

March 16, 2022

## Cerro Los Gatos Mineral Resources and Reserves Miscalculation

Gatos Silver (GATO.T, GATO.NYSE), a single-asset producer in Mexico, announced last week that its lender (BMO) was willing to amend the credit facility to include potential loan covenant deficiencies that may arise following the junior producer's late January 2022 press release, which had cited conflicting information concerning the reserves and resources estimate at its 70%-owned Cerro Los Gatos underground operation and led to the nosedive in the company's share price.

On request from a subscriber a few weeks ago, I spent some time reviewing the underwhelming news and discussing it with colleagues before putting together my notes below, which I hope will help you as an investor improve your ability to filter investment options in the resource sector.



Although there may be other red flags warning of the problem with the reserves and resources estimation at the Cerro Los Gatos mine, the most relevant, in my opinion, are as follows:

- **Red Flag #1:** In 2021, the operation badly underperformed the mine plan outlined in the 2020 feasibility study (FS). Overall, the silver production was down 12%, making it a much less compelling story.
- **Red Flag #2:** The departure of the Chief Operating Officer in mid-August 2021 and the addition of more technical expertise before the end of the year suggested potential issues at the mine.
- **Red Flag #3:** It is very unusual for an underground vein deposit with no significant development to have most of its material assigned to the higher category of resources (Measured vs. Indicated) and reserves (Proven vs. Probable).
- **Red Flag #4:** The methodology chosen for the resource estimate was ordinary kriging (OK), which tends to be used more for evenly distributed mineralized bodies with low grade variability, like disseminated deposits, than epithermal precious-metal vein-style mineralized bodies. Consequently, the method may have wrongly extrapolated high grade material into zones where it does not exist.
- **Red Flag #5:** Most of the stated reserve tonnage (66%) fell into the Proven category, which, again, is remarkable for an underground vein deposit. In addition, the Proven tonnage exceeded the Measured resources as a result of a drop in the cut-off grade, which is highly unusual as reserves should typically be of a higher quality than resources.

## Discussion

Gatos Silver's share price fell 70-75% from a January 2022 peak of US\$11.35 after its January 25 announcement that, due to significant errors in the July 2020 Feasibility Study (FS), the Cerro Los Gatos silver mine's underground resource had been grossly overestimated, (Fig. 1).



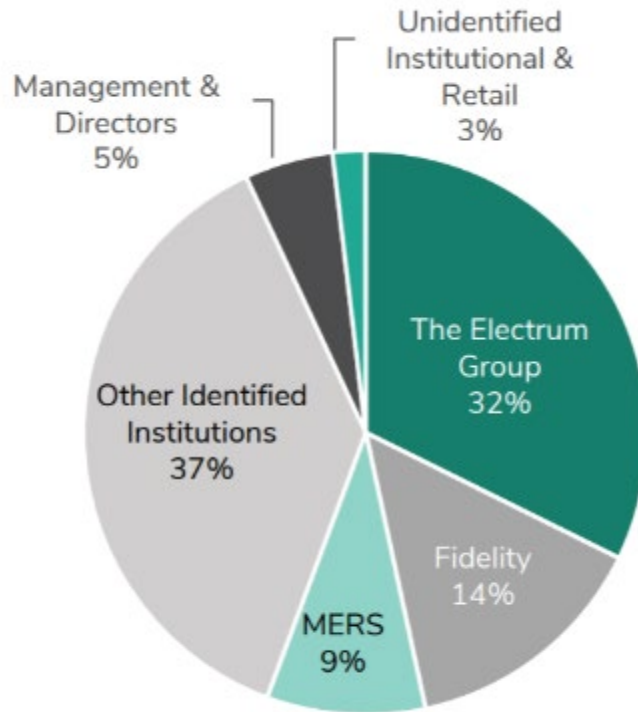
(Figure 1: Gatos Silver [GATO.NYSE] share price performance over the past week. Source: *Investing.com*)

Risks like a flawed resource estimate are inherent to mining projects and could mean significant losses for investors, but they also offer the opportunity to learn how to avoid them in the future. In the discussion below, I will expand on the 'red flags' mentioned above, which could have alerted shareholders to the problems at the mine.

To give a bit of background, Gatos Silver raised ~US\$150 million at US\$7.00 per share in an initial public offering (IPO) in October 2020 to increase its ownership at the Cerro Los Gatos Joint Venture (JV) with Dowa to 70% and fund exploration, future production plans, near-term debt, and G&A expenditures.

The financing transaction was the largest equity private placement by a precious metal company listed on the Toronto and New York exchanges in 2020. Not quite a year later, the company raised another US\$125 million at twice the price (US\$14.00/sh).

Gatos Silver's shareholders are heavily weighted to institutional equity funds (>90%), which is rare for a silver company, and the retail component is low at 3%, (Fig. 2). The significant presence of 'smart money' alone may have led some investors to follow along.



(Figure 2: Shareholders are strongly institutional with little retail. Source: *Gatos Silver*)

As previously mentioned, Gatos Silver owns 70% of the Cerro Los Gatos mining complex in Chihuahua, Mexico, with Dowa Metals and Mining owning the remainder, (Fig. 3). The mine operates at a throughput rate of 1,200 tonnes per day, extracting silver-zinc-lead-gold mineralization from underground workings that exploit intermediate sulfidation epithermal (ISE) veins.



