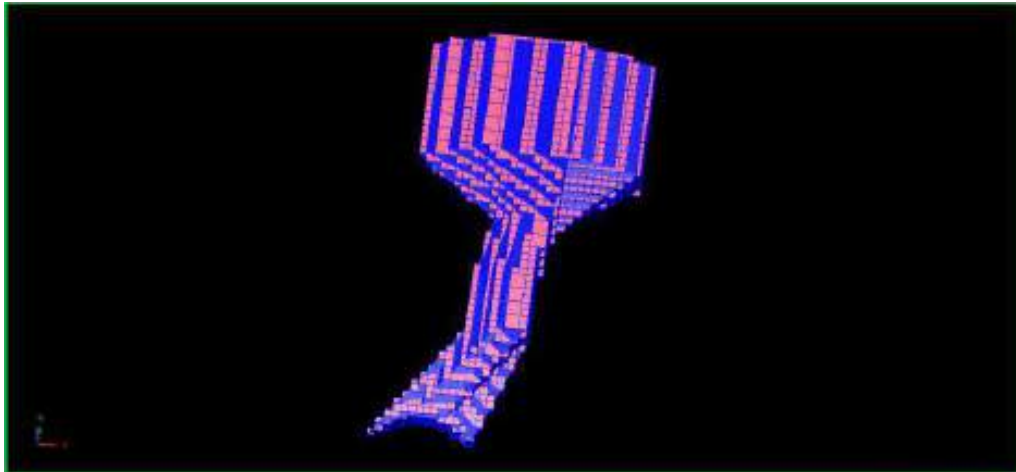


**KWAMSISI GRAPHITE PROJECT  
FEASIBILITY REPORT**

at

**KWAMSISI VILLAGES IN KWAMSISI WARD, HANDENI DISTRICT,  
TANGA REGION.**



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Submission Date 27<sup>th</sup> February, 2023

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## **QUALIFIED PERSONS DECLARATION**

Nicholaus Sloo.

I, Nicholaus Sloo, as co-author of this technical report entitled “Kwamsisi graphite project Pre\_feasibility report” dated 22<sup>th</sup> February 2023, do hereby certify that:

1. I am an employee of a Jorc qualified Exploration Geologist
2. This report is based on my technical and professional expertise being supported by actual data collected by the well experienced Geologist comprising a field team in the company. No any part of this report has been modified or reported based on my own influence in the Company (Azustone Resources Tanzania Ltd).
3. I am a graduate of University of Dar es Salaam, Tanzania with Bachelor of Science degree in Geology (Hons) in 2006.
4. I am an active member of the Australian Institute of Geoscientists (MAIG)
5. I have worked as Exploration geologist profession since my graduation in 2006. My relevant experience for the purpose of the Technical Report is:
  - Mineral exploration project planning, execution and supervision as well as mineral resource estimate experiences for open pit
  - Mineral resource estimation experiences for different commodities in Tanzania
  - Exploration planning and design and execution from glass route through detailed to mining phases for different mining/exploration companies in Tanzania
  - Held senior Exploration planning and mining services role in the mining industry.
6. I have sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as Competent Persons as defined in the JORC Code 2012 Edition of the ‘Australasian Code for Reporting of Exploration Results,

**Mineral Resources and Ore Reserves'. I am responsible for Resource Estimate sections of this Technical Report;**

- 7. I am verified the Project location and all field data collected in this project which has been integrated in this report and participated in the report preparation**
- 8. At the effective date of the Technical Report, to the best of my knowledge, information, and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.**
- 9. I verify that no any part of this Report is based on personal interest, all data reported in this report have been scientifically collected and processed using a series of internationally approved programs.**

Signed and dated this 22<sup>th</sup> day of February 2023.

**Nicholaus Sloo, Bsc in Geology, MAIG.**





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## 1.0 SUMMARY

### 1.1 Introduction

The proposed Project is located in Handeni District, eastern portion of Tanzania, about 245 Kilometres North West of Dar es Salaam City. It is situated around 180 south west of Tanga (the regional headquarter of the Tanga Region). The proposed Project fall under the jurisdiction of Handeni District, Kwamsisi Ward, Kwamsisi Villages.

Access to the Project from Dar es Salaam is via the Dar es Salaam-Bagamoyo -Msata-Mkata on s tarmac Road, approximately 215 km North West of Dar es Salaam. The access road from the Tanga Port is Tanga-Muheza-Mkata approximately 140km South west of Tanga city. The access road to the site from Mkata is rough gravel road, approximately 55 kms south east of Mkata. The access road from Mkata to the site is accessible throught the year.

At Kwamsisi Graphite Project contained 42 primary mining licences (PML), Graphitic mineralisation is hosted within a graphitic gneissic unit along the NNE-SSW approximately 1.8 kms strike length continuity within the licenses area and width of around 70m to 100m and the average graphite mineralised thickness of more than 20m. The graphite's is characteristics principally flake size graphite available on a consistent basis in the outcrop and 13 trenches exposure at numerous locations within the licenses area and at various drill cores.

The Resource was calculated with a 5% Fixed Carbon cut-off grade and the average grade of 8 % Fixed carbon. The average bulk density values for both ligolith and rock that were 2.5, and the average bulk density of the excavated material was used as 1.8, the total resource resources is **15,783,288tons** and the total minable ore is 2,783,288`tons. The mining operation is expected for 300days/year with daily mining capacity 1,800tons which will produce 100.8 graphite tons per day and annual mining capacity of 540,000 tons of graphite ore. The annual graphite production will be 30,240 tons. The expected mining life is 5 years but during mining operation the drilling operation will be continuing in order to update the graphite resources into graphite reserve, hence it is estimated the mining life will **reach 15 years.**

The project area is within the eastern boundary of the Neoproterozoic of Mozambique Belt, characterized by the rocks of Proterozoic age dated 1.9 Ga. These rocks are of the composite metamorphic crustal domain with undifferentiated meta-igneous and sedimentary rocks of variable ages and origins including the Neoarchaeon, Paleoproterozoic, Mesoproterozoic (source) and Neoproterozoic protolith reworked during the Neoproterozoic tectothermal events

The Mozambique Belt system of Proterozoic age consists of metamorphic rocks, mainly granulites, hornblende and biotitic gneisses, Mg-rich crystalline marbles and graphitic schists and gneisses and quartzites. Kyanite-chlorite schists are also present. This rock system contains a fairly wide variety of economic minerals; the majorities are of which rock are forming minerals produced during metamorphism. These rocks are commonly intruded by pegmatite dykes and quartz veins containing variety of minerals including gemstones (graphite, ruby, sapphire, tanzanite, apatite, garnet, aquamarine tourmaline, kyanite, alexandrite or chrysobery etc.), gold and other non-metallic minerals

Drilling programmes were carried out in the area specifically by Azustone Resources in the late 2022. The results of the drilling programmes were compiled by the project and then a geological profile was prepared. Based on the results of the drilling programme, a summary of the geological structure in the individual boreholes was prepared. The interpretation of the data was also given by considering the structure of the surroundings of the level samples and the composite samples, and petrographic analyses.

The core samples drilled was logged for both geological, geotechnical and structural and sampled in order to gain insight into the variation of grades of graphite mineralization with depth. Each core box produced 2 to 3 sample of the core. In addition to logging of the cores in, field sampling was conducted on site and it was carried out in two stages. Stage I field activities included bulk sampling of rocks by the composite sampling method for some selected zones based on the old data. Rock hand specimens for geological studies were also collected at this stage. Stage II field activities included sampling of rocks through trenching on the selected location for trenching method. The rock samples collected in stages I and II were surface materials. The principal aim of the sampling work was to provide suitable and representative samples of graphite that would increase confidence for the probability for the availability for continuing graphite mineralization. All the samples were sent to GST geochemical laboratory at every exploration stage and the results was very encouraging.

Modelling of the Kwamsisi graphite resource began with the establishment of a topographic map of the area, which encompassed surrounding villages, communities Kwedikabo the residential areas etc. Data from past geological studies which included borehole information from various past drilling programs were identified and interpreted to incorporate them in a geological model for better view of the mineralization of the area. A total of 9 boreholes whose information was available were interpreted and entered into a geological model of the deposit. Geological modelling was conducted using Surpac program to enable a three-dimensional view of the deposit to be constructed.

A geological model was produced by first generating a topographic map of the Kwamsisi area and incorporating all boreholes showing the graphite grade profile and borehole collars. Profiles (sections) were then generated from the boreholes which were approximately aligned in a local grid. Polygons were generated from a number of boreholes logged, with each borehole information influencing the area taken up by the polygon. Based on the generated polygons, ten (5m) metre benches across the depth of the mineralization were then produced.

Based on the geological model presented, the economic analysis, topography of the area and the physical features, open pit mining method was found more economical compared to underground mining. A sequence of benches from the highest level to the bottom most level for an ore with cut-off grade of 5% TGC has been worked out. Based on the topography of Kwamsisi graphite Project and the geometry of the ore body, it is logical to work out a deposit from the highest level downwards. Sequence of mining will be in such a way that, the highest bench is mined first followed by successive down ward benches which meet a criteria of having ore above the cut-off grade of 5% TGC The mineralised area is a small hilly. It is therefore planned for the haulage road to start from the location of the processing plant, which is located west of the deposit on a gentle area climbing gently to the top benches in Museum zone where the first production will start. Based on the production figure of 1,800 tons/day, mining equipment, sizing and their costs were determined for the operation of the processing plant for 300 days per year.

The mined ore, which will have an average grade of 8% TGC, will be separated from the gangue and concentrated by two-stages of flotation, preceded by comminution and followed. A number of reagents will be used in the concentration process in order to bring about selective and high recovery of the target mineral, graphite. By and large, these will act to change the nature of the surface of the various mineral phases through the formation of extremely thin (molecular dimensions) surface layers. Therefore, the quantities employed, will be extremely low, a fact that reduces the hazard to the environment.

The economic analysis of the project has been carried out after determining the requirements for operating, development, capital and working capital costs. The operating costs were determined for the individual sections including the mine, processing, engineering and administration. The development cost items are the infrastructural developments which are necessary to support the project to make it start operating. Such infrastructural developments include; power transmission and distribution lines, access roads construction, tailings dam construction, fresh water system construction, office buildings, workshops and fuel bays, crusher and mill foundations, etc. The capital costs have been calculated as those costs spent on purchasing the mining equipment and plant machinery including other fixed assets which are necessary to be used to operate the mine and the processing plant. The depreciation schedules for the assets are also shown and the time at which some of the depreciated mining equipment will have to be replaced is also determined. The working capital is estimated as the amount required to keep the operations running for at least 3 months before the first revenues are generated to keep the operations running. Revenues are estimated based on the amount of total graphic carbon concentrates to be produced. The average feed grade of the ore from the mine has been estimated to be 8% TGC. The ore is planned to be concentrated into 95% TGC, which is a saleable product to an international market. The recovery of the plant is taken to be 70% and it will operate for 300 days in a year to produce a total of 30,240 tonnes of concentrate saleable to the international market.

Revenues and cost estimates which are based on the proposed schedule of operations were evaluated and a cash flow analysis was generated to determine the Net Present Value (NPV) of the project. The analysis was carried out based on the following assumed financial parameters:

- ❑ Mine life of 5 years;
- ❑ Income Tax rate of 30% applicable for Tanzania;
- ❑ An eight-year investment tax credit has been considered under existing Tanzanian tax rules;
- ❑ Tax exemption on fuel, oils, and other imported supplies has not been incorporated in the study though the project qualifies under existing tax incentives accorded to mine development projects in Tanzania. When these incentives are incorporated, it will greatly boost the cash flow of the project.

## **1.2 Property Description, ownership and History**

The proposed Project is located in Handeni District, eastern portion of Tanzania, about 245 Kilometres North West of Dar es Salaam City. It is situated around 180 south west of Tanga (the regional headquarter of the Tanga Region). The proposed Project fall under the jurisdiction of Handeni District, Kwamsisi Ward, Kwamsisi Villages.

Access to the Project from Dar es Salaam is via the Dar es Salaam-Bagamoyo -Msata-Mkata on s tarmac Road, approximately 215 km North West of Dar es Salaam. The access road from the Tanga Port is Tanga-Muheza-Mkata approximately 140km South west of Tanga city. The access road to the site from Mkata is rough gravel road, approximately 55 kms south east of Mkata. The access road from Mkata to the site is accessible throught the year.

At Kwamsisi Graphite Project contained 42 primary mining licences (PML), Graphitic mineralisation is hosted within a graphitic gneissic unit along the NNE-SSW approximately 1.8 kms strike length continuity within the licenses area and width of around 70m to 100m and the average graphite mineralised thickness of more than 20m. The graphite's is characteristics principally flake size graphite available on a consistent basis in the outcrop and 13 trenches exposure at numerous locations within the licenses area and at various drill cores.

The project area is within the eastern boundary of the Neoproterozoic of Mozambique Belt, characterized by the rocks of Proterozoic age dated 1.9 Ga. These rocks are of the composite metamorphic crustal domain with undifferentiated meta-igneous and sedimentary rocks of variable ages and origins including the Neoarchaeon, Paleoproterozoic, Mesoproterozoic (source) and Neoproterozoic protolith reworked during the Neoproterozoic tectothermal events

The project licences is owned by Kusini Gateway Industrial Park Ltd 100%, the Leijin Mining Company Limited has mutual agreement to explore and mine the graphite with Kusini Gateway Industrial Park Ltd

During the mineral exploration stages, the Kwamsisi graphite project passes through various stages of exploration techniques such as:-

### **Geological Mapping**

The mapping traverse were made crossing the strike of the lithologies/outcrops by documenting all the rocks types, grain sizes, colour, geological structures, locating the graphite occurrences and also examined the regolith/ soil to identify the graphite stains at locations under lain by graphitic gneisses.

### **Rock Sampling (Grab)**

Rock samples (grab) are collected along areas of exposed potential graphite mineralized horizons, Grab samples are a locally representative sample of rock mineralization, and cannot be representatively tied to a dimension or thickness interval.

Four (4) samples were collected by using the pick of the hammer and sent to the SGS Geochemical laboratory for graphite analysis ie Total Graphitic Carbon, Ash Content, Volatile Matter and Moisture Content.

### **Ground Magnetic Geophysical Survey**

A ground Magnetic Survey team was consisted of a Mag technician; base station personnel, a magnetometer carrier and a line clearance person. Except a Mag technician, all other persons in this team were trainee from Kwamsisi village. Two GEM 19W magnetometers were used

which are a field magnetometer and a base station magnetometer. The field magnetometer used a WalkMag mode that recorded magnetic intensity measurements continuously whilst walking, while the base station magnetometer recorded magnetic intensities whilst the survey was in progress. The base station magnetometer was set up in an area free of cultural/man made features. The magnetometers were equipped with built-in Global Positioning System (GPS), receivers for location and coordinated universal time (UTC) readings. Both magnetometers were synchronized to the same UTC. During the survey work, the operators used only non-magnetic clothing. The surveyed lines each of was 10 lines each of 700m long, 10 lines each of 520m long and 6 lines each of 370m long were made at an interval of 100m in the entire graphite mineralized envelop of the all PMLs Figure 3.2. The acquired data were loaded in the laptop by GemLink V5.3 software for applicability in the processing stage. The acquired and loaded ground Magnetic data file with their geographic coordinates were then delivered to Magnetic data processing unit as point data in CSV format for further processing.

After the data get received into Magnetic data processing unit in CSV format, the data were loaded in the Oasis Montaj Geosoft and transformed to the projected format of Arc 1960 zone 37s for easy processing. When Profile plots Encom software and test grid was done, it indicated natural variation of magnetic intensity but there are some highs and lows resolutions contributed by artificial objects during data acquisition. The base maps of the survey were presented in the form of colour shaded maps The gridding and enhancement of magnetic data was done using Oasis Montaj program version 9.7, Magmap extension and GIS software (Arc GIS). It consisted of filtering, visualization, and modelling extensions.

The data were gridded at 25m pixel size using Minimum curvatures gridding method which estimates grid value at the nodes of a coarse grid (Usually 8 times the final grid cell size). Bi-directional gridding method which interpolates along the original survey lines and the cross-line direction. The total magnetic intensity (TMI) was obtained and subjected to different filters such as Tilt derivative and down continued grid in order to remove non-geological effects caused by long-wavelength noise along survey lines so as to simplify interpretation.

A total of 12,200m E-W ground magnetic survey line was done across the entire length of the graphite mineralization corridor, the spacing between the line was 100m. The data was then downloaded, cleared, processed and filtered by using different techniques.

Processing of potential field data entails the application of various filters to the data in order to accentuate certain chosen features as an aid in the interpretation of the data.

The process of quantitative interpretation of magnetic anomalies endeavours to determine a source distribution whose anomalous field matches as closely as possible the actual field on the surface of measurement. The non-uniqueness of the potential field problem results in the introduction of constraints in the form of simplification of geometry, limits to size or depth, range limits on susceptibility, or whatever other parameters may seem justified in the context of what is known or can be reasonably inferred about the geologic environment.

Various filters used in the processing of the magnetic data used in this project are as follows.

### **1.3 Geology and Mineralization**

The Kwamsisi Project is located in the area characterized by hilly like terrain, shallow valleys and flat lands with trees and tall grasses. The good surface exposure of outcrops is evident at elevated areas within the property being characterized by light forest and dark brown soil covers at elevated places and black soil covers in valleys. Graphite stains/marks on soil are evident at some locations of the project and have been used on understanding the locations underlain by graphitic gneisses. The dominant lithology identified in the project are crystalline

limestone, graphitic crystalline limestone, gneiss, graphitic gneiss/schists and amphibolitic gneiss. Small units of quartzofeldspathic gneisses, feldspar and calcite were also documented at some locations especially in the eastern and western parts of the project area. The field observation found that this rock is associated with hornblende, garnet and minor biotite. In general, the rock varieties in the project area ranges from high metamorphic grade from amphibolite to granulite facies of sedimentary origin and sediments. The rocks are generally highly fractured and foliated.

At Kwamsisi Graphite Project, Graphitic mineralisation is hosted within a graphitic gneissic unit along the NNE-SSW approximately 2.5kms strike length continuity within the licenses area. The graphite's is characteristics principally flake size graphite available on a consistent basis in the outcrop and 13 trenches exposures at numerous locations within the licenses area.

The graphite is coarse, fully ordered, crystalline and flaky. Grades up to 40.65% TGC were found. Gangue minerals in the ore are quartz, plagioclase, Kfeldspar, biotite and amphiboles. It is believed that the graphitic gneiss were originally sediments rich in organic matter which was converted to graphite during granulite-facies metamorphism.

More than 50 graphite occurrence locations variable were discovered and some 13 trenches were dug for sampling. The underground extensions of the selected orebodies were studied by using the ground magnetic survey to identify the sub-surface structures, faults and the trend of the graphitic gneiss and the most promising anomalies was drilled. The graphite-bearing bodies occur as elongated lenses and following the dominating folds, which trend NNE-SSW in the area.

A good locality illustrating the geological setting of the graphite mineralisation can be seen at the trenches and core tray photographs. The lithologies identified in the trenches including the crystalline limestone on the top and the graphitic gneiss at the bottom.

The Kwamsisi deposit lies within the Mozambique stratigraphy what is known as the Eastern Domain. Graphitic mineralisation is hosted within a graphitic gneissic unit along the NNE-SSW approximately 1.8kms strike length continuity within the licenses area.

At Kwamsisi the graphite mineralization is classified as syngenetic type. Syngenetic results in two categories of graphite, namely crystalline flake graphite and microcrystalline or amorphous graphite. For syngenetic graphite, the crystallinity increases with metamorphic temperatures, hence the quality in terms of flake size and crystallinity depends on the grade of metamorphism.

Crystalline Limestone units overlay the older lithologies such as amphibolitic gneiss, gneiss and graphitic gneiss. Graphitic gneisses are striking parallel with the rest of the lithologies that are striking NNE-SSW (except few locations). The extensions of graphitic gneisses along the strike length are in order of hundred metres to few kilometres, although there are variations of thickness along the same strike length.

The host lithology to graphite mineralization is concordant with the rest of lithologies at the area and they both have a general trend of NNE-SSW with few exceptions

Graphitic mineralisation is hosted within a graphitic gneissic unit along the NNE-SSW approximately 1.8 kms strike length continuity within the licenses area. The graphite's is characteristics principally flake size graphite available on a consistent basis in the outcrop and 14 trenches exposure at numerous locations within the licenses area.

There are three forms of graphite which are amorphous graphite, flake graphite and crystalline vein graphite at Kwamsisi graphite project the dominant form of graphite is flake graphite.

Graphite occurs in metamorphic rocks as a result of the reduction of sedimentary carbon compounds during metamorphism. It also occurs in igneous rocks and in meteorites. Minerals associated with graphite include quartz, calcite, micas and tourmaline.

At Kwamsisi the graphite mineralization is classified as syngenetic type. Syngenetic results in two categories of graphite, namely crystalline flake graphite and microcrystalline or amorphous graphite. For syngenetic graphite, the crystallinity increases with metamorphic temperatures, hence the quality in terms of flake size and crystallinity depends on the grade of metamorphism.

Crystalline Limestone units overlay the older lithologies such as amphibolitic gneiss, gneiss and graphitic gneiss. Graphite flakes form lineation at the outcrop scale within crystalline limestone units but not exceeding 3 vol. % TGC grades based on the field observations. Graphitic gneisses are striking parallel with the rest of the lithologies that are striking NNE-SSW (except few locations). The extensions of graphitic gneisses along the strike length are in order of hundred metres to few kilometres, although there are variations of thickness along the same strike length. Most of the surface graphitic gneisses are weathered and/or altered to oxides and hydroxides of iron, commonly hematite and limonite. Weathering and alteration make these rocks soft and easy to break by hands; however, the graphite flakes remained un-weathered.

Field observations coupled with ground magnetic survey indicate that the graphite mineralization at Kwamsisi area is crystalline flake type with a flake size ranging from medium to coarse. This represents syngenetic rather than epigenetic type of mineralization with no evidence for the existence of amorphous graphite. As a result, this graphite mineralization in the study area points to metasedimentary origin with maximum grade of 40.65 wt.%, that occurs as disseminated flakes in the graphitic gneiss host rocks. The host lithology to graphite mineralization is concordant with the rest of lithologies at the area and they both have a general trend of NNE-SSW with few exceptions. Mineralized zones occur within biotite gneiss and its extension, grade and flakes size qualifies the study area for the economic viability of graphite mineralization. However, further studies on the tonnage for the graphite reserve through drilling is required

#### 1.4 Mineral Resource Estimate

An inferred Mineral Resource of 1,410,200 tons of graphite at grade of 8 % tgc has been estimated for Kwamsisi Project at this level of exploration with expectations of this resource to increase twice after detailed (close space) drilling and increased depth to 60m.

Based on variogram, drilling spacing and experience we classify the material as inferred resources and indicated resources. These guidelines assume all other criteria of the reporting codes are met and will require downgrading if there is risk in other areas. We use 85% of the sill to define inferred resources and the remaining will be classified as indicated. Hence an inferred Mineral Resource of 1,198,670 and indicated resource of 211,530 tons of graphite at grade of 8 %tgc has been estimated.

Classification	Grade(% tgc)	Volume (m3)	tonnes (materials)(t)	tonnes (graphite) (t)
Inferred	8	7,422,100	6,216,712	1,198,670
Indicated	8	1,113,315	2,783,288	211,530
<b>Total</b>	<b>8</b>	<b>7,422,100</b>	<b>9,000,000</b>	<b>1,410,200</b>

## Metallurgical Testing

The mineral processing and metallurgical test for Kwamsisi Project has not yet done at this stage. Preliminary metallurgical test for Kwamsisi Project has been done as shown below. The mineral processing test will be done together with ESIA

### Preliminary Metallurgical Test One

Preliminary Metallurgical Testing was done to determine the graphite flake size, chemical content, mineral content and total graphitic content in % by mass. The preliminary petrographic analysis was done at GST laboratory.

It was observed that, for 11 samples taken from the drill core, which represent the entire project area the mineral contents are as follow as metallurgical testwork one: -

**Graphite-** Fine to coarse grained, subhedral to euhedral in crystal form and fibrous in habit. Approximately average size 0.86mm-2.10mm, 17-29%

**Orthoclase-** Medium grained size, anhedral in crystal form, granular in habit; 24%44%

**Pyroxene-** Fine to medium grained, anhedral to subhedral in crystal form and angular in habit;38%

**Calcite-** Fine to medium grained size, anhedral to subhedral in crystal form, with pinkish-green tint, some occur as infill along fractures;9%,19,21%

**Biotite** -Medium grained size, subhedral in crystal form, some tabular in habit, some grains have altered to form Epidote and Muscovite minerals 3%, 9%

**Plagioclase** Medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning 2%

**Quartz-** Fine to medium grained size, anhedral in crystal form, granular in habit, show undulatory extinction 4%, 34%

**Olivine-** Medium to coarse grained size, anhedral to subhedral in crystal form, granular in habit, high interference colour; 6%, 22%

**Hornblende-** Fine to coarse grained size, anhedral to subhedral in crystal form, granular; 2%, 28%

**Pyrite-** Fine to medium grained size, subhedral to euhedral in crystal form and some cubic in habit; 5%, 7%,10%

**Garnet-**Fine to coarse grained size, anhedral to subhedral in crystal form, granular in habit, with irregular fractures.19%

## Mineral Processing

Graphite ore include amorphous graphite and flaky graphite. Amorphous graphite also calls cryptocrystalline graphite. This ore has small graphite crystal and generally have high grade, general but its floatability is bad. After flotation, the grade has no remarkable increase. The feature of Kwamsisi graphite is the graphite present as flaky or foliated, raw ore grade is around 1.6 to 55% TGC with the average grade of 8% TGC. This graphite ore has good floatability and grade can up to 95% after flotation. So, raw ore grade with 5% can be mined. Flaky graphite has good performance and can be used to make advanced carbon product.

Flaky graphite has good floatability, so mostly use flotation to select. In China, they generally use the kerosene or diesel as collector, oil or new flotation oil as foaming agent. After many years production practice oil are considered as ideal foaming agent for graphite.

Generally, cryptocrystalline graphite associate with mica etc silicate minerals. When flotation, can use starch, dextrin, organic glue, cellulose, etc agent to control the silicate minerals, for example, if the pyrite content is high, add lime and oxide.

## **1.5 Mining Methods**

At Kwamsisi area, exploration carried out so far has defined one major zones that hosts graphitic gneiss and graphitic crystalline limestone that can be commercially concentrated using physical methods. This zone hosts the high-grade graphite which have already been tested for physical concentration and proved successful.

Based on the metallurgical results obtained through a series of pilot plant tests and diamond drilling programs carried out, it is therefore, concluded that the mineable ore reserve so far defined is present.

Whereas drill holes defined mineralization to a depth of 50m, it is therefore at this stage the mineable reserve is at maximum 25m below the ground surface.

Based on the above information, there are two technically sound alternatives of exploiting the ore deposit; that is “Open Pit Mining”, and “Underground Mining”. However, underground mining will be excluded from further consideration because it will demand more resources and long lead times to develop the openings and facilities for mining and handling the ore. Whereas with surface mining, little development will be needed as high-grade ore is already available close to the ground surface which will require minimum development works to be completed before full production of the graphite commences.

Open pit mining is a mining method in which the sought minerals are exploited from the surface downward after stripping out the top-soil which may not be part of the useful mineral. The method utilizes heavy-duty equipment such as bulldozers, loading shovels, rear dump trucks, drilling rigs, etc., to recover the ore from the ground before sending it to the processing plant for beneficiation. The minerals are mined in sequence of benches, which are staged to conform to schedules of exploitation and to the general layout of the mineral deposit.

Based on the geological model presented, a sequence of benches from the highest level to the bottom most level for an ore with cut-off grade of 5% TGC has been worked out. Based on the topography of Kwamsisi Graphite Project and the geometry of the orebody, it is logical to work out a deposit from the highest level downwards. Sequence of mining will be in such a way that, the highest bench is mined first followed by successive down ward benches which meet a criteria of having ore above the cut-off grade of 5% TGC.

Figure 3.1 shows the sequence of benches as seen from south to north of the Kwamsisi graphite mineralized zone.

### **Multistage grinding multistage flotation**

To prevent graphite flakes from breaking, multistage grinding multistage flotation process will be used. After multi grinding and flotation, the concentrated graphite will meet the requirements.

## **Gravity and flotation united process**

For graphite associated with heavy mineral, generally use gravity and flotation united process to select, that use gravity separation to separate heavy mineral firstly, then use flotation to process the light mineral.

## **Detailed Crystalloid Graphite Mineral Processing Flowsheet**

Generally, graphite ore's hardness is medium hard or medium hard soft, grade is between 2-10%, crushing process is simple, use three-stage open circuit, two-stage open circuit or one-stage crushing flow sheet. Flotation processes include multistage grinding, multistage selection, middling's return in order or concentrated. Multistage process has three forms that is concentrate regrinding, middling's regrinding, tailings regrinding. Crystalloid graphite most use concentrate regrinding process, normally, the recovery ratio can up to around 95%.

For further purification of a graphite concentrate to natural high purity graphite products with carbon contents of up to 99,99 wt.-% advanced chemical and thermal processes have to be applied.

Several procedures for purification of graphite concentrates are available. A basic process is thermal treatment in the presence of caustic reagents to dissolve siliceous impurities such as quartz, feldspar or mica. The graphite flotation concentrate is mixed with caustic reagent and baked at elevated temperatures. After baking the graphite is leached with water to wash away dissolved impurities.

In case ultimate purity levels are targeted, the more finely intergrown mineral phases residing in between the graphite layers, have to be removed. Typically, an additional one or multi-stage acid washing with different acids or combinations thereof to remove impurities that are insoluble at alkaline conditions, is applied.

Optimal reaction conditions and reagent uses have to be matched by considering type and level of impurities present in the respective graphite concentrate, targeted product quality, markets and finally economics of the process.

## **Reagent**

A number of reagents are used in the concentration process in order to bring about selective and high recovery of the target mineral, graphite. By and large, these act to change the nature of the surface of the various mineral phases through the formation of extremely thin (molecular dimensions) surface layers. Therefore, the quantities employed, are extremely low, a fact that reduces the hazard to the environment.

Several procedures for purification of graphite concentrates are available. A basic process that will be used is the application of thermal treatment in the presence of caustic reagents to dissolve siliceous impurities such as quartz, feldspar or mica. The graphite flotation concentrate is mixed with caustic reagent and baked at elevated temperatures. After baking the graphite is leached with water to wash away dissolved impurities.

The reagents will be applied as relatively dilute solution. These will be prepared in a specially designed reagent preparation room by appropriately trained personnel. In this way, any hazard associated with the use of the reagents will be minimized and confined.

## **Tailings Disposal Facility**

Tailings disposal facility will be required for storage of tailings from the processing plant. The size determination of the tailings disposal facility (TDF) at Kwamsisi Graphite Project is controlled by the topography.

The total area of the pond and the linear feet of the dam were estimated as follows

The designed cross-sectional area of the tailings dam is 5 hectare with the height from 2m high

The total cost is the cost of preparing the tailings pond plus the cost of construction of impoundment dam around it.

## **1.6 Project Infrastructure**

Administration block which shall contain offices for general, administration and management personnel. Mine technical personnel, clerical, receptionists, secretarial and other personnel will be allocated offices within this block.

A changehouse that will cater for the mining personnel will be located adjacent to the administration block. Smaller changehouses for dedicated personnel, e.g., processing, workshops and others will be located within their working areas.

The main workshop will be located close to the processing plant and will contain four bays for washing, small vehicle repairs, mobile equipment repairs, tire repair) and will be serviced by an overhead crane. Within the main workshop, space will be allocated for a machine shop, an electrical and instrumentation shop, welding, hydraulics and fabrication shop. It is also planned to establish a small workshop within the plant to handle smaller repairs within the pit so as to minimize equipment downtime. This workshop will be a mobile one which will be moved as the pit advances but kept at a distance safe from blasting damage.

The warehouse for storing maintenance spares and other supplies will be located in close proximity to the processing plant and the main workshop. Bulk materials that can be kept in the open will be stored within a partially roofed and fence outside area. Separate warehouses for chemicals and reagents, oils and greases will be constructed separately. Storage of explosives and the associated ingredients will be located and constructed in accordance to

the requirements of the Explosives Act. Prior to utilization of the explosive's magazine, an application for licence and hence inspection by the Chief Inspector will be initiated. 18.2.3 Site

A medical clinic staffed with a qualified medical assistant and nurses will be constructed on site to cater medical emergencies and illnesses that can be handled at site. Complicated cases will either be referred to Tanga or Muhimbili (in Dar-es-Salaam) referral hospitals.

A construction camp that will be used during the mine and plant construction is planned to be erected on the Project site. The camp will be located north of the site identified for plant construction. The construction camp will be constructed using prefabricated, modular air-conditioned units. The camp will consist of bedrooms, washrooms, laundry facilities, kitchen, lunch/dinner room, recreation facilities and a first aid building. Supervisory and skilled workers will be housed in the camp while unskilled workers will be expected to be accommodated in the surrounding community.

After the construction stage, the camp will be converted for use by the operations management, supervisors and skilled workers during the operations stage.

Within the project area, there is electricity supply from the National Grid and is already connected to the one graphite mine in the area, located almost 2km away from the project site. The mine is connected via a 33 kV line from Handeni.

Once power supply has been availed to site, power to different facilities will be distributed by underground feeders, cable tray systems and overhead lines for distant locations. Local distribution transformers will be used to provide power at the desired voltage. Standby power to cater for emergencies during power cuts will be provided by diesel generators that will be chosen to meet the minimum requirements for running the mine and processing operations. The generators will be housed in well-ventilated and roofed shed located south but close to the processing plant.

Fuel stocks required for running the standby generators, mobile equipment (mine trucks, construction equipment), light vehicles and other fuel operated equipment will be stored on site. Storage facilities will have the capacity to cater for at least one month's supply. The storage tanks will be located close to the workshop which will be located north of the processing plant. As an environmental management good practice, the steel fuel storage tanks will be erected with a concrete bunding containment with the capacity to accommodate 110% of the capacity of the tanks. Fuel unloading stations will be provided at both locations and truck refueling will be provided near the main workshop.

During construction and at the start of the operations water supply to the site will be abstracted from underground which according to the hydrogeological study conducted by the other graphite mine near our site, has enough water to cater for the current users and the mining operations.

On the long-term, however, the mine plans to harvest and dam rain water by taking advantage of the hilly topography in the area. Selection of the site for the dam will be done carefully to ensure minimum interruption with the natural drainage system and hence minimize impacts to downstream users. In addition, it is expected that the plant will use about 2 tons of water per ton of ore processed. As the processing wastes are pumped to the tailing's facility, the water will be collected at one end of the facility with sediments allowed to settle and allow clean water to be recycled back to the plant. Calculated according to the annual output of 30,000 tons, the production water consumption is about 150t/h, and the production return water is about 50%. When the drilling depth is 300 meters, the water inflow

is about 20m<sup>3</sup>/h, so as to prevent the production from being affected in the dry season, it is necessary to set up 5 to 10 Wells for backup, and the drilling cost is 147.06 USD/m, totaling 44,118 USD.

The fire protection will be supplied from the fresh water storage pond which will contain a fire reserve equivalent to 2 hours retention at maximum flow. The line supplying water from well will be used to provide backup water if needed. An electric powered fire pump will be provided to automatically supply water through a buried water distribution system.

Strategically located fire hydrants and hose stations will be located near main buildings around the site. All high risk areas will also be equipped with automatic sprinkler system and portable fire extinguisher units. The start-up of the fire pump will automatically activate the alarms which can also be turned on manually.

A 3m firebreak will be constructed around the lease area borders and signs warning against starting of fires will be posted around the area. This measure will aim at controlling the start of fires that are known to be started by pastoralists in a bid to reactivate grass growth for their animals.

Storage of fresh water for use in the processing plant, the mine, fire and other uses will be done through a constructed pond with capacity for nearly two months requirements. The pond will be located close to the processing plant which will be the biggest fresh water consumer.

Sewage from the mine site will be collected by a gravity sewer network through buried PVC plastic pipes to sewage treatment ponds. The sewage treatment ponds will be located east of the processing plant. A set of three ponds will be constructed to allow serial movement of effluents from the intake pond to the discharge pond. It is envisaged that well maintained and functioning ponds will allow the last pond to discharge clean water. The water will be monitored regularly to ensure that no polluted water is discharged into the environment.

Within the project site, mobile telephone services from Halotel and Airtel can be easily accessed. Discussions will be carried out with the Tanzania Telecommunications Company Ltd, TTCL to enable the extension of the existing communication lines to reach the project area.

The project will maintain a fleet of mobile equipment for the maintenance of access and haulage roads and other surface areas of the project site. The fleet of mobile equipment will include a dozer, dump trucks, wheel loaders, mobile crane, pickups, vans and buses.

All imports and exports by sea will have to be shipped through the port of Dar-es-Salaam which is well connected to the project area by both rail and road transport. The Dar-es-Salaam port has ample facilities for handling the project needs. The port has eight deep water berths for general cargo, and three container berths. The container berths have been privatized and is run by a private operator which has increased the efficiency and hence cutting down the time for goods clearing. From the port of Dar-es-Salaam there two major alternatives for transporting goods to the project mainly by railway and road transport. Both road and railway transport have direct connections into the port.

The community surrounding the project area at the moment depend on the public services for some basic services, e.g., access to a clinic, school, transport, access to market for their agricultural produces and others. Most villagers around the area farm in valleys and have to move their produce long distances in order to access the markets or reliable transport. The Kwamsisi Village clinic is small one catering mainly for the villagers. Despite a number of

rivers in the area, villagers have no tap water and it normally not treated. These and many other issues that face the surrounding communities determine their quality of life.

Based on identified priority issues by the local Government and those that can be supported within the Company budget constraints, a plan for implementation will be worked out and agreed between the two parties. In order to implement these, the Company will each year set aside a budget that is in line with its business plans.

### 1.7 Environment and Permitting

As at the time of this report being submitted, the Environmental Impact Studies (EIAs) and Social or Community impact studies was in process being conducted on behalf of project developer Broad Resource (Singapore) Investment & Trading Pte Limited by accredited firm of experts and the certificate will be submitted together with the application for the Mining Licence (ML).

The Environmental certification of the project is every important as one of the major factors on conversion of the currently estimated resource to the reserve (Reserve estimation).

### 1.8 Capital and Operating Cost

Capital costs are those costs spent on purchasing the mining equipment and plant machinery including other fixed assets which are necessary to be used to operate the mine and the processing plant.

**Table 1.1 Capital Cost**

编号 NO	项目 item	名称 Name	单位 Unit	数量 amount	单价/万 Unit price/10K	总价/万 Total price /10 K	
1	破碎 Crushing	振动给料机Vibrating Feeder	台unit	1	2.56	2.56	
		颚式破碎机jaw crusher	台unit	1	13.18	13.18	
		波辊筛Roller screen	台unit	1	3.53	3.53	
		多缸圆锥破Multi cylinder cone break	台unit	1	14.23	14.23	
		格子型球磨机grate ball mill	台unit	1	14.54	14.54	
		螺旋分级机spiral classifier	台unit	1	6.78	6.78	
2	浮选 Flotation	罗茨风机Roots blower	台unit	1	1.95	1.95	
		浮选机flotation machine	台unit	1	13.65	13.65	
		浮选机flotation machine	台unit	1	6.49	6.49	
		立磨vertical mill	台unit	18	1.14	20.60	
		浮选机flotation machine	台unit	6	4.42	26.54	

		浮选机flotation machine	台unit	7	2.31	16.14	
		滚筒筛trommel screen	台unit	4	1.41	4.24	
		精矿泵（柱塞泵） Concentrate pump (plunger pump)	台unit	24	0.52	11.91	
		中矿泵（卧式渣浆泵） Medium mine pump (horizontal slurry pump)	台unit	4	0.44	1.74	
		尾矿泵（卧式渣浆泵） Tailings pump (horizontal slurry pump)	台unit	2	1.56	3.12	
		压滤机（正目） pressure filter( positive mesh)	台unit	1	12.94	12.94	
		压滤机（负目） pressure filter(negative mesh)	台unit	1	12.94	12.94	
3	烘干 Drying	螺旋烘干机Spiral dryer	台unit	2	12.42	24.85	
		螺旋输送机spiral conveyer	台unit	2	0.32	0.64	
		螺旋输送机spiral conveyer	台unit	2	1.07	2.14	
		螺旋输送机spiral conveyer	台unit	2	0.52	1.04	
		螺旋输送机spiral conveyer	台unit	2	0.32	0.64	
		螺旋输送机spiral conveyer	台unit	1	0.38	0.38	
		袋式收尘器bag type dust collector	台unit	1	5.88	5.88	
		收尘风机dust-collecting fan	台	1	1.29	1.29	
		旋风收尘器 rotoclone collector	台	1	0.88	0.88	
		烟气引风机Flue gas induced draft fan	台	1	2.00	2.00	
		烘干炉助燃风机Drying furnace combustion fan	台	1	0.71	0.71	
		插板阀Gate Valve	批	1	0.47	0.47	
		斗提skip winder	台	2	1.18	2.35	
烘干炉drying oven	台	1	2.35	2.35			
4	输送 Conve	皮带机 belt conveyor	台	1	10.78	10.78	

	ying	皮带机 belt conveyor	台	1	15.88	15.88	
		埋地皮带机 burying belt conveyor	台	1	16.35	16.35	
		皮带机 belt conveyor	台	1	37.18	37.18	
		输煤皮带机 coal belt conveyor	台	1	2.96	2.96	
		皮带机钢结构立柱 conveyor steel column	批 batch	1	20.00	20.00	
5	开采 Mining	履带式潜孔钻Crawler type drill	台	1	14.82	14.82	
		液压挖机Hydraulic excavator	台	1	62.51	62.51	
		装载机loader	台	2	6.12	12.24	
		自卸车dumper	台	6	6.12	36.71	
6	供水供气	清水供水泵clean water supply pump	台	1	0.43	0.43	
		浮选设备永磁电机冷却用水泵Flotation permanent magnet motor cooling water pump	台	1	0.12	0.12	
		破碎设备永磁电机、烘干机轴承座冷却用水泵 Crusher permanent magnet motor, dryer bearing housing cooling water pump	台	4	0.03	0.10	
		空压机air compressor	台	1	0.49	0.49	
		空压机管路、储气罐、冷干机Air compressor pipeline, air storage tank, cold drying machine	套set	1	3.53	3.53	
管道、阀门等pipelines and valves etc	套set	1	11.76	11.76			
7	厂房 Plant	1800 square meters	M2	2	56.47	112.94	
		行吊crane	台	4	1.36	5.46	
8	检验 Inspect	化验设备Laboratory equipment	套set	1	2.53	2.53	
9	非标 Non-standa rd		批 batch	1	23.53	23.53	

10	消耗品 Consumables	钢球steel balls	批 batch	27	0.20	5.40	
		陶瓷球ceramic balls	批 batch	24.5	0.31	7.49	
11	电气 Electrical	永磁电机permanent magnet motor	批 batch	1	94.12	94.12	
		电控electrical control	batch	1	105.88	105.88	
总计 (万) : Total				8,532,600USD			

## 1.9 Preliminary Economic Analysis

### Revenue Estimates

The following main technical parameters are considered in the estimation of the Kwamsisi Graphite Project financial analysis:

#### Input Data for the Project Financial Appraisal

Zone	Volume体积	Tonnages吨	Average grade (%)平均品位
rt	矿床储量总吨数Total tonnage of deposit resources	9,000,000	8
rf	回收率Recovery rate	0.70	
dpy	每年运行天数Days of operation per year	300	days
T	可开采吨数mining tonnages	2,783,288	tonnes
L	矿山寿命mine life	5	yrs
COP	生产能力/天production capacity/day	100.8	tonnes
DMC	日开采能力mining capacity/day	1,800	tonnes
AP	年生产量annual production capacity	30,240	tpa
	估计品位范围estimated grade range	5 – 8	% TGC
	石墨销售价格Graphite sales price	680.00	\$/t

### Cash Flow Analysis

Revenues and cost estimates made in sections 5 to 10, which are based on the proposed schedule of operations were evaluated and a cash flow analysis was generated to determine the Net Present Value (NPV). Is a cash flow analysis of the project and presents a picture of the schedules of costs and revenues, based on the following assumed financial parameters:

- Mine life of 9 years;
  - Income Tax rate of 30% applicable for Tanzania;
  - Government Loyalty

- A nine-year investment tax credit has been considered under existing Tanzanian tax rules;
- Tax exemption on fuel, oils, and other imported supplies has not been incorporated in the study though the project qualifies under existing tax incentives accorded to mine development projects in Tanzania. When these incentives are incorporated, it will greatly boost the cash flow of the project.

Based on the above parameters the project has shown to have good potential to generate cash as summarized in some of the important economic indicators shown in Table 13.2.

#### Assumptions

Graphite price will remain at USD \$680/ton over LOM.

#### Estimated Annual NPV for 100% graphite Production for the First year

Entity 个体	Amount (USD) 金额
年收入生产(0.7回收系数)Annual revenue (recovery rate 0.7)	<b>20,563,200.00</b>
运输费用transportation expenses	1,150,000.00
年环境管理成本Annual environmental management cost	116,100.00
营运资金operation cost	12,023,541.18
30% 所得税30%income tax	2,182,067.65
0.03% 服务税0.03% service tax	8,526.60
Total 总计	15,480,235.42
<b>每年净利润Annual net profit</b>	<b>5,082,964.58</b>

## 2.0

## 2.0 INTRODUCTION

### 2.1 Effective Date

The effective date for which the mining site preparation preo to mine operation si planned to be on eary June, 2023.

### 2.2 Abbreviation, Units and Currencies

amsl	Average Mean See Level
APT	Appropriate Processing Technologies
BH	Borehole
bgl	Below ground level
FS	Feasibility Study
BCOG	Break-Even Cut-off Grade
E	East
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
DW	Domestic Water
GST	Geological Survey of Tanzania
GW	Ground Water
GIS	Geographical Information System
IBCOG	Incremental Break -Even Cut-off-Grade in Pit
IW	Industrial water
FeO	Iron Oxide
GPS	Global Positioning System
KVA	Kilovolt-Ampere
Km	Kilometer
MOM	Ministry of Mineral
m	Meter
MCOG	Mill Cut-off Grade
PL	Prospecting Licence
RMO	Resident Mine Officer
VEO	Village Executive Officer
WEO	Ward Executive Officer
W	West
PL	Prospecting Licence
PML	Primary Mining Licence
ppm	Part per million
S	South
PPE	Personal Processing Equipment
SE	South East
PW	Portable water
SW	South west
QAQC	Quality Assurance Quality Control
RBCOG	Resource Break-Even Cut-off grade
RICOG	Resource Incremental Cut-off Grade in Pit
RMCOG	Resource Mill Cut-off Grade
ROM	Run of mine
RW	Raw Water

RL	Reduced Level
SG	Specific Gravity
SOP	Standard Operating Procedures
N	North
TANESCO	Tanzania electrical supply Company
TGC	Total Graphitic Carbon
Tsh	Tanzania shillings
USD	United State Dollar
NE	North East
W	Watt
NPV	Net Present Value
NW	North West
TGC	Total Graphite Carbon
%	Percentage
NNE	North North East
SSW	South South West

### **3.0 RELIANCE ON OTHER EXPERTS**

All the information contained in this report has been compiled from referenced source of information in the public domain and well experienced Geologists participated in the primary property investigation including geological mapping, Trenching, rock sampling and drilling.

## **4.0 PROPERTY DESCRIPTION AND LOCATION**

### **4.1 The Project Location**

The proposed Project is located in Handeni District, eastern portion of Tanzania, about 245 Kilometres North West of Dar es Salaam City. It is situated around 180 south west of Tanga (the regional headquarter of the Tanga Region). The proposed Project fall under the jurisdiction of Handeni District, Kwamsisi Ward, Kwamsisi Villages (Figure 4.1).

At Kwamsisi Graphite Project, Graphitic mineralisation is hosted within a graphitic gneissic and crystalline limestone rock units along the NNE-SSW approximately 1.8kms strike length continuity within the licenses area. The graphite's is characteristics principally flake size graphite available on a consistent basis in the outcrop and 13 trenches exposure at numerous locations within the licenses area, figure 4.1 below

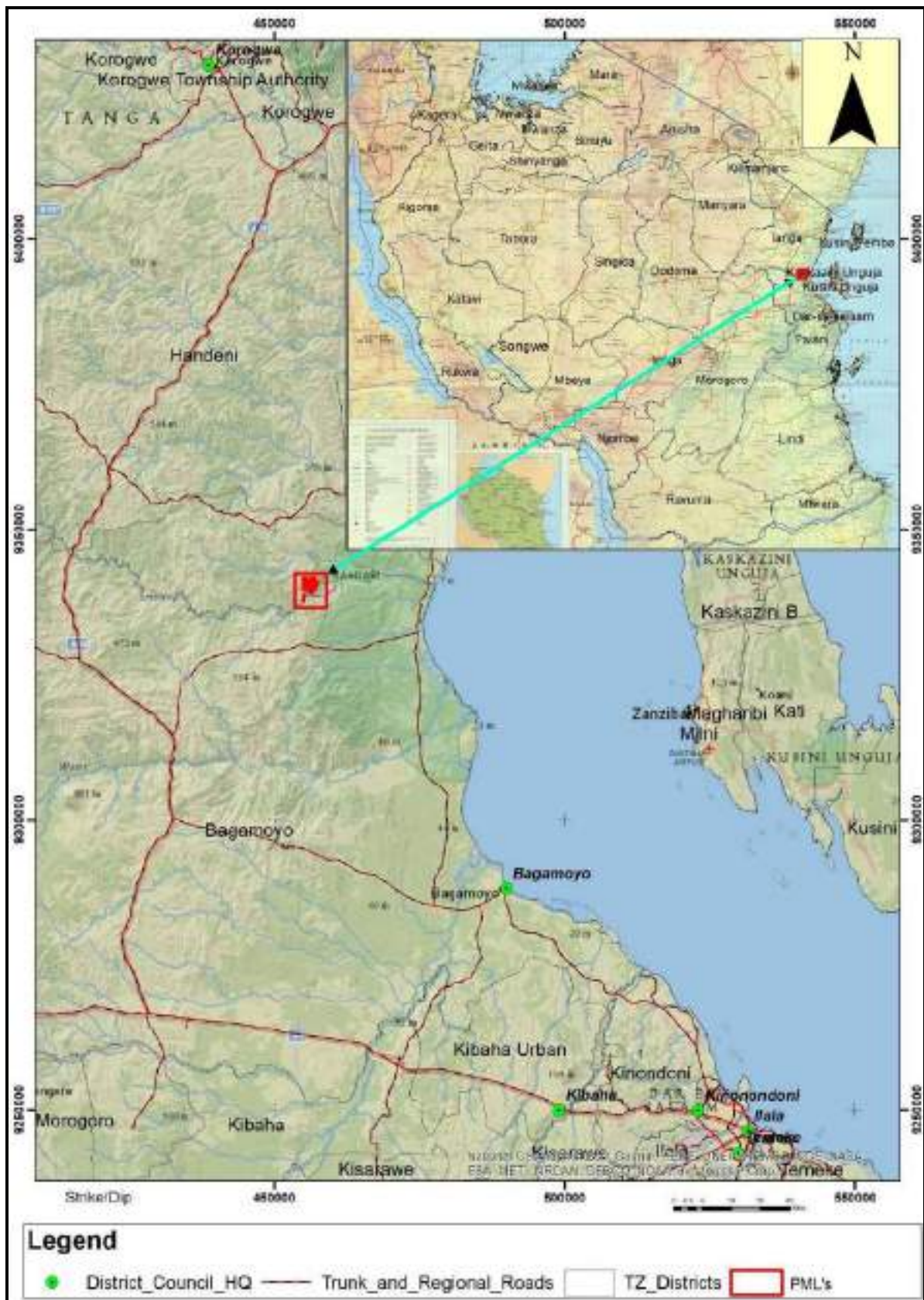


Figure 4.1: Project Locations Map, Kwamsisi Graphite Project, Handeni, Tanzania.

