TECHNICAL REPORT ON THE TURMALINA MINE COMPLEX, MINAS GERAIS STATE, BRASIL

PREPARED FOR JAGUAR MINING INC.

NI 43-101 REPORT

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EXECUTIVE SUMMARY

Jaguar Mining Inc. (Jaguar) with the assistance of Deswik Brasil herein provide a Technical Report supporting disclosure of updated Mineral Reserves and Mineral Resources at the Turmalina Mine Complex located in Minas Gerais state, Brazil. This Technical Report conforms to NI 43-101 Standards of Disclosure for Mineral Projects. The authors are familiar with the property having regularly visited site over the past three years. All currency in this report is in US dollars (US$) unless otherwise noted.

Jaguar is a Canadian mining company listed on the TSX. Jaguar's current gold operations, Turmalina and Caeté, are located in the Iron Quadrangle region, a prolific greenstone belt near the city of Belo Horizonte in the state of Minas Gerais, Brazil.

The Turmalina Mine Complex consists of a number of contiguous mineral rights holdings that cover an area of approximately 5,034 ha. Along with the Turmalina Mine, the Turmalina Mine Complex includes two satellite deposits, Faina and Pontal.

Jaguar acquired the Turmalina Mine from AngloGold Ashanti Ltd. (AngloGold) in September 2004, and commenced mining operations in late 2006. The mine utilizes longhole stoping with backfill at a production rate of 1,200 tonnes per day (tpd) and ore is processed at the adjacent 2,000-tpd carbon-in-pulp (CIP) processing plant. The process plant has excess capacity and operates 1 of 3 installed grinding mills to reduce costs. The process plant flowsheet includes 3 stage crushing, grinding, leaching, adsorption, elution, electrowinning, detoxification, tailings filtration, dry stack tailings, and paste backfill.

The Mineral Resource estimate for the Turmalina Mine with an effective date of December 31, 2019 is summarized in Table 1-1. The Mineral Resources are estimated for the Turmalina Mine (Orebodies A, B, and C) and Faina and Pontal deposits, and conform to Canadian Institute of Mining, Metallurgy and Petroleum Definition Standards for Mineral Resources and Mineral Reserves dated May 10, 2014 (CIM (2014) definitions).

TABLE 1-1 SUMMARY OF MINERAL RESOURCES – DECEMBER 31, 2019
Jaguar Mining Inc. – Turmalina Mine Complex

Category	Tonnes (000)	Grade (g/t Au)	Contained Oz Au (000)
Turmalina			
Measured	2,014	5.14	333
Indicated	2,213	4.66	331
Sub-total M&I	**4,227**	**4.89**	**664**
Inferred	1,818	4.23	248
Faina			
Measured	72	7.39	17
Indicated	189	6.66	42
Sub-total M&I	**261**	**6.87**	**58**
Inferred	1,542	7.26	360
Pontal			
Measured	251	5	40
Indicated	159	4.28	22
Sub-total M&I	**410**	**4.72**	**62**
Inferred	130	5.03	21
Total Turmalina, Faina, and Pontal deposits			
Measured	2,337	5.19	390
Indicated	2,561	4.78	395
Total M&I	**4,898**	**4.98**	**784**
Inferred	3,490	5.60	629

Notes:
1. CIM (2014) definitions were followed for Mineral Resources.
2. Mineral Resources include the Turmalina deposit, Faina deposit, and Pontal deposit.
3. Mineral Resources are inclusive of the Mineral Reserves at the Turmalina deposit.
4. Mineral Resources are estimated at a cut-off grade of 2.1 g/t Au at Turmalina, 3.8 g/t Au at Faina, and 2.9 g/t Au at Pontal.
5. Mineral Resources at the Turmalina deposit include all drill hole and channel sample data and mining excavations as of December 16, 2019. Mineral Resources at the Faina and Pontal deposits include drill hole information as of December 31, 2014.
6. Mineral Resources are estimated using a long-term gold price of US$1,500 per ounce for the Turmalina deposit and US$1,400 per ounce for the Faina and Pontal deposits.
7. Mineral Resources are estimated using an average long-term exchange rate of 3.70 Brazilian Reais: 1 US Dollar for the Turmalina deposit and 2.50 Brazilian Reais: 1 US Dollar for the Faina and Pontal deposits.
8. A minimum mining width of two metres was used.
9. Bulk density is 2.83 t/m^3 for Orebodies A and B and 2.91 t/m^3 for Orebody C at the Turmalina deposit.
10. Gold grades are estimated by the ordinary kriging interpolation algorithm using capped composite samples.
11. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
12. Numbers may not add due to rounding.

Mineral Reserves are estimated for Orebody A and Orebody C and are summarized in Table 1-2.

TABLE 1-2 MINERAL RESERVE ESTIMATE – DECEMBER 31, 2019
Jaguar Mining Inc. – Turmalina Mine Complex

Orebody	Proven Reserves			Probable Reserves			Proven and Probable Reserves		
	ROM (000 t)	Grade (g/t Au)	Oz Au (000)	ROM (000 t)	Grade (g/t Au)	Oz Au (000)	ROM (000 t)	Grade (g/t Au)	Oz Au (000)
Orebody A	408	5.75	75	398	4.91	63	806	5.34	138
Orebody C	347	3.85	43	1,244	3.77	151	1,591	3.79	194
Total	**755**	**4.88**	**118**	**1,642**	**4.04**	**213**	**2,397**	**4.31**	**332**

Notes:
1. CIM (2014) definitions were followed for Mineral Reserves.
2. Mineral Reserves were estimated at a break-even cut-off grade of 2.5 g/t Au, an incremental cut-off grade of 1.4 g/t Au.
3. Mineral Reserves are estimated using an average long-term gold price of US$1,300 per ounce, and an exchange rate of 3.70 Brazilian Reais: 1 US Dollar.
4. A minimum mining width of 2.4 meters was used.
5. Bulk density is 2.83 t/m^3 for Orebodies A and B and 2.91 t/m^3 for Orebody C at the Turmalina Mine.
6. Numbers may not add due to rounding.

Jaguar is not aware of any environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other factors that could materially affect the Mineral Resource and Mineral Reserve estimates.

CONCLUSIONS

Both open pit and underground mining methods have been employed on the property, however, only the underground mine is currently operating.

GEOLOGY AND MINERAL RESOURCES

- It is Jaguar´s opinion that the Turmalina Mineral Resource estimates were prepared in a professional and diligent manner by qualified professionals and that the estimates comply with CIM (2014) definitions.

- The total Mineral Resources for the Turmalina Mine Complex comprise approximately 4.90 million tonnes at an average grade of 4.98 g/t Au - containing 784,000 ounces of gold in the Measured and Indicated Mineral Resource category, and approximately 3.49 million tonnes at an average grade of 5.60 g/t Au - containing approximately 629,000 ounces of gold in the Inferred Mineral Resource category. The Mineral Resources include the Turmalina deposit and two satellite deposits, Faina and Pontal.

A cut-off grade of 2.10 g/t Au was used to report the Mineral Resources for the Turmalina deposit, and cut-off grades of 3.8 g/t Au and 2.9 g/t Au were used to report the Mineral Resources for the Faina and Pontal deposits, respectively.

- Reconciliation studies on a quarterly basis show that the monthly Mine-to-Plant (F2) results exhibit a good correlation between the mine and the plant data throughout most of the 2018 and 2019 production periods, with the monthly block model predicted grades being generally more than those processed by the plant and the block model predicted tonnes being generally less than those processed by the plant.

- In general terms, Jaguar observes that there is good agreement between the plant data and the block model for the 2018 and 2019 periods. Jaguar is of the opinion that this agreement is suggesting that the sampling strategies, assaying methods, and estimation procedures currently used at the mine to prepare the grade block models are producing reasonable predictions of the tonnages, grades, and contained metal that are being received at the processing plant.

- Two recently discovered mineralized lenses are located between Orebody A and the previously known lenses comprising Orebody C. These new lenses were discovered as a result of recent exploration drilling that was carried out from the underground drill bays to define and evaluate the lower portions of the Orebody C "SE" mineralized lenses. As these are newly discovered lenses, their full limits and economic potential are not fully understood at the moment. The presence of potentially economic mineralization therefore is, very likely, not restricted to only the previously defined mineralized horizons and orezones. The possibility of additional mineralized zones being located elsewhere in the mine stratigraphy must be considered and evaluated as exploration targets.

MINING AND MINERAL RESERVES

- It is Jaguar´s and Deswik Brasil's opinion that the Turmalina Mineral Reserve estimates were prepared in a professional and diligent manner by qualified professionals and that the estimates comply with CIM (2014) definitions.

- Proven and Probable Mineral Reserves total 2.40 million tonnes at a grade of 4.31 g/t Au, containing approximately 332,000 ounces of gold. Mineral Reserves are limited to Orebody A and Orebody C.

- A gold price of US$1300/oz and an exchange rate of BR$3.7 to US$1 was used for both the 2018 and the 2019 Mineral Reserves.

- Jaguar 2019 diamond drilling programs added 145,000 ounces of Proven and Probable Mineral Reserves reflecting an increase of 63% over 2018 Mineral Reserves before 2019 depletion. Year over year Mineral Reserves increased 104,000 ounces or 46% over 2018 Mineral Reserves after 2019 depletion.

- Orebody A Proven and Probable Mineral Reserves increased by 32,000 ounces over 2018 Mineral Reserves and net of 2019 depletion. Down plunge infill drilling has extended the Orebody A Mineral Reserves to the base of level 14. Orebody A has been intersected by previous growth exploration to below level 16 where it remains open down plunge for future drill programs.

- Orebody C Proven and Probable Mineral Reserves increased by 72,000 ounces over 2018 Mineral Reserves net of 2019 depletion. Detailed mapping of primary and secondary underground development by Jaguar´s geological team has allowed detailed structural kinematic indicator measurements which defined a more precise orientation of both the C-Central and C-SE (southeast) mineralized payshoots.

- The more accurate plunge direction allowed the 2019 drilling program to target and trace these main payshoots down their structural plunge. The C Central and C-SE payshoots remain open down plunge and these depth extensions remain the primary target for ongoing drill programs.

- At C-Central, exploration drilling first defined the high grade payshoot in March 2019 which was followed by targeted drilling down plunge, resource definition and estimation and underground access development. Initial stoping activities commenced in September 2019. Inclusion of Orebody C-Central Mineral Reserve into inventory for the first time was completed by year end. C-Central provides a new production area for Turmalina.

- At C-SE the definition of a more precise mineralization plunge direction using mapping and structural geology allowed targeted drilling down plunge, increasing the mineralized extension from level 5 to level 8, and defined additional Mineral Reserves where supported by infill drilling and secondary development channel sampling. Like Orebody C-Central, Orebody C-SE remains open down plunge below level 8.

- New Turmalina Mineral Reserves support a mine life of six years.

- Both Orebody A and Orebody C are being mined using sublevel stoping in a retreat sequence with rock fill and paste fill.

- The Mineral Reserve additions in C SE and C Central are higher up in the mine than Orebody A and this reduces the demand on trucking.

- There is good potential for increasing Mineral Reserves by completing infill drilling of the Inferred Mineral Resources at depth in both Orebody A and Orebody C.

- Successful use of Paste fill and Partial Rib Pillars have increased the ore extraction ratio and the conversion ratio from Resources to Reserves while improving the rock mass stability.

METALLURGY AND PROCESSING

- The plant at the Turmalina Mine achieves consistent recoveries.

- Production capacity for the plant exceeds the ability of the mine to deliver ore.

CAPITAL AND OPERATING COSTS

- Direct capital costs over the Life of Mine Plan (LOMP) total $12,6 million for exploration.

- Sustaining capital costs are estimated to be $24,8 million, of which $6.2 million is spent on rebuilds. Reclamation and closure costs are estimated to total $4.5 million.

- Life of Mine (LOM) operating costs are forecast to average $70.29/t. Strengthening of the US dollar against the BRL over the last few years has had a significant impact in reducing US$ unit costs. Jaguar used an exchange rate of US$1.00 = 4.00 BRL for 2020. The exchange rate assumptions are consistent with forecasts.

- All-In Sustaining cost (as defined by the World Gold Council) for the Turmalina Mine is $1,145/oz, including reclamation and closure.

RECENT AND ONGOING ACTIVITIES

Jaguar has incorporated the following recommended actions (from the prior Technical Report (RPA 2019)) into its 2020 mining and exploration planning.

GEOLOGY AND MINERAL RESOURCES

Exploration

- Growth Exploration diamond drilling of the down-plunge and along-strike projections, targeting structurally-controlled, higher grade mineralization on Orebodies A, B and C is in progress.

- Growth Exploration drilling at Turmalina is also targeting additional, parallel-mineralized zones in the hanging wall of Orebody B, at the so-named Orebody B Inflection zone and in the footwall and hanging wall units of Orebodies A and C.

- A high-resolution drone airborne magnetic survey covering the Zona Basal and Faina – Orebody C Gap Area was completed during the first quarter of 2020. The results from this survey will be used to further refine, from a structural perspective, a series of priority targets for testing by surface trenching and diamond drilling. In addition, detailed surface geological mapping has identified prospective extensions to the already defined area exhibiting strong Au and associated elements in soil anomalies; and follow up exploration of these areas will be prioritized in the search for the presence of further gold-bearing mineralization extending into these areas.

Quality Assurance/Quality Control

During 2019 Jaguar has implemented a series of improvements to its QA/QC procedures and practices. These include:

- Jaguar is well advanced with transitioning to a new database MX Deposit from the in-house database previously used (BDI).

- Established clear criteria for acceptance or rejection of drill hole and channel sample data in the drill hole database.

- Established data screening protocols for review of data quality for newly acquired data prior to inserting into the master database.

- A statistically number of pulps from selected drilling programmes are being sent to an external laboratory for duplicate analysis.

- Re-assay thresholds have been revised.

- Including functionality in the new database to store drill core recovery, channel sample recovery, and sample tracking (lost sample) information to assist with addressing null values in resource estimates.

- Completed a review of the surveying practices and quality control procedures being used, to ensure that all drill hole collars are accurately located prior to entry into the final drill hole database.

Mineral Resources

Jaguar is currently reviewing, updating and improving practices and procedures used in resource evaluation and estimation. These include:

- Updating the written procedures for the collection of geological and sampling information. Once complete focused training sessions to present the procedures to all geological staff will be scheduled.

- Updating the core logging and sampling procedures so that the logging geologist ensures that a full series of samples are taken through those portions of the drill holes that are expected to intersect the mineralized zones. The samples should cover not only the expected mineralized intervals, but should extend a short distance into the adjacent wall rocks as well.

- Modification to the logging procedures, whereby detailed information regarding the mineralized intervals is brought forward from the remarks column and inserted as a major level entry in the drill logs - to assist in preparation of updates to the Mineral Resources.

- Codification of the block model for the mined-out excavations using both the development and the stope excavation models.

- Implemented routine geological mapping of all available underground excavations. The results of this geological mapping are used to prepare a lithological model and to improve the allocation of the density measurements for future Mineral Resource updates.

- Collection of bulk density measurements for any newly discovered mineralization.

- Continue with in-house and academic studies to examine the relationship of the gold values to structural, alteration, or lithologic features (such as the presence of quartz veining, for example) to aid in the understanding of the distribution of the higher-grade gold values as seen in Orebodies A and C.

- Re-examination of the stratigraphic/lithologic controls on mineralization for Orebody B, for the possibility of generating drill targets.

- Focused infill drilling to collect additional drill hole information in areas of low drilling density to improve the confidence level of the Mineral Resource estimate, to reduce and remove the estimation artifacts, and to search for the down-dip projections of the mineralization.

- Jaguar is planning to re-evaluate the Mineral Resource estimates for the Faina and Pontal deposits.

MINING AND MINERAL RESERVES

Jaguar is currently reviewing, updating and improving practices and procedures used in reserve estimation. These include:

- Collecting data for modelling mining costs by orebody, such that variable and incremental cut-off grades can be determined by individual orebody, and the Mineral Reserve estimate, LOMP, and processing capacity can be optimized.

- Integration of ground control and rock mechanics analysis into the mine planning process, to improve stability and reduce dilution.

- Balancing production levels between Orebody A and Orebody C, for improved production stability and an operationally achievable plan over the LOM.

- Consideration of an annual long-term planning cycle inclusive of strategic asset planning, Mineral Resource, and Mineral Reserve estimation for all Jaguar operations.

- Evaluation of cost data to capture the variation of unit mining costs between Orebody A and Orebody C, given significant differences between mining widths, production rates, ground conditions, and haul distances.

- Recent change of mining method to improve resource recovery and production stability.

MINERAL PROCESSING AND METALLURGICAL TESTING

- A Diagnostic Metallurgical Testwork Program on representative samples from the Turmalina Mine, including a review of historical test-work completed for Faina and

Pontal materials, was initiated in Q4 – 2019. Results from this test-work program will assist with the identification of opportunities to improve metallurgical recoveries through modifications in the current plant process flowsheet, as well as assessing potential process options for the treatment of refractory material from Faina and Pontal.

- Jaguar is also assessing options for leveraging excess processing capacity.

TECHNICAL SUMMARY

PROPERTY DESCRIPTION AND LOCATION

The Turmalina Mine Complex is located in the Conceição do Pará municipality in the state of Minas Gerais, approximately 120 km northwest of Belo Horizonte and six kilometres south of Pitangui, the nearest important town.

The property comprises a number of mineral rights holdings granted by the Agência Nacional de Mineração (ANM) that cover an area of 5,034 ha. The mine is centred at approximately 19°44'36" south latitude and 44°52'36" west longitude.

Jaguar has 100% ownership subject to 5% net revenue interest up to $10 million and 3% thereafter, to an unrelated third party. In addition, there is a 0.5% net revenue interest payable to the surface landowner.

EXISTING INFRASTRUCTURE

The Turmalina Mine includes a nominal 2,000 tpd capacity processing plant and tailings disposal area. Electrical power is obtained from the national grid. There is no infrastructure related to the Faina and Pontal historic open pit operations.

HISTORY

Gold was first discovered in the area in the 17th century, and through the 19th century, intermittent small-scale production took place from alluvial terraces and outcropping quartz veins. Gold production exploited alluvium or weathered material, including saprolite and saprolite-hosted quartz veins.

AngloGold Ashanti controlled the Turmalina Mine Complex mineral rights from 1978 to 2004 through a number of Brazilian subsidiaries. It explored the area extensively between 1979 and

1988 using geochemistry, ground geophysics, and trenching, which led to the discovery of the Turmalina, Satinoco (later renamed as Orebody C), Faina, and Pontal deposits, and other mineralized zones. In 1992 and 1993, it mined 373,000 t of oxide ore from open pits at these zones recovering 35,500 oz of gold using heap leach technology. Jaguar acquired the Turmalina properties in 2004.

GEOLOGY AND MINERALIZATION

The Turmalina deposits are located in the western part of the Iron Quadrangle, which was the principal region for the Brazilian hard rock gold mining until 1983 and accounted for approximately 40% of Brazil's total gold production. Gold was produced from numerous deposits, primarily in the northern and southeastern parts of the Iron Quadrangle, mostly hosted by Archean or Early Proterozoic-aged banded iron formations (BIF) contained within greenstone belt supracrustal sequences.

The Turmalina Mine Complex is underlain by rocks of Archaean and Proterozoic age. Archaean units include a granitic basement, overlain by the Pitangui Group, a greenstone belt sequence of ultramafic to intermediate volcanic flows and pyroclastics and associated sediments. The Turmalina deposit is hosted by chlorite-amphibole schist and biotite schist units within the Pitangui Group. A sequence of sheared, banded, sulphide-facies iron formations and cherts lies within the stratigraphic sequence. The stratigraphy locally strikes to azimuth 135º.

The Turmalina deposits are believed to be typical examples of mesothermal, epigenetic deposits that are enclosed by host rocks that have undergone amphibolite-facies metamorphism.

Gold mineralization in the Turmalina deposits occurs in fine grains associated with sulphides in sheared schists and BIF packages. Gold particles are mostly associated with arsenopyrite, quartz, and micas (sericite and biotite).

EXPLORATION STATUS

Jaguar´s recent and current exploration programs are mainly focused on in-mine drilling programs aimed at Mineral Resources to Mineral Reserves Conversion. Drilling is sub-divided, in terms of focus, into (i) "lateral exploration", which aims to identify additional mineralization, close to existing mine infrastructure that would potentially support increases in productivity; and (ii) "depth extension drilling", in areas that have potential to add to the life of mine (LOM). "Near mine exploration" is also in progress over priority targets to identify the potential for additional material on which to leverage excess plant capacity.

In 2019, Jaguar's in-mine diamond drilling program focused on testing of down-dip and lateral extensions of Orebodies A and C (and proximal mineralized lenses present in the immediate hanging wall and/or footwall of these orebodies) with the aim of generating additional Mineral Resources for eventual conversion to Mineral Reserves.

MINERAL RESOURCES

TURMALINA DEPOSIT

The database for the Turmalina deposit comprises 4,218 drill holes and 17,282 channel samples. The estimate was generated from a block model constrained by 3D wireframe models that were constructed using a minimum width of approximately two metres. A capping value of 50 g/t Au was applied for all three orebodies. The gold grades were interpolated by the OK interpolation algorithm using capped composited assays. Solid models of the underground excavations have been prepared using available survey data as of December 16, 2019. These solid models were used to code the block model for the mined-out portions of the deposit.

The mineralized material for each orebody was classified into the Measured, Indicated, or Inferred Mineral Resource categories on the basis of the search ellipse ranges obtained from the variography study, of the observed continuity of the mineralization, of the drill hole and channel sample density, and from previous production experience with these orebodies.

Reconciliation studies were completed by Jaguar on both monthly and quarterly periods. The block model data is generally in good agreement with the plant data for the 2018 and 2019 periods. On a metal basis, the block model was within 2% and 7% of the plant for 2018 and 2019, respectively.

FAINA DEPOSIT

The database for the Faina deposit comprises 3,992 drill holes and channel samples for an aggregate length of 52,474 m. The estimate was generated from a block model constrained by a total of 39 3D wireframe models that were constructed using a minimum width of approximately two metres. Two topography models were created, one representing the limit of open pit excavation and the second representing the current topography where a portion of the open pit has been backfilled. A solid model of the underground excavation volume was created using existing centre-line survey data and a general cross section profile. A capping value of 30 g/t Au was applied to channel samples, and a capping value of 25 g/t Au was applied to drill hole samples. The gold grades were interpolated using several interpolation algorithms using capped composited assays. The Mineral Resources are reported using the gold grades estimated by the ID^3 method.

The mineralized material for each wireframe was classified into the Measured, Indicated, or Inferred Mineral Resource categories, on the basis of the search ellipse ranges obtained from the variography study, of the observed continuity of the mineralization, of the drill hole and channel sample density, and of the presence of underground access.

The Mineral Resources for the Faina deposit have been prepared under the conceptual scenario that the contained refractory gold-bearing material will be excavated by means of underground mining methods and transported to the Turmalina plant for processing. A gold-rich flotation concentrate is envisioned to be generated after appropriate upgrades have been made to the existing plant. The gold-rich flotation concentrate would then be shipped or sold to a domestic source for recovery of the gold.

PONTAL DEPOSIT

The database for the Pontal deposit comprises 3,590 drill holes and channel samples for an aggregate length of 19,283 m. The estimate was generated from a block model constrained by a total of 16 3D wireframe models that were constructed using a minimum width of approximately two metres. Two topography models were created that covered the local area of each of the two deposits at Pontal, LB1 and LB2. An approximation of the underground excavation volume was created by digitizing the outlines in plan view from historical underground mapping and sampling programs carried out at the LB1 deposit. The digitized plan view strings were projected upwards by a constant distance of 2.5 m to create the solid model of the underground excavations. A capping value of 30 g/t Au was applied to samples at the LB1 deposit and a capping value of 10 g/t Au was applied to samples at the LB2 deposit. The gold grades were interpolated using several interpolation algorithms using capped composited assays. The Mineral Resources are reported using the gold grades estimated by the ID^3 method.

The mineralized material for each wireframe was classified into the Measured, Indicated, or Inferred Mineral Resource categories on the basis of the search ellipse ranges obtained from the variography study, of the observed continuity of the mineralization, of the drill hole and channel sample density, and of the presence of underground access. The Mineral Resources for the Pontal deposit have been prepared under the conceptual scenario that the contained refractory gold-bearing material will be excavated by means of underground mining methods and transported to the Turmalina plant for processing. A gold-rich flotation concentrate is envisioned to be generated after appropriate upgrades have been made to the existing plant. The gold-rich flotation concentrate would then be shipped or sold to a domestic source for recovery of the gold.

MINERAL RESERVES

The Mineral Reserves consist of selected portions of the Measured and Indicated Mineral Resources within designed stopes and associated development. The stope design was completed by Deswik Brasil, a Brazilian consulting group.

Dilution was applied to the designed stopes projecting 0.5 m for both hanging wall and footwall sides. Dilution estimates average 14%.

Extraction (mining recovery) is assumed to be 95% for most stopes, 90% for blind stopes and remnant areas, 50% for rib pillars and 100% for development tunnels.

A break-even cut-off grade of 2.5 g/t Au was estimated for Mineral Reserves, using a gold price of US$1,300/oz, and average gold recovery of 90% and 2018 cost data for the Turmalina Mine. Gold prices used for Mineral Reserves are based on consensus, long term forecasts from banks, financial institutions, and other sources.

MINING

The Turmalina Mine consists of several zones grouped into three orebodies - Orebodies A, B, and C.

The main production of the mine has been from Orebody A, which is steeply east dipping, with a strike length of approximately 250 m to 300 m, and an average thickness of six metres. Mineralization has been outlined to depths of 1,000 m below surface. The southern portion of Orebody A is composed of two parallel narrow veins. The northern portion of Orebody A is much the same as the southern portion, however, the two parallel zones nearly, or completely, merge, and therefore the zone is wider.. The central area where the 2 parallel zones merge is called the Principal Zone and forms a payshoot that is up to 20 metres thick and higher grade.

Orebody B includes three thinner, lower grade lenses parallel to Orebody A. Two of the lenses are located approximately 50 m to 75 m in the structural hanging wall and are accessed by a series of cross-cuts that are driven from Orebody A. The third lens is located possibly along the axial plane. The mineralization in this deposit has been outlined along a strike length of approximately 350 m to 400 m and to depths of 900 m below surface. Orebody B is narrow along its entire strike length, ranging from one metre to 7.5 m in thickness from hanging wall to footwall. Orebody B is not currently being mined although a payshoot has been identified for future exploration.

The C Orebody is a series of lenses that are located in a broad stratigraphic interval to the southwest, in the structural footwall of the Orebody A. These lenses are, generally, of lower grade, although higher grade, structurally-controlled payshoots have been defined within an overall lower grade mineralized envelope (e.g. “C SE” Orezone and “C Central” Orezone).
The entire C Orebody mineralized setting strikes northwest and dips steeply to the northeast. The contribution of material from the economic payshoots of the Orebody C has increased over the past two years, as primary and secondary development have accessed these areas at shallow levels in the mine.

The broad mineralized zone in this deposit (C Mineralized Trend) has been outlined along a strike length of approximately 800 m to 850 m and to depths of 700 m to 750 m below surface.

The individual economic payshoots being developed and mined in this context, however, display a more limited strike length, of the order of 30-40 m to 120 m (e.g.: “C Central” and “C SE”, respectively). The payshoots are locally thicker (up to 10 m) as well as higher grade. Orebodies A and C are the primary structures being mined, while mining in Orebody B has been halted for several years.

Orebody A is closest to the main ramp and is accessed first. Development is currently progressing to Level 13 in Orebody A.

Orebody C is a secondary system being mined to the west of the portal. Orebody C is accessed from the main ramp at Level 02. A separate internal ramp is utilized for Orebody C, which reduces the haul distance to the run-of-mine ore stockpile, and reduces traffic on the main ramp.

MINING METHOD

The mining method currently in use is sublevel stoping with rock fill and paste fill.

The mine is accessed from a 5 m by 5.5 m primary decline located in the footwall of the deposit. Each level is divided into three sublevels, spaced 20 m apart vertically, that are driven from the main ramp. Sill pillars are left between levels at nominally 60 meter vertical spacing. Sill pillar thickness is based on geotechnical modelling.

At each level and sublevel, drifts are developed in the mineralized zone to expose the hanging wall contact. The drift is extended in both directions along strike, under geological control for alignment, continuing to expose the contacts until the limits of the orebody are reached.

A longitudinal retreat sequence is used for both Orebody A and Orebody C except for the thicker Principal Zone of Orebody A. Sublevels are mined from the bottom up. Stope extraction on a sublevel begins at the ends of the sublevels and retreated back towards the access. Partial rib pillars are left between adjacent stopes and are sized based on geotechnical modelling.

The Principal Zone of Orebody A, where the orebody is higher grade and up to 20 meters thick, uses a modified Transverse Stoping Method using cemented paste backfill. The Transverse Stopes are 25 meters along strike. A center stope is mined from the bottom to the top sublevel to create a cemented paste fill pillar before mining the stopes on either side. The remaining stopes are also mined from bottom to top sublevel and retreat back to the accesses on either side of the Principal Zone. The mining method is safer and more productive by limiting the open hanging wall span, and stabilizing the area with cemented paste backfill and cable bolting the hanging wall. The extraction ratio of the stopes is improved by not needing to leave ore pillars in the higher grade and thicker zone when cemented paste fill is used.

Turmalina has multiple independent scheduling areas at a time to enable the 400 kt/yr ore production scheduled. Orebody A can have up to 4 independent scheduling areas on 1 level with the Principal Zone, 2 structures to the southeast, and 1 structure to the northwest of the Principal Zone. The C-South East zone can have 2 scheduling areas with 1 on each side of the center access drift. The C-Central Zone adds 1 scheduling area with the access from the end.

Although mining of Orebody B is not in the current LOMP, and the orebody is no longer included in the Mineral Reserves, future access is possible, either by mining through cemented paste fill and supporting appropriately, or by mining concurrently with the thinner ends of Orebody A.

LIFE OF MINE PLAN

The production schedule is summarized in Table 1-3 and covers a mine life of six years based on Mineral Reserves.

TABLE 1-3 LOMP PRODUCTION SCHEDULE
Jaguar Mining Inc. – Turmalina Mine Complex

Item	Units	2020	2021	2022	2023	2024	2025	Total
Total Mill Feed	Tonnes (000)	400	399	399	399	399	400	**2,397**
	g/t Au	4.32	4.33	4.33	4.33	4.33	4.21	**4.31**
Development	m	8,362	5,000	4,000	2,943	1,599	39	**21,944**
Recovery	%	90%	90%	90%	90%	90%	90%	**90%**
Gold Produced	Ounces (000)	**50**	**50**	**50**	**50**	**50**	**49**	**299**

Scheduling is based on productivities achieved in the current operation. Development was limited to 60 m per month on the main ramp, 40 m per month on the ore drives and 50 m per month on any single heading elsewhere. Stope scheduling is based on retreat mining and includes delays for backfilling and cement curing.

MINERAL PROCESSING

The plant has a nominal processing capacity of 2,000 tpd, or 720,000 tpa. Since inception, the plant has been achieving annual overall recoveries of between 87% and 92%. The process flowsheet includes two-stage crushing and screening to minus 9.5 mm (-3/8 in.), grinding using ball mills, thickening, cyanide leaching, CIP, elution, electrowinning, and smelting. The tailings are conveyed to a detoxification unit for arsenic removal and cyanide destruction and then are pumped to the paste fill plant to be used either for mine backfill or deposited on a dry-stack storage area. Process tailings have also been dry-stacked in completed open pits on the mine site.

In January 2017, Mill #3 was recommissioned with an estimated installed capacity of 1,600 tpd. Using only Mill #3, Turmalina has been able to achieve the entire throughput of the plant with a lower operating cost, through electricity consumption savings.. The Turmalina combined grinding capacity of all 3 mills of 3,400 tonnes/day (at 92% operating time) could facilitate a production expansion if warranted by future exploration success.

ENVIRONMENTAL AND PERMITTING CONSIDERATIONS

Jaguar has all permits necessary for continuing operation of the Turmalina Mine.

As of December 31, 2019, Jaguar maintained progressive rehabilitation and reclamation provisions of US$ 4.5 million which represent the undiscounted, uninflated future payments for the expected rehabilitation costs.

CAPITAL AND OPERATING COST ESTIMATES

Costs for the LOMP were estimated in BRL, based on recent operating results and Jaguar budgets.

A summary of capital requirements anticipated over the LOMP is provided in Table 1-4.

TABLE 1-4 LOMP CAPITAL COST SUMMARY

Jaguar Mining Inc. –Turmalina Mine Complex

	Units	Total	2020	2021	2022	2023	2024	2025
Direct Cost								
Mining	US$ (000)	**-**	-	-	-	-	-	-
Processing	US$ (000)	**-**	-	-	-	-	-	-
Infrastructure	US$ (000)	**-**	-	-	-	-	-	-
Exploration	US$ (000)	**11,630**	2,434	1,839	1,839	1,839	1,839	1,839
Total Direct Cost	US$ (000)	**11,630**	2,434	1,839	1,839	1,839	1,839	1,839
Sustaining								
Sustaining	US$ (000)	**68,245**	21,653	12,927	11,891	10,855	7,237	3,681
Reclamation and Closure	US$ (000)	**4,525**	93	101	93	258	211	3,769
Total Capital Cost	**US$ (000)**	**72,770**	**21,746**	**13,028**	**11,984**	**11,113**	**7,448**	**7,450**

Operating costs for the LOMP are shown in Table 1-5. Recent strengthening of the US dollar against the BRL has had a significant impact in reducing US$ unit costs. Jaguar used an exchange rate of US$1.00 = 4.00 BRL for 2020.

Operating cost estimates include mining, processing, and general and administration (G&A) expenses. Operating costs are budget cost projections based on actual costs incurred over the past year.

TABLE 1-5 LOM OPERATING COST SUMMARY

Jaguar Mining Inc. – Turmalina Mine Complex

Unit Costs	Unit	Average	2020	2021	2022	2023	2024	2025
Mining (Underground)	US$/t milled	**37.29**	38.50	35.85	36.40	37.01	37.67	38.29
Processing	US$/t milled	**30.21**	26.33	30.98	30.98	30.98	30.98	30.98
G&A	US$/t milled	**2.80**	6.30	2.10	2.10	2.10	2.10	2.10
Total Unit Operating Cost	**US$/t milled**	**70.29**	**71.13**	**68.93**	**69.48**	**70.09**	**70.75**	**71.37**

There are additional corporate overhead costs associated with the Belo Horizonte and Toronto offices, as well as royalties and refining costs, which are not included in the operating cost estimate.

2 INTRODUCTION

The purpose of this report prepared by Jaguar with the assistance of Deswik Brasil is to support disclosure of the updated Mineral Reserves and Mineral Resources for the Turmalina Mine Complex, located in Minas Gerais state, Brazil. This Technical Report conforms to NI 43-101 Standards of Disclosure for Mineral Projects.

Jaguar was formed on March 1, 2002 for the purpose of developing small and medium sized mineral properties in Brazil that have well defined gold resources and reserves with upside exploration potential. Mineração Serras do Oeste (MSOL) is a Brazilian company holding numerous properties in Minas Gerais state, including the Turmalina Mine Complex, and was formed by ex-AngloGold Ashanti Ltd. (AngloGold) geologists and engineers who believed that many of the small gold properties in Minas Gerais had mining potential if run separately as small coordinated operations. MSOL was acquired by Jaguar as its Brazilian subsidiary in 2002. Jaguar's first operation was the Sabará deposit, a small oxide gold heap leach operation which was in production for four years until resource exhaustion.

Jaguar's current gold operations, Turmalina and Pilar, are located in the Iron Quadrangle region, a prolific greenstone belt near the city of Belo Horizonte in the state of Minas Gerais, Brazil. Jaguar is a Canadian-chartered entity with its principal executive office in Toronto, Ontario, Canada and administrative office in Belo Horizonte, Brazil. The common shares of Jaguar are currently listed on the TSX under the symbol JAG.

The Turmalina Mine Complex consists of a number of contiguous mineral rights holdings that cover an area of approximately 5,034 ha. Gold mineralization has been discovered at three deposits, namely the Turmalina, Faina and Pontal deposits. Jaguar commenced mining operations in late 2006 from the Turmalina deposit. The mine utilizes longhole stoping with backfill at a production rate of 1,500 tonnes per day (tpd) and ore is processed at the adjacent 2,000-tpd carbon-in-pulp (CIP) processing plant.

SOURCES OF INFORMATION

This report is prepared by Jaguar with the assistance of Deswik Brasil. All information used in the report was collected first hand by the authors who are familiar with the Turmalina Complex from regular site visits undertaken over the period August 2017 to the current time. Additional information has been derived from prior technical reports prepared by Deswik Brasil, including the most recent report published on the 4th of April 2019.

A summary of the Jaguar staff and its consultants other than the named authors of this Technical Report who contributed to the preparation of the Mineral Resource and Mineral Reserve estimates for the Pilar and Roça Grande mines is presented below.

Name	Position	Company
Vernon Casey Baker	Chief Executive Officer	Jaguar
Eric Duarte	VP - Operations	Jaguar
Hashim Ahmed	Chief Financial Officer	Jaguar
Jonathan Victor Hill	Exploration & Geology – Expert Advisor	Jaguar
Elias de Oliveira Andrade	Technical Service Manager	Jaguar
Hugo Leonardo de Avila Gomes	Resources and Reserves Geologist Sr	Jaguar
Armando José Massucatto	Geology & Exploration Manager	Jaguar
Frederico Lima de Paula	Geology Coordinator	Jaguar
Marco Aurelio Sequetto Pereira	Resource Geologist	Jaguar
Jéssica Morgana Ribeiro Santana	Geotechnical Engineer	Jaguar
Vitor Balbys Moura	Mine Planning Coordinator	Jaguar
Farley Carlos de Oliveira Campos	Mine Planning Engineer	Jaguar
Luiz Henrique Milagres de Oliveira	Mine Planning Engineer	Jaguar
Carlos Michel Farias Bitencourt	Data-base Geologist	Jaguar
Williams Pinto dos Santos	Mine Geologist	Jaguar
Walace Vinícius do Carmo Fernandes	Mine Geologist	Jaguar
Francisco Bittencourt Oliveira	Senior Mining Engineer	Deswik Brasil
Bruno Yoshida Tomaselli	Senior Mining Engineer	Deswik Brasil
Bruna Oliveira Rozendo	Mining Engineer	Deswik Brasil
Jussara da Silva Moreira	Mining Engineer	Deswik Brasil
Laura Barcelos Carneiro Vieira	Mining Engineer	Deswik Brasil

Mr. Jonathan Victor Hill BSc. (Hons) Economic Geology, FAUSIMM, Expert Advisor Exploration and Geology, Jaguar Mining Inc. and Mr. Bruno Yoshida Tomaselli, BSc Mining Engineering, Deswik Brasil, (FAUSIMM), Consulting Manager, are the Qualified Persons for this Technical Report. Mr. Hill prepared Sections 4 to 14, 17 and 23. Mr. Tomaselli prepared

Sections 15, 16, 18 to 22 and 24. All authors share responsibility for Sections 1, 2, 3, 25, 26, and 27 of this Technical Report.

The documentation reviewed, and other sources of information, are listed at the end of this report in Section 27 References.

LIST OF ABBREVIATIONS

Units of measurement used in this report conform to the metric system. All currency in this report is US dollars (US$) unless otherwise noted.

a	annum	L	litre
A	ampere	lb	pound
Acfm	actual cubic feet per minute	L/s	litres per second
bbl	barrels	m	metre
btu	British thermal units	M	mega (million); molar
°C	degree Celsius	m^2	square metre
C$	Canadian dollars	m^3	cubic metre
cal	calorie	μ	micron
cm	centimetre	MASL	metres above sea level
cm^2	square centimetre	μg	microgram
d	day	m^3/h	cubic metres per hour
dia	diameter	mi	mile
dmt	dry metric tonne	min	minute
dwt	dead-weight ton	μm	micrometre
°F	degree Fahrenheit	mm	millimetre
ft	foot	mph	miles per hour
ft^2	square foot	MVA	megavolt-amperes
ft^3	cubic foot	MW	megawatt
ft/s	foot per second	MWh	megawatt-hour
g	gram	oz	Troy ounce (31.1035g)
G	giga (billion)	oz/st, opt	ounce per short ton
Gal	Imperial gallon	ppb	part per billion
g/L	gram per litre	ppm	part per million
Gpm	Imperial gallons per minute	psia	pound per square inch absolute
g/t	gram per tonne	psig	pound per square inch gauge
gr/ft^3	grain per cubic foot	R$ or BRL	Brazilian Real
gr/m^3	grain per cubic metre	RL	relative elevation
ha	hectare	RPM	revolutions per minute
hp	horsepower	s	second
hr	hour	st	short ton
Hz	hertz	stpa	short ton per year
in.	inch	stpd	short ton per day
in^2	square inch	t	metric tonne
J	joule	tpa	metric tonne per year
k	kilo (thousand)	tpd	metric tonne per day
kcal	kilocalorie	US$	United States dollar
kg	kilogram	USg	United States gallon
kgf/cm^2	kilogram force per square cm	USgpm	US gallon per minute
km	kilometre	V	volt

km^2	square kilometre	W	watt
km/h	kilometre per hour	wmt	wet metric tonne
kPa	kilopascal	wt%	weight percent
kVA	kilovolt-amperes	yd^3	cubic yard
kW	kilowatt	yr	year
kWh	kilowatt-hour		

3 RELIANCE ON OTHER EXPERTS

This report has been prepared by Jaguar assisted by Deswik Brasil. The information, conclusions, opinions, and estimates contained herein are based on:

- Information available to Jaguar and Deswik Brasil at the time of preparation of this report, and
- Assumptions, conditions, and qualifications as set forth in this report.

Jaguar can demonstrate ownership of property title and mineral rights for the Turmalina Mine Complex.

Jaguar has provided guidance on applicable taxes, royalties, and other government levies or interests, applicable to revenue or income from the Turmalina mining operation.

Except for the purposes legislated under provincial securities laws, any use of this report by any third party is at that party's sole risk.

4 PROPERTY DESCRIPTION AND LOCATION

The Turmalina Mine Complex is located in the state of Minas Gerais, approximately 120 km northwest of Belo Horizonte and 10 kilometres south of Pitangui, the nearest important town (Figure 4-1). The Turmalina Mine Complex is located in the Conceição do Pará municipality.

Jaguar, like other Brazilian mining companies, has large mining concessions, which typically range upwards of 2,000 ha per concession. As a result, a given mine or project may have numerous related mineralized zones extending over many kilometres of strike length, which may eventually have individual mining operations. They may all be grouped under the single mine name, which is often the first operation put into production. To assist in the definition of the location of the primary operation, the geographic coordinates of this primary operation are listed by latitude and longitude. The Turmalina Mine Complex has geographic coordinates of 19°44’36.96” south latitude and 44°52’36.45” west longitude.

MINERAL TENURE

Jaguar acquired the Turmalina Mine Complex from AngloGold Ashanti in September 2004. Jaguar has 100% ownership subject to a 5% net revenue interest up to $10 million and 3% thereafter, to an unrelated third party. In addition, there is a 0.5% net revenue interest payable to the surface landowner.

The Turmalina Mine Complex comprises a number of contiguous mineral rights holdings granted by the Agência Nacional de Mineração (ANM) that cover an area of 5,034 ha, as summarized in Table 4-1. A summary of mineral royalties is provided in Table 4-2. A summary of the surface rights holdings is provided in Table 4-3. The locations of the mineral rights and surface rights are illustrated in Figures 4-2 and 4-3, respectively.

