Geostatistics: A tool that works

by Normand Champigny
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Guest Column

In your guest column "Geostatistics or voodoo science?" (*T.N.M.*, April 20/92), Jan Merks advocates the new "grade-squared partition technique" as a more precise and realistic approach to reserve estimation than geostatistics. His ideas were submitted for publication in the bulletin of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) but encountered unequivocal rejection from qualified reviewers. Merks' theoretical foundations are fundamentally flawed and his technique's applicability is unproven.

This reply has been prepared in collaboration with five reserve estimation practitioners in Canada and internationally.

Theoretical foundations of geostatistics are well established and have been developed, published and endorsed by mathematicians, statisticians and industry practitioners for more than 30 years. Geostatistics and the estimation method of kriging attempt to use sample information that minimizes the error of the grade (or other variable) estimate, given a particular sampling configuration. The method suffers the same limitation as other reserve estimation techniques with regard to the presence of mineralization discontinuities.

Decisions on the continuity of mineralization are based on geological evidence and are totally independent of the methodology used to estimate reserves. Geostatistics quantifies grade continuity that can be applied to optimize estimation where continuity of mineralization has been demonstrated geologically. All reserve estimation methods, including kriging, can be applied to volumes defined by geological criteria. A kriging variance provides no more false confidence for continuity than does any other estimation technique.

The "grade-squared partition technique" is built on wrong assumptions:

- ☐ There is no such thing as "additive property variances";
- ☐ Independence of variable and independence of their estimation errors are constantly mistaken;
- ☐ Error independence is assumed; this is likely to be met in any mineral deposit.

American Barrick Resources, Anglo American, BHP-Utah, Cameco Corp., Gold Fields Mining, Homestake Mining, Inco Ltd., Newmont Gold, Placer Dome, RTZ Corp. and Teck Corp. are but a few of the world's leading mining companies that have found that geostatistics is a useful tool for reserve estimation and grade control. A large number of published case studies show that when predictions are compared with production results, geostatistics — if applied correctly — outperforms other methods. "The proof of the pudding is in the eating."

Geostatistics is taught in many universities in Canada and internationally. Applications go beyond the field of mining: agriculture, meteorology, forestry, fishery, biological and environmental sciences, biomedical engineering, civil engineering, soil science, petroleum engineering, remote sensing, geochemistry and geophysics. It is worth recalling that the ideas of geostatistics emerged almost simultaneously in several fields of application including forestry, meteorology and mining. These ideas were derived from recognized statistical theories. Geostatistics is certainly based on "proven statistical techniques," to use Merks' own words.

Experience within mining companies has shown that the successful use of geostatistics depends on the ability of the geologist, the mining engineer and the individual knowledgeable in geostatistics, to work as a team. The team's objective is to provide a reserve estimation/grade control approach that provides credible results. The approach must include a high quality of geological interpretation, consideration of the mining and economic parameters and a knowledge of the geostatistical methods available.

Merks' attack on geostatistics can be seen as controversial but is not well founded criticism.

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