Gekko Systems

The Future of Mining

A COMPARISION BETWEEN REAL TIME GOLD ELEMENTAL ANALYSIS AND THE TRADITIONAL ASSAY PROCESS

GEKKO OLGA

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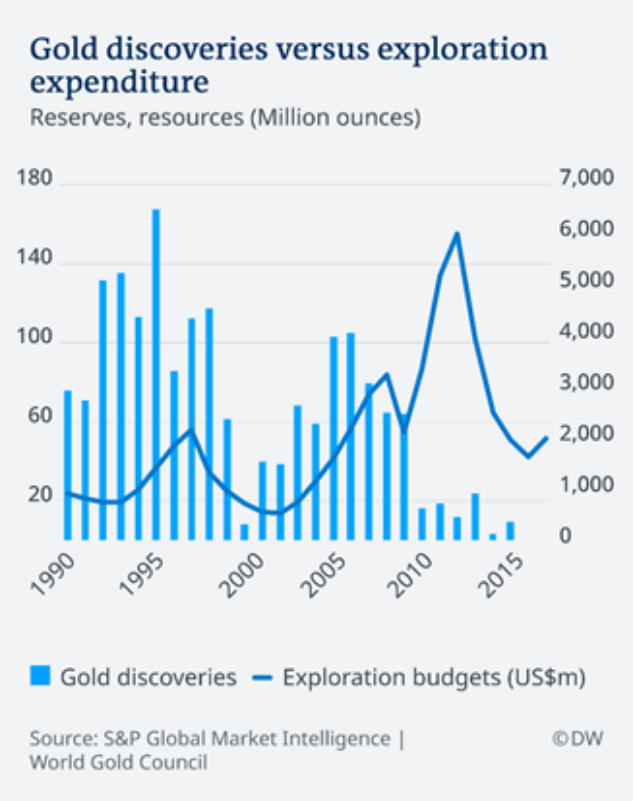
Background

As ore grades decline and deposits are becoming deeper and more complex it becomes increasingly important to improve the efficiency of current gold processing techniques and extract as much value from the deposit as possible. It is far more cost-effective to maximise the extraction of gold as you process it, rather than trying to re-treat it later.

A key component for maximising the efficiency of gold processing will be increasing the data contextualization of the processing plant via digitisation and improving the automation capabilities of the modern gold mine.

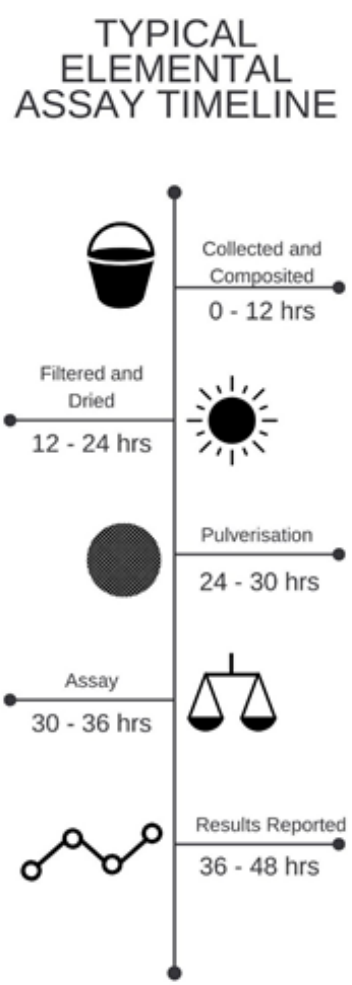


It has been well established in the mining industry that automation based on real-time elemental assays adds considerable value in terms of improving the plant performance. Advanced automation makes processing more predictable, makes responding to fluctuations and changes easier, helps reduce costs associated with reagents and fuels, and reduces the exposure of human operators to potentially dangerous operating conditions. Due to technological limitations in on-stream analysis, these benefits have not been readily available to the gold industry. Gold is usually present in amounts below the detection limits of traditional on-stream analysers.

Recent innovations in the onstream analysis of gold mean that the benefits of advanced software automation and real-time process control are available to the industry... for the first time in history. With long term goals around lower all-in-sustaining-costs (ASIC) delivering elevated cash balances, operations must assess the potential impact that implementation of this technology can bring.