TABLE 4-1 SUMMARY OF MINERAL RIGHTS HOLDINGS
Jaguar Mining Inc. – Turmalina Mine Complex

ANM Registry	Name	Licence Date	Area (ha)	Status
833.584/2012	Zona Basal	16/04/2018	77.87	Exploration Licence (Licence Renewal)
812.003/1975	Casquilho	11/09/1991	980.43	Mining Concession
812.004/1975	Varjao-Pontal e Itamar	04/09/1991	880.00	Mining Concession
803.470/1978	Rio S. João	25/04/1995	952.00	Mining Concession
830.027/1979	Pontal	26/04/1995	120.00	Mining Concession
831.125/2018	Zona Basal	06/09/2018	11.68	Exploration Application
831.126/2018	Zona Basal	06/09/2018	26.13	Exploration Application
831.131/2015	Zona Basal	19/02/2016	131.15	Exploration Licence (Initial)
831.617/2003	Rio S. João	21/07/2010	858.71	Final Exploration Report submitted to ANM
832.203/03	Rio S. João	16/10/2014	996.00	Final Exploration Licence
930.086/2005	Turmalina	26/02/2010		Mining Group
TOTAL			**5,033.97**	

TABLE 4-2 SUMMARY OF MINERAL ROYALTIES, CONCESSION NO. 812.003/1975
Jaguar Mining Inc. – Turmalina Mine Complex
Mineral Rights Royalties

Holder	Royalty	Orebody	Payment Status in BRL	
			Status	Paid in 2019
Eduardo C. de Fonseca	5% of the Production Gross Profits until reaching US$10 million during current fiscal year, then 3% of the Production Gross Profit	A, B and C	Inactive	-
Carlos Andraus / Mirra Empreend. e Participações Ltda.			Active (30%)	1,775,019
Vera A. Di Pace / Vermar Empreend. e Participações Ltda.			Active (30%)	1,775,019
Paulo C. de Fonseca / Sandalo Empreend. E Participações Ltda.			Active (16%)	946,677
Clara Darghan/Mocla Empreend. E Participações Ltda.			Active (12%)	710,007
Eduardo Camiz de F. Junior / Agro Pecuária Aldebaram Empreend. Ltda.			Active (12%)	710,007

Surface Rights Royalties

Holder	Refers to	Orebody	Payment Status in BRL	
			Base Value	Paid in 2019
José Laeste de Lacerda	Surface	A, B and C	6,868	99,289
Wilson Clemente de Faria	Building rent		1,627	119.296
	Surface		6,420	
EPAMIG	Surface	Faina	27,250	327,000
Familia Freitas	Water pipe	A, B and C	2,574	135,207
	Water well		2,143	
	Road access		6,866	

TABLE 4-3 SUMMARY OF SURFACE RIGHTS HOLDINGS
Jaguar Mining Inc. – Turmalina Mine Complex

Name	Registry Number	Location	Area (ha)	Status	20% Area Forest Legal Reserve
FAZENDA CAIAMAL (FAZENDA JOSÉ MARIA, ESPÓLIO)	Mat. R-01-13.321 – Livro 2 – Área: 40 ha / Mat. R-02-5.873 – Livro 2 – Área: 31.5 ha	Tailings Dam (partial)	71.5	Active	The legal reserve of a total of 18.81 ha is in good standing but the registration at the public notary is still pending.
FAZENDA CAIAMAL (FAZENDA BARBIERE)	Mat. 32.288 – Livro 2	Processing Plant, Fill Plant, Tailings Dam and Core shack	96	Active	Legal Reserve is in good standing. Area of 19.50 ha.
FAZENDA IRMÃOS FREITAS (CACA / ANTÔNIO CARLOS ALVES DE FREITAS)	Mat. 30.108 – Livro 2	Orebodies C and D	30	Active	Legal reserve established in name of IBDF (Instituto Brasileiro de Florestas), according to AV – 1 - 30108-03/07/2003, Registration of Legal reserve in name of Jaguar pending.
FAZENDA CASQUILHO (ALEXANDRE FERREIRA DA SILVA)	-	Office, Mess, Mechanic Shop and Decline Portal	3	Active	No Forest legal reserve registered as the area has no more available forest
FAZENDA TANQUE	Pending	Down Dip Projection of Orebodies A & B	25		

FIGURE 4-1 LOCATION MAP

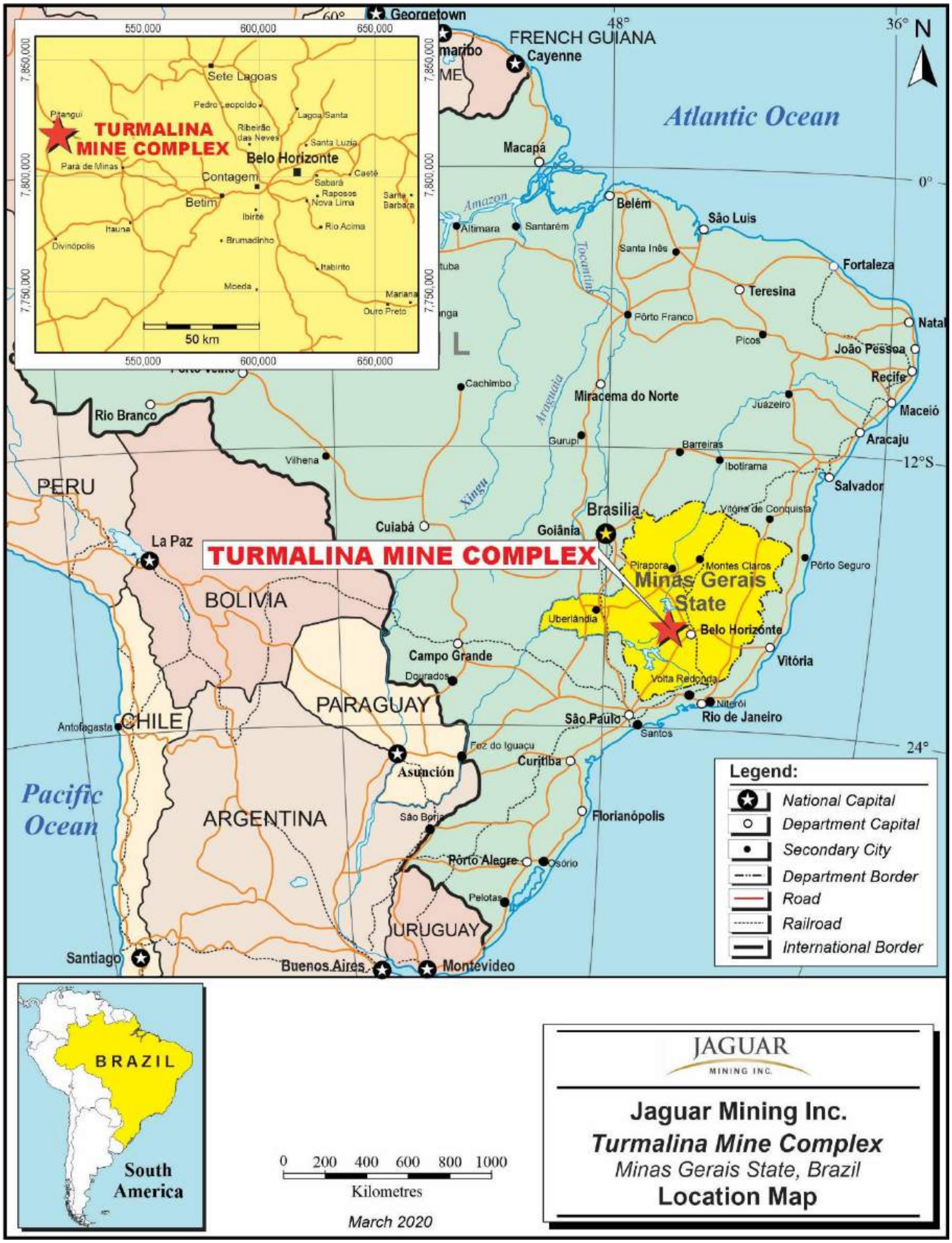


FIGURE 4-2 MINERAL RIGHTS AND INFRASTRUCTURE

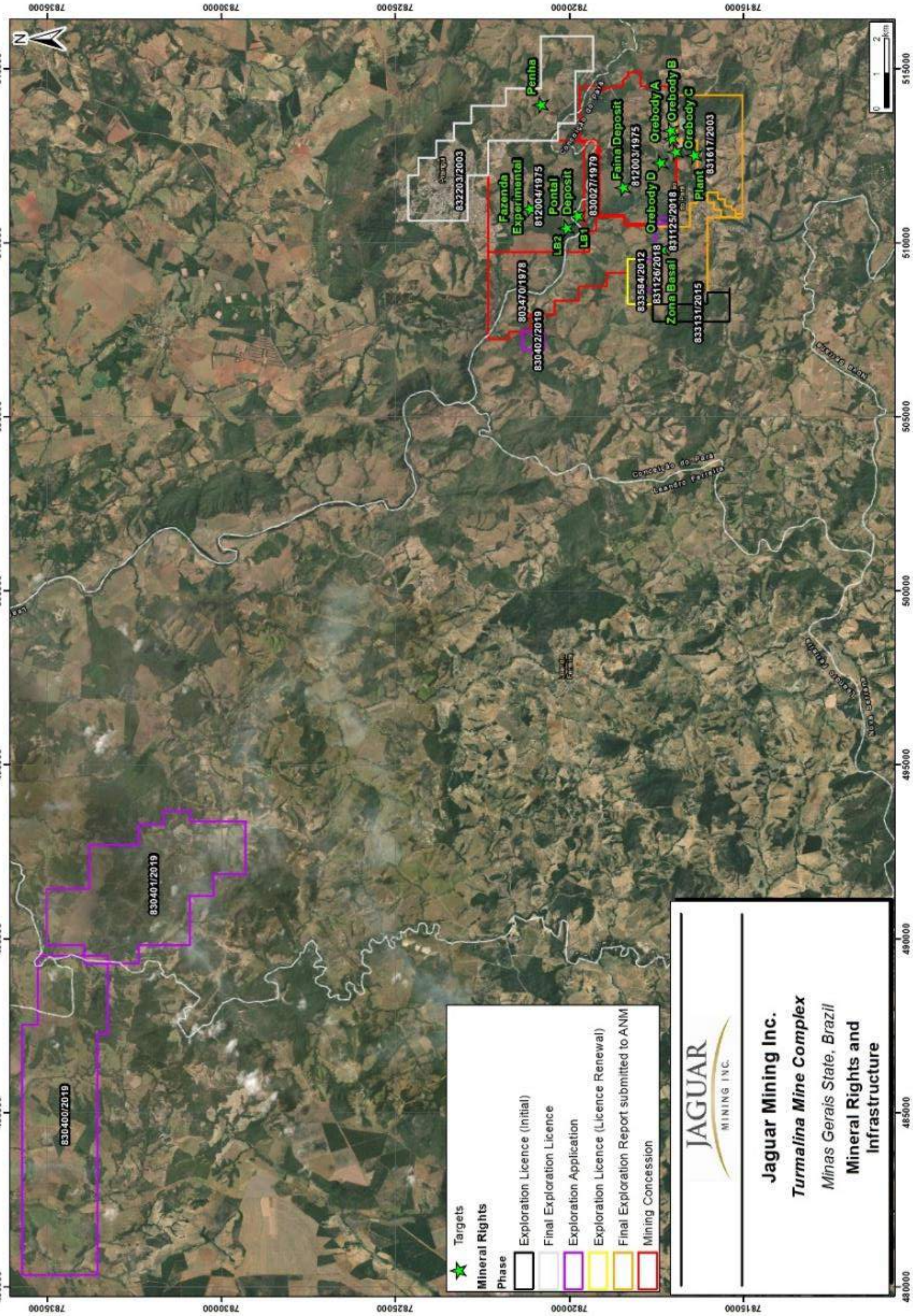
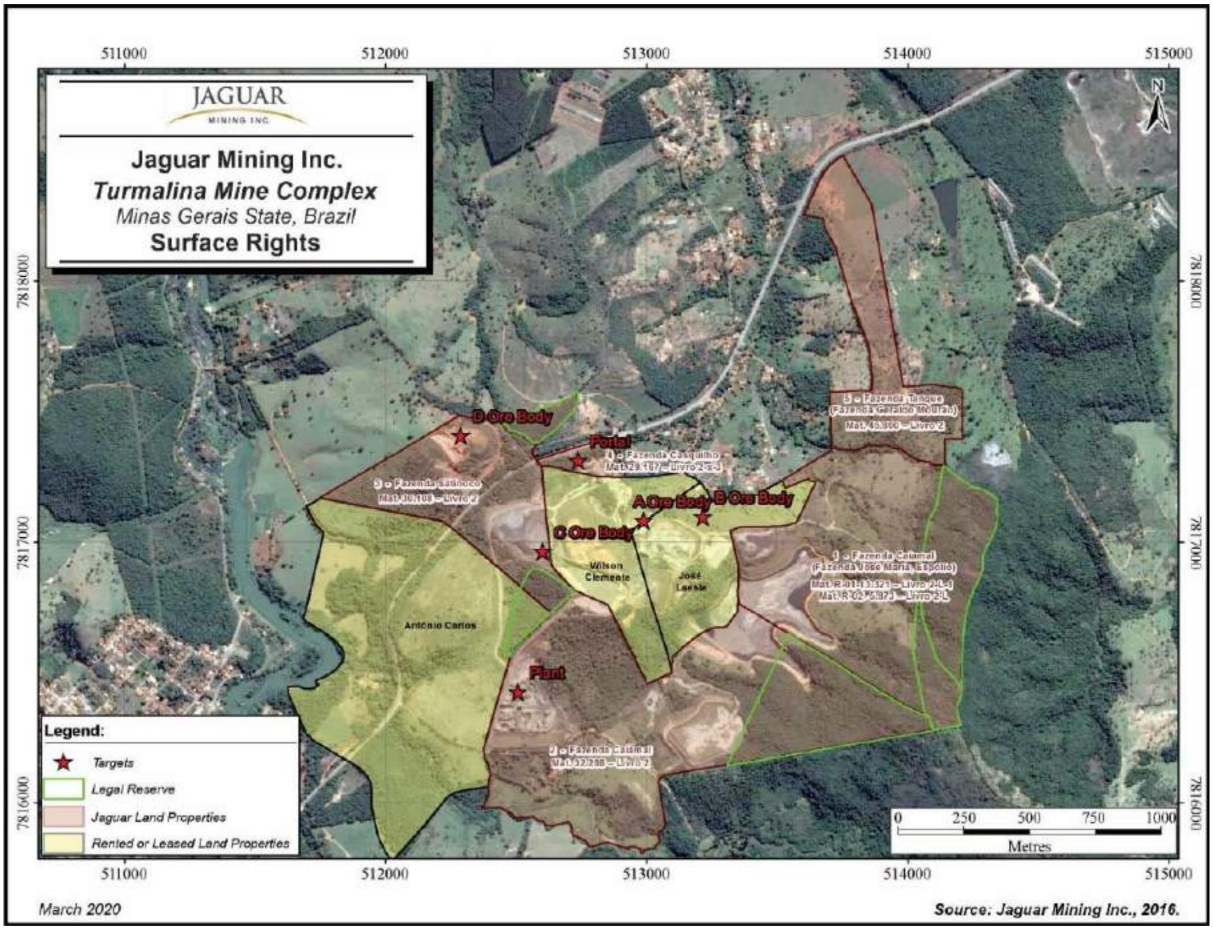


FIGURE 4-3 SURFACE RIGHTS



MINERAL AND SURFACE RIGHTS IN BRAZIL

In Brazil, the Agência Nacional de Mineração, or ANM, issues all mining leases and exploration concessions. Mining leases are renewable annually, and have no set expiry date. Each year, Jaguar is required to provide information to ANM summarizing mine production statistics in order to maintain the mining leases and exploration concessions in good standing.

Exploration concessions are granted for a period of three years. Once a company has applied for an exploration concession, the applicant holds a priority right to the concession area as long as there is no previous ownership. The owner of the concession can apply to have the exploration concession renewed for one-time extension for a period of two or three years. Renewal is at the sole discretion of ANM. Granted exploration concessions are published in the Official Gazette of the Republic (OGR), which lists individual concessions and their change in status. The exploration concession grants the owner the sub-surface mineral rights. Surface rights can be applied for if the land is not owned by a third party.

The owner of an exploration concession is guaranteed, by law, access to perform exploration field work, provided adequate compensation is paid to third party landowners and the owner accepts all environmental liabilities resulting from the exploration work. The exploration permits are subject to annual fees based on its size.

In instances where third party landowners have denied surface access to an exploration concession, the owner maintains full title to the concession until such time as the issue of access is negotiated or legally enforced by the courts. Access is guaranteed under law and the owner of an exploration concession will eventually gain easements to access the concession.

Once access is obtained, the owner has three years to submit an Exploration Report (ER) on the concession. The owner of a mineral concession is obligated to explore the mineral potential of the concession and submit an ER to ANM summarizing the results of the fieldwork and providing conclusions as to the economic viability of the mineralization. The content and structure of the report is dictated by ANM, and a person with suitable professional qualifications must prepare the report.

ANM will review the ER for the concessions and will either:

- approve the report provided ANM concurs with the report's conclusions regarding the potential to exploit the mineralization;
- dismiss the report should the report not address all the requirements, in which case the owner is given a term in which to address any identified deficiencies in the report; or
- postpone a decision on the report should it be decided that exploitation of the deposits is temporarily non-economic.

Approval, dismissal, or postponement of the ER is at the discretion of the ANM. There is no set time limit for the ANM to complete the review of the ER. The owner is notified of the ANM's decision on the ER and the decision ID is published in the OGR.

On ANM approval of the ER, the owner of an exploration concession has one year to apply for a mining lease. The application must include a detailed Development Plan (DP) outlining how the deposit will be mined.

ANM reviews the DP and decides whether or not to grant the application. The decision is at the discretion of ANM, but approval is virtually assured unless development of the project is considered harmful to the public or the development of the project compromises interests more relevant than industrial exploitation. Should the application for a mining lease be denied for exploration concessions for which the ER has been approved, the owner is entitled to government compensation.

On approval of the DP, ANM grants the mining licence, which remains in force until the depletion of the mineral resource. Mining concessions remain in good standing subject to submission of annual production reports and payments of royalties to the federal government.

Jaguar is not aware of any environmental liabilities on the property. Jaguar has all required permits to conduct the proposed work on the property. Jaguar is not aware of any other significant factors and risks that may affect access, title, or the right or ability to perform the proposed work program on the property.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

ACCESSIBILITY

The Turmalina Mine Complex is accessed from Belo Horizonte by 130 km of paved highways (BR-262 and MG-423) to the town of Pitangui. The Turmalina deposits are located approximately 10 kilometres south of Pitangui and less than 1 kilometer from highway MG-423.

Belo Horizonte is the commercial center for Brazil's mining industries and has excellent infrastructure to support world-class mining operations. This mining region has historically produced significant quantities of gold and iron from open pit and large-scale underground mining operations operated by AngloGold Ashanti, VALE, CSN, and Eldorado. The city is a well-developed urban metropolis of almost two million and five hundred thousand residents, and has substantial infrastructure including two airports, an extensive network of paved highways, a fully developed and reliable power grid, and ready access to processed and potable water.

Pitangui is a town of approximately 25,000 people. The local economy is based on agriculture, cattle breeding, and a small pig iron plant. Manpower, energy, and water are readily available.

CLIMATE

The Turmalina Mine Complex lies approximately at 700 MASL. The Pitangui area terrain is rugged in places, with numerous rolling hills incised by deep gullies along drainage channels. Farming and ranching activities are carried out in approximately 50% of the region.

The dominant climate in the region is temperate, with average annual temperatures hovering around 26°C. In the winter period, minimum temperatures of 10ºC are noted. In the summer, there are few records above 32°C. According to the Köppen classification, the region's climate is classified as Cwb, mesothermal, with mild summers and dry autumn and winter seasons.

There are two distinct seasons: the rainy summer, usually from October to March and the dry winter, from April to September. The average annual rainfall is around 1,650 mm and the rainiest months are December and January. The relative humidity of the air ranges from 75% to 85%.

VEGETATION

In phytogeographic terms, the region is located in the western portion of the Atlantic Province, also known as the Atlantic Morphoclimatic Domain or Atlantic Forest Biome. In the Vegetation Map of Brazil (IBGE, 1993) this region is inserted between the types of seasonal semideciduous forest and *cerrado*.

The physiognomy structure of the forest formations of this area, when in climax and depending on the type of soil, present trees up to 25-30 m in height. At this stage, they have a defined stratification, with low dense understory and composed of shrubs and trees of different botanical families.

The predominant vegetation is the *cerrado*, with small trees and shrubs. Large areas are now transformed into pastures. Along the Pará River and its tributary streams, riparian forests are characterized by medium-sized trees.

From the original formations, little is preserved, since the anthropic occupation is old in the region, having already changed the original vegetation cover, replacing it with secondary formations and pastures. The various forest fragments still observed in the region are at a secondary stage, resulting from regeneration.

SOIL ASPECTS

Where well defined, the soils have little variability in appearance, with a clear predominance of silty-clayey soils with a pink to brownish color, resulting from the decomposition of phyllites/schists, widely distributed in the area.

The soils are better exposed on the slopes of the valleys, due to colluvium concentrations. In the higher lands, where the most widely spaced vegetation predominates, there are little developed and stony soils.

LOCAL RESOURCES

Belo Horizonte is one of the world's mining capitals, with a regional population in the range of 2 million people. Automobile manufacturing and mining services dominate the economy. General Electric has a major locomotive plant which produces engines for all of South America and Africa. Mining activities in Belo Horizonte and the surrounding area have been carried out in a relatively consistent manner for over 300 years. The Turmalina Mine Complex is within commuting distance of Belo Horizonte.

INFRASTRUCTURE

The Turmalina Mine Complex includes a nominal 2,000 tpd processing plant and tailings disposal area. Electrical power is obtained from the national grid.

All ancillary buildings are located near the mine entrance: gate house including a reception area and waiting room, administration building, maintenance shops, restaurant, warehouse, change room, first aid, and compressor room. The explosives warehouse is located 1.2 km away from the mine area, in compliance with the regulations set forth by the Brazilian Army.

Other ancillary buildings are located near the processing plant and include an office building, a laboratory, warehousing, and a small maintenance shop.

There is no infrastructure related to the Faina and Pontal historic open pit operations.

6 HISTORY

Gold was first discovered in the area in the 17th century, and through the 19th century, intermittent small-scale production took place from alluvial terraces and outcropping quartz veins. Gold production exploited alluvium or weathered material, including saprolite and saprolite-hosted quartz veins. Records from this historical period are few and incomplete.

AngloGold controlled the mineral rights from 1978 to 2004 through a number of Brazilian subsidiaries. AngloGold explored the Turmalina Mine Complex area extensively between 1979 and 1988 using geochemistry, ground geophysics, and trenching, which led to the discovery of the Turmalina, Satinoco (Orebody C), Faina, and Pontal deposits, and other mineralized zones. Initial exploration work at the what would become Orebody A included 22 surface-based diamond drill holes totalling 5,439 m to test the downward extension of the sulphide mineralized body. At the Satinoco target (Orebody C), a total of 1,523 m were completed in nine holes.

In 1992 and 1993, AngloGold mined 373,000 t of oxide ore from open pits at the Turmalina, Satinoco (now referred to as Orebody C), Pontal, and Faina zones. It recovered 35,500 oz of gold using heap leach technology. Subsequently, AngloGold drove a ramp beneath the Turmalina pit and carried out drifting on two levels in the mineralized zone at approximately 50 m and 75 m below the pit floor to explore the downward extension of the sulphide mineralized body.

Jaguar acquired the AngloGold Turmalina properties in 2004 and continued operation of the underground mine. The mine is accessed from a 5 m by 5 m primary decline located in the footwall of the main deposit. As at December 31, 2019 the decline has reached Level 13, at a vertical depth of approximately 902 m below surface.

HISTORICAL RESOURCE ESTIMATES

Jaguar is not aware of any historical Mineral Resource estimates prepared by previous owners of the land holdings.

PAST PRODUCTION

In 2019, the Turmalina plant processed approximately 334,000 tonnes at an average feed grade of 3.15 g/t Au to produce 33,790 ounces of gold. In total, the plant has processed approximately 6.5 million tonnes of ore to produce a total of approximately 706,000 ounces of gold at an average recovered grade of 3.52 g/t Au (Table 6-1). This production includes a small quantity of material that was processed prior to Jaguar's ownership, the sulphide material extracted by Jaguar from Orebodies A, B, and C, and the oxide portions of the Orebody D, Faina, and Pontal deposits that were amenable to treatment at the existing plant.

Production from the Faina deposit open pit mine took place intermittently over a three-year period between June 2010 and June 2013.

TABLE 6-1 PRODUCTION HISTORY AND MILL RECOVERY
Jaguar Mining Inc. – Turmalina Mine Complex

Year	Tonnes Milled (000)	Feed Grade (g/t Au)	Recovered Grade (g/t Au)	Recovery (%)	Gold Produced (oz)
1992-1993	373		2.96		35,500
Q4 2006	9	2.58		91.5	678
2007	347	5.08	4.37	86.6	44,515
2008	481	5.46	5.37	88.5	72,514
2009	588	4.81	4.29	89.1	73,589
2010	692	3.20	3.06	87.4	61,860
2011	655	3.32	3.27	89.2	61,676
2012	473	2.48	2.13	89.2	37,840
2013	457	3.24	2.85	88.7	43,424
2014	442	3.69	3.27	90.0	47,993
2015	406	4.14	3.87	91.0	50,658
2016	502	3.89	3.92	91.5	63,258
2017	427	3.48	3.17	91.0	45,466
2018	322	3.44	3.12	90.7	33,261
2019	334	3.15	2.83	89.9	33,400
Total	**6,508**	**3.79**	**3.52**		**705,632**

7 GEOLOGICAL SETTING AND MINERALIZATION

REGIONAL GEOLOGY

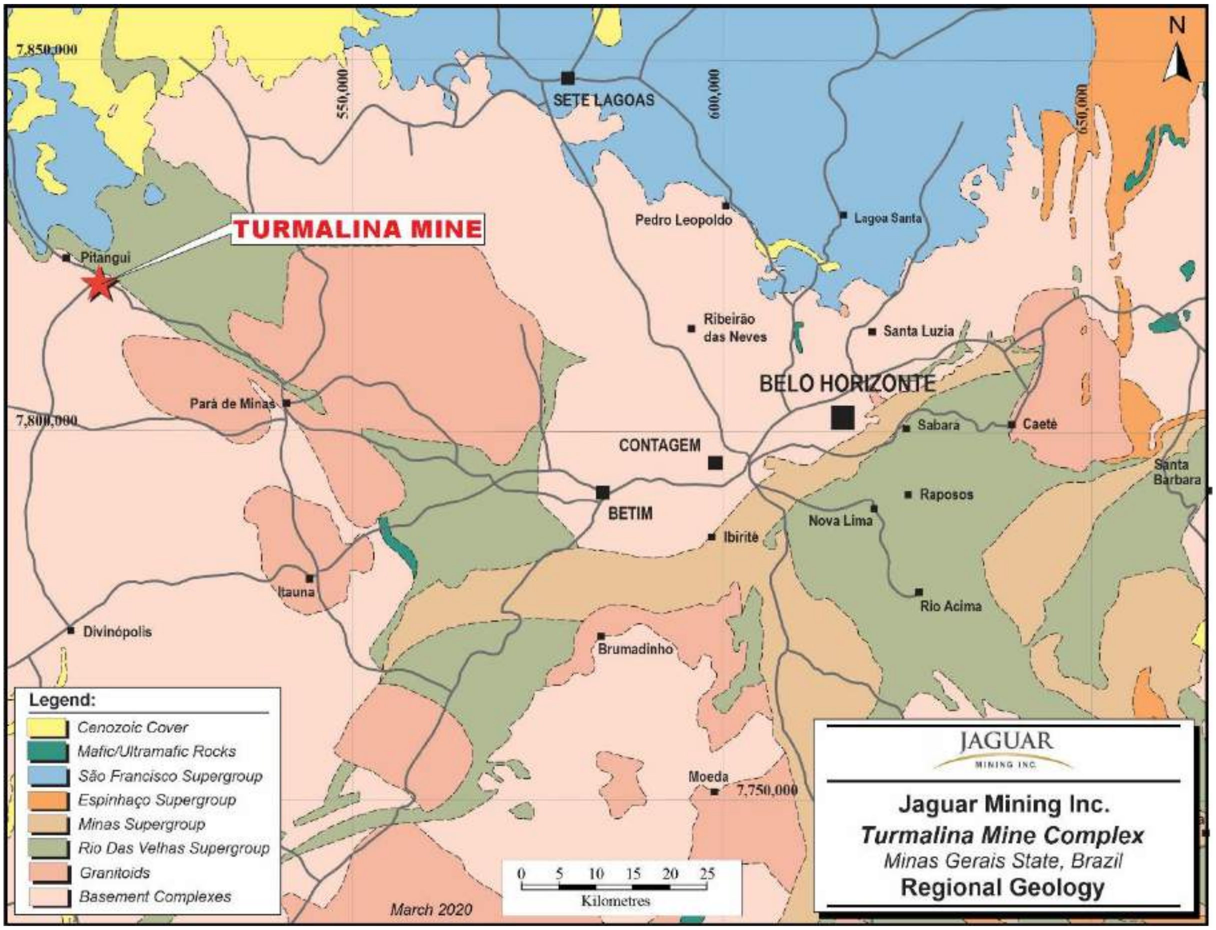
The Turmalina deposits are located in the western part of the Iron Quadrangle, which has been the largest and most important mineral province in Brazil for centuries until the early 1980s, when the Carajás mineral province, in the state of Pará, attained equal status. Many commodities are mined in the Iron Quadrangle, the most important being gold, iron, manganese, bauxite, imperial topaz, and limestone. The Iron Quadrangle was the principal region for the Brazilian hard rock gold mining until 1983, and accounted for about 40% of Brazil's total gold production. Gold was produced from numerous deposits, primarily in the northern and southeastern parts of the Iron Quadrangle, most hosted by Archean or Early Proterozoic banded iron formations (BIF) contained within greenstone belt supracrustal sequences.

In the Brumal-Pilar region, outcrops belonging to the granitic-gneissic basement, and to the Nova Lima and Quebra-Ossos groups of the Rio das Velhas Supergroup occur. The granitic-gneissic basement consists of leucocratic and homogeneous gneisses and migmatites, making up a complex of an initial tonalitic composition intruded by Archean rocks of granitic composition. The upper contact of the sequence is discordant and tectonically induced by reverse faulting. The Rio das Velhas Supergroup is regionally mainly represented by meta-mafic, meta-volcaniclastic and meta-epiclastic schists of the Nova Lima Group, and by meta-ultramafic and meta-mafic rocks of the Quebra-Ossos Group including serpentinites, talc schists, and metabasalts.

"Algoma-type" iron formations occur as the more prominent volcanogenic-sedimentary rocks in the Nova Lima Group, as layers with thicknesses of up to 10 m. The Nova Lima Group can be sub-divided into three units: a) A basal unit composed of mafic (basic) to intermediate meta-volcanic rocks interlayered with meta-pelites, Algoma-type banded iron-formations, and rare acidic meta-volcaniclastic rocks; b) An intermediate unit represented by mafic to felsic volcanic rocks and volcaniclastic rocks interlayered with graphitic phyllite and horizons of Algoma-type banded iron-formation; and c) An upper unit composed of meta-pelites interlayered with felsic meta-volcanic rocks and meta-volcaniclastic rocks, quartzites, and meta-conglomerates.

The regional geology is shown in Figure 7-1.

FIGURE 7-1 REGIONAL GEOLOGY



LOCAL GEOLOGY

The Pitangui area, where the Turmalina Mine Complex is located, is underlain by rocks of Archaean and Proterozoic ages. Archaean units include a granitic basement, which is overlain by the Pitangui Group, a sequence of ultramafic to intermediate volcanic flows and pyroclastics and associated sediments. The Turmalina deposit is hosted by chlorite-amphibole schists and silicified biotite schist units within the Pitangui Group. A sequence of sheared, banded, sulphide-facies and silicate-facies iron formations and cherts lies within the stratigraphic sequence. The stratigraphy broadly strikes towards the azimuth direction 135º.

Proterozoic units include the Minas Supergroup and the Bambuí Group. The former includes basal quartzites and conglomerates as well as phyllites. Some phyllites, stratigraphically higher in the sequence, are hematitic. The Bambuí Group is composed of calcareous sediments.

The local geology in the Turmalina Mine Complex and adjacent exploration areas was defined by AngloGold, more specifically by UNIGEO geologists during the initial exploration field work phase. At that time, the mapped lithologies and stratigraphy were defined and classified as a greenstone sequence, within a possible western extension of the Iron Quadrangle terrain.

The stratigraphic column defined by UNIGEO in the Pitangui region, from bottom to the top was:

BASEMENT

The basement is composed of a foliated, leucocratic granite and gneisses. Locally, it has been defined by its migmatite portions with porphyry crystals of quartz and K-feldspars. Granitic intrusions with fine-to-medium textures, and diabase dikes, are also common.

PITANGUI GROUP

The Pitangui Group is defined as a greenstone-belt sequence, of Archean age. It shows the following stratigraphic sequence (from the base to the top):

- Meta-Ultramafic and Meta-Mafic Volcanic Unit (Basal Unit): constituted by interlayered igneous ultramafic and mafic flows represented by serpentinites, chlorite-actinolite schists and amphibolites with layers of talc schists, oxide-facies BIFs and carbonaceous phyllites;

- Meta-Mafic and Meta-Sedimentary Unit (Middle Unit): constituted by interlayered meta-mafic rocks (chlorite-actinolite schists with dacitic intrusions at the top);

- Meta-Sedimentary: cummingtonite BIFs and meta-chert rich horizons interlayered with carbonaceous and chlorite schists. Locally, layers of meta-arkoses can be observed;

- Meta-Mafic: alternation of layers of amphibolite and chlorite-actinolites;

- Pyroclastic and Meta-Pelites: volcanic meta-conglomerates at the base, transitioning to, or alternating with, foliated meta-lapilli tuffs and meta-tuffs at the top of the sequence, where the meta-tuffs become predominant;

- Meta-Sedimentary Unit (Upper Unit): narrow and numerous interlayered layers of quartz-sericite schists, quartz-chlorite schists, quartz-sericite-chlorite schists, and carbonate-rich schists.

MINAS SUPERGROUP

The Minas Supergroup is defined as clastic and chemical sediments in a Proterozoic sequence composed by thin-to-coarse quartzites with layers of a basal conglomerate. The quartzites are covered by grey carbonatic phyllites and white sericitic phyllites which present hematite increasing towards the stratigraphic top of the sequence.

INTRUSIVE ROCKS

The intrusive rocks are defined as granitic and mafic-to-ultramafic rocks and rocks assemblages.

PROPERTY GEOLOGY

The details of the property geology of the Turmalina Mine Complex area are shown in Figure 7-2. The general stratigraphic sequence strikes towards azimuth 135° and dips moderately to steeply to the northeast. The mine sequence (part of the Pitangui Group) consists of bedded metasediments of volcanic origin including quartz-sericite schists and sericite-chlorite-biotite schists grading stratigraphically upwards into a meta-chert, BIF and carbonaceous schist package. Overlying these sediments is a thicker sequence of tuffaceous metasediments and quartz-chlorite schists. All stratigraphic units have been metamorphosed to the amphibolite facies.

FIGURE 7-2 PROPERTY GEOLOGY

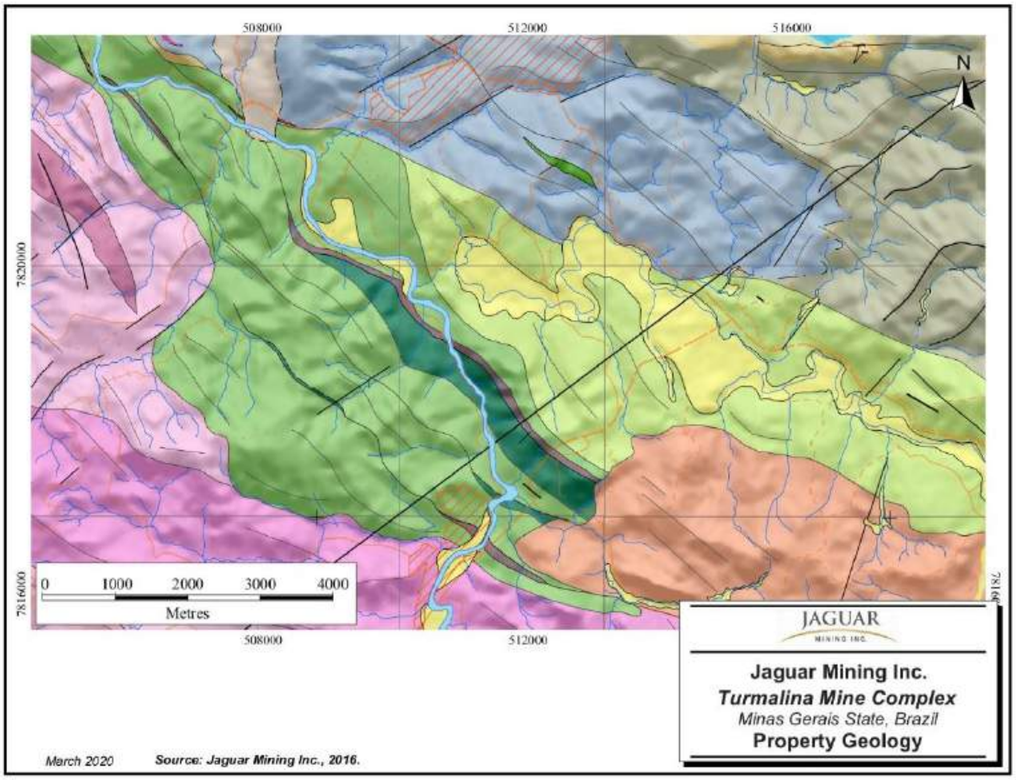


FIGURE 7-2A PROPERTY GEOLOGY LEGEND

MINERALIZATION

The mineralization at the Turmalina deposit consists of a number of tabular bodies that are spatially related to either a BIF package or to a package of slightly silicified biotite schists. These tabular bodies are grouped together, according to spatial configuration and gold content, into Orebodies A, B, and C (together the Orebodies). Gold can occur within the BIF itself, but can equally occur in the other host lithologies.

The main production of the mine has been from Orebody A, which is mostly comprised of a folded (?), steeply northeast dipping tabular deposit with a steep more southeasterly linear plunge. A number of additional tabular mineralized zones occur in close spatial relationship and generally sub-parallel to this main folded zone. The majority of the gold grades are hosted by slightly silicified biotite schist host rocks. The mineralization in this deposit has been outlined along a strike length of approximately 250 m to 300 m (an average thickness of 6 m) and to depths of approximately 1,100 m to 1,150 m below surface. The southeastern portion of Orebody A is composed of two parallel narrow veins. The northwestern portion of Orebody A is much the same as the southeastern; however, the two parallel zones nearly or completely merge and therefore the economic zone is much wider overall to the northwest direction (up to 10-12 m in thickness).

Orebody B includes two lower grade, tabular-shaped lenses that are generally parallel to Orebody A. Two of the lenses are located approximately 50 m to 75 m in the structural hanging wall and are accessed by a series of cross-cuts that are driven from Orebody A in the upper levels of the mine. The third lens is located possibly along an axial plane. The mineralization in this deposit has been outlined along a strike length of approximately 350 m to 400 m and to depths of 650 m to 700 m below surface.

Orebody C is a mineralized structure located to the southwest in the structural footwall of Orebody A. This mineralized structure strikes northwest and dips steeply to the northeast quadrant. Relative to Orebody A, only a minor amount of production has been achieved from Orebody C to date. To date, the mineralization in this deposit has been outlined along a strike length of some 1400m to a depth of 1000m below the surface. The mineralized structure can be defined, in a broad sense, based on current knowledge available from mapping of development on level 4, as being part of a district scale transcurrent/transform shear zone which is manifested and focused within a 4-to-20m-wide package of mineralized, variably silicified, iron-rich volcano-metasediments (BIFs) and graphitic schists.

Two recently discovered mineralized lenses are located between Orebody A and the previously known lenses comprising Orebody C. These new lenses were discovered as a result of recent exploration drilling that was carried out from the underground drill bays to define and evaluate the lower portions of the Orebody C "SE" mineralized lenses. As these are newly discovered lenses, their full limits and economic potential are not fully understood at the moment. The presence of potentially economic mineralization therefore is, very likely, not restricted to only the previously defined mineralized horizons and orezones. The possibility of additional mineralized zones being located elsewhere in the mine stratigraphy must be considered and evaluated as exploration targets.

Gold mineralization in the Turmalina deposits occurs in fine grains associated with sulphides in sheared/foliated schists and BIF sequences. Gold particles average 10 µm to 20 µm and are mostly associated with arsenopyrite, quartz, and micas (sericite and biotite) as presented in Table 7-1.

TABLE 7-1 GOLD MODE OF OCCURRENCE
Jaguar Mining Inc. –Turmalina Mine Complex

Associated with:	% of Gold Content	Notes
Arsenopyrite	61	Occurring both inside and at the borders of the mineral
Quartz	26	Occurring both inside and at the borders of the mineral
Micas	9	Occurring both inside and at the borders of the mineral
Pyrite + Pyrrhotite	4	Occurring only at the borders of the mineral

Coarse-grained gold, on a millimetre scale, is found locally with discrete quartz veins, but this type of occurrence is minor.

The style of the gold mineralization is similar at the Faina and Pontal deposits, with the exception that metallurgical testing has discovered that the mineralization at those two deposits is refractory with respect to the current plant configuration.

8 DEPOSIT TYPES

The gold metallogeny in the Iron Quadrangle is complex.

Gold mineralization has been found mainly within three general types of deposits:

1. Syngenetic deposits. These are hosted by BIFs and chemical sedimentary rock sequences (meta-cherts). Gold is typically associated with fresh to limonite-rich sulphide masses, ranging from disseminated to massive, in association with the BIF layers, or in hydrothermally altered schists rich in quartz, chlorite and sericite. Disseminated sulphides hosted in quartz schists, BIFs, and meta-cherts have also been economically exploited.

2. Epigenetic deposits. These are dominated by hydrothermal quartz veins swarms (silicification zones). Gold is related to masses of grayish and microcrystalline quartz containing fresh to weathered sulphides and, in a few places, to the presence of visible free gold. The quartz veins swarms are hosted by hydrothermally altered schists rich in quartz, chlorite, carbonate and sericite.

3. Paleo-placer deposits. Conglomerates contain clasts of quartzite, milky quartz, massive and banded chert, felsic volcanic rocks, and quartz schists. The matrix can be quartzitic, arkosic, or carbonaceous. Locally, rounded (buckshot) pyrite and crystalline pyrite are abundant in the matrix.

Most gold-bearing units in the Iron Quadrangle, with the exception of the gold-bearing conglomerates, are strongly controlled spatially and geometrically by linear structures such as fold axes, stretching lineations, and intersection lineations. The orebodies form bladed or cigar shapes and geometries, showing great continuity along the plunge direction and relatively small dimensions laterally (along the strike of the host units). They can be longer than 5 km along the plunge direction, such as the main orezones of the well-known Morro Velho and Cuiabá Mines. The thickness of the individual orezones of the deposits varies from a few meters to more than 30 metres. Economic gold grades are directly associated with the presence of sulphide phases, mainly pyrite, pyrrhotite and arsenopyrite. The spatial distribution of the mineralized bodies is often controlled by intersection lineations and fold axes. The deposits at the Turmalina Mine Complex are believed to be typical examples of mesothermal, epigenetic deposits that are enclosed by host rocks that have undergone amphibolite-facies metamorphism.

9 EXPLORATION

GEOCHEMISTRY

AngloGold performed a regional geochemistry survey covering an area of 430 km^2 in the Turmalina region in the 1980´s. A total of 875 stream sediment samples and 446 pan concentrate samples were collected. Stream sediment samples were assayed for Au, Cu, Zn, Pb, Cr, Sb, and As. Pan concentrates samples were assayed for Au only.

Soil geochemistry sampling was executed by AngloGold in both the Faina and Pontal areas, with grids varying from 100 m x 20 m to 10 m x 10 m. At Faina, 1,272 soil samples were collected and 16,900 m of lines were opened. At Pontal, 1,698 soil samples were collected and 28,000 m of lines were opened.

Several soil samples returned gold grades superior to 300 ppb. A significant portion of the soil samples collected from these targets were also assayed for As and Sb. There is a strong, positive relation between gold and As/Sb, since gold is associated directly with quartz veins along with arsenopyrite and/or berthierite in the region.

Initial exploration efforts by Jaguar in 2004 focused on the re-interpretation of the AngloGold data (trenches, soil geochemistry, and drilling) to better understand the local geology. These efforts were concentrated on the targets previously identified by AngloGold.

An exploration program was carried out at the Satinoco (Orebody C) target by Jaguar from March 2006 to April 2008, in order to collect sufficient information to prepare an estimate of the Mineral Resources in accordance with NI 43-101. This program included the opening of about 700 m of trenches, the collection of 146 channel samples crossing the mineralized zone, and a complementary diamond drilling program.

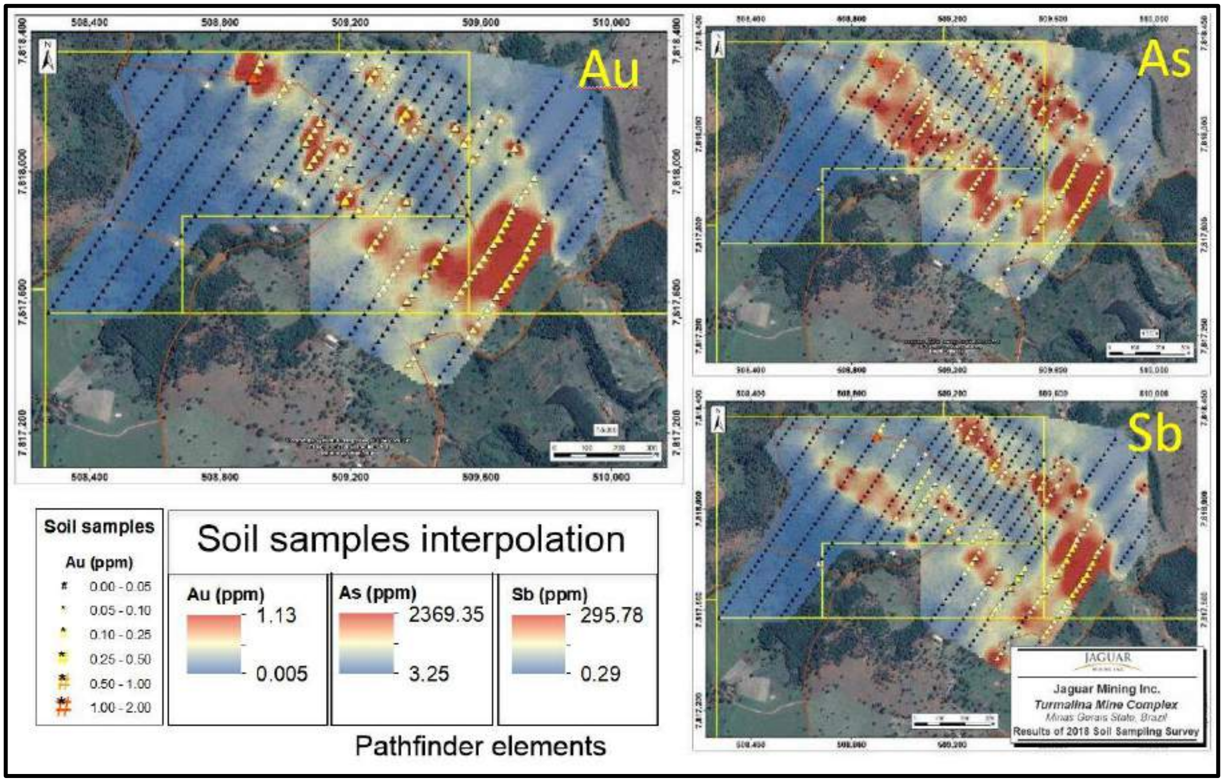
In 2018, Jaguar carried out a program of soil sampling, chip sampling, trenching, and geological mapping on the Zona Basal target, which is located approximately four kilometres to the west of Orebodies A and C.

The soil sampling program involved the collection of 670 soil samples from the B-horizon, which were analyzed for gold and 48 other elements by the ALS Chemex laboratory located in Vespasiano. This soil sampling program was carried out along a series of 12 sampling lines that were spaced approximately 50 m apart. The soil sampling program detected the presence of two gold anomalies that are oriented in a northwest-southeast direction, roughly parallel to the regional stratigraphic trends. The gold anomalies also contain elevated values of arsenic and antimony (Figure 9-1). Detailed mapping undertaken in the area of the soil anomalies also found several small, gossanous outcrops where grab samples yielded grades between 1.38 g/t Au and 26.5 g/t Au (Table 9-1).

