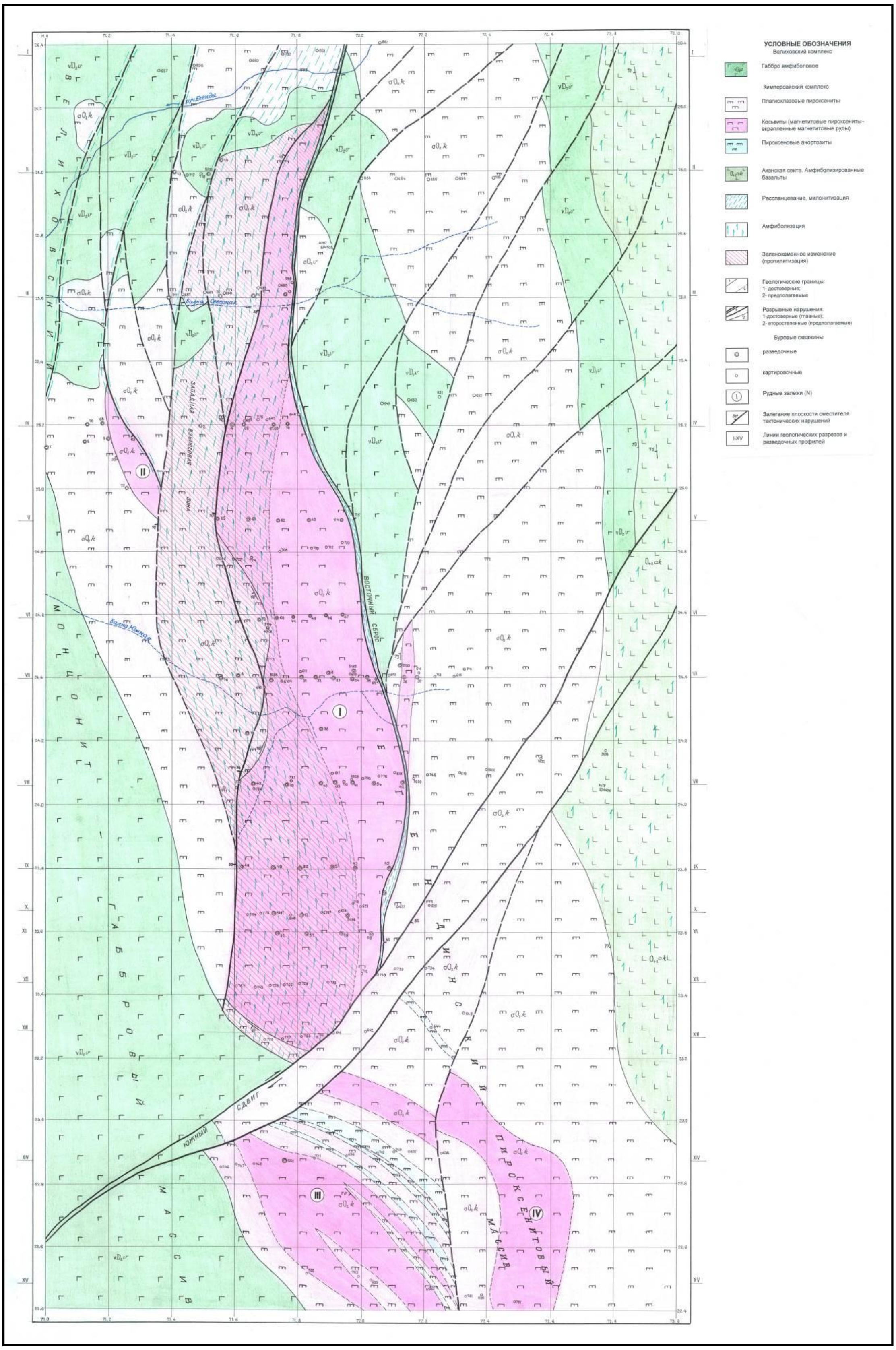



**Figure 3-1: The Velikhovskoe Southern Deposit Geological Map**

The magnetite groundmass is principally presented by augite pyroxene.

The mineralisation composition is as follows: $SiO_2$ 40-42%; $Al_2O_3$ 6-14%; CaO 14-15%; MgO 8-11%. Sulfides, sulfates, and phosphates occur in the mineralisation in concentrations below 1%. The magnetite groundmass at average Fe grade of 15% is characterized by presence of anortite plagioclase that owes increasing content of $Al_2O_3$, CaO and decreasing content of FeO, MgO in the groundmass at relatively stable $SiO_2$ content.

*Martite* refers to weathering crust deposit type. The principal mineral is martite – a hematite pseudomorph replacing magnetite. Besides martite, the mineralisation also contains significant amounts of iron hydroxile oxides (limonite). The mineralisation is loose, clayey, and sometimes powdery. Their composition is unstable.

Increasing contents of CaO and MgO is owed by incomplete decomposition of pyroxene and plagioclase. In the relatively rich mineralisation at Fe grade of 45-50% the slag-forming oxides contents are as follows: $SiO_2$ 23.4%; $Al_2O_3$ 13.26%; CaO 3.88%; MgO 2.06%.

The identified martite bodies were formed owing to hypergene transformation (alteration) of the impregnation magnetite. The transformation essence consists in oxidation and hydration in sequence: magnetite→martite→hydrogoethite→limonit. At that, magnetite oxidation is accompanied by hydration and decomposition of plagioclase and pyroxene with removing Ca, Mg and relative accumulation of $SiO_2$, Fe, Al. Finally, the mineralisation and ultrabasites are replaced with slightly siliceous and aluminous limonite hats (gossans).

When oxidizing the impregnated mineralisation, the Fe, $TiO_2$, $V_2O_5$, contained in magnetite regularly increases up to two times on average. The impregnated magnetite at 20-25% Fe grade are transformed in the weathering crust into ochre martite with 45-50% Fe grade.

At the expense of poor magnetite mineralization in the plagiopyroxenites with $Fe_{tot}$ grade of 7-12%, the mantle-like martite bodies are formed with Fe grade of 14-20%. For this reason, martite occurs outside the magnetite outline.

## 3.4 Metallurgical Types

The metallurgical types of mineralisation of the Velikhovskoe Southern deposit is initially defined by metallurgical grade and then, to a lesser extent by mining and processing methods. From these, the mineralisation can be divided into two types:

1. *Impregnated magnetite*, requiring multi-stage magnetic separation concentration – 96.4%. These magnetite are mineable only using drilling-and-blasting operations.

2. *Martite*, requiring combine processing method (washing to remove clay, gravity separation). Around a third of the martite at $Fe_{tot}$ grade of 45.8% can be mined and used without concentration.

## 3.5 Accompanying Components

Accompanying components in the magnetite and martite are Ti and V, which, owing to close intergrowth of ilmenite and ulvospinel with magnetite keeps the ratio of Fe : $TiO_2$ : $V_2O_5$ around 100:10:1 in all mineralisation types. Bedrock (baseline) content of $TiO_2$ 0.3%, V 0.03% is due to the isomorphic impurity of augite.

In hypergene conditions, Ti and V behaviour is similar to that of iron. At complete magnetite decomposition, Ti and V go to limonite.

## 3.6 Mineralogical Composition

From data of thin sections and metallographic samples investigation, monocline pyroxene dominates in pyroxenites,; in smaller amounts phlogopite and olivine occur in magnetite pyroxenites, and olivine is more rare in thin sections.

Among the magmatogene minerals are magnetite, ilmenite and ulvospinel, possibly a part of sulfides, in descending abundance, pyrite, chalcopyrite, pyrrhotite. Among the post-magmatic minerals are hornblend, actinolite, epidote, zoisite, chlorite, feldspar, albite, calcite, serpentine.

Both magnetite pyroxenites and plagiopyroxenites are small-grained, well-devitrified (crystalline) rocks. Dominating sizes of pyroxene and plagioclase grains are 2 mm, phlogopite 1.5 mm. Grains of magnetite, ilmenite and ulvospinel are much smaller (0.1-0.2 mm), sulfides grains are 0.005-0.2 mm in size, most often around 0.02-0.05 mm. Very fine magnetite (0.0n mm) is widespread, as is ilmenite and their fine intergrowths (titanomagnetite).

*Iron* is major component of the impregnation mineralisation and weathering crust. Fe mineral-holders are magnetite, martite (hematite), pyroxene, ilmenite, titanomagnetite, and to a lesser extent, in sulfides (pyrite, pyrrhotite, chalcopyrite), amphibole, actinolite, epidote, chlorite and others.

*Titanium* in the mineralisation is contained in ilmenite, titanomagnetite, ulvospinel, which are in close intergrowths with magnetite, and after its oxidation with martite. Ratio $Fe_{tot}$: $TiO_2$ in magnetite is 14:1, in martite 15:1.

*Vanadium* in the mineralisation is contained in the magnetite. The V content in silicates is 0.03% maximum. Vanadium is closely tied with titanium both in magnetite and martite.

*Copper* in the mineralisation occurs in sulfides. Copper minerals below the oxidation zone (weathering crust) are presented by chalcopyrite, detected in almost all metallographic specimens in the amount of 0.5-2.0% maximum. In the oxidation zone, native copper, chalcocite, cuprite, bornite, and malachite occur. Chalcopyrite always associates with pyrite. In composite samples the average copper content amounts to 0.0574%; with a peak figure in some samples reaching 0.4%. At that, in intervals with increased copper grade, grades of Zn and Pb also increase up to 3 and 7.8 clarkes (crustal abundance) in average, respectively.

*Gold* in all composite samples demonstrates grades below 0.1 ppm.

# 4 MINERAL RESOURCE ESTIMATION

## 4.1 Introduction

SRK has used the Micromine mining software for data compilation body modelling and database management based on geological information and sampling data obtained in the course of the 2011 exploration program and historical exploration works. SRK provided technical assistance to the 2011 exploration program implementation and inspected the QAQC procedures in place for compliance with JORC Code.

SRK has completed a number of validation checks on the raw data (their quality and confidence) prior to use in the Mineral Resource Estimate.

SRK has collated and checked all the available information from both historical and the latest surveys for the Project evaluation. The project is at a Scoping Study stage.

SRK has compiled an electronic database for the project; this includes the latest drilling results and a GIS database which includes other collated information.

## 4.2 Topography

To date, no data on the base map used for the Soviet period exploration (1960-1964) are available. Most likely the published topographic maps at a scale of 1:25000 were usedas the basis of  the magnetic survey of the area.

At the second stage, in June 2004, at the Velikhovskoe Southern deposit, tacheometrical survey at a scale of 1:2000 on 0.5 m contour intervals was carried out by RGKP Zapgeodeziya.

In the area covered by the topographic survey, 5 permanent geodetic points (survey markers) were installed (of type 159 Nos. 1475, 2752, 3019, 4297, 9704).

To date all the survey markers are in good condition, can be easily found and can be used for locating drillhole sites.

**Figure 4-1: The Survey Markers**

Simultaneously with the tacheometrical survey, of the  hole collars (both historical and drilled in 2004) were located. The holes drilled in 2010-2011 have also been located.

SRK digitized the 2004 topographic base map. Review of the base map and the hole collars altitudes showed considerable difference in data on collar altitudes for some holes drilled in 1960-1964. It is possible that not all holes were found in the course of the 2004 collar locating campaign.

Based on reviewing quality and confidence of the base map and the hole collar location, SRK has created a topographic base map for use in the MRE in the following sequence.

- The digitized 2004 topographic base map was taken as a basis.

- The 1960-1964 hole collar altitudes were adjusted by "lowering" the hole collars to the 2004 topographic base map surface.
- SRK believes that altitudes of hole collars of 2004, 2010-2011 are more precise data and corrected the digitized 2004 topographic base map accordingly.

SRK considers using the topographic base map of such quality is acceptable at this stage. However, in the following stages, more precise topographic base map should be developed with allowable (minimal) discrepancies of altitudes of hole collars or other workings locating.

## 4.3 Drilling

***Mapping and Exploration Drilling of 1960-1964***

The 1960-64 drillholes had various purposes and are divided into two groups:

- mapping drillholes; and
- exploration drillholes.

*The mapping drillholes* were drilled for validation of magnetic anomalies detected by geophysicists, and for geological mapping of the deposit surface below the neogene-quaternary deposits blanket. 132 mapping holes (4,666 m) were drilled in that period.

The hole depth was 40-50 m only; they all were vertical and were drilled by self-propelled rigs ZIF-300A.

Pobedit-armoured (hard alloy) drill bits and rolling cutter bits were used for drilling through neogene-quaternary deposits blanket; diamond bits were applied for drilling through bedrocks.

Water was generally used as a washing fluid. Drilling mud was applied commonly in high-fractured zones, that is, in zones of intensive drilling mud loss.

*The exploration drillholes* were also drilled along exploration lines across the mineralised zone strike.

18 exploration drillholes (5,386 m) were drilled with spacing between the lines of 800 m and hole spacing in a line of 100 m.

All but two drillholes were drilled inclined at an angle of 75-76º predominantly eastwards. Holes 1 and 3 were drilled inclined westwards. Drillhole depth ranged from 113 to 434.9 m, averaging 299.2 m.

Core recovery that period averaged around 90% and 3,344 core samples (6,608 m) and 209 composite samples from core were collected.

Technological (metallurgical) samples weighting 500 and 300 kg, respectively, were collected from drillholes 3 and 4, which then were surveyed in the laboratory of Sibelectrosteel plant, Krasnoyarsk.

In all the drillholes, combination logging was carried out, comprising GR, resistivity log and SP. Besides, directional survey was carried out in the exploration drillholes.

***Exploration Drilling of 2004 (Aktobe-Temir VS LLP)***

During this period, mainly exploration holes were drilled along with four hydrogeological holes.

The holes were aimed to explore and sample body to depth. For the period, 50 exploration (8,314.4 m) and four hydrogeological (255.0 m) holes were drilled.

The holes were predominantly drilled along exploration lines across the mineralised zone strike. The exploration grid density was 70-190 m to 270-410 m along the strike and 50-120 m to the dip.

The holes were inclined, at zenith angle of 75º, eastwards or westwards, depending on magnetic survey data interpretation, and used for approximate determination of magnetic layer dip and contact directions. Loose sediments were drilled to 93 and 89 mm in diameter, and fresh bedrock was drilled with 76 mm diameter diamond bits.

The hydrogeological holes were drilled through loose and weathered rocks with 132 mm diameter bits then cased to a diameter of 108 mm.

To increase core recovery, a Boart Longyear with double tube wireline core barrel was used. At hole diameter of 76 mm, the core diameter was 47 mm.

Core recovery in all holes used for the MRE amounted to 92-100%, at mean of 97.5%. The decreasing recovery was due to inevitable partial disintegration of clayey composition intervals (weathering crust, clayey sands, etc), whereas core recovery in bedrock (even weathered), was close to 99-100%.

From this period, 3,934 channel samples (7805.6 m) were collected. Combination logging and directional survey was carried out in all the drillholes.

The holes deviations from the preset azimuth direction were 8° maximum, and deviatons in zenith angle of 0.5°-2.5°. Such small deviations produce practically negligible impact on construction of geological cross-sections with the body geometrization.

***Confirmatory Exploration Drilling of 2010-2011 (Daughter Company Aktobe-Temir-VS LLP).***

In 2010, the Client drilled three confirmatory (validation-and-verification) holes (holes 1049, 1046 and 1043) along exploration lines 4, 5 and 7. The hole depths were 530, 545 and 540 m, respectively.

***2011 Exploration (Daughter Company Aktobe-Temir-VS LLP)***

SRK Exploration Services Ltd and SRK Consulting (Kazakhstan) Ltd in collaboration with the Client has developed a drilling program for estimation of the most promising blocks of the Velikhovskoe Southern deposit in accordance with JORK Code.

As a result, in 2011 contractor GRK Topaz LLP for the client has drilled 25 exploration holes of total length of 5,306.5 m, completely geologically logged with collection of 2,767 samples.

### 4.3.1 Geological Logging

Geological and geotechnical logging of holes in 2011 was carried out in accordance with the Velikovskoye Drilling, Logging And Sampling Protocol Manual, prepared by SRK Exploration Services Ltd for the Client.

The logging includes two phases:

- geotechnical logging; and
- geological logging.

Geotechnical logging was conducted in compliance with “SRK Geotechnical logging manual”, directly at drill site. At this stage, all core recovery parameters were determined, marking and measuring all crushing and faulting zones was conducted, as well as marking for core sawing.

**Figure 4-2: Geotechnical Logging**

After geotechnical logging, core was placed into core boxes, which were properly labelled, and transferred to the Company base.

At the base, the whole core was carefully photographed both dry and wet. Geological logging was conducted in a room equipped with special tables. Samples were collected for physical-and-mechanical properties determination, specific gravity was measured, and sampling intervals were defined..

Geological logging was carried out in two formats: classical with rock description meeting GKZ requirements, and using a system of codes approved by SRK Exploration Services Ltd.

The logging sheet comprises records on: run length, core recovery, brief geological characteristics of rocks, samples numbers and results of their assays.

Upon processing hole geophysical survey, a composite column of a drillhole was completed, based on geological cross-section along the hole, taking into account results of the hole geophysical survey.

For each hole, a certificate was prepared, including the geological logging sheet, act of hole location, act of hole completion, acts of control measurements, tables of directional survey data and the composite geological-geophysical column.


**Figure 4-3: An Example of Core Photography**

### 4.3.2 Sampling Methodology

Until 2010 and later, mainly core sampling was applied; to a lesser extent, geochemical, composite and metallurgical (dressability) samples were collected.

***Core sampling*** was conducted systematically for all hole intervals except for Cretaceous and Quaternary deposits. This approach was used because the rock-ore borderline is conventional to some extent and is not detected visually. Core of loose rock is halved along axis manually; core of bedrock and ore is sawn with a diamond saw. Half of the 2 m core interval is taken as a sample, and the second half is stored for reference and other investigations (metallurgical sampling, collection samples of various purpose).

***Core sampling in the course of the 2011 exploration.*** After completing geological logging, core is sawn (by line, marked by geologist) into halves by diamond saw (Figure 4.4).

Half of the 2 m core interval was taken for sample preparation, and the second half was stored as geological duplicate for possible other investigations (metallurgical sampling, collection samples of various purpose). Average sample length was 2 m.

Core sampling was conducted throughout the hole from collar. This approach was used because the rock-mineralised borderline is conventional to some extent and is not detected visually. Body boundaries were determined by sampling results only.

**Figure 4-4: Core Sawing and Sampling**

Core samples were collected into dense cloth bags, on which number of sample was labelled; a label of specified form was placed inside the bag, and the same label was put in corresponding interval in core box.

***Sampling for physical-and-mechanical properties.*** Upon completing geological logging, samples for specific gravity (SG) determination and physical-mechanical properties (geotechnical samples GT) of rocks were taken from drill core (Figure 4.5). The samples were taken from intervals of various lithologies and different mineralogical types.

When taking SG or GT samples, its position in core box was marked by wooden insert of the same length. After completing the tests, the sample was placed back precisely to the same place.

The samples were labelled by “SG” (specific gravity) or “GT” (geotechnical tests).

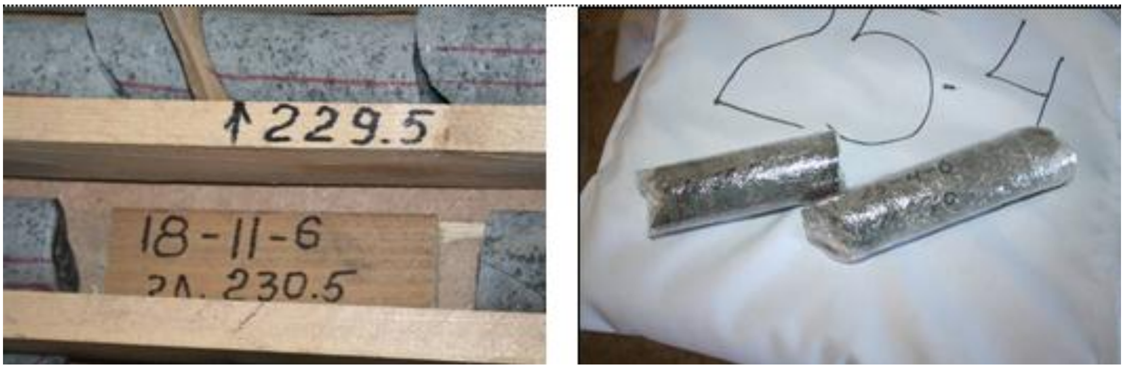



**Figure 4-5: Sampling for physical-and-mechanical properties**

### 4.3.3 Sample Preparation

In the course of the 2004 exploration by the Client, core samples were prepared in the crushing shop of Zaprudgeologiya LLP (Aktobe).

The samples preparation was conducted by machined-manual method by scheme, complied to the Richards-Chechett formula:

$$Q = kd2,$$

where Q – the reliable sample weight (kg), d - diameter of the largest particles in the sample, (mm), and k - coefficient of ore distribution irregularity set at 0.1:

Initial weight of a core sample is 5-6 kg. The sample preparation is implemented by the following scheme:

1. Rolling crushing with systematic removing particles -1mm (screening out), to reach particle size of 1 mm.

2. Cone and quartering to separate a sample of 0.3-0.325 kg. The residual material kept as duplicate until completing of the exploration.

3. The 0.3-0.375 kg sample was pulverized using a disk vibration mill to grain size of 0.075 mm corresponding to 200 mesh with subsequent quartering of powder sample into analytical charge and its duplicate of 0.15-0.16 kg. This analytical charge weight was enough for all assays to be conducted.

As for the processed samples, possible contamination by the previous sample material was immaterial, the preparation QC consisted of systematic verification of the sample duplicate grain size uniformity (1 mm), quality of pulverization and weight of the analytical charge.

The control was conducted by weighting and sieving at screens 1 mm (duplicate samples) and 0.07 mm (analytical charge).

At oversize of above 10%, the sample returned to the shop for re-grinding. At analytical charge weight below 0.1 kg samples were processed again. The control was conducted for 10 randomly chosen samples from each batch (200-300 samples) and amounted to 5% of the total; amount of samples processed.

In the course of the confirmation exploration of 2010-2011, the core and slime samples were processed in the sample preparation shop of Aktobe-Temir VS.

The samples with sample registers arrived at the sample reception unit where they were recorded in Sample Registration Log and weighed (Figure 4.6).

The samples were then dried the oven for 2-6 hours (depending on moisture) at 100-105$^{o}$C.

**Figure 4-6: Scale Balances for Weighing Received Samples and Dewatering Box**

At average length of core sample of 2 m, drilling diameter of 76 mm (core diameter of 47 mm), average bulk density of 3.189 t/m$^3$, the sample weight is:

Q = π x R2 x L x d, where:

Q – core weight, kg;

π – coefficient 3,14;

R – core radius D/2 = 0.0235 m;

L – sample length of 2.0 m (at mean core recovery of 95% sample length is 1.9 m);

d- bulk density, 3.189 t/m3.

Q = 3.14 x 0.00055 x 1.9 x 3.189 = 9.5 kg,

Hence, half-core sample weight is around 5 kg.

According to the approved work project, the dried samples passed preparation by the following scheme (Figure 4.7):

- Crushing of initial material at jaw crusher (DShch) to particle size of 20 mm.
- Crushing at roller crusher with systematic removing undersize -2 mm, reaching particle size of 2 mm.
- Triple quartering with taking sample of 0.3 kg (the rest presents duplicate and is kept until the works completion).
- The 0.3 kg sample is pulverized at Vibro-pulverizer to size 0,074 mm and divided into analytical charge and its duplicate weighting 0.15-0.16 kg each.

Pulverizing a sample to particle size 0.074 mm was conducted for internal assays at spectrometer SRV-1M only.

Preparation of samples for dispatch to the internationally certified laboratory (Stewart Geochemical and Assay) comprised crushing of samples to 2 mm only. Further sample preparation was carried out by the laboratory.

The weight of a sample, dispatched after the reduction, was around 1 kg. The sample reduction was carried out automatically at the roller crusher DSA (crushing-reduction facility).

**Figure 4-7: The Jaw Crusher (DShch 220x160) and the Roll Crusher (DSA)**

The sample preparation shop is kept in clean condition, with daily wet cleaning (washing) of the room in the end of a shift.

Prior to preparing the next sample, all instruments and preparation tables were cleaned and blown with compressed air. The Vibro-pulverizer cups were washed with water and thoroughly dried prior to being used again.

The sample preparation area was only involved in preparing the Velikhovskoe samples. As possible contamination of the next sample with material of the previous sample was immaterial, so the crushers and the pulverizer cups were not cleaned.

QA measures comprised systematic check-up of sample particle size uniformity (2 mm), pulverizing quality and analytical charge weight.

The control was implemented by weighting and sieving (screening out) at screens 2 mm (duplicate samples) and 0.07 mm (analytical charge).

**Figure 4-8: The Vibro-pulverizer (IV 3) and Pulverized Samples**

### 4.3.4 Laboratory Analysis

In the course of the 2004 exploration campaign (Aktobe-Temir VS LLP), assays were carried out in several certified laboratories.

Samples were assayed for $Fe_{tot}$, $TO_2$, V, $Fe_2O_3$, and FeO. Magnetite, being non-prospective for Pt and Pd, excludes the need for assay (in composite samples) for these elements. Micro-component composition of the deposit mineralisation was determined by spectral analysis, which was also used for assay of geochemical samples from zones with copper mineralization.

Amounts and types of the assays and titles of laboratories, involved in the assaying surveys, are given in Table 4-1.

**Table 4-1: Amounts and Types of the 2004 Assays**

| № cons | Types of assays and types of samples, GOST | Amount | Laboratory Certification |
|---|---|---|---|
| 1 | Assay of ordinary samples for total iron | 3118 | Chemical laboratory of Donskoi GOK |
| 2 | Assay of internal control samples | 181 | Certificate № 90 of 12.04.2004, issued by Aktyubinsk branch of JSC «National Expartise and Certification Center» |
| 3 | Assay of control samples for total iron using the second core halves | 25 | |
| 4 | Assay of ordinary samples for $V_2O_5$ and $TiO_2$ GOST 23581.18-81 | 368 | |
| 5 | External control assay for total iron GOST 23581.18-81 | 181 | CJSC Testing Center «Tsentrgeoanalit». Accreditation certificate № KK 658000 06.10.00373<br>Valid until 16.07.2005 |
| 6 | Assay of composite samples GOSTs 23581.1; 13-79; 15; 19-91; 20-81 | 158 | |
| 7 | Semiquantitative spectral analysis for 24 elements | 377 | |
| 8 | Assay of ordinary samples for total iron | 816 | PITs «Geoanalitika» LLP Certificate № 18 of 26.05.2003<br>Kazakhstan State Standard |
| 9 | Assay of ordinary samples for Cu | 34 | |
| 10 | Assay of ordinary samples for $V_2O_5$ and $TiO_2$ | 422 | |
| 11 | Semiquantitative spectral analysis for 24 elements | 493 | |
| 14 | Assay of placer samples for Pt and Pd ND MVI 06/11-5-97 | 57 | Laboratory of Treasure Operation and Deposits of Valuables Center of National Bank of Kazakhstan. Accreditation certificate № KK 658000.06.10.00702 of 16 July 2004 |

The assay quality was estimated on the basis of internal and external control results. Internal control was carried out to determine the assays preciseness, whereas the external control was conducted to estimate correctness of the assays and technique of their implementation.

Amounts of the control assays complied with requirements of the Kazakhstan GKZ instruction in force at the time that the assay work was undertaken.

As can be seen from Table 4-2, the quality of the analytical surveys, implemented in the period, lies within permissible deviations, both in reproducibility and comparability of the assays.

It may be concluded that quality of the assays performed in the 2004 exploration campaign allows them to be used for the MRE for Velikhovskoe Southern deposit.

**Table 4-2: The Assays Quality Estimate from the 2004 Control Results**

| Assay type, grade class (%) | (Admissible) values and the obtained parameters | | | |
|---|---|---|---|---|
| | Standard Deviation $S_r$ % | Discrepancy significance by t < | Systematic discrepancy | Discrepancy + or - |
| ***Internal control*** | | | | |
| Total iron ($Fe_{tot}$) | | | | |
| Grade class (10-20) | (3.0) 2.76 | | | |
| Grade class (20-30) | (2.5) 2.00 | | | |
| Grade class (30-45) | (2.0) 1.81 | | | |
| Grade class (>45) | (1.5) 1.23 | | | |
| $Fe_2O_3$ | (3.0) 0.6 | | | |
| FeO | (5.5) 2.2 | | | |
| Fe magnetite | (4.0) 2.5 | | | |
| $TiO_2$ | (8.5) 2.8 | | | |
| V | (20) 7.1 | | | |
| ***External control*** | | | | |
| Total iron ($Fe_{tot}$) | | | | |
| Grade class 10-20 | | (2.02) 0.02 | (<0.33) 0.02 | (<13) 7 |
| Grade class 20-30 | | (2.02) 0.58 | (<0.33) 0.24 | (<13) 2 |
| Grade class 30-45 | | (2.02) 1.91 | (<0.33) 0.81 | (≤10) 11 |
| Grade class > 45 | | (2.02) 0.58 | (<0.33) 0.24 | (≤12) 2 |

## 4.4 The 2011 Laboratory Analysis Quality Assurance and Quality Control ("QAQC")

In the course of the Velikhovskoe Southern deposit exploration, geological service of Aktobe-Temir VS, in accordance with SRK Exploration Services Ltd recommendations, introduced QAQC procedures the data met the requirements of the JORC Code. The implementation of the procedures is to provide reliability and accuracy of the obtained data and elimination of bias errors in the course of collection and processing of materials and data.

In the course of sample preparation, three QAQC samples were randomly inserted in each batch comprising 25 core samples:

- one CRM (standard);
- one duplicate of crushed sample; and
- one blank.

Upon obtaining the assays data, the results were recorded on the special QAQC forms (protocols).

The data for the crushed duplicates were plotted on special diagrams together with the data for the ordinary samples, and the discrepancy is estimated. If around 90% of the data are beyond 10% error, the discrepancy is significant and the whole sample batch is subject to verification.

CRM are used similarly: if the discrepancy with the certified value exceeds three SD, the assay result is recognized unsatisfactory and the whole sample batch is subject to verification.

Results of allays of blank samples must demonstrate absence of the element of interest in the sample on condition of correct preparation of the blank.

SRK has reviewed the QAQC procedures in place and the results of the review are presented below.

### 4.4.1 "QAQC" for Laboratory Analysis

The Velikhovskoe Southern Deposit Additional Exploration Project provided for the following types of laboratory analyses (assays):

- XRD (x-ray diffraction analysis (rapid) of ordinary core samples to determine "ore or non-ore" and cut amount of expensive chemical assays for iron. Accuracy category V. The instrument – X-ray spectrometer SRN-1V. This analysis is implemented directly at Aktobe-Temir VS base.
- Chemical analysis for total iron, oxide iron, magnetite iron. Accuracy category III. All ordinary samples where Fe grade exceeds 15% are subject to chemical analysis.
- Semiquantitative spectral analysis for 24 elements for geochemical and composite samples for measuring grades of accompanying valuable components and harmful impurities. Accuracy category V.

The basic laboratory analyses were carried out by internationally accredited Stewart Geochemical and Assay.

For the laboratory operation quality control, geological service of Aktobe-Temir VS carried out geological control in compliance with recommendations of SRK Exploration Services Ltd.

The recommendations are as follows:

- Insertion of duplicates into an analyzed batch at the rate of 5 duplicates per 100 ordinary samples. The duplicates are formed from the same sample batch.
- Insertion of CRM into an analyzed batch at the rate of 1 CRM per 20 ordinary samples (the CRM must be ***similar to the deposit mineralisation in grade of the valuable component***).
- Insertion of blank samples into an analyzed batch at the rate of two blanks per 100 ordinary samples. When inserting the blanks, crushed and pulverized samples should be sandwiched. These measures are aimed at detection of possible contamination of samples in the course of sample preparation.

On 11 November 2011, SRK's P. Mukhin and SRK Consulting (Russia) Ltd's D. Ermakov visited Stewart Geochemical and Assay, to observe the implementation of the procedure of the above-mentioned assays.

Based on the review results, it was found that samples are assayed by ICP MA and ICP BF methods instead of the previously planned methods (where ICP MA means inductively coupled plasma spectrometry method with preliminary multi-acid sample decomposition, and ICP BF means inductively coupled plasma spectrometry method with preliminary fusion with borates and following acid sample decomposition).

The actual control is implemented by insertion of ordinary samples duplicates, standards (CRM) and blank samples in an assayed batch.

A batch, as rule, is composed of 25 samples, including 22 ordinary samples, one duplicate (of one of these ordinary samples, randomly selected), one CRM (two 10 g paper bags), and one blank sample.

Table 4-3 presents information on amount of ordinary samples, duplicates, CRM and blank samples from 2011 exploration campaign, analyzed in the laboratory.

**Table 4-3: Amount of ordinary samples, duplicates, CRM and blank samples from the Velikhovskoe Southern deposit, dispatched to Stewart Geochemical and Assay, 2011**

| Sample type | Amount of samples 2011 | % |
|---|---|---|
| Ordinary samples | 2767 | 100.00 |
| Powdery duplicates | 126 | 4.55 |
| Blank samples | 126 | 4.55 |
| CRM | 126 | 4.55 |
| **Total** | 3145 | |

### 4.4.2 Ordinary Samples

In accordance with the contract with Stewart Geochemical and Assay, core samples crushed to 2 mm grain size are dispatched to the laboratory for the assays. Further preparation (pulverizing to 0.074 mm) and assays is carried out by the laboratory. The sole exception is core samples collected from the three holes drilled in 2010: these samples were prepared in the sample preparation shop of Aktobe-Temir VS.

The laboratory has assayed totally 2763 ordinary samples of 2767 collected for assay.

### 4.4.3 Duplicates

Duplicates samples were taken randomly and inserted in each sample batch at a rate of one duplicate per a batch of 25 samples. The duplicates were inserted under their individual codified numbers. 126 duplicate samples from 201 drillholes (4.5% of the total ordinary samples) were submitted to the laboratory for QAQC program. Results for two duplicates were not received, and one duplicate was confused with a CRM (22040).

122 samples were analysed for assay results reproducibility.

The results of correlation between the duplicates and the ordinary samples is presented in Appendix B-7:.

Correlation between the duplicates and ordinary samples was analysed separately by HARD (half the absolute relative difference) plots and scatter plots for all assayed elements – Fe%, Ti%, Al%, P%, Cr%.

The correlation results the following HARD and scatter plots for duplicates are shown in Figure 4-9 to Figure 4-18.

The duplicates performance, results of statistical analysis, the HARD plots and the correlation coefficients for the scatter plots for the assayed elements are summarised in Table 4-4.

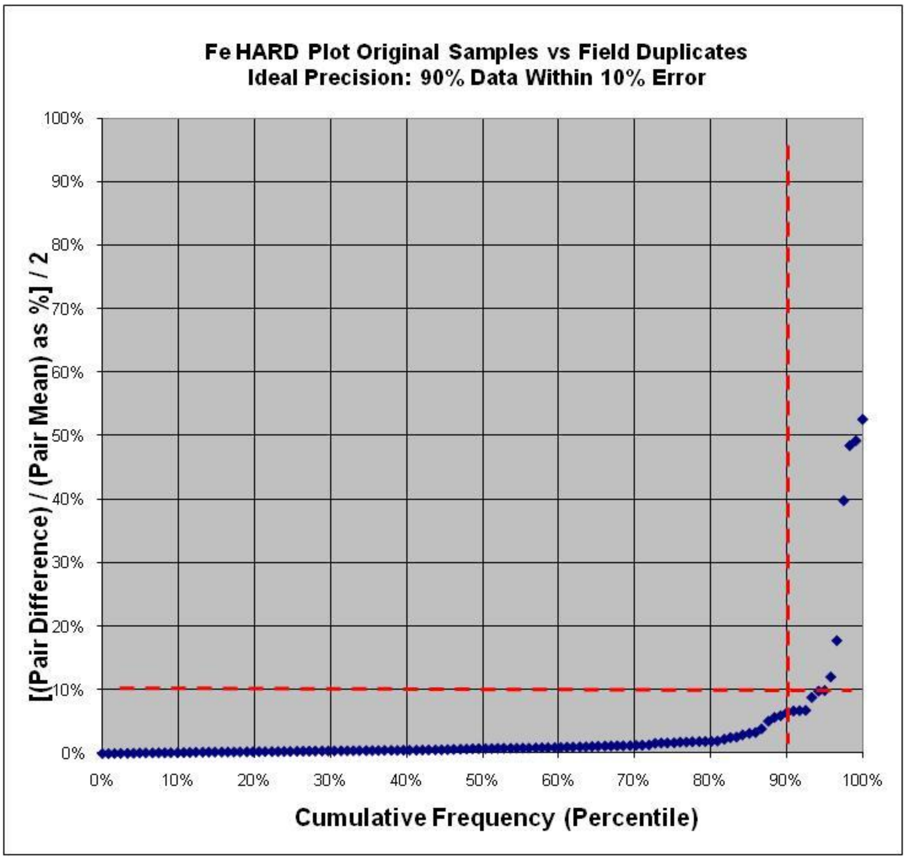



**Figure 4-9: HARD plot for Fe% showing satisfactory precision: 90% of the data are within 10% error (actually within 6% error)**

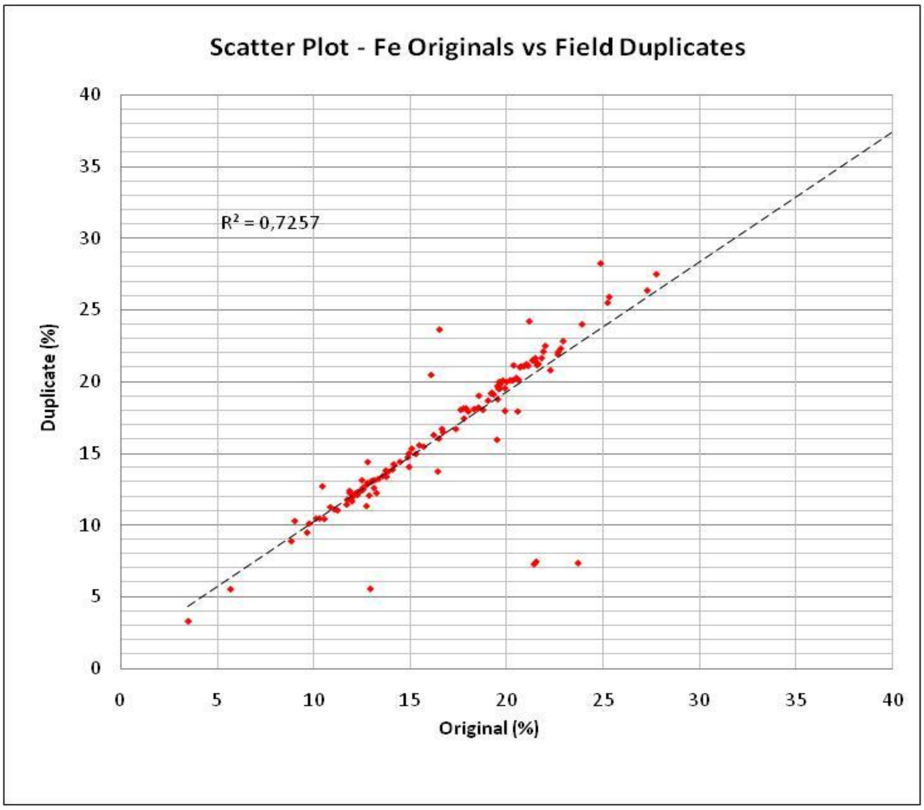



**Figure 4-10: Scatter Plot for Fe %**

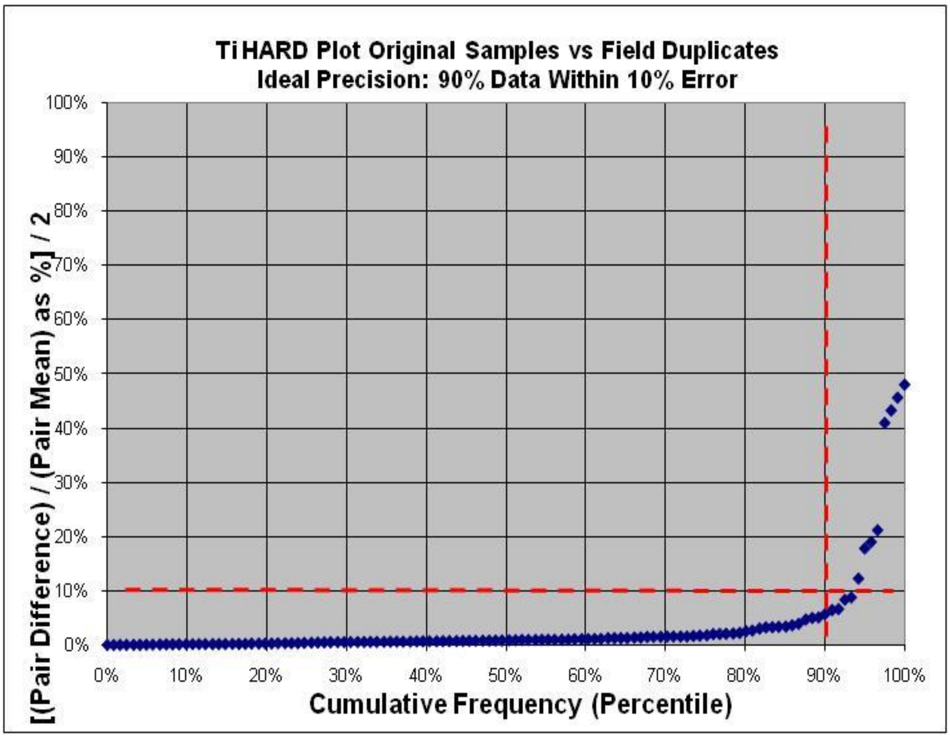



**Figure 4-11: HARD plot for Ti% showing satisfactory precision: 90% of the data are within 10% error (within 5% error)**