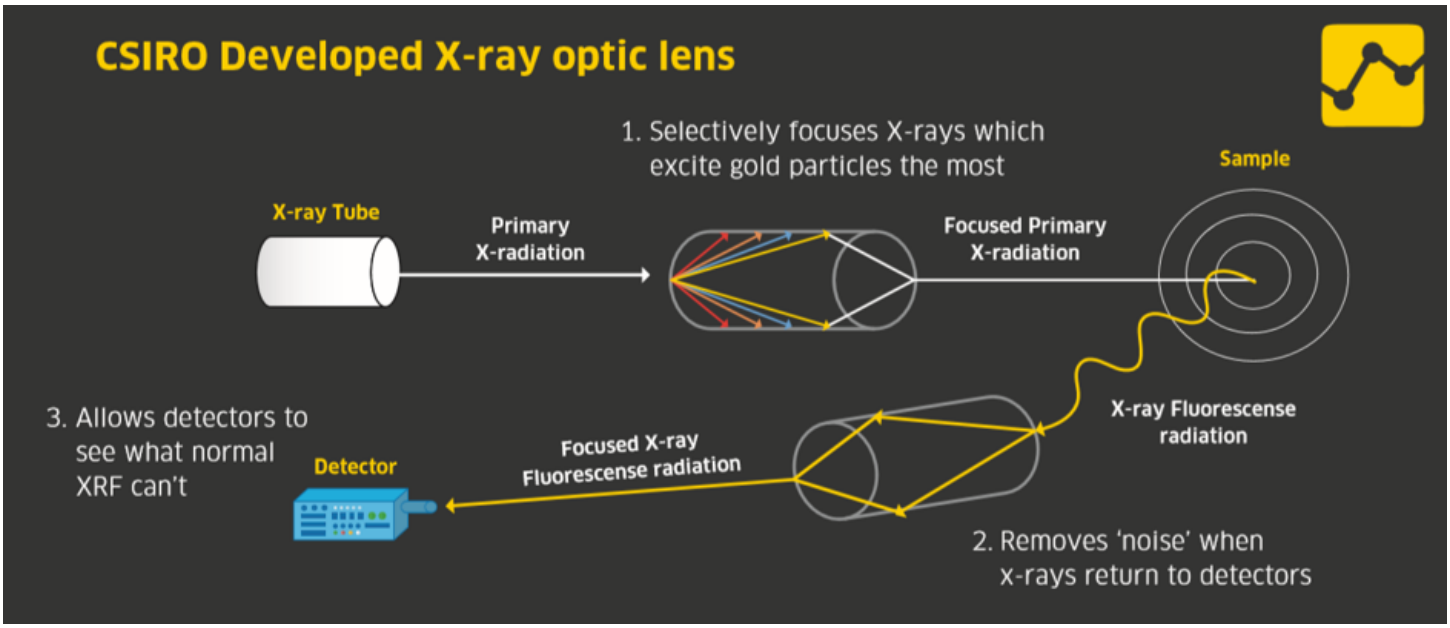
Elemental Analysis of Gold

In the industry today, elemental assays conducted in either on-or-off site laboratories are used to determine the composition of a sample containing gold. Gold can be assayed in several ways including by fire assay, with ICP Spectrometry, with Aqua Regia Digest and with energy dispersive X-ray fluorescence spectrometry (XRF).



Whilst some methods are considered more accurate than others, all methodologies for assaying gold from a slurry sample require considerable time and effort to a) prepare the sample for assay and b) conduct the assay and report the results. The procedures often mean that elemental assays of plant samples are often delayed by as much as 24 – 48 hours. When the results are finally communicated to the appropriate person, they are out-dated and the operators and metallurgists are operating in a vicious cycle of retrospective data.

The following comparison will evaluate typical assay technology against a new technology for instantaneously determining the gold grade in a particular process stream - the Online Gold Analyser (OLGA).



Method

Laboratory Analysis

Gold can be assayed by a variety of methodologies, but Fire Assay is the most commonly accepted globally. Almost all elemental assay methodologies require a single sample to be taken to either an onsite or offsite laboratory facility for analysis. In most instances, the samples are required to be filtered, dried in an oven, pulverized, analysed by the appropriate methodology and then the results are communicated to plant staff via email or database.

On-stream Gold Analysis

Online Gold Analyser (OLGA) is a new on-stream analyser which provides a result to operators every 10 minutes. This result is determined instantaneously and a rolling 1-hour average measurement is communicated directly to plant staff in the control room via an ethernet cable, which can then be logged in the plant historian.

