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CV JOHN VANN

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John is a Principal Consultant with Quantitative Group (QG), a premier provider of geological and mining consulting services. Our key focus is to help clients navigate making informed decisions, dealing with resource related uncertainty and multiple extraction options.

At QG we believe value is fundamentally driven through ore body knowledge and therefore we provide solutions wherever rock properties impact your value chain – from resource estimation, sampling, grade control, reconciliation and mine planning to metallurgical evaluation, strategic options and risk analysis.

We are specialists in mining geostatistics, mine geology, mine planning, geometallurgy and quantitative financial risk analysis. By closely integrating technical expertise, business acumen and high-level communication skills QG can unlock the value hidden in your business.

PERSONAL DETAILS

Name:	John Edward Vann
Date of birth:	22nd September 1962
Citizenship:	Australian/British (Dual)

CAREER SUMMARY

John Vann has a background in mining and exploration geology since 1985 and an extensive track record as a geostatistician since 1990. He started his mining career with Renison Goldfields Consolidated (RGC) in 1985 at Renison Bell in Tasmania. He subsequently worked in the Mining, Exploration and Research Groups of RGC over an 8 year period. He completed a Masters degree in geostatistics at the University of Leeds (UK) during his time with RGC.

In 1993 John joined Geoval, a specialist group of geostatistical consultants jointly owned by the Armines, the commercial arm of the Paris School of Mines (and thus the Centre for Geostatistics at Fontainebleau) and Cogema (now Areva). In 1997 John was appointed General Manager of Geoval.

In late 1998 Geoval merged with SRK Consulting, and John was appointed as a Technical Director of SRK. In this role he managed SRK's Geostatistics Group, based in Perth.

In 2001, John jointly established QG as a specialist resource consulting firm joining as director and principal consultant. John has managed this company in addition to his technical roles.

John's consulting career has covered most mineral commodities (including precious metals, copper, lead, zinc, iron, coal, manganese, bauxite, uranium, industrial minerals, mineral sands, nickel and tin) and included projects in Australasia, Asia, North and South America, Africa and Europe. He has particular experience in porphyry style Cu-Au deposits, all types of gold systems and iron ore. He has been involved in many operational mines, ranging from large

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Director

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scale open-pit and caving projects, to highly selective underground mines.

In addition to his expertise in resource evaluation, John has developed a strong reputation for delivering technically up-to-date, training in the areas of resource evaluation and geostatistics both for technical and managerial audiences, including senior executives.

John has nearly two decades of experience in performing bankable due diligence and various levels of internal audit. This has included working for the world's largest mining companies, banks, and international banking syndicates that involved the World Bank/IFC.

John is a Fellow of the Australian Institute of Geoscientists (AIG) and the Australasian Institute of Mining and Metallurgy (AusIMM). He was an AIG appointed member of the Joint Ore Reserves Committee (JORC) from 1996-2006.

John also has practical experience and expertise in classification issues and has experience of NI 43-101 and the US SEC systems in addition to JORC.

John has active research interests in geosciences and geostatistics and currently holds adjunct academic appointments at the Universities of Western Australia, Queensland and Adelaide. He is also involved in the CRC ORE research initiative at the University of Queensland (which is a collaborative with the University of Tasmania and the Queensland University of Technology).

QUALIFICATIONS

Bachelor of Applied Science (Applied Geology) - Royal Melbourne Institute of Technology, Department of Applied Geology - Melbourne, Victoria, Australia. Awarded with distinction, 1984.

Bachelor of Science (Hons) - The University of New England, Department of Geology and Geophysics - Armidale, NSW, Australia. Awarded first class honours in geology, 1985. Thesis on skarn geology and geochemistry.

Master of Science (Mining Geostatistics) - The University of Leeds, Department of Mining and Mineral Engineering - Leeds, Yorkshire, England. Awarded with distinction, 1993. Thesis on geology-variography linkages, global recoverable reserves by non-linear methods, and empirical testing of estimation variance formulae.

