A Report on the inaugural NExUS: National Exploration Undercover School
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You can register online at: [www.optiro.com/services/training/](http://www.optiro.com/services/training/)

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) 9215 0000   | Email: dititren@optiro.com or training@optiro.com

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The Association Specialists (TAS)
PO Box 576
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Australia
Happy New Year All

Happy New Year all. Trust you made the most of the break over Christmas and are already back at work to what looks like a more promising and prosperous year than last. I am a keen metal price watcher (metal-twitcher?) as the health of our industry depends ultimately on metal prices. Nice to see that copper prices seem to be on a sustained upward trend.

Lots happening this year. AIG’s AGM will be held in Brisbane in April. Half of your Federal Council members step down then (and are eligible to re-nominate) so there are 7 Council positions up for election. If you are interested in volunteering and want help AIG realise our Vision to remain the preeminent professional institute for Australian geoscientists, then I strongly urge you to nominate by contacting our Executive Officer, Lynn Vigar at exec@aig.org.au

In June, we will be holding our annual Face to Face Federal Strategic Planning Meeting hosted by your new Tasmanian Branch in sunny Hobart.

I caught Queensland’s first committee meeting in late January. Lots of discussion around how to get members to attend and support organised events, in particular the monthly Technical Talks where we seem to get the same mature crowd (I’m one of them) and few if any of the younger generation(s). I would encourage members to register with E-News for their state (registration on the front page of the website and you don’t need to be a member to attend) and find out what the state branches are organising.

I’d like to use this space to feature some of the work your Federal Councillors and their committees are working on. This month I have chosen the Professional Standards, Geotourism and an area I am involved in Corporate Governance.

Wayne Spilsbury (Vice-President) and his team have been very busy tackling the issue of professionalism in geoscience (see article in the next issue). Basically do we get the same public recognition that other professionals like doctors, accountants, engineers receive? Short answer is no and Wayne is coming up with ideas to promote our profession. On the radar is compulsory CPD tracking, law and ethics course and licencing. Members will be shortly asked for their input on these issues in a Members Survey.

Patrick Maher has volunteered to drive the Geotourism Committee. I see this as potentially a major growth area for geologist employment. If anyone has come across a suitable Geotourism project that might be of interest to the membership please contact Patrick patrick.maher@csaglobal.com. There are also Geotourism groups doing wonderful things in the states we would like to contact.

My focus continues to be Corporate Governance. AIG is a non-for-profit organisation registered with ASIC and as such has compliance and governance requirements to legally operate and retain its tax free status. Your Federal Councillors are effectively company directors and as president I am the CEO. As directors we have both legislative (Corporations Act) and general law duties. A recent survey of the incumbent Federal Councillors showed a low level of awareness or experience at running an organisation. At the Face to Face meeting we will be having a training session by the Australian Institute...
of Company Directors on the roles and responsibilities of a director (councillor) and the board (council).

One last thing. We have had a lot of enquiries about starting up Specialist Interest Groups. Andrew Waltho is the point of contact to discuss your ideas and assemble a case for presentation to Council for approval, and with that in place, a web page for each group on the AIG website. In progress is a QGIS special interest group. If you are interested as I am, a link to this group will be on the website shortly. We are also trying to reinstate a Geostats-Resources-Reserves group.

President

Field work in Papua New Guinea.
DRILLING FOR GEOLOGY II

26-28 JULY 2017, BRISBANE

The Australian Institute of Geoscientists (AIG) is hosting the second instalment of its very successful Drilling for Geology conference held in 2008. Drilling for Geology II will again focus on drilling, and the collection and analysis of geoscientific information from drilling.

TECHNICAL PROGRAM (Day 1 and 2)

Over 25 presentations introduced via key note talks will cover best practice, case studies, emerging developments and blue sky R&D in the themes of:

- Drilling techniques
- Drilling logistics
- Sensing and geophysics
- Drill hole sampling and logging methods
- Making better use of drilling data (geology, geotechnical, geometallurgical and geoenvironmental applications)

A trade exhibition will run in parallel with the technical program. All conference breaks and the welcome function will be in the exhibition to ensure great networking opportunities.