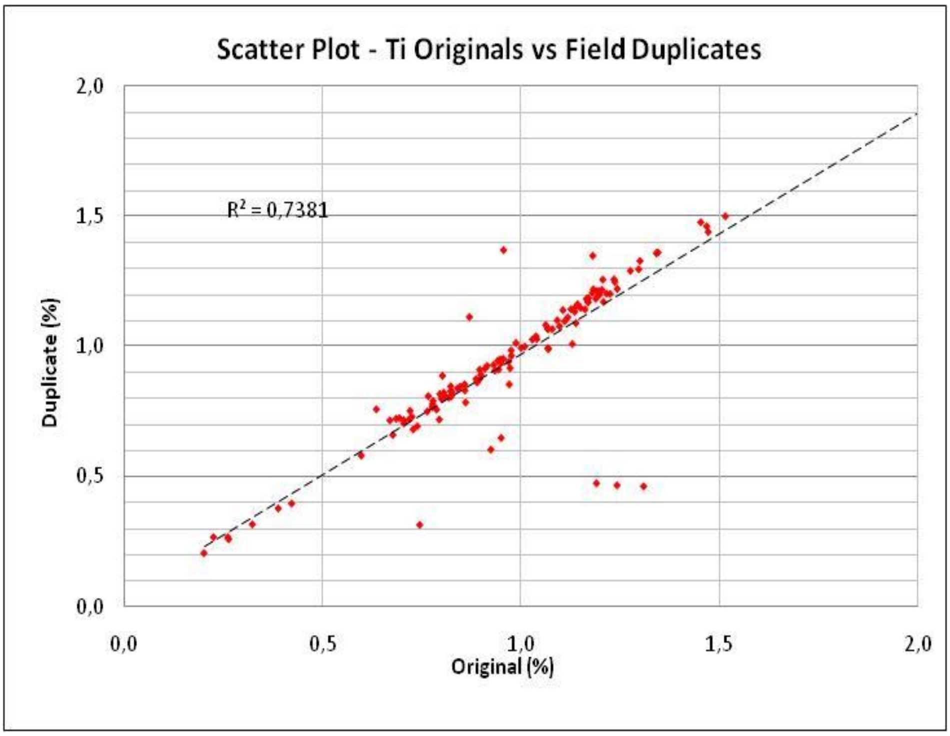



**Figure 4-12: Scatter Plot for Ti%**

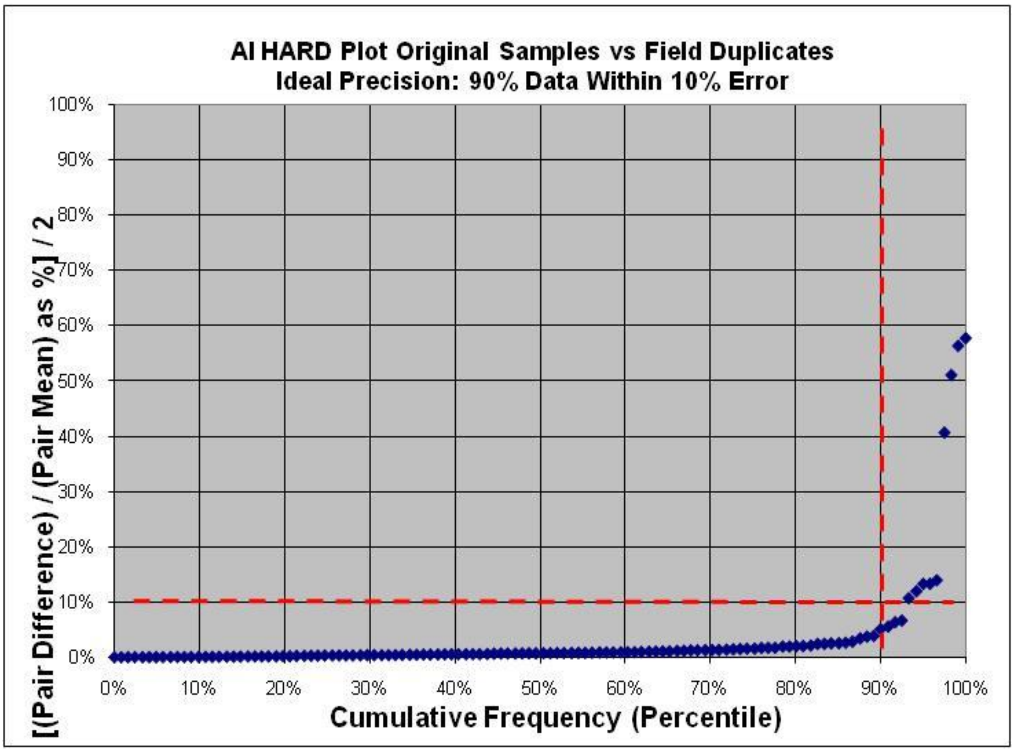



**Figure 4-13: HARD plot for Al% showing satisfactory precision: 90% of the data are within 10% error (within 5% error)**

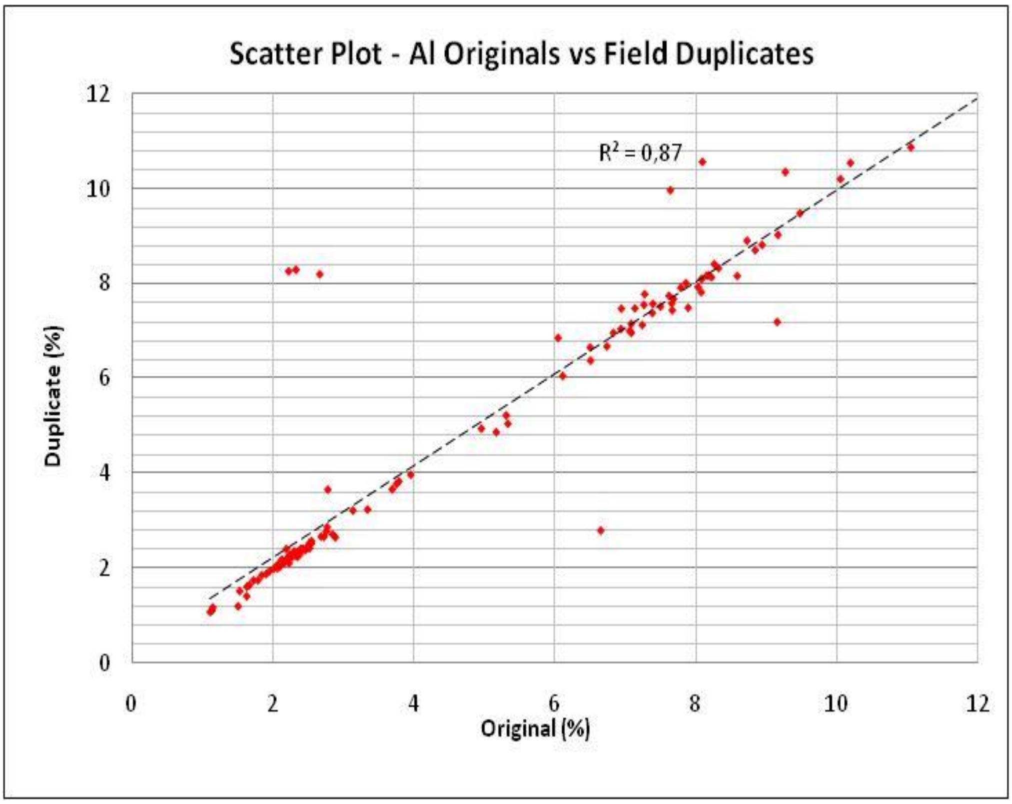



**Figure 4-14: Scatter Plot for Al%**

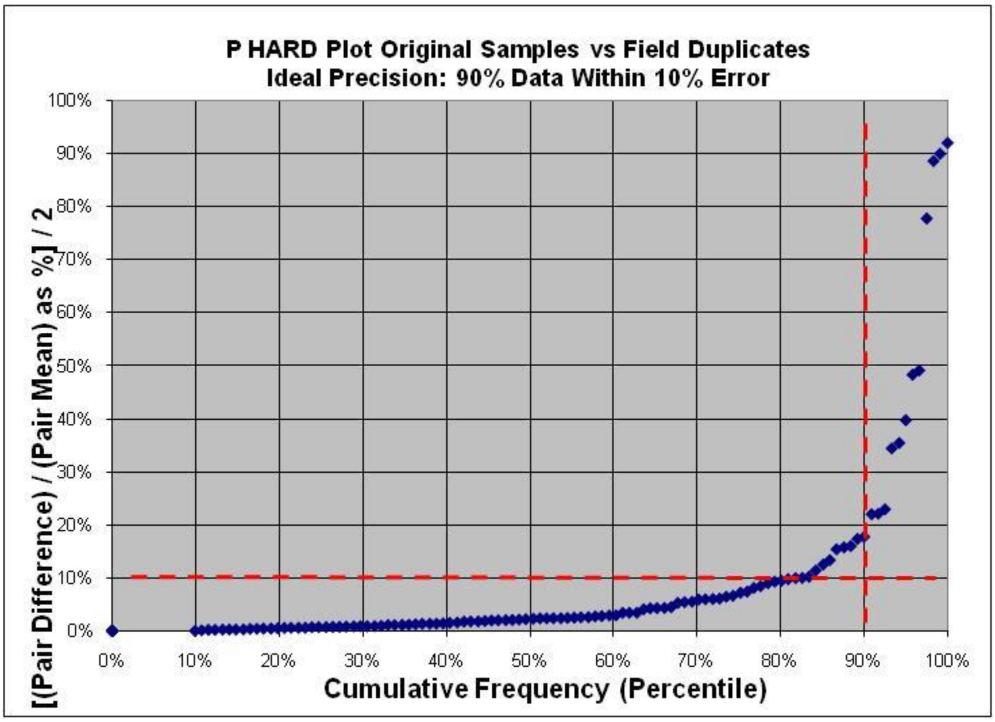



**Figure 4-15: HARD plot for P% showing unsatisfactory precision: 90% of the data are beyond 10% error (within 18% error)**

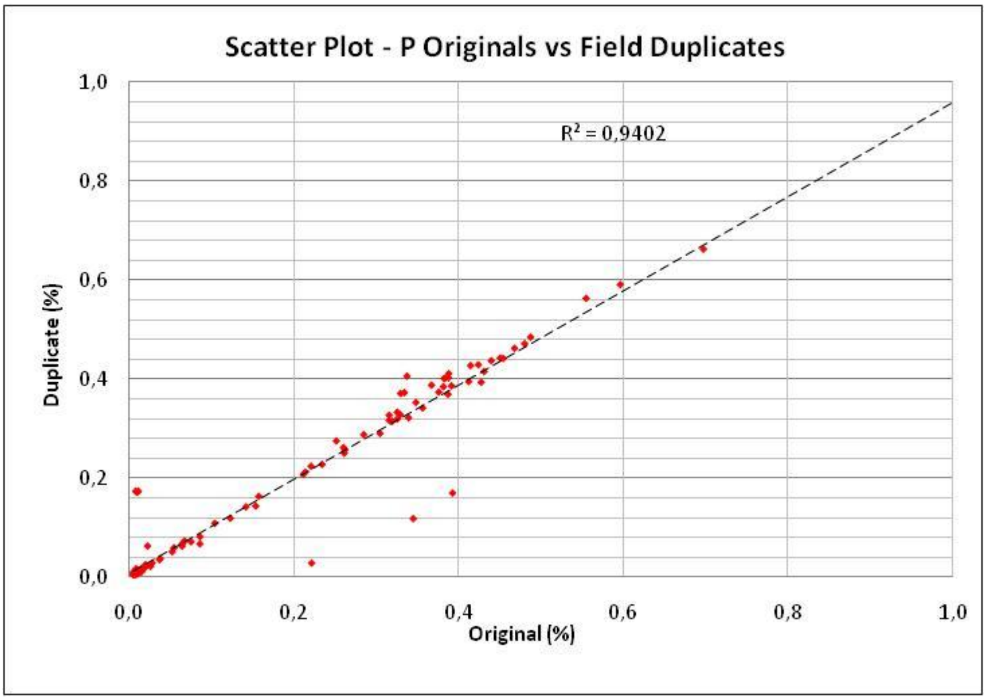



**Figure 4-16: Scatter Plot for P%**

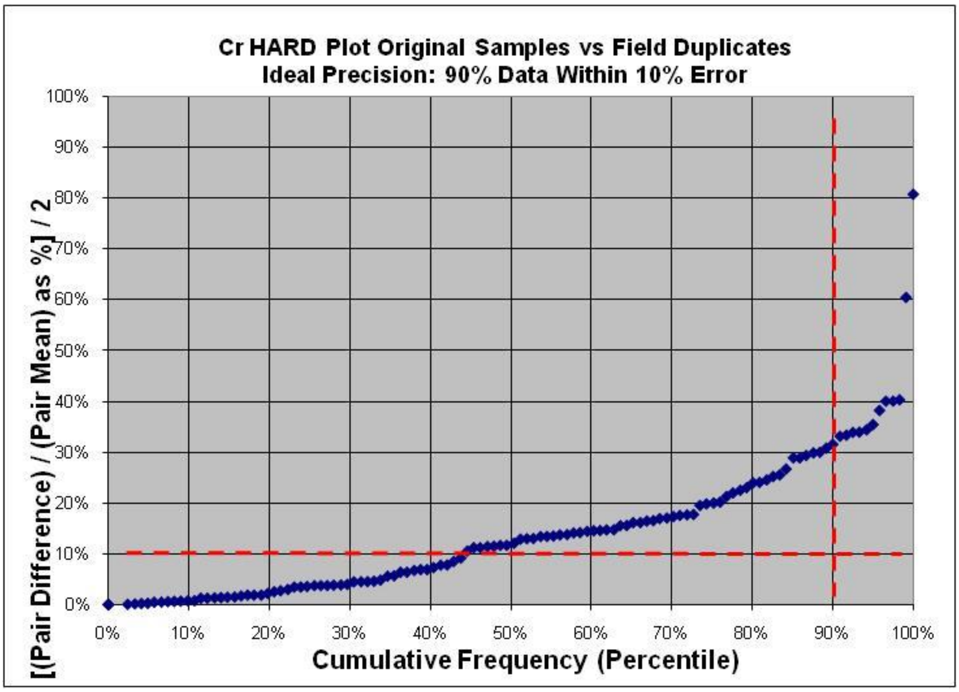



**Figure 4-17: HARD plot for Cr% showing unsatisfactory precision: 90% of the data are beyond 10% error (within 32% error)**

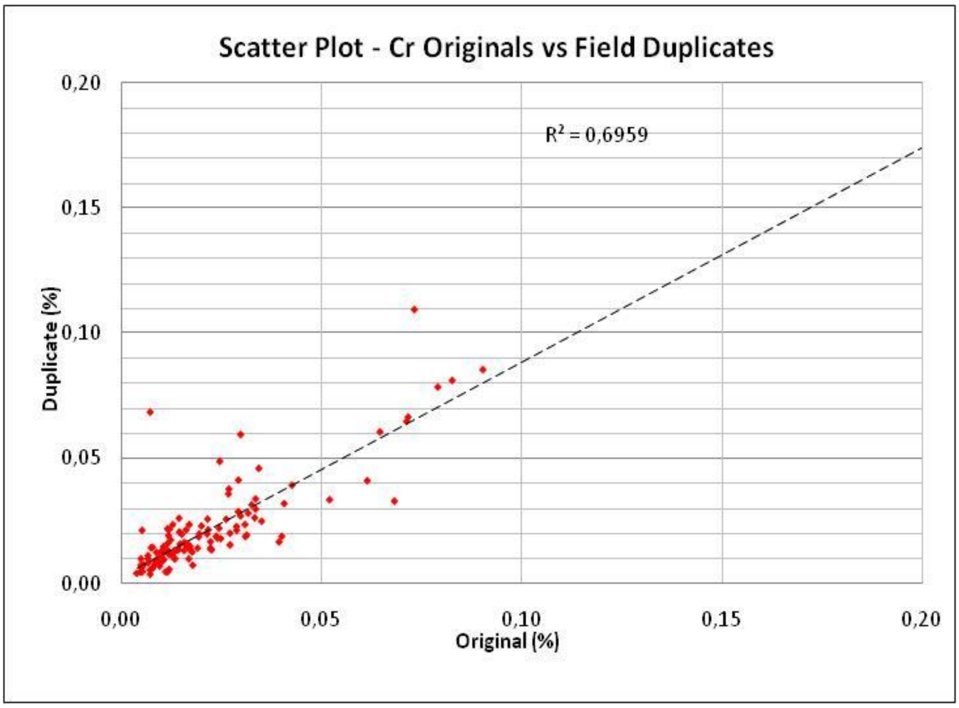



**Figure 4-18: Scatter Plot for Cr%HARD plot for P% showing unsatisfactory precision: 90% of the data are beyond 10% error (within 18% error)**

**Table 4-4: The duplicate performance, results of statistical analysis, the HARD plots, and the correlation coefficients for the scatter plots for the assayed elements**

| Element | Amount of duplicates | Error for 90% data (%) | Correlation coefficient |
|---|---|---|---|
| Fe% | 122 | 6 | 0.73 |
| Ti% | | 5 | 0.74 |
| Al% | | 5 | 0.87 |
| P% | | 18 | 0.94 |
| Cr% | | 32 | 0.69 |

### 4.4.4 Conclusions and Recommendations on Application and Analysis of Duplicates

Overall, the duplicates performed effectively in the QAQC procedure.

For basic assayed elements (Fe, Ti, Al) the duplicates showed high precision of 90% of the data within 10% error.

Notice, however, that for P and Cr the precision proved low (see Table 4-5). SRK recommends that this should be discussed with the laboratory and investigated.

### 4.4.5 Standards (CRMs)

*Standards* serve for verification of laboratory analysis precision. One standard was randomly inserted in each ordinary sample batch. The standard was prepared from two 10 g sachets of GIOP-34 CRM (see Appendix B-2:). The CRM were manufactured by GEOSTATS PTY LTD (Australia). Table 4-5 presents data on the CRM including average grades and mean square deviation (SD).

**Table 4-5: Parameters of GIOP-34 CRM**

| Standard | Variable | Certified Mean (%) | Standard Deviation | Thresholds (%) | | | |
|---|---|---|---|---|---|---|---|
| | | | | +2SD | -2SD | +3SD | -3SD |
| GIOP-34 | Fe | 48,8 | 0,16 | 49,12 | 48,48 | 49,8 | 47,8 |
| | $TiO_2$ | 20,86 | 0,26 | 21,38 | 20,34 | 21,64 | 20,08 |
| | $Al_2O_3$ | 5,66 | 0,08 | 5,82 | 5,5 | 5,9 | 5,42 |
| | P | 0,009 | 0,001 | 0,011 | 0,007 | 0,012 | 0,006 |
| | Cr | 0,065 | 0,0032 | 0,0714 | 0,0586 | 0,0746 | 0,0554 |

126 standard samples have been assayed (4.5% of the total ordinary samples) for QAQC program. The standards assay results are given in Appendix B-5:. One standard sample (No. 22163) was probably confused with a duplicate sample (No. 22040) in the course of sample preparation and was excluded from the assays.

Performance of the standard samples has been analysed for Fe%, $TiO_2$%, $Al_2O_3$%, P%, Cr%. Grades of $TiO_2$% and $Al_2O_3$% were calculated for an assay using data on Ti and Al grades, presented by the laboratory. Figure 4-19 to Figure 4-23 present the results of measuring of the standard samples, where SD = mean square deviation

The Fe% grades fluctuate, but the bulk of the assay results lie within 2 SD that evidences good precision and confidence of the laboratory assays.

The bulk of the $TiO_2$% assay results lies within 3 SD, however two samples (19170 and 21159) have demonstrated grades differing from the certified value by more than 3 SD. The laboratory shows positive bias for $Al_2O_3$, at average $Al_2O_3$ grade of 8.16 % - by 2.495% above the certified value of 5.66%. These results evidence good precision and very low confidence of the assays.

The bulk of the P% assay results lie within 3 SD. However, around 10 samples have demonstrated grades differing from the certified value by more than 3 SD.

The bulk of the Cr % assay results lies within 3 SD, however, the laboratory shows significant negative bias, and a part of the samples lies below the 3 SD limit.

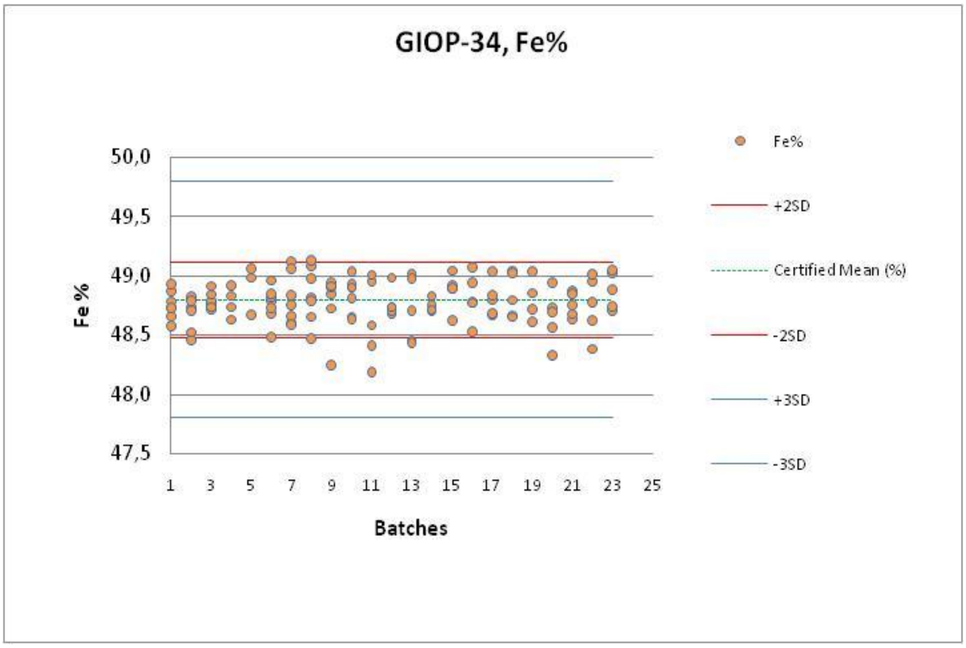



**Figure 4-19: Analysis of Assay Results for CRM GIOP-34 for Fe %**

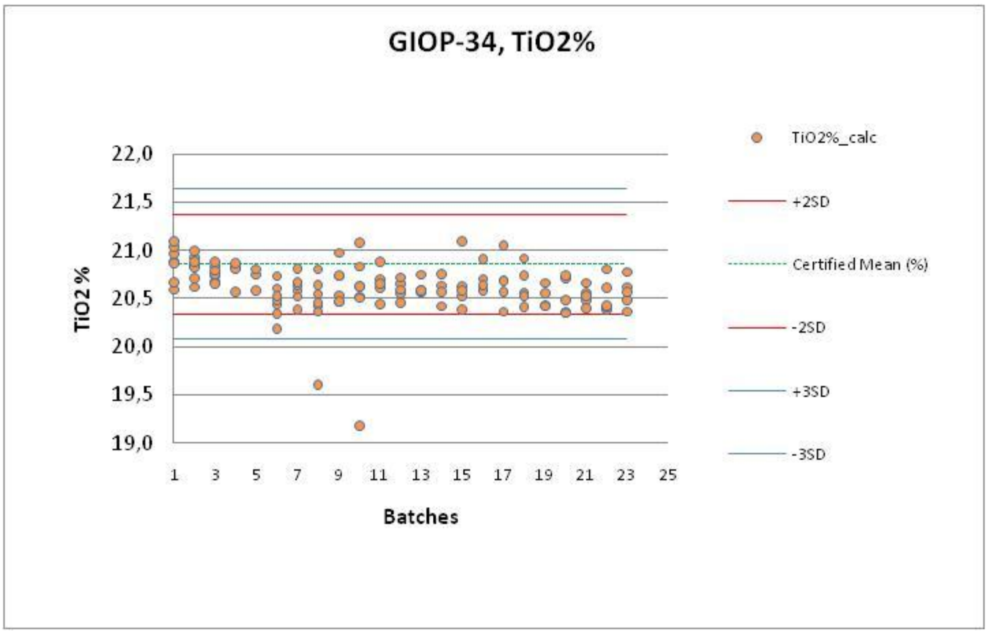


**Figure 4-20: Analysis of Assay Results for CRM GIOP-34 for $TiO_2$ %**

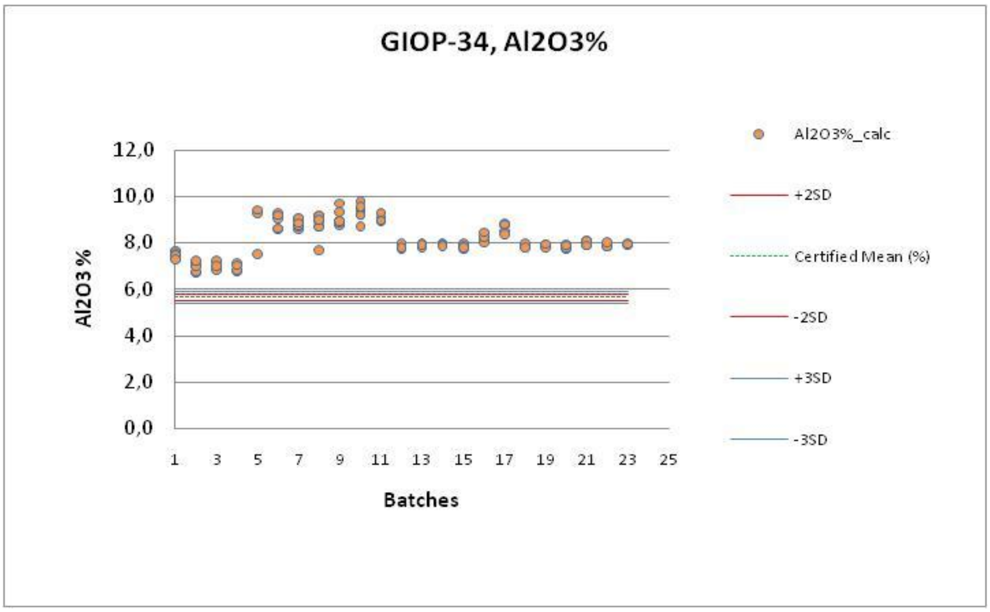



**Figure 4-21: Analysis of Assay Results for CRM GIOP-34 for $Al_2O_3$ %**

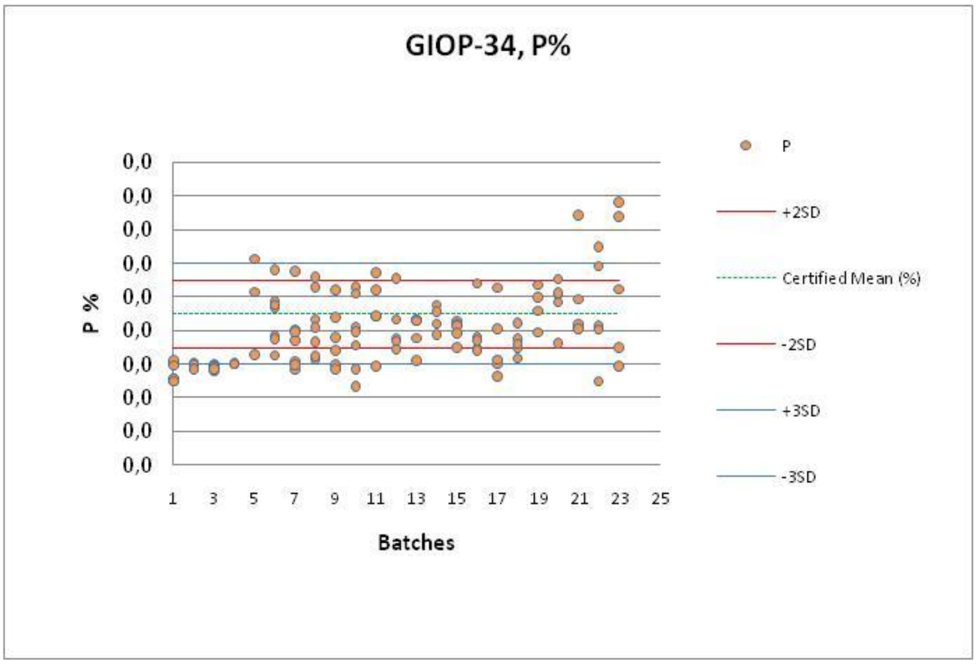



**Figure 4-22: Analysis of Assay Results for CRM GIOP-34 for P %**

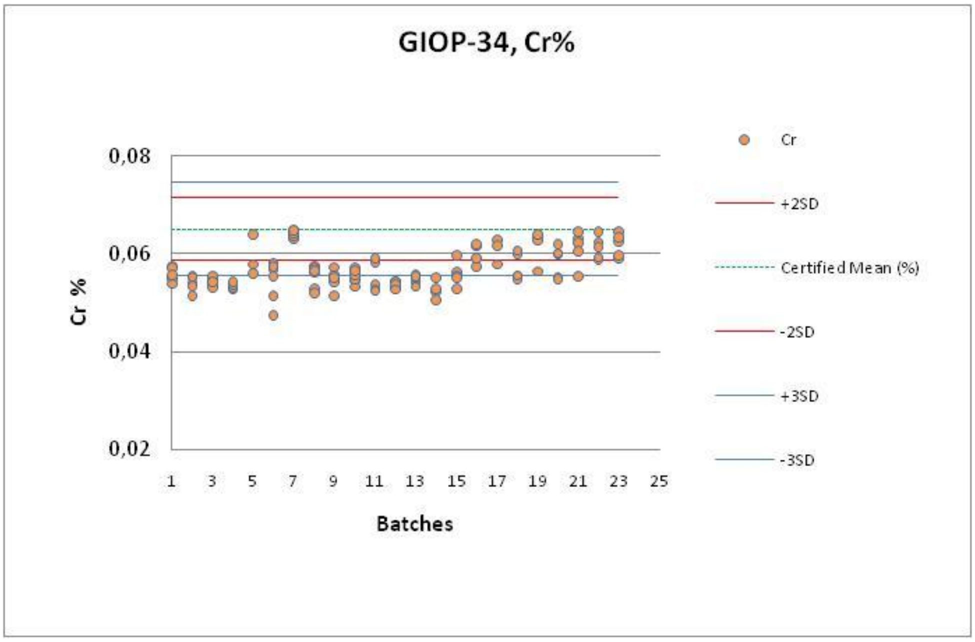



**Figure 4-23: Analysis of Assay Results for CRM GIOP-34 for Cr %**

### 4.4.6 Conclusions and Recommendations on Application and Analysis of CRMs

Overall, statistical analysis of data on GIOP-34 CRM showed satisfactory performance for Fe, $TiO_2$ and P.

The analysis for $Al_2O_3$ has demonstrated obvious positive bias, and negative bias for Cr. At the current stage of the project, these biases may be immaterial for modelling and estimation of resources, but investigation should be carried out to determine the causes.

Within the database a standard had been confused with the duplicate (the incorrectly labelled sample). SRK considers this was due to human error, suggesting the possibility of a low level of QC at the sample preparation stage. If standards were incorrectly labelled this may also apply to ordinary samples and duplicates. However, given the low level of mislabelling evident from the QAQC sampling, SRK does not consider any mislabelling of the original assay samples to be material.

SRK also notes that the CRM is not applicable for the Velikhovskoe Southern Project in grade of Fe and other components. Review of the final analysis results sheet shows that CRM are easily identified by difference in chemical composition from the deposit ordinary samples.

CRM samples are readily identified by the laboratory employees by their dissimilarity to ordinary samples. This difference manifests itself as fine pulverization (0.074 mm) of a CRM sample compared with the crushed to 2 mm ordinary samples.

In future, new CRM should be chosen to comply maximally with chemistry of the deposit mineralisation in the elements of interest to prevent easy identification by laboratory employees.

Moreover, the sample preparation (for assay) procedure should be revised in such a way that all three quality control samples (duplicate, standard and blank) are similar in appearance.

### 4.4.7 Blanks

A blank composite sample was prepared partially in compliance with recommendations and instructions of SRK Exploration Services Ltd.

The sample is presented by two types:

1. Samples № A-6, A-7, A-8 –barren rock – white marble, sampled in the operating open pit at Velikhovskoe Northern deposit (Southern area). The sample certificate and results of its assays in two laboratories is given in Appendix B-3. The sampling certificate was not provided by the Client.
2. Sample 6-2011 (reference standard 1) – barren light grey limestone, sampled in the operating open pit at Velikhovskoe Northern deposit (Southern area). The sample certificate and results of its assays in two laboratories is given in Appendix B-4. The sampling certificate was not provided by the Client.

The Client provided results of assays of the blank samples in two laboratories (Appendix B-3:Appendix B-4:)

- Chemical-and-technological laboratory of Aktobe-Temir VS LLP – technological laboratory of ATVS.
- Aktyubinsk Geological Laboratory LLP – accreditation in Kazakhstan (see Appendix B-8:).

The sample reference standard 1 cannot be considered to be a blank sample as it contains an Fe grade of around 4%, as shown from assays carried out by Aktyubinsk Geological Laboratory. Such a sample will prevent the determination of the degree of sample contamination in the course of sample preparation.

In spite of the SRK's recommendations, the blank sample material was assayed in only one certified laboratory (instead of three independent laboratories), and the sampling certificates were not provided by the Client.

Nevertheless, the Client dispatched a total of 126 samples (4.5% of total samples) of the blank sample material to Stewart Geochemical and Assay, including four samples labelled as blanks. Only 122 blank samples have actually been assayed.

Results of correlations are given in the Figure 4-24 and Figure 4-25 below. The results of the blank samples assays are given in Appendix B-6.

This review shows:

- upward bias of Fe grade (%) for sample ”reference standard-1” at mean 7.36% by 3.2% from 4.16%;
- downward bias of Fe grade (%) for samples PE01, PE02 at mean 0.29% by 0.28% from 0.58%;
- downward bias of Fe grade (%) for sample PE03 at mean 0.21% by 0.05% from 0.26%;

downward bias of Fe grade (%) for sample PE04 at mean 0.21% by 0.09% from 0.30%.


**Figure 4-24: Correlation of blank sample - reference standard-1 assays.**

Red line – Fe% grade from measurements in two laboratories according to the material certificate (see Appendix 4B).

Blues line – results of assays of codified blank samples within ordinary samples batch at Stewart Geochemical and Assay

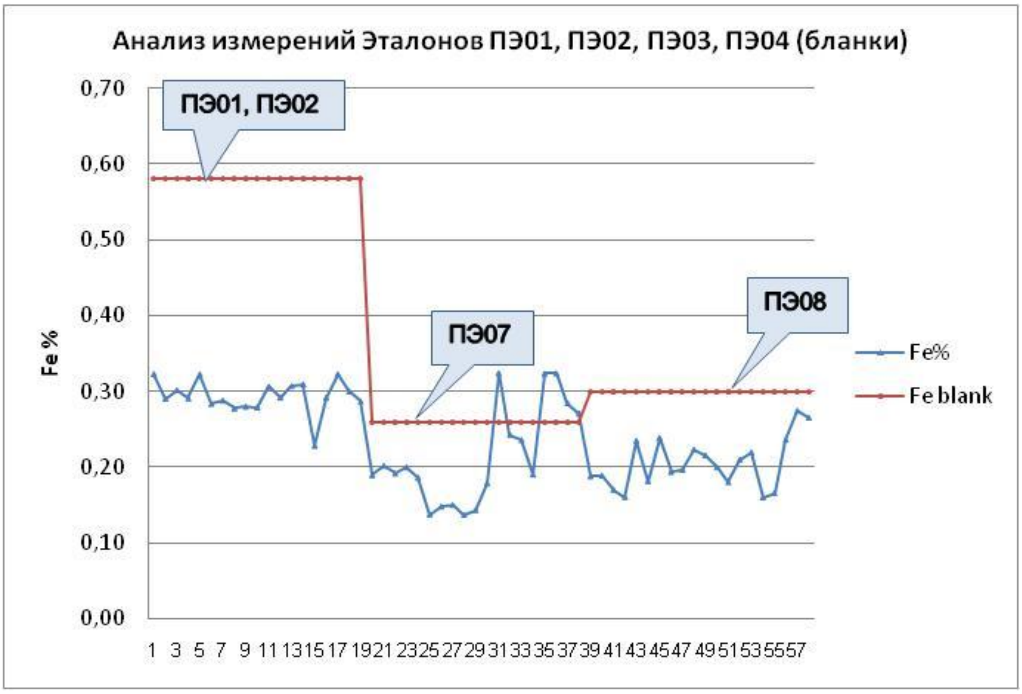



**Figure 4-25: Correlation of blank samples PE01, PE02, PE03, PE04 assays**

Red line – Fe% grade from measurements in two laboratories according to the material certificate (see Appendix 3B).

Blues line – results of assays of codified blank samples within ordinary samples batch at Stewart Geochemical and Assay.

### 4.4.8 Conclusions and Recommendations on Application and Analysis of Blanks

The intention of using blank samples is to determine the degree of sample contamination in the course of sample preparation.

Owing to noncompliance with rules and SRK's recommendations, the blank sample material was prepared improperly and cannot serve for QAQC purposes.

The grade of Fe% and other elements in the blank sample (samples) material was measured in only one accredited laboratory in Kazakhstan (with no checks in other laboratories). These measurements cannot be accepted with any confidence.

The correlation of the assays results showed significant bias, especially for reference standard-1.

For the next exploration stage, all these defects in the blank sample material preparation should be eliminated by strictly following SRK's recommendations.

### 4.4.9 Conclusions and Recommendations on QA/QC Procedures Implementation

#### 4.4.9.1 Conclusions

Based on the results of review of QAQC procedures in place for Velikhovskoe Southern Deposit Project, SRK concludes that:

1. Overall, the duplicates performed effectively in the QAQC procedure. For basic assayed elements (Fe, Ti, Al) the duplicates showed high precision with 90% of the data within 10% error.

2. Overall, statistical analysis of data on GIOP-34 CRM showed satisfactory performance for Fe, $TiO_2$ and P. The analysis for $Al_2O_3$ demonstrated an obvious positive bias, and a negative bias for Cr. At the current stage of the project, these biases may be immaterial for modelling and estimation of resources, but an investigation should be carried out to determine the causes.
3. The QC procedure detected five cases of incorrect labelling of samples in the course of sample preparation: one case of standard confusion and four cases of incorrect labelling of blanks (in fact, a metallurgical sample was dispatched instead of the blank). This fact evinces a low level of QC at sample preparation stage. If standards were incorrectly labelled, ordinary samples may also have been mislabelled.
4. SRK also notes that the CRM used is not applicable for the Velikhovskoe Southern Project in grade of Fe and other components. Review of the final analysis results sheet shows that CRM are easily identified as different from the deposit ordinary samples in chemical composition.
5. CRM samples are readily identified by the laboratory employees by their dissimilarity from ordinary samples. This difference is manifests itself as fine pulverization degree (0.074 mm) of a CRM sample compared with the crushed to 2 mm ordinary samples.
6. Easy identification of CRM by the laboratory employees frustrates all efforts and expenditures on the quality control procedure.
7. Owing to noncompliance with the rules and SRK's recommendations, the blank sample material was prepared improperly and cannot serve for QAQC purposes. The grade of Fe% and other elements in the blank sample (samples) material was measured in only one accredited laboratory in Kazakhstan. These measurements cannot be accepted with any confidence.
8. Correlation of the assays results showed significant bias, especially for the reference standard-1 sample.

#### 4.4.9.2 Recommendations:

- The currently used CRM GIOP-34 should be abandoned. The new CRM should be chosen to comply maximally with chemistry (in the elements of interest), mineralogy, colour and type of the deposit mineralisation.
- For the next exploration stages all these defects in the blank sample material preparation should be eliminated by strictly following SRK's recommendations. Blank samples should be prepared from other material.
- The sample preparation (for assay) procedure should be revised in such a way that all three quality control samples (duplicate, standard and blank) arrive at the laboratory in similar appearance to prevent their easy identification in the laboratory.
- QAQC (standard, blank and duplicate) must not be placed on each 23$^{rd}$, 24$^{th}$ and 25$^{th}$ place in a batch sample list, but their number should be assigned randomly to prevent the samples identification by the laboratory staff.

## 4.5 Density Determination

In the preceding years, the rock density investigations were conducted based on density, dividing the rock into two groups:

- The first group comprises amphibolitic schists and amphibolites of the Akan suite and gabbro and pyroxenites, being barren, and has a density of 2.65-3.00 g/cm$^3$. At those densities of the Velikhovskoe and Kimpersai intrusive complex rocks are denser by 0.12-

0.26 g/cm$^3$ than those of the Kimpersai suite rocks.

- The magnetite pyroxenites (bodies of the Velikhovskoe Southern deposit) show densities ranging 2.85-4.0 g/cm$^3$; these values are generally 0.2-1.2 g/cm$^3$ higher than those of their host rocks.

During the 2011 exploration, bulk density samples were also collected. The density measurements were carried out in the Client's in-house laboratory. The density measurements averaged by rock type codes (logged in the corresponding intervals) are shown in Table 4-6.

**Table 4-6: Average density of the main rock types at the Velikhovskoe Southern deposit basing on the 2011 data**

| Rock type | density, g/cm$^3$ | number of samples | Max. | Min. |
|---|---|---|---|---|
| soil | 1.91 | 12 | 2.19 | 1.52 |
| clay | 2.03 | 29 | 3.26 | 1.45 |
| crust of weathering (clay) | 2.14 | 85 | 3.05 | 1.62 |
| crust of weathering | 2.04 | 18 | 2.71 | 1.73 |
| martite | 3.03 | 17 | 3.33 | 2.67 |
| magnetite pyroxenites (weathering) | 2.97 | 25 | 3.41 | 2.39 |
| magnetite pyroxenites (magnetite) | 3.26 | 1770 | 6.41 | 1.43 |
| plagioclase pyroxenites (weathering) | 2.82 | 46 | 3.41 | 1.86 |
| plagioclase pyroxenites | 3.08 | 714 | 4.93 | 1.69 |
| pyroxenite anorthosites | 2.98 | 48 | 3.44 | 2.54 |
| gabbro | 2.46 | 3 | 2.65 | 2.26 |

## 4.6 Geological Modelling

SRK has undertaken geological modelling for the Velikhovskoe Southern deposit mineralised bodies using Micromine mining software. The construction of the geological/mineralisation model for the Velikhovskoe Southern deposit was based on all the available exploration data for the deposit, including historical drilling and trenching carried out prior to the involvement of the Client.

## 4.7 Data Manipulation

Prior to geological modelling, the sampling and geological logging data has been manipulated and converted into database format suitable for the Micromine software.

In the database, SRK has collated all the available information on 1964, 2004 and 2010-2011 exploration programs. Volumes of the data used for the geological modelling (by year) are given below in Table 4-7.

Following this study, separate collar (with dividing the holes by year), directional survey, assay and lithology (by hole interval) tables have been created, using coding by rock type. All the historical data were coded in compliance with the SRK recommendation, as applied to the 2011 exploration program.

The database was checked for errors, and corrected where possible.

The data for the two basic pay mineralised types, being the main basis for the deposit domaining, were investigated.

**Table 4-7: Total Volume of the Presented Data by Year of the Exploration**

| Category | | Amount |
|---|---|---|
| Drill holes(all) | Collars records | 213 |
| | Number of vertical drill holes | 146 |
| | Number of curved drill holes | 67 |
| | Survey records | 1278 |
| | Assay records | 10822 |
| | Number of Fe(%) assays | 10815 |
| | Number of Fe(%)>15% assays | 6303 |
| | Number of TiO2(%) assays | 6720 |
| | Number of V2O5(%) assays | 3126 |
| | Lithology records | 1012 |
| Drill holes (1964) | Collars records | 136 |
| | Number of vertical drill holes | 121 |
| | Number of curved drill holes | 15 |
| | Survey records | 456 |
| | Assay records | 3320 |
| | Number of Fe(%) assays | 3320 |
| | Number of Fe(%)>15% assays | 1348 |
| | Number of TiO2(%) assays | 3157 |
| | Number of V2O5(%) assays | 3126 |
| | Lithology records | 496 |
| Drill holes (2004) | Collars records | 49 |
| | Number of curved drill holes | 49 |
| | Survey records | 478 |
| | Assay records | 3935 |
| | Number of Fe(%) assays | 3932 |
| | Number of Fe(%)>15% assays | 2979 |
| | Number of TiO2(%) assays | 0 |
| | Number of V2O5(%) assays | 0 |
| | Lithology records | 185 |
| Drill holes (2010) | Collars records | 3 |
| | Number of curved drill holes | 3 |
| | Survey records | 85 |
| | Assay records | 800 |
| | Number of Fe(%) assays | 800 |
| | Number of Fe(%)>15% assays | 459 |
| | Number of TiO2(%) assays | 800 |
| | Number of V2O5(%) assays | 0 |
| | Lithology records | 12 |
| Drill holes (2011) | Collars records | 25 |
| | Number of vertical drill holes | 25 |
| | Survey records | 259 |
| | Assay records | 2767 |
| | Number of Fe(%) assays | 2763 |
| | Number of Fe(%)>15% assays | 1517 |
| | Number of TiO2(%) assays | 2763 |
| | Number of V2O5(%) assays | 0 |
| | Lithology records | 319 |

***Martite***

Martite is the product of incomplete oxidation of the magnetite in the weathering crust. Martite is formed both within massive steeply dipping magnetite bodies (replacing magnetite) and, in some cases, owing to partial relocation (hill-creep), on steep slopes. Martite is most often stratiform near surface bodies within ochre clays, being typical residual mineralisation in the weathering crust zone.