Master of Business and Technology - The University of New South Wales, Australian Graduate School of Management (AGSM) – Sydney, NSW, Australia, 2010.

PROFESSIONAL AFFILIATIONS

Australian Institute of Geoscientists (AIG) Fellow, (also was JORC representative 1996-2006).

Australasian Institute of Mining and Metallurgy, (AusIMM) Fellow.

International Association for Mathematical Geology, (IAMG) Life Member.

Society of Economic Geologists (Member).

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Geological Society of Australia (Member)

Geostatistical Society of Southern Africa (Member).

ACADEMIC AFFILIATIONS

Adjunct Professor of Geology: School of Earth and Geographical Sciences & Center for Exploration Targeting (CET), University of Western Australia (2007 – present). Also Member External Advisory Committee of the CET.

Adjunct Professor in the WH Bryan Mining and Geology Research Centre, University of Queensland (2011- present).

Member External Advisory Committee of the Centre for Exploration Targeting. The CET is a joint venture between The University of Western Australia and Curtin University of Technology.

Adjunct Senior Lecturer in Geostatistics, School of Civil and Environmental Engineering, University of Adelaide (2007 – present).

Adjunct teaching faculty member with Duke Corporate Education, The Fuqua Business School, Duke University Durham, North Carolina, USA (on executive programs; 2006 – present).

Visiting Fellow (2011): Department of Mathematics and Statistics, Queensland University of Technology.

WORK HISTORY

2001 - present
Director and Principal Consultant - Quantitative Group, Perth WA

In his current role John is a managing partner in QG and provides consulting advice on all aspects of resource definition and estimation from sampling and assay through to advanced non-linear geostatistics. John has the technical knowledge and strong communication skills to make him ideally suited to strategic consulting and team training in both mine site and corporate settings. In addition, he has deep and broad consulting and technical experience allow him to quickly get up to speed on specific projects for mining companies, banks and financiers.

John has been involved in audit and due diligence of many significant projects - especially in iron ore, copper and precious metals - both in an independent capacity and as part of company continuous improvement programs. He has run over 200 two to five day short courses and seminars in geostatistics since 1993 and is well regarded as a leading geostatistical teacher. In addition, John has successfully run non-technical seminars for company managers, directors, bankers, financiers and others. To date, John has trained over 2,000 professionals in Australia, the USA, the UK, Canada, Chile, South Africa, Zimbabwe, Indonesia, New Zealand, Papua New Guinea, and Laos.

The range of expertise provided includes:

>> Audit and review of resources (open pit and underground);

>> Review of classification approaches;

>> Technical consulting on drill spacing and

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strategic issues;

>> Technical consulting, and review/advice in the area of sampling, sample preparation, assaying and QA/QC;

>> Risk analysis related to resource risk;

>> Consulting in the area of geometallurgical modelling;

>> Review of both grade control and resource estimation systems;

>> Development of quality management systems for sampling and resource evaluation;

>> Technical consulting in the field of linear and nonlinear geostatistics;

>> Multivariate statistical analysis of exploration geochemical data;

>> Legal expert witness on several matters.

1998 - 2001
Technical Director - SRK Consulting, Perth WA

SRK Consulting are international geological and mining consultants with offices in 7 countries and 22 locations and about 600 staff (as at 2001). John was a Technical Director, and also managed SRK's Perth-based geostatistical consulting team. John increased his experience in international bankable due diligence and audit during this period, working on review of projects in Australia, Asia, North America, Africa and Europe. He also further established his credentials as an expert in geostatistics applied to porphyry and epithermal systems, including metallurgical prediction models. His consulting experience included projects in Australia, Indonesia, the Philippines and the USA. John taught geostatistical courses in Australia, the USA, Canada, Indonesia, South Africa and Zimbabwe. Presented management-level seminars to personnel from several leading Australian and international mining houses. He also taught several courses in geostatistics at universities.