Source: (Azustone Mining Ltd, 2022)

## **5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY**

### **5.1 Site Accessibility**

Access to the Project from Dar es Salaam is via the Dar es Salaam-Bagamoyo -Msata-Mkata on tarmac Road, approximately 215 km North West of Dar es Salaam. The access road from the Tanga Port is Tanga-Muheza-Mkata approximately 140km South west of Tanga city. The access road to the site from Mkata is rough gravel road, approximately 55 kms south east of Mkata. The access road from Mkata to the site is accessible throughout the year (Figure 5.1)

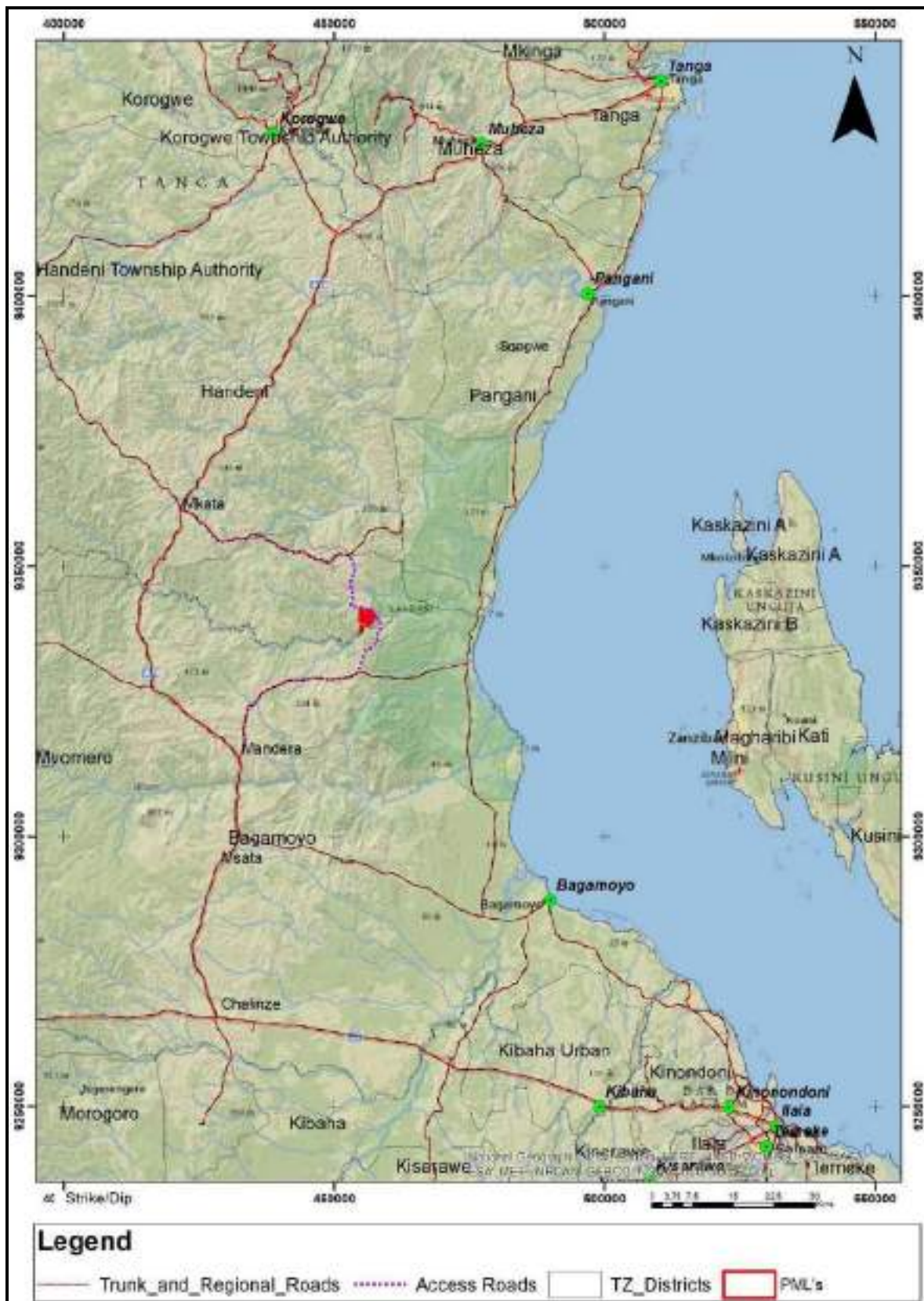


Figure 5.1: Kwamsisi Graphite Project Accessibility Map, Handeni, Tanzania.

(Source: Azustone Resources Tanzania Ltd, 2022)

## 5.2 Climate

There are four main climatic zones in Tanzania: the coastal area where conditions are tropical; the central plateau, which is hot and dry; the semi-temperate highland areas; and the high moist lake regions. There are two rainy seasons in the coast, from November to December and from March through May. In the south there is mainly two rainy season, from October to December and From January to May. The average annual temperature varies between 24°C on the mountains to 40°C. In most parts of the region, the average temperatures are almost uniform at 28°C. In general the hot season runs from September to May.

### 5.2.1 Temperature

The climate is broadly described as tropical with marked seasonal and altitudinal temperature variations, and sharply defined dry and rainy seasons. The situation is prevailing in different geographical areas relative to elevation and seasonal variations.

Tanzania has a predominantly tropical climate with the coastal regions being particularly warm and humid while highland areas are more temperate. Temperatures do not fluctuate substantially through out the year, though they dip slightly in the coolest months (June through September).

In Handeni, the wet season is humid and overcast, the dry season is windy and partly cloudy, and it is hot year round. Over the course of the year, the temperature typically varies from 18°C to 31.4°C and is rarely below 14.5°C figure 1.5.

### 5.2.2 Rainfall

The rainy period of the year lasts for 8 months, from October 1 to May 1. The month with the most rain in Handeni is March, with an average rainfall of 176 mm.

The rainless period of the year lasts for 4 months, from May 30 to September 1. The month with the least rain in Handeni is June to August, with an average 15mm, figure 1.6

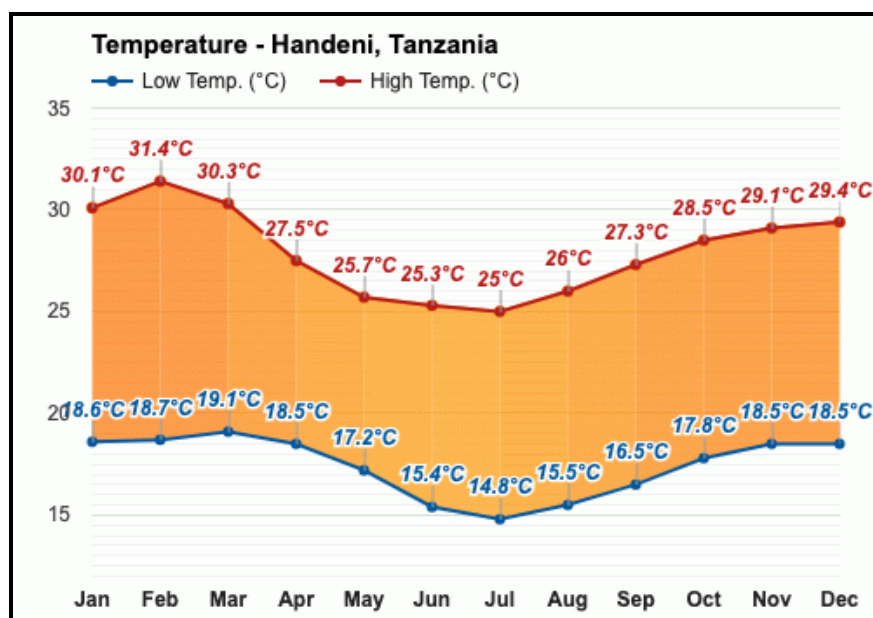


Figure 5.2: Kwamsisi Average Temperature, Handeni, Tanzania.

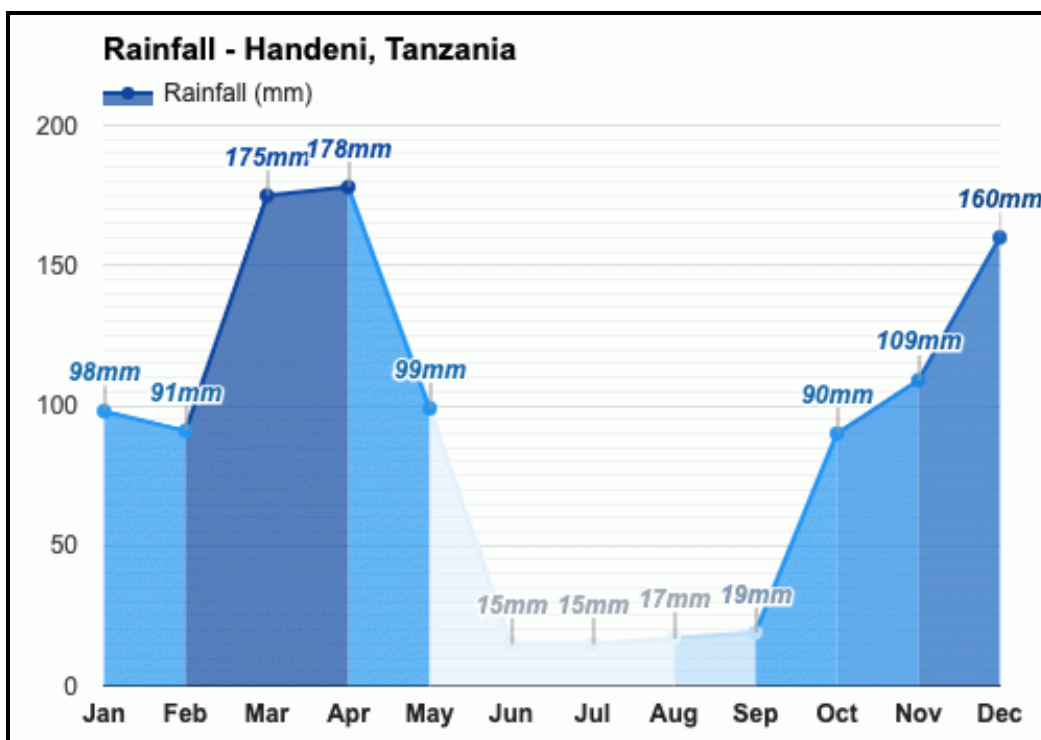


Figure 5.3: Kwamsisi Average Rainfall, Handeni, Tanzania.

### 5.3 Local Resources, Infrastructure and Physiography

#### 5.3.1 Local Resources

Local resources include land availability, land and natural resource use, water availability, water quality, and archaeological and cultural resources.

All land in Tanzania is public land and is held in trust by the President of Tanzania. People are given the right to occupy and use land, with these rights administered at the village government level as prescribed by the Village Land Act (URT 1999c). Local village government bodies manage all land within their respective declared “village areas” and allocate land-use rights to people. As many as half of the households in the Kwamsisi village have acquired at least some of their land through purchase, and more than half of the households have inherited their land.

Most households are not able to cultivate more than 1.2 ha to 2.0 ha due to labour-intensive practices and labour shortages. People may walk long distances to their agricultural holdings to farm, as total holdings are often quite fragmented and dispersed. Allocation systems assign dispersed plots to give people equal access to different sorts of land, particularly some valley bottom land, which provides the opportunity to grow crops during the dry season.

Subsistence agriculture is the basis of the economy throughout the Kwamsisi Villagers. The main subsistence agriculture crops are bananas (in varieties for eating, cooking and brewing), maize, cassava, sorghum, millet, beans (in many different varieties), sweet potatoes and coconut.

People primarily keep goats and chickens, and about a quarter of households have cattle. The occasional household has pigs, sheep or ducks. Livestock holdings between villages vary little, but many do not keep livestock. The keeping of livestock, though important to offset household reliance on agriculture, is limited, with the percentage of households with cattle around 10%. Not much livestock is eaten, but livestock products such as milk and eggs are consumed at the household level or are sold or traded at local markets. Livestock, particularly cattle and goats, are also used in social and economic transactions and serve as a source of wealth in emergencies.

There are many woodlands and village-managed woodlots, and many households have use rights to land that is wooded. Woodlands provide many subsistence resources. People use woodlands to collect food products and firewood, keep bees, graze animals, particularly during the dry season when grasslands provide little forage, and gather traditional medicines. Woodland food products include mushrooms and fruits such as mango, avocado and guava which come from planted trees. Most households cut elephant grass, harvest poles and timber to build houses, livestock enclosures and other household infrastructure. The woodlands also provide materials to make rope, bee hives, small furniture, mats and other products often crafted by women. While most woodland resources are harvested for household consumption, the sale of products such as honey and mats provide cash income.

The availability of improved water sources for domestic use varies widely among villages. Reasons for variability include natural endowment, variable interventions by aid organizations, affordability of improved water source technologies (hand pumps are comparatively more expensive and harder to maintain than gravity flow taps) and the capacity of village water committees to mobilize resources. Overall, most people do not seem overly concerned about water supply, although dispensary staff in particular would

### **5.3.2 Infrastructure**

Community services and infrastructure includes health services, education services, community water supply, local transportation infrastructure and local government

**Health Services** The health system in Tanzania extends from village health workers up to regional and national hospitals that deal with more serious referral cases. Below this, districts are to have a hospital, wards are to have health centers and villages should have dispensaries. The District Hospital is in Handeni, but there are also public and mission hospitals

The ward in the Kwamsisi have health centres This centres provide, mother-and-child clinics, vaccination programs, HIV related services, in- and out-patient services, maternity clinics and minor surgery are common to all.

Dispensaries and health centres are generally well supplied with medicines by the district.

In cases of less serious illness, cases where a non-medical origin of sickness is suspected or for emotional distress some people would seek out a traditional healer. People also collect and use traditional medicines as preventive medicine and to self-treat.

**Education Services** Each village in the Kwamsisi ward has a primary school) All wards have secondary schools, although the large geographic size of some wards means that students may need to board to attend school.

**Community Water Supply** Within the Kwamsisi ward, surface water from streams and traditional shallow dug wells is used to satisfy domestic (household) demand where water wells are not available. Streams and traditional shallow dug wells within the Kwamsisi Ward

are also used for livestock watering. Unimproved and improved water sources are used for both livestock and domestic water supply

The national highway to Handeni is paved and goes through Arusha. There is one gravel road from Mkata to Kwamsisi that will be used by Project vehicles during construction and operations

Villages receive funds from the district, which are allocated specifically for achieving development goals. The only other major source of revenue that a village has is the peoples' contribution, which is essentially money collected by a VGC to supplement the funds received from the district. There are other potential sources of revenue available. Villages can apply for funds through the Tanzania Social Action Fund (TASAF). Bylaw violations (related to environmental conservation and protection of water resources) incur fines. Although districts and villages struggle with resource shortfalls, the local government system is functional. Decentralization and bottom-up planning allow villages some measure of control over their social and economic development while maintaining some consistency across Tanzania with regard to national government objectives and policies. Districts are given some discretion to direct available funds on the basis of need. The beneficial results in the Kwamsisi are evident. Despite high levels of income poverty, villages have at least one primary school, wards have secondary schools, and most villages and wards have health facilities. Village priorities on health and education, as well as on increasing the returns from agricultural activities, seem well-placed.

### **5.3.3 Physiography**

Handeni District is one of the 11 districts of Tanga Region in Tanzania. The District covers an area of 6,534 km<sup>2</sup> (2,523 sq mi). It is bordered to the west by the Kilindi District and the Handeni Urban District, to the north by the Korogwe District, to the east by the Pangani District, and to the south by the Pwani Region. The administrative capital of the district is Mkata town. According to the 2002 Tanzania National Census, the population of the Handeni District was 248,633. According to the 2012 census, the population had increased to: 276,646.

## **6.0 HISTORY**

### **6.1 Exploration Work**

All exploration to date has been conducted by Leijin Mining Company Ltd by Contracted Azustone Resources Tanzania Limited, a Tanzanian Geological Professional Firm, registered in Tanzania. The Azustone Resources Tanzania Limited conducted geological mapping, grab sampling, trenching and ground magnetic survey. As follows-

#### **6.2.1 Geological Mapping**

The mapping traverse were made crossing the strike of the lithologies/outcrops by documenting all the rocks types, grain sizes, colour, geological structures, locating the graphite occurrences and also examined the regolith/ soil to identify the graphite stains at locations under lain by graphitic gneisses.

#### **6.2.2 Rock Sampling (Grab)**

Rock samples (grab) are collected along areas of exposed potential graphite mineralized horizons, Grab samples are a locally representative sample of rock mineralization, and cannot be representatively tied to a dimension or thickness interval.

Four (4) samples were collected by using the pick of the hammer and sent to the SGS Geochemical laboratory for graphite analysis ie Total Graphitic Carbon, Ash Content, Volatile Matter and Moisture Content.

#### **6.2.3 Ground Magnetic Geophysical Survey**

A ground Magnetic Survey team was consisted of a Mag technician; base station personnel, a magnetometer carrier and a line clearance person. Except a Mag technician, all other persons in this team were trainee from Kwamsisi village. Two GEM 19W magnetometers were used which are a field magnetometer and a base station magnetometer. The field magnetometer used a WalkMag mode that recorded magnetic intensity measurements continuously whilst walking, while the base station magnetometer recorded magnetic intensities whilst the survey was in progress. The base station magnetometer was set up in an area free of cultural/man made features. The magnetometers were equipped with built-in Global Positioning System (GPS), receivers for location and coordinated universal time (UTC) readings. Both magnetometers were synchronized to the same UTC. During the survey work, the operators used only non-magnetic clothing. The surveyed lines each of was 10 lines each of 700m long, 10 lines each of 520m long and 6 lines each of 370m long were made at an interval of 100m in the entire graphite mineralized envelop of the all PMLs Figure 3.2. The acquired data were loaded in the laptop by GemLink V5.3 software for applicability in the processing stage. The acquired and loaded ground Magnetic data file with their geographic coordinates were then delivered to Magnetic data processing unit as point data in CSV format for further processing.

After the data get received into Magnetic data processing unit in CSV format, the data were loaded in the Oasis Montaj Geosoft and transformed to the projected format of Arc 1960 zone 37s for easy processing. When Profile plots Encom software and test grid was done, it indicated natural variation of magnetic intensity but there are some highs and lows resolutions contributed by artificial objects during data acquisition. The base maps of the survey were presented in the form of colour shaded maps The gridding and enhancement of

magnetic data was done using Oasis Montaj program version 9.7, Magmap extension and GIS software (Arc GIS). It consisted of filtering, visualization, and modelling extensions.

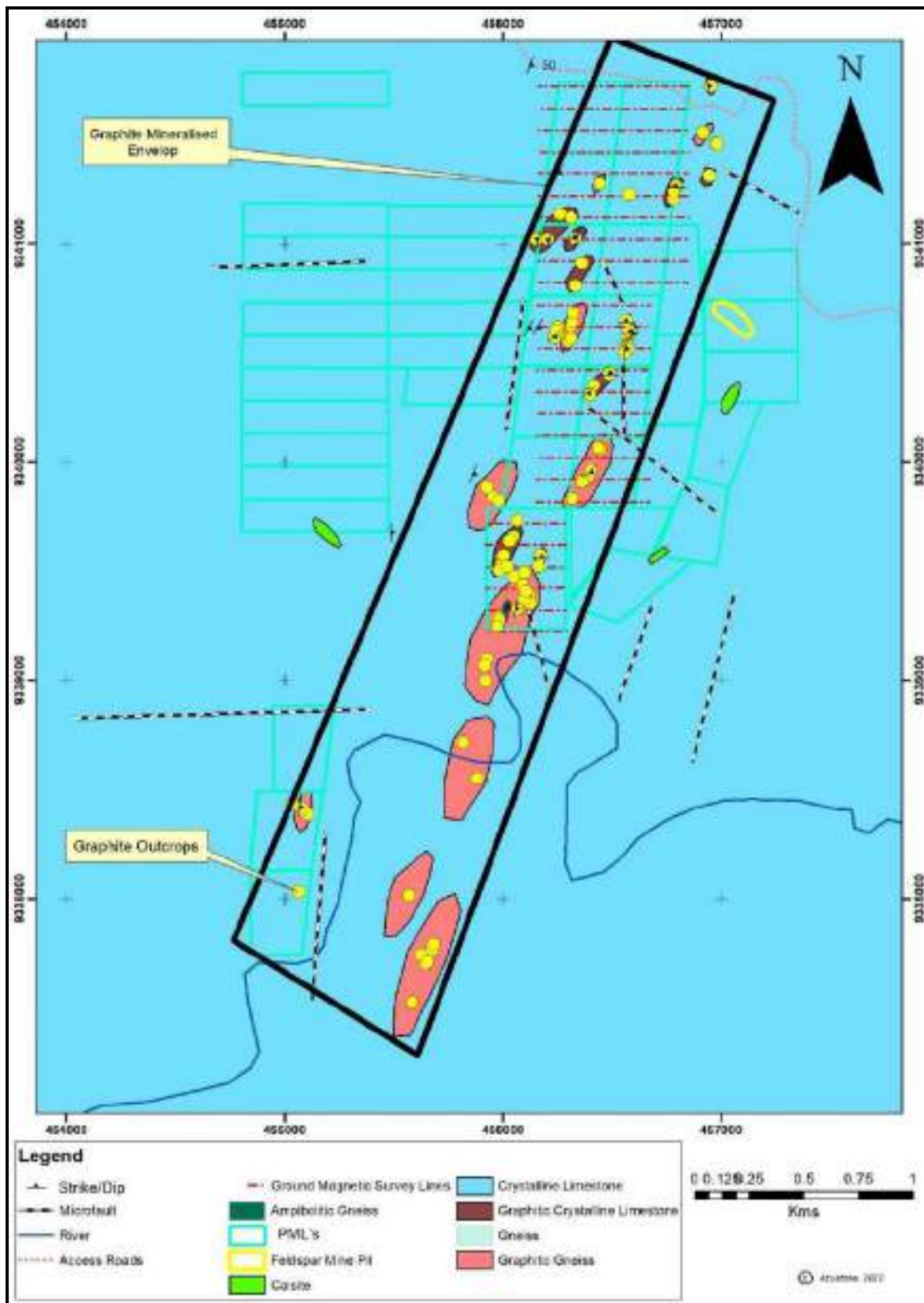
The data were gridded at 25m pixel size using Minimum curvature gridding method which estimates grid value at the nodes of a coarse grid (Usually 8 times the final grid cell size). Bi-directional gridding method which interpolates along the original survey lines and the cross-line direction. The total magnetic intensity (TMI) was obtained and subjected to different filters such as Tilt derivative and down continued grid in order to remove non-geological effects caused by long-wavelength noise along survey lines so as to simplify interpretation.

A total of 12,200m E-W ground magnetic survey line was done across the entire length of the graphite mineralization corridor, the spacing between the line was 100m. The data was then downloaded, cleared, processed and filtered by using different techniques.

Processing of potential field data entails the application of various filters to the data in order to accentuate certain chosen features as an aid in the interpretation of the data.

The process of quantitative interpretation of magnetic anomalies endeavours to determine a source distribution whose anomalous field matches as closely as possible the actual field on the surface of measurement. The non-uniqueness of the potential field problem results in the introduction of constraints in the form of simplification of geometry, limits to size or depth, range limits on susceptibility, or whatever other parameters may seem justified in the context of what is known or can be reasonably inferred about the geologic environment.

Various filters used in the processing of the magnetic data used in this project are as follows.



**Figure 6.1: Ground magnetic survey line crossing different lithologies, Kwamsisi Graphite project, Handeni.**

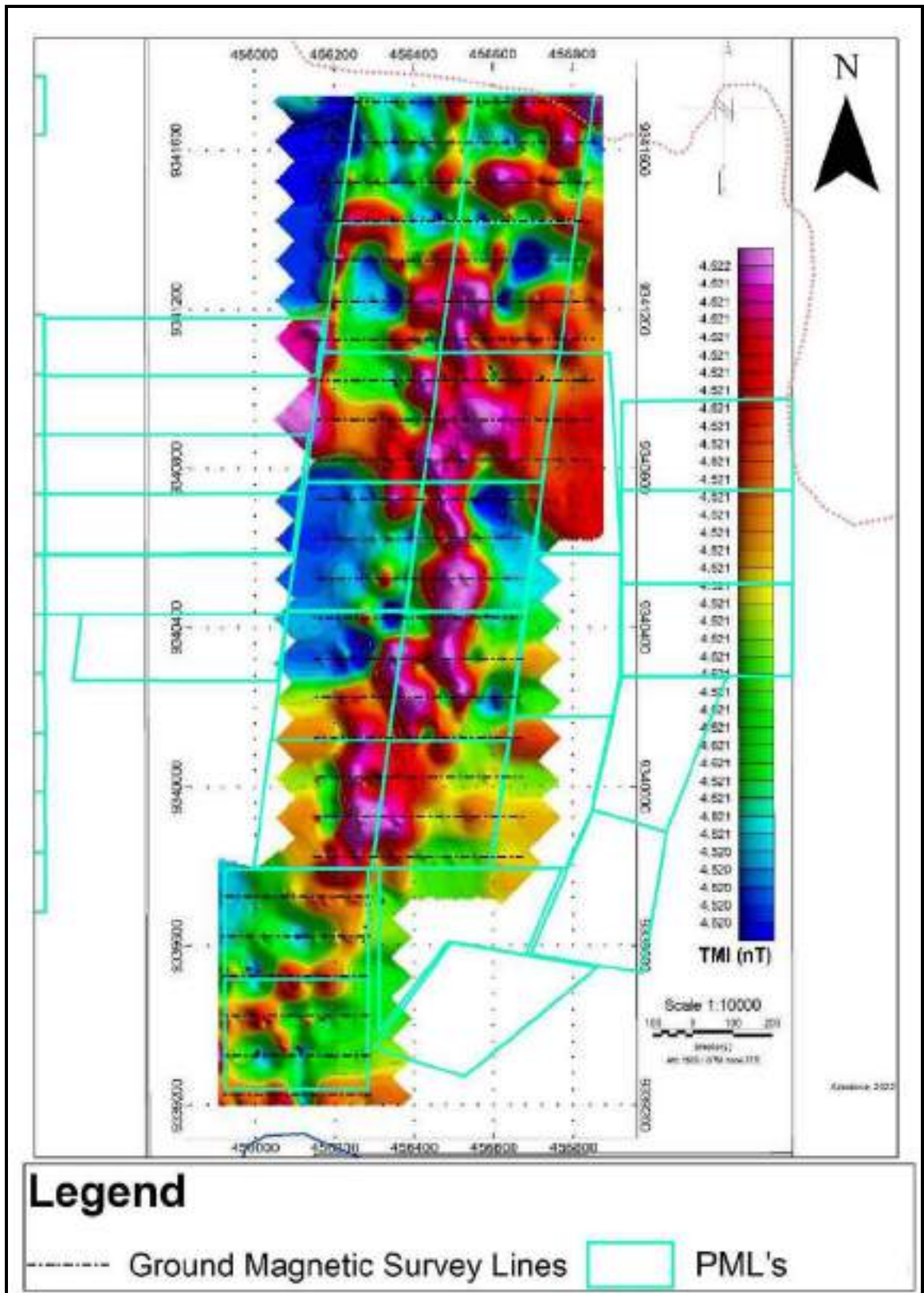
(Source: Azustone Resources Tanzania Ltd, 2022)

### **6.2.3.1 Total magnetic intensity (TMI)**

It gives the vector sum of all components of the magnetic field. The total field magnetic reveals the magnetic characteristics of the various lithological units in the study area. Unfortunately, the nature of a magnetic anomaly is a function of the strike of the body. The total field magnetic contour map is consequently primarily used to identify various lithologies.

The coloured magnetic map of the total magnetic anomaly field indicates high magnetic anomalies trending NNE-SSW following the graphite mineralization trend as observe during geological mapping work. The strong NNE – SSW trend of structures appears to dominate on the central part of the area which shows a pattern of positive structures (Figure 6.2). The area seems to have dominant two units of lithology of which to the central part have high amplitude dipole anomalies, the southern part of the area has low magnetic amplitude which may indicate weak lithological structures. The south-eastern corner of the area shows smooth low magnetic anomalies.

Based on the data presented on the Total magnetic Intensity bellow, it concludes that; The high magnetic signature associated in the central part of the PML's is due to the ferromagnesium minerals associated by the presense of near surface graphitic gneisses or gneisses running NNE-SSW as observed on the total field map



**Figure 6.2: Total Magnetic Intensity Map, Kwamsisi graphite Project**

(Source: Azustone Resources Tanzania Ltd, 2022)

### **6.2.3.2 Tilt Derivative**

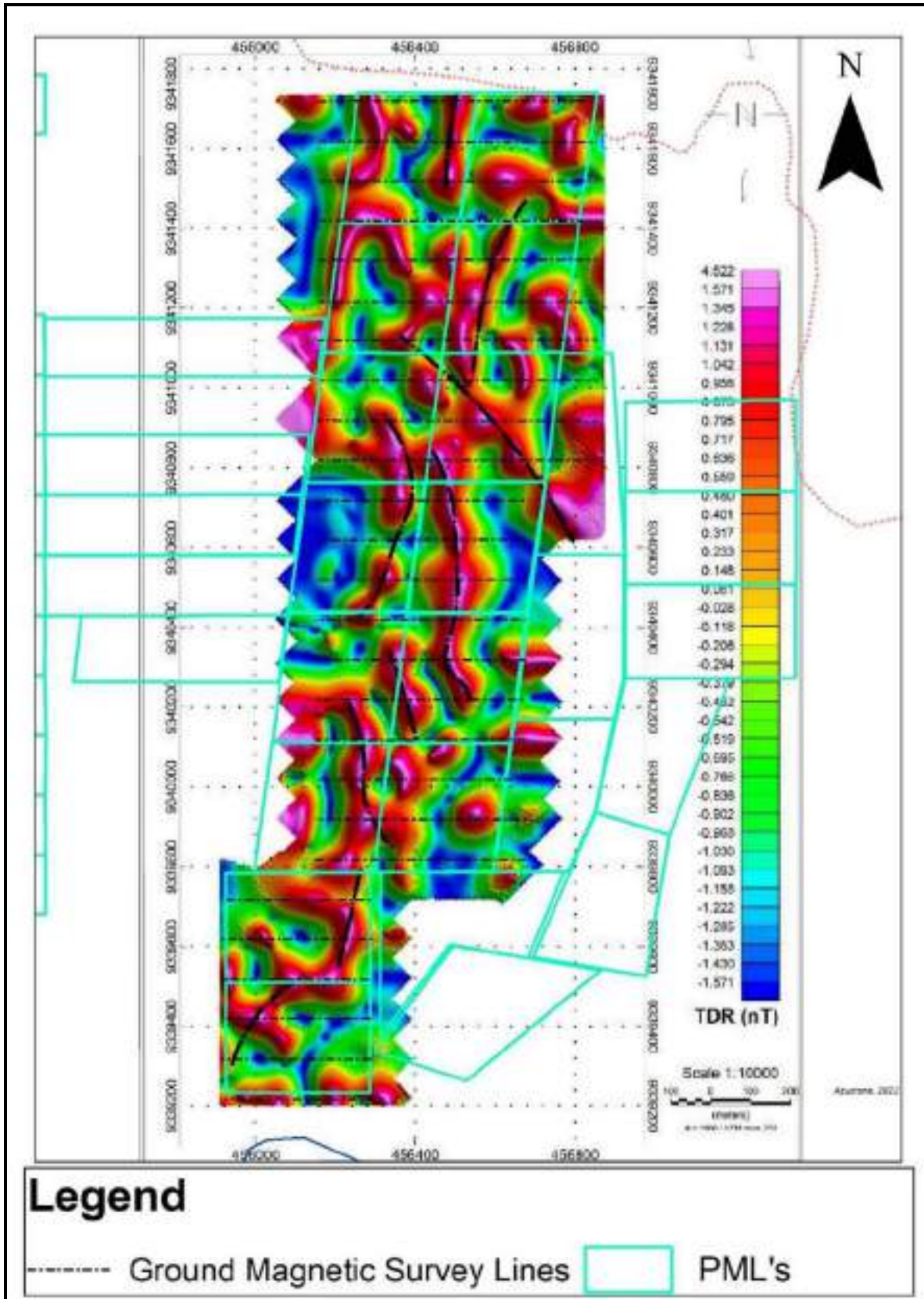
Tilt derivative shows a marked increase in 'visibility' of structural features, especially in the southern part of the PMLs where by before this filtering method the magnetic anomalies were not well visible.

Processing of potential field data entails the application of various filters to the data in order to accentuate certain chosen features as an aid in the interpretation of the data. The process of quantitative interpretation of magnetic anomalies endeavors to determine a source distribution whose anomalous field matches as closely as possible the actual field on the surface of measurement. Derivatives tend to sharpen the edges of anomalies and enhance shallow features.

The vertical derivative is much more responsive to local influences than to broad or regional effects and therefore tends to give sharper picture than the map of the total field intensity. Thus the smaller anomalies are more readily apparent in area of strong regional disturbances. The enhanced magnetic anomaly on figure 6.3

Magnetic derivatives can help define/estimate the physical properties of the source structure causing the anomaly. Combination of the tilt Derivative and its total horizontal derivative are highly suitable for mapping shallow basement structure and mineral exploration targets and that they have distinct advantages over many conventional derivatives. The structural features of the area have been identified after enhancement of the processed data. A combination of uncertainty and number properties used to isolate and pick important features and structures of interest. Result of the survey shows anomalies of interest.

Several linear features have been mapped whose trends are almost similar to those computed under TMI as indicated by black dotted lines. There are few structural linear trending NW-SE direction seems to be older compared to that of NNE-SSW structures. Two structures are observed on the central part of the area where undefined structural pattern was obscured. These could be the potential structure in the area.



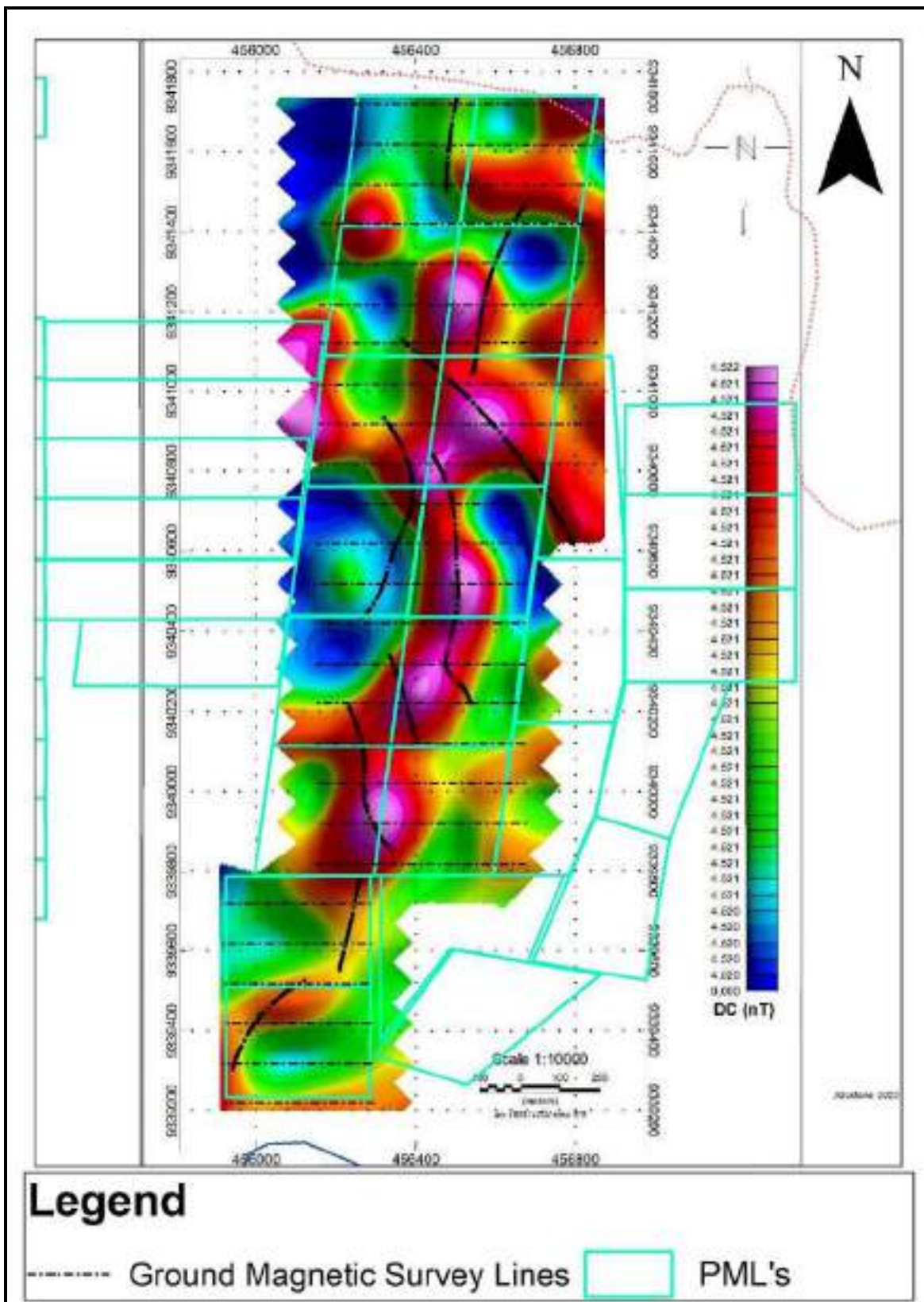
**Figure 6.3: Tilt Derivative Map, Kwamsisi graphite Project**

(Source: Azustone Resources Tanzania Ltd, 2022)

### **6.2.3.3 Downward continuation**

Downward continuation is used to enhance features at a specified depth/elevation, lower than the acquisition level. This procedure accentuates near surface anomalies and can be used as an interpretation tool to determine the depth to a causative body. The filter can be 48 applied to magnetic

The colored magnetic map of the down continued grid indicates high magnetic anomalies trending NNE-SSW following the graphite mineralization trend as observe during geological mapping work. The strong NNE – SSW trend of structures appears to dominate on the central part of the area which shows a pattern of positive structures which implies that there is a shallow seated magnetic anomalous body in this port of the PML's (Figure 6.4 below).



**Figure 6.4: Down Continued Grid Map, Kwamsisi graphite Project**

(Source: Azustone Resources Tanzania Ltd, 2022)

#### 6.2.3.4 Trenching

Trenching works was done after identifying key locations underlain by graphitic gneiss by using the data obtained from geological mapping and confirming with the data obtained from ground magnetic survey. It was revealed that there are two dominant lithologies across the entire PML's area. The crystalline Limestone overlying the graphitic gneiss. Due to magnetic contrast between these lithologies it was easier to establish the trenching location where by near surface graphite bearing rocks could be intersected. A total of 13 trenches were dug across the PML's area, plate6.1 to 6.3.

Seventeen (17) samples were collected from 13 trenches and sent to the GST Geochemical laboratory for graphite analysis ie Total Graphitic Carbon, Ash Content, Volatile Matter and Moisture Content.

The trenches were 1m wide, approximately 1.50 to 2.0 m deep and 8-10 meters long. The trenches were excavated by hand and composite samples were collected from the base of trenches. Luckily due to the application of the geological and geophysical data all trenches intersected graphite bearing rocks and we hope it will return with significant results from the geochemical laboratory.



**Plate 6.1: Trench Number 2 (TR02), crosscutting slightly weathered graphite mineralised gneissic rock, Kwamsisi Graphite Project, Handeni.**

*(Source: Azustone Resources Tanzania Ltd, 2022)*



**Plate 6.2: Trench Number 9 (TR09), crosscutting weathered graphite mineralised gneissic rock, Kwamsisi Graphite Project, Handeni.**

*(Source: Azustone Resources Tanzania Ltd, 2022)*



**Plate 6.3: Trench Number 5 (TR05), crosscutting graphite mineralised weathered crystalline limestone, Kwamsisi Graphite Project, Handeni.**

*(Source: Azustone Resources Tanzania Ltd, 2022)*

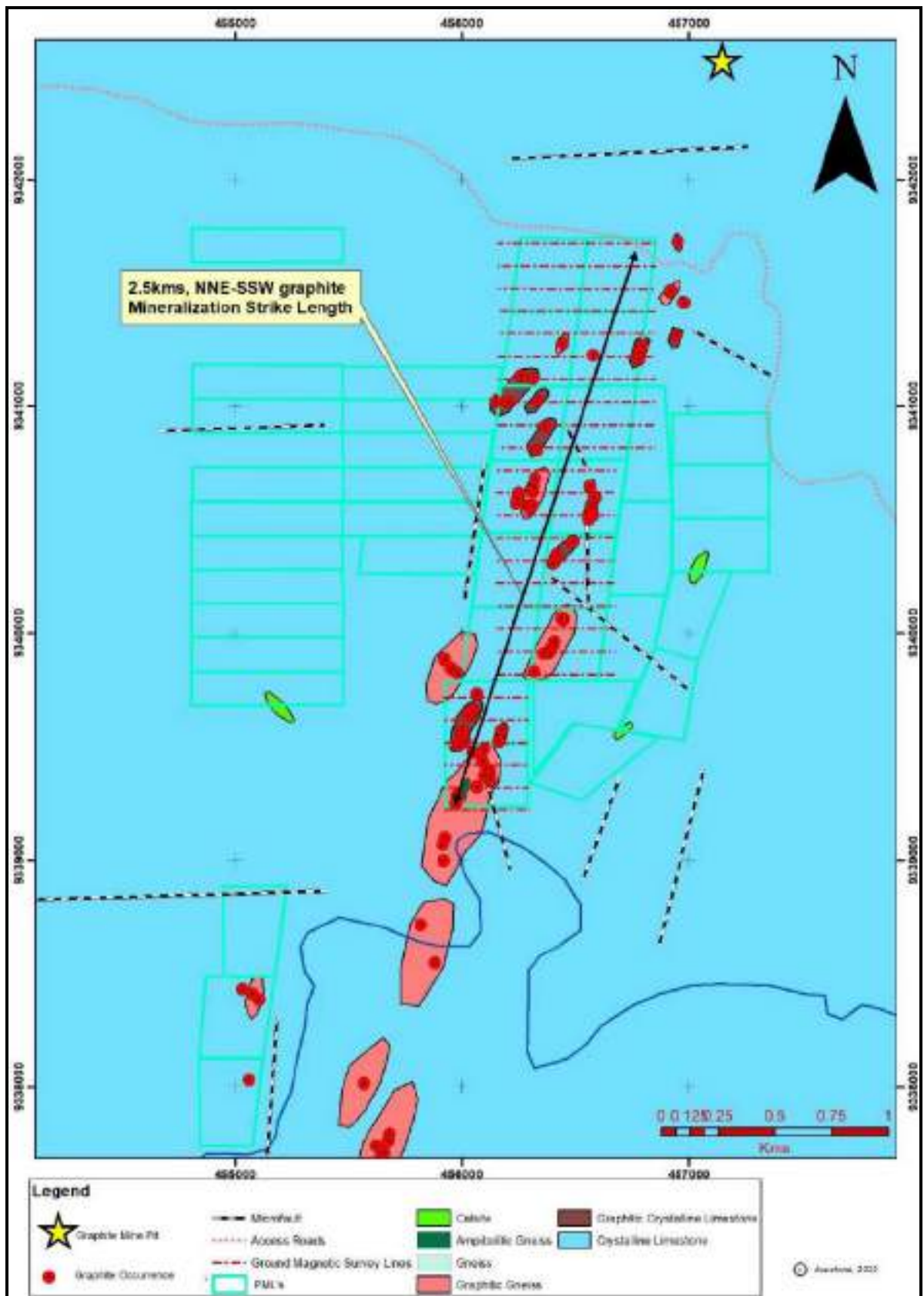
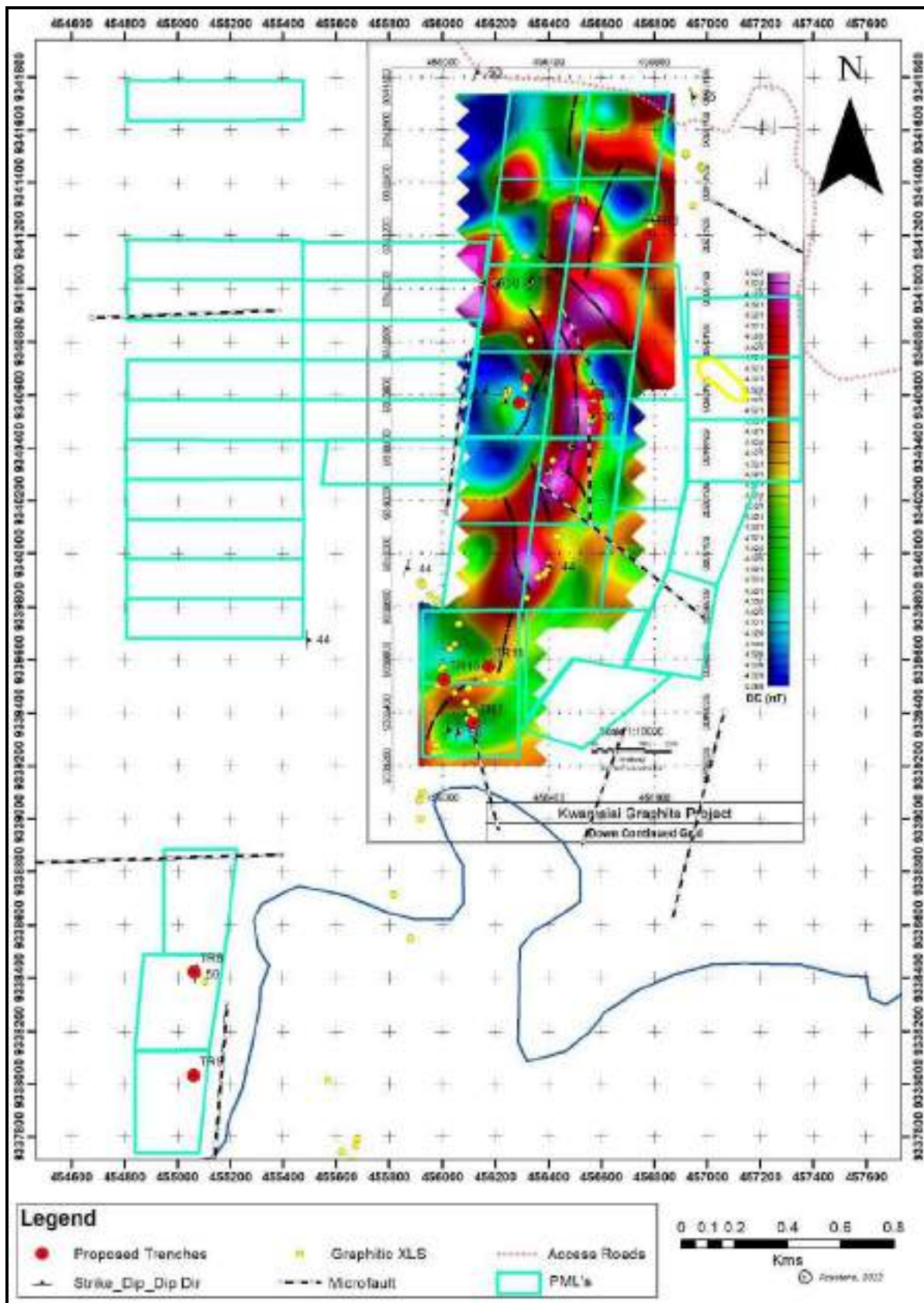


Figure 6.5: Trenches location VS Geological Map, Kwamsisi Graphite Project, Handeni

(Source: Azustone Resources Tanzania Ltd, 2022)



**Figure 6.6: Trenches location VS Total Magnetic Intensity Map, Kwamsisi Graphite Project**

(Source: Azustone Resources Tanzania Ltd, 2022)

#### **6.2.3.5 Drilling work**

Drilling was contracted by Azustone Resources Ltd, using XY3 Diamond drilling rig. The holes were all drilled at 0° azimuth and a dip of -90° from the horizontal. Drill hole parameters for all drill programs are given in Table 4.1

In total, 9 HQ diamond drill holes were drilled. The holes were broadly spaced, with the aim of determining structural continuity. Graphite was encountered at depth and along structures considered to be continuous. Graphite grades from both the regolith and underlying graphitic crystalline limestone and graphitic gneiss rocks were confirmed, and consistent with previous work.