The basic mineral is martite – a hematite pseudomorph replacing magnetite. Besides martite, the mineralisation also contain significant amounts of iron hydroxile oxides (limonite). Martite mineralisation is loose, clayey, and sometimes powdery.

At the contact of the martite (the weathering crust properly), mixed (medium- and low-oxidized) mineralisation are indentified. Contact of the mixed and the non-altered mineralisation is ill-defined. $Fe_{tot}$/ $Fe_{magn}$ ratio in the mixed magnetite-martite is 2.03 that allows to combine them with the magnetite within the magnetite domain.

Martite is well-identified in the course of geological logging, having quite well-defined boundaries. For the modelling, martite was interpreted on the basis of hole lithology logging.

***Magnetite***

Properly, pyroxenite mass is composed of three rock types: magnetite pyroxenites, plagioclase pyroxenites and pyroxenite anorthosites in the volumetric ratio of about 33:65:2 (expressed as percentage). In the historical work, the plagiopyroxenites were referred to as pyroxenite gabbro or gabbro-norites, which was not correct owing to the content of $SiO_2$ and the plagioclase composition. Average petrochemistry of these rocks in comparison with the typical rocks is presented in Table 4-8.

**Table 4-8: Average Petrochemistry of the Basic Rocks**

| Oxides & iron (weight %) | The contents ranges in the typical rocks | | Averaged rock compositions for the deposit (assayed samples amount) | | |
|---|---|---|---|---|---|
| | Gabbro | Piroxenites | Magnetite pyroxenites (32) | Plagioclase pyroxenite (19) | Pyroxenite anorthosite (10) |
| $SiO_2$ | 42-52 | 40-56 | 40.07 | 42.12 | 43.86 |
| $O_2$ | 0.2-4 | 0.1-2.0 | 1.57 | 1.42 | 1.32 |
| $Al_2O_3$ | 8-24 | 0.1-14 | 6.26 | 14.04 | 18.95 |
| $Fe_2O_3$ | 0.5-10 | 0.5-10 | 15.69 | 11.20 | 6.07 |
| FeO | 3-14 | 2-25 | 9.35 | 6.47 | 3.92 |
| MnO | 0.1-0.3 | 0.05-0.3 | 0.29 | 0.28 | 0.21 |
| MgO | 5-17 | 6-24 | 11.15 | 8.10 | 7.45 |
| CaO | 11-17 | 0.5-23 | 14.97 | 14.25 | 16.62 |
| $Na_2O$ | 0.5-3 | 0-3 | 0.25 | 0.82 | 0.42 |
| $K_2O$ | 0.05-2 | 0-1.8 | 0.24 | 0.59 | 0.31 |
| $P_2O_5$ | 0.1-0.6 | 0-0.3 | 0.09 | 0.61 | 0.63 |
| Total | | | 99.93 | 99.9 | 99.76 |
| $Fe_{tot}$ | 2.69-17.92 | 1.91-26.5 | 18.27 | 12.89 | 7.31 |

Logging of intervals within the bodies (this mainly refers to *body I*) showed that the magnetite pyroxenite lenses are also composed of three rock types: properly magnetite pyroxenites, plagioclase pyroxenites and pyroxene anorthosites in the ratio of 73:26:1 (expressed as percentage).

Plagiopyroxenites in the historical studies were incorrectly called pyroxenite gabbro or gabbro-norites and as a result, when modelling these mineralisation types, the gabbro or gabbro-norite rock codes were combined with the plagioclase pyroxenite codes.

For these three rock types, histograms of Fe distribution were built. For this purpose, the mineralisation intervals assay data were divided into groups in accordance with the assigned lithological codes. The intervals corresponding to plagioclase pyroxenites and gabbro or gabbro-norites were combined into a single group.

The histograms for Fe distribution are presented in Figure 4-26 – Figure 4-28.

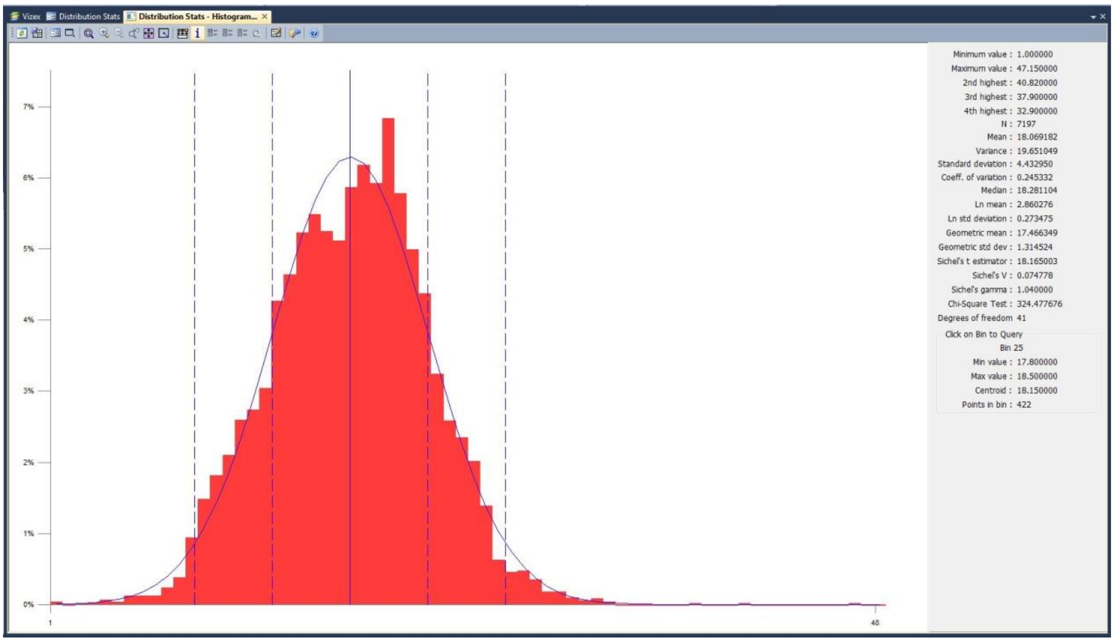



**Figure 4-26: Histogram for Fe distribution in the magnetite pyroxenites**

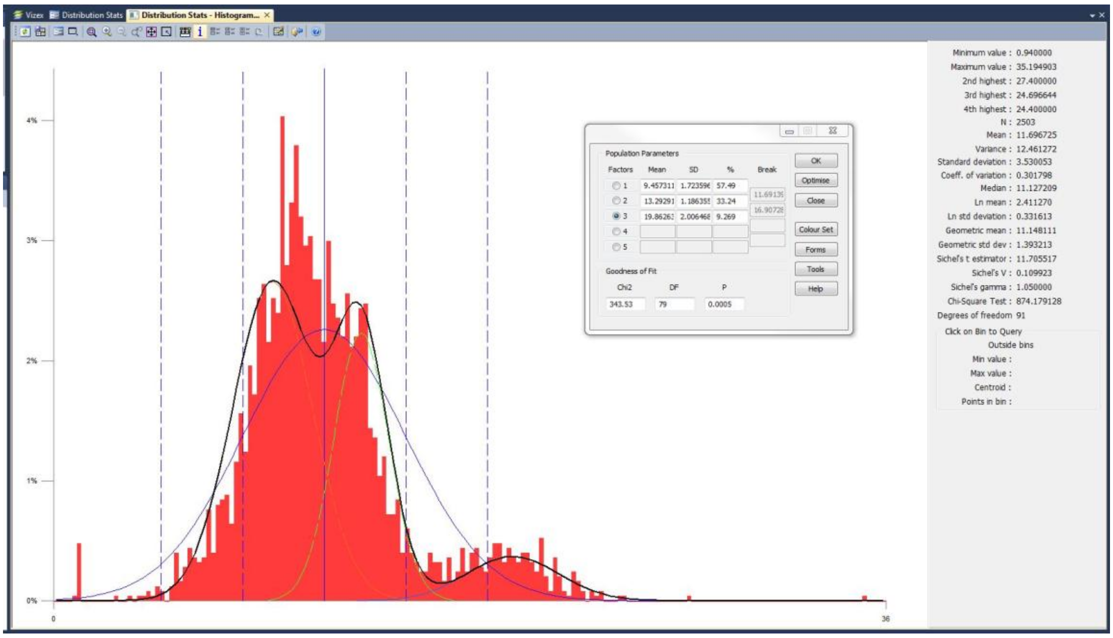



**Figure 4-27: Histogram for Fe distribution in the plagioclase pyroxenites**

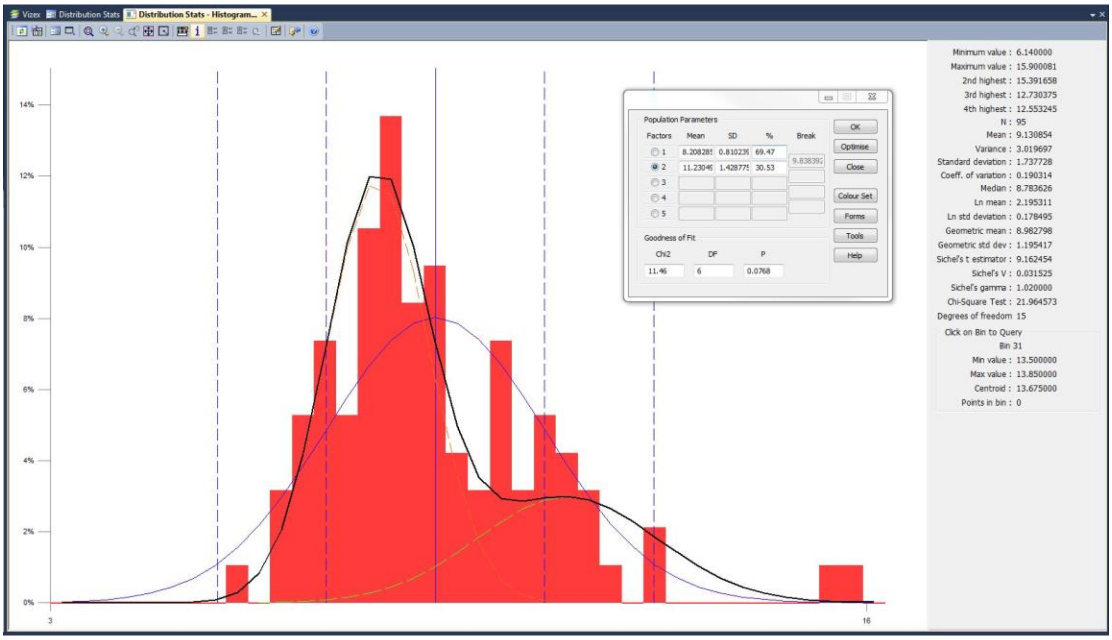



**Figure 4-28: Histogram for Fe distribution in the pyroxene anorthosites**

As can be seen from the plots, the statistical distributions for Fe in each rock type obviously show two populations of Fe distribution (three populations for the plagioclase pyroxenites). This may be caused to some extent by incorrect logging, owing to erroneous adding of data array for one lithology to the data for other lithologies, resulting in abnormal data distribution within the single lithology data array.

## 4.8 Brief Review of the Lithological Logging Quality

In mineralogical composition, two basic pay types are revealed in the deposit: martite (oxidized) and magnetite (primary).

The martite, the product of the oxidation of the magnetite, ranges from weakly-oxidized (with hematite pseudomorph replacing magnetite) to complete decomposition to form limonite ochres and sinter (dripsone) hydrohoetite. The various forms are easily identified visually by appearance and colour (red-brown and yellow). They are readily identified both in outcrops and drill core. Martite is easily distinguishable from both the overlaying Cretaceous-Quaternary sediments and the primary magnetite, presented by pyroxenites.

Identification of the magnetites is more problematic as they do not show distinct visual properties like the martite and therefore the lithological logging requires detailed descriptions to be made as soon as the core is available with an appropriate level of diligence by the logging geologist.

Review of the lithological logging of the rock types and assessment of its quality, correlation of the lithologic rock types (codes) with the chemical rock types, by average Fe grade, was conducted (Table 4-9).

The parameters for the review and its results are given below in Table 4-9, which shows that in more than a third of cases the lithological logging data for mineralisation and rock do not coincide with the chemical parameter-based determination. Based on these results, SRK considers the lithological (geological) mineralisation determination to be inappropriate for use in modelling the resource volume and therefore only grade data for Fe and other components was used for outlining the deposit magnetite mineralisation.

**Table 4-9: Results of the Review of the Lithological Logging Quality**

| Rock code | Name | Interval amount | Type | Rock type boundaries by Fe grade (%) | % of correctly logged samples | % of incorrectly logged samples and the inconsistence parameters |
|---|---|---|---|---|---|---|
| PR | Magnetite pyroxenites | 7197 | Magnetite | >15.58% | 71% | (< 10.1%) - 4%<br>(10.1-15.58%) - 25% |
| PP | Plagiopyroxenites | 2503 | - | 10.1-15.58% | 55.30% | (< 10.1%) - 33.5%<br>(> 15.58%) - 11.2% |
| GB | Gabbro (Plagiopyroxenite s) | | | | | |
| AN | Pyroxenite anorthosites | 95 | - | below 10.1% | 73.70% | (10.1-15.58%) - 26.3% |

## 4.9 The Deposit Geological Modelling

The following materials and data from the Velikhovskoe Southern licence have been used during the creation of the geological model, including:

- topographic surface;
- the database including the sample assay data and the rock interval lithological logging data;
- the adjusted to Micromine medium scanned cross-sections and plans, provided by the Client; and
- results of investigations of material and mineralogical composition of the mineralisation and the host rocks.

At the first stage of the geological modelling, all the data were imported into Micromine.

The visual review of the drillhole data for each of the cross-sections was undertaken for investigating 3D geological and grade continuity.

The data were then visually analyzed from wells on each of the sections to assess the consistency of the 3D geological structure and contents.

At the next stage, geological modelling of the deposit was implemented separately for the martite and the magnetite. The lithological codes were used for outlining the martite, and then composite intervals of Fe grade were also used. For outlining the magnetite only, composite intervals created at $Fe_{tot}$ cut-off grade of 16 % were used.

***Martite***

When modelling the martite for outlining bodies, the geological information from the 1964 drilling exploration data was utilised. However, for the creation of composites and the MRE, the 1964 drillholes were ignored, as it is impossible to check the sampling and assaying results for these drillholes.

The following technique for modelling of the martite body was used:

1. All the geological logging intervals were visualized in accordance with the accepted lithology coding.
2. String creation:
    - All the created strings delineating the weathering crust in each cross-section were

tied to intervals, corresponding to the code for the weathering crust.

- The body interpretation (extrapolation) outside an outermost drillhole was conducted by a half of distance from the preceding drillhole interval.
- If the body thickness in the weathering crust intersection in a cross-section was continuous or tended to a specific shape, this fact was taken into account in determining the edge thickness.
- If the weathering crust was not logged (found) at all in a drillhole, the body string was prolonged to a half-distance between the two holes and was converted to point.

3. Wireframe creation:
   - All the created strings for each cross-section were combined to form the body.
   - For the deposit martite, composites at Fe grade above 30% were created. The martite at Fe grade below 30% were outlined separately.
   - As a result, the martite were divided into two domains:
     - martite at Fe grade <30%;
     - martite at Fe grade >30%.

***Magnetite***

When modelling the magnetite for outlining bodies, the geological information from the 1964 drilling exploration data was utilised. However, for creation of composites and the MRE, the 1964 drillholes were ignored, as it is impossible to check the sampling and assaying results for these drillholes. The tenor of the 1964 assays raises the issue of quality control, as comparison of assay data showed relatively underestimated Fe grades on average when compared with the 2004, 2010, 2011 data. Histograms of sample distribution by Fe grade within the magnetite wireframes by year of exploration drilling are presented in Figure 4-29, Figure 4-30, Figure 4-31 and Figure 4-32.

The magnetite outlining was performed by composite intervals created at cut-off $Fe_{tot}$ grade of 16%. The following methodology was applied:

1. String creation:
   - All the created strings delineating magnetite in each cross-section were tied to intervals of the corresponding composites ($Fe_{tot}$=16%).
   - The body interpretation (extrapolation) outside an outermost drillhole was conducted by a half of a distance from the preceding drillhole interval.

2. Wireframe creation:
   - All the created strings in each cross-section were combined into wireframes.
   - Wireframes for the magnetite have been created (Figure 4-33).

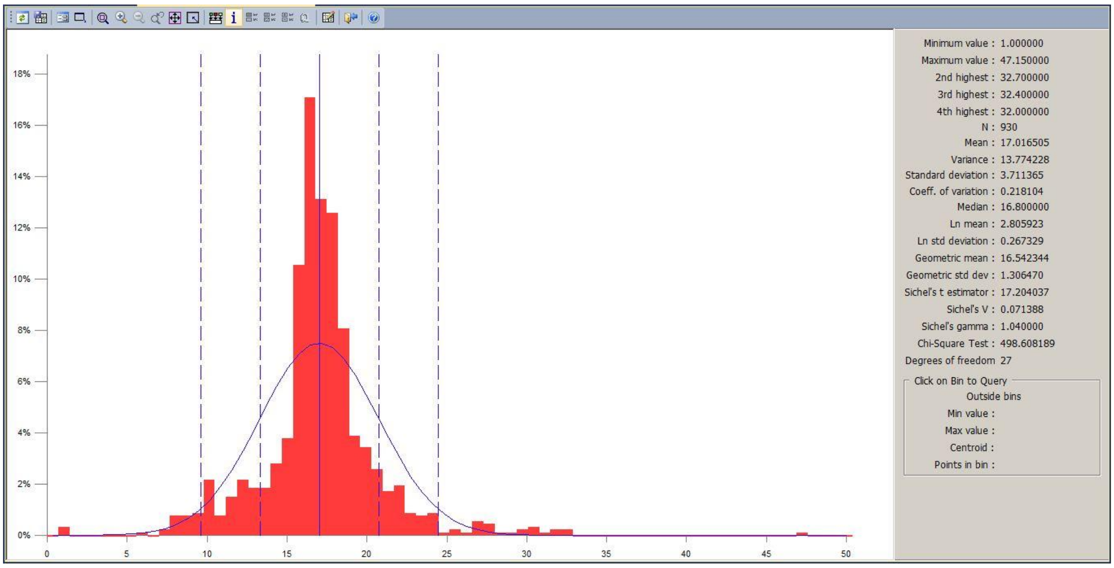



**Figure 4-29: Histogram of Fe distribution in the magnetite basing on the 1964 drilling exploration data. Average grade of Fe = 17.02%**

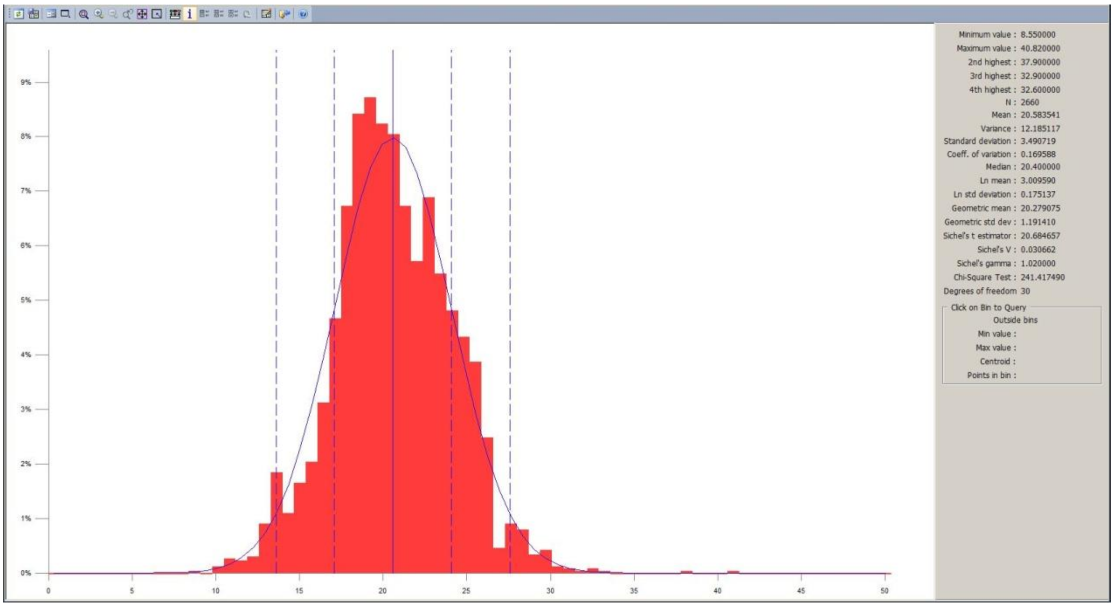



**Figure 4-30: Histogram of Fe distribution in the magnetite basing on the 2004 drilling exploration data. Average grade of Fe = 20.58%**

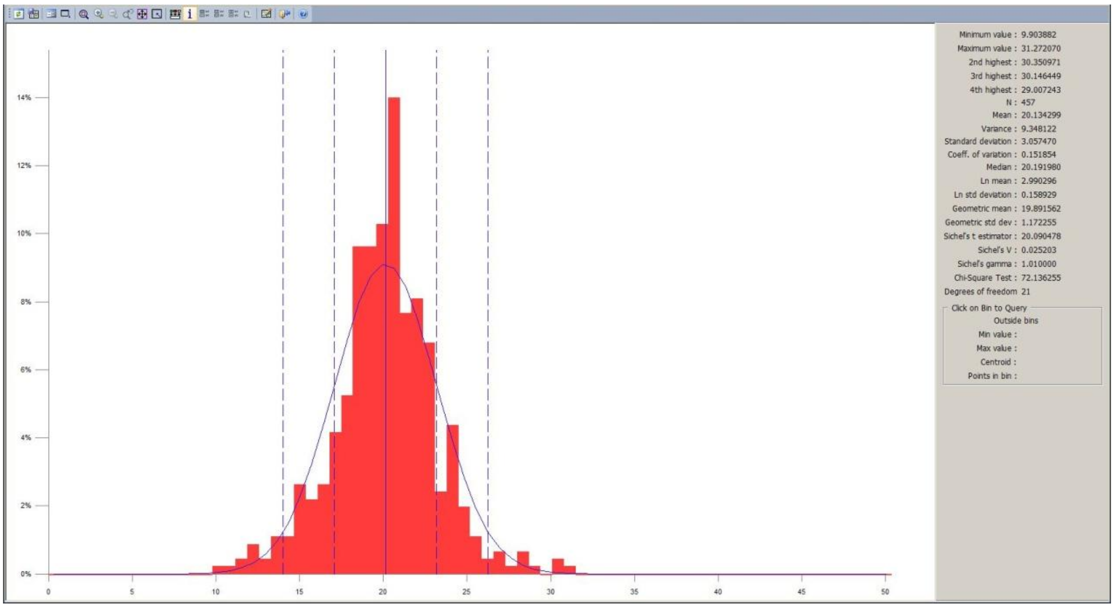



**Figure 4-31: Histogram of Fe distribution in the magnetite basing on the 2010 drilling exploration data. Average grade of Fe = 20.13%**

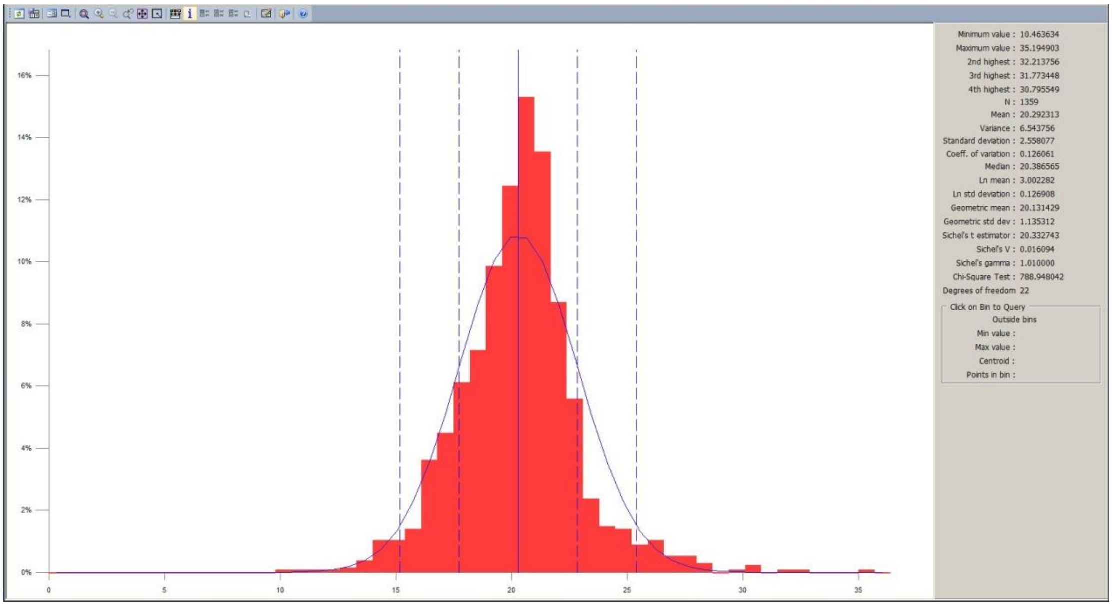



**Figure 4-32: Histogram of Fe distribution in the magnetite basing on the 2011 drilling exploration data. Average grade of Fe = 20.29%**

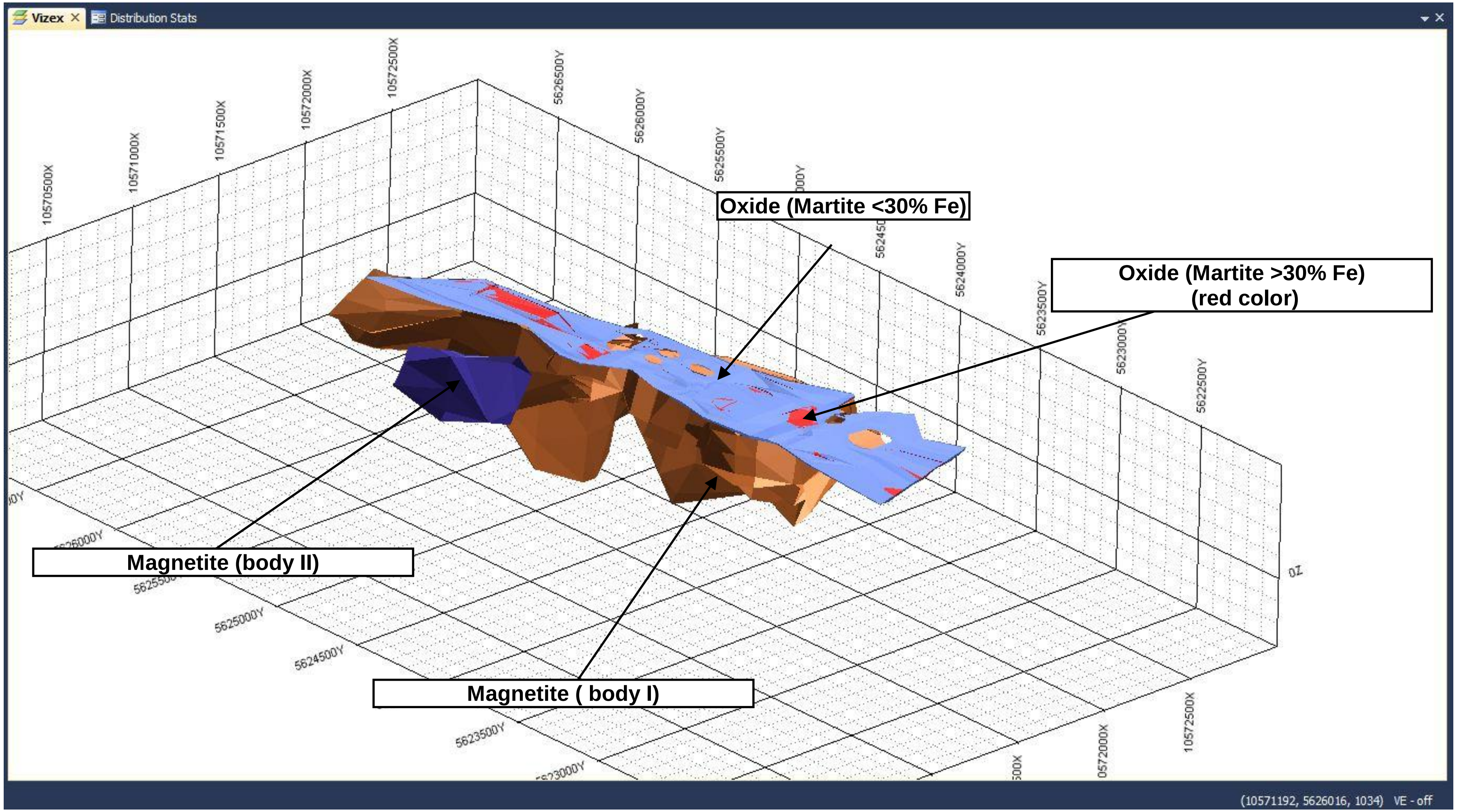



**Figure 4-33: The Created Wireframes of the Mineralised Bodies in the 3D Geological Model**

## 4.10 Classical Statistical Study

The first step in the statistical study is to composite the samples within the created body wireframes and coding of the obtained intervals by the wireframe names. To ensure no bias exists in the computation of the statistics and geostatistics, a standard composite length has been defined of 2 m. SRK has reviewed the original interval sample lengths recorded in the database and found that 87.7% of the samples are 2 m long and only 3.2% are above 2 m long (Figure 4-34).

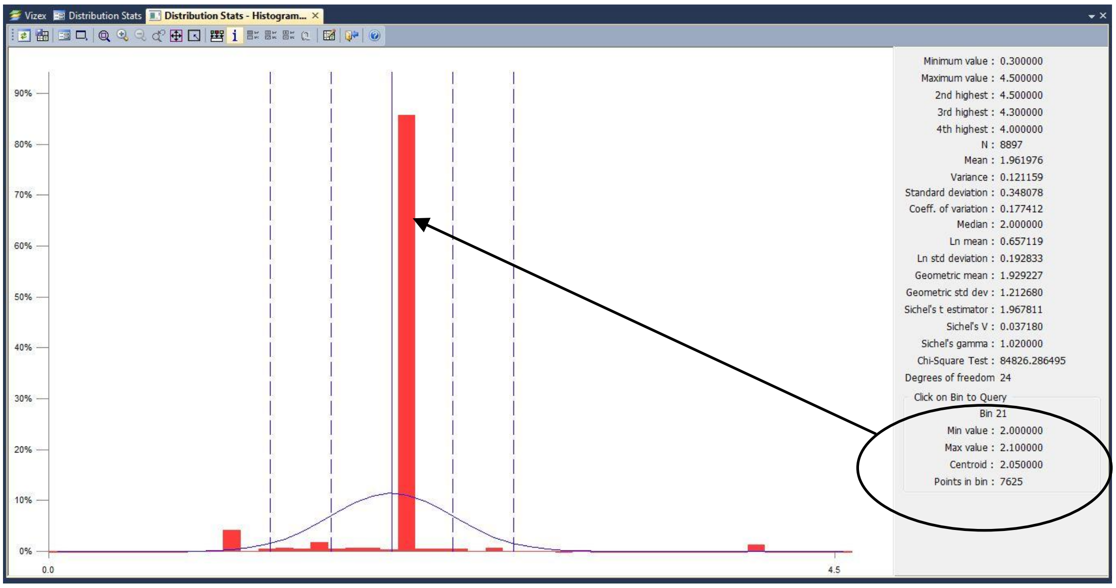



**Figure 4-34: Histogram of the sample interval thickness distribution**

The following component data fields were investigated in the initial statistical study (all expressed in percentage):

- Fe Iron
- $TiO_2$ Titanium oxide

Summary statistics for the components can be seen in Table 4-10.

The comparative histograms have been completed for each of these component for each mineralisation type (see Figure 4-35 – Figure 4-39).

Small amount of composite samples for the martite produces negative effect on the distribution statistics within these domains.

**Table 4-10: Summary Statistics for the 2 m Composites for Both types for Fe and $TiO_2$**

| Body | Variable | No. Samples | Min | Max | Mean | Std. Dev. | Variance | CoV |
|---|---|---|---|---|---|---|---|---|
| Martite (Fe<30%) | Fe | 254 | 2,98% | 29,60% | 17,75% | 6,56 | 43,05 | 0,37 |
| Martite (Fe<30%) | TiO2 | 94 | 0,24% | 2,67% | 1,42% | 0,61 | 0,37 | 0,42 |
| Martite (Fe>30%) | Fe | 112 | 28,50% | 56,30% | 42,13% | 7,15 | 51,13 | 0,17 |
| Martite (Fe>30%) | TiO2 | 10 | 2,68% | 4,70% | 3,55% | 0,69 | 0,48 | 0,19 |
| Magnetite (body I) | Fe | 4246 | 8,55% | 33,89% | 20,48% | 3,11 | 9,69 | 3,11 |
| Magnetite (body I) | TiO2 | 1778 | 0,87% | 3,00% | 1,85% | 0,27 | 0,07 | 0,15 |
| Magnetite (body II) | Fe | 185 | 13% | 25,80% | 19,90% | 2,55 | 6,52 | 0,13 |
| Magnetite (body II) | TiO2 | 0 | 0% | 0% | 0% | 0 | 0 | 0 |

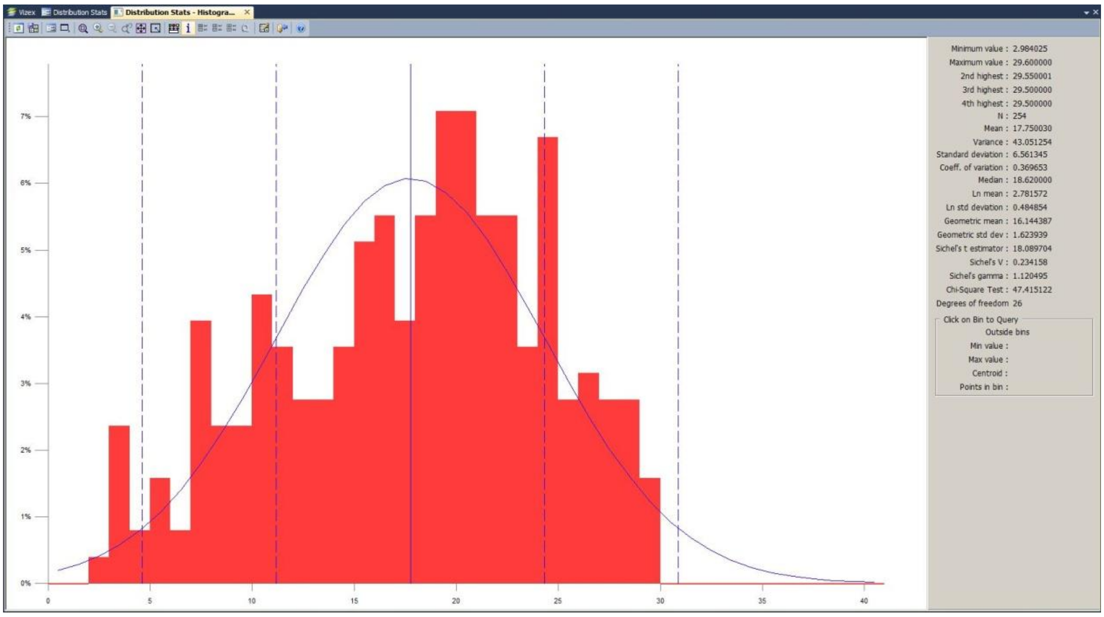



**Figure 4-35: Histogram of Fe (%) distribution for martite (Fe <30%) for 2 m composites**

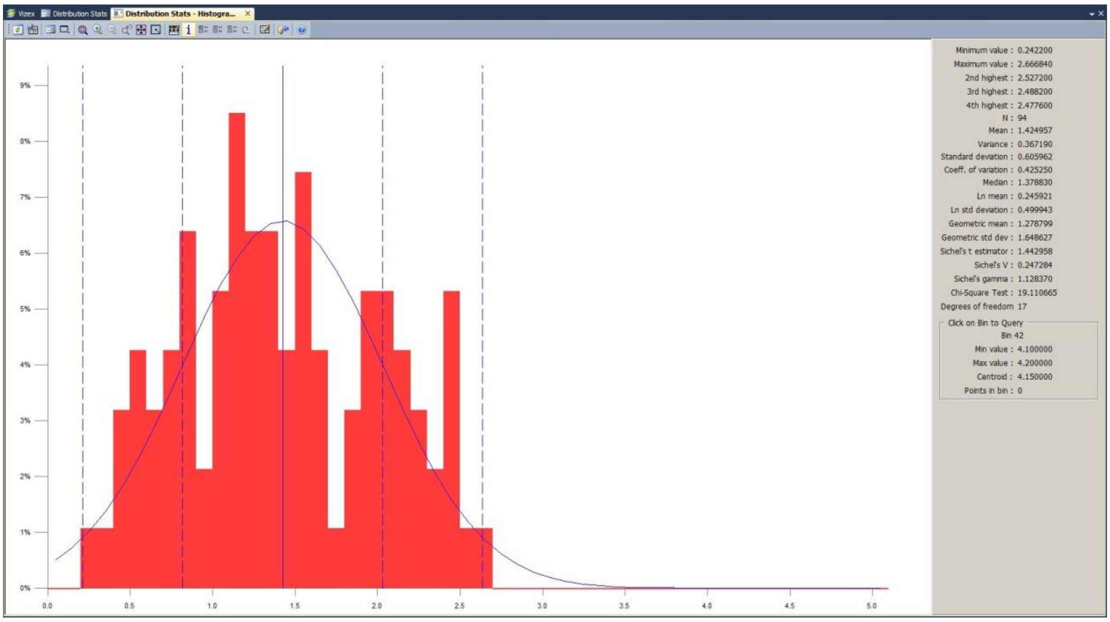



**Figure 4-36: Histogram of $TiO_2$ (%) distribution for martite (Fe <30%) for 2 m composites**

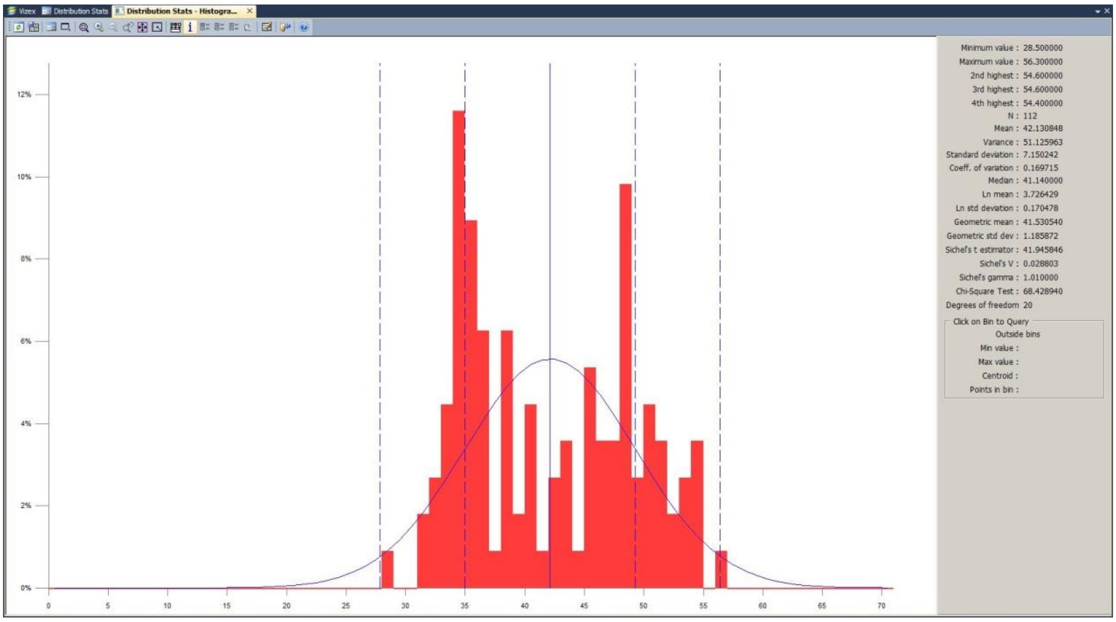



**Figure 4-37: Histogram of Fe (%) distribution for martite (Fe >30%) for 2 m composites**

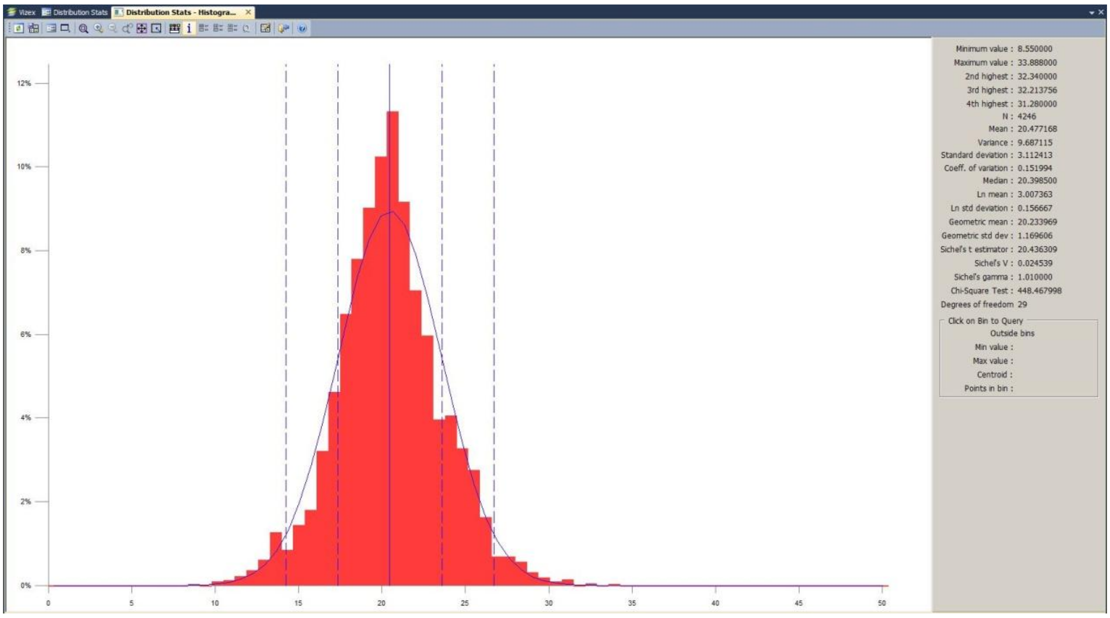



**Figure 4-38: Histogram of Fe (%) distribution in magnetite (body I) for 2 m composites**

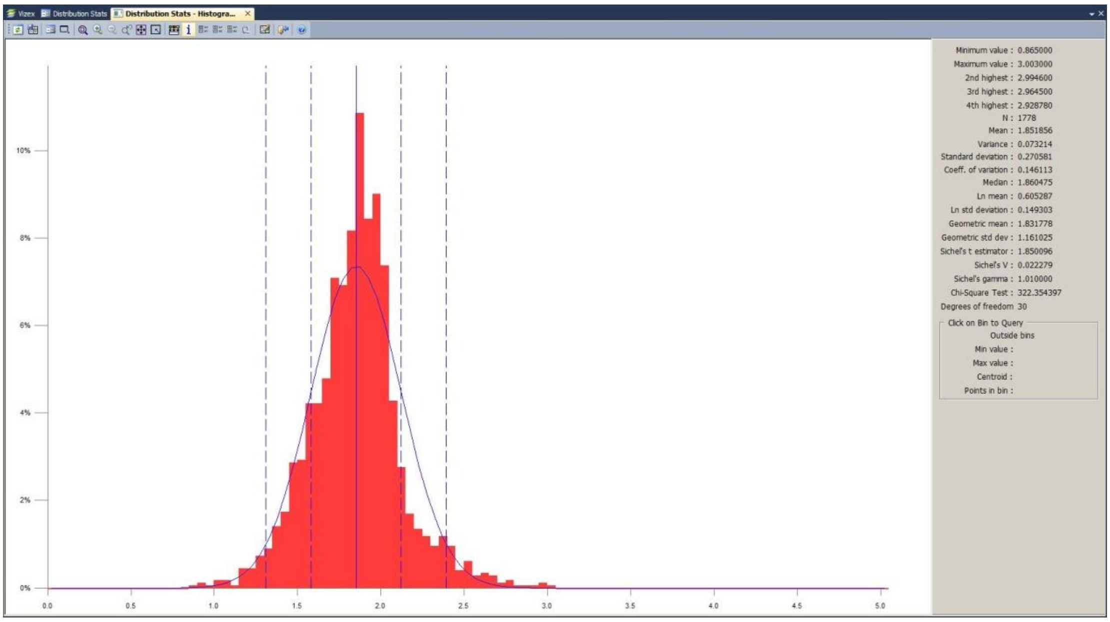



**Figure 4-39: Histogram of $TiO_2$ (%) distribution in magnetite (body I) for 2 m composites**

## 4.11 Geostatistical Study

There was no data cutting of high grades in any domain, since the distribution charts do not show any outstandingly high grades beyond the limits of two standard deviations.