(Figure 3: Cerro Los Gatos operation in Chihuahua, Mexico. Source: *Gatos Silver*)

## Red Flag #1: Falling short of the 2020 Feasibility Study plan

The bad news came only two weeks after the company had reported a record fourth quarter (Q4) for silver production (+35% quarter-on-quarter [q-o-q], 2.3 Moz) at higher than nameplate throughput capacity (>2,600 t/d), due primarily to a jump in silver grade (+29% q-o-q, 331 g/t Ag), (Table 1).

To put a mine's performance into context, one should always compare it to expectations. In this case, the benchmark was set by the July 2020 FS report published soon after the start of operations, and its estimates should have been valid, at the very least, for the 2021 production.

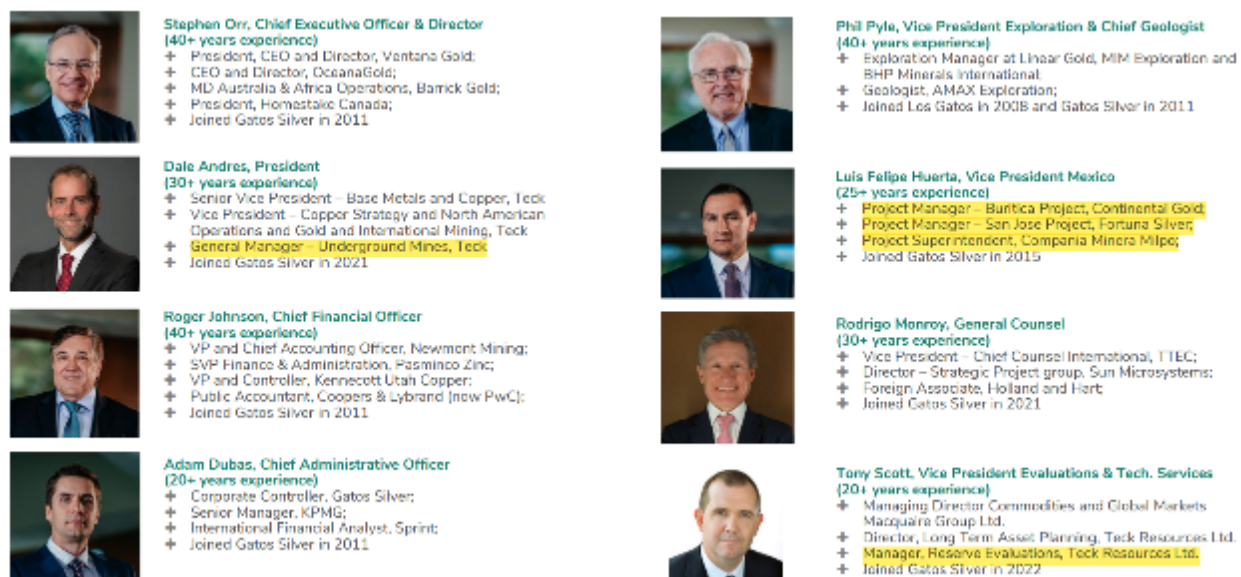
At first glance, the grade increase appears impressive, but compared to the 2020 FS mine plan, Gatos Silver had been running the plant at a marginally higher than expected throughput rate (+1%) to offset a drop in silver head grade (-17%). Overall, the 2021 silver production was down 12% compared to the 2020 FS estimate, making it a much less compelling result.

Los Gatos (100%)	FY 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	FY 2021
Tonnes milled (t) Actual	667,422	203,479	230,656	234,054	241,397	909,586
Tonnes milled (t) 2020 FS	321,000	215,500	215,500	215,500	215,500	862,000
Delta	108%	-6%	7%	9%	12%	6%
Throughput Actual (t/d)	1,829	2,261	2,535	2,544	2,624	2,492
Throughput 2020 FS (t/d)	1,834	2,463	2,463	2,463	2,463	2,463
Delta	0%	-8%	3%	3%	7%	1%
Silver grade Actual (g/t)	229	261	322	256	331	295
Silver grade 2020 FS (g/t)	330	357	356	355	350	356
Delta	-31%	-27%	-10%	-28%	-5%	-17%
Recovery	85%	88%	88%	88%	90%	88%
Silver Actual (Moz)	4.2	1.5	2.1	1.7	2.3	7.6
Silver 2020 FS (Moz)	2.9	2.2	2.2	2.2	2.2	8.7
Delta	44%	-31%	-3%	-22%	6%	-12%

(Table 1: Full-year [2020 and 2021] and quarterly [Q1-Q4 2021] operation results from Cerro Los Gatos silver-gold-lead-zinc mine versus 2020 FS. Source: *Gatos Silver and Exploration Insights*)

## Red Flag #2: Departure of COO and new hires

In August 2021, the company's Chief Operating Officer departed the scene, and all mine operations had to be directly reported to the President (link [here](#)), (Fig. 4). This may have been an early, albeit subtle, signal that bad news was on the horizon. The company has since strengthened its technical capability by hiring a VP of Technical Services in early December, (link [here](#)).



(Figure 4: Management, those with mining experience highlighted. Source: *Los Gatos Silver*)

A review of the 2020 technical report published by Tetra Tech indicates that the "competent person" responsible for the mineral resource estimation had just about 10 years of experience and had visited the property twice (2012 and 2019). Also, although not a red flag, I would add that Tetra Tech is better known for its engineering acumen than resource calculations.