1996 - 1998
General Manager - Geoval, Perth WA

Geoval was a 50:50 joint venture between Armines (the commercial arm of the Paris School of Mines - home of the Centre de Geostatistique) and Cogema, the French nuclear cycle company (now Areva). Geoval grew from four consultants to seven during this period, and established themselves as the premier specialised geostatistical consulting group in Australia. John was involved in technical consulting on a wide range of projects and was invited by the Executive of the Australian Institute of Geoscientists (AIG) to join the Joint Ore Reserves Committee (JORC) as a WA representative during this period.

1995 - 1996
Manager (WA) - Geoval, Perth WA

John managed Geoval's WA activities. Technical projects included considerable exposure to bauxite, base metals and iron ore as well as a broad range of gold deposits from Archaean to Tertiary in age. Established and audited grade control systems in open-pit and underground settings.

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1993 - 1995
Senior Geologist/Geostatistician - Geoval

Senior consultant based out of Geoval's Perth office. Technical projects included application to linear and non-linear geostatistics to a range of gold deposits, plus bauxite, base metals and iron. Involved in consulting related to grade control systems, especially for open-pit gold mines in WA. John was involved in some of the pioneering applications of large-scale multivariate conditional simulation (for iron deposits) and non-linear resource estimation, during this period. He also developed a new program of geostatistical training designed to be presented as public or company ("in house") courses of 3-5 days duration.

1992 - 1993
Senior Ore Reserves Geologist - Renison Bell Tin Mine, Tasmania

Responsible for resource estimation and application of geostatistics on the Renison Bell mine, a geologically complex underground mine exploiting a range of different ore-body styles by several mining methods including open-stoping, short-hole open stoping, cut- and-fill and hand held methods. John also had additional underground mine geology responsibilities.

1989 - 1992
Geostatistician - RGC Research and Technical Services Group, Canberra ACT

Responsible for resource estimation and application of geostatistics across the Renison Goldfields Consolidated (RGC) group of companies. Specific technical projects included extensive grade control studies and pioneering application of non-linear geostatistics at the Pine Creek gold deposit in the Northern Territory. This also formed the basis of a an RGC-sponsored Master of Science thesis completed at the University of Leeds, under the supervision of Peter Dowd.

1988 - 1989
Project Geologist, Mount Magnet - RGC Exploration, Mount Magnet, WA

Responsible for successful exploration and development drill- out of several Archaean gold deposits in the Mount Magnet district. Delineated resources included Milky Way, Stellar, Andromeda and Quasar. Management of a team of geologists, engineers and field hands numbering up to 25 and the planning and execution of trial mining at Stellar. Direct technical involvement in RC drill out, diamond drilling, mapping and sampling, geophysics and geochemical exploration.

1986 - 1988
Geologist, NT - RGC Exploration, Darwin, NT

Responsible for exploration in the Pine Creek Geosyncline locating and mapping several satellite ore bodies within 50km of the existing Enterprise Mine, principally Mount Porter. Extensive 25,000 scale regional mapping projects in the Moline, Wandoo and Pine Creek areas.

1985 - 1986
Geologist, Mount Morgan - RGC Exploration, Mount Morgan, Queensland

Responsible for exploration in the environs of the historic Mount Morgan Au-Cu sulphide orebody. Supervision of drilling, geochemical sampling and geophysics. Extensive 25,000 scale regional mapping projects in the Mount Morgan and Gracemere areas. Mapping and exploration

of porphyry style systems as well as Mount Morgan.

1985
Mine Geologist - Renison Bell Tin Mine, Tasmania

Responsible for underground geological duties at the Renison Bell mine.

TEACHING EXPERIENCE

In addition to many in house and public short courses, John has also taught resource estimation, geostatistics and sampling theory at postgraduate level for several universities, either as short courses or as components of award programs, including:

>> The University of Queensland (intensive short courses for geometallurgy research team and also for the CRC Ore research team);

>> James Cook University (Masters program in economic and mining geology);

>> The University of Ballarat (Post Graduate Diploma in Mining Engineering);

>> The University of British Columbia (intensive short course for post graduates in geology).