## **7.0 GEOLOGICAL SETTING AND MINERALIZATION**

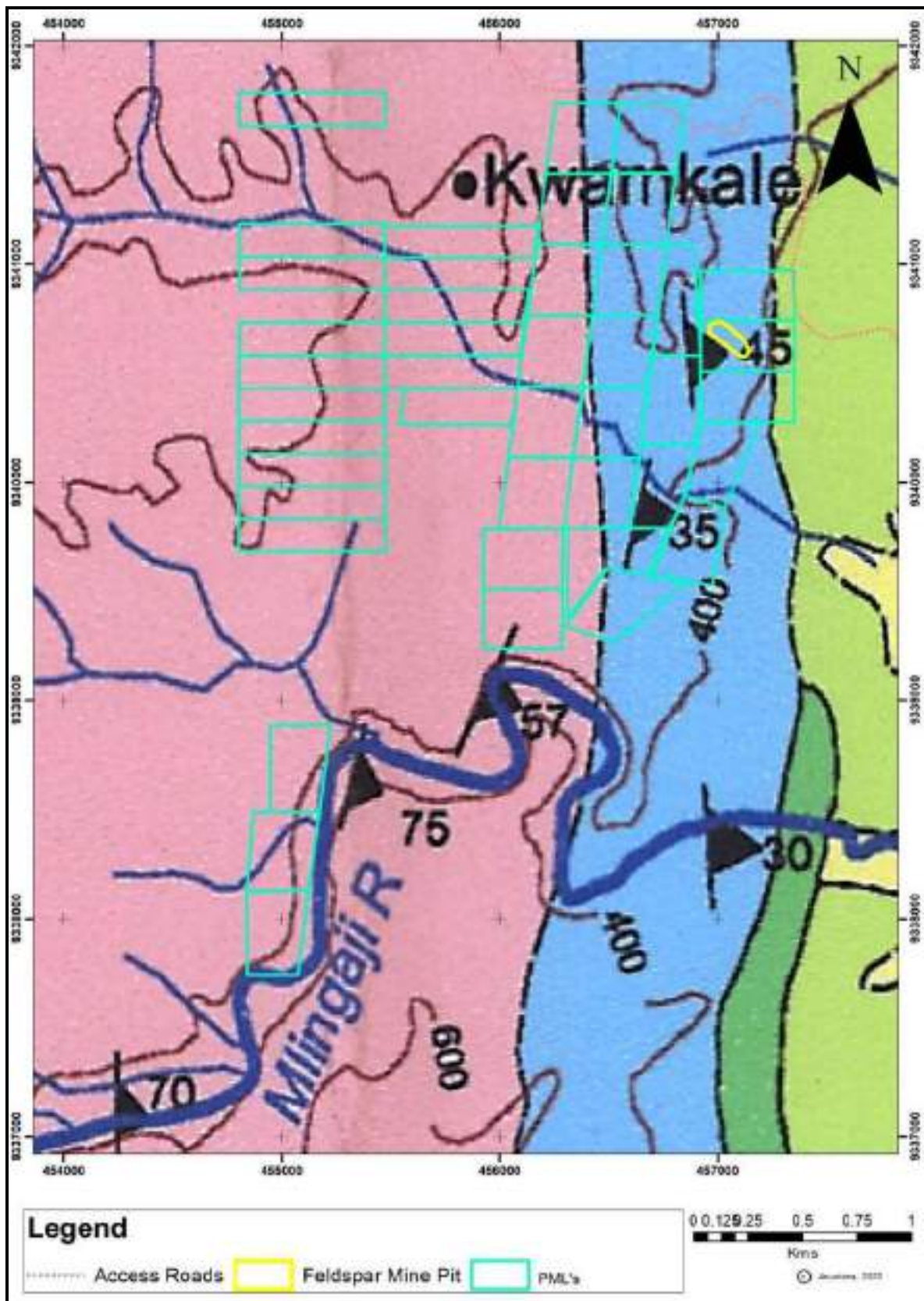
### **7.1 Regional Geology**

The viable economic world-class deposits of graphite are from the two geological settings, which are either Archean or Neoproterozoic metamorphic belts. There are reported occurrences of graphite in the vast Neoproterozoic Mozambique Mobile Belt of Tanzania stretching from North to South in the eastern side of the country, including the Kwamsisi graphite. Though there are many occurrences of graphite in the country, so far, there is no significant production of this mineral.

The property is geologically located within the high-grade metamorphic rocks ranging in Amphibolite to Granulites facies of the Neoproterozoic metamorphic Belt. Regional mapping indicates that the property lies within crystalline limestone and gneissic terrains described as granitic and sedimentary gneiss (dominantly kyanite graphitic gneisses). Other existing lithologies include quartzo-feldspathic gneiss, marble, biotite gneiss and patches of amphibolite gneiss being associated with hornblende and garnet. Crystalline limestone of different variety and quartzite also exist in the area. Most rocks in the area are characterized by NE-SW striking foliations.

Regionally, the project area is within the eastern boundary of the Neoproterozoic of Mozambique Belt, characterized by the rocks of Proterozoic age dated 1.9 Ga. These rocks are of the composite metamorphic crustal domain with undifferentiated meta-igneous and sedimentary rocks of variable ages and origins including the Neoarchaeon, Paleoproterozoic, Mesoproterozoic (source) and Neoproterozoic protolith reworked during the Neoproterozoic tectothermal events (Groves, 2010).

The Mozambique Belt system of Proterozoic age consists of metamorphic rocks, mainly granulites, hornblende and biotitic gneisses, Mg-rich crystalline marbles and graphitic schists and gneisses and quartzites. Kyanite-chlorite schists are also present. This rock system contains a fairly wide variety of economic minerals; the majorities are of which rock are forming minerals produced during metamorphism. These rocks are commonly intruded by pegmatite dykes and quartz veins containing variety of minerals including gemstones (graphite, ruby, sapphire, tanzanite, apatite, garnet, aquamarine tourmaline, kyanite, alexandrite or chrysobery etc.), gold and other non-metallic minerals (Pinna et al, 2004).



**Figure 7.1: Regional Geological Map, Handeni, Tanzania**

(Source: GST, QDS 149. 2006)

### **7.1.1 Antioquia Batholith**

The field observation found that the basement/intrusive rock is high metamorphic grade from amphibolite to granulite facies of sedimentary origin and sediments. The rocks are generally massive and slightly foliated.

## **7.2 Project Geology**

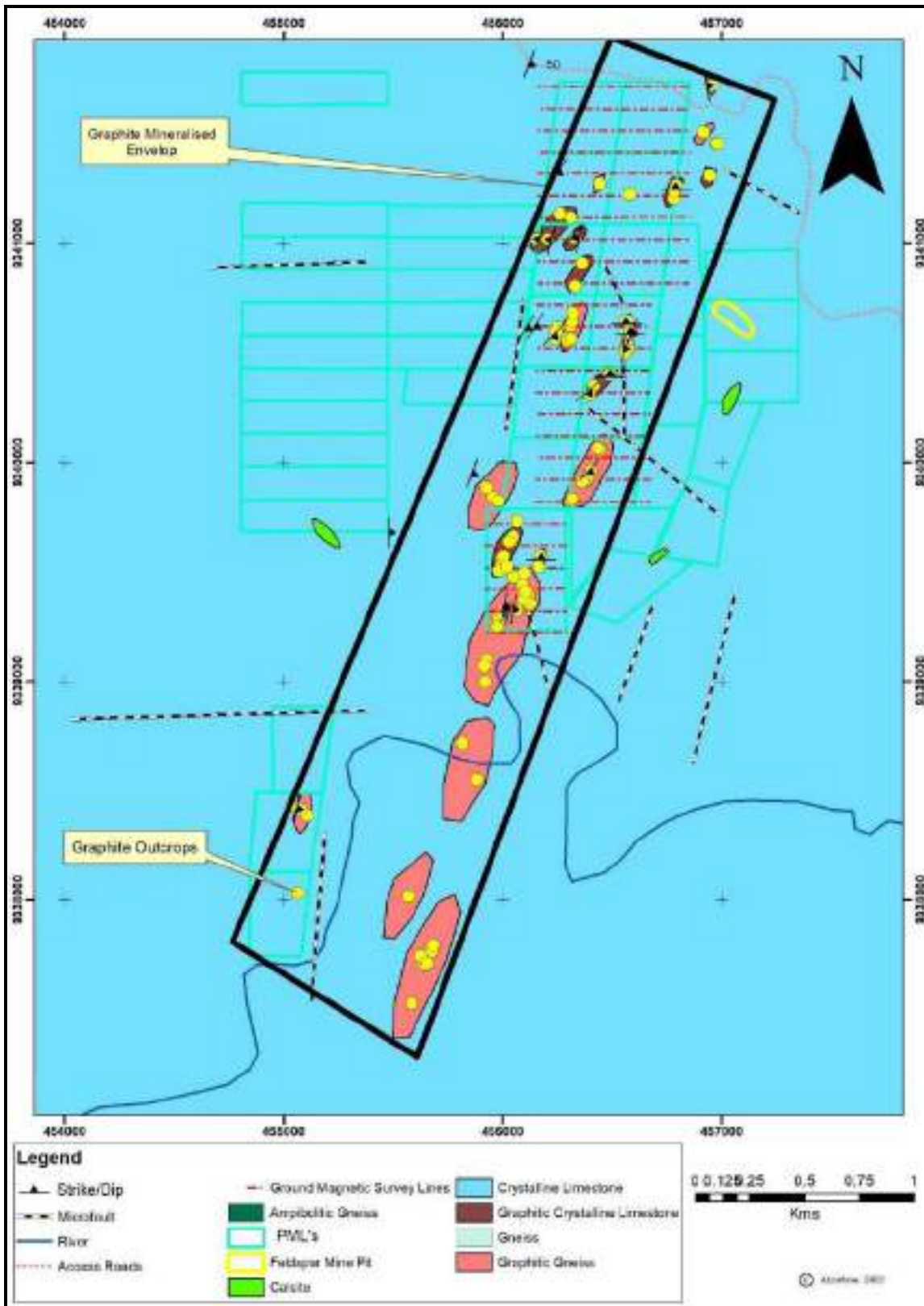
The Kwamsisi Project is located in the area characterized by hilly like terrain, shallow valleys and flat lands with trees and tall grasses. The good surface exposure of outcrops is evident at elevated areas within the property being characterized by light forest and dark brown soil covers at elevated places and black soil covers in valleys. Graphite stains/marks on soil are evident at some locations of the project and have been used on understanding the locations underlain by graphitic gneisses. The dominant lithology identified in the project are crystalline limestone, graphitic crystalline limestone, gneiss, graphitic gneiss/schists and amphibolitic gneiss. Small units of quartzofeldspathic gneisses, feldspar and calcite were also documented at some locations especially in the eastern and western parts of the project area. The field observation found that this rock is associated with hornblende, garnet and minor biotite. In general, the rock varieties in the project area ranges from high metamorphic grade from amphibolite to granulite facies of sedimentary origin and sediments. The rocks are generally highly fractured and foliated.

At Kwamsisi Graphite Project, Graphitic mineralisation is hosted within a graphitic gneissic unit along the NNE-SSW approximately 2.5kms strike length continuity within the licenses area. The graphite's is characteristics principally flake size graphite available on a consistent basis in the outcrop and 13 trenches exposures at numerous locations within the licenses area, figure 7.2

The graphite is coarse, fully ordered, crystalline and flaky. Grades up to 40.65% TGC were found. Gangue minerals in the ore are quartz, plagioclase, Kfeldspar, biotite and amphiboles. It is believed that the graphitic gneiss were originally sediments rich in organic matter which wase converted to graphite during granulite-facies metamorphism.

More than 50 graphite occurrence locations variable were discovered and some 13 trenches were dug for sampling. The underground extensions of the selected orebodies were studied by using the ground magnetic survey to identify the sub-surface structures, faults and the trend of the graphitic gneiss and the most promising anomalies was drilled The graphite-bearing bodies occur as elongated lenses and following the dominating folds, which trend NNE-SSW in the area.

A good locality illustrating the geological setting of the graphite mineralisation can be seen at the trenches and core tray photographies. The lithologies identified in the trenches including the crystalline limestone on the top and the graphitic gneiss at the bottom.



**Figure 7.2: Kwamsisi Local Geological Map, Handeni, Tanzania**

(Source: Azustone Resources Tanzania Ltd, 2022)



**Plate 7.1: Highly weathered graphite mineralised graphitic gneiss outcrop, Kwamsisi Graphite Project.**

*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.2: Graphitic gneiss outcrop near trench no 13, Kwamsisi Graphite Project.**

*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.3: Portion of Trench number 2 exposing weathered graphitic gneiss, Kwamsisi Graphite Project.**

*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.4: Weathered graphitic gneiss from trench number 02 Kwamsisi Graphite Project.**

*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.5 Weathered graphitic gneiss exposed from trench number 09, Kwamsisi Graphite Project, Handeni**

*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.6: Weathered graphitic gneiss from trench number 09, Kwamsisi Graphite Project, Handeni09**

*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.7: Slightly graphite mineralised crystalline limestone, Kwamsisi Graphite Project, Handeni**

*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.8: Rarely fine-grained graphite mineralised crystalline limestone, Kwamsisi Graphite Project, Handeni**

*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.9: Coarse grained flake graphite in weathered crystalline limestone, Kwamsisi Graphite Project, Handeni**  
(Source: Azustone Resources (T) Ltd, field work, 2022)



**Plate 7.10: Low grade, coarse flake graphite mineralised in crystalline limestone Kwamsisi Graphite Project, Handeni**  
(Source: Azustone Resources (T) Ltd, field work, 2022)



**Plate 7.11: Verry coarse flake graphite from slightly weathered crystalline limestone, Kwamsisi Graphite Project, Handeni**  
*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.12: High grade, coarse flake graphite from slightly weathered crystalline limestone, Kwamsisi Graphite Project, Handeni**  
*(Source: Azustone Resources (T) Ltd, field work, 2022)*



**Plate 7.13: Foliated biotite gneiss, Kwamsisi Graphite Project, Handeni**  
(Source: Azustone Resources (T) Ltd, field work, 2022)



**Plate 7.14: Calsite, Kwamsisi Graphite Project, Handeni.**  
(Source: Azustone Resources (T) Ltd, field work, 2022)



**Plate 7.15: BHDD06 showing lithological alterations, Kwamsisi Graphite Project, Handeni.**  
*(Source: Azustone Resources (T) Ltd, field work, 2022)*

### 7.2.1 Structural settings

The Kwamsisi deposit lies in the Mozambique stratigraphy what is known as the Eastern Domain. Graphitic mineralisation is hosted within a graphitic gneissic unit along the NNE-SSW approximately 1.8kms strike length continuity within the licenses area.

At Kwamsisi the graphite mineralization is classified as syngenetic type. Syngenetic results in two categories of graphite, namely crystalline flake graphite and microcrystalline or amorphous graphite. For syngenetic graphite, the crystallinity increases with metamorphic temperatures, hence the quality in terms of flake size and crystallinity depends on the grade of metamorphism.

Crystalline Limestone units overlay the older lithologies such as amphibolitic gneiss, gneiss and graphitic gneiss. Graphitic gneisses are striking parallel with the rest of the lithologies that are striking NNE-SSW (except few locations). The extensions of graphitic gneisses along the strike length are in order of hundred metres to few kilometres, although there are variations of thickness along the same strike length.

The host lithology to graphite mineralization is concordant with the rest of lithologies at the area and they both have a general trend of NNE-SSW with few exceptions

### 7.3 Deposit Mineralization

Graphitic mineralisation is hosted within a graphitic gneissic unit along the NNE-SSW approximately 2.5kms strike length continuity within the licenses area. The graphite's characteristics principally flake size graphite available on a consistent basis in the outcrop and 14 trenches exposure at numerous locations within the licenses area.

There are three forms of graphite which are amorphous graphite, flake graphite and crystalline vein graphite at Kwamsisi graphite project the dominant form of graphite is flake graphite.

Graphite occurs in metamorphic rocks as a result of the reduction of sedimentary carbon compounds during metamorphism. It also occurs in igneous rocks and in meteorites. Minerals associated with graphite include quartz, calcite, micas and tourmaline.

At Kwamsisi the graphite mineralization is classified as syngenetic type. Syngenetic results in two categories of graphite, namely crystalline flake graphite and microcrystalline or amorphous graphite. For syngenetic graphite, the crystallinity increases with metamorphic temperatures, hence the quality in terms of flake size and crystallinity depends on the grade of metamorphism.

Crystalline Limestone units overlay the older lithologies such as amphibolitic gneiss, gneiss and graphitic gneiss. Graphite flakes form lineation at the outcrop scale within crystalline limestone units but not exceeding 3 vol.% TGC grades based on the field observations. Graphitic gneisses are striking parallel with the rest of the lithologies that are striking NNE-SSW (except few locations). The extensions of graphitic gneisses along the strike length are in order of hundred metres to few kilometres, although there are variations of thickness along the same strike length. Most of the surface graphitic gneisses are weathered and/or altered to oxides and hydroxides of iron, commonly hematite and limonite. Weathering and alteration make these rocks soft and easy to break by hands; however, the graphite flakes remained un-weathered.

Field observations coupled with ground magnetic survey indicate that the graphite mineralization at Kwamsisi area is crystalline flake type with a flake size ranging from medium to coarse. This represents syngenetic rather than epigenetic type of mineralization with no evidence for the existence of amorphous graphite. As a result, this graphite mineralization in the study area points to metasedimentary origin with maximum grade of 40.65 wt.%, that occurs as disseminated flakes in the graphitic gneiss host rocks. The host lithology to graphite mineralization is concordant with the rest of lithologies at the area and they both have a general trend of NNE-SSW with few exceptions. Mineralized zones occur within biotite gneiss and its extension, grade and flakes size qualifies the study area for the economic viability of graphite mineralization. However, further studies on the tonnage for the graphite reserve through drilling is required.

## 8.0 DEPOSIT TYPES

Natural graphite deposits of economic interest are grouped into three main categories:

- i Microcrystalline;
- ii Vein graphite (lump and chip); and
- iii Crystalline flake graphite.

Microcrystalline graphite is referred to as 'amorphous graphite'. This term is a misnomer because graphite has a crystal structure (readily detected by X-ray diffraction and Raman spectroscopy). Most microcrystalline graphite deposits are formed by sub-greenschist to greenschist contact metamorphism or regional metamorphism of coal seams (Taylor, 2006). Microcrystalline deposits consist mainly of small graphite particles intergrown with impurities. The product is sold mainly as forging lubricants and for applications where high ash content and low crystallinity is acceptable or preferred.

**Vein graphite deposits** The most economically significant vein-type graphite deposits are found in the same metasedimentary belts as crystalline flake graphite deposit, which are metamorphosed to upper amphibolite and granulite facies. In these belts, vein graphite deposits are found in skarn-type assemblages adjacent to igneous intrusions, in igneous intrusions, and in zones with a retrograde overprint.

Crystalline flake graphite deposits, disseminated graphite flakes are in a variety of rocks including marble, paragneiss, iron formation, quartzite, pegmatite, syenite and, in extremely rare cases, serpentinized ultramafic rocks. By far the most common hosts for economically significant crystalline flake deposits are paragneiss and marble that have been subjected to upper amphibolite to granulite facies metamorphism. Graphite deposits consisting of thick sequences of paragneiss are evenly mineralized and generally grade .5% graphite.

Graphite is regularly distributed throughout the host rock and the size of graphite flakes and calcite or dolomite crystals is directly correlated. Microscopic signs of corrosion or overgrowth on the graphite flakes that would indicate disequilibrium are lacking. Minor constituents such as diopside, magnesite, quartz, tremolite, fosterite, humite group minerals, garnets, scapolite, wollastonite, feldspar, phlogopite, muscovite, and serpentine account for less than 5% per volume of the rock. They contain from trace to 25% crystalline flake graphite.

The Kwamsisi graphite deposit type fall under crystalline flake graphite deposit.

## 9.0 DRILLING

### 9.1 Drilling work

Drilling was contracted to Azustone Resources Ltd, using XY3 Diamond drilling rig. The holes were all drilled at 0° azimuth and a dip of -90° from the horizontal. Drill hole parameters for all drill programs are given in Table 9.1.

**Table 9.1 Drill Hole Parameters**

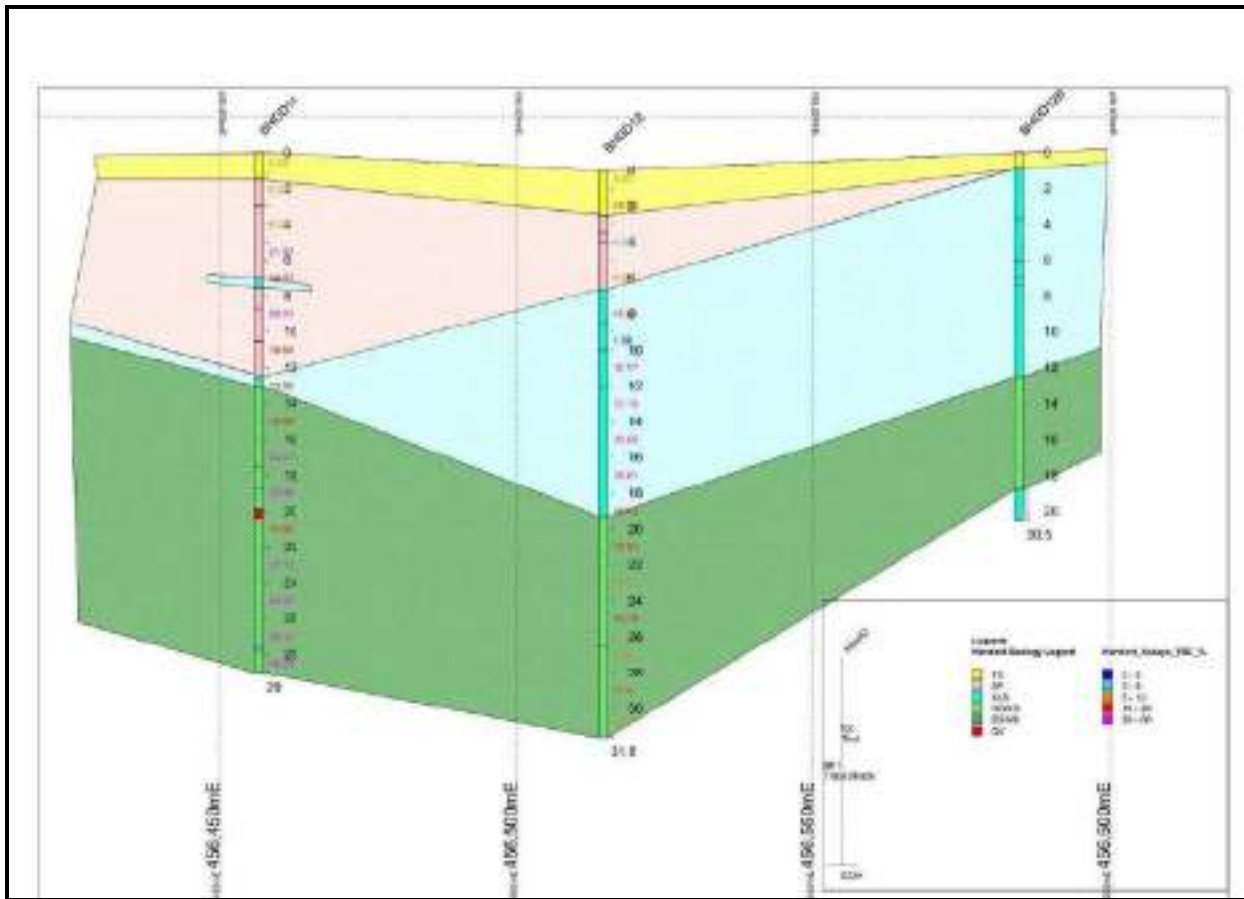
Hole_ID	Y-Arc1960	X-Arc1960	RL-m	MAX_DEPH_m	HOLE_TYPE	Azimuth	Dip
BHDD01	9341220	456430	182	0	DD	0	-90
BHDD02	9341220	456580	180	0	DD	0	-90
BHDD03	9341220	456730	185	20	DD	0	-90
BHDD03B	9341220	456770	186	11.5	DD	0	-90
BHDD04	9340920	456360	170	13	DD	0	-90
BHDD05	9340920	456510	168	23.5	DD	0	-90
BHDD06	9340920	456660	175	50	DD	0	-90
BHDD07	9340608	456520	158	0	DD	0	-90
BHDD08	9340608	456585	163	34.5	DD	0	-90
BHDD09	9340520	456490	148	0	DD	0	-90
BHDD10	9340518	456565	153	0	DD	0	-90
BHDD11	9340432	456458	148	29	DD	0	-90
BHDD12	9340431	456516	147	31.6	DD	0	-90
BHDD12B	9340431	456586	148	20.5	DD	0	-90
BHDD13	9340064	456285	168	0	DD	0	-90
BHDD14	9340064	456436	162	0	DD	0	-90
BHDD15	9339960	456263	169	0	DD	0	-90
BHDD16	9339960	456400	164	0	DD	0	-90
BHDD17	9339851	456238	165	0	DD	0	-90
BHDD18	9339851	456320	170	0	DD	0	-90
BHDD19	9339519	456085	174	0	DD	0	-90
BHDD20	9339520	456193	185	0	DD	0	-90
BHDD21	9339360	456070	163	0	DD	0	-90

(Source: Azustone Resources (T) Ltd, field work, 2023)

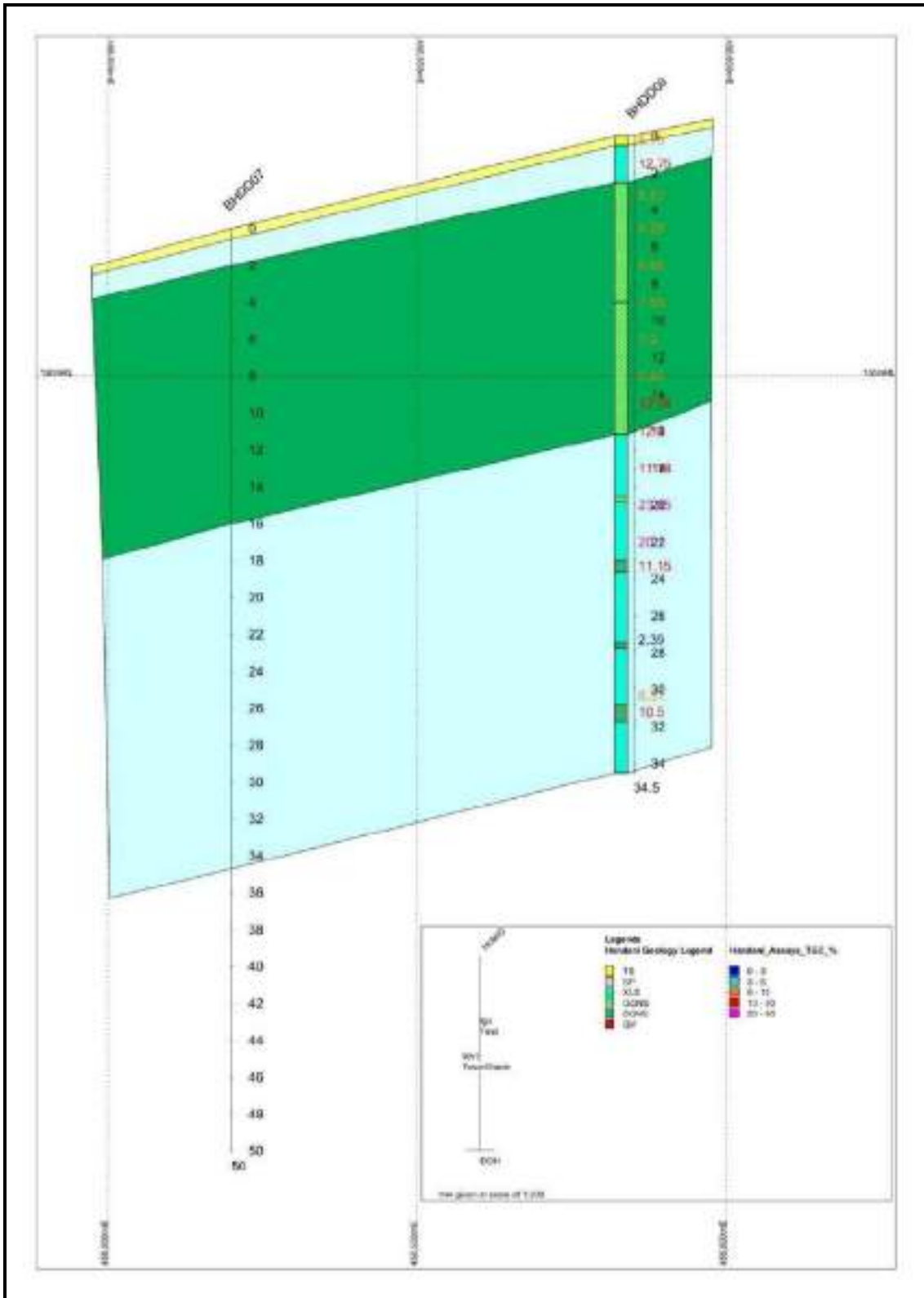
In total, 9 HQ diamond drill holes were drilled. The holes were broadly spaced, with the aim of determining structural continuity. Graphite was encountered at depth and along structures considered to be continuous. Graphite grades from both the regolith and underlying graphitic crystalline limestone and graphitic gneiss rocks were confirmed, and consistent with previous work.

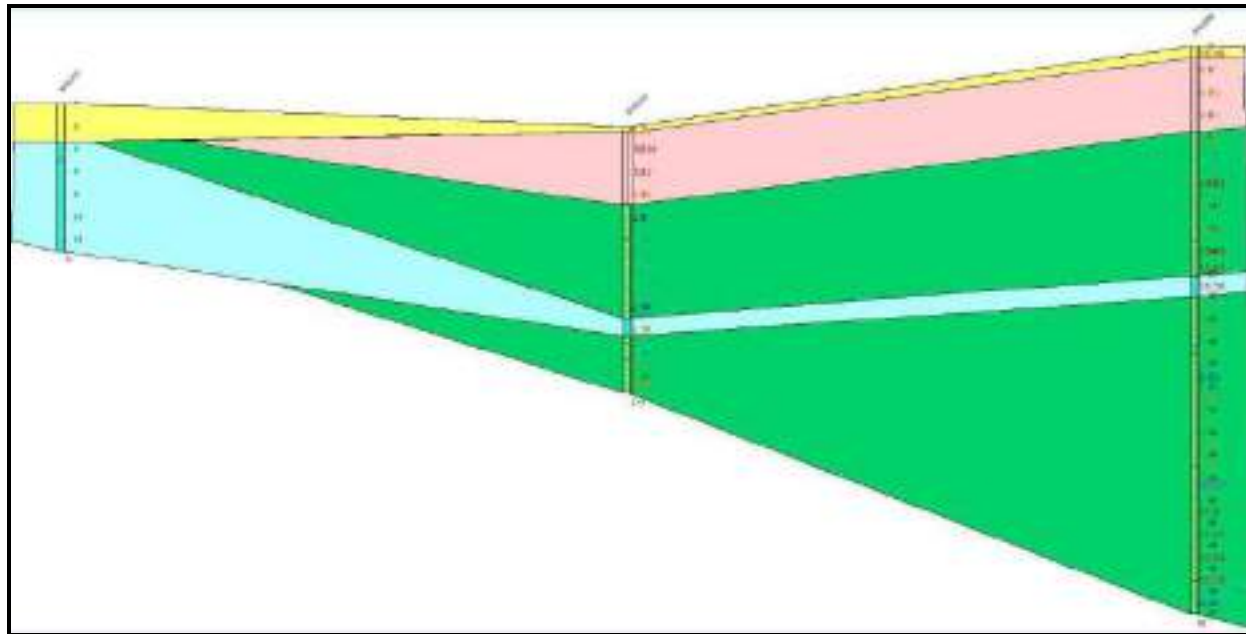
**Table 9.2 Significant Drill Intercepts – 2022 Drill Program**

BH_ID	From_m	To_m	Width
BHDD05	0.00	23.50	23.50
BHDD06	0.00	48.00	48.00
BHDD08	0.00	34.50	34.50
BHDD11	0.00	29.00	29.00
BHDD12	0.00	31.60	31.60



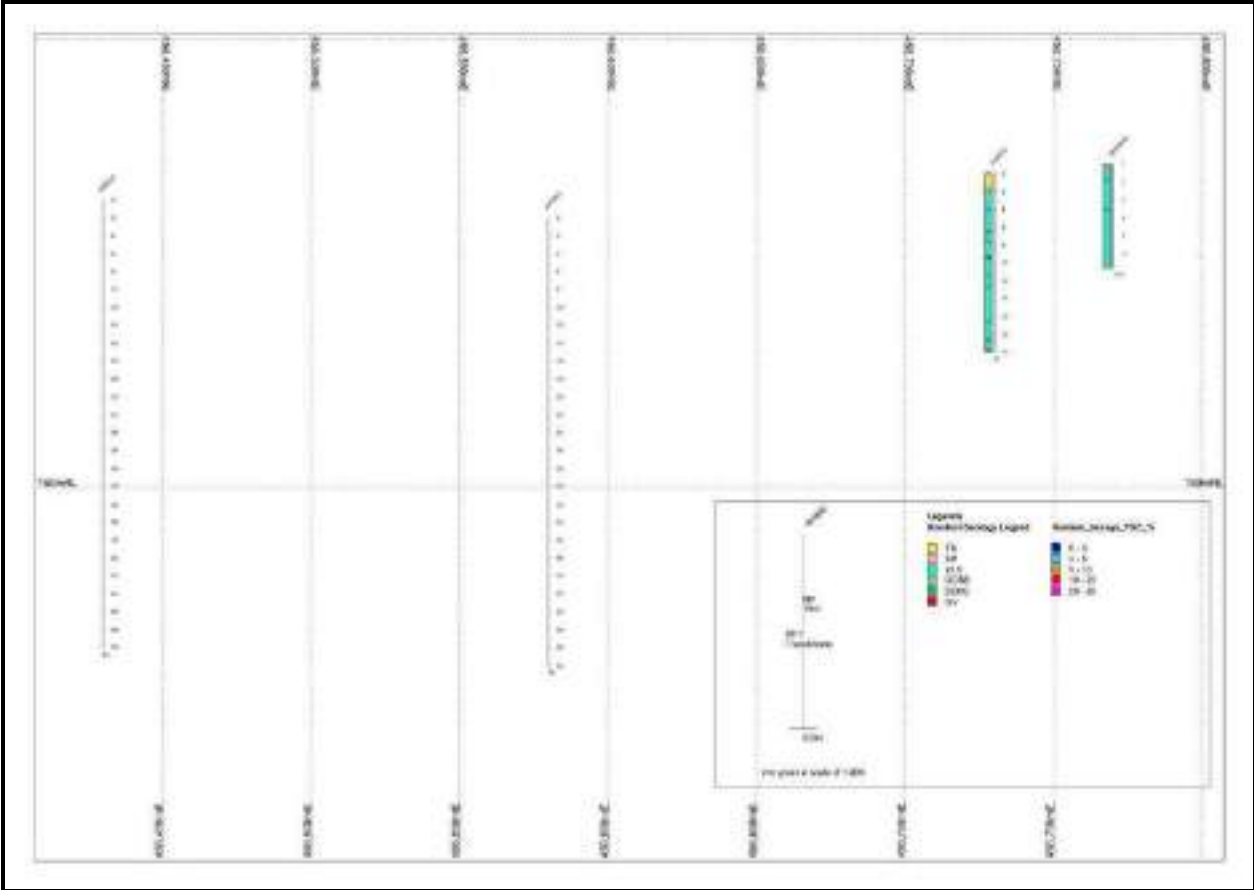
**Figure 9.1: Section 9340430, Handeni, Tanzania.**  
 (Source: Azustone Resources Tanzania Ltd, 2022)





**Figure 9.3: Section 934092, Handeni, Tanzania.**

*(Source: Azustone Resources Tanzania Ltd, 2022)*



**Figure 9.4: Section 934092, Handeni, Tanzania.**

(Source: Azustone Resources Tanzania Ltd, 2022)

## **10.0 SAMPLE PREPARATION, ANALYSES AND SECURITY**

### **10.1 Drill Core Sample Preparation**

A total of 95 drilling core sample was collected, including 3 pulp/standard and 3 duplicate samples in order to control laboratory functionality. The sample preparation procedures presented below focus on the work done in 2022. Drill core was transported by company personnel to core logging facility, located within the PML; s boundary, where geotechnical logging, geological logging, core splitting and sampling were done. Geotechnical procedures included recording core recovery, rock quality determination (RQD), joint number (Jn), joint alteration (Ja), joint roughness (Jr) and stress reduction factor (SRF). After geological logging, the core was sampled, split and bagged, and photographed. The core was stored on core boxes located within the PML's boundaries. Core was generally sampled in 2-metre intervals in the year 2022 drill program and with 1-metre intervals given for lithology changes. Core splitting was done using diamond bladed rock saws operated by Azustone Resources personnel. Quarter the core was sent for analysis; the other three quarters was returned to the core box as a permanent record.

These samples were sent to Geological Survey of Tanzania (GST) geochemical laboratory for analysis. This laboratory is an independent lab that is ISO GST/QFA7.8.2 certified for Competence in Testing.

### **10.2 Bulk Density and the Specific Gravity Determination**

A dry bulk density of a drill core was determined by the volume of water that is displaced by a sample when it is submerged. The weight of the sample was then divided by the volume of water displaced to produce a density with a unit of g/cm<sup>3</sup>.

Specific gravity is a unitless measurement of a sample's density relative to water. The equation used to calculate specific gravity is the weight of a dry sample in air divided by the weight of the sample in air minus the weight of the sample in water (i.e., the weight of water displaced by the sample). It is the most common value used to characterise a sample for resource calculations. The range of specific gravity reported is 0.01 to 20 which covers all rock and mineral types.

### **10.3 Quality assurance and Quality Control**

Quality Control and Quality Assurance ("QC/QA") work was only instituted during the 2022 exploration program. In total, 3 pulp/Standard samples of known value were sent for analysis to SGS Geochemical laboratory. The original samples had been previously prepared and/or analysed at same laboratory. 3 duplicate samples were also submitted to SGS Geochemical laboratory. This laboratory is an independent lab that is ISO GST/QFA7.8.2 certified for Competence in Testing It is the authors' opinion that the analytical results from the certified laboratory cited above is accurate and that the data can be relied upon.

## 10.4 Database

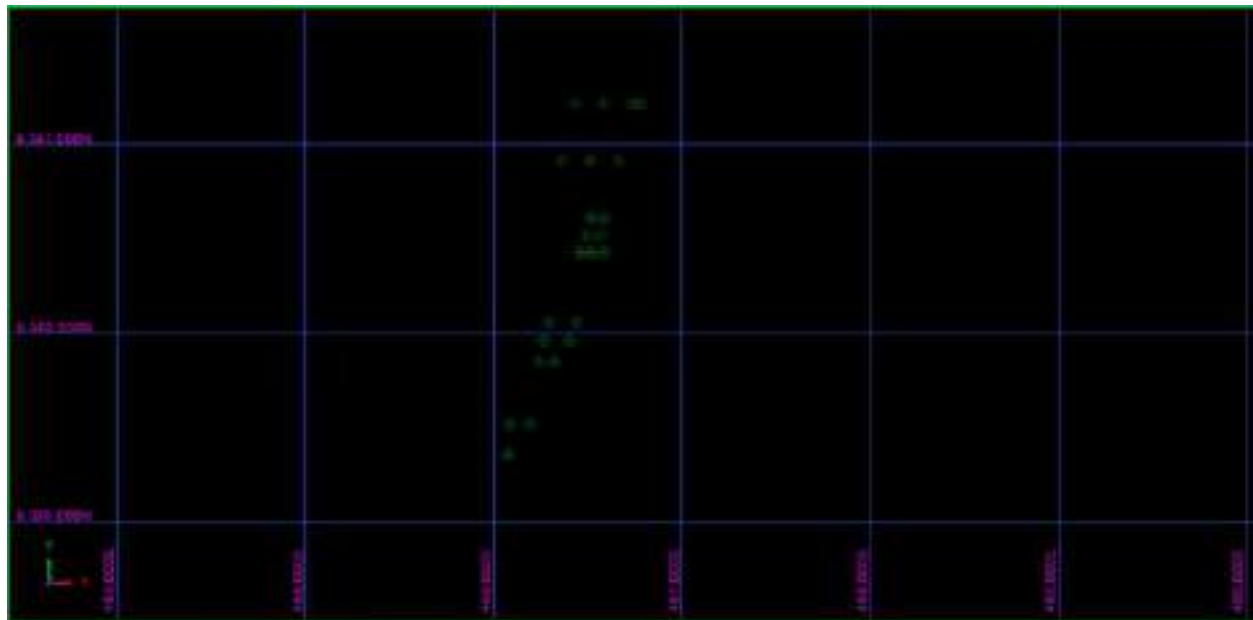
Surpac 6.4.1 software has been used on this Mineral Resource Estimate beginning with making database for the domain then, import data from Collar, Assay, Geology and Survey tables. Then display the imported data in Surpac to verify if they match with the drilling plan, then assigning the colours to grade intervals and lithologies, again displaying the drillholes with assay values/grade and lithology.

depth_from	depth_to	hole_id	samp_id	tgc
3	5	BHDD011	HDD020	8.53
5	6.1	BHDD011	HDD021	21.97
6.1	8	BHDD011	HDD022	19.97
8	10	BHDD011	HDD023	28.51
10	12	BHDD011	HDD024	18.64
12	14	BHDD011	HDD026	13.95
14	16	BHDD011	HDD027	18.08
16	18	BHDD011	HDD028	55.51
18	20	BHDD011	HDD029	35.99
20	22	BHDD011	HDD031	14.02
22	24	BHDD011	HDD032	37.13
24	26	BHDD011	HDD033	28.33
26	28	BHDD011	HDD034	25.33
28	29	BHDD011	HDD035	48.28
0	1	BHDD012	HDD064	8.63
1	3	BHDD012	HDD065	10.66
3	5	BHDD012	HDD066	4.63
5	7	BHDD012	HDD067	6.69
7	9	BHDD012	HDD068	10.61
9	10	BHDD012	HDD069	1.68
10	12	BHDD012	HDD070	32.07
12	14	BHDD012	HDD071	27.15
14	16	BHDD012	HDD072	29.66
16	18	BHDD012	HDD073	20.81
18	20	BHDD012	HDD074	16.43
20	22	BHDD012	HDD076	12.51
22	24	BHDD012	HDD077	8.14
24	26	BHDD012	HDD078	14.74
26	28	BHDD012	HDD079	9.52

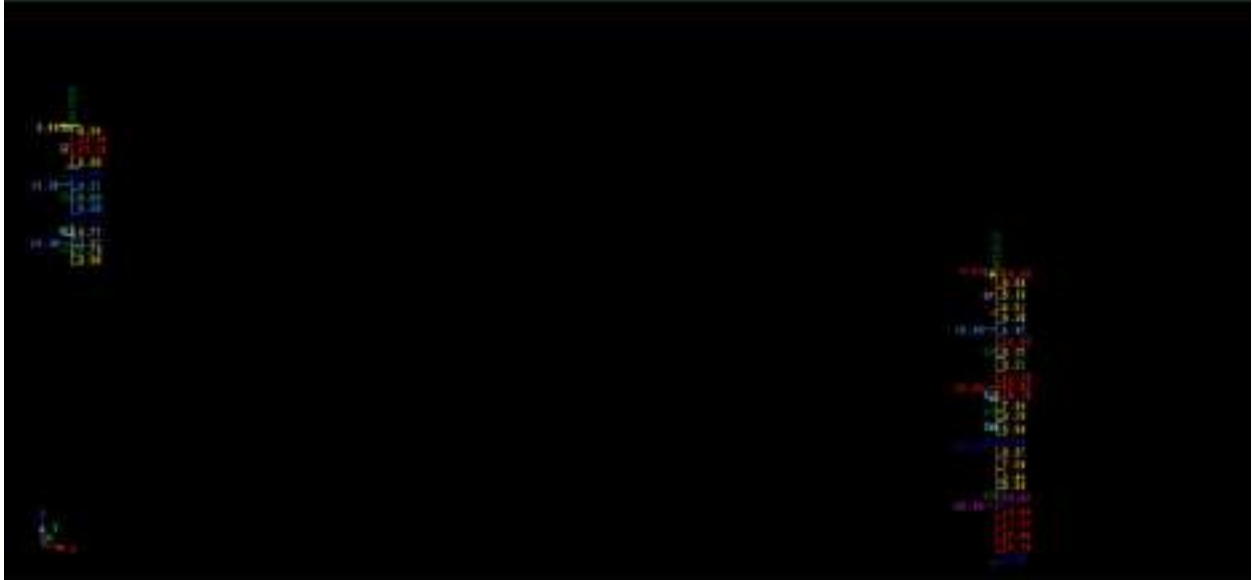
**Table 10.1: The geological database used in Mineral Resource estimate showing the assay table**

hole_id	hole_path	hole_type	max_depth	x	y	z	Click to Add
BHDD01		DD	50	456430	9341220	182	
BHDD02		DD	50	456580	9341220	180	
BHDD03		DD	30	456730	9341220	185	
BHDD03B		DD	11.5	456770	9341220	186	
BHDD04		DD	13	456360	9340920	170	
BHDD05		DD	23.5	456550	9340920	168	
BHDD06		DD	50	456680	9340920	175	
BHDD07		DD	50	456520	9340608	158	
BHDD08		DD	34.5	456585	9340608	163	
BHDD09		DD	50	456490	9340520	148	
BHDD10		DD	50	456565	9340518	153	
BHDD11		DD	29	456458	9340412	148	
BHDD12		DD	33.6	456516	9340411	147	
BHDD12B		DD	30.5	456586	9340411	148	
BHDD13		DD	50	456285	9340054	168	
BHDD14		DD	50	456436	9340064	162	
BHDD15		DD	50	456283	9339960	169	
BHDD16		DD	50	456400	9339960	164	
BHDD17		DD	50	456238	9339851	165	
BHDD18		DD	50	456320	9339851	170	
BHDD19		DD	50	456085	9339510	174	
BHDD20		DD	50	456193	9339520	185	
BHDD21		DD	50	456070	9339260	163	

**Table10.2: The geological database used in Mineral Resource estimate showing the collar table**



**Figure 10.1: Displaying drillholes (in green colour) by surpac 6.4.1**



**Figure 10.2: Drillholes display showing geology and graphite grades**

### **10.5 Sample Security**

During the 2022 drill programs, drill core was transported by Azustone personnel to the core logging yard, where geotechnical procedures and geological core sampling was carried out. Core was again stored in racks at the storage yard. All drill core was placed in secure storage facilities for future reference.

### **10.6 Analytical laboratory**

Drill Core Samples Sample preparation involved drying the samples, followed by crushing in a jaw crusher to produce a -6-mesh product. It was then riffle-split to produce a 200-gram ("g") sample, which was pulverized in a ring-and-puck pulverizer to produce a -150-mesh pulp. The crusher and pulverizer were cleaned with quartz sand between samples to prevent cross contamination. A pulp sample having a mass from 0.01 to 0.25 g was placed in a LECO crucible, accurately weighed, followed by immersion in a dilute hydrochloric acid leach solution to remove any inorganic carbon present in the form of carbonate. The crucible was placed in a suction apparatus and the resulting chloride residue inside the crucible was removed with de-ionized water. The sample was then dried, leaving behind the leached graphite sample. The crucible plus sample was placed in a LECO 200 analyser, where it was vaporized in a high-frequency induction furnace at temperatures approaching 1,500°C. A stream of oxygen was introduced, allowing for combustion of the sample. The gases produced were then passed directly into a cell through which infrared (IR) energy was transmitted, where the amount of carbon dioxide produced from the sample combustion was measured.

The absorption at the precise wavelength for carbon dioxide is related to the total FC content of the sample, and % FC can be determined. The quantity of FC represents the amount of graphite

in a sample. The LECO analytical procedure is the industry standard method for the analysis of graphite. It is an indirect method of analyses; no direct method exists. The method assumes that the carbon-bearing minerals in the sample occur either as graphite, a form of organic carbon, or as carbonates. Any carbonate mineral in the sample is removed by the acid-washing procedure, leaving behind solely organic carbon in the form of graphite, which is then analysed. However, carbonate minerals encased within graphite grains would not be removed by acid washing as they would not be exposed to the acid medium, and would end up reported as graphitic carbon.

## **10.7 Sample preparation and analysis**

### **10.7.1 Sample Preparation**

A total of 95 drilling core sample was collected, including 3 pulp and 3 duplicate samples in order to control laboratory functionality. The sample preparation procedures presented below focus on the work done in 2022. Drill core was transported by company personnel to core logging facility, located within the PML; s boundary, where geotechnical logging, geological logging, core splitting and sampling were done. Geotechnical procedures included recording core recovery, rock quality determination (RQD), joint number (Jn), joint alteration (Ja), joint roughness (Jr) and stress reduction factor (SRF). After geological logging, the core was sampled, split and bagged, and photographed. The core was stored on core boxes located within the PML's boundaries. Core was generally sampled in 2-metre intervals in the year 2022 drill program, with 1-metre intervals given for lithology changes. Core splitting was done using diamond bladed rock saws operated by Azustone Resources personnel. Quarter the core was sent for analysis; the other three quarters was returned to the core box as a permanent record.

These samples were sent to Geological Survey of Tanzania (GST) geochemical laboratory for analysis. This laboratory is an independent lab that is ISO GST/QFA7.8.2 certified for Competence in Testing.

### **10.7.2 Sample analysis**

Drill Core Samples Sample preparation involved drying the samples, followed by crushing in a jaw crusher to produce a -6-mesh product. It was then riffle-split to produce a 200-gram ("g") sample, which was pulverized in a ring-and-puck pulverizer to produce a -150-mesh pulp. The crusher and pulverizer were cleaned with quartz sand between samples to prevent cross contamination. A pulp sample having a mass from 0.01 to 0.25 g was placed in a LECO crucible, accurately weighed, followed by immersion in a dilute hydrochloric acid leach solution to remove any inorganic carbon present in the form of carbonate. The crucible was placed in a suction apparatus and the resulting chloride residue inside the crucible was removed with de-ionized water. The sample was then dried, leaving behind the leached graphite sample. The crucible plus sample was placed in a LECO 200 analyser, where it was vaporized in a high-frequency induction furnace at temperatures approaching 1,500°C. A stream of oxygen was introduced, allowing for combustion of the sample. The gases produced were then passed directly into a cell through which infrared (IR) energy was transmitted, where the amount of carbon dioxide produced from the sample combustion was measured.

The absorption at the precise wavelength for carbon dioxide is related to the total FC content of the sample, and % FC can be determined. The quantity of FC represents the amount of graphite in a sample. The LECO analytical procedure is the industry standard method for the analysis of graphite. It is an indirect method of analyses; no direct method exists. The method assumes that the carbon-bearing minerals in the sample occur either as graphite, a form of organic carbon, or as carbonates. Any carbonate mineral in the sample is removed by the acid-washing procedure, leaving behind solely organic carbon in the form of graphite, which is then analysed. However, carbonate minerals encased within graphite grains would not be removed by acid washing as they would not be exposed to the acid medium, and would end up reported as graphitic carbon.

### **10.7.3 Laboratory Independence and Certification**

Laboratory Results for grab sample and drill core are presented in Appendix D and Appendix E.

## **10.8 Quality Assurance/Quality Control (QAQC)**

Quality Control and Quality Assurance ("QC/QA") work was only instituted during the 2022 exploration program. In total, 3 pulp samples of known value were sent for analysis to SGS Geochemical laboratory. The original samples had been previously prepared and/or analysed at same laboratory. 3 duplicate samples were also submitted to SGS Geochemical laboratory. This laboratory is an independent lab that is ISO GST/QFA7.8.2 certified for Competence in Testing. It is the authors' opinion that the analytical results from the certified laboratory cited above is accurate and that the data can be relied upon.