TABLE 9-1 SUMMARY OF CHIP AND GRAB SAMPLES POSITIVE RESULTS, ZONA BASAL TARGET
Jaguar Mining Inc. – Turmalina Mine Complex

Sample ID	Soil Sample ID	Lithology	Au (ppm)	Ag (ppm)	As (ppm)	Sb (ppm)
LZB0184	SZB1745	FF	26.50	1.58	933	16.3
LZB0185	SZB1744	VQZ	2.72	0.08	87	6.49
LZB0197		FF	2.61	0.5	2830	48.1
LZB0198		FF	1.38	0.39	2290	63.3
LZB0209	SZB1846	FF	0.72	0.14	2420	29.1
LZB0058	SZB1889	VQZ	0.56	0.14	354	16.55
LZB0195	SZB1804	FF	0.47	0.13	1170	34
LZB0203		FF	0.28	0.08	1395	40
LZB0215	SZB1837	MCH	0.26	0.25	201	13.4
LZB0047	SZB1757	VQZ	0.25	0.09	871	235

FIGURE 9-1 RESULTS OF THE 2018 SOIL SAMPLING SURVEY



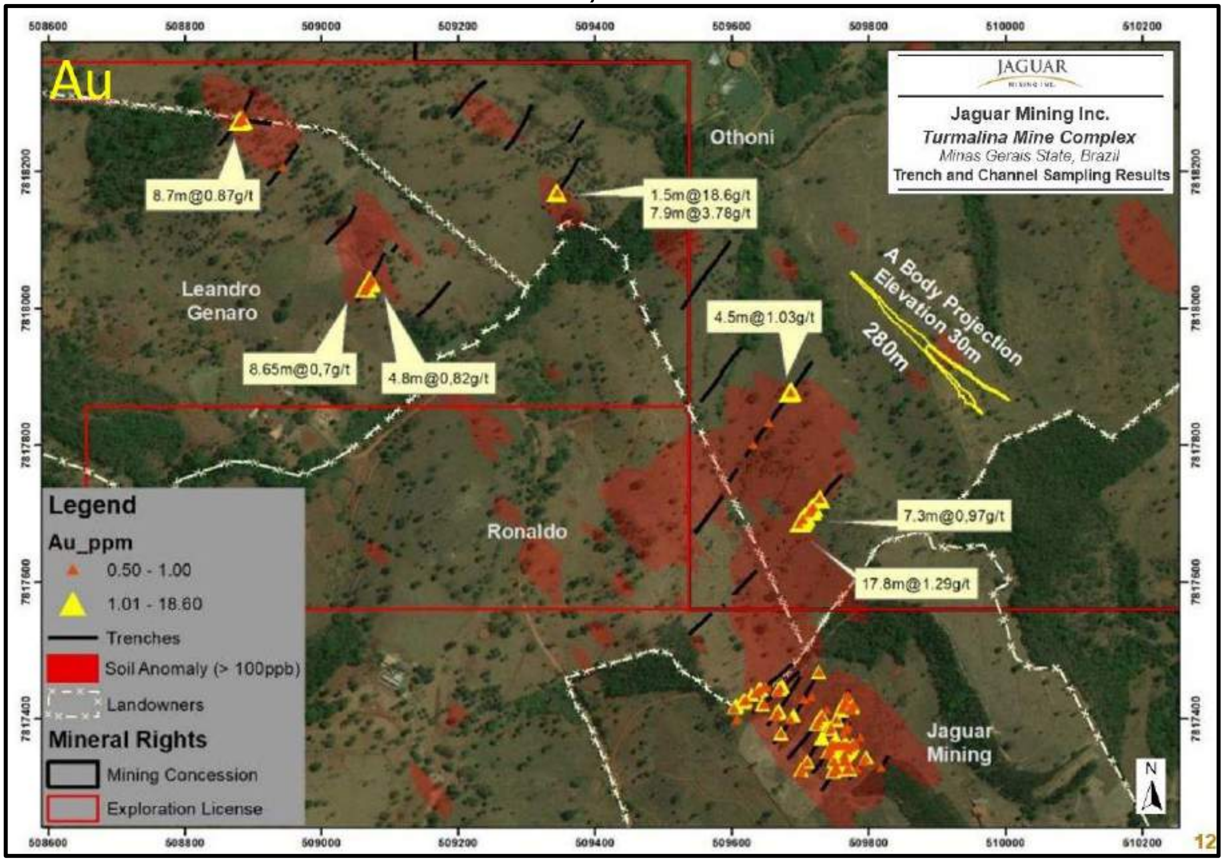
A total of 14 trenches were excavated, totaling 1,434 m in length. These trenches were geologically mapped and samples were taken of any material that was believed to contain gold mineralization. A total of 1,055 channel samples were taken, and the results are presented in Table 9-2. The location of the trenches is shown in Figure 9-2.

TABLE 9-2 SUMMARY OF THE CHANNEL SAMPLING POSITIVE RESULTS, ZONA BASAL TRENCHES

Jaguar Mining Inc. – Turmalina Mine Complex

Trench	Composite
TZB034	8.65m@0.70g/t
TZB034	4.80m@0.82g/t
TZB037	8.70m@0.87g/t
TZB041	17.80m@1.29g/t
TZB041	7.30m@0.97g/t
TZB042	4.50m@1.03g/t
TZB047	1.50m@18.60g/t
TZB047	7.90m@3.78g/t

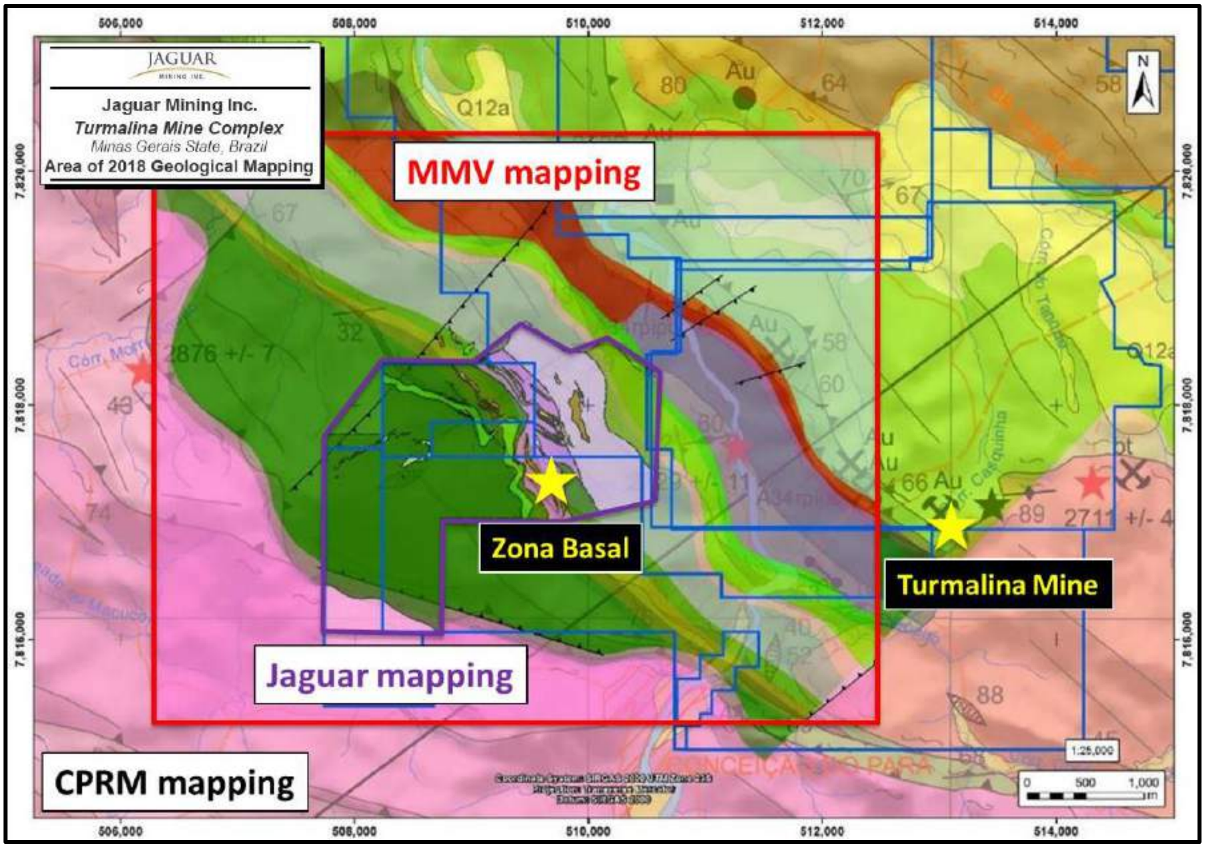
FIGURE 9-2 LOCATION OF THE 2018 TRENCHES AND THEIR CHANNEL SAMPLING RESULTS, ZONA BASAL TARGET



Geological mapping was carried out by Jaguar's exploration team over an area of approximately 78 ha - at a scale of 1:2,500 - at the vicinities of the Zona Basal target (Figure 9-3). This mapping program discovered numerous occurrences of outcrops, mostly located along the various drainages and streams in the area.

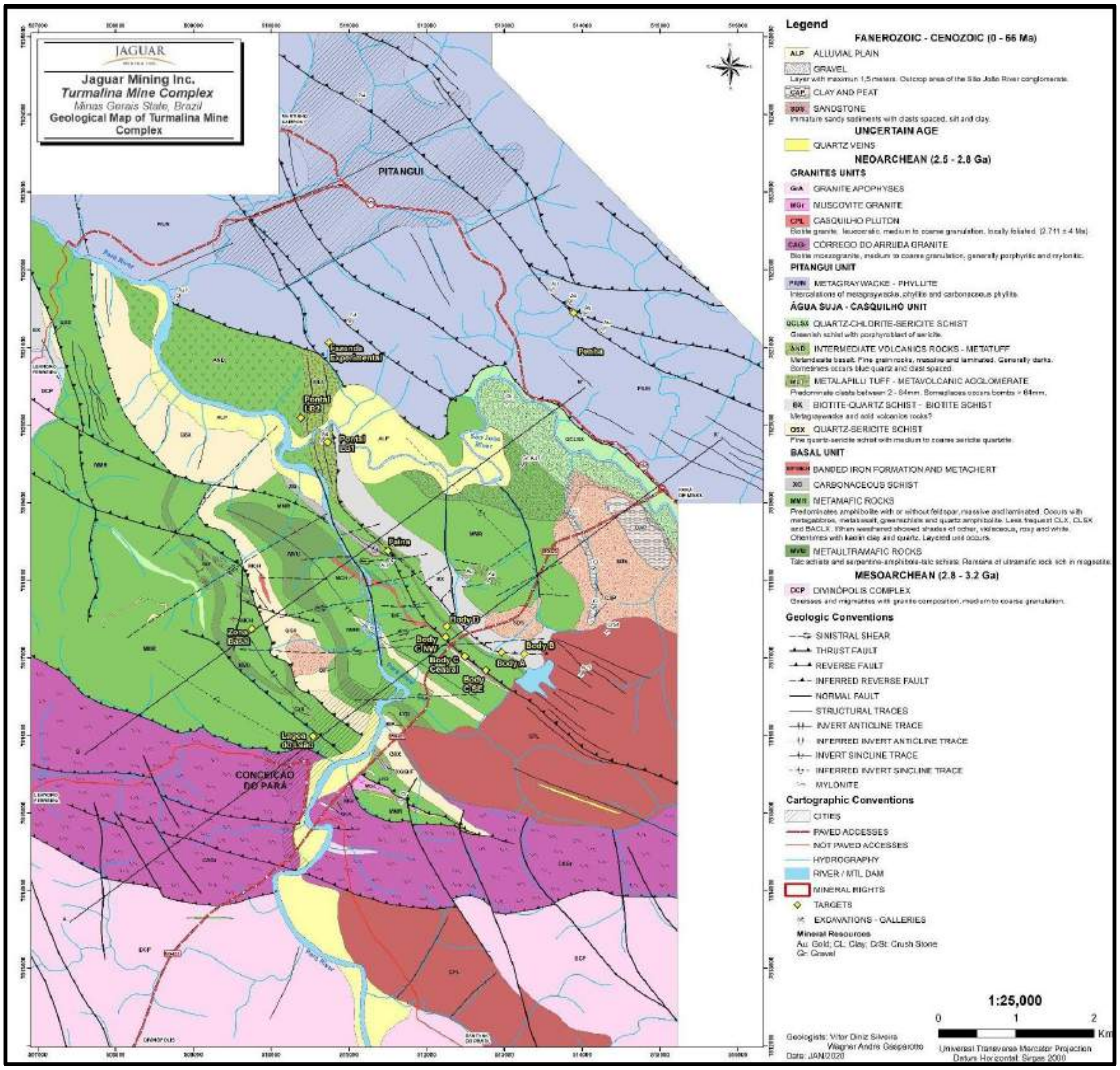
It is clear that the exploration program carried out over the Zona Basal target has discovered gold mineralization over an area of approximately 1,000 m to 1,250 m along strike and approximately 500 m-wide across the strike. It is noteworthy mentioning that this target area was not previously considered as having high potential for hosting mineralization.

FIGURE 9-3 COVERED AREA: 2018 GEOLOGICAL MAPPING TASK, ZONA BASAL TARGET



In 2019, Jaguar Mining Inc. initiated a broader geological mapping program that covered all of the individual mineral rights of Turmalina Mine Complex, an area of approximately 10,000 ha, at a scale of 1:25,000. The resulting new geological map (Figure 9-4) brought to the company a revised geological setting for both the regional structures/stratigraphy and the local gold mineralization event.

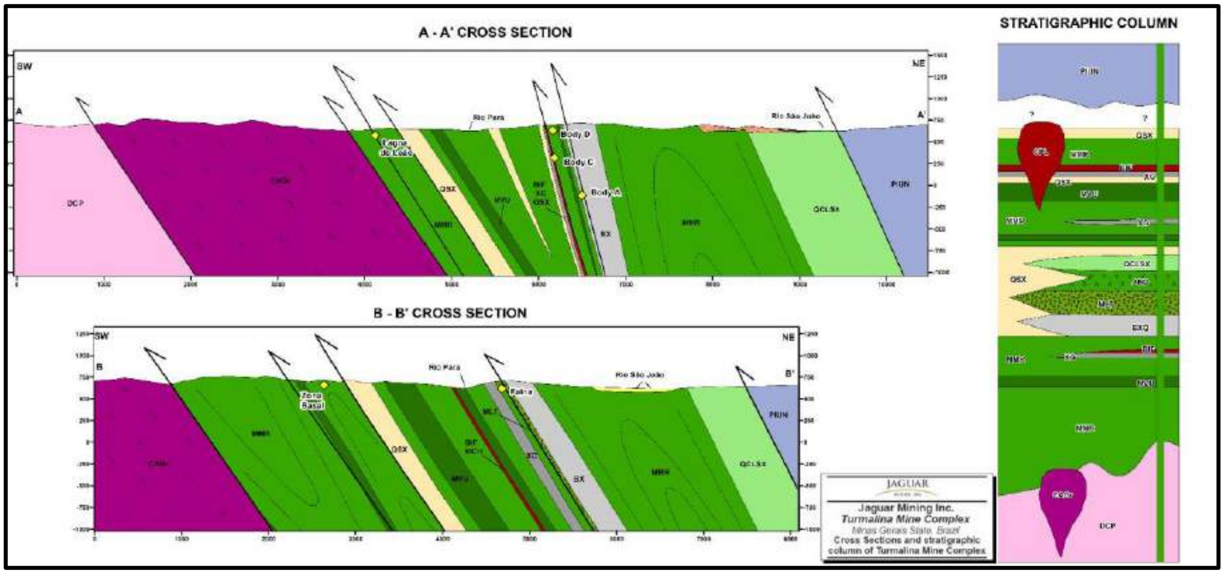
FIGURE 9-4 GEOLOGICAL MAP OF THE TURMALINA MINE COMPLEX



The individual gold deposits in the Turmalina Mine Complex occur along NW-SE oriented regional lineaments, and are associated with epigenetic hydrothermal processes connected to sulfide enrichments and disseminations. The main orezones of the Turmalina operation (Orebody A, Orebody B, Orebody C, Orebody D, Faina and Pontal) are hosted by the most fertile of these recently mapped regional lineaments.

This main lineament is currently being interpreted as a system of reverse faults with transpressive movement which has been spatially focused in the inverted limb of a regional reclined synform; a reverse fault system that crosscuts different types of stratigraphic intervals of the Pitangui greenstone belt right at the broad locality of the Turmalina Mine Complex (Figure 9-5). The geographic termination of this fertile fault system to the SE direction has been mapped where the Casquilho Granitic Pluton (2.71 Ga) outcrops. Here the geometries and shapes of the mineralized bodies resemble the more typical “horsetail-type” faulted edges that commonly occur in association with reverse-fault systems.

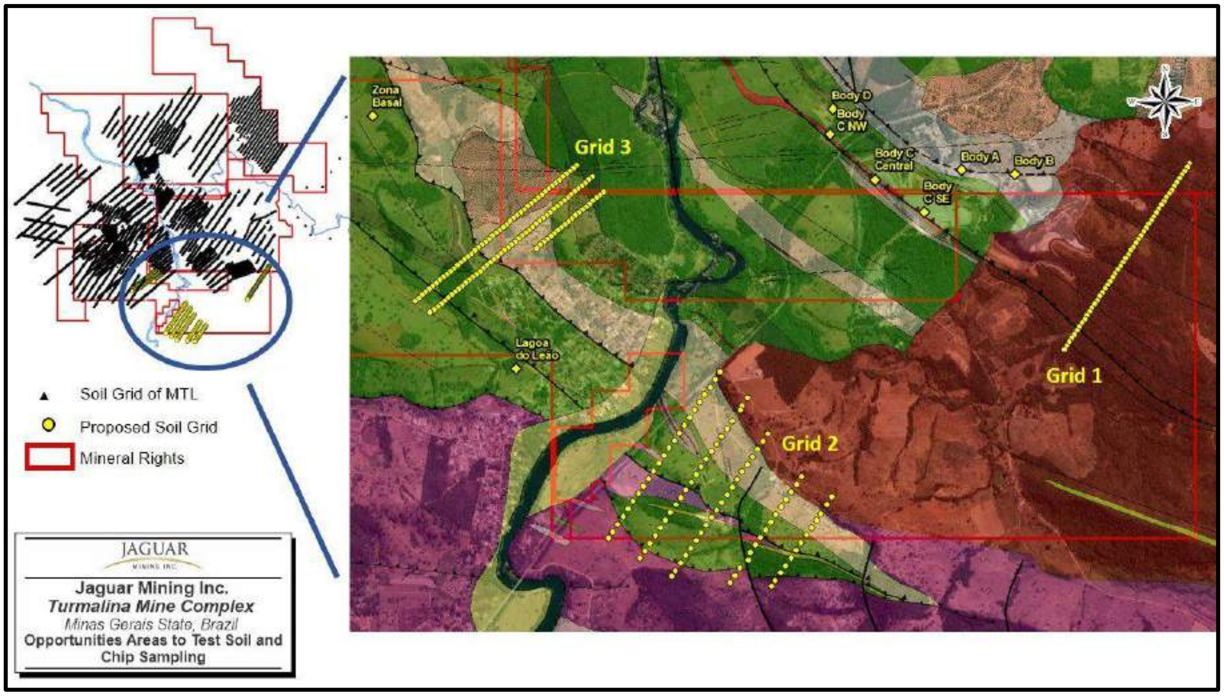
FIGURE 9-5 CROSS-SECTIONS AND SCHEMATIC STRATIGRAPHIC COLUMN OF THE TURMALINA MINE COMPLEX



The second most prominent NW-SE lineament occurs further to the south of the Tourmalina Mine Complex, more precisely at an area that hosts not only an old surficial gold deposit called “Lagoa do Leão”, but also the Zona Basal target.

During and after the completion of the recent regional mapping program, several new target areas have been tested with soil and chip sampling (Figure 9-6). These geochemical investigations involved the collection of 78 grab samples and 284 soil samples (B-horizon), all of them analyzed for gold and 48 other elements at the ALS Chemex laboratories located in Vespasiano, Minas Gerais.

FIGURE 9-6 OPPORTUNITIES: NEW AREAS TESTED WITH SOIL GEOCHEMISTRY AND CHIP SAMPLING



The “Grid 1” target was aimed at testing potential mineralization occurring in association with structures hosted by the Casquilho granitic pluton (a single soil traverse and a total of 50 soil samples collected - at a 25 m sample spacing along the soil traverse). An old excavation for gold was identified inside this target; however, no gold in soil anomalism was found.

The “Grid 2” target covered a small part of the Pitangui greenstone belt area that previously lacked exploratory geochemistry information of any sort (5 soil traverses and a total of 93 soil samples collected - at a 200 m traverse spacing). No gold anomalism was found within the limits of this soil grid.

The “Grid 3” target was also aimed at covering a very small part of the Pitangui greenstone belt area that previously lacked exploratory geochemistry information, despite the encouraging local presence of a potential mineralization trend related to the Lagoa do Leão old open pit. The somewhat positive exploratory results obtained in/for this target can be examined in Figure 9-7.

In addition to the usual brownfields exploration activities being undertaken inside and around the Turmalina Mine Complex, Jaguar Mining is also currently investing in academic geological research activities (and academic dissertations) targeting its mineral deposits, focused on lithostratigraphy, petrography, mineral chemistry, mode of occurrence of the gold particles in the mined ores, gold metallogeny and absolute radiometric dating (via a partnership with the Department of Geological Sciences - Federal University of Rio de Janeiro - UFRJ). The organizational chart of the research team, the general scope of the individual academic dissertations and studies being supported by Jaguar Mining, and general quantitative statistics of the samples being collected and studied by UFRJ´s researchers can be examined in Figure 9.8.

These ongoing academic research activities, combined with the more recent mapping and brownfields exploration activities being undertaken (and with several geophysical surveys to be carried out in the near future), enhances the chances for new discoveries and for important additions of mineral resources to the present mineral resources inventory of the Turmalina Mine Complex.

FIGURE 9-7 2019 RESULTS: ROCK CHIP AND SOIL ANOMALIES DELINEATED

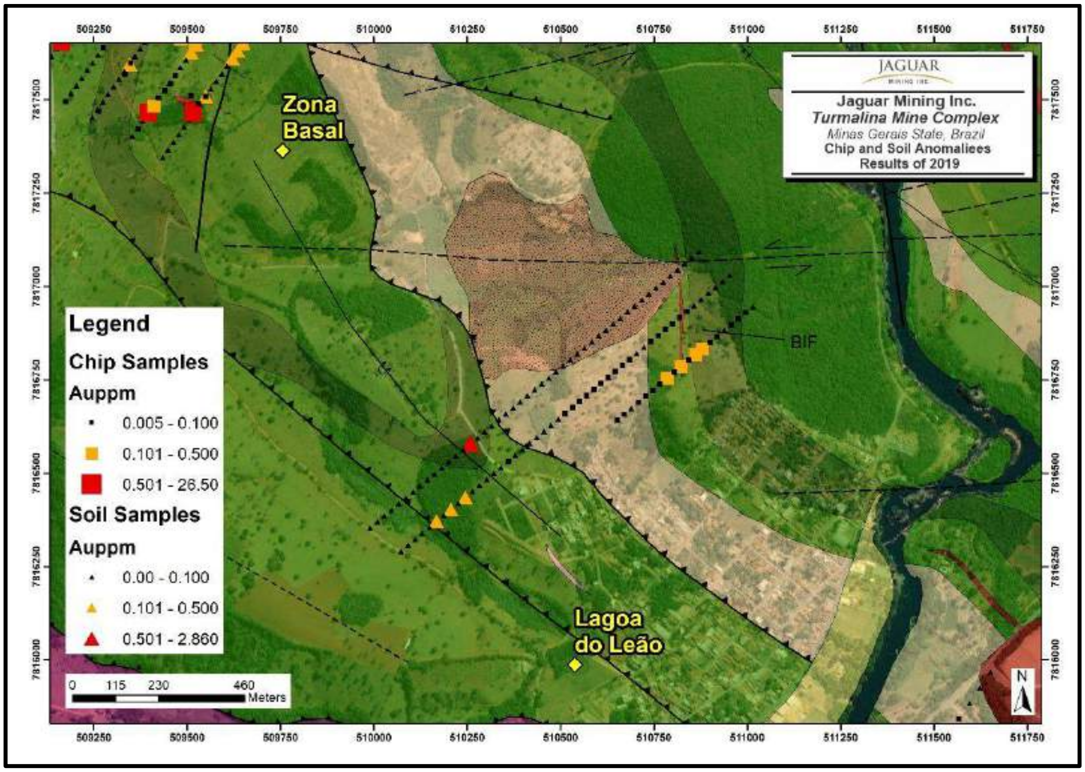
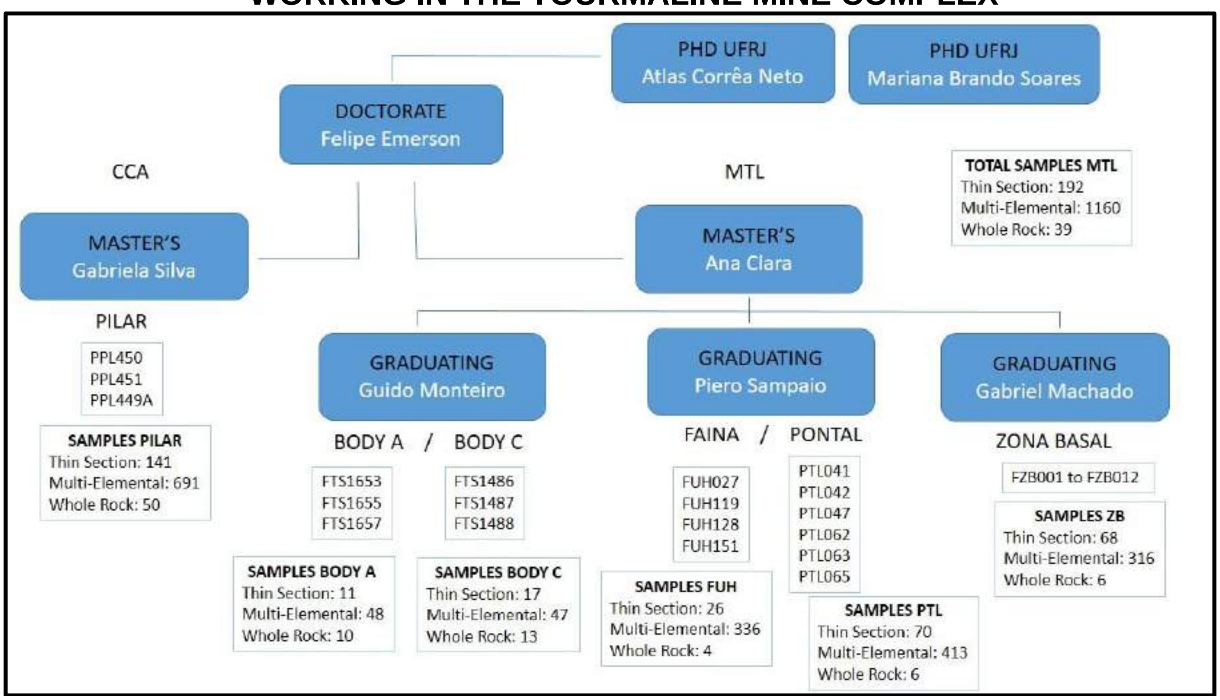


FIGURE 9.8 ORGANIZATIONAL CHART: UFRJ´S ACADEMIC RESEARCHERS WORKING IN THE TOURMALINE MINE COMPLEX



GEOPHYSICAL SURVEYS

In the 1980s, AngloGold contracted the *Instituto de Pesquisas Tecnológicas* (IPT) to execute a ground geophysics survey at the Faina and Pontal deposit areas. At the Faina deposit, a 50 m x 100 m grid was created - composed of 11 lines covering about 31.5 ha. At the Pontal deposit, the grid was 40 m x 100 m in size, with 24 lines covering about 130 ha. Part of this area (approximately 56 ha) was surveyed by ground magnetics in a 5 m x 25 m grid.

Several geophysical anomalies were defined by both methods, and most of them showed a strong relation with the geochemical anomalies. This information was used for the planning of trench locations.

In 2004, the Minas Gerais Government Mining Agency (COMIG) completed a supplementary airborne geophysical survey, covering all the Iron Quadrangle and the adjacent areas, totaling approximately 36,400 km^2. This survey was performed by LASA SA on a 250 m grid using magnetic and gamma ray methods. All Jaguar targets, including the Turmalina deposit, were covered with these geophysical surveys.

10 DRILLING

Following the trenching and channel sampling programs carried out between March 2006 and April 2008, Jaguar completed a three-phase drilling campaign in the Turmalina Mine area:

Phase 1: 5,501 m drilled in 35 holes. This program tested the continuity of the mineralized bodies between the weathered zone and up to 200 m below the surface.

Phase 2: 3,338 m drilled in 24 complementary in-fill holes to create a 25 m x 60 m grid between the surface and 100 m below, and to test the lateral continuity of the mineralized bodies.

Phase 3: An additional drill hole campaign was carried out in 2007, which consisted of 12,763 m drilled in 48 holes. Results from holes FSN 10 to 68 from this campaign were included in the mineral resource estimate contained in the original TechnoMine technical report, dated October 22, 2007. Results from the remaining drill holes FSN 69 to 113 were included in the second TechnoMine technical report dated February 5, 2008.

During the three Satinoco/Orebody C drilling phases, 2,338 core samples from holes FSN 10 to 113 were collected. The drill program was carried out by Mata Nativa Comércio e Serviços Ltda. (Mata Nativa), a local drilling company, using Longyear drill machines.

Drill hole lengths ranged from 32 m to 453 m. Core diameters were consistently HQ (63.5 mm) from surface through the weathered rock to bedrock. At approximately three metres into the bedrock, the holes were reduced to NQ (47.6 mm) diameter to the final depth.

Collar locations for the holes were established by theodolite surveys. All holes were drilled within three metres of the planned location. Azimuth and inclination for angle holes were set by Brunton compass, deemed accurate to within 2° azimuth and <1° inclination.

Following completion of the holes, the collars were resurveyed with theodolite and cement markers emplaced. Downhole surveys were completed in all holes with length greater than 100 m, using Sperry-Sun or Maxibor equipment.

The average core recovery was greater than 90%. Core samples were collected during these phases and sent to laboratories for gold assays (discussed in the next section).

Jaguar has continued to carry out drilling and channel sampling programs on the orebodies. The drilling has been carried out from surface locations which provide general information as to the location of the mineralized zones. Further detailed drill hole information is gathered for the three orebodies from underground locations. Final detailed information of the location and distribution of the gold mineralization is collected by means of channel sampling of underground exposures.

Jaguar completed a program of delineation diamond drilling in 2019 from underground stations where 127 holes with a total combined meterage of approximately 17,746 m were completed. The drill holes mostly tested the down-plunge continuation of Orebodies A and C. Significant intersections from the delineation drilling programs have been disclosed in news releases issued by Jaguar on February 27, 2019 and on May 14, 2019. A selection of the significant intersections encountered during the 2019 drilling campaign - using the uncapped gold assay values - is provided in Table 10-1 (Jaguar 2019).

TABLE 10-1 SAMPLE SIGNIFICANT INTERSECTIONS FROM THE 2019 DRILLING PROGRAM
Jaguar Mining Inc. –Turmalina Mine Complex

Hole ID	From (m)	To (m)	Down Hole Interval (m)	Estimated True Width (m)	Gold Grade (g/t Au)
FTS1628A	57	59	2	1.73	9.23
	73	75	2	1.63	5.13
	78	89.85	11.85	9.7	2.07
	94.6	96	1.4	1.23	4.73
FTS1629	66	76	10	7	3.78
	82	88	6	4.24	8.41

FTS1651	22.1	45.09	22.99	18.83	2.35
FTS1652	29.34	58.97	29.63	22.69	5.76
FTS1660	26.3	40.67	14.37	9.98	4.63
FTS1661	20.7	33.67	12.97	9.17	1.61
	44.7	47.99	3.29	2.52	3.39
FTS1674	62.5	65	2.5	1.05	10.95
	88.45	92.5	4.05	2.02	3.6
FTS1675	112	113	1	0.76	10.01
FTS1676	88	98	10	9.06	1.63
	104.6	110.5	5.9	5.34	3.34
FTS1677	82.67	88.14	5.47	4.91	2.81
	95.7	98.59	2.89	2.45	6.31
FTS1682	48.28	52.08	3.8	2.95	1.23
FTS1683	56.88	72	15.12	11.91	2.49
	78.94	79.63	0.69	0.54	20.35
FTS1684	46.85	60.41	13.56	10.97	3.75
	65.83	68.61	2.78	2.19	8.42
FTS1685	49.32	64.34	15.02	13.26	2.42
FTS1686	54.1	58.01	3.91	3.51	4.56
FTS1687					
FTS1688	43.32	46.17	2.85	2.77	2.09
FTS1690	66.9	74.85	7.95	7.2	2
	105.7	114.46	8.76	8.23	18.35
FTS1706	78	91	13	12.05	3.94
FTS1707	62.75	65	2.25	2.11	2.22
	89.3	91.6	2.3	2.16	13.13
FTS1709	109.6	111.75	2.15	1.9	8.7
FTS1711	84	94.8	10.8	8.5	5.73
FTS1717	100.18	102.2	2.02	1.9	6.2
FTS1653	183.8	186.6	2.8	2.14	3.93
FTS1654	171.3	179.6	8.3	6.07	11.29
FTS1655	139.15	142.7	3.55	2.71	5.22
	144.6	147.5	2.9	2.34	8
	153.25	167	13.75	10.37	2.94
FTS1691	60.81	61.67	0.86	0.79	1.66
	81.38	82.36	0.98	0.83	1.51
	99.65	100.6	0.95	0.86	1.09
FTS1692	137	139.29	2.29	1.75	9.94
FTS1693	123.44	124.31	0.87	0.71	4.13
FTS1694	112.45	113.45	1	0.89	4.02
FTS1710	85.6	91	5.4	4.97	2.39

	94	103	9	8.28	3.49
FTS1715	84.55	87.65	3.1	2.5	2.79
FTS1622	168.8	171	2.2	1.73	3.02
FTS1623	175.2	178.1	2.9	2.37	1.55
FTS1624	159	169.6	10.6	8.88	12.21
FTS1625	127.11	128.95	1.84	1.44	2.76
	154.25	164.2	9.95	8.43	6.39
FTS1656	127.1	130	2.9	2.37	5.46
	169.7	173.05	3.35	2.63	16.41
FTS1657	104.5	109.4	4.9	3.75	8.31
	122.2	125.11	2.91	2.16	11.32
	161.44	163	1.56	1.19	2.76
	167.13	168.15	1.02	0.82	11.65
FTS1716	85.73	87.85	2.12	1.68	1.49
	98.07	100.65	2.58	1.91	1.5
	117.91	118.91	1	0.76	5.06
FTS1718	63.1	65.26	2.16	2	8.76
	88.9	91.7	2.8	2.49	1.37
FTS1695	76.02	78.75	2.73	2.36	2.11
	95.5	98.5	3	2.59	2.1
	107.84	121.37	13.53	11.08	6.85
FTS1698	69.54	75	5.46	4.47	2.27
	104.75	113.91	9.16	7.01	8.18
FTS1720	44.46	45.44	0.98	0.9	3.36
FTS1726					
FTS1648	91.5	95.35	3.85	3.22	7.82
	149.5	153.5	4	3.19	8.74
FTS1696	80.37	84.02	3.65	2.62	2.39
	105.6	107.8	2.2	1.94	3.76
	135.87	137.89	2.02	1.52	4.19
FTS1697	98	103.01	5.01	3.6	2.96
	167.84	170.3	2.46	1.96	3.37
FTS1699	115.15	126.39	11.24	10.99	3.4
FTS1700	83.59	86.37	2.78	2.12	2.45
	122.72	133.26	10.54	7.45	9.83
FTS1701	69.77	75.38	5.61	5.12	1.95
	106.35	113.07	6.72	5.57	18.71
FTS1725	81.77	84.77	3	2.75	8.14
	126.93	128.88	1.95	1.8	2.84
FTS1702					
FTS1730	90.73	96.45	5.72	5.65	2.18

FTS1689	52.71	53.74	1.03	0.85	2.48
FTS1722					
FTS1703	69.02	79.25	10.23	8.85	2.18
FTS1723	66.19	68.02	1.83	1.75	3.95
FTS1626	100.81	102.7	1.89	1.6	3.67
	112.78	115.33	2.55	1.77	3.2
	147.72	153.17	5.45	3.98	2.01
FTS1704	148.43	151.47	3.04	2.25	7.62
	148.43	152.42	3.99	2.96	5.92
FTS1705	60.06	61.03	0.97	0.82	3.04
FTS1731	94.85	106.08	11.23	9.52	3.35
	152.25	154.94	2.69	2.55	5.41
FTS1729	83.03	89.99	6.96	5.7	4.39
FTS1736					
FTS1745	109.89	111.99	2.1	2.02	2.1
FTS1724	60.03	61.88	1.85	1.53	1.36
	69.37	73.35	3.98	3.29	1.92
FTS1727	90.04	94.97	4.93	3.77	1.54
	103.68	118.48	14.8	12.12	2.45
	131.73	146.11	14.38	11.77	5.56
FTS1728	142.68	151.58	8.9	8.36	15.22
FTS1733	52.86	53.95	1.09	0.83	3.05
	59.55	63.06	3.51	2.68	1.99
FTS1734	156.98	157.79	0.81	0.75	2
FTS1740	125.5	136.15	10.65	7.66	8.02
FTS1737	104.5	109.75	5.25	2.95	3.13
FTS1735	130.8	132.01	1.21	1.1	4.83
	144.05	145.97	1.92	1.85	6.96
FTS1746	62.34	63.29	0.95	0.93	1.32
	101.19	103.32	2.13	2.09	1.59
FTS1754	150.72	156.51	5.79	4.56	5.5
FTS1747	91.24	92.31	1.07	0.85	3.3
	107.52	109.56	2.04	1.41	2
	120.77	124.04	3.27	2.57	2.06
	144.51	150.44	5.93	4.67	5.43
FTS1748	117.03	124.59	7.56	6.26	1.6
	132.12	134.4	2.28	1.82	1.9
	146.79	157.82	11.03	9.03	8.62
FTS1738	145.37	146.37	1	0.8	5.5
	169.62	173.41	3.79	2.72	4.19
FTS1749	162.17	165.12	2.95	2.55	2.79

FTS1755	68.69	70.77	2.08	1.59	1.32
	92.86	96.03	3.17	2.65	16.65
	105.15	106.94	1.79	1.5	8.55
	150.32	152.25	1.93	1.41	5.36
FTS1743	79.52	80.47	0.95	0.72	3.3
	114	114.98	0.98	0.78	1.12
	147.64	155.03	7.39	0.71	1.82
	156.73	157.69	0.96	0.84	1.28
	172.79	173.97	1.18	0.66	11.26
	179.49	188.04	8.55	0.66	3.3
FTS1741	40.53	42.56	2.03	0.71	1.48
	75.25	81.5	6.25	0.78	3.16
	113.73	114.59	0.86	0.74	1.35
	126.51	128.33	1.82	0.77	8.45
FTS1750	71.58	72.32	0.74	0.74	1.79
	89.48	95.13	5.65	0.5	3.75
	109.61	110.53	0.92	0.61	1.14
	131.19	133.49	2.3	0.62	1.56
	135.41	137.47	2.06	0.62	5.61
FTS1760	60.89	63.56	2.67	0.17	2.18
	69.23	70.28	1.05	0.17	1.16
FTS1761	53.49	54.33	0.84	0.17	4.75
	55.3	56.49	1.19	0.17	3.09
	61.51	62.5	0.99	0.17	1.19
	86.41	87.36	0.95	0.3	4.66
FTS1756	48.23	49.12	0.89	0.77	1.25
	106.55	107.65	1.1	0.9	1
FTS1639	113.43	114.56	1.13	1.11	1.02
	138.43	146.72	8.29	8	2.95
FTS1762	50.48	55.06	4.58	4.49	2.06
FTS1763	50.64	54.48	3.84	3.58	7.04
FTS1772					
FTS1765	61.35	62.48	1.13	1	1.06
	67.42	68.49	1.07	0.95	1.61
	84.29	85.27	0.98	0.9	2.12
FTS1766	53.88	57.01	3.13	2.9	6.16
FTS1773					
FTS1764	55.62	58.45	2.83	2.5	29.03
FTS1757	119.22	120.15	0.93	0.85	1.64
	121.98	122.73	0.75	0.7	1.7
FTS1758	90.44	92.44	2	1.9	2.89

FTS1771	93.18	96.1	2.92	2.7	2.83
FTS1770	97.27	99.19	1.92	1.85	9.72
FTS1774	89.96	90.83	0.87	0.8	9.73
	136.07	137.64	1.57	1.45	3.24
FTS1775	113.84	116.55	2.71	2.55	3.8
FTS1776	31.19	33.04	1.85	1.75	2.3
FTS1780	60.35	61.4	1.05	0.95	2.11
FTS1781	66.58	69.23	2.65	2.5	7.35
FTS1767	51.46	53.25	1.79	1.6	3.6
FTS1782	1.18	2.36	1.18	1.1	1.21
	79.24	80.44	1.2	1.15	1.98
FTS1777	41	41.84	0.84	0.75	2.37
FTS1778	95.12	97.93	2.81	2.5	3.49
	100.6	101.6	1	0.9	7.27
FTS1798	69.13	71.68	2.55	2.45	9
FTS1783	55.44	57.18	1.74	1.5	1.79
FTS1784	59.16	63.25	4.09	3.95	2.44
FTS1768	56.56	60.65	4.09	3.9	3.99
FTS1769	58.27	59.97	1.7	1.55	3.35
FTS1790	97.02	97.71	0.69	0.6	4.18
FTS1791	99.35	99.94	0.59	0.55	1.24
FTS1779	91.7	92.6	0.9	0.85	3.1
FTS1796	94.69	95.47	0.78	0.7	2.31
FTS1785					
FTS1786	81.95	83.07	1.12	1.05	1.15
FTS1787	60.43	64.29	3.86	3.72	4.71
FTS1788	60.01	65.19	5.18	5.02	2.7
FTS1789	68.65	69.6	0.95	0.85	1.36
FTS1800	85.1	86.65	1.55	1.45	1.95
FTS1801	2.23	3.33	1.1	1.05	2.55
FTS1802	97.96	103.47	5.51	5.41	4.28
FTS1803	65.44	67.58	2.14	2.1	1.15
FTS1804	54.62	59.2	4.58	4.39	5.28
FTS1792					
FTS1793	37.03	37.94	0.91	0.85	2.87
	74.73	75.4	0.67	0.65	2.24
FTS1794	60.67	61.49	0.82	0.75	2.11
FTS1797					
FTS1799	139.21	141.08	1.87	1.73	4.8
FTS1820					

An additional 157 definition drill holes for a total combined meterage of 3,665 m were completed where the holes were targeted to provide detailed information in support of final stope planning and production. A summary of the drilling and channel sample information that was gathered during 2019 is provided in Table 10-2. The locations of the drill holes completed in 2019 are shown in Figure 10-1. Additional detailed information is provided in Section 14 of this report.

TABLE 10-2 SUMMARY OF DRILL HOLE AND CHANNEL SAMPLES COMPLETED IN 2019
Jaguar Mining Inc. –Turmalina Mine Complex

Category	Number	Total Length (m)
Drill Holes – Definition	127	17,746
Drill Holes – Delineation	157	3,665
Collars, Channel Samples	1,014	5,785

The past surface-based diamond drilling programs were carried out by the drilling contractor Mata Nativa using HQ and NQ tools. HQ-sized equipment was used for the portion of the hole that traverses the saprolite horizon, and the hole diameter was then reduced to NQ when the fresh rock was reached. The diamond drill core procedures adopted by Jaguar are described below:

- Only drill holes with more than 90% core recovery from the mineralized zone were accepted.
- Drill hole deviations (surveys) were measured by Sperry-Sun or DDI/Maxibor equipment.
- The cores were stored in wooden boxes of one metre length with three metres of core per box (HQ diameter) or four metres of core per box (NQ diameter). The hole's number, depth, and location were identified in the boxes by an aluminum plate on the front of the box and by a water-resistant ink mark on its side. The progress interval and core recovery are identified inside the boxes by small wooden or aluminum plates.

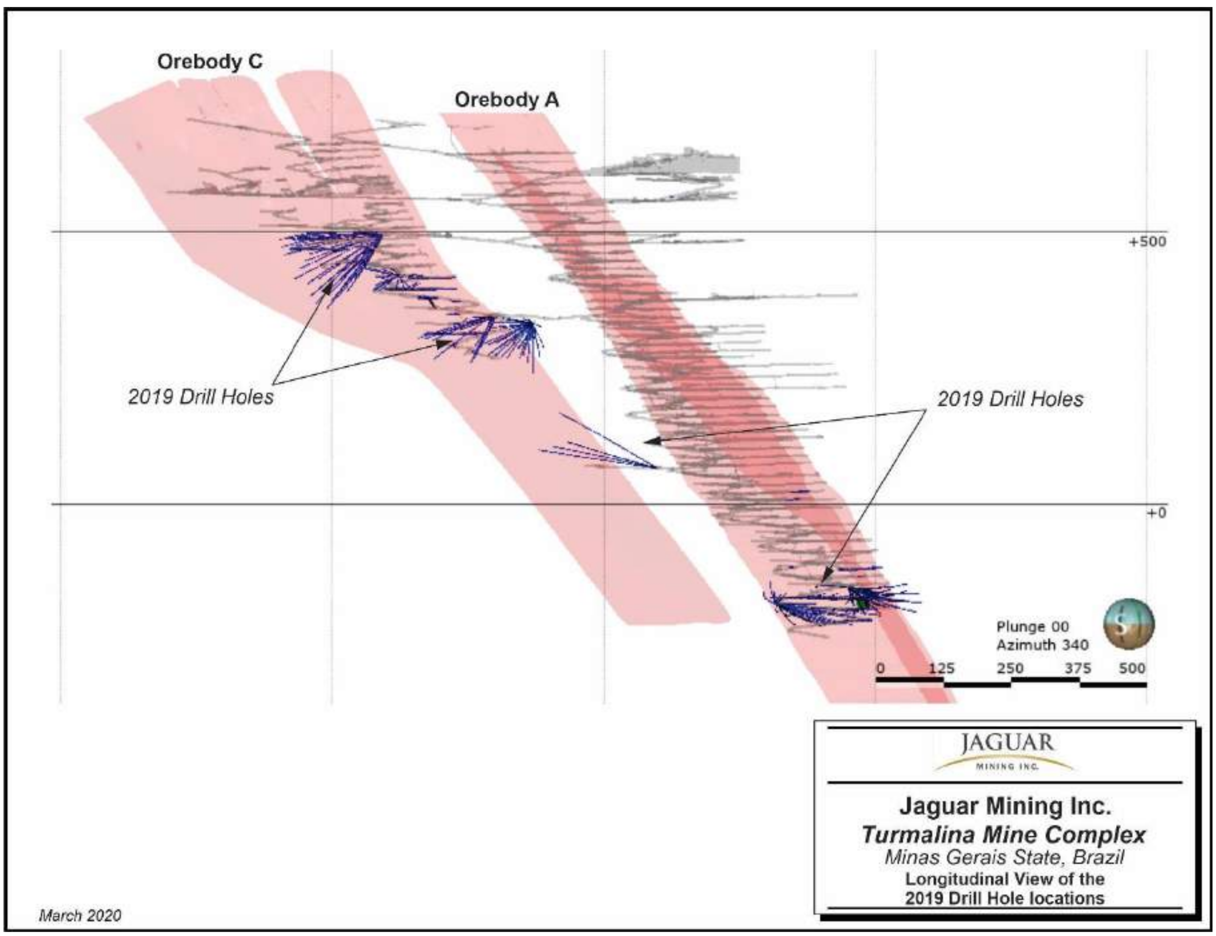
The underground-based drill holes for the 2019 drilling program were completed by Jaguar's personnel and equipment, and also by Major Drilling in Q4. The drilling was carried out using BQ and LTK sized tools and followed Jaguar's established drilling procedures.

The down-plunge limits of the gold grades and the economic zones of the Turmalina deposit have not been defined by the drilling completed to date. In Jaguar's opinion, additional drilling to outline the down-plunge continuation of Orebody A is warranted.

Similarly, the down-plunge limits of the gold grades in portions of Orebody C have not been defined by the drilling completed to date. It is clear that down-plunge continuation of the mineralized shoots within Orebody C warrants continued exploration drilling too.

Jaguar has not identified any drilling, sampling, or core recovery issues that could materially affect the accuracy or reliability of the core samples and drill holes.

FIGURE 10-1 LONGITUDINAL VIEW OF THE 2019 DRILL HOLE LOCATIONS



11 SAMPLE PREPARATION, ANALYSES AND SECURITY

SAMPLING

The sample collection and preparation procedures used by Jaguar are as follows.