In early 2006 John was invited to be one of two adjunct faculty members on a program delivered to Rio Tinto senior personnel by Duke Corporate Education one of the world's leading providers of tailored executive education, and an arm of the Duke University, Fuqua Business School in Durham, North Carolina, USA. This program consisted of a series of six day, intensive residential programs on 'Orebody Knowledge and Strategic Mine Planning'. During 2006-11 this program was delivered on 14 occasions to over 400 senior professionals including General Managers and Managing Director-level participants, in Los Angeles and Salt Lake City (USA), Vancouver (Canada), Perth and Brisbane (Australia) and Phalabowra (South Africa).

In 2010, a focused and bespoke executive version of the 'Orebody Knowledge and Strategic Mine Planning' called 'Resource to Value' was developed by Duke CE and has been delivered in the USA, Australia and the UK for Rio Tinto. John was the only non-Rio Tinto Faculty on this program.

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PUBLICATIONS

Bertoli, O., Job, M., and Vann, J., 2003. *Two dimensional geostatistical methods: theory, practice and a case study from the 1A Nickel Deposit, Leinster, Western Australia.* In: 5th International Mining Geology Conference, Bendigo, Victoria, 17-19 November, 2003.

Boardman, R. C., and Vann, J., 2011. *A review of the application of copulas to improve modelling of non-bigaussian bivariate relationships (with an example using geological data).* Proceedings of 19th International Congress on Modelling and Simulation, Perth, Australia, 12–16 December 2011, pp. 627-633.

Coward, S, Vann, J, Dunham, S and Stewart, M., 2009. *The Primary-Response framework for geometallurgical variables.* In: 7th International Mining Geology Conference, Perth, Western Australia, 17-19 August, 2009: pp. 109-113. The Australasian Institute of Mining and Metallurgy: Melbourne.

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McCuaig, T.C., Vann, J., and Seymour, C., 2000. *Dynamic links between geology and the mining process.* 4th International Mining Geology Conference, Coolum, Queensland, 14-17 May, 2000: pp. 187-194. The Australasian Institute of Mining and Metallurgy: Melbourne.

Stephenson, P.R., and Vann, J., 1999. *Commonsense and good communication in Mineral Resource and Ore Reserve estimation.* In: Proceedings of Pacrim 99 Conference, Bali, Indonesia, October, 1999: pp. 435-441. The Australasian Institute of Mining and Metallurgy: Melbourne.

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Vann, J., Bertoli, O., and Jackson, S., 2002. *An overview of geostatistical simulation for quantifying risk.* Proceedings of the Geostatistical Association of Australasia Symposium "Quantifying Risk and Error" March 2002.

Vann, J., Bertoli, O., and Jackson, S., 2003. *Quantitative Kriging Neighbourhood Analysis for the mining geologist: A description of the method with worked case examples.* In: 5th International Mining Geology Conference, Bendigo, Victoria, 17-19 November, 2003.

Vann, J., and Guibal, D., 1998. *Beyond ordinary kriging : An overview of non-linear estimation.* In: Vann, J., (Ed.), Beyond Ordinary Kriging Seminar, October 30th, 1998, Perth, Western Australia. Geostatistical Association of Australasia Monograph 1.

Vann, J., and Guibal, D., 2000. *Beyond ordinary kriging: An overview of non-linear estimation.* In: Mineral Resource and Ore Reserve Estimation: The AusIMM guide to good practice (Monograph 23): pp. 249-256. The Australasian Institute of Mining and Metallurgy: Melbourne.

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Vann, J., and Humphreys, M., 1994. *Variography and determination of grade modelling parameters.* In: Proceedings of Understanding Resources, Short Course on Resource Estimation Practices. ECS Mining Consultants: Bowral.

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Vann, J., and Stewart, M., 2011. *I think, therefore I add value: Philosophy of science as a practical tool for the mine geologist.* In: 8th International Mining Geology Conference, Queenstown, New Zealand, 22-24 August, 2011: pp 49-56. The Australasian Institute of Mining and Metallurgy: Melbourne.