## 11.0 DATA VERIFICATION

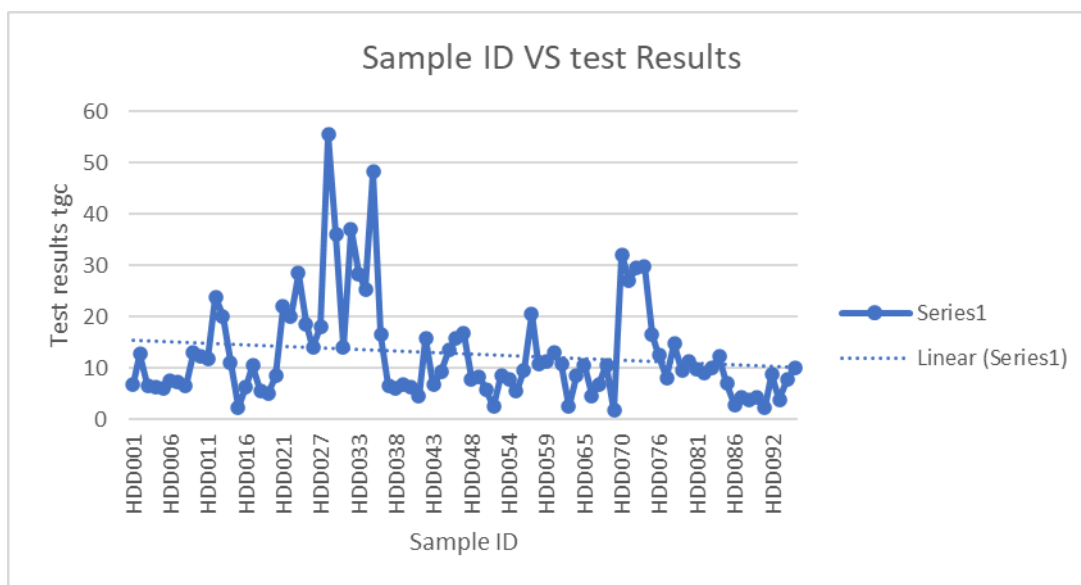
Field data including geological mapping data, trenching data and drilling logging data were collected by Mr. Mayaya Shilinde Pole, Filbert George Maziku and Twahir Hussein Mtally who are well experienced geologists with more than 15 years of experience in the industry.

Mr. Nicholas Sloo reviewed all data sets and found them to be adequate for resource modelling purpose in Inferred Resources category and were incorporated into this report.

The data review involved raw data plotting to confirm the data plotting location, single data review-sampling interval/length in case of overlapping intervals and gaps in sample intervals, check of assay values-minimum values, extreme value, number of decimal places and check on collar elevations against topo DTM.

Also, statistics and geostatistics of the data base was done and data histogram, cumulative curve and probability curves plotted as part of data verification and processing.

The data verification was very important because the Model forms the basis for everything to follow for the project including mine design, schedules, drilling plans, life of the mine, forecast, budget, strategic planning etc. Wrong data will lead poor Model and then project big loss.



**Figure 11.1: Sample ID Vs test results plot (samples test results characteristics)**

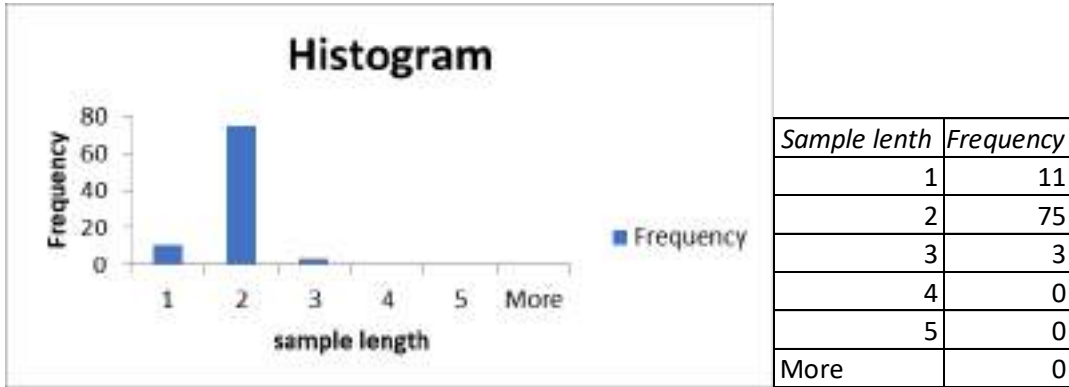


Figure 11.2: Determining dominant sample interval/ sample length

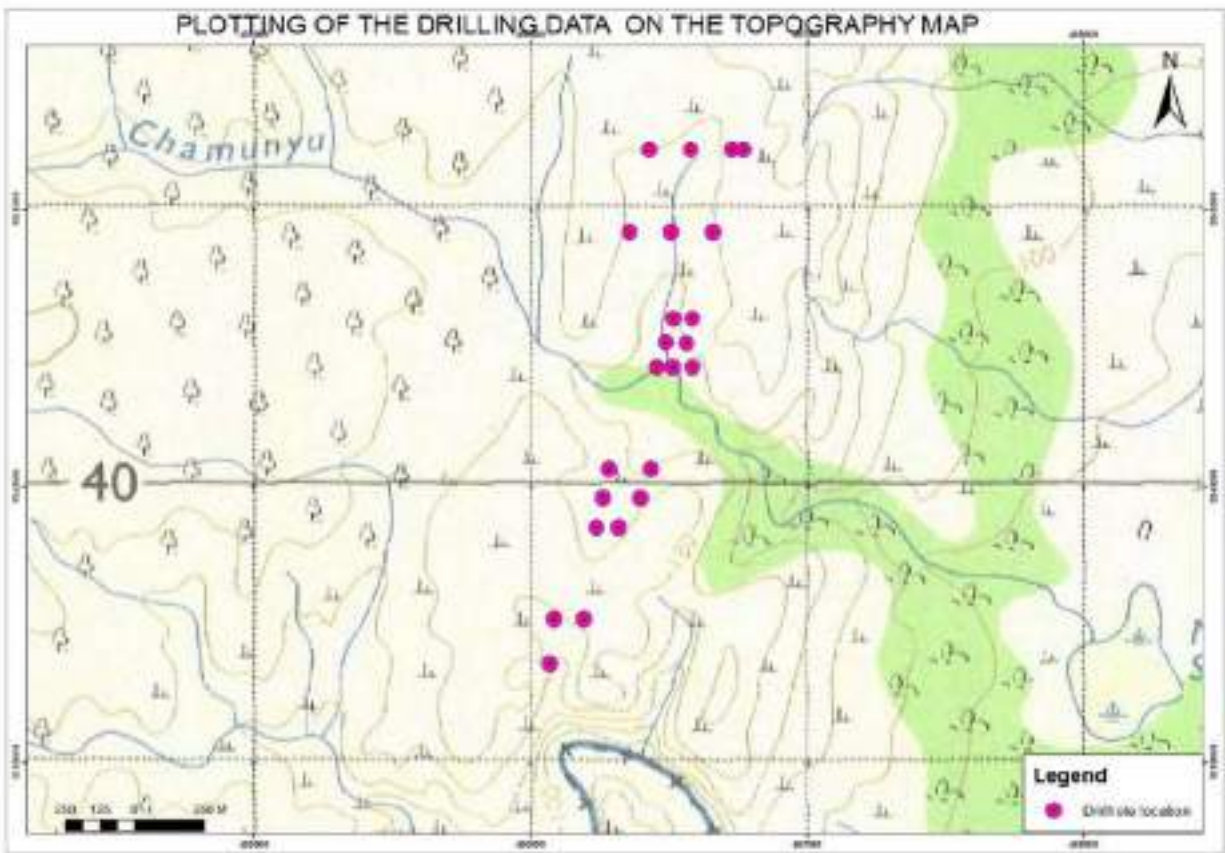
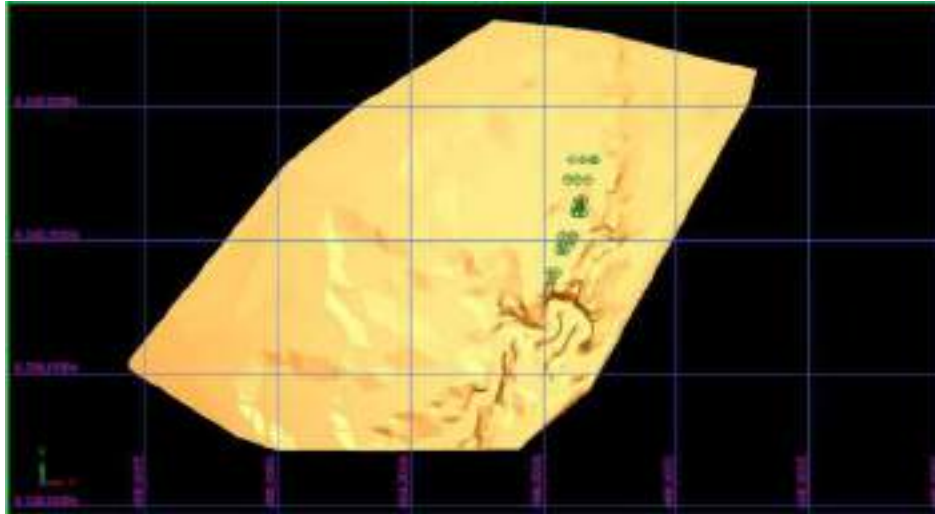
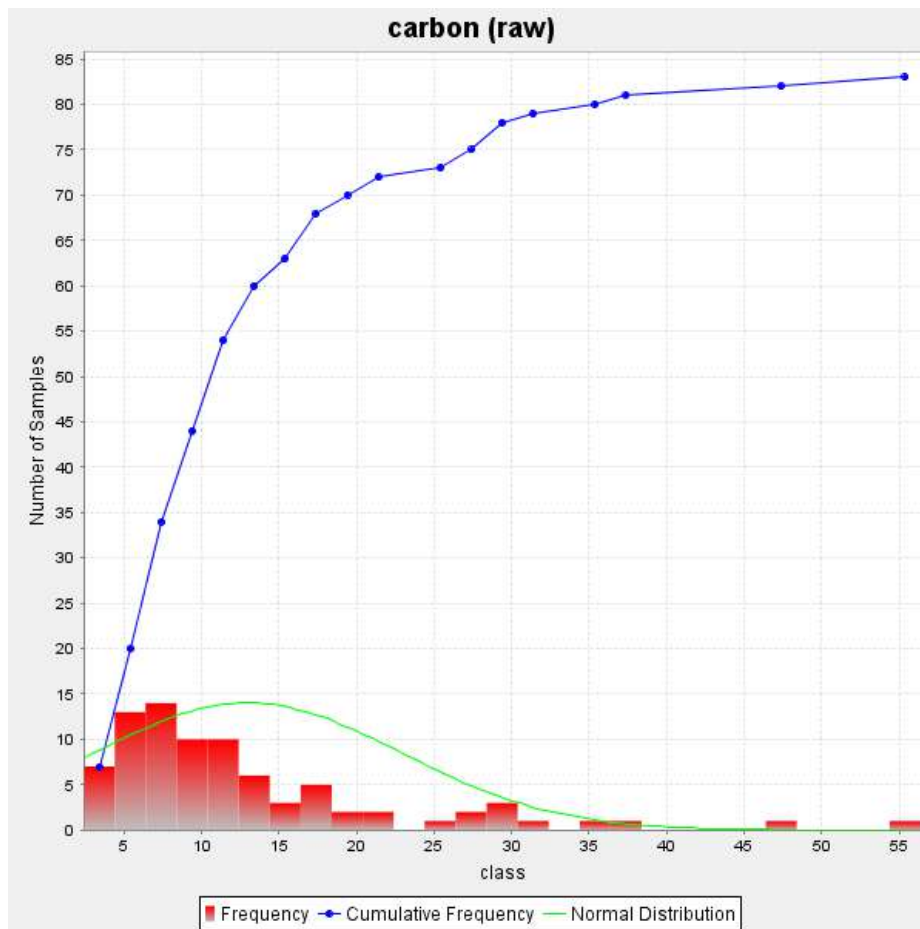


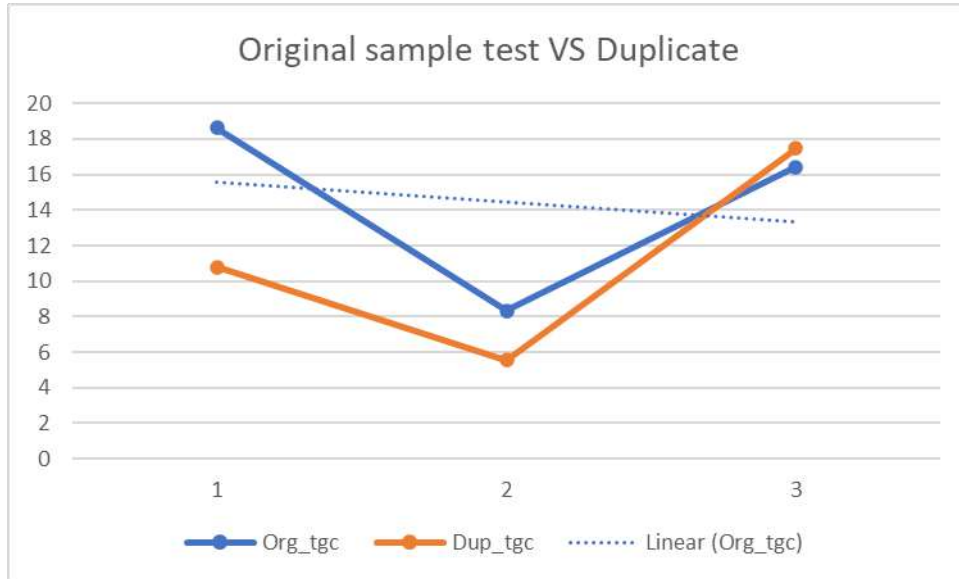
Figure 11.3: Drillholes plots on the same area-Verified



**Figure 11.4: Drill collar plotted against the topo DTM, no drillhole plots above elevation-Verified.**



**Figure 11.5: Statistics of raw data as part of data verification.**



**Figure 11.6: Original samples VS duplicate test results plot**

### 11.1 Independent Verification

The data plotting confirm the data plotting location, single data review-sampling interval/length in there was no any overlapping intervals and gaps in sample intervals, check of assay values-minimum values, extreme value, number of decimal places and check on collar elevations against topo DTM was correct.

Also, statistics and geostatistics of the data base was done and data histogram, cumulative curve and probability curves plotted as part of data verification and processing.

### 11.2 Comments on Section 12

Data was collected, tabulated and presented in a manner required

## 12.0 MINERAL PROCESSING AND METALLURGICAL TESTING

The mineral processing and metallurgical test for Kwamsisi Project has not yet done at this stage. Preliminary metallurgical test for Kwamsisi Project has been done as shown below The mineral processing test will be done together with ESIA

### 12.1 Preliminary Metallurgical Test One

Preliminary Metallurgical Testing was done to determine the graphite flake size, chemical content, mineral content and total graphitic content in % by mass. The preliminary petrographic analysis was done at GST laboratory.

#### 12.1.1 Mineral Content

It was observed that, for 11 samples taken from the drill core, which represent the entire project area the mineral contents are as follow: -

**Graphite-** Fine to coarse grained, subhedral to euhedral in crystal form and fibrous in habit. Approximately average size 0.86mm-2.10mm, 17-29%

**Orthoclase-** Medium grained size, anhedral in crystal form, granular in habit; 24%44%

**Pyroxene-** Fine to medium grained, anhedral to subhedral in crystal form and angular in habit;38%

**Calcite-** Fine to medium grained size, anhedral to subhedral in crystal form, with pinkish-green tint, some occur as infill along fractures;9%,19,21%

**Biotite** -Medium grained size, subhedral in crystal form, some tabula in habit, some grains have altered to form Epidote and Muscovite minerals 3%, 9%

**Plagioclase** Medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning 2%

**Quartz-** Fine to medium grained size, anhedral in crystal form, granular in habit, show undulatory extinction 4%, 34%

**Olivine-** Medium to coarse grained size, anhedral to subhedral in crystal form, granular in habit, high interference colour; 6%, 22%

**Hornblende-** Fine to coarse grained size, anhedral to subhedral in crystal form, granular; 2%, 28%

**Pyrite-** Fine to medium grained size, subhedral to euhedral in crystal form and some cubic in habit; 5%, 7%,10%

**Garnet-**Fine to coarse grained size, anhedral to subhedral in crystal form, granular in habit, with irregular fractures.19%

### **12.1.1 Laboratory Results**

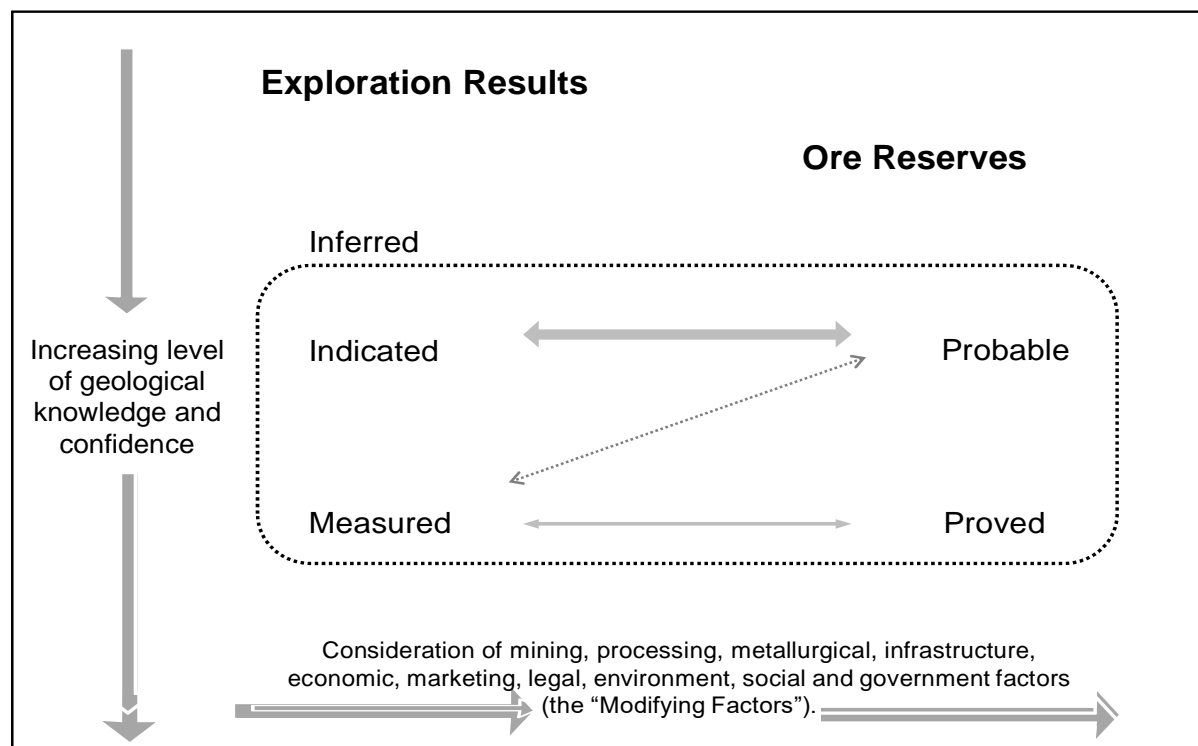
Laboratory results are presented in Appendices D and E.

## 13.0 MINERAL RESOURCE ESTIMATE

A 'Mineral Resource' is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade (or quality), and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade (or quality), continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling. Mineral Resources are sub-divided, in order of increasing geological confidence, into Inferred, Indicated and Measured categories. (Jorc Code 2012 edition).

Mineral Resource estimates are not precise calculations, being dependent on the interpretation of limited information on the location, shape and continuity of the occurrence and on the available sampling results. Reporting of tonnage and grade figures should reflect the relative uncertainty of the estimate by rounding off to appropriately significant figures and, in the case of Inferred Mineral Resources, by qualification with terms such as 'approximately' and to emphasise the imprecise nature of a Mineral Resource, the final result should always be referred to as an estimate not a calculation.

### 13.1 Reporting Terminology



**Figure 14.1: General relationship between Exploration Results, Mineral Resources and Ore Reserves**

As per JORC 2012 edition requirement on exploration results and Mineral Resource Estimate reporting, the Mineral Resource estimated at this level of exploration especially based on data collection spacing (drillholes interval) to be reported is the Inferred Mineral Resource category.

An 'Inferred Mineral Resource' is that part of a Mineral Resource for which quantity and grade (or quality) are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade (or quality) continuity. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.

The author has reviewed the drilling data and found out that most of the drillholes were terminated within the mineralization zone which does not provide detailed information on down dip continuity of the graphite mineralization as one of the key factors for pit design and other project development aspects.

The so far collected data from few drillholes are enough for inferred resource estimate being associated with some assumptions on some aspects.

#### **Assumptions made:**

- Rock specific gravity 2.5

### **13.2 Key Assumptions/Basis of Estimate**

A point of observation (PoB) is a drill hole in which:-

- The entire drillhole was cored,
- Core recovery was greater than 95 percent, and
- Data Points (DP)

A data point (DP) is a drill hole in which:-

- The drillhole was cored but no, or inadequate, analytical data is available.
- The drillhole was not cored, but had been geophysical logged to an adequate standard.

### **13.3 Geological Models**

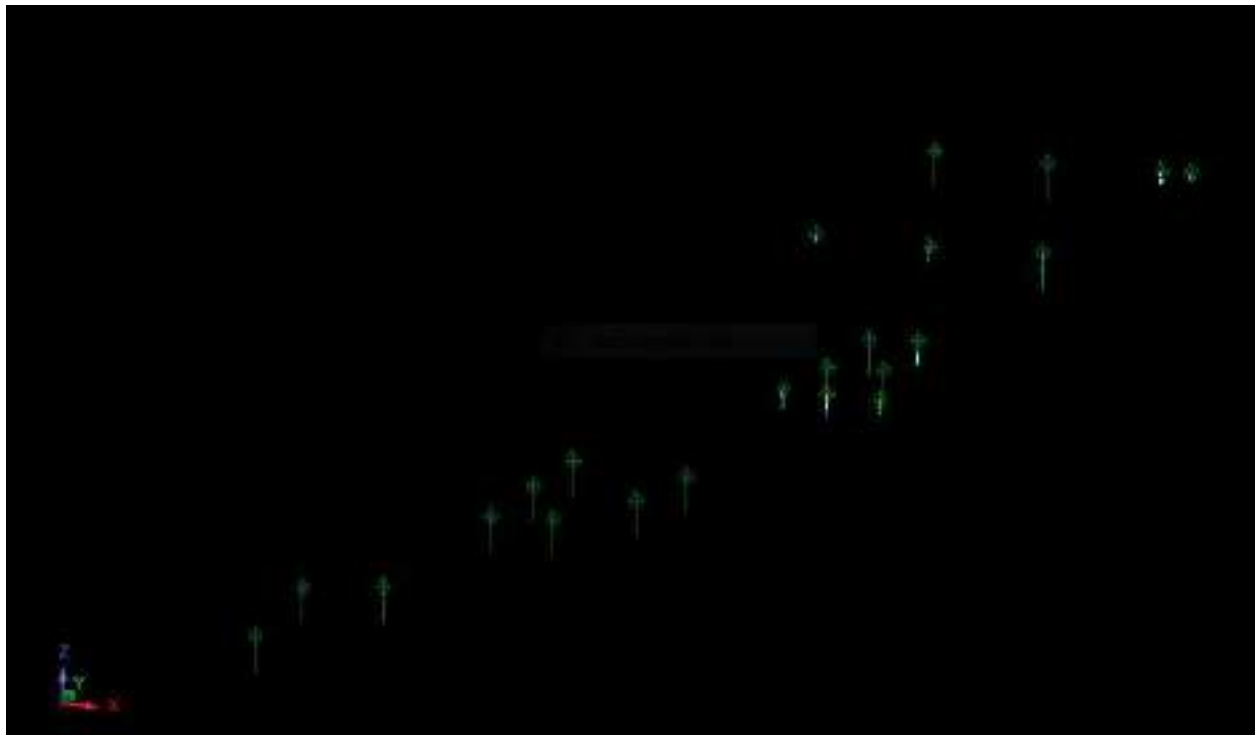
In mining, the geological block model is the foundation of any mining project as it contains all the grade and material information for the mining deposit. The success and failure of a mining operation can rest largely on how the block model is used to evaluate mineral assets.

In 2023, Azustone Resources (T) Ltd calculated a mineral resource estimate ("Resource") on the Deposit for total graphitic carbon, based on the interpretation from the assays and drilling data.

Estimates were made from 3D block models utilizing commercial mine planning software (Surpac®). The Handeni Graphite project exists in a single geologic block model. Cell size was 50m east x 50m north x 25m high. The assays were composited into 2m down-hole composites, reflecting the predominant assay sample length. The compositing honored the modelling domain codes by breaking the composites on the domain code values.

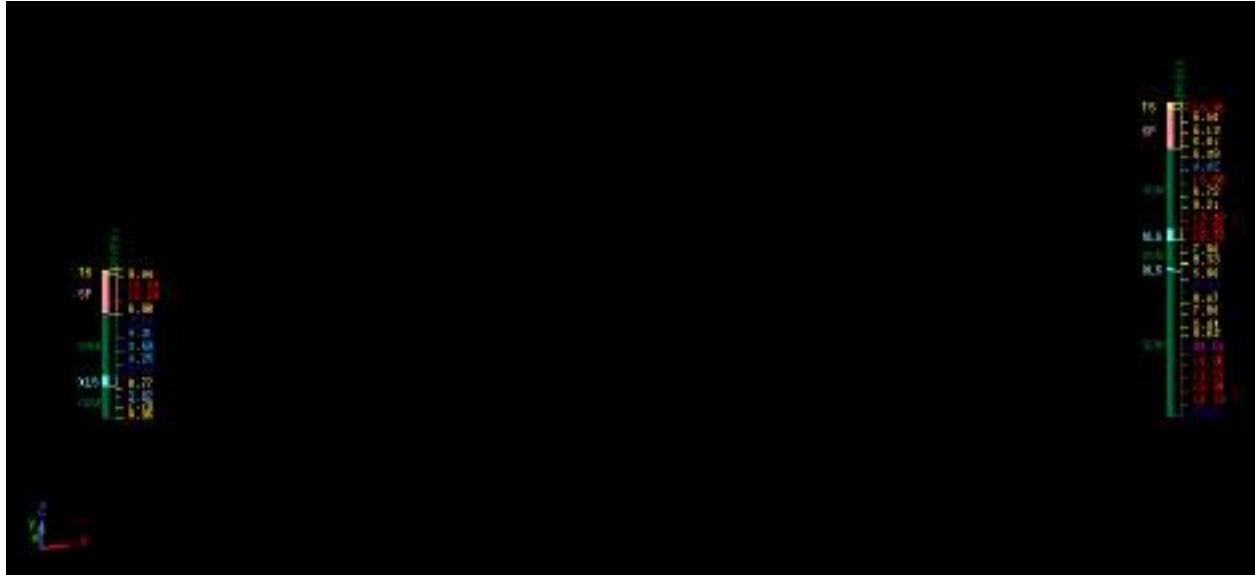
Various coding was done for the block model in preparation for grade interpolation. Modelling consisted of grade interpolation by Inverse distance (OK). Nearest neighbor (NN) grades were also determined for validation purposes. The grade interpolation used an ellipsoidal search of 150 m x 150 m x 10 to 20 m in an NS-EW trending, westerly dipping ellipse. These parameters were based on the geological interpretation and variogram analysis. The number of composites used in estimating a model block grade followed a strategy that matched composite values and model blocks sharing the same ore code or domain. The first pass allowed composites from only one drill hole to be used (longer search distances) and the second pass, run at the shorter search distances, ensured that composites from at least two drill holes were used.

The graphite mineralization is found in both unconsolidated material (regolith) and in hard rock (crystalline limestone and graphitic gneiss). Data analysis demonstrated that the regolith and hard rocks should be treated as separate domains for the purposes of resource modelling. However, the two rock units (Crystalline limestone and Graphitic gneiss) were not distinguished from each other. The data comprised samples and geological information from 9 drill holes, which were used for the Resource calculations; trenches were not included during resources calculation. The mineral resource calculations for the Regolith and the rocks Resources, are as shown on Table 4.8 below.

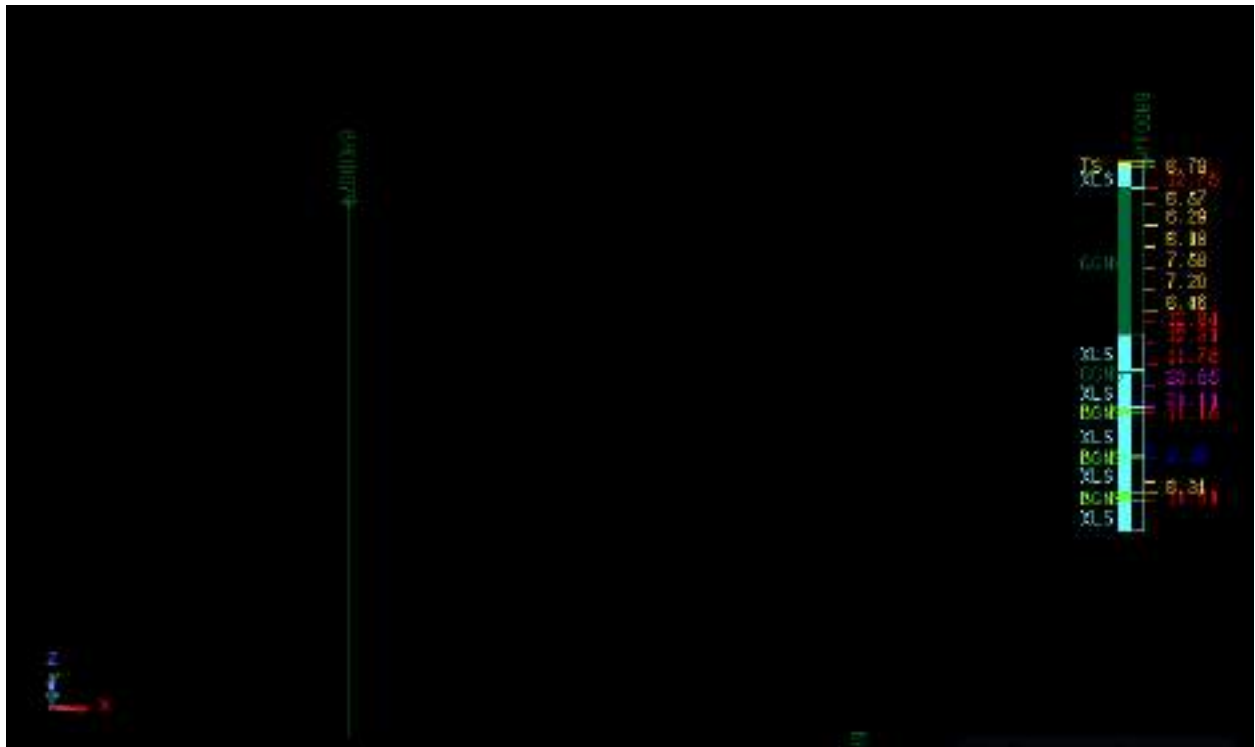


**Figure 14.2: Boreholes in Oblique View, Handeni Graphite Project**

*(Source: Azustone Resources (T) Ltd, field work, 2023)*



**Figure 14.3: BHDD05 and BHDD06 Cross-section**  
 (Source: Azustone Resources (T) Ltd, field work, 2023)



**Figure 14.4: BHDD07 and BHDD08 Cross-section, Handeni Graphite Project**  
 (Source: Azustone Resources (T) Ltd, field work, 2023)



**Figure 14.5: BHDD11, BHDD12 and BHDD12B, Crosection, Handeni Graphite Project**  
(Source: Azustone Resources (T) Ltd, field work, 2023)

### 14.3 Exploratory Data Analysis (EDA)

Surpac 6.4.1 software has been used on this Mineral Resource Estimate beginning with making database for the domain then, import data from Collar, Assay, Geology and Survey tables. Then display the imported data in Surpac to verify if they match with the drilling plan, then assigning the colours to grade intervals and lithologies, again displaying the drillholes with assay values/grade and lithology.

All Access ...

Search

Tables

- assay
- contar
- geology
- intersection
- styles
- survey
- translation

depth_from	depth_to	hole_id	samp_id	tgc	Click to Add
3	5	BHDD11	HDD020	8.53	
5	6.1	BHDD11	HDD021	21.97	
6.1	8	BHDD11	HDD022	19.97	
8	10	BHDD11	HDD023	28.51	
10	12	BHDD11	HDD024	18.64	
12	14	BHDD11	HDD026	13.95	
14	16	BHDD11	HDD027	18.08	
16	18	BHDD11	HDD028	55.51	
18	20	BHDD11	HDD029	35.99	
20	22	BHDD11	HDD031	14.02	
22	24	BHDD11	HDD032	37.13	
24	26	BHDD11	HDD033	28.33	
26	28	BHDD11	HDD034	25.33	
28	29	BHDD11	HDD035	48.28	
0	1	BHDD12	HDD064	8.63	
1	3	BHDD12	HDD065	10.66	
3	5	BHDD12	HDD066	4.63	
5	7	BHDD12	HDD067	6.69	
7	9	BHDD12	HDD068	10.61	
9	10	BHDD12	HDD069	1.68	
10	12	BHDD12	HDD070	32.07	
12	14	BHDD12	HDD071	27.15	
14	16	BHDD12	HDD072	29.66	
16	18	BHDD12	HDD073	20.81	
18	20	BHDD12	HDD074	16.43	
20	22	BHDD12	HDD076	12.51	
22	24	BHDD12	HDD077	8.14	
24	26	BHDD12	HDD078	14.74	
26	28	BHDD12	HDD079	9.52	

**Plate 14.6: The geological database used in Mineral Resource estimate showing the assay table**

hole_id	hole_path	hole_type	max_depth	x	y	z	Click to Add
BHDD01		DD	50	456430	9341220	182	
BHDD02		DD	50	456580	9341220	180	
BHDD03		DD	30	456730	9341220	185	
BHDD03B		DD	11.5	456770	9341220	186	
BHDD04		DD	13	456360	9340920	170	
BHDD05		DD	23.5	456550	9340920	168	
BHDD06		DD	50	456680	9340920	175	
BHDD07		DD	50	456520	9340608	158	
BHDD08		DD	34.5	456585	9340608	163	
BHDD09		DD	50	456490	9340520	148	
BHDD10		DD	50	456565	9340518	153	
BHDD11		DD	29	456458	9340412	148	
BHDD12		DD	33.6	456516	9340411	147	
BHDD12B		DD	30.5	456586	9340411	148	
BHDD13		DD	50	456285	9340054	168	
BHDD14		DD	50	456436	9340064	162	
BHDD15		DD	50	456283	9339960	169	
BHDD16		DD	50	456400	9339960	164	
BHDD17		DD	50	456238	9339851	165	
BHDD18		DD	50	456320	9339851	170	
BHDD19		DD	50	456085	9339510	174	
BHDD20		DD	50	456193	9339520	185	
BHDD21		DD	50	456070	9339260	163	

Figure 14.7: the geological database used in Mineral Resource estimate showing the collar table

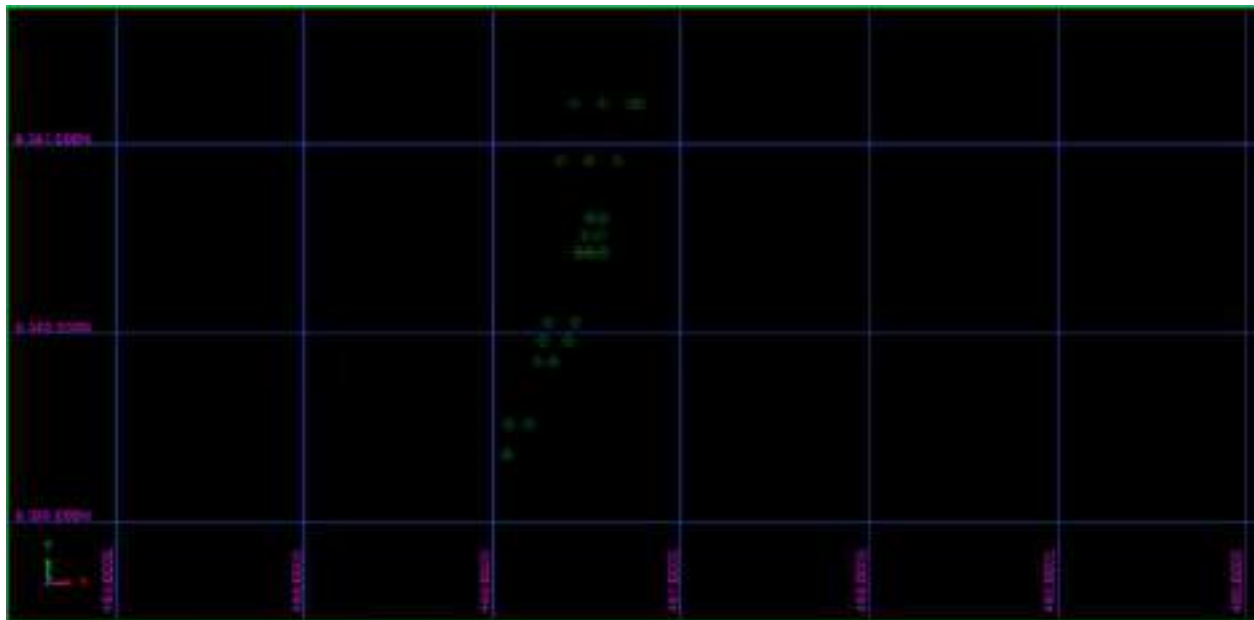
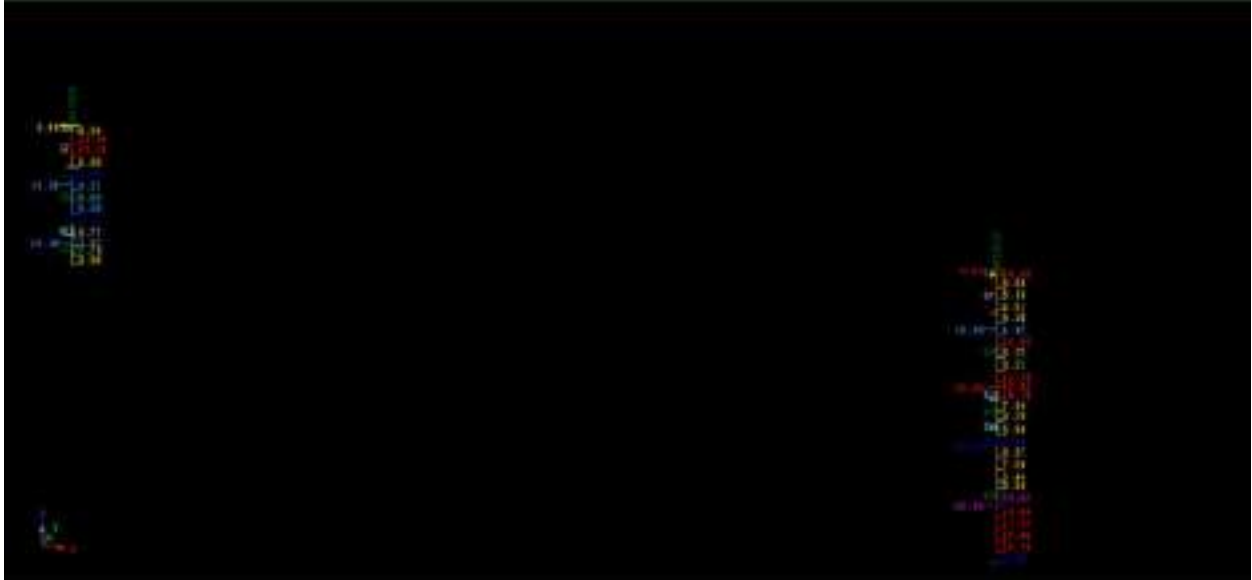


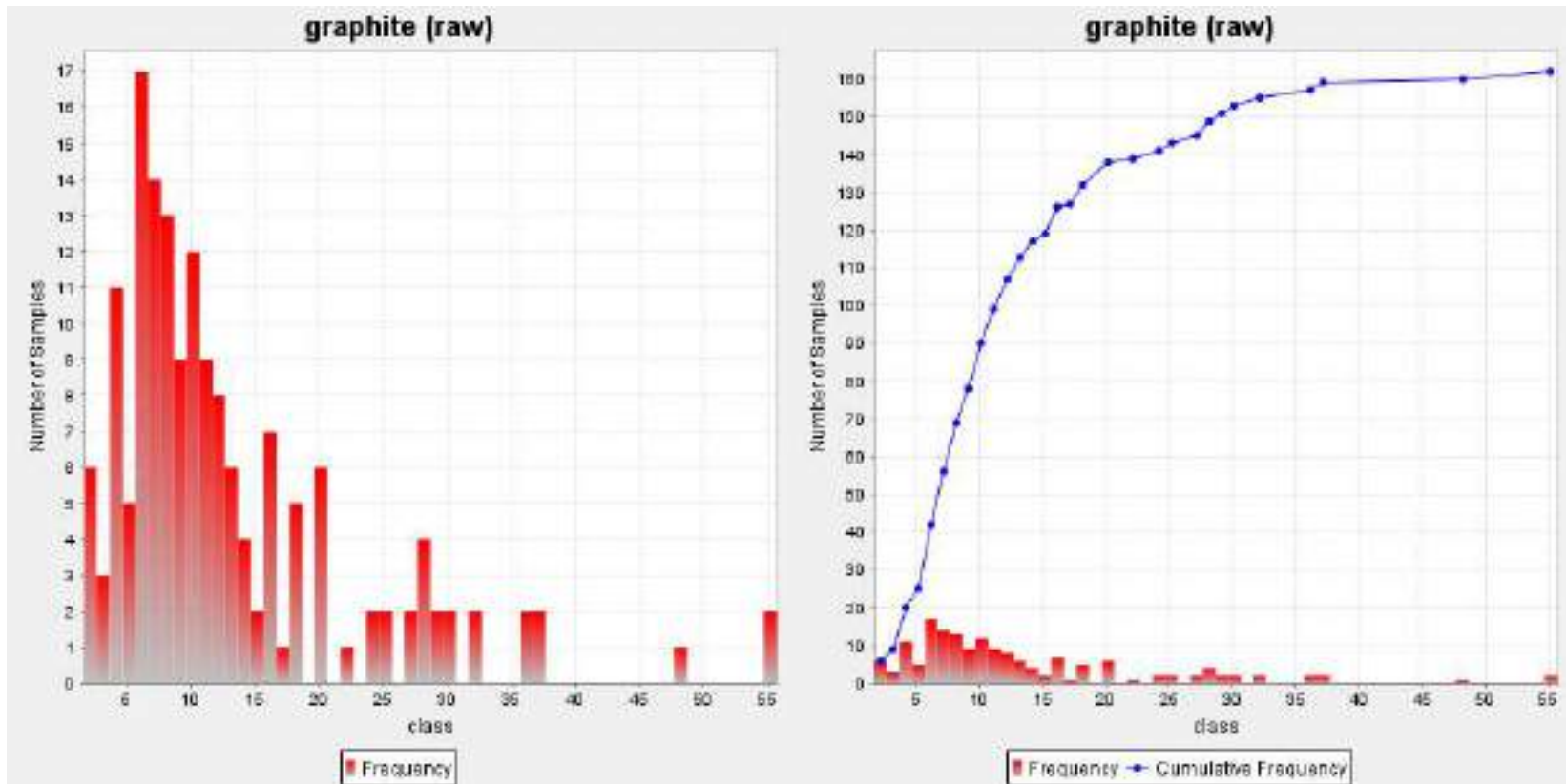
Figure 14.8: displaying drillholes (in green colour) by surpac 6.4.1



**Figure 14.9: Drillholes display showing geology and graphite grades**

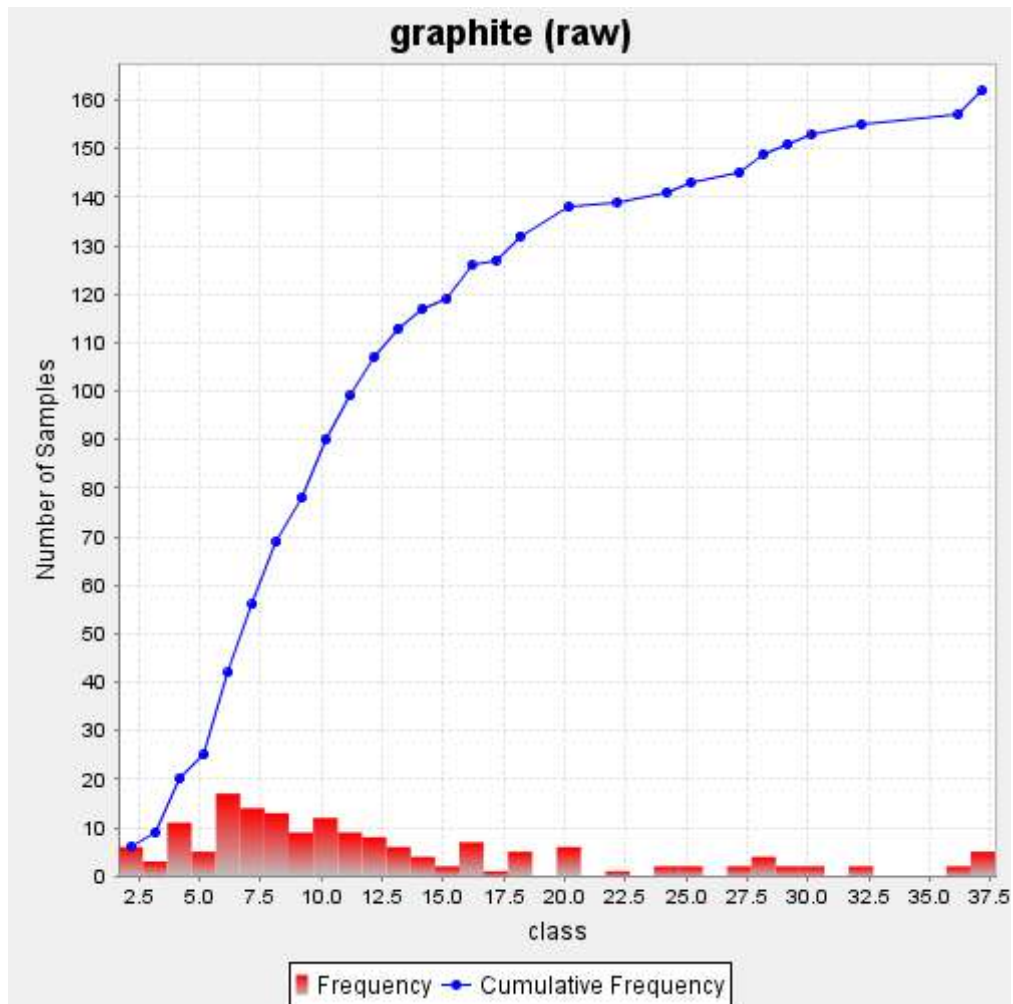
### **13.4 Summary Statistics\_Assays**

Statistics is the collection, organization, analysis, interpretation, and presentation of data. One of the important preliminary steps in performing geostatistical evaluation is to understand the statistical property of the data. Two characteristics which can potentially reduce the quality of the estimations are bimodalism and outliers. All bimodalism and outliers were taken into consideration during data evaluation.



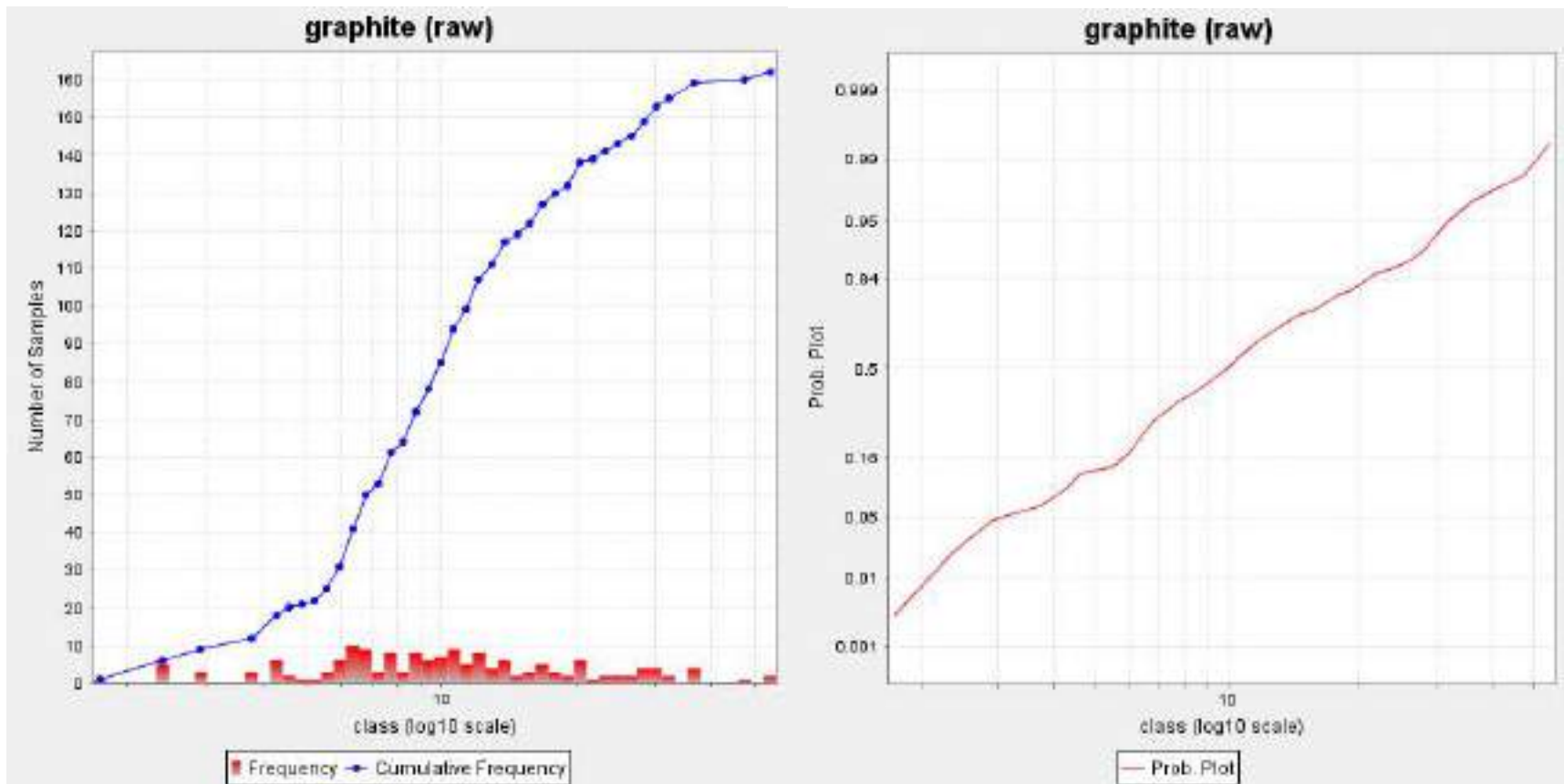
**Figure 14.10: Graphite Grade Histogram and Cumulative Frequency before outliers treated.**

*(Source: Azustone Resources (T) Ltd, field work, 2023)*



**Figure 14.11: Cumulative frequency after treating outliers**

*(Source: Azustone Resources (T) Ltd, field work, 2023)*



**Figure 14.12: Class (log 10 scale) probability curve**

*(Source: Azustone Resources (T) Ltd, field work, 2023)*

### **13.5 Summary Statistics\_Composites**

The statistics and geostatistics for the composite ore string for each domain was done starting with basic statistics followed variogram modelling which lead to creation of experimental variogram, Primary and Secondary variogram maps. No top cut was done as the grade spacing was in good range. This was followed by creation of variogram map (Primary Variogram and then the secondary Variogram) and Modelling using the lag slider to determine the lag with minimum noise in the variogram map. The selection of the direction of maximum continuity in the variogram map was done before modelling. This was followed by Extracting Variogram along axes in order to get the Major, Semi-major and Minor Variogram model, then modelling of major, semi-major and minor variogram created was done and the models saved with the anisotropy ellipsoid report created and saved as well. Then the ellipsoid visualizer string file was created on every domain using the data reported in anisotropy ellipsoid report.



