

SGEG Newsletter

Number 1**April, 2007****Chair: Dr. Frank Bierlein.**

Email: bierlein@cyllene.uwa.edu.au

Hon. Secretary: Dr. Oliver Kreuzer.

Email: okreuzer@cyllene.uwa.edu.au

Hon. Treasurer: Dr. Klaus Gessner.

Email: kgessner@cyllene.uwa.edu.au

This Issue!

Message from the Chair Frank Bierlein	1
Economic Geology Research Centre for Multiscale Earth System Dynamics Klaus Regenauer-Lieb & Florian Fuisseis	2
2006 SGEG Austin B Edwards Medal	4
Edwards, Austin Burton (1909 - 1960) T. G. Vallance	4
Nickel Mini-Symposium Do you prefer your komatiites wet or dry? Marco Fiorentini	6
Membership News	7
Upcoming Short Courses	8

For future submissions, queries and comments please contact Oliver Kreuzer (Newsletter Editor): okreuzer@cyllene.uwa.edu.au.

FROM THE CHAIR

Welcome to the **first Newsletter edition of 2007**. In case you have lost count, this is actually our fourth Newsletter in twelve months! Much of the credit for this increased rate of output must go to our Secretary, Oliver Kreuzer, who has been the driving force behind the push to improve the communication with our members. **SGEG Membership numbers are approaching 500**, which is great to see. I particularly welcome our newest members, and thank all 'renewals' for their continuing support in 2007.

Speaking of support - our Specialist Group is officially a proud '**Gold Level**' sponsor of the **9th Biennial SGA Meeting** in Dublin this August, with all of our sponsorship funds going towards the support of Australia-based postgraduate students that will attend and present at this high-profile meeting. It is particularly pleasing to see that EGRU (James Cook University), CODES (University of Tasmania), the CET (University of Western Australia) and the Cooperative Research Centre for Predictive Mineral Exploration (*pmd**CRC) are recognizing the importance of this event by providing substantial levels of support that will

enable 16 Australia-based postgraduate students to participate in the four-day meeting in Dublin. This commitment should be encouraging news indeed for students contemplating postgraduate research but that might be tempted to forego such a career move in view of the rampant mining and exploration job market. It is important to bear in mind that participation at conferences like the 9th Biennial SGA Meeting can open up fantastic opportunities and provide far more than intellectual stimulation for postgraduate students.

Next month, the **SGEG will be hosting a debate on the volatile content of komatiites**, with two experts on komatiite-hosted Ni deposits going head to head at the monthly GSA WA Division Meeting at the University of Western Australia on May 01. To lubricate the debate and settle the question of whether it is preferable to have ‘wet’ or ‘dry’ komatiites for the formation of nickel deposits, we will be providing a selection of appropriate wines and nibbles. If you are in Perth, come and join what will no doubt be a very lively debate, which will kick off in the Geography Lecture Theatre I at 5.30 pm.

As has become tradition, the SGEN awards the **best paper in the field of economic geology**

published in the Australian Journal of Earth Sciences in the previous year. For 2006 and based on its outstanding presentation, novel subject matter and international significance, the winning paper (out of 16 eligible papers) is “Cenozoic fault control on deep lead palaeoriver systems, Central Highlands, Victoria.” **Congratulations to Guy Holdgate and his co-authors** M.W. Wallace, S.J. Gallagher, R.B. Witten, B. Stats and B.E. Wagstaff for their landmark contribution!

Finally and as always, I would like to emphasise that we welcome your contributions in any shape or form. In particular, **we are looking for short feature articles, comments and opinions that we can publish in our Newsletter**. Bear in mind that we do have an ISSN and as such, every printed scientific article counts as a publication!

