

August 8, 2004

Dr Martha C Piper, President
The University of British Columbia
2329 West Mall
Vancouver, BC V6T 1Z4

Dear Dr Piper,

I brought to your attention on January 31, 2003, that Dr Alistair J Sinclair, PEng, PGeo, a UBC Professor Emeritus, a CIM Distinguished Lecturer, a reviewer for CIM Bulletin, and, perhaps ironically, a former Member of the Discipline Committee with the Association of Professional Engineers and Geoscientists of British Columbia, teaches geostatistics, a fundamentally flawed variant of mathematical statistics. I also submitted a substantial amount of information and was pleased when you passed it on to the relevant faculties and departments.

The lack of feedback suggests that I have failed to persuade you, or any of UBC's scholars for that matter, that geostatistics merits more scientific scrutiny than it has so far been accorded. Therefore, I shall present once more the essence of my case against geostatistics. I enclosed some information with this letter but a great deal more can be found on my website at geostatcam.com.

Geostatisticians assume that their new science does not violate any requirements of mathematical statistics but they are wrong. For example, geostatisticians assume spatial dependence whereas mathematical statisticians verify whether or not in situ ordered sets of independently measured values display spatial dependence in sample spaces. Paradoxically, geostatisticians themselves have shown that interpolation by *kriging* between measured values in ordered sets creates an illusion of spatial dependence where it did not exist. *Kriging* is an eponym to recognize Dr D G Krige, formerly an Honorary Professorial Research Fellow at Witwatersrand University and a pioneer in plotting distance-weighted averages in South Africa's gold reefs.

Geostatistics is extremely popular not only because spatial dependence may be assumed but perhaps even more because two or more independently measured values with different coordinates define an infinite set of kriged estimates. The practice of kriging is equivalent to perpetual motion in data acquisition because the concept of degrees of freedom is irrelevant in geostatistics. Despite Bre-X's phantom gold resource, and despite shrinking ore reserves and resources, geostatisticians persevere in assuming spatial dependence, interpolating by kriging, and violating the rules of mathematical statistics, with the same single-minded fanaticism as Trofim Lysenko preached his variant of genetics.

Each distance-weighted average had its own variance when Sir Ronald A Fisher was knighted in 1952 but when *single* distance-weighted averages metamorphosed into *kriged estimates* in the 1960s, their variances vanished without a trace. Incredibly, *kriging variances* and *kriging covariances* of *sets* of *kriged estimates* became the cornerstones of geostatistics. Incredible indeed because the kriging variance is as meaningless a measure for variability, precision and risk as the kriging covariance is for spatial dependence (associative dependence between in situ ordered data).

In the rarefied world of geostatistics, kriging variances are plotted in variograms or semi-variograms in which they rise to a maximum and then converge on zero. Both the fall of kriging variances and the rise of kriging covariances profoundly troubled geostatistical thinkers. So much so that in a 1989 paper entitled “*A study on kriging small blocks*”, Armstrong and Champigny cautioned against oversmoothing. This odd paper, and another on perfect smoothing, were published in *CIM Bulletin*.

David’s 1977 “*Geostatistical ore reserve estimation*”, in Figure 203 on page 286 and in the text below, make it perfectly clear that each kriged estimate in the set of sixteen is a functionally dependent variable of the same set of nine boreholes. But it was twelve years after this first textbook on geostatistics was published when Armstrong and Champigny finally cautioned against oversmoothing. In spite of their inspired tinkering, kriging variances fall and kriging covariances rise because each kriged estimate is, and will always be, a functionally dependent variable in mathematical statistics. In geostatistics, however, this inviolable requirement can be violated a little but not a lot. Would Sir Ronald A Fisher would have been amused?

I learned that geostatistical peer review is a blatantly biased, shamelessly self-serving sham when “*Precision estimates for ore reserves*” was reviewed and rejected by *CIM Bulletin*, *Journal of Mathematical Geology (JMG)* and *IMM Transactions* before *Erzmetall* praised and published our paper. My son and I were unaware that we had written a “geostatistical” paper until David, the author of “*Geostatistical ore reserve estimation*” and a reviewer for *CIM Bulletin*, deemed our paper deficient in references to the geostatistical literature. The other reviewer who found our paper unsuitable for publication was none other than Sinclair. His review predated by a few days my short course at UBC where he was present but posed no questions during my presentation. Had Sinclair understood our paper, his prestige and my expertise could have been pooled to teach ore reserve practitioners how to compute confidence limits for contents and grades of ore deposits and how to detect salting scams.

Analysis of variance proved that Busang was salting scam several months before Bre-X’s brass was honored for the discovery by showing that the intrinsic variance of gold was indeterminate, or statistically identical to zero, as it ought to be in a phantom gold resource. Even after Bre-X crashed, Sinclair surmised that degrees of freedom disappear in matters of “*spatial correlation*”, and the odd practitioner was still troubled by analysis of variance. Sir Ronald A Fisher would have been proud.

Whenever divergent opinions demand censure, the most elite minds are summoned into action. A case in point was my email to the Councilors of the *International Association of Mathematical Geology*, and to *JMG*'s Editor and his Associates and Assistants. Predictably, Krige himself was drafted to explicate how the missing variance of a single distance-weighted average (the ubiquitous kriged estimate) could possibly converge on the central limit theorem as weighting factors of measured data converge on $1/n$. Geostatistics is so richly embellished with neologisms and *Krige*-derived eponyms that even simple questions trigger tortuous answers. My letter of June 9, 2004, in response to Krige's of June 8, 2004, raises three questions and I am still waiting for answers (to be posted under *Correspondence* on **geostatcam.com** upon receipt). I did email you a synopsis of my case against geostatistics and its peer review process but it is also posted under *Correspondence* (see *JMG20030321*).

Armstrong, Journel, Krige, Sinclair, and scores of other scholars, refuse to accept the irrefutable fact that each distance-weighted average has its own variance because it is a functionally dependent variable. Perhaps it was a human error that the variances of *single* distance-weighted averages went missing, and that the kriging variances and kriging covariances of *sets* of kriged estimates became the essence of geostatistics. But when an academic clique is blinded by ambition, pride and priority, and persists in denying the incontrovertible truth, a human error does turn into a scientific fraud.

The passage from the soundness of mathematical statistics to the madness of geostatistics is without parallel in the history of science. It is true that replacing the missing variance with a meaningless semi-variance is too silly and trivial a matter to merit an independent interdisciplinary scientific inquiry. In time, regulatory agencies are bound to investigate how geostatistics impacts mineral inventories. Inevitably, the science behind geostatistics will be judged in a court of law.

The Seventh International Geostatistics Congress will be held in Banff, Alberta, Canada, from September 26 to October 1, 2004 (see **geostats2004.com**). It offers you a unique opportunity to meet geostatisticians from around the world and find out how so much is done with so little. Alternatively, a renowned UBC scholar such as Dr Nathan Divinsky, Professor Emeritus of Mathematics, could be asked to attend and report to you and your Staff how assuming spatial dependence, interpolating by kriging, smoothing, and rigging the rules of classical statistics, could possibly enhance UBC's role in teaching critical thinking, searching for answers, leading debate and finding solutions.

Yours truly,

Jan W Merks
President