PROFESSIONAL DEVELOPMENT WORKSHOPS (Day 3)

The third day of the conference is dedicated to offering delegates drilling-related workshops. A range of half-day and full-day professional development workshops will be available.

The AIG acknowledges the generous support of its sponsors and supporters

Confirmed Sponsors

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REGISTRATION OPENS IN MARCH 2017
Call for Abstracts

The committee invites you to submit an abstract for presentation at the Conference. Please visit our website to read more information about the submission process and to access the link to the online submission form. All abstracts must be submitted online by 5.00pm EST Friday 12 May 2017. All enquiries regarding abstract submissions should be emailed to program@aegc2018.com.au.

NORTHERN TERRITORY GEOLOGICAL SURVEY

AGES 2017
ANNUAL GEOSCIENCE EXPLORATION SEMINAR
Alice Springs, 28–29 March 2017, Northern Territory

The 18th Annual Geoscience Exploration Seminar (AGES) will be held at the Alice Springs Convention Centre on 28 and 29 March 2017. AGES is the Territory’s premier exploration-focused event, and is a technical conference that presents a unique opportunity to access the latest in fresh exploration ideas and geoscientific data from the Territory and to network with colleagues who share an interest in the discovery and development of the Territory’s minerals and oil and gas resources.

The conference includes presentations of new exploration-focused geoscience from the Northern Territory Geological Survey and its partners, as well as presentations from industry on recent highlights from minerals and onshore petroleum exploration.

AGES 2017 will include major releases of new geoscience data and information from the Territory’s CORE (Creating Opportunities for Resource Exploration) initiative. It will also be an opportunity to learn about the major new geoscience programs planned in the NT under Geoscience Australia’s new $100.5 million Exploring for the Future initiative.

A summary of program highlights is now available from the AGES website and the full program will be available mid-February.

For more information and to register for AGES visit www.ages.nt.gov.au

Mid West WA Geotrail Proposal – have your say!

The Batavia Coast Maritime Heritage Association has initiated plans to establish a Mid West WA Geotrail and is seeking community input.

This area possesses a remarkable array of geological landscapes and rock and mineral formations. These include some of the oldest rocks at Jack Hills (dating back 4.4 billion years) to some of the youngest, with fossilised reef formations perched along our coast from just ~10 thousand years ago when sea levels were higher than at present. Banded iron formations inland, ancient marine ammonite beds, glacial deposits, dinosaur bones, copper, lead and other ores, garnet dunes and stunning landscapes add even more to the geodiversity of the region and the reasons to establish a Geotrail.

How can you help? The Batavia Coast Maritime Heritage Association will convene a meeting of interested individuals and organisations in early 2017 to discuss this proposal and all interested parties are invited to attend. To find out more download the brochure at www.geood.com.au/AGCletter/pdf/BataviaGeotrail.pdf

Australian Geoscientist Employment Survey results

The latest Australian Geoscientist Employment Survey results (for the final quarter 2016) show the recovery evident during 2016 has gone backwards, with unemployment rising to 14.4% and under-employment rising to 19.5%. Both measures are higher than the September 2016 results.

For the full results, please see the AIG website.
Geology of Australia – 3rd edition now available

The Geology of Australia by Robert Henderson and David Johnson brings geoscience to the general public in an intelligent and well written account of Australia’s evolution, tectonics, geology and landscape.

The book presents the story of the geological evolution of the Australian Plate to readers willing to come to terms with the language of this science without being drowned in unnecessary jargon.

Find out more about this book at https://tinyurl.com/aignews127-geology-of-au

HALLBERG 1:25,000 GEOLOGICAL MAPPING GIS DATASETS

Compilation of Hallberg mapping as seamless GIS datasets is in progress, allowing the mapping to be viewed in its overall context and integrated with other datasets (geophysical, geochemical etc). The database is unique, incorporating extensive petrographic and geochemical support and offering consistent mapping carried out by one person.