Best Wishes,

Frank P. Bierlein
Chair, SGEN
Perth, April 2007

Centre for Multiscale Earth System Dynamics

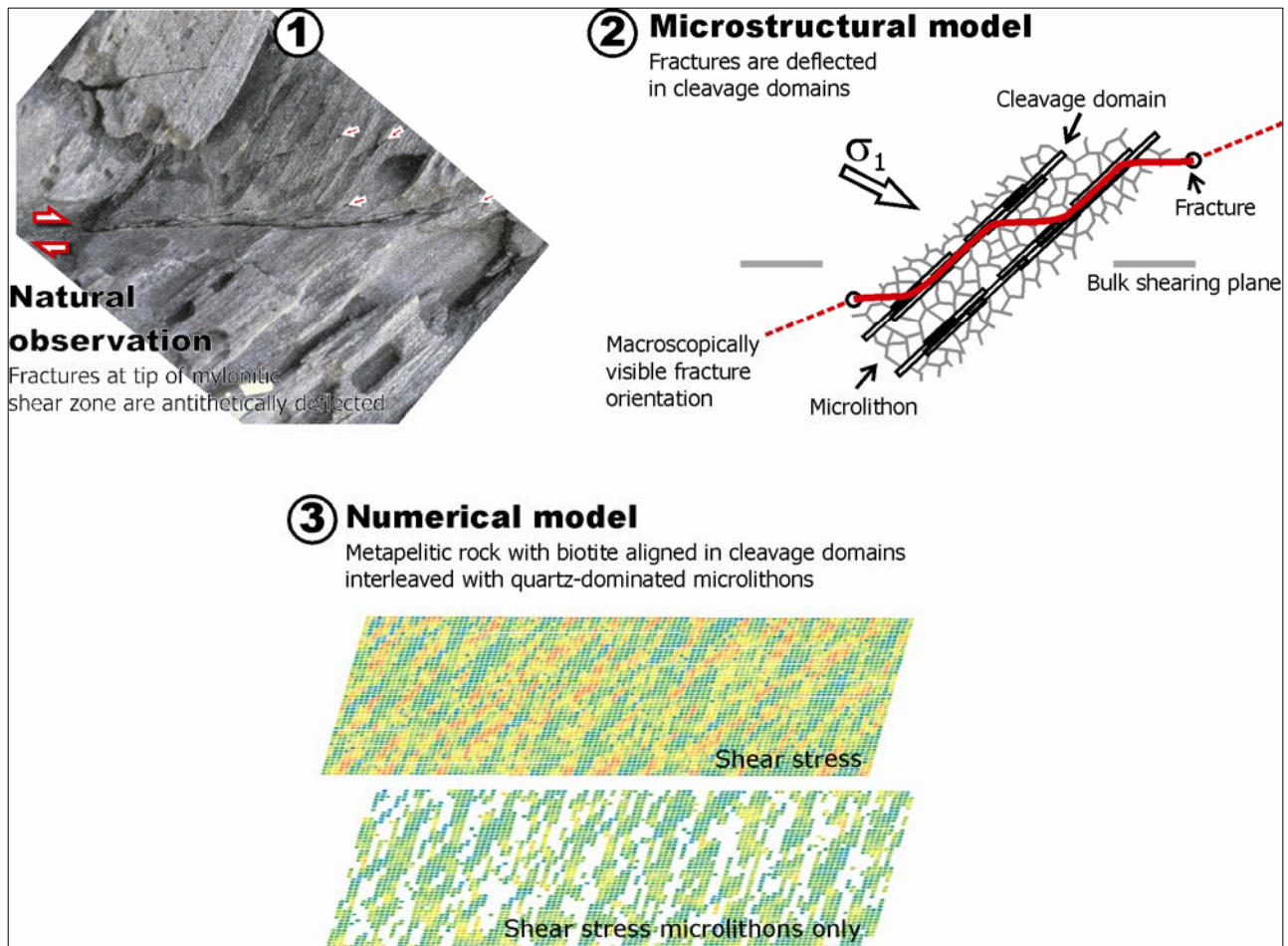
Klaus Regenauer-Lieb & Florian Fousseis

A new Perth-centred research group around Western Australian Premier’s Research Fellow Prof Klaus Regenauer-Lieb is currently starting off. The group involves a core of researchers from UWA’s School for Earth and Geographical Sciences, the School of Civil and Resource Engineering and CSIRO Exploration and Mining and is organized in a Centre for Multiscale Earth System Dynamics.

The group’s research explores the link between Earth’s heat, its chemistry and its mechanical

behaviour from the plate-tectonic down to the microscale. To maximize the scientific outcome, researchers with backgrounds in physics, computational research and structural geology closely cooperate to ensure a permanent feedback between numerical modeling and natural observations.

