# VAST RESOURCES PLC

# MINERAL RESOURCE ESTIMATE FOR THE MANAILA POLYMETALLIC MINE, SUCEAVA COUNTY, ROMANIA

28 February 2018

Prepared by:

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## 1. Executive Summary

Vast Resources PLC ("Vast") has completed an updated mineral resource estimate for its 100% owned Manaila Polymetallic Mine ("MPM") located at Iacobeni in the Suceava County of Romania. The mineral resource estimate has been completed following the principles of the 2012 edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, the ("JORC") code.

Vast is a multi-commodity mining company with operations in Zimbabwe, the Pickstone – Peerless Gold Mine, and within Romania at MPM. The company is listed on the Alternative Investment Market ("AIM") of the London Stock Exchange ("LSE") Code: VAST. The Company has been active with exploration in Zimbabwe since 2004 and in 2015 transformed itself from an exploration company to a mining company. The company has had a presence in Romania in Romania since 2012, is currently awaiting the mining licence for its Baita Plai polymetallic, multi – commodity operation, and has been operating MPM since 2015.

The subject of the mineral resource report is a mineral resource update post surface drilling during 2017 at MPM. Previous mineral resource estimates were completed by Agentia Nationala pentru Resurse Minerala, the National Agency for Mineral Resources ("ANRM") of Romania. These mineral resource estimates were reported under the Russian Code for reporting of Mineral Reserves ("NAEN Code"). The Mineral Resource estimation is based on surface and underground drill holes and underground channel sampling.

This Report has been prepared based on technical reviews and information gathered by staff of Vast from August 2015 to November 2017. The effective date of the mineral resource estimate is 28 February 2018.

The information in this report that relates to Exploration Targets, Exploration Results, Mineral Resources or Ore Reserves is based on information compiled by Mr Craig Harvey, the Chief Operating Officer for Vast and a full time employee of the company. Mr Harvey is a Competent Person who is a Member of the Australian Institute of Geoscientists and of the Geological Society of South Africa, a Recognised Professional Organisation included in a list that is posted on the ASX website from time to time.

Mr Harvey has 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 a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Harvey consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

### 1.1 Locality, Infrastructure and Environment

The Manaila Polymetallic Mine ("MPM") is located in the Suceava County of the country

Romania, approximately 340 kilometres to the north-northwest of the capital city, Bucharest. The open pit mine is located 19 kilometres to the north-northwest of the town of Iacobeni. The metallurgical processing facility for MPM is located within the town of Iacobeni itself. The metallurgical processing facility comprises crushing, milling, and flotation currently producing a copper concentrate, a separate zinc concentrate and a pyrite concentrate containing gold credits.

The exploration licence boundary is 1.389 square kilometres in extent. Within this exploration licence perimeter, the current mining licence boundary is 0.271 square kilometres in extent.

Power to the processing facility is provided from the national power grid and is very stable. Power to the mine is provided from the national grid from overhead power lines from the town of Borsa to the North West.

## 1.2 History, Exploration and Mining

In 1972, the Romanian state exploration company began initial exploration activities geochemical soil sampling and widely spaced surface diamond drilling. This led to the identification of volcanogenic massive sulphide mineralisation within the area. The mineralisation was attributed to Kuroko-type deposits associated with felsic volcanics of the Tg3 Formation similar to the nearby Fundu Moldovei copper mine (Krautner, 1980, 1987, 1997, 1998, Balintoni, 1997, Pana, 2002).

After a hiatus for several years. Exploration once again resumed in 1985 when geophysical surveys including electrical conductivity and resistivity were conducted. Underground development from adit entrances initially targeted the mineralisation in the northern portion of the property but results were not encouraging.

Subsequent drilling along the southern boundary revealed a more robust development of polymetallic massive and disseminated sulphides. This resulted in 6.418 km of underground development along two levels, namely level 4 and level 7. Underground diamond drilling was conducted along the full length of the two levels and channel sampling was conducted where intersections with the mineralised zone took place.

Some trial underground mining took place to generate bulk sample material for metallurgical test work, both on a laboratory scale and pilot plant scale. A trial run of ore processing took place at the nearby Fundu Moldovei copper mine to assess the concentrate obtainable under true plant conditions.

The mine began operations in 1999 when the state owned mining company Remin S.A. (“Remin”) ran the operations until 2006. In 2006, Remin was placed into liquidation and the assets, including the mining license, transferred to another state owned mining company Mina Bucovina (“Bucovina”) who operated the mine until 2009. During 2009, Bucovina was placed into liquidation.

The mining license was acquired by public auction by the Sinarom Mining Group ("SMG") in 2012. SMG operated the mine until July 2015 when Vast acquired a 50.1% stake in the company and assumed operational control.

Since August 2015, Vast has drilled a total of fourteen surface diamond drill holes in the immediate vicinity of the current open pit operations in order to verify the geological model, and thereby allow for the inclusion of the historical drill hole assays and underground channel assays into the assay database.

Vast sent a bulk sample from the open pit to the laboratories of SGS in the United Kingdom for flotation kinetic test work to optimise the quality of the copper concentrate, and to outline the chemical flotation recipe required to depress zinc in the copper concentrate. In addition, test work to subsequently reactivate and float the zinc into a separate zinc concentrate was undertaken. The test work was successful and the implementation in the plant has proved to be a success as well.

This mineral resource update is the result of a further nineteen surface diamond drill holes undertaken during June 2017 to November 2017.

## 1.3 Geology

Romania consists of four major areas of Mesozoic and older rocks, the southern Carpathians, eastern Carpathians, Apuseni Mountains, and Dobrogea. The eastern Carpathians consist of two main paleogeographic and structural units, which are, from west to east, the Crystalline-Mesozoic zone ("CMZ") and the outer flysch zone. The CMZ in turn is made up of four main lithostratigraphic groups, namely the Bretila Group, Tulghes Group, Negrisoara Group and the Rebra Group.

The local geology at MPM comprises lithologies of the lowermost units of the TG4 and the uppermost units of the TG3 formations of the Tulghes Group. They comprise the following:

- TG4 Formation
  - Basque Formation

- TG3 Formation
  - Fundu Moldovei Member
  - Morosan Member

The Morosan Member of the TG3 formation is a rhyolitic volcano sedimentary sequence comprising alternating sequences of quartz sericite schists -\$^{+}$ chlorite -\$^{+}$ graphite and metamorphosed rhyolites. The top of the sequence is marked by the development of a chlorite sericite schist with porphyroblasts of albite. The contact between the Morosan Member and the overlying Fundu Moldovei Member marks the development of the sulphide mineralisation at MPM

The Fundu Moldovei Member of the TG3 Formation is represented by a predominantly metamorphosed rhyolites and quartz-sericite schists, which vary in thickness. The top of the TG3 Formation is marked by the development of the polymetallic mineralisation associated with the mineralisation located within the Putnei – Prasca valley (Lesul Ursului, Fundu Moldova). This mineralised zone occurs along the northern boundary of the current exploration perimeter.

The Basque Member of the TG4 Formation is present in the north western of the exploration perimeter and is comprised of a cyclic alternation of various blastodetrital quartzites and phyllitic lithologies. Thin beds of acid metatuffs occur in the upper portions and indicate late stage extrusive rhyolitic volcanism. The TG4 Formation represents detrital material deposited during and after the waning stage of volcanism (Krautner, 1980, 1987, 1997, 1998).

## 1.4 Mineral Resources

A mineral resource estimate has been compiled for the area delineated by the exploration perimeter. A full geological model has been constructed, constraining the mineralised zone to widths and extents as defined by surface drilling, underground drilling and underground development.

A combination of Ordinary Kriging ("OK") and Inverse Distance Squared ("ID2") was carried out, interpolating values for copper, lead, zinc, sulphur, gold and silver into a three dimensional constrained geological block model. Density values from historical density measurements undertaken in Romania and from density measurements in use at the operating MPM mine were assigned to the block model for heavy, moderate and fresh weathering profiles.

Mineral resource categorisation was undertaken whereby modelled mineralised zones which could be defined from historical drilling but lacking sufficient assay data were assigned to the Exploration Target category and these are reported separately.

Mineralised zones which contained sufficient data from surface drilling, underground drilling and underground channel sampling were typically modelled with OK. The mineral resources within these mineralised zones were categorised based on the number of samples within various search volumes, the slope of regression and the geological confidence assigned to each zone.

The mineral resource estimate has been subdivided into an open pit mineral resources and an underground mineral resource classification. The cut-off point between open pit and underground mining was determined by running a Lerch-Grossman ("LG") pit optimisation based on the prevailing metal prices and the current operational efficiencies being achieved at MPM. The depth of LG pit shells extended to 125 metres below the topographic surface.

Open pit mineral resources were subsequently defined down to a depth of 125 metres below surface and are reported at an in-situ mining grade cut-off of 0.25% Cu. Copper is deemed the main mineral of interest and all mineral resources are based on cut-off grades applied to copper only. Table 1 provides the mineral resources determined to be fresh sulphide open pit mineral resources.

Underground mineral resources were subsequently defined from below a depth of 125 metres below surface to the limits of the mineralised zones and are reported at an in-situ mining grade cut-off of 1.00% Cu. Copper is deemed the main mineral of interest and all mineral resources are based on cut-off grades applied to copper only. Table 2 provides the mineral resources determined to be underground mineral resources.

An exploration target has been defined over the remainder of the exploration perimeter. There is sufficient information available, from existing surface drill holes to literature regarding the development of sulphide mineralisation in the area surrounding MPM to warrant the development of a staged exploration program to advance these areas into a mineral resource category in the future. Table 3 provides the exploration target potential for open pit exploration targets and Table 4 for underground exploration targets. All exploration targets are reported with no cut-off grade applied.

## 1.5 Conclusions

The mineral resource estimate makes use of historical data sets. The nineteen surface drill holes undertaken by Vast were designed to provide a high level of confidence for the near to medium term open pit operations of MPM. Previous mineral resource estimates identified Inferred mineral resources with the potential to be exploited by means of an open pit adjacent to the current working open pit at Manaila.

The nineteen-hole drilling program has subsequently upgraded these Inferred mineral resources to an Indicated mineral resource category to allow for economic feasibility studies to be undertaken.

It may be prudent to convert in time to a multi-element cut-off grade model or Net Smelter Return model (“NSR”) as areas of higher grades of metals other than copper may not be identified for extraction through the use of a single cut-off grade model.

**Table 1: Open Pit Mineral Resource Estimate for the Manaila Polymetallic Mine, February 2018.**

| Category (Open Pit) | Cu % cut-off | Tonnes (Kt) | Cu Metal (Kt) | Pb Metal (Kt) | Zn Metal (Kt) | Au Metal (Koz) | Ag Metal (Koz) | Cu % | Pb % | Zn % | Au g/t | Ag g/t |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measured | 0.25% | - | - | - | - | - | - | - | - | - | - | - |
| Indicated | 0.25% | 3 589 | 33.339 | 10.483 | 22.622 | 27 | 2 867 | 0.93% | 0.29% | 0.63% | 0.23 | 24.9 |
| **Meas + Ind** | **0.25%** | **3 589** | **33.339** | **10.483** | **22.622** | **27** | **2 867** | **0.93%** | **0.29%** | **0.63%** | **0.23** | **24.9** |
| Inferred | 0.25% | 1 045 | 11.529 | 4.180 | 8.774 | 8 | 981 | 1.10% | 0.40% | 0.84% | 0.24 | 29.2 |
| **Meas + Ind + Inf** | **0.25%** | **4 634** | **44.869** | **14.663** | **31.396** | **35** | **3 848** | **0.97%** | **0.32%** | **0.68%** | **0.23** | **25.8** |

**as at 28 February 2018 (topographic surface)*
** too a maximum depth of 125m below topographic surface*
** @ 0.25% Cu cut-off grade*
** Rounding may cause minor differences*

**Table 2: Underground Mineral Resource Estimate for the Manaila Polymetallic Mine, February 2018.**

| Category (Underground) | Cu % cut-off | Tonnes (Kt) | Cu Metal (Kt) | Pb Metal (Kt) | Zn Metal (Kt) | Au Metal (Koz) | Ag Metal (Koz) | Cu % | Pb % | Zn % | Au g/t | Ag g/t |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measured | 1.00% | - | - | - | - | - | - | - | - | - | - | - |
| Indicated | 1.00% | 399 | 6.310 | 3.098 | 3.324 | 2 | 188 | 1.58% | 0.78% | 0.83% | 0.13 | 14.60 |
| **Meas + Ind** | **1.00%** | **399** | **6.310** | **3.098** | **3.324** | **2** | **188** | **1.58%** | **0.78%** | **0.83%** | **0.13** | **14.60** |
| Inferred | 1.00% | 683 | 10.728 | 5.741 | 6.161 | 4 | 321 | 1.57% | 0.84% | 0.90% | 0.17 | 14.60 |
| **Meas + Ind + Inf** | **1.00%** | **1 081** | **17.037** | **8.839** | **9.485** | **5** | **509** | **1.58%** | **0.82%** | **0.88%** | **0.15** | **14.60** |

**as at 28 February 2018 (topographic surface)*
** from a depth of 125m below topographic surface*
** @ 1.00% Cu cut-off grade*
** Rounding may cause minor differences*

**Table 3: Open Pit Exploration Target at Manaila Polymetallic Mine, February 2018.**

| OPEN PIT | Tonnes (Kt) | | Grade | | | | | |
|---|---|---|---|---|---|---|---|---|
| Exploration Target | Minimum | Maximum | Cu% Min | Cu% Max | Pb% Min | Pb% Max | Zn% Min | Zn% Max |
| Range | 1 063 | 3 190 | 0.4% | 1.1% | 0.1% | 0.4% | 0.2% | 0.6% |
| **Total** | **1 063** | **3 190** | **0.4%** | **1.1%** | **0.1%** | **0.4%** | **0.2%** | **0.6%** |

**as at 28 February 2018 (topographic surface)*

** too a maximum depth of 125m below topographic surface*

**Table 4: Underground Exploration Target at the Manaila Polymetallic Mine, February 2018.**

| UNDERGROUND | Tonnes (Kt) | | Grade | | | | | |
|---|---|---|---|---|---|---|---|---|
| Exploration Target | Minimum | Maximum | Cu% Min | Cu% Max | Pb% Min | Pb% Max | Zn% Min | Zn% Max |
| Range | 7 861 | 23 583 | 0.4% | 1.3% | 0.2% | 0.7% | 0.3% | 1.1% |
| **Total** | **7 861** | **23 583** | **0.4%** | **1.3%** | **0.2%** | **0.7%** | **0.3%** | **1.1%** |

**as at 28 February 2018 (topographic surface)*

** from a depth of 125m below topographic surface*

## 2. Introduction

This mineral resource report has been compiled under the guidelines of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, ("the JORC Code 2012"). The report is an update to the Mineral Resource Estimate dated 31 July 2016 on the acquisition of new data derived from surface diamond drilling.

The mineral resource estimate has been compiled by Mr. Craig Harvey, a full time employee of Vast Resources PLC. Mr. Harvey holds the title of Chief Operating Officer for Vast and has been involved with the development of MPM from its acquisition. Mr Harvey has been involved in several mineral resource estimations for a wide range of commodities, including gold, uranium, copper and iron ore, across a range of depositional environments and has the relevant experience required for the mineral resource estimation as detailed in this report. Mr Harvey is a member of the Geological Society of South Africa ("GSSA") and of the Australian Institute of Geoscientists ("AIG").

The mineral resource estimate is reported utilising the main pillars of the JORC code, namely transparency, materiality and competence.

### 2.1 Reliance on Information

This mineral resource estimate is reliant on historical data as outlined in the Mineral Resource report on 31 July 2016. The technical information gathered by Vast has been verified as follows:

- A three dimensional ("3D") geological model has been built utilising the existing historical information comprising;
    - Surface diamond drilling;
    - Underground diamond drilling;
    - Underground channel sampling;
    - Underground mine plans.
- Surface drill holes have been drilled by Vast to verify the initial geological model and to provide a check on the range of grades historically reported;
- Independent metallurgical testing undertaken by SGS (UK);
- Duplicate assays sent to external laboratories for assays;
- Literature reviews regarding depositional environments and ore forming terranes within Romania and more specifically the Eastern Carpathian mountain belt.

The author has satisfied himself that the information and data obtained from the historic documentation is an accurate reflection of the work undertaken at that time. The methodologies described in the documentation are similar to the workflow any mineral resource estimate would require. There are portions of the audit trail which could not be completed or verified and may have resulted in a downgrade in the level of confidence reported for certain areas of the mineral resource estimate.

### 2.2 Site Visit

The Manaila Polymetallic Mine ("MPM") has been visited by the author on numerous occasions since August 2015. During this time, historical hard copy data has been captured and converted to an electronic format for use in the mineral resource estimate

## 3. Property Descriptions and Location

The MPM open pit operation is located in the northern region of Romania, approximately 20 kilometres to the north north-west of the village of Iacobeni in the Suceava County of Romania, or approximately 75 kilometres to the west of the city of Suceava as indicated in Figure 1.

**Figure 1: Locality of MPM within Romania**


Ore mined and destined for processing is transported approximately 32 kilometres by road in $8m^3$ tipper trucks from the open pit to the metallurgical plant located in the village of Iacobeni. Waste material from the metallurgical plant is then transported 14 kilometres by road to a disused manganese open pit which has been permitted as a Tailings Storage Facility

(“TSF”) and is lined with a HDPE liner. Run of Mine waste or overburden is dumped on a waste rock dump facility on site within 1.0 kilometres of the open pit.

The open pit mine is accessed via a forestry gravel road for approximately 7.5 kilometres from the secondary tarred road (DN18) between Iacobeni and Borsa.

The locality of the open pit mine, the TSF and the metallurgical plant is shown in Figure 2.

**Figure 2: Locality of the Open Pit, the Tailings Storage Facility and the Metallurgical Processing Facility in Iacobeni**


## 4. Mineral Tenure and Issuers Interest

### 4.1 Romanian Minerals Legislation

Post the Second World War and with the rise of the communist philosophy in Romania, intensive mining of metalliferous metals began, especially the gold deposits from the Metalliferi Mountains. The mineral resources were subsequently managed mostly in conditions of marginal profitability and even at a loss, which led to a gradual decline in mine industry.

The policy of industrial development with the goal of ‘minimal import of raw materials’, lead to the extraction of sub economic ores, with state interventions or subsidies of up to $12 of subsidy for every $1 of revenue produced from production. Nevertheless, the years 1945-1990 were characterized by the extensive use of the geological, geophysical and geochemical exploration methods, resulting in a comprehensive knowledge base on many deposits and their surrounding areas.

Post the communist era and the principles of state subsidisation, the majority of the previously state owned mining companies either have gone into liquidation completely or have shrunk significantly in size. This is opening the way for a free market with respect to mining and a re-evaluation of the mining economics in Romania.

Prospecting, exploration and mining licences are all registered and acquired through a public auction process unless done on a private deal basis for existing licences. *Prospecting* is carried out based on a non-exclusive permit issued by the competent authority in accordance with the law upon receiving a written request for an area defined by topo-geodesic coordinates. The prospecting permit is issued for a maximum period of three years, without the right to be renewed and with an obligation for the payment of an activity tax prior to the beginning of each calendar year. *Exploration* is carried out based on an exclusive licence granted in respect of any mineral resource discovered within the applied for area, upon application for such an area by an interested Romanian or foreign legal persons. The exploration licence is granted for a period of maximum 5 years with a renewal right of maximum 3 years. *Mining* activities are carried out on a mining licence, which is granted exclusively to the applicant. The mining licence is granted for an initial maximum of 20 years with renewal rights for successive periods of 5 years.

Under the Romanian Mining Law and State Practice prior to 1994 and after the fall of communism, all exploration was vested with the Romanian government.

## 4.2 Surface Rights and Permits

MPM is situated on State Forestry Land and the land is ceded to MPM with no rental payment for land use.

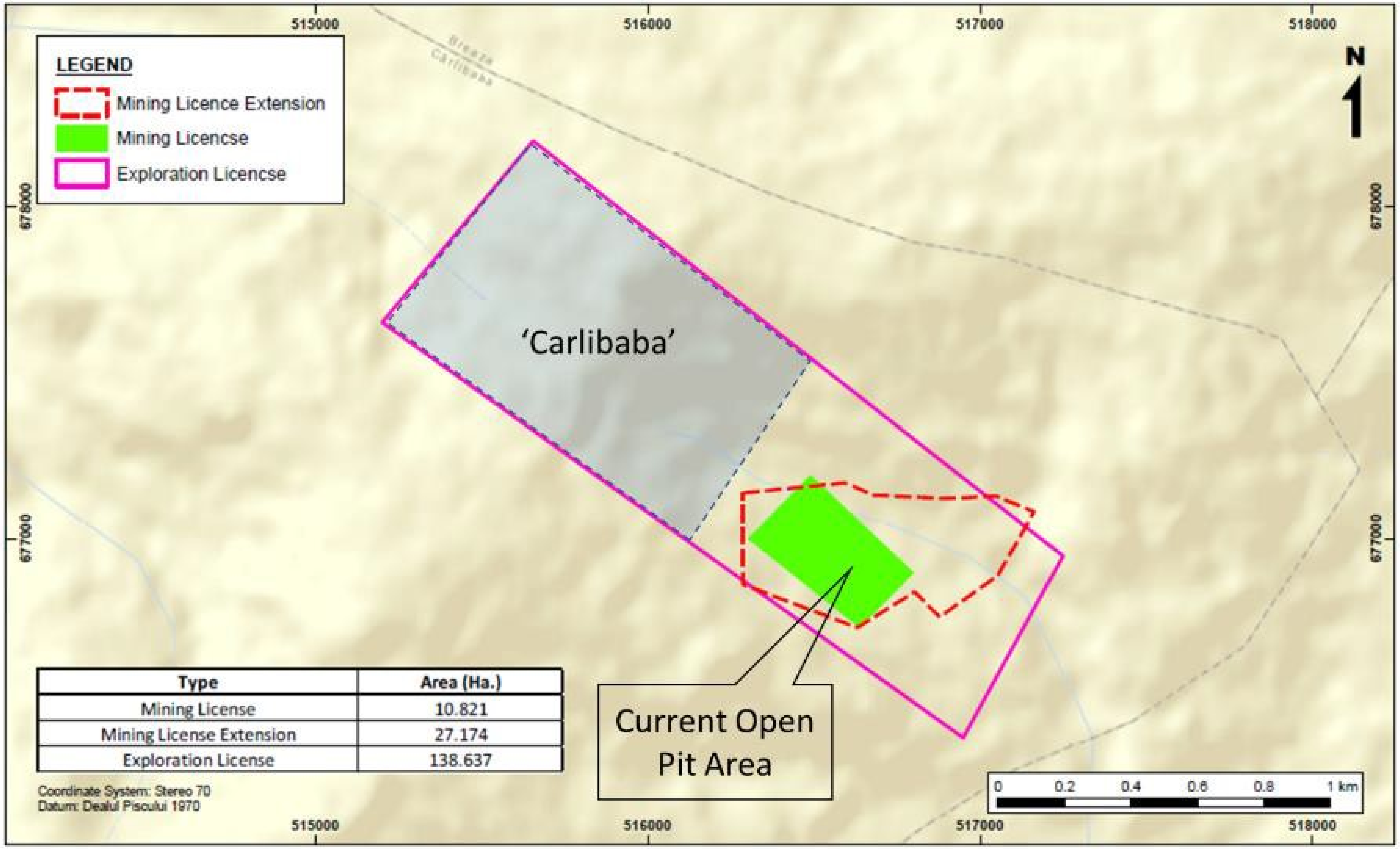
### 4.2.1. Mining Licence

The mining licence or exclusive exploitation licence (“EEL”) as it is known in Romania was obtained by public auction in 2009 by the Sinarom Mining Group SRL. The EEL allows for the exploitation and removal of gold, silver and polymetallic minerals from the mining area under EEL 468/2009. A EEL extension was granted during February 2018 which enlarged the surface area from 0.10821km2 to 0.27174km2. The perimeter of the EEL is indicated in blue in Figure 3.

### 4.2.2. Prospecting Licence

The granted prospecting right is depicted in Figure 3 and is 1.38637km2 in extent.

**Figure 3: Exclusive Exploitation and Granted Prospecting Licence**



# 5. Accessibility, Climate, Local Resources, Infrastructure and Physiography

## 5.1 Accessibility

The open pit mine is accessed via a bitumen sealed road (DN18) for approximately 18 kilometres from the village of Iacobeni. Thereafter, the mine is accessed via a forestry gravel road for approximately 7.5 kilometres. The main access route passes through several small roadside villages where the speed limits are enforced to 50 kilometres per hour. The metallurgical plant is located alongside the main road in the village of Iacobeni.

The nearest airport to Iacobeni is at Suceava, approximately 75 kilometres to the east, which although small, with a single arriving and a single departure flight per day from Bucharest, caters for international flights.

The rail network in Romania is active and there are numerous sidings around Iacobeni with facilities capable of handling bulk material loading and offloading, some of which are in use or in a state of disrepair. The main activities in the area comprise rural agriculture, minor manufacturing (water bottling plants), forestry and tourism.

## 5.2 Climate and Physiography

The open pit mine is located at an elevation of approximately 1 230 metres above mean sea level ("amsl"), in the Barnarelul range of mountains to the north east of Iacobeni. The metallurgical plant is located in the town of Iacobeni along the banks of the Bistrita River, at an elevation of approximately 850 m amsl.

Rainfall in the region occurs throughout the year with the wettest months being June and July with approximately 105mm of precipitation on average being recorded. The driest months of the year are from October to March with average precipitation of approximately 35mm being recorded each month.

Average summer temperatures in July range between 21.6 and 11.0 centigrade with an average temperature of 16.3 centigrade. Winter temperatures in January range between -1.4 and -9.5 centigrade with an average of -5.5 centigrade on record although shirt periods of extreme temperatures up to -30 O centigrade do occur. Snow season in the region is from November to March.

## 5.3 Resources and Infrastructure

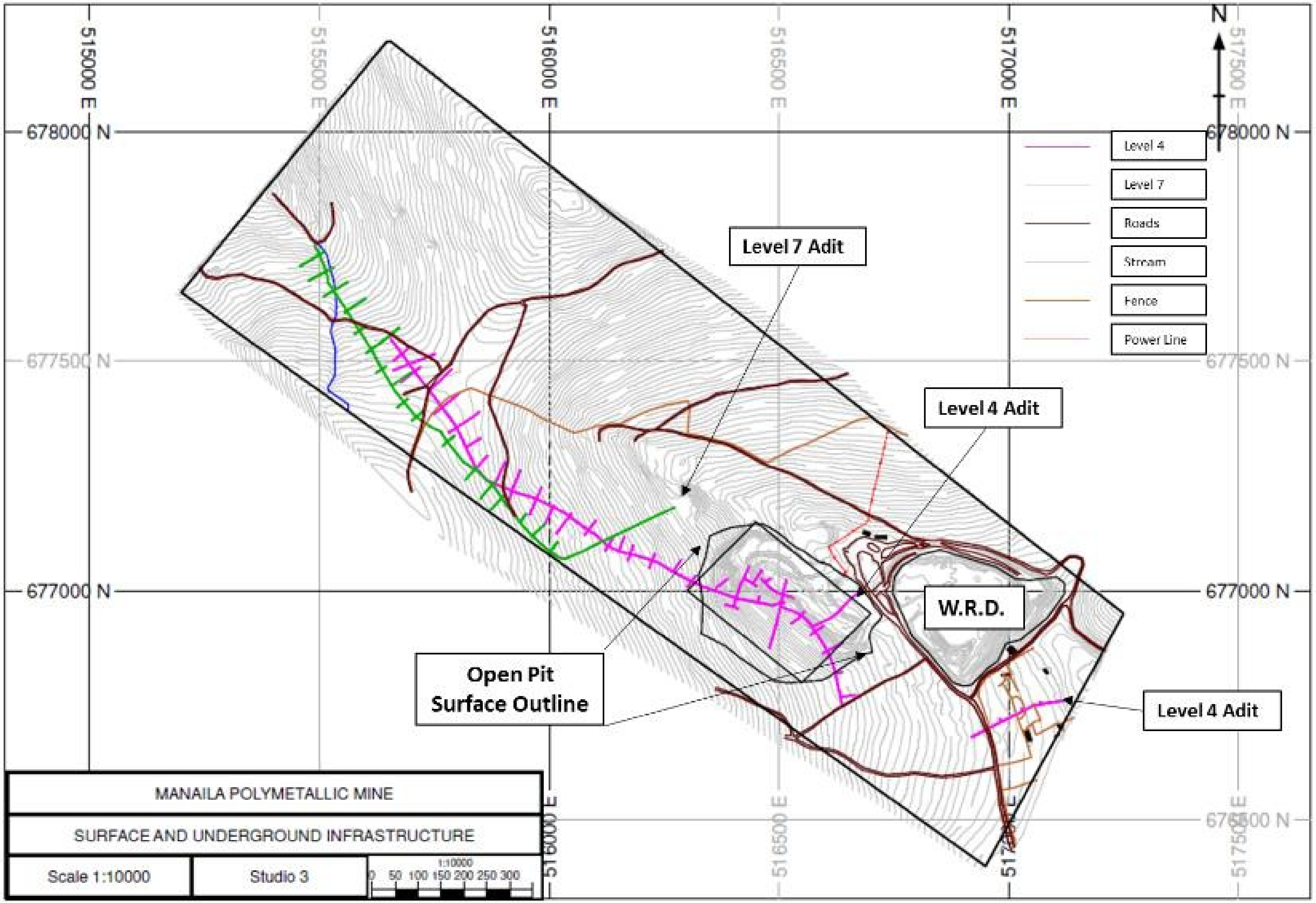
### 5.3.1. Open Pit Mine

The mine does not use much power or water. Power is required for security lighting, dewatering pumps in the open pit and for an electrically driven face shovel. The mine is adequately fed with power from a 33kVa power line that enters the property from the north. No water is required at the mine site except for washing and cleaning bays.

The mine currently owns an electric face shovel with the bulk of the excavators, tipper trucks and articulated dump trucks ("ADT's") being operated by a haulage contractor. In addition to the open pit excavation, there are two levels of underground workings. The underground workings are exploration drives driven along the strike length of the orebody in a northwest – southeast direction. Access is via adits although two entrances have collapsed. The third adit has been removed by mining activities in the open pit.