With your AIG Member Advantage program, plan your next holiday and access savings on accommodation, dining, flights, car hire and more:

- Hotels & Accommodation: Access over 100,000 promotional deals and competitive rates on accommodation options worldwide.
- Car Hire: Obtain either reduced car hire rates or excess in Australia and New Zealand with Hertz, Europcar or Avis/Budget.
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To access your member benefits or for more information, log in with your member number to www.memberadvantage.com.au/aig or call AIG Member Advantage on 1300 853 352.

for geological information, contact:
Jack Hallberg email - msg4jh@hotmail.com ph - (08) 9842 2263

for GIS information and ordering, contact:
Bill Hitch email - datamapping@westnet.com.au ph - 0400247515

for brochure contact Jack or Bill

Meekatharra 11,500 sqkm - in progress
Yalgoo 3,750 sqkm - pending/expression of interest
Leonora 26,000 sqkm - pending/expression of interest
Kalgoorlie 13,400 sqkm - completed
The Territory’s premier exploration event

The Territory continues to offer outstanding opportunities for both minerals and petroleum explorers. Major investment in new geoscience data by the Northern Territory Geological Survey (NTGS) and its partners under the Creating Opportunities for Resource Exploration (CORE) initiative is providing exciting insights into the untapped potential of under-explored areas in the Territory.

Join us in Alice Springs on 28–29th March 2017 for the 18th Annual Geoscience Exploration Seminar (AGES), where a mix of NTGS and industry presentations will showcase the rich minerals and petroleum potential of the Northern Territory. AGES is a technical conference that presents a unique opportunity to access the latest in fresh exploration ideas and geoscientific data from the Territory and to network with colleagues who share an interest in the discovery and development of the Territory’s minerals and oil and gas resources. Nearly 200 people attended the event in 2016.

Seminar highlights

- the latest on the emergence of a new pegmatite-hosted lithium field in the Bynoe area
- technical updates on successful exploration programs and new discoveries from across the Territory for gold, zinc, lithium, oil and gas and more
- release of new data and information on the geology and potential of eastern Arnhem Land
- dedicated session on the McArthur Basin including the release of new geoscience datasets and mineral system studies
- information on major new collaborative geoscience programs between NTGS and Geoscience Australia under the Exploring for the Future initiative
- practical information to assist with issues such as land access, titles and accessing geoscience data
- the AGES dinner – the premier networking and social event for the NT exploration industry

AGES also incorporates the Mining Services Expo – a showcase of Northern Territory businesses and their capabilities to support exploration and mining ventures.
Institute News

By R N (Sam) Lees

This book is a companion to the previously published (2013), Strictly (Mining) Boardroom Insights from Inside the Resources Sector authored by Allan Trench. Volume 11 is published by Major St publishing and costs $34.95.

Allan Trench is research professor (Value & Risk) at the Centre for Exploration Targeting at UWA and John Sykes is undertaking a doctorate at the Centre for Exploration Targeting, UWA.

The book should be read by all geoscientists involved in the mineral exploration and mining industries. Those geoscientists aspiring to management positions in a mining or exploration should regard it as a critical text. Consultants, broker analysts and those working for government will also find it very useful.

The book contains 95 short chapters (typically two to three pages) divided into nine sections. Each section covers a major theme. The individual chapters began life as regular Strictly Boardroom columns on the Miningnews.net portal and date from late 2012 to 2016. The nine sections each have a brief introduction outlining the section and a summary page at the end. There is some minor overlap between the sections and a few of the chapters (being up to 4 years old) appear a little dated nevertheless there is a wealth of ideas and takeaway messages. Those who regularly read Miningnews.net may be familiar with many chapters but here they are presented in a coherent order.

Although I am a geoscientist who has been around the industry since the late 60s and in and out of boardrooms for the past 30 years, I found Strictly (Mining) Boardroom Volume 11 a compelling read. If you are an aspiring manager or director read it, geoscientists already in the boardroom make sure it is in the corporate library.
Was the article, Plate Tectonics better suited to an increasing radius Earth Model?, by James Maxlow published in AIG News 126 as holiday entertainment or was it presenting a serious alternative to plate tectonics? The validity of the latter can be tested by observations.

There are reliable measurements of the actual movement of tectonic plates and they are consistent with plate tectonics and inconsistent with an expanding Earth. The geomagnetic pole observations also are consistent with a mixture of converging and diverging tectonic plates and the cyclic opening and closing of oceans. The plate tectonic model also provides an explanation for the earthquakes, folded rocks and thrusts that occur near continental margins that are or were affected by convergence. Cawood et al. (2006) provide supporting evidence for these processes as far back as the Archean.