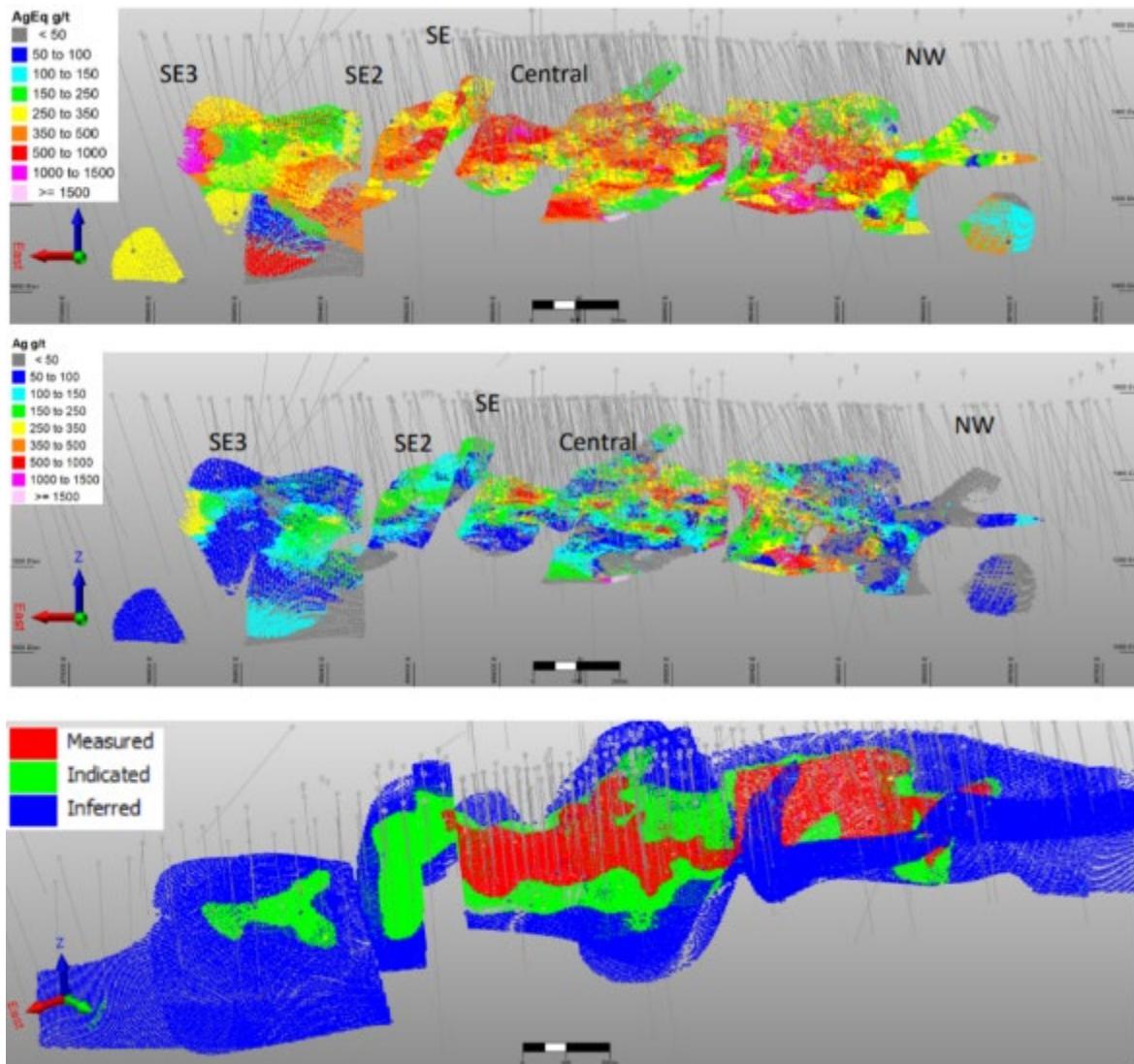
## Red Flag #3: Anomalously high amount of well-defined resources and reserves

More importantly for long-term investors, the company warned them that since it "...cannot accurately quantify the exact magnitude of the reduction, the mineral resource and reserve estimates in the 2020 Technical Report should not be relied upon."

A wide range of estimates (30-50%) was provided to account for the potential drop in resources and reserves, and the miscalculations were ascribed to previously undocumented structural controls on the mineralization and the veins' geometry (not atypical for vein deposits), which were more complex than previously modeled. A revised estimate is planned for the second half of 2022, which seems a long way off, considering the company is already mining the deposit.

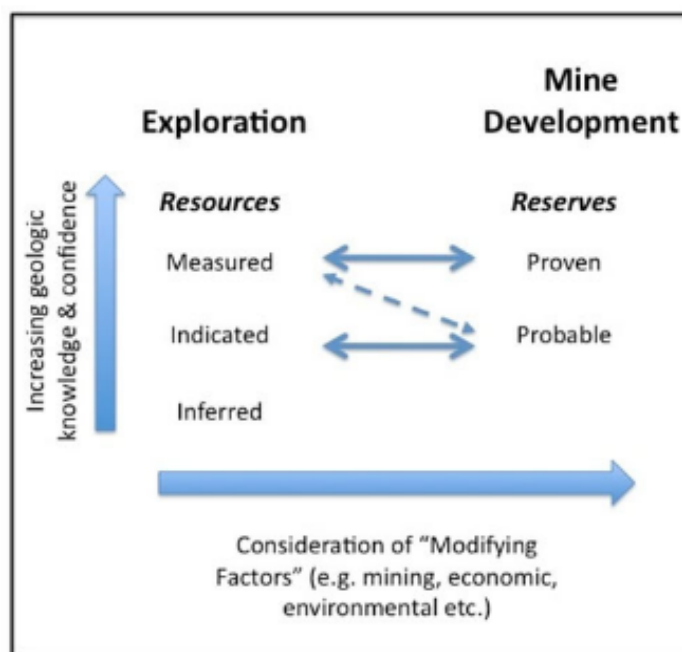


The silver and polymetallic (lead-zinc-copper-gold) mineralization is hosted by epithermal veins and compartmentalized by post-mineral faults into five distinct zones. According to the technical report, most of the mineralization is in the Central block and plunges towards the NW zone, (Fig. 5). The Central and NW blocks are also the first being exploited as they host the majority of the highest-category resources (Measured).



