

# Curriculum Vitae

## Dr Oliver Kreuzer (MAIG RPGeo, MAusIMM)

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## Profile

Oliver is a Registered Professional Geologist with a broad skill set in structural, generative and corporate geology honed during a 16+ year career in applied research and mineral exploration across a wide range of gold, base metals and uranium projects in Australia, Africa, North America, Europe and Asia. His work directly contributed to new company floats, company transforming project acquisitions and new discoveries. Oliver's passion lies in the application of superior geoscience to exploration targeting and shortening the time frame to discovery. His publication record covers aspects of structural and ore deposit geology, exploration targeting and risk-value practice and decision-making applied to mineral exploration.

## Global Exploration Awards

**Third Price**  
Integra Gold Rush  
Challenge  
03/2016

- Crowdsourcing challenge organised by Integra Gold Inc
- Over 1,300 registered competitors
- Total price amount of C\$1,000,000

**Third Price**  
Karelian Gold Rush  
Challenge  
02/2016

- Crowdsourcing challenge organised by Endomines AB
- Over 100 registered competitors
- Total price amount of €80,000

## Skills & Experience

**Generative & Corporate Geology**

- Metallogenic framework and prospectivity studies
- Target generation and ranking
- Project generation
- Identification, review and due diligence of project acquisition and joint venture opportunities

**Field Geology**

- Geological mapping and specialist drill core logging
- Structural, alteration and ore domaining studies

**Commodities & Deposit Styles**

- Gold: Orogenic, Carlin, intrusion-related, epithermal and porphyry
- Base Metals: VMS, IOCG and hydrothermal nickel
- Uranium: Volcanic-, sandstone- and calcrete-hosted

**Management & Leadership**

- Company directorships
- Exploration management
- Large multi-consultant / research studies with budgets of up to A\$2 million

- IT**
- ArcGIS, Geosoft Target, Micromine, Leapfrog
  - Palisade Decision Tools Suite
  - Adobe Creative Suite, Microsoft Office Suite

- Languages**
- German (proficient, native language speaker)
  - English (proficient)
  - French (basic)

## Professional Experience

- Since 01/2014:  
**Adjunct Research Fellow**  
*James Cook University, Australia*
- Responsibilities: (i) Participation in collaborative research projects and research grant applications by staff at the Economic Geology Research Centre (EGRU), (ii) publication of current research activities, and (iii) student supervision (1 BSc Hons, 1 PhD).

- Since 08/2013:  
**Partner & Principal Consultant**  
*Corporate Geoscience Group and X-plore Geoconsulting*
- Recent projects: (i) Patagonia Gold plc (LSE:PGD): Tenement rationalisation and project generation study, Deseado Massif, Santa Cruz Province, Argentina; (ii) The United Nations' International Atomic Energy Agency (IAEA): Surficial uranium systems in Western Australia: Prospective tracts and undiscovered endowment; (iii) Asanko Gold (TSX:AKG): Metallogenic framework study and prospectivity analysis of the Asankrangwa Gold Belt, Ghana; (iv) Australian Mines (ASX:AUZ): Review of project acquisition and joint venture opportunities; supervision of RC and DD drilling programmes in the Yilgarn Craton and Marymia Inlier; (v) First Quantum Minerals (TSX:FM, LSE:FQM): Geological domaining study, Enterprise hydrothermal nickel deposit, Eastern Kabompo Dome, NW Province, Zambia; (vi) InterMet Resources (ASX:ITT): Review of past exploration and assessment of exploration potential, Eight Mile Creek gold project, Charters Towers, North Queensland; including a review of district opportunities; and (vii) IOM Metals Refinery: Geological framework study of gold prospective sites in Luzon, Philippines, and planning and execution of follow-up exploration.