SURFACE/EXPLORATION CHANNEL SAMPLING

- Channel samples are regularly collected from outcrops and trenches.
- The sites to be sampled are cleaned with a hoe, exposing the material by scraping it.
- Structures are mapped and the lithologic contacts defined, and samples marked so that no sample has more than one lithology.
- Samples have a maximum length of one metre and are from one kilogram to two kilograms in weight.
- Each sample is collected manually in channels with average widths between five and ten centimetres, and about three centimetres deep, using a hammer and a chisel.
- Either an aluminum tray or a thick plastic canvas drop sheet is used to collect the material.
- The samples are then stored in a thick plastic bag and identified by a numbered label, which is protected by a thin plastic cover and placed with the sample.
- At the sampling site, samples are identified by small aluminum plates, labels, or small wooden poles.
- Sketches are drawn with lithological and structural information. The sample locations are then surveyed and are entered into the master database.

DIAMOND DRILLING CORE SAMPLING

- Surface drilling is performed by contractors with holes in HQ or NQ diameters.
- Underground drilling in 2019 was performed either by Jaguar or contractors (Major Drilling) with NQ, BQ, or LTK core diameters.
- Drill holes are accepted only if they have more than 85% of recovery from the mineralized zone.

- All the drill holes have their deviations measured by Reflex Gyro ™ or equivalent surveying tool.

- The cores are stored in wooden boxes of one metre length, and with three metres of core per box (HQ and NQ diameter) or with four metres of core per box (BQ or LTK diameters).

- The code number, length, and location of each hole are identified in the boxes by an aluminum plate or by a water-resistant ink mark in front of the box.

- The progress intervals and core recoveries are identified inside the boxes by small wooden plates that contain small aluminium plates with all data.

- During logging, all geological information and the recovery measurements are verified and the significant intervals for sampling are defined.

- Individual samples are identified in the boxes by highlighting/labeling their numbers at the edges of the wood boxes.

- Core samples are cut lengthwise into approximately equal halves, with the use of a diamond saw. On occasion, the core samples are split by means of.

- One half of the sample is placed in a highly resistant plastic bag, identified by a label, and the other half is kept in the box at a warehouse.

- The remaining drill core from the surface-based drill holes is stored at an offsite secure location close to the mine.

- For the shorter-length, bazooka-type drill holes completed from underground set-ups (the LM-series drill holes), the whole core is sampled as the core diameter does not permit splitting into halves.

UNDERGROUND PRODUCTION CHANNEL SAMPLING

- The sector of wall to be sampled is cleaned with pressurized water. Structures are mapped and lithologic contacts defined, and samples marked so that no sample has more than one lithology. Samples have a maximum length of one metre and are from two to three kilograms in weight.

- Channel samples were taken by manually opening the channels, using a hammer and a little steel pointer crowned by carbide or a small jackhammer.

- The channel samples have lengths ranging from 50 cm to one metre, average widths between five and ten centimetres, and about three centimetres deep.

- Two sets of channel samples on the face are regularly collected. One set of channel samples are taken from the top of the muck pile once the work area has been secured. The second set of channel samples are taken at waist height once the heading has been mucked clean and secured.

- At approximately 5 m intervals, the walls and back are sampled by channel sampling. The channel samples are collected starting at the floor level on one side and continue over the drift back to the floor on the opposite side.
- Either an aluminum tray or a thick plastic canvas is used to collect the sample material. The samples are then stored in a thick plastic bag and identified by a numbered label, which is protected by a thin plastic cover and placed with the sample.
- At the sampling site, samples are identified by small aluminum plates, labels, or small wooden poles.
- Sketches are drawn with lithological and structural information. The sample locations are then surveyed and are entered into the master database.

SAMPLE PREPARATION AND ANALYSIS

For drill holes and for the channels collected by Jaguar, samples are prepared at Jaguar's mine site laboratories by drying, crushing to 90% minus 2 mm, quartering with a Jones splitter to produce a 250 g sample, and pulverizing to 95% minus 150 mesh. Analysis for gold is by standard fire assay procedures, using a 50 g or 30 g sample with an atomic absorption (AA) finish.

A process control laboratory at the Turmalina Mine analyzes the shifts and plant samples, while all delineation drill core, channel, and exploration drill core samples from the Turmalina operation are forwarded to the in-house laboratory located at the Caeté mine site.

At Jaguar's Caeté laboratory, the samples are dried and then crushed. A one kilogram sub-sample of the crushed material is selected for pulverization to approximately 70% minus 200 mesh. The ring-and-puck pulverisers are cleaned after each sample using compressed air and a polyester bristle brush. The analytical protocol for all samples employs a standard fire assay fusion using a standard 30 g aliquot, with the final gold content being determined by means of AA. The detection limit for fire assay analyses is 0.05 g/t Au. A second cut from the pulps is taken and re-assayed for those drill core samples where the grade is found to be greater than 30 g/t Au. If the two assays are in good agreement, only the first assay is reported. The AA unit is calibrated to directly read gold grades up to 3.3 g/t Au – samples with grades greater than this are re-assayed by diluting the solute until it falls within the direct-read range.

Jaguar has reviewed the field and underground sampling procedures and is of the opinion that they meet accepted industry standards. In Jaguar's opinion, the sample preparation, analysis, and security procedures at the Turmalina Mine Complex are adequate for use in the estimation of Mineral Resources.

QUALITY ASSURANCE AND QUALITY CONTROL

The geological team at the Turmalina Mine Complex carried out a Quality Assurance and Quality Control (QA/QC) program that monitored the analytical results of samples from the 2019 diamond drilling program. This program is separate and distinct from the QA/QC program that is carried out by the Caeté laboratory. In all 296 blank samples and 166 samples of Certified Reference Materials (CRM) were inserted into the sample stream in 2019. The results are presented in graphical form below and are considered to be acceptable.

Some 5% of pulps from the 2019 - 2020 drilling program will be sent to an external laboratory for duplicate analysis.

Commercially sourced CRMs obtained from Rocklabs are inserted by the Turmalina geological team into their sample stream at a frequency of every 45 to 50 samples. A list of the CRMs that were used is provided in Table 11-1.

TABLE 11-1 LIST OF CERTIFIED STANDARD REFERENCE MATERIALS, 2018 QA/QC PROGRAM
Jaguar Mining Inc. –Turmalina Mine Complex

Standard No.	Recommended Value	Standard Deviation	Number Analyzed
HiSilK4	3.463	0.09	65
HiSiLK4	3.463	0.09	30
HiSiLP3	12.24	0.246	14
SF85	0.848	0.018	32
SG84	1.026	0.084	13
Si81	1.79	0.03	20
SJ80	2.656	0.057	12
SK78	4.134	0.138	2
SL76	5.96	0.192	7
SN91	8.679	0.194	9
SP73	18.17	0.42	27

Blank samples are inserted at a rate of one in every 20 samples, representing an insertion frequency of 5%. Blank samples are composed of crushed, barren quartzite or gneiss and are used to check for contamination and carry-over during the crushing and pulverization stage.

The results of the blanks, duplicates, and standards are forwarded to Jaguar's head office on a monthly basis for insertion into the Jaguar's internal database (referred to as the BDI database). There, the results from the standards samples are scanned visually for out-of-range values on a regular basis. When failures are detected, a request for re-analysis is sent to the laboratory – therefore, only those assays that have passed the validation tests are inserted into the main database.

Sample control charts are presented in Figures 11-1 to 11-3.

The Caeté laboratory carries out an internal program of QA/QC for all drill core samples and channel samples. Blank analysis was undertaken after every 20 samples, representing an insertion frequency of 5%. In total, the Caeté laboratory analyzed 296 blank samples for Turmalina mine for the January to December 2019 period. QAQC results from these samples are presented in figure 11-1. Certified Reference Material in two grade ranges were inserted in each sample batch, QAQC results for these samples are presented in Figures 11-2 and 11-3 below.

FIGURE 11-1 CONTROL CHART FOR BLANK SAMPLES, CAETE LABORATORY, JANUARY TO DECEMBER 2019

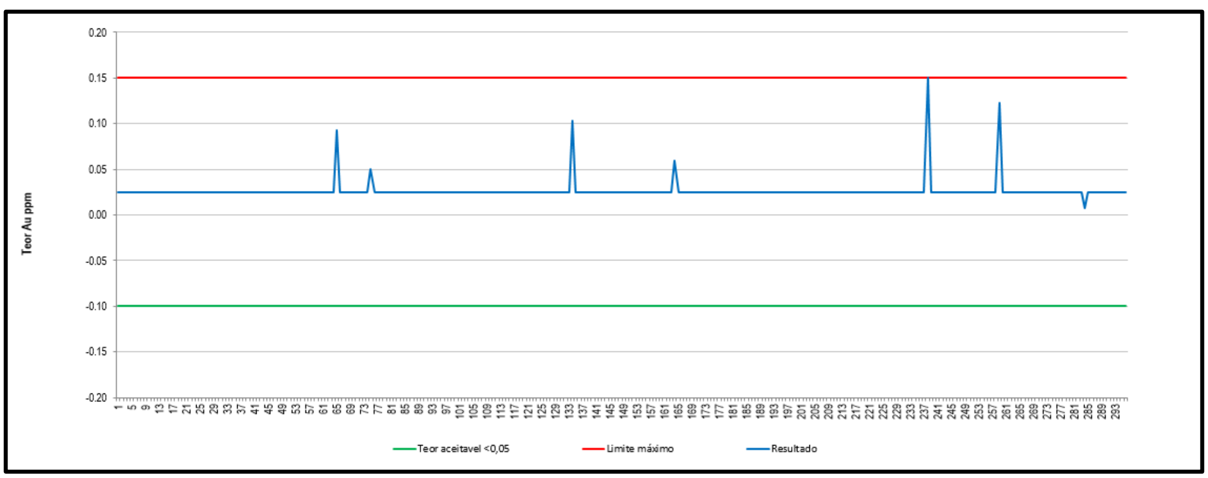


FIGURE 11-2 CONTROL CHART FOR CERTIFIED REFERENCE MATERIAL HISILK4, JANUARY TO DECEMBER 2019

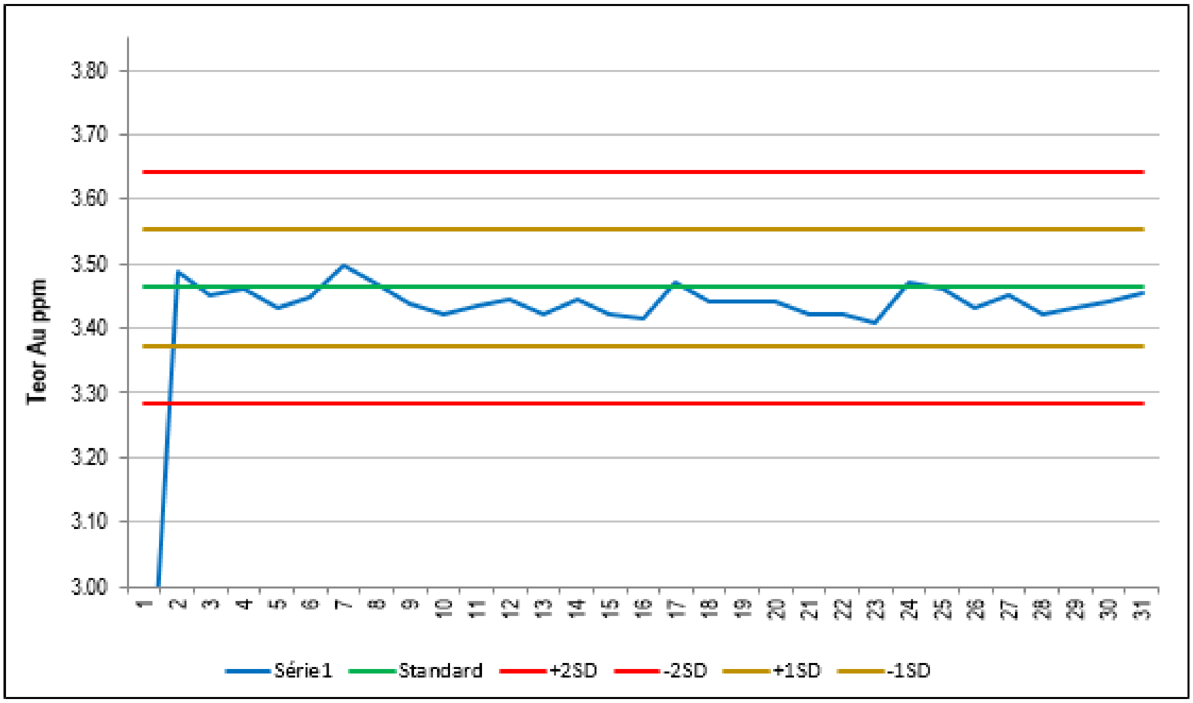
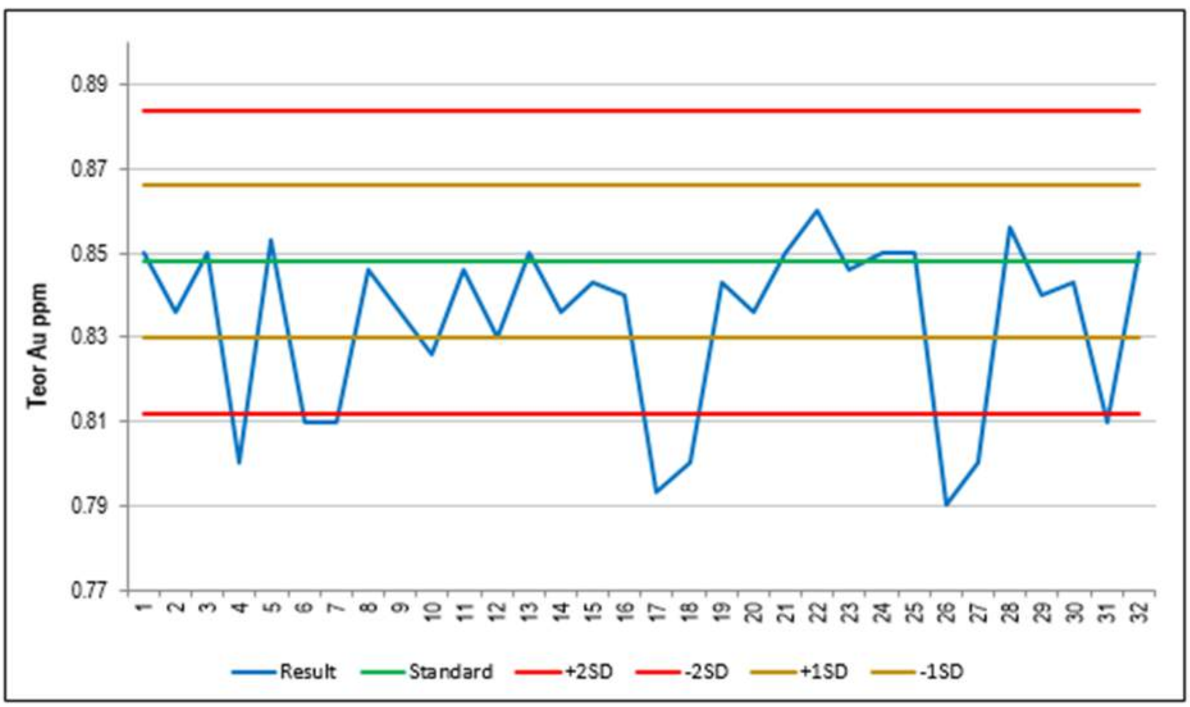


FIGURE 11-3 CONTROL CHART FOR CERTIFIED REFERENCE MATERIAL RL SF85, JANUARY TO DECEMBER 2019



In Jaguar’s opinion, the QA/QC program as designed and implemented by company is adequate and the assay results within the database are suitable for use in a Mineral Resource estimate.

12 DATA VERIFICATION

Validation checks on the Turmalina operation drilling and sampling database in support of the 2019 Mineral Resource estimate included:

- Regular site visits during the reporting period (2019).
- In-House validation of the drill hole database.
- Checked the collar locations relative to either the digital topographic surface or the location of the underground excavation digital model as appropriate.
- Reviewed drill hole and sample orientations (azimuth/dip) relative to the location of the mineralized zones.
- Completed validity checks for out-of-range values, overlapping intervals, and mismatched sample intervals.
- Reviewed the reasonableness of the geological interpretations relative to the nature of the previously extracted mineralization and to the newly discovered mineralized intervals.
- Reviewed the geological wireframes to ensure that a minimum mining width was honoured.
- Reviewed the coding of the mined out material in the block model to ensure a reasonable match with the excavation model.

No significant errors were noted for the collar, survey, lithology, or assay records reviewed.

The surface and underground drill hole collar locations are reasonable and channel samples are appropriately located with respect to the existing underground infrastructure.

Jaguar considers that the drilling and sampling database is appropriate to be used in the preparation of Mineral Resource and Mineral Reserve estimates.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

TURMALINA MINE METALLURGICAL TESTS

Machado (2005) reports that AngloGold carried out the following metallurgical testwork:

- Metallurgical testwork in 1987 on 65 kg of mineralized core, 90% minus 200 mesh. Recovery by direct cyanidation (apparently bottle roll tests) yielded 91.4%.
- Metallurgical testwork in 1992 on mineralized material from the 640 m level, 50 m below the pit floor. Recovery by direct cyanidation (apparently bottle roll tests) yielded 90.3%.
- Metallurgical testwork in 1993 on a 44.9 t sample grading 5.84 g/t Au, from the 640 m and 626 m levels. Samples crushed to 90% and 100% minus 400 mesh yielded recoveries of 86% and 93%, respectively, using direct cyanidation (apparently tank tests).
- Metallurgical testwork in 1994 on a 17,000 t bulk sample grading 5.24 g/t Au. The bulk sample was treated at AngloGold's Nova Lima Pilot Plant, near Belo Horizonte.

A summary of the historical testwork that was carried out prior to Jaguar's ownership is provided in Table 13-1.

In January 2005, as part of the feasibility study work, a 10 t bulk sample was mined from underground for testing purposes (Clow and Valliant, 2006). From this sample, six tonnes were used for the testing as described below:

1. METSO Laboratories, Brazil:
   a. Full crushing tests to determine the size distribution and equipment design parameters.
2. CETEC, Brazil:
   a. Conventional bottle roll tests at various grinds.
3. Dawson Laboratories Inc., USA:
   a. Bond Ball Mill Work Index Tests
   b. Adsorption Kinetic Tests
4. Dawson Laboratories and CDTN Research Center, Brazil:
   a. Agitated leach cyanidation tests at various grinds. Both laboratories reported leaching recoveries of 92% for the 200 mesh samples and 94% for 400 mesh.

5. Federal University of Minas Gerais, School of Engineering – Mining Engineering Department Laboratory, Brazil
    a. Settling Tests
    b. Dynamic Viscosity Tests

6. Lakefield and Geosol, Brazil:
    a. Tailings characterization tests to determine acid generation potential.

7. Mine System Design Inc. (MSD), USA:
    a. Paste fill tests

8. AngloGold Laboratory, Brazil:
    a. Leaching testwork. The samples consisted of diamond drill core from the Principal and NE Zones and attained metallurgical recoveries of 92.96% and 92.87%, respectively.

Jaguar's testwork completed in 2005 and 2006 are summarized in Table 13-1.

TABLE 13-1 HISTORICAL METALLURGICAL TESTWORK
Jaguar Mining Inc. – Turmalina Mine Complex

Year	Owner	Laboratory	Testwork	Results
1987	AngloGold	Morro Velho Mine	Gravity-Flotation-Cyanidation testing on 65 kg sample	Gravity recovery=10.4%
			grading 6.23 g/t Au	Flotation-Cyanidation recovery=90%x90%=81%
				Total recovery=91.4%
1992	AngloGold		Bottle roll	90.3% recovery @ 90% minus 200 mesh
1993-94	AngloGold		35 t bench scale cyanidation	86% recovery @ 90% minus 200 mesh
				93% recovery @ 90% minus 400 mesh
2005	Jaguar	METSO	Optimize crushing/screening by testing 6 t sample	
			Crush to 100 minus 3/8"	
			Test crushability & rod mill indices	
			Measure particle & bulk densities	
			Test abrasiveness	
			Measure flatness index	
2005	Jaguar	CETEC	Bottle roll on 90% minus 100, 200, & 325 mesh	
2005	Jaguar	Dawson Laboratories Inc.	Bond ball mill work index tests @ 100, 200, & 400 mesh	
			Adsorption kinetic tests to study carbon in pulp (CIP) vs. carbon in leach (CIL)	

Year	Owner	Laboratory	Testwork	Results
2005	Jaguar	CDTN Research Centre	Cyanidation in agitated tanks on 90% minus 200 & 325 mesh	92% recovery @ 90% minus 200 mesh 94.5% recovery @ 90% minus 325 mesh
2005	Jaguar	Federal Univ. of Minas Gerais	Viscosity, settling, and flocculent tests for thickener design	
2005	Jaguar	Lakefield/Geosol	Tailings characterization to study acid generation potential	
2005-06	Jaguar	Mine System Design (MSD)	Paste fill preparation tests	
2006	Jaguar	AngloGold Laboratory	Leaching tests	92.96% recovery, Principal Zone, 92.87% recovery NE Zone

FAINA, PONTAL, AND OREBODY D TESTING PROGRAMS

OXIDE MINERALIZATION

In August 2009, direct cyanidation testing was performed by Jaguar's in-house process laboratory, located in Caeté, on oxide mineralization from the Faina deposit. This cyanidation testing resulted in an average gold extraction of 96.1% on a sample of approximately 83% minus 200 mesh.

In August 2011, direct cyanidation testing was performed by Jaguar's in-house process laboratory on oxide mineralization from the Orebody D target. The results indicate that the Orebody D target oxide mineralization is amenable to cyanidation.

In February 2010, direct cyanidation testing was performed by Jaguar's in-house process laboratory on oxide mineralization from the Pontal deposit. The cyanidation testing resulted in an average gold extraction of 94.1%.

SULPHIDE MINERALIZATION

In May 2008, direct cyanidation testing was performed by Jaguar's in-house process laboratory on a sample of sulphide mineralization from the Faina deposit. The testing resulted in an average gold extraction of 42.91% at 80% minus 200 mesh, and an average gold extraction of 42.99% at 80% minus 270 mesh, indicating that a portion of the Faina deposit sulphide mineralization is refractory. In November 2008, direct cyanidation testing was performed by Jaguar's in-house process laboratory on sulphide mineralization from Orebody D. The cyanidation testing resulted in an average gold extraction of 60.0% at 90% minus 200 mesh, indicating that a portion of Orebody D sulphide mineralization is refractory (Machado, 2011).

In October 2010, Jaguar engaged Resource Development Inc. (RDi) to complete a metallurgical test program on a 150 kg composite sample from the Faina and Orebody D deposits. The objective of this test program was to identify and develop the best treatment processing route for the extraction of gold from the refractory sulphide deposits. This metallurgical test program included grinding testwork, gravity concentration, whole ore cyanidation, carbon-in-leach (CIL), flotation and pressure oxidation of whole ore, and flotation concentrate. The RDi test program indicated that 45% of the gold in the composite sample was free milling and the remaining gold was refractory. RDi concluded the best treatment route for the composite sample tested was to float the sulphides, to pressure oxidize the flotation concentrate, and to treat the oxidized material and flotation tailings in a CIL circuit to recover gold. In this manner, the overall gold extraction for the refractory gold mineralization from the Faina and Orebody D deposits combined mineralized material is projected to be approximately 87.4% (Machado, 2011).

In September 2011, RDi completed a metallurgical test program on an approximately 50 kg sample of refractory sulphide mineralization from the Pontal deposit. The objective of the testing was to determine if the metallurgical recovery of the refractory sulphide mineralization can be improved by roasting and subsequent cyanidation over direct cyanidation. Direct cyanidation resulted in a gold extraction of 58.0% and cyanidation of the roasted mineralization improved the gold extraction to 80.3% (Machado, 2011).

14 MINERAL RESOURCE ESTIMATE

SUMMARY

Table 14-1 summarizes the Mineral Resources as of December 31, 2019 based on a US$1,500/oz gold price for the Turmalina deposit and a gold price of US$1,400/oz for the Faina and Pontal deposits. A cut-off grade of 2.10 g/t Au was used to report the Mineral Resources for the Turmalina deposit, and cut-off grades of 3.8 g/t Au and 2.9 g/t Au were used to report the Mineral Resources for the Faina and Pontal deposits, respectively. The Mineral Resource estimates for the Faina and Pontal deposits were prepared with an effective date of December 31, 2014 and were disclosed in RPA (2015).

The updated block model for the Turmalina deposit is based on drilling and channel sample data using a data cut-off date of December 16, 2019. The database comprises 4,218 drill holes and 17,282 channel samples. The estimate was generated from a block model constrained by three-dimensional (3D) wireframe models that were constructed using a minimum width of two metres. The gold grades are interpolated using the ordinary kriging algorithm using capped composited assays. A capping value of 50 g/t Au was applied for all three orebodies. The wireframe models of the mineralization and excavated material for the Turmalina, Faina, and Pontal deposits were constructed by Jaguar.

The mineralized material for each orebody was initially classified into the Measured, Indicated, or Inferred Mineral Resource categories on the basis of the search ellipse ranges as obtained from the variography studies and the estimation passes. These preliminary classifications were subsequently modified by digital and manual methods that considered the observed continuity of the mineralization, the drill hole and channel sample density, and previous production experience with these orebodies to achieve a smoothed classification result.

TABLE 14-1 SUMMARY OF TOTAL MINERAL RESOURCES – DECEMBER 31, 2019
Jaguar Mining Inc. – Turmalina Mine Complex

Category	Tonnes (000)	Grade (g/t Au)	Contained Oz Au (000)
Turmalina			
Measured	2,014	5.14	333
Indicated	2,213	4.66	331
Sub-total M&I	**4,227**	**4.89**	**664**
Inferred	1,818	4.23	248
Faina			
Measured	72	7.39	17
Indicated	189	6.66	42
Sub-total M&I	**261**	**6.87**	**58**
Inferred	1,542	7.26	360
Pontal			
Measured	251	5.00	40
Indicated	159	4.28	22
Sub-total M&I	**410**	**4.72**	**62**
Inferred	130	5.03	21
Total Turmalina, Faina, and Pontal deposits			
Measured	2,337	5.19	390
Indicated	2,561	4.78	395
Total M&I	**4,898**	**4.98**	**784**
Inferred	3,490	5.60	629

Notes:
1. CIM (2014) definitions were followed for Mineral Resources.
2. Mineral Resources include the Turmalina deposit, Faina deposit, and Pontal deposit.
3. Mineral Resources are inclusive of the Mineral Reserves at the Turmalina deposit.
4. Mineral Resources are estimated at a cut-off grade of 2.1 g/t Au at Turmalina, 3.8 g/t Au at Faina, and 2.9 g/t Au at Pontal.
5. Mineral Resources at the Turmalina deposit include all drill hole and channel sample data and mining excavations as of December 31, 2018. Mineral Resources at the Faina and Pontal deposits include drill hole information as of December 31, 2014.
6. Mineral Resources are estimated using a long-term gold price of US$1,500 per ounce for the Turmalina deposit and US$1,400 per ounce for the Faina and Pontal deposits.
7. Mineral Resources are estimated using an average long-term exchange rate of 3.70 Brazilian Reais: 1 US Dollar for the Turmalina deposit and 2.50 Brazilian Reais: 1 US Dollar for the Faina and Pontal deposits.
8. A minimum mining width of two metres was used.
9. Bulk density is 2.83 t/m^3 for Orebodies A and B and 2.91 t/m^3 for Orebody C at the Turmalina deposit.
10. Gold grades are estimated by the ordinary kriging interpolation algorithm using capped composite samples.
11. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
12. Numbers may not add due to rounding.

TURMALINA DEPOSIT

DESCRIPTION OF THE DATABASE

Current drilling and sampling practices involve the initial delineation of the location of the mineralized lenses using either surface-based or underground-based drill holes as appropriate. For the 2019 drilling program, all drilling was completed from underground stations. Once sufficient primary underground access has been established, the mineralized lenses are further outlined by underground-based drill holes at a nominal spacing of 25 m to 50 m. As development of the underground access progresses on the ore, a series of channel samples are taken in two locales (one set on the face and one set along the back) for each round. The average channel sample spacing along development drifts is five metres.

Jaguar maintains an internal database (referred to as BDI), which is used to store and manage all of the digital information for all of its operations. The drill hole database contains drill hole and channel sample information that is coded according to the following naming conventions (Table 14-2).

TABLE 14-2 DRILL HOLE DATABASE, TURMALINA DEPOSIT
Jaguar Mining Inc. – Turmalina Mine Complex

Hole Series	Description
FSN	Jaguar Drill Holes, Orebody C
FMT	Jaguar Drill Holes, Orebodies A and B
FTS	Jaguar Drill Holes
LM	Jaguar Drill Holes
FC	Jaguar Drill Holes
JM*	Jumbo Drill Holes
SMB*	Blast Holes (open pits)

*Note: JM-series and SMB-series drill hole and assay information are not used for construction of mineralized wireframes or grade estimation purposes.

The drill hole and channel sample information for the Turmalina deposit was extracted from this internal database into separate files for use in preparation of the Mineral Resource estimates. The cut-off date for the drill hole database is December 16, 2019. The drilling and sampling data was carried out using the UTM Datum Córrego Alegre, Zone 23S grid coordinate system.

A summary of the drilling and channel sampling information is provided in Table 14-3.

TABLE 14-3 DESCRIPTION OF THE TURMALINA DEPOSIT DATABASE AS AT DECEMBER 16, 2019
Jaguar Mining Inc. – Turmalina Mine Complex

Table Name	Records
assay_minesight_raw	322,155
Collar (4,218 drill holes and 17,282 channel samples)	21,500
composites_minesight	69,796
litho	121,869
survey	159,628
weather	172,869

This drill hole information was modified slightly so as to be compatible with the format requirements of the Hexagon HxGN MinePlan 3D v.15.30 mine planning software and was then imported into that software package. A number of new tables were created during the estimation process to capture such information as the intersection information between the drill holes and the wireframe models, density readings, capped assay records, and composited assay records.

The database included a number of assay records which contained entries of negative values to represent intervals of no sampling, lost core, lost sample, or no core recovery, some of which are contained within the mineralized wireframes. Depending upon the specific local conditions, these null values can introduce an undesired positive bias upon the grade estimations. Jaguar therefore elected to pursue a conservative approach by inserting a very low gold value of 0.01 g/t Au for these intervals of null values.

The Turmalina deposit database also contains a large number of entries for older channel sample and drill hole information which are either clearly in error or for which the confidence of the mineralized intervals are uncertain due to conflicts with more current and accurate information. In these cases, the erroneous and uncertain drill holes and channel samples are flagged and are not used in the preparation of the grade estimation. A summary of the erroneous and suspicious drill holes is presented in Table 14-4.

TABLE 14-4 SUMMARY OF DRILL HOLE AND CHANNEL SAMPLES EXCLUDED FROM ESTIMATION, TURMALINA DEPOSIT
Jaguar Mining Inc. – Turmalina Mine Complex

Sample Type	Number of Channels or Drill Holes
Channel Samples	1869
FMT-series Drill Holes	70
FSN-series Drill Holes	57
Drill Holes, Other	309
Total	**2,305**

Jaguar confirms that all of the deposits modelled and estimated are well drilled and sampled. The drilling and sampling protocols permit the identification and delineation of the mineralized areas with confidence. The drilling and sampling practices are carried out to a high standard. In Jaguar´s view the drill hole and sampling database is suitable for use in preparation of Mineral Resource estimates.

MINERALIZATION WIREFRAMES

The interpreted 3D wireframe models of the gold mineralization have been created using the assay values from surface- and underground-based drill holes, and channel sample data as available. Wireframe models of the gold distribution for the three orebodies were created using the Hexagon HxGN MinePlan and the Leapfrog Geo version 4.3 software packages.

The wireframe limits were drawn using a cut-off grade of 0.50 g/t Au and a nominal minimum width of 2.0 m. Some lower grade gold values were included inside the wireframes to preserve the continuity of the interpretation. The wireframe models were clipped to the original, pre-mining topography surface.

Until 2017, the main production of the mine has been from Orebody A, which is dominated by a steeply northeast dipping tabular deposit that is located in a biotite schist host rock. Contouring activities have shown that the gold grades are oriented along a steep southeasterly plunge within this main, folded portion of the deposit. Additional, smaller mineralized zones also contribute to the production from Orebody A. These zones occur mostly as steeply dipping, tabular zones that are oriented either sub-parallel with or at a slight angle with the axis of Orebody A. In total, Orebody A is comprised of 10 separate mineralized zones. The drilling results from the 2019 program have continued to be successful in intersecting the down-plunge extension of Orebody A. Better gold grades and mineralized widths are found with increased abundances of quartz and pyrite-arsenopyrite in the nose area of this structure, however good gold grades can also be found as steeply plunging shoots along the limbs as well. The mineralization in this deposit has been outlined along a strike length of approximately 250 m to 300 m and to depths of 1,100 m to 1,150 m below surface. The deposit is accessed by a ramp system that has supported production over a vertical distance of approximately 940 m. The mineralization in Orebody A has been defined by drilling below the lowest working level and good potential remains for discovering additional mineralization along the down-plunge projection with additional drilling.

Orebody B includes two lower grade lenses that are oriented approximately parallel to Orebody A. They are located approximately 50 m to 75 m in the structural hanging wall or Orebody A and are accessed in the upper levels of the mine by a series of cross-cuts that are driven from Orebody A development. The mineralization in this deposit has been outlined along a strike length of approximately 350 m to 400 m and to depths of 650 m to 700 m below surface.

As a result of the drilling campaigns carried out in 2019, additional mineralized zones have been discovered such that Orebody C has now increased to include a series of 14 lenses that are located to the west in the structural footwall of Orebody A (Figure 14-1). The mineralization occurs as a number of tabular sheets that strike in a northwesterly direction and dip steeply to the northeast. The lower portions of the Orebody C mineralization are accessed by two cross-cuts from the main ramp, while access to the upper levels is via ramp access from the southwest. While historically a minor amount of production has been achieved from these lenses to date, the increasing successes of Jaguar's drilling programs are leading to production plans where an increasing proportion of the production is being sourced from Orebody C. To date, the mineralization in this deposit has been outlined along a strike length of approximately 1,400m and to a depth of 1,000m below surface.

The possibility of additional mineralized zones located elsewhere in the mine stratigraphy is clear and must be considered and evaluated as exploration targets.

An example cross sectional view of the mineralized wireframes for Orebody C is presented in Figure 14-2.

FIGURE 14-1 OVERVIEW OF THE MINERALIZED WIREFRAMES – TURMALINA DEPOSIT

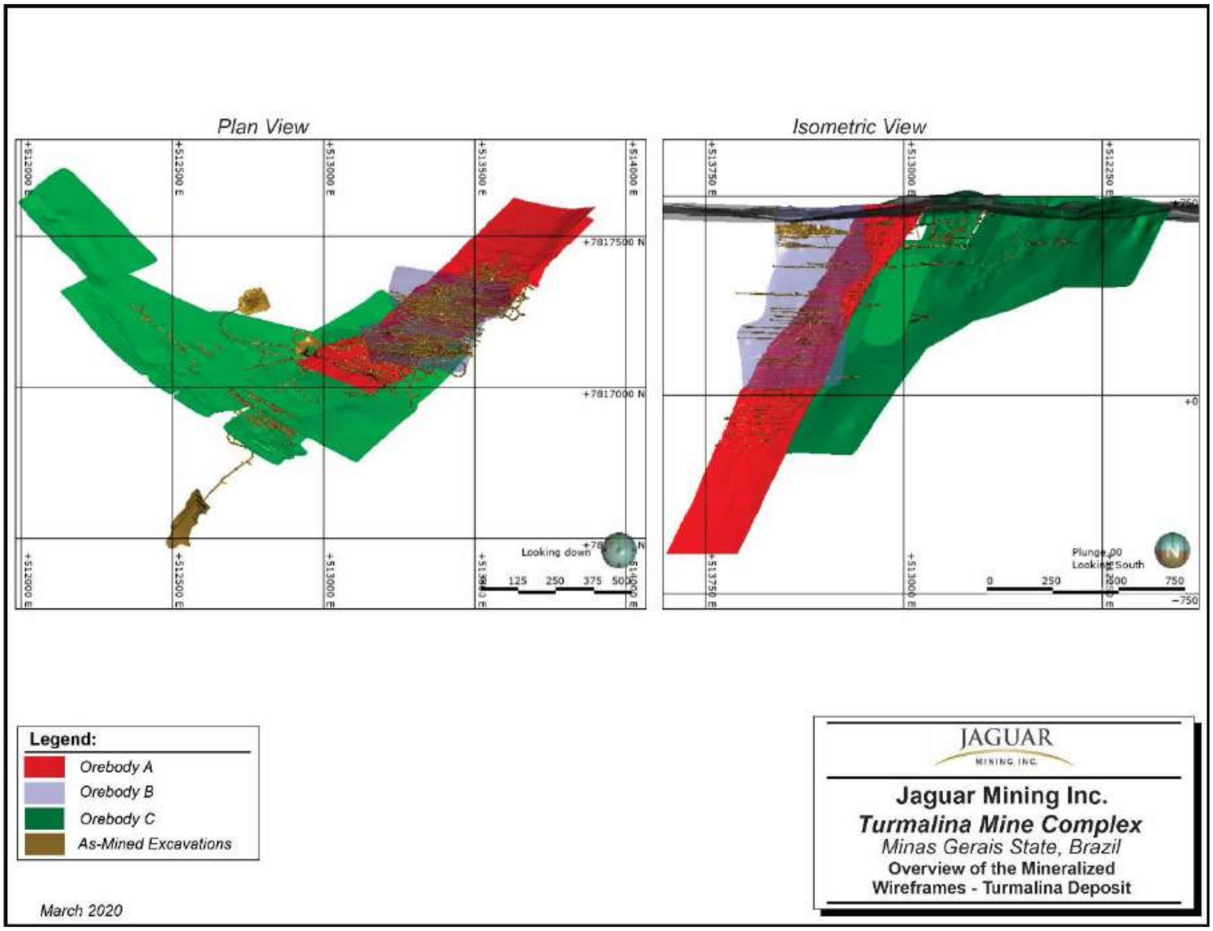
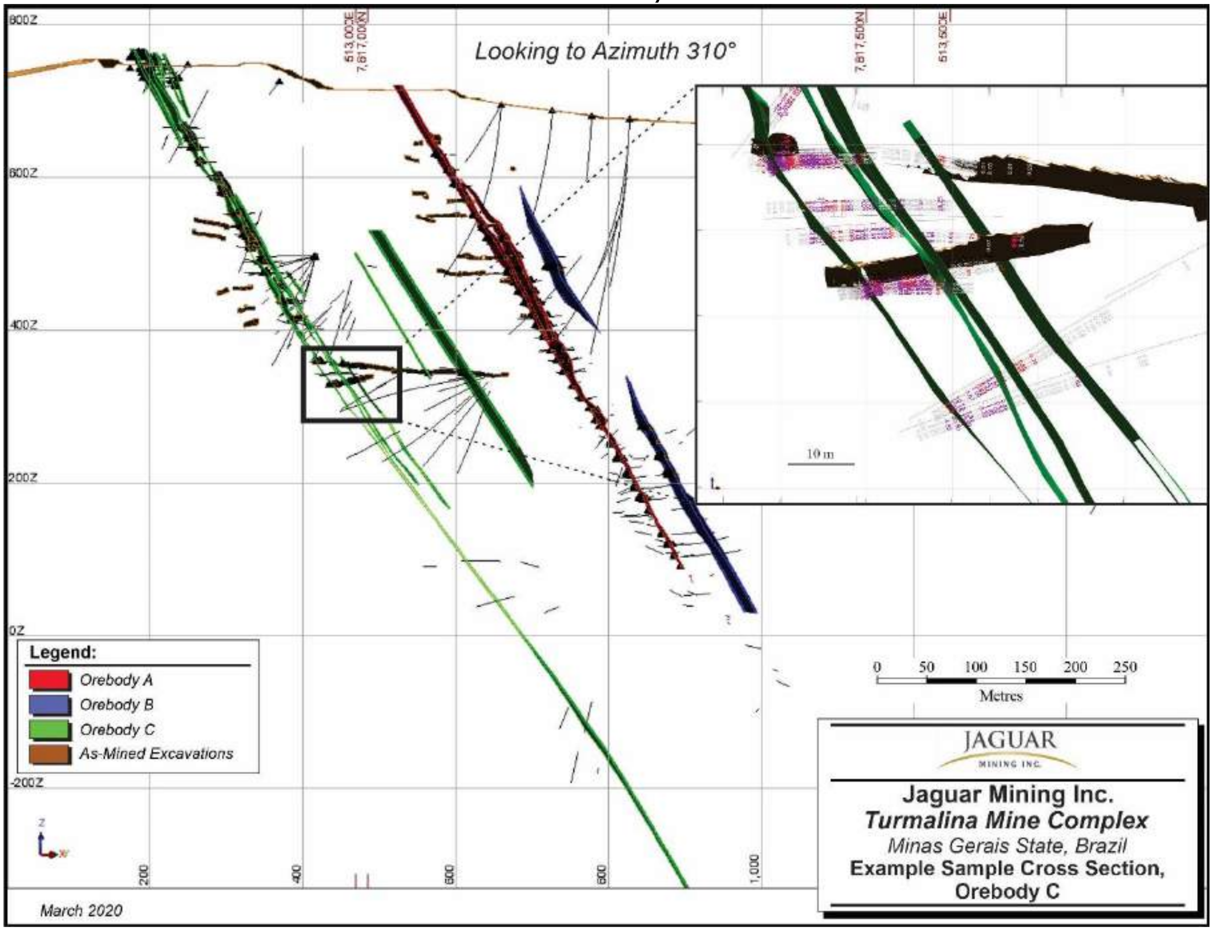


FIGURE 14-2 EXAMPLE CROSS SECTION, OREBODY C



Review of the wireframes by Jaguar reveals that the interpretations are reasonable and appropriate. The various mineralized lenses have been grouped into domains for statistics and modelling purposes. Integer codes were assigned to the various zone wireframes and then the wireframes were used to transfer these codes to the block model. The coding provided the means to customize grade interpolation parameters for each zone and to ensure that only the composites from a given mineralized lens were used to estimate the grades for that same lens. A listing of the domain codes is provided in Table 14-5.

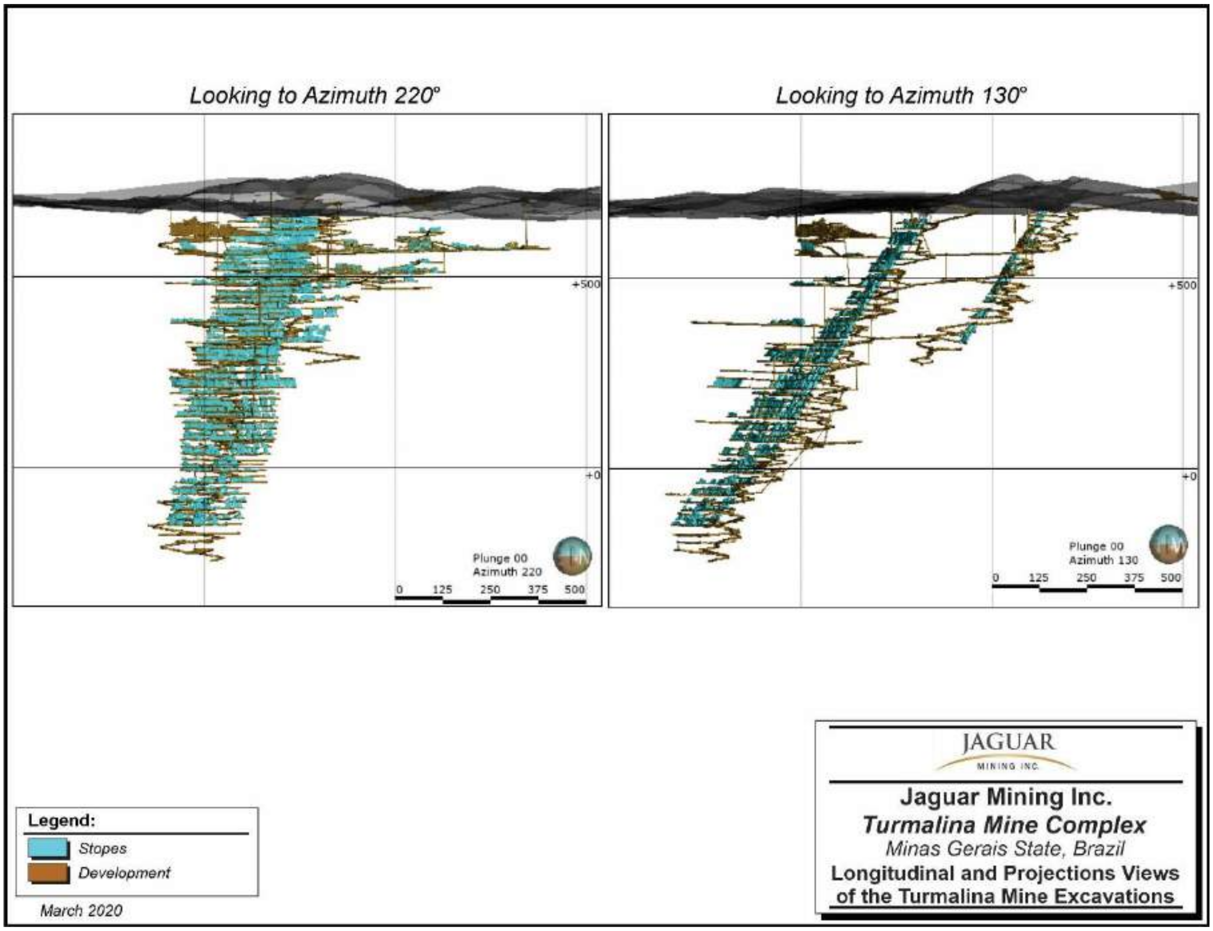
TABLE 14-5 LIST OF WIREFRAME DOMAIN CODES, TURMALINA DEPOSIT
Jaguar Mining Inc. – Turmalina Mine Complex

Domain Code	Name	Orebody
1	ANW	Orebody A - Portion NW
4	ASE01-L01	Orebody A - Portion SE
5	ASE01-L02	Orebody A - Portion SE
6	ASE02	Orebody A - Portion SE
7	ASE03	Orebody A - Portion SE
8	AGRANADA	Orebody A - Portion SE - associated with Garnets
9	MVU	Ultramafic Hosted Zone
10	AXS-FW	Orebody A
11	AXS-HW	Orebody A
12	ANW-L01	Orebody A
15	B	Orebody B
16	BHW	Orebody B Hang wall
21-29	CSE	Orebody C - Portion SE
31-34	CCE	Orebody C - Center Portion - CE "Central"
42-43	CNW	Orebody C - Portion NW

TOPOGRAPHY AND EXCAVATION MODELS

A topographic surface of the immediate mine area that is current as of October 2013 was used to code the block model for those portions of Orebodies A, B, and C that have been excavated by means of open pit mining methods. Wireframe models of the completed underground development and stopes as of December 2018 were prepared and were used to code the block model for the portions of Orebodies A, B, and C that have been mined out (Figure 14-3).

FIGURE 14-3 LONGITUDINAL PROJECTION OF THE TURMALINA MINE EXCAVATIONS



SAMPLE STATISTICS AND GRADE CAPPING

The mineralization wireframe models were used to code the drill hole database and to identify the resource related samples. These samples were extracted from the database into their respective domains, and then subjected to statistical analyses by means of histograms, probability plots, and decile analyses. A total of 105,061 samples were contained within the mineralized wireframes. The sample statistics are summarized in Table 14-6. Frequency histograms of the gold grade distribution are presented in Figures 14-4, 14-5, and 14-6.