(Figure 5: Distribution of the silver equivalent [AgEq g/t, top] and silver only [Ag g/t, middle] grades, and resource categories [bottom] at Los Gatos. Source: *Los Gatos Project technical report, July 2020*)

At this point, it's helpful to do a quick recap of how a "competent person" classifies and reports mineral assets according to industry standards, (Fig. 6):



(Figure 6: CRIRSCO standards for mineral asset reporting. Source: [geologyforinvestors.com](http://geologyforinvestors.com))

The **resource** categories used for calculating **reserves** are Measured and Indicated, as they have the level of geological confidence required to be converted and mined economically, at least theoretically.

In certain situations, Measured resources could be moved to Probable reserves because of additional uncertainties; however, usually, Measured resources move to Proven reserves, the highest category, and Indicated resources, to Probable reserves. Also, reserves can be converted back to resources if the economics of the project change.

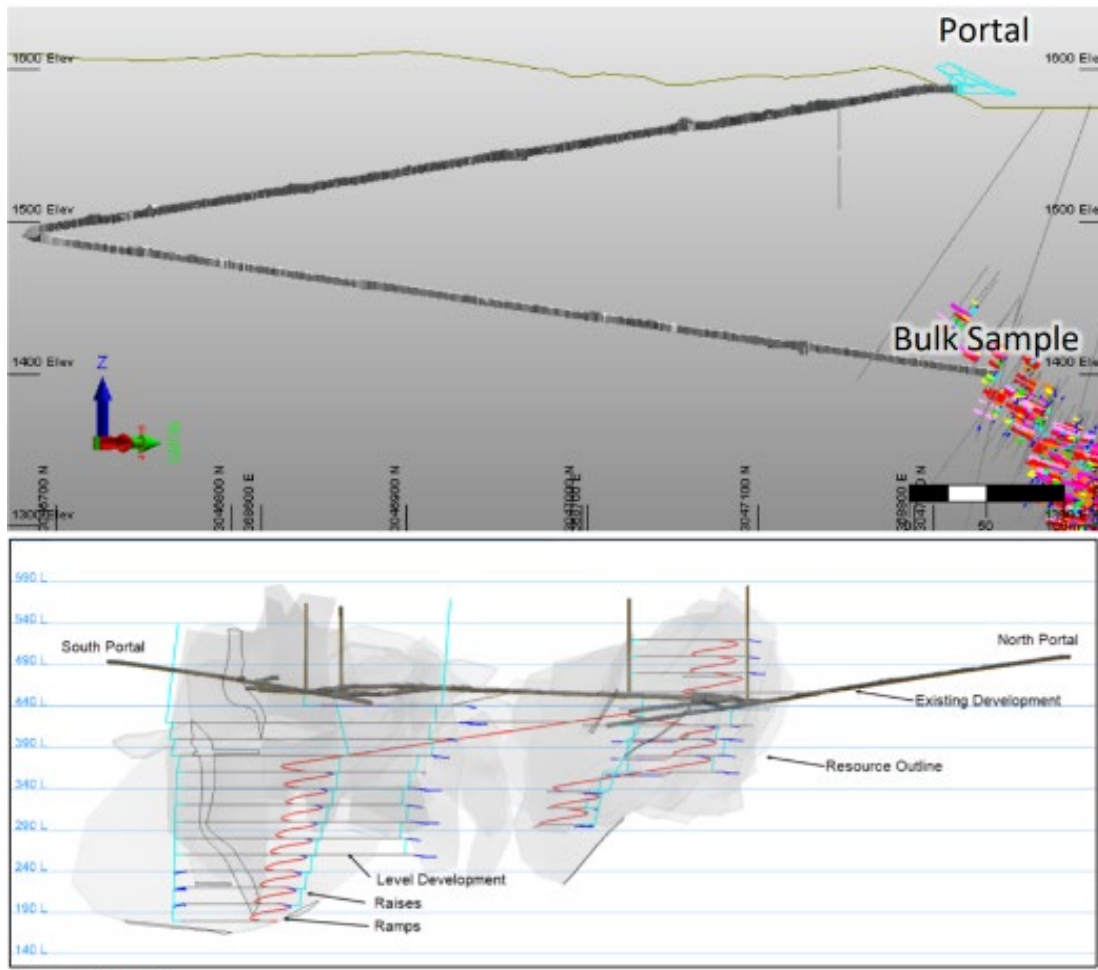
What struck me as strange from the Cerro Los Gatos news was the proportion of global resources assigned to the highest category (Measured >40%), (Table 2). Typically, a high density of drill holes is required to convert Inferred and Indicated resources into Measured, which is more complex and expensive for vein deposits, especially those that need to be exploited by underground methods.