- 05/2010 to 08/2013:  
**Senior Geologist – Project Generation**  
*Mitchell River Group*
- Responsibilities: (i) Project and target generation for African Energy Resources (ASX:AFR), Energy Ventures (ASX:EVE), Exco Resources (ASX:EXS), Anova Metals (ASX:AWV) and prospecting company Eastern Goldfields Exploration (EGE) in Australia, North America, Africa, Asia and Europe, focussing on gold, copper, uranium and coal, (ii) identification and review of new opportunities, (iii) due diligence, (iv) geological and structural reviews and interpretations at all scales, and (v) geological mapping
  - Key achievements: (i) Introduced AWV (current market cap of c. \$23M) to its >1 Moz Au flagship Big Springs gold project in Nevada that was acquired for \$4/oz Au, (ii) evaluated numerous gold, copper, lead-zinc, tin, nickel,

uranium, manganese and coal opportunities in Australia, Africa, Asia, Europe and the Americas, (iii) completed project generation work and project opportunity reviews across large tracts of North America and Africa focusing on gold and uranium, (iii) completed detailed exploration and geological reviews of and target generation exercises covering AFR's uranium projects in Zambia, EVE's uranium projects in the United States and EXS' copper and gold projects in South Australia and Queensland, (iv) produced a belt scale interpretation and geological maps covering EXS' project areas in Queensland, (v) secured an Exploration Incentive Scheme co-funded drilling grant for EGE's Maroonah Project in Western Australia

09/2009 to 05/2010:

**Senior Structural Geologist**

*Silver Swan Group  
(ASX:SWN)*

- Responsibilities: (i) Re-logging of all drill holes into copper-zinc ± silver, gold mineralization at the folded and metamorphosed Austin VMS deposit, Archean Yilgarn Craton, (ii) using geological, structural, geochemical and geophysical data to define the geology and geometry of and controls on mineralisation, (iii) regional geological synthesis and target generation, (iv) planning and supervision of DD and RC drilling programmes, (v) project management, and (vi) radiation safety officer
- Key achievements: (i) Produced a 3D model for Austin that formed the basis for calculating the maiden resource, (ii) improved the understanding of geology and structural controls on mineralisation, (iii) helped to improved drill targeting and hit rates, in particular for deep targets

05/2007 to 09/2009:

**Exploration Manager**

*Transcontinental Group*

- Responsibilities: (i) Design, implementation and management of gold and uranium exploration in Australia and New Zealand on behalf of Ausgold (ASX:AUC) and Regalpoint Resources (ASX:RGU), (ii) budgeting and reporting, (iii) project generation and construction of project pipelines, (iv) exploration targeting and target ranking, (v) assessment and monitoring of competitors, (vi) tenement management, (vii) liaison with contractors, research groups, stakeholders, native title groups and landholders
- Key achievements: (i) Helped to lay the foundations for the \$10M float of AUC (peak market cap of over \$100M) and \$5M float of RGU, (ii) project generation activities culminated in the Winchester copper-nickel and Katanning gold discoveries by AUC and the Skevi uranium discovery by RGU

11/2005–05/2008:

**Research Fellow**

*Centre for Exploration Targeting (CET),  
Curtin University of  
Technology*

- Responsibilities: (i) Initiation and execution of research projects in the CET's Progressive Risk and Value stream, (ii) take the lead in an industry-funded (\$700K), Australia-wide uranium prospectivity study, (iii) develop methodologies for assessing and improving exploration investment performance, (iv) develop methodologies for assessing metal endowment of geological provinces and exploration maturity, (v) develop methodologies for

translating mineral deposit models to risk-adjusted exploration targeting models

- Key achievements: (i) Successfully completed and published the first systematic, continent-wide assessment of Australia's uranium potential, (ii) supervised one BSc Hons and one PhD student to successful completion of their degrees

06/2004 to 11/2005:

**Research Fellow**

*ARC National Key Centre for Geochemical Evolution and Metallogeny of Continents (GEMOC), Macquarie University*

- Responsibilities: Undertake research activities within the framework of a major industry-funded (\$600K) project entitled "Improving mineral exploration performance by superior management of risk, uncertainty and value" supported by BHP Billiton, Codelco, Gold Fields, Placer Dome, Barrick Gold, Teck Cominco, WMC Resources and Geoinformatics Exploration, (ii) conduct research into the strategy, capital structure and market performance of junior exploration companies, (iii) develop probabilistic decision models for mineral exploration, (iv) conduct research into heuristics and biases in decision-making under uncertainty
- Key achievements: Developed practical software tools for (i) assessing risk and uncertainty, (ii) project and target ranking, and (iii) project and portfolio valuation

11/2003 to 06/2004:

**Contract Project Geologist**

*Glengarry Resources (ASX:GGY)*

- Responsibilities: (i) Mapping, (ii) geochemical and geophysical surveying, (iii) drill core logging, (iv) supervision of drilling programs, drilling contractors and field assistants, (v) management of safety with regards to drilling operations, and (vi) construction of targeting models, target generation and target ranking
- Key achievements: (i) Identified new gold prospective areas for acquisition, (ii) produced geological maps assisting drill hole planning and targeting within key project areas

08/1994 to 07/1996:

**Field Assistant**

*Various*

- Solum-Büro für Boden und Geologie (08/1994 to 09/1994): Soil mapping and sampling, soil drilling, core logging, sample preparation
- Ontario Geological Survey (05/1995 to 08/1995): Geological mapping, sample preparation, truck and boat operation, camp setup and operation
- Enmotec GmbH (10/1995 to 07/1996): Soil mapping, soil drilling, core logging, water sampling, sample preparation

**Qualifications**

03/2000 to 10/2003:

**Doctor of Philosophy (PhD)**

*James Cook University, Australia*

- Graduation date: 04/2004
- Thesis title: Structure, timing and genesis of auriferous quartz veins in the Charters Towers goldfield, north Queensland: implications for exploration and prospectivity
- Main focus: Structural controls on gold deposition, exploration targeting

- 10/1992 to 04/1999:
- Graduation date: 04/1999
- Diplom-Geologe (MSc)**
- Thesis title: Stratigraphy and tectonics of the southeastern Taemas Synclinorium, Yass, New South Wales (in German)
  - Main focus: Structural geology, tectonics, stratigraphy
- Freiburg University, Germany*

## Professional Memberships

Australian Institute of Geoscientists (AIG 2001), Society of Economic Geologists (SEG 2001), Society for Geology Applied to Mineral Deposits (SGA 2002), Australasian Institute of Mining and Metallurgy (AusIMM 2012), Geological Society of Nevada (GSN 2013), International Association on the Genesis of Ore Deposits (IAGOD 2013)

## Selected Publications

### Peer-Reviewed Journal Articles

- Chudasama, B., Porwal, A.K., **Kreuzer, O.P.**, and Butera, K., 2016: Geology, geodynamics and orogenic gold prospectivity modelling of the Paleoproterozoic Kumasi Basin, Ghana, West Africa. *Ore Geology Reviews*. doi:10.1016/j.oregeorev.2015.08.012.
- Koek, M., **Kreuzer, O.P.**, Maier, W.D., Porwal, A.K., and Guj, P., 2010: A review of the platinum group metal (PGM) industry, deposit models and exploration practices: Implications for Australia's PGM potential. *Resources Policy*, v. 35 (1), p. 20-35.
- Kreuzer, O.P.**, Miller, A., Peters, K., Payne, C., Wildman, C., Partington, G.A., Puccioni, E., McMahon, M.E., and Etheridge, M.A., 2015. Comparing prospectivity modelling results and past exploration data: a case study of porphyry Cu-Au mineral systems in the Macquarie Arc, Lachlan Fold Belt, New South Wales. *Ore Geology Reviews*, v. 71, p. 516-544.
- Kreuzer, O.P.**, Markwitz, V., Porwal, A.K., and McCuaig, T.C., 2010. A continent-wide study of Australia's uranium potential. Part I: GIS-assisted manual prospectivity analysis. *Ore Geology Reviews*, v. 38 (4), p. 334-366.
- Kreuzer, O.P.**, Etheridge, M.A., Guj, P., McMahon, M.E., and Holden, D.J., 2008: Linking mineral deposit models to quantitative risk analysis and decision-making in exploration. *Economic Geology*, v. 103 (4), p. 829-850.
- Kreuzer, O.P.**, Etheridge, M.A., and Guj, P., 2007: Australian junior exploration floats, 2001 to 2006, and their implications for IPOs. *Resources Policy*, v.32 (4), p. 159-182.
- Kreuzer, O.P.**, Blenkinsop, T.G., Morrison, R.J., and Peters, S.G., 2007: Ore controls in the Charters Towers goldfield, NE Australia: constraints from geological, geophysical and numerical analyses. *Ore Geology Reviews*, v. 32 (1-2), p. 37-80.
- Kreuzer, O.P.**, 2006: Texture, paragenesis and alteration assemblage of auriferous veins in the Charters Towers goldfield, north Queensland: Implications for the conditions of vein formation and ore deposition. *Mineralium Deposita*, v. 40 (6-7), p. 639-663.
- Kreuzer, O.P.**, 2005: Intrusion-hosted mineralization in the Charters Towers goldfield, north Queensland: Isotopic and fluid inclusion constraints on the timing and origin of the auriferous veins. *Economic Geology*, v. 100 (8), p. 1583-1603.
- Kreuzer, O.P.**, 2004: How to resolve the controls on mesothermal vein systems in a goldfield characterized by sparse kinematic information and fault reactivation – a structural and graphical approach. *Journal of Structural Geology*, v. 26 (6-7), p. 1043-1065.
- Porwal, A.K., Deb Das, R., Chaudhary, B., Gonzalez-Alvarez, I., and **Kreuzer, O.P.**, 2014: Fuzzy inference systems for prospectivity modelling of mineral systems and a case-study for prospectivity mapping of surficial uranium in Yeelirrie Area, Western Australia. *Ore Geology Reviews*, v. 71, p. 839-852.
- Porwal, A.K., and **Kreuzer, O.P.**, 2010: Introduction to the Special Issue: Mineral prospectivity analysis and quantitative resource estimation. *Ore Geology Reviews*, v. 38 (3) p. 121-127.
- Zhao, J., Zuo, R., Chen, S., and **Kreuzer, O.P.**, 2015: Application of the tectono-geochemistry method to mineral prospectivity mapping: a case study of the Gaosong tin-polymetallic deposit, Gejiu district, SW China, *Ore Geology Reviews*, v. 71, p. 719-734.