TABLE 14-6 DESCRIPTIVE STATISTICS OF THE RAW GOLD ASSAYS
Jaguar Mining Inc. – Turmalina Mine Complex

	Orebody A		Orebody B		Orebody C	
Item	**Uncapped**	**Capped**	**Uncapped**	**Capped**	**Uncapped**	**Capped**
Length-Weighted Mean (g/t Au)	6.55	6.46	2.38	2.37	3.08	3.05
Median (g/t Au)	2.26	2.26	0.63	0.63	1.17	1.17
Mode (g/t Au)	0.01	0.01	0.01	0.01	0.01	0.01
Standard Deviation (g/t Au)	10.18	9.43	4.99	4.86	5.81	5.47
Coefficient of Variation	1.55	1.46	2.10	2.05	1.89	1.79
Sample Variance (g/t Au)	103.65	88.86	24.9	23.63	33.76	29.89
Minimum (g/t Au)	0.01	0.01	0.01	0.01	0.01	0.01
Maximum (g/t Au)	315.00	50.00	76.83	50.00	184.00	50.00
Count	63,266	63,266	16,506	16,506	31,900	31,900

FIGURE 14-4 FREQUENCY HISTOGRAM OF THE RAW GOLD ASSAYS, OREBODY A

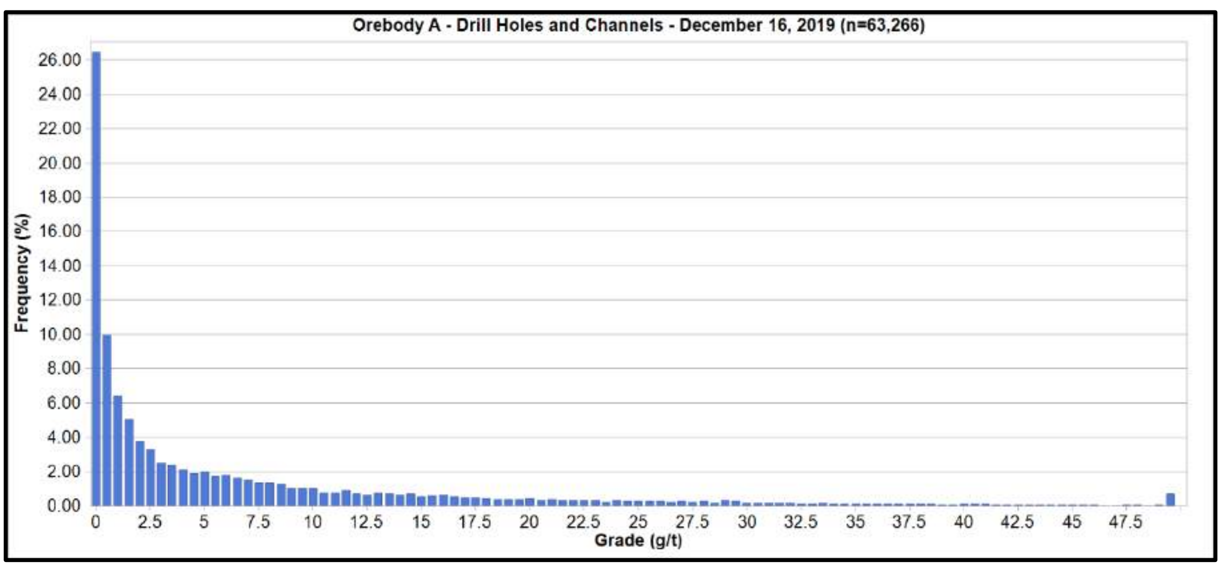


FIGURE 14-5 FREQUENCY HISTOGRAM OF THE RAW GOLD ASSAYS, OREBODY B

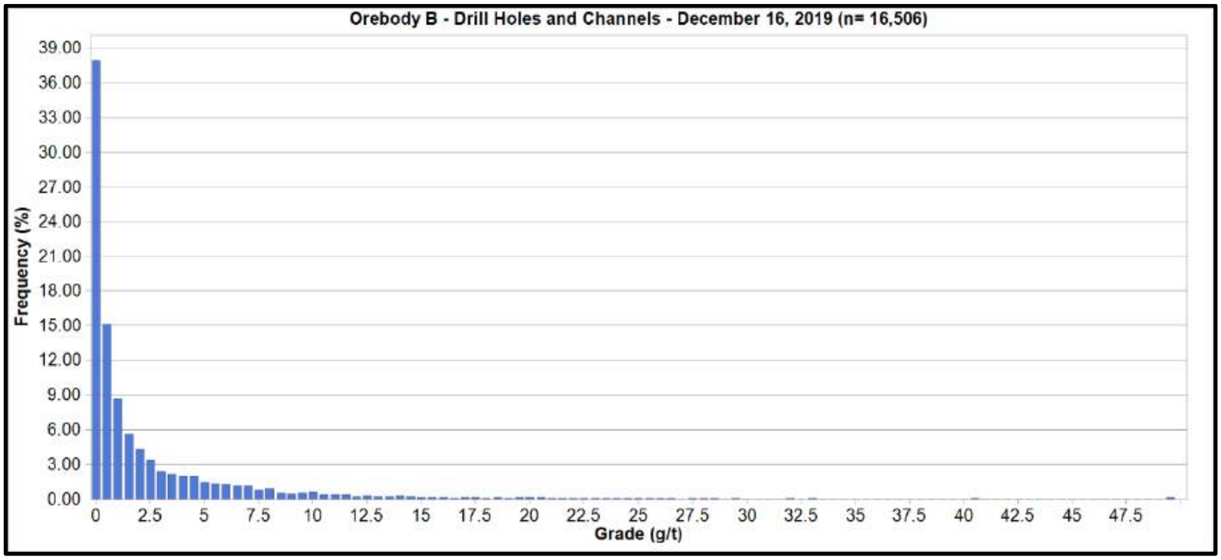
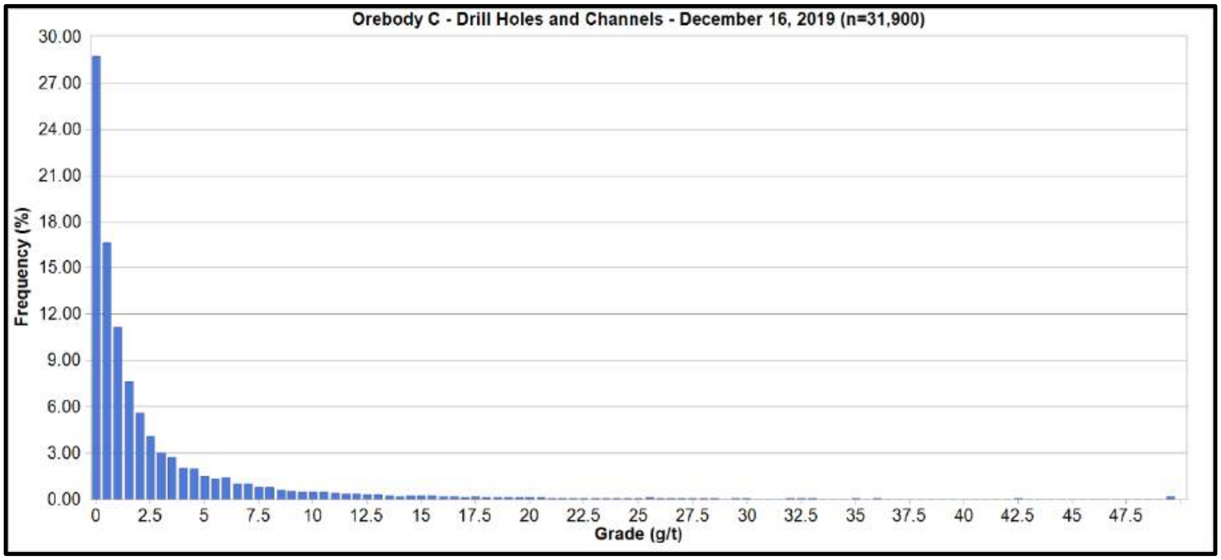


FIGURE 14-6 FREQUENCY HISTOGRAM OF THE RAW GOLD ASSAYS, OREBODY C



On the basis of its review of the assay statistics, Jaguar believes that a capping value of 50 g/t Au remains appropriate for each of the three orebodies, which is unchanged from the recommended capping values presented in RPA (2017). This capping value has been applied to all gold grades prior to the creation of composited assay values.

Capping values be re-examined in light of grade reconciliation information from both Orebody A and Orebody C and adjusted if supported by the data.

COMPOSITING METHODS

The selection of an appropriate composite length began with examination of the descriptive statistics of the raw assay samples and preparation of sample length frequency histograms. Consideration was also given to the size of the blocks in the model. On the basis of the available information, Jaguar believes the composite length of one metre for all samples is reasonable. This composite length remains unchanged from that described in RPA (2017). All samples contained within the mineralized wireframes were composited to a nominal one metre length using the best-fit function of the Hexagon HxGN MinePlan software package. The composite descriptive statistics are provided in Table 14-7.

TABLE 14-7 DESCRIPTIVE STATISTICS OF THE GOLD COMPOSITES
Jaguar Mining Inc. – Turmalina Mine Complex

	Orebody A		Orebody B		Orebody C	
Item	Uncapped	Capped	Uncapped	Capped	Uncapped	Capped
Length-Weighted Mean (g/t Au)	6.55	6.46	2.38	2.37	3.08	3.05
Median (g/t Au)	2.89	2.89	0.77	0.77	1.3	1.3
Mode (g/t Au)	0.01	0.01	0.01	0.01	0.01	0.01
Standard Deviation (g/t Au)	9.33	8.66	4.43	4.33	5.43	5.13
Coefficient of Variation	1.43	1.34	1.86	1.83	1.76	1.68
Sample Variance (g/t Au)	87.12	75.07	19.6	18.7	29.49	26.30
Minimum (g/t Au)	0.01	0.01	0.01	0.01	0.01	0.01
Maximum (g/t Au)	315.00	50.00	68.11	50.00	138.25	50.00
Count	39,691	39,691	10,081	10,081	21,341	21,341

BULK DENSITY

Jaguar continued its program of systematic determination of the bulk densities of the various mineralized zones through 2019 using samples of ore and waste taken from drill holes. The bulk density values were determined by the water displacement method on selected pieces of drill core by Jaguar's laboratory staff at the Caeté site. The bulk densities of 436 ore and waste samples from Orebodies A and C were determined (Table 14-8) in 2019, totalizing 1,930 samples. There is not new results for Orebody B and the historical density available was used. The distribution of the density values are shown in Figures 14-7 and 14-8 for Orebodies A and C, respectively. The average bulk density for the mineralized material in both orebodies remains essentially unchanged from that presented in RPA (2017). The average density values for these mineralized wireframes were coded into the block model.

Examination of the distribution of the density measurements from the mineralized wireframes for Orebody A suggests that the distribution is approximately a Gaussian distribution centred on a mean value that is consistent with a silicate host rock. The distribution of density measurements from the mineralized wireframes for Orebody C suggests that while for the most part the density values are consistent with a silicate host rock, the presence of a weakly developed shoulder in the range of 3.1 t/m^3 to 3.4 t/m^3 suggests the presence of a second lithological unit of higher density. This could be due to the presence of an iron formation unit within the mineralized wireframes.

TABLE 14-8 SUMMARY OF DENSITY MEASUREMENTS BY OREBODY
Jaguar Mining Inc. – Turmalina Mine Complex

Material	No. Samples	Avg. Bulk Density (t/m^3)
	Orebody A:	
Mineralized	344	2.83
Waste	392	2.81
Sub-total	736	
	Orebody C:	
Mineralized	418	2.91
Waste	776	2.83
Sub-total	1,194	

FIGURE 14-7 HISTOGRAM OF BULK DENSITY MEASUREMENTS, OREBODY A MINERALIZED WIREFRAMES

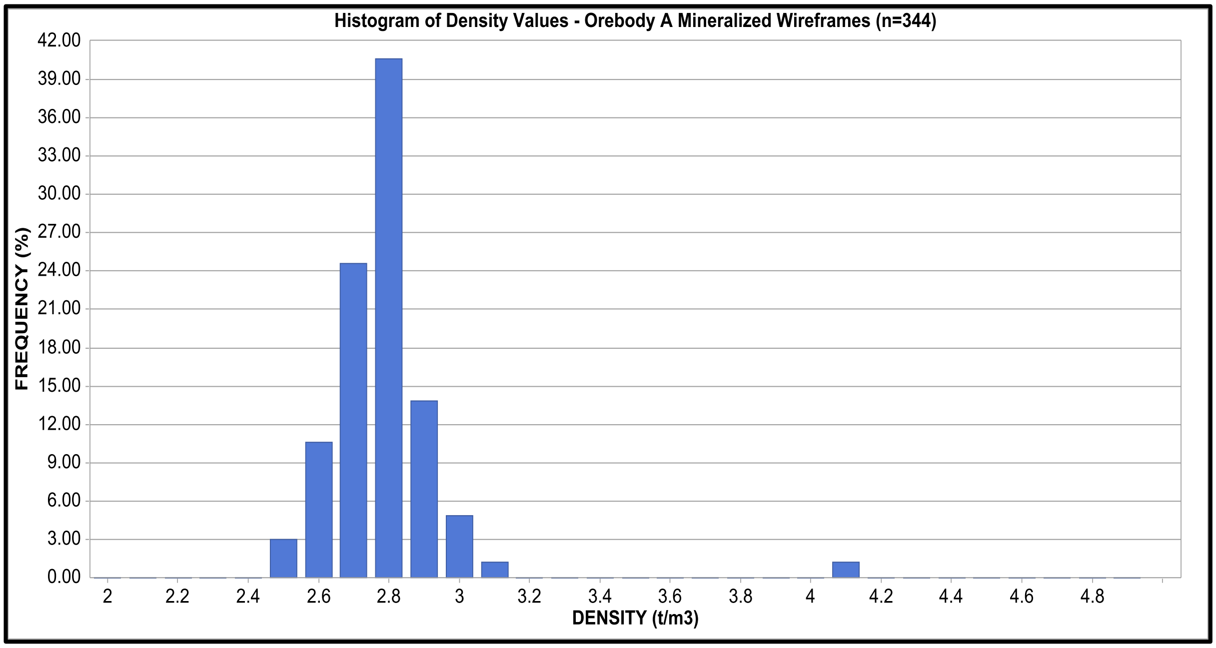
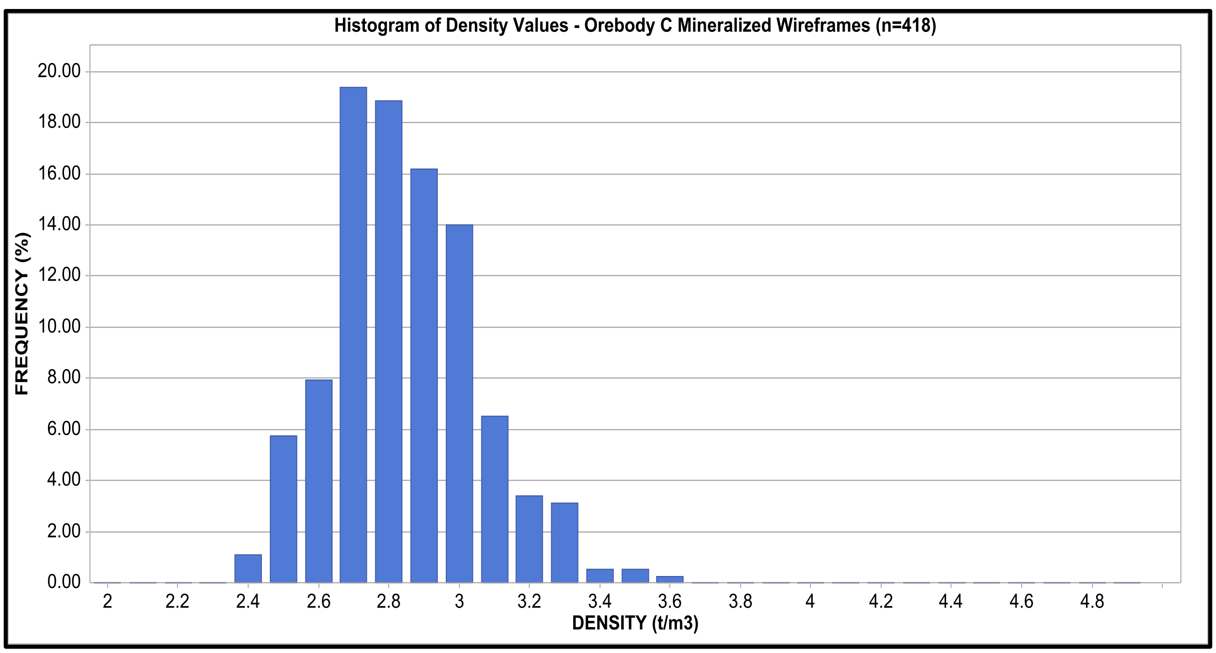


FIGURE 14-8 HISTOGRAM OF BULK DENSITY MEASUREMENTS, OREBODY C MINERALIZED WIREFRAMES



TREND ANALYSIS

As an aid in carrying out variography studies of the distribution and continuity of the gold grades in the mineralized domain models, a short study to examine the overall trends was carried out for selected mineralized lenses. For this exercise, the gold values for each drill hole and channel sample contained within the respective mineralized lens were composited across the entire width of the wireframe and the resulting average grades were contoured using the Leapfrog software package (Figures 14-9 and 14-10).

FIGURE 14-9 GOLD DISTRIBUTION, OREBODY A VIEW SOUTHWEST

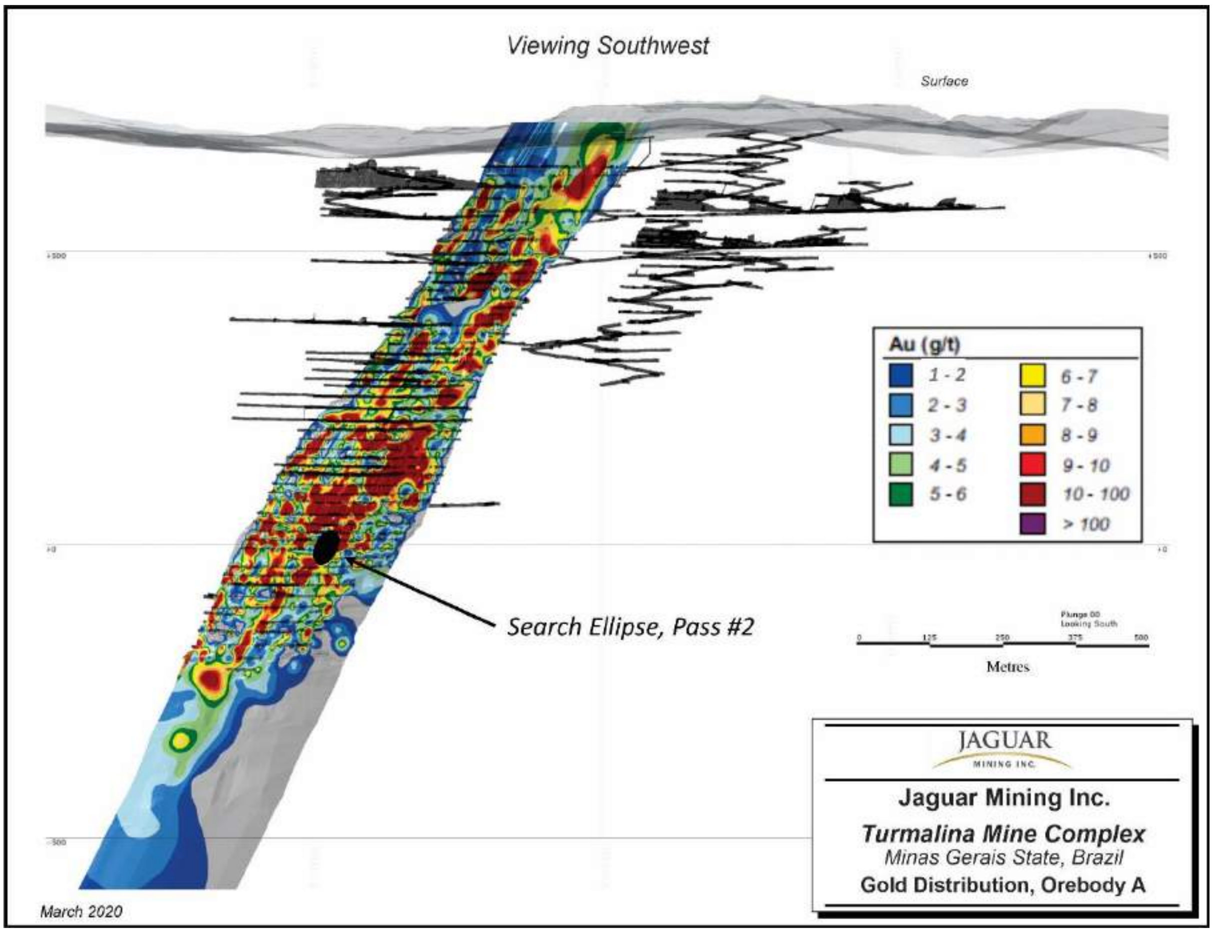
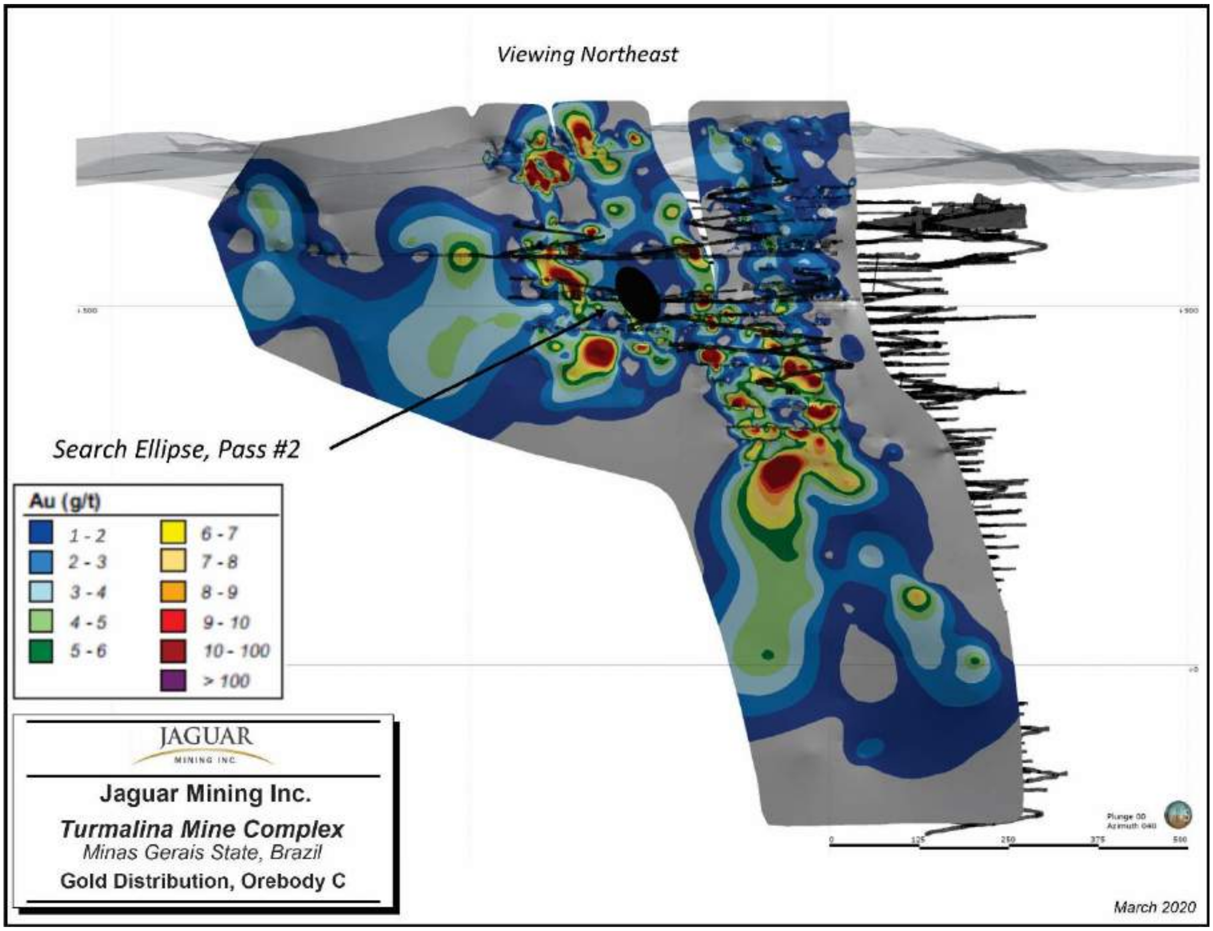


FIGURE 14-10 GOLD DISTRIBUTION OF A PORTION OF OREBODY C



The pronounced southeasterly down-plunge orientation of the higher-grade gold grades initially discussed in RPA (2016) can be seen to persist in both the hanging wall and footwall limbs of Orebody A. The consistency of these trends may indicate the presence of an as-yet not understood structural or stratigraphic control on the distribution of the gold values for these zones. Routine geological mapping and studies to examine the relationship of the gold values to structural, alteration, or lithologic features (such as the presence of quartz veining, for example) to aid in the understanding of the distribution of the higher grade gold values seen in Orebody A are ongoing. The results from these studies will contribute not only towards arriving at an understanding of the controls on the distribution of the high grades, but are also expected to yield exploration targets for areas of the property which have not previously considered as being favourable for hosting potentially economic mineralization. As the lower limit of the gold mineralization clearly remains undefined below the deepest drill hole, additional work to outline the down-plunge continuation of the gold grades in Orebody A is clearly warranted.

In respect of Orebody C, the drilling and sampling activities completed in 2018 have been successful in locating and defining new pods of higher grade mineralization along the down-dip projection of the CSE and C-Central lenses as well as locating new mineralized lenses as discussed above. While some elongation of the higher grade gold values along the down-plunge direction is observed in the C-Central lens, high grade shoots are not as clearly defined at present as in Orebody A. Additional detailed sampling will be required to define the distribution of the higher grade gold values in detail. Additional work is clearly warranted to search for the down-dip limits of the gold mineralization not only of the C-SE and C-Central lenses but beneath the northwest lenses of Orebody C (C-NW) as well. Geological mapping, along with structural and alteration studies are in progress to understand the nature of the gold mineralization and the structural and stratigraphic controls on the distribution of the gold values for Orebody C. The results of these studies will be of great use in understanding the controls on the distribution of the higher grade pods and will aid in developing exploration targets in this area of the mine property.

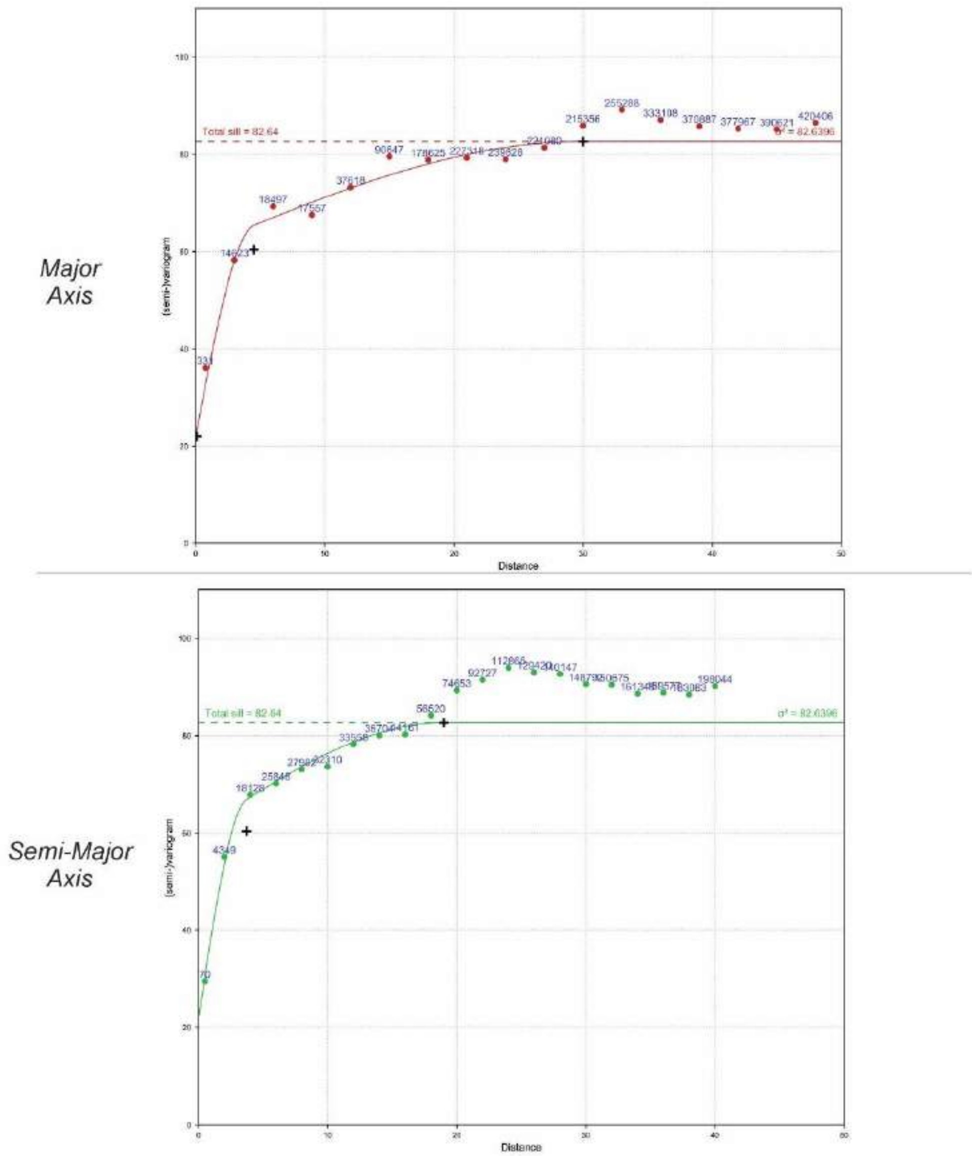
VARIOGRAPHY

Figures 14-12 and 14-13 show the analysis of the spatial continuity of the gold grades that remain effectively unchanged from the conclusions presented in RPA (2015). This study was done in 2019. A summary of the variogram parameters derived for each of the three orebodies is presented in Table 14-9. The spatial continuity of the gold grades in Orebodies A, B, and C is being re-examined in light of Jaguar's increasing understanding of the distribution of the gold grades for these three orebodies.

TABLE 14-9 SUMMARY OF VARIOGRAPHY AND INTERPOLATION PARAMETERS
Jaguar Mining Inc. – Turmalina Mine Complex

	Orebody A			Orebody B	Orebody C		
Item	**Phase 1**	**Phase 2**	**Phase 3**		**Phase 1**	**Phase 2**	**Phase 3**
Nugget (C0)	22	22	22	5	8	8	8
Sill Major Axis (C1)	38.4	38.4	38.4	8.4	11	11	11
Sill Major Axis (C2)	22.2	22.2	22.2	5.8	3.54	3.54	3.54
Model Type	Sph.	Sph.	Sph.	Sph.	Sph.	Sph.	Sph.
Orientation (Az/Dip/Plunge)	050/-55/47	047/-55/40	058/-55/40	030/-65/40	060/-55/35	037/-58/40	051/-53/10
Anisotropy Ratio (Major/Semi-Major)	1.5	1.5	1.5	3.3	1.7	1.7	1.7
Anisotropy Ratio (Major/Minor)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Number of Samples	3	3	3	3	3	3	3
Max. No. of Samples	16	16	16	16	16	16	16
Max No. of Samples per Hole	2	2	2	2	2	2	2
Max No. of Samples per Quadrant	4	4	4	4	4	4	4
Distances:							
Structure1 Major (m)	5	5	5	27	8	8	8
Structure1 Semi-Major (m)	4	4	4	4	7	7	7
Structure1 Minor (m)	3	3	3	3	5	5	5
Structure2 Major (m)	30	30	30	50	50	50	50
Structure2 Semi-Major (m)	20	20	20	15	30	30	30
Structure2 Minor (m)	6	6	6	10	10	10	10

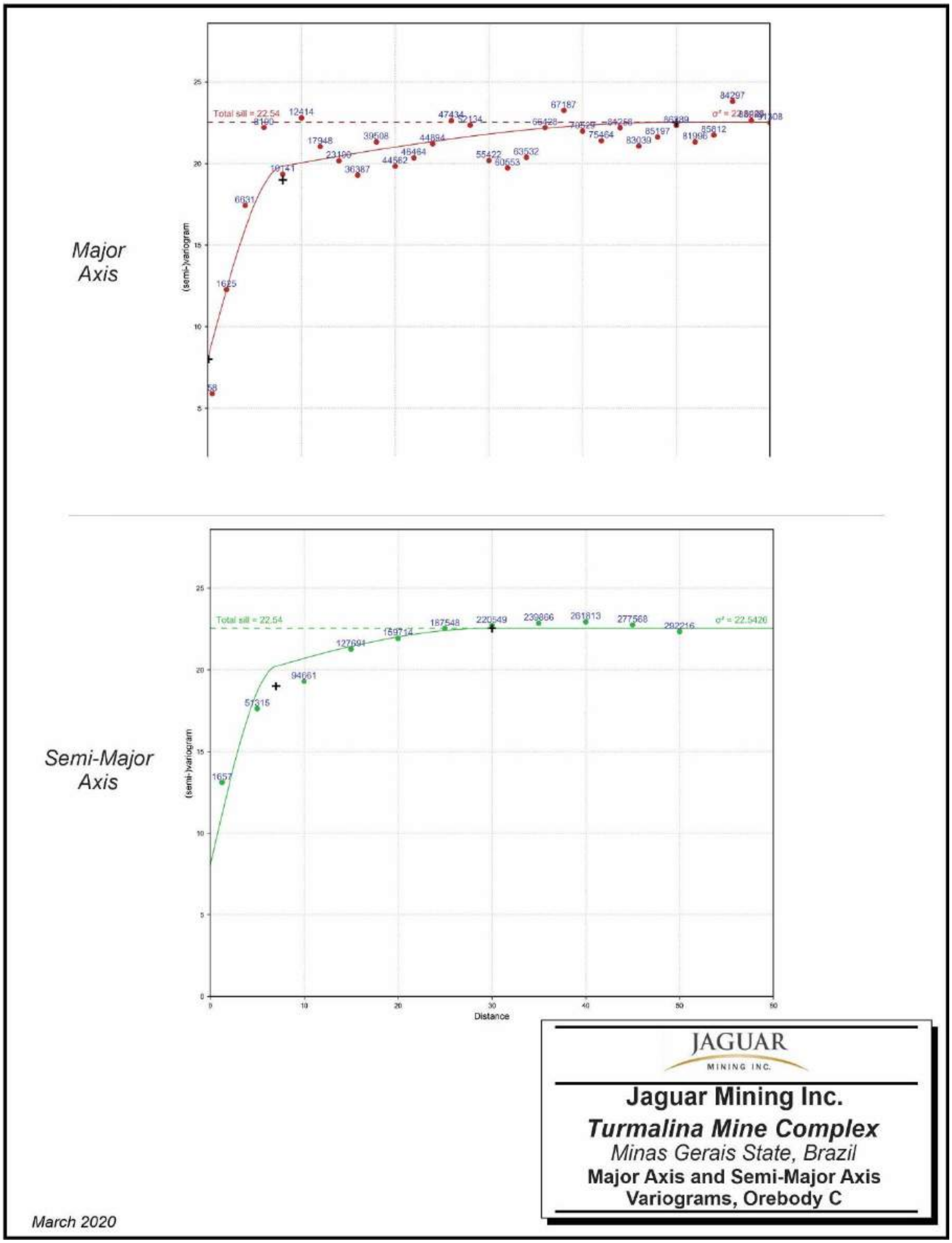
FIGURE 14-11 MAJOR AXIS AND SEMI-MAJOR AXIS VARIOGRAMS, OREBODY A



Jaguar Mining Inc.
Turmalina Mine Complex
Minas Gerais State, Brazil
Major Axis and Semi-Major Axis Variograms, Orebody A

March 2020

FIGURE 14-12 MAJOR AXIS AND SEMI-MAJOR AXIS VARIOGRAMS, OREBODY C



BLOCK MODEL CONSTRUCTION

The block model construction strategy was modified from what was previously employed at the Mine. The current block model was constructed using the Hexagon HxGN MinePlan software package and comprised an array of 4 m x 4 m x 4 m sized parent blocks using sub-blocking to a minimum block size of 1 m x 1 m x 1 m. The model is oriented parallel to the coordinate grid system (i.e., no rotation or tilt). The block sizes for this model were carefully selected so as to minimize the variation when compared with the block model strategy previously employed at the mine. The block model origin, dimensions, and attribute list are provided in Table 14-10. A number of attributes were created to store such information as rock code, material densities, estimated gold grades, mineral resource classification, mined out material, and the like (Table 14-11).

Gold grades were estimated into the blocks by the ordinary kriging (OK) interpolation algorithms. A total of four interpolation passes at different ranges were carried out using distances derived from the variography results and the search ellipse parameters presented above. The orientations of the search ellipses were varied for Orebodies A and C so as to provide a better alignment with the three dimensional orientations of the individual mineralized wireframes. In total, three different search ellipse orientations (Phases 1 to 3) were used to estimate the gold grades for Orebody A. Three different search ellipse orientations were also used to estimate the gold grades for Orebody C.

In general, "hard" domain boundaries were used along the contacts of the mineralized domain models for all of the mineralized lenses. Only data contained within the respective wireframe model were allowed to be used to estimate the grades of the blocks within the wireframe in question, and only those blocks within the wireframe limits were allowed to receive grade estimates. The block grades were estimated in four estimation passes using the parameters presented in Table 14-12.

TABLE 14-10 BLOCK MODEL DEFINITION
Jaguar Mining Inc. – Turmalina Mine Complex

Type	Y (Northing)	X (Easting)	Z (Elevation)
Minimum Coordinates (m)	7,816,600	514,200	-600
Maximum Coordinates (m)	7,818,100	514,200	800
User Block Size (m)	4	4	4
Min. Block Size (m)	1	1	1
Rotation (°)	0.000	0.000	0.000

TABLE 14-11 LIST OF BLOCK MODEL ATTRIBUTES
Jaguar Mining Inc. – Turmalina Mine Complex

Variable Name	Description
auokc	Gold by Ordinary Kriging
avd	Average Distance of Informing Samples
class	Pass Number, Ordinary Kriging (1=Half of Variogram Range, 2=Variogram Range, 3=2x Range, 4=4x Range)
clod	Distance to Closest Informing Sample
dens	Material Density
ndh	Number of Drill Holes for Estimation
nq	Number of Quadrants with Information
nsmp	Number of Informing Samples
fthd	Distance to Farthest Informing Sample
rclass	Mineral Resource Classification (1=measured, 2=indicated, 3=inferred)
rock	Material Code
topo%	Percent of Block Below Topography Surface
var	Variance

TABLE 14-12 SUMMARY OF THE ESTIMATION STRATEGY
Jaguar Mining Inc. – Turmalina Mine Complex

Parameters	Pass 1	Pass 2	Pass 3	Pass 4
Minimum No. of Composites	3	2	1	1
Maximum No. of Composites	16	16	16	16
Maximum No. Composites per Drill Hole	2	2	4	8
Maximum No. Composites per Quadrant	2	2	4	8
Minimum No. Quadrant with Composites	2	2	1	1

BLOCK MODEL VALIDATION

GLOBAL ESTIMATE

Validation of the estimated block model grades included a comparison of the average of all estimated block grades to the average of the composites (Table 14-13). In consideration of such items as the volume-variance effect, projection of estimated grades beyond the limits of the drill hole information and the effect of clustered data, the average estimated block grades agree reasonably well with the average grades of the informing composites.

TABLE 14-13 COMPOSITE VERSUS BLOCK GRADES BY OREBODY
Jaguar Mining Inc. – Turmalina Mine Complex

Item	Orebody A (g/t Au)	Orebody B (g/t Au)	Orebody C (g/t Au)
Composite Average	6.46	2.37	3.05
Block Grade Average	4.56	1.88	2.14

LOCAL ESTIMATE

A series of swath plots were prepared in which the average grade of the composites and the block grades were compared by elevation and by easting coordinate (Figures 14-16 and14-17).

Generally speaking, a good agreement between the estimated block grades and the informing composites is observed in areas where the density of the sample data is low, while greater variances are observed in those areas with regular, systematic channel or drill hole composites. This high variance is in agreement with the differences in average grades shown in table 14-13 but the trend is the same for composites and the block models.

FIGURE 14-13 SWATH PLOT BY EASTING, OREBODY A

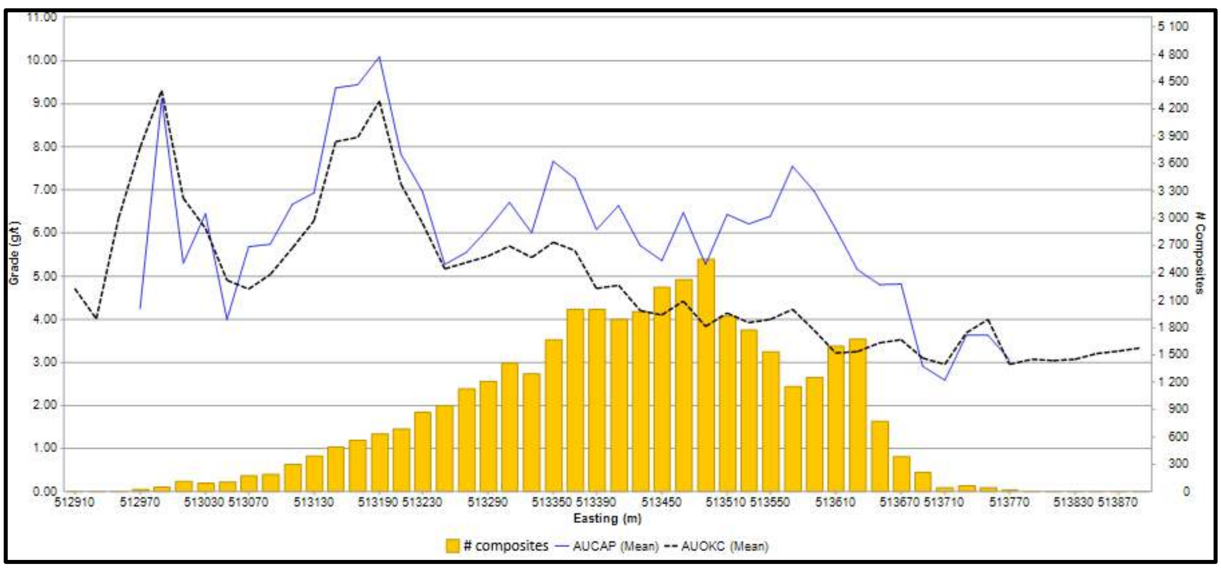


FIGURE 14-14 SWATH PLOT BY ELEVATION, OREBODY A

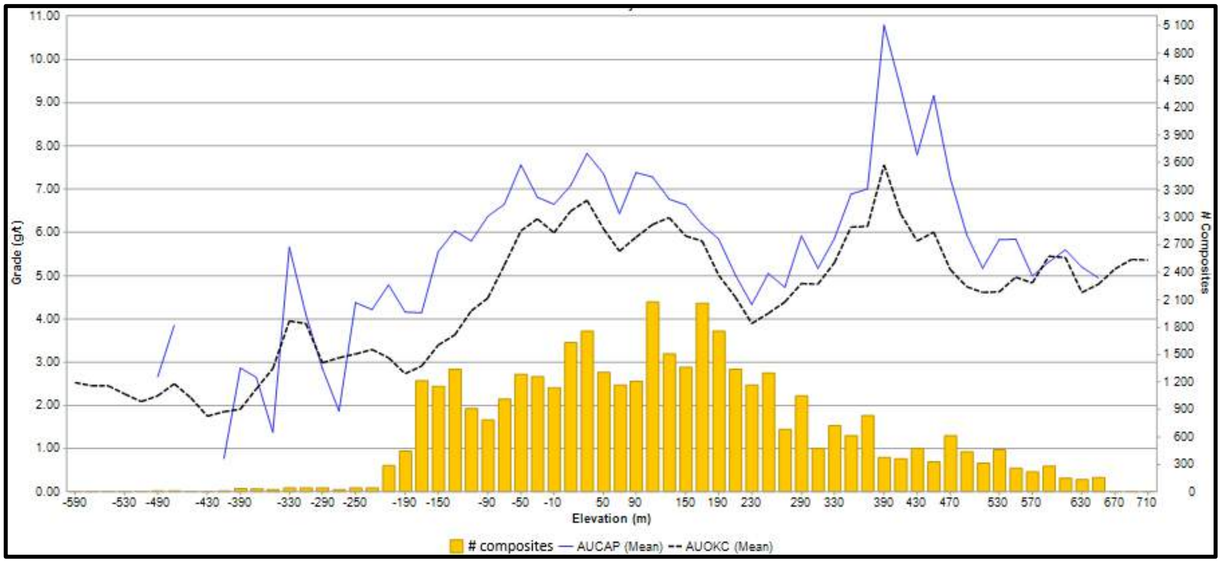


FIGURE 14-15 SWATH PLOT BY EASTING, OREBODY C

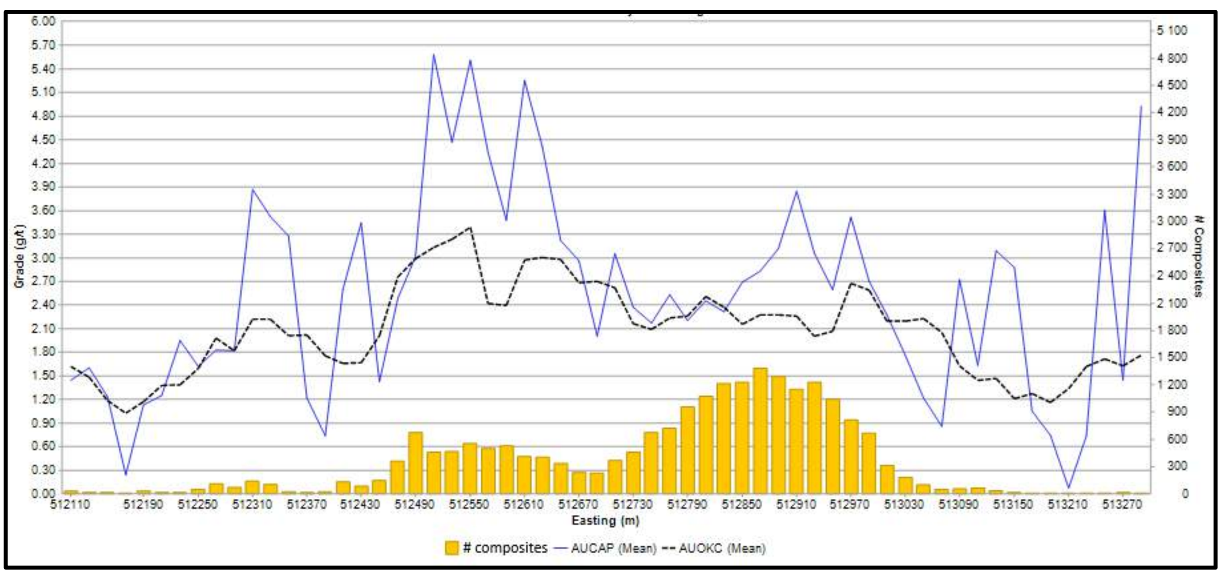
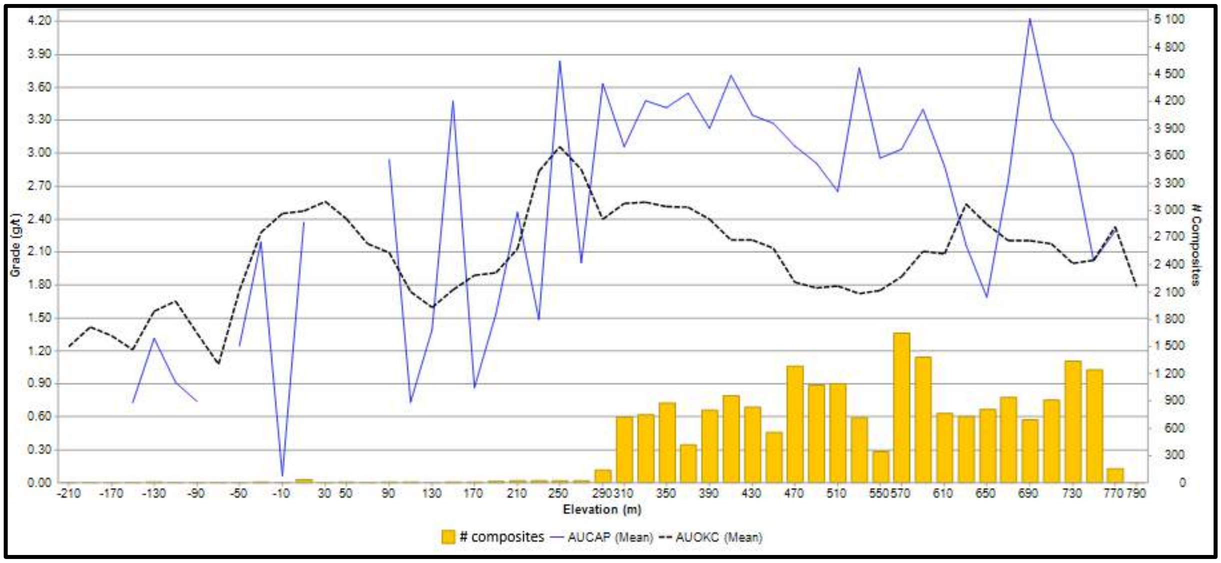


FIGURE 14-16 SWATH PLOT BY ELEVATION, OREBODY C



Evaluation of the accuracy of the local estimate was also carried out by visually comparing the composite gold grades against the estimated block grades in longitudinal views. Examples are presented in Figures 14-18, 14-19, and 14-20. While variances were observed at a local scale, in general good correlation was observed for those areas of higher sample data density.