A new numerical approach originally presented in *Science* (2001, 294/5542, p. 578 – 580) is used to predict the formation of geological structures out of a random perturbations. On a



global scale this tool just recently unravelled the distribution of earthquakes in subduction zones as well as explained the curvature of oceanic arcs through forward modeling of the underlying physics (Geology 2006, 34/10, p. 877-880). On a crustal scale the model explained the source for weakening the brittle-ductile transition, thus allowing the development of major detachments (Nature 2006, 442/7098, p. 67-70). The approach was also successfully applied to folding in the middle to lower crust (Geology 2007, 35/2, p. 175-178).

Currently the same approach is downscaled to investigate the behaviour of upper-greenschist facies deformation structures at outcrop to microscales (to be presented at the SGTSG meeting Deformation in the Desert in July, Poulet et al. 2007, Fousseis 2007). First results

of this predictive microstructural analysis are shown in the figure.

In the near future we will provide a prototype tool for the analysis of mesothermal deformation-related ore deposits. In contrast to classical engineering-based approaches this will be the first physics-based framework allowing prediction of deformation from micrometer to Earth scale.

2006 SGEG Austin B Edwards Medal

Australian Journal of Earth Sciences, Volume 53

WINNING PUBLICATION

G.R. Holdgate, M.W. Wallace, S.J. Gallagher, R.B. Witten, B. Stats, B.E. Wagstaff

Cenozoic fault control on 'deep lead' palaeoriver systems, Central Highlands, Victoria, p 445-468.

HONORABLE MENTION

G. Mark, N.H.S. Oliver, M.J. Carew

Insights into the genesis and diversity of epigenetic Cu – Au mineralisation in the Cloncurry district, Mt Isa Inlier, northwest Queensland, p 109-124.

J.McL. Miller, C.J.L. Wilson, L.J. Dugdale

Stawell gold deposit: a key to unravelling the Cambrian to Early Devonian structural evolution of the western Victorian goldfields, p 677-695.

P.M. Schaub, T.J. Rawling, L.J. Dugdale, C.J.L. Wilson

Factors controlling the location of gold mineralisation around basalt domes in the Stawell corridor: insights from coupled 3D deformation – fluid-flow numerical models, p 841-862.

R.R. Whittam, F.P. Bierlein, S. McKnight

Leven Star deposit: an example of Middle to Late Devonian intrusion-related gold systems in the western Lachlan Orogen, Victoria, p 343-362.

Edwards, Austin Burton (1909 - 1960)

T. G. Vallance, 'Edwards, Austin Burton', in J. Ritchie (ed), Australian Dictionary of Biography, Volume 14, pp 81-82, Melbourne University Press (Melbourne, 1996)

EDWARDS, AUSTIN BURTON (1909-1960), geologist, was born on 15 August 1909 at

Caulfield, Melbourne, third son of William Burton Edwards, public service inspector, and

his second wife Mabel, née Mueller, both Australian born. Austin was educated at Caulfield Grammar School where he was dux and captain. At the University of Melbourne (B.Sc., 1930; D.Sc., 1942) he graduated with first-class honours in geology. A scholarship then enabled him to study the geology and petrology of the Healesville and Warburton districts: his account of the work was published in 1932. In that year he won an 1851 Exhibition scholarship to the Royal College of Science, University of London (Ph.D., 1934), where he wrote his thesis on the tertiary volcanic rocks of Victoria.

On 22 April 1935 in the chapel of the Collegiate School of St Peter, Adelaide, Edwards married with Anglican rites Eileen Mary McDonnell, a psychologist. Six months earlier he had joined F. L. Stillwell in the mineragraphic section of the Council for Scientific and Industrial Research, Melbourne. There Edwards learned the techniques of ore microscopy and mineralogy from Australia's leading expert. When Stillwell retired in 1953, Edwards succeeded him as officer-in-charge of what had become a section of the Commonwealth Scientific and Industrial Research Organization. He was a councillor (1953-60) of the Australasian Institute of Mining and Metallurgy.

A major paper (1936) on the mineragraphy of the iron ores of the Middleback Ranges, South Australia, had reported Edwards's first research for the C.S.I.R. It was followed by other detailed studies, for instance on the iron ores of Yampi Sound, Western Australia, and the copper deposits of Mount Lyell, Tasmania. Few Australian ore deposits escaped his attention. His own contributions to *Geology of Australian Ore Deposits*—the volume he edited for the Fifth Empire Mining and Metallurgical Congress (1953)—no more than hint at the range of his experience.