### 13.6 Grade Capping/Outlier Restrictions

Statistics is the collection, organization, analysis, interpretation, and presentation of data. One of the important preliminary steps in performing geostatistical evaluation is to understand the statistical property of the data. Two characteristics which can potentially reduce the quality of the estimations are bimodalism and outliers. All bimodalism and outliers were taken into consideration during data evaluation.

### 13.7 Variography

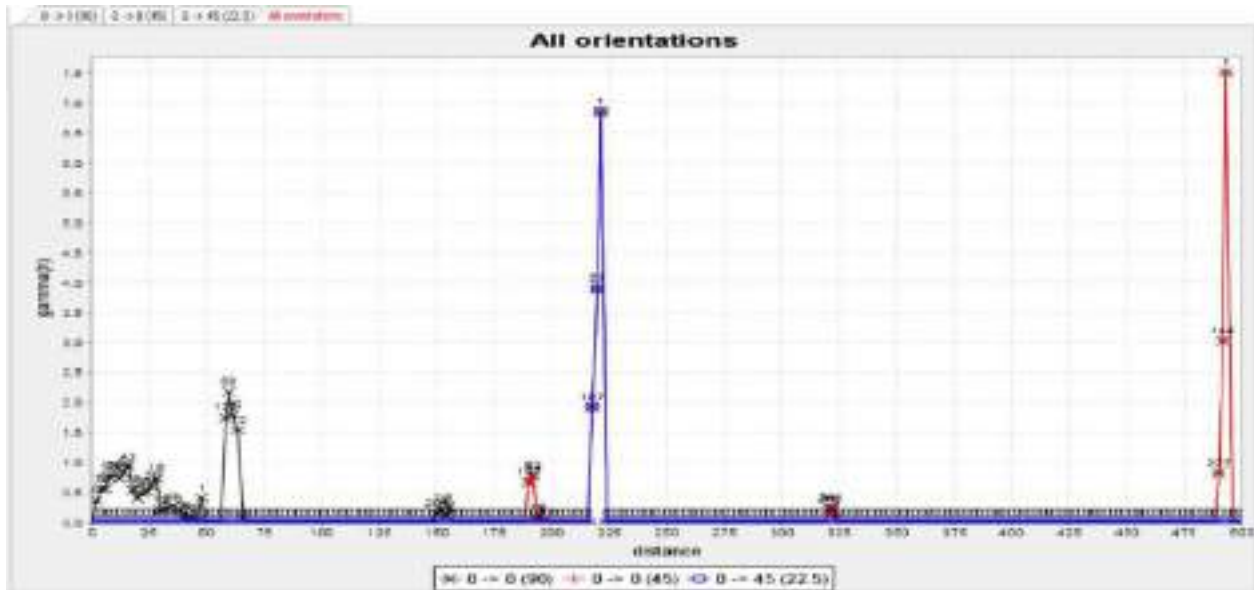
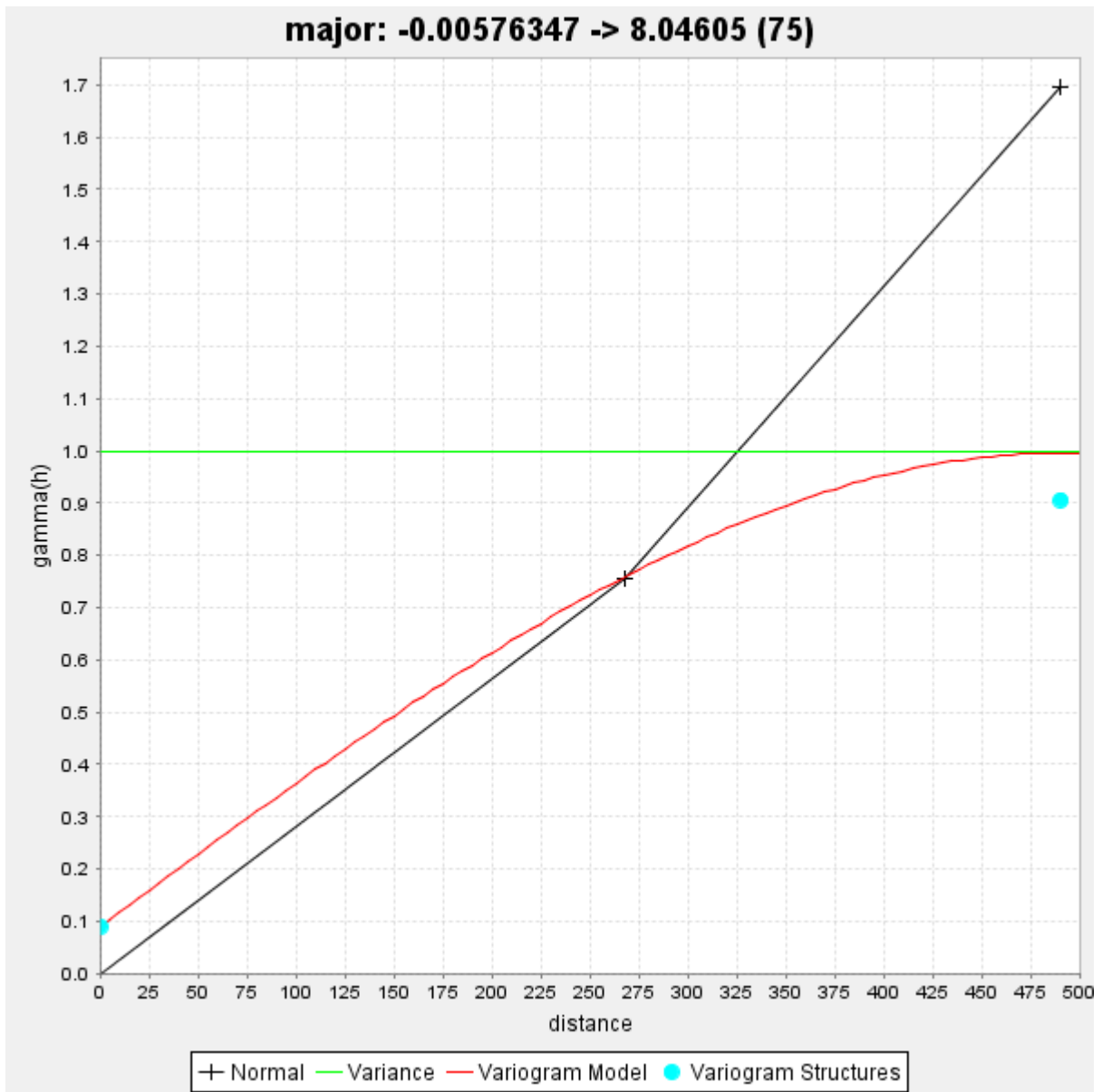
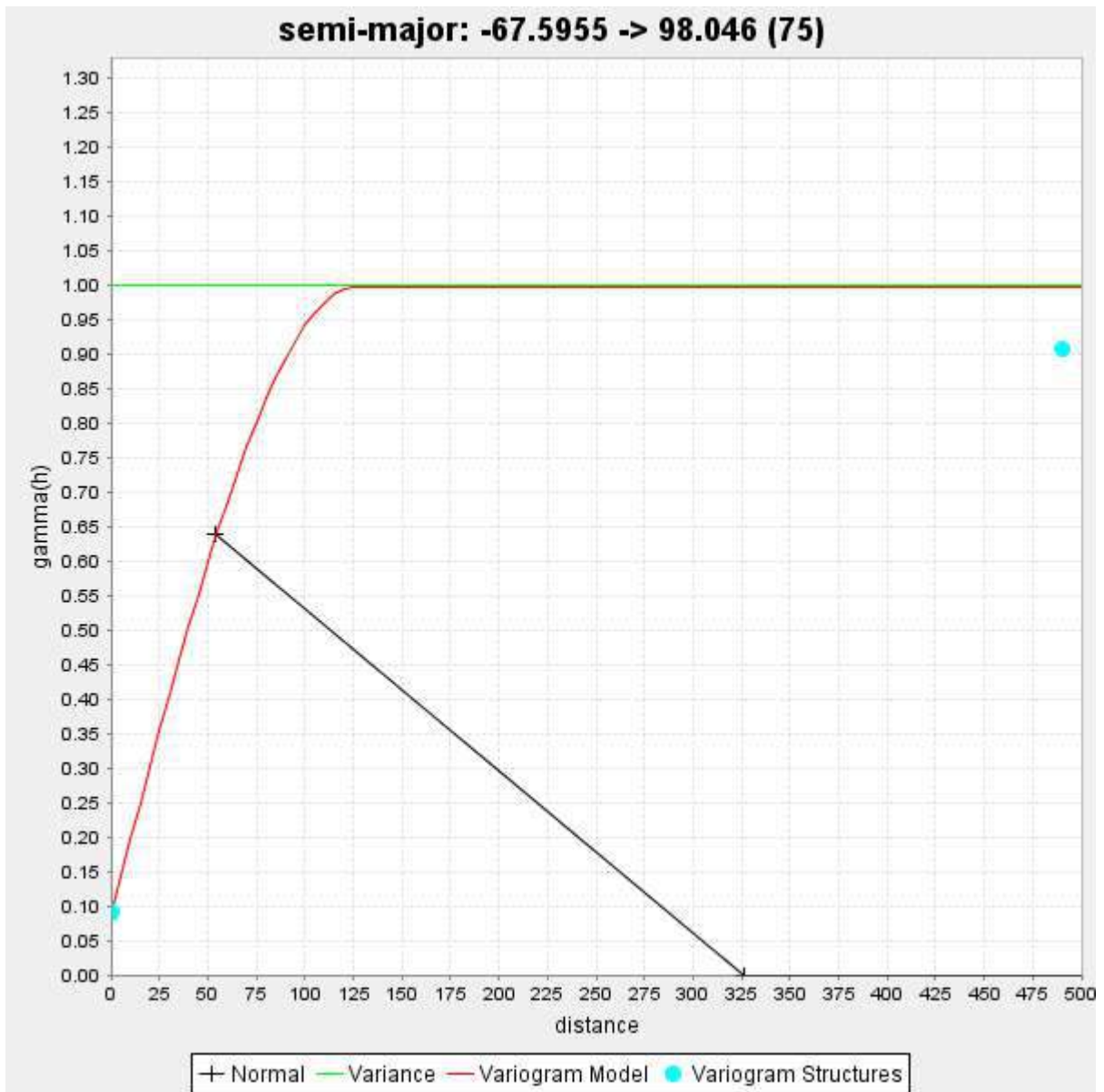


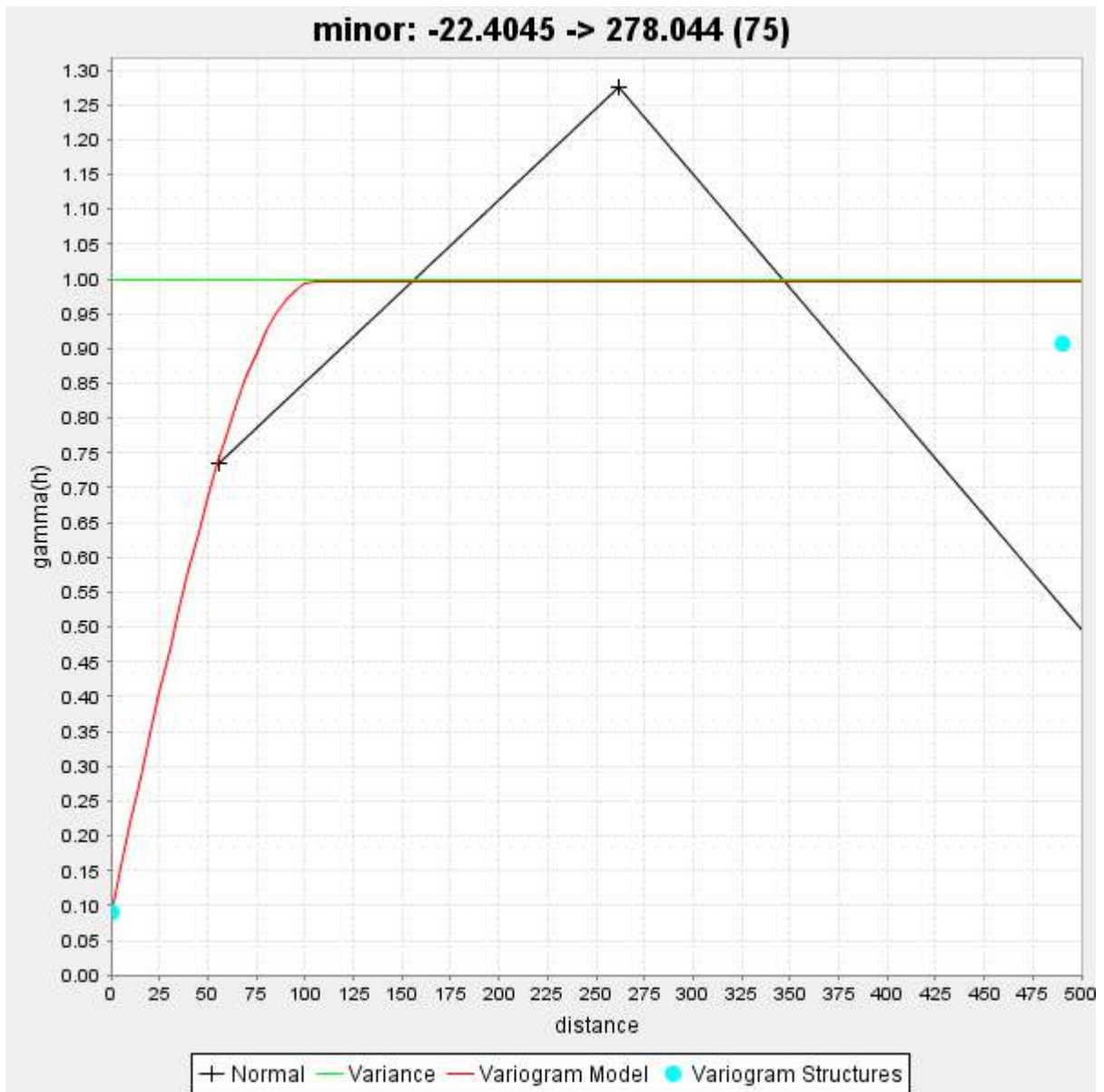
Figure 4.13: Experimental Variogram for Composite\_ore2001.str



**Figure 4.15: Major Variogram model**



**Figure 14.16: Semi-Major Variogram model**



**Figure 4.17: Minor variogram model**

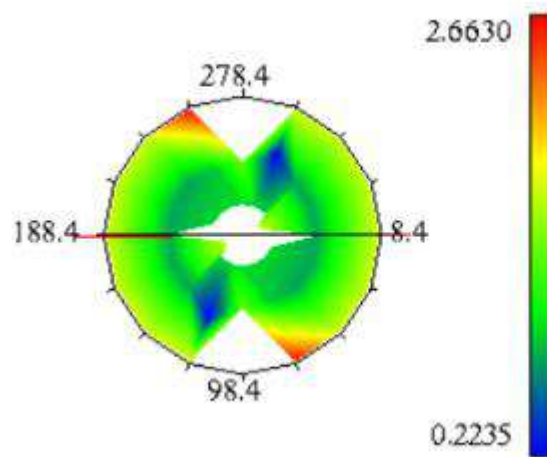
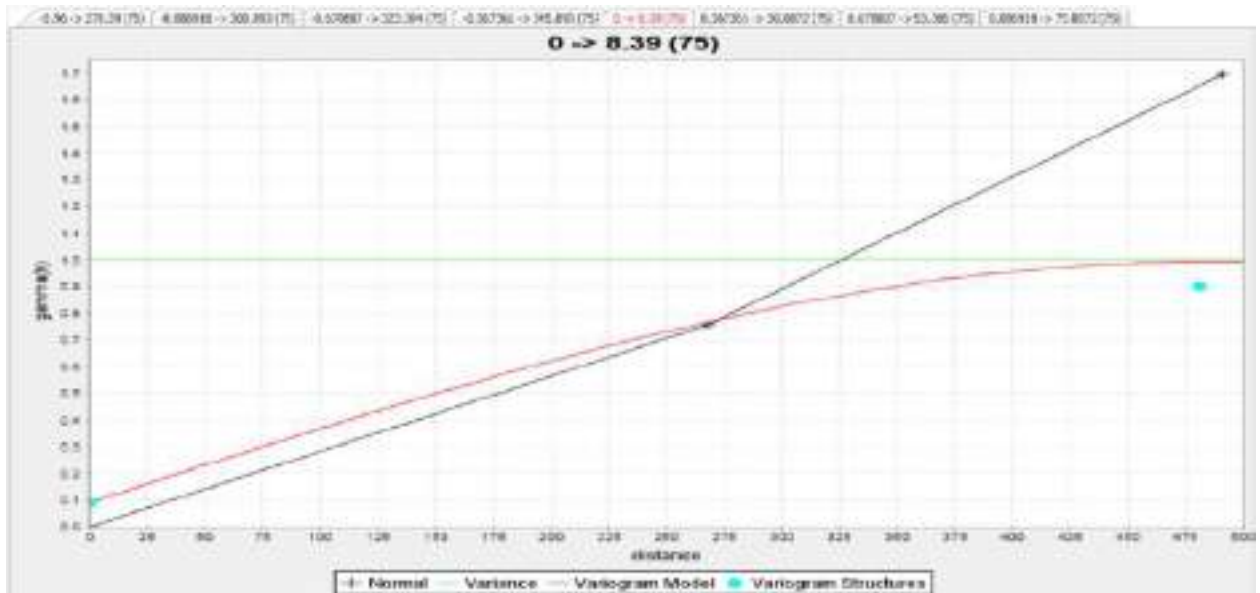
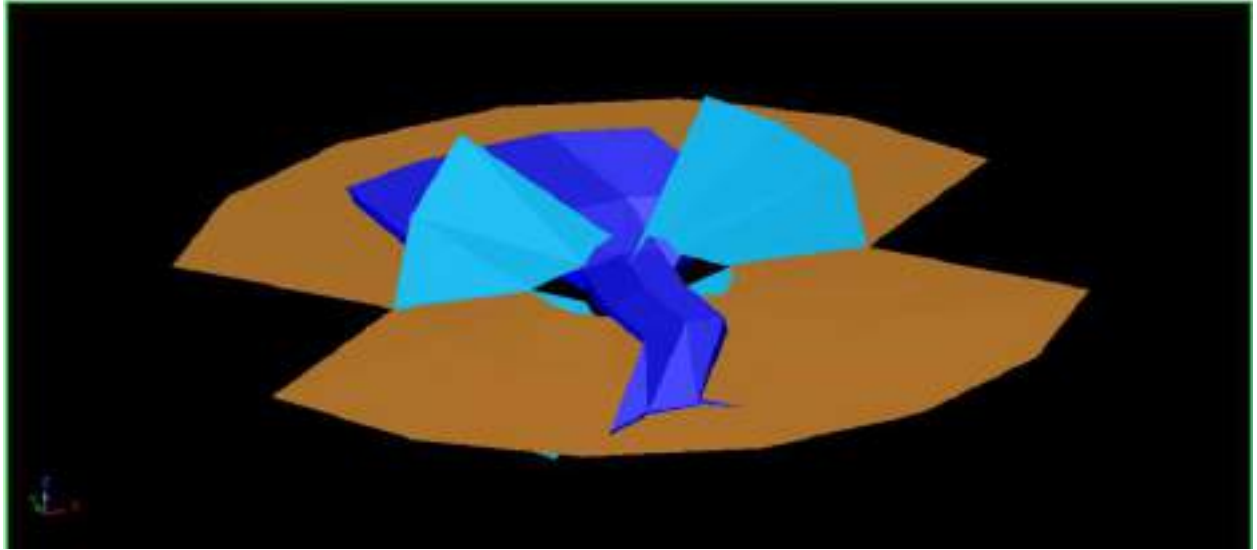
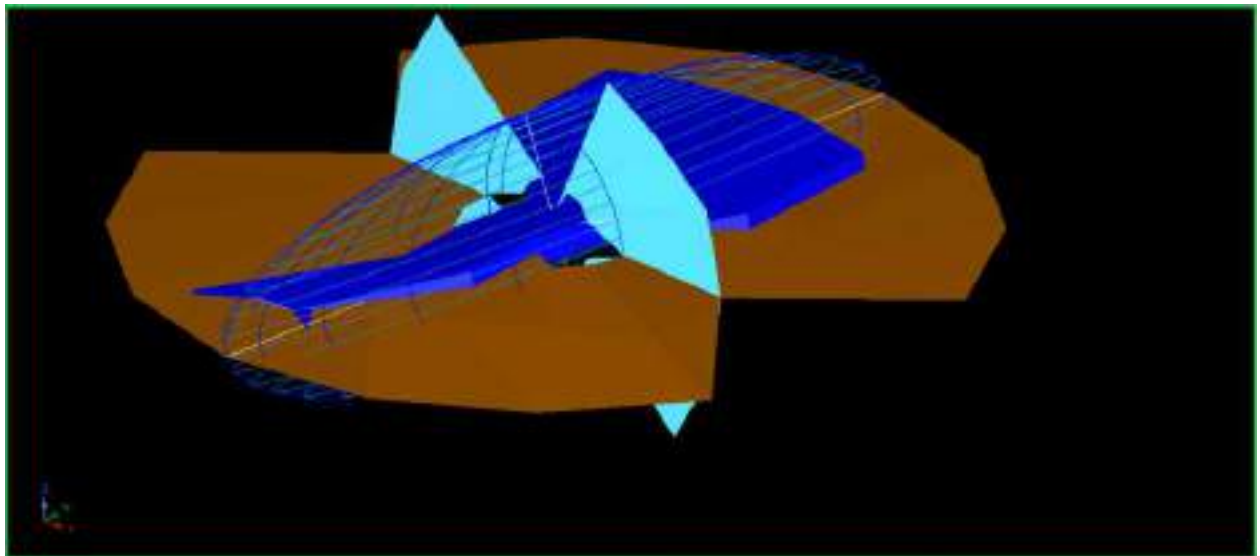


Figure 14.18: Variogram modelling and variogram map



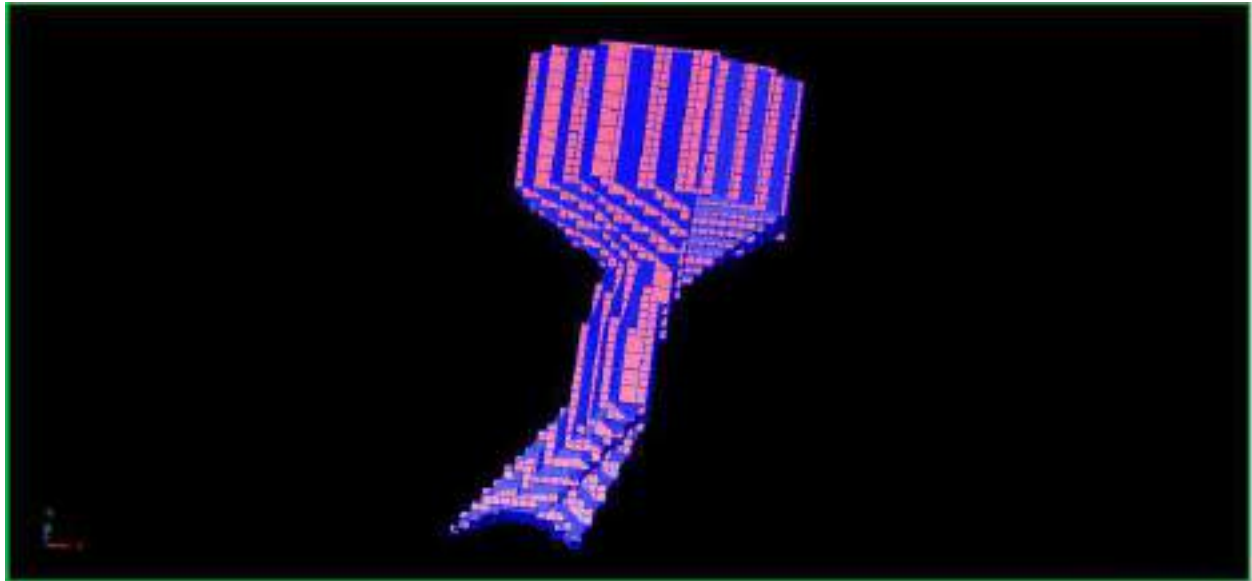
**Figure 14.19: Primary and secondary variogram map**

The creation of ellipsoid visualizer string file for the domain was followed by Block Modelling which first of all involved clipping/trimming the ore solids below the (topo) DTM, the trimmed/clipped solids/DTMs were again validated and saved.



**Figure 14.20: Ellipsoid visualizer2001.str plotted against Primary and Secondary variogram map**

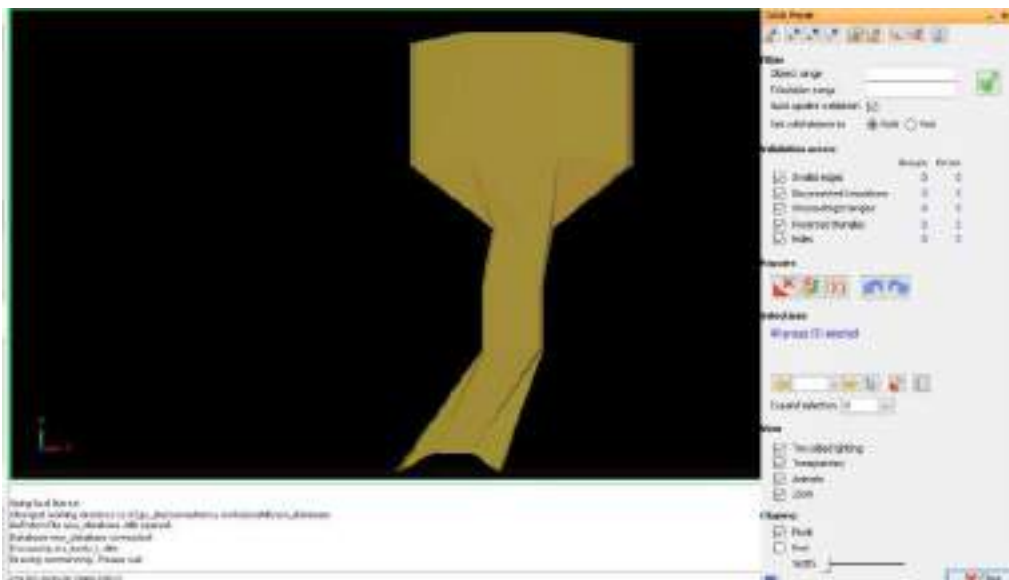
This was followed by creating the Block Model using Ordinary Kriging, followed by adding attributes and assigning values to the Block Model. This was followed by Flagging the solid to the Block model, the domain code was assigned as 2001. Then the estimation was run for Inferred Mineral Resource category.



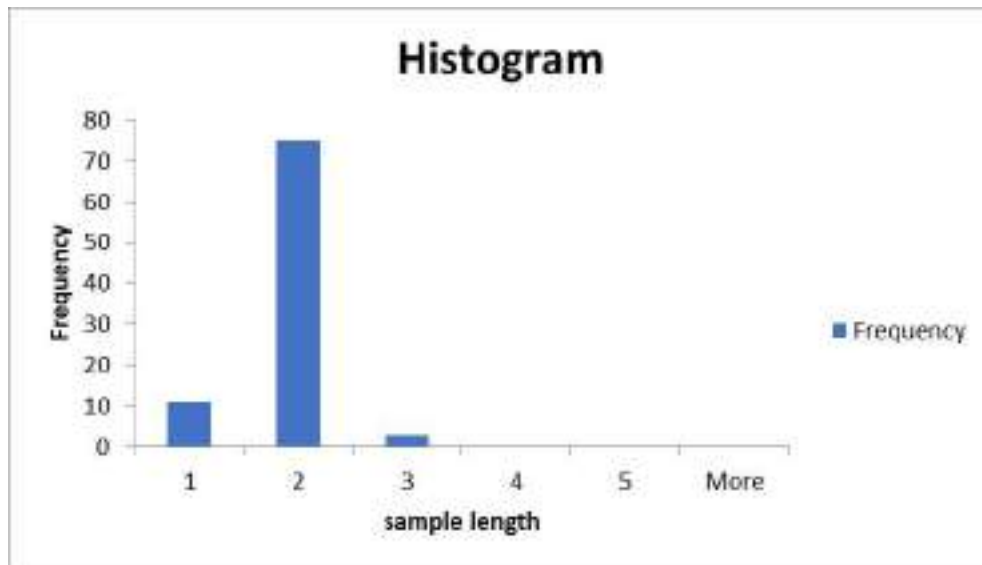
**Figure 14.21: flagging the Solid into the Block model**

### 13.8 Estimation and Interpolation Methods

The drillholes displayed with grades and lithology were put in sections ready for interpretation by digitizing the grade intervals to generate the wireframes/ strings which then was triangulated between segments and then inside the segments to generate the ore solid (DTM). The ore solid was validated and its volume reported. This was followed by creating an intersection table for the DTM/ ore solid, getting samples length and final running composite downhole for the data to get the composite ore string with the domain code assigned as 2001.



**Plate 14.22: Ore solids validation (the green tick on top right) shows that the ore solid has been successfully validated**



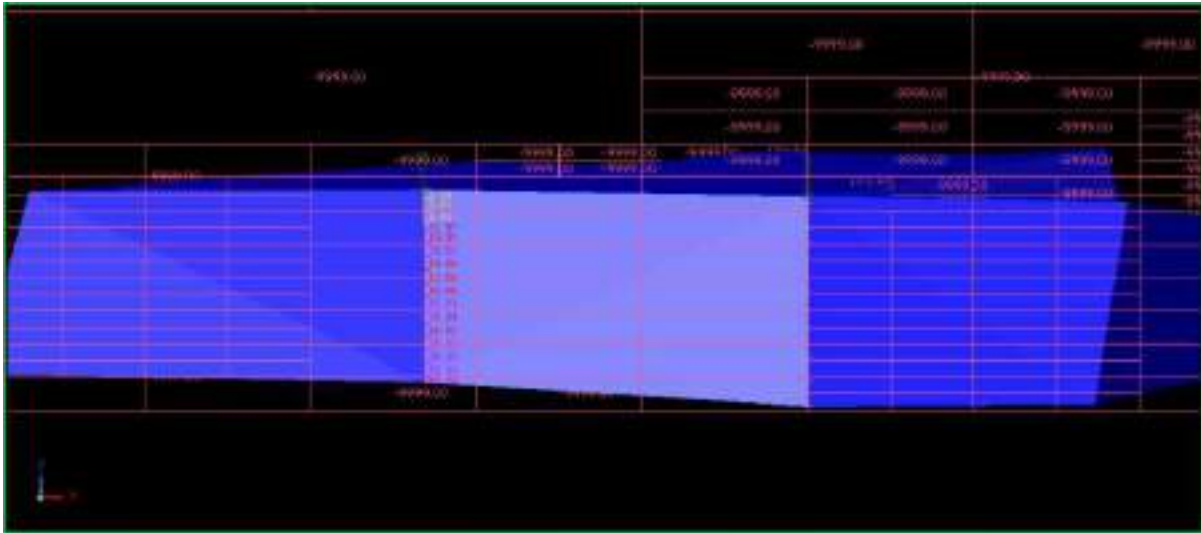
**Figure 14.23: determining the sample length for creating composite ore string**

### **13.9 Block Model Validation**

The created Block model was validated by:

- 1) comparing the raw data to estimated values by viewing the cross-sections of the block model compared to the assay data by opening the block model:

This was done by loading the drillholes and display the assay values, load the ore solids, then create the section view and finally display the point attributes. Each block in the block model showed the value of assay assigned to it from the corresponding wireframe (figures 18, 19 below).

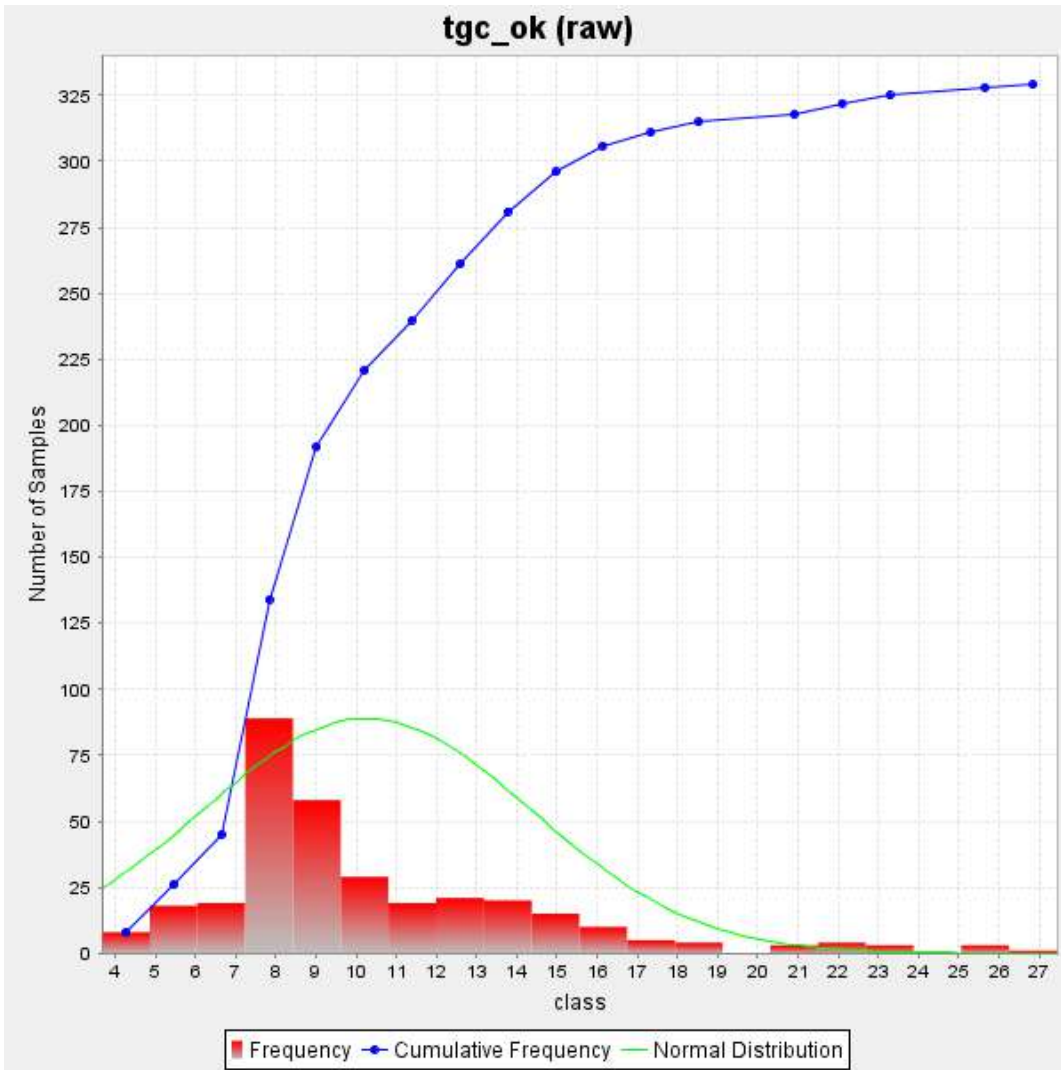


**Figure 14.24: Validation of the block model by comparing the raw data to the block model (estimated) value**



**Figure 14.25: Block model Validation by comparing the raw data to the Block model (estimated) value**

- 2) Running the basic statistics for the block model values. This was done by running the tgc attribute (values) in the block model and constraining the domain = 2001. The resulting block model value plot was similar characteristics (traditional indicator) to the raw data (composite ore data)/ data base values plot. See the two plot below Figure 14.26-14.28):



**Figure 14.26: Block model values grades (tgc\_ok) plot**

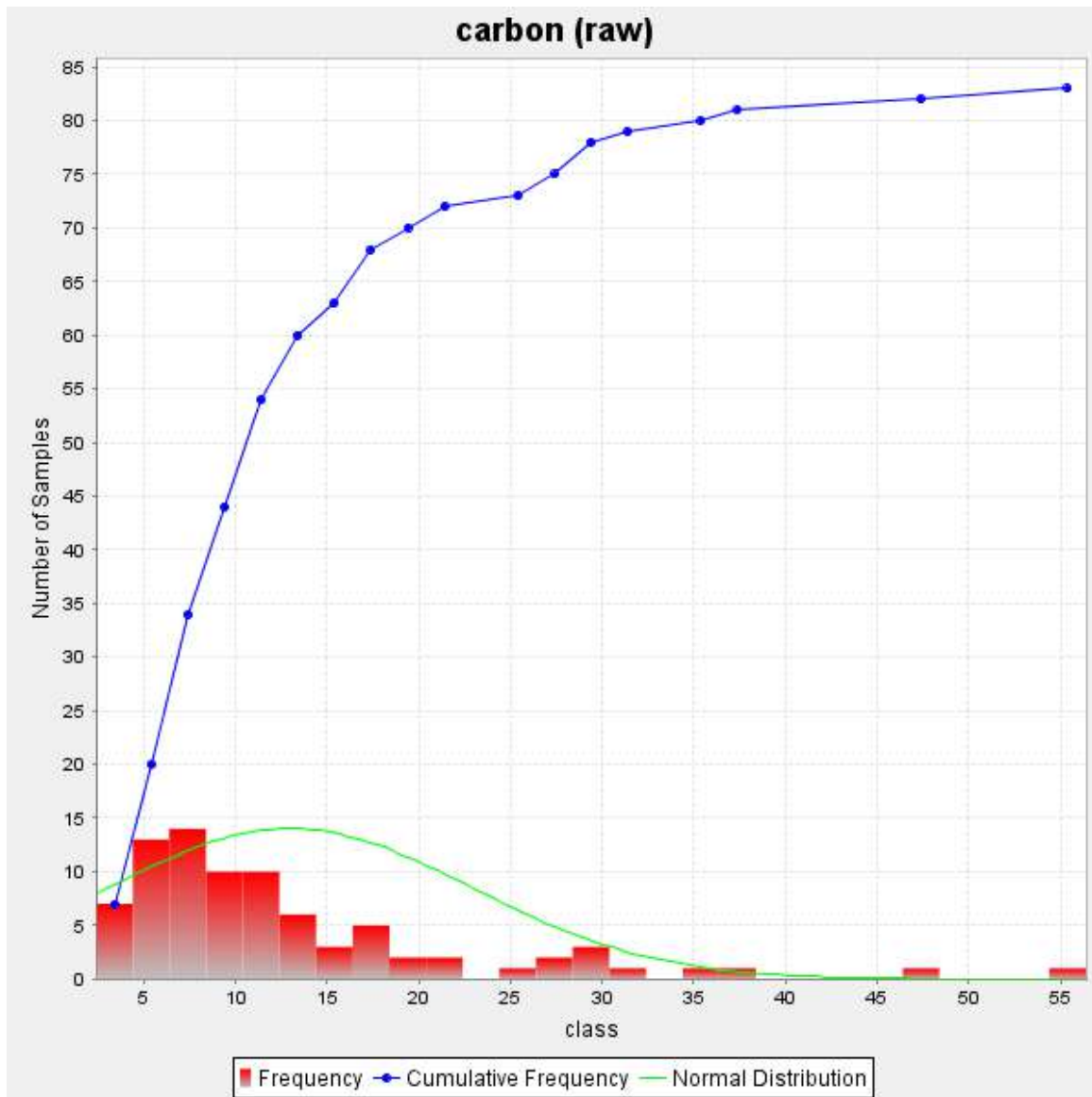


Figure 14.27: Composite ore2001.str data plot

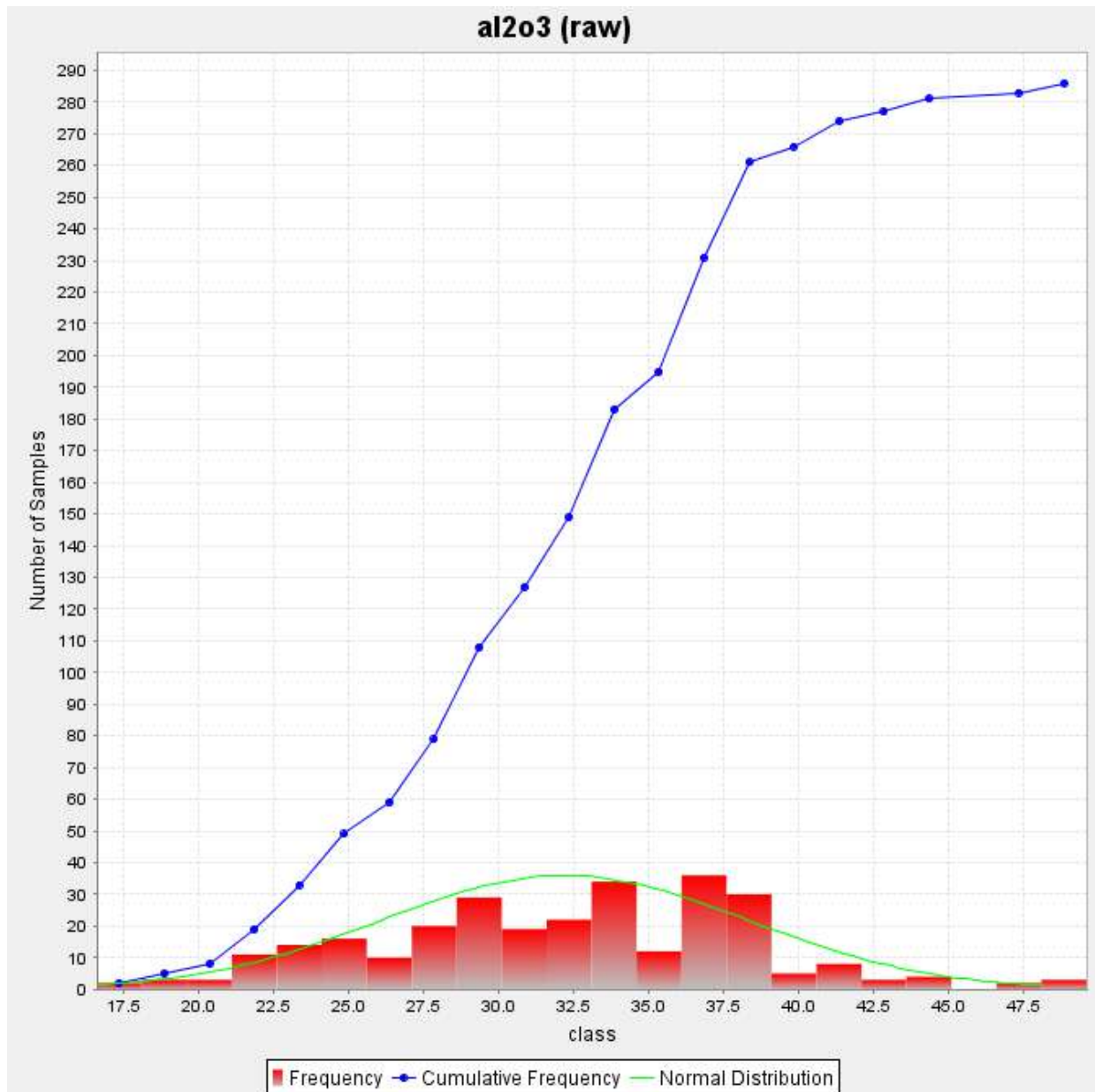


Figure 14.28: Composite ore2001.str value plot

### 13.10 Classification of Mineral Resources

The terms Mineral Resource, Measured Mineral Resource, Indicated Mineral Resource, and Inferred Mineral Resource and their usage have the meaning ascribed by both the Canadian Institute of Mining, Metallurgy and Petroleum (“CIM”) Standards on Mineral Resources and Reserves Definitions and Guidelines adopted by CIM Council on May 10, 2014 and Australasian Institute of Mining and Metallurgy “The JORC Code’ the australasian Code for reporting of Exploration results, Mineral resources and Ore reserves-2004

### 13.10.1 Inferred Resource

- Low Level of confidence
- Information of limited or of uncertain quality; and
- Assumed geological and/or grade continuity

### 13.10.2 Indicated Resource

- Reasonable Level of confidence
- Information gathered using appropriate techniques; and
- Assumed geological and/or grade continuity

### 13.10.3 Measured Resource

- High Level of confidence;
- Detailed and reliable information gathered using appropriate techniques
- Confirmed geological and/or grade continuity; and
- Any potential for variation would be unlikely to materially affect economic viability.

## 13.11 Mineral Resource Statement

**Table 14.2: Mineral Resource Estimate Statement for Kwamsisi Project – 5% graphite cut-off**

Classification	Grade (% tgc)	Volume (m3)	tonnes (materials)(t)	tonnes (graphite) (t)
Inferred	8	7,422,100	15,783,288	1,198,670
Indicated	8	1,113,315	2,783,288	211,530
<b>Total</b>	<b>8</b>	<b>7,422,100</b>	<b>18,555,250</b>	<b>1,410,200</b>

An inferred Mineral Resource of 1,410,200 tonnes of graphite at grade of 8 %tgc has been estimated for Kwamsisi Project at this level of exploration with expectations of this resource to increase twice after detailed (close space) drilling and increased depth to 60m.

Based on variogram, drilling spacing and experience we classify the material as inferred resources and indicated resources. These guidelines assume all other criteria of the reporting codes are met and will require downgrading if there is risk in other areas. We use 85% of the sill to define inferred resources and the remaining will be classified as indicated. Hence an inferred Mineral Resource of 1,198,670 and indicated resource of 211,530 tonnes of graphite at grade of 8 %tgc has been estimated.

### 2.1.1

## **14.0 MINERAL RESERVE ESTIMATE**

No formal and compliant Mineral Reserve estimate have been made for Kwamsisi Project at present. This will be once the infill drilling is done.

## **15.0 MINING METHODS**

Because of the nature and type of the graphite deposits in the project area which has been found concentrated at shallow depth up as per current corrected data, open pit mining would be the only mining method for this project. The design and optimization of the pit(s) have not been done at this stage of the project.

### **15.1 Introduction**

At Kwamsisi area, exploration carried out so far has defined one major zones that hosts graphitic gneiss and graphitic crystalline limestone that can be commercially concentrated using physical methods, whose resources has been indicated above This zone hosts the high-grade graphite which have already been tested for physical concentration and proved successful.

Based on the metallurgical results obtained through a series of pilot plant tests and diamond drilling programs carried out, it is therefore, concluded that the mineable ore reserve so far defined is present.

Whereas drill holes defined mineralization to a depth of 50m, it is therefore at this stage the mineable reserve is at maximum 25m below the ground surface.

Based on the above information, there are two technically sound alternatives of exploiting the ore deposit; that is “Open Pit Mining”, and “Underground Mining”. However, underground mining will be excluded from further consideration because it will demand more resources and long lead times to develop the openings and facilities for mining and handling the ore. Whereas with surface mining, little development will be needed as high-grade ore is already available close to the ground surface which will require minimum development works to be completed before full production of the graphite commences.

### **15.2 Deposit Characteristics**

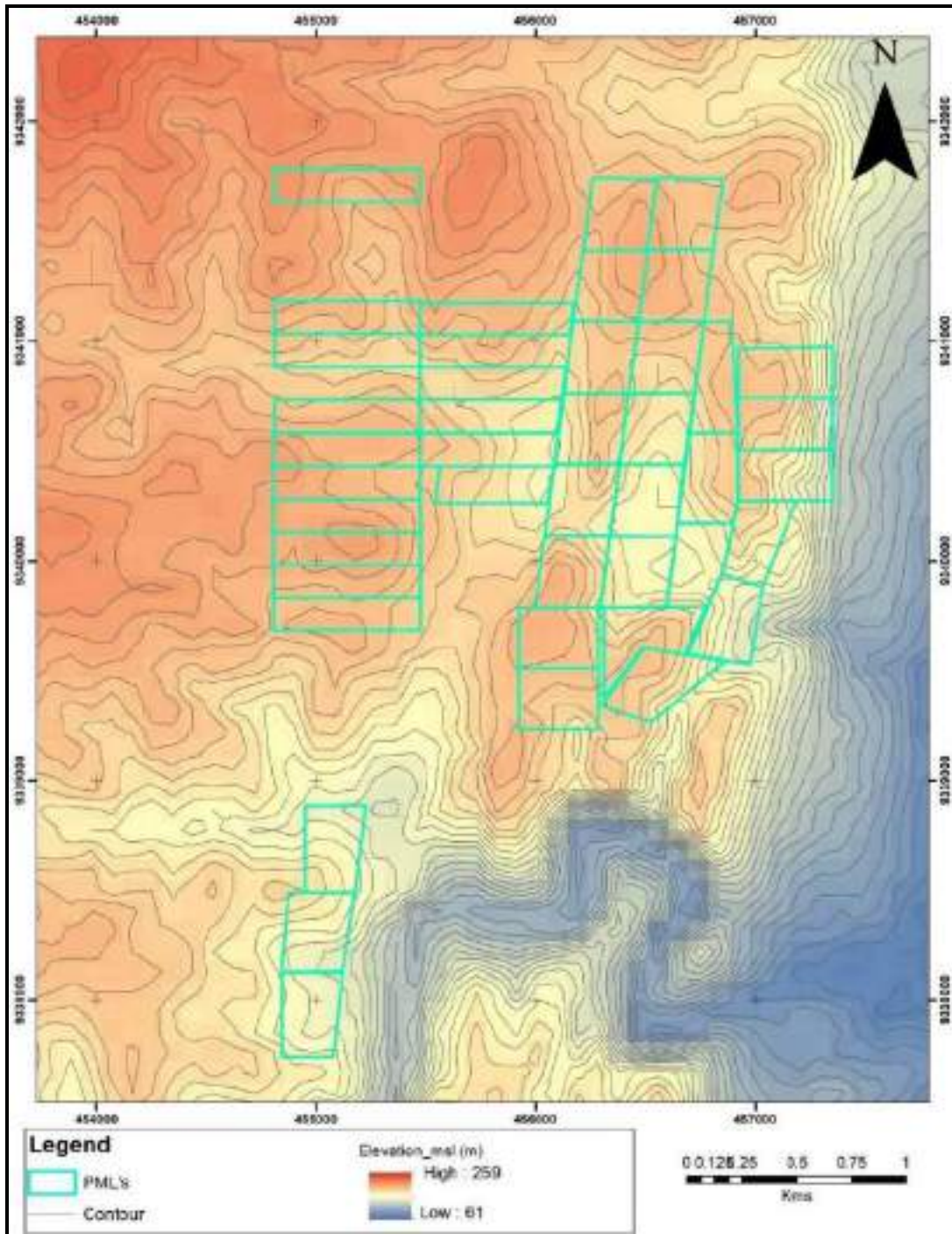
The Project area lies at an altitude of approximately 145 m above mean sea level (amsl) at the valley bottoms and 185 m amsl at the highest point. The area has a series of hilly-like terrain, with abruptly elevated hills to the central parts of the Project area.