A geostatistical study was undertaken in order to investigate the grade continuity and derive parameters for grade interpolation. The 3D variogram analysis was undertaken on the Fe field.

In summary, the following methodology was followed in the geostatistical study:

- experimental variogram maps to investigate any principle directions of grade continuity and anisotropy;
- experimental omni-directional variography with short lags to calculate and model the down-hole variogram of the composite elements values to characterise the nugget effect;
- experimental omni-directional variography with longer lags to calculate experimental semi-variograms within the plane of maximum continuity to determine the directional variograms for the strike, cross strike, and;
- variogram model fitting to the experimental omni-directional variograms to obtain and analyse the nugget, sill values and ranges.

## 4.12 Variogram Spatial Analysis

Variography is the study of the spatial variability of an attribute (such as Fe grade). SRK considers there is sufficient data of appropriate quality to allow a geostatistical assessment to be undertaken.

As the directional variograms for the magnetite are unsatisfactory, the decision was taken to apply the omni-directional variogram in the plane of the body oriented along the strike and dip (see Figure 4-40).

For the martite, the downhole variograms and the variograms along the body strike were produced (Figure 4-41 to Figure 4-42).

In Table 4-11, the normalised variogram parameters used for $Fe_{tot}$ grade interpolation are presented.

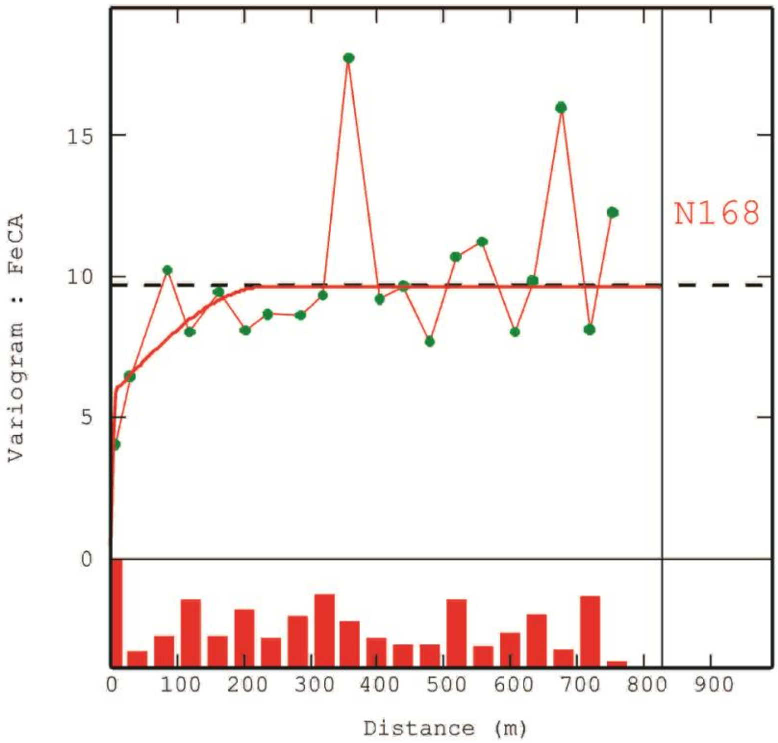



**Figure 4-40: The Omni-directional Variogram for Magnetite (body I)**

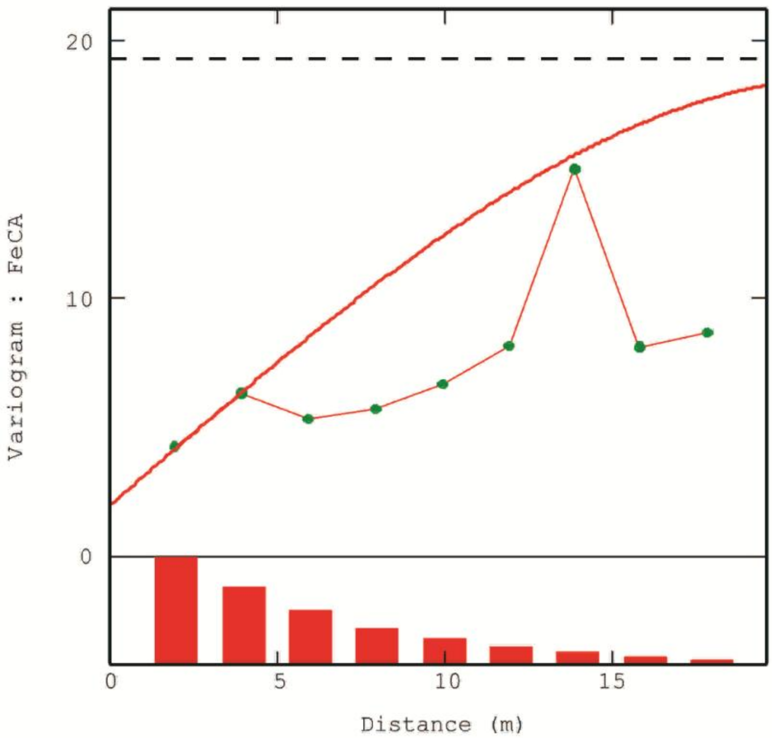



**Figure 4-41: Downhole Variogram for Martite (Fe <30%)**

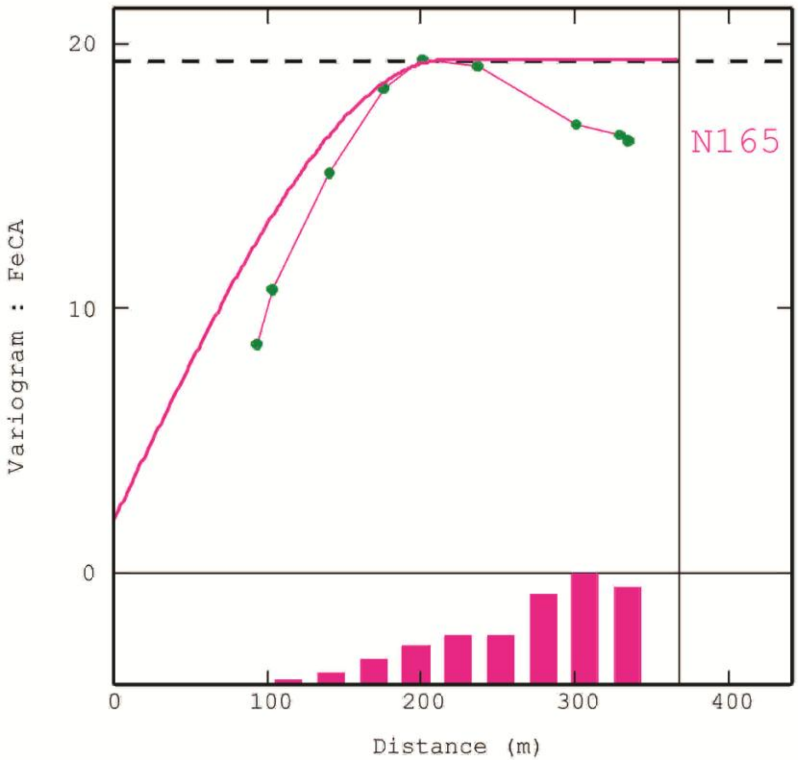



**Figure 4-42: Directional Variogram for Martite (Fe <30 %)**

**Table 4-11: Normalised Variogram Parameters Used for Fe Grade Interpolation**

| Domain | Direction | Azimuth | Dip | Range | Sill | Nugget |
|---|---|---|---|---|---|---|
| Martite all | 1 | 348 | 0 | 200 | 17,44 | 1,95 |
| | 2 | 258 | 0 | 150 | 17,44 | 1,95 |
| | 3 | 258 | -90 | 15 | 17,44 | 1,95 |
| Magnetite, body I | 1 | 348 | 0 | 200 | 9,185 | 0,4432 |
| | 2 | 258 | -62 | 200 | 9,185 | 0,4432 |
| | 3 | 78 | -28 | 20 | 9,185 | 0,4432 |
| Magnetite, body II | 1 | 321 | 0 | 200 | 9,185 | 0,4432 |
| | 2 | 231 | -61 | 200 | 9,185 | 0,4432 |
| | 3 | 51 | -28 | 20 | 9,185 | 0,4432 |

The parameters for Fe, given in Table 4-11, were also applied for $TiO_2$, as the Fe and $TiO_2$ correlation plots evidence reasonably good correlation between these elements for both the mineralisation types (see Appendix C-1:Appendix C-2:Appendix C-3:).

## 4.13 Block Modelling and Grade Interpolation

### 4.13.1 Block Model set-up

The digitised wireframes for magnetite and martite were used to code a block model with a framework as shown in Table 4-12, the block size being chosen on the basis of the body morphology and drillhole spacing.

**Table 4-12:** Block model framework (Grade Model)

| Axis | Min (UTM) | Max (UTM) | Block Size | No. Blocks |
|---|---|---|---|---|
| X | 10570960 | 10573000 | 10 | 205 |
| Y | 5621800 | 5626250 | 40 | 112 |
| Z | -250 | 510 | 20 | 39 |

### 4.13.2 Grade Interpolation

Given the grades spatial distribution over the deposit, the results of the statistical study showing adequate domaining of the samples, and the moderate-good definition of geostatistical parameters (the omni-directional-variogram), SRK has taken the decision to use Ordinary Kriging (OK) for the grade interpolation.

*Parameters interpolation*

For all of the domains, an OK weighting function has been used within an anisotropic elliptical search using suitable parameters, as detailed below in Table 4-13 and Table 4-14.

**Table 4-13: The search parameters applied during Fe grade interpolation**

| Body | Search No. | Distance along axis 1, m | Distance along axis 2, m | Distance along axis 3, m | Min amount of drillholes | Min amount of samples | Max amount of samples |
|---|---|---|---|---|---|---|---|
| **Magnetite, body I, body II** | 1 | 133.4 | 133.4 | 13.34 | 2 | 10 | 40 |
| | 2 | 200 | 200 | 20 | 2 | 10 | 40 |
| | 3 | 400 | 400 | 40 | 1 | 5 | 80 |
| | 4 | 1000 | 1000 | 100 | 1 | 1 | 80 |
| **Martite (Fe<30%)** | 1 | 133.4 | 100.05 | 10.005 | 2 | 10 | 40 |
| | 2 | 200 | 150 | 15 | 2 | 10 | 40 |
| | 3 | 400 | 300 | 30 | 1 | 5 | 80 |
| | 4 | 1000 | 750 | 75 | 1 | 1 | 80 |
| **Martite (Fe>30%)** | 1 | 133.4 | 100.05 | 10.005 | 2 | 10 | 40 |
| | 2 | 200 | 150 | 15 | 2 | 10 | 40 |
| | 3 | 400 | 300 | 30 | 1 | 5 | 80 |
| | 4 | 1000 | 750 | 75 | 1 | 1 | 80 |

**Table 4-14: The search parameters applied during $TiO_2$ grade interpolation**

| Body | Search No. | Distance along axis 1, m | Distance along axis 2, m | Distance along axis 3, m | Min amount of drillholes | Min amount of samples | Max amount of samples |
|---|---|---|---|---|---|---|---|
| **Magnetite, body I, body II** | 1 | 133.4 | 133.4 | 13.34 | 2 | 10 | 20 |
| | 2 | 200 | 200 | 20 | 2 | 10 | 20 |
| | 3 | 400 | 400 | 40 | 1 | 5 | 40 |
| | 4 | 1000 | 1000 | 100 | 1 | 1 | 40 |
| **Martite (Fe<30%)** | 1 | 133.4 | 100.05 | 10.005 | 2 | 10 | 20 |
| | 2 | 200 | 150 | 15 | 2 | 10 | 20 |
| | 3 | 400 | 300 | 30 | 1 | 5 | 40 |
| | 4 | 1000 | 750 | 75 | 1 | 1 | 40 |
| **Martite (Fe>30%)** | 1 | 133.4 | 100.05 | 10.005 | 2 | 10 | 20 |
| | 2 | 200 | 150 | 15 | 2 | 10 | 20 |
| | 3 | 400 | 300 | 30 | 1 | 5 | 40 |
| | 4 | 1000 | 750 | 75 | 1 | 1 | 40 |

## 4.14 Model Validation

### 4.14.1 Visual Validation

Visual validation provides a local validation of the interpolated block model on a local block scale, using visual assessments and validation plots of sample grades versus estimated block grades. A thorough visual inspection of cross-sections, long-sections and bench/level plans, comparing the sample grades with the block grades has been undertaken, which demonstrates good comparison between local block estimates and nearby samples (Figure 4-43).

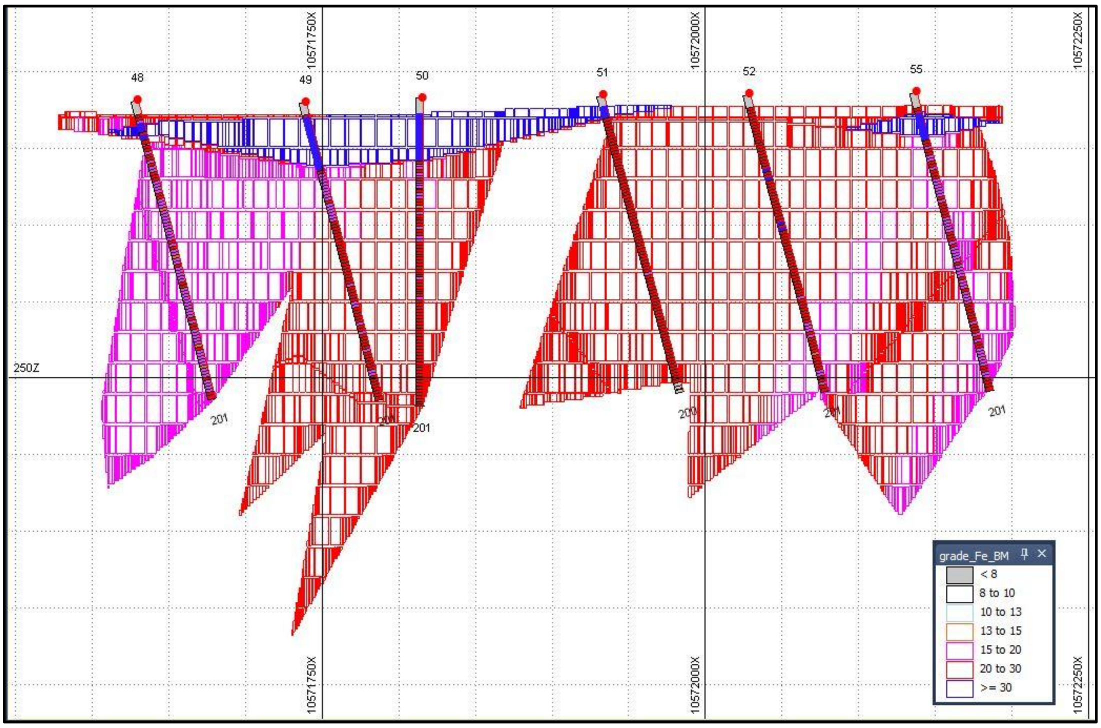



**Figure 4-43: Cross-section along line 8 demonstrates good correlation between the block grades and the drill core sample grades for $Fe_{tot}$**

### 4.14.2 Sectional/Swath Plot Validation

As part of the validation process, the input composite samples are compared to the block model grades within a series of coordinates. The results of which are then displayed on graphs to check for visual discrepancies between the grades.

Figure 4-44 to Figure 4-52 below present these results for Fe for the X-Coordinate, Y-Coordinate and Z-Coordinate. The graph shows the block model grades (red line) and the sample composite grades (blue line). The graphs demonstrate good correlation between the grades in the block model and the grades in the composite samples, and the former naturally demonstrate the typically smoothed profiles of the latter. The graphs also prove the absence of systematic errors.

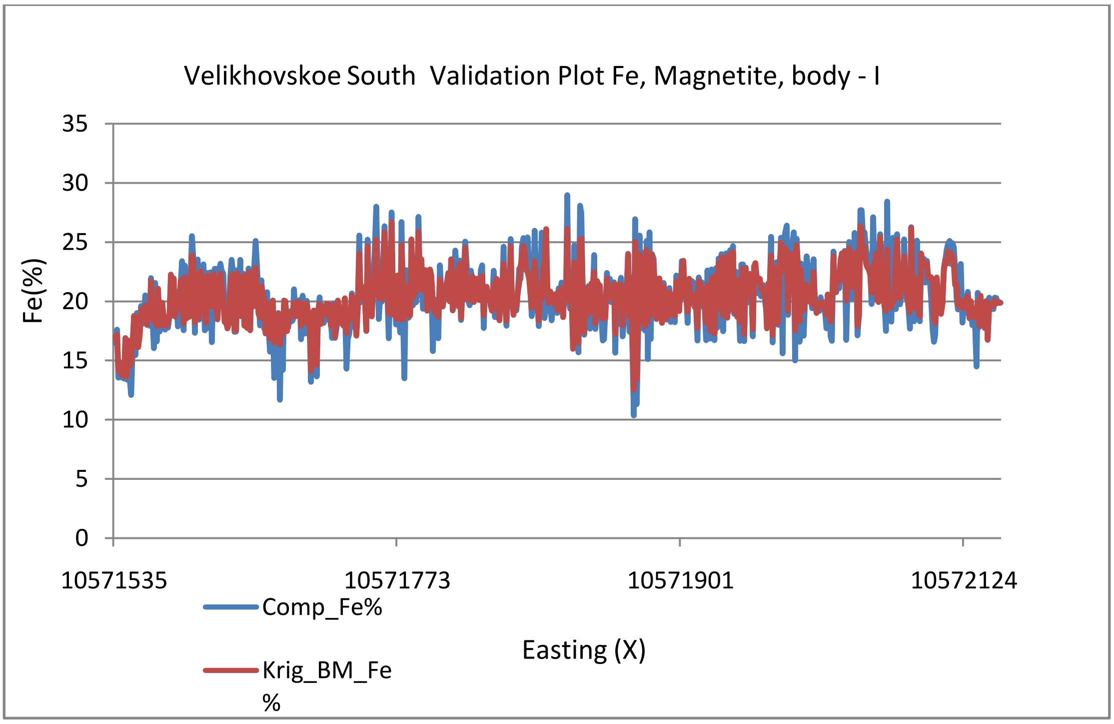



**Figure 4-44: Validation Plots Fe Ordinary Kriged, Magnetite, body I, X-Direction**

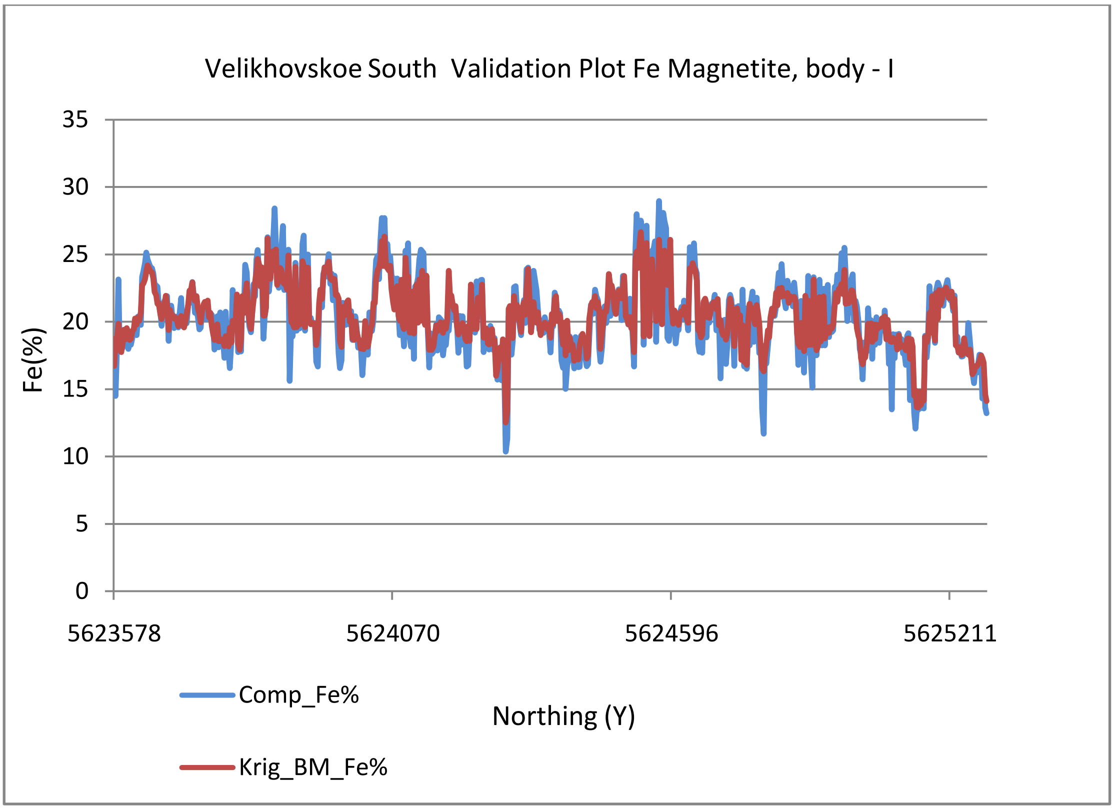



**Figure 4-45: Validation Plots Fe Ordinary Kriged, Magnetite, body I, Y-Direction**

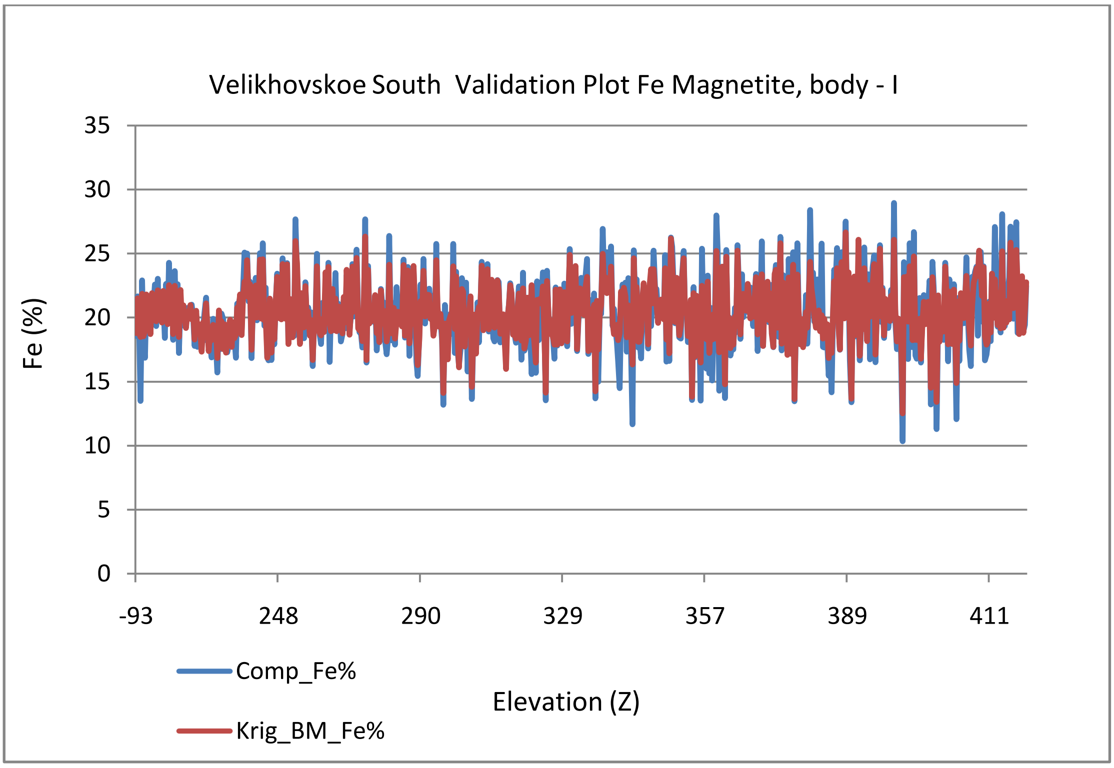



**Figure 4-46: Validation Plots Fe Ordinary Kriged, Magnetite, body I, Z-Direction**

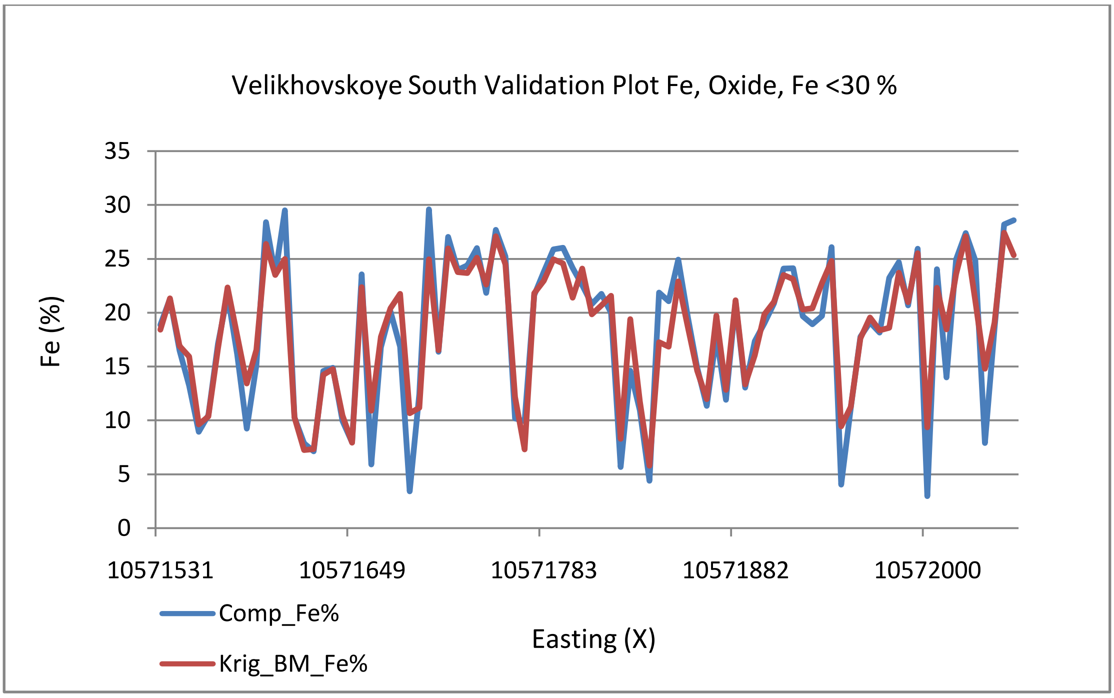



**Figure 4-47: Validation Swath Plots Fe Ordinary Kriged, Oxide Fe<30%, X-Direction**

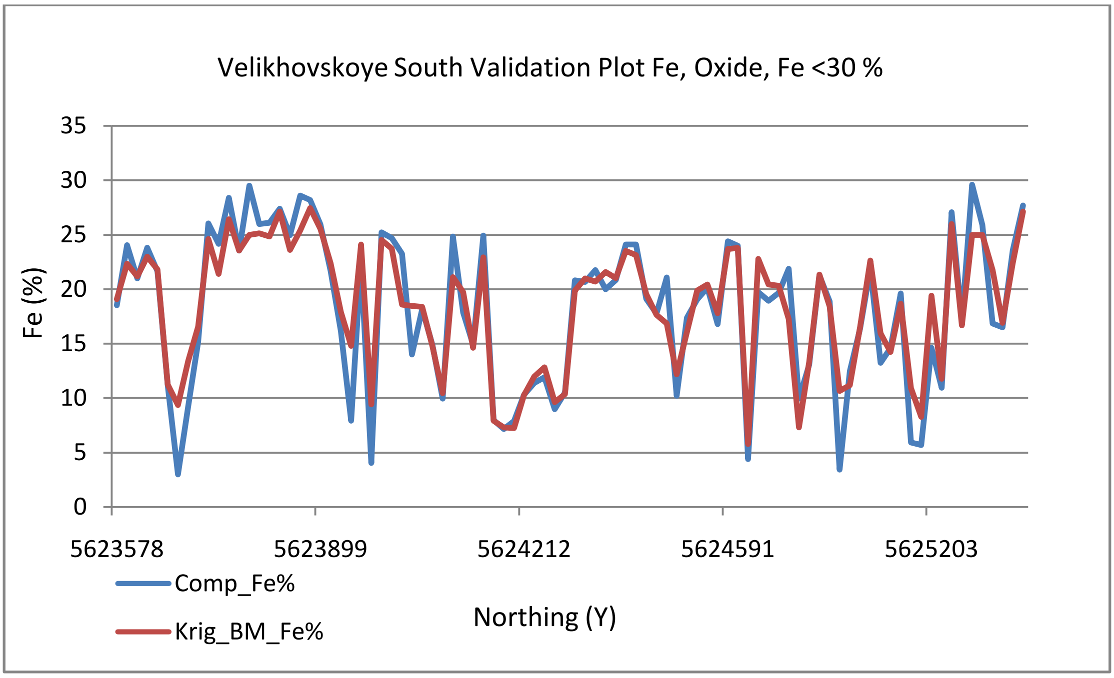



**Figure 4-48: Validation Swath Plots Fe Ordinary Kriged, Oxide Fe<30%, Y-Direction**

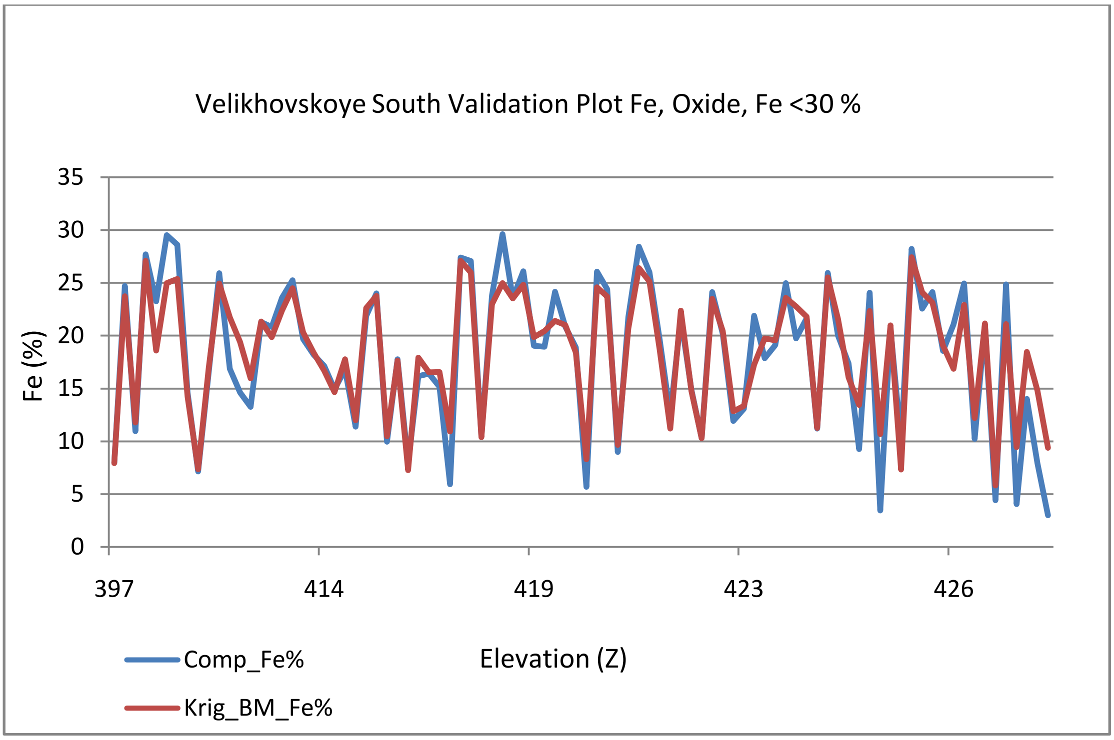



**Figure 4-49: Validation Swath Plots Fe Ordinary Kriged, Oxide Fe<30%, Z-Direction**

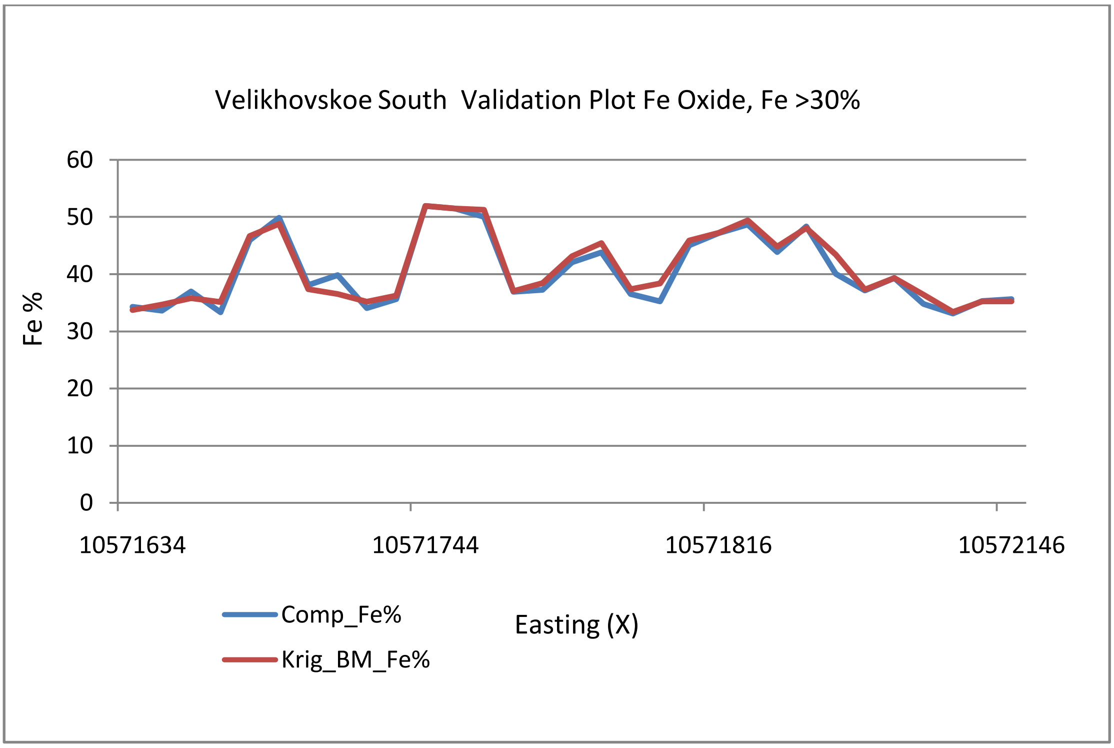



**Figure 4-50: Validation Swath Plots Fe Ordinary Kriged, Oxide Fe>30%, X-Direction**

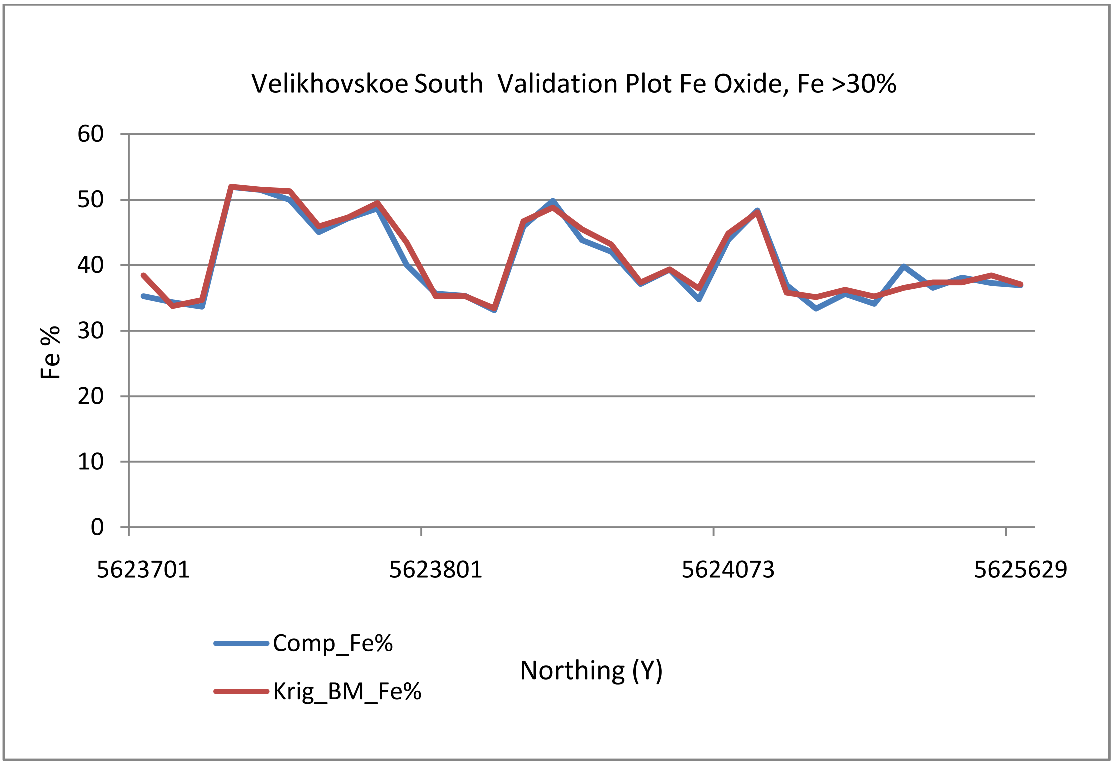



**Figure 4-51: Validation Swath Plots Fe Ordinary Kriged, Oxide Fe>30%, Y-Direction**

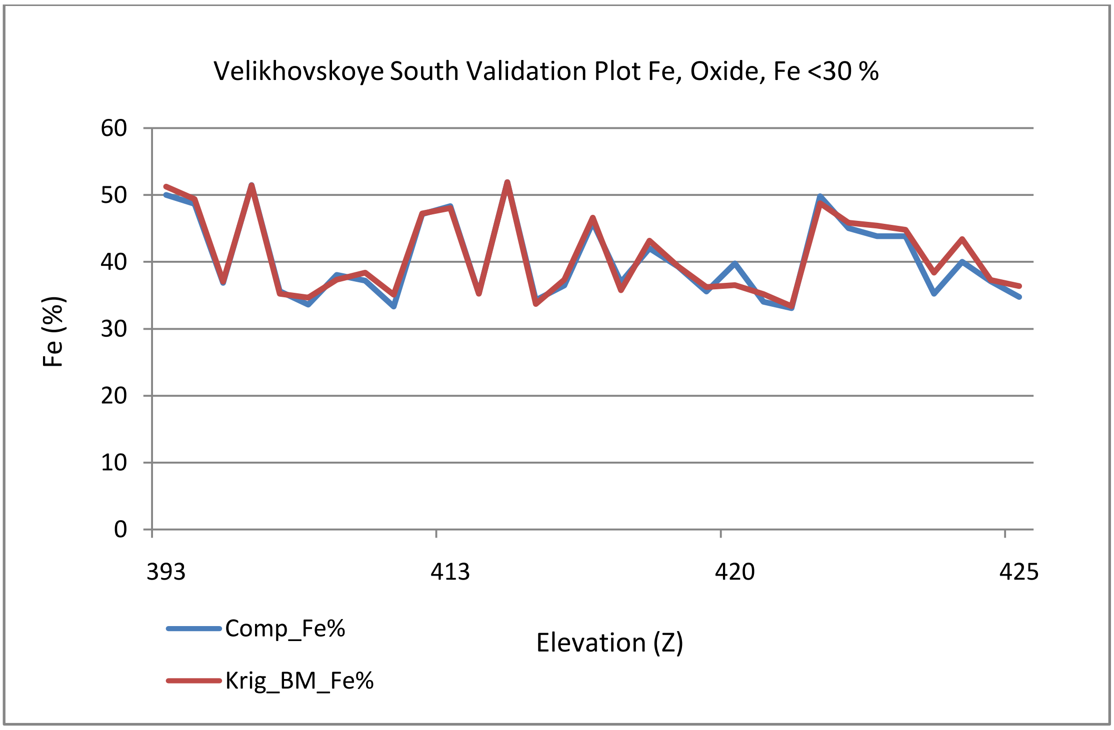



**Figure 4-52: Validation Swath Plots Fe Ordinary Kriged, Oxide Fe>30%, Z-Direction**

### 4.14.3 The Block Model Validation by the Inverse Distance Method (IDW)

All the grades were also interpolated by the Inverse Distance Method (IDW) at degree two and three, and were then compared with the grades estimated by the Kriging Method. Comparison of grades and tonnage of Fe and $TiO_2$ between the Kriging Method and the IDW is presented below in Table 4-15 below.

Interpolation by the IDW on the whole resulted in higher grades, but the grades difference between the two methods was below 2% (relative) for Fe and 7% (relative) for $TiO_2$ that can be considered to be acceptable accuracy.

**Table 4-15: Comparison for Grades and Tonnage of Fe ($TiO_2$) between the Kriging Method and the Inverse Distance Method (IDW)**

| Type | Cut off Grade, Fe % | Ordinary Kriging | | | IDW2 | | | IDW3 | | | DIFFERENCE % | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | IDW2 | | | IDW3 | | |
| | | Tonnage, t | Average grade Fe % | Average grade TiO2 % | Tonnage, t | Average grade Fe % | Average grade TiO2 % | Tonnage, t | Average grade Fe % | Average grade TiO2 % | Tonnage, % | Average grade Fe % | Average grade TiO2 % | Tonnage, % | Average grade Fe % | Average grade TiO2 % |
| **Magnetite, body - I** | 16 | 457 614 467,36 | 20,24 | 1,80 | 455 266 693,60 | 20,35 | 1,80 | 454 292 709,92 | 20,37 | 1,80 | 0,516 | -0,537 | 0,100 | 0,731 | -0,614 | 0,161 |
| **Magnetite, body-II** | 16 | 9 829 786,72 | 20,18 | 0,00 | 9 821 701,92 | 20,33 | 0,00 | 9 821 388,96 | 20,36 | 0,00 | 0,082 | -0,744 | - | 0,086 | -0,896 | - |
| **Martite <30% Fe** | 16 | 22 025 360,88 | 19,85 | 1,41 | 22 950 238,08 | 19,66 | 1,48 | 22 718 091,60 | 19,90 | 1,50 | -4,030 | 0,961 | -4,982 | -3,049 | -0,263 | -6,178 |
| **Martite >30% Fe** | 20 | 4 991 815,92 | 41,00 | 3,39 | 4 991 815,92 | 41,64 | 3,45 | 4 991 815,92 | 41,64 | 3,45 | 0,000 | -1,531 | -1,676 | 0,000 | -1,533 | -1,897 |

## 4.15 Mineral Resource

### 4.15.1 Classification Code and Definitions

The Mineral Resource statement presented in Section 4.16 has been classified following the definitions and guidelines of the Australasian Code for the Reporting of Exploration Results, Mineral Resources and Ore Reserves, The JORC Code, 2004 Edition (“JORC Code”).

