

'Goldmine', an analytical strategy game

Goldmine is a strategy game, for analytical chemists and others, that reinforces the importance of a proper consideration of the uncertainty from sampling. It demonstrates, with financial constraints, the interactions between sampling uncertainty, analytical uncertainty, and the cost effectiveness of the outcome. Although the game is based in the context of prospecting for gold, the principles illustrated apply to most applications of chemical analysis.

You play *Goldmine* initially as a one-off exercise, but you can subsequently determine the average cost of the strategy you select, or try different strategies on the same geological situation. Each time the game is initiated, the geological context of the anomaly is different, so a different strategy may be optimal.

Before you start you need to know the basic information about the area to be investigated, the likely size of a prospect, and also the costs involved in sampling, analysis, and follow-up study. Then you can formulate your initial strategy.

Uncertainty from sampling is often an important contributor to the total uncertainty surrounding an analytical result, because the customer nearly always needs to base a decision on the composition of the target, rather than that of the sample taken from it.

adjacent successful follow-up sites identifies a prospect that you can sell for €100. If your selected strategy costs less than that you have made a profit.

- § You can specify the sampling pattern (see Figure 1 overleaf), the sampling density, the precision of sampling and the analytical precision that you require.
- § You are charged for the costs of sampling, analysis and follow-up (details below), but the smaller the uncertainty (in this instance the precision) on each result, the greater the cost.
- § If you specify too low a sampling density, there is a risk of failing to identify a prospect. If the sampling density is too high, you pay excessively for sampling, analysis and follow-up.
- § You are penalised automatically for false negatives (when you fail to identify a truly anomalous site) because you spend money but fail to find a prospect.
- § You are penalised also for false positives (when your result incorrectly identifies a site as anomalous for follow-up).

How to run the program

§ The game is written here as a Minitab macro, so you need to have Minitab 1