FIGURE 14-17 COMPARISON OF COMPOSITES GOLD GRADES AND BLOCK GRADES, OREBODY A FOLD

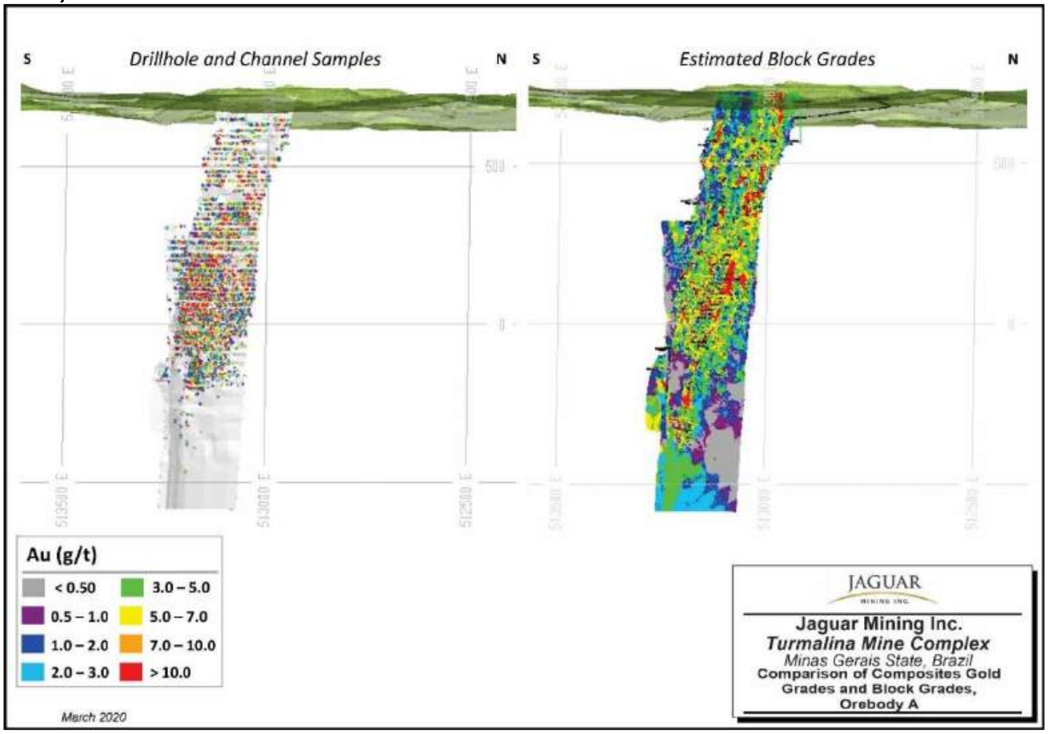
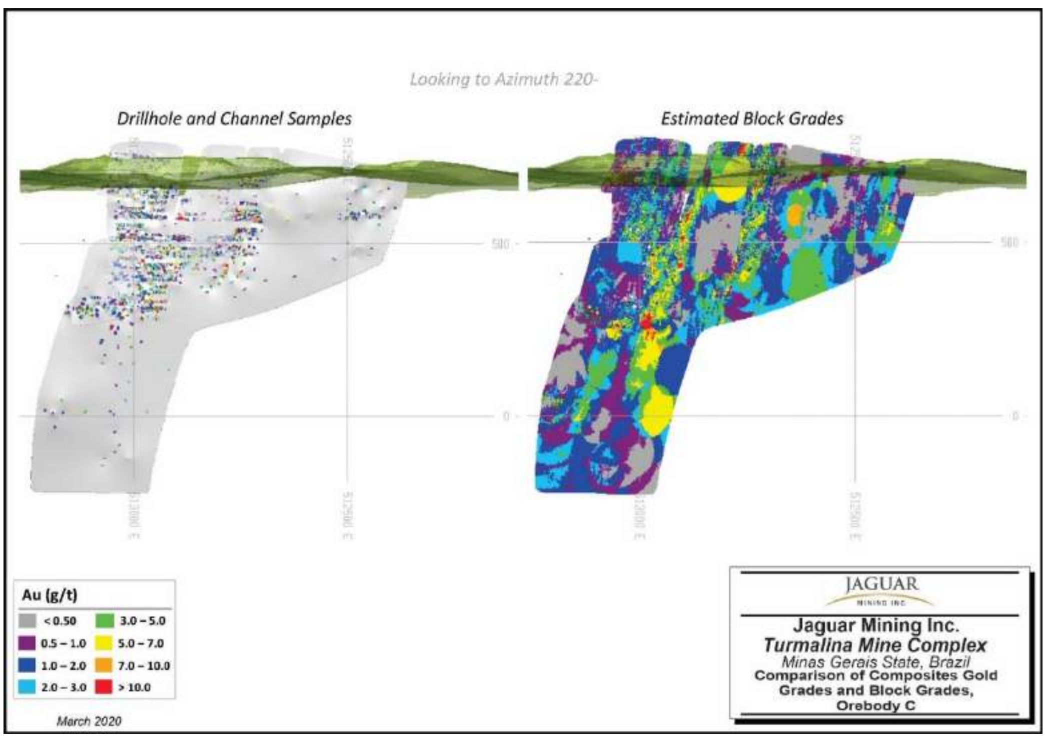


FIGURE 14-18 COMPARISON OF COMPOSITES GOLD GRADES AND BLOCK GRADES, OREBODY C



RECONCILIATION

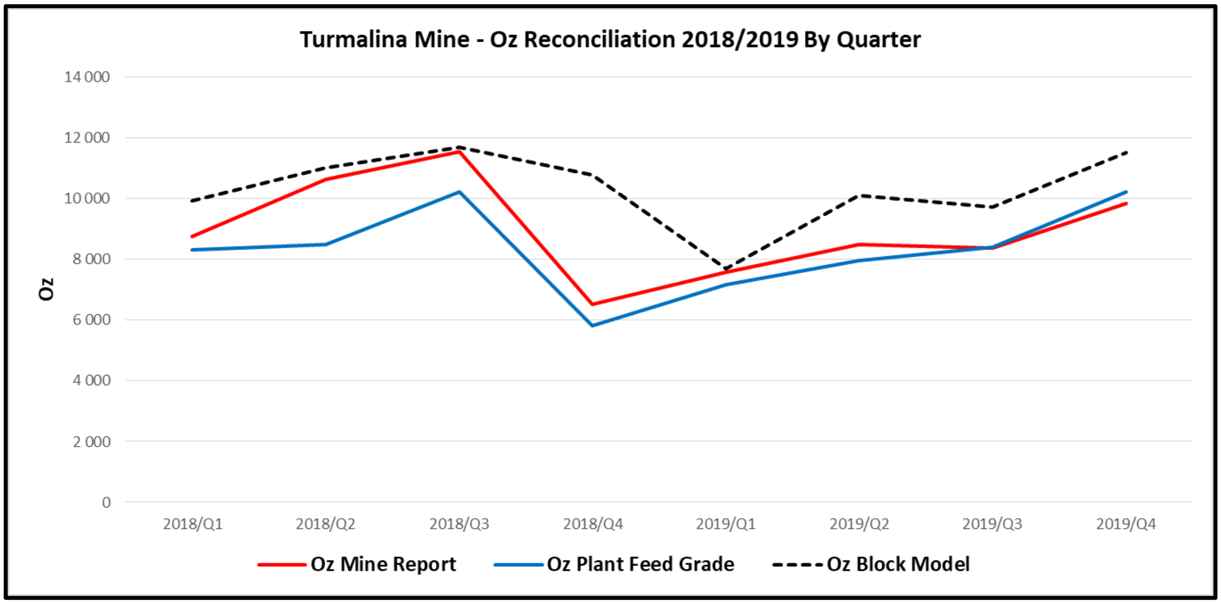
Validation exercises also consisted of comparing the revised block model estimated grades and tonnes against the 2018 and 2019 mine and plant production data on a quarterly basis (Table 14-14, Figure 14-19). In brief, the broken muck from the development headings and stopes is brought to surface and transported by truck to the stockpile area at the Turmalina plant. Samples are taken for each truck load to determine the grade of the material that was excavated from the mine. From the stockpile area, the broken muck is then fed into the plant.

The plant tonnages are derived from weightometer measurements on the feed belt and the plant feed grades are determined from direct sampling of material in the plant prior to the leaching circuit. The mine tonnages are derived from truck counts and the mine grade information is derived from stockpile samples. The trucks are tallied on a daily basis. Considering that the updated block model incorporated all drill hole and channel sample information up to December 16, 2019, this comparison is closer to an F2 (Mine to Plant) reconciliation as described in Parker (2004) because the resource model has data support equivalent to a grade control model.

TABLE 14-14 QUARTERLY PRODUCTION, 2018 AND 2019
Jaguar Mining Inc. – Turmalina Mine Complex

Period	Mine Report			Plant Feed Grade			Block Model		
	Tonnes	Grade (g/t Au)	Oz Au	Tonnes	Grade (g/t Au)	Oz Au	Tonnes	Grade (g/t Au)	Oz Au
2018/Q1	80,806	3.38	8,775	81,145	3.19	8,333	70,404	4.39	9,931
2018/Q2	76,538	4.33	10,650	77,227	3.42	8,501	72,181	4.75	11,029
2018/Q3	89,668	4.01	11,566	88,173	3.61	10,230	79,229	4.59	11,698
2018/Q4	57,195	3.55	6,523	58 130	3.11	5,813	70,646	4.75	10,787
2019/Q1	65,550	3.60	7,579	65,410	3.41	7,174	57,049	4.20	7,704
2019/Q2	77,045	3.42	8,484	75,362	3.29	7,980	76,370	4.12	10,127
2019/Q3	95,725	2.72	8,375	94,071	2.78	8,402	91,383	3.32	9,741
2019/Q4	94,733	3.24	9,862	98,945	3.22	10,240	92,013	3.90	11,528
Total, 2018	304 207	3.84	37 515	304 675	3.36	32 877	292 459	4.62	43 445
Total, 2019	333 054	3.20	34 300	333 788	3.15	33 796	316 815	3.84	39 100

FIGURE 14-19 2018 AND 2019 RECONCILIATION INFORMATION BY QUARTER, CONTAINED OUNCES

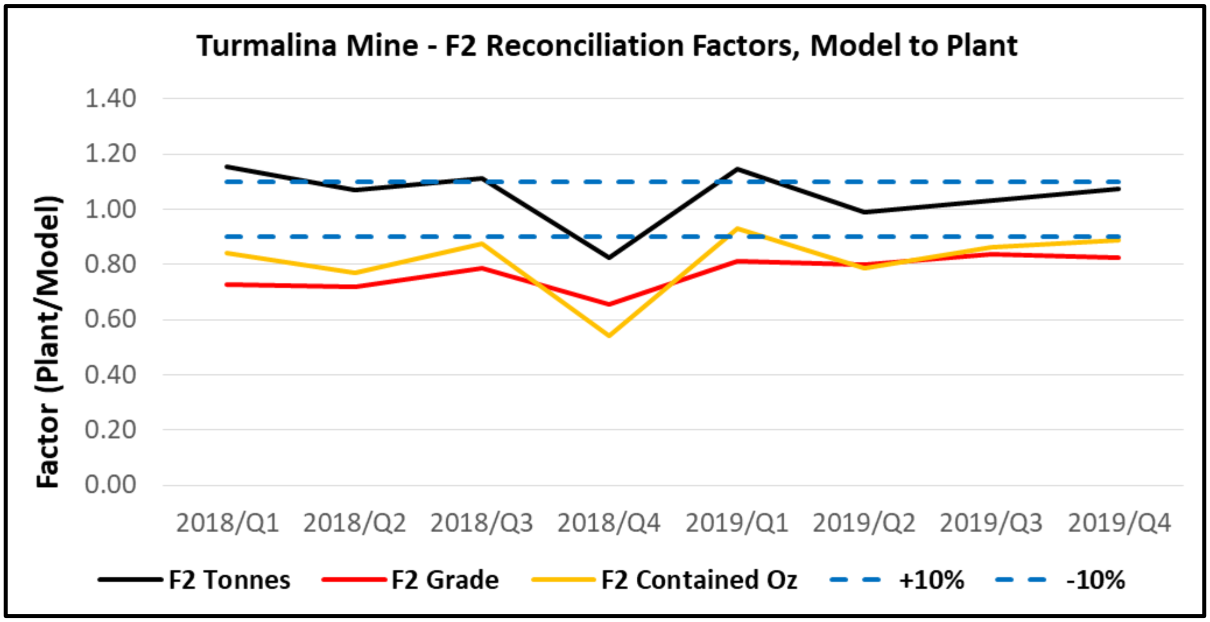


The monthly tonnage and grade figures derived from the year-end 2018-block model utilized the as-mined excavation solids models for the development and stopes completed in 2017 and 2019 to constrain the reports. The mined out volumes were created using data collected using a Cavity Monitoring Survey (CMS) and/or Total Station survey equipment. In a small number of cases, the shape and size of the excavated volumes could not be picked up due to equipment failures, timing, or safety issues. This is likely the main reason why the model tonnes are less than the mined tonnages in Table 14-14.

The grade of all blocks that are located outside of the mineralized wireframe models (ostensibly the waste materials) has been set to a value of zero for the 2019 block model. This approach will then result in the inclusion of all waste tonnes (both planned and unplanned dilution) along with the recovered ore tonnes. The data then represent the fully diluted, recovered tonnes and grade as predicted from the block model and so will be appropriate for comparison with plant feed grade. The quarterly F2 reconciliation results are presented in Figure 14-20.

In general terms, there is good agreement between the plant data and the block model for the 2017 and 2018 period. Jaguar is of the opinion that this agreement is suggesting that the sampling strategies, assaying methods, and estimation procedures currently used at the mine to prepare the grade block models are producing reasonable predictions of the tonnages, grades, and contained metal being received at the processing plant.

FIGURE 14-20 QUARTERLY F2 RECONCILIATION FACTORS, MODEL TO PLANT



The reconciliation information presented above utilizes the grade block model that was prepared using the drill hole and channel sample information that was available as of December 31, 2019. The estimated grades are then compared to the production information for the previous periods, thus allowing an analysis of the effectiveness of the sampling, assaying, and estimation protocols.

FIGURE 14-21 GOLD PRODUCTION BY QUARTER, 2019

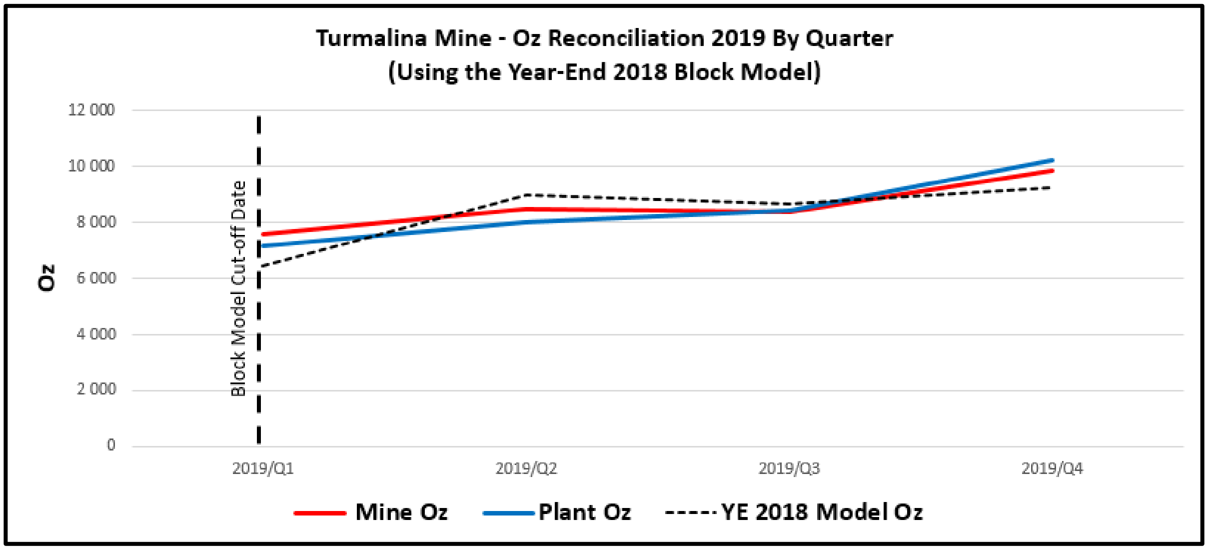
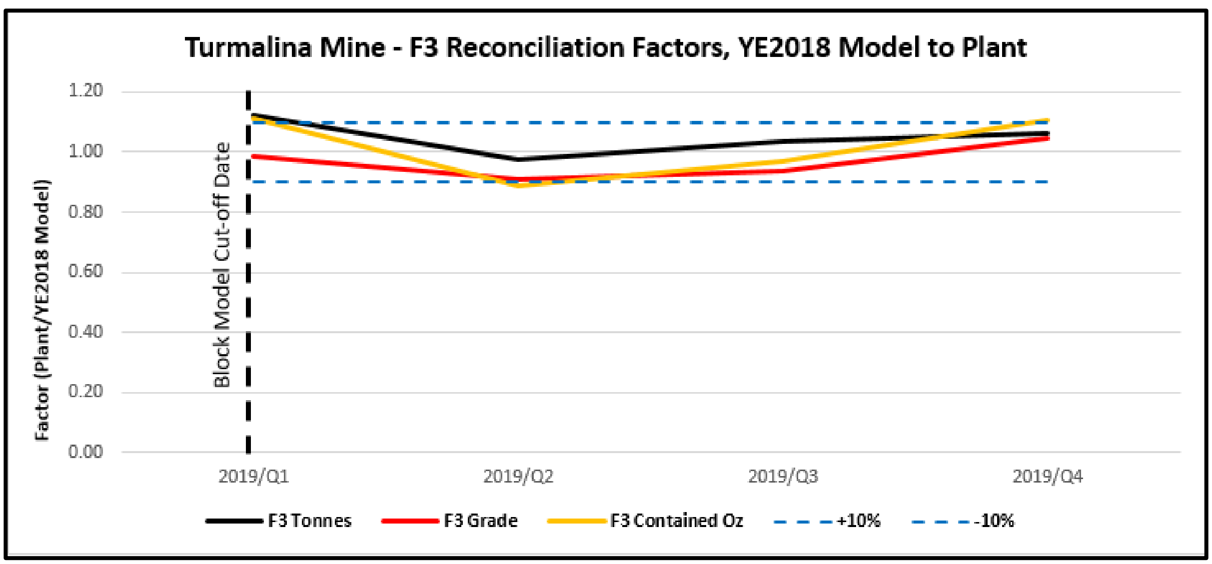


FIGURE 14-22 F3 RECONCILIATION FACTORS (YEAR-END 2018 MODEL TO PLANT)



MINERAL RESOURCE CLASSIFICATION CRITERIA

The Mineral Resources in this report were estimated in accordance with the definitions contained in CIM (2014).

The mineralized material for each wireframe was classified into the Measured, Indicated, or Inferred Mineral Resource category on the basis of the search ellipse ranges obtained from the variography study, the demonstrated continuity of the gold mineralization, the density of drill hole and chip sample information, and the presence of underground access.

On the basis of these criteria, Measured Mineral Resources comprise material that has been estimated using Pass #1 and that is located between developed levels. Indicated Mineral Resources comprise material that has been estimated using Pass #2, and Inferred Mineral Resources comprise material that has been estimated using Pass #3. Clipping polygons were used in a final stage of the classification process to ensure continuity and consistency of the classified blocks in the model.

CUT-OFF GRADE

A cut-off grade of 2.10 g/t Au is used for reporting of Mineral Resources at the Turmalina deposit. This cut-off grade was calculated using a gold price of US$1,500/oz, average gold recovery of 90%, and 2018 long-term cost data. Gold prices used for reserves are based on consensus, long term forecasts from banks, financial institutions, and other sources. For resources, gold prices used are slightly higher than those for reserves.

For the 2019 Mineral Resource estimate, Jaguar has used a cut-off grade of 0.50 g/t Au to prepare the interpreted outlines of the mineralized domains, which is below either the economic or incremental cut-off grades.

MINERAL RESOURCE ESTIMATE

The Mineral Resources are inclusive of Mineral Reserves. For those portions of the Mineral Resources that comprise the Mineral Reserve, the stope design wireframes were used to constrain the Mineral Resource reports.

Additional Mineral Resources are present that reside beyond the Mineral Reserves. For these areas, clipping polygons were prepared to aid in the estimation of the Mineral Resources. The clipping polygons were prepared in either plan or longitudinal views, as appropriate. The clipping polygons were drawn to include continuous volumes of blocks whose estimated grades were above the stated cut-off grade, and were not located in mined out areas. The clipping polygons were used to appropriately code the block model and report the Mineral Resources. The Mineral Resources are presented in Table 14-15 and are shown in Figure 14-23. It is important to note that the Mineral Resources include remnant material for those areas in the upper portions of the mine where potentially economic grade material has been left behind. These areas were scrutinized and evaluated for their potential of being recoverable prior to being categorized as Mineral Resources.

TABLE 14-15 SUMMARY OF MINERAL RESOURCES AS OF DECEMBER 31, 2019 – TURMALINA DEPOSIT
Jaguar Mining Inc. – Turmalina Mine Complex

Category	Tonnage (000)	Grade (g/t Au)	Contained Oz Au (000)
Orebody A:			
Measured	1,020	6.40	210
Indicated	473	5.90	90
Sub-total M&I	**1,493**	**6.24**	**300**
Inferred	364	4.65	54
Orebody B:			
Measured	353	3.34	38
Indicated	192	4.26	26
Sub-total M&I	**545**	**3.66**	**64**
Inferred	18	6.46	4
Orebody C:			
Measured	641	4.13	85
Indicated	1,548	4.33	215
Sub-total M&I	**2,189**	**4.27**	**301**
Inferred	1,436	4.10	189
Total Turmalina Deposit:			
Total, Measured	2,014	5.14	333
Total, Indicated	2,213	4.66	331
Total Measured & Indicated	**4,227**	**4.89**	**664**
Total, Inferred	1,818	4.23	248

Notes:
1. CIM (2014) definitions were followed for Mineral Resources.
2. Mineral Resources are inclusive of Mineral Reserves.

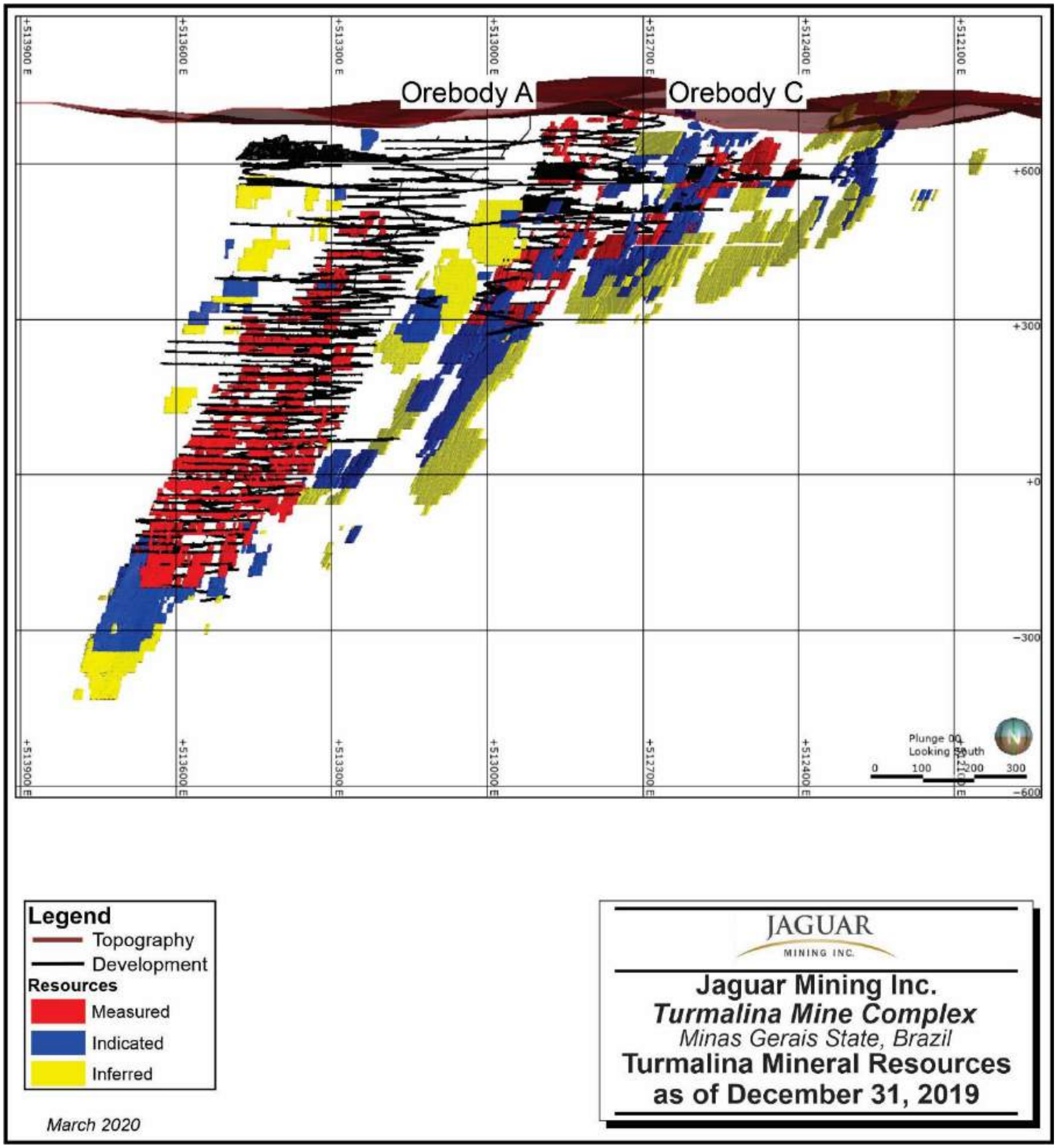
3. Mineral Resources are estimated at a cut-off grade of 2.1 g/t Au for the Turmalina deposit.
4. Mineral Resources include all drill hole and channel sample data and mining excavations as of December 31, 2018.
5. Mineral Resources are estimated using a long-term gold price of US$1,500 per ounce.
6. Mineral Resources are estimated using an average long-term foreign exchange rate of 3.70 Brazilian Reais: 1 US Dollar.
7. A minimum mining width of approximately two metres was used.
8. Bulk density is 2.83 t/m^3 for Orebodies A and B and 2.91 t/m^3 for Orebody C at the Turmalina deposit.
9. Gold grades are estimated by the ordinary kriging interpolation algorithm using capped composite samples.
10. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
11. Numbers may not add due to rounding.

Categories of Inferred, Indicated, and Measured Mineral Resources are recognized in order of increasing geological confidence.

Jaguar is not aware of any environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other factors that could materially affect the Mineral Resource estimates.

The Turmalina deposit Mineral Resource estimate was prepared in a professional and diligent manner by qualified professionals and that the estimate complies with CIM (2014).

FIGURE 14-23 TURMALINA DEPOSIT MINERAL RESOURCES AS OF DECEMBER 31, 2019



FAINA DEPOSIT

An updated Mineral Resource estimate for the Faina deposit was prepared in early 2015. A detailed description of the data and procedures to prepare the Mineral Resource estimate has been presented in RPA (2015). A summary of the salient items relating to that Mineral Resource estimate is presented below.

DATABASE

The drill hole database for the Faina deposit includes surface and underground drill holes along with surface trench and underground channel samples taken from the open pit and underground excavations, respectively. The drill hole and trench/channel sample data includes both historical-based samples collected by Mineração Morro Velho (MMV), a prior owner of the property, along with more recently completed drill holes and samples collected by Jaguar. In total, 3,992 diamond drill hole, chip, and trench samples were included in the drill hole database, along with a total of 47,667 assay records.

MINERALIZATION WIREFRAMES

The interpreted 3D wireframe models of the gold mineralization have been created using the assay values from surface and underground drill holes, channel sample data as available, and the detailed geological mapping information contained on the historical plan maps of the underground excavations. Wireframe models of the gold distribution were created using the Leapfrog Geo version 2.0.2 software package. The wireframe limits were drawn using a cut-off grade of 0.50 g/t Au and a nominal minimum width of 2.0 m.

A total of 39 individual wireframe models were created along a strike length of approximately 750 m and to a vertical depth of approximately 500 m from surface. In general, the wireframe models display a general northwest strike and plunge to the northeast at approximately 40°.

Wireframe surfaces were also created for oxidized and transitional weathering volumes using all available drill hole, channel, and trench sample information.

TOPOGRAPHY AND EXCAVATION MODELS

Two topography surfaces have been created that provide coverage over the area of the Faina deposit. The first surface represents the limit of open pit excavation, and was used to properly code the block model with the mined out volume. The second surface represents the current topography surface and accounts for the volume in the southeast portion of the mined out pit that was filled in with backfill material. The depth of the backfilled area is estimated at approximately 20 m.

A solid model of the underground excavation volume was created using existing centre-line survey data and a general arched cross section profile of 3 m x 3 m.

SAMPLE STATISTICS, GRADE CAPPING, AND COMPOSITES

The mineralization wireframe models were used to code the drill hole database and identify the resource-related samples. These samples were extracted from the database into their respective domains, and then subjected to statistical analyses by means of histograms, probability plots, capping curves, and decile analyses. A total of 12,419 samples were contained within the mineralized wireframes.

On the basis of its review of the assay statistics, Jaguar believes that a capping value of 30 g/t Au for channel samples and 25 g/t Au for drill hole samples is appropriate for each of the three domains at Faina - NW, Central, and SE.

The selection of an appropriate composite length began with examination of the descriptive statistics of the raw assay samples and preparation of frequency histograms. Consideration was also given to the size of the blocks in the model. On the basis of the available information, Jaguar believes that a composite length of one metre for all samples is reasonable. All samples contained within the mineralized wireframes were composited to a nominal one metre length using the best-fit function of the MineSight software package.

VARIOGRAPHY

Jaguar carried out an analysis of the spatial continuity by constructing separate omnidirectional variograms using the composites for each of the three domains, with the objective of determining an appropriate value for the global nugget (C0) using the MineSight software package. The analysis proceeded with the evaluation of any anisotropies that may be present in the data which resulted in successful variograms with reasonably good model fits for the down-plunge direction. Due to the spatial complexities inherent in the mineralized wireframe models, poor model fits were obtained for the along-strike and across-dip directions. A summary of the variography and interpolation parameters for the Faina deposit is presented in Table 14-16.

TABLE 14-16 SUMMARY OF VARIOGRAPHY AND INTERPOLATION PARAMETERS – FAINA DEPOSIT
Jaguar Mining Inc. – Turmalina Mine Complex

Item	NW Domain	Central Domain	SE Domain
Nugget (C0)	5.0	6.0	4.0
Sill, Major Axis (C1)	5.45 (40 m)	4.28 (30 m)	6.62 (65 m)
Model Type	Spherical	Spherical	Spherical
Orientation*	070/-50/15	60/-55/-45 & 60/-55/60	60/-50/-25
Anisotropy Ratio (Major/Semi-Major)	2.67	1.88	1.91
Anisotropy Ratio (Major/Minor)	6.67	6.0	3.61
Minimum Number of Samples	3	3	3
Maximum Number of Samples	8	8	8
Maximum Number of Samples per Hole	2	2	2
Maximum Number of Samples per Quadrant	2	2	2

BLOCK MODEL CONSTRUCTION

The block model was constructed using the MineSight version 7.60 software package and comprised an array of 2 m x 2 m x 2 m sized blocks using a partial percentage attribute. The model is oriented parallel to the coordinate grid system (i.e., no rotation or tilt). The selection of the block size for this model was based upon the block size employed at the mine.

Gold grades were estimated into the blocks by means of ID^2, ID^3, OK, and nearest neighbor (NN) interpolation algorithms. A total of four interpolation passes were carried out using distances derived from the variography results and the search ellipse parameters presented above. Pass #1 used search ellipses that were one-half of the variogram ranges, Pass #2 used search ellipses with the variogram ranges as defined, Pass #3 used twice the variogram ranges, and Pass #4 used four times the variogram ranges. A single search ellipse orientation was used for the NW Domain and SE Domain, however, two search ellipse orientations were used for the Central Domain due to the complex spatial geometry in this area. The number of samples per quadrant was relaxed from two to one for passes #3 and #4, and the maximum number of composites per hole was relaxed from two to one for pass #4.

In general, “hard” domain boundaries were used along the contacts of each of the 39 individual mineralized domain models. Only data contained within the respective individual wireframe model were allowed to be used to estimate the grades of the blocks within the wireframe in question, and only those blocks within the wireframe limits were allowed to receive grade estimates.

CUT-OFF GRADE

The conceptual operational scenarios considered during preparation of previous Mineral Resource estimates envisioned that the fresh, unoxidized mineralization from the Faina deposit would be excavated on a satellite deposit basis and transported by truck to the existing Turmalina plant for processing. Preliminary metallurgical tests have been completed on samples of fresh, unoxidized mineralization from the Faina deposit from that conceptual perspective. They have yielded unacceptably low recoveries when the material is considered as potential feed to the existing Turmalina plant, and it has been concluded that the mineralization at the Faina deposit is refractory. While the arsenical nature of the mineralization at Faina is suspected to play a role in the poor recoveries, Jaguar believes that the testwork completed to date has not definitively supported this conclusion.

An alternative conceptual operational scenario was developed for the 2015 Mineral Resources in which the mineralized material will be excavated by means of underground mining methods and transported to the Turmalina plant for processing. A gold-rich flotation concentrate is envisioned to be generated after appropriate upgrades have been made to the existing plant. The gold-rich flotation concentrate would then be shipped or sold to a domestic source for recovery of the gold.

Input parameters to the estimate of an appropriate reporting cut-off grade considered this revised conceptual operating scenario along with the potential mining methods that are suitable for the narrow widths, short strike-length lenses, and highly convoluted nature of the mineralized wireframes at the Faina deposit. Consideration was also given to the actual costs incurred at the Turmalina plant where appropriate.

A cut-off grade of 3.8 g/t Au is used for reporting of Mineral Resources. This cut-off grade was calculated using a gold price of US$1,400/oz, average gold recovery of 85% to flotation concentrate, 2014 actual cost data for the Turmalina Mine, along with estimated transportation and treatment charges. The gold prices used for resources are based on consensus, long term forecasts from banks, financial institutions, and other sources. Jaguar believes that the stated cut-off grade remains reasonable considering the relatively stable Mineral Resource cut-off grades at the Turmalina Mine between 2014 and 2018.

MINERAL RESOURCE ESTIMATE

At the Faina deposit, the Mineral Resources are dominated by fresh, unoxidized material, but also contain a small proportion of oxide- and transition-hosted weathered material.

At a cut-off grade of 3.8 g/t Au, the Mineral Resources at the Faina deposit total 261,000 tonnes at an average grade of 6.87 g/t Au containing 57,500 ounces of gold in the Measured and Indicated Mineral Resource category and 1,542,000 tonnes at an average grade of 7.3 g/t Au containing 360,200 ounces of gold in the Inferred Mineral Resource category (Table 14-17). Jaguar plans to revise the Mineral Resource estimate for the Faina deposit to reflect market and other related changes to the values of the cut-off grade input parameters.

No Mineral Reserves are present at the Faina deposit.

TABLE 14-17 SUMMARY OF MINERAL RESOURCES AS OF DECEMBER 31, 2014 – FAINA DEPOSIT

Jaguar Mining Inc. – Turmalina Mine Complex

Category	Tonnes (000)	Grade (g/t Au)	Contained Oz Au (000)
		Oxide	
Measured	11	6.81	2
Indicated	7	6.48	2
Sub-total M&I	**18**	**6.68**	**4**
Inferred	3	5.65	1
		Transition	
Measured	5	6.65	1
Indicated	3	6.20	1
Sub-total M&I	**8**	**6.48**	**2**
Inferred	2	6.30	0
		Fresh	
Measured	56	7.51	14
Indicated	179	6.85	39
Sub-total M&I	**235**	**6.88**	**52**
Inferred	1,537	7.27	359
		Total: Oxidized, Transition and Fresh	
Measured	72	7.39	17
Indicated	189	6.66	42
Sub-total M&I	**261**	**6.87**	**58**
Inferred	1,542	7.26	360

Notes:
1. CIM (2014) definitions were followed for Mineral Resources.
2. Mineral Resources are estimated at a cut-off grade of 3.8 g/t Au.
3. Mineral Resources are estimated using a long-term gold price of US$1,400 per ounce.
4. Mineral Resources are estimated using an average long-term foreign exchange rate of 2.5 Brazilian Reais: 1 US Dollar.
5. A minimum mining width of two metres was used.
6. Bulk density is 1.70 t/m^3 for oxidized material, 2.25 t/m^3 for transition, and 2.85 t/m^3 for fresh, un-weathered material.
7. Gold grades are estimated by the inverse distance cubed interpolation algorithm.
8. No Mineral Reserves exist for the Faina deposit.
9. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
10. Numbers may not add due to rounding.

PONTAL DEPOSIT

An updated Mineral Resource estimate for the Pontal deposit was prepared in early 2015. A detailed description of the data and procedures to prepare the Mineral Resource estimate has been presented in RPA (2015). A summary of the salient items relating to that Mineral Resource estimate is presented below.

DATABASE

The drill hole database for the Pontal deposit includes surface and underground drill holes along with surface trench samples and underground channel samples. The drill hole and trench/channel sample data includes both historical-based samples collected by MMV, a prior owner of the property, along with more recently collected samples taken by Jaguar. In total, 3,590 DDH, chip, and trench samples were included in the drill hole database, along with a total of 17,043 assay records.

MINERALIZATION WIREFRAMES

The interpreted 3D wireframe models of the gold mineralization have been created using the assay values from surface and underground drill holes, trench and channel sample data as available, and the detailed geological mapping information contained on the historical plan maps of the underground excavations. The gold values are hosted in two principal deposits known as LB1 and LB2.

Wireframe models of the gold distribution were updated using the MineSight v.7.60 software packages. The wireframe limits were drawn using a cut-off grade of 0.50 g/t Au and a nominal minimum width of 2.0 m. The wireframe models were clipped to the as-mined surface. A total of 16 individual wireframe models were created, including seven wireframes for the LB1 deposit and nine wireframes for the LB2 deposit.

In general, the LB1 wireframe models measure approximately 250 m x 250 m in plan view and continue downwards to a vertical depth of approximately 300 m from surface. The mineralization at the LB1 deposit has been traced by drilling along a dip of approximately -60° to the east.

The mineralization wireframes at the LB2 deposit display a general northwesterly strike of approximately 335° and have been traced by drill hole and trench sampling along a strike length of approximately 300 m. The wireframes generally dip at approximately -45° to the northeast and extend to a depth of approximately 100 m from surface.

Wireframe surfaces were also created for oxidized and transitional weathering volumes using all available drill hole, channel, and trench sample information.

TOPOGRAPHY AND EXCAVATION MODELS

Two topography surfaces were created that covered the local area of each of the two deposits using contour lines from available topography maps along with local spot heights derived from the locations of any drill hole or trench sample data.

An approximation of the underground excavations was created by digitizing the outlines in plan view from historical underground mapping and sampling programs carried out at the LB1 deposit. The digitized plan view strings were projected upwards by a constant distance of 2.5 m to create the solid model of the underground excavations. In total, two levels were excavated – the upper level was excavated at a toe elevation of approximately 609 m and the lower level was excavated at a toe elevation of approximately 603 m.

SAMPLE STATISTICS, GRADE CAPPING, AND COMPOSITES

The mineralization wireframe models were used to code the drill hole database and identify the resource-related samples. These samples were extracted from the database into their respective domains, and then subjected to statistical analyses by means of histograms, probability plots, capping curves, and decile analyses. A total of 6,569 samples were contained within the LB1 mineralized wireframes and a total of 1,308 samples were contained within the LB2 mineralized wireframes.

On the basis of its review of the assay statistics, Jaguar believes that a capping value of 30 g/t Au is appropriate for the LB1 wireframes and a capping value of 10 g/t Au is appropriate for the LB2 wireframes. The selection of an appropriate composite length began with examination of the descriptive statistics of the raw assay samples and preparation of frequency histograms. Consideration was also given to the size of the blocks in the model. On the basis of the available information, Jaguar believes that a composite length of one metre for all samples is reasonable. All samples contained within the mineralized wireframes were composited to a nominal one metre length using the best-fit function of the MineSight software package.

VARIOGRAPHY

Jaguar verified the analysis of the spatial continuity of the mineralization contained within the LB1 wireframe models as presented in Machado (2011) using the variography package contained in the SGeMS software package. Its work resulted in construction of a successful omnidirectional variogram using the composite data. The analysis proceeded with the evaluation of any anisotropies that may be present in the data which resulted in a successful variogram with reasonably good model fits for the down-plunge direction.

Unfortunately, no successful model fits were possible for the LB2 deposit due to the lack of sufficient sample pairs.

A summary of the variography and interpolation parameters for the two deposits is presented in Table 14-18.

TABLE 14-18 SUMMARY OF VARIOGRAPHY AND INTERPOLATION PARAMETERS – PONTAL DEPOSIT
Jaguar Mining Inc. – Turmalina Mine Complex

Item	LB1 Deposit	LB2 Deposit
Nugget (C0)	3.0	3.0
Sill, Major Axis (C1)	2.9 (90 m)	2.9 (30 m)
Model Type	Spherical	Spherical
Orientation*	115/-60/-15	0/0/0
Anisotropy Ratio (Major/Semi-Major)	2.37	1.0
Anisotropy Ratio (Major/Minor)	9.0	3.0
Minimum Number of Samples	3	3
Maximum Number of Samples	8	8
Maximum Number of Samples per Hole	2	2
Maximum Number of Samples per Quadrant	2	2

BLOCK MODEL CONSTRUCTION

The block model was constructed using the MineSight version 7.60 software package and comprised an array of 2 m x 2 m x 2 m sized blocks using a partial percentage attribute. The selection of the block size for this model was based upon the block size employed at the mine.

Gold grades were estimated into the blocks by means of ID^2, ID^3, OK, and NN interpolation algorithms. A total of four interpolation passes were carried out using distances derived from the variography results and the search ellipse parameters presented above. Pass #1 used search ellipses that were one-half of the variogram ranges, Pass #2 used search ellipses with the variogram ranges as defined, Pass #3 used twice the variogram ranges, and Pass #4 used four times the variogram ranges. The number of samples per quadrant was relaxed from two to one for passes #3 and #4, and the maximum number of composites per hole was relaxed from two to one for pass #4.

In general, “hard” domain boundaries were used along the contacts of each of the 16 individual mineralized domain models. Only data contained within the respective individual wireframe model were allowed to be used to estimate the grades of the blocks within the wireframe in question, and only those blocks within the wireframe limits were allowed to receive grade estimates.

CUT-OFF GRADE

The conceptual operational scenarios considered during preparation of previous Mineral Resource estimates envisioned that the fresh, unoxidized mineralization from the Pontal deposit would be excavated on a satellite deposit basis and transported by truck to the existing Turmalina plant for processing. Preliminary metallurgical tests have been completed on samples of fresh, unoxidized mineralization from the Pontal deposit from that conceptual perspective. They have yielded unacceptably low recoveries when the material is considered as potential feed to the existing Turmalina plant, and it has been concluded that the mineralization at the Pontal deposit is refractory. While the arsenical nature of the mineralization at Pontal is suspected to play a role in the poor recoveries, Jaguar believes that the testwork completed to date has not definitively supported this conclusion.

An alternative conceptual operational scenario was developed for the 2015 Mineral Resources in which the mineralized material will be excavated by means of underground mining methods and transported to the Turmalina plant for processing. A gold-rich flotation concentrate is envisioned to be generated after appropriate upgrades have been made to the existing plant. The gold-rich flotation concentrate would then be shipped or sold to a domestic source for recovery of the gold.

Input parameters to the estimate of an appropriate reporting cut-off grade considered this revised conceptual operating scenario along with the potential mining methods that are suitable for the mineralized wireframes at the Pontal deposit. Consideration was also given to the actual costs incurred at the Turmalina plant where appropriate.

A cut-off grade of 2.9 g/t Au is used for reporting of Mineral Resources. This cut-off grade was calculated using a gold price of US$1,400/oz, average gold recovery of 85% to flotation concentrate, 2014 actual cost data for the Turmalina Mine, along with estimated transportation and treatment charges. The gold prices used for resources are based on consensus, long term forecasts from banks, financial institutions, and other sources. Jaguar believes that the stated cut-off grade remains reasonable considering the relatively stable Mineral Resource cut-off grades at the Turmalina Mine between 2014 and 2018.