The following definitions are taken from the JORC code.

***Inferred Mineral Resources***

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

An Inferred Mineral Resource has a lower level of confidence than that applying to an Indicated Mineral Resource.

The Inferred category is intended to cover situations where a mineral concentration or occurrence has been identified and limited measurements and sampling completed, but where the data are insufficient to allow the geological and/or grade continuity to be confidently interpreted. Commonly, it would be reasonable to expect that the majority of Inferred Mineral Resources would upgrade to Indicated Mineral Resources with continued exploration. However, due to the uncertainty of Inferred Mineral Resources, it should not be assumed that such upgrading will always occur.

***Indicated Mineral Resources***

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

An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource, but has a higher level of confidence than that applying to an Inferred Mineral Resource.

Mineralisation may be classified as an Indicated Mineral Resource when the nature, quality, amount and distribution of data are such as to allow confident interpretation of the geological framework and to assume continuity of mineralisation.

Confidence in the estimate is sufficient to allow the application of technical and economic parameters, and to enable an evaluation of economic viability.

***Measured Mineral Resources***

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

Mineralisation may be classified as a Measured Mineral Resource when the nature, quality, amount and distribution of data are such as to leave no reasonable doubt, in the opinion of the Competent Person determining the Mineral Resource, that the tonnage and grade of the mineralisation can be estimated to within close limits, and that any variation from the estimate would be unlikely to significantly affect potential economic viability.

This category requires a high level of confidence in, and understanding of, the geology and controls of the mineral deposit.

Confidence in the estimate is sufficient to allow the application of technical and economic parameters and to enable an evaluation of economic viability that has a greater degree of certainty than an evaluation based on an Indicated Mineral Resource.

***Velikhovskoe Southern Deposit Classification***

Based on these JORC requirements and guidelines, SRK have assigned portions of the Velikhovskoe Southern Mineral Resource into the Inferred and Indicated categories.

In determining the appropriate classification criteria, several factors were considered:

- JORC requirements and guidelines;
- Quality of data used in the estimation;
- Quantity and density of sample data;
- Geological knowledge and understanding, focusing on geological and grade continuity;
- Quality of the geostatistics and interpolated block model, and;
- Experience with other deposits of similar style.

***Quality of Data***

SRK provided protocols for the Client's 2011 exploration drilling programme and, on review of the results of the data, it was accepted that the Client used industry best-practice methodologies in line with peers within similar style deposits and which was accompanied with rigorous Quality Assurance Protocols and Quality Control Measures in place to monitor accuracy, confidence and repeatability of data collected.

The results from the QAQC programme show no evidence of bias within the laboratory. However, five cases of incorrect sample labelling in the course of sample preparation were revealed: in one of the cases, a standard sample was confused with a duplicate, and in the other four cases, instead of blank samples, metallurgical (dressability) samples were submitted (under blank labels). This evidences a low level of sampling control at a stage of sample preparation.

SRK has been supplied with electronic copies of the drilling database, with no observable errors encountered when importing the data into mining software packages.

The topography being used currently is based on Satellite SRTM data, which is adequate and has to some degree been confirmed by recent borehole collar surveys, is adequate for MRE purposes, however is not sufficiently detailed for use in later multi-disciplinary technical studies, Pre-Feasibility and Feasibility studies.

SRK has digitized the 2004 topographic base. Review of the obtained digitized topographic base and drillhole collars elevations, a significant discrepancy in collar elevation data for some 1960-1964 drillholes was revealed. This may be possibly explained by the fact that in the course of topographic locating of drillhole collars in 2004 a part of drillholes was not found, and old data were used.

SRK considers the topographic base quality is adequate for MRE purposes at current exploration stage. However, later more accurate topographic base should be produced, with admissible discrepancies with drillhole and other workings collars.

***Quantity of Data***

The Velikhovskoe Southern deposit territory is covered by irregular exploration drilling grid, and the exploration was carried out in four stages:

- 1961-1964 Exploration. 132 mapping holes (the holes depth in bedrock was 40-50 m only) and 18 exploration drillholes were drilled.
- In 2004 exploration of the deposit was carried out by Aktobe-Temir VS LLP: 50 core holes were drilled.
- In 2010 Daughter Company Aktobe-Temir-VS LLP drilled three confirmatory holes (Nos. 1049, 1046 and 1043) along exploration lines 4, 5 and 7.
- In 2011 Daughter Company Aktobe-Temir-VS LLP drilled 25 exploration holes
- Note that SRK did not use the 1961-1964 exploration drilling data in the MRE.

***Geological knowledge and understanding, and geological and grade continuity***

The geological setting of the Velikhovskoe Southern deposit is rather simple. Structurally, the deposit is a stratified (under effect of gravitation at high temperature) sill-like intrusive body. On the whole, the body is well understood, but understanding of its mineralogy and mineralisation quality requires further, more in-depth investigations.

Based on the available geological data, SRK delineated magnetite and martite, with a data confidence level sufficient for estimation of Indicated Resources in areas of more dense drillhole exploration grid to a depth of 200 m and Inferred Resources at a depth of more than 200 m.

***Quality of Geostatistics and Grade Interpolation***

The results of the current geostatistical analysis returned robust semi-variograms for $Fe_{tot}$

The resultant block model validates very well with the input sample data, this validation has been completed visually, statistically, spatially and with different estimation methods, and therefore SRK consider the model to be unbiased and robust.

The Mineral Resource Summary for the Velikhovskoe Southern deposit at various Fe cut-off grades is shown in Table 4-16 and Table 4-17.

**Table 4-16: The Mineral Resources for the Velikhovskoe Southern deposit at various Fe cut-off grades for magnetite**

| Type | Cut off Grade Fe % | SG | Volume, m3 | Tonnage, t | Average grade Fe % | Average grade $TiO_2$ % | Class |
|---|---|---|---|---|---|---|---|
| Magnetite, body - I | 12 | 3,26 | 35 015 672,00 | 114 151 090,72 | 20,84 | 1,88 | Indicated |
| | | | 106 792 896,00 | 348 144 840,96 | 19,98 | 1,78 | Inferred |
| | | | ***141 808 568,00*** | ***462 295 931,68*** | ***20,19*** | ***1,80*** | ***TOTAL*** |
| | 13 | 3,26 | 35 015 016,00 | 114 148 952,16 | 20,84 | 1,88 | Indicated |
| | | | 106 783 376,00 | 348 113 805,76 | 19,98 | 1,78 | Inferred |
| | | | ***141 798 392,00*** | ***462 262 757,92*** | ***20,19*** | ***1,80*** | ***TOTAL*** |
| | 14 | 3,26 | 34 967 232,00 | 113 993 176,32 | 20,85 | 1,88 | Indicated |
| | | | 106 715 848,00 | 347 893 664,48 | 19,98 | 1,78 | Inferred |
| | | | ***141 683 080,00*** | ***461 886 840,80*** | ***20,20*** | ***1,80*** | ***TOTAL*** |
| | 15 | 3,26 | 34 814 048,00 | 113 493 796,48 | 20,88 | 1,88 | Indicated |
| | | | 106 461 576,00 | 347 064 737,76 | 19,99 | 1,78 | Inferred |
| | | | ***141 275 624,00*** | ***460 558 534,24*** | ***20,21*** | ***1,80*** | ***TOTAL*** |
| | 16 | 3,26 | 34 617 080,00 | 112 851 680,80 | 20,91 | 1,88 | Indicated |
| | | | 105 755 456,00 | 344 762 786,56 | 20,02 | 1,78 | Inferred |
| | | | ***140 372 536,00*** | ***457 614 467,36*** | ***20,24*** | ***1,80*** | ***TOTAL*** |
| | 17 | 3,26 | 34 204 888,00 | 111 507 934,88 | 20,96 | 1,88 | Indicated |
| | | | 102 197 344,00 | 333 163 341,44 | 20,14 | 1,78 | Inferred |
| | | | ***136 402 232,00*** | ***444 671 276,32*** | ***20,35*** | ***1,80*** | ***TOTAL*** |
| | 18 | 3,26 | 32 301 672,00 | 105 303 450,72 | 21,16 | 1,89 | Indicated |
| | | | 92 114 968,00 | 300 294 795,68 | 20,43 | 1,78 | Inferred |
| | | | ***124 416 640,00*** | ***405 598 246,40*** | ***20,62*** | ***1,81*** | ***TOTAL*** |
| | 19 | 3,26 | 28 605 000,00 | 93 252 300,00 | 21,50 | 1,90 | Indicated |
| | | | 76 188 272,00 | 248 373 766,72 | 20,82 | 1,79 | Inferred |
| | | | ***104 793 272,00*** | ***341 626 066,72*** | ***21,00*** | ***1,82*** | ***TOTAL*** |
| | 20 | 3,26 | 23 974 744,00 | 78 157 665,44 | 21,88 | 1,92 | Indicated |
| | | | 55 522 744,00 | 181 004 145,44 | 21,30 | 1,81 | Inferred |
| | | | ***79 497 488,00*** | ***259 161 810,88*** | ***21,48*** | ***1,84*** | ***TOTAL*** |
| Magnetite, body-II | 14 | 3,26 | 3 015 616,00 | 9 830 908,16 | 20,18 | - | Inferred |
| | | | ***3 015 616,00*** | ***9 830 908,16*** | ***20,18*** | ***-*** | ***TOTAL*** |
| | 15 | 3,26 | 3 015 576,00 | 9 830 777,76 | 20,18 | - | Inferred |
| | | | ***3 015 576,00*** | ***9 830 777,76*** | ***20,18*** | ***-*** | ***TOTAL*** |
| | 16 | 3,26 | 3 015 272,00 | 9 829 786,72 | 20,18 | - | Inferred |
| | | | ***3 015 272,00*** | ***9 829 786,72*** | ***20,18*** | ***-*** | ***TOTAL*** |
| | 17 | 3,26 | 3 013 536,00 | 9 824 127,36 | 20,18 | - | Inferred |
| | | | ***3 013 536,00*** | ***9 824 127,36*** | ***20,18*** | ***-*** | ***TOTAL*** |
| | 18 | 3,26 | 2 999 384,00 | 9 777 991,84 | 20,19 | - | Inferred |
| | | | ***2 999 384,00*** | ***9 777 991,84*** | ***20,19*** | ***-*** | ***TOTAL*** |
| | 19 | 3,26 | 2 765 280,00 | 9 014 812,80 | 20,32 | - | Inferred |
| | | | ***2 765 280,00*** | ***9 014 812,80*** | ***20,32*** | ***-*** | ***TOTAL*** |
| | 20 | 3,26 | 1 890 752,00 | 6 163 851,52 | 20,64 | - | Inferred |
| | | | ***1 890 752,00*** | ***6 163 851,52*** | ***20,64*** | ***-*** | ***TOTAL*** |

**Table 4-17: The Mineral Resources for the Velikhovskoe Southern deposit at various Fe cut-off grades for martite**

| Type | Cut off Grade Fe % | SG | Volume, m3 | Tonnage, t | Average grade Fe % | Average grade $TiO_2$ % | Class |
|---|---|---|---|---|---|---|---|
| Martite <30% Fe | 10 | 3,03 | 1 662 912,00 | 5 038 623,36 | 20,07 | 1,53 | Indicated |
| | | | 7 438 104,00 | 22 537 455,12 | 18,34 | 1,36 | Inferred |
| | | | ***9 101 016,00*** | ***27 576 078,48*** | ***18,66*** | ***1,39*** | ***TOTAL*** |
| | 11 | 3,03 | 1 652 248,00 | 5 006 311,44 | 20,13 | 1,53 | Indicated |
| | | | 7 353 952,00 | 22 282 474,56 | 18,43 | 1,36 | Inferred |
| | | | ***9 006 200,00*** | ***27 288 786,00*** | ***18,74*** | ***1,39*** | ***TOTAL*** |
| | 12 | 3,03 | 1 636 248,00 | 4 957 831,44 | 20,21 | 1,53 | Indicated |
| | | | 7 217 856,00 | 21 870 103,68 | 18,56 | 1,36 | Inferred |
| | | | ***8 854 104,00*** | ***26 827 935,12*** | ***18,87*** | ***1,40*** | ***TOTAL*** |
| | 13 | 3,03 | 1 618 176,00 | 4 903 073,28 | 20,30 | 1,54 | Indicated |
| | | | 6 996 232,00 | 21 198 582,96 | 18,75 | 1,36 | Inferred |
| | | | ***8 614 408,00*** | ***26 101 656,24*** | ***19,04*** | ***1,40*** | ***TOTAL*** |
| | 14 | 3,03 | 1 583 232,00 | 4 797 192,96 | 20,45 | 1,55 | Indicated |
| | | | 6 718 456,00 | 20 356 921,68 | 18,97 | 1,36 | Inferred |
| | | | ***8 301 688,00*** | ***25 154 114,64*** | ***19,25*** | ***1,40*** | ***TOTAL*** |
| | 15 | 3,03 | 1 537 776,00 | 4 659 461,28 | 20,62 | 1,56 | Indicated |
| | | | 6 291 912,00 | 19 064 493,36 | 19,27 | 1,36 | Inferred |
| | | | ***7 829 688,00*** | ***23 723 954,64*** | ***19,54*** | ***1,40*** | ***TOTAL*** |
| | 16 | 3,03 | 1 470 384,00 | 4 455 263,52 | 20,86 | 1,57 | Indicated |
| | | | 5 798 712,00 | 17 570 097,36 | 19,59 | 1,36 | Inferred |
| | | | ***7 269 096,00*** | ***22 025 360,88*** | ***19,85*** | ***1,41*** | ***TOTAL*** |
| | 17 | 3,03 | 1 377 432,00 | 4 173 618,96 | 21,14 | 1,58 | Indicated |
| | | | 5 265 600,00 | 15 954 768,00 | 19,91 | 1,36 | Inferred |
| | | | ***6 643 032,00*** | ***20 128 386,96*** | ***20,17*** | ***1,41*** | ***TOTAL*** |
| | 18 | 3,03 | 1 219 888,00 | 3 696 260,64 | 21,62 | 1,60 | Indicated |
| | | | 4 556 736,00 | 13 806 910,08 | 20,27 | 1,36 | Inferred |
| | | | ***5 776 624,00*** | ***17 503 170,72*** | ***20,55*** | ***1,41*** | ***TOTAL*** |
| | 19 | 3,03 | 1 027 048,00 | 3 111 955,44 | 22,20 | 1,59 | Indicated |
| | | | 3 646 616,00 | 11 049 246,48 | 20,71 | 1,37 | Inferred |
| | | | ***4 673 664,00*** | ***14 161 201,92*** | ***21,03*** | ***1,42*** | ***TOTAL*** |
| | 20 | 3,03 | 816 136,00 | 2 472 892,08 | 22,89 | 1,59 | Indicated |
| | | | 2 040 328,00 | 6 182 193,84 | 21,72 | 1,40 | Inferred |
| | | | ***2 856 464,00*** | ***8 655 085,92*** | ***22,05*** | ***1,46*** | ***TOTAL*** |
| Martite >30% Fe | 20 | 3,03 | 1 647 464,00 | 4 991 815,92 | 41,00 | 3,39 | Inferred |
| | | | ***1 647 464,00*** | ***4 991 815,92*** | ***41,00*** | ***3,39*** | ***TOTAL*** |

## 4.16 Mineral Resource Statement

The Velikhovskoe Southern deposit has been explored and sampled using appropriate methodologies and at sufficient spacing to support the estimation of Indicated and Inferred Mineral Resources in accordance with the JORC Code.

The standard adopted for the reporting of Mineral Resources in this technical report is the JORC Code (2004) and the Mineral Resource Statement presented herein has been estimated in accordance with the JORC Code (2004). Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.

The estimate is based on 14,684.3 m of drilling samples. The resource estimation work was supervised by Dr John Arthur, (CGeol FGS; C.Eng MIMMM), Principal Geologist with SRKUK who is a Competent Person according to the definition given in the JORC Code (2004). The Effective Date of the resource statement is 2 February 2012.

SRK has undertaken a preliminary cut-off grade calculation which delineates the iron mineralisation within the SRK model area. Cut-off grade of 16% Fe for magnetite and martite at < 30% Fe was taken, and cut-off grade of 20% Fe was taken for martite at >30% Fe.

Table 4-18 shows the resulting Mineral Resource Statement for the Velikhovskoe Southern Project.

**Table 4-18: JORC Compliant Mineral Resource Statement for the Velikhovskoe Southern deposit effective date 2 February 2012**

| Type | Class | Cut Off Grade, Fe (%) | SG, g/cm³ | Volume, m³ | Tonnage, t | Average grade Fe (%) | Average grade $TiO_2$ (%) |
|---|---|---|---|---|---|---|---|
| Magnetite, body - I | Indicated | 16 | 3,26 | 34 617 080,00 | 112 851 680,80 | 20,91 | 1,88 |
| Martite <30% Fe | Indicated | 16 | 3,03 | 1 470 384,00 | 4 455 263,52 | 20,86 | 1,57 |
| | Sub_total All Indicated | | | 36 087 464,00 | 117 306 944,32 | 20,91 | 1,87 |
| Magnetite, body - I | Inferred | 16 | 3,26 | 105 755 456,00 | 344 762 786,56 | 20,02 | 1,78 |
| Magnetite, body-II | Inferred | 16 | 3,26 | 3 015 272,00 | 9 829 786,72 | 20,18 | - |
| Martite <30% Fe | Inferred | 16 | 3,03 | 5 798 712,00 | 17 570 097,36 | 19,59 | 1,36 |
| Martite >30% Fe | Inferred | 20 | 3,03 | 1 647 464,00 | 4 991 815,92 | 41,00 | 3,39 |
| | Sub_total Magnetite Inferred | | | 108 770 728,00 | 354 592 573,28 | 20,03 | - |
| | Sub_total Martite Inferred | | | 7 446 176,00 | 22 561 913,28 | 24,33 | 1,81 |
| | Sub_total All Inferred | | | 116 216 904,00 | 377 154 486,56 | 20,28 | - |
| | Total | | | 152 304 368,00 | 494 461 430,88 | 20,43 | - |

## 4.17 Grade-Tonnage Curves by Classification

SRK has produced a Grade-Tonnage Curve for $Fe_{tot}$ for the combined Indicated and Inferred Mineral Resource (Fe) of the Velikhovskoe Southern deposit, which is shown in Figure 4-53 Figure 4-54, Figure 4-55.

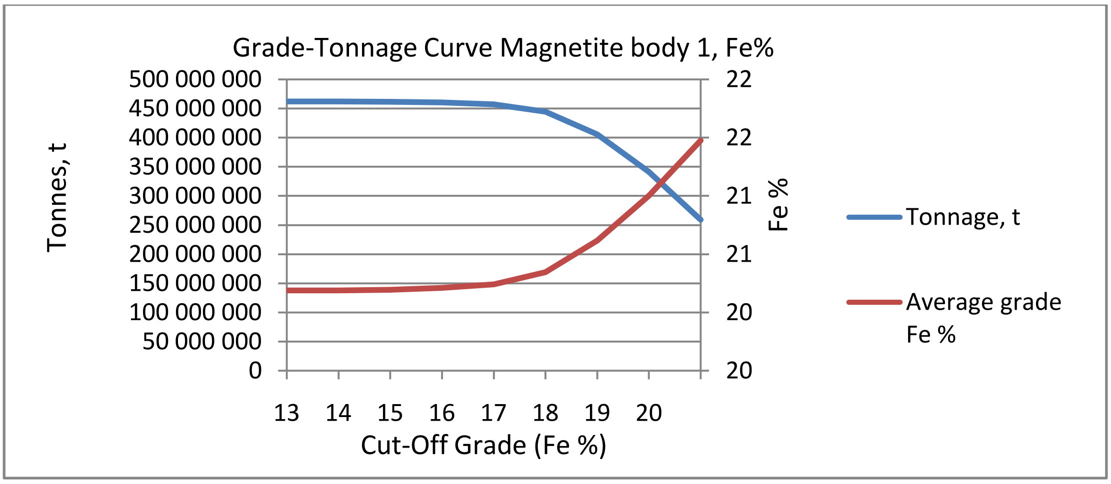



**Figure 4-53: Mineral Resource Grade-Tonnage Curve for Fe (Magnetite body I)**

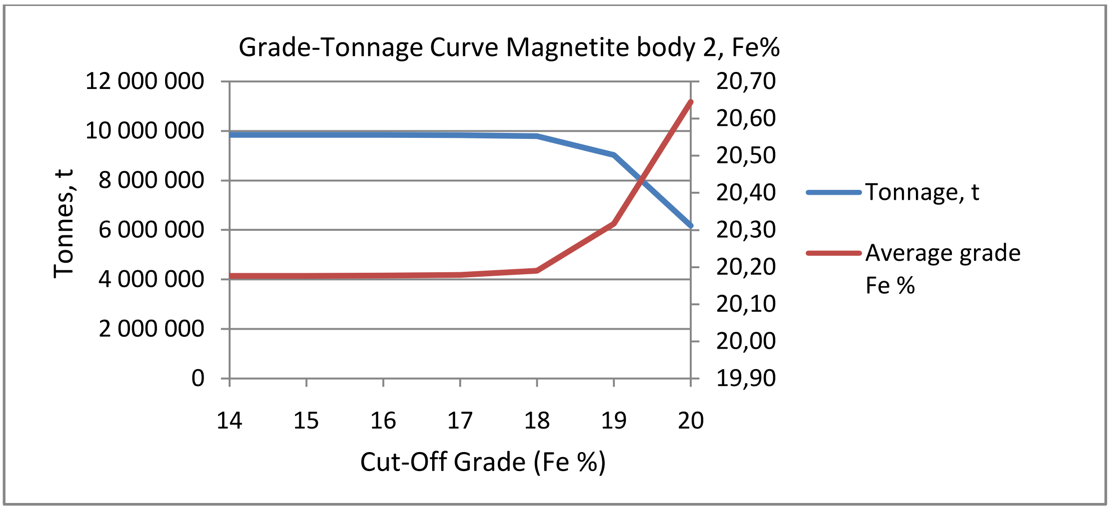



**Figure 4-54: Mineral Resource Grade-Tonnage Curve for Fe (Magnetite body I)**

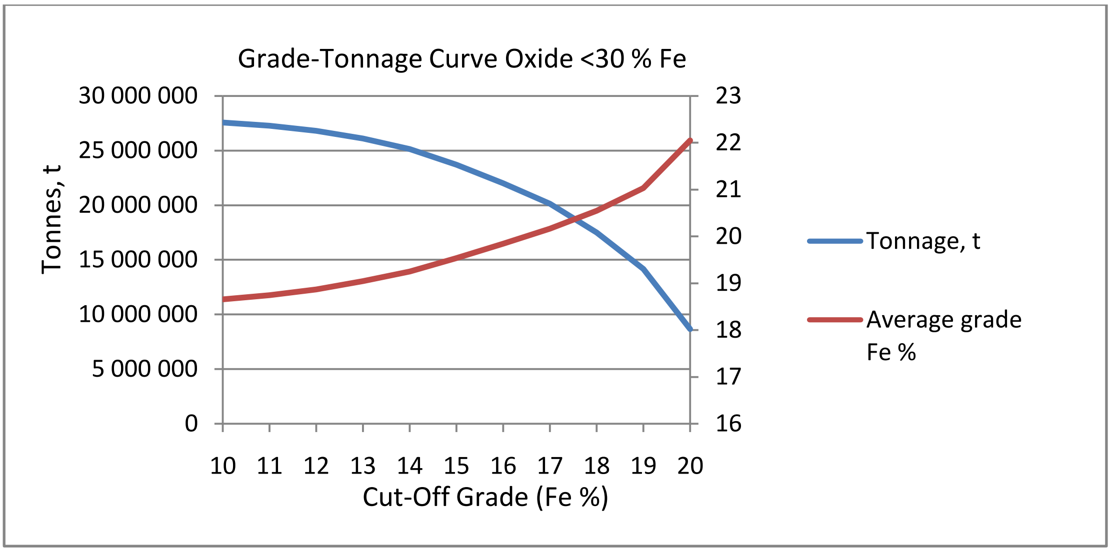



**Figure 4-55: Mineral Resource Grade-Tonnage Curve for Fe (Martite <30% Fe)**

# 5 EXPLORATION POTENTIAL

Further drilling is recommended by SRK for:

- revision of geological setting of the deposit;
- more precise and confident delineation of bodies and their boundaries; and
- thickening drilling grid (infill drilling) for revision of grades and upgrading geological resources up to higher categories.

# 6 PRELIMINARY ECONOMIC ANALYSIS

A preliminary economic analysis was conducted on the Velikhovskoe South resource. Only the magnetite resource was included in the study, martite resources were treated as waste. A pit optimisation was conducted and this was scheduled at 5, 10 and 20 Mtpa resource material production rates.

## 6.1 Brief

The Client requested a Preliminary Economic Assessment to be conducted on a first pass pit optimisation using prices, mining and processing costs agreed with the client.

## 6.2 Magnetite grade and concentrate Fe grade

Sampling results from the resource drilling have only provided $Fe_{tot}$ and $TiO_2$ from the core pulps. No testing of drill core was undertaken to provide magnetite recovery from the core so weight recovery of magnetite was estimated using functions developed during previous drilling campaigns. As no recovery of magnetite was undertaken, there is no assay determination of Fe or contaminants in the magnetite concentrate so again this value was estimated from previous test work.

### 6.2.1 Magnetite weight recovery estimation from Fe grade

Previous work reported in the Velikhovskoye GKZ report 2005 (p 52 paragraph I.3.4) reported the following relationship between $Fe_{tot}$ and magnetite Fe;

%Fe in Magnetite = %$Fe_{tot}$ -3.1

From this relationship, SRK has estimated the percent magnetite (DTR grade) for each block using the following formula;

%DTR = (%$Fe_{tot}$ -3.1)/0.723 (the % mass of Fe in pure magnetite is 72.3%).

The GKZ report of 2005 specifies average $Fe_{tot}$ grade for magnetite ores to 19.69% while the recent SRK resource estimate is 20.2% which is a 2-3% improvement. By using the same factor 3.1 as in the previous study, it is assumed by SRK that the portion of magnetite in the resource has remained the same.

Using the Fe to magnetite relationship, the resource prior to the current drilling campaign was estimated to have an average weight recovery of magnetite (DTR) of 22.9%. Using the new resource grade the average weight recovery of magnetite is estimated at 23.7%.

Other major sources of Fe in the deposit that are listed in the reports are hematite, pyroxene, ilmenite and iron sulphides. These represent the source of the 3.1% of Fe not contained in magnetite.

### 6.2.2 Concentrate Fe grade estimation

Two analysis of magnetite recovery have been carried out in the past. These have been reported in Geological Exploration Work report dated 2008, written by “Alaigyr” LLP, section number 2.4.1, in Russian (4.2.1 Результаты технологических исследований).

Based on this report, there were two grind sizes tested for Velikhovskoe:

- -0.071mm (71 micron) magnetite concentrate with Fe 61.3% and Magnetic Separation Recovery of saleable magnetite 20.95%.

- -0.044mm (44 micron) magnetite concentrate with Fe 62-63% and Magnetic Separation Recovery of saleable magnetite 22-23%.

From this data, SRK assumes that the concentrator is capable of producing concentrate grading 62% Fe from the Velihovskoe magnetite ore.

## 6.3 Economic Analysis

A preliminary economic assessment has been performed using the Micromine pit optimiser software to calculate an optimum pit shape. The resource inside this shape has then been scheduled and a discounted cash flow analysis of the project calculated using estimated capital costs.

The economic evaluation was done by estimating the total amount of magnetite recovered from the resource blocks using the (%Fe – 3.1)/0.723 function. From the estimated magnetite grade, a total magnetite production tonnage inside the optimal pit was calculated. From this %Fe content, a sale price has been estimated for the fines. This price was derived from the China Import Iron Ore Fines 62% Fe.

### 6.3.1 Operating costs

Operating costs developed by SRK for mining and processing operations were adjusted by the Client and final operating costs agreed between SRK and the Client. Rail freight to a steel mill was estimated using a rail distance from Velihovskoe to Magnitogorsk of 500 km, the nearest blast furnace, representing a minimum freight cost.

**Table 6-1: Operating costs**

| Activity | Operating cost USD | Unit | Notes |
|---|---|---|---|
| Ore mining | 3.50 | Per tonne mined | Contractor |
| Waste mining | 3.50 | Per tonne mined | Contractor |
| Crushing & Processing | 5.00 | Per tonne ore | |
| Management & Overheads | 1.50 | Per tonne ore | |
| Fixed annual costs | 3,000,000 | Total annual | |
| Rail freight | 20.00 | Per tonne concentrate | Magnitogorsk |
| Production tax | | 2.8% Per tonne concentrate | |
| Working capital | 91,000,000 | 25% operating costs | |

**Table 6-2: Material parameters**

| Parameter | Value | Unit |
|---|---|---|
| Ore density | 3.26 | t/m³ average |
| Ore grade | 19% Fe 23.7% DTR | Per tonne mined |
| Waste density | 3.0 | t/m³ |
| Concentrator recovery | 96% | |
| Dilution | 2% @ 0.0 DTR | |
| Conc recovered | 0.207 | Tonnes conc per tonne ore |

### 6.3.2 Pit Optimisation

The optimum pit depth occurs when further incremental deepening of the pit does not produce any profit from the ore mined. In this situation, the cost of deepening the mine by one metre is matched by the revenue from the ore gained in the extra metre of depth. The Micromine pit optimisation software was used to calculate the optimum pit outline from the resource block model. Pit slopes were set to 45º for all walls. As the block model has no waste modelling, a single waste type with an SG of 3.00 was used for optimisation.

**Table 6-3: Summary of resource recovered from the optimal pit**

| | | |
|---|---|---|
| Total pit volume | 267,537,976 | m³ |
| Total resource | 372,215,351 | tonnes |
| DTR recovered resource | 22.86% | % magnetite |
| Total waste | 460,361,145 | tonnes |
| Total magnetite recovered | 85,103,910 | tonnes |
| Waste : Ore ratio | 1.24 : 1 | |
| Total tails (estimated) | 287,111,441 | tonnes |

**Table 6-4: Resource contained in optimal pit shell**

| | %DTR | | | | |
|---|---|---|---|---|---|
| | From | To | Tonnes | SG | Avg %DTR |
| WF Resource* | 17 | 65 | 369,946,234 | 3.3 | 23.9 |
| WF Resource | 16 | 17 | 1,235,514 | 3.3 | 16.6 |
| WF Resource | 15 | 16 | 822,250 | 3.3 | 15.6 |
| WF Resource | 14 | 15 | 171,554 | 3.3 | 14.7 |
| WF Resource | 13 | 14 | 37,842 | 3.3 | 13.2 |
| WF Resource | 12 | 13 | 1,956 | 3.3 | 12.6 |
| **Total Resource** | | | **372,215,351** | **3.3** | **23.8** |
| **Total Waste** | | | **460,361,145** | **3.0** | |
| **Total Resource + Waste** | | | **832,576,496** | | |

*Wire frame resource

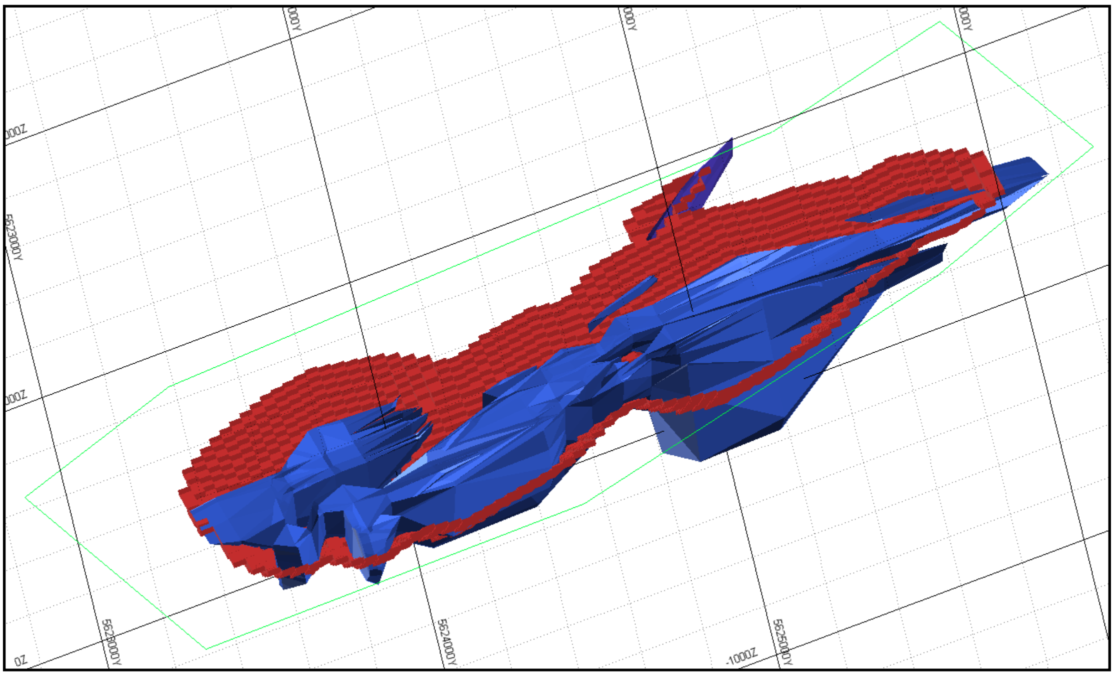


**Figure 6-1: Optimal pit shell (RED) and resource wireframe (BLUE)**

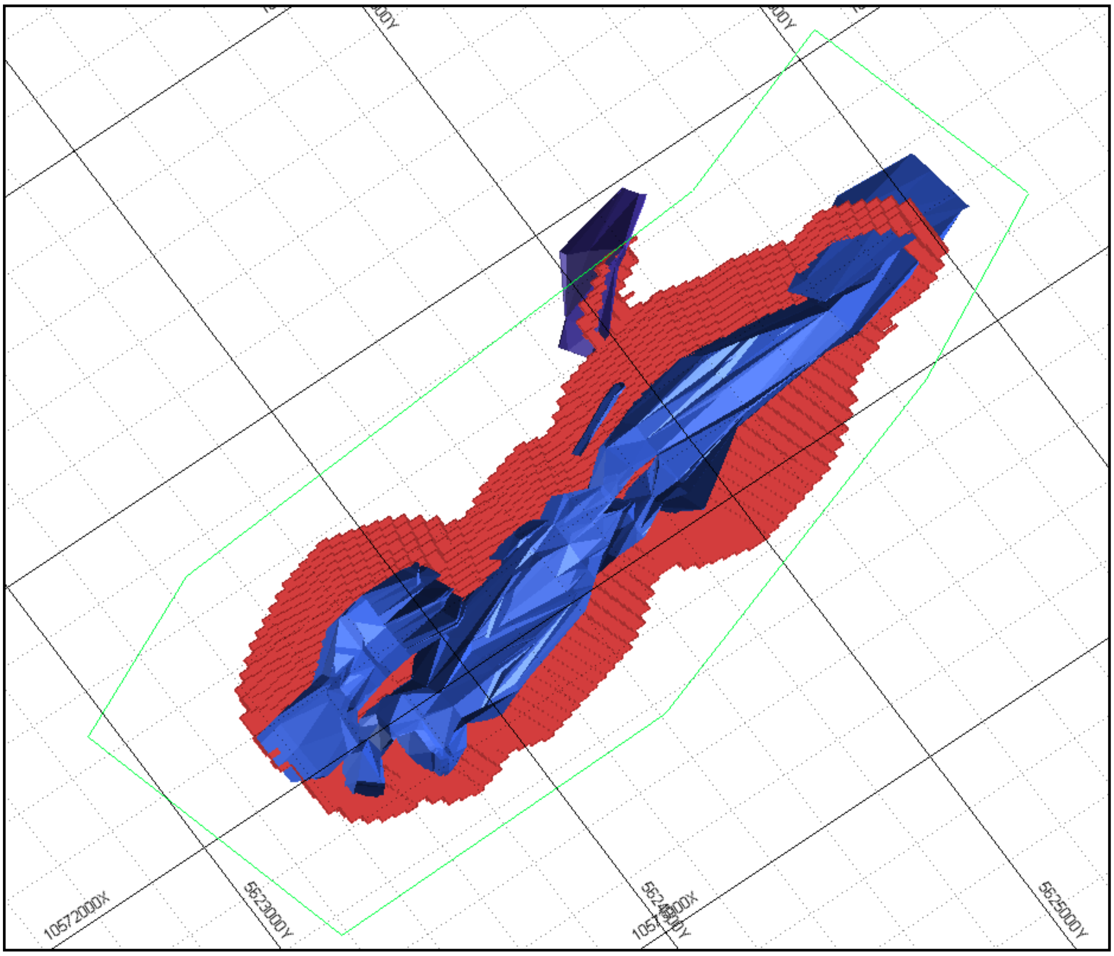



**Figure 6-2: Optimal pit inside license boundary**

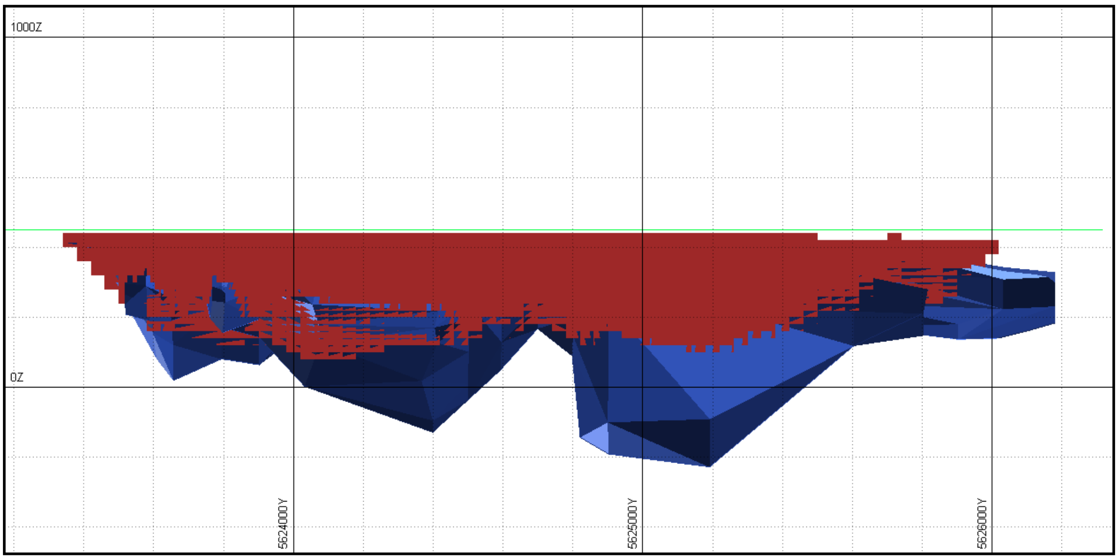



**Figure 6-3: Long section of optimal pit**

### 6.3.3 Mining Schedule

All analysis has been done on the material inside the Micromine optimum pit outline. No pit design was drafted and no detailed scheduling was carried out. The W:O ratio was assumed constant over the whole mine life. The simple financial model used has the ability to weight stripping to early or late in the project, but for this analysis the average life of mine waste to ore ratio was used. The mining license conditions specify a 5 Mtpa processing capacity and the concentrator capital cost provided by the client is for a 5 Mtpa capacity plant. At 5 Mtpa and an optimal pit resource of 372 Mt, this gives a mine life of 74 years. Increasing the processing rate above 5 Mtpa increased the net present value (NPV) of the project. Table 6-5 shows the NPV for 5, 10 and 20 Mtpa production rates.

**Table 6-5: NPV for increasing production rates**

| Parameter | Units | Option 1 | Option 2 | Option 3 |
|---|---|---|---|---|
| In pit resource | (Mt) | 375 | 375 | 375 |
| Mining Production Rate | (Mtpa) | 5 | 10 | 20 |
| Concentrate production | (Mtpa) | 1.075 | 2.150 | 4.300 |
| LoM (ore production) | (years) | 75 | 38 | 19 |
| **NPV** | **(USDm)** | **103** | **290** | **560** |
| **WACC** | **(%)** | **10%** | **10%** | **10%** |
| **IRR** | **(%)** | **15%** | **20%** | **26%** |

At the simple level of analysis used in the model, it is clear that increasing the production rate will increase the project NPV. As the model assumes contract mining the increasing capital cost of the mining fleet with increased production rate is not included in the NPV calculation, thus favouring increasing production rates. A more detailed study is required to determine the most profitable production rate.

### 6.3.4 Capital costs

Capital costs were developed by SRK for mining and processing operations, these were adjusted by the customer and final capital costs agreed between SRK and the customer. SRK has assumed mining is carried out by a contractor and there is no capital costs included for mining equipment. Other capital costs are shown in Table 6-6.

**Table 6-6: Project capital costs**

| Capital Item | Amount USD | Notes |
|---|---|---|
| Additional resource drilling | 584,000 | 4.5 km @ USD127/m |
| Rail link | 27,000,000 | USD675,000/km |
| Power link | 14,000,000 | USD260,000/km + USD4M. is substation 110/10kV |
| Water | 9,510,000 | USD290 000 per 1 km of waterpipe and 4mln. of artificial water reservoir |
| Concentrator 5Mtpa feed | 151,076,000 | Provided by Client |
| Concentrator 10Mtpa feed | 264,383,000 | Estimated by SRK |
| Concentrator 20Mtpa feed | 400,000,000 | Estimated by SRK |
| Tails dam | 36,574,000 | USD0.18/$m^3$ using tails SG of 1.45 t/$m^3$ |
| Contingency | | 2% of capital |
| Feasibility studies | | 5% of capital |
| Sustaining capital | 10,000,000 | Annual sustaining capital calculated as 10% of concentrator operating cost. |

EPCM costs are included in the concentrator capital. SRK considers the 2% contingency applied at this exploratory stage of the project to be too small and would recommend at least 30%.

### 6.3.5 Product sales

The economic model assumed that the concentrate would be shipped to Magnitogorsk as advised by the Client. As the resource contains titanium and vanadium, the steel mill at Magnitogorsk may not be capable of processing the concentrate. The Nizhny Tagil and Chusovoy metallurgical plants in the Russia are the closest plants with a known capability for processing high titanium and vanadium concentrates. The Nizhny Tagil plant is the closest to Velihovskoe at approximately 1,000 km rail distance. No sale pricing has been determined for Ti - V concentrates, the price used in the model is a Fe fines price as detailed in section 4.3. Figure 6.4 shows the 62% Fe spot price, (CFR Tianjin Port) for the period January 2000 to March 2012. The model uses a life of project price of USD140/t concentrate.