Like Stillwell, Edwards sought to understand the significance of textural relations between mineral phases in ore deposits, a subject of

practical value in the treatment of ores but more particularly important in elucidating the genesis of ore assemblages. *Textures of the Ore Minerals and their Significance* (1947) revealed not only Edwards's mastery of mineragraphy but also his grasp of structural crystallography and experimental phase chemistry. In 1952 he delivered the (W. B.) Clarke lecture to the Royal Society of New South Wales and in 1960 was awarded its Clarke medal for outstanding work in geology.

Edwards undertook research covering geological inquiries outside mineragraphy and ore deposits. Some, like the detailed study of coal made for the State Electricity Commission of Victoria, had economic interest. Many others simply added to knowledge in fields as diverse as the development of landforms, the nature of meteorites and various aspects of petrology, his first scientific love. He published several useful papers on both sedimentary and metamorphic petrology, but igneous rocks dominated his petrological interest. His numerous contributions on the nature of basalts and basaltic differentiation, in particular, won him an international reputation. He was a fellow of the Mineralogical Society of America, a corresponding fellow of the Edinburgh Geological Society and an honorary member of the Mineralogical Society of India.

A talented teacher, Edwards never allowed himself to be isolated in his research position. In 1941-55 he lectured part time in geology at the University of Melbourne and occasionally offered postgraduate lectures. Although at times impatient with those he thought undeserving of his interest, he supported his staff and they in turn gave him impressive loyalty. Authorship of many of his papers he shared with colleagues. As a student, Edwards had excelled at sport, winning a half-Blue for football at Melbourne and colours for athletics at Imperial College. Latterly, he coached the university third XVIII football team. Among other outside interests, he served on the council of his old school. He travelled widely, in Australia and abroad.

While on a working visit to Europe, Edwards collapsed and died on 8 October 1960 in Rome; he was buried in the Protestant cemetery of that city. His wife, son and three daughters survived him.

Select Bibliography

Dictionary of Scientific Biography, vol 17, supplement 2 (NY, 1990); Australasian Institute of Mining and Metallurgy, Proceedings, no

196, 1960; Australian Journal of Science, 23, 1961, p 260; American Mineralogist, 45, Mar-Apr 1961, p 488.

Published with permission of the Editor, Australian Dictionary of Biography Research School of Social Sciences Coombs Building, No. 009 Australian National University Canberra, ACT 0200

Nickel Mini-Symposium: Do you prefer your komatiites wet or dry?

Speakers: Steve Barnes (CSIRO) and
Marco Fiorentini (University of Western Australia)

Tuesday 1st May 2007, 5.30 pm

Geography Lecture Theatre 1, Geology-Geography Building,
The University of Western Australia, Nedlands

The role of volatiles in Precambrian Ultramafic magmatism is very controversial and has been widely debated, with multiple models proposed by various workers. Several authors suggest that volatiles generally play a minor role in the petrogenesis of most Precambrian komatiites and ferropicrites, which are ascribed to high-degree dry partial melting in deep mantle plumes. These authors argue that evidence for degassing is lacking in most komatiitic and ferropicritic flow sequences, and that the localised occurrence of volatile-bearing phases (e.g. hydromagmatic amphibole) and/or degassing textures (e.g. amygdales) is primarily due to assimilation, either during the ascent of the magmas through the crust or during emplacement close to the surface.

Conversely, other workers suggest that the presence of volatiles largely controls the petrogenesis of many komatiites and ferropicrites, which may form by lower degrees

of partial melting of “wet” sources. These authors indicate that volatiles derive from the mantle and have a direct role in the petrogenesis and evolution of Precambrian ultramafic magmas. Accordingly, the presence of vesicles and/or explosive eruption styles may be directly ascribed to primary volatile contents in melts, and the hydrous nature of magmas is reflected in the widespread occurrence of volatile-bearing phases. However, disagreement arises on the origin of the “wet” mantle sources: it is largely unconstrained whether the magmatic volatiles derive from the occurrence of “wet” plumes or the interaction of a dry plume with a “wet” subcontinental lithospheric mantle.

