



# GEOSTATISTICAL ASSOCIATION OF AUSTRALASIA

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### IN BRIEF

The GAA symposium on non-linear geostatistics has been and gone and I'm sure people would agree it was a very informative time. Plenty of food for thought about how non-linear methods are applied today – even some thoughts for the future! Simulation is growing in importance and the GAA is looking at presenting their second symposium on this topic sometime next year.

If people have further ideas for conferences or symposiums or even topics for articles in this newsletter, please contact the GAA or the editors at the addresses given above.

Please note also that there is an APCOM conference with papers covering many applications of computers in mining on December 7 to 9, 1998 in Kalgoorlie.

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Panel discussion at the end of the conference. Left to right: John Henstridge (DAA), Lynn Bloom (ECU), Brett Gossage (RSG), Ian Glacken (Snowden), John Vann (Geoval), Daniel Guibal (Geoval – hidden) and John Horton (MRT).



Review of GAA's Inaugural Symposium by John Vann, Convenor

On Friday the 30<sup>th</sup> of October, the GAA ran its first 1 day technical symposium entitled "Beyond Ordinary Kriging: Non-linear Geostatistical Methods in Practice". The symposium was held at the Rydges Hotel in Perth and attended by approximately 70 people.

The papers presented covered a range of applications of non-linear geostatistical estimation techniques. This was – as far as we know – the first technical meeting ever held in Australia dedicated the subject of non-linear estimation. With such estimation techniques now widely applied in the mining industry (and with clear applications elsewhere e.g. environmental hazard mapping and petroleum) the timing was good.

Attendees heard the approaches, pitfalls and suggestions of a wide ranging group of practitioners from mine-sites, academia and industrial consulting companies. It was particularly interesting to hear several papers on the subject of geological modelling using non-linear numerical approaches.

Presenters and authors ranged from an honours student to geostatisticians with more than two decades experience – reinforcing the GAA's "openness".

Above all the GAA was, from inception, a forum for the exchange of ideas and improvement of practice, rather than an academic society.

The symposium was very well received (feedback forms indicated that attendees found the whole day very well organised and the technical content of high standard).

Plans are underway to run a second symposium in 1999 on the subject of conditional simulation. This format seems to work quite well: inexpensive, one day, topical papers with a "key-note" overview paper.

On behalf of the GAA I would like to thank our major sponsors: Edith Cowan University, Mining and Resource Technology and Resource Services Group, as well as Geoval for satchel sponsorship and administrative support. In particular, Meredith Gillespie at Geoval was instrumental in the smooth logistics on the day.

The other sponsors – Gemcom, GMS, Snowden and Associates, Arne Berckmans and the CSIRO – are greatly appreciated.

I would also like to acknowledge Bill Shaw's help in editing papers.

Of course, without the support of the GAA members on the day nothing could happen.

Finally, thanks to all the authors and presenters. I think we set the benchmark for what (hopefully) will be a symposium series of longevity.

*Editors' note:*

*On behalf of the GAA we would like to express our appreciation for all of the work that John Vann put into organising the conference and echo his thanks to Meredith Gillespie. Without the efforts of these two in particular, the conference would not have gotten off the ground.*



# *Mathematical Geology*

*An International Journal*

Dear Colleagues:

For the last three decades, *Mathematical Geology* has been the major international journal for technical publications in all *quantitative* aspects of geology and earth sciences. At the same time, it has been the major technical international journal for geostatistics.

*Mathematical Geology* publishes papers on the application and use of mathematics, statistics, and computers in earth sciences and welcomes papers on case studies, theory, and relevant teaching materials.

*Mathematical Geology* is the only major peer reviewed publication in the field to communicate new developments, innovative applications, insights to old problems and techniques, and provide book reviews and broad discussions of interest to our community. In addition, the new editor of the journal since the beginning of this year has taken the initiative to promote 'teaching aids' and consider an 'industry view' section that will advance the cause of the journal.