The surface infrastructure at the open pit is shown in Figure 4.

**Figure 4 : General Infrastructure at the Open Pit Operation, MPM.**



### 5.3.2. Metallurgical Plant

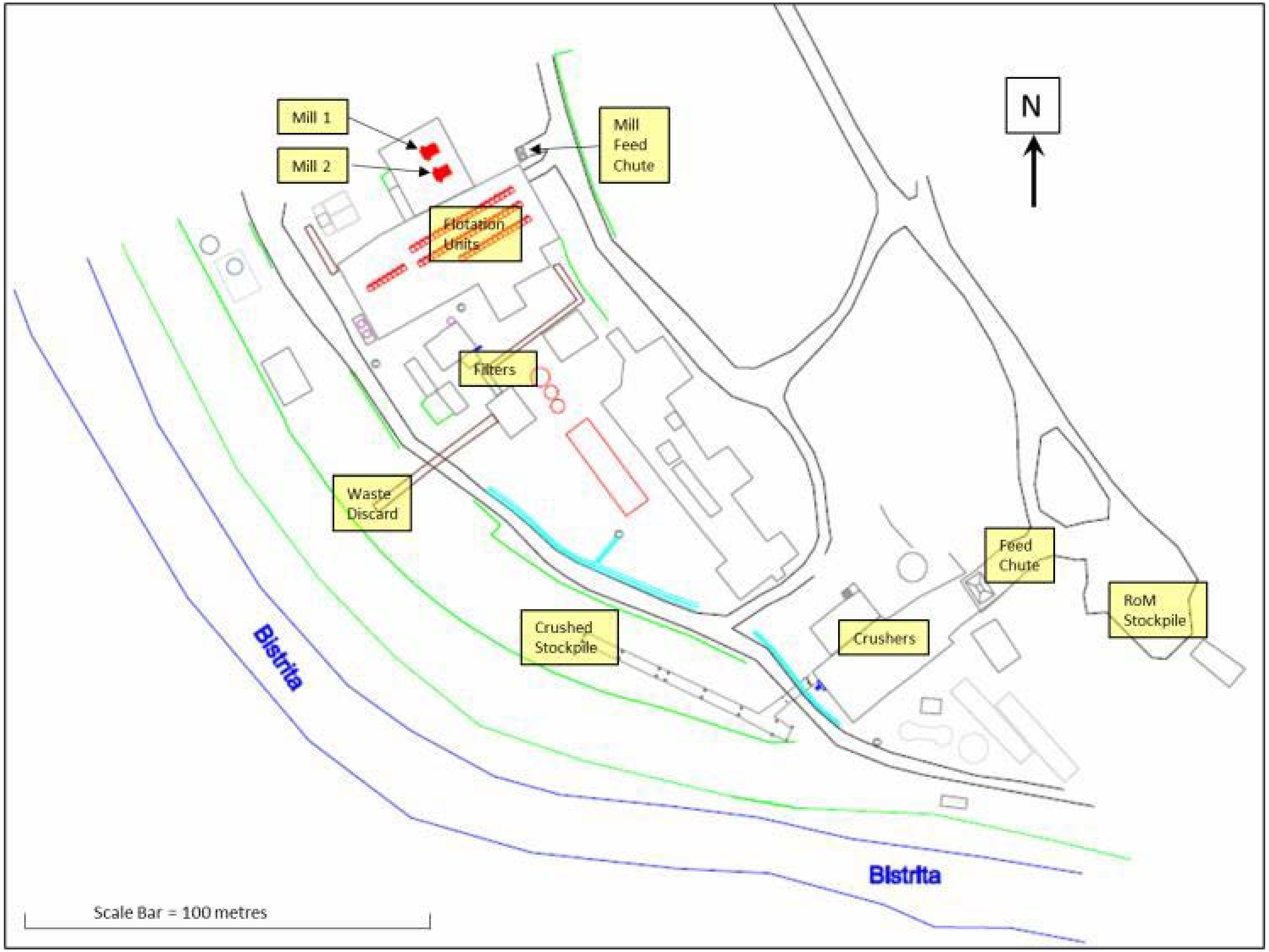
The metallurgical plant is sited in Iacobeni on the footprint of a closed manganese processing facility. Power is on site with water being drawn from the adjacent Bistrita River. Process water is returned to the river after passing through settling ponds to remove suspended particles. Water samples are taken daily from the discharge pond with records from start of operation to present day being kept on the mine.

The metallurgical plant comprises the following;

- Crushing Section
  - Primary Jaw Crusher with twin Secondary Cone Crushers.
- Milling Section
  - Mill 1 (2.5 x 5.0 metres) approx. 600tpd capacity
  - Mill 2 (2.7 x 3.0 metres) approx. 300tpd capacity
- Flotation Section
  - 2 Lines of 22 cells at 2.8$m^3$ volume per cell
  - 1 Line of 15 cells at 4.5$m^3$ volume per cell
  - 1 line of 15 cells at 0.6$m^3$ volume per cell
- Filtration Section
  - 2 Cylindrical cloth presses
  - 1 Larox Hydraulic press

The general layout of the metallurgical plant is provided in Figure 5.

**Figure 5: General Schematic Drawing of the Metallurgical Plant Layout at Iacobeni**



#### 5.3.3. Tailings Storage Facility

The Tailings Storage Facility ("TSF") is located approximately 14 kilometres away at the site of a closed manganese quarry. The quarry has been subdivided into three portions with the upper portion currently being used to deposit tailings material from the Iacobeni processing plant.

The base of the quarry floor has been lined with an HDPE plastic liner in the areas that are currently being utilised. The material deposited on the TSF is derived from the waste filter press at the plant. The material being deposited at the TSF has a moisture content of 8% - 15% as determined by the laboratory at the plant site.

There is sufficient depositional space for an estimated additional 540 000 tonnes of tailings material at the date of this report. The TSF is shown in Figure 6.

**Figure 6: Depositing of Tailings at the Manaila TSF**

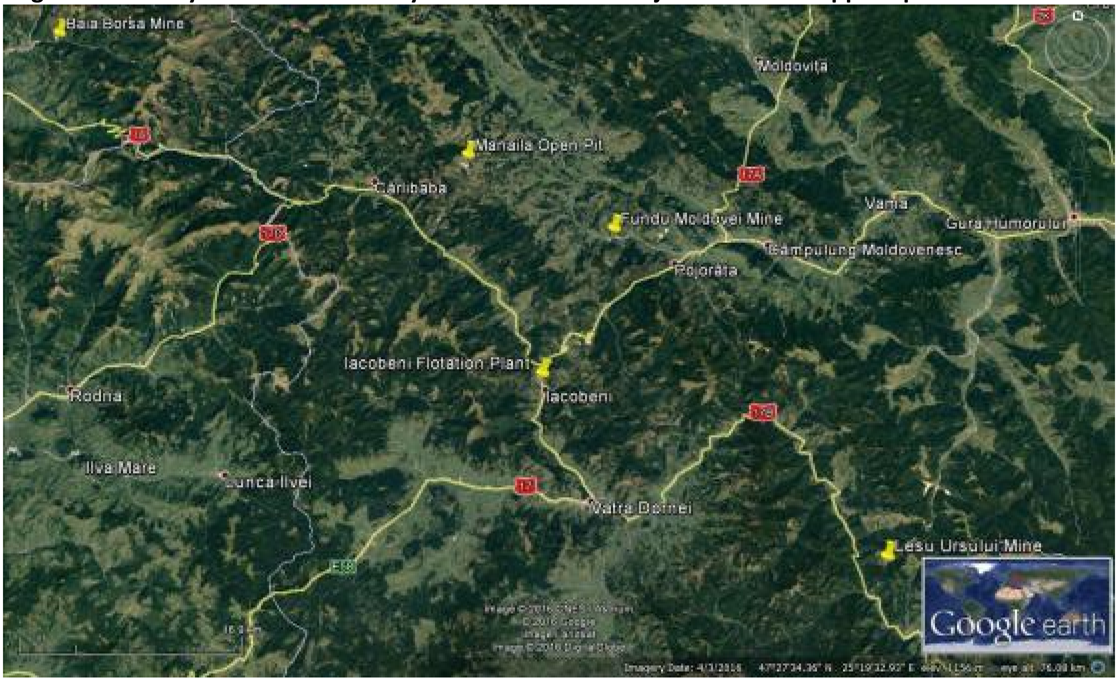

### 5.4 Adjacent Properties

There are no immediately adjacent mining or exploration properties at MPM. The nearest operations to MPM would be the closed Fundu Moldovei, Lesul Ursului and Baia Borsa polymetallic mines.

These closed operations are the victim of state subsidy removal and at Lesul Ursului and Baia Borsa, significant mineral resources are reported to remain.

The locality of these mineralised areas is shown in Figure 7.

**Figure 7: Locality of the Manaila Polymetallic Mine and adjacent closed copper operations.**




Alexandru Voda (2013) conducted research on the Carlibaba – Drosteni fault system and identified structural and metallogenic correlations on a regional scale for the area from Baia Borsa in the northeast to Lesul Ursului in the southeast. He concluded that Lesu Ursului and Baia Borsa initially belonged in the same metallogenic zone with the mineralisation at Lesul Ursului being displaced along the Carlibaba – Drosteni strike slip fault system.

## 6. History

### 6.1 Prior Ownership and Changes

MPM was initially operated by Remin S.A. ("(Remin"), a state owned mining company from the Baia Mare region. Remin operated MPM from 1999 until 2006 when REMIN was placed into provisional liquidation. The MPM assets and exploitation licence was transferred to Mina Bucovina in 2006 who operated the MPM asset until 2009 when they too were placed into liquidation.

The MPM exploitation licence was put to a public auction and subsequently acquired by the Sinarom Ming Group ("SMG"). SMG operated the MPM asset until July 2015 when Vast acquired 50.1% of SMG and took ownership and operational control of MPM.

### 6.2 Historic Exploration

Exploration activity in the Manaila area began at the turn of the 19th century when traces of historic working known as “Mantz's mines" were discovered. During this period, limonite ore was extracted, and an approximate 35% Fe product produced. Walter B. (1876) describes the limonite ore occurrence in the Valley at Basque as the superficial alteration of a body of pyrite.

Formal exploration of the Manaila area began in 1972 when the Romanian state exploration company undertook geochemical soil sampling and widely spaced surface drilling. Geological mapping at a 1:5000 scale was compiled for the area. The exploration and mapping revealed the presence of copper bearing sulphide lithologies which were subsequently assigned to the adjacent nearby Fundu Moldovei sulphide horizon of the Bucovinian nappe from drill holes F10, F11 and F19.

Exploration resumed in 1985 and during the period 1985 to 1987, geophysical and electrical survey methods were undertaken.

Initial underground development began from adits in the hills in the northern portion of Manaila during 1987. This was to determine the nature of the mineralisation associated with the Fundu Moldovei massive sulphide horizon. A series of further surface drilling, trenching and short adits (level No. 1 @ +1155.21 m, level 2 @ +1213,6m, level 3 @ +1162.5 m, level 5 @ +1192.4 m). Results were disappointing and the exploration of this sulphide horizon in the northern and north eastern area of Manaila was stopped in 1992.

Based on the results of the exploration, exploration in the form of underground drives developed from adits in the hillside at elevations of 1189m amsl (level 4) and 1253m amsl (level 7) commenced in 1989 and continued throughout until approximately 1996. As the development advanced, underground exploration drilling followed on with the development.

The electrical survey methods included Induced Polarisation (“IP”) which when compiled on a map revealed the presence of a number of anomalies orientated along a geological structure from the Manaila peak in the north to the Pine River in the south.

Surface drill holes were laid out approximately equidistant from one another and at right angles to the identified zones of mineralisation, geochemical and geophysical anomalies. Geological maps detailing the lithological and structural data for the Manaila area were compiled at 1:5000 and 1:25000 scales.

Data from the geophysical and geochemical surveys were compiled into maps and anomalous areas identified for future work. Topographic surveys and mineralogical studies were undertaken.

A summary of exploration activities undertaken is provided in Table 5.

**Table 5: Exploration activities at MPM, 1972 - 1997**

| Activity | Units | Amount Completed |
|---|---|---|
| Underground Drives and Cross-Cuts | metres | 6418 |
| Inclines (raises) | metres | 140 |
| Underground Stopes | cubic metre | 399 |
| Pits | metres | 335.7 |
| Trenches and Stripping | cubic metre | 5172 |
| Digging with Probe | metres | 21813 |
| Surface Drilling (0 – 100m) | metres | 3097 |
| Surface Drilling (0 – 300m) | metres | 7282 |
| Surface Drilling (0 – 700m) | metres | 7258 |
| Underground Drilling (0 – 100m) | metres | 4176 |

## 6.3 Metallurgy

### 6.3.1. Historic Test Work

Initial laboratory scale test work for flotation was carried out in 1991 by the laboratory of S.C. ICPM Baia Mare S.A., associated with the state mining company Remin, based in the town of Baia Mare.

A second set of metallurgical samples were sent to the same laboratory complex for pilot plant test work during the period 1994 – 1995.

In 1997, plant trials on 1 050 tonnes of ore mined from underground stoping at MPM were carried out at the metallurgical facility located at the Fundu Moldovei mine in Fundu Moldovei.

Table 6 lists the head assay results for the various ore samples sent and analysed in 1991, 1994-1995 and 1997.

**Table 6: Historic Laboratory and Plant Scale Metallurgical Test Work at MPM, 1991 - 1997**

| Ore Type | Year | Locality | Cu % | Pb % | Zn % | Au g/t | Ag g/t | S % |
|---|---|---|---|---|---|---|---|---|
| Massive Sulphide | 1991 | Unknown | 1.89 | 0.67 | 2.80 | 0.94 | 96.04 | 30.72 |
| Massive Polymetallic Sulphide | 1991 | Unknown | 0.62 | 0.16 | 0.33 | 0.50 | 50.85 | 15.04 |
| Massive Polymetallic Sulphide | 1994 | Drives 2NE & 3SV | 1.39 | 0.76 | 1.37 | 0.54 | 48.00 | 29.04 |
| Pyrite Rich Copper Massive | 1994 | Drives 8NE & 10SV | 1.05 | 0.07 | 0.23 | 0.48 | 33.20 | 29.12 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sulphide | | | | | | | | |
| Blended Ore | 1997 | Unknown | 1.01 | 0.57 | 1.45 | 0.36 | 27.12 | 13.70 |

Results from some of the laboratory test work and pilot plant and full plant scale test are summarised below;

a) Initial Laboratory Test Work (1991)

- Selective flotation was tested for successive copper, zinc and pyrite concentrates;
  - A copper concentrate grading 24.17% Cu, 1.04% Pb, 3.26% Zn, 29.04% S, 1.72g/t Au and 112.04g/t Ag was produced;
  - A zinc concentrate grading 1.32% Cu, 2.51% Pb, 47.58% Zn, 32.96% S, 2.50g/t Au and 114.08g/t Ag was produced;
  - A pyrite concentrate grading 0.38% Cu, 0.39% Pb, 0.61% Zn, 50.28% S, 0.40g/t Au and 42.84g/t Ag was produced.

b) Pilot Plant Test Work (1994-1995)

- A collective (bulk) flotation test was carried out with the following results;
  - A bulk concentrate grading 14.62% Cu, 3.73% Pb, 14.08% Zn, and 31.25% S was produced;
  - A copper cleaner circuit produced a copper concentrate grading 20.78% Cu, 5.80% Pb, 5.40% Zn and 34.56% S;
  - A zinc cleaner circuit produced a zinc concentrate grading 6.90% Cu, 6.65% Pb, 42.94% Zn and 30.96% S.
- A collective flotation for copper and lead with zinc depression and subsequent separation of copper and lead was trialled with the following results;
  - A copper concentrate grading 20.02% Cu, 2.9% Pb, 3.3% Zn and 33.84% S was produced;
  - A lead concentrate grading 3.06% Cu, 35.15% Pb, 16.70% Zn and 34.04 S was produced
  - A zinc concentrate grading 2.10% Cu, 2.95% Pb, 48.86% Zn, 32.64 % S, 1.42g/t Au and 141.32g/t Ag was produced.
  - A pyrite concentrate grading 0.32% Cu, 0.39% Pb, 0.51% Zn, 50.24% S, 0.72g/t Au and 27.8g/t Ag was produced.

c) Trial Plant Test Work (1997)

- A single concentrate was produces with the following results;
  - 16.58% Cu, 0.96% Pb, 3.55% Zn, 35.42 % S 1.05g/t Au and 151.64g/t Ag was produced.

### 6.3.2. Recent Test Work

During the period May 2016 to November 2016, metallurgical test work was carried out at the SGS (UK) laboratories and independent industry consultants Minxcon were engaged to optimise the test work program and translate any laboratory scale results into operational processing plant performance.

A sample of 300 kilograms of ore material from Manaila was supplied to SGS as a blended sample of 150 kilograms disseminated sulphide ore and 150kg massive sulphide ore. The head grade of the sample as analysed by SGS was 1.38% Cu, 0.44% Pb, 1.17% Zn, 29.06% S, 1.08g/t Au and 41.5g/t Ag.

A mineralogical analysis revealed the main copper minerals to be chalcopyrite with minor covellite and enargite. The main zinc mineral is sphalerite while the main lead mineral is galena.

A series of flotation tests were conducted, and it was determined that the optimum grind size for flotation was 85% passing 75 microns. The study indicated that a copper – zinc separation could be achieved by using a combination of sodium sulphide and zinc sulphate with lime as a pH modifier.

Conclusive results from the test work indicated that a copper recovery of 80.97% and a zinc recovery of 23.53% could be achieved in the copper rougher with a mass pull of 8%. A zinc rougher concentrate, produced from the tails of the copper flotation, grading 14.63% zinc corresponding to a 66.9% zinc recovery was achieved.

The period August 2016 to November 2017 has seen the actual recovery in the copper concentrate average 70.5% Cu and 22.1% Zn. The actual recovery on the copper flotation tails for the zinc concentrate has averaged 10.0% Cu and 22.7% Zn.

Further test work to improve the recoveries of the primary minerals in both concentrates is ongoing.

## 6.4 Historic Assays

### 6.4.1. Sample Assays

Chemical analyses for copper, lead and zinc were undertaken by the SC Geomold SA (“Geomold”) laboratories located in Campulung Moldovenesc. Precious metal assays were undertaken by the Frasin laboratory associated with S.M. Bucovina located in Vatre Dornei. The Frasin laboratory conducted external control assaying for the copper, lead, zinc and sulphur samples submitted to Geomold.

It is reported that approximately 3 500 samples were submitted for copper, lead, zinc and sulphur analysis and approximately 250 sample for gold and silver analysis over the life of the exploration activities undertaken at MPM prior to 1999.

Unfortunately, no record of the analytical method employed at the time is found in the historic documents. Quality Assurance (“QA”) and Quality Control (“QC”) records were able to be sourced with reference being made to seventy six internal control assays and a subset of forty two external control assays undertaken at S.M. Bucovina in Vatre Dornei. These are duplicate and they are visually represented in Figure 8.

Underground channel samples were collected by chipping a rectangular slot with the dimensions of 0.05 x 0.10 x 1.0 metres at right angle to the mineralisation. The underground channel samples are recorded on plans with a unique sample identifier and the analyses for copper, lead, zinc, sulphur and in some cases for gold and silver.

For surface drilling, core samples of less than 59mm were sampled entirely and for core samples with a diameter greater then 59mm, the core was split longitudinally and half sent for assay and half stored for reference purposes. Sample lengths were typically 1.0 metres and only in homogenous zones of large widths were samples submitted at 3.0 metre lengths.

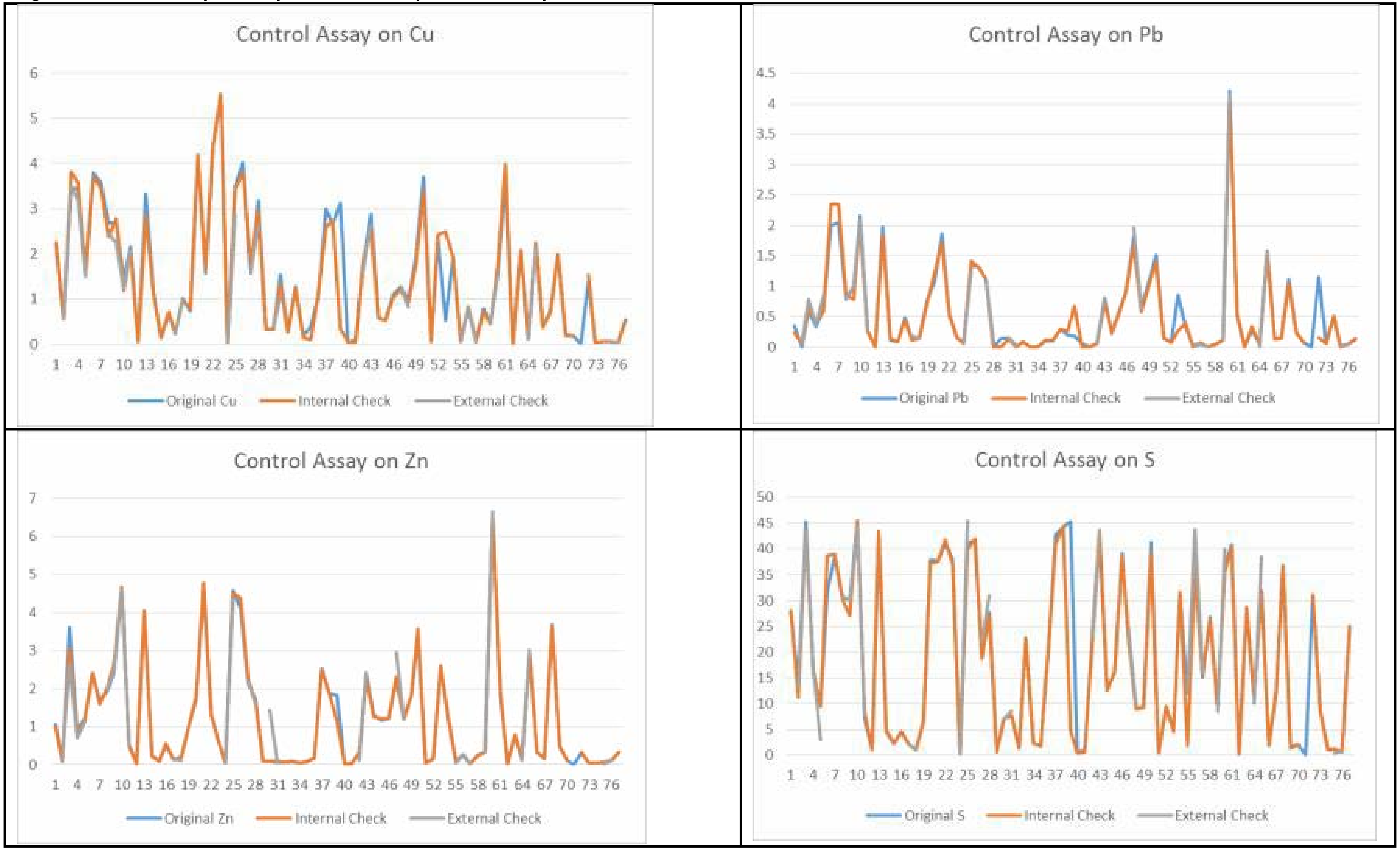
All underground drilling was of NQ (48mm) core size and the whole core was submitted for assay.

A number of the historic drill holes in the northern and western portion of the exploration perimeter do not have the original assay results available. The drill holes have been surveyed for collar position and geologically logged. These records together with the sample assay numbers as submitted to the laboratories at the time are available yet the assay values have not been sourced. These drill holes do however assist in building the overall geological model for MPM.

#### 6.4.2. Density Samples

Density samples were sent to the laboratories of Remin, S.C. Baia Mare located in Baia Mare. The sample results are reported in a range of 3.81 – 4.62 tons per cubic metre for the massive sulphide mineralisation. Densities are reported for the waste lithologies namely, sericite chlorite schist, quartz sericite schist and the metamorphosed rhyolites, and are in a closely spaced range of 2.62 – 2.80 tons per cubic metre.

**Figure 8: Control Sample Assays on Historic Exploration Assays at MPM**



### 6.5 Historic Mining

The State exploration company carried out underground development during the exploration phase. A total of 6418 metres of underground development comprising strike drives and cross cuts were developed during the period 1972 to 1997. In the south western portion of the current mining licence area, some trial underground mining was carried out to provide sample mass for a pilot metallurgical plant. A total of 399$m^3$ was extracted from underground for metallurgical test work purposes.

The bulk of the mining since the completion of the state run exploration mining has been by means of open pit mining. MPM was initially operated by Remin, a state mining company from the Maramures County, centred on the gold and polymetallic operations near Baia Mare. Ownership was transferred to Mina Bucovina in 2006 who were subsequently liquidated. The mining or exploitation right for MPM was subsequently put on open auction and the Sinarom Mining Group ("SMG") acquired the right in 2009. SMG owned and operated the mine until being acquired by Vast in August 2015. Production records prior to Vast's involvement in August 2015 are inconsistent.

### 6.6 Historical Mineral Resource and Reserve Estimates

The historic mineral resource and ore reserve estimates for the MPM as reported to the National Agency for Mineral Resources ("NAMR") are classified according to the Russian system for reporting of mineral reserves and mineral resources.

The compilation of the mineral reserve and mineral reserve estimates is detailed in the volume entitled "Raport Geologic cu situatia rezervelor de minereu polimetalic si piritos – cuprifer din perimetrul Manaila, jud. Suceava la data de 01.10.1997. Translated to English the title reads "Geological report on the pyritic copper rich polymetallic resources from the Manaila area, Suceava County, on 1 October 1997. This report only deals with the area bounded by the current mining licence perimeter.

A compilation of the mineral resources for the mining licence perimeter and the enlarged exploration perimeter has been compiled by local staff from reports to hand. The mineral resources as derived from these reports at the date of acquisition, August 2015, are summarised in Table 7

**Table 7: Historic Mineral Resources for the MPM Exploration Perimeter as per the Russian System of Reporting for Mineral Resources and Ore Reserves**

| | GEOLOGICAL | GRADE | | | | | METAL CONTENT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RESERVE (t) | Pb (%) | Zn (%) | Cu (%) | Au (g/t) | Ag (g/t) | Pb (t) | Zn (t) | Cu (t) | Au (kg) | Ag (kg) |
| **Deposit 1 (C1 + C2 Resources)** | 350000 | 1.10 | 2.00 | 1.25 | 0.70 | 50.0 | 3850 | 7000 | 4375 | 245 | 17500 |
| **Deposit 2 (C1 + C2 Resources)** | 360000 | 0.95 | 1.90 | 1.15 | 0.65 | 45.0 | 3420 | 6840 | 4140 | 234 | 16200 |
| **Deposit 3 (C1 + C2 Resources)** | 1100000 | 0.90 | 1.80 | 1.15 | 0.60 | 45.0 | 9900 | 19800 | 12650 | 660 | 49500 |
| **TOTAL MANAILA** | **1810000** | **0.95** | **1.86** | **1.17** | **0.63** | **46.0** | **17170** | **33640** | **21165** | **1139** | **83200** |

### 6.7 Previous Mineral Resource and Reserve Estimates

A previous mineral resource estimate was completed by Vast during July 2016 and is provided in Table 8 to Table 11.