A tensional regime associated with Earth expansion does not explain the observed plate motions and these other effects. The expanding Earth model proposed by Maxlow accepts that oceanic crust formed as the continents moved apart. He reconstructs previous continental positions by removal of progressively older oceanic crust and an equivalent amount of surface area of the Earth (by reducing the radius). He explains the absence of a 10-15 km deep layer of water over the continuous early Mesozoic continent on this smaller Earth by assuming that the water was yet to be released from the mantle. This significant change in volatiles in the mantle should be reflected in the composition of basalt and other magmas during the Mesozoic.

Almost all current oceanic crust is less than 150 million years old so this reconstruction predicts that all the oceans were closed in the late Jurassic. This lack of gaps is hard to explain if the same expansion mechanism had been operating for the previous 4000 million years. Maxlow’s explanation is that prior to the Jurassic fragmentation, the crust stretched and rifted and these zones are represented by sedimentary basins and orogenic belts on thinner older crust. He then proposes that these basins can be progressively eliminated, just as oceanic crust was, to get back to an Archean Earth. It had a radius about one eighth of the present radius. One unstated assumption is that either there was no oceanic crust prior to the Jurassic or any oceanic crust was rapidly covered by sedimentary basins. Another assumption is that up to 95% of the present crustal material must have come from the mantle during this period. If not, this material now found in the post-Archean crust would have formed a blanket 500 km thick over the early Archean cratons and resulted in ultra-high pressure metamorphism, which is not observed in the current Archean exposes.

Maxlow avoids a mechanism proposed by some recent expanding Earth proponents that depended on a decrease in the gravitational constant, G. That theory does not adequately explain why it is only the mantle and/or core of the Earth that is expanding. If the crust is expanding at the same rate it will increase in size with the mantle and not be fragmented. Maxlow’s solution is that the solar wind pumps protons and electrons [and some alpha particles] into the Earth and they are trapped in the lower mantle causing it to expand. He assumes that nuclear fusion occurs in the lower mantle. However, pressures and temperatures are too low there (and even in the Sun) to create the heavier elements that predominate in the mantle. If fusion could occur, the heat generated would probably vaporise the Earth. If these particles are trapped in the mantle and fusion does not occur, the electrons would combine with protons to form hydrogen and with alpha particles to form helium. Fortunately there is no seismic evidence of this layer of hydrogen (and helium) so we need not fear that a leak would deplete the oxygen from the atmosphere or that Hindenberg Earth would explode.


Richard Carver Consulting Geochemist B.Sc (Hons) FAEG MAIG
32 Years in Exploration Geochemistry
Extensive International Experience Australia - China - Africa
Project Management
Survey design & Implementation
Laboratory Audits
QA/QC & Data due diligence
Data & Database Compilation
ArcView/MapInfo GIS
richard.carver@gcxplore.com
Membership Update
A warm welcome to AIG’s new members

NEW/UPGRADES MARCH 2017

STUDENTS
CHEN, Qian • KING, Antoine • KRAK, Dean Michael • LG, Kai Yee

GRADUATE
CHALK, Henry Charles • DEACON, Melinda • GRIMSHAW, Matthew • HAMILTON, Benjamin Lee • JOHNSTON, Alexander • KAY, Tristan James • KEYS, Melinda Alice • LEE, Ryan • WHITE, Haydn • YEOMANS, Christopher Mark

MEMBER (Cont’d)
HUFFADINE, Scott • JONES, Benjamin Michael • KOEN, Andries • LISTER, Graham • MANAMPER, Athula Sanjeeva • MAXWELL, Mark • MCLEOD, Aaron • PAWLEY, Heath • PLAYFORD, Benjamin Guy • RAYNER, Jeffrey Guy • REID, David William • REID, Joshua • REYNOLDS, Gareth • ROBERTS, Grant Willis • STRICKLAND, Trent Jonathon • VAN HEERDEN, Mark John • VAN WYK, Michael Jakobus • WATERS, Gregory Dafydd • WILLIAMS, Jacinta Maree