Classification	Tonnes	AgEq g/t	Ag g/t	Pb %	Zn %	Au g/t	Cu %	AgEq toz M	Ag toz M	Pb lbs M	Zn lbs M	Au toz K	Cu lbs M
Measured	5,774,314	652	324	2.9	5.8	0.39	0.11	121	60	375	744	72	13
Indicated	4,586,507	489	202	2.5	5.2	0.28	0.11	72	30	251	528	42	12
<b>Measured and Indicated</b>	<b>10,360,822</b>	<b>576</b>	<b>269</b>	<b>2.7</b>	<b>5.5</b>	<b>0.34</b>	<b>0.11</b>	<b>193</b>	<b>90</b>	<b>626</b>	<b>1,272</b>	<b>114</b>	<b>25</b>
Inferred	3,717,063	361	107	2.8	4.0	0.28	0.14	43	13	231	330	34	12

(Table 2: Mineral resource estimate for Los Gatos. Source: *Los Gatos Project technical report, July 2020*)

Before the start of the mining operations, the only underground development was a 1.3-kilometer decline to access the upper part of the Central block built in September 2016 to extract a bulk tonnage sample (1,215 t) from the 1,400-meter level for metallurgical testwork, (Fig. 7).

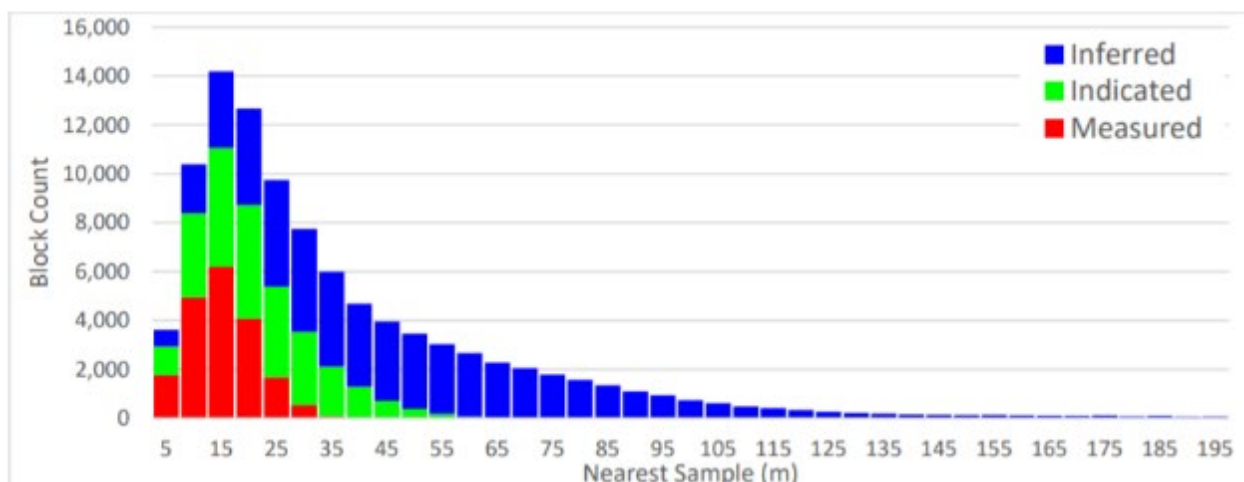
By contrast, the Cerro Blanco underground workings in Guatemala operated by **Bluestone Resources (BSR.V, BSSRF.OTC)**, which I visited in 2020, span 2.5 kilometers and provide an excellent three-dimensional view of the vein system. Before turning into an open pit scenario (link [here](#)), the Cerro Blanco underground resource contained only a small portion of Measured resources (~8%).



(Figure 7: Schematic of the underground decline to the 1400-m level at the Cerro Los Gatos mine [top] and the 2.5 km of underground development at Cerro Blanco [bottom]. Source: *Los Gatos Project technical report, July 2020*)

Moreover, according to the resource block histogram, (Fig. 8), the company has many blocks defined by samples from drill holes that are more than 15 meters apart from each other, which may be too far apart to accurately reflect the grade and width of veins in the areas between holes.





(Figure 8: Number of resource blocks by category [Measured - red, Indicated - green, and Inferred - blue]. Source: *Los Gatos Project technical report, July 2020*)

The increase in Measured resources had a knock-on impact on reserves. According to the 2020 FS, the deposit hosted 9.6 million tonnes of Proven and Probable reserves grading 306 grams per tonne silver containing 94.5 million ounces of silver, with most of the tonnage (66%) in the Proven or highest category, which, as mentioned before, is remarkable for an underground vein deposit, (Table 3).

Also, since the grade of the Proven reserves is also higher than the Probable (332 vs. 254 g/t Ag), the proportion of Proven silver ounces is also higher.