**Table 8: Open Pit Mineral Resource Estimate for the Manaila Polymetallic Mine, July 2016.**

| Category (Open Pit) | Cu % cut-off | Tonnes (Mill t) | Cu Metal (Kt) | Pb Metal (Kt) | Zn Metal (Kt) | Cu % | Pb % | Zn % |
|---|---|---|---|---|---|---|---|---|
| Measured | 0.25% | - | - | - | - | - | - | - |
| Indicated | 0.25% | 1.160 | 1.270 | 0.540 | 1.300 | 1.1 | 0.5 | 1.1 |
| **Meas + Ind** | **0.25%** | **1.160** | **1.270** | **0.540** | **1.300** | **1.1** | **0.5** | **1.1** |
| Inferred | 0.25% | 1.440 | 1.280 | 0.540 | 0.950 | 0.9 | 0.4 | 0.7 |
| **Meas + Ind + Inf** | **0.25%** | **2.600** | **2.540** | **1.070** | **2.260** | **1.0** | **0.4** | **0.9** |

**as at 31 July 2016 (topographic surface)*
** too a maximum depth of 125m below topographic surface*
** @ 0.25% Cu cut-off grade*

**Table 9: Underground Mineral Resource Estimate for the Manaila Polymetallic Mine, July 2016.**

| Category (Underground) | Cu % cut-off | Tonnes (Mill t) | Cu Metal (Kt) | Pb Metal (Kt) | Zn Metal (Kt) | Cu % | Pb % | Zn % |
|---|---|---|---|---|---|---|---|---|
| Measured | 1.00% | - | - | - | - | - | - | - |
| Indicated | 1.00% | 0.100 | 0.150 | 0.020 | 0.080 | 1.5 | 0.2 | 0.8 |
| **Meas + Ind** | **1.00%** | **0.100** | **0.150** | **0.020** | **0.080** | **1.5** | **0.2** | **0.8** |
| Inferred | 1.00% | 0.210 | 0.370 | 0.090 | 0.090 | 1.8 | 0.4 | 0.4 |
| **Meas + Ind + Inf** | **1.00%** | **0.310** | **0.520** | **0.110** | **0.170** | **1.7** | **0.4** | **0.5** |

**as at 31 July 2016 (topographic surface)*
** from a depth of 125m below topographic surface*
** @ 1.00% Cu cut-off grade*

**Table 10: Open Pit Exploration Target at Manaila Polymetallic Mine, July 2016.**

| OPEN PIT | Tonnes (Mill t) | | Grade (%) | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Exploration Target** | **Minimum** | **Maximum** | **Cu% Min** | **Cu% Max** | **Pb% Min** | **Pb% Max** | **Zn% Min** | **Zn% Max** |
| Weathered Zone | 0.320 | 0.860 | 0.8 | 2.0 | 0.2 | 0.5 | 0.3 | 0.8 |
| Fresh Zone | 4.130 | 11.020 | 0.9 | 2.3 | 0.2 | 0.5 | 0.4 | 1.1 |
| **Total** | **4.450** | **11.880** | **0.8** | **2.3** | **0.2** | **0.5** | **0.4** | **1.1** |

**as at 31 July 2016 (topographic surface)*
** too a maximum depth of 125m below topographic surface*

**Table 11: Underground Exploration Target at the Manaila Polymetallic Mine, July 2016.**

| UNDERGROUND | Tonnes (Mill t) | | Grade (%) | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Exploration Target** | **Minimum** | **Maximum** | **Cu% Min** | **Cu% Max** | **Pb% Min** | **Pb% Max** | **Zn% Min** | **Zn% Max** |
| Weathered Zone | - | - | - | - | - | - | - | - |
| Fresh Zone | 5.920 | 15.780 | 1.0 | 2.6 | 0.7 | 2.0 | 1.0 | 2.6 |
| **Total** | **5.920** | **15.780** | **1.0** | **2.6** | **0.7** | **2.0** | **1.0** | **2.6** |

**as at 31 July 2016 (topographic surface)*

** from a depth of 125m below topographic surface*

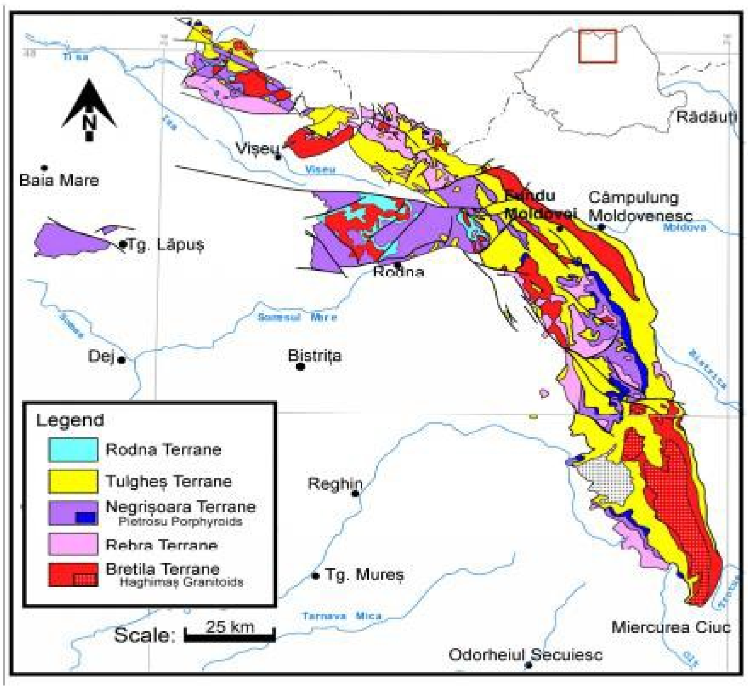
## 7. Geological Setting

### 7.1 Regional Geology

Romania consists of four major areas of Mesozoic and older rocks: the southern Carpathians, eastern Carpathians, Apuseni Mountains, and Dobrogea. The eastern Carpathians consist of two main paleogeographic and structural units, which are, from west to east, the inner crystalline zone, or Crystalline-Mesozoic zone ("CMZ") and the outer flysch zone. Mesozoic rocks of the CMZ are mainly shallow marine and nonmarine and overlie crystalline rocks of Paleozoic and Precambrian age. Structurally, the CMZ consists of a sequence of relatively east-directed thrust slices or nappes; all but the uppermost nappe contains pre-Mesozoic crystalline rocks.

The metamorphic basement of the CMZ is made up of four main lithostratigraphic groups: Bretila Group (Kräutner, 1938), Tulghes Group (Kober, 1931), Negrisoara Group (Balintoni and Gheuca, 1978; Balintoni, 1982) and Rebra Group (Kräutner, 1968), Figure 9.

**Figure 9: Geological Terranes of the Bucovinian and Sub-Bucovinian Nappes**

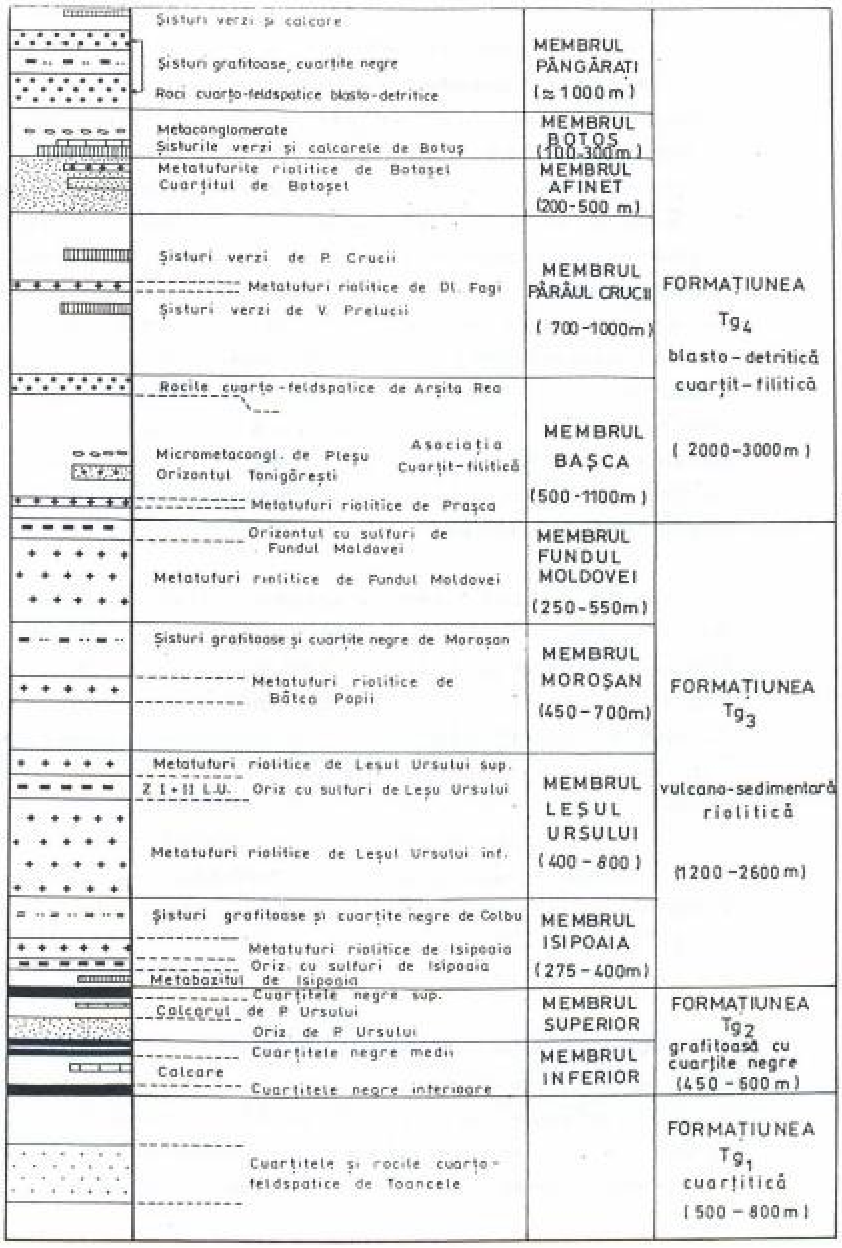


The Tulghes Group is made up of four formations, discriminated on the basis of changes in depositional conditions: Tg1, psammitic (sericite quartzites, sericite chlorite schists); Tg 2, graphitic (sericite-chlorite±graphite schists, graphitic metacherts±Mn deposits, carbonate rocks); Tg 3, volcanic (felsic metavolcanics±Kuroko-type base metal deposits, sericite-chlorite schists); Tg 4, composite (sericite-chlorite schists, metagreywackes, greenschists, acid metavolcanics, metacherts, carbonate rocks). Geochronological data indicate Lower Paleozoic ages for both deposition and metamorphism of the Tulghes Group. The Tulghes Group was metamorphosed under greenschist facies P-T conditions, as illustrated by the occurrence of biotite and garnet in metapelite rocks.

The four metamorphic groups are superimposed as the result of pre-Alpine thrust faults. Each group is considered to make up a discrete nappe (Balintoni et al., 1983; Sandulescu, 1984). The lowermost Rodna Nappe consists of the Rebra Group and is overridden by the Pietrosu Bistritei Nappe (Negrisoara Group) and Putna Nappe (Tulghes Group). The Bretila Group rests on top, forming the Rarau Nappe.

As visible in Figure 9, from a geological point of view, the studied area lies within the Tulgheș low-grade metamorphic unit, in the Crystalline-Mesozoic Zone of the Eastern Carpathians. The Tulghes metamorphic unit was the major Mn producer in Romania and it accounted for a notable output of Pb, Zn, Cu, pyrite and barite (Balintoni, 2010). The Tulghes metamorphic unit is of Ordovician age and is divided into four formations (Vodă and Balintoni, 1994): A. The Căboaia sub-unit (Tg1) – a quartzitic formation; B. The Holdița sub-unit (Tg2) – a quartzitic-graphitic formation; C. The Leșu Ursului sub-unit (Tg3) – a volcanic-sedimentary rhyolitic formation; D. Arșița Rea sub-unit (Tg4) – a phyllitic-quartzitic formation. Figure 10 provides the stratigraphic column as it applies to the mineralisation around the MPM area.

**Figure 10: Stratigraphic Column Referencing the MPM area.**



## 7.2 Local Geology

The local geology within the greater exploration perimeter of MPM comprises lithologies of the TG3 and TG4 formations of the Tulghes Group within the Bucovinian nappe. The geology comprises the lowermost units of the TG4 Formation and the uppermost units of the TG3 Formation. They comprise the following;

- TG3 Formation
  - Morosan Member
  - Fundu Moldovei Member
- TG4 Formation
  - Basque Formation

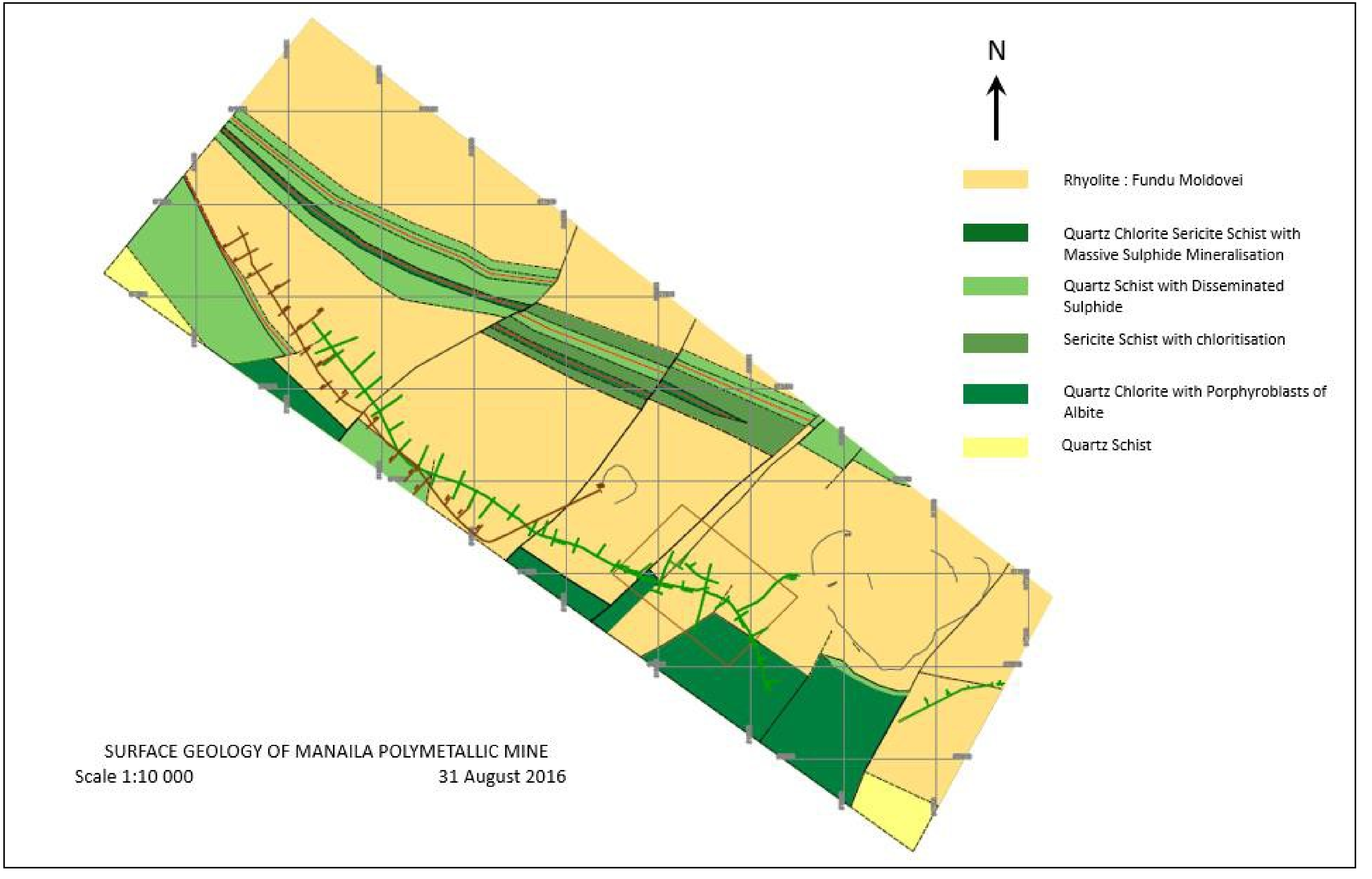
The rhyolitic volcanosedimentary sequence of the TG3 Formation begins with the Morosan Member at the base, which comprises quartz-sericite schists with intercalated chlorite. Interspersed within the schist is a 20 metre to 40 metre thick metamorphosed rhyolite unit termed the Bitca Popii. Above this unit are quartz-sericite-chlorite schists, which appear greenish white in colour and have thin discontinuous quartz veining. These schists grade towards a quartz-sericite-graphite schist. The Morosan Member ends with a chlorite-sericite schist with porphyroblasts of albite and is considered to be the immediate footwall of the level of the polymetallic mineralisation within the Manaila exploration area.

The Fundu Moldova Member is represented by a predominantly metamorphosed rhyolites and quartz-sericite schists which vary in thickness. The general stratigraphic thickness of the Fundu Moldovei Member is between 200 metres to 250 metres thick. The Fundu Moldovei Member overlies the Morosan Member, often marked by some shearing or thrusting, and comprises a 30 metre – 60 metre thick unit of quartz-sericite schists within which the polymetallic mineralisation develops. The mineralisation develops conformable to the schist and typically occurs in the lower two thirds of the unit. Overlying the quart-sericite schist unit is a discontinuous chloritic – feldspathic altered epiclastite, typically 20 metres – 40 metres thick where developed, which marks the end of the mineralisation event. Metamorphosed rhyolites with discontinuous, intercalated, thin intercalated quartz-sericite schists overly the meta-epiclastites. The top of the TG3 Formation is marked by the development of the polymetallic mineralisation associated with the mineralisation located within the Putnei – Prasca valley (Lesul Ursului, Fundu Moldova).

The TG4 Formation is located stratigraphically above the TG3 Formation and the lowermost lithologies are represented within the exploration perimeter by the Basque Member. The Basque Member is present in the north western of the exploration perimeter and is comprised of a cyclic alternation of various blastodetrital quartzites and phyllitic lithologies. Thin beds of acid metatuffs occur in the upper portions and indicate late stage extrusive rhyolitic volcanism. The TG4 Formation represents detrital material deposited during and after the waning stage of volcanism.

The surface geology of MPM is provided in Figure 11.

**Figure 11: Surface Geology of the Manaila Polymetallic Mine**



## 8. Deposit Type

Krautner has compared the stratiform polymetallic and pyrite ore deposits to that of the Japanese, Iberic and Canadian provinces. Similar ore forming processes have taken place in the Eastern Carpathians to those encountered in these provinces and represent a submarine volcanic environment marked by a predominantly rhyolitic volcano-sedimentary formation.

According to microscopic studies on mineral samples from MPM conducted by Moldoveanu, the ore consists predominantly of pyrite and chalcopyrite. X-Ray Diffraction ("XRD") determinations of quartz, pyrite and chalcopyrite were performed with a reasonable accuracy. This led Moldoveanu to conclude that the ore paragenesis is most likely of an initial volcanogenic Kuroko type and it consists of pyrite, chalcopyrite, some sphalerite, galena and tetrahedrite.

## 9. Mineralisation

Polymetallic mineralisation at MPM comprises a disseminated sulphide and a massive sulphide which grade into one another. The massive sulphide unit can be further subdivided into a pyrite rich massive sulphide and a polymetallic massive sulphide although the contacts are gradational with one another. Each are discussed below.

### 9.1 Disseminated Sulphide

The disseminated sulphide unit typically forms the flanks of the massive sulphide mineralisation and is the dominant type of mineralisation present. The grade tenor is lower than that of the massive sulphide and typically grades 0.2% - 0.6% Cu and Zn with localised increases in value to over 1.0% Cu and Zn.

### 9.2 Massive Sulphide

#### 9.2.1. Polymetallic Massive Sulphide

The polymetallic massive sulphides are well developed between drill hole F222 and the underground stope 3NV on level 4 in an ellipsoidal shape of 400 metres along strike and 200 metres down dip. This mineralisation has been sampled historically from underground, both by underground channel sampling over a distance of 300 metres and from underground drilling.

The average dip of the massive sulphides in this area ranges from $20^0$ – $30^0$ to the north east with a horizontal thickness of between 0.40 – 46.0 metres. This converts to a stratigraphic true thickness of between 0.25 – 29.5 metres. Mineralisation takes the form of pyrite, sphalerite, chalcopyrite and galena with subordinate tetrahedrite, covellite, bornite and native gold. Gangue materials form irregular masses and form a small percentage of the massive sulphide. The gangue minerals are typically quartz, chlorite and sericite derived from the host quartz sericite schists.

The majority of the sulphide minerals are in a subhedral form and the massive sulphide exhibits a hypidiomorphic texture which can grade both vertically and laterally into a semi-massive sulphide showing banding and ultimately into a disseminated sulphide orebody.

Mineralogical tests and assays undertaken at Baia Mare during the 1990's show the typical tenor for this type of mineralisation as shown in Table 12.

**Table 12: Typical Polymetallic Massive Sulphide Grade Ranges**

| Element | Cu % | Pb % | Zn % | S % | Au g/t | Ag g/t |
|---|---|---|---|---|---|---|
| Min Value | 0.01 | 0.01 | 0.02 | 0.35 | 0.10 | 20.00 |
| Max Value | 6.31 | 8.28 | 7.40 | 47.40 | 3.50 | 100.00 |

### 9.2.2. Pyrite Rich Massive Sulphide

The pyrite rich copper massive sulphide is developed along the same lithostratigraphic horizon as the polymetallic massive sulphide within the quart-sericite schist and typically grades out from the polymetallic massive sulphide 'core'.

The pyrite rich massive sulphide has been exposed and mapped in cross cutting drives from the main horizontal drives on level 4 and level 7 of the underground workings. The mineralisation has been mapped and sampled from underground channel samples and underground drilling and indicated to be approximately 1 700 metres long along strike and extending down dip for 600 metres through surface drill hole F154. Isolated areas or lenses of more polymetallic massive sulphide do occur within this zone.

The mineralisation remains concordant with bedding of the host quartz sericite schist, dipping at approximately $30^0$ – $40^0$ to the northeast with locally variable induced through localised faulting. Horizontal thickness as exposed from underground workings ranges from 0.5 metres to 17.0 metres, averaging 3.5 metres in horizontal thickness. This converts to a true thickness of approximately 0.3 – 10.9 metres.

Mineralisation takes the form of pyrite (approximately 70% of total sulphide mineralisation), chalcopyrite with subordinate tetrahedrite, sphalerite and galena. Gangue materials form irregular masses and form a small percentage of the massive sulphide. The gangue minerals are typically quartz, chlorite and carbonate with subordinate chlorite and clay minerals.

The majority of the sulphide minerals are in a subhedral form and the massive sulphide exhibits a hypidiomorphic or microgranoblastic texture. Mineralogical tests and assays undertaken at Baia Mare during the 1990's show the typical tenor for this type of mineralisation as shown in Table 13.

**Table 13: Typical Pyrite Rich Massive Sulphide Grade Ranges**

| Element | Cu % | Pb % | Zn % | S % | Au g/t | Ag g/t |
|---|---|---|---|---|---|---|
| Min Value | 0.04 | 0.01 | 0.04 | 0.45 | 0.10 | 10.00 |
| Max Value | 10.04 | 3.86 | 6.43 | 45.80 | 2.80 | 70.00 |

# 10. Vast Resources PLC Exploration – August 2015 to present

## 10.1 Surface Exploration Drilling

Vast has undertaken two phases of surface diamond drilling as reported in the mineral resource report dated 31 July 2016 since the acquisition of MPM in August 2015.

The third and most recent phase of surface diamond drilling is detailed in this report.

### 10.1.1. Phase 3 Surface Diamond Drilling

A total of nineteen surface diamond drill holes were undertaken at MPM during July 2017 to October 2017 by Vast. The purpose of the drilling was to expand and improve on the mineral resource classification of the mineral resources in the area known as Carlibaba to the north east of the current operational open pit.

A total of nineteen surface diamond drill holes were collared and completed for a total of 2 210.8 metres of diamond drilling. The locality of the drill holes in relation to the underground workings and channel sampling, the historic drill holes and the outline of the open pit are provided in Figure 12.

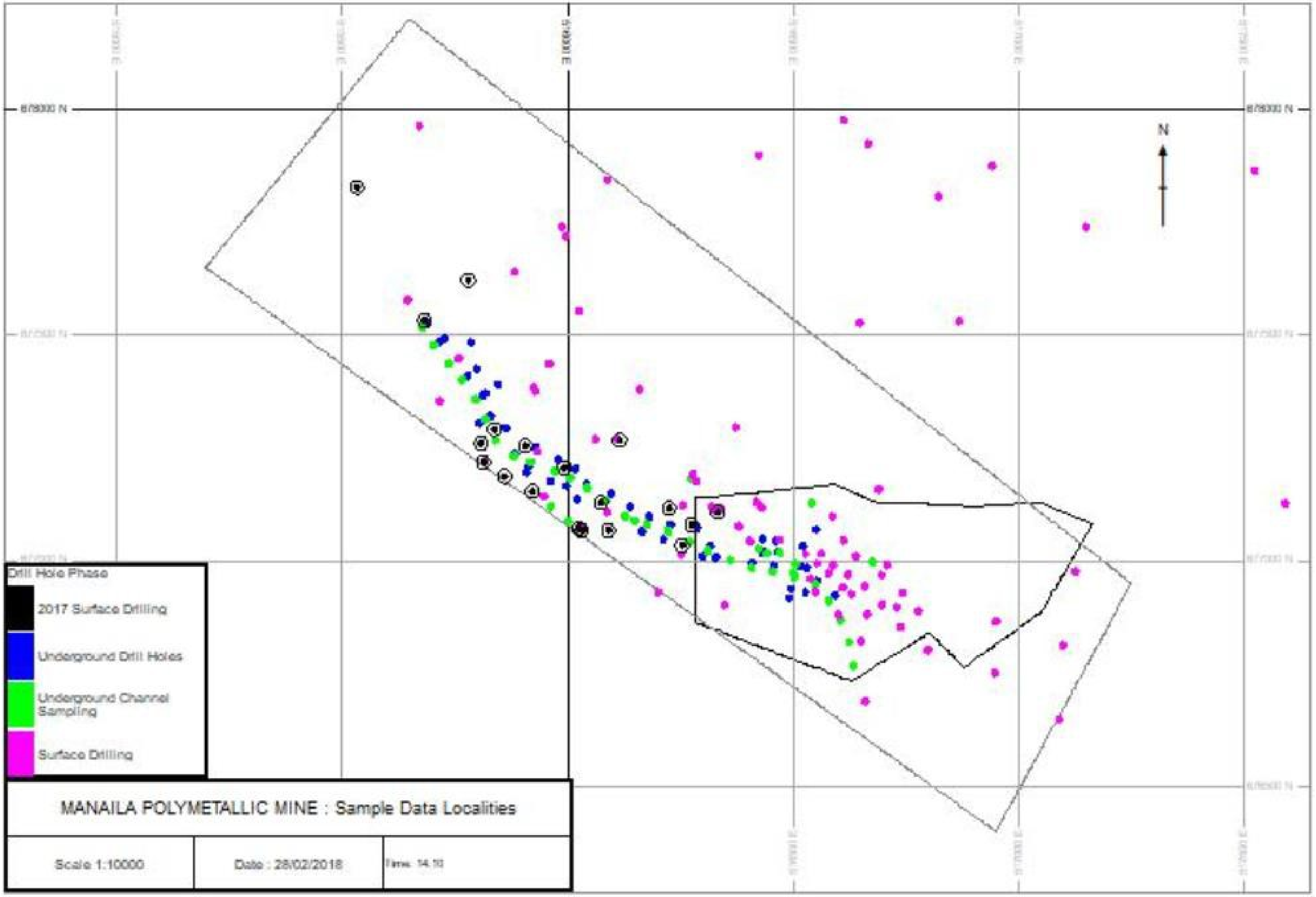
The drill holes were logged on site at the open pit by Vast geologists in conjunction with personnel from a Romanian geological consultancy, FORMIN S.A. The holes were drilled utilising an air driven, track mounted diamond core drilling machine, which produced a PQ size (ID = 85mm) core run. The core was placed into 1 metre long core trays with space for 3 x 1 metre runs. The core was marked for depth and tested against final hole depth to ascertain core loss if any.

The results of the surface diamond drilling programme are provided in Table 14.

**Table 14 : Results of nineteen surface drill hole program at Carlibaba**

| Drill hole ID | From (m) | To (m) | Length (m) | Au (g/t) | Ag (g/t) | Cu % | Pb % | Zn % |
|---|---|---|---|---|---|---|---|---|
| F001 | 28 | 55 | 27.0 | 0.28 | 11.19 | 0.49 | 0.21 | 0.45 |
| F002 | 21.5 | 24 | 2.5 | 0.26 | 4.72 | 0.21 | 0.01 | 0.06 |
| | 41 | 48.5 | 7.5 | 0.06 | 1.23 | 0.13 | 0.04 | 0.05 |
| F003 | 85 | 97 | 12.0 | 0.16 | 3.00 | 0.49 | 0.01 | 0.07 |
| | 101.3 | 105 | 3.7 | 0.22 | 3.03 | 0.33 | 0.03 | 0.08 |
| F004 | 109.2 | 113.7 | 4.5 | 0.18 | 9.98 | 1.17 | 0.08 | 0.21 |
| | 122 | 127.7 | 5.7 | 0.77 | 10.63 | 0.80 | 0.04 | 0.15 |
| F005 | 114.6 | 127 | 12.4 | 0.44 | 14.60 | 1.11 | 0.18 | 0.43 |
| F006 | 122 | 124 | 2.0 | Intersected underground drive. Massive sulphides in the final 0.10 metres of core obtained. | | | | |
| F007 | 63 | 67.3 | 4.3 | 0.20 | 3.53 | 0.29 | 0.03 | 0.07 |
| | 87 | 89.5 | 2.5 | 0.06 | - | 0.16 | 0.01 | 0.14 |
| F008 | 26 | 27.5 | 1.5 | 0.15 | 5.00 | 0.15 | 0.07 | 0.14 |
| F009 | 79 | 81 | 2.0 | 0.10 | 11.40 | 0.38 | 0.11 | 0.36 |
| | 136 | 145.5 | 9.5 | 0.36 | 39.42 | 1.48 | 0.40 | 0.83 |
| F010 | 0.0 | 80.0 | 80.0 | No Intersection | | | | |
| F011 | 0.0 | 139.0 | 139.0 | Faulted | | | | |
| F012 | 38.5 | 38.8 | 0.3 | 0.23 | 9.0 | 1.25 | 0.04 | 0.25 |
| | 80.4 | 91.0 | 0.47 | 41.74 | 0.82 | 0.52 | 0.68 | 0.47 |
| F013 | 61.3 | 62.8 | 1.5 | 0.13 | 18.33 | 0.43 | 0.45 | 1.07 |
| | 92.0 | 94.7 | 2.7 | 0.33 | 62.44 | 0.94 | 1.18 | 0.41 |
| | 100.5 | 105.0 | 4.5 | 0.26 | 16.22 | 0.39 | 0.27 | 0.53 |
| F014 | 227.8 | 228.5 | 0.7 | 0.27 | 7.00 | 0.63 | 0.05 | 0.29 |
| F015 | 0.0 | 227.0 | 227.0 | Faulted, Intrusive, Breccia | | | | |
| F016 | 122 | 128.0 | 6 | 0.06 | 3.00 | 0.08 | 0.02 | 0.05 |
| F017 | 0.0 | 107.0 | 107.0 | Faulted | | | | |
| F018 | 70.9 | 77.4 | 6.5 | 0.12 | 9.11 | 0.65 | 0.09 | 0.20 |
| F019 | 42.3 | 46.6 | 4.3 | 0.21 | 48.79 | 1.25 | 0.55 | 1.85 |

**Figure 12: Locality of sample localities compiled by Vast Resources PLC**



The core was marked up for sampling based on lithological breaks and a minimum sample interval of 0.2 metres. All zones selected for sampling were halved by means of a diamond saw cutter and each sample of the mineralised zone was logged for the perceived visual percentage and type of sulphide mineral present. The samples were bagged on site with a unique sample number which was recorded on the individual drill hole logging sheets.

The core samples were despatched to the in-house analytical laboratory at the Iacobeni metallurgical facility for further preparation. The samples were crushed and riffle split to produce two samples for every initial core sample. One sample was kept for analyses by the on-site laboratory at the metallurgical facility at Iacobeni. The second sample was despatched to the laboratory facilities of ALS Minerals located at Rosia Montana, Alba County, within Romania. The sample analyses were conducted by ALS Loughrea located at Dublin Road, Loughrea, County Galway, Ireland. The drill hole collar positions were surveyed by Vast personnel upon completion of drilling. No downhole surveys were conducted due to the relatively shallow drilling depth and the size of the core produced.

