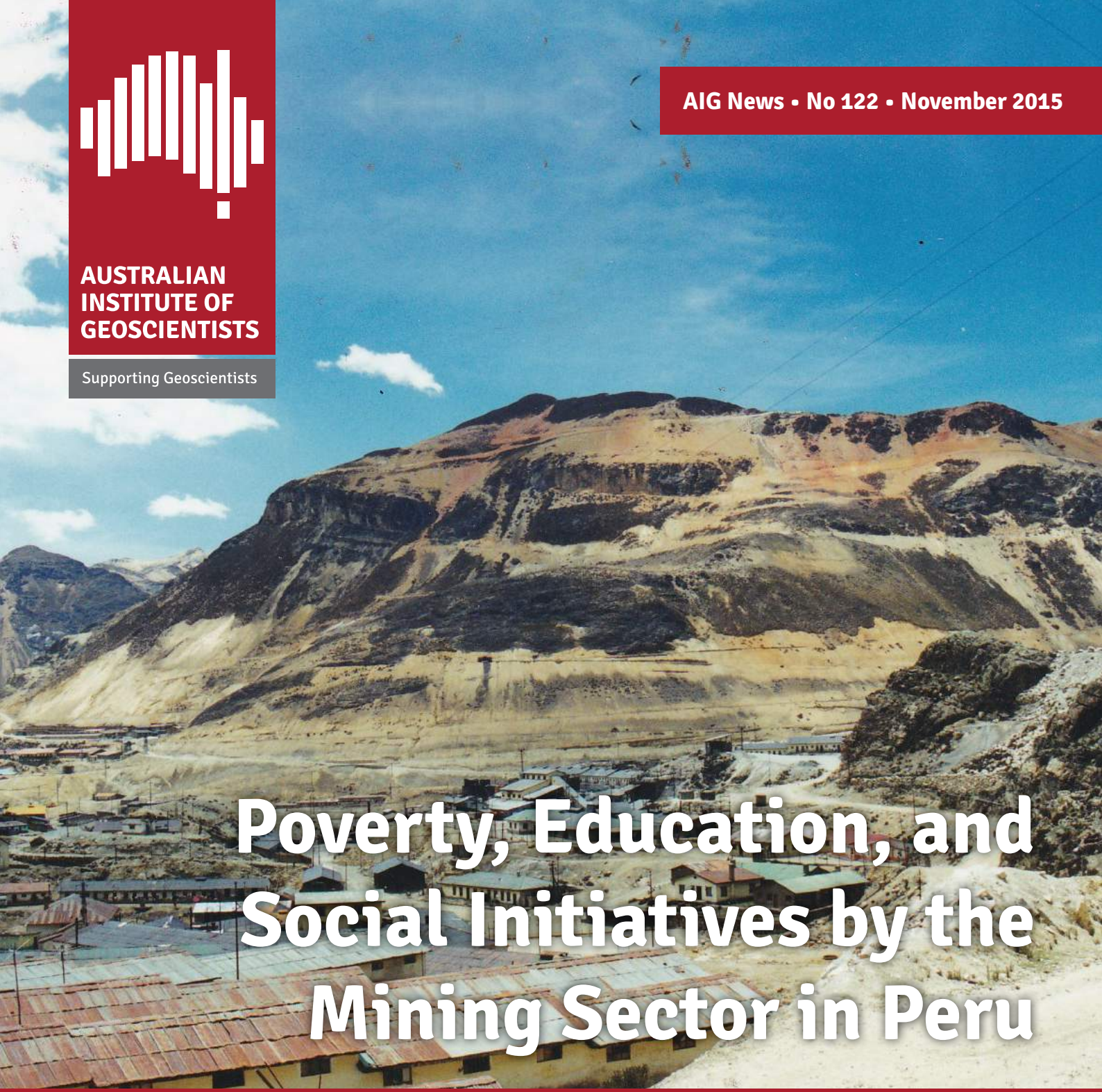




**AUSTRALIAN
INSTITUTE OF
GEOSCIENTISTS**

Supporting Geoscientists

AIG News • No 122 • November 2015



Poverty, Education, and Social Initiatives by the Mining Sector in Peru

Inside this AIG News...

From Your President: Are you competent? • Institute News • Snippets • Member rewards • NSW Branch News • Education News • Membership Updates • Registered Professional Geoscientists Applications • Poverty, education, and social initiatives by the mining sector in Peru • Upcoming events • Cape Liptrap Field Trip Report • 13th SGA Biennial Meeting “Mineral Resources in a Sustainable World” • Rock collections for Junior High School – just what is needed? • Latest Australian Geoscientist Employment Survey Results Show No Signs of Improvement • Report on the first Panels of Experts Workshop in Slovenia, September 2015 • 5: Seven wonders of the hydrogeological world - Canning Basin • Reporting Sulphide Mineral Observations in Drilling Intersections • Mines and Wines 2015 – Uncorking the Tasmanides • AIG VIC Deepcore Drilling Workshop • Events calendar and more...

AMC Specialist Technical Workshops

January – December 2016



AMC Consultants (AMC) is a leading independent mining consultancy, providing services exclusively to the minerals sector. We are pleased to announce dates for our specialist technical career development workshops. Participants on all workshops will receive a bound, full-colour workshop manual. AMC can also run these workshops in-house and tailor them for your specific needs. Discounts are available for participants who attend several workshops in the same week (March, June, August, November).

JORC 2012—Complying with the Code in the Reporting Environment

Brisbane: 2 March, 22 June, 24 August, 16 November
Presenters: Peter Stoker and Mark Berry

This half-day workshop will present the fundamental requirements of the JORC Code, including new and changed provisions adopted in 2012. Examples of compliant and non-compliant reports will be reviewed, including case studies. This workshop is designed for existing and intending Competent Persons and management staff at all levels.

Lessons Learnt from Auditing Mineral Resource Estimates

Brisbane: 3 March, 23 June, 25 August, 17 November
Hong Kong: 4 April (in conjunction with Mines and Money)
Presenters: Peter Stoker and Mark Berry

This one-day workshop will present key learnings from AMC's extensive international audits of mineral resource estimates. It is designed to provide new and senior geological staff with insights into best practice and common problems. Topics covered will include drill programme design and drilling, surveying, sample preparation and analytical techniques, logging and related processes, geological interpretation and domaining, geostatistics, estimation, classification, reporting, QA/QC processes, and data management.

Preparing Appropriate Inputs for Robust Grade Estimation

Brisbane: 29 February, 20 June, 22 August, 14 November
Presenter: Alex Virisheff

This one-day workshop will present fundamental considerations and understandings in preparing information as inputs for completing a mineral resource estimate. It is designed to provide guidance on addressing issues associated with data inputs to grade estimates and grade estimation tasks.

Delivering High-quality Grade Estimates

Brisbane: 1 March, 21 June, 23 August, 15 November
Presenter: Alex Virisheff

This one-day workshop will present fundamental considerations and understandings in carrying out grade estimation in completing a mineral resource estimate. It is designed to provide guidance on setting grade estimation parameters, selecting grade estimation methods, and completing validation of grade estimates.

Assessment of Geological Uncertainty in Mining and Management of Risk

Brisbane: 4 March, 24 June, 26 August, 18 November
Presenter: Mark Berry

This one-day workshop will identify and assess the sources of geological uncertainty that feed into mineral resource and ore reserve estimates, with implications from pit to port. Case studies and a range of risk management strategies will be presented. This workshop is designed for geologists, engineers, metallurgists, and management staff at all levels.

Excellence in Mineral Resources Estimation

Brisbane: 23–27 May, 17–21 October
Presenters: Peter Stoker, Mark Berry, Alex Virisheff, Brian Hall, and other industry specialists

This five-day workshop provides geologists with a comprehensive review of all inputs into resource estimation, from data collection to reporting. Case studies are used extensively to illustrate and reinforce concepts. The workshop is presented by AMC principal consultants, supplemented by guest presentations covering topics such as sample preparation and analysis issues.

Register online at www.amcconsultants.com/training

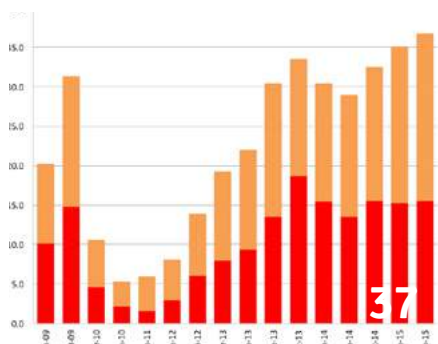
For more information, contact: Alana Philips: (T) +61 7 3230 9000 (E) bristraining@amcconsultants.com

www.amcconsultants.com

AMC — the business of mining



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Cover photo: Morococha Mine, Peru
(Photo: Dave Shatwell).

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**AUSTRALIAN
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GEOSCIENTISTS**

Supporting Geoscientists

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From Your President



Wayne Spilsbury

Are You Competent?

My GP has referred me to a neurosurgeon for possible treatment of chronic sciatic nerve pain. So how do I know this neurosurgeon is competent? Well Google his name of course! The first site that comes up is "Rate MDs" <https://www.ratemds.com/> doctor-ratings where 20 former patients gave my neurosurgeon 4.5 stars out of 5. That's encouraging. More encouraging is the fact that my neurosurgeon is a member of the Australian Medical Association which has mandatory Continuous Professional Development reporting. All good.

So how do you tell if a geoscientist is competent? Back to Google for "Rate Geoscientists" and I am immediately directed to our AIG website for the latest Employment Survey! Ironical. (More on the Employment Survey later.) As a member of AIG you are able to act as a Competent Person for JORC reporting because you have agreed to be bound by AIG's Code of Ethics, where inappropriate conduct can lead to members being disciplined by the Institute's Ethics and Standards Committee. Your academic training and skill sets were vetted by your peers through our Membership Committee and your application was approved by Council. But is this enough? There is no requirement for continued professional development unless you have also opted to become a Registered Professional Geoscientist (RPGeo). Will you be competent for the rest of your career

without further training as the practice of geoscience evolves? I think not. Competency should be supported by a commitment to the maintenance and continuous development of your technical and professional skills and capabilities. Many other professions insist on this and it is widely expected of professionals by the broader community to the extent where a commitment to continued professional development (CPD) is frequently included in the definition of "professional". Are we out of step with broadly comparable professions? Is a commitment to continued professional development one that should be expected of all members? Many of us participate in Professional Development activities such as attending seminars and workshops, industry conferences, postgraduate education, in-house courses, on-the-job training, private reading of learned publications or distance learning such as that delivered by the AIG Edumine campus (<https://www.aig.org.au/education-training/aig-edumine-campus>). Some amongst us will have a view that undertaking CPD is expensive and onerous, but that view is far from correct. It also does not need to be a major impost on the schedules of busy professionals with all CPD activities subject to a multiplier which takes account of the value or effort associated with the activity being undertaken. Most professional bodies also allow CPD to be averaged over several, frequently three, years to help make compliance by members easier.

Individual members simply need to keep a record of CPD in a log book, such as the CPD log book facility provided by AIG through the member portal so that the efforts of Members towards meeting CPD requirements may be verified by AIG or provided to current or potential employers.

Ultimately, should a commitment to CPD become a condition of AIG membership to confirm your competency to employers, clients and the public? I feel this is a debate we need to have if we as geoscientists are to have professional standing in the community alongside doctors, lawyers, accountants etc.

In concluding my comments on competency, I draw your attention to a publication by Geoscientists Canada <http://goo.gl/IURkMB>. This reference document outlines the entry level competency profile for the geoscience professions (Geology, Environmental Geoscience and Geophysics) in Canada. I encourage you to review this document. Are you competent? While you may not agree with the approach being taken by Geoscientists Canada (it is a topic being hotly debated in Canada currently), it provides insight into the direction being followed by some professional geoscience bodies overseas. CPD is already a requirement of membership for Registered geoscientists under the RPGeo programs in each Canadian province and US states, where a Geoscientist must be registered to practice, as must engineers. It is also a requirement

of membership of a number of European geoscience professional groups.

In this issue you will see the results of our September quarter employment survey (p. 37). The results are extremely discouraging with over one-third of the 926 respondents either unemployed (15.5%) or underemployed (21.2%). The root cause is easy to attribute to low metal and energy resource prices. While we all know the minerals industry is extremely cyclic, is it time to admit that the "stronger for longer" boom between 2002-2012 will never be repeated? Certainly this is the opinion of respected economist, Saul Eslake as he spoke at the International Mining and Resources Conference (IMARC) in Melbourne where he commented "...the downturn in mineral commodity prices had probably not reached its nadir, and there was little prospect of the recent China boom being repeated in the future." So if a high school student asked me about employment prospects in the minerals industry in all honesty I would have to say "not good". However the study of earth sciences can lead to a fascinating and rewarding career but perhaps don't expect high salaries and multiple job offers as in the recent past. Demand for geoscience skills is becoming more diverse, as we make broader use of Earth resources and in sectors where Earth systems are a major consideration. We saw an interesting example of this in the past few weeks with Aon Insurance seeking AIG's assistance with me promoting their graduate

program to young members, with geoscience, of course, fundamental to the assessment of many risks against which governments, companies and individuals seek insurance.

You may be aware that AIG recently wrote to Mr. Peter Dutton MP, Minister for Immigration and Border Protection, requesting that Labour Market Testing (LMT) be extended to overseas geoscientists seeking temporary work in Australia at a time of high geoscientist unemployment. An Immigration Department representative responding on behalf of the minister confirmed that the Temporary Work (Skilled) (subclass 457) program is designed to address labour shortages with genuinely skilled overseas workers on a temporary basis where employers are unable to find an appropriately qualified Australian resident to fill the position. Further, the intent of the programme has always been that employers should look to the local labour market prior to sourcing overseas workers to fill vacancies and the Australian Government is committed to ensuring that the 457 programme acts as a supplement to, and not a substitute for Australian workers.

In order to strengthen the integrity of the subclass 457 visa programme and ensure that Australian workers have priority, the Government is implementing recommendations from the independent 457 Integrity Review. Key areas of reform include an increased focus on targeting employers who seek to misuse the programme and

exploring options that ensure that sponsors don't engage in discriminatory employment practices. The Government has also reinstated the Ministerial Advisory Council on Skilled Migration (MACSM) to provide advice on skilled migration issues to the Minister and also established a Dedicated Labour Market Resource (DLMR) to provide policy and statistical advice to the MACSM.

In the future the results of the AIG employment surveys will be provided to the DLMR for their consideration and advice to the MACSM.

Finally, I wish to congratulate Rick Rogerson as the latest recipient of AIG's Service Award for "outstanding service contributing to AIG's objectives". Rick served on AIG Council for 12 years, including two years as AIG President, six years as Federal Treasurer, and several years as Chair of the Complaints Committee. Rick is only the third recipient of this award, joining previous recipients Mike Smith and Kaylene Camuti, since AIG was founded in 1981. Well done Rick! 🎉



Wayne Spilsbury
President



Fresh thinking, fresh growth

OPTIRO 2016 Professional Development Courses: using real-life data-sets

The Optiro courses give you the knowledge, skills and tools to confidently and efficiently work on your own.

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Each training-day has a 7PD HOURS AusIMM rating.

Essential Excel Skills for Geologists

key tips, tricks, tools and templates to save you time and effort – and make your work look great!

Sampling Theory and Best Practice

understanding the key issues - how to optimise the frequency, size and the nature of the sample, and quantifying the errors associated with the sample. Practice of how the sample is taken, delimited, reduced, transported and prepared; and the theory of how to measure the errors associated with our sampling protocols, and to optimise those protocols.

Getting The Most Out of QAQC Data

covers the QAQC life cycle: planning types and frequencies of QAQC data to be collected; mechanics of collecting, transporting and submitting samples; analyses for systematic and trending errors; what is and what isn't a failure; making changes in the resource database.

Reconciliation - getting it right the first time

all aspects of reconciliation process, including key data to be collected, importance of unbiased measurement of volumes, tonnages and grades (among other metrics). How to map out the production data flow and discuss the important measures of performance – using real-life data.

Resource Estimation and Evaluation

uses a real-life data set to cover the entire resource estimation and evaluation cycle and its requirements - from data collection and quality assurance through to classification. The 5th day of the course consolidates all that you have learned by taking you step-by-step through a check-list of the resource estimation and evaluation processes, and gives you the opportunity to bring your own data along to discuss and get advice on.

Recoverable Resources: getting to the High Grade

demystifies and solves one of the great paradoxes of project evaluation – how to do more with less information. How to assess the recoverable resources for project valuation when the relative drill spacing does not provide sufficient coverage for the direct estimation into small blocks or selective mining units (SMU) required at the production stage.

Report Writing for Geologists and Engineers

how to plan your document; write your summaries and conclusions; the essential grammar rules; styles and formatting; key features and time-saving tips in Word; how to review your document and review others' documents; how to write the references, abbreviations, acronyms, glossaries and the appendixes; and how to achieve your objective of writing an accurate report that grabs your readers' attention!

Mining & Geology Fundamentals for Non-Miners

this course has been designed for non-miners working, investing, financing or associated with the mining industry – who need to understand the key fundamentals about the mine cycle, from exploration through to mine closure.