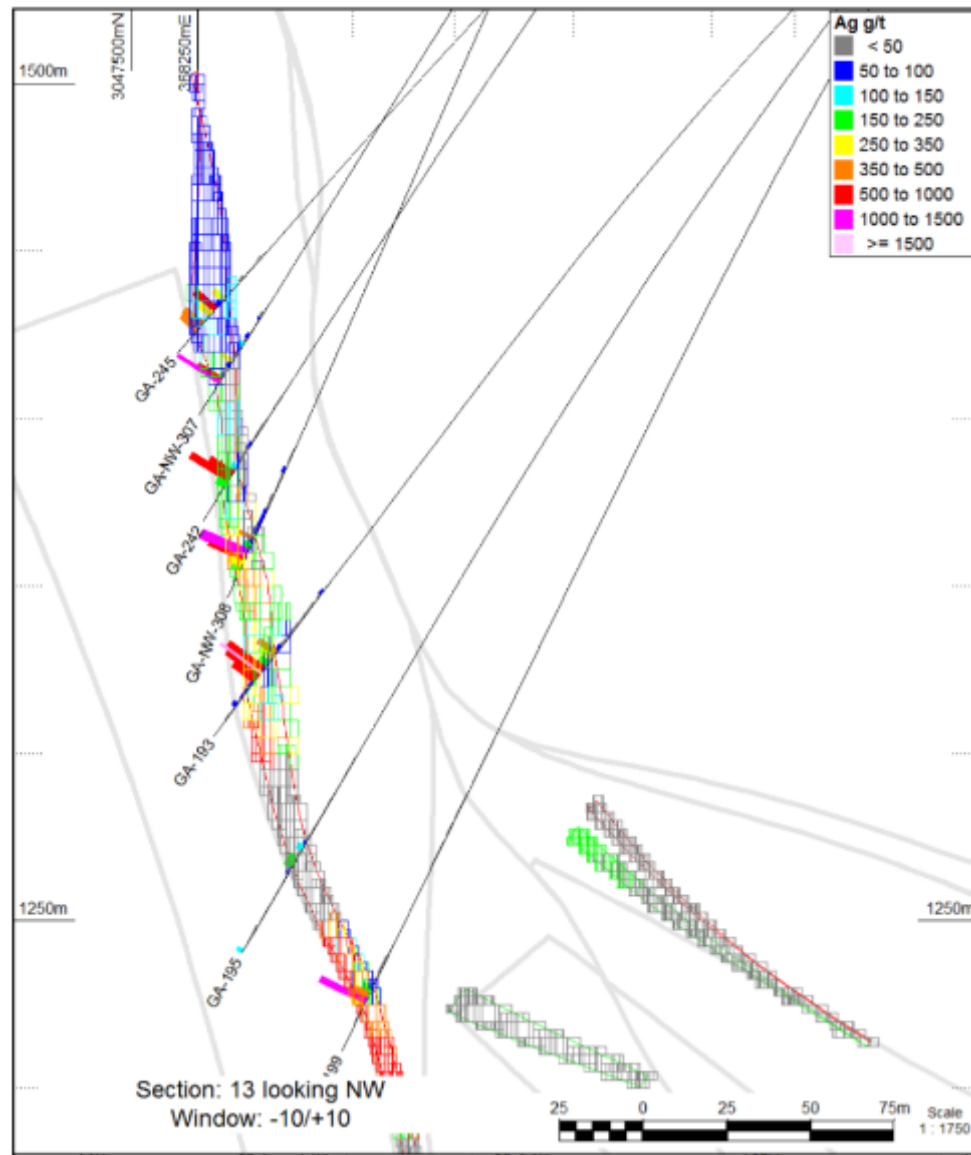
Zone	Classification	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
NWZ	Proven	2,587,684	359	0.43	3.09	5.88
	Probable	492,892	333	0.34	2.86	5.88
CZ	Proven	3,767,456	314	0.31	2.55	5.32
	Probable	1,772,921	299	0.44	2.32	5.82
SEZ	Proven	5,751	148	0.16	3.69	7.23
	Probable	569,380	148	0.16	3.69	7.23
SEZ2	Probable	421,547	118	0.17	3.11	4.16
<b>Total</b>	<b>Proven</b>	<b>6,360,890</b>	<b>332</b>	<b>0.36</b>	<b>2.77</b>	<b>5.55</b>
<b>Total</b>	<b>Probable</b>	<b>3,256,740</b>	<b>254</b>	<b>0.34</b>	<b>2.74</b>	<b>5.86</b>
<b>Total</b>	<b>Proven + Probable</b>	<b>9,617,631</b>	<b>306</b>	<b>0.35</b>	<b>2.76</b>	<b>5.65</b>

(Table 3: Proven and probable reserves at Cerro Los Gatos with tonnage and grade of silver, gold, lead, and zinc. Source: *Los Gatos Project technical report, July 2020*)

#### Red Flag #4: Estimation methodology not OK

The chosen estimation methodology for the Cerro Los Gatos deposit was ordinary kriging (OK), which tends to be used more for mineralized bodies where the mineralization is evenly distributed (with low variability), like in disseminated deposits, rather than for vein-type deposits.

To illustrate, one of the deep holes [GA-195] drilled to intersect a vein, cut a 'dead zone' (no anomalous grade); however, by using the OK method, anomalous silver mineralization from the upper and lower holes was extended ~25 meters into the barren zone.



(Figure 9: Cross section of a vein at Cerro Los Gatos with seven drill holes intersecting it at intervals between ~25 and 50 meters. Note the high grade mineralization [colored bars] on each hole as they intersect the vein, the 'barren' section close to the bottom of the hole [mostly gray rectangles], and the 'modeled' high grade mineralization [colored rectangles], which extends into the barren zone, both down and up. Source: *Los Gatos Project technical report, July 2020*)

A comparison of estimation methodologies to ordinary kriging (OK), including inverse distance squared (ID2), nearest neighbor (NN), and multiple indicator kriging (MIK), (Table 4), shows that the alternate methods generate both lower tonnage, from -3% (MIK) to -15% (NN), and contained silver ounces, from -2% (NN) to -4% (MIK), than OK.