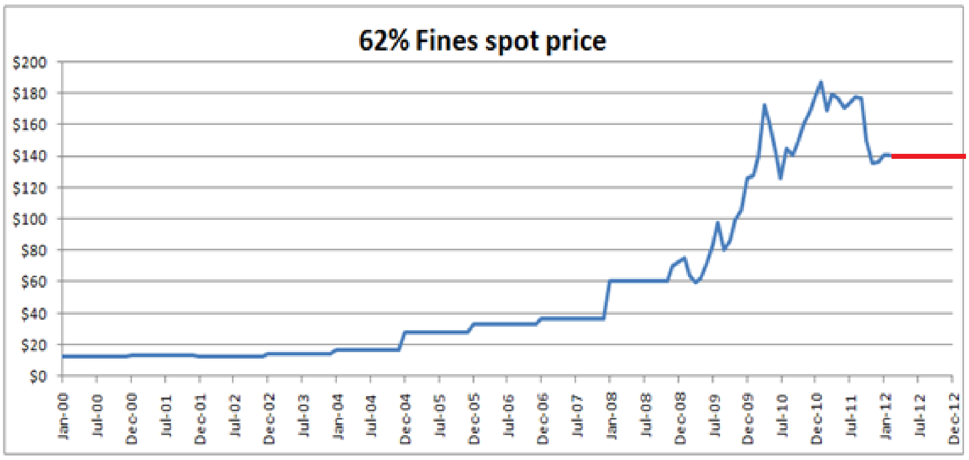



**Figure 6-4: 62% FE Fines spot price, CPR Tianjin Port**

### 6.3.6 Economic Model

The model calculated NPV from the project cashflow over the life of the project. Taxation and depreciation rates are as per the Kazakhstan tax code in force at the time of authoring. Total capital in the model is shown in Table 6-7 for each production rate.

**Table 6-7: Total preproduction capital**

| Production case | Preproduction Capital USD | Working capital USD | Annual sustaining capital USD |
|---|---|---|---|
| 5 Mtpa | 255,811,000 | 22,800,000 | 2,500,000 |
| 10 Mtpa | 377,082,000 | 45,500,000 | 5,000,000 |
| 20 Mtpa | 522,192,000 | 91,000,000 | 10,000,000 |

The same mining cost was used over the whole life of mine. Although haulage cost would increase with depth of the mine, the reduced waste haulage at the deeper parts of the mine would act to offset this increase. A more detailed mine schedule and operating cost model should be developed for future evaluations.

### 6.3.7 Economic Analysis

The simple economic analysis has demonstrated that a 5 Mtpa production rate is sub optimal. The NPV increases with increasing production but due to the simplicity of the capital and operating costs used in the model it cannot be used to derive the optimal production rate. The level of accuracy of the costs used in the model is ±30%. The costs used are order of magnitude only and derived from similar sized operations and are not calculated with conditions at Velikhovskoe taken into account.

Table 6-8 shows a summary of the results for the three production cases.

**Table 6-8: Summary Analysis Production Cases**

| Case | 5 Mtpa | 10 Mtpa | 20 Mtpa | Units |
|---|---|---|---|---|
| NPV | 103 | 290 | 560 | USD millions |
| WACC | 10.0% | 10.0% | 10.0% | |
| IRR | 15.4% | 20.4% | 26.0% | |

| | | | | |
|---|---|---|---|---|
| Average conc price | 140 | 140 | 140 | USD/tonne |
| Production life | 75 | 38 | 19 | Years |
| Operating cost | 18.87 | 18.63 | 18.60 | USD/tonne ore |
| Revenue per tonne ore | 30.10 | 30.10 | 30.10 | USD/tonne ore |
| Operating cost | 87.76 | 86.66 | 86.52 | USD/tonne conc |

## 6.4 Recommendations

Any further drilling conducted on the deposit must include analysis of magnetite recovery from drill core using the Davis Tube Recovery (DTR) technique. The recovered magnetite then must be analysed for Fe and the complete set of steel making trace elements and contaminants.

Prior to undertaking DTR assaying, there must be metallurgical sampling to estimate the most suitable grind size for the project, this grind size once determined will be replicated in all DTR testing.

As the concentrate is a high Ti-V concentrate, there needs to be market research undertaken into the price and potential customer base. Once this is known, the need for a pelletising plant can be evaluated with reference to potential customer needs. This will also provide information on the customers trace element limits to assist with specification of product quality targets for the concentrator process design. The freight costs will also need to be updated to reflect the customer location.

The DTR grades and trace elements need to be modelled so that production scheduling can report on contaminants as well as Fe, Ti and V.

Mineralised material outside the wireframe needs to be modelled as the higher grade mineralisation outside the wireframe may be profitable to process at the end of the mine life if stockpiled into low grade waste dumps.

Waste modelling needs to be included in the block model. Rock types and SG need to be modelled as a minimum, but there should also be analysis of the potential for acid producing and acid neutralising rock types in the waste.

# 7 CONCLUSIONS AND RECOMMENDATIONS

## 7.1 Conclusions

SRK has been requested to undertake a Mineral Resource Estimate ("MRE") for the Velikhovskoe Southern project in accordance with the JORC Code, 2004 Edition ("JORC").

The project territory within the license is relatively well understood. The Velikhovskoe Southern project is located in favourable regional geological conditions and demonstrates all key geomorphological features and rock types, favourable for iron mineralisation deposit formation. Geology and mineralization control, geology and Fe grades continuity are well-understood basing on exploration results.

Obtaining the 2011 exploration campaign data was accompanied by implementation of corresponding QAQC procedures in place, and the data quality can be considered acceptable for an MRE and reporting the Indicated and Inferred Resources in accordance with the JORC Code.

SRK has constructed a 3D wireframe geological/mineralisation model for the Velikhovskoe Southern deposit martite and magnetite, which is based upon all the drilling results.

SRK has undertaken a detailed statistical and geostatistical study of the coded sample data which has validated the geological model appropriateness and which has confirmed the grade continuity to be good within the model domains.

SRK has used Ordinary Kriging to interpolate grades into the block model, and has assessed the estimation quality and fully validated the model. This validation has confirmed the robustness of the parameters used and the resultant model.

Estimation of the deposit Indicated and Inferred Mineral Resources within the block model was carried out in accordance with the JORC Code and at cut-off grades reflecting reasonable prospect for eventual economic extraction. The Resources categorization by SRK was mainly based on sample spacing, but also quality and amount of data, geological knowledge, geology and grades continuity, geostatistical data and calculation quality was taken into consideration.

A preliminary economic assessment was carried out using capital and operating costs agreed with the client. An optimal pit shell was generated using the operating costs and 45° pit slopes. The ore and waste inside this shell was scheduled and a NPV calculation was done on the life of mine cashflows. The results were a positive NPV for 5, 10 and 20 Mtpa productions rates.

## 7.2 Recommendations

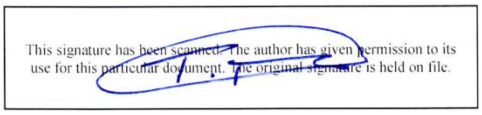
The Preliminary Economic Assessment shows that a positive NPV is attainable at the 20 Mtpa production rate. If the Company wishes to continue with the development of this project, SRK recommends that a Scoping Study is undertaken. In this study, in addition to the normal study areas for a report of this nature, work should be undertaken in the following important areas:

- All further drilling conducted on the deposit must include analysis of magnetite recovery from drill core using the Davis Tube Recovery (DTR) technique. The recovered magnetite then must be analysed for Fe and the complete set of steel making trace elements and contaminants.

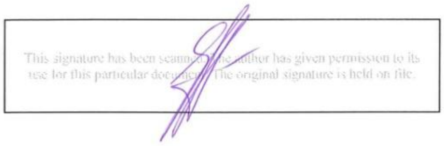
- Prior to undertaking DTR assaying, there must be a programme of metallurgical sampling and testing to determine the most suitable grind size for the project. Once determined, the grind size should be replicated in all DTR testing.
- An assessment of the suitability of the coarse reject material from the 2011 drilling campaign should be made to determine its suitability for grind size analysis, DTR analysis and metallurgical testing. The sampling of this material would significantly increase the available data and should be carried out prior to any additional drilling.
- The coarse reject material from the 2011 drilling should also be sampled for vanadium grades.
- As the product is a high Ti/V concentrate there is a need for a market research study into the price and potential customer base for the final product. This study should also include investigation into the financial and marketing potential for producing a pellet from the concentrate.
- The DTR grades and trace elements need to be modelled so that production scheduling can report on contaminants as well as Fe, Ti and V.
- Mineralised material outside the wireframe needs to be modelled as the higher grade mineralisation outside the wireframe may be profitable to process at the end of the mine life if stockpiled into low grade waste dumps.
- Waste modelling needs to be included in the block model.
- A detailed topographical survey to accurately locate all the drilling data should be carried out over the drilled areas. This will further enhance the accuracy of the present Digital Terrain Model (DTM) and will be required for further project development.
- Replacing the previously-used standard Certified Reference Materials (CRM) GIOP-34 with more applicable CRM (standards) which should match the expected grades in the deposit mineralisation and be of similar mineralisation type, colour and mineral composition.
- If the initial DTR and marketing studies are positive, then an infill campaign of drilling over selected areas of the deposit (principally between lines 4400 and 4700) could be carried out to determine whether the grade variability is of a suitable level to allow the categorisation of Measured Mineral Resources. SRK would recommend a maximum spacing of 50 m along strike in order to determine possible Measured Resources, however, it should be made clear that drill spacing alone does not allow a Measured category to be applied to individual blocks of ground.
- The need for geotechnical and hydrological drilling and testing needs to be assessed as part of the next phase of work, especially given the water problems encountered in the early stages of drilling during the 2011 campaign.
- Any future drilling and testwork should be concentrated in the areas of the conceptual pits derived from this current phase of work.

As part of a future Scoping Study, a preliminary Environmental and Social Impact Assessment should be undertaken to identify any sensitive receptors or related issues that could constrain project development.

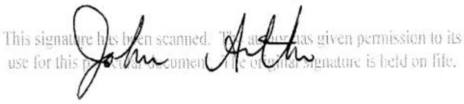
**For and on behalf of SRK Consulting (Kazakhstan) Limited**



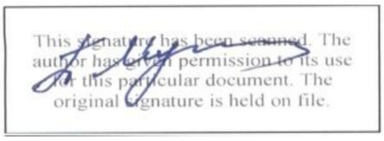

A Thornton
Director
SRK Consulting (Kazakhstan) Limited




N Yenshin
Project Manager
SRK Consulting (Kazakhstan) Limited




Dr John Arthur
Principal Consultant (Resource Geology)
SRK Consulting (UK) Limited




Dr Pavel Mukhin
Principal Consultant (Geology)
SRK Consulting (Kazakhstan) Limited

# APPENDICES

# APPENDIX A: HOLE LOGGING SHEET

# Appendix A-1: Hole logging sheet

**Месторождение Велиховское Южное**

**Velihovskoe South Iron Project**

## Журнал документации скважины

Logging Sheet

| | | | |
|---|---|---|---|
| **Линия №** | **7** | | |
| | Borehole line | | |
| **Скважина №** | **1121** | | |
| | Borehole ID | | |
| **Назначение** | разведочная | | |
| | Target | | |
| **Буровой агрегат №** | ПБУ 300/45-17 | | |
| | Drill rig number | | |
| **Бурение начато** | 10.09.2011 | **закончено** | 19.09.2011 |
| | Drilling started | | Drilling completed |

DRILL HOLE DETAILS

| | | | |
|---|---|---|---|
| **Координаты, м** | **X** | 10572080,0 | |
| Location | | Easting | |
| | **Y** | 5624404,7 | |
| | | Northing | |
| **Высота устья, м** | | 428,5 | |
| | | Elevation | |
| **Глубина, м** | | 300,0 | |
| | | Hole length | |

**Конструкция скважины**
DRILLING INFORMATION

| | | **от / from** | **до / to** |
|---|---|---|---|
| **Тип бурения / Drilling type** | | | |
| колонковое | | 0,0 | 300,0 |

**Обсадка / Casing**

| **Тип** | **Диаметр** | | |
|---|---|---|---|
| | 108 | 0,0 | 3,0 |
| HQ | 89 | 3,0 | 21,2 |

**Тип и диаметр коронки / Dril bit size, mm**

| **Тип** | **Внут.** | **Внеш.** | | |
|---|---|---|---|---|
| Победит | 108 | 112 | 0,0 | 3,0 |
| Алмаз | 89 | 93 | 3,0 | 21,2 |
| | 70 | 76 | 21,2 | 300,0 |

**Тип опробования / Sampling type**

| | | |
|---|---|---|
| керновое | 0 | 300 |

**Примечания / Notes**

**Инклинометрия / Directional survey**

**Прибор** Кит - А
Divice

| **Замер №** Meas. # | **Глубина** Depth, m | **Угол** Dip | **Азимут** Azimuth | **Примечание** Note |
|---|---|---|---|---|
| 1 | 20 | 88,0 | 90 | |
| 2 | 40 | 88,0 | 90 | |
| 3 | 60 | 88,5 | 90 | |
| 4 | 80 | 88,0 | 90 | |
| 5 | 100 | 88,1 | 90 | |
| 6 | 120 | 88,5 | 90 | |
| 7 | 140 | 88,0 | 90 | |
| 8 | 160 | 87,5 | 90 | |
| 9 | 180 | 87,0 | 90 | |
| 10 | 200 | 87,5 | 90 | |
| 11 | 220 | 88,0 | 90 | |
| 12 | 240 | 87,5 | 90 | |
| 13 | 260 | 88,0 | 90 | |
| 14 | 280 | 88,0 | 90 | |
| 15 | 300 | 87,0 | 90 | |

**Обработка данных**
DEVELOPMENT DATA COLLECTED

| | **Исполнитель** Completed by | **Дата** Date | **Ввод данных** INPUT BY | **Дата ввода** Input date | **Проверил** Verified by | **Дата проверки** VER. DATE |
|---|---|---|---|---|---|---|
| **Каратаж** Geophis. Logging | Корнев В. | 19.09.2011 | Темиргалиев А. | 20.09.2011 | Мамбетов Б. О. | 20.09.2011 |
| **Геотехника** Geotech Log | Бекетов А. | 19.09.2011 | Темиргалиев А. | 20.09.2011 | Мамбетов Б. О. | 20.09.2011 |
| **Фото геотехнич.** Geotech. photos | Есадилова К. | 19.09.2011 | Темиргалиев А. | 20.09.2011 | Мамбетов Б. О. | 20.09.2011 |
| **Геология** Geol Log | Бекетов А. | 20.09.2011 | Темиргалиев А. | 20.09.2011 | Мамбетов Б. О. | 20.09.2011 |
| **Фото геологич.** Geology photos | Ангам Д. | 19.09.2011 | Темиргалиев А. | 20.09.2011 | Мамбетов Б. О. | 20.09.2011 |
| **Изм. плотности** Density samp | Ангам Д. | 20.09.2011 | Темиргалиев А. | 20.09.2011 | Мамбетов Б. О. | 20.09.2011 |
| **Геотех. образцы** Geotech sampl | Есадилова К. | 19.09.2011 | Темиргалиев А. | 20.09.2011 | Мамбетов Б. О. | 20.09.2011 |
| **Привязка** Survey | Оспанов Б. | 19.09.2011 | Темиргалиев А. | 20.09.2011 | Оспанов Б. | 20.09.2011 |

**Великовское Южное. Скважина / Borehole 1121**

srk exploration

## Геотехническая документация, лист 1 из 6

Geotechnical logging

**Документатор / Logger** Бекетов А.

| Буровой рейс, м / Drilling Run, m: от / from | до / to | длина / length | TCR - выход керна, м | TCR - выход керна, % | Литология Lithology | Геотехнический интервал, м / LOGGING INTERVAL: от / from | до / to | длина / length | Выход и качество керна / Recovery & quality: TCR - выход керна, м | SCR - выход целого керна, м | RQD - выход керна >10см, м | Открытые трещины / OPEN JOINTS: Число на интервал / Count per interval: Jr1 (0-30°) | Jr2 (30-60°) | Jr3 (60-90°) | Форма Shape | Шероховатость Roughness | Качество стенок Wall Alt. | Заполнение Joint Infill | Залеченные трещины / CEMENTED: Число / Count | Прочность Strength | Тип цемента Cement type | Частота микропрожилков Microdefect Density | Прочность пород / Intact rock strength: IRS strong - ненарушенные | IRS weak - ослабленные | Выветривание Weathering | Примечания Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0,0 | 1,0 | 1,0 | 1,0 | 100 | | 0,0 | 1,2 | 1,2 | 1,2 | 1,2 | 0,0 | | | | | 5 | | | | | | | | S1 | W6 | По глинистым отлажениям нет трещин |
| 1,0 | 2,0 | 1,0 | 1,0 | 100 | CW2 | 1,2 | 2,6 | 1,4 | 1,4 | 1,4 | 0,0 | | | | | 5 | | | | | | | | S1 | W6 | |
| 2,0 | 3,0 | 1,0 | 1,0 | 100 | CW2 | 2,6 | 11,6 | 9,0 | 9,0 | 8,5 | 0,5 | | | | | 5 | | | | | | | | S1 | W6 | |
| 3,0 | 4,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 4,0 | 5,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 5,0 | 6,00 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 6,0 | 7,0 | 1,0 | 1,0 | 100 | | | | | | | | | | | | | | | | | | | | | | |
| 7,0 | 8,0 | 1,0 | 1,0 | 100 | | | | | | | | | | | | | | | | | | | | | | |
| 8,0 | 9,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 9,0 | 10,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 10,0 | 11,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 11,0 | 12,0 | 1,0 | 0,95 | 95 | CW2 | 11,6 | 17,1 | 5,5 | 5,5 | 5,0 | 0,5 | | | | | 5 | | | | | | | | S1 | W6 | |
| 12,0 | 13,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 13,0 | 14,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 14,0 | 15,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 15,0 | 16,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 16,0 | 17,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 17,0 | 18,0 | 1,0 | 0,95 | 95 | CW3 | 17,1 | 21,2 | 4,1 | 4,1 | 3,0 | 1,1 | | | | | 5 | | 2 | | 0 | C | 1 | R5 | | W5 | |
| 18,0 | 19,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 19,0 | 20,0 | 1,0 | 0,95 | 95 | | | | | | | | | | | | | | | | | | | | | | |
| 20,0 | 21,2 | 1,2 | 1,15 | 96 | | | | | | | | | | | | | | | | | | | | | | |

**Крупные структуры / Lagre scale structures**

| от / from | до / to | Интер-вал, м | ТИП / Type | Описание / Description |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Примечания / Notes**

**Великовское Южное. Скважина / Borehole 1121**

srk exploration

## Выход керна и геологическая документация, лист 1 из 4

CORE RECOVERY AND GEOLOGICAL LOG

**Документатор / Logger** Бекетов А. **Дата / Date** 12.09.2011

| Рейс, м / Drilling Run, m: от from | до to | длина / length | TCR - выход керна, м | Геологический интервал / Geological interval: от from | до to | длина / length | Коды / Codes: Порода Litology | Тип руды Ore Type | Магнетит Magnetite, % | Пирит/ Pyrite, % | Халькопирит Chalcopyrite, % | Зарисовка / GRAPHIC LOG: Глубина, м Depth | Литология Litology | Краткое описание, примечания, образцы, фото / Short description, notes, specimens, photos |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0,0 | 1,0 | 1,0 | 1,0 | 0,0 | 1,2 | 1,2 | | | | | | | | Почвенно-растительный слой. Супесь темно-коричневого цвета |
| 1,0 | 2,0 | 1,0 | 1,0 | 1,2 | 2,6 | 1,4 | CW2 | RR | <5 | <0,1 | | 1,2 | | Глинистая кора выветривание коричневато-зеленого цвета |
| 2,0 | 3,0 | 1,0 | 1,0 | 2,6 | 11,6 | 9,0 | CW2 | RR | <5 | <0,1 | | 2,6 | | Глинистая кора выветривание коричневато-зеленого цвета |
| 3,0 | 4,0 | 1,0 | 0,95 | | | | | | | | | | | Глинистая кора выветривание, желтовато-зеленого цвета, местами белесоватого цвета. |
| 4,0 | 5,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 5,0 | 6,00 | 1,0 | 0,95 | | | | | | | | | | | |
| 6,0 | 7,0 | 1,0 | 1,0 | | | | | | | | | | | |
| 7,0 | 8,0 | 1,0 | 1,0 | | | | | | | | | | | |
| 8,0 | 9,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 9,0 | 10,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 10,0 | 11,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 11,0 | 12,0 | 1,0 | 0,95 | 11,6 | 17,1 | 5,5 | CW2 | RR | <5 | <0,1 | | 11,6 | | |
| 12,0 | 13,0 | 1,0 | 0,95 | | | | | | | | | | | Глинистая кора выветривание, желтовато –коричневого, слабо коричневатого-бурого цвета, рыхлые. |
| 13,0 | 14,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 14,0 | 15,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 15,0 | 16,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 16,0 | 17,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 17,0 | 18,0 | 1,0 | 0,95 | 17,1 | 21,2 | 4,1 | CW3 | RR | <5 | <0,1 | | 17,1 | | |
| 18,0 | 19,0 | 1,0 | 0,95 | | | | | | | | | | | Сильно выветрили плагиопироксениты,рыхлые сильно трещиноватые, местами раздробленные до щебнистого состояний. |
| 19,0 | 20,0 | 1,0 | 0,95 | | | | | | | | | | | |
| 20,0 | 21,2 | 1,2 | 1,15 | | | | | | | | | | | |
| 21,2 | 22,5 | 1,3 | 1,25 | 21,2 | 72,0 | 50,8 | PP | 0 | 5 | <0,1 | | 21,2 | | |
| 22,5 | 25,5 | 3,0 | 2,95 | | | | | | | | | | | Плагиопироксенит светло-серого, серого цвета. Сильно трещиноваты. Мелко-среднезернистая. Порода, раздробленная до щебнистого материала. Слабо содержит магнетит. |
| 25,5 | 28,5 | 3,0 | 2,95 | | | | | | | | | | | |
| 28,5 | 31,5 | 3,0 | 2,95 | | | | | | | | | | | |
| 31,5 | 34,5 | 3,0 | 2,95 | | | | | | | | | | | |
| 34,5 | 37,5 | 3,0 | 2,95 | | | | | | | | | | | |
| 37,5 | 40,5 | 3,0 | 2,95 | | | | | | | | | | | |
| 40,5 | 43,5 | 3,0 | 2,95 | | | | | | | | | | | |

**Велиховское Южное. Скважина / Borehole 1121**

srk exploration

**Образцы, лист 1 из 10**

Specimens

**Образцы на геофизические исследования**

Specimens for geophisical study

| № образца | Тип образца | Глубина | Порода | Минерали-зация | Удельный вес | Сухой объём. вес | Магнит. Восприимч-ть |
|---|---|---|---|---|---|---|---|
| Specimen ID | Spec. type | Depth (m) | LITHOLOGY | Mineralisation | Specific Gravity | Dry Bulk Density | Magnetic Susceptibility |
| 21001 | керн10,5 | 1,7 | Глин.кора выв. | | 1,81 | 1270 | |
| 21002 | 12,0 | 4,1 | Глин.кора выв. | | 1,78 | 660 | |
| 21003 | 14,0 | 5,8 | Глин.кора выв. | | 1,77 | 640 | |
| 21004 | 11,0 | 8,1 | Глин.кора выв. | | 1,89 | 530 | |
| 21005 | 11,0 | 10,4 | Глин.кора выв. | | 1,85 | 650 | |
| 21006 | 11,5 | 11,3 | Глин.кора выв. | | 1,90 | 760 | |
| 21007 | 12,0 | 13,3 | Глин.кора выв. | | 1,89 | 740 | |
| 21008 | 12,0 | 15,4 | Глин.кора выв. | | 2,59 | 700 | |
| 21009 | 13,5 | 17,1 | Глин.кора выв. | | 2,18 | 830 | |
| 21010 | 11,0 | 19,0 | плагиопир. выв. | | 2,60 | 1070 | |
| 21011 | 11,0 | 20,1 | плагиопир. выв. | | 3,11 | 1090 | |
| 21012 | 14,5 | 22,7 | плагиопирокс. | | 2,76 | 720 | |
| 21013 | 16,0 | 23,3 | плагиопирокс. | | 2,86 | 1030 | |
| 21014 | 12,0 | 27,1 | плагиопирокс. | | 2,79 | 670 | |
| 21015 | 16,5 | 28,0 | плагиопирокс. | | 2,96 | 920 | |
| 21016 | 20,5 | 30,3 | плагиопирокс. | | 2,84 | 1080 | |

**Образы на геотехнические исследования**

GEOTECHNICAL SAMPLING

| № образца | Тип образца | Глубина | Порода | ТИП SX | Примечания |
|---|---|---|---|---|---|
| Specimen ID | Spec. type | DEPTH (m) | LITHOLOGY | SX type(S) | Notes |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Образцы на минералого-петрографические иследования**

Petrographical sampling

| № образца | Тип образца | Глубина | Порода | Минерали-зация | Примечания |
|---|---|---|---|---|---|
| Specimen ID | Spec. type | Depth (m) | LITHOLOGY | Mineralisation | Notes |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Великовское Южное. Скважина / Borehole 1121

**Опробование, лист 1 из 3**

SAMPLE LOG

| Опробщик / sample taker | Есадилова К. | Дата / Date | 13.09.2011 |
|---|---|---|---|

| Номер пробы SAMPLE ID | Тип пробы Sample type | от from | до to | Длина, м Length | № заказа Batch ID | Примечания Notes |
|---|---|---|---|---|---|---|
| 21001 | керн. | 1,2 | 2,6 | 1,4 | 21-I | |
| 21002 | керн. | 2,6 | 4,6 | 2,0 | 21-I | |
| 21003 | керн. | 4,6 | 6,6 | 2,0 | 21-II | |
| 21004 | керн. | 6,6 | 8,6 | 2,0 | 21-II | |
| 21005 | керн. | 8,6 | 10,6 | 2,0 | 21-II | |
| 21006 | керн. | 10,6 | 11,6 | 1,0 | 21-II | |
| 21007 | керн. | 11,6 | 13,6 | 2,0 | 21-II | |
| 21008 | керн. | 13,6 | 15,6 | 2,0 | 21-II | |
| 21009 | керн. | 15,6 | 17,1 | 1,5 | 21-II | |
| 21010 | керн. | 17,1 | 19,1 | 2,0 | 21-II | |
| 21011 | керн. | 19,1 | 21,2 | 2,0 | 21-II | |
| 21012 | керн. | 21,2 | 23,2 | 2,0 | 21-II | |
| 21013 | керн. | 23,2 | 25,2 | 2,0 | 21-II | |
| 21014 | керн. | 25,2 | 27,2 | 2,0 | 21-II | |
| 21015 | керн. | 27,2 | 29,2 | 2,0 | 21-II | |
| 21016 | керн. | 29,2 | 31,2 | 2,0 | 21-II | |
| 21017 | керн. | 31,2 | 33,2 | 2,0 | 21-II | |
| 21018 | керн. | 33,2 | 35,2 | 2,0 | 21-II | |
| 21019 | керн. | 35,2 | 37,2 | 2,0 | 21-II | |
| 21020 | керн. | 37,2 | 39,2 | 2,0 | 21-II | |
| 21021 | керн. | 39,2 | 41,2 | 2,0 | 21-II | |
| 21022 | керн. | 41,2 | 43,2 | 2,0 | 21-II | |
| 21023 | керн. | 43,2 | 45,2 | 2,0 | 21-II | |
| 21024 | керн. | 45,2 | 47,2 | 2,0 | 21-II | |
| 21025 | керн. | 47,2 | 49,2 | 2,0 | 21-III | |
| 21026 | керн. | 49,2 | 51,2 | 2,0 | 21-III | |
| 21027 | керн. | 51,2 | 53,2 | 2,0 | 21-III | |
| 21028 | керн. | 53,2 | 55,2 | 2,0 | 21-III | |
| 21029 | керн. | 55,2 | 57,2 | 2,0 | 21-III | |
| 21030 | керн. | 57,2 | 59,2 | 2,0 | 21-III | |
| 21031 | керн. | 59,2 | 61,2 | 2,0 | 21-III | |
| 21032 | керн. | 61,2 | 63,2 | 2,0 | 21-III | |
| 21033 | керн. | 63,2 | 65,2 | 2,0 | 21-III | |
| 21034 | керн. | 65,2 | 67,2 | 2,0 | 21-III | |
| 21035 | керн. | 67,2 | 69,2 | 2,0 | 21-III | |
| 21036 | керн. | 69,2 | 70,5 | 1,3 | 21-III | |
| 21037 | керн. | 70,5 | 72,0 | 1,5 | 21-III | |
| 21038 | керн. | 72,0 | 74,0 | 2,0 | 21-III | |
| 21039 | керн. | 74,0 | 76,0 | 2,0 | 21-III | |
| 21040 | керн. | 76,0 | 78,0 | 2,0 | 21-III | |
| 21041 | керн. | 78,0 | 80,0 | 2,0 | 21-III | |
| 21042 | керн. | 80,0 | 82,0 | 2,0 | 21-III | |
| 21043 | керн. | 82,0 | 84,0 | 2,0 | 21-III | |
| 21044 | керн. | 84,0 | 86,0 | 2,0 | 21-III | |
| 21045 | керн. | 86,0 | 88,0 | 2,0 | 21-III | |
| 21046 | керн. | 88,0 | 90,0 | 2,0 | 21-III | |
| 21047 | керн. | 90,0 | 92,0 | 2,0 | 21-IV | |
| 21048 | керн. | 92,0 | 94,0 | 2,0 | 21-IV | |
| 21049 | керн. | 94,0 | 96,0 | 2,0 | 21-IV | |
| 21050 | керн. | 96,0 | 98,0 | 2,0 | 21-IV | |
| 21051 | керн. | 98,0 | 100,0 | 2,0 | 21-IV | |
| 21052 | керн. | 100,0 | 102,0 | 2,0 | 21-IV | |
| 21053 | керн. | 102,0 | 104,0 | 2,0 | 21-IV | |
| 21054 | керн. | 104,0 | 106,0 | 2,0 | 21-IV | |

**Велиховское Южное. Скважина / Borehole 1121**

srk exploration

## Генерализованные интервалы, лист 1 из 3

SUMMARY GEOLOGICAL LOG

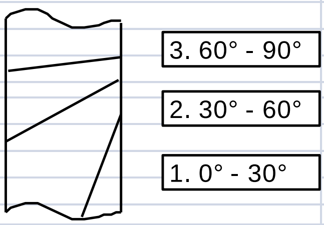
**Документатор / Logger** Есадилова К. **Дата / Date** 13.09.2011

| от from, m | до to, m | Код породы ROCK CODE | Код оруде-нения ORE CODE | Номера проб SAMPLE ID's | Описание / DESCRIPTION |
|---|---|---|---|---|---|
| 1,2 | 2,6 | CW2 | RR | 21001 | Глин. кора выветривание |
| 2,6 | 11,6 | CW2 | RR | 21002 | Глин. кора выветривание |
| | | | | 21003 | Глин. кора выветривание |
| | | | | 21004 | Глин. кора выветривание |
| | | | | 21005 | Глин. кора выветривание |
| | | | | 21006 | Глин. кора выветривание |
| 11,6 | 17,1 | CW2 | RR | 21007 | Глин. кора выветривание |
| | | | | 21008 | Глин. кора выветривание |
| | | | | 21009 | Глин. кора выветривание |
| 17,1 | 21,2 | CW3 | RR | 21010 | плагиопироксениты выветр. |
| | | | | 21011 | плагиопироксениты выветр. |
| 21,2 | 72,0 | PP | 0 | 21012 | плагиопироксенит |
| | | | | 21013 | плагиопироксенит |
| | | | | 21014 | плагиопироксенит |
| | | | | 21015 | плагиопироксенит |
| | | | | 21016 | плагиопироксенит |
| | | | | 21017 | плагиопироксенит |
| | | | | 21018 | плагиопироксенит |
| | | | | 21019 | плагиопироксенит |
| | | | | 21020 | плагиопироксенит |
| | | | | 21021 | плагиопироксенит |
| | | | | 21022 | плагиопироксенит |
| | | | | 21023 | плагиопироксенит |
| | | | | 21024 | плагиопироксенит |
| | | | | 21025 | плагиопироксенит |
| | | | | 21026 | плагиопироксенит |
| | | | | 21027 | плагиопироксенит |
| | | | | 21028 | плагиопироксенит |
| | | | | 21029 | плагиопироксенит |
| | | | | 21030 | плагиопироксенит |
| | | | | 21031 | плагиопироксенит |
| | | | | 21032 | плагиопироксенит |
| | | | | 21033 | плагиопироксенит |
| | | | | 21034 | плагиопироксенит |
| | | | | 21035 | плагиопироксенит |
| | | | | 21036 | плагиопироксенит |
| | | | | 21037 | плагиопироксенит |
| 72,0 | 113,0 | PP | 0 | 21038 | плагиопироксенит |
| | | | | 21039 | плагиопироксенит |
| | | | | 21040 | плагиопироксенит |
| | | | | 21041 | плагиопироксенит |
| | | | | 21042 | плагиопироксенит |
| | | | | 21043 | плагиопироксенит |
| | | | | 21044 | плагиопироксенит |
| | | | | 21045 | плагиопироксенит |
| | | | | 21046 | плагиопироксенит |
| | | | | 21047 | плагиопироксенит |
| | | | | 21048 | плагиопироксенит |
| | | | | 21049 | плагиопироксенит |
| | | | | 21050 | плагиопироксенит |
| | | | | 21051 | плагиопироксенит |

# Appendix A-2: Logging codes

| Порода | Code |
|---|---|
| Песок | SN |
| Глина | KL |
| КВ перемещенная | CW1 |
| КВ глинистая | CW2 |
| КВ глинисто-щебенистая | CW3 |
| Пироксенит | PR |
| Плагиопироксенит | PP |
| Диабаз, диорит | DB |
| Габбро | GB |
| Анартозит | AN |
| Песчаник, туфопесчаник(сланцы) | SS |
| Известняк | LM |
| Метасоматит (Mg <10%) | MS |
| Эксплозивные брекчии | BR |
| Кварцевая жила | QZ |
| Руда окисленная (окислы Fe >10%) | RO |
| Руда полуокисленная (окислы Fe >10%) | RH |
| Руда пятистая (Mg >10%) | R2 |
| Руда массивная (Mg >10%) | R3 |

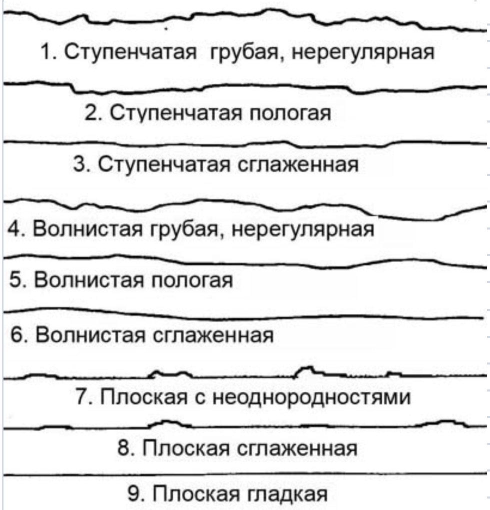
**Joint orientation**




**Joint shape**

| | |
|---|---|
| Wavy, multi-direction | 1 |
| Wavy – uni-direction | 2 |
| Curved | 3 |
| Slight Undulation | 4 |
| Straight | 5 |

**Roughness Profiles**




**Crushing (impossible to calculate joints)**

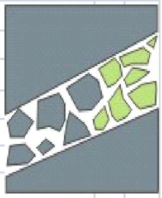
| | |
|---|---|
| Absent | 0 |
| Crushing (not cemented clusts) | DR |

**Joint Wall Softening**

| | |
|---|---|
| Absent | 0 |
| Presented | 1 |

**Joint Infill**

| | |
|---|---|
| Absent | 0 |
| Non Softening Coarse (>10) | 1 |
| Non Softening Medium (3-10) | 2 |
| Non Softening Fine (<3mm) | 3 |
| Soft Sheared Coarse | 4 |
| Soft Sheared Medium | 5 |
| Soft Sheared Fine | 6 |



**Cemented Joint Strength**

| | |
|---|---|
| More strong then rock | 0 |
| Same as the rock | 1 |
| More weak then rock | 2 |

**Minerals in cement**

*k* каолинит / kaolinite
*c* карбонат / carbonate
*l* лимонит / limonite
*q* кварц / quartz
*e* эпидот / epidote
*s* серицит / sericitex
*x* хлорит / chlorite
*ak* актинолит / actinolite
*ab* альбит / albite
*Mg* магнетит
*Cp* халькопирит / chalcopyrite
*Gl* галенит / galena
*Py* пирит / pyrite
*Sl* сульфиды / sulphide

**Microdefect Frequency**

| | |
|---|---|
| Absent | 0 |
| Minor (distances >1cm) | 1 |
| Moderate (1-10cm) | 2 |
| Heavy (<1cm) | 3 |

**Weathering**

| | |
|---|---|
| Fresh rock | 0 |
| Sligthly weathered | W |
| Moderately weathered | 3 |
| Highly weathered | W |
| Comletely weathered | W |
| Residual soil (clay crust of weatering) | W |

**Strength - IRS strong**

| | |
|---|---|
| Extremly weak | R6 |
| Very weak | R5 |
| Weack | R4 |
| Medium | R3 |
| Srtong | R2 |
| Very srtong | R1 |
| Extremly strong | R0 |

**IRS weak**

| | |
|---|---|
| Very soft clay | S |
| Soft clay | S |
| Firm clay | S |
| Stiff clay | S |
| Very stiff clay | S |
| Hard clay | S |

# APPENDIX B: 2011 ASSAYING QUALITY ASSURANCE AND QUALITY CONTROL (“QAQC”)

# Appendix B-1: Stewart Geochemical and Assay Accreditation Certificate

ilac-MRA

AsNaLiTiCa

Ассоциация аналитических центров "Аналитика"
Орган по аккредитации лабораторий
Полноправный член и участник Соглашений
о взаимном признании ILAC и APLAC

## Аттестат аккредитации

**№ ААС.А.00004**

Действителен до
21 января 2016 г.

**Орган по аккредитации ААЦ «Аналитика» удостоверяет, что**
**<u>ООО «Стюарт Геокемикл энд Эссей»</u>**
**117246, г. Москва, ул. Обручева, д. 31**
**аккредитован(а) в соответствии с требованиями Международного стандарта ИСО/МЭК 17025:2005 (ГОСТ Р ИСО/МЭК 17025-2006).**

**Аккредитация подтверждает техническую компетентность в заявленной области аккредитации и функционирование системы менеджмента качества лаборатории (см. Официальное заявление ISO-ILAC-IAF от января 2009 года).**

**Область аккредитации приведена в Приложении, являющимся неотъемлемой частью настоящего аттестата.**

**Управляющий**
**органом по аккредитации** "АНАЛИТИКА" **И.В. Болдырев**

21 января 2011 г.

119991, Москва, Ленинский пр-т., д. 1, оф. 1320, тел/факс: 959-93-43, 959-93-33
http://aac-analitica.ru e-mail: info@analitica.org.ru"

# Appendix B-2: Standard GIOP-34 Certificate

## GEOSTATS PTY LTD

Mining Industry Consultants
Reference Material Manufacture and Sales

Certified Pulp Iron Ore Reference Material

# GIOP-34

Certified Control Values

Iron Ore Analyses

| Element | Units | Grade | Standard Deviation | No of Analyses | 95% Confidence Interval |
|---|---|---|---|---|---|
| Fe | % | 48.8 | 0.16 | 37 | +/- 0.05 |
| SiO2 | % | 0.96 | 0.03 | 48.00 | +/- 0.01 |
| Al2O3 | % | 5.66 | 0.08 | 50.00 | +/- 0.02 |
| TiO2 | % | 20.86 | 0.260 | 50 | +/- 0.072 |
| Mn | % | 0.239 | 0.0063 | 50 | +/- 0.0017 |
| P | % | 0.009 | 0.0010 | 40 | +/- 0.0003 |
| S | % | 0.018 | 0.0028 | 49 | +/- 0.0008 |
| MgO | % | 2.756 | 0.0471 | 50 | +/- 0.0131 |
| Zn | % | 0.111 | 0.0014 | 29 | +/- 0.0005 |
| V | % | 0.328 | 0.0031 | 30 | +/- 0.0011 |
| Cr | % | 0.065 | 0.0032 | 30 | +/- 0.0012 |
| Cl | % | 0.012 | 0.0021 | 30 | +/- 0.0008 |
| As | % | 0.006 | 0.0020 | 30 | +/- 0.0007 |
| Ni | % | 0.038 | 0.0023 | 40 | +/- 0.0007 |
| Co | % | 0.019 | 0.0013 | 40 | +/- 0.0004 |
| LOI425 | % | 0.23 | 0.016 | 36 | +/- 0.005 |
| LOI | % | -1.01 | 0.054 | 50 | +/- 0.015 |

CRM Details

**Control Statistic Details**
Control values for this material were determined during a certification program.

**Certification Date**
This material was certified with the above values on:
July 2010

**Source Material**
Prior to homogenisation and testing, this material was sourced from:
Africa

**Material Type**
Titano-Magnetite Pulp Iron Ore, 10g samples.

**Usage**
This product is for use in the mining industry as reference materials for monitoring and testing the accuracy of laboratory assaying.

**Preparation and Packaging**
This reference material was dried in an oven for a minimum of 12 hours at 110C. The dry material is then crushed in a micron mill and homogenised in a vee-blender. The material is then stored in a sealed, stable container ready for final packaging.

Materials are statistically sampled from stores, then packaged into heat sealed, air tight, plastic packets ready for distribution. All packaging has been chosen to ensure minimal contamination from outside sources during shipment, use and storage.

**Assay Testwork**
This standard was tested in a dedicated certification program. 10 x 10g samples were sent to 5 laboratories for XRF analyses. Assay distributions are checked and processed statistically, producing monitoring statistics for these standards. Materials are tested regularly to ensure stability and homogeneity.

10A Marsh Close, O'Connor, Western Australia 6163
Phone : +61 8 9314 2566, Fax : +61 8 9314 3699
e-mail : pjh@geostats.com.au, srr@geostats.com.au
Website http://www.geostats.com.au

GIOP-34

Geostats Pty Ltd, Certified Iron Ore Reference Material, Product Code:

# Appendix B-3: Sampling Statement and Certificate of Blank Samples A-6, A-7, A-8

**ТОО «ДП» Актобе – Темир ВС»**

**г. Актобе**

**16 сентября 2011 г.**

**ПАСПОРТ**
**лабораторных проб : А-6, А-7, А-8**

Пробы № А-6, А-7, А-8 отобраны для проведения тестовых лабораторных испытаний методом химического анализа на определение железо общего, $Al_2O_3$ и $SiO_2$. Отбор производился: с действующего карьера месторождения Велиховское Северное уч. Южный маркшейдерских линий 37-39 горизонт 400-405. Пробы состоят из безрудных мраморов белого цвета.

Вес проб:

| № пробы | Вес пробы, кг |
|---|---|
| А-6 | 15,45 |
| А-7 | 14,76 |
| А-8 | 15,35 |

Все три пробы продроблены до 2 см и часть (навески) истерты до 74 микрон. Навески проб для анализа отправлены в ТОО «Актюбинская геологическая лаборатория».

Технический директор ТОО «ДП «Актобе-Темир-ВС» — К.К. Иргебаев

Ведущий геолог — А. А. Темиргалиев

Ведущий маркшейдер — Б. А. Оспанов

**Химико-технологическая лаборатория**
**ТОО «ДП «Актобе-Темир-ВС»**

**Протокол испытаний №500**
**от 10.11.2011г.**

| № | № пробы | № пробы для АГЛ | Fe,% | $SiO_2$,% | P,% | S,% | $Al_2O_3$,% | $H_2O$% |
|---|---|---|---|---|---|---|---|---|
| 8923 | ПЭ-2 | А-6 | <1,00 | | | | | |
| 8924 | ПЭ-3 | А-7 | <1,00 | | | | | |
| 8925 | ПЭ-4 | А-8 | <1,00 | | | | | |

Анализ выполнила лаборант ХТЛ Мадарова Б.С.