Understanding Mineral Processing – metallurgy fundamentals for non-metallurgists

this course has been designed for engineers, geologists, mineralogists, environmental scientists, plant operators, marketers, financial advisors and anyone who either deals with mineral processing or needs a better understanding of the principles of extractive metallurgy. It gives an overview of mineral processing – from how metal is geologically detected, extracted from rocks and minerals to the final metal product.

Surpac Geology Fundamentals

this course uses a real-life data-set to cover the basics of using Surpac as a geologist. You learn about the fundamental concepts of Surpac's interface, graphics environment, geology database, string files, DTM surfaces, solids modelling (wireframing), block modelling and macros.

Resource Estimation and Evaluation with Surpac

this course uses a real-life data-set to cover the resource evaluation cycle and its requirements - from data collection and quality assurance through to classification, using Surpac. All attendees receive a free copy of Optiro's OREpack Declus Optimiser, and FREE 30 day trial of one of these OREpack modules: Kriging Neighbourhood Analysis; Localised Uniform Conditioning; Drillhole Spacing Optimiser; or Estimation Manager. Bring your data and Rowdy will set it up to ensure you're able to use the modules by the end of the course.

22 January
22 February

PERTH

23 February
20 May

PERTH

24-25 February
21-22 May

PERTH

26 February
23 May

PERTH

18-22 January
14-18 March

PERTH

21-22 March
6-7 June

PERTH

19 February
23 March

PERTH

29 January
12 February

PERTH

29 January
12 February

PERTH

20 June
21 November

PERTH

21-24 June
22-25 November

PERTH

You can register online at:

www.optiro.com/training-and-mentoring/

If you would like more information or you would like a quote for on-site training, please contact Optiro's Training Manager Diana Titren
TEL: +61 (0)8 9215 0000 | Email: dtitren@optiro.com or training@optiro.com

www.optiro.com

Institute News Snippets

35th International Geological Congress

IGCconferenceThe 35th International Geological Congress is being held in Cape Town, South Africa, 27 August – 4 September, 2016.

The Congress Programme is now available from the 35IGC website - www.35igc.org. This details the many and varied sessions being planned during the congress. AIG is involved in the theme Global Geoscience Professionalism and Geoethic being championed by Ruth Allington, Oliver Bonham and Andy Clay.

General deadline for submitting abstracts: 31 January 2016.
Successful presenters will be notified of abstract acceptance by 31 March 2016.



Queensland's Exploration Scorecard

Queensland's minerals and energy exploration industry has put policy and regulations under the microscope at the fifth annual Exploration Scorecard released yesterday, 13 November, in Brisbane by the Queensland Exploration Council.

QEXSCoverThe fifth edition marks the mid-point of a decade-long journey, a key milestone for reflection of achievements and charting a course of what needs to be achieved over the next five years to achieve QEC's 2020 for Queensland to be recognised as an exploration leader...



To read the full article, visit

www.aig.org.au/queenslands-exploration-scorecard/

Position magazine now available free on-line



Position magazine is the only ANZ-wide independent publication for the spatial industries.



Position covers the acquisition, manipulation, application and presentation of geo-data in a wide range of industries including agriculture, disaster management, environmental management, local government, utilities, and land-use planning.

The latest issue includes:

- How the utilities sector is redefining enterprise GIS
- Saving lives with satellites
- Preparing for BIM
- Generating more maps from spatial big data
- Solve real-world problems with reality capture



And much more! Read the latest issue here:

<http://position.realviewdigital.com/?iid=125666#folio=1>

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International Map Year

The International Map Year (IMY) is a worldwide celebration of maps and their unique role in our world. Supported by the United Nations, IMY provides opportunities to demonstrate, follow, and get involved in the art, science and technology of making and using maps and geographic information.

International Map Year was officially opened at the ICA conference in Rio de Janeiro in August, 2015 and then continue until December 2016.

The purposes of the International Map Year are...

- making maps visible to citizens and school children in a global context,
- demonstrating how maps and atlases can be used in society,
- showing how information technology can be used in getting geographic information and producing one's own maps,
- displaying different types of maps and map production,
- showing the technical development of mapping and atlas production,
- showing the necessity of a sustainable development of geographic information infrastructures,
- increasing the recruitment of students to cartography and cartography-related disciplines.

A new book, The World of Maps, www.mapyear.org/the-world-of-maps-book has been produced to help celebrate

International Map Year.



To find out more about International Map Year and events planned around the world visit the web site - www.mapyear.org

“Geophysics for the Mineral Exploration Geoscientist” Short course in Sydney, February 2016

SPONSORED JOINTLY BY THE NSW BRANCH COMMITTEES OF THE ASEG, GSA AND AIG

DATES: 16th and 17th February 2016 | **VENUE:** The Barbarian Room, Level 3, The Rugby Club, Rugby Place, off 31 Pitt Street, Sydney



www.aig.org.au/events/geophysics-for-the-mineral-exploration-geoscientist

NSW Exploration Code of Practice: Community Consultation

NSW DRE Logo The Division of Resources and Energy (DRE), part of the Department of Industry, Resources and Energy in New South Wales, is currently reviewing



Department of Industry Resources & Energy

its Guidelines for Community Consultation Requirements for Exploration and the associated community consultation reporting information.

One of the conditions on titles is that title holders must undertake community consultation according to the guidelines set out by the DRE.

A draft of the new Exploration Code of Practice: Community Consultation is now available for public comment...



To read the full article visit...

www.aig.org.au/new-nsw-exploration-code-of-practice-community-consultation/



Asia Pacific Stock Exchange to Commence Operations in December

The Asia Pacific Stock Exchange launched a new set of listing rules last week which are specifically aimed at mining and oil and gas companies.

The rules will take effect from Monday December 14.

It effectively creates a new exchange

for public companies a new listing venue which have operations in Asia, Australia and the Pacific region. Companies listed on the APX will be able to use a number of international codes for publicly reporting exploration results, mineral resources and ore reserves...



To read the full article visit:

www.aig.org.au/asia-pacific-stock-exchange-to-commence-operations-in-december

The Ethics Column: Lessons for Competent Persons from a Recent Federal Court Judgement

A recent judgement in a case relating to a dispute between parties involved in a Western Australian iron ore project contained several important lessons for Competent Persons preparing statements of Exploration Results, Mineral Resource and Ore Reserve estimates. The judgement was handed down on 14th August, 2015 following hearings in the Federal Court of Australia during June 2015.

Technical reports tendered as evidence in the case were ruled to be inadmissible by the Judge hearing the case. Some of the shortcomings identified by the Judge have been addressed by the 2012 edition of the JORC Code (JORC 2012), largely through mandating the transparent and material assessment of all items included in Table 1 of the JORC Code and mandating the use of an “if not – why not” approach, which itself is an important means of ensuring transparency. The reporting of Exploration Potential has also been further clarified in JORC 2012.

Important lessons arising from the judgement for geoscientists acting as Competent Persons include:

- 1 Any report presented to any company, publicly listed or private, has potential to be legally discoverable with the potential to be made public. The JORC Code, first and foremost, is a standard of best practice that AIG recommends members follow, rigorously, at all times.
- 2 Maintenance of document control and versioning for announcements and reports of Exploration Results, Mineral Resources and Ore Reserves is critical:
 - Where more than one person contributes to preparation of an announcement or report, all authors should be named, even though the responsibility for the document will rest with the nominated Competent Person(s);
 - Reports issued in draft form should be clearly marked as drafts;
 - All versions of a report should bear the date on which it was completed;
 - Any updates to a report should bear a new version and date so that the chronology and process of preparing a report can be clearly and unambiguously established.
- 3 Statements of Exploration Potential are forward-looking predictions of what a resource may become with exploration and evaluation, or a target that must be achieved for the explorer or developer of a project to consider it a viable future prospect. This differs markedly from Resource or Reserve estimates which are based on actual data. The guidelines for stating Exploration Potential in JORC 2012 need to be clearly followed. This includes clearly distinguishing Exploration Potential from Resources and Reserves, that extensive work is required to realise Exploration

Potential and that statements of Exploration Potential are subject to considerable uncertainty.

- 4 The work of others used in preparing report of Exploration Results, Mineral Resources and Ore Reserves must be reported in context. The assessed reliability of the data and the extent to which it was reviewed and relied upon in preparing any report must be transparently described.



To read the full article visit

www.aig.org.au/the-ethics-column-lessons-for-competent-persons-from-a-recent-federal-court-judgement/

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Receive exclusive discounts on e-gift cards for Myer, Flight Centre, David Jones and other retailers.



Movie Tickets: Treat someone to a night at the movies at a film of their own choice. Gift vouchers available for all major Australian cinemas including tickets for Gold Class, Lux, the candy bar and IMAX. E-Vouchers tickets are available for Hoyts and Palace cinemas.

Lifestyle experiences and Gifts: Take a walk on the wild side and give an experience like no other. Choose one of many hair raising experiences like car racing, balloon rides, jet boating and more with RedBalloon and Adrenalin.

Online shopping: Avoid the crazy crowds and shop for your loved ones via our online shopping hubs. Enjoy a range of discounted toys and manchester, electronics, magazine subscriptions, flower deliveries, IT products and services all at the click of a button!

Accommodation: Indulge yourself for less and book a room with Best Western across Australia, New Zealand and Fiji or with HotelClub Partner Network at thousands of hotels worldwide.

Dining: Christmas lunch is on us this year with access to generous discounts at selected restaurants across Australia, including two for one meals. 🍷



For more information, visit the AIG Member Advantage website (<http://goo.gl/tyLuSO>) or call 1300 853 352. Terms & conditions apply.

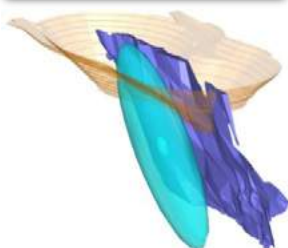
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Linear Geostats
Variography, block models.
OK and ID² interpolation.
Resource Categorisation.



TORRIDON EXPLORATION

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- Project Evaluation
- Nickel, Base Metals, Tin & Gold
- Field Programmes

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YOUR MEMBER BENEFITS PROGRAM

Save on your Christmas presents.



Discover great ways to enjoy Christmas this year. Whether you're looking to entertain the kids, or enjoy a relaxing day out with friends, take advantage of your AIG membership discounts these holidays.

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Movie Tickets

You and your family can access exclusive savings on pre-purchased movie tickets for major cinemas including Hoyts, Village, Great Union, Reading Cinemas and more.

E-Voucher tickets are also available for Hoyts & Palace cinemas.

For more information and to use your benefits, contact AIG Member Advantage.

Visit www.aig.org.au/memberadvantage or call 1300 853 352



**AUSTRALIAN
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NSW Branch Report

Verity Borthwick

The NSW Branch of the AIG is active in organising events during the year. These include one day seminars, student information nights and the fabulous bi-annual Mines and Wines Conference, as well as joint events with other societies.

The NSW Branch hosted a number of student careers nights during the quarter. On the 10th of September the AIG hosted a careers night at the University of Sydney. Wendy Corbett gave a presentation about careers in minerals exploration as well as speaking about the role of the AIG and benefits of membership, Michael Edwards talked about environmental consulting and Katarina David spoke about a career in hydrogeology. Vlad David also came along to join in the discussions and answer any questions. After the talks the students and

speakers mingled over beer and pizza and had an opportunity to ask speakers questions. Eleven new student applications were received.

On the 12th of October the NSW branch hosted a careers night at Macquarie University. Mike Smith was the MC and spoke first about the role of the AIG and the benefits of membership, Michael Edwards gave a presentation about environmental consulting, Rosie Sloan spoke about what a career in mineral exploration might involve and Louisa Rochford talked about hydrogeology. Mike Smith concluded the talks with a review of his international work in geophysics and exploration management. The talks were well-received, there were many well considered questions and the students enjoyed the discussions afterwards in the rock garden facilitated by the usual pizza and beer.

The NSW branch has a number of workshops in the pipeline including career support for Geoscientists looking for a job and a core logging course that will be held at the core library in Londonderry.

We also take a leading role in organising the Mines and Wines Conference every two years. The latest Mines and Wines conference was held in September, in Queanbeyan and was a fantastic event with the theme 'Uncorking the Tasmanides'. Planning for the next conference will begin next year, with the first committee meeting set for February.

For those who couldn't make it to the conference, the presentations are up on the SMEDG website (see below). So make sure to check them out!

AIG NSW has a close association with SMEDG. SMEDG meetings are held on the last Thursday of the month at the Rugby Club. Gatherings are very informal with a free bar at the beginning, an interesting speaker and often dinner afterwards. For more details go to the SMEDG web site www.smedg.org.au and scroll down to "Join the SMEDG mailing list" to register for your free membership. You will then receive an email once a month reminding you of the meeting and the topic. If you're interested in giving a talk about mineral exploration please get in touch with the committee members (you can find their details on the SMEDG web site).

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- ◆ A truck licence – is it possible!
- ◆ A WorkCover NSW OH&S General Induction card (\$119 + one Day)
- ◆ A Boat Drivers Licence – NSW Roads and Maritime Services (Test + 1 year \$100 – 3 year \$153)
- ◆ St Johns Ambulance First Aid Course (CPR Course \$99, 2 Day First Aid \$220)
- ◆ Are you a welder – TAFE – Community welders course ??
- ◆ Hands on skills – (can you drive a 4 wheel drive? Learn!)

Slide from Michael Edwards presentation with skills relevant to a career in geoscience.



SMEDG also hosts harbour cruises twice a year, which are always great events and an excellent opportunity to catch up with old friends and network. The next cruise will be coming up in December, so keep an eye out on the SMEDG website for the finalised date.

NSW AIG provides funding support for young and for unemployed geoscientists. Limited funding is available to provide NSW-based AIG members with opportunities to participate in professionally organised geological field trips, conferences and courses

(see the AIG web site under the Education tab, NSW AIG Support Fund).

The branch committee continues to assist in the assessment of applicants from NSW, seeking Registered Professional Geoscientist status with the AIG.

The NSW branch committee meets every two months in Sydney – visitors, guests, members and potential committee members are always welcome. 🍷

Speakers Mike Smith, Michael Edwards, Rosie Sloan and Louisa Rochford with Olivia Penlington, the Macquarie University student co-ordinator.



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Education Report

Kaylene Camuti
Chair, AIG Education Committee

AIG Bursary Awards

This year the AIG received applications from 29 postgraduate, Honours and third year geoscience students from 12 universities. As in previous years, the AIG Education Committee had the opportunity to review high quality applications from students working in a range of geoscience disciplines. We are pleased to congratulate the following students on their bursary awards:

Luke George, who is completing a PhD at Adelaide University on the "Partitioning of minor and trace elements between sphalerite and chalcopyrite in Zn-Pb-Cu sulphide ores". Luke has used his AIG Postgraduate Bursary to assist with attending the SGA meeting in France in August, where he presented his research in a session on "Strategic metals: their sources, and ore-forming processes". Luke's report on the meeting is included in this issue of AIG News on page 31.

Eleanor Blereau, PhD student at Curtin University, who is completing a thesis on the "Petrochronology of the Rogaland – Vest Agder ultrahigh temperature metamorphic terrain, southwestern Norway". Eleanor will use her AIG Postgraduate Bursary to help with the costs of presenting her research at the 2016 Goldschmidt Conference in Japan.

Chad Burton from Monash University, who is completing an Honours project on "Using tritium and major ion geochemistry to define transit times and assess groundwater stores within the upper reaches of the La Trobe and Woori Yallock rivers". Chad was awarded an AIG Honours Bursary.

Callum McIlhenney from UWA, who is completing an Honours project on "Reservoir characterisation and depositional history of the Jurassic Plover formation, Torosa Field, Browse Basin, North West Shelf, Australia". Callum was awarded a Davis – AIG Honours Bursary.

Natalie McIver from JCU, who was awarded an AIG Honours Bursary to provide support during her Honours project on the "Structural and geochemical constraints on ore paragenesis at Piccadilly gold prospect, North Queensland".

Jordan Mill, Honours student at Adelaide University, who is completing his Honours project on a "Sequence Stratigraphic Analysis of the Epsilon Formation, Merrimelia Ridge, Cooper Basin – South Australia". Jordan was awarded a DSD – AIG Honours Bursary.

Cheng Tong Pang from JCU, who has just completed an Honours project on the "Origin of Ladder Dykes and Associated Rocks, Ravenswood: Implications in Magmatic Evolution. Cheng was awarded a Davis – AIG Honours Bursary.

Elizabeth Phillipa, Honours student at ANU, who is completing a project on "An analysis of fluid inclusion arrays and trace Ti content in stockwork quartz as a function of temperature in the Red Mountain, Arizona, copper porphyry deposit". Elizabeth was awarded an AIG Honours Bursary.

Philemon Poon from UNSW, who is completing an Honours project on the "Mineral distribution and provenance of heavy mineral sands (zircon, ilmenite, rutile) deposits from the NW Murray Basin, far western NSW". Philemon was awarded a SMEDG – AIG Honours Bursary.

Shaun Anderson from QUT, who was awarded an AIG Third Year Geoscience Bursary.

Daniel Franks from QUT, who was also awarded an AIG Third Year Geoscience Bursary.

The Education Committee would like to thank all bursary applicants for their contribution to the Bursary Program, and all the supporters of the bursary program.