The Project is located close to Mlingaji River that ultimately flows into Wami river located approximately southern portion of the Project.

The local terrain is dominated by a rocky ridge (the Project ridge) that trends in a north-NE-SW direction through the Project Area at an elevation in excess of 185 metres above sea level (amsl). Steep-sided, narrow valleys are present on both flanks of the Project ridge.

The Project ridge comprises a sequence of steeply dipping, layered rocks that include crystalline limestones and few gneiss outcrops. The crystalline limestone comprises the high ground along the Project ridges, Figure 16.1.

Favourable location of the processing plant site with Kwamsisi Graphite Project being on the left is shown in Figure 15.4.



**Figure 15.1: Topography of Kwamsisi PML's, Kwamsisi Graphite Project, Handeni.**

*Source: (Azustone Resources Tanzania Ltd, 2020)*

## **15.3 Mining method**

### **15.3.1 Open Pit Mining**

At Kwamsisi area, exploration carried out so far has defined one major zones that hosts graphitic gneiss and graphitic crystalline limestone that can be commercially concentrated using physical methods, whose resources has been indicated in Table 4.10 above This zone hosts the high-grade graphite which have already been tested for physical concentration and proved successful.

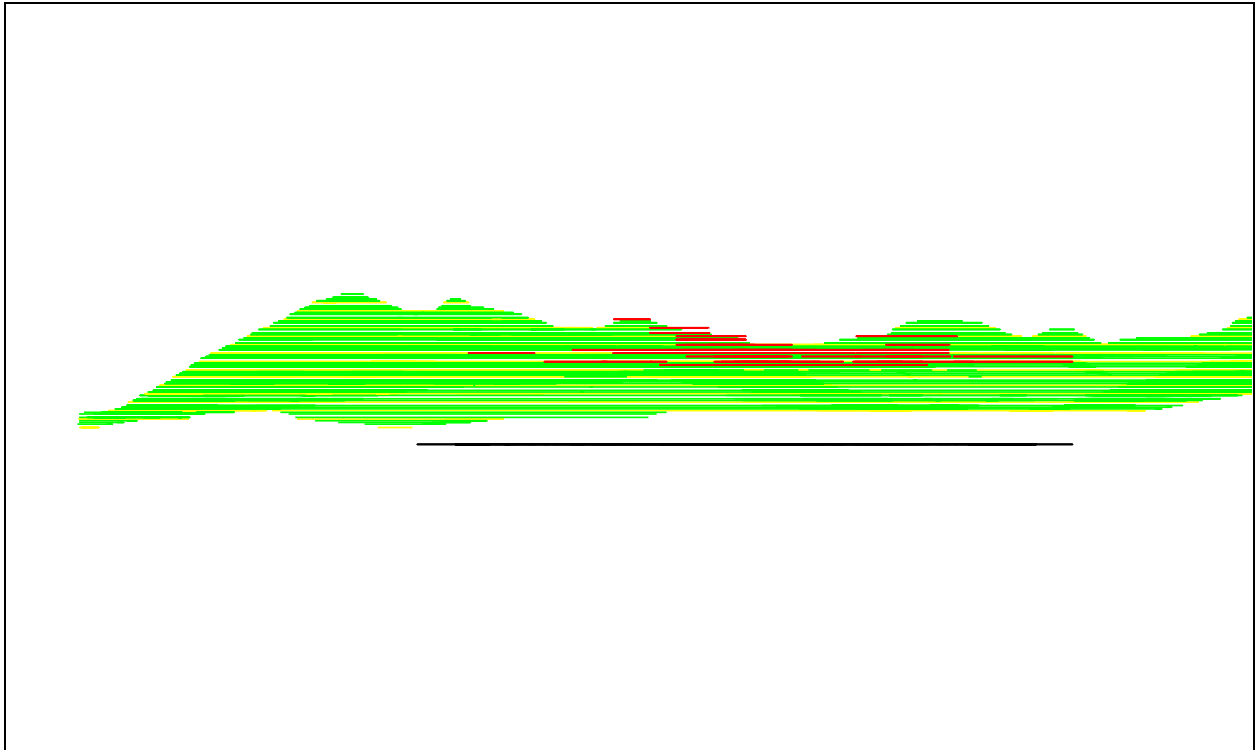
Based on the metallurgical results obtained through a series of pilot plant tests and diamond drilling programs carried out, it is therefore, concluded that the mineable ore reserve so far defined is present.

Whereas drill holes defined mineralization to a depth of 50m, it is therefore at this stage the mineable reserve is at maximum 25m below the ground surface.

Based on the above information, there are two technically sound alternatives of exploiting the ore deposit; that is “Open Pit Mining”, and “Underground Mining”. However, underground mining will be excluded from further consideration because it will demand more resources and long lead times to develop the openings and facilities for mining and handling the ore. Whereas with surface mining, little development will be needed as high-grade ore is already available close to the ground surface which will require minimum development works to be completed before full production of the graphite commences.

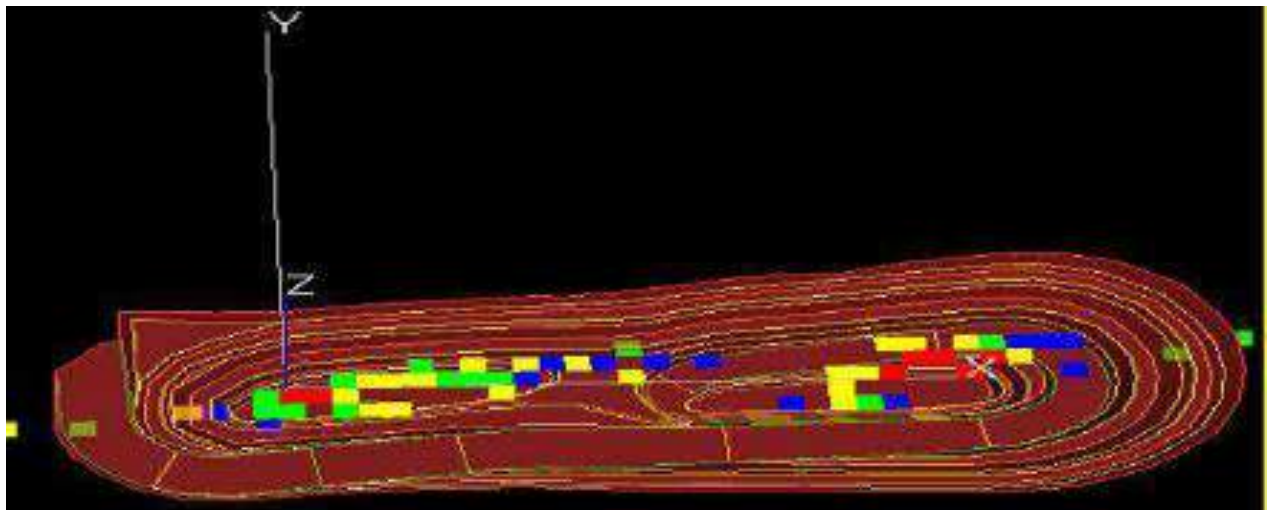
Open pit mining is a mining method in which the sought minerals are exploited from the surface downward after stripping out the top-soil which may not be part of the useful mineral. The method utilizes heavy-duty equipment such as bulldozers, loading shovels, rear dump trucks, drilling rigs, etc., to recover the ore from the ground before sending it to the processing plant for beneficiation. The minerals are mined in sequence of benches, which are staged to conform to schedules of exploitation and to the general layout of the mineral deposit.

Based on the geological model presented, a sequence of benches from the highest level to the bottom most level for an ore with cut-off grade of 5% TGC has been worked out. Based on the topography of Kwamsisi Graphite Project and the geometry of the orebody, it is logical to work out a deposit from the highest level downwards. Sequence of mining will be in such a way that, the highest bench is mined first followed by successive down ward benches which meet a criteria of having ore above the cut-off grade of 5% TGC.



**Figure 15.2: Cross section view of the Kwamsisi Benches as seen south to north (Red colour)**

The selected pit shell that best estimated the economic mining limit was used as the basis for final pits design



**Figure 15.3: Final pit design, Kwamsisi graphite Project.**

### 15.3.2 Mining Benches size and slope determination

#### Mine Parameters

The open pit to be opened at Kwamsisi Graphite Project will conform to parameters identified in the geological model to be able to recover the valuable minerals with minimal dilution and according to a planned schedule.

The following parameters will therefore be applied at Kwamsisi Graphite deposit:

- (i) Technically the bench height will be fixed to 5m to conform with the geological model constructed for this deposit. The model used 5m benches to define the deposit over a 50m depth. Since bench heights are dictated by the size of the loading and transport equipment, loading equipment to work over a 5m bench will be large for the size of the mining operations planned for the Kwamsisi graphite project. Normally, 5m benches are worked by shovels with bucket capacities of 10 cum. In this Kwamsisi graphite Project case one 5-m benches will be worked successively with a 5m berm.
- (ii) Bench width will be variable but not less than 3m.
- (iii) The overall pit slope will be approximately 65-80 degrees depending on how competent an individual sector of the pit is. The rock is relatively stable and high walls can withstand blast vibration
- (iv) The thickness of the top soil (waste) to be stripped out before mining of the fresh ore rock is estimated to be less than 1.00m
- (v) Since bench heights are based on 5m lifts, drilling depth will therefore be 6m to account for sub-drill to avoid hard toe when the excavator digs the blasted material.
- (vi) The mining area is considered to be well drained and hence there will be no mine drainage costs in this study.
- (vii) The specific gravity of graphite ore is at an average of 2.3 whereas the loose bulk density is 1.8 tonnes/cum.
- (viii) The life of the mine has been calculated in as 5 years based on the quantities of the resource available at Kwamsisi Graphite Project. However, since economic projections of more than 10 year are normally unreliable due to the fast changes in technology worldwide, which is what is creating demand for the valuable minerals at Kwamsisi (Graphite), a mine life of 15 years has been assumed in this study.
- (ix) The cut-off grade of the graphite is 5%TGC and daily material requirement for feeding the processing plant is 1,800t/d. The average feed grade of the material is taken as 8% TGC

## 15.4 Unit Operation

### 15.4.1 Equipment Selection and Sizing

Mine equipment selection and sizing are necessary to ensure the quantities of ore planned for the project are delivered to the processing plant in time taking into account schedules of maintenance and compatibility between equipment and machinery. Similarly, support equipment has to be identified and sized to ensure the conditions of roads, the pit and other

operating environment do not prevent the key equipment from performing to their expected efficiency.

#### **15.4.2 Stripping Equipment Capacity**

Stripping of topsoil and overburden is normally undertaken by the bulldozers. This equipment can easily negotiate steep slopes at easy and are quite robust and stronger enough to strip out waste material without requiring drilling and blasting of the waste cover. For the Kwamsisi Graphite resource, the graphitic gneiss and graphitic crystalline limestone is outcropping requiring minimal waste cover stripping. It is however assumed that a less than 1.00 m soil material may have been accumulated during the long time of in activity in the area.

- ◇ A bulldozer of similar size and capacity to the CATD8N with single shank rippers and rakes blade type for uprooting trees and vegetation is chosen.
- ◇ Initially, since the work of clearing the area for road construction, plant site, stockpiles areas, etc., additional bulldozers will be hired.
- ◇ One permanent bulldozer of same type and size will be purchased to work at the mine for several clean up duties on benches, etc., and to work on stockpiles at the processing plant and for raising embankments of a tailings dam.

#### **15.4.3 Drilling and Blasting Equipment Capacity**

Drilling will be undertaken using a drill rig similar in size to that of Atlas Copco Rockdrill ROC 742 HC01, with dust collector, 170Hp, 2150 rpm and feed force of 20KN. Plate 16.1 shows an example of a mobile rock drill for Kwamsisi Graphite project. Diameter of holes to be drilled is taken as 48 mm. There will be approximately 1 airleg hand held jackhammers for use in secondary blasting of oversize boulders.



**Plate 15.1: Example of a Mobile rock drill for Kwamsisi Graphite Project**

The aim of drilling is to break the in-situ rock into sizable boulders, which can easily pass through the mouth (gape) of the primary crusher. Too much of the oversize boulders will increase the costs of secondary drilling & blasting and also slow the rate of production. Similarly, over-drilling and blasting will produce much fines which will be costly in terms of explosive costs and also will reduce the effective load required to be fed to the crusher.

#### 15.4.4 Drilling Pattern Design

Conditions:

- Bench height:  $K = 5 \text{ m}$
- Width of round:  $w = 5 \text{ m}$
- Blasthole diameter:  $d = 48 \text{ mm}$
- Rock constant:  $c = 0.4$
- Hole inclination:  $3:1$
- Explosive: Emulite 150 in 40 mm Plastic pipes dropped into hole
- Charging condition: Dry holes
- Charge concentration:  $l_b = 2.3 \text{ kg/m}$

- Maximum Burden:  $B_{\max} = 1.45 \times [\text{Sqrt}(l_b)]$   
 $= 1.45 \times [\text{Sqrt}(2.3)] = 2.2 \text{ m}$
- Subdrilling:  $U = 0.3 \times B_{\max}$   
 $= 0.3 \times 2.2 = 0.66 \text{ m}$
- Depth of Blasthole:  $H = 1.05 \times [K + U]$   
 $= 1.05 \times [5 + 0.66] = 5.99 \text{ m}$
- Error in Drilling:  $E = d/1000 + 0.03 \times H$   
 $= 48/1000 + 0.03 \times 5.99 = 0.23 \text{ m}$
- Practical Burden:  $B = B_{\max} - E$   
 $= 2.2 - 0.23 = 1.97 \text{ m}$
- Practical Spacing:  $S = 1.25 \times B$   
 $= 1.25 \times 1.97 = 2.46 \text{ m}$
- Adjustment for width of the round:  
 $W / S = 30.0/2.46 = 12.2 = 12 \text{ spaces}$   
 $S_{\text{adj}} = \text{width} / [\text{No. of spaces or row}]$   
 $= 30.0 / 12 = 2.5 \text{ m } (n = 12 + 1)$

***Note that the number of holes in a row is the number of spaces + 1.***

- Specific drilling:

$$\begin{aligned}
 b &= [n \times H] / [B \times K \times w] \\
 &= [13 \times 5.99] / [1.97 \times 5.0 \times 30] \\
 &= 77.87 / 295.5 \\
 &= 0.26 \text{ m/cum}
 \end{aligned}$$

- This therefore, means that for every cubic meter of rock, 0.26 m of drilling has to be completed.
- **A drilling pattern will be 2.5 m spacing x 1.97 m burden for 5.99 m holes. This can simply be put as [ 2.5 m x 2.0 m ] for 6.0 m holes.**

- Based on the Specific drilling of 0.26 m/cum, total amount of drilling to be undertaken per year to obtain a tonnage of 1,800 per day for 300 days in a year will be:
  - Tonnage per year = 1,800 t/d x 300 days = 540,000 t/yr
  - For specific gravity of rock of 2.3 corresponding volume of rock will be 207,692 cubic metres of rock.
  - Amount of drilling will therefore be 0.26 m/cum x 207,692 cum  
= 54,000 m per year
  - **For 6m holes, a total of 54,000/6 = 9,000 holes will be drilled per year.**

#### 15.4.5 Drilling Rig working capacity

- For the number of days scheduled to operate the mine, 300 days/year, it is required to drill approximately:
  - = 9,000 holes/ 300days/year = 30 holes/day
- Capacity for the Rig to drill:
  - ◇ An approximate penetration rate for a rock with uniaxial compressive strength of between 5,000 and 15,000 in which graphite lies, for 100 rpm, is approximately 40 ft/hour or (12.8m/hr). (Bauer & Calder, 1967 – Surface Mining, B.A. Kennedy, 1990, pg. 530)
  - ◇ Assuming that the Atlas Copco drill available will operate on the same rate, then we get the following:
  - ◇ Drilling time for the 6m hole = 6/12.8 = 28 min.
  - ◇ Manoeuvre time from one hole to the next = 5 min.
  - ◇ Cycle time = 28 + 5 = 33 min.
  - ◇ Number of holes to be drilled for a 10hr shift = 10 x 60/33 = 18 holes/shift
- This indicates that one drill rig will cope with the work load. In this case, one similar sized drill rigs will be able to drill at least 18 holes/day less than the required 30 holes/day to be able to match with the loading & haulage schedules.
- Two drilling rigs will therefore be purchased to cope with the required production.
- One air leg hand held jackhammers will also be acquired for secondary blasting, preferably Atlas Copco BBC16W
- Portable air compressor for use with air leg jackhammers for other general plant and workshop usage.

#### 15.4.6 Loading Equipment Capacity

There is a wide range of loading equipment type that can be purchased from the market depending on characteristics of the mine to which they will be operating. Loaders can either load from the top downwards with trucks parking on the lower bench (Backhoe excavators) or stay on the same bench where the truck is parked and load from there upwards (Shovels/excavators).

Bench heights of 5m are quite high to allow a backhoe to operate efficiently and safely loading a truck parked on the lower bench. Similarly, sighting problems will often arise as the operator of the loading equipment will be somehow out of sight from the truck driver.

A loading shovel is therefore selected in this case to allow efficient loading of the trucks.

- **If CAT 5080 Front Shovel** is selected, it can meet most of the conditions of the pit, since it has the following characteristics:
  - ◇ A maximum reach of 9.53m,
  - ◇ Minimum reach of 5.59m,
  - ◇ Truck loading dump height of 5.64m
  - ◇ Bucket capacity of 4.2 cum. of rock loading
  - ◇ 40 seconds per cycle, with 90 cycles per hour.
  - ◇ Can therefore load approximately  $4.2 \times 90 = 378 \text{ m}^3$  per hour of loose material
  - ◇ For a loose density of  $1.8 \text{ tonnes/m}^3$ , approximately  $378 \times 1.8 = 680.4$  tonnes per hour can be loaded assuming constant loading. For a 10-hour shift, a total of 6,804 tonnes can be loaded per day which is more than the required 540,000 tonnes per year/ 300 days/year, from the mine.
  - ◇ The planned annual production is at 540,000 therefore one front shovel loader will be sufficient enough.
- Two-wheel loaders, one for stockpile management and for feeding the crusher, and the second one for auxiliary duties such as tailings management, etc. Size and types similar to CAT966F, with 220Hp,

#### 15.4.7 Haulage Equipment Capacity

- ◇ Haulage equipment which are common and efficient for the case of Kwamsisi graphite project are mainly rear dump trucks. Considering that shovels of 4.2 m<sup>3</sup> bucket capacity have been selected, trucks must be compatible with this type of loading equipment.
  - ◇ Rule of Thumb require that for compatibility between trucks and shovels to exist, a shovel should be able to load a truck in five to six cycles. Therefore,  $4.2 \text{ m}^3 \times 3.25 = 13.25 \times 1.8$  (loose density) = 24.57 tonnes.
  - ◇ Hence 25-tonne trucks are chosen.
  - ◇ The haul distance to the stockpile near the processing plant and back is approximately 30 minutes for a route of approximately 2 km long.
  - ◇ For a 10 hour shift, the number of cycles to be made assuming availability factor of 75%, and a lunch time of 1 hour will be  $[10-1 \text{ hrs} \times 60\text{minutes}/30\text{minutes}] \times 75\% = 13$  trips which is approximately 13 trips  $\times 25\text{t}/\text{trip} = 325$  tonnes/day
- For a target of 1,800 tonnes per day, number of trucks will be  $1,800 \text{ t} / 325 = 6$  trucks.

- IF the truck with loading capacity less than 25 tons will be used, the number of trucks should be increases.
- Any shortfall in production can be compensated with working in the dry days during the wet weather condition.

## 15.5 Mine Equipment

### 15.5.1 Mine Service Equipment Capacity

Important mine service equipment to be purchased by the company include the following:

**Table 16.1: Mining Equipment Fleet**

<b>SN</b>	<b>EQUIPMENT TYPE</b>	<b>NO. OF UNITS</b>
1.	Bulldozer ripper, CATD8N with shank ripper	1 units
2.	Rock drill, model ROC 742 HC01	1 units
3.	Air leg jackhammers, type BBC16W	1 units
4.	Portable Air Compressor, Atlas Copco XA175	1 unit
5.	Front Shovel, Model CAT5080, 4.2m <sup>3</sup> bucket	1 units
6.	Wheel loader, Model CAT966F	2 units
7.	Haulage trucks, SHACMAN, 25 tonne capacity	6 units
10.	Water Bouser, 20 tonne capacity	1 unit

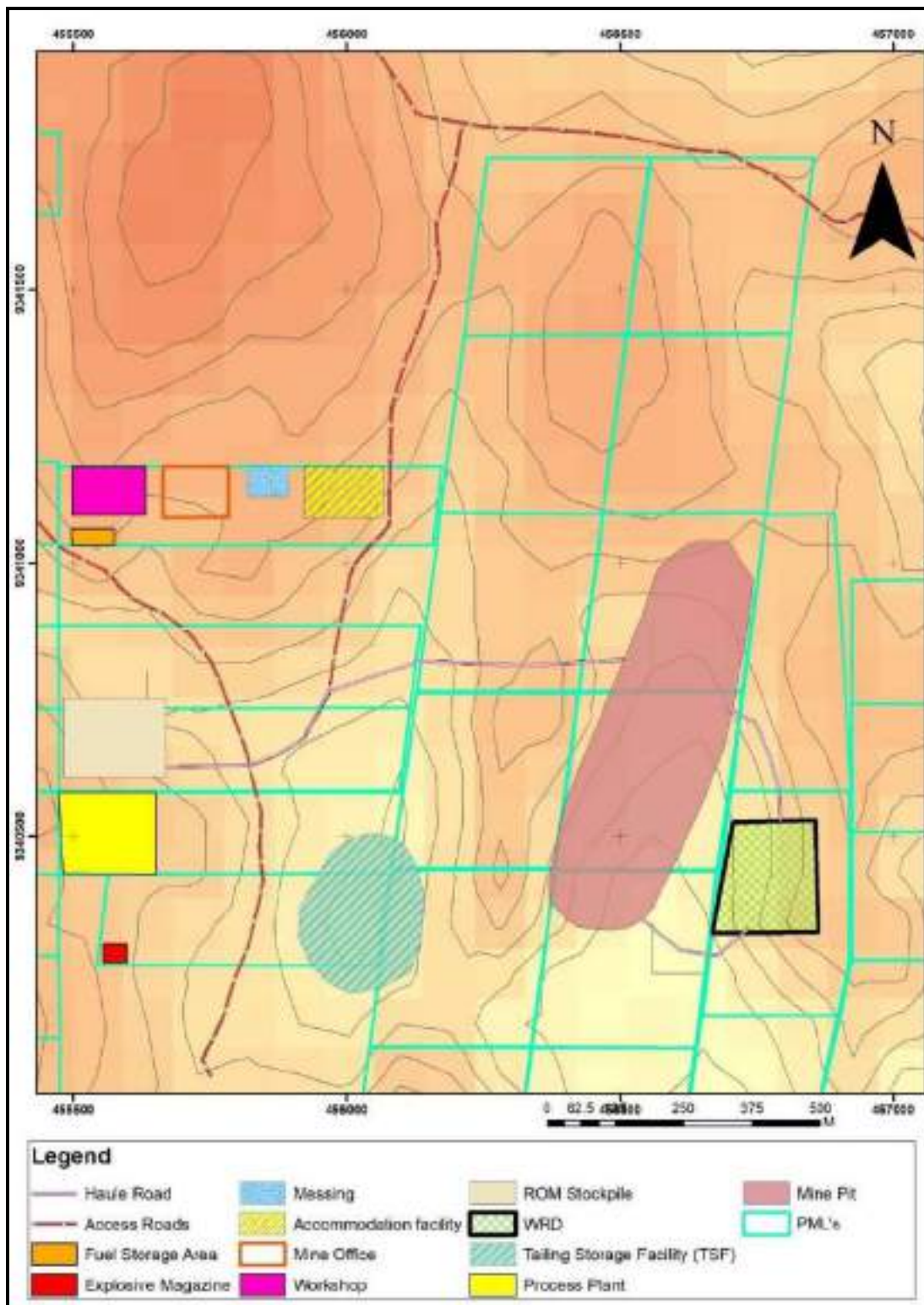


Figure 16.4: Site Layout view, Kwamsisi Graphite Project.

## 15.6 Mine Production Schedule

### 15.6.1 Mine Operational Schedules

Scheduling of the mining operation has taken into account the following factors:

- (i) The climatic conditions of Handeni area, in which three months of February, March, and April are wet months. Minimal open pit mine activities will be taking place.

- (ii) Provision of time for service and maintenance for the mining equipment and the crushing plant.
- (iii) The processing plant will work for 1 shift of 9 hours each for seven days a week for 50 weeks in a year. Two weeks in a year will be for major service of the processing plant. Minor services and repairs will be undertaken in between shifts. There will be a total of 300 working days for the processing plant.
- (iv) The mine will be operating for one shift of 10 hours from Monday to Saturday with Sundays being days off. Sundays have been considered days off. The 12 days of public holidays per year will be compensated during the three months of closure of the mine due to wet weather condition. The three months of heavy downpour have been taken out of schedules for production. The total number of working days is therefore 300 Days/year

A Life of Mine (LOM) plan was completed for the deposit based on the final pits design. This was done to ensure that the mining method is practical and achievable

The mine plan targeted production of 30,000 tons of graphite in year 1 (2024), building up to 211,553 in year 9 (2032). The results of the mine plan showing the active mining pits. The stage plans cover the periods;

The mine plan is considered to be a preliminary mine plan and changes can be expected once further detailed exploration has been undertaken.

## **16.0 GRAPHITE ORE PROCESSING AND RECOVERY METHODS**

### **16.1 Introduction**

The commercial objective of the Kwamsisi Graphite Project operation is to market a merchant grade (>5% TGC) concentrate of graphite ore containing with high recovery.

### **16.2 Graphite Processing**

Graphite ore include amorphous graphite and flaky graphite. Amorphous graphite also calls cryptocrystalline graphite. This ore has small graphite crystal and generally have high grade, general but its floatability is bad. After flotation, the grade has no remarkable increase. The feature of Kwamsisi graphite is the graphite present as flaky or foliated, raw ore grade is around 1.6 to 55% TGC with the average grade of 8% TGC. This graphite ore has good floatability and grade can up to 95% after flotation. So, raw ore grade with 5% can be mined. Flaky graphite has good performance and can be used to make advanced carbon product.

Flaky graphite has good floatability, so mostly use flotation to select. In China, they generally use the kerosene or diesel as collector, oil or new flotation oil as foaming agent. After many years production practice oil are considered as ideal foaming agent for graphite.

Generally, cryptocrystalline graphite associate with mica etc silicate minerals. When flotation, can use starch, dextrin, organic glue, cellulose, etc agent to control the silicate minerals, for example, if the pyrite content is high, add lime and oxide.

#### **16.2.1 Multistage grinding multistage flotation**

To prevent graphite flakes from breaking, multistage grinding multistage flotation process will be used. After multi grinding and flotation, the concentrated graphite will meet the requirements.

#### **16.2.2 Gravity and flotation united process**

For graphite associated with heavy mineral, generally use gravity and flotation united process to select, that use gravity separation to separate heavy mineral firstly, then use flotation to process the light mineral.

#### **16.3.3 Detailed Crystalloid Graphite Mineral Processing Flowsheet**

Generally, graphite ore's hardness is medium hard or medium hard soft, grade is between 2-10%, crushing process is simple, use three-stage open circuit, two-stage open circuit or one-stage crushing flow sheet. Flotation processes include multistage grinding, multistage selection, and middling's return in order or concentrated. Multistage process has three forms that is concentrate regrinding, middling's regrinding, tailings regrinding. Crystalloid graphite most use concentrate regrinding process, normally, the recovery ratio can up to around 95%.

For further purification of a graphite concentrate to natural high purity graphite products with carbon contents of up to 99,99 wt.-% advanced chemical and thermal processes have to be applied.

Several procedures for purification of graphite concentrates are available. A basic process is thermal treatment in the presence of caustic reagents to dissolve siliceous impurities such as quartz, feldspar or mica. The graphite flotation concentrate is mixed with caustic reagent and baked at elevated temperatures. After baking the graphite is leached with water to wash away dissolved impurities.

In case ultimate purity levels are targeted, the more finely intergrown mineral phases residing in between the graphite layers, have to be removed. Typically, an additional one or multi-stage acid washing with different acids or combinations thereof to remove impurities that are insoluble at alkaline conditions, is applied.

Optimal reaction conditions and reagent uses have to be matched by considering type and level of impurities present in the respective graphite concentrate, targeted product quality, markets and finally economics of the process.

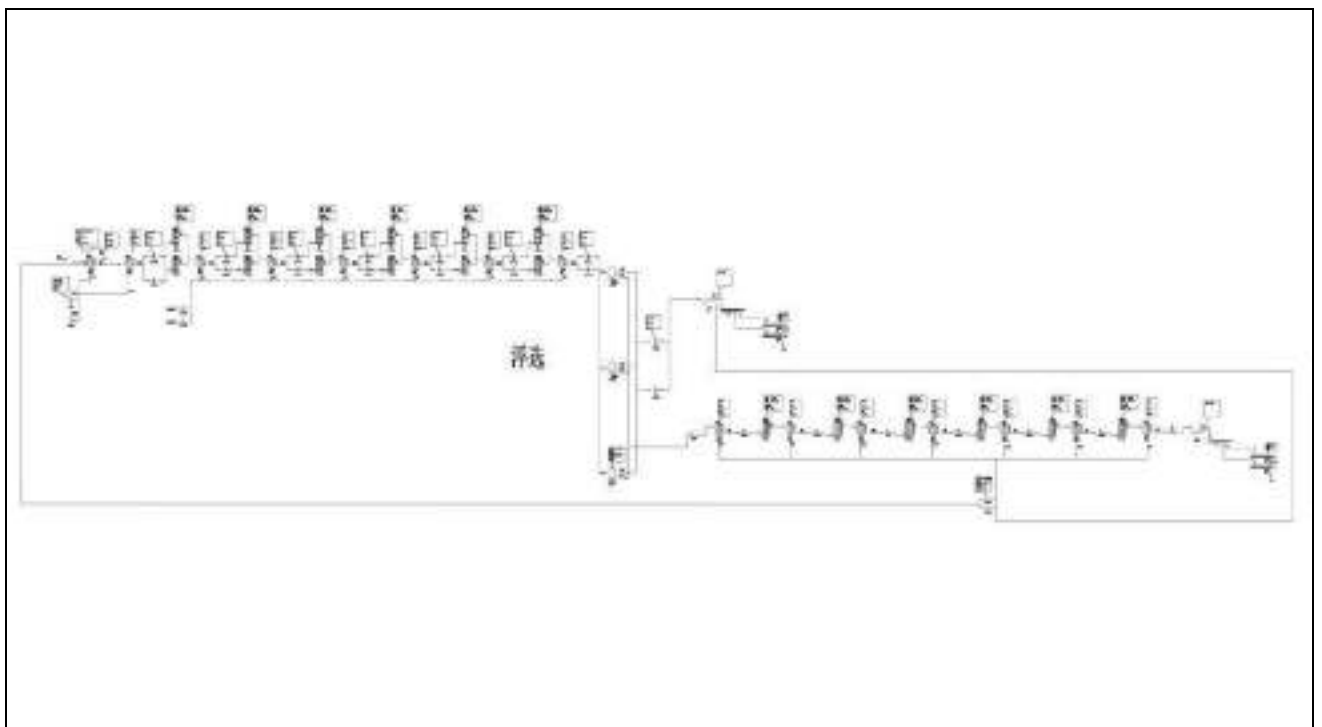
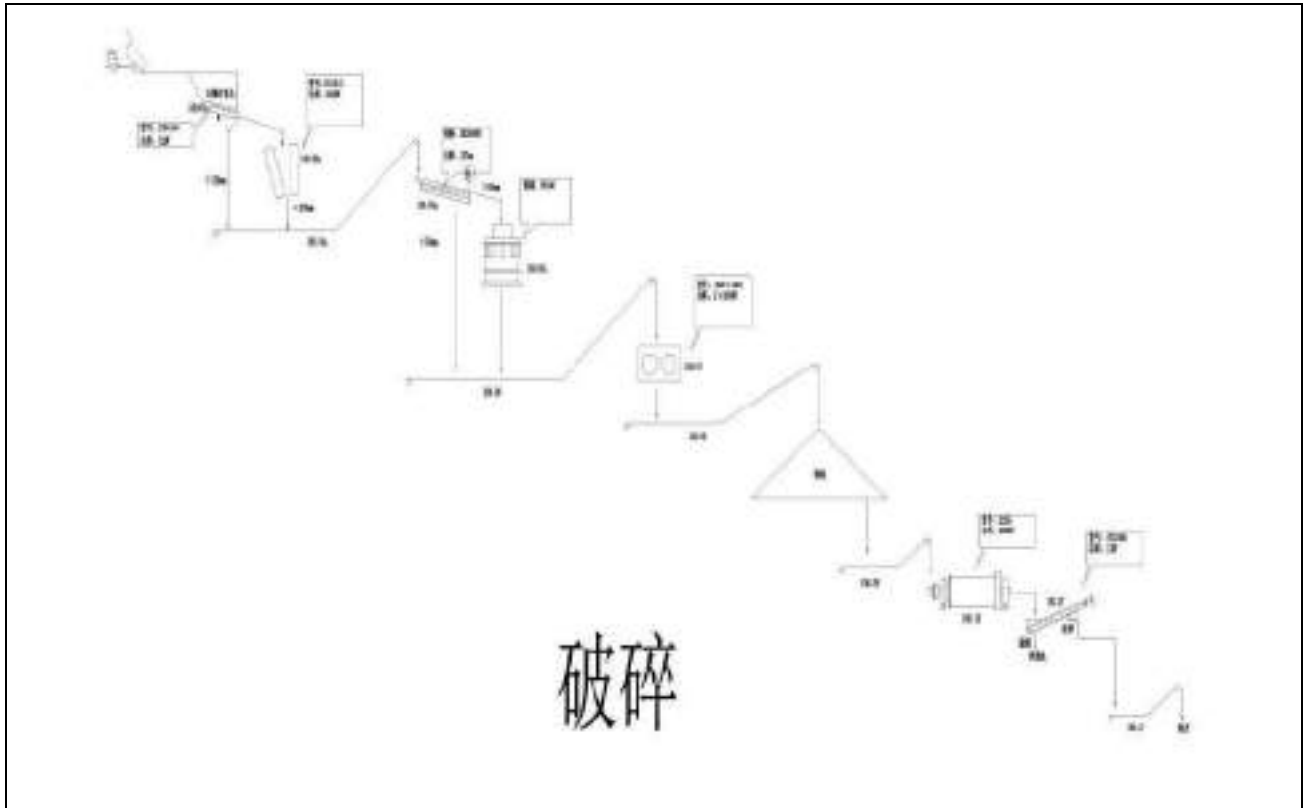


Figure 16.1: Typical Graphite Processing Circuit



**Figure 16.2: Typical Graphite Flotation Machine**

#### **16.1.4 Reagent**

A number of reagents are used in the concentration process in order to bring about selective and high recovery of the target mineral, graphite. By and large, these act to change the nature of the surface of the various mineral phases through the formation of extremely thin (molecular dimensions) surface layers. Therefore, the quantities employed, are extremely low, a fact that reduces the hazard to the environment.

Several procedures for purification of graphite concentrates are available. A basic process that will be used is the application of thermal treatment in the presence of caustic reagents to dissolve siliceous impurities such as quartz, feldspar or mica. The graphite flotation concentrate is mixed with caustic reagent and baked at elevated temperatures. After baking the graphite is leached with water to wash away dissolved impurities.

The reagents will be applied as relatively dilute solution. These will be prepared in a specially designed reagent preparation room by appropriately trained personnel. In this way, any hazard associated with the use of the reagents will be minimized and confined.

#### **16.1.5 Tailings Disposal Facility**

Tailings disposal facility will be required for storage of tailings from the processing plant. The size determination of the tailings disposal facility (TDF) at Kwamsisi Graphite Project is controlled by the topography.

The total area of the pond and the linear feet of the dam were estimated as follows

The designed cross-sectional area of the tailings dam is 5 hectare with the height from 2m high

The total cost is the cost of preparing the tailings pond plus the cost of construction of impoundment dam around it.

## 16.2 Process Waste disposal

### 16.2.1 Solids

More than 87% of the mined ore reports to waste. The waste solids consist of extremely stable minerals, calcite, dolomite, apatite, and iron oxide minerals. They might also contain a small amount (about 0.1%) of pyrite. If this oxidizes, the resulting acid and soluble iron will be neutralized and precipitated by the associated calcium minerals.

The solids, together with an appropriate quantity of the accompanying solution will be directed to a TSF dam. The volume of solids accumulated each year will depend on the grade of the ore mined. A conservative (maximum) estimate is 300,000 m<sup>3</sup> per annum.

### 16.2.2 Liquids

The plant will use about 2 tons of water per ton of ore processed. The majority of this water will be recycled. Some of the solutions will be recycled within the flotation stages, as a way of economizing on the addition of reagents. Some of the liquid, which is used in transporting waste solids to the tailings impoundment, will be recovered there and returned to the process.

Any water that is discharged from the plant will contain small amounts of the organic chemicals used in the flotation process. These are all thought to be biodegradable. It is not expected that the effluent will contain troublesome concentrations of toxic heavy metals.

The tailings impoundment (slimes dam) will be provided with an impervious bottom to prevent soluble components of the solution from seeping into the ground water. The quality of the ground water will be monitored through sampling wells to detect whether contamination occurs in practice.

### 16.2.3 Processing Plant Operating Costs

Processing plant operating costs (excluding labour) will mostly involve reagents, power to run the processing plant and repair & maintenance of the various machineries. Table 6.1 provides a breakdown of the various operating costs for the processing plant.

**Table 16.1: Processing Plant Operating Costs per Year 每年加工厂的运营成本**

S/N	描述Description	Amount (US \$)金额
1.	矿山开采(包含爆破、燃料等)Mining (including explosive and fuel etc)	3,494,118
2.	试剂Reagents	469,118
3.	电力Power	5,217,647
4.	工厂机器、维护、保养费用Plant machinery, service and maintenance costs	523,529
5.	人员工资Personnel salary	345,600
6.	尾矿管理费用Tailings management expense	50,000
7.	水费water bills	100,000
8.	烘干费用drying expenses	1,173,529
9	其他杂费other incidental expenses	98,529
10	钢球损耗steel ball consumption	352,94
11	陶瓷球损耗ceramic ball consumption	198,529
	<b>总计Total</b>	<b>12,023,541</b>

## 16.2.4 Contents of Plant Construction

In accordance with the production scale of annual output of 30,000 tons of graphite concentrate and the requirements of the relevant national design specifications, build the main crushing workshop, grinding and floating workshop, filter press workshop, drying workshop, packaging workshop and finished products warehouse, It should be accompanied by office buildings , staff dormitories, canteen and bathrooms, health and epidemic prevention and other office and living rooms, in addition, also including silo, pool, belt corridor and other structures.

**Table 16.2: The Sub-building and Structures List**

	名称Name	占地面积 (m2) Floor space	建筑面积 (m2) Building area	建筑层数 Building Stories	层高 (m) Story height	结构形式 Structure	备注Remark
1	破碎车间crushing workshop					框架结构 frame structure	
2	磨浮车间 grinding and floating workshop					框架结构 frame structure	
3	压滤车间filter press workshop					框架结构 frame structure	
4	烘干车间drying workshop					轻钢结构 light steel structure	
5	成品库finished products warehouse					轻钢结构 light steel structure	
6	workshop power distribution NO 1, 车间变配电1					框架结构 frame structure	
7	Workshop power distribution NO 2 车间变配电2					框架结构 frame structure	
8	Workshop power distribution NO 3 车间变配电3					框架结构 frame structure	
9	Workshop power distribution NO 4 车间变配电4					框架结构 frame structure	
10	生活区变电所 Living area substation					框架结构 frame structure	
11	材料库material warehouse					轻钢结构 light steel structure	
12	机修车间repair shop					轻钢结构 light steel	

	名称Name	占地面积 (m2) Floor space	建筑面积 (m2) Building area	建筑层数 Building Stories	层高 (m) Story height	结构形式 Structure	备注Remark
						structure	
13	药剂库Pharmacy shop					轻钢结构 light steel structure	
14	门卫1/NO1 guard room					框架结构 frame structure	
15	门卫2/NO2 guard room					框架结构 frame structure	
16	新鲜水池fresh pool						
17	回水池water recycling tank						
18	加压泵房booster pump chamber						
19	办公楼office building					框架结构 frame structure	
20	食堂浴室canteen and bathroom					框架结构 frame structure	
合计in total		128,250					

### 16.2.3 Quality grade

- i. The fire risk category is Class D and the fire resistance grade is 2;
- ii. The seismic category is standard fortification (C) class, and the seismic fortification intensity is 6 degrees;
- iii. The durability of the main structure of each building is 30 years, and the durability of the envelope is 25 years;
- iv. The layout of each subitem and the construction of production facilities shall be arranged according to the technological process to meet the requirements of the technological process and use;
- v. The facade design not only meets the landscape requirements, but also serves as a symbol for the building to display the corporate image. The facade of the workshop of the production facilities adopts simple modern style, and the facade of the overall design is simple, so that the building has modern flavor and novelty.

### 16.2.4 Main architectural structure features

The design follows the principle of giving priority to the selection of local construction materials, and the relevant atlas of local engineering construction standards is taken as the basis for the selection of construction materials. At the same time, construction materials can

be selected reasonably according to the functional requirements of each sub-item in the project, so as to achieve the goal of economic investment in the project construction.

- i External wall: 240 thick concrete block wall, double laminated steel insulation wall;
- ii Interior wall: 240 thick concrete block wall;
- iii Roof: Frame structure roof adopts structural slope finding. Color steel roof waterproof grade is II, glass wool insulation layer, slope roof slope is 1:20;
- iv Floor: Concrete floor;
- v Building surface: Concrete floor;
- vi Doors and Windows: Aluminum alloy doors and Windows;
- vii Paint: polyurethane matte paint, alcohol benzene enamel finish;
- viii Sanitary ware: domestic medium sanitary ware.

#### **16.4.3 Design standard for reliability of building structure**

The safety level of the proposed buildings in this project is two. The roof load is calculated according to the load specification of the building structure. The design life of all the buildings in this project is 30 years, and the foundation design grade of the buildings to be built is Class C.

- Design load (standard value of variable load);
- Floor load and ground load are calculated according to process data. The values of live loads for other places are as follows:
  - Floor: 2.0kN/m<sup>2</sup> plus 1.0kN /m<sup>2</sup> (flexible partition);
  - Meeting room: 2.0kN/m<sup>2</sup>;
  - Toilet: 4.0kN/m<sup>2</sup>;
  - Stairs: 2.0kN/m<sup>2</sup>;
  - Evacuation stairs: 3.5kN/m<sup>2</sup>;
  - Outboard balcony: 2.5kN/m<sup>2</sup>;
  - Reinforced concrete roof: a. upper roof 2.0kN/m<sup>2</sup>; b. Roof 0.5kN/m<sup>2</sup> not occupied;
  - The load of the roof equipment is calculated according to the actual calculation;
- Basic wind pressure: 0.7kN/ m<sup>2</sup>;

Basic snow pressure: Snow pressure is not considered in this area.

#### **16.4.4 Material**

Concrete; The foundation is made of C30 concrete. Foundation cushion C15 grade.

Steel material: Adopt the national standard hot rolled steel HRB400. The embedded steel plate is made of Q235 steel and Q345 steel, and the hook is made of HPB300. The welding rod and method used for steel connection shall be in accordance with the corresponding standards and specifications.

Partition wall and enclosure wall: the filling wall of the frame structure shall adopt masonry materials (concrete blocks) that meet the requirements of environmental protection and energy saving, and the material strength shall meet the requirements of GB50003-2001.

#### **16.4.5 Foundation**

The engineering geological condition of the mining right area is good, and the tentative foundation type is independent foundation under column.

#### **16.4.6 General layout of civil engineering plan**

The general layout is composed of several parts, such as quarries, dumps, industrial sites, concentrators, tailings dry storage yards and mine roads. See general layout plan for details

## **17 ANCILLARY SITE FACILITIES AND INFRASTRUCTURE**

### **17.1 Site**

#### **17.1.1 Location**

The proposed Project is located in Handeni District, eastern portion of Tanzania, about 245 Kilometres North West of Dar es Salaam City. It is situated around 180 south west of Tanga (the regional headquarter of the Tanga Region). The proposed Project fall under the jurisdiction of Handeni District, Kwamsisi Ward, Kwamsisi Villages (Figure 1.3).

The location for the processing plant and ancillary facilities have been done by taking into consideration the following considerations:

- Relatively good geotechnical and hydrotechnical conditions in view of the small hilly terrain and valleys that dominate the topography in the area;
- Relatively good drainage characteristics, safe distance from nearby River and its tributaries;
- Safe distance from the Tanzania Railway corporation (TRC) line installations and in line with the requirements of the Mining Act, 1998.
- Good accessibility from the mining pits and from the main access road that joins the project area to the main trunk road (Dar es salaam- Arusha Road); and
- Capability for future expansion.

#### **17.1.2 Site Layout and Security**

The location of the mining area within the licence area is dictated by the geology and the selected mining method and has been done by considering critically both economic and safety factors.

The area earmarked for mining is located to the central of the licences area. This area can be easily accessed through the existing earth road connecting the project area to the Dar es Salaam-Arusha highway.

Access to the Project from Dar es Salaam is via the Dar es Salaam-Bagamoyo -Msata-Mkata on s tarmac Road, approximately 215 km North West of Dar es Salaam. The access road from the Tanga Port is Tanga-Muheza-Mkata approximately 140kk South west of Tanga city. The access road to the site from Mkata is rough gravel road, approximately 55 kms south east of Msata. The access road from Mkata to the site is accessible throught the year.

### **17.2 Surface Buildings**

#### **17.2.1 Administration and Changehouse**

There will be an administration block which shall contain offices for general, administration and management personnel. Mine technical personnel, clerical, receptionists, secretarial and other personnel will be allocated offices within this block.

A changehouse that will cater for the mining personnel will be located adjacent to the administration block. Smaller changehouses for dedicated personnel, e.g., processing, workshops and others will be located within their working areas.

### **17.2.2 Workshops and warehouses**

The main workshop will be located close to the processing plant and will contain four bays for washing, small vehicle repairs, mobile equipment repairs, tire repair) and will be serviced by an overhead crane. Within the main workshop, space will be allocated for a machine shop, an electrical and instrumentation shop, welding, hydraulics and fabrication shop. It is also planned to establish a small workshop within the plant to handle smaller repairs within the pit so as to minimize equipment downtime. This workshop will be a mobile one which will be moved as the pit advances but kept at a distance safe from blasting damage.

The warehouse for storing maintenance spares and other supplies will be located in close proximity to the processing plant and the main workshop. Bulk materials that can be kept in the open will be stored within a partially roofed and fence outside area. Separate warehouses for chemicals and reagents, oils and greases will be constructed separately. Storage of explosives and the associated ingredients will be located and constructed in accordance to the requirements of the Explosives Act. Prior to utilization of the explosive's magazine, an application for licence and hence inspection by the Chief Inspector will be initiated.

### **17.2.3 Site Medical Facilities**

A medical clinic staffed with a qualified medical assistant and nurses will be constructed on site to cater medical emergencies and illnesses that can be handled at site. Complicated cases will either be referred to Tanga or Muhimbili (in Dar-es-Salaam) referral hospitals.

### **17.2.4 Site Camp**

A construction camp that will be used during the mine and plant construction is planned to be erected on the Project site. The camp will be located north of the site identified for plant construction. The construction camp will be constructed using prefabricated, modular air-conditioned units. The camp will consist of bedrooms, washrooms, laundry facilities, kitchen, lunch/dinner room, recreation facilities and a first aid building. Supervisory and skilled workers will be housed in the camp while unskilled workers will be expected to be accommodated in the surrounding community.

After the construction stage, the camp will be converted for use by the operations management, supervisors and skilled workers during the operations stage.

## **17.3 Power Supply**

Within the project area, there is electricity supply from the National Grid and is already connected to the one graphite mine in the area, located almost 2km away from the project site. The mine is connected via a 33 kV line from Handeni.

Once power supply has been availed to site, power to different facilities will be distributed by underground feeders, cable tray systems and overhead lines for distant locations. Local distribution transformers will be used to provide power at the desired voltage. Standby power to cater for emergencies during power cuts will be provided by diesel generators that will be chosen to meet the minimum requirements for running the mine and processing operations. The generators will be housed in well-ventilated and roofed shed located south but close to the processing plant.

## **17.4 Site Services**

### **17.4.1 Fuel Storage**

Fuel stocks required for running the standby generators, mobile equipment (mine trucks, construction equipment), light vehicles and other fuel operated equipment will be stored on site. Storage facilities will have the capacity to cater for at least one months supply. The storage tanks will be located close to the workshop which will be located north of the processing plant. As an environmental management good practice, the steel fuel storage tanks will be erected with a concrete bunding containment with the capacity to accommodate 110% of the capacity of the tanks. Fuel unloading stations will be provided at both locations and truck refueling will be provided near the main workshop.

### **17.4.2 Water Supply**

During construction and at the start of the operations water supply to the site will be abstracted from underground which according the hydrogeological study conducted by the other graphite mine near our site, has enough water to cater for the current users and the mining operations.

On the long-term, however, the mine plans to harvest and dam rain water by taking advantage of the hilly topography in the area. Selection of the site for the dam will be done carefully to ensure minimum interruption with the natural drainage system and hence minimize impacts to downstream users. In addition, it is expected that the plant will use about 2 tons of water per ton of ore processed. As the processing wastes are pumped to the tailing's facility, the water will be collected at one end of the facility with sediments allowed to settle and allow clean water to be recycled back to the plant. Calculated according to the annual output of 30,000 tons, the production water consumption is about 150t/h, and the production return water is about 50%. When the drilling depth is 300 meters, the water inflow is about 20m<sup>3</sup>/h, so as to prevent the production from being affected in the dry season, it is necessary to set up 5 to 10 Wells for backup, and the drilling cost is 147.06 USD/m, totaling 44,118 USD.

### **17.4.3 Fire Protection**

The fire protection will be supplied from the fresh water storage pond which will contain a fire reserve equivalent to 2 hours retention at maximum flow. The line supplying water from well will be used to provide backup water if needed. An electric powered fire pump will be provided to automatically supply water through a buried water distribution system.

Strategically located fire hydrants and hose stations will be located near main buildings around the site. All high risk areas will also be equipped with automatic sprinkler system and portable fire extinguisher units. The start-up of the fire pump will automatically activate the alarms which can also be turned on manually.