In numerous Precambrian komatiites and ferropicrites, there is a strong spatial association between nickelsulfide (NiS) mineralisation and degassing textures and/or volatile-bearing

phases. The presence of volatiles in silicate melts appears to have three major controls on the genesis of Ni-Cu-(PGE) deposits: 1) they physically concentrate magmatic sulfides (e.g. sulfide-infilled vesicles), 2) they increase the ability of sulfide liquids to be mobilised from their host magma during late stages of emplacement, and 3) they radically modify the relationship between pressure and sulfur solubility in mafic and ultramafic systems. However, the strong empirical relationship between NiS mineralisation and evidence of the

hydrous nature of some ferropicrites and komatiites remains to be explained.

Steve Barnes (CSIRO: advocate of the “dry” hypothesis) and Marco Fiorentini (UWA: advocate of the “wet” hypothesis) will discuss the source of volatiles in ultramafic melts and put forward their ideas on this highly controversial topic. Ideas on the role of volatiles in the genesis of associated Ni-Cu-(PGE) deposits will be also discussed.

SGEG Membership News

We welcome the following new members:

(1) **Rhiannon Brooke**, (2) **Michael Crighton**, (3) **Michael Hawtin** Queensland University of Technology, (4) **Natasha McGregor** Minara Resources, (5) **John Miller** University of

Western Australia, (6) **Alexander Musson** University of Adelaide, (7) **Cameron Quinn** Geological Survey of New South Wales, (8) **Arne Scherrenberg** University of Queensland.

Economic Guidelines for Mineral Exploration

Centre for **EXPLORATION**
TARGETING



***19 – 13 July 2007
The University Club of Western Australia***

Michael Doggett – Geological Sciences & Geological Engineering, Queen's University
Pietro Guj – Centre for Exploration Targeting, University of Western Australia

Course Objectives

This five-day course is intended for mineral exploration and mining professionals, financial analysts and policy-makers who wish to gain a practical understanding of financial evaluation principles and develop the basic skills necessary to translate geological knowledge and expertise into sound exploration and mineral project assessments and investment decisions.

Course Content

The main topics covered by the course will include:

- ✓ ***Exploration Economics and Evaluation*** the mineral supply process; mining company planning; evaluating costs, risks, and returns; the investment decision process; economic evaluation techniques.
- ✓ ***Concept of Cash Flow*** specification of currency; end-of-year convention; taxation considerations; constant and current money values; real changes in future economic conditions.
- ✓ ***Cash Flow Criteria*** total profit; project size; operating margin; competitive cost position; payback period.
- ✓ ***Time Value of Money*** cost of capital; economic justification of investment; time value relationships.
- ✓ ***Discounted Cash Flow Methods*** classification of alternatives; equivalent annual value; net present value; present value ratio; rate of return; comparative strengths and weaknesses; the problem of contradictory results.
- ✓ ***Mining Taxation Considerations*** effect of taxation on individual projects cost and benefit elements; individual project and integrated company tax bases; mining taxation systems in selected international jurisdictions.
- ✓ ***Sensitivity and Risk Analysis Techniques*** analyzing the possible effects of uncertain parameters; definition of strategic variables; answering 'what if' questions; traditional risk analysis methods; the probabilistic concept of risk; estimating probabilities; analytical risk analysis techniques; the Monte Carlo simulation technique; risk adjusted cost of capital.

- ✓ **Exploration Planning Issues** establishing minimum acceptable exploration target conditions; examining the returns from exploration success; structuring exploration agreements.
- ✓ **Exploration Economics and Strategies** role of exploration in the mining company; international case study appraisals of exploration economics; historical trends in exploration expenditure, technological advances and changing exploration targets; assessing costs, risks, and returns for exploration environments of interests.

Profile of Course Presenters

Michael Doggett is the Director of the Mineral Exploration Program and Associate Professor in the Department of Geological Sciences and Geological Engineering at Queen's University. Michael completed an MSc in 1987 and a PhD in 1994 in mineral economics studies at Queen's University under the supervision of Dr Brian Mackenzie. From 1990-7, he carried out mineral industry research, eventually becoming Interim Director of the Centre for Resource Studies. Since 1995, Prof Doggett has taught courses on project evaluation, corporate decision-making, and exploration/acquisition issues facing the mining industry, and from 1999, he has been an Invited International Lecturer at the Western Australian School of Mines Master's Program in Mineral Economics. Prof Doggett has taught professional development seminars to more than 600 industry participants in over a dozen countries. He also has carried out a range of consulting activities with mining companies, governments and international agencies