These include:

- Bursary Sponsors, who have consistently supported the Bursary Program over the 15 years it has been running, and who have ensure the Program can continue to offer support to geoscience students.
- AIG Members who, through their donations to the AIG Education Foundation, are contributing critical support to Australian geoscience students.
- AIG State Branches, who frequently provide financial support for the Bursary Program, and also promote and organise student involvement in AIG events.
- AIG Federal Council, which continues to provide an annual contribution to the Education Foundation to support geoscience education.

Thank you, also, to members of the AIG Education Committee for their continuing commitment to the bursary program, and for the time and effort they give to reviewing the bursary applications:

Martin Robinson (AIG Vic)
Graham Teale (AIG SA)
Chris Torrey (AIG NSW)
Doug Young (AIG Qld)

This year the Bursary Program was also assisted by Lynn Vigar, the AIG Executive Officer, who ensured the Program ran smoothly when other commitments took me away from the office.

If you're interested in sponsoring the bursary program, or donating to the AIG tax deductible Education Foundation, I would be

very happy to hear from you. Please send me an email at education@aig.org.au.

To all those AIG members who have donated to the AIG Education Foundation when renewing their membership – thank you. Your generosity not only provides financial support for students, but also gives encouragement to all involved in the AIG's education activities.



AIG Bursary Sponsors – August 2015

The AIG wishes to thank the following individuals and organisations for their support of the

Geoscience Student Bursary Program

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- **CHRIS BONWICK**
Sponsoring the Bonwick-AIG Geoscience Student Bursaries
- **GEOFF DAVIS**
Sponsoring the Davis-AIG Geoscience Student Bursaries
- **MACQUARIE ARC CONFERENCE – GEOLOGICAL SURVEY NSW**
Sponsoring the Macquarie Arc Conference-AIG Geoscience Student Bursaries
- **SYDNEY MINERAL EXPLORATION DISCUSSION GROUP**
Sponsoring the SMEDG-AIG Geoscience Student Bursaries

PLATINUM

- **AIG STATE BRANCHES**
- **ALEXANDER RESEARCH – JONATHAN BELL**
Sponsoring the Alexander Research-AIG Geoscience Student Bursary
- **SA DEPARTMENT OF STATE DEVELOPMENT (DSD)**
Sponsoring the DSD-AIG Geoscience Student Bursary

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BRONZE

- **DOUG YOUNG**



For more information on the Student Bursary Programme visit
www.aig.org.au/education-training/student-bursary-programme

Teacher Earth Science Education Program (TESEP)

This year TESEP has continued to provide professional development training for earth science teachers. Although the program continually faces the challenge of raising funds to ensure its continuation, it consistently receives accolades for its PD courses and field trips. A report by the TESEP Chairperson, Jill Stevens, on a recent field trip to Cape Liptrap is included in this issue of AIG News. Also included is an article by Greg McNamara, the TESEP Executive Officer, about developing appropriate rock collections for junior high schools and a request for expressions of interest from anyone willing to help with this project.

It was also great to hear from Jill last month that Ken Silburn had been awarded the 2015 Prime Minister's Prize for Excellence in Science Teaching in Secondary Schools (<http://science.gov.au/community/PrimeMinistersPrizesforScience/Recipients/2015/Pages/Ken-Silburn.aspx>). Ken is the Head of Science at Casula High School in Sydney, and the TESEP NSW Coordinator. He was presented with his award by the Prime Minister at a ceremony at Parliament House. Ken is the second TESEP Coordinator to be awarded the Prime Minister's Prize, following Len Altman from SA who was presented with the Prize in 2009.

Wishing you a very happy holiday season. 🎉



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Membership Update

We welcome all new members to the AIG

NEW/UPGRADES SEPTEMBER/NOVEMBER 2015

STUDENT

ABEN Cesar Anthony • ASKEW Jessica Elizabeth
 • BANADA Divine Laura • COCHRANE Gemma •
 DOUBE Michael Henry • DUGMORE Marnie •
 ELMI Ibrahim • HARRIS Stephen • HONRADO Chris
 • HUANG Pao-Yu • MACAULAY Ashley • ORRO
 Ezekiel Taaniel • PARRY Cameron •
 PILOTE Thomas • PUNZALAN Kristine • ROGERS
 Edward Ian • STEEL Elliot Lewis • WAMBUI Angela
 • GUERIN Kristy • HUXLEY Lachlan

GRADUATE

JONES Richard • JURU Raymond • KE Xusheng •
 MOORE Timothy • WATSON Sally Joan •
 WILSON Giles

MEMBER

BARKER Andrew • BASSO Wanderly • BAYLEY
 Oliver Charles • BOOTH Kathleen Elizabeth •

MEMBER (Cont'd)

CERVOJ Kahan Mit-Hat • CHARLTON Thomas •
 CRONIN Daniel Edward • CROW James Blomdahl
 • DESPAIGNE Diaz Ana Ibis • GHIMIRE Shyam
 • GREENFIELD John Edward • JAFAROV Fizuli
 • MACCORQUODALE Fraser • MOREIRA SOCIO
 Angelo • PANTON Shawn Douglas • PARK Julie
 Anna • PEARSON Stephen • QUIGLEY Melissa
 • WOODLAND Jarrad • WOODS Trent Jason •
 ZANGRANDI Marcelo Juan • FISK Keith • GLOVER
 Christopher • LEIGH Joshua • SYKES John

FELLOW

FERGUSON Grant • STEPHENSON Patrick

RETIRED

PAULL Peter Lawrence • SUTHERLAND Frederick
 Linstead

RPGeo Applications

CANDIDATES APPROVED BY AIG COUNCIL IN SEPTEMBER, 2015

MR DARRYL WEST of Bardon, Qld, in Hydrogeology

MR TIMOTHY CHALKE of Chapel Hill, Qld, in Mineral Exploration

MR DANIEL CARD of Mt Lawley, WA, in Geophysics

MR HUW SMITH of Old Toongabbie, NSW, in Geotechnical and Engineering

MR MICHAEL SAWYER of Narrawong, Victoria, in Mineral Exploration

NEW CANDIDATES PUBLISHED FOR PEER REVIEW BY THE MEMBERS OF THE AIG

MR EOIN ROTHERY of Roseville, NSW, is seeking registration in the fields of Mineral Exploration and Mining.

DR MICHAEL AGNEW of Buderim, Qld, is seeking registration in the field of Mineral Exploration.

MR FRASER MACCORQUODALE of Beaumaris, Victoria, is seeking registration in the field of Mineral Exploration.



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Poverty, Education, and Social Initiatives by the Mining Sector in Peru

Dave Shatwell
Former Editor AIG News

In 1990, a US couple travelled to a city in northern Peru and adopted an indigenous baby from an orphanage. Mark (not his real name) was brought up in the US, and now works there in hospital administration. He has a Master's degree, and is working towards a PhD. This year, Mark visited Peru for the first time since leaving as a baby 25 years ago. Who knows what kind of future he might have looked forward to if he hadn't been adopted? More to the point, Mark is proof of the talent and ability which might be unlocked in Peru's poorest and most disadvantaged children, if given the advantages of family, health, nutrition and education that most of us take for granted.

Here are some statistics on where Peru stands on the scale of poverty and inequality, and what progress has been made. Between

1997 and 2010, the poverty level fell from 42.7% to 31.3%, and extreme poverty from 18.2% to 9.8% (Yamada and Castro, 2012). By 2014, when Peru's population was 31.2 million, 22.7% were poor and 4.3% extremely poor (World Bank data). In terms of inequality, the GINI index (in which 0 means total equality, and 10 total inequality), Peru scored 4.4 in 2014, marginally down from 4.9 in 2004, an improvement which is in line with most other Latin American countries. So there has been significant reduction in poverty in recent years, but Peru remains among the most unequal 25% of all the countries included in the survey.

Poverty and inequality are not evenly distributed, and are higher in rural areas than in cities, and higher for children than adults (because poorer families tend to have more children). While poverty and extreme poverty

(as well as extreme wealth) certainly exist in Lima and other cities, where over three quarters of Peruvians live, poverty may be statistically twice as high in rural areas, and extreme poverty may be four times as high (Giugale et al., 2007). Only 45% of people in rural areas have access to adequate sanitation, compared to 73% of the country as a whole. In 2008, 60% had adequate drinking water in rural areas, 90% in the cities. One child death in ten is due to polluted drinking water. And so on.

Why is this relevant to AIG News readers, who are mostly exploration geoscientists? Because in developing countries, mining and exploration projects have to improve, and be seen to be improving, the lives of the people in the rural communities where they are located, in the face of distrust, anti-mining sentiment and, in some cases, political manipulation by regional authorities. We need to understand the social landscape in which we are operating.

Poverty and inequality persist in spite of the relative strength of Peru's economy in recent years compared to other countries in



25 year old adoptee from the same orphanage, now with a Masters degree in the US



Left: Morococha mine Peru (Photo: Dave Shatwell).



Huaraz Peru (Photo: Ted Cooper)

the region. Inflation between 2005 and 2014 has averaged about 2.9%, and economic growth averaged 6.1% in the same period, but fluctuated between 9% in 2008 and 2010 and 1% in 2009 (following the global economic crisis) in response to metal prices and the world economy. The question is why a country which has experienced growth well above the OECD average in recent years still has twice the OECD poverty rate.

Poverty and inequality in Peru cost many thousands of lives, mostly those of the rural poor. In these conditions terrorism has flourished in the past, resulting in an estimated 69,280 deaths between 1980 and 2000 according to the Peruvian Truth and Reconciliation Commission. Over half of the victims of terrorism were farmers, and 79% of the attacks occurred in rural areas. It has been estimated that 7000 Peruvians die each year from environmental degradation at an annual cost of 4% of GDP – more than is spent on education (Giugale et al., 2007). Mortality in children under five in 2015 is 17 per 1000, four times as high as Australia and the UK (World Bank data). In the mining and smelting

town of La Oroya, almost all children have unacceptably high blood levels of lead, which is associated with mental retardation.

A 2008 study by UNICEF showed that a third of rural children in Peru were chronically undernourished, and over half were anemic (UNICEF, 2008, 'Situation of children in Peru, executive summary'). Child health has undoubtedly improved with the reduction in poverty in recent years,

but had remained relatively constant in the ten years preceding the UNICEF study. Poverty creates malnutrition, which affects children's capacity to learn, which perpetuates poverty in a vicious cycle that has to be attacked on several fronts. Children who are sick, cold and hungry will not do well at school.



Near La Oroya Peru (Photo: Dave Shatwell)

THE IMPORTANCE OF EDUCATION

After World War 2, Japan made a concerted effort to produce engineers through low-cost technical education, and thereby rebuild a shattered economy through production, first of steel and ships, and then of motor vehicles, electronic goods and the like. Singapore's achievement of one of the highest GDPs per capita in the world, despite negligible natural resources, was achieved through a highly developed education system. Education is one of the ways in which children might escape the cycle of poverty and marginalization, and by which countries might grow their economies.

At first glance, Peru scores reasonably well in terms of education. Literacy is 90% in adults over 15, and 97% in 15-24 year olds (Unesco data, June 2013), although the



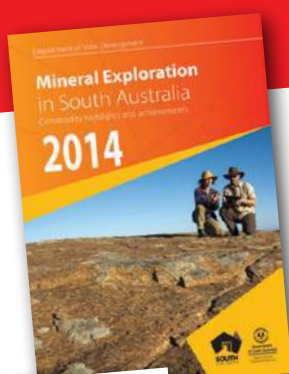
Schoolgirls (Photo: Ted Cooper).

criteria for literacy seem to be rather flexible - by one definition, the ability to read 30 words a minute. Almost 90% of children between 6 and 12 are enrolled in primary school, three quarters of them continue to grade 6, and 65% finish secondary school, so access to school education is not the main issue. Education, at

least theoretically, is free and compulsory up to the end of high school, and comprises one year of pre-school, 6 years of primary, and 5 years of secondary school (which may include technical courses). Post-secondary education includes institutes of technology which offer two to five year study courses; there are over

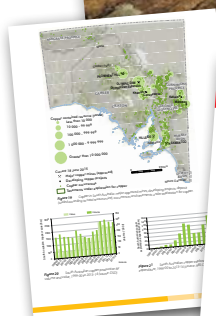
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New releases



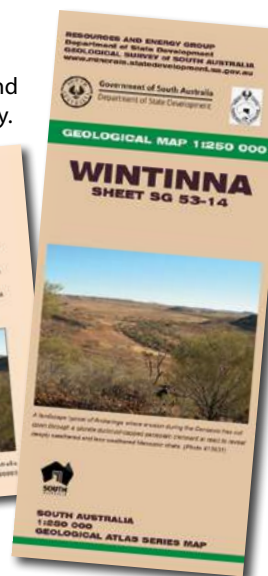
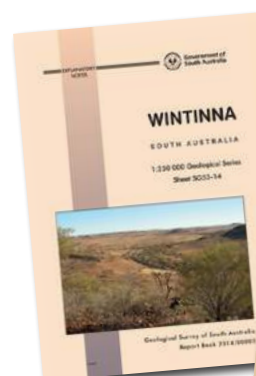
Mineral exploration in South Australia 2014 provides commodity highlights and achievements of the exploration industry. Included are detailed company exploration, data releases outlining successful discovery of a diverse range of mineral commodities, comprehensive statistical analysis of exploration expenditure, resources and production, and an overview of the opportunities for investors.

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1200 of these institutes, including teacher-training colleges. In 2013 there were 51 public and 89 private universities in Peru, with almost a million undergraduates.

But the problem with education in Peru is not quantity, but quality, especially in the state-run school system, which is the only one available to the poor, and especially the rural poor. In March this year, the Peruvian Minister of Education said that almost 70% of the 50,000 schools in Peru need renovation and 15% should be demolished. He claimed it would take about \$20 billion and 20 years to bring education infrastructure up to standard. Of course there are good public schools and bad private schools, but they are the exception. Expenditure on public education was 3.3% of GDP in 2013, equivalent to about \$1.45 billion, whereas the World Bank considers that an appropriate figure is between 4 and 6%. In October 2011, a Fulbright scholar, Sabrina Karim, posted on the internet 'The (public) secondary schools do not train students to be able to pass an entrance exam into a university, and thus many must take pre-university classes. The result is that only a very small, elite percentage is able to attend an institution of higher education'. Giugale et al. (2007) echoed this view, saying 'Peru's public secondary schools turn out graduates who are on the average unemployable'. In other words, although most Peruvian children attend school, if they are poor they don't learn much. In fact, the Program of International School Assessment (PISA) placed Peru last out of 66 countries in maths, science and reading skills in 2009-



School assembly Bolivia



Kids in Peru (Photo: Giuliana Pittaluga).

2012 (nces.ed.gov/surveys/pisa). A secondary education is not enough to escape poverty.

Because not many of Peru's poor are qualified to attend a tertiary technical school, much less a university, most students in free universities are not poor, so there is a leakage of resources which benefits those who could afford to pay. About a third of all students who complete secondary school go on to tertiary education, but only 6.6% go to a private university (Castro and Yamada, 2011).

Moreover, 80% of all university students, and 64% of students in technical colleges,

come from non-poor families (Yamada and Castro, 2012), as shown by the table.

But in the more affluent suburbs of Lima – Miraflores, San Isidro, Surco and San Borja – middle and upper class parents send their children to private schools from which virtually all students, regardless of aptitude or ability, will go on to further education. In most cases this will be a university, where favored courses include law, management, economics and so on. Some will study medicine and engineering, but very few will do science (much less geoscience) courses – not surprisingly,

Distribution by income level of students in Peru (from Yamada and Castro, 2012)

CLASS	PRE-PRIMARY	PRIMARY	SECONDARY	NON-UNIVERSITY	UNIVERSITY
Extreme poor %	23.1	31.3	19.9	7.3	1.9
Non-extreme poor %	40.7	40.8	40.0	28.7	18.4
Non-poor %	36.2	28.0	40.1	64	79.7
Total %	100	100	100	100	100



Cental Andes Peru (Photo: Dave Shatwell)

since they yield the lowest return on the education investment, which can be as high as 17% for other courses (Castro and Yamada, 2011). A university education is necessary to maintain the level of income which allowed the students to go to an expensive private school in the first place, a Catch-22 situation if ever there was one.

The less affluent, if they can, will send their children to a much cheaper private school, where the chances of going to university will

be less. The children of the vast majority, comprising a large percentage of Lima's 10 million inhabitants as well as the rural poor, will go to a state-run school and their chance of a tertiary education will be very low, even if they complete high school. They are likely to be trapped in low-skill, low-paying jobs, in informal service occupations, or in subsistence agriculture. The situation described by Giugale et al. (2007), in which an indigenous Peruvian living in a rural area is ten

times more likely to be poor than a non-indigenous person living in a city, starts at primary school.

