



## **Bulk sampling as an exploration tool**

Bulk sampling is an underutilized tool that provides critical technical information that establishes the amenability of any given type of mineralization to various recovery methods and also provides unique three dimensional insight into the structure, mineralization, and geometry of a mineral deposit that is not available through any other technique.

Although there are many examples of bulk sampling throughout the world, it remains an under-utilized yet critical tool for a variety of reasons including:

- Investor expectations and the securities regulatory framework emphasize continued drilling in a rush to establish an initial NI 43-101 resource oftentimes without the essential benefits of metallurgy knowledge (both process and recovery) and understanding of the deposit's geology in three dimensional space.
- In Canada, the reliance upon flow through funding discourages bulk sampling as only portions of such a program are allowable expenses.
- Routinely, smaller companies have technical teams that may contain considerable geological expertise but fewer have the required metallurgical and mining engineering skills on their teams.
- The cost to properly obtain and process a bulk sample is often times considered too high compared to drilling or other exploration techniques.

Golden Predator made the decision to bulk sample at its 3 Aces project relatively early due to the realization that the bulk of the gold contained in the veins at 3 Aces is high grade (not uncommonly over one ounce per tonne) and of a nuggety nature – the so-called nugget effect. That is to say, the gold is not distributed evenly throughout the deposit but rather is accumulated in clumps within the veins. Whenever the nugget effect is present the best way to achieve a true gold value of a deposit is to conduct large scale bulk sampling. The high grades of mineralization at 3 Aces also contributed to the decision in that the proceeds of the gold produced would at least partially offset the cost of the bulk sampling.

As one of the relatively few Canadian companies conducting bulk sampling, the Company went even further by building its own pilot processing plant in the Yukon. This was done to eliminate the cost of shipping bulk sample materials to far away destinations such as China and effectively manage costs of the actual processing. By having its own pilot plant, the Company is able to address the security issues of gold recovery with much greater control and confidence than by a third party. An additional consideration was the benefit to the community by not only keeping jobs in the Yukon but also establishing the first such sampling plant available to service the potential

needs of other explorers and developers in the Territory. The plant is currently a relatively simple gravity circuit utilizing water with no other chemicals required. This is due to the free- milling nature of the 3 Aces gold.

The lack of chemicals used in this test process could have ecologically friendly impacts on future mining methods while building local knowledge, local wealth and spinoff benefits.

This article will explore the benefits of this underused, and possibly misunderstood exploration method and how building a test plant has resulted in community benefits and a chemical free test processing system for the 3 Aces Project.

### **This article will:**

- Explain what bulk sampling is and its benefits
- Discuss why bulk sampling is not widely utilized extensively as an exploration tool, generally and especially in the Yukon
- Why Golden Predator started bulk sampling early in the exploration process and how this led to the test processing plant
- Highlight Golden Predator's bulk sample pilot processing facility as an example of how innovative thinking and testing led to considering a chemical free processing option for the 3 Aces Project

### **1. What is bulk sampling? Why did Golden Predator decide to use bulk sampling as an exploration tool?**

Bulk sampling typically extracts tonnages ranging from hundreds of tonnes to as much as 100,000 tonnes and is a standard evaluation practice utilized throughout the world. In British Columbia some companies such as Pretium and Barkerville have conducted extensive bulk sampling. Bulk sampling provides necessary technical information to assess and reconcile drill-predicted amounts of mineralization as well as whether or not the mineral of interest (gold, silver, copper etc.) can be efficiently recovered. Further information critical to predicting future potential mining methods will be gained by observing the way in which various rock types break and shatter with the use of explosives as well as the quantity and density of blast holes and blasting agents.

In Golden Predator's case we bulk sampled our 3 Aces Project in the Yukon in 2016 on a very small scale to determine if the gold present in the veins was recoverable from the enclosing quartz veins economically. This testing proved that the gold was "free-milling" requiring only gravity recovery methods and water. This process required no chemicals in order to achieve up to 90% recovery of the gold. Although free milling gold was not uncommon in the 1800s, most of it has already been mined making the 3 Aces project notable. The bulk sampling continued in 2018 with the extraction of an expected 6,000 to 7,000 tonnes from an adjacent area that had previously been drilled on close spacing (up to 5m x5m) and had been modeled to predict the distribution, grade and total gold content of the area sampled. During the next few months, we will be reconciling the actual gold recovered from the plant, on a bench by bench basis (the 2018 sample involved surface cuts each 2m high), and again as a total on all materials extracted, these results

will permit us to verify or make necessary adjustments to our drill density and our modelling parameters.