A continuous slurry sample is delivered directly to the analyser from a sampler in the plant. The sample is fed to an agitated tank which maintains the solids in suspension. An x-ray generator fires x-rays through a patented x-ray optics lense system (developed by the CSIRO) which selecttivly focuses the x-rays onto the sample stream, and also focuses the fluorescent x-rays emitted from the gold particles to the twin detector system. Advanced analysis algorithms are used to convert the detector signals into elemental concentrations.

The OLGA assesses material in 10 minute increments, calculated almost instantaneously and communicated back the plant control and historian systems. As sample prep, handling and analysis time are greatly reduced, results are determined in less than 1% of the time taken for laboratory assays.

Accuracy

Laboratory Assays

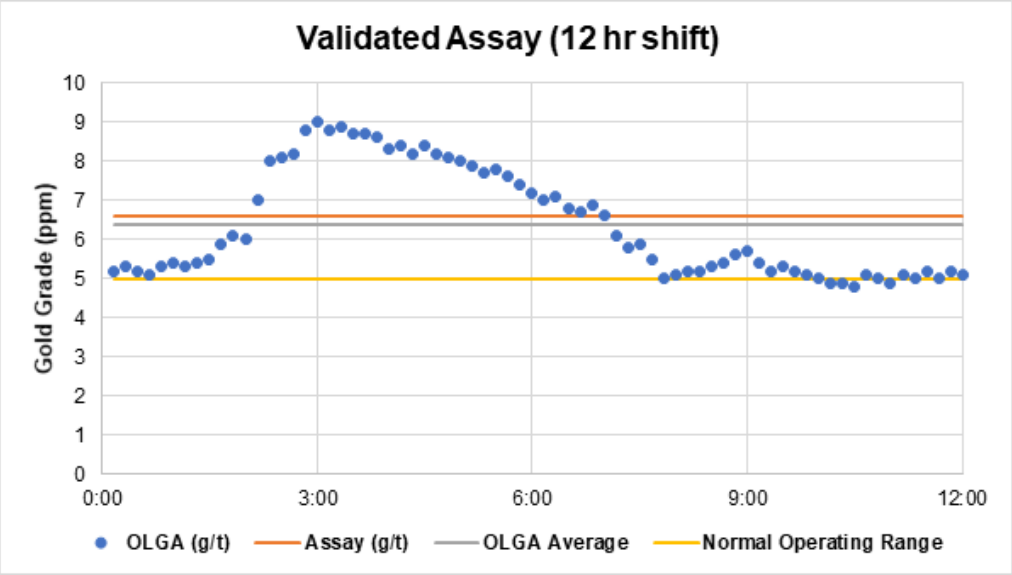
Fire assay is generally seen as the most accurate method for determining gold content from samples. Fire assays require ~ 30 of dried sample and can recover ~ 99% of the gold present in that sample. A routine fire assay should provide accuracy and precision better than 10% at a concentration level > 50 times the limit of reporting which can be between 0.001 – 0.01 ppm[1] (i.e. +/- 10% at 0.05 – 0.5 ppm depending on the assay methodology).

Whilst the fire assay process is seen as very accurate for determining the gold content in a small sample, the process is labour intensive and often one x 30 g sample is used to represent an entire shift's worth of data. In a small 100 tph plant, this represents 0.0000025% of the total throughput. Whilst plants often have excellent metallurgical samplers and assay facilities, it is quite common for outliers to occur. Outliers are often validated by waiting for the next assay, some 12 hours later and it is impossible to know if the original assay was a true outlier or does represent a deviation in the plant.

On-stream Gold Analysis

On-stream analysers are generally seen as less accurate than elemental assays and the confidence interval of the OLGA is about +/- 10%. However, the OLGA analyses a far greater proportion of the material than an elemental assay, the equivalent of ~1% of the throughput from a 100 tph plant. Additionally, the confidence interval is reduced as the number of measurements increases. The equivalent shift sample is comprised of 12 x 1 hour measurements, so +/- 10% is reduced to +/- 3%.

As the OLGA information is displayed as a rolling average it is very easy to determine if a traditional assay is an outlier or is a valid measurement. The frequency of the OLGA data ensures there is always visibility of the micro-trends within a shift and is unlikely to be as influenced by a a potential 'pocket' of high grade. Operators can now have confidence in understanding what is moving through the plant at a particular time.