**Newsletter Articles, Conference Abstracts & Presentations**

- Etheridge, M.A., and **Kreuzer, O.P.**, 2009: The black art of valuing mineral properties. AIG Mineral Asset Reporting and Valuation Seminar, East Perth, 19 October 2009.
- Etheridge, M.A., **Kreuzer, O.P.**, McMahon, M.E., Compton, R., and McAneney, K.J., 2006: Making better decisions and generating greater value in mineral exploration. SEG 2006 Conference – Wealth Creation in the Minerals Industry: Integrating Science, Business, and Education, Keystone. Abstracts, Society of Economic Geologists, Littleton, pp. 21-23.
- Kreuzer, O.P.**, and Etheridge, M.A., 2010: Risk and uncertainty in mineral exploration: Implications for valuing mineral exploration properties. Australian Institute of Geoscientists, Quarterly Newsletter, v. 100, p. 20-28.
- Kreuzer, O.P.**, Porwal, A.K., Markwitz, V., and McCuaig, T.C., 2009. A continent-wide study of Australia's uranium potential. Australian Uranium Conference, Fremantle, 22-23 July 2009.
- Kreuzer, O.P.**, 2007: Risk modelling – increasing the effectiveness of our exploration investments, in Bierlein, F.P., and Knox-Robinson, C.M., eds., Proceedings of Geoconferences (WA) Inc. Kalgoorlie'07 Conference: Geoscience Australia Record 2007, v. 14, pp. 226-230.
- Lord, D., Williams, P.R., **Kreuzer, O.P.**, and Etheridge, M.A., 2012: Meaningful market based valuation of exploration assets. In: VALMIN Seminar Series 2011–12.
- McCuaig, T.C., **Kreuzer, O.P.**, and Brown, W.M., 2007: Fooling ourselves – dealing with model uncertainty in a mineral systems approach to exploration. SGA 9<sup>th</sup> Biennial Meeting 2007 – Mineral Exploration and Research: Digging Deeper, Dublin. Society of Geology Applied to Mineral Deposits.
- Miller, A.V.M., Partington, G.A., **Kreuzer, O.P.**, McMahon, M.E., and Etheridge, M.A., 2015: Quantifying exploration effectiveness in the Lachlan Fold Belt, New South Wales. In: Proceedings of the AusIMM New Zealand Branch Conference 2015, p. 275-285.
- Wilde, A.R., and **Kreuzer, O.P.**, 2016: Rush to find gold in data. Mining Journal, March 25-April 7, 2016, p. 45-46 [<http://www.mining-journal.com/technology-top-articles/rush-to-find-gold-in-data/>].