### **The only true grade**

Complex gold deposits are generally characterized by strong structural controls on grade distribution and often they have a pronounced nugget effect. The use of larger diameter diamond drilling, reverse circulation and fire assays in this environment help but are still subject to uncertainty of grade. Bulk samples are likely to be the closest estimators of true grade and may be required to evaluate true grade.

When doing a bulk sample, you take ore from certain places depending on what kind of information you want from the area you are exploring. You can choose to bulk sample only from one place to get the true grade in one area or you could choose to mix ore from different areas to get a broader estimate of true grade. Bulk sampling also gives more confidence to predict grade from drill holes.

In the final analysis nothing is more important than the actual recoverable ounces of gold available at a profit. The milled or recoverable grade is critical to this analysis.

### **Size of the bulk sample**

The size of the bulk sample can vary but depending on the factors being analyzed will generally increase with the variability of the ore present, the presence of multiple veins or structures containing the valuable mineral and the number and types of rocks present that will ultimately be included in any potential mine plan.

### **Summary**

1. A bulk sample gives you information about the actual and true grade of the ore on any project where drilling alone often does not. This is particularly true of higher grade deposits.
2. You can choose one area or mix ore from several areas, depending on what kind of information you want to have from the explored area.
3. A variety of technical information including geology, extractive metallurgy and mining engineering can be gained via bulk sampling; all necessary in reducing the risks of moving a project into commercial production.

## **2. Why did Golden Predator build its own plant? Cost? Benefit?**

Mother was the necessity of invention in our case. We needed to try to find a way to process the gold from the bulk sample to achieve results scientifically, efficiently and accurately. This led to the conclusion that it would be most cost effective and allow the best internal control if the plant was located in the Yukon. With no such facility available in the Yukon, we built the Yukon's first plant dedicated to bulk sample processing. As we began processing we started improving the plant. What started as a plant that processed a ton a day manually operated and built largely of scrap material has turned into a closed system plant with a skilled team that runs consistently at 50 tpd. With visible gold, many times sitting loosely in open spaces (vugs) and along fractures,

we suspected that the gold might well be free milling which gave us the opportunity to look at alternative processing methods and kept exploring and expanding the chemical free option.

The key to the success of the plant is the team you put in place. Geologists are perfect for the field work that gets the sample to the test plant. They oversee the grade control drilling, the extraction and sample area calculations. But without those people skilled in extraction and processing, the system would not operate effectively. Golden Predator has built the infrastructure and put together an amazing team. Best of all the knowledge is now local which can benefit the Yukon mining and exploration industry. It's now a competitive advantage for the Yukon due to innovation.

### **3. Explain the chemical-free process Golden Predator uses for bulk sampling?**

Its basically crushing rock into small particles smaller than sand grains, then using gravity and water to separate the gold from the rock. Gold is much heavier than quartz so it settles. Our first goal in the plant was to determine if we could get the gold out and we quickly demonstrated from lab results that gravity and water, done right, could get over 80%.

By having the right people and the right equipment we have built that up to over 87% without the use of chemicals. Our goal now is to try to get consistent 90% recovery at our plant and see how far we can push the testing without chemicals as this would be a huge benefit for future mining and to the First Nation and the Yukon. It is a big factor in looking at potential mining as we need to test different areas of the property to see if the chemical free processing continues to work or what modifications can be made; at all times the goal is to minimize the use of any chemicals where possible. If the project can be successfully operated with water alone, it will provide cost savings as well as streamline permitting and significantly reducing any environmental concerns.

### **4. Why do so few companies conduct bulk sampling?**

Bulk sampling is used by companies to test metallurgy but it is not fully eligible as an exploration expense under flow through financing so not generally used in Canadian companies until much later in the project, if at all. It is generally employed to determine how mineable a project is once a resource is known. It is not a meaningful process to build resource ounces as part of the 43-101 process. Yet bulk sampling helps answer several critically important questions right up front; all of which lead to whether or not the project can be mined economically. All the drilling in the world will not answer that question. You need both methods on a project like 3 Aces and we believe how mineable a project is should be a question that is answered earlier rather than later.

*"Bulk sampling can be compared to the old adage of "a picture is worth a thousand words".... Just more detail and you literally walk through the project as opposed to looking at pin prick cores through various parts of it as determined by pre conceived geologic thought that may or may not be correct or in need of revision," said Janet Lee-Sheriff, Chief Executive Officer of Golden Predator Mining Corp. "We started bulk sample early in the exploration process due to the high grade native gold found at 3 Aces. We built the plant in the Yukon out of necessity, to manage the sampling and processing to ensure accurate results."*