The geological log sheets, collar positions and sampling intervals were captured into an Excel spreadsheet. These were checked by additional geological staff to eliminate transposing errors while capturing the data and the data was subsequently imported into a Datamine Studio 3 drill hole database for drill hole compositing and safe keeping.

## 11. Sample Preparation, Analyses and Security

### 11.1 Vast Exploration Drilling

#### 11.1.1. Phase 3

The phase 1 surface drilling undertaken by Vast was split into duplicate sample batches with one batch being analysed on site at the Iacobeni metallurgical laboratory and the second batch sent for analyses at with ALS Minerals ("ALS"). The samples were received at the ALS laboratories located at communa Rosia Montana, Alba County, Romania where the samples underwent sample preparation according to the ALS protocol WEI-21.

These samples were dispatched to the ALS laboratories located at Dublin road, Loughrea, County Galway, Ireland for analyses. The samples were analysed for copper, lead, zinc and sulphur values using the ALS protocol method ME-ICPORE.

Blank samples, standard assay value samples and duplicate samples were inserted into the sample stream at ALS as part of the Quality Assurance ("QA") and Quality Control ("QC") program. No sample anomalies were detected and the QC certificate of analysis, and the certificate of analysis RM17182704, is provided in Appendix 1 and the certificate of analysis RM17237044 in Appendix

**12.** The blank sample standards all returned assay values of less than the detection limits for the elements assayed. Ten standard samples were used to cover the range of assays done. Results of the standard assays are provided in Figure 13 through **Error! Reference source not found.**.

**Figure 13: Assay Results of Standard Samples for AU**

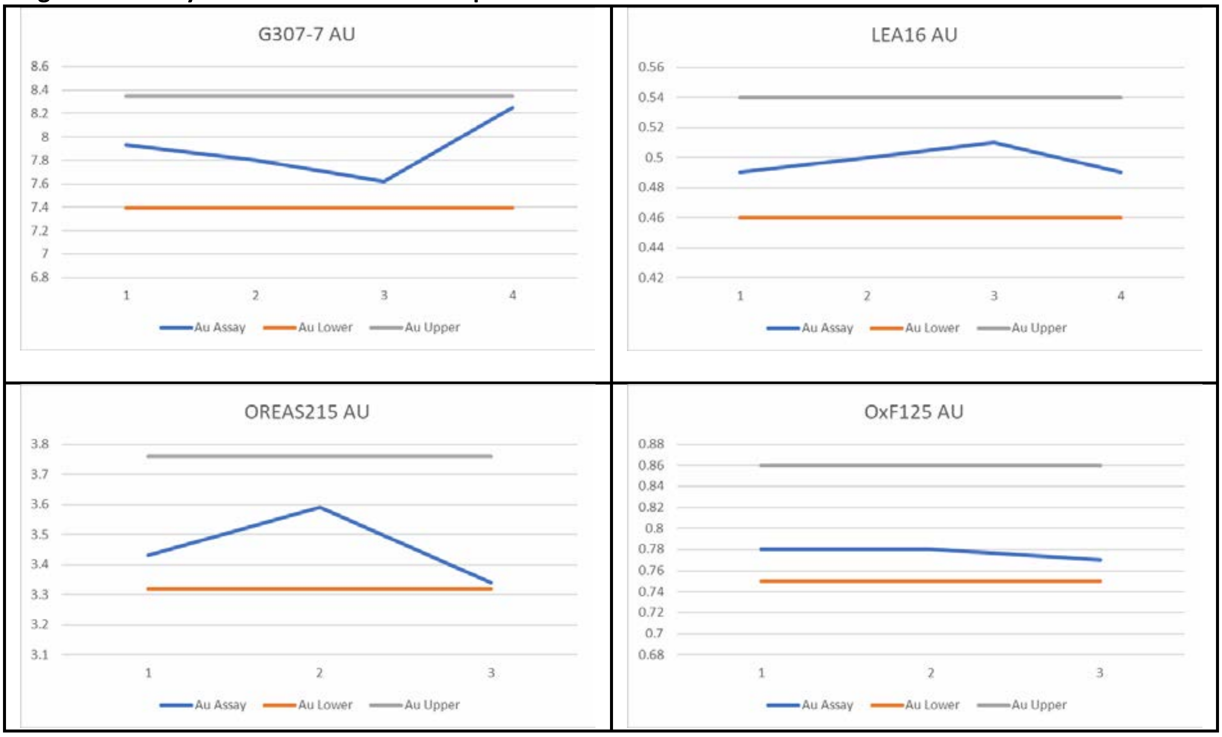
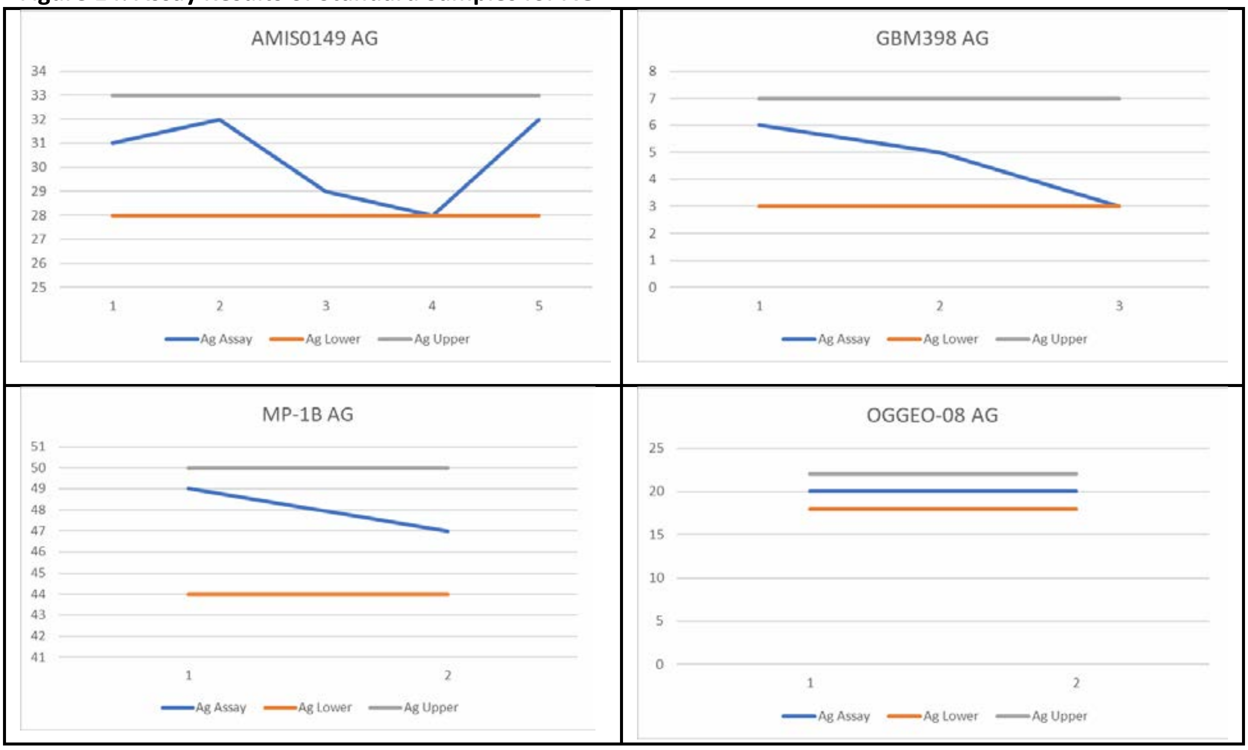



**Figure 14: Assay Results of Standard Samples for AG**



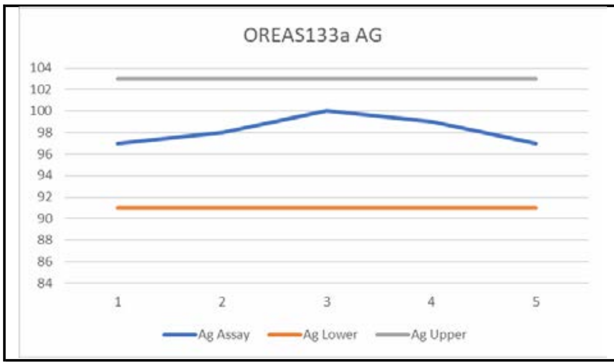



**Figure 15: Assay Results of Standard Samples for CU**

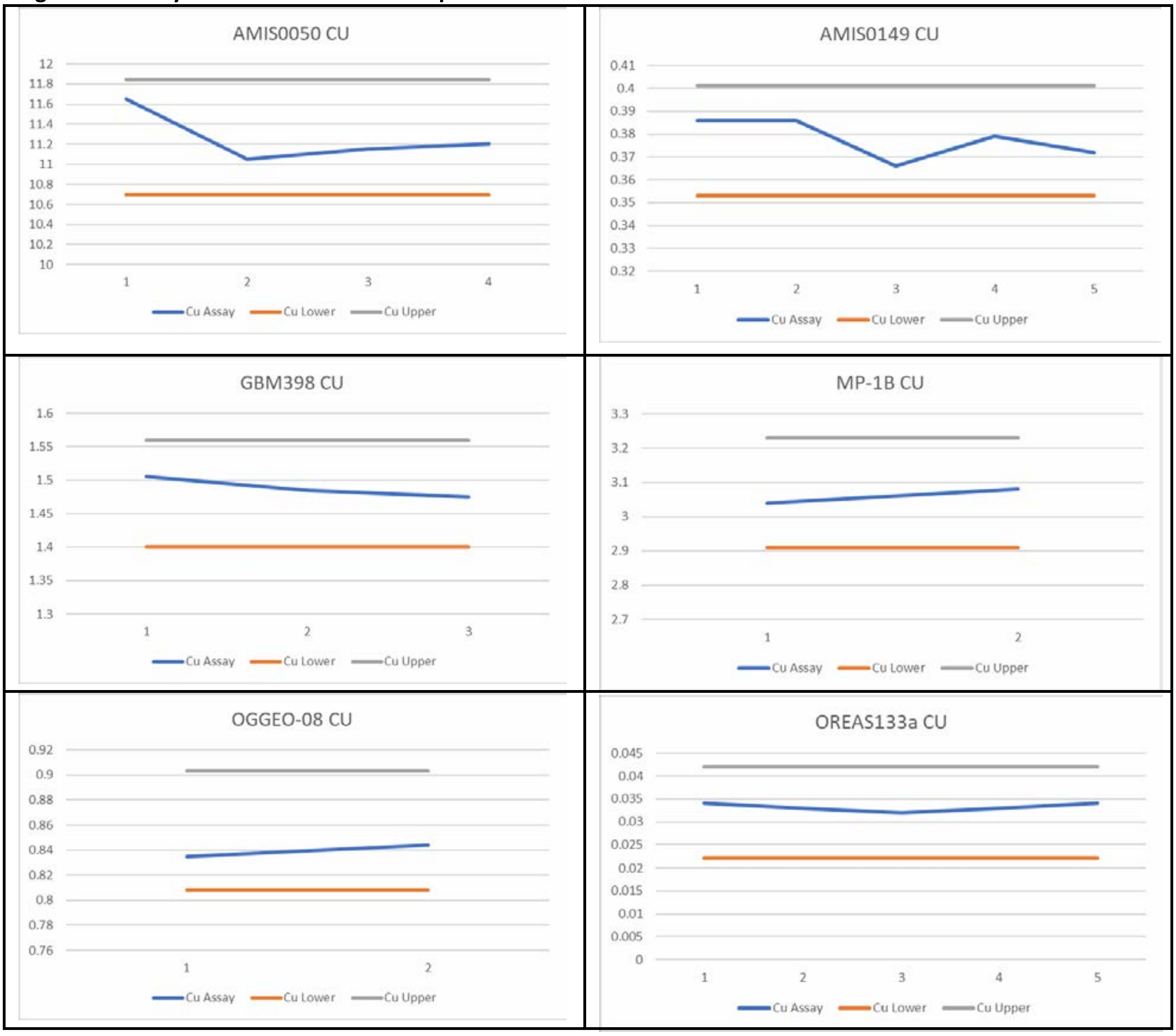



**Figure 16: Assay Results of Standard Samples for ZN**

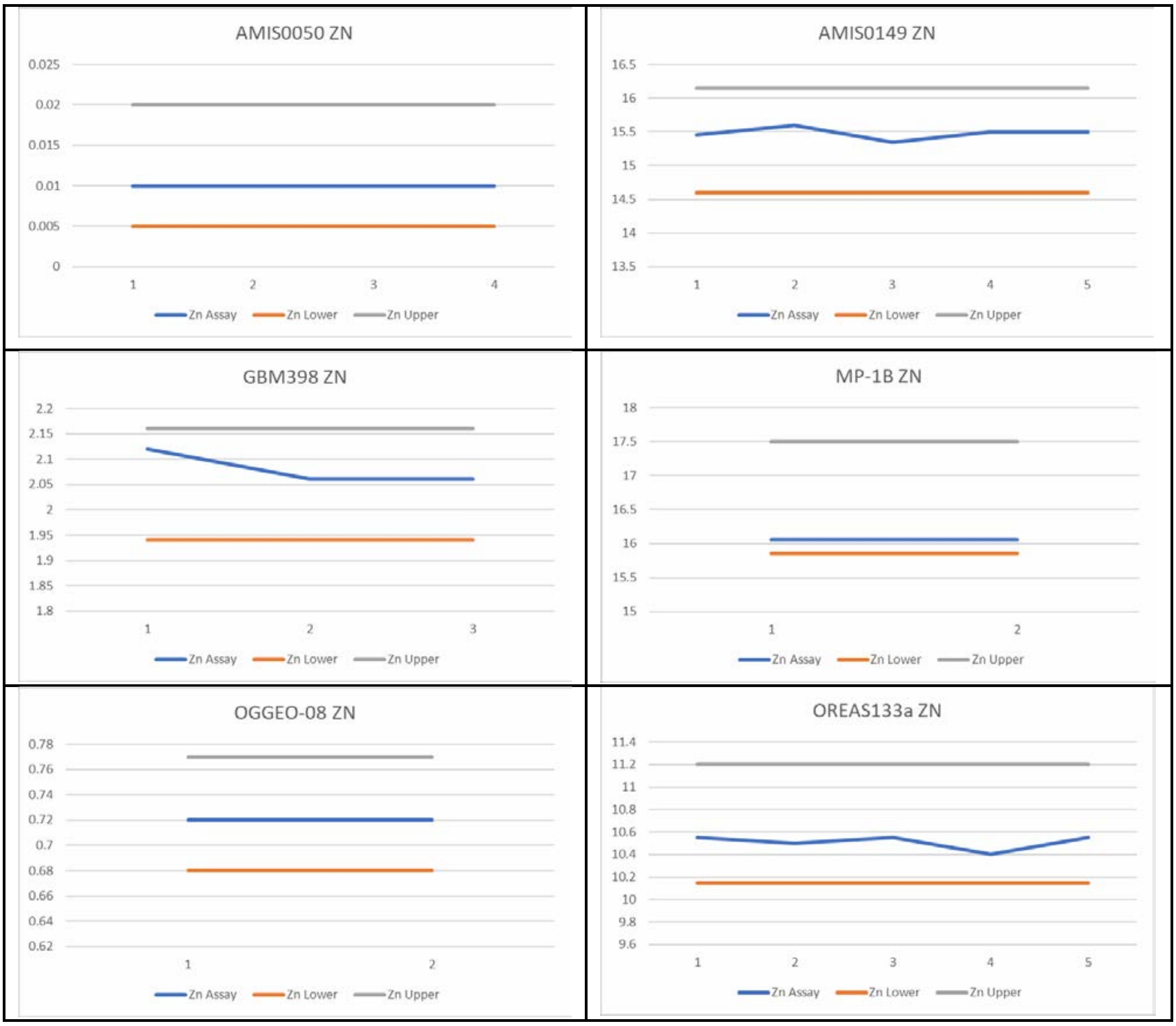
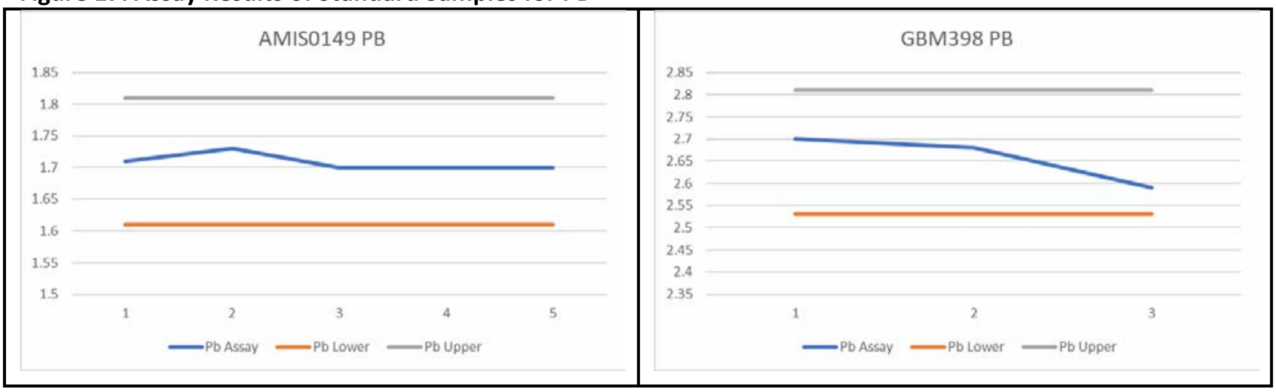
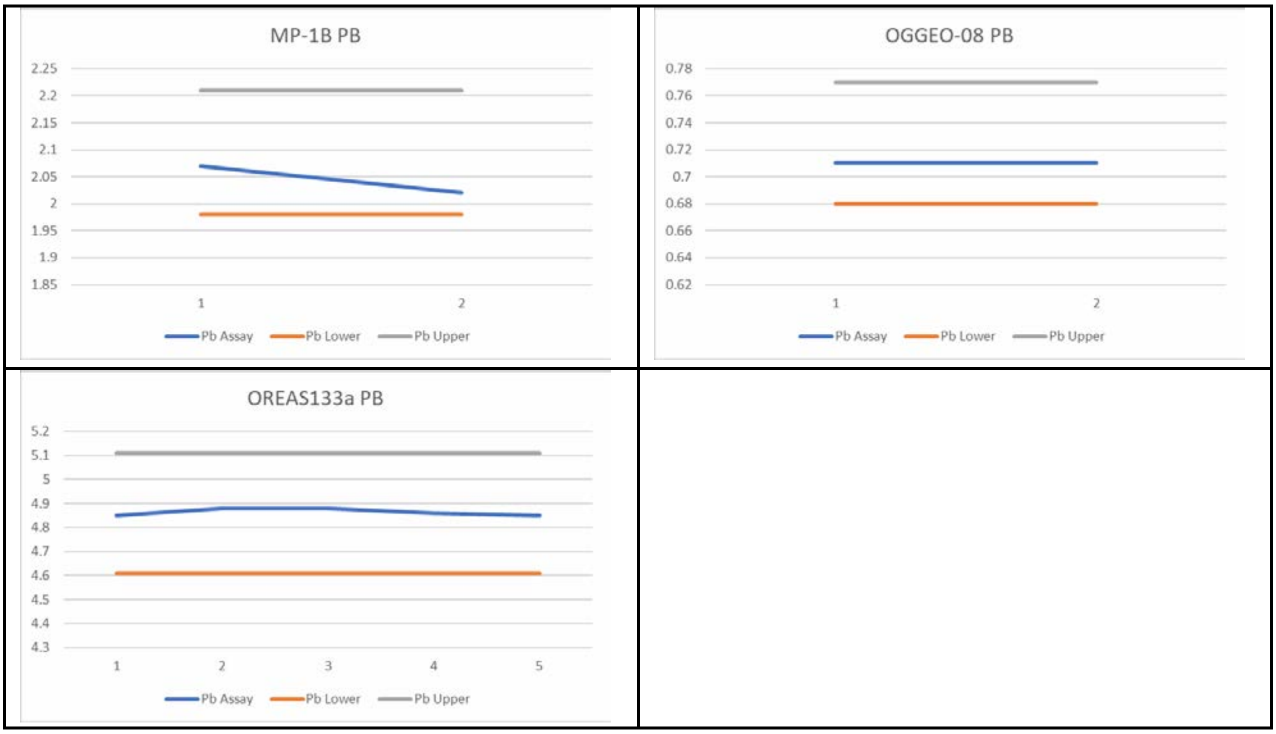



**Figure 17: Assay Results of Standard Samples for PB**






ALS conducted duplicate assaying on a total of eighteen samples submitted for assay. The results of the duplicate sample assaying are provided in Figure 18.

**Figure 18: Assay Results of Duplicate Samples**

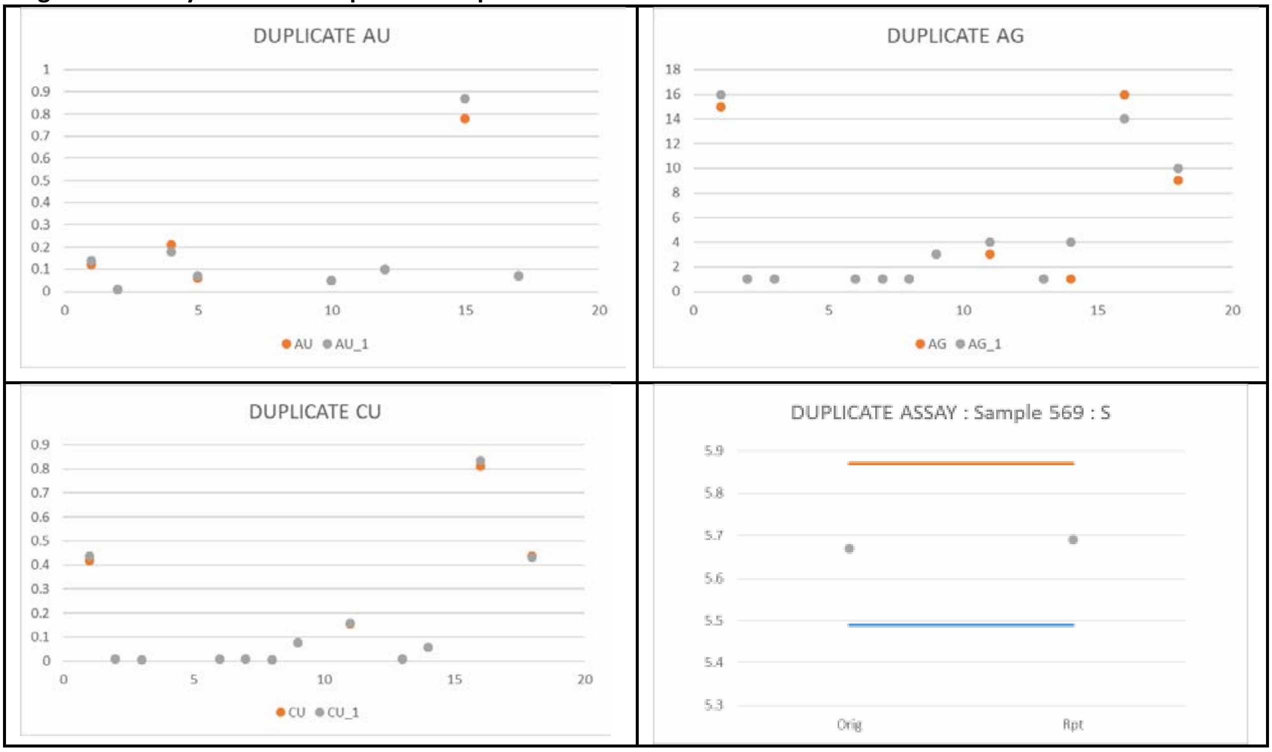
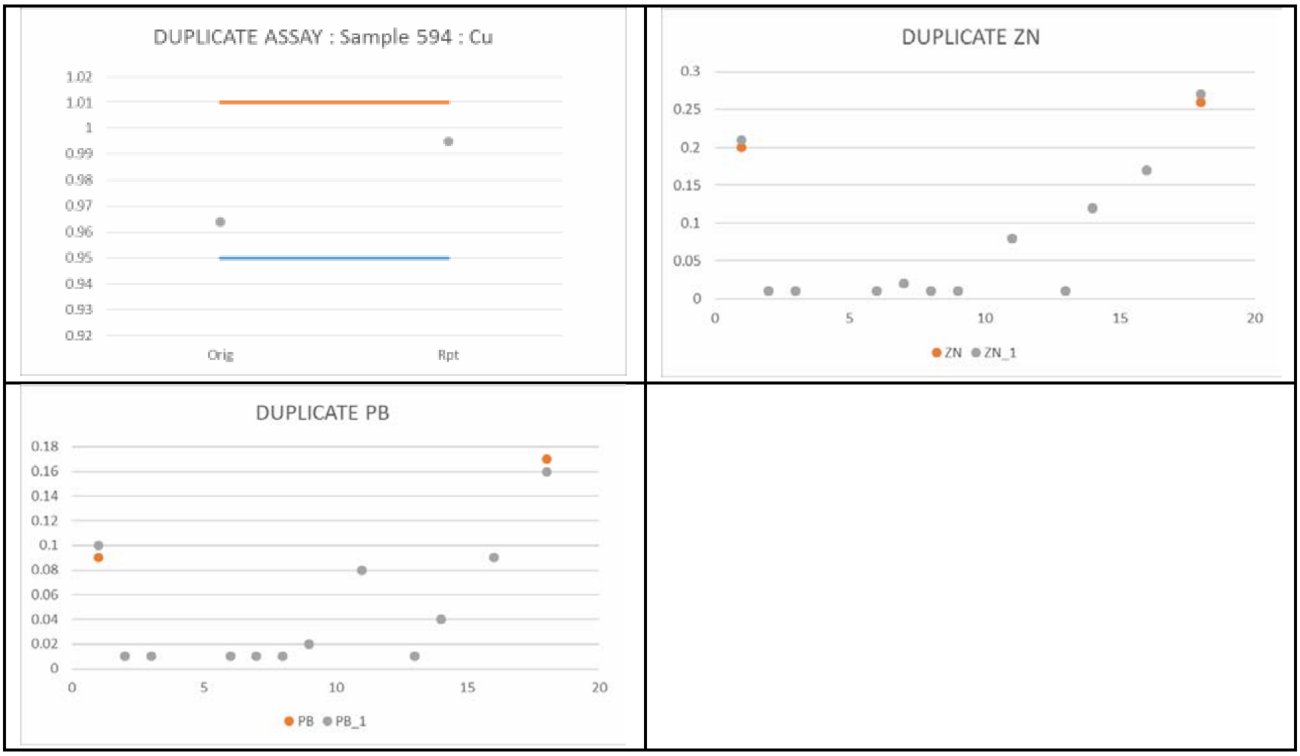



**Figure 19: Assay Results of Duplicate Sample Number 594**




## 12. Mineral Resource Estimates

### 12.1 Geological Modelling

The geological modelling has been completed using all available geological data. This includes lithological mapping and data from underground workings, underground and surface core diamond drilling together with surface geological mapping. The structural data was interpreted from surface and open pit geological mapping together with logs from underground and surface drill holes. A structural model was created defining discrete structural blocks within the exploration license area. Faulting of <5.0 metres displacement is not modelled in this geological model. Figure 20 depicts the structural blocks within the exploration license area and Figure 21 is a three dimensional representation depicting the orientation of the structural blocks in three dimensional space.

The structural blocks were grouped into three discrete zones. Zone 1 represents the area around the currently operational open pit, Zone 2 represents the area across a structural feature defining a natural break between the Carlibaba area and the current mining operations. Zone 3 is the depth extension across Zone 1 and Zone 2 and has limited data. Figure 22 depicts the three zones.