The problems of rural education in Peru are formidable. Teachers have to teach and live in substandard conditions, with inadequate resources, children may live far from the nearest school, and many of them are undernourished or anemic. Even the language may be a problem in the rural areas where the

15% of Peruvians who speak Quechua or Aymara, rather than Spanish, live. Not surprisingly, it is difficult to recruit teachers in these areas, and (also not surprisingly) efforts by the Humala government to compel teachers to pass public examinations have been strongly resisted by the Teachers Union. In the Cajamarca area, in northern Peru, I have seen teachers walking many kilometers from the city to the school. And it is the same story, to varying degrees, elsewhere in Latin America. In Catamarca province in northern Argentina, I once stayed a couple of nights at a school which had two teachers but only two students. (The teacher refused payment, except for a few liters of diesel for the generator). Another school in the area was abandoned, with neither teachers nor students. In the Altiplano of southern Bolivia, a husband and wife were teaching the entire range of primary school children in a single room. They asked for Bandaid and Mercurochrome, as well as any writing paper we could spare.

A cynic might argue that the five-year electoral cycle in Peru versus the eleven year school education cycle promotes pork-barrel solutions. This view may be supported by the recent 'One Laptop per Child' (OLPC) program, whereby 902,000 laptops (which may or may not include tens of thousands apparently destroyed in a fire at a Ministry of Education warehouse) were distributed in schools by the Alan García government at a cost of close to \$200 million in 2005-2010 (Cristia et al., 2012). An evaluation of the program in rural schools by Cristia et al. found that there was a slight improvement in cognitive skills in children who received a laptop, but none in language or maths skills. Moreover, hardly any of the rural schools or households had internet access. Similar results were found in a survey of schools in Lima (Beuermann et al., 2013). There is an interesting discussion of the program on <http://blogs.worldbank.org/edutech/olpc-peru2>.



Schoolkids in Bolivia (Photo: Dave Shatwell)



Parents in Bolivia (Photo: Dave Shatwell).

THE ROLE OF MINING COMPANIES

The extractive industries, of which mining comprises 85% and petroleum the rest, are the mainstays of the Peruvian economy, representing 7% of GDP, 62% of total exports, and 75% of total private sector investment in 2011-2012 (Third Extractive Industries Transparency Initiative Reconciliation Report, 2014). In those two years, Perú collected \$6.7 billion, or \$3.35 billion per year, in taxes, royalties and fees from the mining sector, of which 58%, or \$1.9 billion, came from income tax, and 38% from royalties. Fifty percent of income tax from mining projects (known as the *canon*), and ten percent of mining royalties, is paid to the local communities in the vicinity of the mine, which translates to over a billion dollars a year 2011-12. So over half of the revenue from extractive industries is managed by regional authorities, rather than the central government. The Ministry of Energy and Mines and the Instituto Peruano de Economía have released figures showing that investment in mining or mining-related-related projects in 2014-2020 could total \$59 billion and generate \$30 billion in exports in 48 projects, although only \$20 billion is classed as 'confirmed investment', and it remains to be seen how many projects are actually developed.

That may not be many. Development of Newmont's Conga porphyry copper project was halted in 2011 due to community opposition, and it is generally assumed that if only this can be resolved, the project will go ahead; but in its 2014 Annual Report, Newmont said that development of the project would depend on *acceptable project returns* (my italics) and on getting local government and community support. Commodity prices peaked in 2011, with gold reaching \$1900/oz and copper \$4.50/lb. The trend has been downwards since, with gold at \$1090/oz in July 2015, and copper at \$2.30-2.40/lb. The decline is reflected in company balance sheets:

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“Communities benefit from mining taxes, royalties and tenement fees, but some of the poorest regions of Peru are still those with large mines...”

Newmont reported sales, mainly of gold and copper, of \$10.4 billion in 2011, but this was down 30% to \$7.3 billion in 2014 (Newmont Annual report for 2014). Newmont's operating margin on gold also fell over 30% from \$971/oz in 2011 to \$662/oz in 2014. In real terms, there has only been one other gold spike comparable to the one in 2011 since the US went off the gold standard in 1971: it occurred when gold briefly reached \$800, or about \$2080/oz in today's dollars, in 1980. The fall in metal prices means that existing mines will pay less in taxes to fund education and other projects, they will be less able to afford voluntary contributions, and there will be fewer new projects to take up the slack.

Communities benefit from mining taxes, royalties and tenement fees, but some of the poorest regions of Peru are still those with large mines, such as the Yanacocha gold project in Cajamarca Region. In 2009, Cajamarca was fifth in terms of income from mining taxes (World Bank, 2010), but was worst in terms of poverty (Robles and Martinez, 2010) out of all the 25 Peruvian regions. Why this should be is a whole topic in itself, and calls into question the ability of local and regional governments to administer funds effectively. Voluntary programs which operate independently of regional governments can supplement the *canon*, and those which improve school infrastructure and increase the quality of school education, and therefore broaden the availability of university education to poorer students, can be effective in the long term. The following are two interesting initiatives:

- 1 Recently, the Peruvian government introduced the Works for Taxes scheme, which allows for the payment of up to 50% of the income tax due the following year by funding public works in the current year. In this way, companies are given more control of how their tax dollars are spent in the regions. Such projects are generally selected from a list compiled by regional and local authorities and public universities, but may also be submitted by a company. Southern Peru, which operates the Cuajone and Toquepala porphyry copper deposits, says it will finance the construction of three high performance schools, known as COARs (Colegios de Alto Rendimiento) in the Moquegua, Tacna and Arequipa regions of southern Peru (El Peruano, September 25, 2015). COARs provide free education to students who have scored well in the first two years of a public high school, for the remaining three years of their school education.



Bolivia kids with flags for Independence Day (Photo: Dave Shatwell)



Bolivian teachers are saluting, arms outstretched (Photo: Dave Shatwell)

2 ExE (www.empresariosporlaeducación.org.pe), or Businessmen for Education, was established in 2007, primarily to promote education by cooperation with the Ministry of Education and others who work in the area of education. Over half of the 43 participating companies listed on the ExE website are mining companies or organizations. Current programs affect 1.4 million students, 72,000 teachers, and over 8000 schools. They include:

- Reading to Grow: Improving teacher performance in reading and writing techniques, in cooperation with USAID, the Universidad Peruana Cayetano Heredia, and private companies. To date, 687 teachers and 18,700 students in 122 schools have been involved in the program.
- Digital inclusion: In cooperation with Microsoft Peru (as part of its overall program 'Alianza por la Educación'), currently training 62,000 teachers and 1.4 million students in 5364 schools in the efficient use of information technology in the classroom.
- Intel Learn and Intel Teach programs: Technological education for children aged 8-16 (Intel Learn) and for teachers (Intel Teach). The programs have benefited 78,000 students and 5570 teachers in 1912 schools.
- IBM reading companion: Aims to improve reading skills in English by training teachers and students in the relevant software.
- Teacher training: Investing \$4.45 million in training all of the 2900 teachers in the Moquegua region to improve technology, communication, and mathematical-logical skills. 9700 students and 387 schools are expected to benefit.



Kids in a Cajamarca orphanage last August.

- Medical and educational community center in the Pisco-Chincha area of coastal Peru: Improve health and nutrition and development of children up to five years old, and promote educational development through workshops and online training, potentially benefiting close to 300,000 people in the region.
- Innovative projects in free-creative writing: Jointly with the National Fund for Development of Education in Peru (FONDEP) and Antamina Mining, to award prizes for creative writing in the Ancash region of northern Peru
- Prizes for reading and creative expression: 276 prizes available to 27,000 students in over 1000 schools.
- An annual fair, show-casing successful education initiatives from the private and public sectors
- Collection of information on education projects developed by the private sector.

Economic growth is a necessary but not a sufficient condition to reduce poverty: education is part of the equation, and initiatives such as the two examples cited above have to take advantage of commodity price cycles, when mining companies can best afford them. Improved school education leading to increased participation in tertiary education is a first step towards reducing poverty and unlocking the intellectual capital of the rural and urban poor in Peru. 🗣️

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SEG-CODES 2015 Conference in Hobart Tasmania

Mike Erceg
Vice President AIG

The SEG-CODES Conference in Hobart was a great success for the organisers with approximately 750 attendees and I believe they only expected 350. The 4 day event started with a Sunday afternoon Student Mentoring Programme with a panel including Kathy Ehrig, Cam McCuaig, James Johnson and James MacDonald (see notes following on forum).

AIG's booth was busy with local inquiries for both membership and the RPGeo programme.

The principal reason for the booth was to promote AIG to Tasmanian geoscientists. Hobart AIG member Robert (Bob) Findlay volunteered to help man the booth and has taken on the responsibility of organising a Tasmanian AIG Branch. Bob was encouraged by the local support offered by Tasmanian resident AIG members. John Bishop and Roger Taylor were two prominent local geoscientists that came forward and indicated support.

The Geoscience Society of the AusIMM had a booth opposite AIG's so we had time to discuss common issues. We met the new AusIMM President (Rex Berthelsen) and I mentioned AIG's plan to collaborate and cooperate more with other organisations which he welcomed. I also discussed this with Dale Simms (AusIMM Newcastle) who is instrumental in organising many events for AusIMM on the east coast and will be liaising closely with us should he be organising events in the future.

A delegation from New Zealand (photo below) confirmed interest in helping set up an AIG Branch in NZ. AIG is liaising with AIG member Damian Brett at NZ Ministry of Business Innovation and Employment (MBIE) who has indicated interest in setting up a NZ branch. This was encouraged with a target to get established ahead of the Gold17 Conference (21-23 Feb 2017) to be held in Rotorua. AIG is on the organising committee.

Josh Leigh (National Graduate Committee) attended and made valuable contacts with SEG Hobart Student Chapter (Angela Escolme) and with the Geoscience Society of the AusIMM.



Rex Berthelsen (AusIMM President) and Mike Erceg (AIG Vice-President) agree to collaborate more on providing professional development to their respective members witnessed by Josh Leigh (AIG National Graduate Committee).

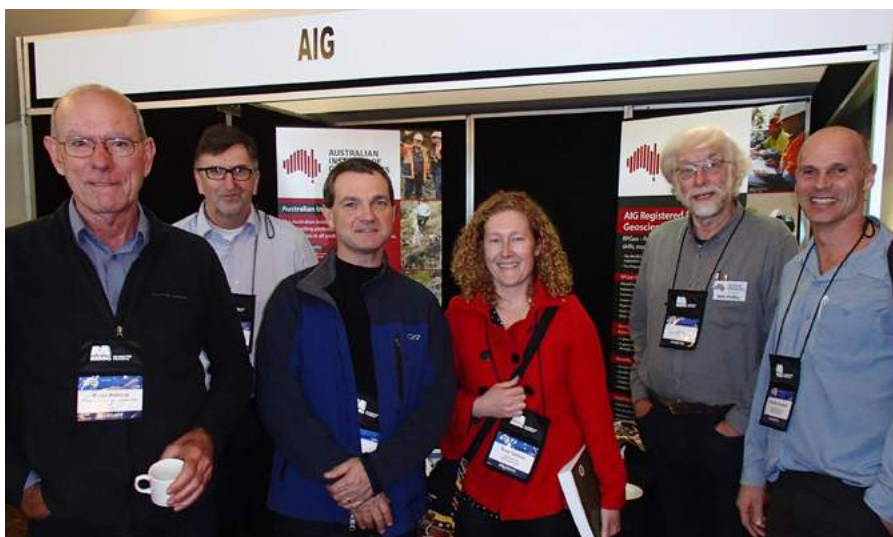
STUDENT MENTORING FORUM

On Sunday 27th September BHP Billiton hosted a student mentoring forum. The panel included Kathy Ehrig (Geometallurgist Olympic Dam), Cam McCuaig (CET University of WA), James Johnson (Deputy CEO Geoscience Australia), James MacDonald (Consultant) and Andrew Davies (Chief Geoscientist Teck). The forum was well supported with about 150 students attending.

Each member of the panel summarised their careers emphasizing critical decisions made on the way and what follows are pearls of wisdom noted (those points highlighted were mentioned multiple times by the panel);

- If you don't love doing geology – get out
- Be aware boom/bust cycles of industry
- **Mentoring important**
- Summer jobs during degree e.g. mapping with geological surveys
- Luck plays a big part – make your own.
- **Networking**
 - Be seen
 - Giving presentations
 - Geological field trips
 - Formal mentoring (SEG have 50 geologists available for mentoring)
- Critical thinking testing assumptions
- Be self-aware not delusional – **know what you are good at** – important for marketing oneself
- Work to see as many rocks and cultures as possible – **be prepared to travel/relocate**

- **Don't ever give up a chance to learn**
i.e. retain willingness to learn, and don't squander support offered
- **Geoscience is a job of creating value**
– understand what metallurgists and engineers need
- Forget about having a career plan – too many external factors with no control
- **Passion for rocks and outdoors**
- Willingness to do anything required (even fieldy type work) – chance to learn business
- **Masters degree minimum** – learnt to deal with problems
- PhD required in Canada not so much in Australia – Australia has well balanced degrees
- Skill sets
 - People who can think (anybody can be taught software)
 - Maths in degree
 - Balance of core courses – structure, geochemistry, geophysics
 - Excellent writing skills
 - Ability to communicate with professionals outside of geology e.g. metallurgists, engineers, business people (be able to talk business/finance)
- Don't chase money – think about learning opportunities
- Make yourself indispensable to organisation – multitask, ability to adapt
- Hardwork pays off! 📢



Tasmanian AIG rep Bob Findlay (second from right) at the AIG booth with delegates including (L-R) Peter Pollard (Consultant Brisbane), Grant Craighead (Canterbury Resources NSW), Rob Smillie (GNS NZ), Rose Turnbull (GNS NZ) and Richard Jongens (Consultant NZ).

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Teacher Earth Science Education Program (TESEP)

Cape Liptrap Field Trip Report

Jill Stevens
TESEP Chairperson

In September the Teacher Earth Science Education Programme (TESEP), supported by many geological societies and some government, university and corporate partner funds (including AIG support), gave 30 Science Teachers of Excellence from across Australia the chance to learn from experienced industry geologists at some world-class field exposures in Gippsland, Victoria. The three days in the field were followed by Teachers' Day at an international conference in Melbourne (AAPG-SEG ICE).

The teacher group was dominated by young female Science teachers and a few senior male and female teachers. This demographic reflected the athleticism needed to get down steep slopes and rock-scramble at Cape Liptrap field exposures. The three days of the field trip went smoothly and to plan, with no incidents or injuries and the satellite phone taken for emergencies was not used.

The 30 teachers from Qld, NSW, ACT, Tas, Vic, SA (including 6 TESEP state coordinators) were guided on the 3-day Gippsland field trip by presenters structural geologist Dr Kevin Hill (OilSearch) and sedimentologist Dr Richard Lovell (ex-ExxonMobil) and assisted by TESEP Coordinator presenters. The team made an earlier reconnaissance trip to the field sites and scoped out the field trip specifically for teachers. Using high-quality industry workbook material, generously supplied by Dr Kevin Hill, TESEP Executive

Officer, Greg McNamara, compiled a hands-on field workbook including many questions for teachers to take back to their classrooms.

Sites visited were:

- Walkerville – Waratah Fault, historic lime kilns, Devonian-Ordovician marl and limestone and Cambrian volcanics and metamorphics
- Wonthaggi State Coal Mine – underground mine tour of this historic mine with a veteran coal miner
- Cape Liptrap – turbidites and deepwater sedimentary facies with colonial coral fossils, folded & faulted by Tasman Fold Belt orogenic movements
- Inverloch - Cretaceous dinosaur dig site; palaeoenvironment/ sedimentology of coastal outcrops and visit to the Dinosaur Museum at Inverloch – tour of the site and museum was led by Mike Cleeland from Dinosaur Dreaming.

At Teachers' Day, 8 industry professionals including a geotechnician; oil/gas, mining and environmental geologists; a geophysicist; a palaeontologist and a board director spent several hours sharing their stories of work and career choices, which had started with a secondary school Science and Mathematics background.

Seismic for the Classroom was demonstrated using government & industry-donated geophones. Teachers took geophones, career booklets (AusIMM) and TESEP Plate Tectonics posters back to their schools. Teachers enjoyed plenary sessions, Exhibition Hall, technical sessions and meeting industry and university geologists.





TEACHER FEEDBACK

A TESEP state coordinator wrote: "Thanks again for a wonderful experience. I spoke to the Head Teacher from East Hills Girls High School this morning. She commented that the teachers had returned to school extremely motivated about earth and environmental science and raving about their weekend."

A teacher wrote: "I would like to commend all those involved in organising the recent TESEP Field Trip in Victoria. It was obviously a well thought and well planned event, and was of great benefit to all those involved. Apart from the opportunity to see some unique geology, even more importance was the chance to spend time with teachers that share a passion for earth science."

A TESEP state coordinator wrote "This trip was an excellent example of how TESEP can engage with a broad range of interested

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teachers to deliver an informative and memorable experience. I am confident that everyone completed the trip feeling much more confident with their understanding of a wide variety of geological concepts. The location was spectacular, the geology varied and able to keep the teachers engaged, and of course the weather was absolutely fantastic!

The opportunity to attend the AAPG-SEG ICE was an event that none of them would have experienced... to hear from industry personnel their individual stories added a real human dimension to the whole four days of "rocky stories".

Those that attended my demonstration of remote sensing through a classroom seismograph saw the benefit of how hugely expensive technologies could be shown in an easily understood method that can be done with basic equipment in the classroom."

A year-12 Science teacher said: "this was the best PD she had ever done - so well organized".