ТОО «Актюбинская геологическая лаборатория»
Кому: ТОО "ДП Актобе-Темир ВП"
Письмо: Вх. № 407/л от 24.11.2011 г.

РЕЗУЛЬТАТЫ ИСПЫТАНИЙ

| № п/п | № пробы | содержание,% | | |
|---|---|---|---|---|
| | | $SiO_2$ | $Al_2O_3$ | Fe общ |
| 1 | А-1 (7029) | 8,00 | 5,00 | 54,98 |
| 2 | А-2 (14266) | 22,56 | 10,70 | 33,95 |
| 3 | А-3 (14238) | 21,32 | 7,14 | 33,66 |
| 4 | А-4 (3950725) | 79,48 | 8,79 | 3,35 |
| 5 | А-5 (3950719) | 71,58 | 9,06 | 7,39 |
| 6 | А-6 (ПЭ1,ПЭ2) | 1,36 | 0,54 | 0,58 |
| 7 | А-7 (ПЭ3) | 1,66 | 0,41 | 0,26 |
| 8 | А-8 (ПЭ4) | 1,48 | 0,41 | 0,30 |

Исполнитель: Цицура Н.Г.

Директор ТОО «Актюбинская геологическая лаборатория» Головина И.В.

**Certificates of blank samples (A-6, A-7, A-8)**

**Tests protocols and results for samples (including blank samples)**

# Appendix B-4: Appendix 4. Sampling Statement and Certificate of Blank Sample «6-2011»

г. Актобе

**ТОО «ДП» Актобе – Темир ВС»**

**18 июня 2011 г.**

**ПАСПОРТ**
**лабораторных пробы № 6-2011**

Проба № 6-2011 отобрана для проведения тестовых лабораторных испытаний методом химического анализа на определение железо общее.

Отбор производился: с действующего карьера месторождения Велиховское Северное уч. Южный маркшейдерских линий 37-39 горизонт 405-410. Проба состоит из безрудных известняков светло - серого цвета.

Вес проб:

| № пробы | Вес пробы, кг |
|---|---|
| 6-2011 | 57,50 |

Проба продроблена до 2 см и часть (навеска) истерта до 74 микрона. Навеска пробы для анализа отправлена в ТОО «Актюбинская геологическая лаборатория».

Технический директор ТОО «ДП «Актобе-Темир-ВС» К.К. Иргебаев

Ведущий геолог А. А. Темиргалиев

Ведущий маркшейдер Б. А. Оспанов

ТОО «Актюбинская геологическая лаборатория»
Кому: ТОО «ДП «Актобе-Темир-ВС»
Объект: месторождение Велиховское Южное «участок Центральный»
Письмо: Вх.№ 162/л от 20.06.2011 г.

ТОО «Актюбинская геологическая лаборатория» Исх.№ 302/1 21.07 2011 ж/г.

РЕЗУЛЬТАТЫ ИСПЫТАНИЙ

| № п/п | № пробы | Fe общее |
|---|---|---|
| 1 | 6-2011 (1 эталон) | 4,16 |
| 2 | 7-2011 | 5,2 |
| 3 | 8-2011 | 4,18 |
| 4 | 9-2011 | 1,95 |

Исполнитель: Виноградова Н.А.

Директор ТОО «Актюбинская геологическая лаборатория» Головина И.В.

**Химико-технологическая лаборатория**
**ТОО «ДП «Актобе-Темир-ВС»**

**Протокол испытаний №56**
**от 2.06.2011г.**

| № | № пробы | | № пробы для АГЛ | Fe,% | $SiO_2$,% | P,% | S,% | $Al_2O_3$,% | $H_2O$% |
|---|---|---|---|---|---|---|---|---|---|
| 353 | Эталон | 1 | 6-2011 | 4,99 | 26,04 | 0,09 | 0,001 | >10,00 | |

Анализ выполнила лаборант ХТЛ Слюсарева.И.Н.

# Appendix B-5: Appendix Standard samples, analyzed in the laboratory

| Cons. No. | Sample No. | Lab_certif | cert_code | Fe% | P | S | Al | Al2O3%_calc | Ti | TiO2%_calc | Cr | Notes | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18025 | 1109382 | 1 | 48.728 | 0.005 | | 1.937 | 7.318 | 12.523 | 20.889 | 0.055 | GIOP-34 | ICP-BF |
| 2 | 18050 | 1109382 | 1 | 48.871 | 0.006 | | 2.025 | 7.649 | 12.573 | 20.972 | 0.055 | GIOP-34 | ICP-BF |
| 3 | 18075 | 1109382 | 1 | 48.653 | 0.006 | | 1.954 | 7.383 | 12.617 | 21.046 | 0.055 | GIOP-34 | ICP-BF |
| 4 | 18100 | 1109382 | 1 | 48.781 | 0.005 | | 2.025 | 7.650 | 12.648 | 21.097 | 0.057 | GIOP-34 | ICP-BF |
| 5 | 18125 | 1109382 | 1 | 48.574 | 0.005 | | 1.992 | 7.526 | 12.512 | 20.871 | 0.057 | GIOP-34 | ICP-BF |
| 6 | 18150 | 1109382 | 1 | 48.725 | 0.006 | | 1.971 | 7.448 | 12.349 | 20.598 | 0.054 | GIOP-34 | ICP-BF |
| 7 | 18175 | 1109382 | 1 | 48.930 | 0.005 | | 1.926 | 7.277 | 12.392 | 20.671 | 0.056 | GIOP-34 | ICP-BF |
| 8 | 25024 | 1109383 | 2 | 48.806 | 0.006 | | 1.849 | 6.986 | 12.498 | 20.847 | 0.055 | GIOP-34 | ICP-BF |
| 9 | 25049 | 1109383 | 2 | 48.456 | 0.006 | | 1.867 | 7.055 | 12.548 | 20.930 | 0.055 | GIOP-34 | ICP-BF |
| 10 | 25074 | 1109383 | 2 | 48.733 | 0.006 | | 1.776 | 6.711 | 12.592 | 21.004 | 0.051 | GIOP-34 | ICP-BF |
| 11 | 25099 | 1109383 | 2 | 48.826 | 0.006 | | 1.785 | 6.743 | 12.423 | 20.721 | 0.052 | GIOP-34 | ICP-BF |
| 12 | 25124 | 1109383 | 2 | 48.520 | 0.006 | | 1.904 | 7.192 | 12.487 | 20.829 | 0.054 | GIOP-34 | ICP-BF |
| 13 | 25149 | 1109383 | 2 | 48.705 | 0.006 | | 1.845 | 6.972 | 12.365 | 20.625 | 0.053 | GIOP-34 | ICP-BF |
| 14 | 25174 | 1109383 | 2 | 48.791 | 0.006 | | 1.909 | 7.214 | 12.524 | 20.891 | 0.055 | GIOP-34 | ICP-BF |
| 15 | 28160 | 1109384 | 3 | 48.712 | 0.006 | <0.01 | 1.908 | 7.207 | 12.437 | 20.745 | 0.054 | GIOP-34 | ICP-MA |
| 16 | 28163 | 1109384 | 3 | 48.759 | 0.006 | <0.01 | 1.908 | 7.209 | 12.399 | 20.682 | 0.054 | GIOP-34 | ICP-MA |
| 17 | 28166 | 1109384 | 3 | 48.769 | 0.006 | <0.01 | 1.827 | 6.903 | 12.448 | 20.764 | 0.055 | GIOP-34 | ICP-MA |
| 18 | 28169 | 1109384 | 3 | 48.789 | 0.006 | <0.01 | 1.814 | 6.852 | 12.492 | 20.838 | 0.053 | GIOP-34 | ICP-MA |
| 19 | 28172 | 1109384 | 3 | 48.842 | 0.006 | <0.01 | 1.860 | 7.028 | 12.523 | 20.888 | 0.055 | GIOP-34 | ICP-MA |
| 20 | 28175 | 1109384 | 3 | 48.913 | 0.006 | <0.01 | 1.917 | 7.242 | 12.389 | 20.664 | 0.056 | GIOP-34 | ICP-MA |
| 21 | 28178 | 1109384 | 3 | 48.734 | 0.006 | <0.01 | 1.857 | 7.017 | 12.467 | 20.795 | 0.054 | GIOP-34 | ICP-MA |
| 22 | 30161 | 1109385 | 4 | 48.628 | 0.006 | <0.01 | 1.796 | 6.785 | 12.486 | 20.827 | 0.053 | GIOP-34 | ICP-MA |
| 23 | 30164 | 1109385 | 4 | 48.828 | 0.006 | <0.01 | 1.814 | 6.852 | 12.336 | 20.576 | 0.053 | GIOP-34 | ICP-MA |
| 24 | 30167 | 1109385 | 4 | 48.733 | 0.006 | 0.010 | 1.885 | 7.122 | 12.480 | 20.818 | 0.054 | GIOP-34 | ICP-MA |
| 25 | 30170 | 1109385 | 4 | 48.920 | 0.006 | <0.01 | 1.863 | 7.039 | 12.511 | 20.869 | 0.054 | GIOP-34 | ICP-MA |
| 26 | 30173 | 1110334 | 5 | 49.062 | 0.012 | | 1.992 | 7.524 | 12.441 | 20.752 | 0.064 | GIOP-34 | ICP-BF |
| 27 | 30176 | 1110334 | 5 | 48.668 | 0.010 | | 2.459 | 9.288 | 12.343 | 20.588 | 0.056 | GIOP-34 | ICP-BF |
| 28 | 30179 | 1110334 | 5 | 48.982 | 0.007 | | 2.489 | 9.405 | 12.476 | 20.810 | 0.058 | GIOP-34 | ICP-BF |
| 29 | 36162 | 1110335 | 6 | 48.790 | 0.007 | | 2.442 | 9.225 | 12.433 | 20.739 | 0.057 | GIOP-34 | ICP-BF |
| 30 | 36165 | 1110335 | 6 | 48.816 | 0.008 | | 2.278 | 8.604 | 12.358 | 20.613 | 0.047 | GIOP-34 | ICP-BF |
| 31 | 36168 | 1110335 | 6 | 48.848 | 0.012 | | 2.283 | 8.624 | 12.201 | 20.351 | 0.052 | GIOP-34 | ICP-BF |
| 32 | 36171 | 1110335 | 6 | 48.960 | 0.010 | | 2.406 | 9.090 | 12.253 | 20.439 | 0.058 | GIOP-34 | ICP-BF |
| 33 | 36174 | 1110335 | 6 | 48.477 | 0.009 | | 2.391 | 9.031 | 12.103 | 20.188 | 0.055 | GIOP-34 | ICP-BF |
| 34 | 36177 | 1110335 | 6 | 48.682 | 0.008 | | 2.453 | 9.267 | 12.287 | 20.495 | 0.058 | GIOP-34 | ICP-BF |
| 35 | 36180 | 1110335 | 6 | 48.727 | 0.010 | | 2.432 | 9.188 | 12.307 | 20.528 | 0.057 | GIOP-34 | ICP-BF |
| 36 | 17158 | 1110336 | 7 | 48.596 | 0.006 | | 2.396 | 9.051 | 12.346 | 20.594 | 0.064 | GIOP-34 | ICP-BF |
| 37 | 17161 | 1110336 | 7 | 49.121 | 0.007 | | 2.267 | 8.563 | 12.386 | 20.661 | 0.063 | GIOP-34 | ICP-BF |
| 38 | 17164 | 1110336 | 7 | 48.659 | 0.008 | | 2.308 | 8.719 | 12.380 | 20.650 | 0.065 | GIOP-34 | ICP-BF |
| 39 | 17167 | 1110336 | 7 | 49.062 | 0.006 | | 2.371 | 8.957 | 12.304 | 20.524 | 0.064 | GIOP-34 | ICP-BF |
| 40 | 17170 | 1110336 | 7 | 48.752 | 0.008 | | 2.322 | 8.771 | 12.394 | 20.674 | 0.064 | GIOP-34 | ICP-BF |
| 41 | 17173 | 1110336 | 7 | 48.582 | 0.006 | | 2.402 | 9.073 | 12.482 | 20.820 | 0.064 | GIOP-34 | ICP-BF |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | 17176 | 1110336 | 7 | 48.831 | 0.012 | | 2.340 | 8.840 | 12.223 | 20.389 | 0.065 | GIOP-34 | ICP-BF |
| 43 | 19158 | 1110337 | 8 | 48.817 | 0.009 | | 2.431 | 9.185 | 12.245 | 20.425 | 0.058 | GIOP-34 | ICP-BF |
| 44 | 19161 | 1110337 | 8 | 49.083 | 0.006 | | 2.033 | 7.679 | 12.375 | 20.642 | 0.053 | GIOP-34 | ICP-BF |
| 45 | 19164 | 1110337 | 8 | 48.786 | 0.007 | | 2.427 | 9.168 | 12.211 | 20.368 | 0.057 | GIOP-34 | ICP-BF |
| 46 | 19167 | 1110337 | 8 | 48.466 | 0.008 | | 2.369 | 8.949 | 12.266 | 20.460 | 0.052 | GIOP-34 | ICP-BF |
| 47 | 19170 | 1110337 | 8 | 49.134 | 0.011 | | 2.300 | 8.688 | 11.756 | 19.609 | 0.057 | GIOP-34 | ICP-BF |
| 48 | 19173 | 1110337 | 8 | 48.652 | 0.011 | | 2.298 | 8.680 | 12.476 | 20.810 | 0.056 | GIOP-34 | ICP-BF |
| 49 | 19176 | 1110337 | 8 | 48.979 | 0.006 | | 2.381 | 8.996 | 12.322 | 20.553 | 0.057 | GIOP-34 | ICP-BF |
| 50 | 22157 | 1110338 | 9 | 48.944 | 0.010 | | 2.316 | 8.751 | 12.432 | 20.737 | 0.055 | GIOP-34 | ICP-BF |
| 51 | 22160 | 1110338 | 9 | 48.245 | 0.006 | | 2.363 | 8.927 | 12.272 | 20.470 | 0.054 | GIOP-34 | ICP-BF |
| 52 | 22166 | 1110338 | 9 | 48.844 | 0.007 | | 2.469 | 9.329 | 12.579 | 20.982 | 0.056 | GIOP-34 | ICP-BF |
| 53 | 22169 | 1110338 | 9 | 48.902 | 0.008 | | 2.345 | 8.859 | 12.436 | 20.743 | 0.057 | GIOP-34 | ICP-BF |
| 54 | 22172 | 1110338 | 9 | 48.723 | 0.009 | | 2.365 | 8.936 | 12.312 | 20.537 | 0.051 | GIOP-34 | ICP-BF |
| 55 | 22175 | 1110338 | 9 | 48.910 | 0.006 | | 2.566 | 9.694 | 12.278 | 20.480 | 0.055 | GIOP-34 | ICP-BF |
| 56 | 21156 | 1110339 | 10 | 48.653 | 0.008 | | 2.499 | 9.439 | 12.368 | 20.630 | 0.057 | GIOP-34 | ICP-BF |
| 57 | 21159 | 1110339 | 10 | 48.814 | 0.005 | | 2.491 | 9.409 | 11.499 | 19.181 | 0.056 | GIOP-34 | ICP-BF |
| 58 | 21162 | 1110339 | 10 | 48.630 | 0.006 | | 2.436 | 9.203 | 12.304 | 20.523 | 0.055 | GIOP-34 | ICP-BF |
| 59 | 21165 | 1110339 | 10 | 48.900 | 0.007 | | 2.300 | 8.689 | 12.297 | 20.512 | 0.053 | GIOP-34 | ICP-BF |
| 60 | 21168 | 1110339 | 10 | 48.929 | 0.011 | | 2.433 | 9.192 | 12.371 | 20.635 | 0.055 | GIOP-34 | ICP-BF |
| 61 | 21171 | 1110339 | 10 | 49.035 | 0.008 | | 2.591 | 9.789 | 12.492 | 20.837 | 0.056 | GIOP-34 | ICP-BF |
| 62 | 21174 | 1110339 | 10 | 48.902 | 0.010 | | 2.524 | 9.536 | 12.643 | 21.088 | 0.057 | GIOP-34 | ICP-BF |
| 63 | EP1105 | 1110340 | 11 | 48.956 | 0.009 | | 2.357 | 8.903 | 12.361 | 20.619 | 0.058 | GIOP-34 | ICP-BF |
| 64 | EP1108 | 1110340 | 11 | 48.180 | 0.006 | | 2.412 | 9.114 | 12.412 | 20.703 | 0.054 | GIOP-34 | ICP-BF |
| 65 | EP1111 | 1110340 | 11 | 48.406 | 0.010 | | 2.460 | 9.295 | 12.389 | 20.665 | 0.053 | GIOP-34 | ICP-BF |
| 66 | EP1114 | 1110340 | 11 | 49.008 | 0.011 | | 2.460 | 9.295 | 12.520 | 20.884 | 0.059 | GIOP-34 | ICP-BF |
| 67 | EP1117 | 1110340 | 11 | 48.579 | 0.009 | | 2.371 | 8.955 | 12.261 | 20.451 | 0.052 | GIOP-34 | ICP-BF |
| 68 | EP2111 | 1111366 | 12 | 48.676 | 0.008 | | 2.091 | 7.899 | 12.328 | 20.564 | 0.053 | GIOP-34 | ICP-BF |
| 69 | EP2114 | 1111366 | 12 | 48.734 | 0.011 | | 2.104 | 7.947 | 12.387 | 20.661 | 0.054 | GIOP-34 | ICP-BF |
| 70 | EP2117 | 1111366 | 12 | 48.702 | 0.007 | | 2.114 | 7.987 | 12.347 | 20.596 | 0.054 | GIOP-34 | ICP-BF |
| 71 | EP2120 | 1111366 | 12 | 48.734 | 0.009 | | 2.051 | 7.749 | 12.425 | 20.725 | 0.054 | GIOP-34 | ICP-BF |
| 72 | EP2123 | 1111366 | 12 | 48.984 | 0.007 | | 2.068 | 7.812 | 12.265 | 20.458 | 0.053 | GIOP-34 | ICP-BF |
| 73 | EP3108 | 1111367 | 13 | 48.708 | 0.009 | | 2.072 | 7.827 | 12.332 | 20.570 | 0.054 | GIOP-34 | ICP-BF |
| 74 | EP3111 | 1111367 | 13 | 49.021 | 0.006 | | 2.067 | 7.809 | 12.443 | 20.755 | 0.053 | GIOP-34 | ICP-BF |
| 75 | EP3114 | 1111367 | 13 | 48.451 | 0.009 | | 2.106 | 7.957 | 12.443 | 20.755 | 0.055 | GIOP-34 | ICP-BF |
| 76 | EP3117 | 1111367 | 13 | 48.977 | 0.009 | | 2.090 | 7.895 | 12.347 | 20.595 | 0.056 | GIOP-34 | ICP-BF |
| 77 | EP3120 | 1111367 | 13 | 48.430 | 0.008 | | 2.090 | 7.896 | 12.344 | 20.591 | 0.055 | GIOP-34 | ICP-BF |
| 78 | EP7107 | 1111368 | 14 | 48.704 | 0.010 | | 2.104 | 7.947 | 12.373 | 20.639 | 0.055 | GIOP-34 | ICP-BF |
| 79 | EP7110 | 1111368 | 14 | 48.753 | 0.009 | | 2.115 | 7.990 | 12.335 | 20.575 | 0.052 | GIOP-34 | ICP-BF |
| 80 | EP7113 | 1111368 | 14 | 48.829 | 0.008 | | 2.102 | 7.942 | 12.246 | 20.427 | 0.053 | GIOP-34 | ICP-BF |
| 81 | EP7116 | 1111368 | 14 | 48.709 | 0.008 | | 2.082 | 7.865 | 12.443 | 20.755 | 0.051 | GIOP-34 | ICP-BF |
| 82 | EP4108 | 1111369 | 15 | 48.917 | 0.009 | | 2.069 | 7.816 | 12.227 | 20.394 | 0.053 | GIOP-34 | ICP-BF |
| 83 | EP4111 | 1111369 | 15 | 48.887 | 0.008 | | 2.049 | 7.740 | 12.369 | 20.631 | 0.056 | GIOP-34 | ICP-BF |
| 84 | EP4114 | 1111369 | 15 | 48.624 | 0.008 | | 2.109 | 7.968 | 12.309 | 20.532 | 0.056 | GIOP-34 | ICP-BF |
| 85 | EP4117 | 1111369 | 15 | 48.897 | 0.008 | | 2.088 | 7.888 | 12.342 | 20.587 | 0.055 | GIOP-34 | ICP-BF |
| 86 | EP4120 | 1111369 | 15 | 49.041 | 0.007 | | 2.067 | 7.811 | 12.652 | 21.103 | 0.060 | GIOP-34 | ICP-BF |
| 87 | EP8109 | 1111370 | 16 | 48.938 | 0.007 | | 2.138 | 8.078 | 12.354 | 20.607 | 0.057 | GIOP-34 | ICP-BF |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 88 | EP8112 | 1111370 | 16 | 48.774 | 0.011 | | 2.187 | 8.261 | 12.416 | 20.710 | 0.059 | GIOP-34 | ICP-BF |
| 89 | EP8115 | 1111370 | 16 | 49.071 | 0.008 | | 2.117 | 7.998 | 12.344 | 20.591 | 0.059 | GIOP-34 | ICP-BF |
| 90 | EP8118 | 1111370 | 16 | 48.527 | 0.007 | | 2.186 | 8.259 | 12.541 | 20.919 | 0.062 | GIOP-34 | ICP-BF |
| 91 | EP8121 | 1111370 | 16 | 48.768 | 0.007 | | 2.239 | 8.457 | 12.380 | 20.650 | 0.062 | GIOP-34 | ICP-BF |
| 92 | EP5109 | 1111371 | 17 | 48.792 | 0.006 | | 2.333 | 8.815 | 12.408 | 20.696 | 0.063 | GIOP-34 | ICP-BF |
| 93 | EP5112 | 1111371 | 17 | 49.036 | 0.008 | | 2.320 | 8.766 | 12.333 | 20.571 | 0.063 | GIOP-34 | ICP-BF |
| 94 | EP5115 | 1111371 | 17 | 48.668 | 0.005 | | 2.253 | 8.513 | 12.211 | 20.368 | 0.058 | GIOP-34 | ICP-BF |
| 95 | EP5118 | 1111371 | 17 | 48.836 | 0.006 | | 2.210 | 8.350 | 12.624 | 21.058 | 0.062 | GIOP-34 | ICP-BF |
| 96 | EP5121 | 1111371 | 17 | 48.679 | 0.011 | | 2.327 | 8.792 | 12.404 | 20.690 | 0.062 | GIOP-34 | ICP-BF |
| 97 | EP9107 | 1111372 | 18 | 48.662 | 0.007 | | 2.062 | 7.791 | 12.241 | 20.418 | 0.056 | GIOP-34 | ICP-BF |
| 98 | EP9110 | 1111372 | 18 | 49.043 | 0.008 | | 2.089 | 7.891 | 12.330 | 20.568 | 0.055 | GIOP-34 | ICP-BF |
| 99 | EP9113 | 1111372 | 18 | 48.792 | 0.006 | | 2.106 | 7.956 | 12.439 | 20.749 | 0.060 | GIOP-34 | ICP-BF |
| 100 | EP9116 | 1111372 | 18 | 48.651 | 0.007 | | 2.060 | 7.782 | 12.308 | 20.530 | 0.056 | GIOP-34 | ICP-BF |
| 101 | EP9119 | 1111372 | 18 | 49.028 | 0.008 | | 2.065 | 7.801 | 12.544 | 20.924 | 0.061 | GIOP-34 | ICP-BF |
| 102 | EP6107 | 1111373 | 19 | 48.607 | 0.008 | | 2.096 | 7.918 | 12.251 | 20.435 | 0.056 | GIOP-34 | ICP-BF |
| 103 | EP6110 | 1111373 | 19 | 49.034 | 0.009 | | 2.082 | 7.865 | 12.327 | 20.562 | 0.063 | GIOP-34 | ICP-BF |
| 104 | EP6113 | 1111373 | 19 | 48.852 | 0.011 | | 2.067 | 7.807 | 12.247 | 20.428 | 0.063 | GIOP-34 | ICP-BF |
| 105 | EP6116 | 1111373 | 19 | 48.719 | 0.010 | | 2.103 | 7.943 | 12.389 | 20.666 | 0.064 | GIOP-34 | ICP-BF |
| 106 | EP11108 | 1111374 | 20 | 48.322 | 0.010 | | 2.050 | 7.746 | 12.208 | 20.363 | 0.055 | GIOP-34 | ICP-BF |
| 107 | EP11111 | 1111374 | 20 | 48.727 | 0.010 | | 2.073 | 7.831 | 12.286 | 20.493 | 0.062 | GIOP-34 | ICP-BF |
| 108 | EP11114 | 1111374 | 20 | 48.558 | 0.011 | | 2.102 | 7.939 | 12.418 | 20.714 | 0.060 | GIOP-34 | ICP-BF |
| 109 | EP11117 | 1111374 | 20 | 48.942 | 0.010 | | 2.055 | 7.764 | 12.439 | 20.748 | 0.060 | GIOP-34 | ICP-BF |
| 110 | EP11120 | 1111374 | 20 | 48.693 | 0.007 | | 2.087 | 7.883 | 12.203 | 20.354 | 0.055 | GIOP-34 | ICP-BF |
| 111 | EP10106 | 1111375 | 21 | 48.873 | 0.008 | | 2.085 | 7.876 | 12.282 | 20.487 | 0.063 | GIOP-34 | ICP-BF |
| 112 | EP10109 | 1111375 | 21 | 48.848 | 0.008 | | 2.129 | 8.044 | 12.325 | 20.559 | 0.065 | GIOP-34 | ICP-BF |
| 113 | EP10112 | 1111375 | 21 | 48.755 | 0.008 | | 2.148 | 8.114 | 12.310 | 20.533 | 0.062 | GIOP-34 | ICP-BF |
| 114 | EP10115 | 1111375 | 21 | 48.631 | 0.010 | | 2.138 | 8.076 | 12.233 | 20.405 | 0.055 | GIOP-34 | ICP-BF |
| 115 | EP10118 | 1111375 | 21 | 48.673 | 0.015 | | 2.086 | 7.880 | 12.390 | 20.667 | 0.061 | GIOP-34 | ICP-BF |
| 116 | EP12107 | 1111376 | 22 | 48.619 | 0.012 | | 2.080 | 7.859 | 12.362 | 20.620 | 0.064 | GIOP-34 | ICP-BF |
| 117 | EP12110 | 1111376 | 22 | 48.955 | 0.005 | | 2.096 | 7.918 | 12.223 | 20.388 | 0.059 | GIOP-34 | ICP-BF |
| 118 | EP12113 | 1111376 | 22 | 48.377 | 0.008 | | 2.077 | 7.845 | 12.237 | 20.412 | 0.059 | GIOP-34 | ICP-BF |
| 119 | EP12116 | 1111376 | 22 | 48.775 | 0.008 | | 2.072 | 7.829 | 12.475 | 20.808 | 0.062 | GIOP-34 | ICP-BF |
| 120 | EP12119 | 1111376 | 22 | 49.014 | 0.013 | | 2.128 | 8.038 | 12.251 | 20.435 | 0.061 | GIOP-34 | ICP-BF |
| 121 | EP14032 | 1111377 | 23 | 48.705 | 0.015 | | 2.093 | 7.908 | 12.364 | 20.623 | 0.064 | GIOP-34 | ICP-BF |
| 122 | EP13029 | 1111377 | 23 | 48.885 | 0.016 | | 2.090 | 7.897 | 12.286 | 20.494 | 0.059 | GIOP-34 | ICP-BF |
| 123 | EP15030 | 1111377 | 23 | 48.738 | 0.010 | | 2.095 | 7.913 | 12.333 | 20.573 | 0.060 | GIOP-34 | ICP-BF |
| 124 | EP16027 | 1111377 | 23 | 49.026 | 0.006 | | 2.108 | 7.965 | 12.212 | 20.369 | 0.063 | GIOP-34 | ICP-BF |
| 125 | EP16030 | 1111377 | 23 | 49.049 | 0.007 | | 2.102 | 7.940 | 12.460 | 20.784 | 0.063 | GIOP-34 | ICP-BF |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 22163 | 1110338 | 9 | 31.040 | 0.006 | | 2.262 | | 1.833 | | 0.051 | GIOP-34 | ICP-BF |

There is confusion about the sample

# Appendix B-6: Blank samples, analyzed in the laboratory

| # | Sample_ID | Fe% | P% | S% | Al% | Ti% | Cr% | Notes | Method | Lab # | Fe blank |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18023 | 7.41 | 0.18 | | 7.90 | 0.54 | 0.03 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 2 | 18048 | 7.50 | 0.18 | | 7.97 | 0.54 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 3 | 18073 | 7.56 | 0.19 | | 8.07 | 0.56 | 0.03 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 4 | 18098 | 7.54 | 0.17 | | 7.87 | 0.54 | 0.04 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 5 | 18123 | 7.36 | 0.17 | | 7.69 | 0.54 | 0.01 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 6 | 18148 | 7.31 | 0.18 | | 7.36 | 0.55 | 0.03 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 7 | 18173 | 7.32 | 0.17 | | 7.77 | 0.56 | 0.03 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 8 | 25022 | 7.32 | 0.17 | | 8.09 | 0.45 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 9 | 25047 | 7.25 | 0.18 | | 8.05 | 0.46 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 10 | 25072 | 7.33 | 0.18 | | 8.18 | 0.46 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 11 | 25172 | 7.22 | 0.18 | | 8.51 | 0.47 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 12 | 28158 | 7.10 | 0.18 | <0.01 | 8.27 | 0.48 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 13 | 28161 | 7.02 | 0.17 | <0.01 | 8.24 | 0.47 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 14 | 28164 | 7.15 | 0.17 | <0.01 | 8.25 | 0.46 | 0.01 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 15 | 28167 | 7.19 | 0.17 | <0.01 | 8.19 | 0.45 | 0.01 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 16 | 28170 | 7.03 | 0.16 | <0.01 | 8.17 | 0.44 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 17 | 28173 | 7.06 | 0.17 | <0.01 | 8.29 | 0.45 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 18 | 28176 | 7.17 | 0.17 | <0.01 | 8.26 | 0.47 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 19 | 30159 | 7.13 | 0.17 | <0.01 | 8.31 | 0.46 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 20 | 30162 | 7.27 | 0.17 | <0.01 | 8.21 | 0.48 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 21 | 30165 | 7.11 | 0.18 | <0.01 | 8.33 | 0.48 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 22 | 30168 | 7.05 | 0.17 | <0.01 | 8.22 | 0.46 | 0.02 | 1 standard | ICP-MA | 6-2011 | 4.16 |
| 23 | 30171 | 7.11 | 0.17 | | 8.72 | 0.48 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 24 | 30174 | 7.25 | 0.18 | | 8.82 | 0.50 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 25 | 30177 | 7.43 | 0.19 | | 8.75 | 0.50 | 0.03 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 26 | 36160 | 7.38 | 0.19 | | 8.81 | 0.46 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 27 | 36163 | 7.19 | 0.17 | | 8.84 | 0.48 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 28 | 36166 | 7.47 | 0.18 | | 8.40 | 0.49 | 0.03 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 29 | 36169 | 7.24 | 0.19 | | 8.43 | 0.48 | 0.03 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 30 | 36172 | 7.19 | 0.18 | | 8.66 | 0.45 | 0.03 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 31 | 36175 | 7.23 | 0.19 | | 8.79 | 0.46 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 32 | 17156 | 7.03 | 0.16 | | 8.23 | 0.43 | 0.02 | T-4 | ICP-BF | 6-2011 | 4.16 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | standard | | | |
| 33 | 17159 | 7.16 | 0.16 | | 8.21 | 0.42 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 34 | 17162 | 6.95 | 0.16 | | 8.37 | 0.48 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 35 | 17165 | 7.01 | 0.16 | | 8.30 | 0.45 | 0.01 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 36 | 17168 | 6.97 | 0.16 | | 8.10 | 0.44 | 0.01 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 37 | 17171 | 7.10 | 0.16 | | 8.25 | 0.45 | 0.01 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 38 | 17174 | 7.28 | 0.17 | | 8.40 | 0.43 | 0.01 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 39 | 19156 | 7.10 | 0.18 | | 8.53 | 0.47 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 40 | 19159 | 9.89 | 0.38 | | 10.09 | 0.71 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 41 | 19162 | 7.25 | 0.18 | | 8.54 | 0.45 | 0.04 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 42 | 19165 | 10.50 | 0.39 | | 10.44 | 0.71 | 0.03 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 43 | 19168 | 7.16 | 0.17 | | 8.61 | 0.45 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 44 | 19171 | 7.38 | 0.16 | | 8.61 | 0.40 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 45 | 19174 | 7.48 | 0.16 | | 8.68 | 0.42 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 46 | 22155 | 7.42 | 0.17 | | 8.74 | 0.50 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 47 | 22158 | 7.24 | 0.18 | | 8.69 | 0.49 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 48 | 22161 | 7.26 | 0.18 | | 8.81 | 0.50 | 0.03 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 49 | 22164 | 7.33 | 0.18 | | 8.66 | 0.50 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 50 | 22167 | 7.24 | 0.18 | | 8.61 | 0.49 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 51 | 22170 | 7.21 | 0.18 | | 8.73 | 0.49 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 52 | 22173 | 7.30 | 0.18 | | 8.66 | 0.50 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 53 | 21154 | 7.26 | 0.18 | | 8.46 | 0.46 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 54 | 21157 | 7.12 | 0.17 | | 8.29 | 0.43 | 0.03 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 55 | 21160 | 7.39 | 0.18 | | 8.58 | 0.47 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 56 | 21163 | 7.21 | 0.18 | | 8.57 | 0.45 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 57 | 21166 | 7.06 | 0.18 | | 8.72 | 0.45 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 58 | 21169 | 7.36 | 0.17 | | 8.28 | 0.43 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 59 | 21172 | 7.09 | 0.18 | | 8.68 | 0.45 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 60 | EP1103 | 7.43 | 0.19 | | 8.59 | 0.48 | 0.04 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 61 | EP1106 | 7.42 | 0.18 | | 8.61 | 0.46 | 0.01 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 62 | EP1109 | 7.46 | 0.18 | | 8.71 | 0.46 | 0.04 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 63 | EP1112 | 7.34 | 0.18 | | 8.57 | 0.46 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 64 | EP1115 | 7.18 | 0.17 | | 8.67 | 0.45 | 0.02 | T-4 standard | ICP-BF | 6-2011 | 4.16 |
| 65 | EP2109 | 0.32 | 0.01 | | 0.05 | <0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 66 | EP2112 | 0.29 | 0.01 | | 0.05 | 0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 67 | EP2115 | 0.30 | 0.01 | | 0.06 | 0.01 | <0.01 | standard | ICP-BF | A-6 | 0.58 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PE02 | | | |
| 68 | EP2118 | 0.29 | 0.01 | | 0.05 | 0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 69 | EP2121 | 0.32 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 70 | EP3106 | 0.28 | 0.01 | | 0.05 | <0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 71 | EP3109 | 0.29 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 72 | EP3112 | 0.28 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 73 | EP3115 | 0.28 | 0.01 | | 0.07 | <0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 74 | EP3118 | 0.28 | 0.01 | | 0.06 | <0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 75 | EP7105 | 0.31 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 76 | EP7108 | 0.29 | 0.01 | | 0.05 | <0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 77 | EP7111 | 0.31 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 78 | EP7114 | 0.31 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 79 | EP4106 | 0.28 | 0.01 | | 0.06 | <0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 80 | EP4109 | 0.27 | <0.01 | | 0.05 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 81 | EP4112 | 0.32 | 0.01 | | 0.06 | 0.01 | 0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 82 | EP4115 | 0.30 | 0.01 | | 0.05 | <0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 83 | EP4118 | 0.29 | 0.01 | | 0.06 | <0.01 | <0.01 | standard PE02 | ICP-BF | A-6 | 0.58 |
| 84 | EP8107 | 0.19 | 0.01 | | 0.07 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 85 | EP8110 | 0.20 | 0.01 | | 0.07 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 86 | EP8113 | 0.19 | <0.01 | | 0.05 | <0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 87 | EP8116 | 0.20 | 0.01 | | 0.05 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 88 | EP8119 | 0.19 | <0.01 | | 0.05 | <0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 89 | EP5107 | 0.14 | <0.01 | | 0.06 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 90 | EP5110 | 0.15 | 0.01 | | 0.04 | <0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 91 | EP5113 | 0.15 | <0.01 | | 0.04 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 92 | EP5116 | 0.14 | <0.01 | | 0.04 | <0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 93 | EP5119 | 0.14 | <0.01 | | 0.04 | <0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 94 | EP9105 | 0.18 | 0.01 | | 0.05 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 95 | EP9108 | 0.32 | <0.01 | | 0.07 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 96 | EP9111 | 0.24 | 0.01 | | 0.08 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 97 | EP9114 | 0.24 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 98 | EP9117 | 0.19 | 0.01 | | 0.08 | <0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 99 | EP6105 | 0.32 | 0.01 | | 0.07 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 100 | EP6108 | 0.32 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE03 | ICP-BF | A-7 | 0.26 |
| 101 | EP6111 | 0.19 | 0.01 | | 0.04 | 0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 102 | EP6114 | 0.19 | 0.01 | | 0.04 | 0.01 | <0.01 | standard | ICP-BF | A-8 | 0.3 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PE04 | | | |
| 103 | EP11106 | 0.17 | 0.01 | | 0.04 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 104 | EP11109 | 0.16 | 0.01 | | 0.04 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 105 | EP11112 | 0.23 | <0.01 | | 0.03 | 0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 106 | EP11115 | 0.18 | 0.01 | | 0.05 | 0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 107 | EP11118 | 0.24 | 0.01 | | 0.06 | 0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 108 | EP10104 | 0.19 | <0.01 | | 0.05 | 0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 109 | EP10107 | 0.20 | <0.01 | | 0.04 | 0.01 | 0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 110 | EP10110 | 0.22 | <0.01 | | 0.04 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 111 | EP10113 | 0.22 | <0.01 | | 0.05 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 112 | EP10116 | 0.20 | 0.01 | | 0.03 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 113 | EP12105 | 0.18 | 0.01 | | 0.06 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 114 | EP12108 | 0.21 | 0.01 | | 0.05 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 115 | EP12111 | 0.22 | 0.01 | | 0.05 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 116 | EP12114 | 0.16 | 0.01 | | 0.06 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 117 | EP12117 | 0.17 | 0.01 | | 0.05 | 0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 118 | EP14030 | 0.24 | 0.01 | | 0.10 | <0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 119 | EP13027 | 0.27 | 0.02 | | 0.11 | 0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 120 | EP15028 | 0.26 | 0.01 | | 0.11 | 0.01 | <0.01 | standard PE04 | ICP-BF | A-8 | 0.3 |
| 121 | EP16025 | 0.23 | 0.01 | | 0.09 | <0.01 | <0.01 | Standard PE01 | ICP-BF | A-6 | 0.58 |
| 122 | EP16028 | 0.29 | 0.01 | | 0.10 | 0.01 | <0.01 | standard PE01 | ICP-BF | A-6 | 0.58 |

In the course of sample preparation, the samples have been mistakenly inserted as blanks

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 25097 | 21.25 | 0.01 | | 2.23 | 1.19 | 0.01 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 12 | 25122 | 21.65 | 0.01 | | 2.76 | 1.28 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 13 | 25147 | 23.83 | 0.01 | | 2.23 | 1.30 | 0.02 | 1 standard | ICP-BF | 6-2011 | 4.16 |
| 35 | 36178 | 36.38 | 0.38 | | 4.57 | 0.24 | 0.01 | T-4 standard | ICP-BF | 6-2011 | 4.16 |