**Figure 20: Structural Domains within the Exploration Perimeter of the Manaila Polymetallic Mine.**

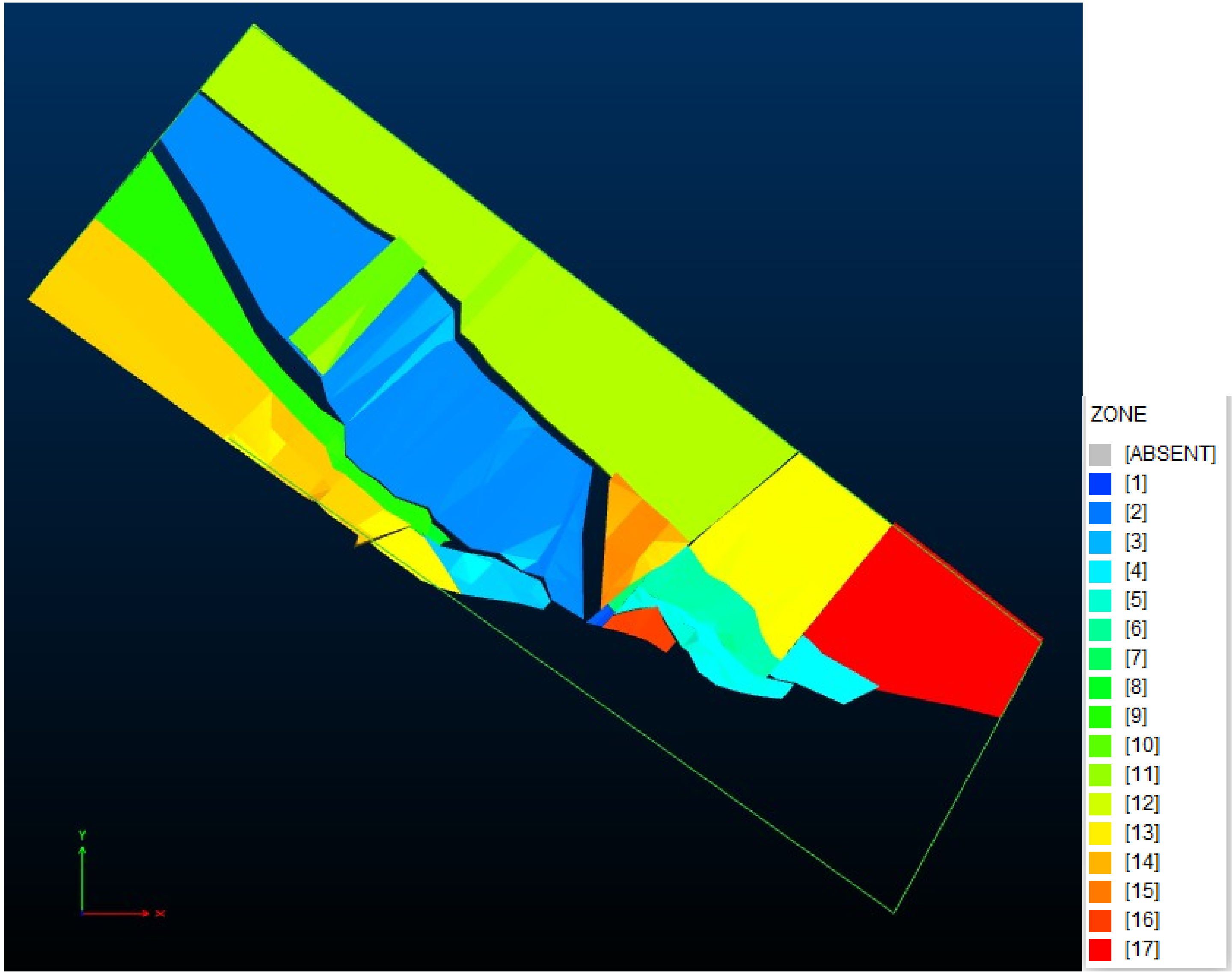


**Figure 21: 3 Dimensional View of the Structural Blocks of the Manaila Polymetallic Mine looking from Above in an Easterly Direction**

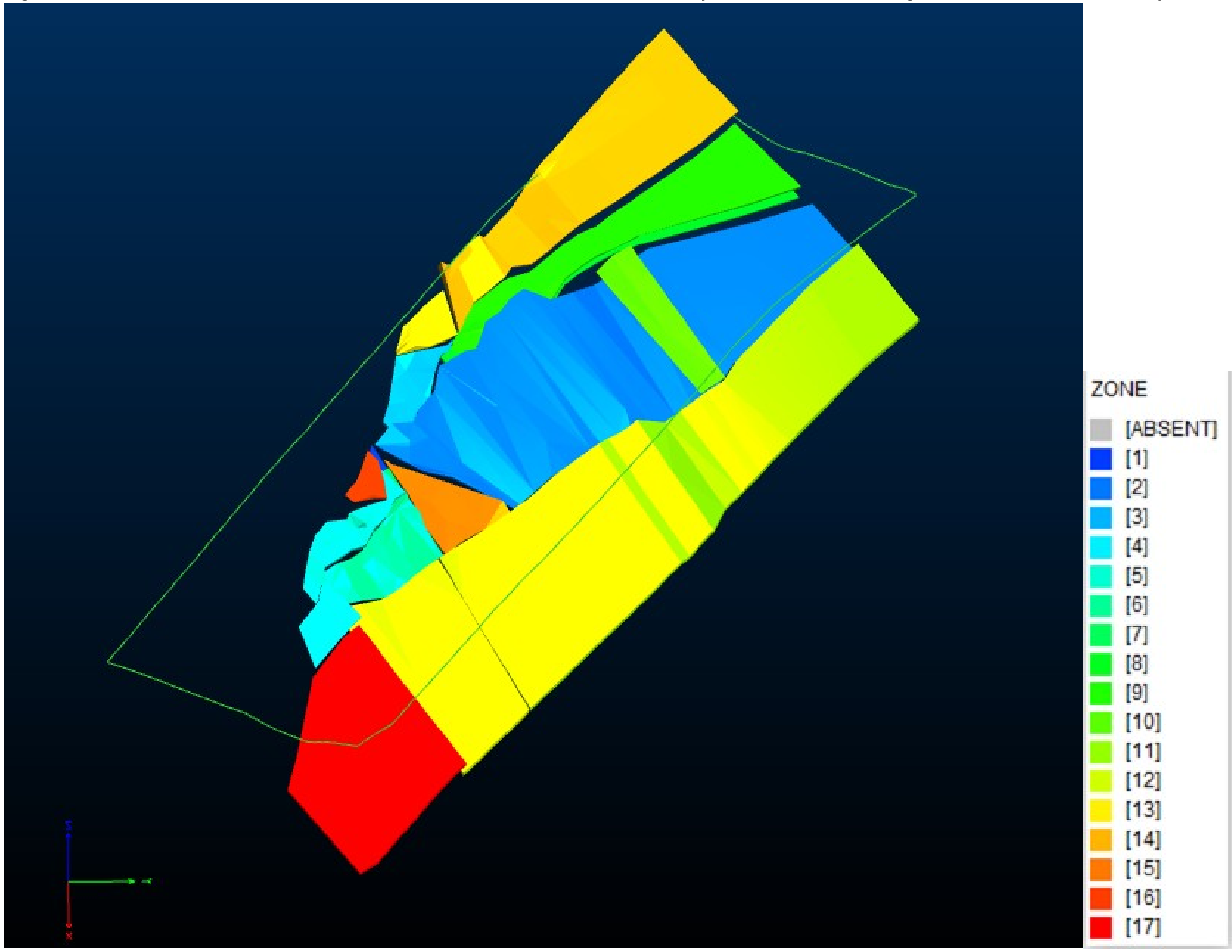
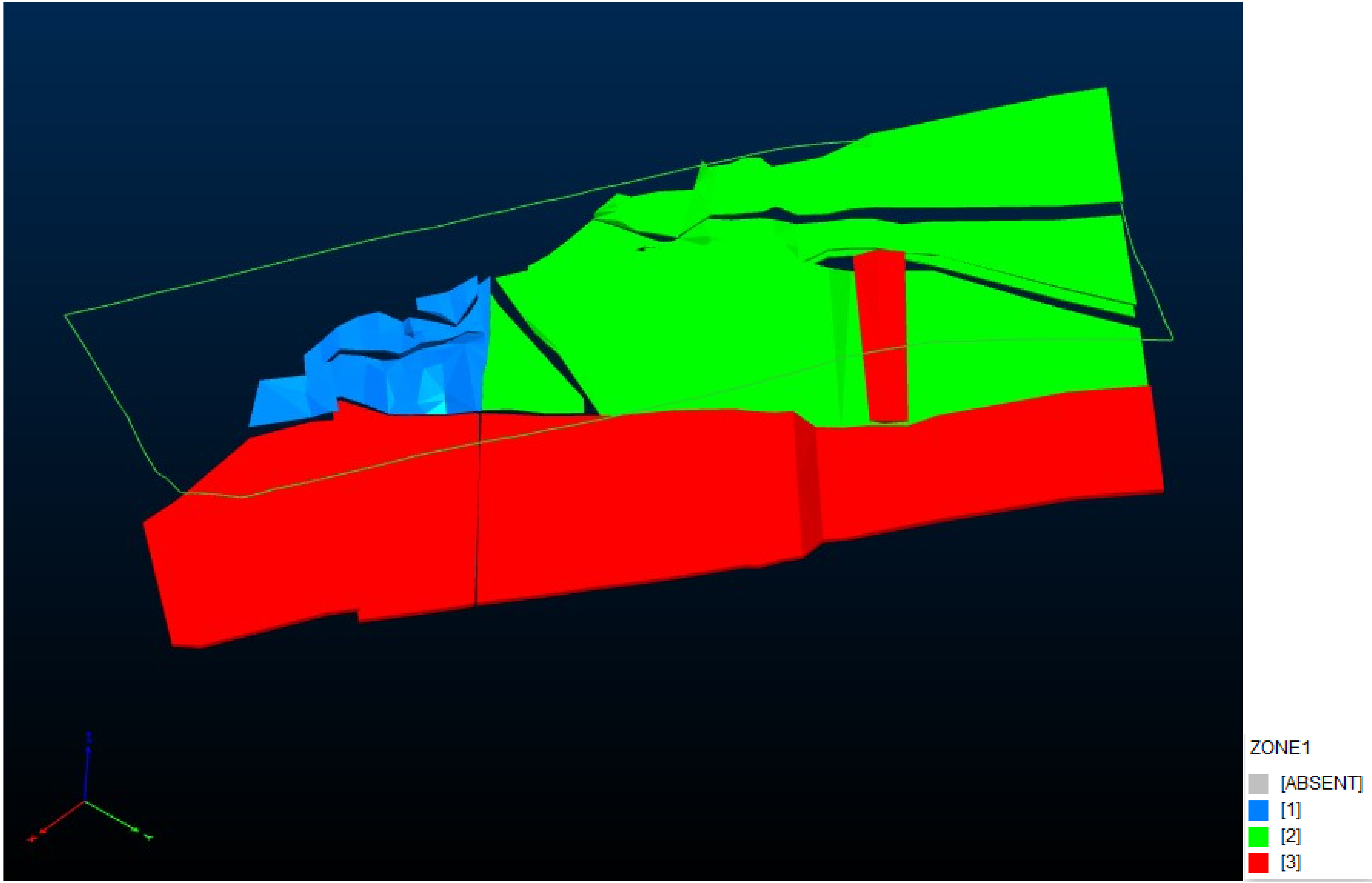


**Figure 22: Estimation Zones within the Exploration Perimeter of the Manaila Polymetallic Mine.**



## 12.2 Data Handling

The drill hole database was code with an identifier for the source of the data. Table 15 lists the various types of data used and the corresponding data amount for each type.

**Table 15: Source of Data Input to Drill Hole Database**

| Data Type | Code (Field = 'GROUP') | Data Points / Samples |
|---|---|---|
| Historic Surface Drilling | 1 | 263 |
| Vast Drilling – Phase 1 | 2 | 50 |
| Vast Drilling – Phase2 | 3 | 40 |
| Historic Underground Drilling | 4 | 486 |
| Historic Underground Sampling | 5 | 731 |
| Vast Drilling – Phase 3 | 6 | 188 |

### 12.2.1. Data Statistics

Data statistics for the two main zones with data are provided in Table 16 on a raw assay and basis and Table FF on a 1.0 metre length composite basis.

**Table 16: Data Statistics for Raw Assay Data**

| Zone | Value | Samples | Min | Max | Mean | Variance | Std Dev | CoV |
|---|---|---|---|---|---|---|---|---|
| 1 | AG | 13 | 11.55 | 90.35 | 58.31 | 738.50 | 27.18 | 0.47 |
| 1 | AU | 13 | 0.15 | 0.75 | 0.33 | 0.02 | 0.15 | 0.47 |
| 1 | CU | 517 | 0.01 | 6.72 | 1.61 | 1.33 | 1.15 | 0.72 |
| 1 | PB | 427 | - | 4.62 | 0.71 | 0.52 | 0.72 | 1.02 |
| 1 | S | 413 | 0.06 | 46.64 | 23.43 | 168.73 | 12.99 | 0.55 |
| 1 | ZN | 517 | 0.02 | 7.40 | 1.60 | 2.30 | 1.52 | 0.95 |
| | | | | | | | | |
| 2 | AG | 98 | 1.00 | 166.00 | 12.41 | 515.81 | 22.71 | 1.83 |
| 2 | AU | 106 | 0.01 | 1.32 | 0.22 | 0.06 | 0.24 | 1.10 |
| 2 | CU | 326 | 0.01 | 10.04 | 0.83 | 1.66 | 1.29 | 1.55 |
| 2 | PB | 267 | 0.01 | 2.85 | 0.21 | 0.20 | 0.45 | 2.09 |
| 2 | S | 273 | - | 45.80 | 18.03 | 186.46 | 13.65 | 0.76 |
| 2 | ZN | 326 | 0.01 | 4.41 | 0.39 | 0.44 | 0.67 | 1.71 |

**Table 17: Data Statistics for 1.0 metre length composite sample**

| Zone | Value | Samples | Min | Max | Mean | Variance | Std Dev | CoV |
|---|---|---|---|---|---|---|---|---|
| 1 | AG | 16 | 11.55 | 90.35 | 58.55 | 756.64 | 27.51 | 0.47 |
| 1 | AU | 16 | 0.15 | 0.75 | 0.32 | 0.02 | 0.14 | 0.45 |
| 1 | CU | 586 | 0.01 | 6.72 | 1.59 | 1.28 | 1.13 | 0.71 |
| 1 | PB | 462 | 0.00 | 3.69 | 0.70 | 0.49 | 0.70 | 1.01 |
| 1 | S | 437 | 0.06 | 46.50 | 23.29 | 164.75 | 12.84 | 0.55 |
| 1 | ZN | 586 | 0.02 | 7.40 | 1.58 | 2.19 | 1.48 | 0.94 |
| | | | | | | | | |
| 2 | AG | 159 | 1.00 | 166.00 | 12.00 | 493.65 | 22.22 | 1.85 |
| 2 | AU | 177 | 0.01 | 1.32 | 0.22 | 0.05 | 0.23 | 1.07 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | CU | 401 | 0.01 | 10.04 | 0.85 | 1.67 | 1.29 | 1.53 |
| 2 | PB | 334 | 0.01 | 2.83 | 0.21 | 0.19 | 0.44 | 2.05 |
| 2 | S | 340 | - | 45.59 | 17.89 | 178.39 | 13.36 | 0.75 |
| 2 | ZN | 401 | 0.01 | 4.41 | 0.39 | 0.44 | 0.66 | 1.67 |

## 12.3 Block Model Creation

Datamine Studio 3 was used to create a resource block model. Parent cell sizes of 5.0 metres in the X direction, 5.0 metres in the Y direction and 2.0 metres in the Z direction were used. The geological wireframes defining the structural blocks and sulphide mineralisation type were filled with the resource blocks and sub-celling was allowed to take place in order to accurately define the boundaries between the mineralised and waste zones. The resource blocks were coded with the corresponding structural and evaluation domains. No rotation of the resource block model was undertaken.

## 12.4 Block Model Density

A density field was created within the resource block model and densities were assigned as per Table 18.

**Table 18: Densities Assigned to the Geological Block Model**

| Zone Number | Heavily Weathered Density (t/m$^3$) | Moderately Weathered Density (t/m$^3$) | Fresh Density (t/m$^3$) |
|---|---|---|---|
| 1 - Ore | 2.50 | 2.90 | 3.20 |
| 2 - Ore | 2.50 | 2.90 | 3.20 |
| 3 - Ore | 2.50 | 2.90 | 3.20 |
| 1 - Waste | 1.80 | 2.20 | 2.70 |
| 2 - Waste | 1.80 | 2.20 | 2.70 |
| 3 - Waste | 1.80 | 2.20 | 2.70 |

Operationally, the mining and geology departments of MPM assign and use the densities as quoted for the fresh material in the planning and accounting of ore and waste tonnages.

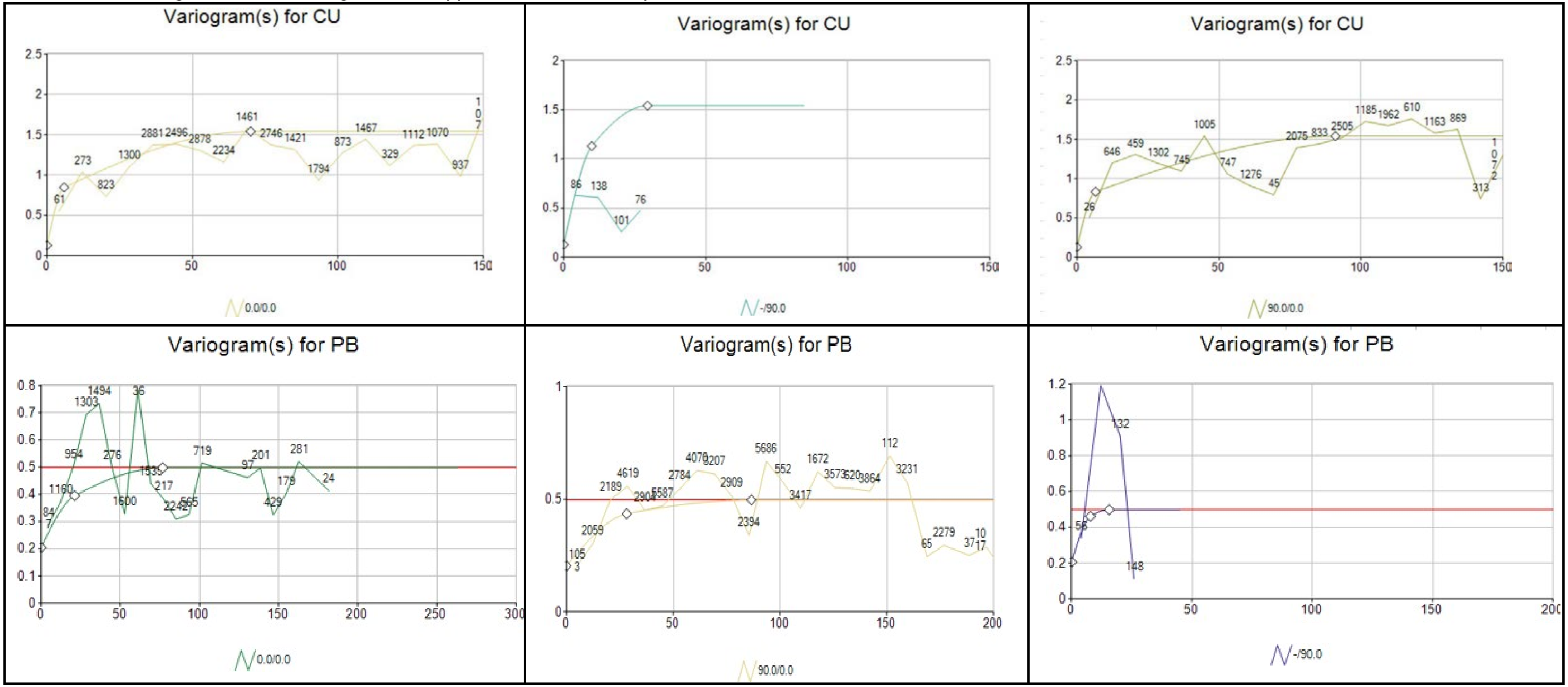
## 12.5 Mineral Resource Estimation

### 12.5.1. Variography

Zone 1 and Zone 2 were modelled for variography for copper, lead, zinc and sulphur. Figure 23 provides directional anisotropic variography for Zone 1 and Figure BB provides directionless isotropic variography for Zone 2.

Variography was not conducted on Zone 3, or for any of the gold and silver values due to a lack of data.

**Figure 23: Semi-Variograms for Copper, Lead, Zinc and Sulphur in Zone 1.**



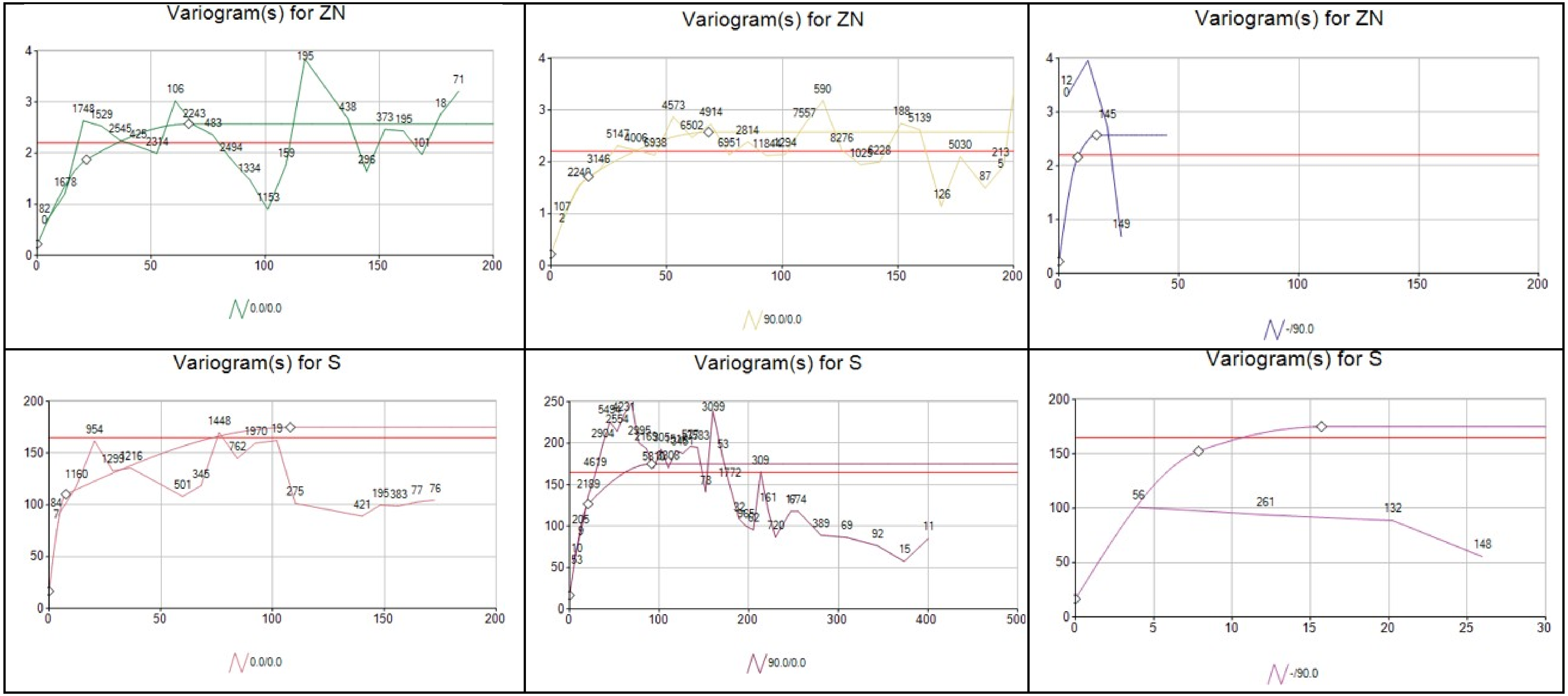
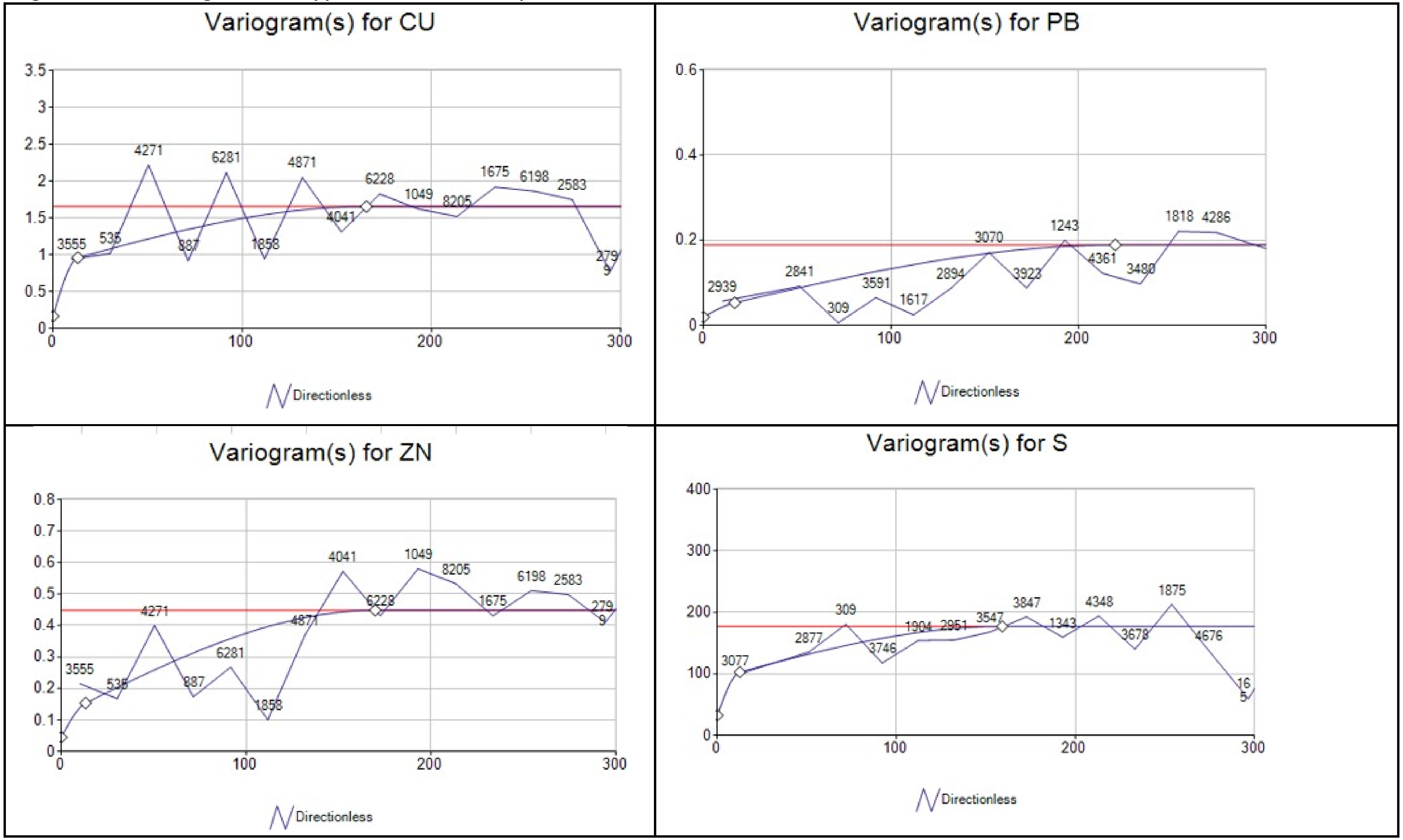

Variogram(s) for ZN
0.0/0.0
Variogram(s) for ZN
90.0/0.0
Variogram(s) for ZN
-/90.0
Variogram(s) for S
0.0/0.0
Variogram(s) for S
90.0/0.0
Variogram(s) for S
-/90.0

**Figure 24: Semi-Variograms for Copper, Lead, Zinc and Sulphur in Zone 2**



### 12.5.2. Methodology

A summary of the interpolation method used for each structural domain is provided in Table 19 and **Error! Reference source not found.**.

**Table 19: Interpolation Method used for Zones 1, 2 and 3.**

| Zone Number | Interpolation Method | Search Radius | | | Search Volume Rotation | | | Samples per Search Volume | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | X (m) | Y (m) | Z (m) | X (deg) | Y (deg) | Z (deg) | min / max | min /max | min / max |
| 1 | OK | 95 | 50 | 16 | 23.7 | -27.5 | 336.3 | 10/30 | 10/30 | 10/30 |
| 2 | OK | 166 | 166 | 50 | 30 | 0 | 40 | 10/30 | 10/30 | 10/30 |
| 3 | ID2 | 150 | 150 | 50 | 30 | 0 | 40 | 10/30 | 10/30 | 10/30 |

**Table 20: Variogram Parameters used for Interpolation in Zone1 and Zone 2**

| Domain Number | Value Estimated | Variogram Parameters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Nugget Effect | Sill_1 | Range X | Range Y | Range Z | Sill_2 | Range X | Range Y | Range Z |
| 1 | CU | 0.402 | 0.56 | 11.0 | 26.6 | 7.8 | 0.61 | 94.8 | 49.8 | 15.7 |
| | PB | 0.204 | 0.18 | 28.3 | 21.2 | 7.8 | 0.12 | 86.5 | 76.8 | 15.7 |
| | ZN | 0.220 | 1.03 | 16.2 | 21.6 | 7.8 | 1.32 | 68.2 | 69.8 | 15.7 |
| | S | 16.479 | 86.18 | 20.6 | 7.6 | 7.8 | 72.32 | 91.5 | 108.0 | 15.7 |
| | AU | | | 100 | 100 | 10 | | | | |
| | AG | | | 100 | 100 | 10 | | | | |
| 2 | CU | 0.165 | 0.7 | 13.2 | 13.2 | 13.2 | 0.79 | 165.6 | 165.6 | 165.6 |
| | PB | 0.019 | 0.02 | 16.6 | 16.6 | 16.6 | 0.15 | 219.6 | 219.6 | 219.6 |
| | ZN | 0.045 | 0.07 | 13.2 | 13.2 | 13.2 | 0.33 | 169.8 | 169.8 | 169.8 |
| | S | 32.455 | 60.48 | 12.7 | 12.7 | 12.7 | 84.15 | 159.2 | 159.2 | 159.2 |
| | AU | | | 150 | 150 | 50 | | | | |
| | AG | | | 150 | 150 | 50 | | | | |

## 12.6 Mineral Resource Categorisation

Mineral resource estimates were categorised based on several contributing factors. These include the level of confidence in the interpretation of the geological structures derived from the all data sources, including underground mapping of the two horizontal underground drives.

Zone 3 has been designated as an Exploration Target due to widely spaced drilling and the absence of assay information in the historical drill hole records. Table 21 identifies the domains which have been hard coded for mineral resource categorisation.

**Table 21: Mineral Resource Categorisation based on Geological Confidence**

| Zone | Hard Coded (y/n) | Resource Category | Interpolation Method |
|---|---|---|---|
| 1 | N | As per estimation | Ordinary Kriging |
| 2 | N | As per estimation | Ordinary Kriging |
| 3 | Y | Exploration Target | Inverse Distance $^{2}$ |

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The remaining structural domains were classified according to the search volume used, number of samples for estimation and the kriging efficiency, where ordinary kriging was used as the interpolation method. All domains were filled on the last pass of interpolation, search volume = 3, and these resource estimates were assigned as an exploration target. Table 22 provides information per domain used in the mineral resource classification.