*Mathematical Geology* promotes technical soundness and excellence, as well provides a service as a conduit to promote future research and developments in the field, and it counts and on your support – which in turn is *support to our profession*. Subscription to the journal is a major form of support. Unfortunately, despite the exceptionally low cost of subscription (US\$32), Australia is behind most other countries in its subscription numbers and I would like to suggest that we should make an effort to promote *Mathematical Geology* within Australia. The submission of high quality technical papers to the journal and the willingness to review colleague's papers is an additional form of support.

## **MAKE *Mathematical Geology* YOUR JOURNAL TOO!**

For subscription or further information, please do not hesitate to contact me or the journal's web site: <http://epidote.wvgs.wvnet.edu/~mathgeo/>

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Post-Doctoral Fellow in Geostatistics Appointed at Edith Cowan University

Edith Cowan University has recently appointed Dr Bielin Shi to the position of Postdoctoral Fellow in Geostatistics. Dr Shi graduated with a BSc in exploration geology from the Department of Resources Engineering, Guizhou Institute of Technology, Guiyang, China, in 1980 and worked for a time with the Geological and Mining Company of Yunnan Province.

He obtained an MSc in 1985 from Guizhou and was subsequently employed there as a lecturer in geology. In 1987 he obtained a Diploma of Geostatistics and Management Technology from the Geological University of China and took part in a research project on the geostatistical study of gold deposits in Guizhou and Guangxi Provinces.

He came to Australia in 1990 as a visiting scholar at the University of Canberra, carrying out a research project on gold deposits at Kalgoorlie. In 1995 he completed his PhD at Melbourne University, where his doctoral studies involved the geochemistry of platinum-group element and gold deposits. He worked as a mine computer geologist at the Cobar Mine in NSW from 1996 until its closure in February 1998 and was then for a brief time with the Geoscience Information Services, Department of Mineral Resources, New South Wales before taking up his position at Edith Cowan University at the end of May 1998.

Dr Shi is currently located at the Mount Lawley Campus and can be reached at [b.shi@cowan.edu.au](mailto:b.shi@cowan.edu.au)



Convenor John Vann and Anna Ryba (Snowdens) enjoy the morning tea

Ivor Jones, WMC giving his presentation



### Small Block Problems?

One of the emphases at the GAA symposium was on not estimating blocks that are "too small". How do you know what "too small" means? Quite simply, you need to test!

Every case will have its peculiarities and defining parameters. Generally, a block size of the approximate data spacing is fine. To use blocks smaller than this you need to justify the choice, otherwise you could seriously over-smooth your estimate. The simplest test is to run kriging on a small number of single blocks in different locations whilst storing all the available outputs. You can then check the weights, bias, estimation error (kriging variance), etc for each

#### References:

- Armstrong, M. And Champigny, N., 1989.** A study on kriging small blocks. *CIM Bulletin*. Vol. 82, No. 923, pp. 128-133.
- Krige, D.G., 1994.** An analysis of some essential basic tenets of geostatistics not always practised in ore valuations. *Proceedings of the Regional APCOM, Slovenia*.
- Krige, D.G., 1996a.** A basic perspective on the roles of classical statistics, data search routines, conditional biases and information smoothing effects in ore block valuations. *Proceedings of the Regional APCOM, Slovenia*.
- Krige, D.G., 1996b.** A practical analysis of the effects of spatial structure and data available and accessed, on conditional biases in ordinary kriging. In: *Geostatistics Wollongong '96. Proceedings of the International Geostatistical Congress, Wollongong, NSW, Australia, September, 1996, pp. 799-810.*

block to see if the result is acceptable.

How much do the results change for different block sizes, for blocks near or distant from data, etc? Another test involves running Simple Kriging instead of Ordinary Kriging. Simple Kriging assumes a known mean and you may have to enter one, but it outputs the weight assigned to this mean as part of the estimation. If this is high, the block is not estimated well and more data could be needed. A weight of 10% or less is desirable. If this weight cannot be reduced, particularly for blocks without data inside them, then the block is too small.