A 3m firebreak will be constructed around the lease area borders and signs warning against starting of fires will be posted around the area. This measure will aim at controlling the start of fires that are known to be started by pastoralists in a bid to reactivate grass growth for their animals.

#### **17.4.4 Water Distribution and Sewage Disposal**

Storage of fresh water for use in the processing plant, the mine, fire and other uses will be done through a constructed pond with capacity for nearly two months requirements. The pond will be located close to the processing plant which will be the biggest fresh water consumer.

Sewage from the mine site will be collected by a gravity sewer network through buried PVC plastic pipes to sewage treatment ponds. The sewage treatment ponds will be located east of the processing plant. A set of three ponds will be constructed to allow serial movement of effluents from the intake pond to the discharge pond. It is envisaged that well maintained and functioning ponds will allow the last pond to discharge clean water. The water will be monitored regularly to ensure that no polluted water is discharged into the environment.

#### **17.4.5 Communications**

Within the project site, mobile telephone services from Halotel and Airtel can be easily accessed. Discussions will be carried out with the Tanzania Telecommunications Company Ltd, TTCL to enable the extension of the existing communication lines to reach the project area.

#### **17.4.6 Mobile Equipment**

The project will maintain a fleet of mobile equipment for the maintenance of access and haulage roads and other surface areas of the project site. The fleet of mobile equipment will include a dozer, dump trucks, wheel loaders, mobile crane, pickups, vans and buses.

### **17.5 Transportation and Logistics**

#### **17.5.1 The Port**

All imports and exports by sea will have to be shipped through the port of Dar-es-Salaam which is well connected to the project area by both rail and road transport. The Dar-es-Salaam port has ample facilities for handling the project needs. The port has eight deep water berths for general cargo, and three container berths. The container berths have been privatized and is run by a private operator which has increased the efficiency and hence cutting down the time for goods clearing. From the port of Dar-es-Salaam there two major alternatives for transporting goods to the project mainly by railway and road transport. Both road and railway transport have direct connections into the port.

### **17.6 Community Support**

The community surrounding the project area at the moment depend on the public services for some basic services, e.g., access to a clinic, school, transport, access to market for their agricultural produces and others. Most villagers around the area farm in valleys and have to move their produce long distances in order to access the markets or reliable transport. The Kwamsisi Village clinic is small one catering mainly for the villagers. Despite a number of rivers in the area, villagers have no tap water and it normally not treated. These and many other issues that face the surrounding communities determine their quality of life.

Based on identified priority issues by the local Government and those that can be supported within the Company budget constraints, a plan for implementation will be worked out and agreed between the two parties. In order to implement these, the Company will each year set aside a budget that is in line with its business plans.

## 18 MANPOWER REQUIREMENTS

### 18.1 Introduction

The staffing requirements for the project will be determined in accordance to the specialized sections of the project. The main areas include, Mining, Processing Engineering, Administration (general administration, personnel, finance, stores, health, transport, etc), Environment, Health and Safety (HSE). Each of these areas will determine the staff requirements in line with the production schedules. In general, the project will aim at employing locals and only use expatriates where local expertise is not available.

### 18.2 Technical Staff Requirements

#### 18.2.1 Processing Personnel

The processing of the ore to recover graphite concentrate will consist mainly of comminution which will aim at size reduction of the mined ore to produce a minus 0.5 inches product. The crushed product will then be wet ground to a minus 65 mesh before being fed to the floatation circuit. The material will then be fed into a three-stage floatation circuit the output of which will be the desired graphite. In order to meet the processing requirements of the plant, it is envisaged that the plant will operate through three 10-hour shifts and seven days a week. The estimated number of personnel required to meet these requirements include:

**Table 18.1: Processing Personnel**

Position 职位	Number 数量	Remarks
破碎机操作员 Crusher operator	1	
球磨机操作员 Ball Mill Operator	1	
浮选操作员 Flotation operator	1	
	<b>3</b>	

#### 18.2.2 Engineering Personnel

The engineering department will be responsible for the maintenance of all mining, processing and service equipment. In addition to maintenance, the department will also maintain the houses, roads, communication and electrical installations. Fabrication of various components that will be required from time to time to meet production needs will also be the responsibility of the engineering department.

**Table 18.2: Engineering Personnel**

Position	Number	Remarks
机械工程师 Mechanical Engineer	1	
电气工程师 Electrical Engineer	1	
焊工 Welders	1	
	<b>3</b>	

#### 18.2.3 Administration Personnel

The administration department incorporates all personnel for the general and personnel administration, finance, stores, transport, general workers health, community development.

**Table 18.3: Administration Personnel**

Position	Number	Remarks
项目经理 Project Manager	1	
财务 Finance	1	
仓库采购 Warehouse purchase	1	
翻译 Translator	1	
	<b>3</b>	

### 18.3 Training

A training programme for all employees will be put in place and will include several approaches including on-the-job training, short courses on and off-site, seminars and other forms of training. On the job-training will utilize experienced personnel to train the less experienced ones. All expatriate personnel will be required, as part of the employment contract, to train a local person who shall finally be able to replace him/her.

All training programmes will be the responsibility of the Administration Department under the supervision of the personnel officer who shall be responsible for developing and ensuring delivery of the training. All equipment and service providers on the mine will be required by their contracts to provide training on the efficient and appropriate use of their equipment and services. On the job training will be supplemented by off-site training, both locally and abroad, through specialized institutions, equipment and service providers. Selection of such training will be in accordance to an approved training programme aimed at addressing the needs of the employees and those of the Company. On a case by case basis, individual employees will also be considered for postgraduate university training to meet their respective needs.

While training of local employees on the English language will be encourage, expatriates will also be provided with opportunities to learn Kiswahili as a way of promoting easy communication and interaction amongst all employees. Training on the local cultural values will also be organized for foreign employees.

### 18.4 Personnel Costs

The personnel costs are estimated based on the numbers presented in the specific sections above. The monthly wages are based on the current figures used in the mining industry and takes into consideration the competitiveness of the job market. In additional, it assumed that 95% of the workforce will be local with only 5% being expatriates.

**Table 18.4: Personnel Cost**

职位	Number 数量	Monthly wage (\$) 工资	Total monthly (\$) 总计	Annual Cost (\$) 年
项目经理Project manager	1	4300	4300	51600
财务Finance	1	2100	2100	25200
仓库采购warehouse purchase	1	2100	2100	25200
翻译translator	1	2100	2100	25200
机械工程师Mechanical engineer	1	2400	2400	28800
电气工程师electrical engineer	1	2400	2400	28800
焊工welder	1	1850	1850	22200
破碎机操作员operator of crusher	1	1850	1850	22200
球磨机操作员operator of ball mill	1	1850	1850	22200

职位	Number 数量	Monthly wage (\$) 工资	Total monthly (\$) 总计	Annual Cost (\$) 年
浮选机操作operator of flotation	1	1850	1850	22200
当地操作工local operators	20	150	3000	36000
当地辅助工local auxiliary workers	20	150	3000	36000
	<b>50</b>		<b>28,800</b>	<b>345,600</b>

## **19.0 MARKET STUDIES AND CONTRACTS**

Because of recent evolution in auto electric industries in the world, graphite and its associate products remains in a robust demand. The details study on the current market prices for graphite and its associate products was not conducted by the author.

No contracts are in place concerning property development, mining, processing, transportation, handling, marketing, sales etc.

**19.1 Royalties**

**19.2 Graphite**

**Prices**

## **20.0 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT**

### **20.1 Environmental and Social Assessment**

Environmental and Social Impact Assessment will be undertaken to

- Identify and predict the impact on the environment and on community health and well-being by the proposed graphite project, policies, programs and operational procedures, and to interpret and communicate information about their mitigation
- Assess the character of the receiving environment, the potential impact of the project and confidence of predicting impacts, the resilience of the environment to cope with change, the technology to be used, the plans, policies or procedures which influence land use changes and the degree of public interest (i.e. concerns of the general public);

In the process of undertaking this ESIA, all possible impacts will be identified. Ultimately, the assessment will propose mitigation measures and an Environmental Management Plan, to avoid, compensate or reduce adverse environmental effects and to maximize positive impacts resulting from the project implementation.

### **20.2 Strategic Environmental Measures**

The following measures will be undertaken by project owner for environmental protection:

- Identify all environment impacts as a result of operations
- Develop and apply an Environmental Management System to mitigate all impacts identified
- Perform periodic audits of the Environmental Management System and transparently communicate audit results to interested parties
- Use audit results for continual improvement of work methods
- Train employees to improve their skills supporting their duties in implementing environmental management and monitoring

### **20.3 Environmental Management Plan**

Detail of the potential project impacts and mitigation measures will be presented from ESIA

### **20.4 Environmental Monitoring**

The Environmental Monitoring System will be implemented as a complimentary to the Environmental Management Plan to monitor the impacts of the proposed project and the mitigatory measures and to provide a permanent record of such monitoring.

The objectives of the Monitoring System are to:

- Provide a permanent record of compliance with ESMP against the present and future legislation;
- Control risks and (significant) environmental impacts;
- Control and improve the project on the basis of the operational information gathered;
- Monitor continuous improvement of the environmental and social management system;

- Provide a simple framework to improve the level of environmental management and compliance;
- Co-ordinate and integrate the tasks of the project proponent and those of the governmental agencies involved in the project implementation;
- Integrate present and future environmental and social monitoring activities.
- Periodic Reporting
- Investigation of environmental incidents and reporting damage to the environment
- Inspection and remedy of environmental damage affecting the local community

## 20.5 Environmental Costs

The environmental costs have been presented as part of the Environmental Management Plan (EMP) and is presented in terms of annual costs for land management, water management, pollution control, conservation, community plan and monitoring activities. Also presented as part of the EMP are the costs for mine closure which will be incurred through continuous rehabilitation during the operations and at the end of the project in order to meet the closure regulatory requirement. A summary of the environmental costs are summarized in Table 21.1 below:

**Table 20.1 Environmental Management Costs**

<b>Environmental management Activity环境管理活动</b>	<b>Annual Cost (US \$)金额</b>
Land Management土地管理	22,500.00
Water Management水管理	20,000.00
Pollution Control污染管理	12,000.00
Conservation保护	5,500.00
Community Plan社区规划	9,000.00
Monitoring监控	17,100.00
Closure plan关闭规划	30,000.00*
<b>Total总计</b>	<b>116,100.00</b>

1

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<sup>1 1</sup> Closure plan cost is for the activities to be carried at the end of the operations. The continuous rehabilitation costs are included as part of the other environmental management activities.

关闭计划成本是指在作业结束时进行的活动。持续的修复费用已列入其他环境管理活动的一部分

## 21 DEVELOPMENT AND CAPITAL COST ESTIMATES

Development and capital cost estimates were estimated based on the 2022/2023 market survey of the specified equipment from various sources including manufacturers of the equipment.

### 21.1 Development Costs

Development cost items are the infrastructural developments which are necessary to support the project to make it start operating. Examples of such infrastructural developments include; power transmission and distribution lines, access roads construction, tailings dam construction, fresh water system construction, office buildings, workshops and fuel bays, crusher and mill foundations, etc.

**Table 21.1 Development Cost**

设施Infrastructure	(US\$)估算成本 Estimated cost	备注Remark
尾矿设施tailings facility	100,000.00	
淡水系统freshwater system	100,000.00	包括储存和管道include storage and pipelines
办公楼和工作间office building and workshop	100,000.00	
车间设施和燃油储存workshop facility and fuel storage	3000,000.00	包括分配include distribution
输配电power transmission and distribution	200,000.00	
通往道路和排水系统access road and drainage system	150,000.00	运输道路收费hauling road charge
设备地基equipments foundation	300,000.00	设备单独收费Separate charge for equipment
<b>总计Total</b>	<b>3,950,000.00</b>	

### 21.2 Capital Costs

Capital costs are those costs spent on purchasing the mining equipment and plant machinery including other fixed assets which are necessary to be used to operate the mine and the processing plant.

**Table 21.2 Capital Cost**

编号NO	项目item	名称Name	单位Unit	数量amount	单价/万Unit price/10K	总价/万Total price /10 K	
1	破碎Crushing	振动给料机Vibrating Feeder	台unit	1	2.56	2.56	
		颚式破碎机jaw crusher	台unit	1	13.18	13.18	
		波辊筛Roller screen	台unit	1	3.53	3.53	
		多缸圆锥破Multi cylinder cone break	台unit	1	14.23	14.23	
		格子型球磨机grate ball mill	台unit	1	14.54	14.54	

		螺旋分级机spiral classifier	台unit	1	6.78	6.78	
2	浮选 Flotation	罗茨风机Roots blower	台unit	1	1.95	1.95	
		浮选机flotation machine	台unit	1	13.65	13.65	
		浮选机flotation machine	台unit	1	6.49	6.49	
		立磨vertical mill	台unit	18	1.14	20.60	
		浮选机flotation machine	台unit	6	4.42	26.54	
		浮选机flotation machine	台unit	7	2.31	16.14	
		滚筒筛trommel screen	台unit	4	1.41	4.24	
		精矿泵（柱塞泵） Concentrate pump (plunger pump)	台unit	24	0.52	11.91	
		中矿泵（卧式渣浆泵） Medium mine pump (horizontal slurry pump)	台unit	4	0.44	1.74	
		尾矿泵（卧式渣浆泵） Tailings pump (horizontal slurry pump)	台unit	2	1.56	3.12	
		压滤机（正目） pressure filter( positive mesh)	台unit	1	12.94	12.94	
		压滤机（负目） pressure filter(negative mesh)	台unit	1	12.94	12.94	
3	烘干 Drying	螺旋烘干机Spiral dryer	台unit	2	12.42	24.85	
		螺旋输送机spiral conveyer	台unit	2	0.32	0.64	
		螺旋输送机spiral conveyer	台unit	2	1.07	2.14	
		螺旋输送机spiral conveyer	台unit	2	0.52	1.04	
		螺旋输送机spiral conveyer	台unit	2	0.32	0.64	
		螺旋输送机spiral conveyer	台unit	1	0.38	0.38	
		袋式收尘器bag type dust collector	台unit	1	5.88	5.88	
		收尘风机dust-collecting fan	台	1	1.29	1.29	
		旋风收尘器 rotoclone collector	台	1	0.88	0.88	

		烟气引风机Flue gas induced draft fan	台	1	2.00	2.00	
		烘干炉助燃风机Drying furnace combustion fan	台	1	0.71	0.71	
		插板阀Gate Valve	批	1	0.47	0.47	
		斗提skip winder	台	2	1.18	2.35	
		烘干炉drying oven	台	1	2.35	2.35	
4	输送 Conveying	皮带机 belt conveyor	台	1	10.78	10.78	
		皮带机 belt conveyor	台	1	15.88	15.88	
		埋地皮带机 burying belt conveyor	台	1	16.35	16.35	
		皮带机 belt conveyor	台	1	37.18	37.18	
		输煤皮带机 coal belt conveyor	台	1	2.96	2.96	
		皮带机钢结构立柱 conveyor steel column	批 batch	1	20.00	20.00	
5	开采 Mining	履带式潜孔钻Crawler type drill	台	1	14.82	14.82	
		液压挖机Hydraulic excavator	台	1	62.51	62.51	
		装载机loader	台	2	6.12	12.24	
		自卸车dumper	台	6	6.12	36.71	
6	供水供气	清水供水泵clean water supply pump	台	1	0.43	0.43	
		浮选设备永磁电机冷却用水泵Flotation permanent magnet motor cooling water pump	台	1	0.12	0.12	
		破碎设备永磁电机、烘干机轴承座冷却用水泵Crusher permanent magnet motor, dryer bearing housing cooling water pump	台	4	0.03	0.10	
		空压机air compressor	台	1	0.49	0.49	
		空压机管路、储气罐、冷干机Air compressor pipeline, air storage tank, cold drying machine	套set	1	3.53	3.53	

		管道、阀门等pipelines and valves etc	套set	1	11.76	11.76	
7	厂房 Plant	1800 square meters	M2	2	56.47	112.94	
		行吊crane	台	4	1.36	5.46	
8	检验 Inspect	化验设备Laboratory equipment	套set	1	2.53	2.53	
9	非标 Non-standa rd		批 batch	1	23.53	23.53	
10	消耗品 Consumables	钢球steel balls	批 batch	27	0.20	5.40	
		陶瓷球ceramic balls	批 batch	24.5	0.31	7.49	
11	电气 Electrical	永磁电机permanent magnet motor	批 batch	1	94.12	94.12	
		电控electrical control	batch	1	105.88	105.88	
总计（万）： Total			8,532,600USD				

$$3,950,000+8,532,600=12,482,600$$

After calculation, the total investment amount of the mine: development cost plus capital cost=total investment (USD)

$$3,950,000+8,532,600=12,482,600 \text{ USD}$$

### 21.3 Project Revenue Estimates

Revenues are estimated based on the amount of graphite to be produced. The average feed grade of the ore from the mine has been estimated to be 8% TGC. The ore is planned to be concentrated into 95%TGC, which is a saleable product to an international market.

- ❑ If a plant recovery of 70% is taken, for every tonne of ore, only  $8\% \times 70\% = 5.6\%$  will be recovered in the concentrates;
- ❑ At a feeding rate of 120 tons /h and working 15 hours a day,  $120 \times 5.6\% \times 15 = 100.8$  tons of raw ore will be produced every day;
- ❑ For 300 days in a year, a total of  $100.8 \times 300 = 30,240$  tonnes of concentrates will be produced.
- ❑ Price of 1 tonne of graphite Concentrate is sold at USD 680. For 30,240 tonnes, revenues will be:  
 $= 30,240 \times 680 = \mathbf{\$20,563,200}$  per year.

Salvage value, which is the market price of the assets after the project life has come to an end is assumed to be zero in this study.

## **22.0 HEALTH AND SAFETY**

Health, Safety and Environment regulations for mining operations provides explanation and guidance on the health and safety of mining including the following:

1. Every Mining activity, based on the amount of employees and/or the characteristic of the working area, are required to create a unit for handling health and safety under the supervision of the Health and Safety Manager.
2. The (Health and Safety) unit supervised by the Health and Safety Manager are responsible for:
  - a. Collecting data and recording every incident, the conditions before the incident, cause of the incident, analysis of the incident and identification and implementation of controls to prevent of the incident in the future.
  - b. Collecting data related to the area and activities that need extra supervision in order to give advice to the Technical Head. This could include advice about the working bench, mining machinery and how to use detection and protective equipment
  - c. Give explanation and guidance about Health and Safety to all mining employees by organising meetings, speeches, discussions, using film, publication, etc.
  - d. If needed, building and training the mining rescue team.
  - e. Compiling statistical incident data.
  - f. Evaluating Health and Safety.
3. Creating Health and Safety committee within the organisation with the following duties:
  - a. Doing regular inspections of all Health and Safety aspects and problems which are found in the mine and provide action items to eliminate problems, and
  - b. Arrange all inspections and record of the mine working area.
  - c.

### **22.1 General health and Safety Obligations**

The project owner has the following general Health and Safety obligations.

Production must follow the Production Targets with minimum incidents.

1. Safety is everyone's responsibility.
2. Every employee must obey safety rules.
3. A Technical Head must be appointed as the representative who has the responsibility of all Health and Safety aspects. The Technical Head is also responsible for the Management of the Health, safety and environment Department.

4. Develop an effective and efficient Health and Safety organisation structure that includes owner operators, contractors and sub contractors as members.
5. Standardised SOPs (Safe Operating Procedure) must be developed for all contractors and sub-contractors that work in this site.
6. Every employee and every person inside the mining activity area must use PPE (Personal Protective Equipment).
7. The Company must provide PPE free of charge to employees.
8. All employees must know their working procedures:
  - a. Understand and know their job
  - b. Know the hazards of their job
  - c. Check that their working conditions are safe
  - d. Check that tools and equipment are in a safe condition
  - e. Wear PPE

Everyone must work to minimise hazardous incidents by strictly implementing Health and Safety Rules, and every effort must be utilised to reduce incidents by conducting yearly Training Programs, developed by the Safety Committee for all staff, contractors, and sub-contractors.

## **22.2 Operational procedures**

The Technical head is responsible for developing a Work Program for Health and Safety every year. It will include:

1. Identification and assessment of hazards and risks in all work areas.
2. Developing Standard Operating Procedures (SOP) for all activities which involve significant risk.
3. Ensure routine medical check-ups for employees who operate equipment.
4. A quick check of health for heavy equipment operators and drivers before they start their shift.
5. 24 hour supervision of high risk areas.
6. Disciplinary action for those who violate any SOPs for Health and Safety.

All Standard Operating Procedures will be controlled documents, and a register will be kept and maintained by the safety department. Development of standard operating procedures for the use and storage of explosives is particularly important as these activities are closely regulated.

### **22.3 Safety Equipment**

A variety of equipment will be provided depending on the location and function of the work being performed. The company will provide such PPE as required to protect from injury.

The following items shall be provided:

- Safety Shoes
- Safety Glasses
- Reflector Vests
- Ear Plugs
- Dust Masks
- Hand Gloves
- Safety Helmets

## 23.0 COMMUNITY RELATIONS

Corporate social responsibility requires the company to develop community programs in coordination with the local government. The nature and type of the community programs will depend on the needs of the local communities affected by the mining operations, and close consultation with the local government and local community leaders is required to determine how to maximise the value of these programs in the community.

Community programs generally fall into the following categories:

- Provision of infrastructure and services to the community, such as construction of schools and the provision of medical services
- Provision of training and skills development in the community to prepare them for employment in the mining operations
- Assistance in the development of other business and economic activities independent of the mine so that the community can be self-sustaining after mining activities are finished

Building a common understanding and relationship can be difficult with remote communities due to social and cultural barriers, and it is common for problems to occur due to the wrong assumptions about what the community really needs. A competent and experienced community services department will be recruited to assist with management of these issues.

Compensation for land is also a key community issue and one where care and judgement will be exercised to prevent conflict with members of the community. It is common that records of land ownership are not clear, and for overlapping land claims to be made. The project owner will work closely with the, government, local community leaders to ensure that the process is fair and transparent, and detailed records will be kept of all land payments, including surveys of the compensated area. All payments will be recorded with signed records and photographs of the persons being compensated to avoid future conflicts.

## 24.0 ECONOMIC ANALYSIS

### 24.1 Revenue Estimates

The following main technical parameters are considered in the estimation of the Kwamsisi Graphite Project financial analysis:

**Table 24.1: Input Data for the Project Financial Appraisal**

Zone	Volume体积	Tonnages吨	Average grade (%)平均品位
rt	矿床储量总吨数Total tonnage of deposit resources	9,000,000	8
rf	回收率Recovery rate	0.70	
dpy	每年运行天数Days of operation per year	300	Days
T	可开采吨数mining tonnages	2,783,288	Tonnes
L	矿山寿命mine life	5	Yrs
COP	生产能力/天production capacity/day	100.8	Tonnes
DMC	日开采能力mining capacity/day	1,800	Tonnes
AP	年生产量annual production capacity	30,240	Tpa
	估计品位范围estimated grade range	5 – 8	% TGC
	石墨销售价格Graphite sales price	680.00	\$/t

### 24.2 Cash Flow Analysis

Revenues and cost estimates made in sections 5 to 10, which are based on the proposed schedule of operations were evaluated and a cash flow analysis was generated to determine the Net Present Value (NPV). Table 12.2 is a cash flow analysis of the project and presents a picture of the schedules of costs and revenues, based on the following assumed financial parameters:

- Mine life of 9 years;
  - Income Tax rate of 30% applicable for Tanzania;
  - Government Loyalty
  - A Five-year investment tax credit has been considered under existing Tanzanian tax rules;
  - Tax exemption on fuel, oils, and other imported supplies has not been incorporated in the study though the project qualifies under existing tax incentives accorded to mine development projects in Tanzania. When these incentives are incorporated, it will greatly boost the cash flow of the project.

Based on the above parameters the project has shown to have good potential to generate cash as summarized in some of the important economic indicators shown in Table 13.2.

#### Assumptions

Graphite price will remain at USD \$680/ton over LOM.

**Table 24.2: Estimated Annual NPV for 100% graphite Production for the First year**

<b>Entity个体</b>	<b>Amount (USD)金额</b>
年收入生产(0.7回收系数)Annual revenue (recovery rate 0.7)	<b>20,563,200.00</b>
运输费用transportation expenses	1,150,000.00
年环境管理成本Annual environmental management cost	116,100.00
营运资金operation cost	12,023,541.18
30% 所得税30%income tax	2,182,067.65
0.03% 服务税0.03% service tax	8,526.60
Total总计	15,480,235.42
<b>每年净利润Annual net profit</b>	<b>5,082,964.58</b>

#### Remark :

The current calculation model is calculated according to the ideal product selling price, which is only an expected income of both parties. The expected income is related to the operating cost, the selling price of goods and the local tax policy. The production is tentatively set at 30,000 tons, and the operating cost is fixed, the higher the selling price, the more taxes need to be paid, which can be appropriately reduced through the Subsidiary sales company model.

Both parties may have different opinions on the selling price, or they can distribute the total production amount according to the contract proportion, control the selling price by themselves, and increase the profits of both parties.

## 25.0 ADJACENT PROPERTIES

The potential graphite mine is around 700m NE of the Project area. The graphite mine share the same lithological and structural trends with the Kwamsisi Project site (NNE-SSW). The annual production of this graphite mine is not known, as the owner where not willing to share the information but it is approximately the daily production could be more than 100tons (TGC).

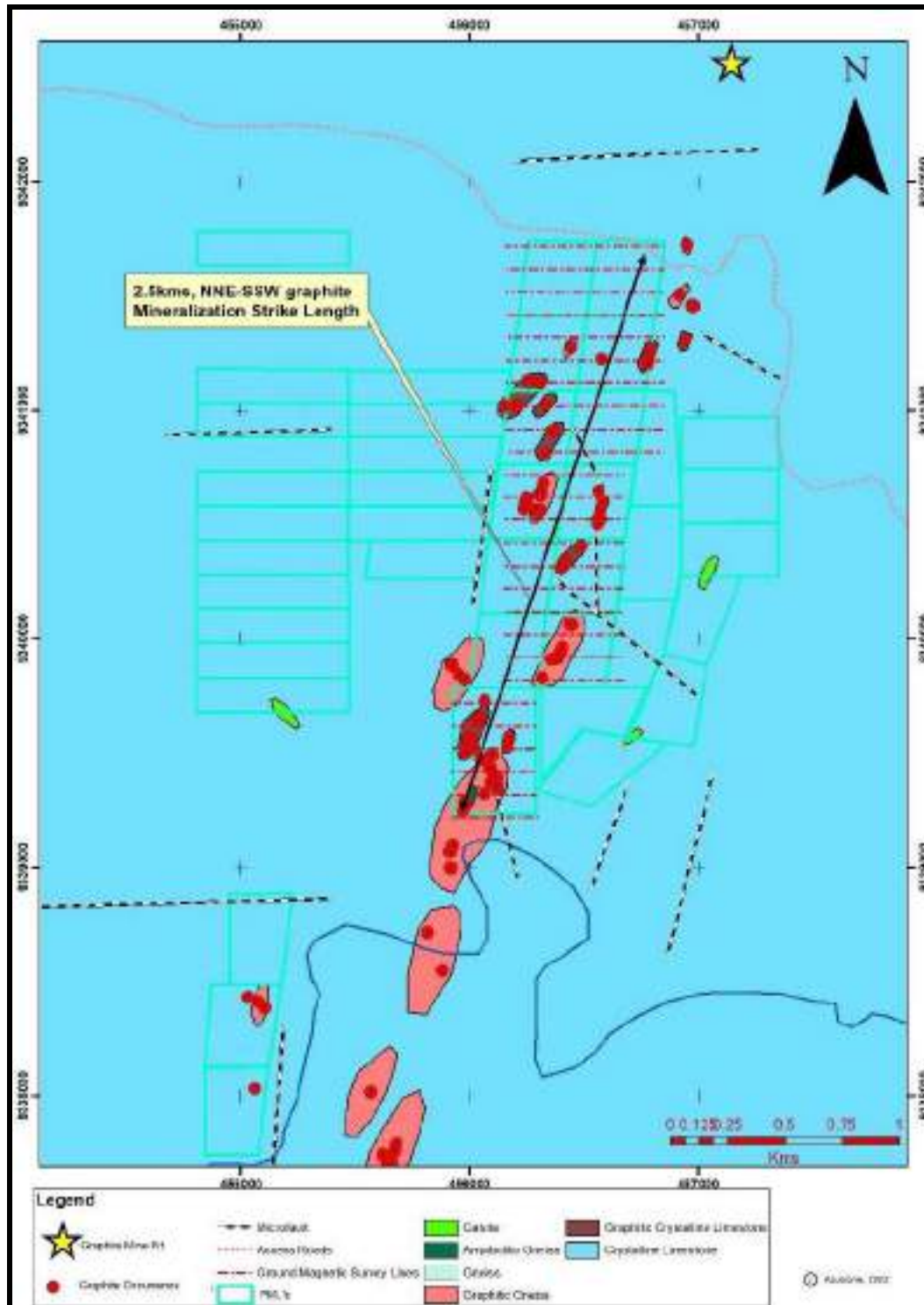


Figure 24.1: Graphite Mine adjacent to Kwamsisi Graphite Project

## 26.0 CONCLUSIONS

The graphite mineralization found at the Property is best categorized as a disseminated flake graphite deposit. The graphite mineralization on the Property is particularly amenable to extraction by quarry methods as it is lying at the shallow depth from the surface and offers the benefits of a low stripping ratio. The Deposit has road access and is located in an area of excellent infrastructure and resources.

So far, the detailed evaluation of this project has been completed with positive findings of graphite deposits which host extensive mineralization with a total Inferred Mineral Resource of 1,410,200 tonnes of graphite.

The Resource was calculated with a 5% Fixed Carbon cut-off grade and the average grade of 8 % fixed carbon. The average bulk density values for graphite ore is 2.5, and the average bulk density of the excavated material was used as 1.8, the total resource resources is 9,000,000 tons and the total minable ore is 2783288tons. The mining operation is expected for 300days/year with daily mining capacity 1,800tons which will produce 100.8 graphite tons per day and annual mining capacity of 540,000 tons of graphite ore. The annual graphite production will be 30,240 tons. The expected mining life is 5 years but during mining operation the drilling operation will be continuing in order to update the graphite resources into graphite reserve, hence it is estimated the mining life will reach 15 years.

The graphite mineralization at Kwamsisi property seems to be lithological controlled, mainly concentrated in graphitic gneiss and crystalline limestone which is associated with biotite and muscovite. All samples collected from graphitic gneiss has shown good grade of graphitic carbon ranging from 1.63% to 55% and average of 8%TGC which is an economic grade

## 27.0 RECOMMENDATIONS

- The Kwamsisi project host economic graphite mineralization covering a total area of approximately 400 hectares. The Project still need detailed study on economic criteria of the deposit which will increase the level of confidence on the mineral resource estimated so far. These studies include:
  - Conduct detailed feasibility which will include adequate information on project infrastructure, marketing and contract study, mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified.
  - Completing Environmental and Social Impact Assessment for the entire deposit which will be also needed together with other factors to put in consideration on converting the Mineral Resource to The Mineral Reserve.

Contingent on the successful completion of the phase i program, additional drilling would likely be required to provide sufficient data for an updated resource estimate. in addition to new drilling sampling of drill core would be necessary to conform with industry-accepted QA/QC procedures.

## 28.0 REFERENCE

Charles D Moye<sup>1, 2\*</sup> and Michael M Msabi<sup>1</sup>, 2021, Mineralogical and Geochemical Characteristics of Graphite-Bearing Rocks at Chenjere Area, South-Eastern Tanzania: Implications for the Nature and Quality of Graphite Mineralization

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## **29.0 CERTIFICATES OF QUALIFIED PERSONS**

### **20.1 Qualified Persons**

Nicholaus Sloo.

I, Nicholaus Sloo, as co-author of this technical report entitled “Kwamsisi graphite project Pre\_feasibility report” dated 23<sup>th</sup> February 2023, do hereby certify that:

**10. I am an employee of a Jorc qualified Exploration Geologist**

**11. This report is based on my technical and professional expertise being supported by actual data collected by the well experienced Geologist comprising a field team in the company. No any part of this report has been modified or reported based on my own influence in the Company (Azustone Resources Tanzania Ltd).**

**12. I am a graduate of University of Dar es Salaam, Tanzania with Bachelor of Science degree in Geology (Hons) in 2006.**

**13. I am an active member of the Australian Institute of Geoscientists (MAIG)**

**14. I have worked as Exploration geologist profession since my graduation in 2006. My relevant experience for the purpose of the Technical Report is:**

- Mineral exploration project planning, execution and supervision as well as mineral resource estimate experiences for open pit**
- Mineral resource estimation experiences for different commodities in Tanzania**
- Exploration planning and design and execution from glass route through detailed to mining phases for different mining/exploration companies in Tanzania**
- Held senior Exploration planning and mining services role in the mining industry.**

**15. I have sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as Competent Persons as defined in the JORC Code**

**2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. I am responsible for Resource Estimate sections of this Technical Report;**

- 16. I am verified the Project location and all field data collected in this project which has been integrated in this report and participated in the report preparation**
- 17. At the effective date of the Technical Report, to the best of my knowledge, information, and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.**
- 18. I verify that no any part of this Report is based on personal interest, all data reported in this report have been scientifically collected and processed using a series of internationally approved programs.**

Signed and dated this 22<sup>th</sup> day of February 2023.

**Nicholaus Sloo, Bsc in Geology, MAIG.**



## 29.2 Certificates



## APPENDICES

### APPENDIX A: List of Primary Mining Licenses covering the PML's Area Subject of the Geological Exploration.

S/N	LICENCE	LOCATION	REGISTERED OWNER	MINERAL	SIZE OF AREA COVERAGE
1	1374TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.28 Hectares
2	1375TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	10.00 Hectares
3	1381TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.9 Hectares
4	1379TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.99 Hectares
5	1380TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.98 Hectares
6	1349TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	10.00 Hectares
7	1348TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	10.00 Hectares
8	1353TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	10.00 Hectares
9	1346TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.99 Hectares
10	1444TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.99 Hectares
11	1342TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.98 Hectares
12	0068TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Feldspar	9.95 Hectares
13	1195TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.70 Hectares
14	1194TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.71 Hectares
15	1196TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.69 Hectares
16	1199TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	8.74 Hectares
17	1206TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.93 Hectares

S/N	LICENCE	LOCATION	REGISTERED OWNER	MINERAL	SIZE OF AREA COVERAGE
18	1205TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.63 Hectares
19	1204TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.66 Hectares
20	1200TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.69 Hectares
21	1207TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.63hectares
22	0067TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Feldspar	8.96 Hectares
23	0066TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Feldspar	8.50 Hectares
24	0065TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Feldspar	10.00 Hectares
25	0064TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Feldspar	10.00 Hectares
26	0063TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Feldspar	9.69 Hectares
27	1452TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.99 Hctares
28	1202TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.60 Hectares
29	1203TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.67 Hectares
30	1208TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.70 Hectares
31	1201TNG	Kwedikabu-Handeni	Mohamed §Zahor Mohamed	Graphite	9.63hectares
32	1197TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	9.76 Hectares
33	1198TNG	Kwedikabu-Handeni	Mohamed Zahor Mohamed	Graphite	8.77 Hectares
34	1345TNG	Kwedikabu-Bagamoyo	Kusini Gateway Industrial Park Limited	Graphite	9.98 Hectares
35	1456TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	10.00 Hectares
36	1454TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	10.00 Hectares
37	1405TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.99 Hectares
38	1453TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park	Graphite	9.84hectares

S/N	LICENCE	LOCATION	REGISTERED OWNER	MINERAL	SIZE OF AREA COVERAGE
			Limited		
39	1455TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.54 Hectares
40	1450TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.99hectares
41	1401TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	9.99hectares
42	1347TNG	Kwedikabu-Handeni	Kusini Gateway Industrial Park Limited	Graphite	10.00 Hectares

## Appendix B: Drill holes Locations

Hole_ID	X_Arc1960	Y_Arc1960	z_m	WGS84_X	WGS84_Y	Planned Depth_m	E.O.H_m
BHDD01	456430	9341220	182	38° 36' 25.8804"	-5° 57' 45.1764"	50	0.00
BHDD02	456580	9341220	180	38° 36' 30.7584"	-5° 57' 45.18"	50	0.00
BHDD03	456730	9341220	185	38° 36' 35.64"	-5° 57' 45.1836"	50	20.00
BHDD03B	456770	9341220	186	38° 36' 36.90"	-5° 57' 45.1836"	50	11.50
BHDD04	456360	9340920	170	38° 36' 23.598"	-5° 57' 54.9468"	50	13.00
BHDD05	456510	9340920	172	38° 36' 28.476"	-5° 57' 54.9504"	50	23.50
BHDD06	456660	9340920	178	38° 36' 33.354"	-5° 57' 54.954"	50	50.00
BHDD07	456520	9340608	158	38° 36' 28.7928"	-5° 58' 5.1096"	50	0.00
BHDD08	456585	9340608	170	38° 36' 30.9096"	-5° 58' 5.1132"	50	34.50
BHDD09	456490	9340520	149	38° 36' 27.8172"	-5° 58' 7.9752"	50	0.00
BHDD10	456565	9340518	160	38° 36' 30.2544"	-5° 58' 8.0436"	50	0.00
BHDD11	456458	9340432	148	38° 36' 26.7732"	-5° 58' 10.8408"	50	29.00
BHDD12	456516	9340431	148	38° 36' 28.6596"	-5° 58' 10.8768"	50	31.60
BHDD12B	456584	9340610	179	38° 36' 28.1"	-5° 58' 10.8768"	50	20.50
BHDD13	456285	9340064	168	38° 36' 21.1392"	-5° 58' 22.8216"	50	0.00
BHDD14	456436	9340064	162	38° 36' 26.0496"	-5° 58' 22.8252"	50	0.00
BHDD15	456263	9339960	169	38° 36' 20.4192"	-5° 58' 26.2056"	50	0.00
BHDD16	456400	9339960	164	38° 36' 24.876"	-5° 58' 26.2092"	50	0.00
BHDD17	456238	9339851	165	38° 36' 19.6056"	-5° 58' 29.7552"	50	0.00
BHDD18	456320	9339851	170	38° 36' 22.2696"	-5° 58' 29.7588"	50	0.00
BHDD19	456085	9339519	174	38° 36' 14.6196"	-5° 58' 40.566"	50	0.00
BHDD20	456193	9339520	185	38° 36' 18.1332"	-5° 58' 40.5336"	50	0.00
BHDD21	456070	9339360	163	38° 36' 14.1264"	-5° 58' 45.7428"	50	0.00

### Appendix C: Trenches Locations

WP	Arc1960_X	Arc1960_Y	Elev_m	WGS84_X	WGS84_Y
TR1	456442	9341282	184	38° 36' 26.2728"	-5° 57' 43.1568"
TR2	456582	9340602	178	38° 36' 30.8088"	-5° 58' 5.3076"
TR3	456780	9341207	188	38° 36' 37.2636"	-5° 57' 45.6084"
TR4	456288	9340571	172	38° 36' 21.2472"	-5° 58' 6.312"
TR5	456570	9340546	168	38° 36' 30.42"	-5° 58' 7.1328"
TR6	456322	9340666	167	38° 36' 22.356"	-5° 58' 3.216"
TR7	456116	9339362	167	38° 36' 15.624"	-5° 58' 45.678"
TR8	455062	9338423	141	38° 35' 41.316"	-5° 59' 16.2312"
TR9	455061	9338033	158	38° 35' 41.2728"	-5° 59' 28.932"
TR10	456004	9339526	172	38° 36' 11.9844"	-5° 58' 40.3356"
TR11	456174	9339575	185	38° 36' 17.5176"	-5° 58' 38.7408"
TR12	456314	9339838	186 m	38° 36' 22.0752"	-5° 58' 30.18"
TR13	456439	9340065	178 m	38° 36' 26.1468"	-5° 58' 22.7928"

## Appendix D: Laboratory Results\_Grab and Trenching Work

	 <b>SADCAS</b> SOUTH AFRICAN DEVELOPMENT CORP. LABORATORY	 GST GST/QAF 7.B.2 Effective Date: 15 Nov 2021
<b>TEST-5 0043</b>		
<b>ANALYTICAL REPORT</b>		
Lab ref: 2022-Z3EX 969		
Submitted by: AZUSTONE RESOURCES (T) LTD		
Received date: 08/11/2022		
Reported date: 10/11/2022		
#Samples: 22		
Pages: 2		
Type of Samples: ROCK		
Address: PO BOX 68163, DAR ES SALAAM		
Copy	<input type="text"/>	
Notes	<input type="text"/>	
Management Signatory		Technical Signatory
		
	BUNANZE SHIDA ✓	
	DELIPHINA ALEX	
	RIZKI WILLIAM	
<i>Results in this analytical report pertain to the samples provided to this laboratory for preparation and/or analysis as requested by the client.</i>		
<i>Geological Survey of Tanzania Conditions of Service apply</i>		
<i>This report may not be reproduced except in full, without written permission of the Laboratory</i>		
<i>These results are in conformity with ISO/IEC 17025:2017 requirement</i>		



## ANALYTICAL REPORT

Lab Ref: 2022-23EX 969  
Submitted by: AZUSTONE RESOURCES (T) LTD  
Received date: 08/11/2022  
Reported date: 10/11/2022  
Type of Samples: ROCK  
Sample condition: ACCEPTABLE  
Analysis Type: Proximate  
# Samples: 22

Sample ID	Total graphitic carbon (By Calculation)	Ash (DB)	Moisture Content (ADB)	Volatile Matter (DB)
TR01	13.28	82.73	0.46	3.53
TR02A	25.30	69.69	0.29	4.72
TR02B	18.01	77.18	0.78	4.03
TR03	30.74	64.8	0.60	3.86
TR04	28.08	65.96	0.05	4.91
TR05A	35.59	59.56	0.76	4.09
TR05B	31.42	62.99	0.61	4.98
TR06	15.98	80.48	0.31	3.23
TR07	9.67	85.64	0.46	4.03
TR08	9.58	85.95	0.41	4.06
TR09A	15.43	79.95	0.84	3.78
TR09B	16.44	78.56	0.99	4.01
TR10	34.17	60.84	0.06	4.93
TR11	13.26	82.45	0.71	3.58
TR12	17.99	76.67	0.96	4.38
TR13	11.33	83.61	0.28	4.78
TR014	20.1	75.50	0.39	4.01
KDG01	21.72	73.11	0.96	4.21
KDG02	12.05	84.63	0.54	2.78
KDG03	27.02	68.85	0.41	3.72
KDG04	35.38	59.45	0.96	4.21
KDG05	40.65	54.69	0.03	4.63
<b>METHOD</b>	<b>ASTM D3172</b>	<b>GST</b>	<b>ASTM D3302</b>	<b>ASTM D3175</b>

- not analysed | - element not determined | I.S. insufficient sample | L.N.R. listed not received | \* Accredited

Management Signatory

Technical Signatory

## Appendix E: Laboratory Results\_Drilling Work



TEST-5 0043



GST/QAF 7.8.2  
Effective Date: 15 Nov 2021

### ANALYTICAL REPORT

Lab ref: 2021-22 EX1441

Submitted by: BROAD RESOURCES(SINGAPORE) & AZUSTONE RESOURCES(T) LTD

Received date: 27/12/2022

Reported date: 05/01/2023

#Samples: 95

Pages: 6


Type of Samples: DRILL CORE

Address: P. O. BOX 68163, DAR ES SALAAM.


Copy

Notes

Management Signatory

  
P. Kasonga

Technical Signatory

  
RIZIKI WILLIAM  
BUNANZE SHIJA ✓  
DELIFINA ALEX

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These results are in conformity with ISO/IEC 17025:2017 requirement*

**Geological Survey of Tanzania**

Kikuyu Avenue 01, Dodoma, P. O. Box 003, Dodoma, Tanzania.  
t+255 (0)28 232 3020. f+255 (0) 28 232 3020 www.gst.go.tz  
Ministry of Minerals



## ANALYTICAL REPORT

Lab Ref: 2021-22 EX1441  
Submitted by: BROAD RESOURCES(SINGAPORE) & AZUSTONE RESOURCES(T) LTD  
Received date: 27/12/2022  
Reported date: 05/01/2023  
Type of Samples: DRILL CORE  
Sample condition: ACCEPTABLE  
# Samples: 95

S/N	Sample ID	Total Graphitic Carbon (Calculated)	Ash (ADB)	Volatile Matter (ADB)	Moisture Content (ADB)
1	HDD001	6.79	91.93	1.27	0.01
2	HDD002	12.75	82.82	4.35	0.08
3	HDD003	6.57	91.42	1.76	0.25
4	HDD004	6.29	90.38	3.23	0.10
5	HDD005	6.08	91.23	2.53	0.16
6	HDD006	7.58	90.71	1.50	0.21
7	HDD007	7.20	90.48	1.96	0.36
8	HDD008	6.46	91.09	2.04	0.41
9	HDD009	12.94	84.65	2.37	0.04
10	HDD010	12.30	85.80	1.82	0.08
11	HDD011	11.78	85.93	1.68	0.61
12	HDD012	23.83	70.87	4.57	0.73
13	HDD013	20.10	75.55	4.33	0.02
14	HDD014	11.15	86.24	2.55	0.06
15	HDD015	2.39	94.89	2.49	0.23
16	HDD016	6.31	91.13	2.10	0.46
17	HDD017	10.50	87.92	1.51	0.07
18	HDD018	5.59	92.54	1.28	0.59
19	HDD019	5.01	92.66	1.34	0.99
20	HDD020	8.53	88.07	3.20	0.20
21	HDD021	21.97	73.57	4.31	0.15
22	HDD022	19.97	76.30	3.72	0.01
<i>Units</i>		%	%	%	%
<i>METHOD</i>		ASTM D3172	GST	ASTM D3302	ASTM D3175

- not analysed | - element not determined | I.S. insufficient sample | L.N.R. listed not received | \* Accredited

Management Signatory

Technical Signatory



## ANALYTICAL REPORT

Lab Ref: 2021-22 EX1441  
Submitted by: BROAD RESOURCES(SINGAPORE) & AZUSTONE RESOURCES(T) LTD  
Received date: 27/12/2022  
Reported date: 05/01/2023  
Type of Samples: DRILL CORE  
Sample condition: ACCEPTABLE  
# Samples: 95

S/N	Sample ID	Total Graphitic Carbon (Calculated)	Ash (ADB)	Volatile Matter (ADB)	Moisture Content (ADB)
23	HDD023	28.51	68.85	2.61	0.02
24	HDD024	18.64	76.65	4.30	0.41
25	HDD025	10.77	86.66	2.11	0.46
26	HDD026	13.95	82.83	3.01	0.21
27	HDD027	18.08	77.15	4.28	0.49
28	HDD028	55.51	40.80	3.61	0.08
29	HDD029	35.99	60.83	3.09	0.09
30	HDD030	6.88	92.72	0.39	0.01
31	HDD031	14.02	81.64	4.31	0.03
32	HDD032	37.13	58.13	4.70	0.04
33	HDD033	28.33	70.51	1.01	0.15
34	HDD034	25.33	69.61	4.72	0.34
35	HDD035	48.28	47.54	3.92	0.26
36	HDD036	16.46	79.18	3.58	0.78
37	HDD037	6.50	90.84	2.13	0.53
38	HDD038	6.13	90.96	2.01	0.90
39	HDD039	6.81	92.10	0.71	0.38
40	HDD040	6.39	89.08	3.62	0.91
41	HDD041	4.42	94.12	1.21	0.25
42	HDD042	15.88	82.49	1.28	0.35
43	HDD043	6.72	88.55	4.30	0.43
44	HDD044	9.21	85.35	4.81	0.63
<b>Units</b>		<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
<b>METHOD</b>		<b>ASTM D3172</b>	<b>GST</b>	<b>ASTM D3302</b>	<b>ASTM D3175</b>

- not analysed | - element not determined | I.S. insufficient sample | L.N.R. listed not received | \* Accredited

Management Signatory

Technical Signatory



## ANALYTICAL REPORT

Lab Ref: 2021-22 EX1441

Submitted by: BROAD RESOURCES(SINGAPORE) & AZUSTONE RESOURCES(T) LTD

Received date: 27/12/2022

Reported date: 05/01/2023

Type of Samples: DRILL CORE

Sample condition: ACCEPTABLE

# Samples: 95

S/N	Sample ID	Total Graphitic Carbon (Calculated)	Ash (ADB)	Volatile Matter (ADB)	Moisture Content (ADB)
45	HDD045	13.49	81.99	4.23	0.29
46	HDD046	15.81	80.67	3.13	0.39
47	HDD047	16.78	78.66	4.10	0.46
48	HDD048	7.90	87.58	4.28	0.24
49	HDD049	8.33	88.61	2.85	0.21
50	HDD050	5.53	90.64	3.51	0.32
51	HDD051	5.90	90.31	3.44	0.35
52	HDD052	2.43	93.71	3.46	0.40
53	HDD053	8.57	89.77	1.30	0.36
54	HDD054	7.80	88.50	3.47	0.23
55	HDD055	5.44	91.60	2.05	0.91
56	HDD056	9.63	88.34	1.80	0.23
57	HDD057	20.61	74.46	4.79	0.14
58	HDD058	10.90	84.69	4.13	0.28
59	HDD059	11.21	83.81	4.54	0.44
60	HDD060	9.32	89.81	0.44	0.43
61	HDD061	12.94	82.78	3.70	0.58
62	HDD062	10.79	83.92	4.80	0.49
63	HDD063	2.45	95.89	1.02	0.64
64	HDD064	8.63	89.40	1.79	0.18
65	HDD065	10.66	84.16	4.27	0.91
66	HDD066	4.63	91.97	2.45	0.94
<b>Units</b>		%	%	%	%
<b>METHOD</b>		<b>ASTM D3172</b>	<b>GST</b>	<b>ASTM D3302</b>	<b>ASTM D3175</b>

- not analysed | - element not determined | I.S. insufficient sample | L.N.R. listed not received | \* Accredited

Management Signatory

Technical Signatory



## ANALYTICAL REPORT

Lab Ref: 2021-22 EX1441

Submitted by: BROAD RESOURCES(SINGAPORE) & AZUSTONE RESOURCES(T) LTD

Received date: 27/12/2022

Reported date: 05/01/2023

Type of Samples: DRILL CORE

Sample condition: ACCEPTABLE

# Samples: 95

S/N	Sample ID	Total Graphitic Carbon (Calculated)	Ash (ADB)	Volatile Matter (ADB)	Moisture Content (ADB)
67	HDD067	6.69	90.91	1.92	0.48
68	HDD068	10.61	84.74	4.08	0.57
69	HDD069	1.68	96.81	1.15	0.36
70	HDD070	32.07	63.58	4.15	0.20
71	HDD071	27.15	68.88	3.67	0.30
72	HDD072	29.66	66.68	3.01	0.65
73	HDD073	29.81	65.23	4.92	0.04
74	HDD074	16.43	78.98	4.56	0.03
75	HDD075	17.49	78.63	3.82	0.06
76	HDD076	12.51	85.90	1.28	0.31
77	HDD077	8.14	89.98	1.83	0.05
78	HDD078	14.74	83.14	1.82	0.30
79	HDD079	9.52	88.88	1.52	0.08
80	HDD080	11.40	86.55	2.02	0.03
81	HDD081	9.81	88.71	1.46	0.02
82	HDD082	9.04	87.35	2.54	0.07
83	HDD083	10.04	86.99	2.45	0.52
84	HDD084	12.20	86.45	1.28	0.07
85	HDD085	6.98	88.89	3.35	0.78
86	HDD086	2.90	95.48	0.73	0.89
87	HDD087	4.31	94.94	0.34	0.41
88	HDD088	3.69	95.24	0.71	0.36
<b>Units</b>		<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
<b>METHOD</b>		<b>ASTM D3172</b>	<b>GST</b>	<b>ASTM D3302</b>	<b>ASTM D3175</b>

- not analysed | -- element not determined | I.S. insufficient sample | L.N.R. listed not received | \* Accredited

Management Signatory

Technical Signatory



TEST-5 0043



GST/QAF 7.8.2

Effective Date: 15 Nov 2021

## ANALYTICAL REPORT

Lab Ref: 2021-22 EK1441

Submitted by: BROAD RESOURCES(SINGAPORE) & AZLSTONE RESOURCES(T) LTD

Received date: 27/12/2022

Reported date: 05/01/2023

Type of Samples: DRILL CORE

Sample condition: ACCEPTABLE

# Samples: 95

S/N	Sample ID	Total Graphitic Carbon (Calculated)	Ash (ADB)	Volatile Matter (ADB)	Moisture Content (ADB)
89	HCD089	4.26	95.15	0.43	0.16
90	HCD090	10.11	89.17	0.45	0.27
91	HCD091	2.37	96.28	0.84	0.51
92	HCD092	8.77	88.14	2.92	0.17
93	HCD093	3.82	95.28	0.35	0.55
94	HCD094	7.70	88.87	3.38	0.05
95	HCD095	5.96	89.54	0.49	0.01
<b>Units</b>		%	%	%	%
<b>METHOD</b>		<b>ASTM D3172</b>	<b>GST</b>	<b>ASTM D3302</b>	<b>ASTM D3175</b>

- not analysed | -- element not determined | I.S. insufficient sample | L.N.R. listed not received | \* Accredited

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## Appendix F: Petrographic Samples Analysis fo Determination of Flake Graphite

	<h1>LABORATORY REPORT</h1>	
		<small>GS/T/001/78.2/PM/09 Effective date: 20-11-2019</small>
<p><i>Client's Name:</i> Broad Resources(Singapore)&amp; Azurstone Resources(T) Ltd <i>Address:</i> P.O.BOX 68163,DSM <i>Laboratory Ref:</i> 2022-23EX 1442 <i>Received Date:</i> 27/12/2022 <i>Study Date:</i> 09/01/2023 <i>Reported Date:</i> 11/01/2023 <i># Samples:</i> 11 <i># Pages:</i> 27 <i>Type of Samples:</i> ROCK <i>Sample Condition:</i> DRY <i>Method:</i> <b>XLO1, PETROGRAPHIC STUDY</b></p>		
<i>Copy</i>	<div style="border: 1px solid black; width: 200px; height: 60px; margin: 0 auto;"></div>	
<i>Management Signatory</i>		<i>Analyst</i>
Name: .....		Name: .....
Signature: .....		Signature: .....
		<i>Supervisor</i>
		Name: .....
		Signature: .....
<p><small><i>This report pertains only to the samples provided to this laboratory for analysis or as requested by the client. Geological Survey of Tanzania Conditions of Service apply. This report may not be reproduced except in full, without written permission of the Laboratory. Results in this report are in conformity with ISO/IEC 17025:2017 requirements.</i></small></p>		
<p><b>Geological Survey of Tanzania</b> Kilaya Avenue 01, Dodoma, P.O. Box 903, Dodoma, Tanzania t +255 (0)26 232 3020 f +255 (0) 26 232 3020 www.gst.go.tz</p>		
Page 1 of 27		



## LABORATORY REPORT



GST/QAF 7.3.0 PMMH  
Effective date: 20.12.2018

*Laboratory Ref:* 2022-23EX 1442  
*Received Date:* 27/12/2022  
*Reported Date:* 11/01/2023  
*Total Samples:* 11  
*Type of Samples:* ROCK  
*Sample Condition:* DRY

### PETROGRAPHIC ANALYSIS REPORT

Eleven(11) rock samples submitted at GST Laboratory for petrographic study, polished thin sections were studied using a routine petrographic method and the results are here below:

**Sample Id:** HDD 010

#### Mineral composition

##### (a) Primary minerals

- 1.Orthoclase - 44%
- 2.Pyroxene - 38%
- 3.Calcite - 9%
- 4.Quartz - 4%
- 5.Biotite - 3%
- 6.Plagiochase(Albite) - 2%

**Rock name:** Syenite Porphyry

#### Description

The sample is of fine to medium grained size,anhedral to subhedral in crystal outline, the sample is slightly weathered and moderately fractured.