A teacher said: "Best geology weekend ever. I will have more enthusiasm in teaching Geology (after doing this PD). I could influence about 600 students (yr 7-12)."

Another reported: "I could pass this experience and knowledge on to 10s of teachers and 100s of students."

One 7-10 Science/Maths teacher said: "The field trip was amazing ... so much of my Tertiary studies was made real here,

(albeit 20 years later). Kevin and Richard's knowledge was presented at a very appropriate level."

"I welcomed the opportunity to discuss applications with teachers from other states."

"The field exposures were fantastic."

This type of extraordinary learning experience for teachers, outside of the national, one-day professional development PD workshops that TESEP generally runs, was only possible through the financial support of TESEP partner societies PESA, ASEG, MCA (Vic), AIG, AusIMM, AGC and GSA. Thanks to ExxonMobil for staff time in field workbook preparation. Thanks also to Velseis and Geoscience Australia for geophones.

During the time the state coordinators were in Victoria a TESEP Coordinators' Forum was



held on 13 Sept 2015, Melbourne.

Key special projects on the TESEP coordinators wish list are:

- 1 Rock Doctor rock kit checks and compilation of 35-piece new Rock & Mineral Kits for schools without any kit; schools either have no rock and mineral kit or ones that are incomplete and inadequate.
- 2 Teacher mentoring - a day at the classroom or with students at field sites (member society geologists could possibly assist with this).
- 3 Hands-on Exercises - more integrated geoscience exercises e.g. remote sensing, basic mapping & map-reading.
- 4 Case Studies on geological locations across Australia, with student worksheet questions, to supplement each of the chapters in the Year 11-12 Environmental and Earth Science Textbook (examples are shown on the TESEP web site www.tesep.org.au). 📱



If you're interested in helping with TESEP projects please contact
Jill Stevens cp@tesep.org.au or Greg
McNamara eo@tesep.org.au.



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13th SGA Biennial Meeting “Mineral Resources in a Sustainable World”

Luke George
University of Adelaide

The 13th SGA Biennial Meeting was hosted in Nancy, France, on the 24th – 27th of August 2015 to celebrate the 50th anniversary of the society. Since the beginning of the SGA all those years ago, economic growth around the world has led to an increased demand for mineral resources. The challenge moving forward is providing such resources in a reliable, responsible and sustainable way. Thus the theme of the 13th Biennial meeting was “Mineral Resources in a Sustainable World”. Hundreds of international scientists presented and discussed research on mineral deposits and related topics within 16 scientific sessions, 5 symposia and 8 plenary sessions.

By far the most engaging and interesting session for me was entitled “Strategic metals: their sources, and ore-forming processes”. This was also the session I presented my original research in. This session focused on discussing the source, availability and corresponding geological controls on strategic metals such as indium, germanium and gallium; metals that are essential for growing high-tech applications, yet are vulnerable to imbalances between supply and demand. Both Nigel Cook and Rémi Belissont gave compelling presentations with direct implications to my own research. I then presented “Trace element partitioning between co-existing sphalerite, galena and chalcopyrite” in which I discussed predictable partitioning trends that have been observed



between many trace elements and base metal sulphides in hydrothermal ores. Discussions with colleagues and fellow researchers that took place during and after my session were of great benefit to myself and my research moving forward. It was an incredible opportunity to travel to Nancy to present some of my findings to a world-class geoscience audience, and interact with some leading researchers.

Other highlights of the meeting included an industry-mining networking event held at a local pub in Nancy. This was a great opportunity to meet and network with many different industry professionals as well as students from all around the world. Similarly, two informal poster sessions were held that were a great opportunity to meet many students, academics and industry folk, discuss their research and get different perspectives on my own research.

I would love to thank the AIG for their generous student bursary which allowed me to attend the SGA meeting in Nancy. 🍷

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Rock collections for Junior High School – just what is needed?

Greg McNamara

When I present a Professional Development (PD) workshop for the Teacher Earth Science Education programme (TESEP) at a school I am invariably asked by the science teacher or the laboratory technician to help them classify their rock collection. Other teachers at the PD also often ask my advice on where to get this kind of in-school help to sort out their own school collections.

School rock collections are mostly rubbish

I have helped schools on numerous occasions but I am yet to be shown a school rock teaching collection that was anything other than unsatisfactory in almost every regard. Usually the teachers or laboratory technicians are of the opinion that their rock collection is usable if only the labels were not rubbed off and the staff knew what each specimen was. Their request for help is mostly about getting to grips with what each rock is so they can teach Years 8-9-10 Earth & Space curriculum

content with Year 8 being the time when rocks and minerals are frequently dusted off for students to ponder. The problem is the rocks they have, be they ones bought as teaching kits or ones assembled over the years by well-meaning donations and acquisitions are – more often than not – next to useless for teaching Year 8 students the methods of identifying the common rock types and understanding their basic properties.

School rock collections fail the usefulness test in many ways. Kits supplied to schools through laboratory supply companies are almost always assembled overseas. Such kits usually supply specimens that are too small to be useful and often kits often contain specimens not important – at Year 8 level – to the understanding of rocks as required by the curriculum. They are also often labelled with names that are not part of the Australian lexicon and in some cases even labelled incorrectly.

Rock collections assembled by well-meaning teachers, laboratory technicians or

parents often contain good sized specimens of great geological interest but usually fail to tick all the boxes when it comes to the appropriateness of the specimens for teaching Year 8 students the key elements of rock identification and rock properties.

In short, school collections are frequently nothing more than piles of gravel that are not fit for road base let alone teaching. If I had my way all schools would have a useful collection of key rock types with supporting documentation that would enable teachers and technicians to keep track of the specimens they have and maintain them in good order for teaching. That way the piles of gravel could be consigned to landfill where they belong and students could meaningfully engage with the specimens. Rather than pretending they can see the difference between a gneiss and a granite in a couple of thumbnail sized pieces and hoping the bell will ring so the painful experience will be over students might not only understand the difference but what to know more!

So what should a basic teaching collection of rocks look like?

To determine what is needed we first need to examine the curriculum. While each state sets their own curriculum the national approach to the K-10 curriculum adopted in recent years means that there is very little difference between the state curriculum documents and the national guidelines set by Australian Curriculum, Assessment and Reporting Authority (ACARA).

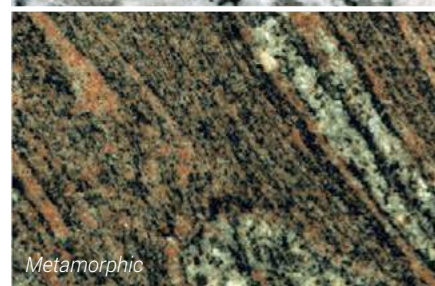
At Year 8 level the curriculum content expectation is typically spelled out at the higher level by a statement such as: Students are expected to understand: Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales. Further elaborations include: identifying a range of common rock types using a key based on observable physical and chemical properties & recognising that rocks are a collection of different minerals. In practice this often comes down to one or two classroom lessons about rocks, hopefully with a practical aimed at teaching students the difference between the 3 major rock types and highlighting a range of rock types within each of the 3 major groups.

Leaving aside the issue of mineral identification – a major problem in itself at this level in schools – this begs the question:

What rocks should a school teaching collection contain at the very minimum?

All geoscientists will all quickly rattle off a list of the most important rocks to know about in the 3 major rock types if you ask them and I am no different. My bare minimum list looks like this:

- Sedimentary
 - Clastic
 - Conglomerate
 - Sandstone
 - Mudstone
 - Biological
 - Limestone
- Igneous
 - Plutonic – intrusive
 - Granite
 - Gabbro
 - Volcanic – extrusive
 - Rhyolite
 - Basalt
- Metamorphic
 - Contact
 - Marble
 - Quartzite
 - Regional
 - Gneiss
 - Schist
 - Slate



Many readers will now be asking: ... but what about ... Siltstone / Breccia / Diorite / Andesite / Phyllite etc? The list above is the bare minimum needed to show students the key elements of each of the 3 major rock types and examples of the range of rocks found in each and is far from an ideal collection. Most schools that claim to have these specimens in their collections actually just have gravel with some labels that sometimes correctly identify the fragments. I would rather see all schools have 13 excellent specimens that really enable the teacher to teach and students to learn and understand than 35 specimens that confuse teachers and students, discourage teachers from teaching the subject and foster a dislike for the subject amongst students who would otherwise happily spend time discovering things about rocks.

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MINERAL EVALUATION & EXPLORATION

What this list does not do is tell us what the collection should actually look like. To be useful at Year 8 level all teaching specimens must:

- 1 Be excellent well indurated examples of their type.
- 2 Exhibit grainsizes at the larger end of the type's spectrum
- 3 Be big enough to hold in the hand but no smaller than ~70mm x ~70mm x ~50mm
- 4 Be small enough to be easily handled by students and staff

“ Firstly, we need to agree on a common suite of rocks that each kit should contain. Apart from the basic 13 rocks mentioned above there are others that would make a more rounded kit...”

To elaborate:

- 1 Excellent examples do not exhibit unusual features, even if they are sometimes found in this rock. They must not be friable or easily crumbled. For example, at this teaching level hand specimens of granite should not feature xenoliths. Nor should the sample be weathered to the point of crumbling. A larger piece of granite with a xenolith is appropriate for the display cabinet and for the teacher/student to elaborate on it during extension work.
- 2 A sandstone sample should be a coarse grained sandstone so that the grains and the relationship of the grains one-to-another can be easily seen, described and/or drawn. A sandstone that is almost a siltstone or a granite that might be better described as a micro-granite is of no use to teachers or students at Year 8 level. A sandstone with a non-carbonate cement is best as students are easily confused by fizzing should the acid-test be applied to a carbonate cemented rock.
- 3 Hand specimens should be just that, lumps of rock that fill the hand. Pieces this size enables grain-to-grain relationships to be seen from all sides, directional fabrics to be identified and drawn and textures and colours to be appreciated. A fragment the size of a thimble is useless for seeing layering in a gneiss or schistosity in a schist.
- 4 Hand specimens are safe to handle for students and staff alike. No hand specimen should weigh more than 500-750g. Larger, one-off, display and extension specimens should not weigh more than a few kilograms and have a reasonable base to rest stably on where possible.

What else should be included?

Firstly we need to ensure a minimum quality of sample for each rock type. Secondly, we need to provide primary support materials for each rock type provided. This should take the form of high resolution images of the whole surface of a typical slab plus detailed images of key features of the rock fabric and mineralogy. These should be provided in unannotated and annotated versions so that they can be used by teachers with students and to also refresh the teacher's memories of the information embodied in the rock. In addition, the support material should include written histories of the rock's formation, exactly how it can be classified and other useful information that is likely to be of use in Year 8 classes and extension classes.

Sacrificial samples need to be considered. Good samples of limestone should not be put to an acid or scratch test but extra - to-be-tested-samples of limestone, marble and mudstone - should be supplied.

Secondary support materials, such as petrological analysis, thin-section micrographs, chemical analysis and XRD analysis should not be a priority but could be supplied at a later date, especially if the rock collection is likely to be used with senior Earth and Environmental Science students.

So how do we build a rock collection for schools that is useful?

Carefully! Over the years well-meaning parents, clubs and professional groups have all provided schools with rock collections or kits that have invariably come from local mines, quarries and private collections.

The majority of the best specimens in these kits are often of great use in senior secondary teaching at best but most likely of use at some level of university undergraduate teaching. They are only sources of confusion and frustration at Year 8 level and are akin to asking teachers to teach basic Year 8 chemistry by starting with atomic orbital theory.



Igneous: Volcanic Lava

TESEP is seeking partners to enable the development of a truly useful rock collection for schools that request one.

Firstly, we need to agree on a common suite of rocks that each kit should contain. Apart from the basic 13 rocks mentioned above there are others that would make a more rounded kit. I estimate that means each kit should contain anywhere between 20 and 33

samples depending upon how comprehensive we decide the kit should be. 33 samples is probably too ambitious but around 22-25 is probably necessary. I can supply my list of 20-33 rocks upon request but the final list is up for discussion. Each rock must be evaluated against a set of criteria that ensure minimum standards of quality and usefulness are met in each case.



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- ✓ Competitor analysis
- ✓ Devil's advocate

○ ANALYSIS

- ✓ Country and sector reviews
- ✓ Endowment profiling
- ✓ White papers

○ EDUCATION

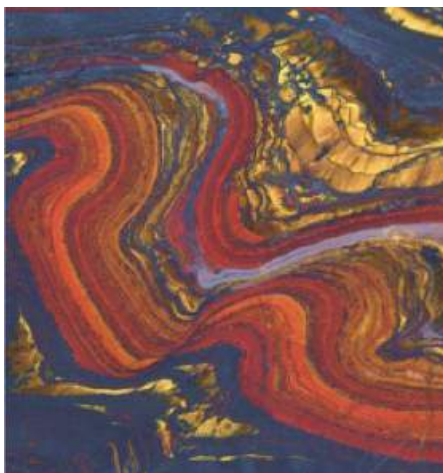
- ✓ Training
- ✓ Mentoring
- ✓ Peer review

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Semper Sursum

Secondly, we need to agree upon materials that should not be included in a first order Year 8 kit. Altered rocks, extreme end member examples, samples with secondary mineral overprints, deeply weathered samples and ore-rocks have no place in this type of kit. Some have a place in the school collection as larger one-off samples and extension material but this should not be a case of just sending school bits of geologically interesting stuff. Anything that a school is supplied with must come complete with primary supporting materials as well. However, in the first instance these extraneous “nice pieces” are a distraction and should not be part of the initial kit production.

Thirdly, we need to source materials from places where large volumes of consistent quality materials can be obtained. If we are to produce hundreds of kits for schools we need samples to be of the highest quality



and consistent so that the primary support materials do not need to be tailored to each individual kit. That will mean identifying quarries, mines and other locations where it is safe and legal to either collect or purchase sufficient volumes to meet our up front needs. Such sources also need to be able to supply larger volumes down the track should the demand prove high.

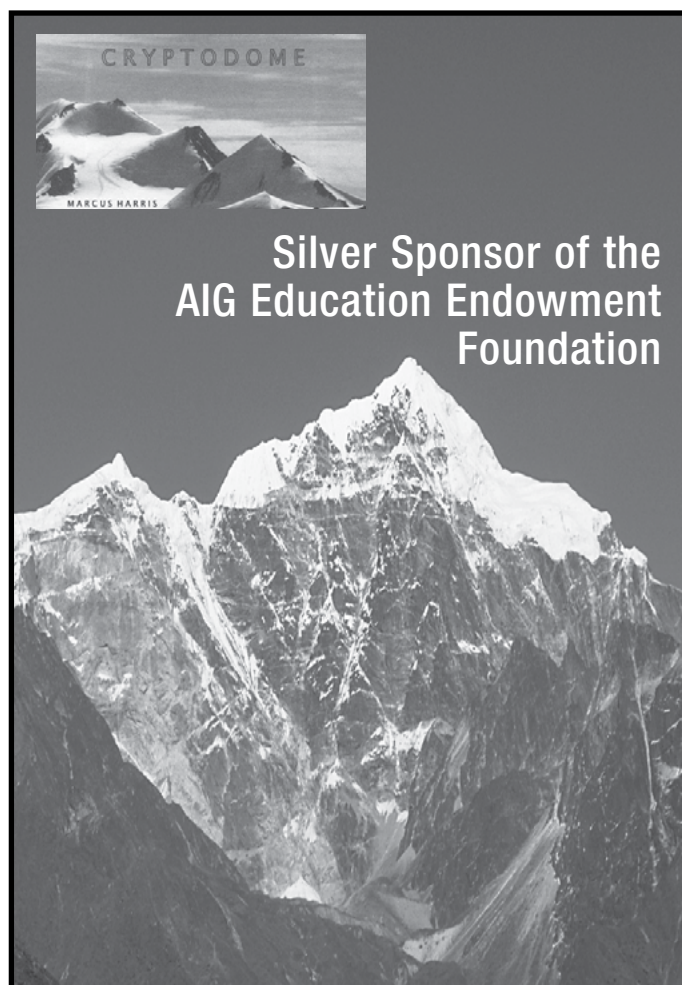
Only once we have carefully evaluated all samples on offer from our partners and/or

their contacts should we commit to building the kits. Once we decide to proceed we should look at creating between 50 and 100 kits to start with. Once we receive feedback from the use of these kits in schools that volunteer to use them [and we have acted to fix any identified problems] should we consider scaling up to making as many more kits as the Australian schools network requires.

Prior to assembly we will also need to consider how many samples of each rock type will be supplied in each kit and how they will be stored. Schools do not necessarily have large storage spaces and boxes of rocks can easily exceed modern legal standards for lifting and moving by teachers and technicians. All these considerations will add to the overall cost of producing a kit, even if we source some of the rocks for free. Finally, there will also be a freight cost in the equation when distribution begins.

What now?

