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Summary comments on gold and silver ratios





Explanatory note

We have an occasion when a primary laboratory has reported much lower values than we did as the umpire laboratory.

Our method includes an inspection of the gold recovered in the fire assay process so makes our result virtually irrefutable.

The possibility of the differences being explained by spotty gold is unlikely in this case because of

- a) Uniform results from the gravimetric assays, and
- b) The results were on the (relatively uniform) minus fraction and would take the average above the figures reported by the primary laboratory.

Relevant technical facts

- a) A high silver to gold ratio is required to effect dissolution of silver from a gold/silver prill. The preferred ratio of silver to gold is 3:1 for the silver to dissolve (when done as part of the gravimetric process this is called inquarting, i.e. making the gold one quarter of the alloy). Ratios of 2:1 can also dissolve but get more unreliable in the totality of the digest.

If the silver ratio is low the silver won't dissolve completely in nitric acid.

- b) High silver ratios in gold-silver alloys will inhibit the dissolution of gold by Aqua Regia.

If the gold ratio is low the gold won't dissolve completely in Aqua Regia.

The coming together of these two facts means that there will be critical levels when neither of these two requirements are met and hence neither the silver nor gold will be dissolved.

Assumptions on the primary assays

Commercial laboratories – as far as is known – universally use an AAS or ICP finish for quantifying gold. It is not known how much silver is added by the primary laboratory but 6mg is common. To achieve this they use a two stage process whereby the silver is dissolved first, leaving the gold which is then digested in Aqua Regia (formed by adding HCl to the nitric acid).

If the gold in the sample was high, and the silver added wasn't sufficient to dissolve in nitric acid the silver would have remained.

When the HCl was added to produce Aqua Regia the silver that was left probably inhibited the dissolution of the gold by the acid.

Summary

Curiously, the effect of this phenomenon means that very high values could report as very low, and the higher the gold content the greater the risk. For that reason caution is expressed and advice given that geology should be taken into account when getting gold samples checked, not just those that have high values.

Gravimetric (part and weigh) assays will not report low, but would report high because the total of the silver and gold will be weighed if not noticed.

Independent Assay Laboratories use a gravimetric procedure where the silver is dissolved (in a much more controlled manner) and the gold left behind. That gold is weighed on a microbalance after being inspected under a microscope. Because every piece of gold is inspected such errors are virtually impossible.

If you have problems, or don't understand some weird events, talk to us.