**Orthoclase** - are of medium grained size,anhedral to subhedral in crystal form, granular in habit.

**Pyroxene** - are of fine to medium grained size, anhedral to subhedral in crystal form and granular in habit.

**Calcite** - are of fine to medium grained size,anhedral to subhedral in crystal form, with pinkish-green tint,some occur as infill along fractures.



## LABORATORY REPORT

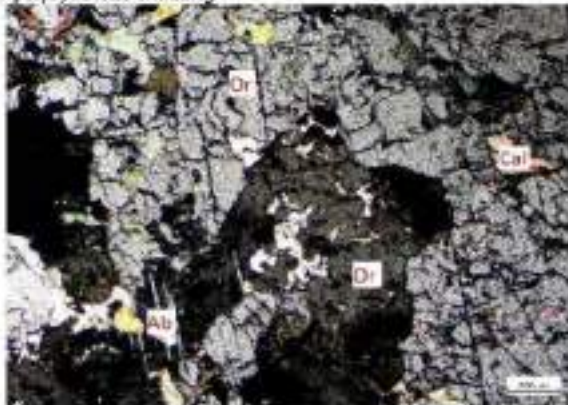


GS/NIG 73.0 PMMH  
Effective date: 20-12-2018

**Quartz** - are of fine to medium grained size, anhedral in crystal form, granular in habit, some grains tends to show undulatory extinction.

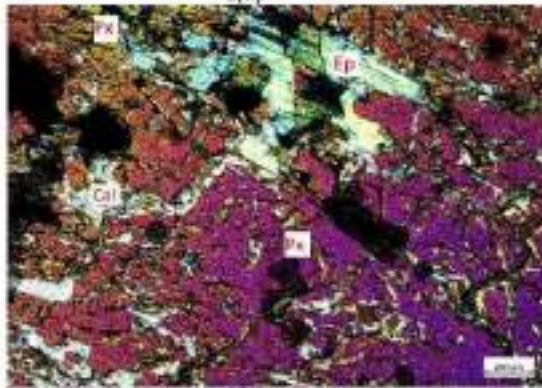
**Biotite** - are of medium grained size, subhedral in crystal form, some grains tends to show basal cleavage, some grains have altered to form Epidote mineral.

Plagioclase(**albite**) - are of fine to medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning.



1(a)

Fig.1:Microphotograph (1a) showing Calcite(Cal),Orthoclase (Or) and Albite (Ab) under Cross Polarised Light(XPL) at 5X magnification objective.



1(b)

Fig.1:Microphotograph(1b) showing Pyroxene(Px),Epidote(Ep) and Calcite(Ca) under Cross Polarized Light(XPL) at 5X magnification objective.



## LABORATORY REPORT



GSI/DAF 7.8.3(P)/MH  
Effective date: 20-12-2019

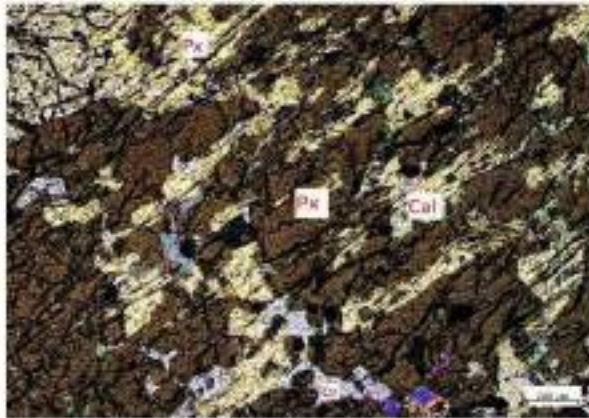


Fig.1: Microphotograph (1c) showing Pyroxene (Px) and Calcite (Cal) under Cross Polarised Light (XPL) at 5X magnification objective.

1©

**Sample Id:** HDD 011

### **Mineral composition**

#### **(a) Primary minerals**

1. Orthoclase - 49%
2. Pyroxene - 22%
3. Calcite - 19%
4. Biotite - 5%
5. Plagioclase (Albite) - 5%

**Rock name:** Syenite Porphyry

### **Description**

The sample is of fine to coarse grained size, anhedral to subhedral in crystal outline, the sample is slightly weathered and fractured.

**Orthoclase** - are of fine to coarse grained size, anhedral to subhedral in crystal form, granular in habit.

**Pyroxene** - are of fine to coarse grained size, anhedral to subhedral in crystal form and granular in habit.



## LABORATORY REPORT



GSN/DM 7.3 (2016/17)  
(Effective date: 2012-2015)

**Calcite** - are of medium grained size, anhedral to subhedral in crystal form, with pinkish-green tint.

**Biotite** - are of medium grained size, subhedral in crystal form, some tabular in habit, some grains have altered to form Epidote and Muscovite minerals.

**Plagioclase (albite)** - are of medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning.

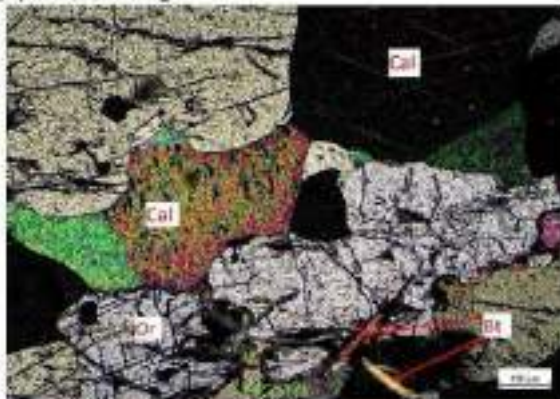


Fig.2: Microphotograph (2a) showing Biotite(Bo), Calcite(Cal) and Orthoclase(Or) under Cross Polarised Light(XPL) at 5X magnification objective.



Fig.2: Microphotograph (2b) showing Calcite(Cal), Pyroxene (Px), Plagioclase(Pl) under Cross Polarised Light(XPL) at 5X magnification objective.



## LABORATORY REPORT



GST/OM/ T.A. 20/MMR  
Effective Date: 10-12-2021

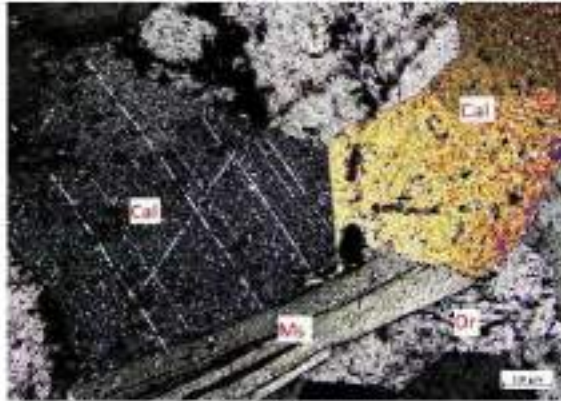


Fig.2: Microphotograph (2c) showing Muscovite(Ms), Calcite (Cal) and Orthoclase(Or) under Cross Polarised Light(XPL) at 10X magnification objective.

2c

**Sample Id:** HDD 032

### Mineral composition

#### (a) Primary minerals

1. Quartz - 30%
2. Graphite - 19%
3. Calcite - 18%
4. Pyrite - 12%
5. Biotite - 7%
6. Olivine - 6%
7. Plagioclase(Albite) - 5%
8. Hornblende - 3%

**Rock name:** Graphitic-Granite

### Description

The sample is of fine to coarse grained size, anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured.

**Quartz** - are of fine to medium grained size, anhedral in crystal form, granular in habit, show undulatory extinction.

**Calcite** - are of fine to medium grained size, subhedral in crystal form, with pinkish-green tint.



## LABORATORY REPORT



ICIT/OLP 7 & 8 (PMAP)  
Effective date: 30-12-2010

**Pyroxene** - are of fine to coarse grained size, anhedral to subhedral in crystal form and granular in habit.

**Graphite** - are of fine to coarse grained size, subhedral to euhedral in crystal form and fibrous in habit. Approximately average Flake size is 1.55mm.

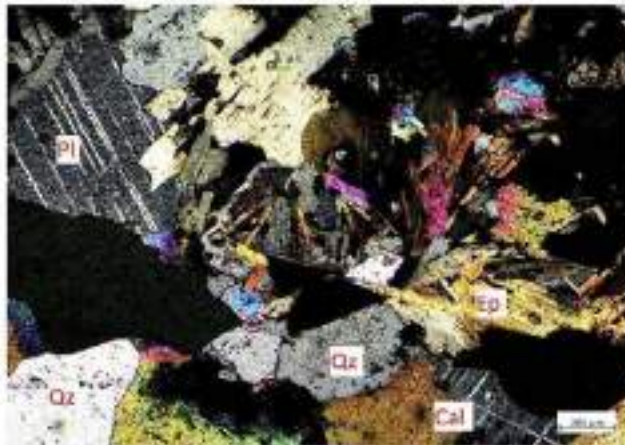
**Pyrite** - are of medium grained size, subhedral to euhedral in crystal form and some cubic in habit.

**Biotite** - are of medium grained size, subhedral in crystal form, some tabular in habit, some grains show perfect basal cleavage, some grains have altered to form Epidote mineral.

**Plagioclase(albite)** - are of medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning.

**Olivine** - are of medium to coarse grained size, anhedral to subhedral in crystal form, granular in habit, high interference colour.

**Hornblende** - are of fine to coarse grained size, anhedral to subhedral in crystal form, granular.



3(a)

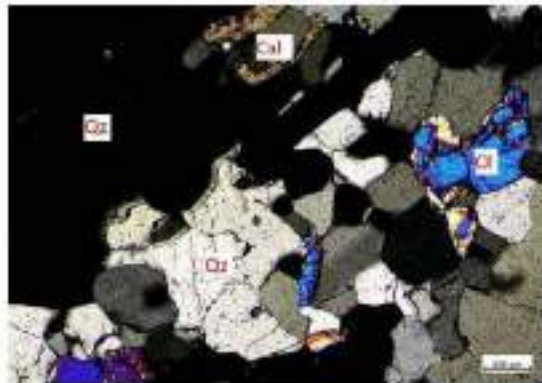
Fig.3: Microphotograph (3a) showing Quartz (Qz), Plagioclase (Pl), Calcite (Cal) and Epidote (Ep) under Cross Polarised Light (XPL) at 5X magnification objective.



## LABORATORY REPORT



GSN/DAF 3.4.2(Rev.01)  
Effective date: 20.12.2015



3(b)

Fig.3:Microphotograph (3b) showing Quartz(Qz),Olivine(Ol) and Calcite(Cal) under Cross Polarised Light(XPL) at 5X magnification objective.



3(c)

Fig.3:Microphotograph (3c) showing Graphite(Gr) and Pyrite(Py) under Reflected Light (RL) at 5X magnification objective.



## LABORATORY REPORT



Geological Survey of Nigeria (GSN)  
Effective date: 20-12-2019

**Sample Id:** HDD 033

### **Mineral composition**

#### **(a) Primary minerals**

1. Quartz - 34%
2. Graphite - 31%
3. Biotite - 9%
4. Calcite - 8%
5. Olivine - 6%
6. Pyrite - 5%
7. Plagioclase - 5%
8. Hornblende - 2%

**Rock name:** Graphitic-Granite

### **Description**

The sample is of fine to coarse grained size, anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured.

**Quartz** - are of medium grained size, anhedral in crystal form, granular in habit, show undulatory extinction.

**Calcite** - are of fine to medium grained size, subhedral in crystal form, with pinkish-green tint.

**Pyroxene** - are of fine to coarse grained size, anhedral to subhedral in crystal form and granular in habit.

**Graphite** - are of fine to medium grained size, subhedral to euhedral in crystal form and fibrous in habit. Approximately average flake size is 1.13mm.

**Pyrite** - are of fine to medium grained size, subhedral to euhedral in crystal form and some cubic in habit.

**Biotite** - are of medium grained size, subhedral in crystal form, some tabular in habit, some grains show perfect basal cleavage, many grains have altered to form Epidote mineral.

**Plagioclase** - are of medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning.

**Olivine** - are of medium grained size, anhedral to subhedral in crystal form, granular in habit, high interference colour.

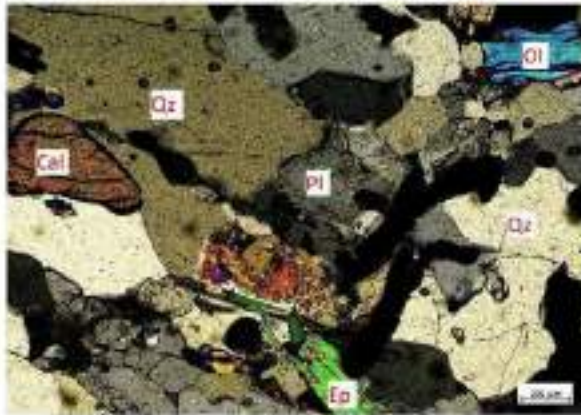


## LABORATORY REPORT



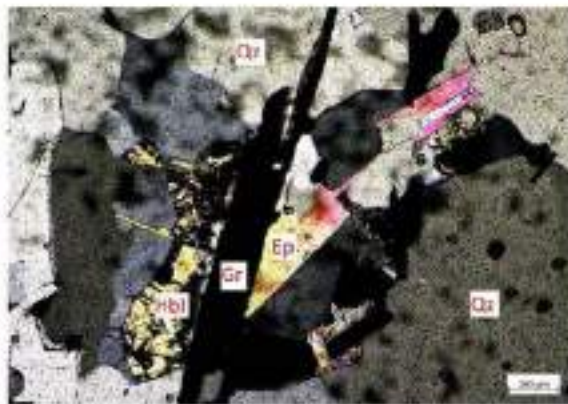
GSN/QR 7.6.2 (MAY)  
Effective date: 20.12.2013

**Hornblende** - are of medium grained size, anhedral to subhedral in crystal form, granular.



4(a)

Fig.4: Microphotograph (4a) showing Quartz(Qz), Olivine(Ol) Plagioclase(Pl), Epidote(Ep) and Calcite(Cal) under Cross Polarised Light(XPL) at 5X magnification objective.



4(b)

Fig.4: Microphotograph (4b) showing Quartz(Qz), Graphite(Gr) Epidote(Ep) and Hornblende(Hbl) under Cross Polarised Light (XPL) at 5X magnification objective.



## LABORATORY REPORT



GSI/DM/ 7.6.20(MMF)  
Effective date: 20-12-2019



Fig.4:Microphotograph (4c) showing Graphite(Gr) and Pyrite(Py) under Reflected Light (RL) at 5X magnification objective.

4(c)

**Sample Id:** HDD 051

### Mineral composition

#### (a) Primary minerals

- 1.Hornblende - 28%
- 2.Calcite - 19%
- 3.Graphite - 17%
- 4.Plagioclase - 12%
- 4.Quartz - 15%
- 6.Pyrite - 7%
- 7.Biotite - 2%

**Rock name:** Graphitic-Quartz Diorite

### Description

The sample is of fine to coarse grained size,anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured.

**Hornblende** - are of medium to coarse grained size,anhedral to subhedral in crystal form, granular.



## LABORATORY REPORT



EGS/DMF 78.2(P/AN/9)  
Effective date: 20-11-2019

**Calcite** - are of medium to coarse grained size, subhedral in crystal form, with pinkish-green tint.

**Graphite** - are of fine to coarse grained size, subhedral to euhedral in crystal form and fibrous in habit. Approximately average Flake size is 0.97mm.

**Quartz** - are of fine to coarse grained size, anhedral in crystal form, granular in habit, show undulatory extinction.

**Plagioclase** - are of medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning.

**Pyrite** - are of fine to medium grained size, subhedral to euhedral in crystal form and some cubic in habit.

**Biotite** - are of medium grained size, subhedral in crystal form, some grains have altered to form Epidote mineral.

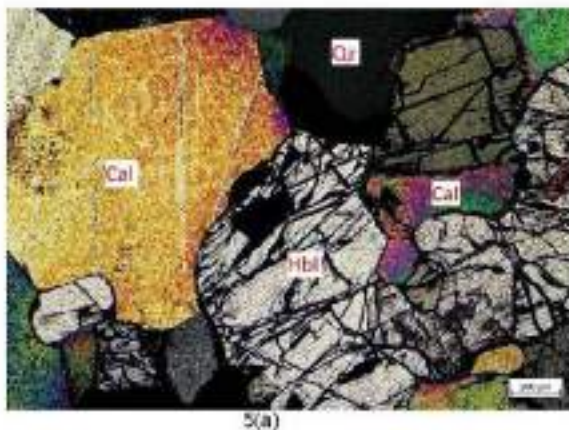


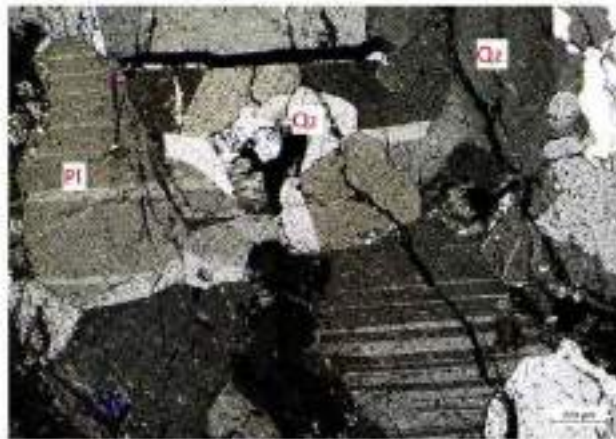
Fig.5-Microphotograph (5a) showing Quartz(Qz), Calcite(Cal) and Hornblende(Hbl) under Cross Polarised Light (XPL) at 5X magnification objective.



## LABORATORY REPORT



GSI/QM/7.5.2(PM/16)  
Effective date: 09.12.2015



5(b)

Fig.5:Microphotograph (5b) showing Quartz(Qz) and Plagioclase(Pl) under Cross Polarised Light (XPL) at 5X magnification objective.



5(c)

Fig.5:Microphotograph (5c) showing Graphite(Gr) and Pyrite(Py) under Reflected Light (RL) at 5X magnification objective.



## LABORATORY REPORT



GSN/GEF T.X.2(M/AM)  
Effective date: 10-12-2018

**Sample Id:** HDD 052

### **Mineral composition**

#### **(a) Primary minerals**

- 1.Quartz - 25%
- 2.Calcite - 21%
- 3.Olivine - 22%
- 4.Graphite - 17%
- 5.Pyrite - 10%
- 6.Plagioclase(Albite) - 5%

**Rock name:** Graphitic-Diabase

### **Description**

The sample is of fine to medium grained size, anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured.

**Quartz** - are of fine to medium grained size, anhedral in crystal form, granular in habit, show undulatory extinction.

**Calcite** - are of medium grained size, subhedral in crystal form, with pinkish-green tint.

**Graphite** - are of fine to medium grained size, subhedral to euhedral in crystal form and fibrous in habit. Approximately average Flake size is 0.93mm.

**Olivine** - are of medium grained size, subhedral in crystal form, showing high interference color.

**Plagioclase(Albite)** - are of fine to medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning.

**Pyrite** - are of fine to medium grained size, subhedral to euhedral in crystal form and some cubic in habit.



## LABORATORY REPORT

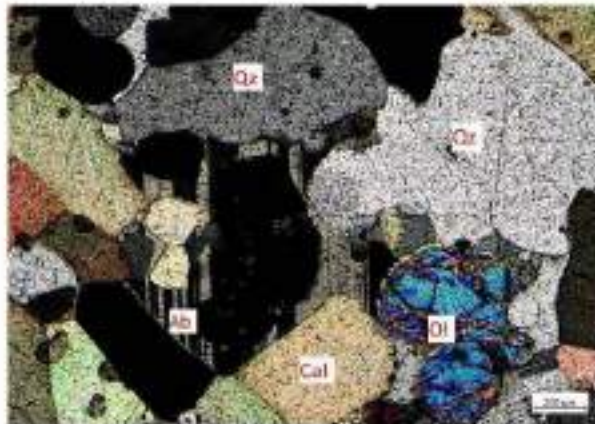


GSN/RAF T.4. (2014M/R)  
Effective date: 20-11-2015



6(a)

Fig.6:Microphotograph (6a) showing Quartz(Qz), Calcite(Cal) and Olivine(Ol) under Cross Polarised Light (XPL) at 5X magnification objective.



6(b)

Fig.6:Microphotograph (6b) showing Quartz(Qz), Calcite(Cal) Albite(Ab) and Olivine(Ol) under Cross Polarised Light (XPL) at 5X magnification objective.



## LABORATORY REPORT



GSI/DG/ 7.1.3/PM/MP/1  
Effective date: 10-12-2019



Fig.6:Microphotograph (6c) showing Graphite(Gr) and Pyrite(Py) under Reflected Light (RL) at 5X magnification objective.

6c

**Sample Id:** HDD 053

### Mineral composition

#### (a) Primary minerals

- 1.Plagioclase - 23%
- 2.Quartz - 20%
- 3.Graphite - 18%
- 4.Calcite - 11%
- 5.Olivine - 12%
- 6.Biotite - 9%
- 7.Pyrite - 4%
- 8.Hornblende - 3%

**Rock name:** Graphitic-Diabase

### Description

The sample is of fine to medium grained size, anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured.

**Plagioclase(Albite)** - are of medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning.



## LABORATORY REPORT



GS/DAI 7.8 (PM/MH)  
Effective date: 23-12-2019

**Graphite** - are of fine to medium grained size, subhedral to euhedral in crystal form and fibrous in habit. Approximately average Flake size is 0.06mm.

**Quartz** - are of fine to medium grained size, anhedral in crystal form, granular in habit, show undulatory extinction.

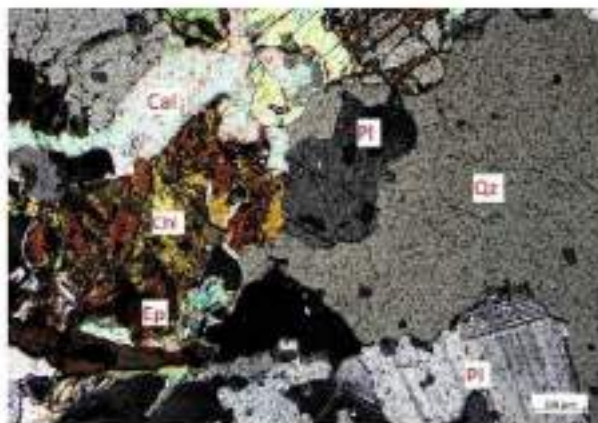
**Olivine** - are of fine to medium grained size, anhedral to subhedral in crystal form, shows high interference color.

**Calcite** - are of medium to coarse grained size, subhedral in crystal form, with pinkish-green tint.

**Biotite** - are of medium grained size, subhedral in crystal form, some grains have altered to form Chlorite and Epidote mineral.

**Hornblende** - are of medium grained size, anhedral to subhedral in crystal form, granular.

**Pyrite** - are of fine to medium grained size, subhedral to euhedral in crystal form and some cubic in habit.



7(a)

Fig.7:Microphotograph (7a) showing Quartz(Qz), Calcite(Cal) Plagioclase(Pl), Chlorite and Epidote(Ep) under Cross Polarised Light (XPL) at 5X magnification objective.



## LABORATORY REPORT



GSZ/048 7 & 8 (PHMPP)  
Effective date: 20-12-2010



7(b)

Fig.7: Microphotograph (7b) showing Quartz(Qz), Plagioclase(Pl) and Olivine(Ol) under Cross Polarised Light (XPL) at 5X magnification objective.



7(c)

Fig.7: Microphotograph (7c) showing Graphite(Gr) and Pyrite(Py) under Reflected Light (RL) at 5X magnification objective.



## LABORATORY REPORT



GSI/GAF T.L.2(PMMH)  
Effective date: 20-11-2019

**Sample Id:** HDD 054

### **Mineral composition**

#### **(a) Primary minerals**

1. Quartz - 28%
2. Plagioclase (Albite), Microcline - 11%
3. Graphite - 23%
4. Calcite - 10%
5. Olivine - 17%
6. Biotite - 3%
7. Pyrite - 8%

**Rock name:** Graphitic Diabase

### **Description**

The sample is of fine to coarse grained size, anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured.

**Quartz** - are of fine to coarse grained size, anhedral in crystal form, granular in habit, show undulatory extinction.

**Graphite** - are of fine to medium grained size, subhedral in crystal form and fibrous in habit. Approximately average Flake size is 2.10 mm.

**Olivine** - are of fine to coarse grained size, anhedral to subhedral in crystal form, shows high interference color.

**Plagioclase (Albite), Microcline** - are of medium grained size, subhedral in crystal form, Albite tend to show polysynthetic twinning, while **microcline** show cross hatched twin.

**Calcite** - are of medium grained size, subhedral in crystal form, with pinkish-green tint.

**Pyrite** - are of medium grained size, subhedral in crystal form and some cubic in habit.

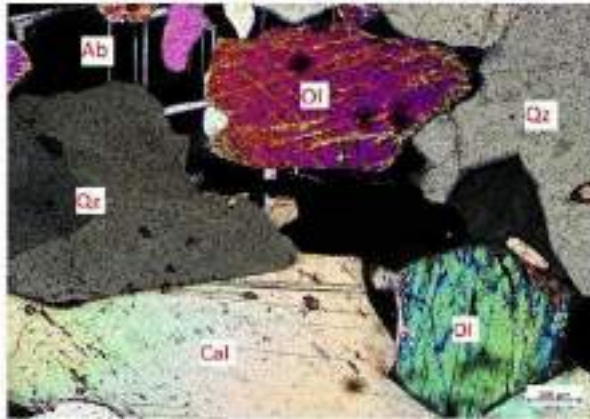
**Biotite** - are of medium grained size, subhedral in crystal form, some grains have altered to form Epidote mineral.



## LABORATORY REPORT



GSN/DAF 7.3.2(PMWP)  
Effective date: 03-11-2018



8(a)

Fig.8:Microphotograph (8a) showing Quartz(Qz),Calcite(Cal) Albite(Ab) and Olivine(Ol) under Cross Polarised Light (XPL) at 5X magnification objective.



8(b)

Fig.8:Microphotograph (8b) showing Graphite(Gr) and Pyrite(Py) under Reflected Light (RL) at 5X magnification objective.



## LABORATORY REPORT



GS/KAR 1 & 2 (P/M/P)  
Effective date: 20-12-2012

**Sample id:** HDD 076

### Mineral composition

#### (a) Primary minerals

1. Orthoclase - 24%
2. Graphite - 22%
3. Biotite - 10%
4. Olivine - 14%
5. Pyroxene - 9%
6. Plagioclase(Albite) - 9%
7. Calcite - 7%
8. Pyrite - 5%

**Rock name:** Graphitic-Granite Porphyry

### Description

The sample is of fine to coarse grained size, anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured. Graphite observed in hand specimen.

**Orthoclase** - are of fine to coarse grained size, anhedral to subhedral in crystal form, granular in habit.

**Biotite** - are of medium grained size, subhedral in crystal form, some grains tends to have perfect basal cleavage, some grains have altered to form Epidote mineral.

**Olivine** - are of fine to coarse grained size, anhedral to subhedral in crystal form, shows high interference color.

**Pyroxene** - are of fine to coarse grained size, anhedral in crystal form, granular in habit.

**Plagioclase(Albite)** - are of medium grained size, subhedral in crystal form, Albite tends to show polysynthetic twinning.

**Calcite** - are of fine to coarse grained size, anhedral to subhedral in crystal form, with pinkish-green tint.

**Pyrite** - are of fine to medium grained size, subhedral in crystal form and some cubic in habit.



## LABORATORY REPORT



OST/OM/ T.A. 20MM/18  
Effective Date: 10-12-2023

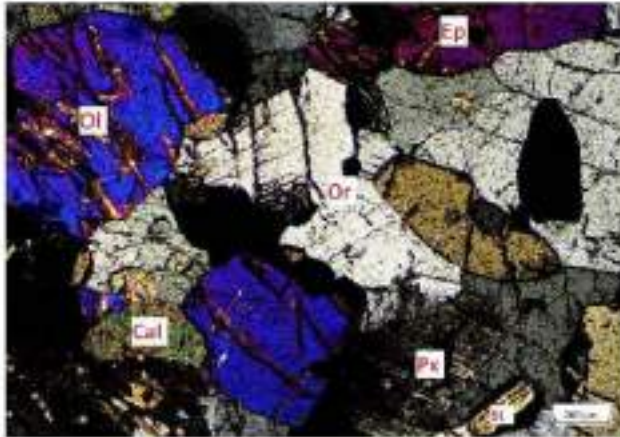


Fig.9: Microphotograph (9a) showing Orthoclase(Or), Calcite (Cal), Pyroxene(Px), Epidote(Ep), Biotite(Bt) and Olivine(Ol) under Cross Polarised Light (XPL) at 5X magnification objective.

9(a)

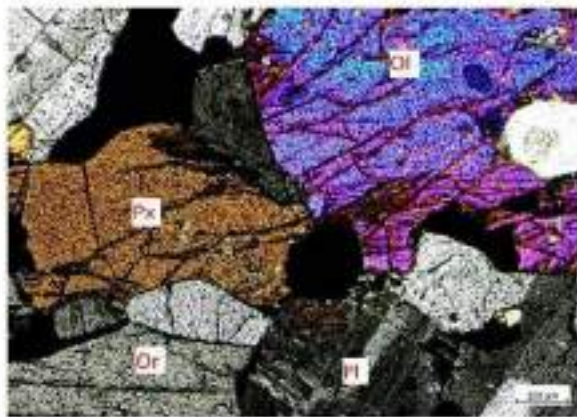


Fig.9: Microphotograph (9b) showing Pyroxene(Px), Olivine(Ol), Plagioclase(Pl) and Orthoclase(Or) under Cross Polarised Light (XPL) at 5X magnification objective.

9(b)



## LABORATORY REPORT



GS/KAR P.F. 2/MS/KS  
Effective date: 10-12-2019

**Sample Id:** HDD 077

### **Mineral composition**

#### **(a) Primary minerals**

1. Quartz - 34%
2. Graphite - 29%
3. Garnet - 19%
4. Olivine - 7%
5. Pyrite - 6%
6. Calcite - 3%
7. Biotite - 2%

**Rock name:** Graphitic-Granite Porphyry

### **Description**

The sample is of fine to coarse grained size, anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured.

**Quartz** - are of fine to coarse grained size, anhedral in crystal form, granular in habit, shows undulatory extinction.

**Graphite** - are of medium grained size, subhedral in crystal form and fibrous in habit. Approximately average Flake size is 0.71mm.

**Garnet** - are of fine to coarse grained size, anhedral to subhedral in crystal form, granular in habit, with irregular fractures.

**Olivine** - are of fine to coarse grained size, anhedral to subhedral in crystal form, shows high interference color.

**Pyrite** - are of medium grained size, subhedral in crystal form and some cubic in habit.

**Calcite** - are of fine to coarse grained size, anhedral to subhedral in crystal form, with pinkish-green tint.

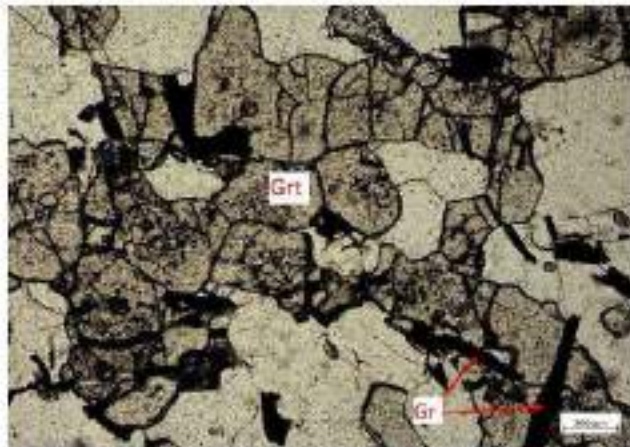
**Biotite** - are of medium grained size, subhedral in crystal form, some grains have altered to form Epidote mineral.



## LABORATORY REPORT

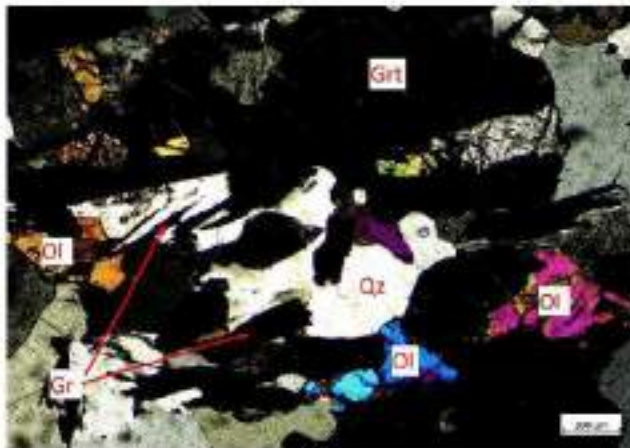


GGI/CLAF 2.3.2(P/MMP)  
Effective date: 28-12-2019



10(a)

Fig.10:Microphotograph (10a) showing Garnet(Grt), Graphite (Gr) under Plane Polarised Light (PPL) at 5X magnification objective.



10(b)

Fig.10:Microphotograph (10b) showing Garnet (Grt), Olivine(Ol),Quartz(Qz) and Graphite(Gr) under Cross Polarised Light (XPL) at 5X magnification objective.



## LABORATORY REPORT



CGT/2016-78-20/PM/01  
Effectiveness date: 29-12-2015



Fig.10: Microphotograph (10c) showing Graphite(Gr) under Reflected Light (RL) at 5X magnification objective.

10(c)

**Sample Id:** HDD 078

### **Mineral composition**

#### **(a) Primary minerals**

- 1.Quartz - 37%
- 2.Graphite - 17%
- 3.Garnet - 11%
- 4.Plagioclase(Albite) - 10%
- 5.Biotite - 9%
- 6.Pyrite - 7%
- 7.Olivine - 5%
- 8.Calcite - 4%

**Rock name:** Graphitic-Granite Porphyry

### **Description**

The sample is of fine to coarse grained size, anhedral to euhedral in crystal outline, the sample is slightly weathered and fractured.



## LABORATORY REPORT



Q17/15/ 74-20/AM/01  
Effective date: 29-12-2013

**Quartz** - are of fine to coarse grained size, anhedral in crystal form, granular in habit, shows undulatory extinction.

**Graphite** - are of fine to medium grained size, subhedral in crystal form and fibrous in habit. Approximately average Flake size is 1.08mm.

**Garnet** - are of medium grained size, anhedral to subhedral in crystal form, granular in habit, with irregular fractures.

**Plagioclase** - are of medium grained size, subhedral in crystal form, some grains tabular in habit, showing polysynthetic twinning.

**Biotite** - are of medium grained size, subhedral in crystal form, some grains show perfect basal cleavage, many grains have altered to form Epidote mineral.

**Pyrite** - are of medium grained size, subhedral to euhedral in crystal form and some cubic in habit.

**Olivine** - are of medium grained size, anhedral to subhedral in crystal form, granular in habit, shows high interference color.

**Calcite** - are of fine to coarse grained size, anhedral to subhedral in crystal form, with pinkish-green tint.



11(a)

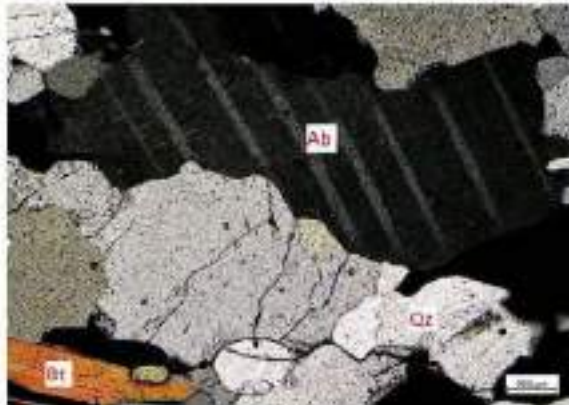
Fig.11: Microphotograph (11a) showing Garnet (Grt), Olivine (Ol), Quartz (Qtz) and Epidote (Ep) under Cross Polarised Light (XPL) at 5X magnification objective.



## LABORATORY REPORT



SCT/OLP 1 & 2 (PMAP)  
Effective date: 30-12-2010



11(b)

Fig.11:Microphotograph (11b) showing Albite (Ab), Quartz(Qz) and Biotite(Bt) under Cross Polarised Light (XPL) at 5X magnification objective.



11(c)

Fig.11:Microphotograph (11c) showing Graphite(Gr) and Pyrite(Py) under Reflected Light (RL) at 5X magnification objective.

Management Signatory  
Signature: .....

Analyst  
Signature: .....

Supervisor  
Signature: .....

## Appendix G: Sample List, Sampling Interval and Assay Results

HOLE_ID	Sample_No	mFrom	mTo	Sample Interval_m	TGC_%	Ash_%	VM_%	MC_%	QC_ Category
BHDD08	HDD001	0.00	0.50	0.50	6.79	91.93	1.27	0.01	
BHDD08	HDD002	0.50	2.50	2.00	12.75	82.82	4.35	0.08	
BHDD08	HDD003	2.50	4.00	1.50	6.57	91.42	1.76	0.25	
BHDD08	HDD004	4.00	6.00	2.00	6.29	90.38	3.23	0.10	
BHDD08	HDD005	6.00	8.00	2.00	6.08	91.23	2.53	0.16	
BHDD08	HDD006	8.00	10.00	2.00	7.58	90.71	1.50	0.21	
BHDD08	HDD007	10.00	12.00	2.00	7.20	90.48	1.96	0.36	
BHDD08	HDD008	12.00	14.00	2.00	6.46	91.09	2.04	0.41	
BHDD08	HDD009	14.00	15.00	1.00	12.94	84.65	2.37	0.04	
BHDD08	HDD010	15.00	17.00	2.00	12.30	85.80	1.82	0.08	
BHDD08	HDD011	17.00	19.00	2.00	11.78	85.93	1.68	0.61	
BHDD08	HDD012	19.00	21.00	2.00	23.85	70.87	4.57	0.73	
BHDD08	HDD013	21.00	23.00	2.00	20.10	75.55	4.33	0.02	
BHDD08	HDD014	23.00	23.60	0.60	11.15	86.24	2.55	0.06	
BHDD08	HDD015	26.80	27.80	1.00	2.39	94.89	2.49	0.23	
BHDD08	HDD016	29.85	30.80	0.95	6.31	91.13	2.10	0.46	
BHDD08	HDD017	30.80	31.65	0.85	10.50	87.92	1.51	0.07	
BHDD11	HDD018	0.00	1.20	1.20	5.59	92.54	1.28	0.59	
BHDD11	HDD019	1.20	3.00	1.80	5.01	92.66	1.34	0.99	
BHDD11	HDD020	3.00	5.00	2.00	8.53	88.07	3.20	0.20	
BHDD11	HDD021	5.00	6.10	1.10	21.97	73.57	4.31	0.15	
BHDD11	HDD022	6.10	8.00	1.90	19.97	76.30	3.72	0.01	
BHDD11	HDD023	8.00	10.00	2.00	28.51	68.86	2.61	0.02	
BHDD11	HDD024	10.00	12.00	2.00	18.64	76.65	4.30	0.41	Original
BHDD11	HDD025	10.00	12.00	2.00	10.77	86.66	2.11	0.46	Duplicate
BHDD11	HDD026	12.00	14.00	2.00	13.95	82.83	3.01	0.21	
BHDD11	HDD027	14.00	16.00	2.00	18.08	77.15	4.28	0.49	
BHDD11	HDD028	16.00	18.00	2.00	55.51	40.80	3.61	0.08	
BHDD11	HDD029	18.00	20.00	2.00	35.99	60.83	3.09	0.09	
	HDD030				6.88	92.72	0.39	0.01	RSP/PULP
BHDD11	HDD031	20.00	22.00	2.00	14.02	81.64	4.31	0.03	
BHDD11	HDD032	22.00	24.00	2.00	37.13	58.13	4.70	0.04	
BHDD11	HDD033	24.00	26.00	2.00	28.33	70.51	1.01	0.15	
BHDD11	HDD034	26.00	28.00	1.00	25.33	69.61	4.72	0.34	
BHDD11	HDD035	28.00	29.00	1.00	48.28	47.54	3.92	0.26	
BHDD06	HDD036	0.00	1.00	1.00	16.46	79.18	3.58	0.78	
BHDD06	HDD037	1.00	3.00	2.00	6.50	90.84	2.13	0.53	
BHDD06	HDD038	3.00	5.00	2.00	6.13	90.96	2.01	0.90	
BHDD06	HDD039	5.00	7.00	2.00	6.81	92.10	0.71	0.38	
BHDD06	HDD040	7.00	9.00	2.00	6.39	89.08	3.62	0.91	
BHDD06	HDD041	9.00	11.00	2.00	4.42	94.12	1.21	0.25	
BHDD06	HDD042	11.00	13.00	2.00	15.88	82.49	1.28	0.35	
BHDD06	HDD043	13.00	15.00	2.00	6.72	88.55	4.30	0.43	
BHDD06	HDD044	15.00	17.00	2.00	9.21	85.35	4.81	0.63	
BHDD06	HDD045	17.00	19.00	2.00	13.49	81.99	4.23	0.29	
BHDD06	HDD046	19.00	20.20	1.20	15.81	80.67	3.13	0.39	
BHDD06	HDD047	20.20	22.00	1.80	16.78	78.66	4.10	0.46	
BHDD06	HDD048	22.00	24.00	2.00	7.90	87.58	4.28	0.24	
BHDD06	HDD049	24.00	25.50	1.50	8.33	88.61	2.85	0.21	Original
BHDD06	HDD050	24.00	25.50	1.50	5.53	90.64	3.51	0.32	Duplicate
BHDD06	HDD051	25.80	28.00	2.20	5.90	90.31	3.44	0.35	
BHDD06	HDD052	28.00	30.00	2.00	2.43	93.71	3.46	0.40	

HOLE_ID	Sample_No	mFrom	mTo	Sample Inteerval_m	TGC %	Ash %	VM %	MC %	QC_ Catergory
BHDD06	HDD053	30.00	32.00	2.00	8.57	89.77	1.30	0.36	
BHDD06	HDD054	32.00	34.00	2.00	7.80	88.50	3.47	0.24	
BHDD06	HDD055	34.00	36.00	2.00	5.44	91.60	2.05	0.91	
BHDD06	HDD056	36.00	37.20	1.20	9.63	88.34	1.80	0.23	
BHDD06	HDD057	37.20	40.00	2.80	20.61	74.46	4.79	0.14	
BHDD06	HDD058	40.00	42.00	2.00	10.90	84.69	4.13	0.28	
BHDD06	HDD059	42.00	44.00	2.00	11.21	83.81	4.54	0.44	
	HDD060				9.32	89.81	0.44	0.43	RSP/PULP
BHDD06	HDD061	44.00	46.00	2.00	12.94	82.78	3.70	0.58	
BHDD06	HDD062	46.00	48.00	2.00	10.79	83.92	4.80	0.49	
BHDD06	HDD063	48.00	50.00	2.00	2.45	95.89	1.02	0.64	
BHDD12	HDD064	0.00	1.00	1.00	8.63	89.40	1.79	0.18	
BHDD12	HDD065	1.00	3.00	2.00	10.66	84.16	4.27	0.91	
BHDD12	HDD066	3.00	5.00	2.00	4.63	91.97	2.46	0.94	
BHDD12	HDD067	5.00	7.00	2.00	6.69	90.91	1.92	0.48	
BHDD12	HDD068	7.00	9.00	2.00	10.61	84.74	4.08	0.57	
BHDD12	HDD069	9.00	10.00	1.00	1.68	96.81	1.15	0.36	
BHDD12	HDD070	10.00	12.00	2.00	32.07	63.58	4.15	0.20	
BHDD12	HDD071	12.00	14.00	2.00	27.15	68.88	3.67	0.30	
BHDD12	HDD072	14.00	16.00	2.00	29.66	66.68	3.01	0.65	
BHDD12	HDD073	16.00	18.00	2.00	29.81	65.23	4.92	0.04	
BHDD12	HDD074	18.00	20.00	2.00	16.43	78.98	4.56	0.03	ORIG
BHDD12	HDD075	18.00	20.00	2.00	17.49	78.63	3.82	0.06	Duplicate
BHDD12	HDD076	20.00	22.00	2.00	12.51	85.90	1.28	0.31	
BHDD12	HDD077	22.00	24.00	2.00	8.14	89.98	1.83	0.05	
BHDD12	HDD078	24.00	26.00	2.00	14.74	83.14	1.82	0.30	
BHDD12	HDD079	26.00	28.00	2.00	9.52	88.88	1.52	0.08	
BHDD12	HDD080	28.00	30.00	2.00	11.40	86.55	2.02	0.03	
BHDD12	HDD081	30.00	31.60	1.60	9.81	88.71	1.46	0.02	
BHDD05	HDD082	0.00	1.00	1.00	9.04	87.35	2.54	0.07	
BHDD05	HDD083	1.00	3.00	2.00	10.04	86.99	2.45	0.52	
BHDD05	HDD084	3.00	5.00	2.00	12.20	86.45	1.28	0.07	
BHDD05	HDD085	5.00	7.00	2.00	6.98	88.89	3.35	0.78	
BHDD05	HDD086	7.00	9.00	2.00	2.90	95.48	0.73	0.89	
BHDD05	HDD087	9.00	11.00	2.00	4.31	94.94	0.34	0.41	
BHDD05	HDD088	11.00	13.00	2.00	3.69	95.24	0.71	0.36	
BHDD05	HDD089	13.00	15.00	2.00	4.26	95.15	0.43	0.16	
	HDD090				10.11	89.17	0.43	0.16	RSP/PULP
BHDD05	HDD091	15.00	16.90	1.90	2.37	96.28	0.84	0.51	
BHDD05	HDD092	16.90	19.00	2.10	8.77	88.14	2.92	0.17	
BHDD05	HDD093	19.00	20.40	1.40	3.82	95.28	0.35	0.55	
BHDD05	HDD094	20.40	22.00	1.60	7.70	88.87	3.38	0.05	
BHDD05	HDD095	22.00	23.50	1.50	9.96	89.54	0.49	0.01	