TESEP is seeking expressions of interest from organisations willing to enable this project to move forward. Once we have established a core group of project supporters a working party will be established to formalise the content of the kit and supporting materials and begin the task of identifying sources for each specimen and how the kit will be put together. This working group will also involve classroom teachers and laboratory technicians. 🗨️



Latest Australian Geoscientist Employment Survey Results Show No Signs of Improvement

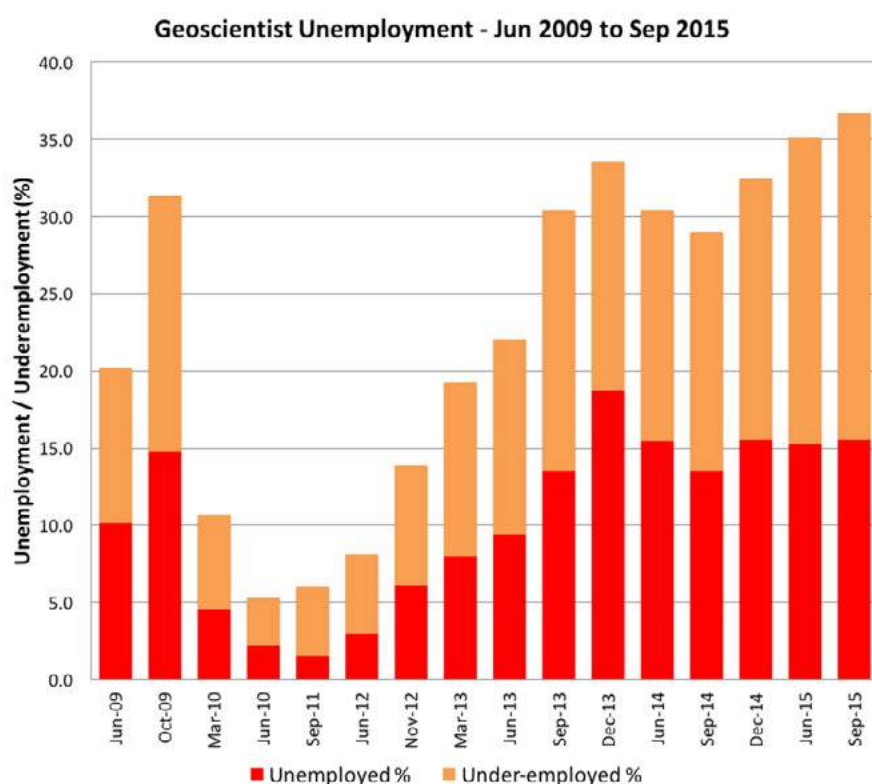
Andrew Waltho
AIG Councillor, Australian
Institute of Geoscientists

The results of the Australian Geoscientist Employment Survey for the September Quarter of 2015 show no improvement in employment prospects for Australia's struggling geoscientists.

The survey recorded the highest levels of geoscientist unemployment and underemployment since the survey series commenced in 2009.

Australian geoscientist unemployment in the September quarter of 2015 was 15.5% nationally, up slightly from the June quarter result of 15.2%. The underemployment rate was 21.2%, a significant increase on the 19.9% recorded in June.

More than one third of underemployed geoscientists were unable to secure more than 10% of their desired workload.



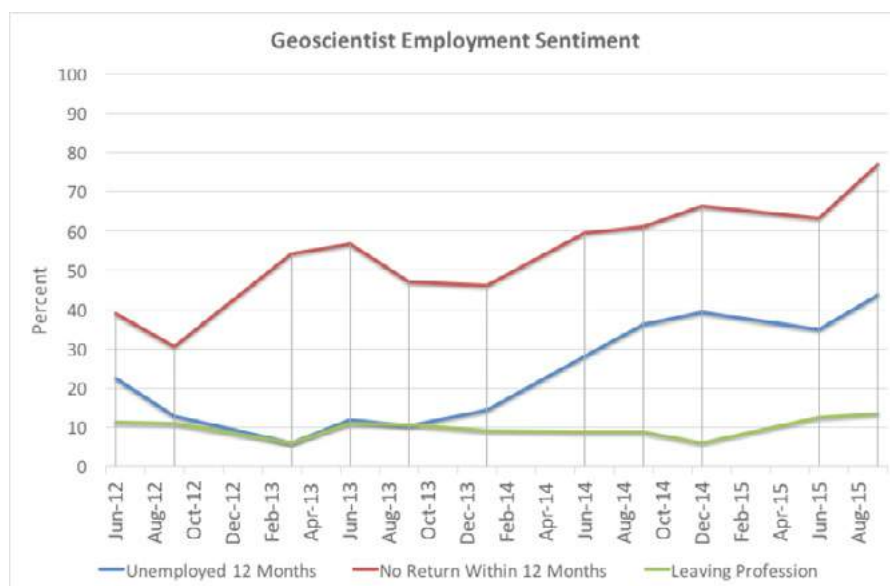
A total of 926 responses were received to the survey from both AIG members and non-members. Responses were received from the full spectrum of professional geoscience

experience, from new graduates to geoscientists with more than 30 years experience.

Unemployment and underemployment rates varied between states.

STATE	SEPTEMBER 2015			JUNE 2015		
	Unemp %	Underemp %	Combined %	Unemp %	Underemp %	Combined %
National	15.5	21.2	36.7	15.2	19.9	35.1
Western Australia	16.1	19.0	35.1	14.8	17.9	32.7
Queensland	12.5	23.4	35.9	18.6	16.5	35.1
NSW and ACT	5.8	31.2	37.0	9.3	20.4	29.6
Victoria	26.5	11.8	38.2	6.5	22.6	29.0
South Australia	14.7	26.5	41.2	14.3	25.0	39.3

“If there was any doubt that financial market uncertainty, questions regarding long-term demand for commodities and depressed prices have a profound impact on exploration activity, these figures should dispel that.”



Insufficient responses were received from Tasmania and the Northern Territory to report meaningful state results.

Geoscientist employment (combined unemployment and underemployment) deteriorated in every state, in line with the national trend. Unemployment fell in Queensland and New South Wales / ACT but this fall was offset by increased underemployment amongst self-employed geoscientists. Underemployment fell dramatically in Victoria, but again, this was more than offset by the increase in unemployment in that state.

New South Wales / ACT and Victoria recorded the greatest increases in the combined unemployment-underemployment rate.

In the latest survey, almost 44 percent of unemployed or underemployed geoscientists had not worked for 12 months or more. This rate has been increasing steadily since June 2012 when collection of this data was added to the survey. The proportion of unemployed geoscientists who are seeking permanent, alternate employment has increased, as has the proportion who have little confidence of returning to employment in less than 12 months. More than 13 percent of geoscientists are now seeking permanent employment outside geoscience. A massive 77 percent of unemployed and

underemployed geoscientists have no confidence in their ability to return to work in less than 12 months.

Only six percent of geoscientists regained employment after being unemployed during the September quarter.

Some 80 percent of geoscientists responding to the survey, currently in employment, were full-time employees. Six percent work part-time and the remainder were seeking work as self-employed contractors or consultants.

Respondents currently in employment were asked to comment on their employment conditions for the first time in this survey. Just under 20 percent thought that their employment conditions had improved over the past year, while about 55 percent thought that their conditions had been maintained, and 25 percent thought that their conditions had declined.

Professional association and learned society membership is being maintained by Australian geoscientists, with only four percent of respondents reporting that they were not a member of a professional institute or learned society. More than 80 percent of respondents were members of either AIG or the Australasian Institute of Mining and Metallurgy (AusIMM), demonstrating a commitment to professional standards,

ethics, continued professional development and the professional networking opportunities provided by membership.

“The survey results demonstrate, without any doubt, that the ongoing depressed employment situation for geoscientists in Australia are really starting to bite” said AIG President, Mr Wayne Spilsbury.

“If there was any doubt that financial market uncertainty, questions regarding long-term demand for commodities and depressed prices have a profound impact on exploration activity, these figures should dispel that.”

“Australia’s geoscientists are demonstrating incredible resilience in the face of a protracted downturn in their employment prospects”.

“There has been no tangible improvement in stubbornly high unemployment rates since September 2013: two years in which we are seeing more and more talented and experienced professionals with the skills essential to Australia’s long term economic prospectively not being used productively” Mr Spilsbury said.

“The potential solutions AIG and other professional and industry groups have been advancing for two years now have not changed. Governments need to reduce the burden imposed on explorers associated with access to land for exploration which can be done without threatening the environment and

while fully respecting the rights and interests of other stakeholders”.

“AIG members would be aware, through recent newsletters and the Institute’s web site, that AIG recently wrote to Mr. Peter Dutton MP, Minister for Immigration and Border Protection proposing the extension of labour market testing (LMT) to overseas geoscientists seeking temporary employment in Australia.” “An Immigration Department representative responding on behalf of the minister confirmed the intent of the 457 visa program as providing Australian employers with access to skilled overseas professionals at times when local candidates for roles are in short supply.”

“The Commonwealth government is currently implementing recommendations from a recent, independent review of the 457 visa system which included reinstatement of a Ministerial Advisory Council on Skilled

Migration (MACSM) to provide advice on skilled migration issues and establishment of a Dedicated Labour Market Resource office (DLMR) to provide policy and statistical advice to the MACSM, which will in future use the results of these surveys with other data to monitor trends in Australian geoscience employment to help deliver appropriate advice to the MACSM.”

“AIG considers this initiative to be positive one, preserving employers’ access to essential skills at times when they cannot be sourced within Australia, while not disadvantaging Australia’s resident geoscientists in lean periods” Mr Spilsbury said.

“Investment in exploration also needs to be supported to promote sustainability and maintain Australia’s resource project pipeline, which underpins the nation’s economic prosperity, has a significant employment multiplier, and drives innovation which

improves productivity and leads to the development of new goods and services.”

“The human element of this protracted downturn has not received adequate attention”. “The cyclical nature of geoscience employment in Australia needs to be considered.” “Taxation measures such as income averaging or income splitting, where the working member of a couple is able to allocate part of their income to a partner who cannot work, or cannot secure work, need to be carefully considered”. “Income splitting has been shown to be highly effective in Canada where it enables many productive individuals to stay in work in difficult times” Mr Spilsbury said.

“First and foremost, Australia’s geoscientists need to be able to get back to work where it matters”. 🗣️

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PNG MINERAL RESOURCES AUTHORITY (MRA) PROJECT

As part of the World Bank sponsored 2nd Mining Sector Institutional Strengthening Technical Assistance Project (MSISTAP) in PNG, Terra Search has commenced a 12 month contract designed to add significant further historical Geological and Geochemical Data to the over 450,000 data points already captured by Terra Search during the 1st MSISTAP in 2002-2005.

With over 15 years of experience providing database services to government and industry, Terra Search is well placed to deliver the best possible outcome for the MRA.

All data compiled and validated during this project will be made available globally to exploration companies through the MRA.

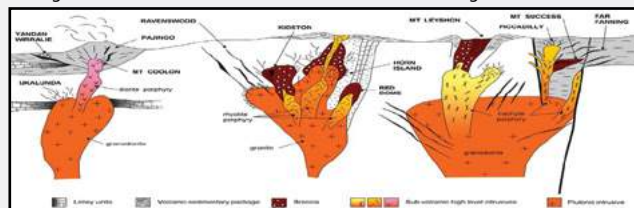


INTRUSION-RELATED MINERALIZATION SYSTEMS IN NE QLD

Terra Search and Klondike Exploration Services are undertaking a comprehensive study of the geology and metallogeny of gold-bearing magmatic hydrothermal systems incorporating:

- A new metallogenic database of the Charters Towers Region, GIS data package and map
- Metallogenic model documenting genetic types & spatial controls in Charters Towers region
- Revision and update of the geology of the Charters Towers District
- Templates of geophysical & geochemical signatures of deposit styles

This study is a part of a North QLD research initiative in collaboration with local Industry, EGRU (James Cook University) and the Geological Survey of QLD, funded through the Queensland Government Future Resources Program.



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INTRAW – An international project on raw materials (www.intraw.eu)

Report on the first Panels of Experts Workshop in Slovenia, September 2015

Kaylene Camuti
Chair, AIG Education Committee

In mid-September the European Union (EU) research project on raw materials, INTRAW, held its first Panels of Experts Workshop in the town of Bled, located on the shores of beautiful Lake Bled in Slovenia. The three-year INTRAW project is part of the EU's Horizon 2020 Programme for Research and Innovation, and the aim of the project is to identify best practices and to develop new cooperation opportunities between the

EU and technologically advanced countries. INTRAW is intended to play a key role in the alignment of the Research & Innovation activities among the EU countries and enhance synergies with international research and innovation programmes. Following the launch of the project in February this year the project consortium compiled draft reports on raw materials' development for each of the project's reference countries:

Australia, Canada, Japan, South Africa and the USA.

The three Panels of Experts on "Research & Innovation", "Education & Outreach" and "Industry & Trade" comprise representatives from each of the reference countries. At this first workshop in Bled, the Panels met with members of the project consortium to discuss the project's objectives and tasks, and to review the critical factors identified in the draft reports on the reference countries in terms of the technological and economic advancement of those countries in the 20th and 21st centuries.

I attended the workshop in Bled as the Australian member of the Panels of Experts, and had the opportunity to work with a group of skilled and experienced geoscientists from around the world who willingly shared their knowledge. Over the two days of the workshop we took part in a series of intensive sessions addressing issues relevant to raw materials. The issues were considered under the following headings: research and innovation, policies and strategies, joint educational and



INTRAW workshop session with representatives from the reference countries and members of the project consortium.



INTRA workshop delegates taking some time out on the shores of Lake Bled. From left to right: Anita Stein (EFG, Belgium), Ed Swindell (Geological Society of South Africa), Malcolm Robb (Government of the Northwest Territory, Canada), Kaylene Camuti (Australia), Fatheela Brovko (CSIR, South Africa), Mrs José Carvalho (Portugal), Christopher Keane (American Geosciences Institute, USA), Pär Weihed (Luleå University of Technology, Sweden).

skills programmes, licensing and permitting procedures, royalties and tax policies, data reporting systems, exploration, extraction, processing and recycling practices, and management and substitution of critical raw materials. We discussed and compared policies and processes in the reference countries, including the factors that both enhance and reduce the potential for exploration investment, with the issue of costly and time-consuming permitting procedures being raised several times.

The importance of high quality professional training and skills development was also

discussed at length, and various approaches to providing relevant educational opportunities were compared and contrasted by the country representatives. The role of industry in education and professional training was also considered, and processes and opportunities for academic-industry collaboration in training and research were debated. The results of the workshop discussions by the experts will contribute to the final versions of the reference country reports, which will be published late this year.

The workshop in Bled was organised by the European Federation of Geologists (EFG),

the organisation responsible for coordinating and leading the project. I would like to thank everyone involved in organising the project and the workshop, with a particular thank you to members of the EFG executive for their help with facilitating travel and accommodation for us all, and to the Slovenian Geological Survey for its hospitality. (A special thank you, also, to Pivovarna Pelicon - brewers of a very fine Slovenian India Pale Ale.) 🍺



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5: Seven Wonders of the Hydrogeological World - Canning Basin

Pauline English

PhD, Groundwater Group, Geoscience Australia

Reproduced with thanks to the International Association of Hydrogeologists,

Australia National Chapter

Seven Wonders of the Hydrogeological World (in Australia)

In an effort to raise the national profile of hydrogeology, the Australian branch of the International Association of Hydrogeologists (IAH Australia) launched a competition in 2010, challenging interested parties to nominate Seven Wonders of the Hydrogeological World (in Australia).

With a \$1000 cash prize on offer for the best submission, entries were impressive, varied and reflective of the diverse and abundant hydrogeological wonders Australia has to offer. Submissions were assessed on the basis of scientific merit, interest to scientific media, visual amenity, quality of submission and public interest. Of the wonders nominated, there were seven clear standouts.

Over coming issues of the AIG News, we will be featuring each of these wonders, continuing with number 5: The Canning Basin of Western Australia.

The Canning Basin of Western Australia is a magnificent hydrogeological entity, representing Australia's second largest sedimentary basin (after the Great Artesian Basin) and containing a fascinating ensemble of extensive aquifers and doubtlessly large volumes of groundwater beneath the Great Sandy Desert. The underexplored, pericratonic Early Ordovician to Early Cretaceous Canning Basin occupies about 506,000 km², of which 430,000 km² are onshore. It has a maximum sediment

thickness of over 15,000 metres concentrated in two NW trending depocentres.