MEMBER
APPS, Simon James • BARNETT, Bryant Kimbal • BARTLE, James • BROWNE, Callum • CHACÓN, Guillermo Angel • COOTE, John Anthony • EDMONDS, Paul • GRANT, Hamish James • HARRIS, Dale Anthony • HATHAWAY, Christopher Ian • HEALY, Scott Graham • HIPWELL, Bethany • HODIE, Paul Joseph

MEMBER (Cont’d)
KNEESHAW, Allan Darley • STOCKTON, Ian Robert

FELLOW
GARGANO, Diego Francisco

ASSOCIATE

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

The NSW branch also has a number of other workshops in the pipeline, including career support for geoscientists, a valuation seminar, JORC update seminar, geological mapping and field skills workshop, as well as another core logging workshop, this time to be extended to 3 days after the success of the first.

We also take a leading role in organising the Mines and Wines Conference every two years. Planning is well underway for the next Conference, to be held from the 6 – 8th September, 2017, in Orange, with the technical program full of presentations on exploration in the Tasmanides. Make sure to put those dates in your diary and keep any eye out on the website for registrations opening.

The AIG is also involved in organising the 26th AEGC (Australasian Exploration Geoscience Conference) conference, with planning and sponsorship going well. The conference is a joint effort between the AIG, ASEG and PESA. The conference is planned for the 18 – 21st February 2018. A call for papers for the conference went out in February.

AIG NSW has a close association with SMEDG (Sydney Mineral Exploration Discussion Group). SMEDG meetings are held on the last Thursday of the month. With the closing down of the Sydney Rugby Club building, the monthly meetings of the Sydney Minerals Exploration Group (SMEDG) will now be held at the venue known as Club99 on York Street in the city. This venue is very close to Town Hall Station, and can also provide low cost parking. The first SMEDG meeting for 2017 was held in February. 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).
SMEDG also organises networking cruises twice a year, and the Dave Timms SMEDG Christmas Cruise, on Friday the 16th December, was another great day out on the harbour.

For those living and working in the Central West of NSW CWEDG (Central West Exploration Discussion Group) has restarted regular informal meetings, with speakers from a variety of companies who operate within the Central West. If anyone is interested in helping organise these catch ups, please contact the NSW AIG.

CWEDG held a technical session in Orange on the 1st of December, with around 40 attendees who came to hear a talk on modelling structures from MicroMine, an update from the NSW Minerals Council, and from Glen Diemar about his previous work and adventures in Central Asia. It was a great evening and a good way to end the year, catching up with geologists and friends from around the Central West. Plans for technical meetings in 2017 are progressing, with events flagged for a variety of locations across the area in order to encourage everyone living and working in the Central West to come along.

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 NSW Branch is also starting an AIG mentoring program, similar to that which has been run very successfully in WA. We are currently looking for geoscientists with 20 years or more experience who would be interested in mentoring. If that sounds like you, please get in touch with the NSW Branch committee (email address below).

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. If anyone is interested in joining the committee, or helping in any capacity they should contact any NSW branch committee member or email nsw@aig.org.au. In particular we are looking for young professionals and graduates who might be interested in joining.

In 2016 the response to the AIG Bursary Program was excellent and 16 AIG bursaries were awarded to third year, honours and postgraduate geoscience students from 10 universities. In this issue of AIG News we include reports and abstracts from four of the students who were awarded bursaries in 2016:

- Chairmaine McGregor from UWA, who used her AIG Postgraduate bursary award to help with the costs of attending the International Dyke Conference in Beijing.
- Shaun Anderson from QUT, who was awarded an AIG Honours Bursary.
- Jessica Godfrey from UWA, who was awarded an AIG Honours Bursary.
- Hugh Merrett from Adelaide University, who was awarded an AIG Honours Bursary.

The 2017 AIG Bursary Program will soon be underway. If you’re interested in becoming a sponsor of the Bursary Program please contact us - we would be very happy to hear from you.