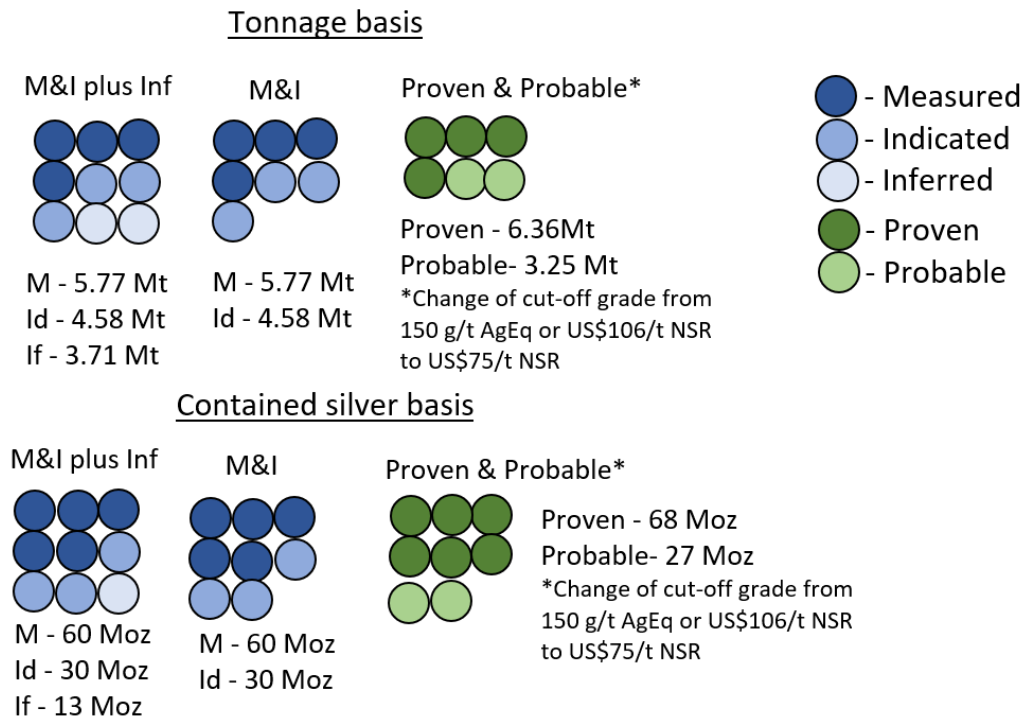
Method	Tonnes	AgEq g/t	Ag g/t	Pb %	Zn %	AgEq toz	Ag toz	Pb lbs	Zn lbs
OK	0	0	0	0	0	0	0	0	0
ID <sup>2</sup>	-4	-1	2	-3	-2	-4	-3	-6	-6
NN	-15	14	16	10	9	-7	-2	-10	-11
MIK	-3	-7	-1	-11	-12	-9	-4	-13	-14

(Table 4: Percentage change in tonnage, grade, and contained metal between the chosen estimation methodology [OK] and other alternatives. Source: *Los Gatos Project technical report, July 2020*)

### Red Flag #5: More proven reserves than measured resources?

I left the most important issue for last, given that this is the first time I and those I consulted with have seen a diluted mine reserve plan that adds both tonnes and ounces to a deposit.

In the below diagram, I depict the conversion of resources (Measured & Indicated plus Inferred or M&I plus I) to reserves before digging into details, (Fig. 10):

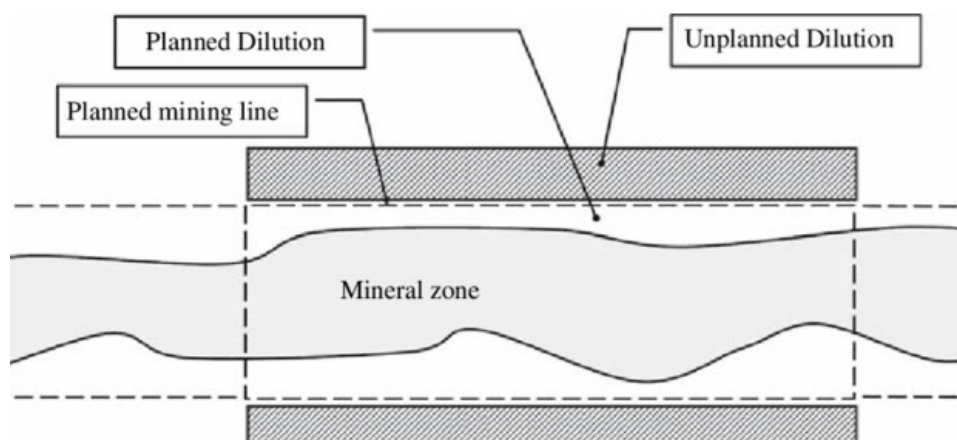


(Figure 10: Schematic representation of the conversion of resources on a tonnage [top] and contained silver ounces [bottom] basis to reserves, by category, at Cerro Los Gatos. NSR=net smelter return. Source: *Exploration Insights*)

The Inferred resource was netted out of the global resource (M&I plus I) as it cannot be used for resource conversion. Then, the Measured and Indicated resource was converted to reserves.

The number of circles illustrates that the vast majority of M&I resources were converted to Proven and Probable reserves, both on a tonnage and contained silver ounces bases, due to a reduction in the cut-off grade by about a third (from 150 g/t to ~100 g/t AgEq).

In a typical scenario, the conversion rate would be much lower, especially in the case of underground deposits. That is to say, if the chosen mining method added tonnes of low grade material to the reserves for geotechnical reasons, it would lower the overall grade, (Fig. 11). Conversely, if the mine plan were designed to extract only the high grade core of a deposit, the reserves tonnage would be reduced.