Visibility of trends validates potential outliers which may normally be ignored or excluded

[1] Fire Assay Technical Note, ALS Minerals, 2012

Using the Data

Laboratory Assays

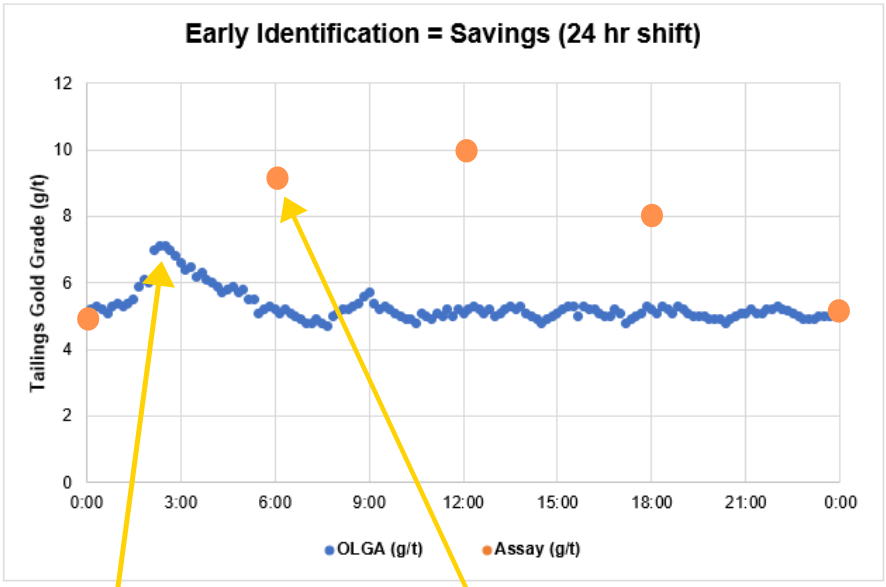
Operators and metallurgists on gold plants currently operate their plants based on the delayed information and data. If plant conditions change causing a drop in plant performance (i.e. decreased recovery), this is only identified when the assay results are received 12 – 24 hours later. That is 12 – 24 hours of sub-optimal performance, which is gold lost to the tailings dams. Deviations may occur 1 – 4 times per month and often result in $1 – 10 million per annum in potentially recoverable gold being lost because the losses are not identified and rectified earlier.

Potential Uses			
Continously optimised grind size	Automatically adjusted reagents	Concentrate grade control	Feed blend control
Benefits			
Prevents overgrinding, saving power and wear parts	Minimise reagents costs	Maximise smelter returns	Plants remains at steady state
Result			
Maximised recovery at lowest cost			

On-stream Gold Analysis

The way an operator or metallurgist may use the data generated from on-stream analysis will differ from plant to plant, however, one commonality is that having immediate access to gold data means that actions can happen much faster and the effects of deviations and variations within the plant can be minimised.

Once data is available, it is then possible to use the stream within the control system of the plant and become less reliant on operators' decision making.



Early identification results in preventative action

Late identification results in extended loss of recovery

Implementation

On-stream analysis and elemental assays are both techniques which can be well utilised by operations globally, regardless of whether they are greenfields or brownfields projects. Whilst laboratory assays (especially fire assays) are considered industry standard, more advanced technology is becoming available.

The primary considerations for the implementation of onstream analysis are:

- Do I want to have better control of my plant?
- Do I want to increase automation on my plant?
- Do I want to track gold through my plant in real-time?
- Do I want an increased understanding of how my plant responds to operational changes?

Gekko's OnLine Gold Analyser

Comparison Summary

	Laboratory Assays	On Stream Gold Analysis with OLGA
Method	Collect, Dry, Prep, Analyse, Report	Continuous measurement of slurry stream in plant
% of Target stream analysed	~0.0000025%	~1%
Accuracy	+/- 10% at 0.05 – 0.5 ppm	~ +/- 10% at ~ 5 pmm
Analysis Time	12 – 24 hours	10 minutes
Use of Data	Retrospective on macro time scale	Immediate control on micro time scale

Optimising the recovery of the processing plant is critical to maximising the value of the investment and providing returns to shareholders. Embracing digital technologies such as the Online Gold Analyser and utilizing real time data to continuously optimise operations is an essential step in maximising the value of a deposit.

To find out if your process streams are amenable to onstream gold analysis with the OLGA, contact us at Gekko Systems.

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