Pietro Guj is an Associate Professor in Mineral Economics at Curtin University of Technology's Western Australian School of Mines. He also leads the "Progressive Risk and Value Analysis" research theme at the Centre for Exploration Targeting (CET), a joint venture between the University of Western Australia, Curtin University and the mining industry, financially supported by the State Government of Western Australia. Pietro joined Curtin University following a distinguished career in the mining industry and Government of Western Australia. He held the roles of Deputy Director General of the Department of Minerals and Energy, Director of the Geological Survey and Manager Financial Planning and Revenue of the Water Authority of Western Australia. These roles were preceded by 18 years of professional experience in the fields of geology, exploration and mining in Asia, Africa and Australia. Pietro has a PhD in Geology from the University of Cape Town and a MBA from the University of Western Australia. His main interests and expertise are in project evaluation and decision analysis as applied to the mineral and petroleum industries and in the formulation and administration of internationally competitive regulatory and fiscal regimes, fields in which he has lectured and consulted widely internationally.

Course Fees and Registration

\$1,950.- (plus GST). CET Corporate Members 20% discount.

Registration includes course notes, lunch, and morning and afternoon tea. No refund will be made for cancellations received within 10 days of the start of the course but a substitute course participant may be nominated.

Please contact Mr. Heath Nelson, Business Manager, CET

Phone: (08) 6488 2636

Fax: (08) 6488 1178

Email: hnelson@cyllene.uwa.edu.au

Computer-Aided Exploration Techniques

Centre for EXPLORATION
TARGETING



9 – 20 July 2007

The University of Western Australia

Warick Brown – Centre for Exploration Targeting, University of Western Australia

Klaus Gessner – Centre for Exploration Targeting, University of Western Australia

Course Content

- ✓ **Introduction to Geographic Information Systems for Geoscientists** This is a highly focussed course covering the basic methods required in the Spatial Data Analysis course that follows. In order to assess variables as predictors of gold mineralization, such as the proximity to the nearest trace of a regional-scale anticlinal axis or positive magnetic anomaly, specific GIS techniques are required. Examples of these techniques include; conversion of vector-based layers to grids, editing structural layers to separate shear zones into geologically meaningful groups that can be represented as separate GIS layers, simplification of the geological legend through re-classification, buffering, counting deposit points in separate buffer zones or selected areas, importing point data sets from an EXCEL spreadsheet, cookie cutting smaller areas of interest from a larger one, editing attribute tables, joining relational tables, conversion of map calculations and queries into permanent grids, creating layers that represent the distance to the nearest line (e.g. fault), intersection of lines or polygon (e.g. anomaly), and creation of binary maps from selected features. Additional topics such as data entry, query, basic manipulation of attribute table data, map algebra operations, creation of derived GIS layers and conversion of exploration criteria to GIS layers are also covered in the course.
- ✓ **Spatial Data Analysis for Mineral Exploration** This course examines how to test regional-scale exploration concepts using a GIS database. The advantage of this approach is that the GIS database can be a testing ground for exploration ideas and lessons learnt from this relatively inexpensive phase of the work can be applied to improve ground selection and the choice of data that is acquired in later stages. Participants in the course are taken through the process of translating empirical and conceptual exploration criteria into mappable features that can be represented as GIS layers. Once exploration concepts are expressed as GIS layers, the following types of questions can be addressed: "does a positive spatial relationship between the geological feature and known deposits actually exist at a regional scale (i.e., not just at a few locations of interest)", "is the spatial relationship statistically significant (i.e. not an artifact of data coverage or due to random chance)", "which are the most favourable values for exploration variables e.g., proximity to faults, magnetic anomalies etc", "how useful is a particular exploration criterion as a predictor of mineralization and how does it compare with the other criteria" (i.e., ranking of criteria). In order to answer these questions, methods like $(O - E)/E$ (where O = observed and E = expected numbers of known deposits within a buffer zone), Kolmogorov-Smirnov, contrast of weights, Chi-square, and bi-variate J-function plots, capture efficiency ratios, and conversion of categorical variables (e.g. rock types) to fuzzy membership

values are used. In addition, we look at the problem of how to deal with patchy coverage of geochemical data over large areas. The course consists of a combination of short lectures and practical exercises. A basic knowledge of GIS is assumed but participants are assisted as much as possible in practical sessions. The GIS skills required are taught in the "Introduction to GIS for Geoscientists" short course (see above).