(Figure 11: A mineralized zone is diluted by planned and unplanned low grade tonnes or waste due to the minimum mining width necessary to extract it. Source: *John G. Henning and ResearchGate.net*)

In summary, the conversion of resources to reserves rarely adds both tonnes and ounces, as it did at Cerro Los Gatos, (Table 5). Although the conversion from Indicated to Probable looks more reasonable (71% tonnage and 89% contained silver) than from Measured to Proven (110% tonnage and 113% contained silver), it is still on the high end and, therefore, considered risky.

<b>Los Gatos 100%</b>	<b>Tonnage (kt)</b>	<b>Silver (g/t Ag)</b>	<b>Silver (Moz)</b>
Measured	5,774	324	60.2
Indicated	4,587	202	29.8
<i>M&amp;I</i>	10,361	270	89.9
Proven	6,361	332	67.9
Probable	3,257	254	26.6
2P total	9,618	306	94.5
<b>Conversion from Measured to Proven</b>	<b>110%</b>		<b>113%</b>
Conversion from Indicated to Probable	71%		89%

(Table 5: Comparing tonnage, silver grade, and contained ounces as resource categories are converted into reserves. Also, the dilution factor for each category to reserves. Source: *Los Gatos Project technical report, July 2020*)

According to the authors of the 2020 FS, the reason the Proven reserves exceeded the Measured resources is the change in cut-off grade, which is not unusual. However, the direction of the change is concerning as the cut-off grade went down, not up.

The reserves calculation used a cut-off grade that was about one-third lower, from 150 grams per tonne silver equivalent (US\$106/t net smelter return, NSR) to ~100 grams per tonne silver equivalent (US\$75/t NSR).

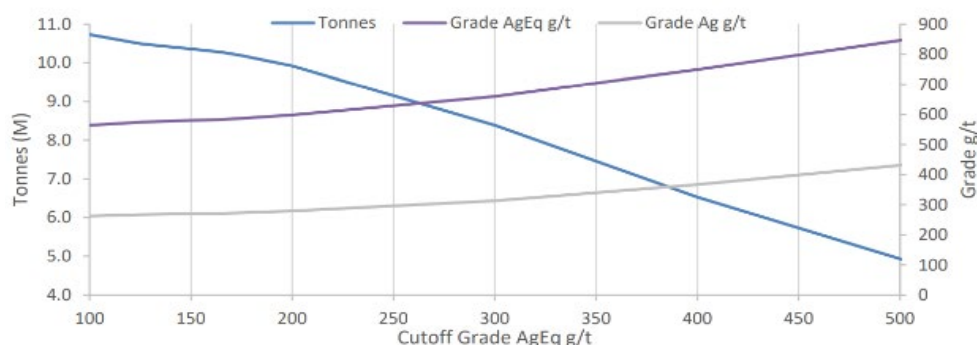
The change in grade could be attributed to the rising silver price, which was closing in on US\$30 per ounce in 2020 but was trading at less than US\$15 per ounce in 2019 when the resource was calculated, (Fig. 12).



(Figure 12: Silver price [US\$ per ounce] over the past three years. Source: *Investing.com*)

However, since Cerro Los Gatos is a vein deposit, it does not have a large halo of disseminated mineralization; therefore, resources and reserves should be relatively insensitive to a drop in cut-off grade.

The graphic below shows that lowering the cut-off grade from 150 to ~100 grams per tonne silver equivalent (g/t AgEq) does not significantly impact the tonnes or the silver grade, (Fig. 13).



(Figure 13: Grade and tonnage curves for Cerro Los Gatos silver mine for cut-off grades from 100 to 500 AgEq g/t. Source: *Los Gatos Project technical report, July 2020*)



## Dead cat bounce?

Gatos Silver is guiding to a 2022 production forecast of 8.5 to 9.0 million ounces of silver, which would be 12-18% higher than the 2021 production but still 13-18% lower than the 2020 FS guidance. I gather that the company must be more confident in its near-term plan than the long one considering the potential 30-50% reduction in resources and/or reserves.

Given the outlined risks, I am not a buyer of Gatos Silver, but those seeking a price level to purchase shares in a rebound should know that the company hopes to replace the expected loss in resources and reserves with potential ounces from surrounding areas.

On the other hand, if the reserves miscalculation is consequential, it could result in a default for the company, even under its credit facility, where it has US\$13 million outstanding as of the end of 2021, or it could lead to an impairment and restatement of its financial statements.

Gatos Silver believes it has enough liquidity to manage the process, but I have heard that before. That being said, the current market sentiment for precious metals is improving, which may allow the junior silver producer to return to the equity markets to add to its treasury.

*That's the way I see it,*

Joe Mazumdar

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### **Disclosures**

*Of the companies mentioned in this week's letter, Exploration Insights owns shares of all the companies listed in its Open Positions (link [here](#)).*

*[Note that our trading activity is based on our investment thesis, which can be short-(tactical) or long-term (strategic), but the timing will not always be perfect due to market volatility and share price liquidity. As a subscriber, you may want to purchase/sell a stock sooner or later than we do. As we need to justify our purchases and sales while allowing our subscribers to trade with us, we, unfortunately, cannot always act as quickly as we would like. We also want to remind all our subscribers that they have access to the open and closed positions in the EI Portfolio via the website. As soon as we execute a trade, we update the price and date of the open and closed positions, depending on whether the position was purchased or sold. There can be delays due to the illiquidity of some of the junior mining stocks and the time needed to link a new stock to our website. Our site visit expenses are covered by the company.]*

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