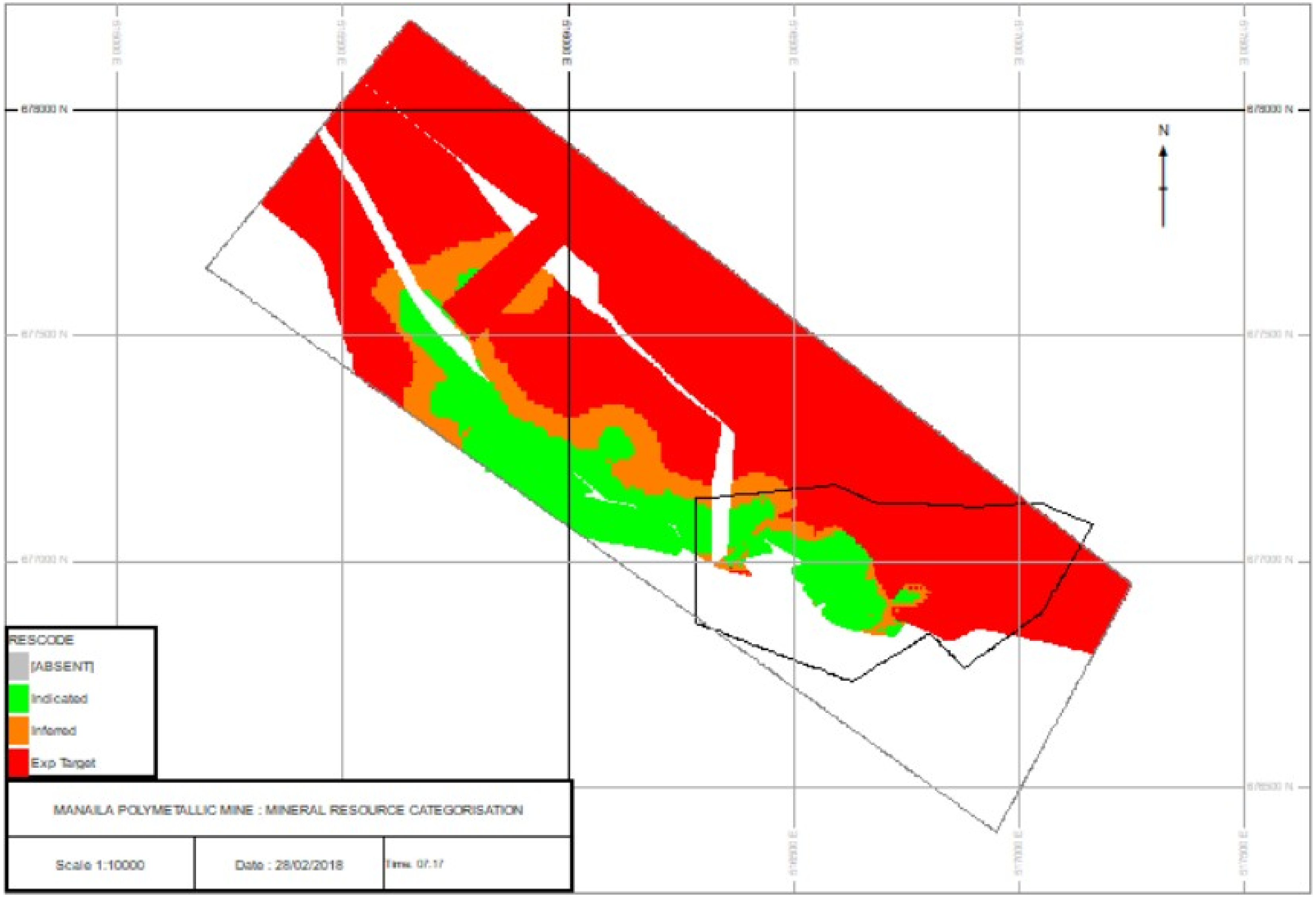
**Table 22: Mineral Resource Classification based on Interpolation**

| Item | Measured | Indicated | Inferred | Exp. Target |
|---|---|---|---|---|
| Search Volume | 1 | 1 or 2 | 1 or 2 | 1 or 2 or 3 |
| Regression Slope | >=0.85 | >=0.60 <0.85 | >=0.20 <0.60 | <=0.20 |

The mineral resource categories are displayed visually in Figure 25.

.

**Figure 25: Mineral Resource Categories at the Manaila Polymetallic Mine**



## 12.7 Mineral Resource Validation

A Quantitative Kriging Neighbourhood Analysis (“QKNA”) was carried out for Zone 1 and Zone 2 utilising the multivariate functionality within Datamine Studio RM. The results are discussed below.

### 12.7.1. QKNA

#### 12.7.1.1. Cell Discretisation

Cell discretisation was examined as per Figure 26. Final selection was 3 x 3 x 3 discretisation points.

#### 12.7.1.2. Block Size

The impact of various block sizes was examined, and results are provided in Figure 27. A final selection of 5.0m x 5.0m x 2.0m was selected as the best compromise between processing time and results.

#### 12.7.1.3. Search Distance

The search distance parameters were examined for the most efficient distance parameters for a well-informed area, moderately informed area and a sparsely informed area. Results are provided in Figure 28 and these were used as guidelines when determining the search ellipse to be used for both the Ordinary Kriging and Inverse Distance Squared methods of interpolation.

#### 12.7.1.4. Number of samples

The optimal minimum and maximum number of samples to be used were tested and the results are provided in Figure 29. A final selection of 10 samples as a minimum and 30 samples as a maximum was selected.

### 12.7.2. Swathe Plots

Swathe plots were created for copper, lead, zinc, sulphur, gold and silver for Zone 1 and Zone2. The results are provided in Figure 30 and Figure 31.

**Figure 26: Cell Discretisation**

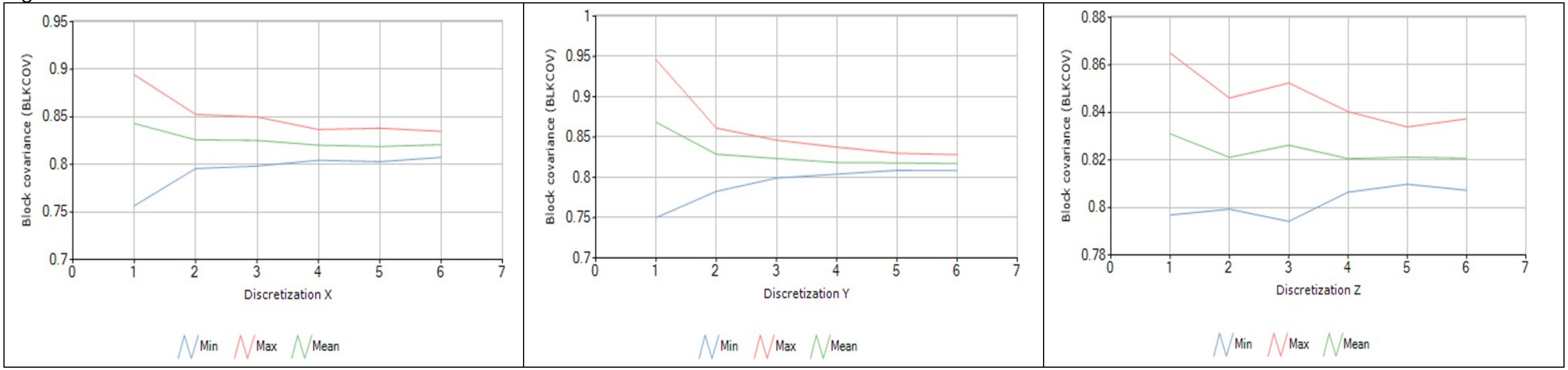



**Figure 27: Block Sizes**

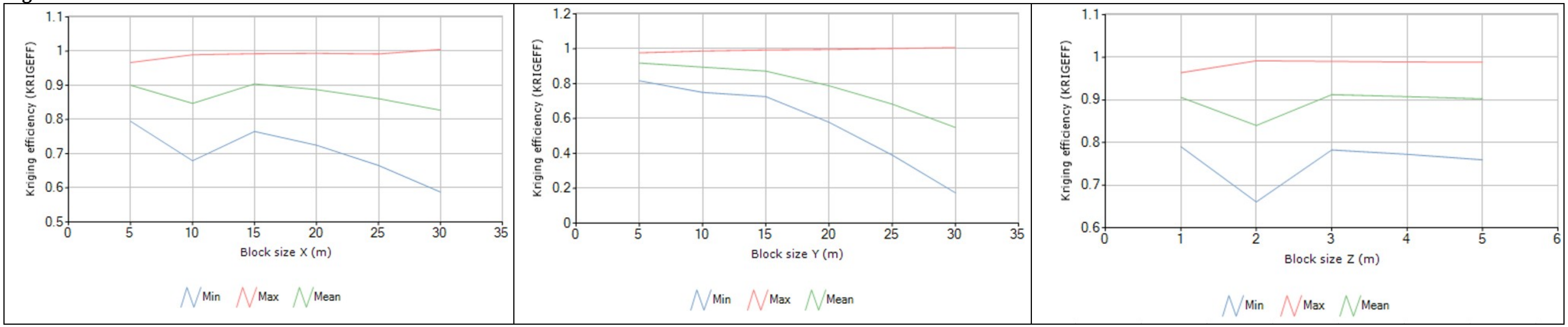


**Figure 28: Search Distance**

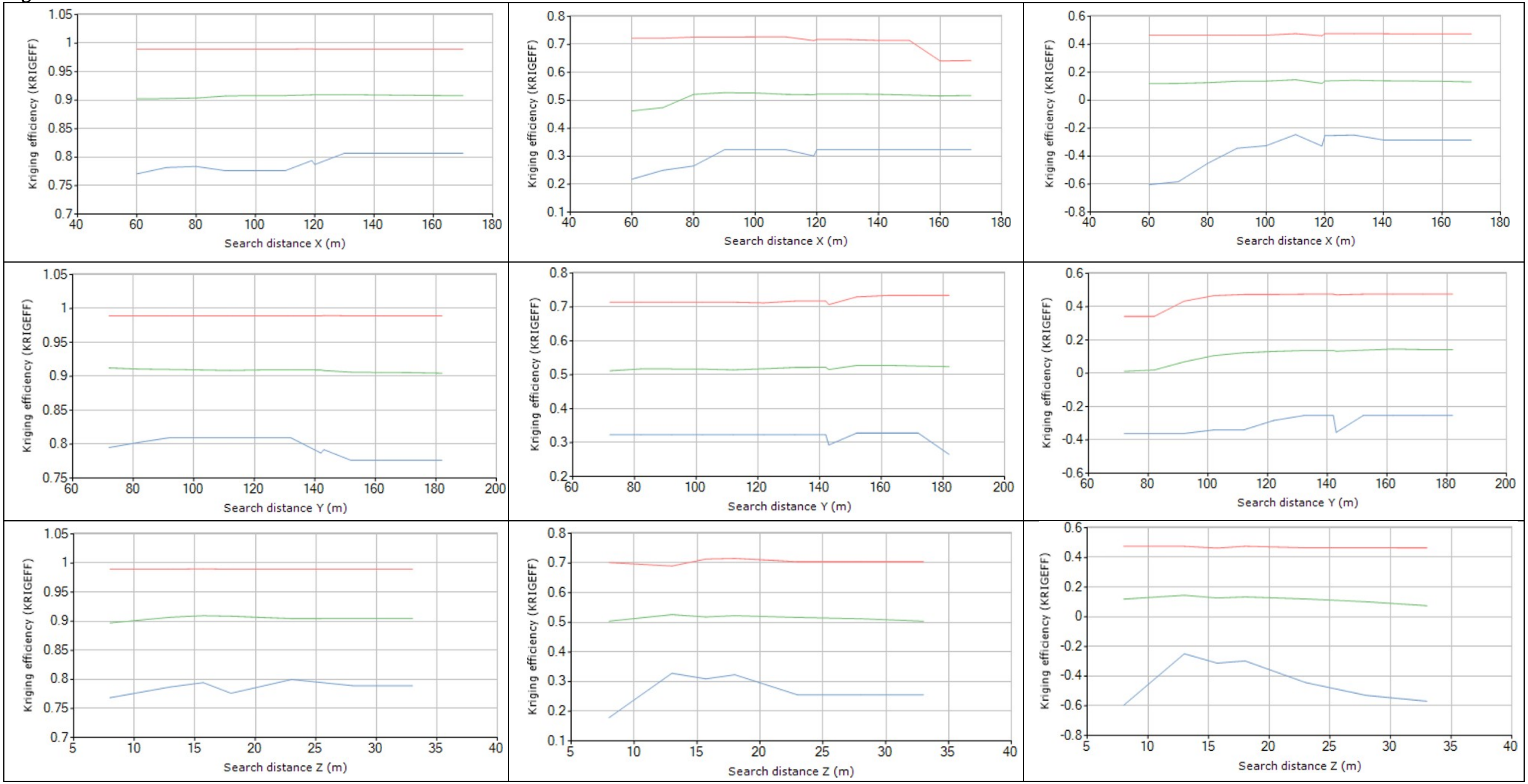


**Figure 29: Number of Samples**

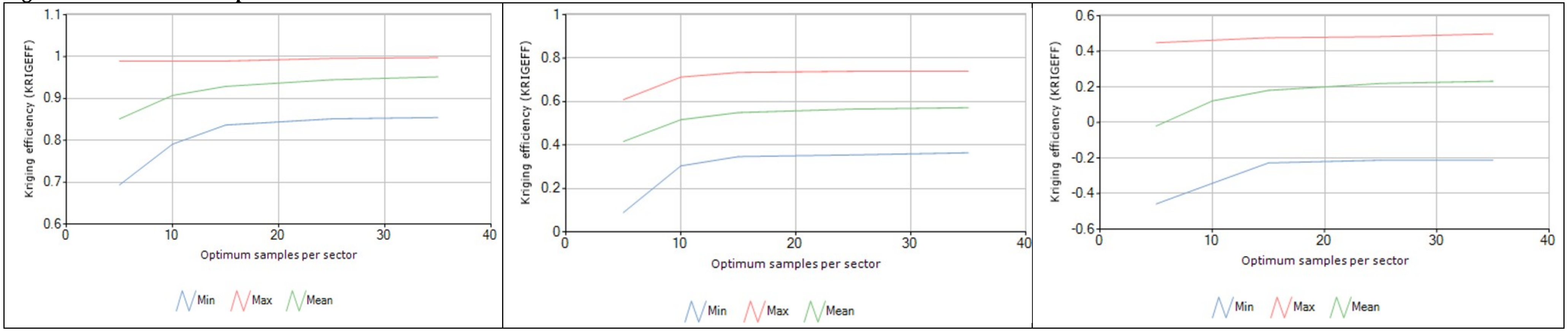
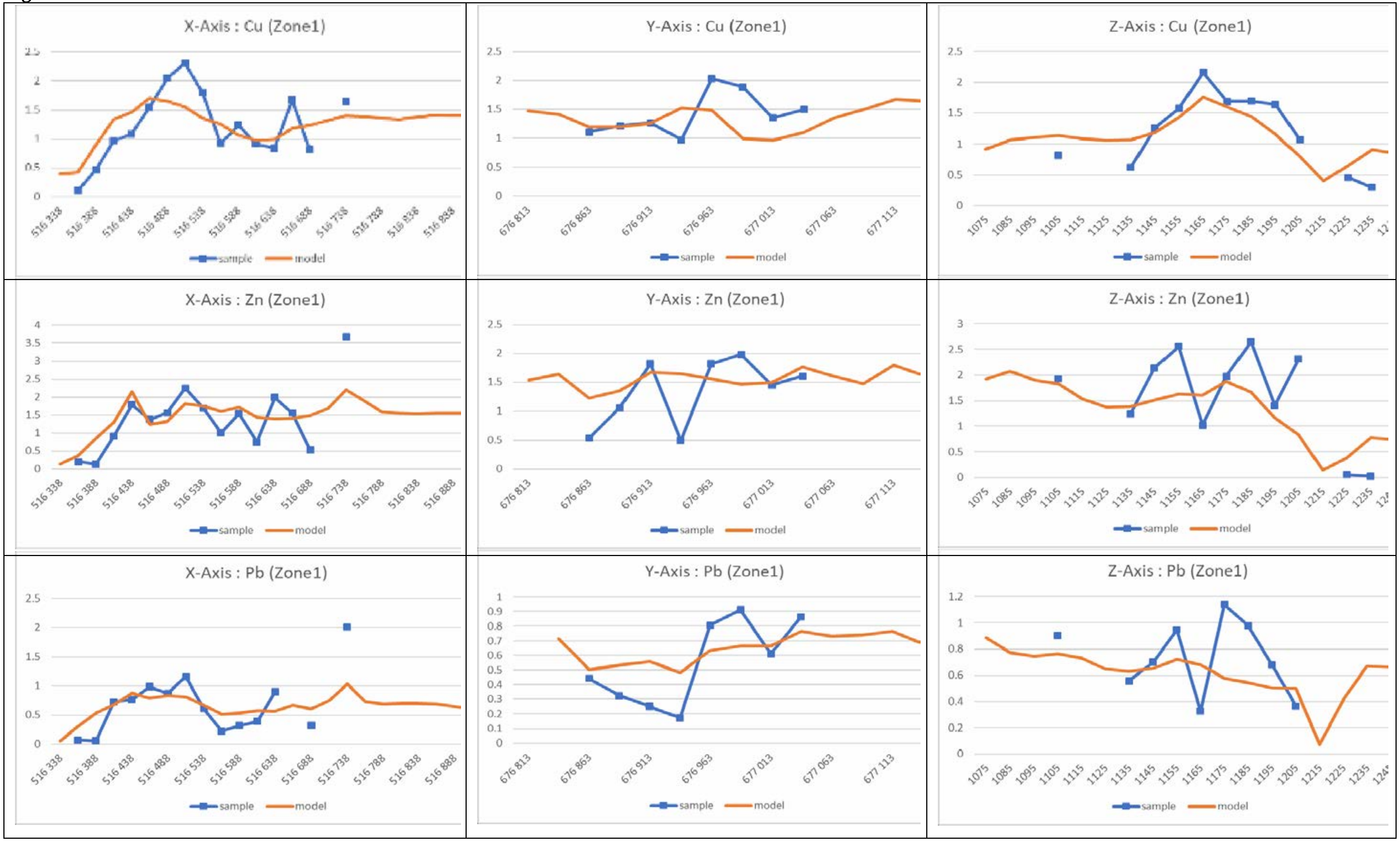
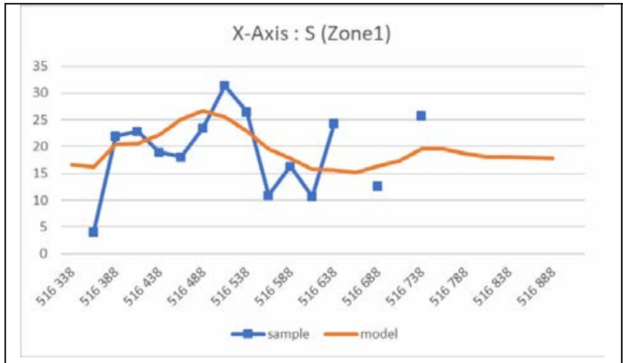
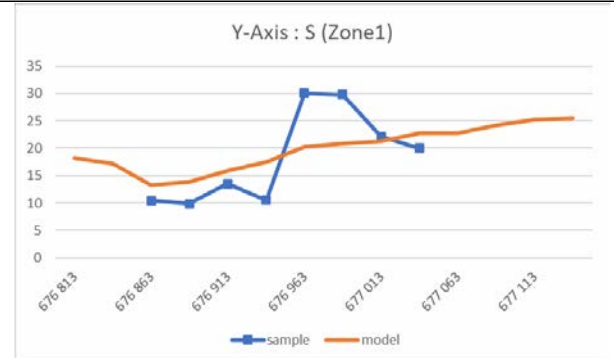
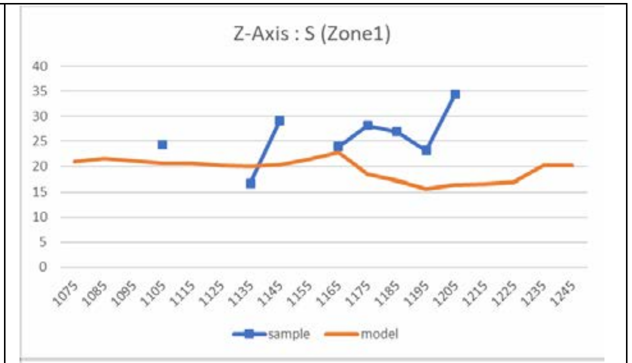


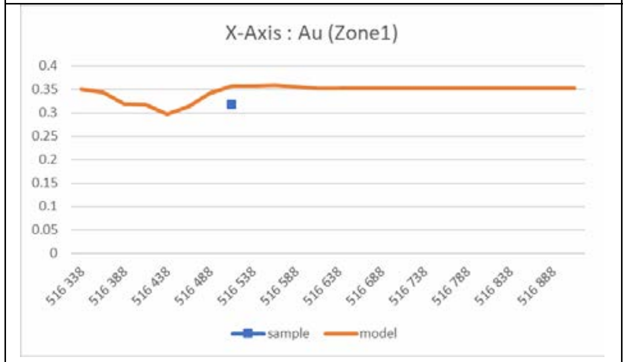
**Figure 30: Swathe Validation Plots for Zone 1**

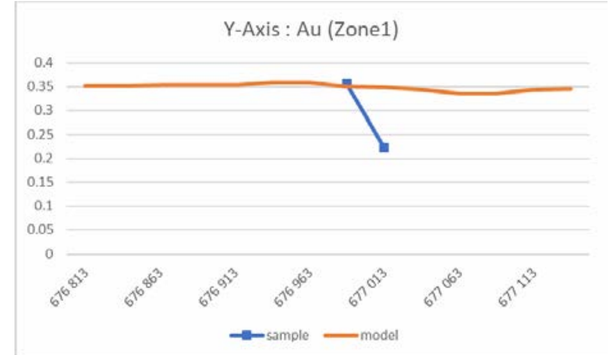


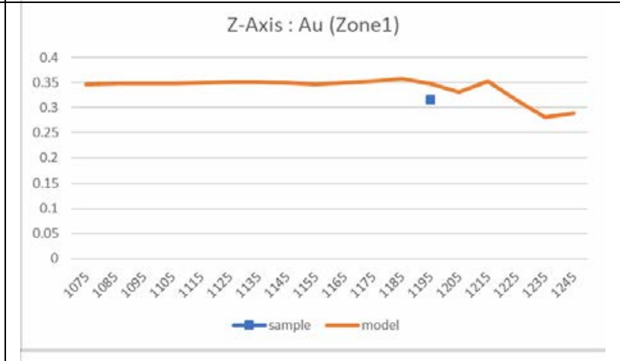

X-Axis : S (Zone1)
sample
model

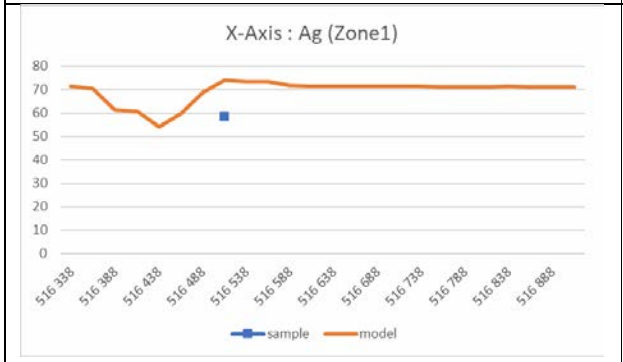

Y-Axis : S (Zone1)
sample
model

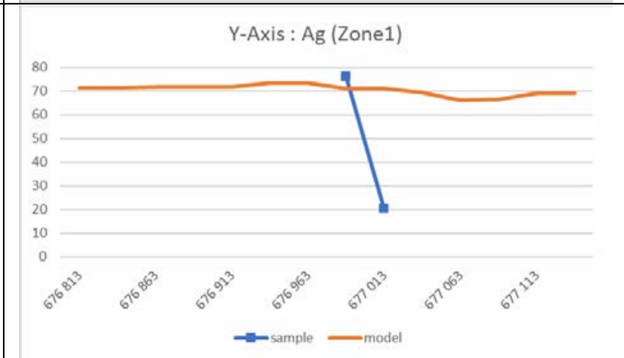

Z-Axis : S (Zone1)
sample
model


X-Axis : Au (Zone1)
sample
model


Y-Axis : Au (Zone1)
sample
model


Z-Axis : Au (Zone1)
sample
model


X-Axis : Ag (Zone1)
sample
model


Y-Axis : Ag (Zone1)
sample
model

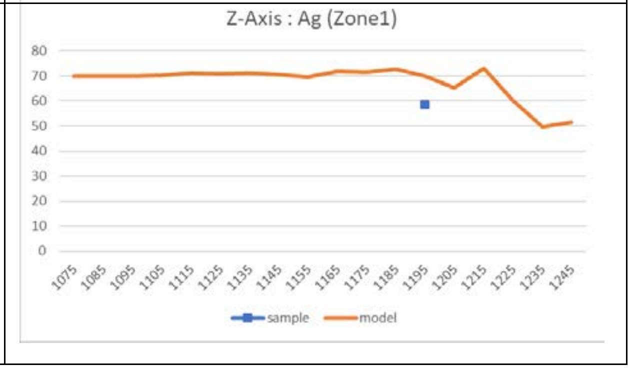
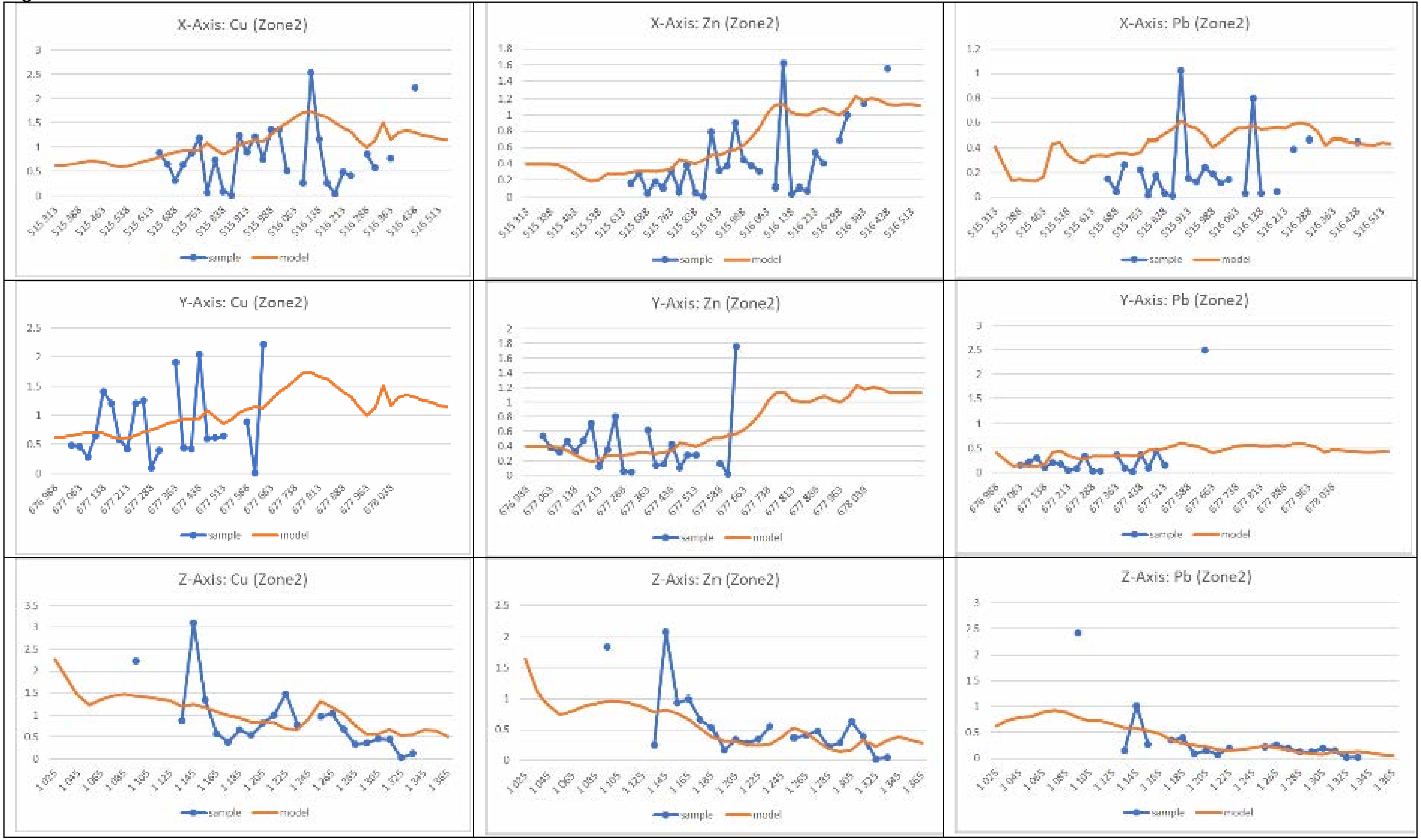
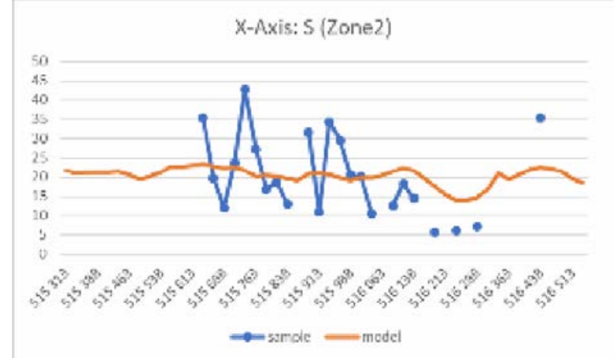
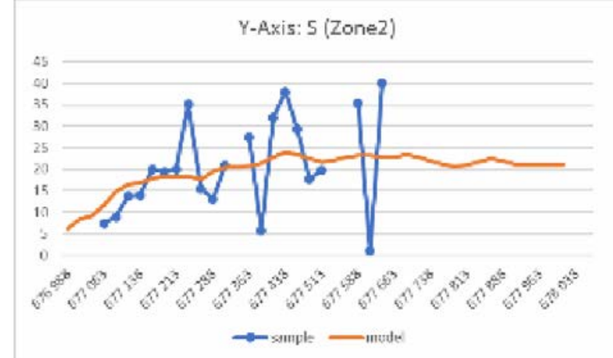
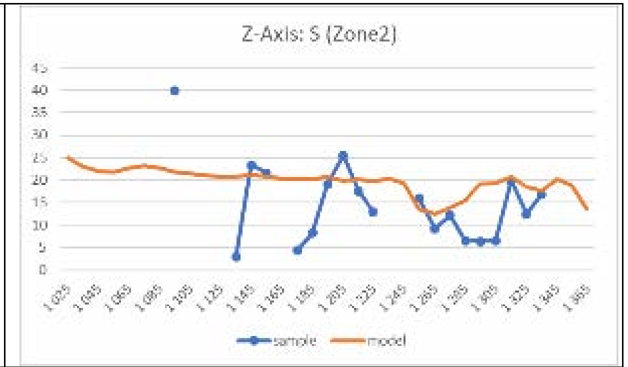