MINERAL RESOURCE ESTIMATE

The Mineral Resources are dominated by fresh, unoxidized material, but also contain a small proportion of oxide- and transition-hosted weathered material.

At a cut-off grade of 2.9 g/t Au, the Mineral Resources at the Pontal deposit total 410,000 tonnes at an average grade of 4.72 g/t Au containing 62,200 ounces of gold in the Measured and Indicated Resource category and 130,000 tonnes at an average grade of 5.0 g/t Au containing 21,000 ounces of gold in the Inferred Mineral Resource category (Table 14-19). Jaguar plans to review the Mineral Resource estimate for the Pontal deposit if any material changes occur to the values of the cut-off grade input parameters.

No Mineral Reserves are present at the Pontal deposit.

TABLE 14-19 SUMMARY OF MINERAL RESOURCES AS OF DECEMBER 31, 2014 - PONTAL DEPOSIT
Jaguar Mining Inc. – Turmalina Mine Complex

Category	Tonnes (000)	Grade (g/t Au)	Contained Oz Au (000)
Oxide			
Measured	30	4.13	4
Indicated	1	3.41	0
Sub-total M&I	**31**	**4.11**	**4**
Inferred	9	6.24	2
Transition			
Measured	9	4.33	1
Indicated	2	3.34	0
Sub-total M&I	**11**	**4.17**	**1**
Inferred	2	7.28	1
Fresh			
Measured	212	5.16	35
Indicated	157	4.29	22
Sub-total M&I	**369**	**4.79**	**57**
Inferred	119	4.89	19
Total: Oxidized, Transition and Fresh			
Measured	251	5.00	40
Indicated	159	4.28	22
Sub-total M&I	**410**	**4.72**	**62**
Inferred	130	5.03	21

Notes:

1. CIM definitions were followed for Mineral Resources.
2. Mineral Resources are estimated at a cut-off grade of 2.9 g/t Au.
3. Mineral Resources are estimated using a long-term gold price of US$1,400 per ounce.
4. Mineral Resources are estimated using an average long-term foreign exchange rate of 2.5 Brazilian Reais: 1 US Dollar.
5. A minimum mining width of approximately two metres was used.
6. Bulk density is 1.46 t/m^3 or 1.52 t/m^3 for oxidized material, 2.24 t/m^3 or 2.28 t/m^3 for transition, and 2.73 t/m^3 for fresh, un-weathered material.
7. Gold grades are estimated by the inverse distance cubed interpolation algorithm.
8. No Mineral Reserves exist for the Pontal deposit.
9. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
10. Numbers may not add due to rounding.

15 MINERAL RESERVE ESTIMATE

SUMMARY

Table 15-1 summarizes the Mineral Reserves as of December 31, 2019 based on a US$1,300/oz gold price for the Turmalina Mine. Mineral Reserves are based on the Mineral Resources, mine designs, and external factors.

TABLE 15-1 MINERAL RESERVE ESTIMATE – DECEMBER 31, 2019
Jaguar Mining Inc. – Turmalina Mine Complex

Orebody	Proven Reserves			Probable Reserves			Proven and Probable Reserves		
	ROM (000 t)	Grade (g/t Au)	Oz Au (000)	ROM (000 t)	Grade (g/t Au)	Oz Au (000)	ROM (000 t)	Grade (g/t Au)	Oz Au (000)
Orebody A	408	5.75	75	398	4.91	63	806	5.34	138
Orebody C	347	3.85	43	1,244	3.77	151	1,591	3.79	194
Total	**755**	**4.88**	**118**	**1,642**	**4.04**	**213**	**2,397**	**4.31**	**332**

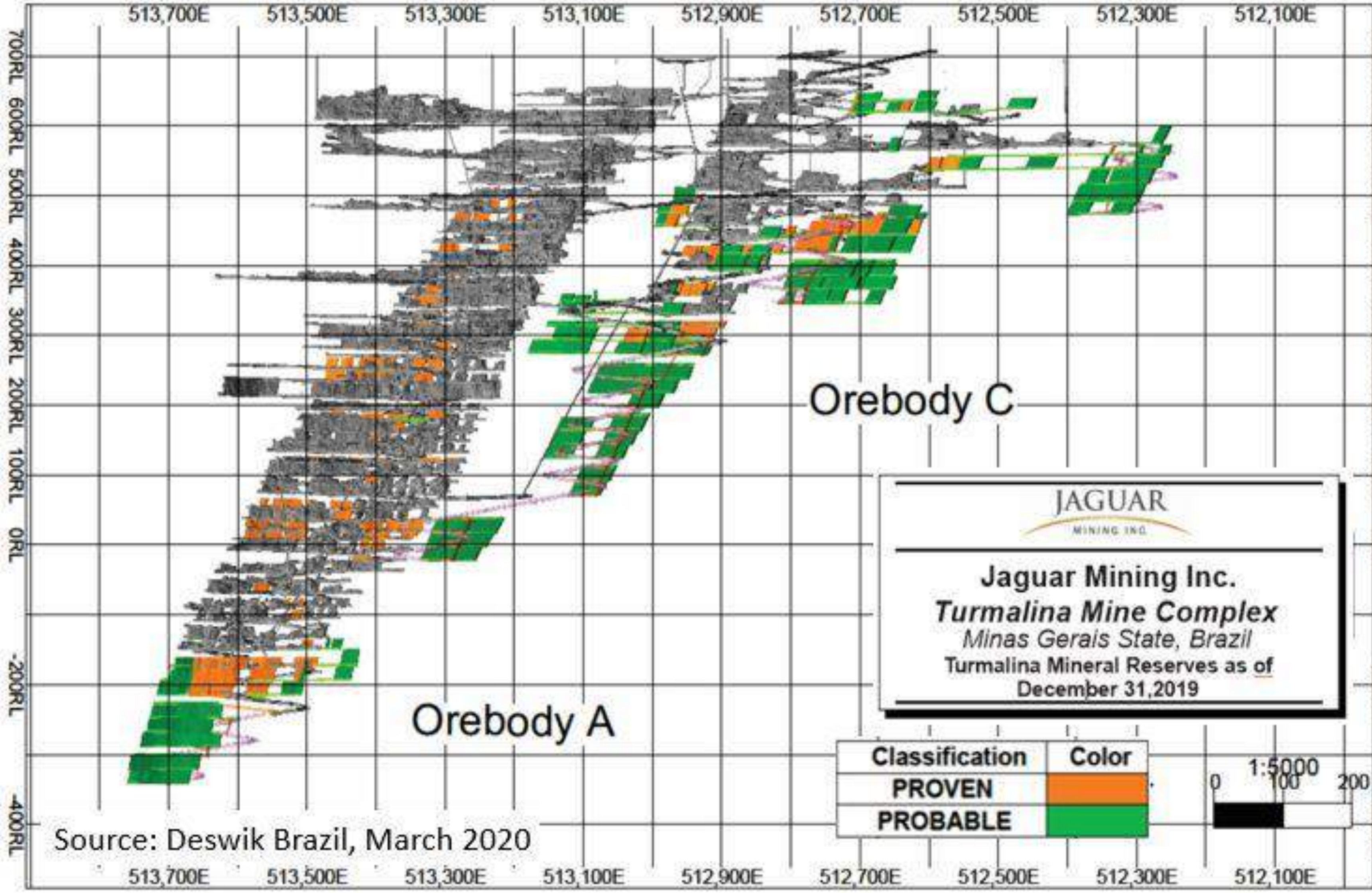
Notes:
1. CIM (2014) definitions were followed for Mineral Reserves.
2. Mineral Reserves were estimated at a break-even cut-off grade of 2.5 g/t Au, an incremental cut-off grade of 1.4 g/t Au.
3. Mineral Reserves are estimated using an average long-term gold price of US$1,300 per ounce, and an exchange rate of 3.70 Brazilian Reais: 1 US Dollar.
4. A minimum mining width of 2.4 m was used.
5. Bulk density is 2.83 t/m^3 for Orebodies A and B and 2.91 t/m^3 for Orebody C at the Turmalina Mine.
6. Numbers may not add due to rounding.

The Mineral Reserves consist of selected portions of the Measured and Indicated Mineral Resources that are within designed stopes and associated development. Deswik Brazil was responsible for the mine design and are of the opinion that the Turmalina Mineral Reserve estimates comply with CIM (2014) definitions.

Deswik Brasil is not aware of any mining, metallurgical, infrastructure, permitting, or other relevant factors that could material affect the Mineral Reserve estimate.

The Mineral Reserves are illustrated in Figure 15-1.

FIGURE 15-1 TURMALINA MINERAL RESERVES AS OF DECEMBER 31, 2019 (LOOKING TO AZIMUTH 180°)



DILUTION AND EXTRACTION

Dilution is addressed extending 0.5 m for both hanging wall and footwall beyond the resource wireframe. Mining shapes are designed to be operationally achievable and respect minimum mining widths.

Total dilution included in Reserves averages 14%.

Extraction (mining recovery) is assumed to be 95% for most stopes, 90% for blind stopes and remnant areas, 50% for rib pillars and 100% for development.

CUT-OFF GRADE

A break-even cut-off grade of 2.5 g/t Au was estimated for Mineral Reserves, using a gold price of US$1,300/oz, an average gold recovery of 90%, and 2018 cost data for the Turmalina Mine. Gold prices used for Mineral Reserves are based on consensus, long term forecasts from banks, financial institutions, and other sources.

Cost data was converted into US dollars, using an exchange rate of 3.70 BRL to the US dollar. The majority of the Turmalina costs are denominated in BRL. An operating cost of US$ 92 per tonne was used for the cut-off grade calculation.

TABLE 15-3 CUT OFF GRADE DATA
Jaguar Mining Inc. – Turmalina Mine Complex

Item	Value (US$)
Mining	39.5
Processing	24.1
G&A	21.8
Refinery	0.2
Royalties	6.2
TOTAL	**91.7**

The minimum cut-off grade that defines boundary material which should be mined is the mine cut-off grade, and is estimated using the following formula:

$$\text{COG} = \frac{Mining\ Cost + Processing\ Cost + G\&A\ Cost}{Au\ Recovery \times (Au\ Price - Selling\ Costs)}$$

Based on these numbers, a cut-off grade of 2.5 g/t was used for stope optimization. An incremental cut-off grade of 1.40 g/t Au was estimated using variable costs only, and is applied for development and stopes in which the infrastructure to access it is already in place. Although the cost data available from Turmalina is not easily categorized, unit mining costs vary between Orebody A and C, given significant differences between mining widths, production rates, ground conditions, and haul distances. The mill has excess production capacity, not otherwise put to use.

16 MINING METHODS

The Turmalina Mine consists of a number of zones grouped into three orebodies – Orebodies A, B, and C. Two satellite deposits, Faina and Pontal, are located along strike to the northwest. At present the mine produces 1,200 tpd from orebodies A and C.

The main production of the mine has been from Orebody A, which is folded, steeply east dipping, with a strike length of approximately 250 m to 300 m, and an average thickness of six metres. Mineralization has been outlined to depths of 900 m below surface. The southern portion of Orebody A is composed of two parallel narrow veins. The northern portion of Orebody A is much the same as the southern portion, however, the two parallel zones nearly, or completely, merge and therefore the north zone is much wider overall (up to 10 m).

Orebody B includes three thinner, lower grade lenses parallel to Orebody A. Two of the lenses are located approximately 50 m to 75 m to the east in the hanging wall and are accessed by a series of cross-cuts that are driven from Orebody A. The mineralization in this deposit has been outlined along a strike length of approximately 350 m to 400 m and to depths of 900 m below surface. Orebody B is narrow along its entire strike length. No mining is currently carried out in Orebody B.

Orebody C is a series of 26 lenses that are located to the southwest in the structural footwall of Orebody A and are generally of lower grade. They strike northwest and dip steeply to the northeast. A minor amount of production has been achieved from these lenses to date. The mineralization in this deposit has been outlined along a strike length of approximately 800 m to 850 m and to depths of 700 m to 750 m below surface.

Figures 16-1 and 16-2 show mining in Orebodies A and C, respectively. No mining is currently carried out in Orebody B.

FIGURE 16-1 ISOMETRIC VIEW OF OREBODY A (LOOKING TO AZIMUTH 180°)

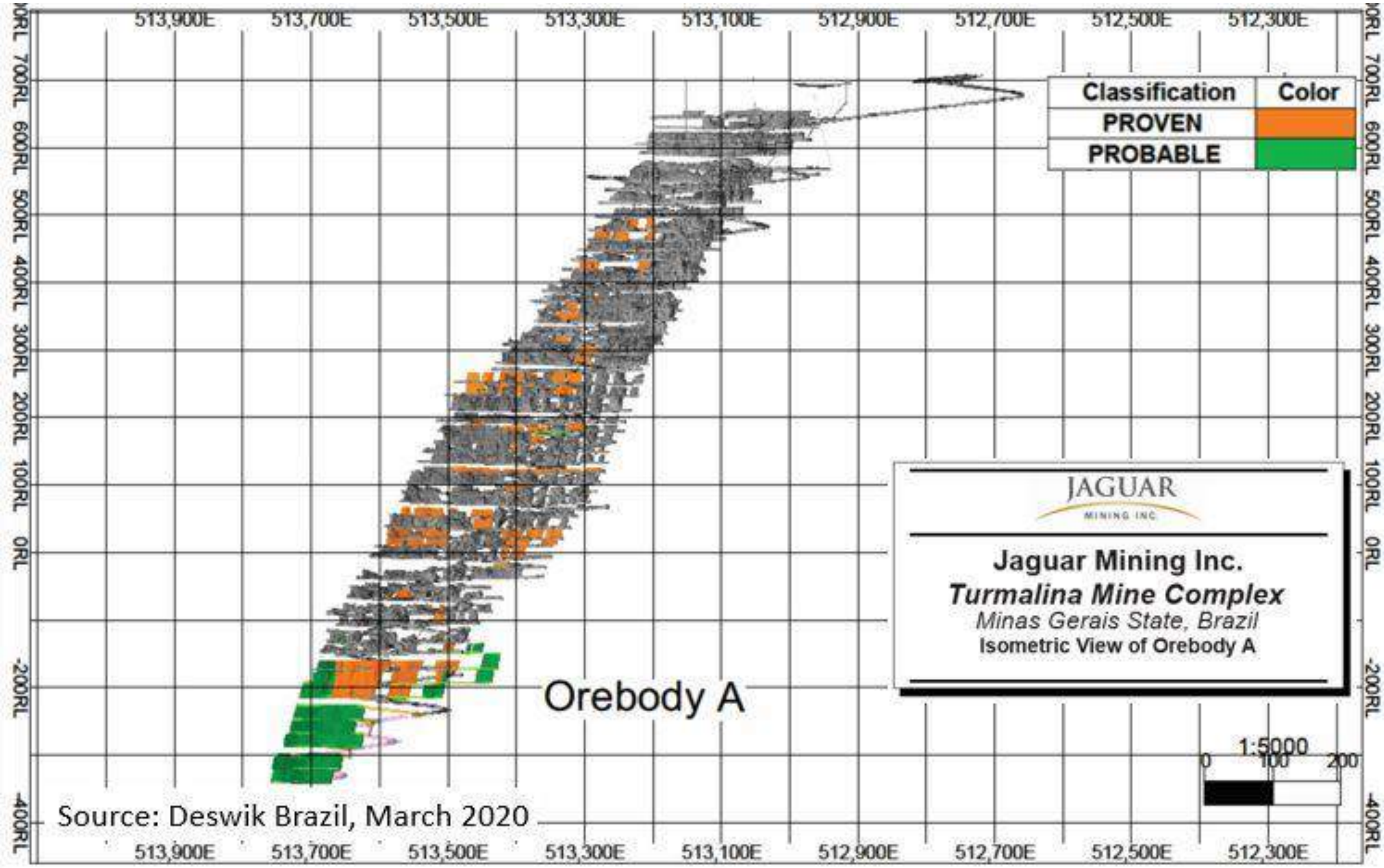
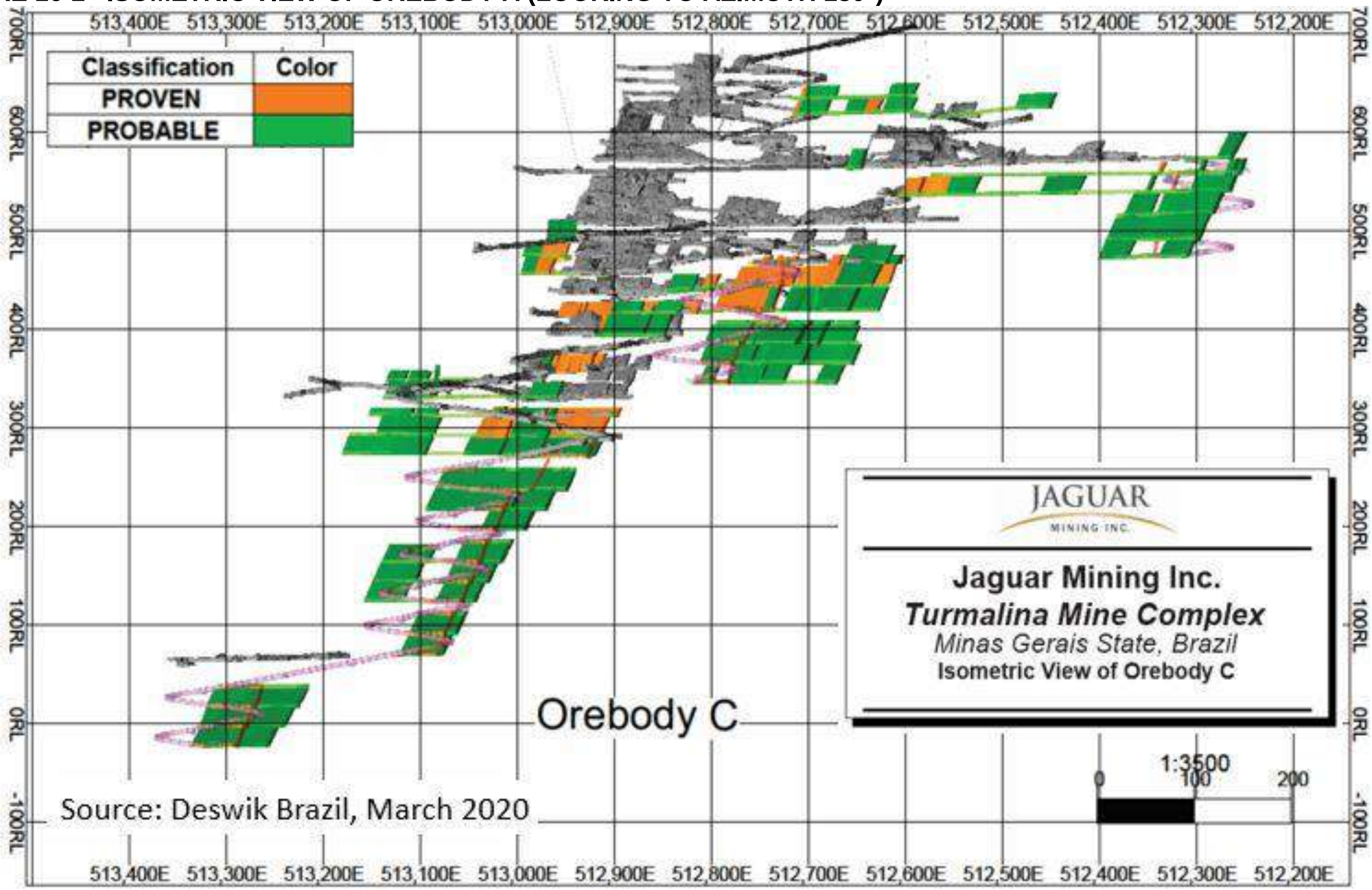


FIGURE 16-2 ISOMETRIC VIEW OF OREBODY A (LOOKING TO AZIMUTH 180°)



MINING METHOD

The mining method currently in use is sublevel stoping with delayed backfill producing 1,200 tpd. Backfill consists of cemented rock fill, or a paste fill product prepared from detoxified CIP tailings in a plant located near the mill. Ore is hauled to surface using trucks via a ramping system for Orebodies A and C.

Ventilation for the mine is a pull system. Air is drawn down the haulage ramps and is exhausted via 3 vent raises . The levels are ventilated using auxiliary ventilation fans and ducting.

Pumping water out of the mine is done using centrifugal pumps. The water is pumped level to level and then to surface.

The mine is accessed from a 5 m by 5.5 m primary decline located in the footwall of Orebody A, and a ramp system for Orebody C. The Orebody A ramp portal is located at an elevation of 695 m. The mine is divided into levels with Level 01 established at an elevation of 626 MASL. The upper levels had 5 sublevels spaced at 20 vertical meters. Levels were mined from the bottom to the top sublevel. The sublevel stopes were mined from the ends retreating to the access. Adjacent stopes were separated by rib pillars. Backfill was either waste rock or paste. A sill pillar was left between levels.

Currently, levels are divided into three sublevels, spaced 20 m apart vertically, that are driven from the main ramp.

At each level and sublevel, drifts are developed in the mineralized zone to expose the hanging wall contacts. The drift is extended in both directions along strike, under geological control for alignment. The hanging wall is supported with cable bolts before stoping begins. In areas where the orebody is less than 5 meters thick, both the hanging wall and footwall are exposed, mapped, and channel sampled as development advances. The minimum width of the ore development is 4 meters to accommodate the equipment while reducing dilution. In areas where the orebody is greater than 5 meters thick, the drift is driven at 4.5 meters wide and the hanging wall is delineated with short diamond drill holes drilled with a small mobile drill. The ore development is then widened (drilled and blasted) to follow the foot wall contact prior to stoping, except in the Principal Zone of Orebody A which is explained below.

The Principal Zone of Orebody A is where the 2 ore structures to the south-east merge into 1 structure to the north-west. The Principal Zone of Orebody A is 50 to 60 meters along strike, is from 7 to over 20 meters wide and generally has the highest ore grades (7 to +10 g/t). The Principal Zone contains the majority of Orebody A gold production. Orebody A is accessed from the A Ramp. The access drive splits to access on both ends of the Principal Zone. The stoping sequence is shown in Figure 16-3. The mining method uses a modified transverse stoping method. Transverse development from the initial hanging wall ore drive to the footwall is done 1 stope at a time. This limits the stope hanging wall span to 25 meters along strike and 30 meters high for a hydraulic radius of <7. The stope is designed to maintain a stable hanging wall span. The footwall is more stable. The stope back (roof) span is lower since the distance from HW to FW is less than the 30 M stope height. The stope sequence mines 1 vertical column of stopes from the lower to upper sill pillars to create a central paste fill pillar (stopes 1, 2, and 3 in Figure 16-3) before mining the stopes on either side. The central paste fill pillar stabilizes the area while mining the remaining stopes. The paste fill product is prepared from detoxified CIP tailings in a shear mixer and batch plant located near the mill. The remaining stopes (stopes 4 to 15 in Figure 3) are mined in a retreat sequence to the access drifts on each end of the Principal Zone. The remaining stopes can use paste fill or rock fill. Partial rib pillars (island pillars) are left between rock filled stopes to limit the span. The size of the partial rib pillars and thickness of the sill pillars are determined with geotechnical modelling.

A longitudinal retreat mining sequence (Figure 16-4) is used for the remainder of Orebody A on both ends of the Principal Zone and for Orebody C. Sublevels are spaced at 20 meters vertically with normally 3 sublevels between sill pillars. Stopes are nominally 40 meters along strike between partial rib pillars but are modified to fit the geometry of ore grade zone and by geotechnical modeling. The size of partial rib pillars and sill pillars are designed based on stope specific geotechnical modeling and local ore thickness. Partial rib pillars limit the stope span, and prevent backfill dilution. Rock backfill is normally used, however, paste fill is available if justified to eliminate ore remaining in pillars or justified by geotechnical modelling.

Turmalina has multiple independent scheduling areas at a time to enable the 400 kt/yr ore production scheduled. Orebody A can have up to 4 independent scheduling areas on 1 level with the Principal Zone, 2 structures to the southeast, and 1 structure to the northwest of the Principal Zone. The C-South East zone can have 2 scheduling areas with 1 on each side of the center access drift. The C-Central Zone adds 1 scheduling area with the access from the end.

FIGURE 16-3 SCHEMATIC SEQUENCE FOR PRINCIPAL ZONE OREBODY A

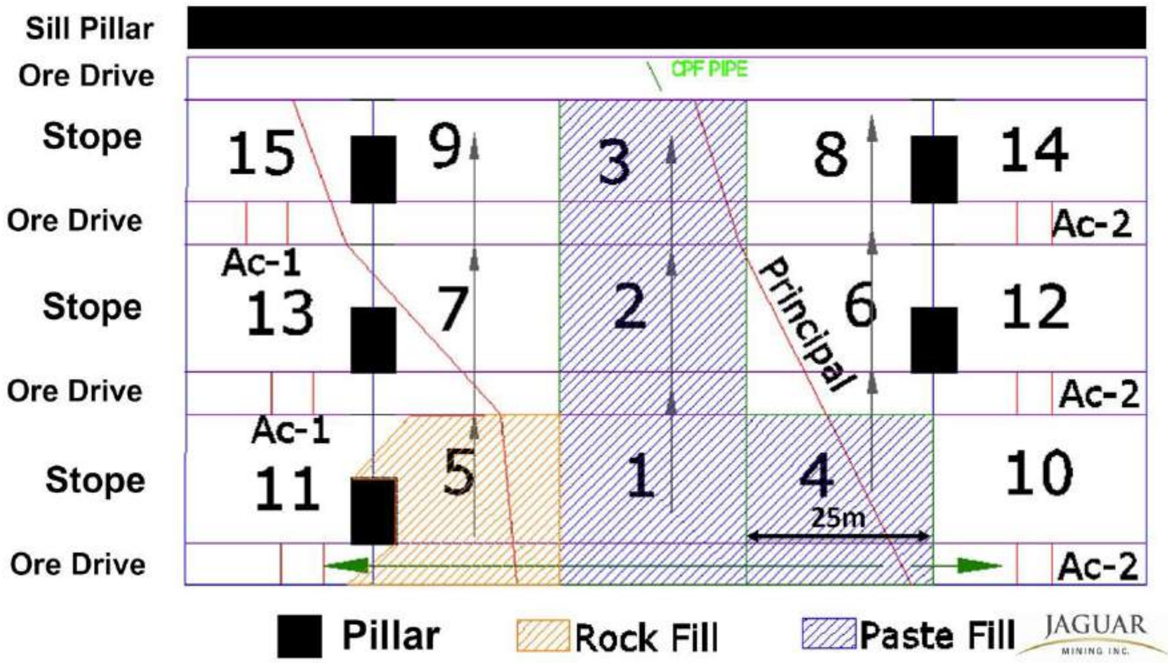
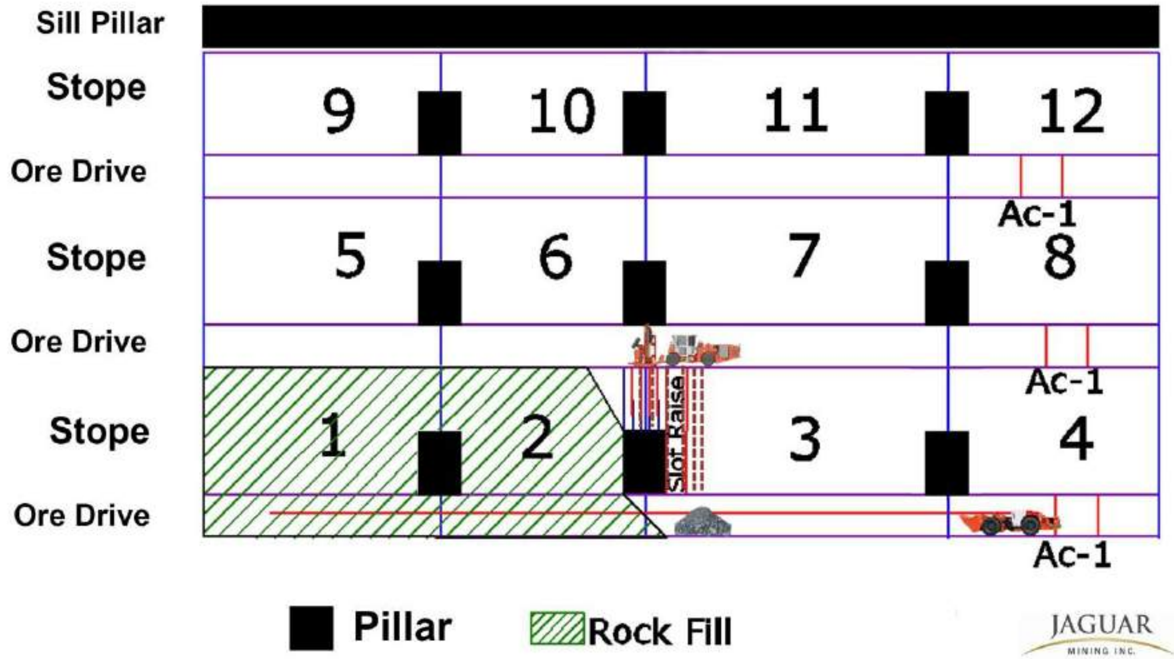


FIGURE 16-4 SCHEMATIC LONGITUDINAL RETREAT STOPE SEQUENCE



Although mining of Orebody B is not in the LOMP, and this orebody is no longer included in Mineral Reserves, future access is possible, either by mining through cemented paste fill and supporting appropriately, or by mining concurrently with the thinner ends of Orebody A.

GEOMECHANICS

Ground conditions were observed by Jaguar to be good. The main decline, portions of which were developed up to ten years ago, did not exhibit any roof or wall deterioration. Primary support in the mine is provided by the use of Swellex, grouted rebar, and, in the wider areas, grouted cable bolts. In areas of friable ground, split-sets are used to hold welded-wire mesh in place.

In late 2017, there was a ground failure on Level 9 (sublevel 0) of the mine that shut down the surrounding levels. The factors of the failure can be attributed to lack of timely placement of backfill. Jaguar hired full time ground control engineers to work at the mines. They have since modelled in situ and induced stresses using 2D and 3D software to determine effective stope, pillar and drift designs. Additional changes include more effective cable bolt designs for stopes and drifts, use of cemented paste backfill, improved sequencing and scheduling of stope production and backfill, ground support QA/QC testing, and CMS surveys of stopes. The methodology for this analysis can be found in the report “Geotechnical properties of Turmalina Mine”, 2018, by Jaime A. Corredor H (Corredor H., 2018).

MINING EQUIPMENT

Development is completed using two-boom electric-hydraulic jumbos and six cubic yard load-haul-dump (LHD) units. In order to create adequate working space for the equipment, minimum widths of four metres must be maintained, causing significant dilution in areas where the orebodies are narrow. Two single-boom jumbos are used for the installation of ground support.

Drilling of the production holes and cable bolt holes is completed using a fleet of four Atlas Copco Simba longhole drills .

Development and stope mucking is completed using a fleet of seven LHD units, 10 t to 14 t capacity, (one ST14 and six ST1030 units), with development waste hauled to stopes or remuck areas.

Primary development on the main ramp is outsourced to Toniollo Busnello SA (TBSA).

Ore haulage to surface is by a fleet of seven Volvo 30 t off-highway surface trucks.

LIFE OF MINE PLAN

Stope and development designs, and production scheduling were carried out by Deswik Brazil using the Deswik mine design software. Mined out stopes and existing tunnels as of December 31, 2019 were supplied by Jaguar, to deplete them from the current mining plan.

The production schedule is summarized in Table 16-1 and covers a mine life of six years based on Mineral Reserves.

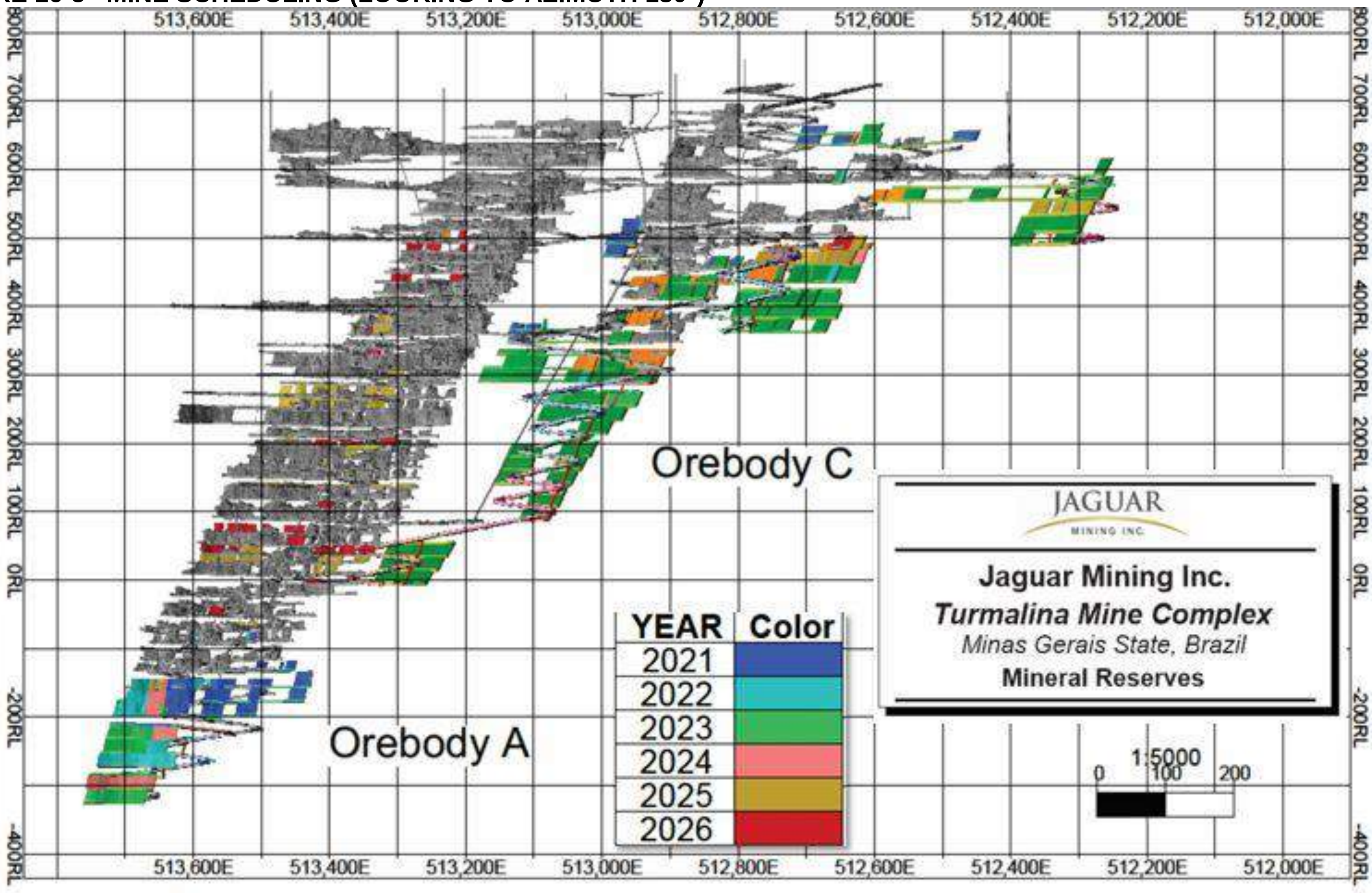
TABLE 16-1 LOMP PRODUCTION SCHEDULE

Jaguar Mining Inc. – Turmalina Mine Complex

Item	Units	2020	2021	2022	2023	2024	2025	Total
Total Mill Feed	Tonnes (000)	400	399	399	399	399	400	**2,397**
	g/t Au	4.32	4.33	4.33	4.33	4.33	4.21	**4.31**
Development	m	8,362	5,000	4,000	2,943	1,599	39	**21,944**
Recovery	%	90%	90%	90%	90%	90%	90%	**90%**
Gold Produced	Ounces (000)	**50**	**50**	**50**	**50**	**50**	**49**	**299**

Scheduling is based on productivities achieved in the current operation. Development was limited to 60 m per month on the main ramp, 40 m per month on the ore drives and 50 m per month on any single heading elsewhere. Stope scheduling is based on retreat mining and includes delays for backfilling and cement curing. Remnant areas were left to be mined at the end of the LOM. Figure 16-5 shows the mine sequence colored by year.

FIGURE 16-5 MINE SCHEDULING (LOOKING TO AZIMUTH 180°)



17 RECOVERY METHODS

The plant has a nominal processing capacity of 2,000 dmt per day, or 720,000 dmt per year. Since inception, the plant has been achieving annual overall recoveries of between 87% and 92%. The process flowsheet includes two-stage crushing and screening to minus 9.5 mm (-3/8 inches), primary grinding, thickening, cyanide leaching, CIP, elution, electrowinning, and smelting. The tailings are conveyed to a detoxification unit for arsenic removal and cyanide destruction, and then are pumped to the paste fill plant to be used either for mine backfill or deposited on a purpose-built dry-stack storage area. Process tailings have also been stored in completed open pits on the mine site (Figure 17-1).

A process control system has been established at the supervisory level via a conventional programmable logic controller (PLC) system. It is based on a process control philosophy that is compatible to harbor an online optimizing system (Advanced Control System, or ACS) in the future. The ACS entails both Expert and AI-based levels, the highest objective function being throughput. PIMS, LIMS, and MES Corporate Systems are also envisioned to be implemented when appropriate. The control room is located close to the hydrometallurgical plant. Three dedicated PLCs control the crushing and screening plant, the thickener, grinding plant, hydrometallurgical plant, the paste fill plant, and the Detox plant.

The current flowsheet is shown in Figure 17-2 and is described below. A summary of the mill production history and recovery has been presented in Table 6-1 in Section 6 of this report.

CRUSHING AND SCREENING

Ore produced at the Turmalina Mine is transported to the adjacent CIL processing plant.

ROM material is stored in a surge pile and fed to the primary jaw crusher using a front end loader at a nominal rate of 140 tonnes per hour (tph). The crushing plant has a design capacity of 180 tph (3700 tonnes/day at 85% operating time). Oversized material is managed with a grizzly and rock breaker. The primary crusher product is fed to secondary cone crushers. The final product, minus 9.5 mm (-3/8 inches), is stored in a grinding plant surge bin. The fine ore storage bin allows the crushing plant to operates only the number of hours/day to satisfy daily mine tonnage available to conserve energy and costs while the grinding and CIP circuit runs continuously.

GRINDING, CLASSIFICATION AND THICKENING

The Turmalina plant has been operating 1 of 3 installed ball mills since 2017 to conserve energy and reduce costs. The Number 3 ball mill with a capacity of 70 tonnes/hour (1500 tonnes/day at 92% operating time) has more than sufficient capacity for current and planned mined ore tonnage of 1100 tonnes/day.

The first ball mill is 3.2 m x 4.7 m (10.5 ft x 15.5 ft) in size with a maximum capacity of 25 tph and is operated by a 745 kW (1,000 HP) motor. The second mill is 3.8 m x 5.5 m (12.5 ft x 18 ft) in size with a maximum capacity of 60 tph and is operated with a 1,342 kW (1,800 HP) motor. The third mill is 4 m x 6.6 m (13 ft x 21.8 ft) in size with a maximum capacity of 70 tph and is operated by a 1,491 kW (2,000 HP) motor. The Turmalina combined grinding capacity of all 3 mills of 3,400 tonnes/day (at 92% operating time) could facilitate a production expansion if warranted by future exploration success.

The feed grade to the grinding mills is determined by sampling with an automatic sampler. Material is fed from the surge bin to the grinding circuit. Lead nitrate [$Pb(NO_3)_2$] is added at a rate of 50 g/t in the grinding feeds in order to avoid excessive NaCN consumption by the formation of thiocyanides (SCN), ferrocyanides $(Fe(CN)_6)^{4-}$, and ferricyanides $(Fe(CN)_6)^{3-}$.

The milling products are sized with cyclones to 80% passing 200 mesh (P_{80} = 200 mesh), with the overflow passing on to the thickener and the underflow recycled. The grinding circuit is automated.

The secondary cyclone overflow stream is fed to a 30.5m (100 ft) thickener where flocculants are added to optimize the settling cycle of the pulp. The thickener underflow, 53% solids by weight, is pumped to the pulp conditioning system of the CIP plant, which is instrumented to maintain the pulp at a density of approximately 48% to 50%, by weight, solids. The water addition flow rate is monitored and controlled by a magnetic flow meter and pulp densitometer. The thickener overflow is directed to the process water tank as make-up water.

During 2019, the plant processed approximately 334,000 tonnes at an average grade of 3.15 g/t Au compared to 322,000 tonnes at 3.44 g/t Au in 2018. Overall, the processing plant recovery was 89,9 % in 2019, which is slightly lower than the 90,7% recovery rate for 2018.

LEACHING CIRCUIT

The leaching circuit consists of seven agitation tanks. Lime is added to the first tank to adjust the pH. Cyanidation begins in the first tank with the addition of sodium cyanide (NaCN). Lead nitrate is also added in the grinding circuit to control excessive NaCN consumption. Compressed air is injected in the bottom of all the tanks at a rate of 2,000 cfm and at a pressure of 3.5 kg/cm^2, as the process consumes large amounts of oxygen. The residence time in the leaching circuit is approximately 25 hrs.

ADSORPTION CIRCUIT

The adsorption circuit is a conventional CIP circuit. The gold-bearing pulp passes through five adsorption tanks arranged in series. Activated carbon with a size range of 8 mesh to 16 mesh and a minimum pulp concentration of 20 g/L is added to the last in the series of tanks, and is pumped in the opposite direction from the sludge flow. Thus, the carbon adsorbs the gold from the pulp as the process continues. When the adsorption cycle is completed, in approximately ten hours, the loaded carbon, containing approximately 1.5 kg of gold per tonne of carbon, is pumped from the bottom of the first tank in the series to the elution and electrowinning circuit.

ELUTION AND ELECTROWINNING

The loaded carbon is screened and the minus 28 mesh material is redirected back to the adsorption circuit. The oversize feeds the elution circuit, comprising four columns, two of which are stripping while the other two are loading. The estimated carbon load in each column (1.25 m in diameter and 6.25 m high) is approximately 2.7 t. Loaded carbon is stripped using caustic soda, injected into the elution columns from bottom to top at a concentration of 1% by weight with 200 L of ethylic alcohol (per batch) kept at 95°C. The pregnant solution is stored in a tank, with overflow to feed the electrowinning circuit. The electrowinning circuit consists of six cathodes and seven anodes, energized with a 360 A current and a voltage of 3.5 V to 4.0 V.

Jaguar ships the electrowinning sludge to a third party for smelting and refining.

ACID WASHING

The activated carbon first undergoes a stripping process in the elution columns, where the adsorbed gold is removed by a 1% (by weight) NaOH alcoholic solution at 95°C. It is then conveyed to a surge tank via an ejector directed towards a 28 mesh screen for the removal of fines (undersize). The screen oversize is conveyed to an 8 m^3 fibreglass acid washing tank. Acid washing is necessary to maintain the loading capacity of the activated carbon since the mineral matrix possesses other cations such as calcium, iron, copper, zinc, and lead that compete with gold in the interstices of the activated carbon. The acid washing is completely effected by passing an acid solution of HCl at 10%, removing the impurities that diminish the capacity of the carbon to adsorb gold, mainly carbonates and basic metals.

The acid solution of HCl at 10% (by weight) is prepared in a fibreglass HCl solution tank by adding water and HCl at 33% by weight. This solution is injected at the bottom and discharged at the top of the acid washing tank by overflow, returning to the HCl solution tank by gravity. The time involved in the acid washing is approximately 16 hours.

Once acid washing is completed, the acid solution is drained towards a neutralization tank. The carbon will be neutralized with a 1% (by weight) NaOH solution using a procedure identical to the one used for the acid solution. The neutralization time ranges from one to two hours, depending on the pH control of the recycled solution. The remaining solution is also drained to the neutralization pond. Thereafter, the carbon is washed with water in open circuit with regard to the neutralization pond. This operation lasts approximately two hours. After these stages, the carbon is transferred to the 28 mesh screen and can be conveyed to the carbon addition circuit in the volumetric control vessel, and then to the last adsorption tank in the CIP circuit.

DETOXIFICATION PLANT

The adsorption tank tailings (86 tph at 42% solids) are conveyed by gravity to a belt screen in order to avoid carbon loss and then to a tailings pulp treatment plant (TPTP or Detox plant) and then to the filter and paste fill plant.

FILTER AND PASTE FILL PLANT

The treated tailings from the Detox plant, a pulp at 42% solids by weight, are conveyed to a pumping station where they are sent by rubber lined centrifugal pumps (75 HP – one operating and one standby) to the filter and paste fill plant, which is located about one kilometre away from the pumping station. The slurry is received in a pulp storage tank, from which it is pumped to a hydrocyclone cluster, and the overflow feeds a thickener. The cyclone underflow, together with thickener underflow, feeds three drum filters (3.0 m x 4.9 m, 10 ft x 16 ft). The filtration process generates a cake and a filtrate (liquid phase). The thickener overflow is recycled to the industrial water tank for process water. The filtrate, less than 3% of the total tailings as utra-fines is pumped to the tailings dam for polishing and water management.

The cake from the filters, after having gone through the stages of the filtration cycle (cake formation, washing, drying, blow, and discharge), contains approximately 30% moisture. The filter cake is transported by truck and placed in a dry stack filtered tailings storage facility if not needed for mine backfill.

The filter cake is conveyed to the paste fill circuit if needed for cemented underground paste backfill. It is conveyed through a 914.4 mm (36 in). wide, 27 m long conveyor belt to the cake preconditioning hopper, after which the cake is sent to the weigh hopper where additives such as Portland cement or, alternatively, “Fosbinder” are added in proportion to the cake mass flow. Other binders aimed to impart structural properties to the paste, as well as to neutralize excess acidity due to its high carbonate content, can also be added. The cake is then directed to the paste mixer for the final paste production. The paste will be used as fill in the underground mine.

Paste fill plant rebuilding is complete and the plant was fully operational in 2018. The paste fill plant was changed from a continuous process to a batch process, which will allow better control on the paste characteristics for backfill. Paste fill has been used at the mine recently – rockfill and cemented rockfill have been used in backfilling Orebody A.