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

Geoscience Student Bursary Program

**DIAMOND**

- **CHRIS BONWICK**
  Sponsoring the Bonwick – AIG Geoscience Student Bursaries
- **GEOFF DAVIS**
  Sponsoring the Davis – AIG Geoscience Student Bursaries.
- **MACQUARIE ARC CONFERENCE - GSNSW**
  Sponsoring the Macquarie Arc Conference – AIG Geoscience Student Bursaries
- **SYDNEY MINERAL EXPLORATION DISCUSSION GROUP (SMEG)**
  Sponsoring the SMEG – AIG Geoscience Student Bursaries
- **AIG NSW & WA STATE BRANCH**
  Sponsoring the AIG Geoscience Student Bursaries

**PLATINUM**

- **AIG STATE BRANCHES**
  Sponsoring AIG Geoscience Student Bursaries
- **ALEXANDER RESEARCH**
  Sponsoring the Jonathan Bell-Alexander Research – AIG Geoscience Student Bursary

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For more information on the Student Bursary Programme visit www.aig.org.au/education-training/student-bursary-programme
I would like to acknowledge and thank AIG for awarding me the postgraduate student bursary that allowed me to attend and present at the 7th International Dyke Conference (IDC7) in Beijing this year. This meeting occurs every five years and covers a wide range of aspects related to mafic dyke swarms and Large Igneous Provinces.

The title of my presentation was 'ID-TIMS U-Pb Geochronology of the Tayatea Dyke Swarm of Australia: Identifying Australia’s Nearest Neighbours in the Proterozoic' and was accepted in the theme 'The role of giant dyke swarms in reconstruction of supercontinents: progress, problems and potential'. I presented new geochronology of the Tayatea Dyke Swarm of Tasmania and constrained passive rifting margins in the Proterozoic. These precise ages allow for the matching of potentially adjacent cratons or their ‘nearest neighbours’ and assists in overall constraining the rifting of the supercontinent Rodinia. My project investigated the temporal differences between the distinctive geochemical groups of the Tayatea Dyke Swarm using the ID-TIMS analysis of Baddeleyites. My main findings were that the Western Tasmanian Terrane has had a distinct geological evolution in the Proterozoic compared to mainland Australia, and the potential ‘nearest neighbour’ was situated in Laurentia.

The main theme of the IDC7 was "Dyke Swarms: Keys to Paleogeographic Reconstruction" and focused on mafic dyke swarms and related igneous associations, such as sills, Kimberlites, syenites, carbonatites and volcanics. The IDC7 was organised by the State Key Laboratory of Lithospheric Evolution and the Institute of Geology and Geophysics of the Chinese Academy of Sciences. Overall the conference hosted approximately 200 participants and included several key note speakers, notably Henry C. Halls who founded the conference over 35 years ago.

The IDC7 hosted a wide range of dyke related topics ranging from their mapping, emplacement mechanisms, links to mineralisation, geochronology, paleomagnetism, paleo-continent reconstruction, oceanic dyke complexes, and dyke relations in terms of planetary bodies. The main findings of my presentation were well received at the conference and allowed me to present my new data and receive feedback from world-leading professionals. The IDC7 environment enabled myself to network with potential international ventures and has encouraged me to pursue further postgraduate studies in geology.

As my first conference and international presentation this experience was invaluable and beneficial to the development of my findings. Finally, I would like to again thank AIG for their support through their student bursary that enabled my attendance and presentation at the 7th International Dyke Conference in Beijing.
Update January 2017...

Future Understanding of Tectonics, Ores, Resources, Environment and Sustainability

4 - 7 June 2017
Rydges Townsville
South Townsville, Queensland, Australia

Confirmed Speakers

- Richard Sillitoe
- Larry Meinert
- Ross Large
- Bruce Gemmell
- Cornell de Ronde
- Roger Skirrow
- David Huston
- Vladimir Lisitsin
- David Giles
- Peter Betts
- Annette George
- Ravi Anand
- Dan Wood
- Doug Kirwin
- Antonio Arribas
- Roric Smith
- Jeremy Cook
- Yashushi Watanabe
- Jingwen Mao
- Steffen Hagemann
- Allan Collins
- Steven Micklethewaite
- Simon Richards
- John Walshe
- Rich Goldfarb
- Noel White
- David Cooke
- David Leach
- Jeremy Richards
- Steve Cox
- Joel Brugger
- Ross Cayley
- Richard Lilly
- Carsten Laukamp
- Jo Whelan

Workshops

- Skarn Deposits: Zhaoshan Chang, Larry Meinert
- Magma Fertility and Tectonic Settings of Porphyry-Epithermal Deposits: Jeremy Richards
- Structures in Epithermal Deposits: Nick Oliver, Julie Rowland, John McLellan
- Leapfrog Training: Aranz Geo (Leapfrog)