The northernmost of these is the Fitzroy Trough-Gregory Sub-basin complex, while the southernmost is the Willara Sub-basin-Kidson

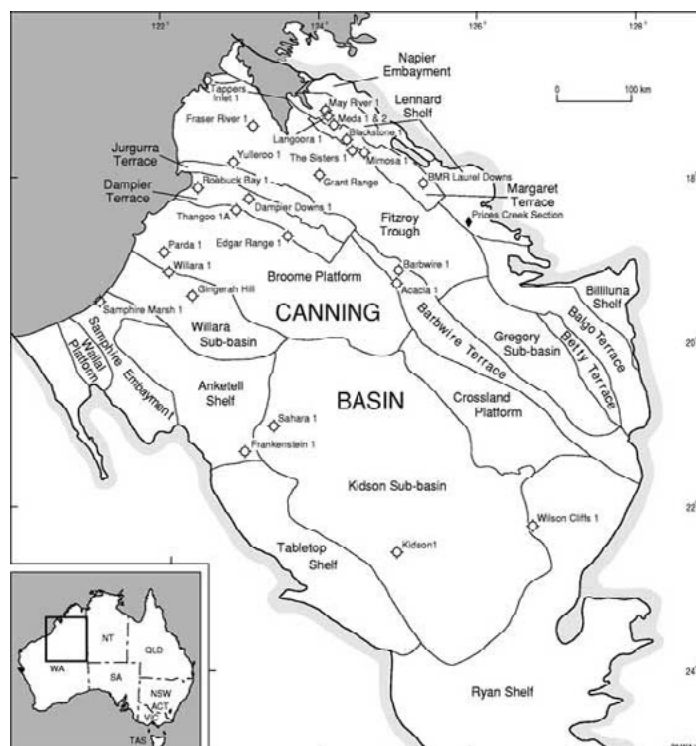
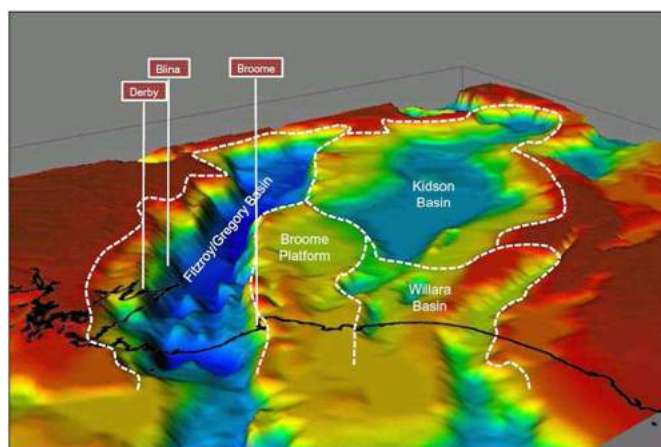


*Image from
Geoscience
Australia*



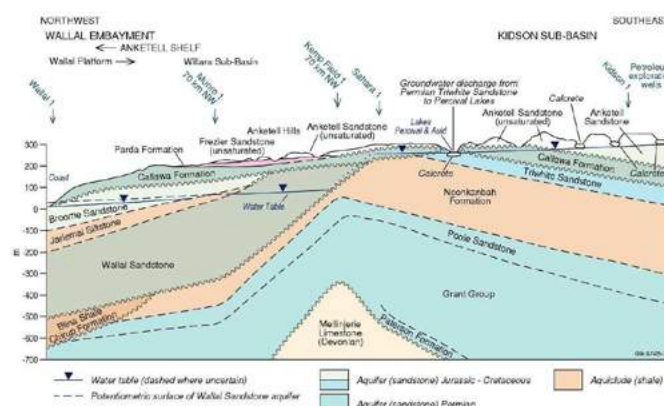
Canning landscape (P. English).



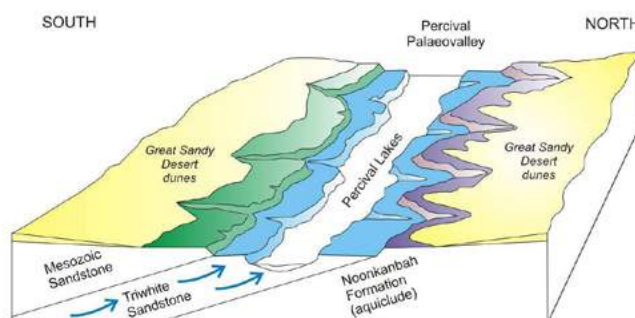
The four main sub-basins of the Canning Basin: The Fitzroy/Gregory Basin (up to 15 kilometers of section); Kidson Basin has thinner section (4 to 5 kms) Broome Platform; Willara Basin. Image from Buru Energy Ltd: www.buruenergy.com.au/files/Image/canning-geology-large.jpg

Sub-basin complex¹. The Canning Basin is also exceptional because of the unique cultural history and significance to remote desert dwellers and early settlers. The latter is well-represented along the Canning Stock Route where an unusual variety of aquifers supply natural wells and watering points.

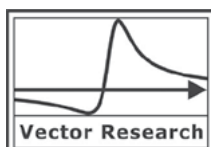
Five phases of geologic evolution are recognised in the basin, from the Early Ordovician onwards. Of these, perhaps the fifth is the most significant in terms of



Canning Basin aquifers, after Commander 1985; Laws 1991.



Palaeovalley conceptual model for the Permian Triwhite Sandstone where the Percival Palaeoriver has incised through Mesozoic sediments to the aquifer, from which groundwater is discharging into the valley (English, 2010).



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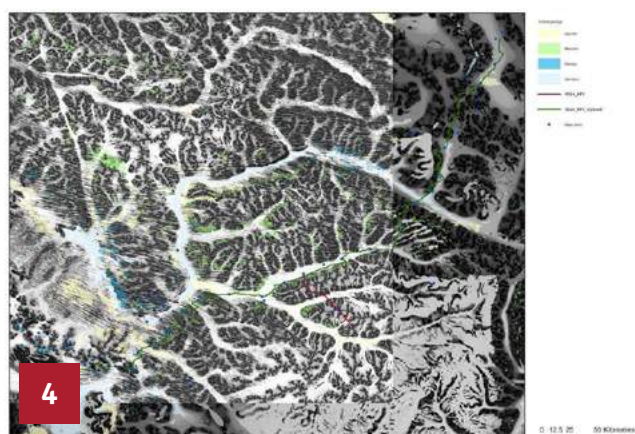
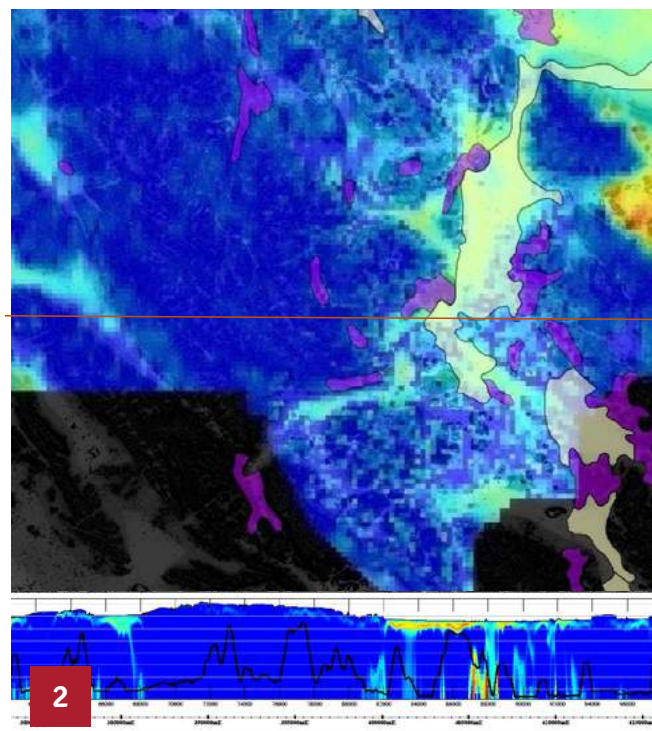
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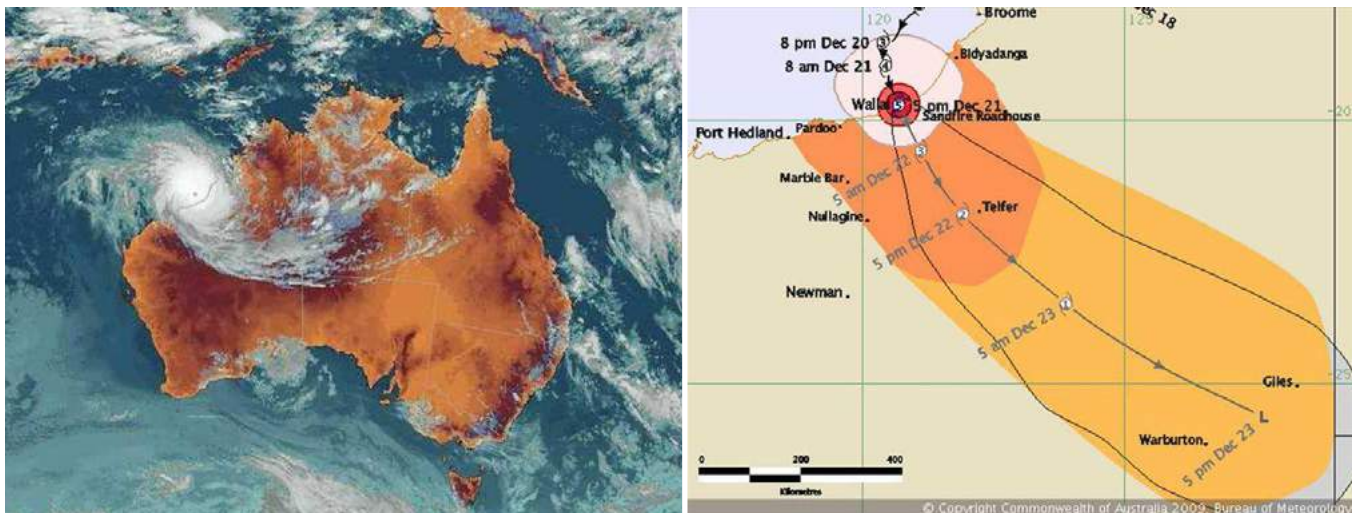
deposition of sediments that now function as aquifers in the upper strata: marked by renewed extension and rapid subsidence, coinciding with the onset of glacial conditions in the Early Permian and incorporates a sag stage with widespread marine transgression following the glaciation. The final tectonic phase was triggered by regional dextral wrench movements in the Late Triassic - Early Jurassic when up to 3 km of uplift and erosion occurred, accompanied by extensive molasse deposition. This was followed by deposition of fluvio-deltaic and marine sediments. Thus, the most significant aquifers are the Cretaceous Callawa Fm and Anketell Sandstone, the Triassic Erskine Sandstone, and the Permian Grant Group strata, each interspersed with shale aquicludes.

1 Polished glaciogenic striae on the Archean-Proterozoic Pinjin Chert, Carrawine Gorge, legacy of Permian deglaciation from the Pilbara ice Cap. Glacial scouring of palaeovalleys in crystalline bedrock and deposition of Permian fluvio-glacial sediments, the Paterson Formation, represent a distinctive aquifer system in the edges of the Canning Basin (P. English).

2 Airborne Electromagnetic (AEM) data for part of the Paterson Province at the edge of the Canning Basin. Permian Paterson Formation outcrops shown overlain in purple, and buried extents revealed as higher conductivity palaeovalleys inset into resistive crystalline bedrock, in an area where palaeovalley groundwater is sought to support mining activity (English, 2010).

3 Cenozoic Oakover Formation near Carrawine Gorge, Oakover River, Pilbara, at the edge of the Canning Basin (P. English).

4 Palaeovalley network in the central Canning Basin, along part of the Canning Stock Route, revealed beneath dense dunes of the Great Sandy Desert using a modified high-resolution Digital Elevation Model. The sparse outcrops of key lithological units are shown (P. English, 2010).



The most interesting Canning aquifers include the following, although these are not necessarily the most important in terms of quantities and quality of stored waters, but merely examples of distinctive scenarios where the geology and hydrogeologic scope, extent and characteristics are a source of wonder (selected photographs and figures as shown):

- Permian glaciogenic Paterson Formation palaeovalley aquifers, incised into Proterozoic bedrock at the edges of the basin;
- Permian Triwhite Sandstone, groundwaters from which emerge as springs in the Percival Lakes chain across the basin, sustaining Punmu and other isolated inhabitants and unique ecological habitats;
- Distinctive shallow aquifers including (silicified?) karstic calcrete, representing many of the Canning Stock Route wells, and rock waterholes whose connectivity with deeper aquifers and geologic structures is unknown.

Although limited data from current investigations by Geoscience Australia's Groundwater Group² indicates the widespread presence of palaeowaters, the region nonetheless is subject to relatively common cyclonic incursions associated with the northern monsoon system and is episodically inundated and a well-watered desert environment, suggesting some recharge of shallower aquifers is likely. 🌧️

Above: Typical trajectory of cyclonic incursions into the Canning Basin, episodically replenishing shallow aquifers (Bureau of Meteorology, 2009).



Left: Groundwater discharging at a exploration drill-hole near Lake Waukarlycarly, Canning Basin, possibly from the Triwhite Sandstone aquifer, obscured in dunefields, creating a local oasis for camels (P. English). Right: Mesozoic strata typical of the Canning Basin (P. English)

¹ Geoscience Australia: http://www.ga.gov.au/oceans/ea_OnsCanning.jsp

² <http://www.nwc.gov.au/www/html/538-water-for-arid-zone-palaeovalley-groundwaterresources.asp?intSiteID=1>

Reporting Sulphide Mineral Observations in Drilling Intersections

Andrew Waltho
Chairperson, AIG Complaints Committee

Exploration Results: Reporting Sulphide Mineral Observations in Drilling Intersections

“ Estimates by experienced, competent geoscientists are considered to be reliable and reproducible semi-quantitative estimates of the abundance of minerals present in a sample..”

Correspondence has been received from members in recent weeks regarding the description and reporting of sulphide mineralisation in drilling samples. This relates, essentially, to sulphide intersections being reported without any attempt to:

- 1 Describe the nature of sulphide mineral occurrence (e.g. massive, disseminated, in veins, forming veins or bands concordant or discordant with bedding or a penetrative foliation observable in the host rock);
- 2 Identify the minerals observed; or,
- 3 Estimate the abundances of any sulphide minerals observed.

Estimation of the proportions of mineral species present in a sample, where individual grains or crystals are visible in hand specimen, is considered to be:

- 1 a skill in which geologists are trained during the course of their university studies in, but not confined to, mineralogy, petrology and economic geology;
- 2 an aspect of exploration and mining work in which geologists may be readily and meaningfully trained; and,
- 3 work that may be guided by published resource materials (e.g. mineral percentage estimation charts published in the AusIMM Field Geologists' Manual and numerous other publications, including reference cards that may be readily accessed and referred to by geologists undertaking sample examination and description (Figure 1, Figure 2).

Estimates by experienced, competent geoscientists are considered to be reliable and reproducible semi-quantitative estimates of the abundance of minerals present in a sample. Visual estimates of sulphide mineral abundance should, however, never be considered a proxy or substitute for laboratory analyses where metal concentrations or grades are the factor of principal economic interest. Visual estimates also potentially provide no information regarding potential

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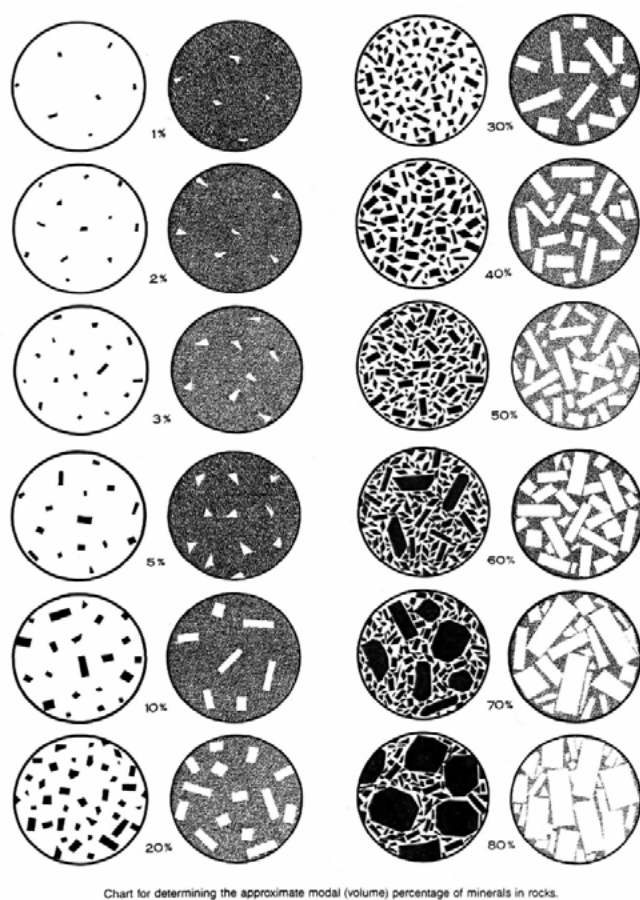


Figure 1. Chart for estimating the modal percentages of minerals in rocks, http://faculty.uml.edu/Nelson_Eby/89.506/Assignments/Modal%20percent%20chart.jpg, accessed 12 Sep 2015.

impurities or deleterious physical properties relevant to valuations of some mineral commodities such as graphite and many industrial minerals. Where visual estimates are reported, Competent Persons should provide an indication of when more substantive and reliable data in the form of laboratory analyses will be available.

Further, the ability to identify economically significant minerals, comprising either a mineral of value or a potentially deleterious constituent is considered to be a required skill possessed by geoscientists acting as Competent Persons for the commodity

and style of mineralisation that forms the subject of any announcement or statement of Exploration Results, Mineral Resources or Ore Reserves issued in compliance with the JORC Code (2012).

Not adequately describing mineral species present, their relative abundances and the form in which they occur when their presence in samples is included in announcements and reports of exploration results may be considered not to comply with the underlying transparency and materiality principles of the JORC Code (2012) that may constitute a breach of the Code.

