

# Horizonte Minerals Plc: High Purity Cobalt and Nickel Sulphate From the Vermelho Project

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[Horizonte Minerals Plc](#), (AIM: HZM, TSX: HZM) (‘Horizonte’ or ‘the Company’) the nickel cobalt development Company focused in Brazil, is pleased to announce the successful completion of the previously announced test work on samples of limonite ore from the Company’s 100% owned Vermelho nickel-cobalt project (‘Vermelho’) located in the southern part of the Carajás mining district in Pará state, northern Brazil.

## Highlights:

- High purity product containing 21.8% cobalt, exceeding the reference grade used for sulphate pricing;
- Nickel sulphate produced as a solution ready for purification to final battery grade product.
- The results confirm the suitability of the Pressure Acid Leach (‘PAL’) Process and subsequent purification stages for processing Vermelho limonite ore to produce high purity cobalt and nickel sulphate suitable to supply the EV battery markets;
- Positive results from the test work to be integrated into the Pre-feasibility Study underway on the Vermelho Project; and
- The results follow test work earlier in the year which also showed that Vermelho saprolite ore is suitable for conventional processing at the Rotary Kiln Electric Furnace (“RKEF”) to be built at the Company’s Araguaia FeNi project.

*Horizonte CEO Jeremy Martin said, ‘Producing high purity nickel and cobalt sulphate from the Vermelho project of suitable quality and grade for use in EV battery production is a major milestone in the development of the project. The Vermelho project is a value driver for the Company, it is a high-grade scalable resource, with good infrastructure and has the potential to be fast tracked to development.*

*The successful completion of this sulphate test work confirms that the selected process flow sheet is suitable to treat the Vermelho ore and when combined with the earlier successful RKEF test work demonstrates that alternate process routes exist for the project. The data from the test programmes will be incorporated into the Vermelho Pre-feasibility Study, for release in early H2, with the objective of demonstrating a robust set of economics for the project.*

*The EV market continues to grow with increased activity shown from miners and battery manufactures in securing high quality resource projects. We see Vermelho as an attractive strategic asset with the ability to produce nickel sulphate and a non-conflict, ethical source of cobalt.*

*Elsewhere we continue to advance the project financing (PF) on the Araguaia Ferronickel Project, with positive interest shown from seven international banks regarding a PF syndicate. Discussions are also underway with a number of groups on product marketing and offtake. The overall demand picture for nickel is robust, running at around 4% to 5% per year with stainless steel currently accounting for two thirds of demand. Crucially nickel inventories continue to be drawn down with the LME levels at around 170,000 tonnes, its lowest level in 5 years with this downward trajectory due to run through the end of the year. The medium term consensus nickel price is around US\$16,200/tonne which, based on the Feasibility Economics on Araguaia, deliver over US\$2 billion of net cash flow over the life of mine at a C1 cash cost of around US\$6,800/t nickel placing the project in the lower quartile of global laterite nickel operations and one of a very limited number of scalable, high grade, fully permitted, construction ready projects globally.*

*This robust demand picture for nickel positions Horizonte well, owning 100% of two Tier 1 nickel projects,*

*within trucking distance of each other with the potential to produce 40,000 to 50,000 tonnes per year of nickel to service both the traditional stainless and EV battery market as well a cobalt revenue stream from outside of the Democratic Republic of Congo (DRC ) and service both the traditional stainless and EV battery market*

## Summary

The Company completed bench scale hydrometallurgical test work at the test facilities of SGS in Lakefield, Ontario, Canada during Q1-Q2 2019 on representative samples of Vermelho limonite ore, averaging 1.72% Ni, 0.076% Co and 27.7% Fe. Approximately 157 kg (wet) of Vermelho limonitic ore was received at SGS. After homogenisation, a sub-sample was taken for full chemical analysis. The bulk sample was then scrubbed in batches of about 25 kg using fresh water. The scrubbed ore was then screened, with the oversize ground and recycled so that all screen under-flow was used for the hydrometallurgical test work. It is noted that a beneficiation step, as would be included in a commercial plant, was not carried out in the laboratory tests.

The individual hydrometallurgical tests carried out are briefly summarised under the following four major test stages;

1. HPAL Leaching and neutralisation of solution
2. Production of Mixed Hydroxide Precipitate (MHP) and re-leaching
3. Separation of Co and Ni and purification of the Co solution
4. Cobalt sulphate crystallisation.

## Detailed Information

### 1. PAL Leaching and neutralisation of solution

Initially, two leach tests were carried out in a 2-litre autoclave with 400 gm of ore in order to determine conditions for the subsequent full-scale leaching using the 20-litre test autoclave (to be carried out in ~20 individual leach batches with about 5 kg of ore at a time).

The leach conditions used in previous work by Vale were also taken into account. Typical leach conditions used are presented in Table 1.

Table 1. Typical leach conditions used for the tests

Item	Value
Solids, %	35
Acid used, kg/t dry ore	350-400
Pressure, psi	585
Temperature, °C	250
Ni extraction, %	98
Co extraction, %	96

A total of 20 individual leach batches were carried out to process all the ore. A typical analysis of the final pulp filtrate is presented in Table 2.

Table 2. Typical chemical analysis of final pulp filtrate

Element Analysis, mg/L	
Ni	7,880
Co	345
Fe	7,660
Mg	10,600

Al	2,370
Cu	49.2
Zn	152
Mn	1,490
Cr	230

Nickel and cobalt extractions were very high.