*For more details contact the GAA or the editors.*

#### References:

- Krige, D.G., 1997.** Block kriging and the fallacy of endeavouring to reduce or eliminate smoothing. *Proceedings of the Regional APCOM, Moscow*.
- Ravenscroft, P.J., and Armstrong, M., 1990.** Kriging of block models – the dangers re-emphasised. *Proceedings of APCOM XXII, Berlin, September 17-21, 1990, pp. 577-587.*
- Royle, A.G., 1979.** Estimating small blocks of ore, how to do it with confidence. *World Mining, April 1979.*
- Vann J. and Guibal D., 1998.** Beyond Ordinary Kriging – An overview of non-linear estimation. *Beyond Ordinary Kriging Seminar, Geostatistical Association of Australasia, Perth, WA (this volume).*

### Update on the Development of the Revised JORC code

Regarding the 1999 JORC Code, the present situation is that we have just completed a review of the (20+) submissions received to the Exposure Draft and are in the process of revising the draft 1999 Code. There are ongoing discussions with Reserve committees in other countries, legal advisers to JORC and coal industry representatives which will all impact on the revision process. We hope to have the final version ready

for consideration by JORC's parent bodies by January 1999. Assuming that this approval process goes reasonably smoothly, the 1999 JORC Code would then be forwarded to the ASX which (we presume) will again attach it to its Listing Rules. The ASX has not yet decided exactly when its revised Listing Rules will be released, but it will probably be in either July 1999 or September 1999.





Symposium Proceedings	Web Page for the GAA	Membership
<p>The GAA are looking into the possibility of re-printing the proceedings of the symposium on non-linear estimation, giving the authors a further chance to polish their papers and for inclusion of the one paper left out of the proceedings available at the symposium.</p> <p>If anyone is interested in obtaining a copy of the proceedings – or obtaining extra copies – please contact the GAA to register your interest.</p> <hr/> <p><b>Ideas Wanted</b></p> <p>Please submit ideas for topics to base conferences or newsletter articles on to the GAA.</p>	<p>The web page for the GAA is not quite completed. We hope to be able to have it up and running soon. General information about GAA and ideas/references are some of the things being looked at for inclusion.</p> <p>Ideas for the web page are also welcome.</p> <hr/> <p style="text-align: center;"><b>GAA in the Pilbara</b></p> <p>Last GAA news we noted that Craig Moulton had taken the role of the GAA representative in the Pilbara. Unfortunately for the GAA, Craig has gone walkabout with various postings over the next year (including one on a beach in Thailand we believe!). Please contact the GAA in Perth if you are chasing any details (not of the holiday!!).</p>	<p>There are four types of Membership:</p> <ul style="list-style-type: none"> <li>• Ordinary Membership (full voting rights)</li> <li>• Associate Membership (no voting rights)</li> <li>• Student Membership (no voting rights)</li> <li>• Corporate Membership (by invitation of the Executive Committee)</li> </ul> <p>Membership forms are available by email from:</p> <p style="text-align: center;">Ian Glacken GAA Secretary, PO Box 1719 West Perth, WA, 6872</p> <p style="text-align: center;">email: iglacken@snowdenau.com</p> <hr/> <p>Current GAA membership stands at 99 ordinary members, two honorary members, 7 associate members and one student member.</p>
<b>Geostatistical Fallacies</b>		
<p><i>Always search to the range.....</i> the search will depend on the data spacing compared to the range, the short scale variability and nugget (amongst others) and tests should be run to determine what is an appropriate search distance (and other parameters).</p> <p><i>The variograms don't give any structure, therefore it's OK to use Inverse Distance.....</i> If the variograms, which characterise spatial variability, do not show structure then usually there is either not enough data - and one should be careful about doing an estimate - or there is no structure to the variable and inverse distance, particularly for high powers (two or more), may not be appropriate.</p> <p><i>I want my distribution/variability of estimated block values to look very similar to that of my assays....</i> looking at bench plans for example. This is the issue of support – touched on numerous times at the GAA symposium just finished. Larger volume blocks will be more averaged than assays, resulting in a more smoothed and less skewed distribution of values.</p>		