Visual estimates of proportions of mixtures

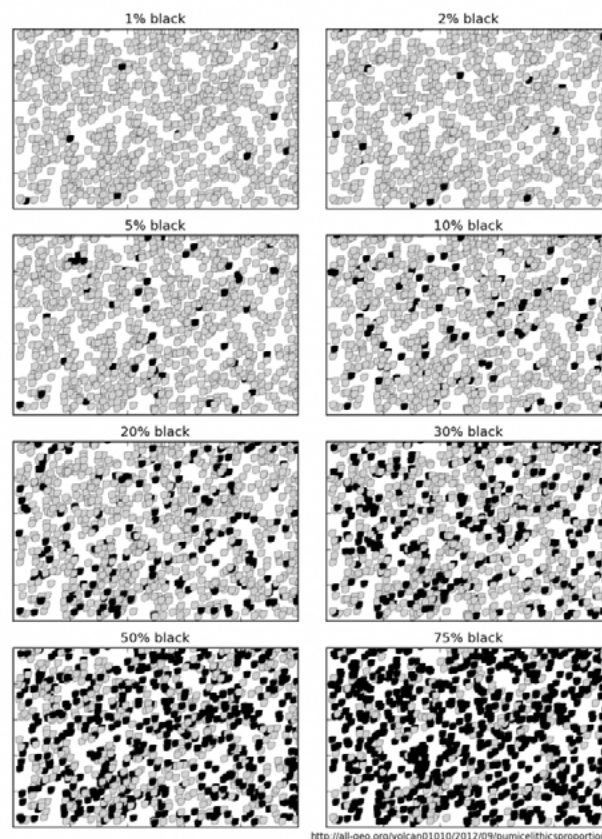


Figure 2. Estimation of the proportion of constituents in mixtures. <http://all-geo.org/volcan01010/wp-content/uploads/2012/09/PumiceLithicsProportions.png> accessed 12 Sep 2015.

The correspondence received does not constitute a complaint against any Member. The issue is, however, one within the remit of the AIG Complaints Committee to review, consult with members in relation to, and issue advice and guidance to Members.

Future failure to adequately address these requirements will expose Members acting as Competent Persons for statements of Exploration Results, Mineral Resources and Ore Reserves to complaints of being in breach of the JORC Code (2012), that may result in complaints being referred to AIG's Ethics and Standards Committee. 🚫

Mines and Wines 2015 – Uncorking the Tasmanides

Verity Borthwick

The Mines and Wines 2015 conference was held in Queanbeyan from 2 to 4 September 2015. Nearly 200 people attended the Queanbeyan Bi-Centennial Hall to hear the talks and a modest profit was made. This profit will be used to support students, pay for workshops and provide reserves for the NSW Support Fund.

There was an excellent one-day pre-conference field trip to the Lake George Mine at Captains Flat and the Dargues Reef Gold Mine project at Majors Creek. The historic Lake George base metal mine is a late Silurian volcanic associated massive sulphide system that produced lead-zinc, copper, gold, silver and pyrite up until 1962. The Dargues Reef deposit is an early Devonian granite-related gold deposit. The excursion included mine and local geology stops and drill core inspection.



The conference program focussed on exploration and development projects in the Tasmanides of eastern Australia from Tasmania to the Cape. Presentations covered projects in Queensland, New South Wales, Victoria and Tasmania. Mines and Wines is an opportunity for geoscientists to share the geoscience challenges of their projects with their peers.

Below: Field trip attendees doing what Geologists do best – checking out a road cutting!



Field trip visit to Dargues Reef.



The two days of presentations were structured along four themes:

- **The Big Picture –**

Addressing current thinking on tectonics and metallogenesis of the Tasmanides.

- **Arc Mineral Systems –**

Focusing on porphyry and epithermal mineralisation. Presentations included projects in the Miga Arc in western Victoria, the Macquarie Arc in NSW, and arc-related systems in Queensland.

- **Basins and More –**

Including volcanic- and sediment-hosted base-metal mineralisation such as the NSW and Victorian VMS deposits and the Cobar-type.

- **Granites and More –**

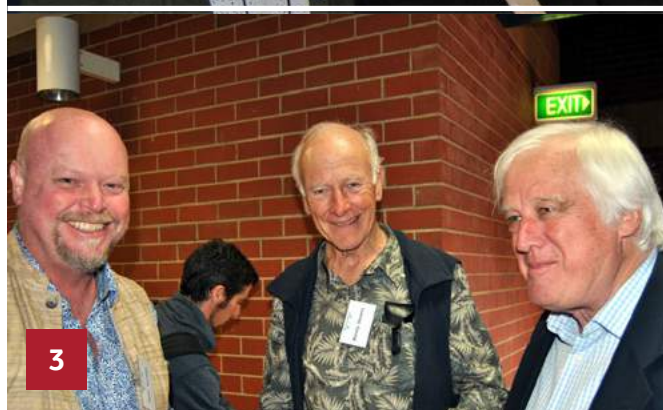
Addressing the diversity of granitoid-related mineral systems with which the Tasmanides is so richly endowed.

Eminent keynote speakers also provided overviews of the particular mineral system themes.

1 *Mines and Wines attendees visiting the fantastic array of booths.*

2 *Verity Borthwick and Rosie Sloan at the conference.*

3 *Peter Buckley, Barney Stevens and Ian Plimer at the conference.*



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Left: Neil Williams giving his presentation at the conference.



Left-below: Chris Yeats, Wendy Corbett and Neil Williams enjoying the conference dinner.

The conference dinner was held at the Old Parliament House dining room where we sampled excellent food and were entertained by our after dinner speaker, Ian Plimer.

This was a wonderful chance to catch up on all the latest news from exploration successes in eastern Australia as well as JV opportunities or, in the case of those students who attended, find a future employer.

The talks were excellent, but the real benefit ultimately flowed from the discussions stimulated. Keep an eye out for notice of the next Mines and Wines to be held around September 2017, possibly in Dubbo. 🗣️



All abstracts and presentations can be found on the smedg web site at www.smedg.org.au

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Steven Williamson
Chairman, AIG Victorian Branch
Principal Geologist,
Steven Williamson Pty Ltd

The Victoria branch of the AIG hosted a one day workshop called Drilling Plus at the Victoria Hotel in Woodend on October 9. The Victoria branch committee coordinated and arranged speakers and were considerably assisted by Deepcore Drilling Pty Ltd and mrgraphics in staging the event. A group of 90 drillers and geoscientists from academia, industry and government attended the event on what was an uncharacteristically warm October day for Woodend.

The day commenced with a talk on drill rig safety by Worksafe Victoria Inspectors Donna Conley and Christopher Walschots. Their talk emphasised the common issues they encounter and focus on when inspecting drill rigs and introduced their Surface Exploration Drilling Checklist, which is available for download from the Worksafe website.

The morning continued with a presentation by Deepcore's Business Development Manager, Luke Jackson, formerly Chief Geologist at Ok Tedi, on drilling methods and their history. In addition to practical tips for young (and old) players, we learnt, amongst other things, that cable drilling was used in China some 4,000 years ago to drill holes over 1,000 m deep and of the existence of

techniques such as 'hydro jet' and 'flame jet'. Luke also described the super-deep borehole drilled in the Kola Peninsula by the Russians between 1970 and 1994. The hole got to 12,262 m but progress was extremely slow over the last decade as the rocks behaved plastically and the hole would close after drilling: the drill bit turned but the rods stayed still.

Another Luke, Deepcore's Drilling Supervisor Luke Fitzpatrick then took us through wedging theory and deep directional drilling techniques;

the cost and benefits; the maximum degree of deviation before you risk breaking rods; and the need for careful planning with an experienced driller before undertaking the exercise.

This presentation was followed by a talk from Deepcore's Regional Manager, Don MacDonald, on drilling surveys and Ori tools. The talk outlined the potential sources of error when undertaking downhole surveys and core orientation. It generated a lively discussion which highlighted the need for systematic



Luke Jackson & Luke Fitzpatrick from Deepcore with their rig



Steve Williamson presenting the opening address



Enjoying drinks on the balcony at the end of a great day



It was very rewarding to have a packed house

QA/QC of core orientation data, in particular from electronically oriented core. It was also noted that the sometimes the biggest challenge can be making sure the driller's offsider placed the core in the tray the right way around.

The next presentation was by Dave Williams, founder of Mudex, on the true costs of drilling fluids. The key take home point from this presentation was that a pre-planned mud program should be in place before you encounter ground stability issues. In other words, "drilling fluids are to keep you out of trouble not to get you out of trouble". It was also emphasised that when assessing the cost of drilling fluids one needs to take into account the cost of freight and look at the performance of the product. In problematic ground, higher cost drilling fluids (on a per litre basis) with high miscibility may actually reduce volumes used, reduce freight costs and improve productivity.

The last talk of the morning was by Randal Nott, Chairman of the Victorian Drillers Licensing Board and Manager of Resource Assessment and Planning, Groundwater at the Victorian Department of Environment, Land Water and Planning. Randal's presentation focussed on the current regulatory framework for drilling and bore construction and the agenda for regulatory improvement. A nationally portable driller licence and online bore licencing are two key initiatives to look forward to in the not too distant future. The issue of coal seam and shale gas exploration was raised and it was noted that CSG exploration is currently under a moratorium pending completion of a Parliamentary inquiry.

Prior to lunch the workshop moved from the Victoria Hotel's function room to the grounds of the nearby Country Fire Authority where a McCulloch DR950 truck-mounted multi-

purpose drill was on display. The Deepcore team described the rig and demonstrated safety features and drilling tools.

The first afternoon session focussed on advancements in drilling technologies and was kicked off with a presentation on Coiled Tubing Drilling Rigs by Soren Soe, Project Leader at the Deep Exploration Technologies Cooperative Research Centre (DETCRC) in Adelaide. The aim of the DETCRC Project is to develop a rig for greenfields mineral exploration capable of drilling to a depth of 500 metres at a cost of \$50/metre and weighing less than 10 tonnes with ancillary safety and environmental benefits.

The project is chasing penetration rates of up to 100 m per hour in soft, predictable sedimentary rocks and 30 to 60 m per hour in hard rock. Central to achieving their aims is the development and testing of suitable coiled tubing materials and new drill bit technology. DETCRC have also developed a solids removal unit that is achieving 99.9% removal of cuttings from drilling fluids and is undertaking research into Lab-at-Rig technology that can provide same day characterisation of drill core. The coiled tubing rig combined with Lab-at-Rig technologies could transform regional prospecting strategies.

Mike Mercuri, Director of Matrix Drilling, was our next presenter. He gave an overview of drilling and sampling methods used in soil and groundwater investigations. Technological advances that have improved sample representativity and in some cases reduced drilling costs include sonic drilling, pre-packed screens and multi-level groundwater sampling systems. Also explained was the use of flexible FLUTE liners, which are 'everted' into a borehole to locate non-aqueous phase liquids.

Sandvik Mining and Exploration's technical sales representative, Len Maluga, completed the pre-tea session. Len described advances in electronic control systems and their use in remote monitoring and support of drill



Staff from Worksafe Victoria presenting on hazards.

operations and the potential for automation of drilling functions such as rig location, leveling and setup, rod handling and drilling. Other developments included Sandvik's SU bit and barrel system in which the bits have a thin kerf and give up to 24% more core as compared to other bit types.

The session after afternoon tea focussed on data acquisition and logging systems. Tim Hopper of NMR Services treated the participants to a lesson in the physics of NMR (Nuclear Magnetic Resonance) and how Bound and Free fluid volumes and total porosity may be measured and permeability calculated. The importance of determining moisture content (as measured by bound fluid volume) in iron ore shipments was emphasised by the transport moisture limit, a regulation established in 2012 that restricts the moisture content of shipments to 10% in order to mitigate the risk of shipments fluidising in rough weather and causing a vessel to capsize. Tim noted that while NMR has been around for some 60 years it has mainly been applied to oil and gas and of course medicine (MRI) where the N has been omitted to avoid public hysteria. Only recently has the technology been adapted for bore diameters of less than 150 mm and used in mining and groundwater applications. NMR logs for coal and channel iron deposits were presented showing grain size distribution, matrix density and permeability. Examples were also shown of how NMR can be combined with a suite of other logs to provide a continuous



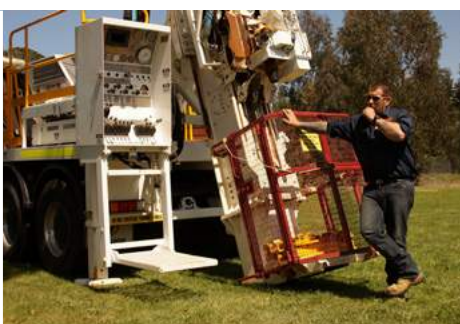
Many new and old faces made the event a big success.

lithological log and multi-mineral solutions.

Mary Harris, Project Geoscientist from Rio Tinto gave the penultimate talk of the day on down-hole hyper-spectral logging. Mary described the operation, wavelength and spatial resolution of three commercially available logging systems; Corescan, TerraCore and HyLogger. Mary also gave examples of logs showing vein and matrix mineralogy, overlays of mineral class maps on high resolution photography, stacked class maps highlighting broad changes in alteration and images that clearly show the sequence of mineral paragenesis. The quality and speed of

the scanning process is impressive, subject to the core being clean and dry. The portability of these systems also provides the opportunity to generate real time data on site in support of core logging.

Peter Smith, Consultant Hydrogeologist, had the task of presenting the last talk of the day to a, by then, thirsty audience. Appropriately the subject was groundwater related, although most would have been thinking of an effervescent variety and slightly amber in colour. All mines require a water supply and many need dewatering. Peter's presentation gave a general overview of the types of data



Deepcore Drilling presenting their McCulloch DR950 truck-mounted multi-purpose drill.

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that can be readily and cheaply recorded both during and after drilling programs to help plan and provide inputs to mining hydrogeological assessments. The talk was lightly peppered with examples of projects Peter had undertaken in the barren, arid landscapes of Northern Chile.

The workshop was completed with thanks to speakers and sponsors and congratulations to the organising committee. A GoPro, donated by East West Drilling and Mining Supplies, was handed out as a door prize to Andrew Nelson from Iluka. On Site Laboratory Services in Bendigo generously sponsored drinks and the participants gathered on the balcony with Mt Macedon as the back drop to gain some fresh air, converse and digest the day's events.

The key to a good story is how you tell it, but for those that missed out, or wish to jog their memory, copies of the day's presentations can be viewed at <https://goo.gl/hku5tF>.

*Geoff Turner
presenting Andrew
Nelson our lucky door
prize winner a GoPro.*



Events calendar



Keep up to date with upcoming AIG and Geological events at www.aig.org.au/events

December 2015

WA Branch Christmas Cruise 2015

December 4, 2015

Barrack Street Jetty, Perth WA

Greenland Day

December 9, 2015

University of Western Australia, Cawley WA

Ore Textures/Breccias

December 9-10, 2015

Regal Park Motor Inn, North Adelaide SA

AusIMM Monograph 30 Roadshow - Adelaide

December 10, 2015

Adelaide Convention Centre, Adelaide SA

What lies beneath the western Gawler

Craton?

December 10, 2015

Department of State Development South
Australia, Adelaide SA

12th South Australian Exploration and Mining Conference

December 11, 2015

Adelaide Convention Centre, Adelaide SA

Brisbane AIG Geoscience Christmas Party

December 11, 2015

The Rendezvous Studio Hotel, Brisbane QLD

Terroir of the McLaren Vale Wine Region Study Tour

December 12, 2015

Regal Park Motor Inn, North Adelaide SA

February 2016

Business and Financial Management for the Minerals Industry

February 8 - 19th, 2016

James Cook University, Townsville QLD

Geophysics for the Mineral Exploration Geoscientist

February 16 - 17, 2016

Rugby Club, Sydney NSW

Understanding of, and Exploration for, Epithermal and Porphyry Deposits:

Transitions and Variations

February 25-26th, 2016

Professor Jeffrey Hedenquist
James Cook University, Townsville QLD

Exploration Management - Setting Priorities

February 29 - March 1, 2016

Tawarri Reception and Function Centre,
Dalkeith WA

March 2016

IOCG and Other Mineral Systems in the

World-Class Cloncurry District: New

Advances in Exploration and Deposit

Understanding - an EGRU Workshop

March 16 - 18, 2016

Cloncurry QLD

April 2016

Integrated Spatial Analysis and Remote Sensing of Mineral Exploration Targets

April 18-29th, 2016

James Cook University, Townsville QLD

May 2016

Hyperspectral Analysis for Exploration and Mining - A silver bullet?

May 09, 2016

CSIRO Australian Resources Research Centre,
Kensington WA

August 2016

ASEG-PESA-AIG 2016: 25th International Geophysical Conference and Exhibition

August 21 - 24, 2016

Adelaide Convention Centre, Adelaide SA

35th International Geological Congress

August 27 - September 4, 2016

Cape Town International Convention Centre,
Cape Town

September 2016

13th International Nickel-Copper-PGE Symposium 2016

September 5 - 9, 2016

Esplanade Hotel, Fremantle WA

Granites: Crustal evolution and mineralization

September 26 - 30, 2016

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October 2016

Exploration Through Cover - Applied Geophysics

October 17, 2016

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AIG NEWS



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