# Appendix B-7: Comparison of Duplicates and Ordinary Samples Assay Results

| Cons No. | Sample No. | Fe%_o | P%_o | S%_o | Al%_o | Al2O3%_o_calc | Ti%_o | TiO2%_o | Cr%_o | Duplicate No. | Fe%_к | P%_к | S%_к | Al%_к | Al2O3%_k_calc | Ti%_к | TiO2%_k | Cr%_к | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18013 | 17.764 | <0.01 | | 1.653 | 6.246 | 0.858 | 1.430 | 0.033 | 18024 | 17.43 | <0.01 | | 1.65 | 6.247 | 0.85 | 1.423 | 0.03 | ICP-BF |
| 2 | 18060 | 11.047 | 0.007 | | 1.137 | 4.297 | 0.263 | 0.439 | 0.073 | 18074 | 11.11 | 0.01 | | 1.19 | 4.483 | 0.26 | 0.430 | 0.11 | ICP-BF |
| 3 | 18096 | 19.472 | <0.01 | | 1.620 | 6.121 | 0.950 | 1.584 | 0.030 | 18099 | 15.95 | 0.01 | | 1.42 | 5.358 | 0.65 | 1.079 | 0.06 | ICP-BF |
| 4 | 18106 | 17.340 | <0.01 | | 1.896 | 7.161 | 0.944 | 1.574 | 0.041 | 18124 | 16.70 | <0.01 | | 1.89 | 7.126 | 0.91 | 1.519 | 0.03 | ICP-BF |
| 5 | 18139 | 12.157 | 0.009 | | 1.102 | 4.163 | 0.201 | 0.335 | 0.079 | 18149 | 12.24 | 0.01 | | 1.09 | 4.118 | 0.21 | 0.342 | 0.08 | ICP-BF |
| 6 | 18168 | 12.012 | 0.010 | | 1.127 | 4.257 | 0.225 | 0.375 | 0.090 | 18174 | 11.99 | 0.01 | | 1.12 | 4.229 | 0.27 | 0.443 | 0.09 | ICP-BF |
| 7 | 25010 | 19.167 | 0.027 | | 2.052 | 7.754 | 1.000 | 1.669 | 0.007 | 25023 | 19.17 | 0.03 | | 2.08 | 7.841 | 0.99 | 1.657 | 0.01 | ICP-BF |
| 8 | 25032 | 27.730 | 0.007 | | 2.258 | 8.532 | 1.453 | 2.423 | 0.022 | 25048 | 27.49 | 0.01 | | 2.29 | 8.648 | 1.48 | 2.464 | 0.03 | ICP-BF |
| 9 | 25050 | 22.620 | 0.019 | | 2.390 | 9.027 | 1.208 | 2.015 | 0.020 | 25073 | 21.89 | 0.02 | | 2.43 | 9.162 | 1.17 | 1.953 | 0.02 | ICP-BF |
| 10 | 25080 | 21.502 | 0.007 | | 2.316 | 8.751 | 1.190 | 1.985 | 0.012 | 25098 | 7.46 | 0.17 | | 8.29 | 31.324 | 0.47 | 0.788 | 0.02 | ICP-BF |
| 11 | 25108 | 21.393 | 0.011 | | 2.657 | 10.039 | 1.242 | 2.071 | 0.016 | 25123 | 7.28 | 0.17 | | 8.20 | 30.971 | 0.47 | 0.776 | 0.02 | ICP-BF |
| 12 | 25139 | 23.676 | 0.009 | | 2.215 | 8.367 | 1.309 | 2.183 | 0.015 | 25148 | 7.35 | 0.17 | | 8.26 | 31.194 | 0.46 | 0.769 | 0.02 | ICP-BF |
| 13 | 25160 | 19.968 | 0.009 | | 2.299 | 8.685 | 1.135 | 1.894 | 0.022 | 25173 | 19.99 | 0.01 | | 2.28 | 8.618 | 1.13 | 1.889 | 0.01 | ICP-BF |
| 14 | 28008 | 19.631 | 0.054 | 0.025 | 6.935 | 26.201 | 1.126 | 1.878 | 0.010 | 28159 | 19.812 | 0.059 | 0.026 | 7.473 | 28.231 | 1.142 | 1.905 | 0.009 | ICP-MA |
| 15 | 28028 | 10.529 | 0.315 | 1.385 | 7.611 | 28.754 | 0.677 | 1.129 | 0.016 | 28162 | 10.427 | 0.317 | 1.408 | 7.745 | 29.261 | 0.659 | 1.099 | 0.022 | ICP-MA |
| 16 | 28052 | 11.208 | 0.450 | 0.437 | 8.931 | 33.741 | 0.799 | 1.334 | 0.010 | 28165 | 11.034 | 0.443 | 0.439 | 8.815 | 33.303 | 0.797 | 1.330 | 0.007 | ICP-MA |
| 17 | 28073 | 12.706 | 0.345 | 0.437 | 7.631 | 28.829 | 0.924 | 1.542 | 0.008 | 28168 | 11.334 | 0.118 | 1.970 | 9.967 | 37.652 | 0.602 | 1.004 | 0.007 | ICP-MA |
| 18 | 28092 | 12.399 | 0.304 | 0.425 | 8.022 | 30.307 | 0.818 | 1.364 | 0.008 | 28171 | 12.370 | 0.290 | 0.408 | 7.932 | 29.966 | 0.803 | 1.339 | 0.006 | ICP-MA |
| 19 | 28117 | 13.233 | 0.329 | 0.422 | 7.656 | 28.922 | 0.794 | 1.325 | 0.004 | 28174 | 12.238 | 0.328 | 0.343 | 7.437 | 28.096 | 0.718 | 1.197 | 0.004 | ICP-MA |
| 20 | 28137 | 14.915 | 0.251 | 0.320 | 7.256 | 27.413 | 0.805 | 1.343 | 0.006 | 28177 | 14.059 | 0.275 | 0.389 | 7.552 | 28.532 | 0.821 | 1.369 | 0.008 | ICP-MA |
| 21 | 30002 | 5.673 | 0.21 | 0.07 | 5.159 | 19.490 | 0.422 | 0.704 | 0.052 | 30160 | 5.536 | 0.20 | 0.06 | 4.87 | 18.421 | 0.395 | 0.659 | 0.034 | ICP- |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 1 | | | | | | | | 8 | 8 | 6 | | | | | MA |
| 22 | 30025 | 10.109 | 0.555 | 0.344 | 8.718 | 32.934 | 0.823 | 1.372 | 0.005 | 30163 | 10.461 | 0.563 | 0.358 | 8.903 | 33.635 | 0.846 | 1.411 | 0.005 | ICP-MA |
| 23 | 30047 | 11.682 | 0.480 | 0.304 | 8.834 | 33.373 | 0.840 | 1.401 | 0.020 | 30166 | 11.433 | 0.471 | 0.300 | 8.704 | 32.884 | 0.837 | 1.396 | 0.023 | ICP-MA |
| 24 | 30068 | 11.833 | 0.220 | 0.310 | 7.777 | 29.381 | 0.721 | 1.202 | 0.017 | 30169 | 12.387 | 0.224 | 0.314 | 7.916 | 29.905 | 0.752 | 1.254 | 0.016 | ICP-MA |
| 25 | 30091 | 12.236 | 0.261 | | 7.851 | 29.661 | 0.705 | 1.175 | 0.010 | 30172 | 12.103 | 0.250 | | 8.014 | 30.276 | 0.703 | 1.173 | 0.011 | ICP-BF |
| 26 | 30113 | 11.958 | 0.596 | | 9.157 | 34.592 | 0.968 | 1.615 | <0.01 | 30175 | 11.664 | 0.591 | | 9.026 | 34.099 | 0.940 | 1.567 | <0.01 | ICP-BF |
| 27 | 30135 | 13.124 | 0.376 | | 8.147 | 30.778 | 0.899 | 1.500 | 0.013 | 30178 | 13.121 | 0.373 | | 8.167 | 30.852 | 0.891 | 1.485 | 0.024 | ICP-BF |
| 28 | 30156 | 13.560 | 0.315 | | 8.215 | 31.035 | 1.069 | 1.783 | 0.017 | 36161 | 13.420 | 0.327 | | 8.135 | 30.732 | 0.989 | 1.649 | 0.015 | ICP-BF |
| 29 | 36020 | 18.745 | 0.153 | | 2.837 | 10.717 | 1.138 | 1.898 | 0.013 | 36164 | 18.037 | 0.143 | | 2.724 | 10.292 | 1.089 | 1.816 | 0.013 | ICP-BF |
| 30 | 36040 | 19.005 | 0.697 | | 2.539 | 9.590 | 1.242 | 2.072 | 0.012 | 36167 | 18.682 | 0.663 | | 2.542 | 9.603 | 1.220 | 2.036 | 0.022 | ICP-BF |
| 31 | 36065 | 12.533 | 0.326 | | 7.383 | 27.891 | 0.823 | 1.374 | 0.014 | 36170 | 12.467 | 0.319 | | 7.571 | 28.603 | 0.806 | 1.344 | 0.014 | ICP-BF |
| 32 | 36090 | 18.281 | 0.026 | | 2.149 | 8.120 | 0.931 | 1.554 | 0.011 | 36173 | 18.081 | 0.021 | | 2.120 | 8.010 | 0.929 | 1.549 | 0.010 | ICP-BF |
| 33 | 36110 | 9.746 | 0.319 | | ##### | 38.479 | 0.778 | 1.298 | 0.005 | 36176 | 10.105 | 0.315 | | ##### | 39.820 | 0.789 | 1.316 | 0.010 | ICP-BF |
| 34 | 36130 | 9.634 | 0.234 | | ##### | 41.715 | 0.388 | 0.647 | 0.017 | 36179 | 9.478 | 0.227 | | ##### | 41.074 | 0.376 | 0.628 | 0.010 | ICP-BF |
| 35 | 17003 | 24.839 | 0.221 | | 3.684 | 13.916 | 1.515 | 2.527 | 0.061 | 17157 | 28.246 | 0.028 | | 3.672 | 13.872 | 1.500 | 2.502 | 0.041 | ICP-BF |
| 36 | 17020 | 18.517 | 0.009 | | 1.498 | 5.659 | 0.970 | 1.619 | 0.007 | 17160 | 18.200 | 0.014 | | 1.209 | 4.567 | 0.853 | 1.423 | 0.069 | ICP-BF |
| 37 | 17040 | 19.556 | 0.007 | | 2.114 | 7.985 | 1.097 | 1.829 | 0.030 | 17163 | 19.497 | 0.005 | | 2.093 | 7.907 | 1.077 | 1.796 | 0.027 | ICP-BF |
| 38 | 17060 | 21.412 | 0.014 | | 2.340 | 8.840 | 1.151 | 1.919 | 0.027 | 17166 | 21.463 | 0.015 | | 2.355 | 8.897 | 1.147 | 1.913 | 0.020 | ICP-BF |
| 39 | 17085 | 21.541 | <0.01 | | 2.196 | 8.298 | 1.137 | 1.896 | 0.031 | 17169 | 21.289 | <0.01 | | 2.214 | 8.363 | 1.150 | 1.918 | 0.019 | ICP-BF |
| 40 | 17105 | 25.288 | <0.01 | | 2.117 | 7.998 | 1.341 | 2.237 | 0.043 | 17172 | 25.908 | <0.01 | | 2.109 | 7.967 | 1.358 | 2.265 | 0.040 | ICP-BF |
| 41 | 17130 | 19.619 | 0.008 | | 2.097 | 7.924 | 1.009 | 1.683 | 0.029 | 17175 | 19.529 | 0.008 | | 2.116 | 7.994 | 0.998 | 1.665 | 0.029 | ICP-BF |
| 42 | 19003 | 16.408 | 0.086 | | 8.086 | 30.546 | 0.976 | 1.628 | 0.009 | 19157 | 13.741 | 0.067 | | ##### | 39.908 | 0.963 | 1.607 | 0.013 | ICP-BF |
| 43 | 19015 | 8.995 | 0.337 | | 9.261 | 34.986 | 0.670 | 1.117 | 0.015 | 19160 | 10.290 | 0.406 | | ##### | 39.106 | 0.715 | 1.193 | 0.021 | ICP-BF |
| 44 | 19040 | 17.874 | 0.015 | | 2.373 | 8.966 | 0.896 | 1.495 | 0.025 | 19163 | 18.137 | 0.012 | | 2.313 | 8.737 | 0.910 | 1.517 | 0.049 | ICP-BF |
| 45 | 19060 | 12.751 | 0.284 | | 8.178 | 30.897 | 0.766 | 1.278 | 0.026 | 19166 | 12.933 | 0.288 | | 8.175 | 30.883 | 0.808 | 1.348 | 0.026 | ICP-BF |
| 46 | 191 | 20.54 | 0.02 | | 2.7 | 10.460 | 1.0 | 1.78 | 0.0 | 191 | 17.92 | 0.06 | | 3.66 | 13.845 | 0.9 | 1.65 | 0.0 | ICP- |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 5 | 2 | | 69 | | 68 | 1 | 29 | 72 | 4 | 2 | | 5 | | 93 | 7 | 42 | BF |
| 47 | 19125 | 17.987 | 0.067 | | 3.742 | 14.138 | 0.987 | 1.646 | 0.068 | 19175 | 17.923 | 0.073 | | 3.785 | 14.299 | 1.012 | 1.688 | 0.033 | ICP-BF |
| 48 | 19150 | 10.280 | 0.381 | | 9.469 | 35.771 | 0.795 | 1.327 | 0.019 | 22156 | 10.471 | 0.385 | | 9.478 | 35.807 | 0.816 | 1.361 | 0.019 | ICP-BF |
| 49 | 22017 | 27.258 | <0.01 | | 2.243 | 8.474 | 1.472 | 2.455 | 0.016 | 22159 | 26.360 | <0.01 | | 2.263 | 8.551 | 1.439 | 2.401 | 0.013 | ICP-BF |
| 50 | 22060 | 19.890 | <0.01 | | 2.261 | 8.542 | 1.161 | 1.937 | 0.027 | 22165 | 19.544 | <0.01 | | 2.249 | 8.496 | 1.142 | 1.904 | 0.016 | ICP-BF |
| 51 | 22080 | 18.531 | <0.01 | | 2.238 | 8.454 | 1.091 | 1.820 | 0.025 | 22168 | 19.023 | 0.008 | | 2.240 | 8.464 | 1.100 | 1.834 | 0.018 | ICP-BF |
| 52 | 22101 | 19.891 | <0.01 | | 2.876 | 10.864 | 1.129 | 1.884 | 0.016 | 22171 | 17.959 | <0.01 | | 2.661 | 10.054 | 1.008 | 1.681 | 0.015 | ICP-BF |
| 53 | 22125 | 19.492 | <0.01 | | 2.492 | 9.415 | 1.105 | 1.844 | 0.017 | 22174 | 19.688 | <0.01 | | 2.476 | 9.353 | 1.139 | 1.899 | 0.024 | ICP-BF |
| 54 | 22150 | 12.271 | 0.440 | | 8.254 | 31.183 | 0.764 | 1.274 | 0.013 | 21155 | 12.317 | 0.437 | | 8.410 | 31.770 | 0.749 | 1.250 | 0.010 | ICP-BF |
| 55 | 21010 | 11.720 | 0.427 | | 8.581 | 32.417 | 0.739 | 1.232 | 0.015 | 21158 | 11.775 | 0.394 | | 8.161 | 30.832 | 0.692 | 1.155 | 0.020 | ICP-BF |
| 56 | 21040 | 13.316 | 0.391 | | 7.375 | 27.862 | 0.705 | 1.175 | 0.034 | 21161 | 13.212 | 0.386 | | 7.381 | 27.885 | 0.716 | 1.194 | 0.030 | ICP-BF |
| 57 | 21060 | 13.842 | 0.454 | | 7.883 | 29.780 | 0.776 | 1.294 | 0.029 | 21164 | 13.747 | 0.442 | | 7.491 | 28.302 | 0.765 | 1.277 | 0.029 | ICP-BF |
| 58 | 21080 | 12.523 | 0.388 | | 7.490 | 28.295 | 0.718 | 1.198 | 0.021 | 21167 | 12.605 | 0.411 | | 7.514 | 28.387 | 0.719 | 1.199 | 0.020 | ICP-BF |
| 59 | 21100 | 12.478 | 0.387 | | 7.126 | 26.923 | 0.694 | 1.158 | 0.034 | 21170 | 13.128 | 0.403 | | 7.479 | 28.255 | 0.723 | 1.206 | 0.034 | ICP-BF |
| 60 | 21125 | 13.102 | 0.431 | | 8.069 | 30.484 | 0.787 | 1.313 | 0.024 | 21173 | 12.590 | 0.415 | | 7.822 | 29.552 | 0.756 | 1.261 | 0.022 | ICP-BF |
| 61 | 21150 | 11.845 | 0.382 | | 7.649 | 28.897 | 0.686 | 1.144 | 0.019 | EP1104 | 12.251 | 0.401 | | 7.584 | 28.650 | 0.721 | 1.203 | 0.014 | ICP-BF |
| 62 | EP1020 | 19.593 | 0.005 | | 2.538 | 9.589 | 1.038 | 1.731 | 0.012 | EP1107 | 19.982 | 0.007 | | 2.584 | 9.762 | 1.038 | 1.732 | 0.018 | ICP-BF |
| 63 | EP1040 | 12.934 | 0.414 | | 8.313 | 31.407 | 0.725 | 1.210 | 0.008 | EP1110 | 13.024 | 0.427 | | 8.330 | 31.468 | 0.728 | 1.214 | 0.015 | ICP-BF |
| 64 | EP1060 | 13.750 | 0.367 | | 7.267 | 27.453 | 0.861 | 1.435 | 0.012 | EP1113 | 13.375 | 0.388 | | 7.781 | 29.396 | 0.784 | 1.307 | 0.006 | ICP-BF |
| 65 | EP1085 | 17.745 | 0.122 | | 4.947 | 18.689 | 0.942 | 1.571 | 0.012 | EP1116 | 18.132 | 0.118 | | 4.947 | 18.690 | 0.945 | 1.576 | 0.013 | ICP-BF |
| 66 | EP2009 | 19.209 | 0.016 | | 2.110 | 7.970 | 1.079 | 1.799 | <0.01 | EP2110 | 19.223 | 0.016 | | 2.116 | 7.994 | 1.066 | 1.778 | <0.01 | ICP-BF |
| 67 | EP2025 | 16.058 | 0.037 | | 3.126 | 11.810 | 0.870 | 1.451 | 0.010 | EP2113 | 20.471 | 0.037 | | 3.222 | 12.171 | 1.112 | 1.855 | 0.011 | ICP-BF |
| 68 | EP2047 | 20.275 | 0.021 | | 2.715 | 10.258 | 1.110 | 1.851 | 0.009 | EP2116 | 20.088 | 0.023 | | 2.673 | 10.097 | 1.096 | 1.828 | 0.009 | ICP-BF |
| 69 | EP2070 | 22.775 | 0.019 | | 2.510 | 9.481 | 1.216 | 2.028 | 0.007 | EP2119 | 22.313 | 0.024 | | 2.432 | 9.186 | 1.202 | 2.005 | 0.006 | ICP-BF |
| 70 | EP2090 | 21.871 | 0.010 | | 2.507 | 9.471 | 1.197 | 1.997 | <0.01 | EP2122 | 22.099 | 0.010 | | 2.533 | 9.570 | 1.197 | 1.997 | <0.01 | ICP-BF |
| 71 | EP3 | 22.23 | <0.0 | | 2.0 | 7.908 | 1.2 | 2.01 | 0.0 | EP3 | 20.79 | 0.01 | | 2.04 | 7.727 | 1.2 | 2.09 | 0.0 | ICP- |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 024 | 1 | 1 | | 93 | | 06 | 2 | 08 | 110 | 9 | 0 | | 5 | | 56 | 5 | 15 | BF |
| 72 | EP3047 | 21.549 | 0.005 | | 2.094 | 7.912 | 1.182 | 1.972 | 0.014 | EP3113 | 21.153 | 0.007 | | 2.079 | 7.856 | 1.219 | 2.034 | 0.014 | ICP-BF |
| 73 | EP3068 | 12.027 | <0.01 | | 1.622 | 6.128 | 0.598 | 0.997 | 0.072 | EP3116 | 12.060 | 0.004 | | 1.619 | 6.118 | 0.579 | 0.966 | 0.067 | ICP-BF |
| 74 | EP3090 | 10.842 | 0.487 | | ##### | 37.946 | 0.915 | 1.526 | 0.011 | EP3119 | 11.246 | 0.485 | | ##### | 38.540 | 0.924 | 1.542 | 0.013 | ICP-BF |
| 75 | EP7007 | 19.296 | 0.008 | | 2.126 | 8.031 | 1.068 | 1.781 | 0.034 | EP7106 | 19.110 | 0.016 | | 2.167 | 8.188 | 1.065 | 1.777 | 0.046 | ICP-BF |
| 76 | EP7029 | 16.195 | 0.260 | | 6.104 | 23.061 | 0.973 | 1.622 | 0.013 | EP7109 | 16.282 | 0.261 | | 6.056 | 22.880 | 0.916 | 1.527 | 0.013 | ICP-BF |
| 77 | EP7051 | 15.273 | 0.012 | | 6.929 | 26.178 | 0.859 | 1.432 | 0.011 | EP7112 | 14.961 | 0.010 | | 7.045 | 26.615 | 0.830 | 1.384 | 0.015 | ICP-BF |
| 78 | EP7073 | 21.971 | 0.006 | | 2.422 | 9.150 | 1.204 | 2.008 | 0.017 | EP7115 | 22.497 | 0.007 | | 2.418 | 9.133 | 1.217 | 2.030 | 0.014 | ICP-BF |
| 79 | EP7095 | 15.066 | 0.348 | | 6.494 | 24.532 | 0.847 | 1.412 | 0.016 | EP4107 | 15.333 | 0.353 | | 6.658 | 25.153 | 0.844 | 1.408 | 0.017 | ICP-BF |
| 80 | EP4013 | 22.899 | 0.015 | | 2.060 | 7.781 | 1.192 | 1.988 | 0.012 | EP4110 | 22.832 | 0.017 | | 2.060 | 7.782 | 1.211 | 2.021 | 0.013 | ICP-BF |
| 81 | EP4035 | 20.592 | 0.064 | | 2.749 | 10.384 | 1.196 | 1.996 | 0.011 | EP4113 | 20.130 | 0.067 | | 2.782 | 10.509 | 1.210 | 2.019 | <0.01 | ICP-BF |
| 82 | EP4057 | 20.665 | 0.012 | | 1.833 | 6.923 | 1.062 | 1.772 | 0.039 | EP4116 | 21.016 | 0.013 | | 1.865 | 7.045 | 1.082 | 1.805 | 0.017 | ICP-BF |
| 83 | EP4079 | 20.473 | 0.085 | | 2.396 | 9.051 | 1.164 | 1.942 | 0.022 | EP4119 | 20.262 | 0.081 | | 2.395 | 9.048 | 1.181 | 1.971 | 0.017 | ICP-BF |
| 84 | EP4102 | 21.298 | 0.036 | | 2.674 | 10.101 | 1.276 | 2.128 | 0.005 | EP8108 | 21.482 | 0.035 | | 2.678 | 10.116 | 1.290 | 2.151 | 0.007 | ICP-BF |
| 85 | EP8018 | 15.674 | 0.356 | | 7.077 | 26.737 | 0.895 | 1.493 | 0.018 | EP8111 | 15.474 | 0.342 | | 6.965 | 26.314 | 0.873 | 1.456 | 0.013 | ICP-BF |
| 86 | EP8040 | 21.610 | 0.008 | | 2.138 | 8.078 | 1.169 | 1.950 | 0.022 | EP8114 | 21.230 | 0.006 | | 2.126 | 8.033 | 1.168 | 1.949 | 0.014 | ICP-BF |
| 87 | EP8062 | 21.786 | <0.01 | | 1.945 | 7.349 | 1.188 | 1.982 | 0.033 | EP8117 | 21.647 | <0.01 | | 1.953 | 7.377 | 1.182 | 1.972 | 0.032 | ICP-BF |
| 88 | EP8084 | 23.874 | 0.013 | | 2.529 | 9.555 | 1.345 | 2.244 | 0.012 | EP8120 | 23.992 | 0.014 | | 2.531 | 9.561 | 1.360 | 2.268 | 0.012 | ICP-BF |
| 89 | EP5001 | 3.481 | 0.075 | | 5.326 | 20.122 | 0.323 | 0.539 | 0.012 | EP5108 | 3.304 | 0.071 | | 5.053 | 19.090 | 0.315 | 0.525 | 0.019 | ICP-BF |
| 90 | EP5022 | 20.331 | 0.011 | | 2.178 | 8.229 | 1.234 | 2.059 | 0.013 | EP5111 | 21.138 | 0.012 | | 2.184 | 8.251 | 1.258 | 2.098 | 0.010 | ICP-BF |
| 91 | EP5044 | 21.141 | 0.064 | | 2.179 | 8.232 | 1.181 | 1.970 | 0.010 | EP5114 | 24.213 | 0.062 | | 2.413 | 9.115 | 1.348 | 2.249 | 0.013 | ICP-BF |
| 92 | EP5066 | 16.460 | 0.007 | | 2.337 | 8.829 | 0.934 | 1.558 | 0.018 | EP5117 | 16.027 | 0.008 | | 2.248 | 8.492 | 0.907 | 1.513 | 0.008 | ICP-BF |
| 93 | EP5088 | 15.447 | 0.008 | | 2.259 | 8.534 | 0.909 | 1.516 | <0.01 | EP5120 | 15.567 | 0.008 | | 2.283 | 8.625 | 0.914 | 1.524 | 0.008 | ICP-BF |
| 94 | EP9004 | 12.740 | 0.104 | | 3.336 | 12.602 | 0.887 | 1.479 | 0.032 | EP9106 | 12.819 | 0.108 | | 3.248 | 12.271 | 0.873 | 1.457 | 0.028 | ICP-BF |
| 95 | EP9026 | 20.876 | 0.007 | | 2.227 | 8.413 | 1.296 | 2.162 | 0.009 | EP9109 | 21.077 | 0.007 | | 2.289 | 8.649 | 1.296 | 2.162 | 0.008 | ICP-BF |
| 96 | EP9 | 19.76 | 0.00 | | 2.1 | 7.997 | 1.3 | 2.16 | 0.0 | EP9 | 20.08 | 0.00 | | 2.19 | 8.276 | 1.3 | 2.21 | 0.0 | ICP- |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 048 | 7 | 5 | | 17 | | 00 | 8 | 07 | 112 | 5 | 6 | | 1 | | 28 | 5 | 11 | BF |
| 97 | EP9070 | 17.592 | 0.141 | | 3.947 | 14.910 | 1.169 | 1.951 | 0.029 | EP9115 | 18.035 | 0.141 | | 3.977 | 15.024 | 1.186 | 1.978 | 0.023 | ICP-BF |
| 98 | EP9092 | 14.908 | 0.214 | | 6.823 | 25.774 | 0.975 | 1.626 | 0.023 | EP9118 | 14.996 | 0.212 | | 6.963 | 26.304 | 0.984 | 1.641 | 0.014 | ICP-BF |
| 99 | EP6010 | 14.120 | 0.262 | | 6.732 | 25.433 | 0.948 | 1.581 | 0.012 | EP6106 | 14.246 | 0.257 | | 6.680 | 25.235 | 0.949 | 1.583 | 0.012 | ICP-BF |
| 100 | EP6032 | 22.642 | <0.01 | | 2.221 | 8.390 | 1.224 | 2.042 | 0.005 | EP6109 | 22.075 | <0.01 | | 2.116 | 7.992 | 1.201 | 2.003 | 0.022 | ICP-BF |
| 101 | EP6054 | 19.505 | 0.012 | | 2.762 | 10.433 | 1.067 | 1.780 | 0.022 | EP6112 | 18.775 | 0.010 | | 2.871 | 10.846 | 1.069 | 1.784 | 0.022 | ICP-BF |
| 102 | EP6076 | 20.154 | 0.008 | | 2.453 | 9.267 | 1.168 | 1.949 | 0.012 | EP6115 | 20.097 | 0.007 | | 2.389 | 9.025 | 1.176 | 1.962 | 0.022 | ICP-BF |
| 103 | EP6098 | 16.676 | 0.009 | | 1.520 | 5.742 | 0.808 | 1.347 | 0.071 | EP11107 | 16.475 | 0.006 | | 1.530 | 5.780 | 0.807 | 1.347 | 0.065 | ICP-BF |
| 104 | EP11016 | 18.446 | 0.009 | | 2.072 | 7.829 | 1.040 | 1.734 | 0.027 | EP11110 | 18.096 | 0.008 | | 2.075 | 7.839 | 1.027 | 1.713 | 0.036 | ICP-BF |
| 105 | EP11038 | 16.495 | <0.01 | | 2.002 | 7.564 | 0.956 | 1.595 | 0.015 | EP11113 | 23.632 | <0.01 | | 2.001 | 7.558 | 1.370 | 2.284 | 0.026 | ICP-BF |
| 106 | EP11060 | 25.204 | 0.007 | | 2.101 | 7.936 | 1.468 | 2.449 | 0.031 | EP11116 | 25.508 | 0.006 | | 2.112 | 7.979 | 1.461 | 2.437 | 0.024 | ICP-BF |
| 107 | EP11082 | 14.440 | 0.325 | | 7.075 | 26.727 | 0.826 | 1.377 | 0.012 | EP11119 | 14.407 | 0.333 | | 7.153 | 27.022 | 0.822 | 1.372 | <0.01 | ICP-BF |
| 108 | EP10007 | 12.851 | 0.339 | | 5.302 | 20.032 | 0.728 | 1.214 | 0.009 | EP10105 | 12.056 | 0.322 | | 5.227 | 19.745 | 0.680 | 1.135 | 0.009 | ICP-BF |
| 109 | EP10020 | 16.618 | 0.157 | | 3.779 | 14.275 | 0.949 | 1.583 | 0.024 | EP10108 | 16.703 | 0.163 | | 3.838 | 14.500 | 0.934 | 1.557 | 0.018 | ICP-BF |
| 110 | EP10040 | 20.987 | 0.010 | | 2.056 | 7.767 | 1.180 | 1.968 | 0.024 | EP10111 | 21.217 | 0.006 | | 2.012 | 7.602 | 1.205 | 2.011 | 0.019 | ICP-BF |
| 111 | EP10070 | 21.453 | <0.01 | | 1.780 | 6.724 | 1.143 | 1.906 | 0.065 | EP10114 | 21.642 | <0.01 | | 1.756 | 6.633 | 1.161 | 1.937 | 0.061 | ICP-BF |
| 112 | EP10090 | 20.724 | 0.014 | | 2.120 | 8.011 | 1.236 | 2.062 | 0.017 | EP10117 | 21.061 | 0.010 | | 2.125 | 8.029 | 1.247 | 2.080 | 0.015 | ICP-BF |
| 113 | EP12015 | 10.428 | 0.334 | | 9.147 | 34.555 | 0.635 | 1.060 | 0.013 | EP12106 | 12.708 | 0.373 | | 7.196 | 27.184 | 0.757 | 1.263 | 0.012 | ICP-BF |
| 114 | EP12030 | 14.852 | 0.424 | | 6.499 | 24.551 | 1.028 | 1.715 | 0.013 | EP12109 | 14.729 | 0.429 | | 6.381 | 24.106 | 1.026 | 1.711 | 0.014 | ICP-BF |
| 115 | EP12060 | 13.708 | 0.387 | | 7.676 | 28.998 | 0.955 | 1.593 | 0.035 | EP12112 | 13.797 | 0.369 | | 7.681 | 29.017 | 0.951 | 1.587 | 0.025 | ICP-BF |
| 116 | EP12080 | 14.068 | 0.412 | | 7.232 | 27.320 | 0.823 | 1.372 | 0.040 | EP12115 | 13.879 | 0.395 | | 7.129 | 26.933 | 0.828 | 1.381 | 0.019 | ICP-BF |
| 117 | EP12100 | 13.025 | 0.383 | | 8.075 | 30.505 | 0.777 | 1.296 | 0.027 | EP12118 | 13.097 | 0.402 | | 8.099 | 30.595 | 0.777 | 1.296 | 0.038 | ICP-BF |
| 118 | EP14020 | 8.818 | 0.052 | | 1.715 | 6.481 | 0.262 | 0.436 | 0.083 | EP14031 | 8.890 | 0.051 | | 1.756 | 6.634 | 0.265 | 0.442 | 0.081 | ICP-BF |
| 119 | EP13012 | 11.923 | 0.468 | | 7.052 | 26.640 | 0.889 | 1.484 | 0.007 | EP13028 | 11.788 | 0.462 | | 7.007 | 26.472 | 0.860 | 1.435 | 0.009 | ICP-BF |
| 120 | EP15010 | 12.914 | 0.392 | | 6.643 | 25.095 | 0.745 | 1.242 | 0.007 | EP15029 | 5.558 | 0.169 | | 2.804 | 10.591 | 0.313 | 0.522 | 0.004 | ICP-BF |
| 12 | EP1502 | 12.77 | 0.32 | | 6.0 | 22.818 | 0.8 | 1.33 | 0.0 | EP1602 | 14.39 | 0.37 | | 6.85 | 25.902 | 0.8 | 1.47 | 0.0 | ICP- |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 4 | 9 | | 40 | | 02 | 8 | 29 | 6 | 8 | 1 | | 6 | | 86 | 8 | 22 | BF |
| 122 | EP16019 | 21.083 | 0.009 | | 2.293 | 8.663 | 1.118 | 1.865 | 0.031 | EP16029 | 21.103 | 0.009 | | 2.372 | 8.960 | 1.111 | 1.853 | 0.020 | ICP-BF |

Results of duplicates assays are not available

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 19085 | 21.009 | 0.007 | | 2.273 | | 1.065 | | 0.050 | 19169 | | | | | | | | | ICP-BF |
| | EP3003 | 6.066 | 0.078 | | 4.963 | | 0.396 | | 0.013 | EP3107 | | | | | | | | | ICP-BF |

Most likely the duplicate has been confused with the standard (CRM).

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 22040 | 30.655 | <0.01 | | 2.260 | | 1.794 | | 0.051 | 22162 | 48.561 | 0.007 | | 2.506 | | ##### | | 0.057 | ICP-BF |

# Appendix B-8: Aktyubinsk Geological Laboratory Accreditation Certificate

НАЦИОНАЛЬНЫЙ ЦЕНТР АККРЕДИТАЦИИ
КОМИТЕТА ТЕХНИЧЕСКОГО РЕГУЛИРОВАНИЯ И МЕТРОЛОГИИ
МИНИСТЕРСТВА ИНДУСТРИИ И НОВЫХ ТЕХНОЛОГИЙ РЕСПУБЛИКИ КАЗАХСТАН

## АТТЕСТАТ АККРЕДИТАЦИИ

**Зарегистрирован в реестре субъектов аккредитации**

**№ KZ.И.05.1057**
**от «9» декабря 2010 года**
**действителен до «9» декабря 2015 года**

***Испытательная лаборатория***
**ТОО «АГЛ-Актобе»**
**город Актобе, проспект 312 Стрелковой девизии, 10**
*(наименование, организационно-правовая форма, место нахождение субъекта аккредитации)*

**аккредитован(а) в системе аккредитации Республики Казахстан на соответствие требованиям СТ РК ИСО/МЭК 17025-2007 «Общие** *(наименование нормативного документа)* **требования к компетентности испытательных и калибровочных лабораторий»**

**Объекты оценки соответствия: испытание продукции согласно области аккредитации.**

**Область аккредитации приведена в приложении на 21 листах.**

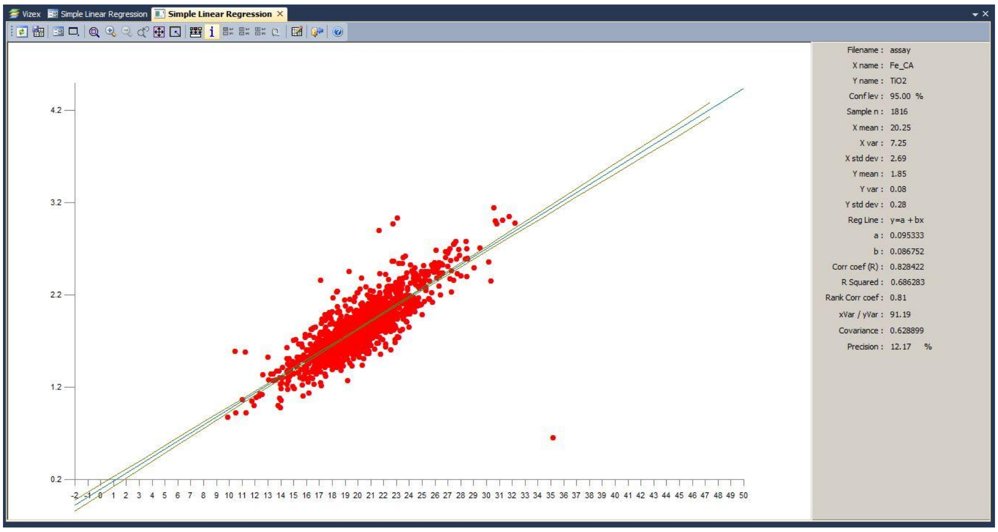
**Руководитель органа по аккредитации** ____ *(подпись)* **Т. Нурашев**

М.П

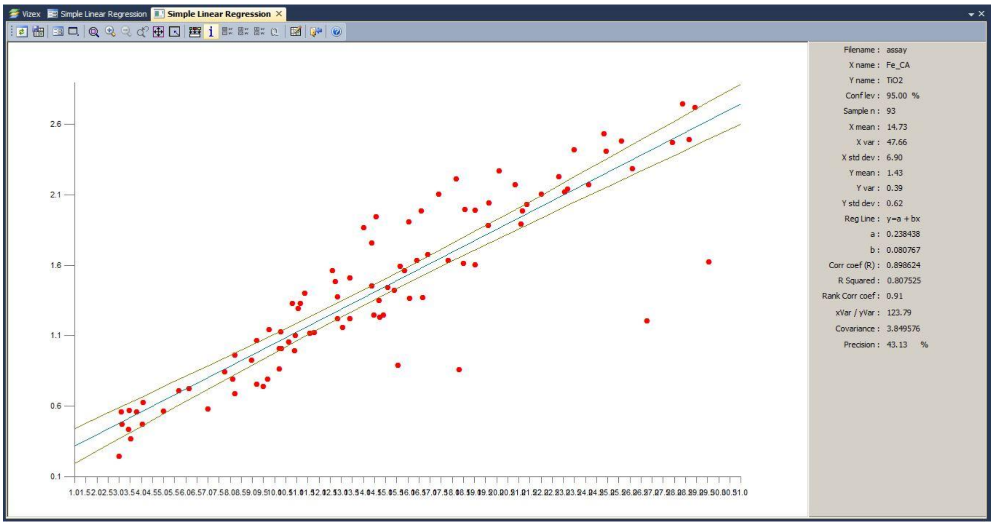
0002086

# APPENDIX C: FE AND $TiO_2$ CORRELATION PLOTS

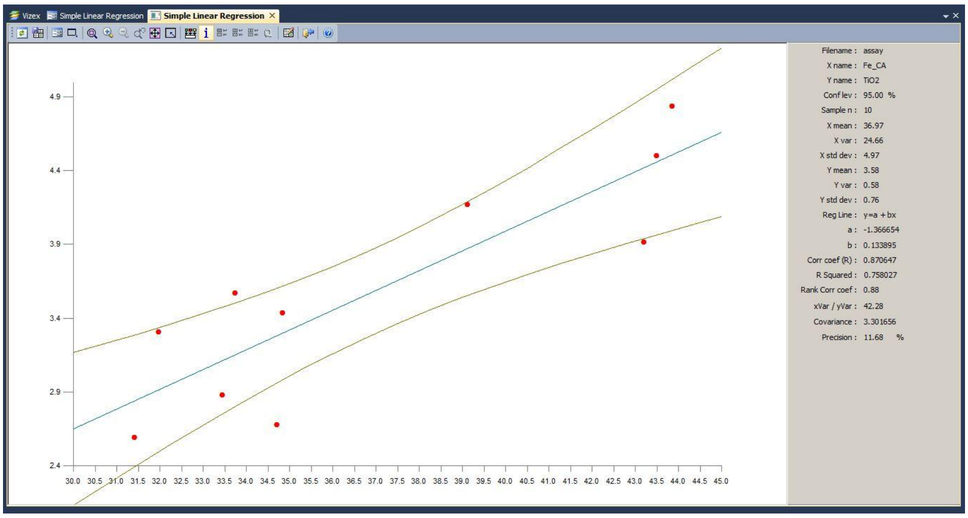
# Appendix C-1: Fe - $TiO_2$ Correlation Plot for magnetite.



# Appendix C-2: Fe - $TiO_2$ Correlation Plot for Martite (Fe <30%).



# Appendix C-3: Fe - $TiO_2$ Correlation Plot for Martite (Fe >30%).



# APPENDIX D: GLOSSARY

| | |
|---|---|
| Block model | A three dimensional electronic model in which geological characteristics and qualities are housed. |
| Client | Daughter Company Aktobe-Temir-VS LLP |
| Company | Daughter Company Aktobe-Temir-VS LLP |
| Competent Person | A person who is a Member or Fellow of The Australasian Institute of Mining and Metallurgy, or of the Australian Institute of Geoscientists, or of a 'Recognised Overseas Professional Organisation' included in a list promulgated from time to time. A 'Competent Person' must have a minimum of five years experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which that person is undertaking. |
| Composite | A single sample generated by the aggregation of many other samples. |
| Concentrate | The clean product recovered through the beneficiation processes. |
| Core | A solid, cylindrical sample of rock produced by an annular drill bit, generally rotatively driven but sometimes cut by percussive methods. |
| Crushing | Size reduction into relatively coarse particles by stamps, crushers, or rolls. |
| Dip | The angle at which a bed, stratum, or vein is inclined from the horizontal, measured perpendicular to the strike and in the vertical plane. |
| Domain | A domain in which the properties display similar characteristics. |
| Drillhole | Technically, a circular hole drilled by forces applied percussively; loosely and commonly, the name applies to a circular hole drilled in any manner. |
| Exploration | The search for coal, mineral, or ore by (1) geological surveys; (2) geophysical prospecting (may be ground, aerial, or both); (3) boreholes and trial pits; or (4) surface or underground headings, drifts, or tunnels. Exploration aims at locating the presence of economic deposits and establishing their nature, shape, and grade, and the investigation may be divided into (1) preliminary and (2) final. |
| Fault | A fracture or a fracture zone in crustal rocks along which there has been displacement of the two sides relative to one another parallel to the fracture. The displacement may be a few inches or many miles long. |
| Grade | The relative quantity or the percentage of ore-mineral or metal content in a mineralised body. |
| Indicated Mineral Resources | That part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a reasonable level of confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes. The locations are too widely or inappropriately spaced to confirm geological and/or grade continuity but are spaced closely enough for continuity to be assumed. |
| Inferred Mineral Resources | That part of a Mineral Resource for which tonnage, grade and mineral |

content can be estimated with a low level of confidence. It is inferred from geological evidence and assumed but not verified geological and/or grade continuity. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes which may be limited or of uncertain quality and reliability.

Infill drilling — The process of secondary drilling to aid further definition of an exploration and/or mining target.

Interpolation — Estimation of a statistical value from its mathematical or graphical position intermediate in a series of determined points.

JORC Code — The 2004 Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves as published by the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia.

Lithology — The character of a rock described in terms of its structure, colour, mineral composition, grain size, and arrangement of its component parts.

Magnetite — A magnetic greyish black iron mineral ($Fe_3O_4$)

Martite — Redish-ocherous iron mineral derived from hematite ($Fe_2O_3$)

Measured Mineral Resources

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

Mineral Resource — A concentration or occurrence of material of intrinsic economic interest in or on the Earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge. Mineral Resources are sub-divided, in order of increasing geological confidence, into Inferred, Indicated and Measured categories.

.

Pit design — A design for an open-pit which comprises all benches, berms, batter angles and haul roads.

Pit optimisation — A process whereby a series of optimised shells for open-pits are generated each corresponding to a specific commodity price assumption.

Pre-feasibility study (PFS)

A technical and economic study which demonstrates the technical and economic viability of a mining project to within a range of accuracy of 25% and to an appropriate degree of detail such that a decision for proceeding to the project development stage may be made without substantive revision to either scope or scale.

| | |
|---|---|
| QAQC | Quality Assurance and Quality Control programme to assess the quality and reliability of data collected and stored. |
| Sampling | The gathering of specimens for appraisal. Since the average of many samples may be used, representative sampling is crucial. The term is usually modified to indicate the mode or locality; e.g., hand sampling, mine sampling, and channel sampling. |
| Scoping Study | A study that includes an economic analysis of the potential viability of Mineral Resources taken at an early stage of the project prior to completion of a PFS |
| SRK | SRK Consulting (Kazakhstan) Limited. |
| SRK Group | SRK Global Limited. |
| Strike | The course or bearing of the outcrop of an inclined bed, vein, or fault plane on a level surface; the direction of a horizontal line perpendicular to the direction of the dip. |

# APPENDIX E: ABBREVIATIONS

| | |
|---|---|
| ADR | American Depositary Receipt |
| CEng | Chartered Engineer |
| CGeol | Chartered Geologist |
| Conc | Concentrate |
| CRM | Certificate Reference Material |
| DTR | Davis Tube Recovery |
| DTM | Digital Terrain Model |
| FAIG | Fellow of Australian Institute of Geoscientists |
| Fe | Iron |
| FeO | Iron oxide |
| $Fe_2O_3$ | Iron oxide |
| $Fe_3O_4$ | Iron – magnetite |
| GDR | Global Depositary Receipt |
| IDW | Inverse Distance Weighting |
| IMMM | Institute of Materials, Minerals and Mining |
| IRR | Internal Rate of Return |
| IPO | Initial Public Offering |
| JORC | Joint Ore Reserves Committee |
| JSE | Johannesburg Stock Exchange |
| KZ | Kazakhstan |
| LoM | Life of Mine |
| MRE | Mineral Resource Estimate |
| MIMMM | Member of the Institute of Materials, Minerals and Mining |
| No | Number |
| NPV | Net Present Value |
| QAQC | Quality Assurance and Quality Control |
| QKNA | Quantitative Kriging Neighbourhood Analysis |
| PEA | Preliminary economic analysis |
| $SiO_2$ | Silica |
| SG | Specific gravity |
| SRK | SRK Consulting (Kazakhstan) Limited |
| $TiO_2$ | Titanium dioxide |
| UK | United Kingdom |
| $V_2O_5$ | Vanadium pentoxide |
| WACC | Weight Adjusted Cost of Capital |
| WF | Wire Frame |
| 3D | Three dimensional |

# APPENDIX F: UNITS

| | |
|---|---|
| g | gramme |
| g/cm$^3$ | gramme per cubic centimetre |
| kg | kilogramme (1,000 grammes) |
| km | kilometre |
| km$^2$ | square kilometre |
| m | metre |
| m$^3$ | cubic metre |
| Mm$^3$ | million cubic metres |
| mm | millimetre |
| Mt | million metric tonnes. |
| Mtpa | million metric tonnes per annum |
| ppm | parts per million |
| t | metric tonne (1,000 kilogrammes) |
| tonne | metric tonne (1,000 kilogrammes) |
| USD | United States dollar |
| % | percentage. |
| ° | degree |
| °C | degree centigrade. |
| ‘ | minute |
| “ | second |
| < | less than |
| > | greater than |