Z-Axis : Ag (Zone1)
sample
model

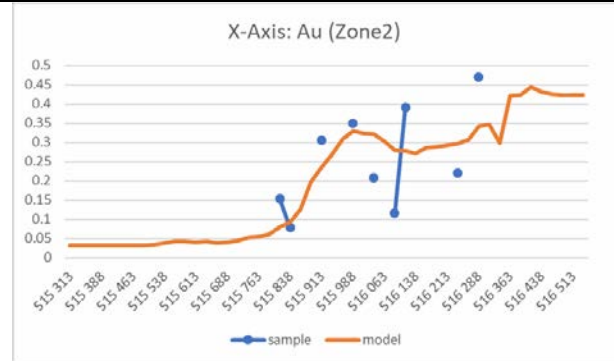
**Figure 31 : Swathe Validation Plots for Zone 2**

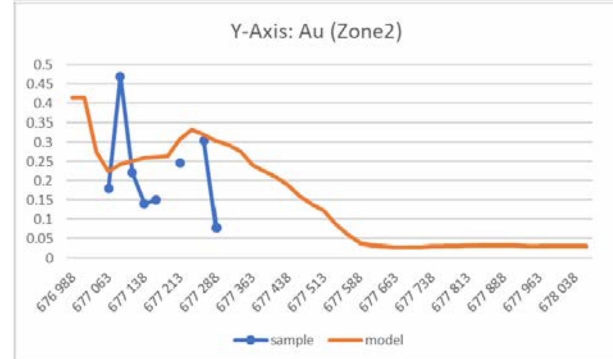


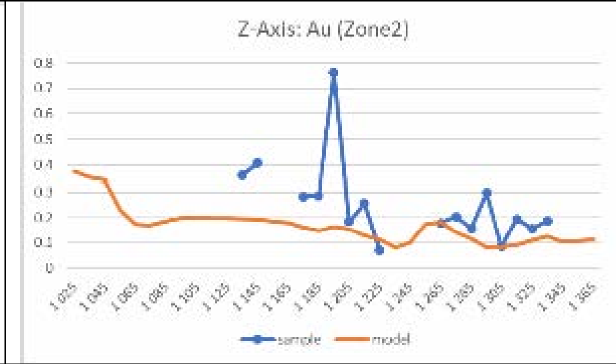

X-Axis: S (Zone2)
sample
model

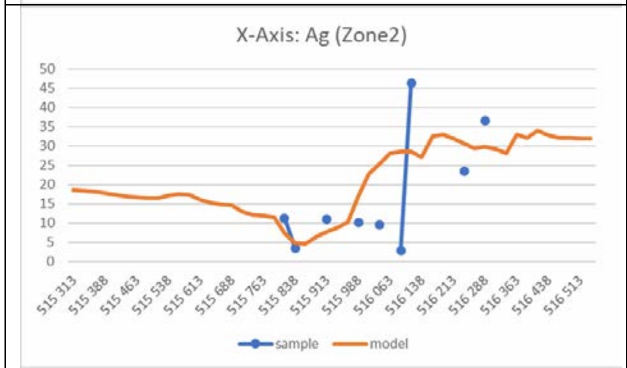

Y-Axis: S (Zone2)
sample
model

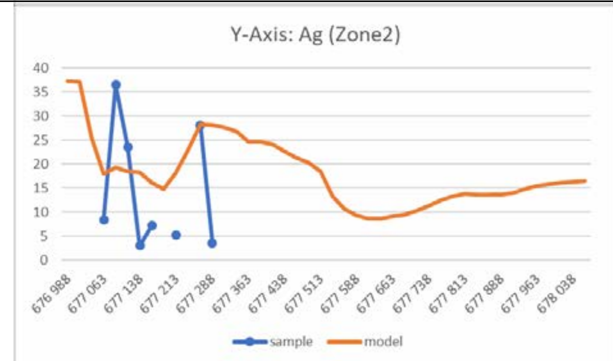

Z-Axis: S (Zone2)
sample
model

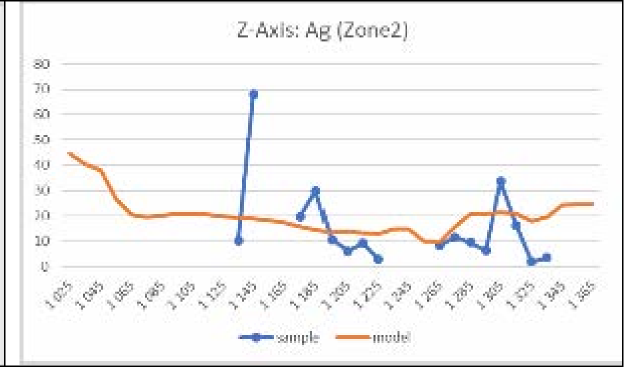

X-Axis: Au (Zone2)
sample
model


Y-Axis: Au (Zone2)
sample
model


Z-Axis: Au (Zone2)
sample
model


X-Axis: Ag (Zone2)
sample
model


Y-Axis: Ag (Zone2)
sample
model


Z-Axis: Ag (Zone2)
sample
model

## 13. Mineral Resource Estimate

The mineral resource estimate has been categorised to reflect the likelihood of varying exploitation methods, namely by open pit or by underground methods. An ultimate pit shape was derived from pit optimisation software to determine the extent of depth limitations for an open pit operation. The depth of the ultimate pit was used to indicate the hand over point between open pit and underground operations. Table 23 reflects the mineral resource classification for an open pit operation while Table 24 reflects the mineral resource estimate for an underground operation.

The mineral resource estimate is visually represented in Figure 32 through to Figure 34.

**Figure 32: Estimate for Copper % at the Manaila Polymetallic Mine**

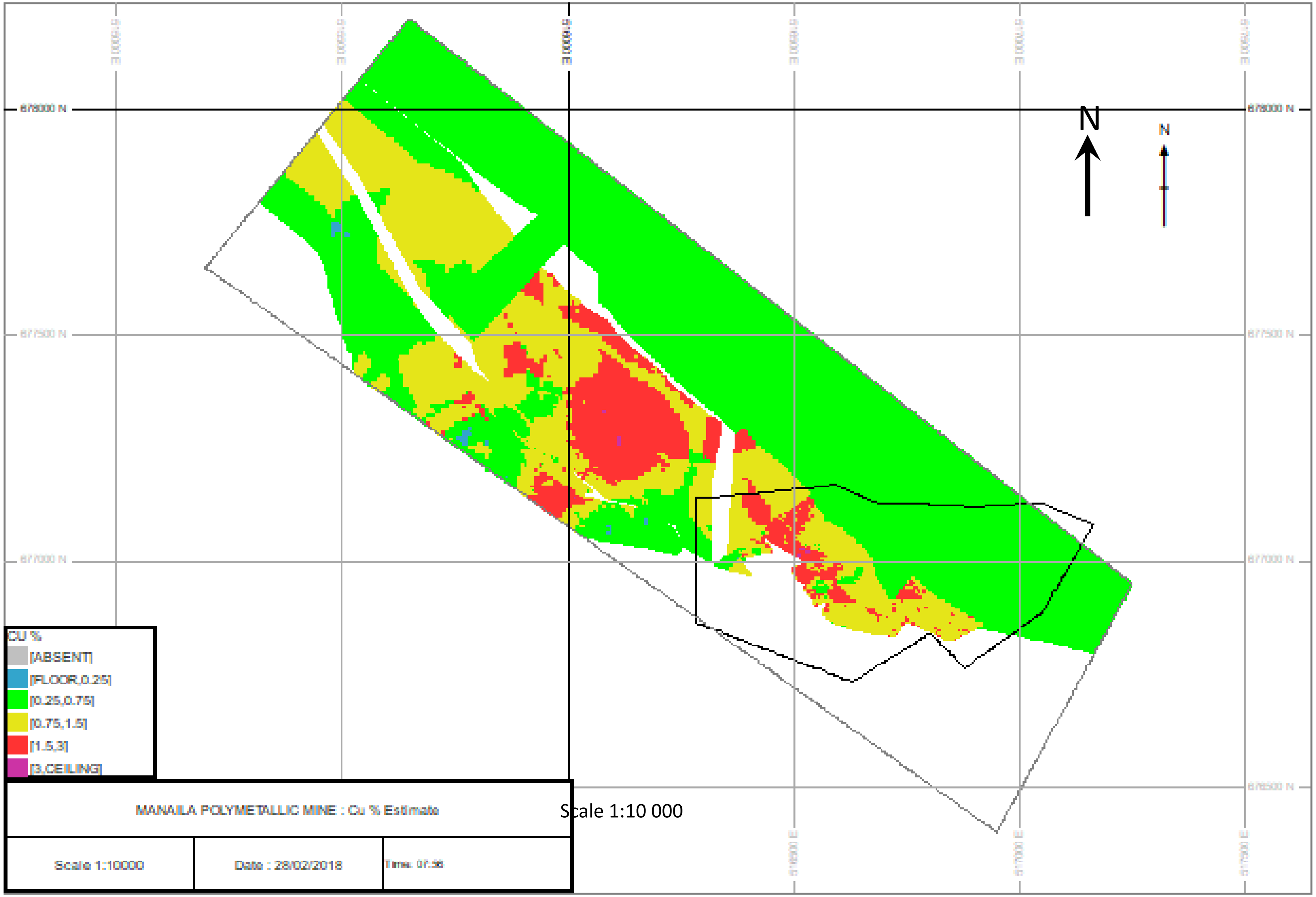


**Figure 33: Estimate for Lead % at the Manaila Polymetallic Mine**

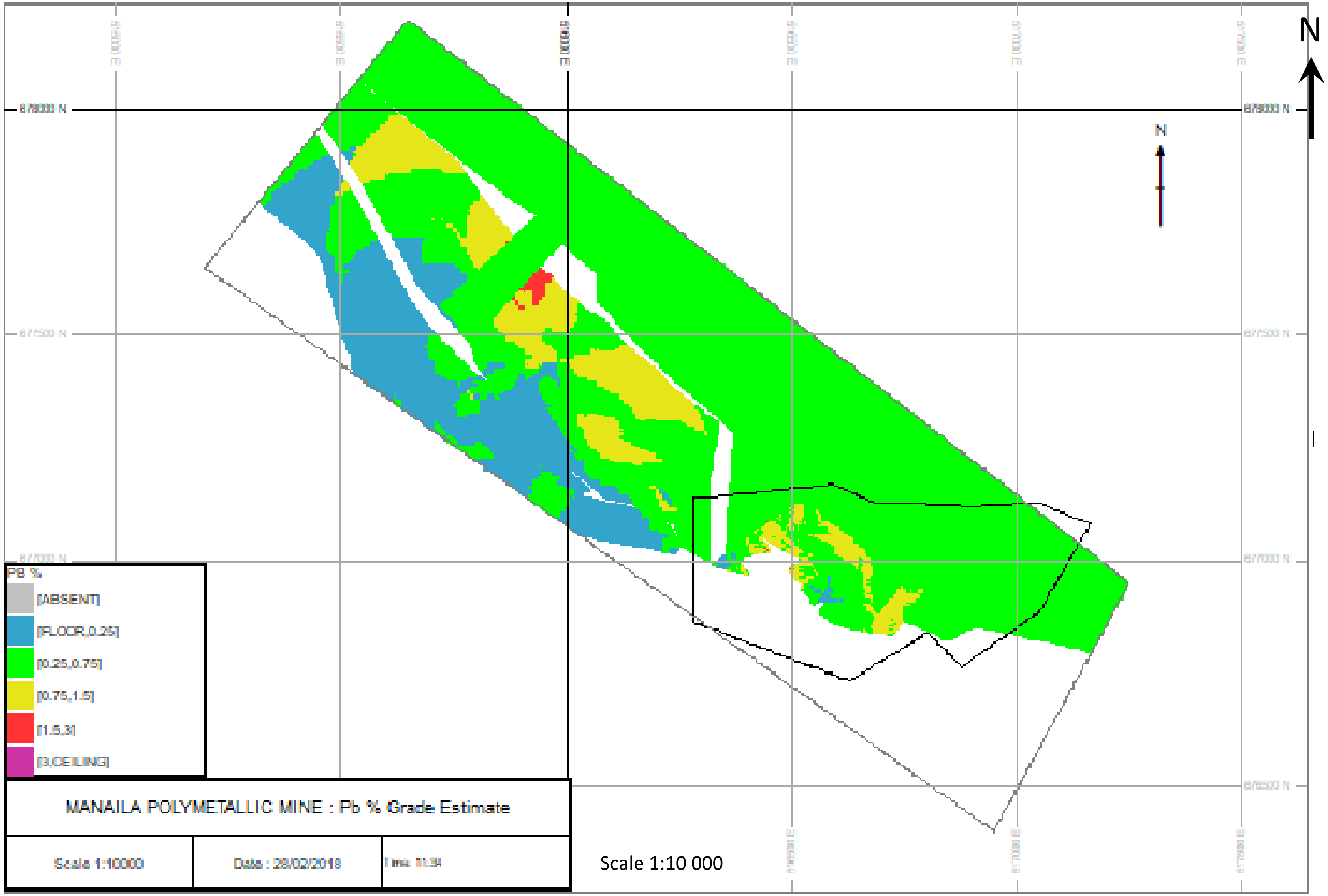


**Figure 34: Estimate for Zinc % at the Manaila Polymetallic Mine.**

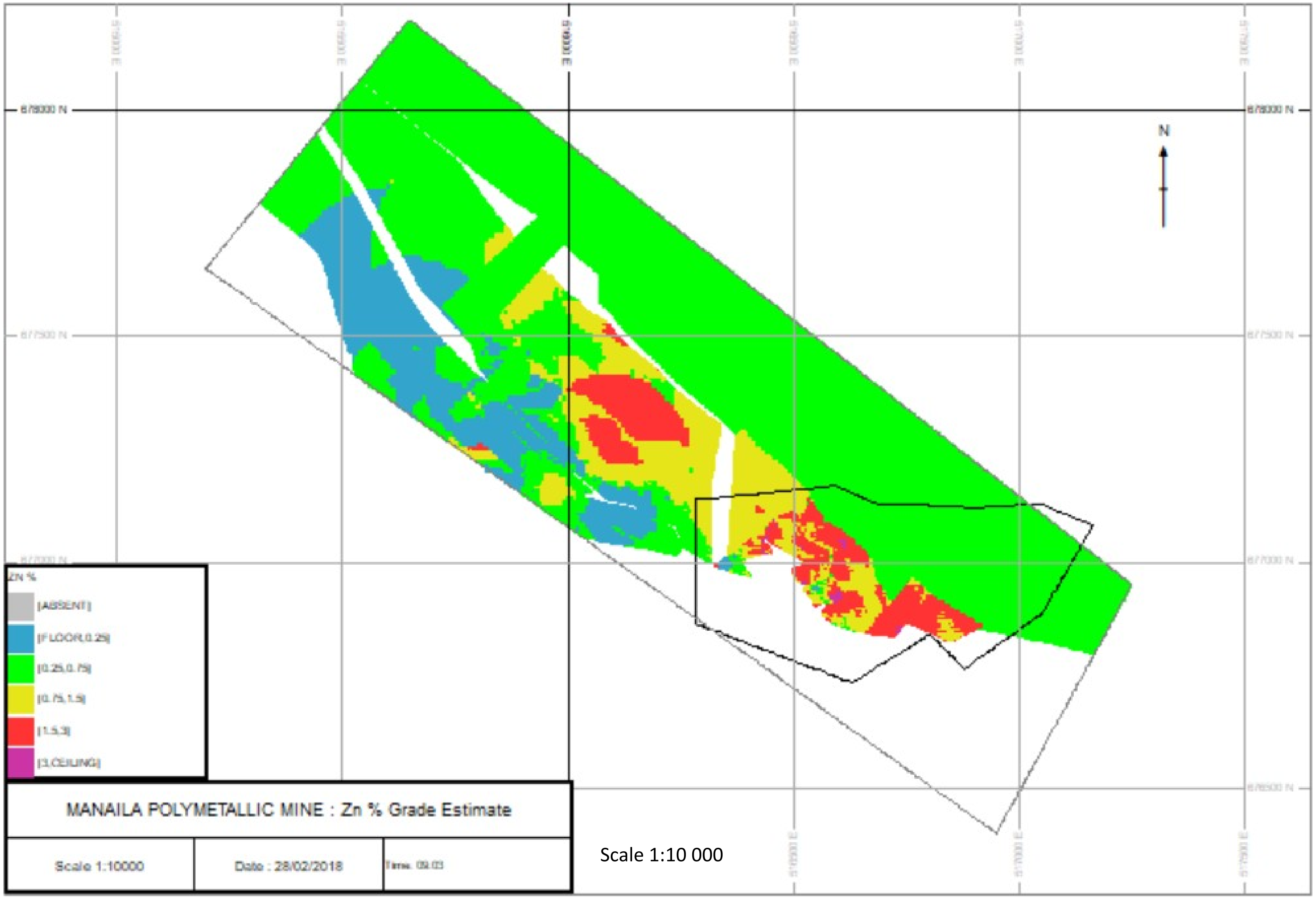


Figure 35: Estimate for Sulphur % at the Manaila Polymetallic Mine.

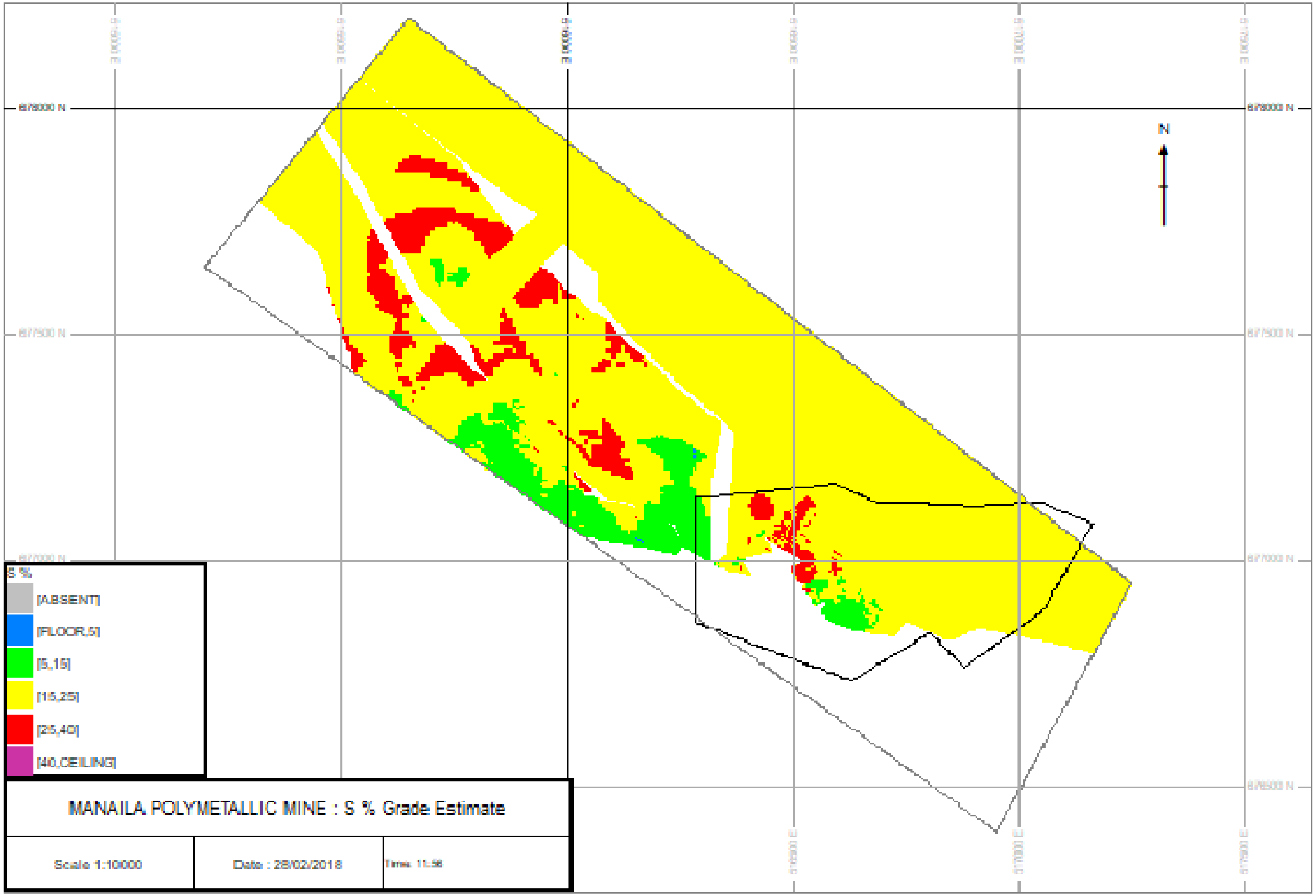


**Figure 36: Estimate for Gold gram per tonne at the Manaila Polymetallic Mine.**

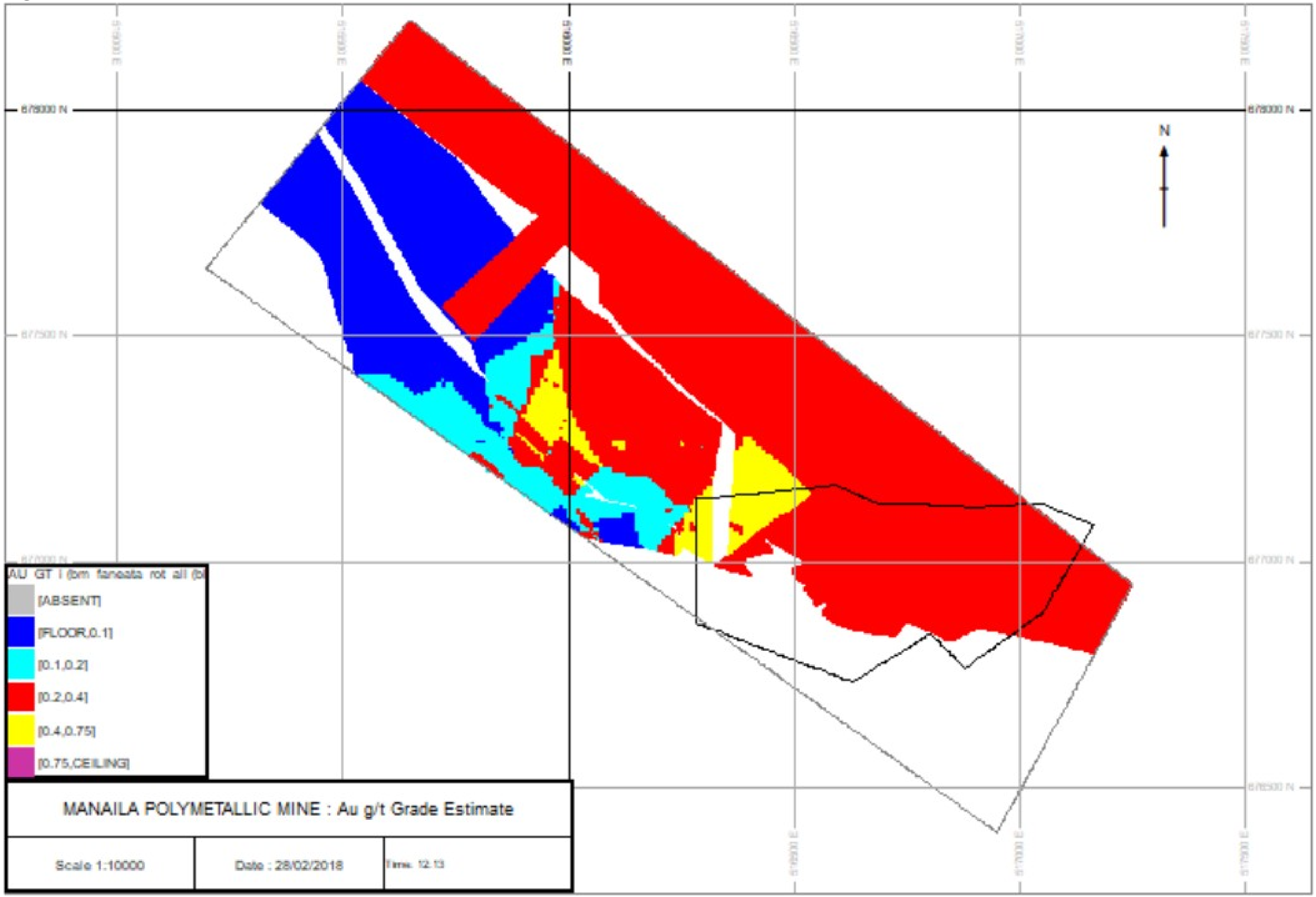


**Figure 37: Estimate for Silver gram per tonne at the Manaila Polymetallic Mine.**

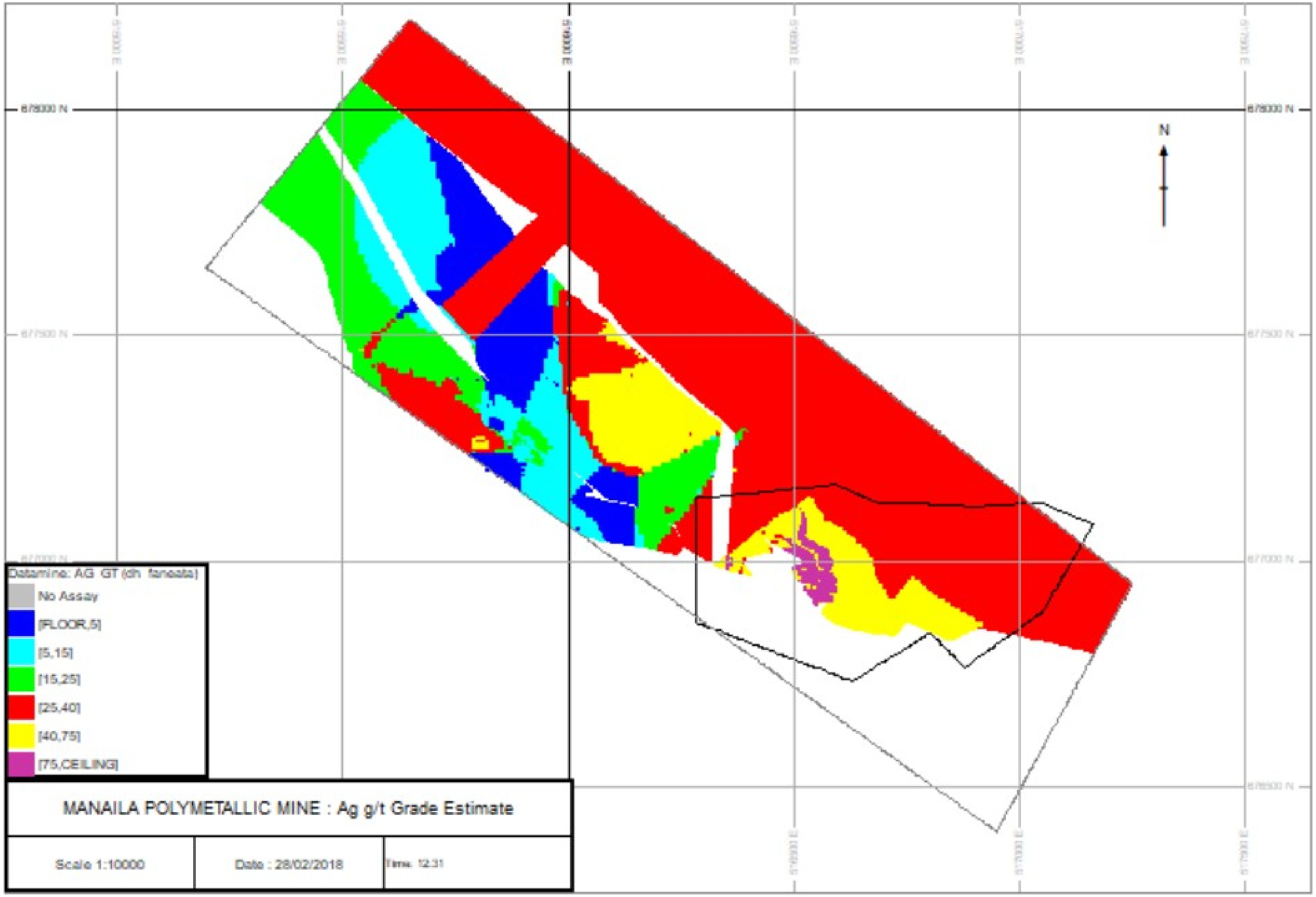


Table 23: Mineral Resource Estimate for the area within the Exploration Perimeter and extraction by Means of Open Pit

| Category (Open Pit) | Cu % cut-off | Tonnes (Kt) | Cu Metal (Kt) | Pb Metal (Kt) | Zn Metal (Kt) | Au Metal (Koz) | Ag Metal (Koz) | Cu % | Pb % | Zn % | Au g/t | Ag g/t |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measured | 0.25% | - | - | - | - | - | - | - | - | - | - | - |
| Indicated | 0.25% | 3 589 | 33.339 | 10.483 | 22.622 | 27 | 2 867 | 0.93% | 0.29% | 0.63% | 0.23 | 24.9 |
| **Meas + Ind** | **0.25%** | **3 589** | **33.339** | **10.483** | **22.622** | **27** | **2 867** | **0.93%** | **0.29%** | **0.63%** | **0.23** | **24.9** |
| Inferred | 0.25% | 1 045 | 11.529 | 4.180 | 8.774 | 8 | 981 | 1.10% | 0.40% | 0.84% | 0.24 | 29.2 |
| **Meas + Ind + Inf** | **0.25%** | **4 634** | **44.869** | **14.663** | **31.396** | **35** | **3 848** | **0.97%** | **0.32%** | **0.68%** | **0.23** | **25.8** |

** as at 28 February 2018 (topographic surface)*
** too a maximum depth of 125m below topographic surface*
** @ 0.25 % Cu cut-off grade*
** Rounding may cause differences*

**Table 24: Mineral Resource Estimate for the area within the Exploration Perimeter and extraction by Means of Underground Methods**

| Category (Underground) | Cu % cut-off | Tonnes (Kt) | Cu Metal (Kt) | Pb Metal (Kt) | Zn Metal (Kt) | Au Metal (Koz) | Ag Metal (Koz) | Cu % | Pb % | Zn % | Au g/t | Ag g/t |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measured | 1.00% | - | - | - | - | - | - | - | - | - | - | - |
| Indicated | 1.00% | 399 | 6.310 | 3.098 | 3.324 | 2 | 188 | 1.58% | 0.78% | 0.83% | 0.13 | 14.60 |
| **Meas + Ind** | **1.00%** | **399** | **6.310** | **3.098** | **3.324** | **2** | **188** | **1.58%** | **0.78%** | **0.83%** | **0.13** | **14.60** |
| Inferred | 1.00% | 683 | 10.728 | 5.741 | 6.161 | 4 | 321 | 1.57% | 0.84% | 0.90% | 0.17 | 14.60 |
| **Meas + Ind + Inf** | **1.00%** | **1 081** | **17.037** | **8.839** | **9.485** | **5** | **509** | **1.58%** | **0.82%** | **0.88%** | **0.15** | **14.60** |

** as at 28 February 2018 (topographic surface)*
** from 125 meters below topographic surface*
** @ 1.00 % Cu cut-off grade*
** Rounding may cause differences*

## 13.1 Exploration Target

An exploration target is reported for the remainder of the area within the exploration license perimeter. A number of surface diamond drill holes have been completed in the extended area. Records for the drill hole locality, drill hole orientation and lithological records exist on site at the mine. It is reported however that as a result of change of owners, assay records for some of the drill holes have been lost.

