

EDITORIAL AND OPINION

Re-opening debate may benefit investors

Challenging geostatistics

In the early 1990s, following post-mortems of several failed mines financed during the previous decade's flow-through boom, a brave soul suggested that the industry should examine the role of geostatistics in some of those failures. The mere suggestion was enough to spark a heated debate about geostatistics, which played itself out in the pages of this newspaper for a few months before disintegrating into a flurry of thinly veiled put-downs.

Considering that the issue proved so sensitive, we were hesitant to reopen a can of worms. After all, it is an arcane topic, and the terms employed — "kriged variances," "semi-variograms," "applied probability" and the like — are not exactly the stuff of everyday conversation. Moreover, the arguments, both pro and con, would seem to be intelligible only to reserve and resource professionals, and maybe mathematical wizards, or so we had thought. . .

In late 1996 a remarkable development took place in a basement just outside of Vancouver. The basement belonged to Jan Merks, a metrologist (metrology being the science of measurement), who had been retained to examine data from an Indonesian property that several large gold producers were interested in acquiring.

It was in his basement that Merks, without seeing a rock or setting foot on the property, debunked Bre-X Minerals' claim that it had millions of ounces of gold at its Busang project in Indonesia. While computer terminals manned by geostatisticians were still churning out millions of ounces, Merks's methods were providing unequivocal proof that the deposit was not real.

Even today, he won't provide specifics, but Merks does say that "only a handful of Bre-X's samples and assays would have been enough to prove beyond a reasonable doubt that Busang was a fraud, and would have proved it long before John Felderhof was honored by his peers."

Analysis of variance, he adds, "would have shown that the intrinsic variability of the gold was indeterminate (as it ought to be in a phantom deposit) and that preparing test samples of drill core added most to the variance of the measurement chain."

For more than a decade, Merks has been railing against what he calls "voodoo geostatistics." It is his studied opinion that kriging, the modelling of grades and their variances using trend surfaces, "attempts to make a few drill holes go a long way" by creating

ore grade values in domains where grades and their variances cannot possibly be estimated with a realistic degree of confidence, and where discontinuities are bound to occur.

Merks believes that kriging tends to inflate expectations for the continuity of mineralization between measured data points. He believes that "applying the brute force of computers to fabricate more data from measured data is somewhat similar to perpetual motion, mankind's dream of making a little energy go a long way."

With the proof now in the pudding, and conventional statistics having clearly bested geostatistics in a high-profile case of fraud, perhaps Merks's views on geostatistics deserve an airing. Why not reopen the debate and determine if, as Merks maintains, analysis of variance can be applied to quantify the probability that the mineralization between measured values is continuous?

Investors might benefit from the exercise. Merks believes that a return to conventional statistical methods and its cornerstone, analysis of variance, would result in confidence limits being reported for grades and contents of resources and reserves. This, in turn, would help investors and bankers quantify risks that arise when prospects are advanced toward producer status.

Geostatistical practitioners have challenged Merks's views many times over the years. They have said his ideas are fundamentally flawed and that the application of his technique is unproved. They have pointed out that Merks's ideas were submitted for publication by the CIM's *Bulletin* but were unequivocally rejected by qualified reviewers. Merks counters that his ideas were published in respected technical publications in Europe and Australia.

Proponents of geostatistics argue that the world's leading mining companies have found geostatistics to be a useful tool for reserve estimation and grade control. And they point to a large number of case studies that compare predictions with production results — studies which show that geostatistics, if applied correctly, outperforms other methods. They say the successful use of geostatistics depends on the ability of the geologist, the mining engineer and the geostatistician to work as a team.

But the team approach applied to Busang was not enough to detect abnormalities we suspect might have been unmasked earlier by applied statistics and analysis of variance. Only one man and his computer were needed to do that.