- ✓ **Regional-Scale Mineral Prospectivity Mapping** Methods that can be used to combine multi-source geoscience data in the form of GIS layers into a single map depicting the favourability for one type of deposit is the focus of this course. The GIS layers that are incorporated into a prospectivity map correspond to the best exploration criteria that have been identified, tested and ranked in the preceding Spatial Data Analysis course. The three main methods are weights of evidence, fuzzy logic and neural networks, representing empirical (statistically-based), empirical (robust, non-statistical) and conceptual approaches, respectively. A variety of methods to quantitatively assess the effectiveness of alternative mineral prospectivity maps are introduced. These include plots of Spearman's rank correlation coefficient versus prospectivity map class, receiver-operator characteristic curves, capture efficiency ratios and plots of exploration efficiency using a method developed by Harris and Pan.
- ✓ **Numerical Modelling of Geologic Processes as a Tool for Exploration Targeting** This course module will focus on the simulation of physical and chemical processes of tectonics and ore deposition with numerical methods to generate targeting values based on an integrated mineral systems perspective. This will be demonstrated for a well-documented orogenic gold case study in the Yilgarn.

Profile of Course Presenters

Dr Warick Brown is an MCA lecturer and MSc coordinator at the Centre for Global Metallogeny, University of Australia. He graduated with BSc(Hons) and MSc degrees in geology from La Trobe university and subsequently worked as a project geologist for W.M.C. Ltd for four years in surface exploration, prospect evaluation and underground mine work at Olympic Dam, Kambalda and Bendigo. His geological experience also includes exploration work for Marathon Petroleum (Australia) and compilation of geochemical GIS databases for Terra Search. After returning to La Trobe University to complete a Diploma in Computer Science, he worked as a programmer on COBOL on-line and batch transaction processing systems at Telecom, Melbourne. He also worked on the development of commercial/technical IMS and DB2 database applications in an IBM mainframe environment at pdv Nord-Ost GmbH for five years at Volkswagen, Germany. He recently completed a PhD at the University of Western Australia on a neural network method for mineral prospectivity mapping. He continued this research as postdoctoral research fellow in the School of Information Technology, Murdoch University in a collaborative project with WMC Ltd on the application of hybrid fuzzy-neural networks and self-organizing maps to mineral exploration. He has previously presented short courses on mineral prospectivity mapping at James Cook University and the University of Western Australia.

Dr Klaus Gessner joined UWA in 2004 as a Senior Lecturer at the Centre for Exploration Targeting in the School of Earth and Geographical Sciences. He leads the Earth Systems Modelling Group, a WA Government-funded initiative that contributes to research and teaching at UWA and within the Predictive Mineral Discovery CRC (pmd*²CRC). Dr Gessner's expertise lies in the application of numerical simulations to problems of structural geology, ore deposition processes and tectonics. Klaus has a strong background in field and lab based analysis of geological structures and has worked in western Turkey, the Adelaide Fold Belt, Mt Isa and the MacDonnell Ranges. Before joining UWA, Dr Gessner has worked as a Structural Geologist in the Computational Geoscience research group at CSIRO Exploration and Mining. He has carried out research on Mount Isa-style copper mineralisation

in a project of the pmd*CRC, and has worked on the simulation of tectonic denudation in metamorphic core complexes. Prior to his appointment as a Structural Geologist Dr Gessner has been a visiting postdoctoral fellow at CSIRO, where he worked on the numerical simulation of shear zones and on continental extension tectonics. Dr Gessner has worked on the tectonic evolution of western Turkey as a postgraduate and a postdoctoral researcher at the Institute for Geosciences, Johannes Gutenberg University Mainz, Germany. Klaus received a PhD from Johannes Gutenberg University in Mainz in 2000, and a Diploma in Geology from Johann Wolfgang Goethe-University in Frankfurt, Germany.

For more information contact

Dr Warick Brown

Tel.: (08) 6488 2640

Fax: (08) 6488 1178

Email: wbrown@cyllene.uwa.edu.au