Two limestone scoping tests (for the primary and secondary neutralisation) were successfully carried out to develop the conditions for solution neutralisation. The final pH was set at between 5 and 5.1. The primary and secondary neutralisation steps on the bulk solution were subsequently carried out. It is noted that in the present batch laboratory testing, a number of sub-products were generated which were not recycled as would occur in a continuous commercial operation; metal recovery, which is impacted by this situation, was not to be evaluated in the present work.

## 2. Production of Mixed Hydroxide Precipitate (MHP) and re-leaching

As planned, Ca(OH)<sub>2</sub> was used to generate the MHP product containing mostly Ni and Co hydroxides. The analysis of the MHP prior to re-leaching is presented in Table 3.

Table 3. Typical chemical analysis of the produced MHP

Element Analysis, %	
Ni	18.3
Co	0.97
Mn	1.92
Mg	0.67
Ca	13.1
Cu	<0.01
Zn	0.12

## 3. Separation of Co and Ni and purification of the Co solution

### Solvent Extraction

Test conditions were established on small-scale batch laboratory scoping tests. In addition, Cytec Canada Inc. provided recommendations for test conditions. (The modelling by Cytec recommended to use a 10% Cyanea 272 reagent in Exxsol D80 with a phase ratio of 1:1; the scrub liquor was also defined). The solvent extraction on the bulk solution was then carried out on a continuous basis in laboratory apparatus which was assembled for the purpose.

### Ion Exchange

Ion exchange was carried out as a two-stage ion exchange contacting sequence. A sulphide precipitation step was then carried out after the ion exchange step following initial tests using a synthetic solution to determine the best conditions. (Thermochemical computations showed that under the proposed conditions, cobalt sulphide would precipitate ahead of that for zinc, copper and manganese, thus affording a means of elemental separation and purification). A further manganese removal stage was also carried out.

## 4. Cobalt sulphate crystallisation.

The near-pure cobalt sulphate solution was crystallised batch-wise under controlled conditions and a single harvest of cobalt sulphate crystals was gathered. This material at over 99.91 % pure is considered ready for a final purification stage for specific battery market applications.

Figure 1. Sample of cobalt sulphate heptahydrate

<https://www.globenewswire.com/NewsRoom/AttachmentNg/f365046f-d473-49ba-8389-557f383bcde3>

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About Horizonte Minerals:

[Horizonte Minerals Plc](#) is an AIM and TSX-listed nickel development company focused in Brazil. The Company is developing the Araguaia project, as the next major ferronickel mine in Brazil, and the Vermelho nickel-cobalt project, with the aim of being able to supply nickel and cobalt to the EV battery market. Both projects are 100% owned.

#### CAUTIONARY STATEMENT REGARDING FORWARD LOOKING INFORMATION

Except for statements of historical fact relating to the Company, certain information contained in this press release constitutes "forward-looking information" under Canadian securities legislation. Forward-looking information includes, but is not limited to, the ability of the Company to complete the Acquisition as described herein, statements with respect to the potential of the Company's current or future property mineral projects; the success of exploration and mining activities; cost and timing of future exploration, production and development; the estimation of [Mineral Resources Ltd.](#) and reserves and the ability of the Company to achieve its goals in respect of growing its [Mineral Resources Ltd.](#); the ability of the Company to complete the Placing as described herein, and the realization of mineral resource and reserve estimates. Generally, forward-looking information can be identified by the use of forward-looking terminology such as "plans", "expects" or "does not expect", "is expected", "budget", "scheduled", "estimates", "forecasts", "intends", "anticipates" or "does not anticipate", or "believes", or variations of such words and phrases or statements that certain actions, events or results "may", "could", "would", "might" or "will be taken", "occur" or "be achieved". Forward-looking information is based on the reasonable assumptions, estimates, analysis and opinions of management made in light of its experience and its perception of trends, current conditions and expected developments, as well as other factors that management believes to be relevant and reasonable in the circumstances at the date that such statements are made, and are inherently subject to known and unknown risks, uncertainties and other factors that may cause the actual results, level of activity, performance or achievements of the Company to be materially different from those expressed or implied by such forward-looking information, including but not limited to risks related to: the inability of the Company to complete the Acquisition as described herein, exploration and mining risks, competition from competitors with greater capital; the Company's lack of experience with respect to development-stage mining operations; fluctuations in metal prices; uninsured risks; environmental and other regulatory requirements; exploration, mining and other licences; the Company's future payment obligations; potential disputes with respect to the Company's title to, and the area of, its mining concessions; the Company's dependence on its ability to obtain sufficient financing in the future; the Company's dependence on its relationships with third parties; the Company's joint ventures; the potential of currency fluctuations and political or economic instability in countries in which the Company operates; currency exchange fluctuations; the Company's ability to manage its growth effectively; the trading market for the ordinary shares of the Company; uncertainty with respect to the Company's plans to continue to develop its operations and new projects; the Company's dependence on key personnel; possible conflicts of interest of directors and officers of the Company, the inability of the Company to complete the Placing on the terms as described herein, and various risks associated with the

legal and regulatory framework within which the Company operates. Although management of the Company has attempted to identify important factors that could cause actual results to differ materially from those contained in forward-looking information, there may be other factors that cause results not to be as anticipated, estimated or intended. There can be no assurance that such statements will prove to be accurate, as actual results and future events could differ materially f

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