Using the lithological logs from the drill holes, a full geological model has been built for the exploration perimeter. Values have been assigned to the modelled mineralised zones from the few assay records still on site and a range for an exploration target within the exploration perimeter has been determined. There is not sufficient information available to provide a reasonable estimate of the gold and silver contained within the remainder of the exploration perimeter boundary. The mineral resource not in the measured, indicated or inferred mineral resource categories are reported as exploration targets in Table 25 for open pit exploitation and in Table 26 for underground exploitation.

**Table 25: Open Pit Exploration Target at MPM within the Exploration Perimeter**

| OPEN PIT | Tonnes (Kt) | | Grade | | | | | |
|---|---|---|---|---|---|---|---|---|
| Exploration Target | Minimum | Maximum | Cu% Min | Cu% Max | Pb% Min | Pb% Max | Zn% Min | Zn% Max |
| Range | 1 063 | 3 190 | 0.4% | 1.1% | 0.1% | 0.4% | 0.2% | 0.6% |
| **Total** | **1 063** | **3 190** | **0.4%** | **1.1%** | **0.1%** | **0.4%** | **0.2%** | **0.6%** |

**as at 31 July 2016 (topographic surface)*
** too a maximum depth of 125m below topographic surface*
** @ 0.0 % Cu cut-off*

**Table 26: Underground Exploration Target at MPM within the Exploration Perimeter**

| UNDERGROUND | Tonnes (Kt) | | Grade | | | | | |
|---|---|---|---|---|---|---|---|---|
| Exploration Target | Minimum | Maximum | Cu% Min | Cu% Max | Pb% Min | Pb% Max | Zn% Min | Zn% Max |
| Range | 7 861 | 23 583 | 0.4% | 1.3% | 0.2% | 0.7% | 0.3% | 1.1% |
| **Total** | **7 861** | **23 583** | **0.4%** | **1.3%** | **0.2%** | **0.7%** | **0.3%** | **1.1%** |

**as at 31 July 2016 (topographic surface)*
** from a depth of 125m below topographic surface*
** @ 0.0 % Cu cut-off*

## 14. References


1. **Sorin-Ionuţ BALABAN1, Ovidiu Gabriel IANCU1 & Dumitru BULGARIU1 (2011),** THE GEOCHEMICAL DISTRIBUTION OF HEAVY METALS FOR SOME MINE TAILINGS FROM THE FUNDU MOLDOVEI AREA, ROMANIA. Carpathian Journal of Earth and Environmental Sciences, September 2011, Vol. 6, No. 2, p. 279 – 288

2. **Simona MOLDOVEANU1, Ovidiu Gabriel IANCU2, Gheorghe DAMIAN3, Haino Uwe KASPER4.** Mineralogy of metamorphic formations from the Manaila area (Eastern Carpathians)

3. **Marian Munteanu1* and Mihai Tatu2 (2002),** The East-Carpathian Crystalline-Mesozoic Zone (Romania): Paleozoic Amalgamation of Gondwana- and East European Craton-derived Terranes, Gondwana Research, V. 6, No. 2, pp. 185-196

4. **Leonard OLARU1 (2008),** GEOTECTONIC CONTEXT AND PALYNOLOGICAL ARGUMENTS FOR CAMBRIAN / ORDOVICIAN BOUNDARY IN THE METAMORPHITES OF TULGHEŞ GROUP FROM EAST CARPATHIANS, ROMANIA. ACTA PALAEONTOLOGICA ROMANIAE V. 6 (2008), P 253-277

5. **Alexandru Vodă (2013).** Cârlibaba-Broşteni strike-slip fault - a possible old segment of Bogdan Vodă-Dragoş Vodă fault system: implications for the structural and metallogenetic correlations in the Crystalline-Mesozoic Zone of the Eastern Carpathians (Romania). Romanian Journal of Earth Sciences, vol. 87(2013), issue 1

6. **Krautner H.G. (1984),** Syngenetic models for the pyrite and polymetallic sulphide ore province of the East Carpathians; In : Syngenesis and epigenesis in the formation of mineral deposits, A. Wauschkukn and R.A. Zimmerman, 537-552, Springer-Verlag, Berlin

7. **Ioan V. Jenica M.,** Raport Geologic cu situatia rezervelor de minereu polimetalic si piritos – cuprifer din perimetrul Manaila, jud. Suceava la data de 01.10.1997

8. **Harvey C.,** Mineral Resource Estimate for the Polymetallic Mine, Sucevea County, Romania, 31 July 2016.

**15. JORC Table 1 Compliance**

## *Section 1 Sampling Techniques and Data*

(Criteria in this section apply to all succeeding sections.)

| Criteria | JORC Code explanation | Commentary |
|---|---|---|
| *Sampling techniques* | • *Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sounds, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling.*<br>• *Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.*<br>• *Aspects of the determination of mineralisation that are Material to the Public Report.*<br>• *In cases where 'industry standard' work has been done this would be relatively simple (eg 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (eg submarine nodules) may warrant disclosure of detailed information.* | • Database comprises historic underground channel sampling, underground core drill holes and surface drill holes. Vast has drilled 33 surface drill holes since January 2016 to verify historical data and generate a resource and geological model<br>• The method of assay for the historic assay database is unknown but was carried out at state run mining and plant operations in Romania. Samples generated by recent drilling have been prepared and assayed by ALS laboratories in Romania and in the United Kingdom.<br>• ALS Code of Practice WEI-21 applies to samples received at the Rosia Montana laboratories of ALS in Romania<br>• ALS Code of Practice ME-ICPORE applies to assay method carried out at the Loughrea laboratories of ALS located in Ireland, United Kingdom. |
| *Drilling techniques* | • *Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).* | • All drill holes are core<br>• Surface drilling has been completed using a standard core barrel generating a PQ size run of core.<br>• Underground drilling is reported to have been done using a standard core barrel with a core size of NQ (48mm) |
| *Drill sample recovery* | • *Method of recording and assessing core and chip sample recoveries and results assessed.*<br>• *Measures taken to maximise sample recovery and ensure representative nature of the samples.*<br>• *Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.* | • The total length of the core run is measured against the total of the lengths of the drill rods inserted into the hole.<br>• All drilling is supervised by an onsite geologist and the packing procedure or transfer of the core from core barrel to core tray is supervised by him / her.<br>• No relationship between core loss and grade has been observed. The formations being cored and specifically the massive sulphide units are particularly competent. |

| Criteria | JORC Code explanation | Commentary |
|---|---|---|
| *Logging* | • *Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.*<br>• *Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography.*<br>• *The total length and percentage of the relevant intersections logged.* | • The historic drill holes have been logged for lithology and mineralization type only.<br>• Recent drilling has been logged for lithology, mineralization type and mineralogy.<br>• The full length of the core has been logged and all sulphide intersections are recorded in the lithological logs. Faulting and shearing is recorded with a view to support and update the structural model. |
| *Sub-sampling techniques and sample preparation* | • *If core, whether cut or sawn and whether quarter, half or all core taken.*<br>• *If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry.*<br>• *For all sample types, the nature, quality and appropriateness of the sample preparation technique.*<br>• *Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples.*<br>• *Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling.*<br>• *Whether sample sizes are appropriate to the grain size of the material being sampled.* | • All historic drill holes, underground and surface were drilled as core. It is not known if and how the core was split, or if full core was submitted for assay and sub samples subsequently split from the main sample to obtain duplicate control samples.<br>• All recent drilling has the core cut in half by a diamond cutter on site at the operation. All samples are bagged on site as split core and tagged with a unique identifier. The bagged samples are delivered directly to the on-site laboratory for assay or for dispatching to an external laboratory.<br>• Sample sizes are appropriate for the nature of the orebody. |
| *Quality of assay data and laboratory tests* | • *The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.*<br>• *For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc.*<br>• *Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.* | • The analytical method and laboratory procedures used on the historic assay samples are unknown.<br>• Recent drilling has been analysed by polarography on site at the laboratory at Iacobeni. Duplicate samples (half core) were dispatched to ALS laboratories located at Rosia Montana in Romania. The laboratory received the samples in good order and dispatched them for analysis to the ALS laboratories located in Loughrea, Ireland. Samples underwent the ALS procedure 'ME-ICPORE' which is an oxidizing digestion with ICP-AES finish. This is considered appropriate for this type of mineralization.<br>• ALS inserted blanks and standards into the sample stream and selected a number of assays for duplicate assay.<br>• All assays reporting into the assay database are from the external ALS laboratory. The analyses undertaken by polarography have been used a check samples against these. |

| Criteria | JORC Code explanation | Commentary |
| --- | --- | --- |
| *Verification of sampling and assaying* | • *The verification of significant intersections by either independent or alternative company personnel.*<br>• *The use of twinned holes.*<br>• *Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.*<br>• *Discuss any adjustment to assay data.* | • The onsite management of the core drilling has been undertaken by the Senior Pit geologist. The logging has been verified, checked and audited by the Chief Geologist in Romania. The Group Geologist has reviewed the logging on a select number of drill holes with remaining half core at the open pit. Recent drilling was co-supervised by a local Romanian independent consultancy, Formin S.A.<br>• No twinned holes were drilled<br>• Data is recorded on paper logging sheets which is then entered into a database by the GIS / survey operator at the mine. These entries are checked by the logging geologist and again by the Chief Geologist based in Romania. Sample assays are received by the Chief Geologist, entered by the GIS / survey operator and checked by the logging geologist. Final sign off is provided by the Chief Geologist.<br>• All original paper logging sheets are filed for record keeping. An electronic pictorial drill log is created utilizing CAD software in addition to the electronic database created.<br>• No adjustment to assay results are undertaken. |
| *Location of data points* | • *Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.*<br>• *Specification of the grid system used.*<br>• *Quality and adequacy of topographic control.* | • The historic surface drill holes positions are listed with collar co-ordinates in literature available on the mine. A number of positions have been checked without errors.<br>• Original mine plans for the underground workings are available with the positions of the underground channel samples indicated. These have been captured into digital format and points of reference such as surface adits and holings into old workings within the open pit surveyed and compared. No errors or need for adjustments have been found.<br>• The underground drill hole localities are recorded at the operation both on plan and in hard copy documents with a locality given by a distance from a reference point underground. When comparing plan to document, no major errors were encountered in drill hole positioning.<br>• The grid system in use is Stereo 70<br>• The topography of the area has been surveyed with a GPS based total station and the topography is considered accurate for these requirements. |

| Criteria | JORC Code explanation | Commentary |
|---|---|---|
| *Data spacing and distribution* | • *Data spacing for reporting of Exploration Results.*<br>• *Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied.*<br>• *Whether sample compositing has been applied.* | • The majority of the area has been well explored through a combination of surface core drilling, underground development and underground drilling. In the immediate vicinity of the operational open pit, data spacing (excluding underground assays) generally approximates a 25m by 20m grid. For the remainder of the exploration area, data spacing is not uniform but approximates 150m by 150m. For the areas with underground development, cross-cuts are spaced 20m to 40m apart and as such, for a large part of the perimeter, data spacing is around 30m by 50m (50m level spacing)<br>• The data spacing and the high level of geological knowledge is sufficient to establish the geological continuity on the property. Unfortunately a number of the historic drill holes, particularly to the north and North West do not have their assay information. As such the confidence in grade continuity in these areas is low and subsequently these have been reported as an exploration target based on the surrounding mining operations and geological continuity as these areas do not meet the requirement for classification as mineral resources.<br>• The majority of the samples are 1.0 metres in length. All samples have been composited to a 1.0m sample length |
| *Orientation of data in relation to geological structure* | • *Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type.*<br>• *If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.* | • Surface and underground drilling typically intersect the mineralized zone at angles of less than 30 degrees. Underground sampling was undertaken perpendicular to the dip of the mineralized zones.<br>• No bias has been perceived in the sampling relating to the orientation of sampling to the mineralized zones. |
| *Sample security* | • *The measures taken to ensure sample security.* | • Samples are bagged on site with a sample tag inserted into the bag and closed with a zip lock tie. Samples are stored in a locked storage facility on site at the mine until transported to the laboratory. Samples sent to external laboratory are dispatched with a weigh bill detailing number of samples, contact person and sample number lists. |
| *Audits or reviews* | • *The results of any audits or reviews of sampling techniques and data.* | • An informal review of the sample laboratory was undertaken by an independent third party consultancy while on a site visit to the operation. By means of verbal communication, the sample laboratory is up to standard in terms of preparation and assay techniques. |

## *Section 3 Estimation and Reporting of Mineral Resources*

(Criteria listed in section 1, and where relevant in section 2, also apply to this section.)

| Criteria | JORC Code explanation | Commentary |
|---|---|---|
| *Database integrity* | • *Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes.*<br>• *Data validation procedures used.* | • Data has been validated on site in Romania by the Senior Mine Geologist, the Senior Geologist responsible for auditing and compliance with Romanian legislature and the Chief Geologist within Romania.<br>• Data postings have been used to verify positions. All data is imported into a Datamine Studio 3 drill hole database which reports any 'From – To' errors together with any missing assay or lithological information. All drill holes have had a CAD log generated which includes lithologies as logged and the reported assay result per assay interval with the unique sample identifier. |
| *Site visits* | • *Comment on any site visits undertaken by the Competent Person and the outcome of those visits.*<br>• *If no site visits have been undertaken indicate why this is the case.* | • The site has been visited on numerous occasions during the past 12 months. All visits have been completed with no major setbacks. |
| *Geological interpretation* | • *Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit.*<br>• *Nature of the data used and of any assumptions made.*<br>• *The effect, if any, of alternative interpretations on Mineral Resource estimation.*<br>• *The use of geology in guiding and controlling Mineral Resource estimation.*<br>• *The factors affecting continuity both of grade and geology.* | • The confidence in the interpretation of the geology for the perimeter is high. Major structures are understood and reasonably well defined.<br>• The mineralized zones are conformable to the dip of the lithological units and these mineralized zones have been constrained through the use of wireframe surfaces.<br>• The absence of assay data from drill holes in certain portions of the perimeter may have an effect on the upgrading of portions of the exploration target |
| *Dimensions* | • *The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.* | • |
| *Estimation and modelling techniques* | • *The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used.*<br>• *The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data.*<br>• *The assumptions made regarding recovery of by-products.* | • A combination Ordinary Kriging ("OK") and Inverse Distance Squared ($ID^2$) was used as the interpolation methods for mineral resource estimation. The exploration target was evaluated based on ID2 and average grades assigned from neighbouring structural blocks.<br>• The structural domains all exhibit fairly uniform grade with Coefficients of Variation close to 1.0.<br>• Historical mineral resource estimates (NAEN Code) for the perimeter did not encompass the entire area. The estimates are similar for some of the minerals estimated although there are variations in the global estimation |

| Criteria | JORC Code explanation | Commentary |
|---|---|---|
| | • *Estimation of deleterious elements or other non-grade variables of economic significance (eg sulphur for acid mine drainage characterisation).*<br>• *In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed.*<br>• *Any assumptions behind modelling of selective mining units.*<br>• *Any assumptions about correlation between variables.*<br>• *Description of how the geological interpretation was used to control the resource estimates.*<br>• *Discussion of basis for using or not using grade cutting or capping.*<br>• *The process of validation, the checking process used, the comparison of model data to drill hole data, and use of reconciliation data if available.* | results. The reported tonnages for the mineral resource categories have increased based on both a lateral and depth extension when compared to the previous non JORC mineral resource estimate.<br>• Block sizes are 5.0m x 5.0m x 2.0m.<br>• The geological interpretation controlled the mineral resource estimate by constraining the mineralized zones into solid wireframes. The wireframes, or structural domains, were further assigned as an exploration target if the information in determining the general orientation of the structural domain was sparse and there was a lack of sufficient data to inform the grade using either OK or ID2.<br>• Means, variance and spread for each of the structural domain data sets were compared to the estimates to identify domains which may vary from the data sets.<br>• A full Quantitative Kriging Neighbourhood Analysis was carried out and optimised, the search distances, number of sample used, block sizes and discretisation points. |
| *Moisture* | • *Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.* | • Tonnages are estimated on a dry basis |
| *Cut-off parameters* | • *The basis of the adopted cut-off grade(s) or quality parameters applied.* | • The cut-off parameters were derived from operational costs related to the existing open pit operation.<br>• Cut-off parameters for the underground section was derived from a desktop estimate of operational costs for an underground operation based in Romania. |
| *Mining factors or assumptions* | • *Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.* | • A Lerch-Grossman open pit optimization was run on the mineral resource block model using operating cost parameters and current commodity prices. The ultimate pit shell generated for the existing open pit operation extended to a depth of approximately 125 metres below surface. A depth limit of 125 metres was subsequently imposed on the mineral resource block to delineate the cut-off point between open pit and underground mining methods. |

| Criteria | JORC Code explanation | Commentary |
|---|---|---|
| *Metallurgical factors or assumptions* | • *The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.* | • The operating parameters of the existing metallurgical plant were used as the basis for estimating metal recoveries and the process methodology. Significant test work has been undertaken on the mineralization at MPM from its inception. |
| *Environmental factors or assumptions* | • *Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.* | • The current Tailings Storage Facility has sufficient capacity for approximately a further 540 000 tons of deposition. Sufficient space exists at the open pit operation for extensions onto the existing waste rock dump.<br>• Underground operations will generate less waste material overall and purchasing of land from the State and Private forestry operations remains an option for further extensions. |
| *Bulk density* | • *Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples.*<br>• *The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc), moisture and differences between rock and alteration zones within the deposit.*<br>• *Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.* | • The initial historical test work has accurately determined the range of the densities associated with the sulphide mineralisation and the footwall and hangingwall lithologies. The tonnage reconciliation is within acceptable parameters utilizing these density factors. The lower range of the density measurements has been utilized in the mineral resource estimate.<br>• The weathering profile is not accurately determined. With this in mind and as a result of observations within the operating open pit, a weathered depth profile to 25 metres below surface has been assigned across the perimeter and the densities adjusted accordingly based on previous experience. |
| *Classification* | • *The basis for the classification of the Mineral Resources into varying confidence categories.*<br>• *Whether appropriate account has been taken of all relevant factors (ie relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data).*<br>• *Whether the result appropriately reflects the Competent Person's view of the* | • Initial mineral resource classification is based on the confidence of the geological continuity. Structural domains with minimal or sparse data have been assigned exploration target status.<br>• Search volumes equal to the variogram ranges and at double the variogram range were utilized for the estimation methodology. Resource blocks not filled in the first two search volumes were assigned to the exploration target category and interpolated based on increased search volume sizes until all |

| Criteria | JORC Code explanation | Commentary |
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| | *deposit.* | blocks were filled.<br>• Final mineral resource classification was based on the two search volumes with a minimum and maximum number of samples together with the kriging efficiency and the slope of regression.<br>• Mineral resource blocks in the vicinity of the dense sampling grid around the current open pit which reported to the measured mineral resource category, were manually downgraded to the indicated mineral resource category as a consequence of some uncertainty on the sample preparation and sample assay techniques from the historical underground channel sampling |
| *Audits or reviews* | • *The results of any audits or reviews of Mineral Resource estimates.* | • Not Applicable |
| *Discussion of relative accuracy/ confidence* | • *Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate.*<br>• *The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used.*<br>• *These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.* | • The mineral resource block model has been examined through sections with drill holes and underground assays plotted for the area in the immediate vicinity of the operating open pit. The mineral resource estimation approximates the current results being achieved with allowance for mining dilution and other factors.<br>• The mineral resource is a global resource estimate and locally resource estimates may vary in a negative or positive manner.<br>• The exploration target stated is based on mineralised zones derived from widely spaced surface drilling and grades derived from limited drill holes with grade information. The exploration target is reported as an expected grade and tonnage range which may or may not be confirmed through further exploration activities.<br>• The mineral resource model was validated through swathe plots along the X, Y and Z axes together with visual examination of cross sections in the vicinity of data points. |

## 16. Glossary

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|---|---|
| Archaean | The earlier part of Precambrian Time, from approximately 3.8 to 2.5 billion years ago, corresponding to Achaean rocks. |
| Albite | End member of the plagioclase feldspars ($NaAlSi_3O_8$) |
| Arsenopyrite | A tin-white to steel grey orthorhombic mineral: FeAsS, which constitutes the principal ore of arsenic. |
| Assay | The chemical analysis of rock or ore samples to determine the proportions of metals. |
| Adit | A subhorizontal mine entrance driven into the side of a hill. |
| Chalcopyrite | An important ore of copper ($CuFeS_2$) |
| Chlorite | A group of phyllo-silicates found in metamorphic, sedimentary and altered igneous rocks |
| Clastic | A rock or sediment composed of broken fragments that are derived from pre-existing rocks or minerals and have been transported from their places of origin. |
| Cut-off grade | Lowest grade of mineralised material considered to be economically viable to extract. |
| Disseminated Sulphide | A form of sulphide mineralisation where the sulphides are scattered through the host lithology |
| Dip | The angle that a surface, bedding or structure makes with the horizontal measured perpendicular to strike or down its steepest slope. |
| Epiclastite | Sedimentary deposit consisting of sediment redeposited from a previously existing sediment. |
| Flotation | A method of concentrating minerals whereby the mineral attaches to bubbles blown through a mixture of ground ore, water and a frothing agent and then rises to form a surface froth. |
| Flysch | Sedimentary deposits deposited by turbidity currents arising from the erosion of rapidly forming mountain belts. |
| Footwall | In metal mining, the part of the country rock that lies below the ore deposit. Also the underlying side of a fault, orebody, or mine working; esp. the wall rock beneath an inclined vein or fault. |
| Galena | An important ore of lead (PbS) |
| Geophysical Survey | The use of one or more geophysical techniques in geophysical exploration. |
| Grade | The relative quantity or percentage of ore mineral content in an orebody. |
| Hangingwall | The overlying side of an orebody, fault, or mine working, esp. the wall rock above an inclined vein or fault. |
| Granite | A light-coloured, course-grained igneous rock. |
| Igneous | Rock or material solidified from molten or partially molten material. |
| Indicated Resource | An 'Indicated Mineral Resource' is that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a reasonable level of confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes. The locations are too widely or inappropriately spaced to confirm geological and/or grade continuity but are spaced closely enough for continuity to be assumed. |
| Inferred Resource | An 'Inferred Mineral Resource' is that part of a Mineral Resource for which tonnage, grade and mineral content can be estimated with a low level of confidence. It is inferred from geological evidence and assumed but not verified geological and/or grade continuity. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes which may be limited or of uncertain quality and reliability. |
| Interpolate | In the mathematical field of numerical analysis, interpolation is a method of estimating new data points within the range of a discrete set of known data points. |
| Intrusion | A unit of igneous rock, which is emplaced within pre-existing rocks as magma and then solidifies below surface. |
| JORC Code | The Australasian Code for Reporting of Mineral Resources and Ore Reserves prepared by the Joint Ore Reserves Committee of the Australian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Mineral Council of Australia, as amended. |
| Kriging | Best linear unbiased estimate. In particular kriging employs the variogram model as the weighting function because of |

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| | this kriging weights are assigned in a way that reflects the spatial correlation of the grades themselves. |
| Kuroko-type | A type of volcanic associated massive sulphide deposit formed in a back arc basin environment |
| Lineament | A linear topographic feature of regional extent that is believed to reflect crustalstructure. |
| Massive Sulphide | A compact form of ore sulphides |
| Mafic | Said of igneous rock composed mainly of ferromagnesian (dark-coloured) minerals. |
| Measured Resource | A 'Measured Mineral Resource' is that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a high level of confidence. It is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes. The locations are spaced closely enough to confirm geological and grade continuity. |
| Metasedimentary | Sedimentary material that has been subjected to metamorphism. |
| Metamorphism | The mineralogical, chemical and structural adjustment of solid rocks in response to physical and chemical conditions which differ from the conditions under which the rocks originated. |
| Metavolcanic | Volcanic material that has been subjected to metamorphism. |
| Mesozoic | An era comprising the Triassic, Jurassic and Cretaceous periods from 245 – 65 million years ago. |
| Mineralisation | The process or processes by which a mineral or group of minerals are introduced to a host rock. |
| Mineral Reserve | Is the economically mineable material derived from a Measured and/or Indicated Mineral Resource. |
| Mineral Resource | A 'Mineral Resource' is a concentration or occurrence of material of intrinsic economic interest in or on the Earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge. Mineral Resources are sub-divided, in order of increasing geological confidence, into Inferred, Indicated and Measured categories. |
| Nappe | A body of rock, generally highly folded with a greater degree of deformation than a conventional thrust slice. Typically in in orogenic belts |
| Ordovician | A sub-era of the Palaeozoic between 510 – 439 million years ago |
| Ore | The naturally occurring material from which a mineral(s) can be extracted at a reasonable profit. |
| Orebody | A continuous well defined mass of material to sufficient ore content to make extraction economically feasible. |
| Polymetallic | An ore containing several different metals |
| Pyrite | A common, pale bronze or brass yellow mineral, FeS2. |
| Psammitic | A metamorphic rock rich in quartz |
| Sampling | Taking small representative pieces of rock or material along exposed mineralisation or diamond drill core for assay. |
| Schist | A rock exhibiting a foliation of minerals and / or representing a grade of metamorphism |
| Sedimentary | Refers to rocks formed by deposition of detrital or chemical material that originates form the weathering of rock, and is transported from a source to a site of deposition. |
| Sericite | A fine grained variety of the mica muscovite |
| Shear Zone | A tabular zone of rock that has been deformed by many parallel fractures due to shear strain.. |
| Sphalerite | An important ore of zinc (ZnS) |
| Stratigraphy | The arrangement of strata, with reference to geographical position and chronological order of sequence. |
| Strike | Direction along slopping strata or surface, which is at right angles to dip. |
| Sulphide | A chemical compound of sulphur. |
| Tetrahedrite | An end member of a series of solid solutions into which arsenic enters to form tennantite: mined as an ore of copper and silver |

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| Trenching | The act of excavating a narrow, shallow ditch cut across a mineral deposit to obtain samples or to observe character. |
| Ultramafic | An igneous rock composed of predominantly ferromagnesian minerals and no free quartz. Silica content is less than 45 percent. |
| Volcanogenic | Of a volcanic origin |

## 17. APPENDICES

Appendix 1: Quality Control Certificate, ALS Minerals.

ALS ROMANIA SRL
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Alba Alba 517619
Phone: +40 258 780 395 Fax: +40 258 780 208
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Page: Appendix 1
Total # Appendix Pages: 1
Finalized Date: 26- SEP- 2017
Account: SINMIN

Project: BUCOVINA/MANAILA

CERTIFICATE OF ANALYSIS RM17182704

CERTIFICATE COMMENTS

ACCREDITATION COMMENTS

The methods immediately below this line are ISO 17025:2005 Accredited. INAB Registration No: 173T

Applies to Method: ME- ICPORE

INAB ISO 17025 ACCREDITED TESTING DETAILED IN SCOPE REG NO.173T

LABORATORY ADDRESSES

Processed at ALS Rosia Montana located at Loc. Gura Rosiei, communa Rosia Montana, Alba, Romania.

Applies to Method:

| | | | |
|---|---|---|---|
| Au- AA25 | LOG- 24 | LOG- QC | PUL- 31 |
| PUL- QC | WEI- 21 | WSH- 22 | |

Processed at ALS Loughrea located at Dublin Road, Loughrea, Co. Galway, Ireland.

Applies to Method: ME- ICPORE

Appendix 2: Certificate of Sample Analysis, ALS Minerals

ALS ROMANIA SRL
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Account: SINMIN

Project: BUCOVINA/MANAILA

**QC CERTIFICATE OF ANALYSIS RM17237044**

## CERTIFICATE COMMENTS

### ACCREDITATION COMMENTS

The methods immediately below this line are ISO 17025:2005 Accredited. INAB Registration No: 173T

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|---|---|---|---|---|
| Applies to Method: | ME- ICPORE | | | |

### LABORATORY ADDRESSES

Processed at ALS Rosia Montana located at Loc. Gura Rosiei, communa Rosia Montana, Alba, Romania.

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|---|---|---|---|---|
| Applies to Method: | Au- AA25 | LOG- 24 | PUL- 31 | PUL- QC |
| | WEI- 21 | WSH- 22 | | |

Processed at ALS Loughrea located at Dublin Road, Loughrea, Co. Galway, Ireland.

| | |
|---|---|
| Applies to Method: | ME- ICPORE |