FIGURE 17-1 SITE PLAN

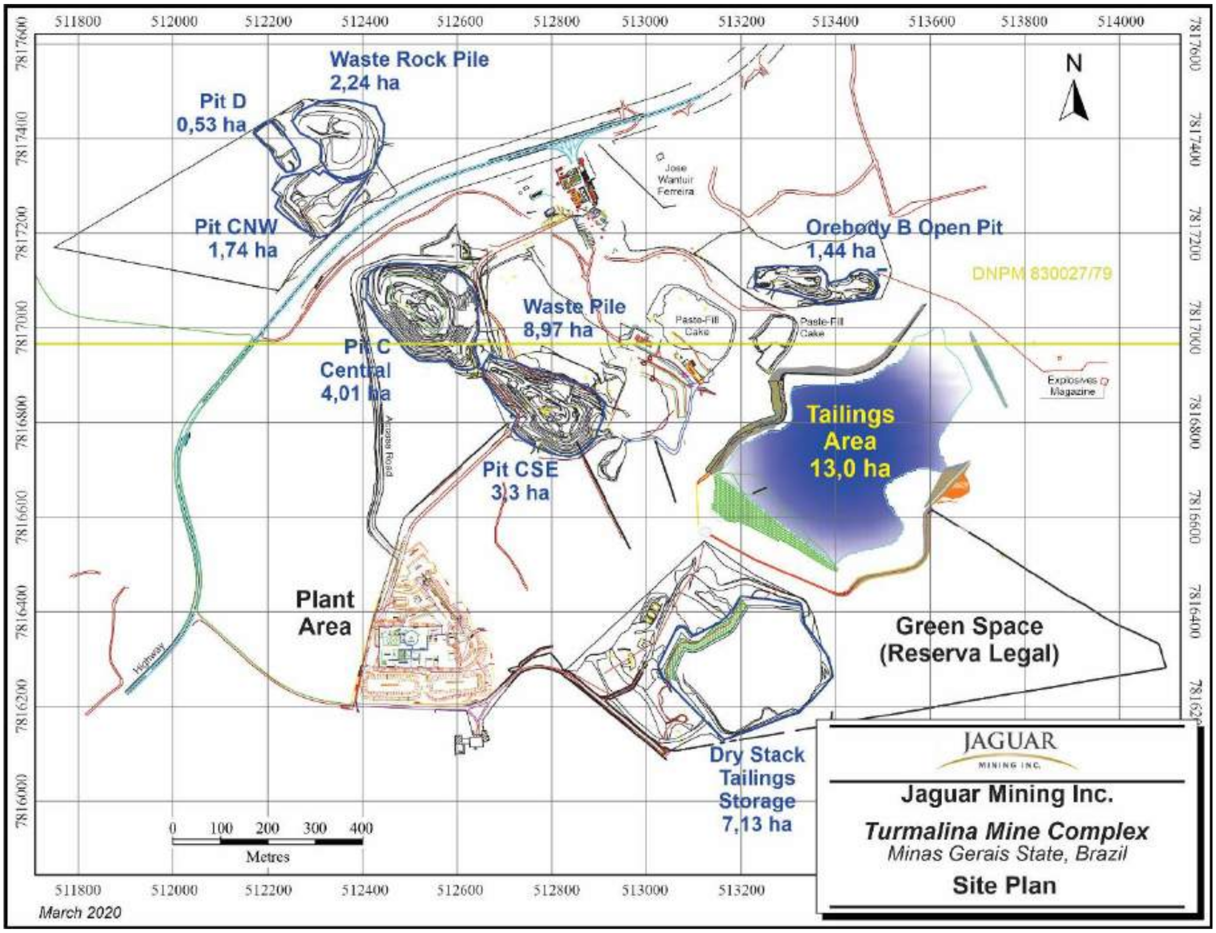
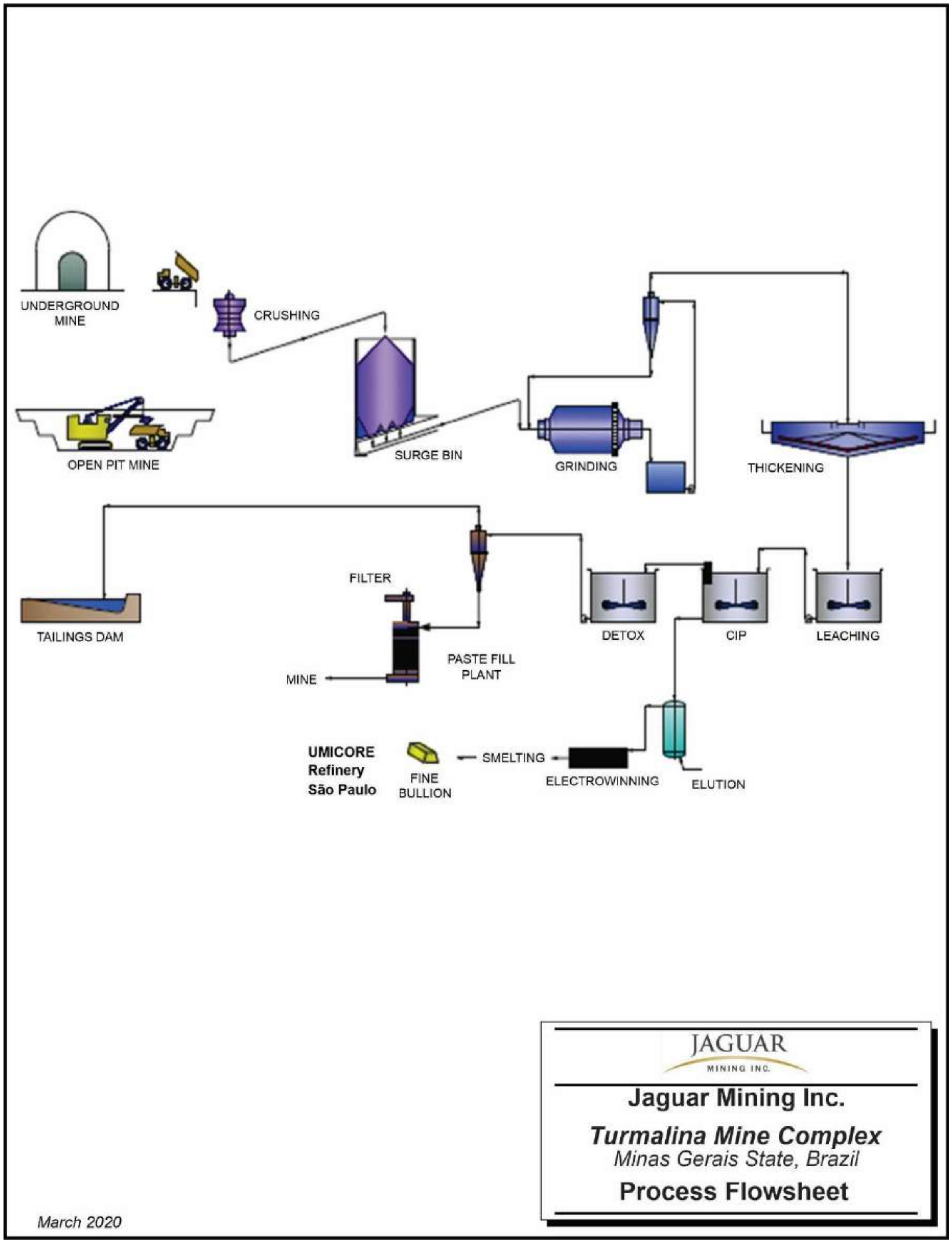


FIGURE 17-2 PROCESS FLOWSHEET



18 PROJECT INFRASTRUCTURE

The Turmalina Mine Complex includes a nominal 2,000 tpd processing plant and tailings disposal area. Electrical power is obtained from the national grid.

All ancillary buildings are located near the mine entrance: gate house including a reception area and a waiting room, an administration building, maintenance shops, a cafeteria, warehouse, a change room, a first aid room, and a compressor room. The explosives warehouse is located 1.2 km away from the mine area, in compliance with the regulations set forth by the Brazilian Army. There is no camp at the mine site.

Other ancillary buildings are located near the processing plant and include an office building, a laboratory, warehousing, and a small maintenance shop.

There is no infrastructure related to the Faina and Pontal historic open pit operations.

19 MARKET STUDIES AND CONTRACTS

MARKETS

Gold is the principal commodity at the Turmalina Mine Complex and is freely traded, at prices that are widely known, so that prospects for sale of any production are virtually assured. A gold price of $1,300 per ounce was used for estimation of the Mineral Reserves.

CONTRACTS

Jaguar regularly reviews costs for transportation, security, insurance, and sales of doré, and considers them to be within industry norms.

20 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

ENVIRONMENTAL STUDIES

Environmental studies related to the acid mine drainage potential have been carried out as requested by SUPRAM, the state environmental agency, on Operation Licence ('Licença de Operação', or LO) 012/2008. These studies continued from 2007 through 2017. In February 2018, a specialized report was issued. It indicated the low potential to generate acid mine drainage due to the low concentration of sulphides and the presence of compounds with neutralization potential, such as carbonates. However, the study also indicated the arsenic leaching potential and, as a result, the company initiated - the contamination plume investigation. The company has officially informed the agency about the arsenic leaching potential.

PROJECT PERMITTING

ORIGINAL TURMALINA PROJECT LICENCES

In 2005, Jaguar applied for a Preliminary Licence ('Licença Prévia', or LP) related to the original Turmalina Gold Project, for both the open pit and underground exploitation of the sulphide mineralized body on Mining Concession ANM 812.003/75 and the mineral processing plant. LP 078/2005 was granted to Jaguar in October 2005. Along with the LP application, an environmental study was submitted which formed an Environmental Control Report ('Relatório de Controle Ambiental', or RCA). In November 2005, Jaguar applied for an Installation Licence ('Licença de Instalação', or LI) for the Turmalina Gold Project. In August 2006, COPAM, the State Environmental Policy Council, granted Jaguar the LI (LI 114/2006) upon review of the Environmental Control Plan ('Plano de Controle Ambiental, or PCA). An Operating Licence ('Licença de Operação', or LO) for the Turmalina Gold Project was applied for in February 2007 and was granted in June 2008 (LO 012/2008).

Jaguar applied for the revalidation of the LO in March 2012, renovating all the operations at the project, including the tailings disposal system, underground open pit operations, the plant, and mine, which are currently under review by SUPRAM under process 01154/2005/012/2012.

In August 2018, Jaguar submitted an additional information report as requested by SUPRAM.

A list of the existing permits is presented in Tables 20-1 and 20-2.

TABLE 20-1 LIST OF EXISTING OPERATING LICENCES
Jaguar Mining Inc. – Turmalina Mine Complex

Enterprise	Certificate Number	Process Number (PA COPAM)	ANM	Granting Date	Expiration Date	Observation
Plant, waste pile, open pit and underground mine	LO 012/2008	01154/2005/003/2007	812.003/1975	19/06/2008	19/06/2012	This licence is in revalidation process since 2012 (PA COPAM 01154/2005/012/2012).
Tailings dam	LO 012/2009	01154/2005/008/2009	812.003/1975	17/12/2009	17/12/2013	This licence is in revalidation process since 2012 (PA COPAM 01154/2005/012/2012).
Expansion Project – plant, waste pile, open pit and underground mine	LOC 076/2009	01154/2005/007/2009	812.003/1975	17/12/2009	17/12/2013	The LOC 076/2009 improved the first licence (LO 012/2008). This licence is in revalidation process since 2012 (PA COPAM 01154/2005/012/2012).

Note 1: Application to renew these permits has been submitted; renewal approvals are pending. Some complementary information was requested by SUPRAM and has been supplied by environmental team. According to the law (Deliberação Normativa COPAM 17/1996) the licences remain valid.

TABLE 20-2 LIST OF WATER USE LICENCES

Jaguar Mining Inc. – Turmalina Mine Complex

Ordinance	Grant Date	Expiration Date	Procedure Number	Watercourse	Permitted Rates	Status	Revalidation Process Number
00716/2011	05/04/2011	17/03/2017	12594/2010	Pará river	Surface water – 28.3 L/s	In revalidation process	45241/2016
00579/2009	10/03/2009	09/03/2014	07142/2008	Dam	24 L/s	In revalidation process	5360/2014
03404/2012	26/11/2012	23/11/2017	03962/2010	Lowering water Level for Mining	470.9 m³/h	In revalidation process	13594/2017
01129/2009	15/05/2009	12/05/2014	03924/2006	Water well	4.6 m³/h	In revalidation process	11549/2014
02783/2009	20/10/2009	20/10/2013	01170/2008	Water well	6.77 m³/h	In revalidation process	20869/2013

EXPANSION PROJECT LICENCES

Minas Gerais State Decree 44.844/2008 of June 25, 2008, states that given the operating situation and production status at the Turmalina Mine, Jaguar was allowed to apply directly for an LO for the Expansion Project, which was granted in December 2009 (LO-C 076/2009). To be able to start the development works at the Expansion Project, Jaguar applied for an Environmental Authorization for Operation (AAF), as reported below.

In April 2008, Jaguar applied for two AAFs, one for underground and the other for open pit operations in Orebody C, located on ANM 803.470/1978. The AAF for the underground operations was granted by SUPRAM in September 2008 (AAF 04524/2008) and the AAF for the open pit was granted in January 2009 (AAF 00001/2009).

For the open pit operations at Faina, located on ANM 812.003/1975, an AAF was applied for in September 2009 and granted by SUPRAM in June 2010 (AAF 01822/2010).

The AAFs for an open pit mine allow for the mining of 50,000 tpa at each of Orebody C and Faina, while the AAF for an underground mine permits mining of 100,000 tpa.

In November 2009, an LP+LI for the Expansion Project was applied for, and granted in February 2011 (LP+LI 001/2011). In June 2013 the operations at Faina were paralyzed.

TURMALINA AND TURMALINA EXPANSION TAILINGS DISPOSAL SYSTEM LICENCES

Jaguar applied for an LI for the tailings disposal system in November 2007, along with the Environmental Impact Assessment/Report of Impacts on the Environment (EIA/RIMA) and the PCA. The tailings disposal system is a downstream construction and is currently being used as a water dam. Turmalina tailings are filtered and dry stacked or used as underground paste fill. All dams are inspected twice a month by an external geotechnical consultant. This is an operating inspection. There are semi-annual geotechnical stability inspections done by an external geotechnical consultant. The stability consultant for the first semesters was DIEFRA Engenharia and for the second was GEOHIDROTECH Engenharia. The application and pertinent documents were reviewed by SUPRAM, and LI 005/2009 was granted in August 2009.

In regard to the tailings disposal system operations, the LO was applied for in September 2009 and granted in December 2009 (LO 012/2009).

The upper portion of the central Orebody C was mined using the open pit method, which is now completed. Part of the mine surface area does not belong to Jaguar. The benches were designed to have a slight incline (1.0%) from slope crest to toe to allow drainage of storm and ground water. Benches between elevations 750 m and 720 m also had an incline of 1% to their toes at the natural ground level. Below elevation 720 m, sumps were constructed to collect all ground and storm water, which was then pumped to the mine’s water treatment system.

Orebody C is currently being mined using sublevel stoping. Underground mining of Orebody C was fully integrated with the remainder of Turmalina’s underground mining operations, including the opening of a ramp and access drifts to the bodies from the main decline. After being mined, panels are filled with paste fill from the current Turmalina paste backfill plant. This underground method is considered to be favourable from an environmental impact perspective, since placing paste backfill in the stope panels reduces the requirement for surface tailings storage.

A new waste stockpile has been designed for waste rock storage adjacent to the existing Turmalina waste stockpile. It has the same configuration as the existing stockpile, with a bench height of 10 m, bench width of 5 m, slope face angle of 30°, and overall stockpile angle of 26°.

The tailings system is a single downstream step with a full capacity of 790,682 m^3. Less than three percent of the tailings is sent to the dam. The tailings are filtered and dry stacked, and used for paste fill. The detailed engineering project was completed by the local consulting company Engeo Ltda (ENGEO).

All tailings disposed of in the dam are first detoxified in a Caro's acid detoxification plant (CyPlus technology – "cold"), as described below. The detoxification plant was constructed by EVONIK in Mobile, Alabama, USA. The process was conceived by CyPlus, a Degussa technology company that specializes in the application of peroxide, SO_2, and/or Caro's acid to detoxify cyanide residue and arsenic from the tailings of gold processing plants. The selected treatment uses Caro's acid as a reagent to promote the decomposition of cyanide to cyanate and to reduce the concentration of arsenic in the tailings that will be used in the production of the paste fill.

In order to generate Caro's acid, concentrated sulphuric acid is mixed with 50% oxygenized water in a Teflon/stainless steel reactor. Caro's acid promotes the oxidation of cyanide to cyanate, and cyanate is considered to be 1,000 times less toxic than cyanide. The cyanate then decomposes into carbon dioxide and ammonia by hydrolysis.

Caro's acid acts with efficiency to eliminate arsenic while in solution, causing the oxidation of As(III) to As(IV), and As(IV) is easily precipitated with ions from iron, calcium, and magnesium. Under these conditions, the used metal becomes immobilized in the paste fill, neither interacting with the environment nor undergoing any type of leaching, being dissolved by the underground water or by rainfall (if the paste is not contained and piled outside).

After the detoxification process, the pulp is sent to two 0.25 m (10 in.) cyclones, where it is either thickened to make paste fill or, if there is no current need for paste, sent to the tailings disposal system.

When required for use as backfill, the cyclone underflow from the plant, with 70% solids, is used in the production of the paste fill and then returned to the mine as fill to the mining stopes. The overflow, with fine solid particles and the majority of the water, is thickened and also used in the production of the paste fill. In the event of a temporary malfunction of the above process, the referred material is sent to the emergency chambers or to the tailings disposal system. The detoxified solution, separated from the tailings, is then recirculated for use in the processing plant, thus closing the circuit for the process water.

TABLE 20-3 TURMALINA TAILINGS DAM CONTROL PROCESS
Jaguar Mining Inc. – Turmalina Mine Complex

Technical Sheet	
/Height of the Dam (m)	17
Full Capacity (m^3)	790,682.70
Total Length of the Crest (m)	198
DPA (associated potential damage)	High
CRI (category of risk)	Low
Class by Law nº 70.389/2017	B
Class by Law DN nº 62/2002	III
Waste Class	Class I
Construction Method	Single downstream step
Spillway System	Yes
Emergency Action Plan (PAEBM)	Yes
Construction Year	2009
Sealing Dam	Yes

The Turmalina dam has control processes in place, through periodic inspections carried out twice a month and reports of stability condition, in addition to a monitoring network that allows the company to be constantly alert about its structures.

Jaguar has been following all the recent changes in the laws and complies with all regulations.

SOCIAL OR COMMUNITY REQUIREMENTS

The Turmalina operations are located close to the border of the municipality of Conceição do Pará in the central western part of the state of Minas Gerais, near the district of Casquilho.

The Casquilho community is a district of Conceição do Pará and is in the area that is indirectly impacted by the operations. Being too small, this district does not offer quality infrastructure services, which are sourced them from a nearby larger town, Pitangui, located 15 km from Conceição do Pará.

State road MG 423 divides the Casquilho community into Casquilho de Baixo (lower Casquilho) and Casquilho de Cima (upper Casquilho), with a total population of 130 families. The majority of the Casquilho de Cima houses is permanently occupied and most residents work in Pitangui. Only five houses are used as weekend properties.

The Casquilho de Cima community is supplied with water and power by the state-run companies Copasa and CEMIG. The community does not have any sanitation sewage system. Old fashioned farm-like sanitation holes/ditches, typically built in the backyards, are used. No additional public service is available to the Casquilho de Cima residents.

Since the beginning of the Turmalina Mine operation, dust suppression has been carried out by Jaguar at the mine and plant access roads.

Jaguar has good community relationships with the surrounding communities.

MINE CLOSURE REQUIREMENTS

Six months before the mine is exhausted, Jaguar must submit the Mining Closure Plan (‘Plano de Fechamento de Mina’, or PAFEM) to SUPRAM for approval, according to the “Deliberação Normativa COPAM nº 220/2018”. This regulation also enforces that all mining activities in the state of Minas Gerais include the rehabilitation plan of disturbed areas.

The actions and steps for the environmental recovery of the areas impacted by mining activity were adopted when the LI was granted, and will continue until after the mine is exhausted.

The recovery of the surface areas will follow the following steps:

- Removal and stockpiling of the fertile soil layer;
- Waste and backfill paste disposal;
- Rehabilitation of the mined areas;
- Topographical regularization;
- Re-vegetation of the impacted areas, mainly those resulting from open pit mining;
- Rehabilitation of drainage ditches, contention sumps, contention dykes, etc.;

The following actions will be required with regard to the underground mine:

- Gradual refill of the exhausted panels.
- Obstruction of the initial 50 m of the ramp with waste, to be stocked near the mine entrance in advance.
- Construction of a cut at the mine entrance at an inclination of 35º to fill the opening created during the mine entrance development with the removed material. It will be completely filled, and the cut and fill re-vegetated.
- Obstruction of the entrances to the ventilation and emergency raises with a 10 m deep reinforced concrete wall. This will be done with waste material, to be stocked for this purpose in advance. The related surface areas will be re-vegetated.

As of December 31, 2019, Jaguar estimated rehabilitation and reclamation costs to be US$4.5 million, on an undiscounted, uninflated basis as shown in Table 20-4.

TABLE 20-4 PROGRESSIVE REHABILITATION AND CLOSURE COST ESTIMATES

Jaguar Mining Inc. – Turmalina Mine Complex

Description	Units	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total
Waste Pile	US$ (000)	33	35	13	109	93	450	219	62	25	13	**1,050**
Pit	US$ (000)	14	8	6	37	29	20	9	-	3	8	**132**
Dam	US$ (000)	-	-	18	11	9	301	301	31	25	11	**705**
Infrastructure	US$ (000)	25	10	16	12	-	255	206	35	20	10	**589**
Plant	US$ (000)	-	-	12	-	8	215	486	25	14	8	**768**
G&A	US$ (000)	21	32	17	45	37	109	104	40	47	83	**533**
Contingency	US$ (000)	-	16	12	44	36	276	271	39	26	25	**746**
Total	US$ (000)	**93**	**101**	**93**	**258**	**211**	**1,626**	**1,596**	**232**	**158**	**157**	**4,525**

*Note: Numbers may not add due to rounding. No inflation or discount factors applied.

21 CAPITAL AND OPERATING COSTS

Costs for the LOMP were estimated in BRL, based on recent operating results and Jaguar budgets.

Strengthening of the US dollar against the BRL over the past few years has had a significant impact in reducing US$ unit costs. Jaguar used an exchange rate of US$1.00 = 4.00 BRL for 2020.

CAPITAL COSTS

A summary of capital, exploration, and closure requirements anticipated over the LOMP is summarized in Table 21-1.

TABLE 21-1 LOMP CAPITAL COST SUMMARY

Jaguar Mining Inc. –Turmalina Mine Complex

	Units	Total	2020	2021	2022	2023	2024	2025
Direct Cost								
Mining	US$ (000)	**-**	-	-	-	-	-	-
Processing	US$ (000)	**-**	-	-	-	-	-	-
Infrastructure	US$ (000)	**-**	-	-	-	-	-	-
Exploration	US$ (000)	**11,630**	2,434	1,839	1,839	1,839	1,839	1,839
Total Direct Cost	US$ (000)	**11,630**	2,434	1,839	1,839	1,839	1,839	1,839
Sustaining								
Sustaining	US$ (000)	**68,245**	21,653	12,927	11,891	10,855	7,237	3,681
Reclamation and Closure	US$ (000)	**4,525**	93	101	93	258	211	3,769
Total Capital Cost	**US$ (000)**	**72,770**	**21,746**	**13,028**	**11,984**	**11,113**	**7,448**	**7,450**

Sustaining capital costs are estimated to be $68.2 million, of which $6.2 million is spent on rebuilds. Primary development consists of approximately 12,793 of horizontal development over the LOMP. The capital development is well advanced at the mine, hence the low amount of development.

Exploration drilling will continue, with an aim to extend and define resources at depth.

Reclamation and closure costs are as described in Section 20.

OPERATING COSTS

Operating costs for the LOMP are shown below in Table 21-2. Operating cost estimates include mining and processing, and general and administration (G&A). Operating costs are budget cost projections based on actual costs incurred over the past year.

TABLE 21-2 LOM OPERATING COST SUMMARY

Jaguar Mining Inc. – Turmalina Mine Complex

Unit Costs	Unit	Average	2020	2021	2022	2023	2024	2025
Mining (Underground)	US$/t milled	**37.29**	38.50	35.85	36.40	37.01	37.67	38.29
Processing	US$/t milled	**30.21**	26.33	30.98	30.98	30.98	30.98	30.98
G&A	US$/t milled	**2.80**	6.30	2.10	2.10	2.10	2.10	2.10
Total Unit Operating Cost	**US$/t milled**	**70.29**	**71.13**	**68.93**	**69.48**	**70.09**	**70.75**	**71.37**

There are additional corporate overhead costs associated with the Belo Horizonte and Toronto offices, as well as royalties and refining costs, which are not included in the operating cost estimate.

The All-In Sustaining cost (as defined by the World Gold Council) for the Turmalina Mine throughout the LOM is $856/oz, including reclamation and closure.

22 ECONOMIC ANALYSIS

This section is not required as the property is currently in production, Jaguar is a producing issuer, and there is no material expansion of current production. Deswik Brasil has verified the economic viability of the Mineral Reserves via cash flow modelling, using the inputs discussed in this report.

23 ADJACENT PROPERTIES

There are no adjacent properties relevant to the Turmalina Mine Complex.

24 OTHER RELEVANT DATA AND INFORMATION

No additional information or explanation is necessary to make this Technical Report understandable and not misleading.

25 INTERPRETATION AND CONCLUSIONS

Both open pit and underground mining methods have been employed on the property, however, only the underground mine is currently operating.

GEOLOGY AND MINERAL RESOURCES

- It is Jaguar´s opinion that the Turmalina Mineral Resource estimates were prepared in a professional and diligent manner by qualified professionals and that the estimates comply with CIM (2014) definitions.

- The total Mineral Resources for the Turmalina Mine Complex comprise approximately 4.90 million tonnes at an average grade of 4.98 g/t Au - containing 784,000 ounces of gold in the Measured and Indicated Mineral Resource category, and approximately 2.74 million tonnes at an average grade of 5.60 g/t Au - containing approximately 629,000 ounces of gold in the Inferred Mineral Resource category. The Mineral Resources include the Turmalina deposit and two satellite deposits, Faina and Pontal. A cut-off grade of 2.10 g/t Au was used to report the Mineral Resources for the Turmalina deposit, and cut-off grades of 3.8 g/t Au and 2.9 g/t Au were used to report the Mineral Resources for the Faina and Pontal deposits, respectively.

- Reconciliation studies on a quarterly basis show that the monthly Mine-to-Plant (F2) results exhibit a good correlation between the mine and the plant data throughout most of the 2018 and 2019 production periods, with the monthly block model predicted grades being generally more than those processed by the plant and the block model predicted tonnes being generally less than those processed by the plant.

- In general terms, Jaguar observes that there is good agreement between the plant data and the block model for the 2018 and 2019 period. Jaguar is also of the opinion that this agreement is suggesting that the sampling strategies, assaying methods, and estimation procedures currently used at the mine to prepare the grade block models are producing reasonable predictions of the tonnages, grades, and contained metal that are being received at the processing plant.

MINING AND MINERAL RESERVES

- The Turmalina Mine is a well-run and professional operation. The mine produces 1,200 tpd.

- It is Jaguar´s and Deswik Brasil's opinion that the Turmalina Mineral Reserve estimates were prepared in a professional and diligent manner by qualified professionals and that the estimates comply with CIM (2014) definitions.

- Proven and Probable Mineral Reserves total 2.40 million tonnes at a grade of 4.31 g/t Au, containing approximately 332,000 ounces of gold. Mineral Reserves are limited to Orebody A and Orebody C.

- A gold price of US$1300/oz and an exchange rate of BR$3.7 to US$1 was used for both the 2018 and the 2019 Mineral Reserves.

- Jaguar 2019 diamond drilling programs added 145,000 ounces of Proven and Probable Mineral Reserves reflecting an increase of 63% over 2018 Mineral Reserves before 2019 depletion. Year over year Mineral Reserves increased 104,000 ounces or 46% over 2018 Mineral Reserves after 2019 depletion.

- Orebody A Proven and Probable Mineral Reserves increased by 32,000 ounces over 2018 Mineral Reserves net of 2019 depletion. Down plunge infill drilling has extended the Orebody A Mineral Reserves to the base of level 14. Orebody A has been intersected by previous growth exploration to below level 16 where it remains open down plunge for future drill programs.

- Orebody C Proven and Probable Mineral Reserves increased by 72,000 ounces over 2018 Mineral Reserves net of 2019 depletion. Detailed mapping of primary and secondary underground development by Jaguar´s geological team has allowed detailed structural kinematic indicator measurements which defined a more precise orientation of both the C-Central and C-SE (southeast) mineralized payshoots.

- The more accurate plunge direction allowed the 2019 drilling program to target and trace these main payshoots down their structural plunge. The C Central and C-SE payshoots remain open down plunge and these depth extensions remain the primary target for ongoing drill programs.

- These payshoots are structurally controlled mineralized lenses that have significantly higher grade and thickness than the overall Orebody C host structure and by inference contain the majority of the Orebody C gold ounces. The payshoots are generally limited in strike length ranging between 25 and 50 meters but may extend up to 100m. The more accurate plunge direction allowed the 2019 drilling program to target and trace these main payshoots down their structural plunge. The C Central and C-SE payshoots remain open down plunge and these depth extensions remain the primary target for ongoing drill programs.

- At C-Central, exploration drilling first defined the high grade payshoot in March 2019 which was followed by targeted drilling down plunge, resource definition and estimation and underground access development. Initial stoping activities commenced in September 2019. Inclusion of Orebody C-Central Mineral Reserve into inventory for the first time was completed by year end. C-Central provides a new production area for Turmalina.

- At C-SE the definition of a more precise mineralization plunge direction using mapping and structural geology allowed targeted drilling down plunge, increasing the mineralized extension from level 5 to level 8, and defined additional Mineral Reserves where supported by infill drilling and secondary development channel sampling. Like Orebody C-Central, Orebody C-SE remains open down plunge below level 8.

- At surface Orebody C was previously exploited from a series of three open pits (C-SE, C-Central, and C-NW (northwest)). The depth extensions of the C-NW payshoot below the old open pit workings remains as an exploration target that will be drilled when underground drill platforms are available.

- In Orebody B a higher grade payshoot was also defined during 2019 using the Orebody C payshoot parameters to historical Orebody B drilling and development data. A series of targets for follow up drilling in 2020 have been generated to further define these areas of expected higher grade and thickness. Orebody B is not included in the current Turmalina Life of Mine Plan.

- This higher grade payshoot in Orebody B may define an opportunity for a potentially new mining area.

- The newly updated Turmalina Mineral Reserves support a mine life of six years.

- Both Orebody A and Orebody C are being mined using sublevel stoping in a retreat sequence with rock fill and paste fill.

- The Mineral Reserve additions in C SE and C Central are higher up in the mine than Orebody A and this reduces the demand on trucking.

- There is good potential for increasing Mineral Reserves by completing infill drilling of the Inferred Mineral Resources at depth in both Orebody A and Orebody C.

- Successful use of Paste fill and Partial Rib Pillars have increased the ore extraction ratio and the conversion ratio from Resources to Reserves while improving the rock mass stability.

METALLURGY AND PROCESSING

- The plant at the Turmalina Mine is well run and achieves consistent recoveries.

- Production capacity for the plant exceeds the ability of the mine to deliver ore.

CAPITAL AND OPERATING COSTS

- Direct capital expenditures over the Life of Mine Plan (LOMP) total $11.6 million for exploration.

  Sustaining capital costs are estimated to be $68.2 million, of which $6.2 million is spent on rebuilds. Reclamation and closure costs are estimated to total $4.5 million.

- Life of Mine (LOM) operating costs are forecast to average $70.29/t. Strengthening of the US dollar against the BRL over the last few years has had a significant impact in reducing US$ unit costs. Jaguar used an exchange rate of US$1.00 = 4.00 BRL for 2020. The exchange rate assumptions are consistent with forecasts.

- The All-In Sustaining cost (as defined by the World Gold Council) for the Turmalina Mine throughout the LOM is $856/oz, including reclamation and closure.

26 RECENT AND ONGOING ACTIVITIES

The following activities, several of which are actions arising from recommendations contained in the previous Technical Report have been completed during the reporting period, are currently being undertaken, or are planned for 2020.

GEOLOGY AND MINERAL RESOURCES

EXPLORATION

- The results obtained from the Zona Basal target area merit further examination by means of diamond drilling. Jaguar is currently extending the soil sampling and geological mapping programs along the southwestern projection of the Zona Basal stratigraphy, targeting the presence of additional gold-bearing mineralization in this area.

- Exploration drilling of the down-plunge and along-strike projection of Orebodies A and C is in progress.

- Drilling planned for 2020 is aimed at locating and defining additional, parallel-mineralized zones in the hanging wall of Orebody B and in the footwall units of Orebody C.

QUALITY ASSURANCE/QUALITY CONTROL

During 2019 Jaguar has implemented a series of improvements to its QA/QC procedures and practices. These include:

- Jaguar is well advanced with transitioning to a new database MX Deposit from the in-house database previously used (BDI).

- Established clear criteria for acceptance or rejection of drill hole and channel sample data in the drill hole database.

- Established data screening protocols for review of data quality for newly acquired data prior to inserting into the master database.

- A number of pulps from selected drilling programmes are being sent to an external laboratory for duplicate analysis.

- Re-assay thresholds have been revised.

- Including functionality in the new database to store drill core recoveries, channel sample recoveries, and sample tracking (lost samples) information to assist with addressing null values in the resource estimates.

- Completion of a review of the surveying practices and quality control procedures being used, to ensure that all drill hole collars are accurately located prior to entry into the final drill hole database.

MINERAL RESOURCES

Jaguar is currently reviewing, updating and improving practices and procedures used in resource evaluation and estimation. These include:

- Updating the written procedures for the collection of geological and sampling information. Once complete focused training sessions to present the procedures to all geological staff are scheduled.

- Updating the core logging and sampling procedures so that the logging geologist ensures that a full series of samples are taken through those portions of the drill holes that are expected to intersect the mineralized zones. The samples should cover not only the expected mineralized intervals but should extend a short distance into the adjacent wall rocks as well.

- Modification to the logging procedures, whereby detailed information regarding the mineralized intervals is brought forward from the remarks column and inserted as a major level entry in the drill logs, to assist in preparation of updates to the Mineral Resources.

- Codification of the block model for the mined out excavations using both the development and the stope excavation models.

- Implemented routine geological mapping of all available underground excavations in the vicinity of the Orebody C mineralized wireframes. The results of this geological mapping is used to prepare a lithological model and to improve the allocation of the density measurements for future Mineral Resource updates.

- Collection of bulk density measurements for any newly discovered mineralization.

- Continue with in-house and academic studies to examine the relationship of the gold values to structural, alteration, or lithologic features (such as the presence of quartz veining, for example) to aid in the understanding of the distribution of the higher grade gold values seen in Orebodies A and C.

- Re-examination of the stratigraphic/lithologic controls on mineralization for Orebody B, for the possibility of generating drill targets.

- Focused infill drilling to collect additional drill hole information in areas of low drilling density, to improve the confidence level of the Mineral Resource estimate, to reduce and remove the estimation artifacts, and to search for the down-dip projections of the mineralization.

- Jaguar is planning to re-evaluate the Mineral Resource estimates for the Faina and Pontal deposits.

MINING AND MINERAL RESERVES

Jaguar is currently reviewing, updating and improving practices and procedures used in reserve estimation. These include:

- Collecting data for modelling mining costs by orebody, such that variable and incremental cut-off grades can be determined by individual orebody, and the Mineral Reserve estimate, LOMP, and processing capacity can be optimized.
- Integration of ground control and rock mechanics analysis into the mine planning process, to improve stability and reduce dilution.
- Balancing production levels between Orebody A and Orebody C, for improved production stability and an operationally achievable plan over the LOM.
- Consideration of an annual long-term planning cycle inclusive of strategic asset planning, Mineral Resource, and Mineral Reserve estimation for all Jaguar operations.
- Evaluation of cost data to capture the variation of unit mining costs between Orebody A and Orebody C, given significant differences between mining widths, production rates, ground conditions, and haul distances.
- Recent change of mining method to improve resource recovery and production stability.

MINERAL PROCESSING AND METALLURGICAL TESTING

- Based on the information provided, the metallurgical testwork on samples from the Faina, Pontal, and Orebody D deposits has been carried out to at a preliminary level only. Metallurgical testing should continue on these potentially refractory deposits to help determine the most appropriate processing route to be adopted.
- Options for the use of excess processing capacity for toll milling should be investigated.

27 REFERENCES

Alvim, M. D., 2014, Jaguar Mining Geological Database Validation: Unpublished internal document prepared for Jaguar Mining, 93 p.

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2014, CIM Definition Standards for Mineral Resources and Mineral Reserves, adopted by CIM Council on May 10, 2014.

Corredor H., Jaime A., 2018, Geotechnical Properties of Turmalina Mine, Internal Report Jaguar Mining Inc., pp. 1-17.

de Souza, Márcia Cristina, 2006, Cyanidation Tests in Samples from the Turmalina Mine, Internal Report for MSOL, May 6, 2006

Jaguar Mining Inc., 2014a, Jaguar Mining Intercepts 15.32 Grams Per Tonne Over 19.0 Meters at the Turmalina Mine: News release dated October 9, 2014, Obtained from the SEDAR website at www.SEDAR.com, 4 p.

Jaguar Mining Inc., 2014b, Company presentation dated March 2, 2014.

Jaguar Mining Inc., 2015, Jaguar Reports Q4 2014 Gold Production and Provides 2015 Guidance: News release dated January 8, 2015, Obtained from the SEDAR website at www.SEDAR.com, 5 p.

Jaguar Mining Inc., 2016, Jaguar Reports Q4 2015 Gold Production, Releases Annual 2016 Guidance: News release dated January 19, 2016, Obtained from the SEDAR website at www.SEDAR.com, 4 p.

Jaguar Mining Inc., 2017, Jaguar Exceeds 2016 Gold Production Guidance: News release dated January 18, 2017, Obtained from the SEDAR website at www.SEDAR.com, 4 p.

Jaguar Mining Inc., 2018, Jaguar Mining Continues to Intercept Significant Gold Mineralization at Orebody C; Pilar and Turmalina Principal Orebodies Report Increasing Grades and Thickness: News release dated June 18, 2018, Obtained from the SEDAR website at www.SEDAR.com, 15 p.

Ladeira, E.A., 1980, Metalogenesis of Gold at the Morro Velho Mine and in Nova Lima District, Quadrilátero Ferrífero, Minas Gerais, Brazil. University of Western Ontario, Unpublished Ph.D. Thesis, London, Ontario, Canada: 272 p.

Ladeira, E.A., 1991, Genesis of gold in Quadrilátero Ferrífero: A remarkable case of permanency, recycling and inheritance - A tribute to Djalma Guimarães, Pierre Routhier and Hans Ramberg. In Ladeira, E.A., ed., Proceedings of Brazil Gold '91. An International Symposium on the Geology of Gold: Belo Horizonte, 1991: A.A. Balkema, Rotterdam, pp. 11-30.

Machado, I.C., 2005, Turmalina Gold Project, Feasibility Draft 12C, Including Cash Flow: Unpublished Internal Report Prepared for Jaguar Mining Inc.

Machado, I.C., 2007a, Paciencia Gold Project, Santa Isabel Mine. Volume I. Feasibility Study. TechnoMine Services, LLC, August 7, 2007.

Machado, I.C., 2007b, Turmalina Gold Project, Satinoco Target Resource Statement. TechnoMine Services, LLC, October 22, 2007.

Machado, I.C., 2008a, Turmalina Gold Project: Satinoco Target Resource Statement. TechnoMine Services LLC, February 5, 2008.

Machado, I.C., 2008b, Caeté Expansion (CTX) Gold Project Pilar and Roça Grande Properties. Feasibility Study, Volume I. TechnoMine Services, LLC, September 15, 2008.

Machado, I.C., 2008c, Turmalina Expansion Project (Phase I – 610 ktpy), Turmalina "Satinoco" and "Main" Ore Bodies, Feasibility Study: Unpublished Technical Report, 150 p.

Machado, I.C., 2011, Turmalina Gold Mining Complex Faina, Pontal, and Body D Targets Statement of Resources. Volume I. TechnoMine Services LLC, October 19, 2011.

Marinho, M.S., Silva, M.A., Lombello, J.C., Di Salvio, L.P. Silva, R.N., Féboli, W.L., and Brito, D.C., 2018, Projecto ARIM-Áreas de elevante Interesse Mineral – Noroeste do Quadrilátero Ferrifero – Mapa Geológico Integrado do Sinclinório Pitangui, Belo Horizonte, CPRM, 2018, 1 map, scale 1:75 000.

Martini, S. L., 1998, An Overview of Main Auriferous Regions of Brazil, in Revista Brasileiera de Geociências, Volume 28, 1998.

Parker, H., 2014, Reconciliation Principles for the Mining Industry: *in* Mineral Resource and Ore Reserve Estimation, The AUSIMM Guide to Good Practice, The Australasian Institute of Mining and Metallurgy Monograph 30, Second Edition, pp. 721-738.

RPA, 2005, Technical Report on the Turmalina Gold Project, Pitangui, Minas Gerais, Brazil – NI43-101 Report Prepared by Clow, G. G., and Valliant, W. W., for Jaguar Mining Inc. by Roscoe Postle Associates Inc., September 16, 2005.

RPA, 2006, Technical Report on the Turmalina Gold Project, Pitangui, Minas Gerais, Brazil – NI43-101 Report Prepared by Clow, G. G., and Valliant, W. W., for Jaguar Mining Inc. by Roscoe Postle Associates Inc., July 31, 2006, 120 p.

RPA, 2015, Technical Report on the Turmalina Mine, Minas Gerais State, Brazil: Report Prepared by Cox, J., and Pressacco, R., for Jaguar Mining Inc. available on the SEDAR website at www.SEDAR.com, 175 p.

RPA, 2016, Technical Report on the Turmalina Mine, Minas Gerais State, Brazil: Report Prepared by Cox, J., and Pressacco, R., for Jaguar Mining Inc. available on the SEDAR website at www.SEDAR.com, 169 p.

RPA, 2017, Technical Report on the Turmalina Mine, Minas Gerais State, Brazil: Report Prepared by Cox, J., and Pressacco, R., for Jaguar Mining Inc. available on the SEDAR website at www.SEDAR.com, 175 p.

RPA, 2019, Technical Report on the Turmalina Mine, Minas Gerais State, Brazil: Report Prepared by Sepp J, and Pressacco, R., Patel, A for Jaguar Mining Inc. available on the SEDAR website at www.SEDAR.com, 177 p.

Scarpelli, W., 1991, Aspects of gold mineralization in the Iron Quadrangle, Brazil. In Ladeira, E.A., ed., Proceedings of Brazil Gold '91, An International Symposium on the Geology of Gold: Belo Horizonte, 1991: A.A. Balkema, Rotterdam, pp. 151-158.

SGS Geosol Laboratórios Ltda., 2016, Relatorio de QA-QC: Unpublished Internal Document Prepared for Jaguar Mining, 28 p.

Thorman, C.H., DeWitt, E., Maron, W.A.C., and Ladeira, E.A., 2001, Major Brazilian Gold deposits –1982 to 1999. Mineralium Deposita, pp. 218-227.

Thorman, C.H., and Ladeira, E.A., 1991, Introduction to a workshop on gold deposits related to greenstone belts in Brazil--Belo Horizonte, Brazil, 1986 in Thorman, C.H. Ladeira, E.A., and Schnabel, D.C., eds., Gold deposits related to greenstone belts in Brazil —Deposit modeling workshop, Part A--Excursions: U.S. Geological Survey Bulletin 1980-A, pp. A5-A22.

Vieira, F.W.R., 1991, Textures and processes of hydrothermal alteration and mineralization in the Nova Lima Group, Minas Gerais, Brazil. In Ladeira, E.A., ed., Proceedings of Brazil Gold '91, An International Symposium on the Geology of Gold: Belo Horizonte, 1991: A.A. Balkema, Rotterdam, pp. 319-326.

Zucchetti, M., et al., 2000, Volcanic and Volcaniclastic Features in Archean Rocks and Their Tectonic Environments, Rio Das Velhas Greenstone Belt, Quadrilátero Ferrífero, MG, Brazil, in Revista Brasileiera de Geociencias, Volume 30, 2000.

28 DATE AND SIGNATURE PAGE

This report titled “Technical Report on the Turmalina Mine, Minas Gerais State, Brazil” and dated April 17th , 2020 was prepared and signed by the following authors:

JONATHAN VICTOR HILL (BSc Hons) Economic Geology, FAUSIMM.

BRUNO TOMASELLI (BSc) Mining Engineering, FAUSIMM.

Dated at Belo Horizonte, MG, April 17th, 2020

29 CERTIFICATES OF QUALIFIED PERSONS

JONATHAN VICTOR HILL

I, Jonathan Victor Hill BSc (Hon) Economic Geology, FAusIMM, Exploration & Geology – Expert Advisor to Jaguar and co-author of this report entitled "Technical Report on the Turmalina Mine, Minas Gerais State, Brazil" prepared for Jaguar Mining Inc., and dated April 3, 2020, do hereby certify that

1. I am Exploration and Geology Expert Advisor to Jaguar Mining Inc., 323 Rua Levindo Lopes, Funcionarios, Belo Horizonte-MG, Brazil, 30140-170
2. I am a graduate of the University of Cape Town, South Africa (1988) with a Bachelor of Science degree (Hons) in Economic Geology.
3. I am a Fellow of the Australasian Institute of Mining and Metallurgy (FAusIMM).
4. I have worked as a Geologist for a total of 34 years since graduation. My relevant experience for the purpose of the Technical Report is:

   - 34 years relevant gold and base metals mining operational, resources and exploration geology experience in Africa, Australasia, and the Americas.
5. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.
6. I am very familiar with the Turmalina Mine having visited that operation as part of my duties at Jaguar Mining Inc., on a monthly basis since August 2017.
7. I am responsible for Sections 4 to 14, 17 and 23 of this Technical Report.
8. I am independent of the Issuer applying the test set out in Section 1.5 of NI 43-101.
9. The Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.
10. At the effective date of the Technical Report, to the best of my knowledge, information, and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 17th of April, 2020

(Signed and Sealed) Jonathan Victor Hill

Jonathan Victor Hill, FAusIMM

BRUNO YOSHIDA TOMASELLI

I, Bruno Yoshida Tomaselli, FAusIMM, as an author of this report entitled "Technical Report on the Turmalina Mine, Minas Gerais State, Brazil" prepared for Jaguar Mining Inc., and dated April 3, 2020, do hereby certify that

1. I am a Consulting Manager with Deswik Brazil, Rua Antonio de Albuquerque, 330, Belo Horizonte-MG, Brazil, 30112-010
2. I am a graduate of the University of São Paulo, São Paulo, Brazil, in 2004 with a Bachelor of Science degree in Mining Engineering.
3. I am a Fellow Member of the Australasian Institute of Mining and Metallurgy (FAUSIMM).
4. I have worked as a Mining Engineer for a total of 16 years since my graduation. My relevant experience for the purpose of the Technical Report is:

   - Mine planning for several mines in Brazil and Latin America

   - Review and report as a consultant on many mining operations and projects around the world for due diligence

   - Feasibility Study project work on many mining projects

   - Work as a mining engineer consultant on various projects around the world
5. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

6. I visited the Turmalina Mine several times in 2018 and have been developing mining plans for this mine over in the past two years.
7. I am responsible for Sections 15, 16, 18 to 22, and 24 and relevant disclosure in Sections 1, 2, 3, 25, 26, and 27 of the Technical Report.
8. I am independent of the Issuer applying the test set out in Section 1.5 of NI 43-101.
9. I have had no prior involvement with the property that is the subject of the Technical Report.
10. I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.
11. At the effective date of the Technical Report, to the best of my knowledge, information, and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 17th day of April, 2020

(Signed and Sealed) Bruno Yoshida Tomaselli

Bruno Yoshida Tomaselli, FAusIMM