Field Trips

- Mt Carlton - Ravenswood - Pajingo (3 days)
- Mt Garnet - Chillagoe - Wolfram Camp (4 days)
- Mt Isa - Cloncurry (4 days)
- Fiji: Vatukoula/Emperor - Vuvatu - Namosi, 13-17 June, JCU SEG Student Chaper

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Email: FUTORES2@jcu.edu.au
Join the EGRU mailing list for regular updates: egru@jcu.edu.au
Two intrusions emplaced on Cape Upstart in north east Queensland have U-Pb and K-Ar age data suggesting emplacement during the Early Carboniferous and Middle Cretaceous respectively. Uncertainty over the dominant emplacement age on the Cape exists though as the K-Ar age from Upstart has been interpreted as reflecting thermal disturbance during the Whitsundays Silicic Large Igneous Province event. Regionally defined igneous events also show a trend from I-type to A-type magmatism over this period. Other examples of I-type to A-type transitions suggest a relationship of source but only over a short period, whether this relationship can be expanded over a greater period is not yet well understood.

The synthesis of field observations and U-Pb data unequivocally confirm that Cape Upstart was emplaced during the Middle Cretaceous at 104.6 ±1.7Ma. Interpretations of field evidence and petrological observations indicate that the Middle Cretaceous pluton was emplaced in a sub-volcanic environment, associated with a trapdoor caldera collapse. The Early Carboniferous rocks on the Cape represent country rock that has been stoped into the Middle Cretaceous pluton. The Middle Cretaceous rocks are principally diorites and leucogranites.

Two scales of I-A-type transitions were identified, from the Early Carboniferous to...
Middle Cretaceous, and within the Middle Cretaceous, the latter a reverse transition back to I-type. Both transitions are not tenable however as 1) No source relationship exists between Early Carboniferous and Middle Cretaceous intrusions, as zircon inheritance signatures, regional magmatic trends and scale of igneous events vary markedly between the intrusions. 2) A-I-type transitions are not possible without abrupt changes of source or tectonics, which is not evident within the rocks at Cape Upstart or regionally over this small window; 3) The Middle Cretaceous intrusion does not unambiguously classify as an A-type (sensu stricto). The two intrusions can therefore only be related over time, in space but not source.

The roles of magma mixing, fractional crystallisation and melt extraction from cumulates were explored as possible processes creating the diversity of compositions on the Cape. The process of fractional crystallisation and melt extraction from cumulates was ultimately favoured for the Middle Cretaceous rocks as; 1) Field evidence only supports mingling between diorites and leucogranites, not mixing; 2) Petrographic observations note cumulate textures within leucogranites and diorites; 3) Residual cumulate and extracted melt crystallisation support the step-wise changes in REE patterns in diorites and leucogranites; 4) Daly gaps, kinks, inflections and bows in variation diagrams can be sufficiently explained by residual cumulates and melt extractions; 5) Several minerals are observed to have fractionation trends; and 6) The concentration of some elements like Zr within residual cumulates can sufficiently explain anomalous A-I-type transitions observed.

The status of Cape Upstart as the northern most cretaceous pluton in the New England Orogen is safe. However, the implications of the age assignment have wider influence beyond confirming the emplacement age of Cape Upstart. Recognition of similar U-Pb age data in detrital zircons in Western Queensland, and southern off-shore basins, highlights that potentially Cape Upstart and other Middle Cretaceous plutons within the Bowen-Mackay region are potential roots to eroded eruptive centres, providing additional scope on the influence of the Whitsunday Silicic Large Igneous Province within the sedimentary record and address gaps in age data.
REALISE THE OPPORTUNITY

SCIENCE IN THE SURVEYS 2017

IMPEDEMENTS TO EXPLORATION SUCCESS: SOLUTIONS AND IMPLEMENTATION STRATEGIES

Come along and discover the outstanding science being conducted by Australia’s geological surveys, CSIRO, UNCOVER and the DET CRC.

This year’s event will be hosted by the Geological Survey of Victoria.

Take the opportunity to directly engage with senior government geoscientists. Learn how their teams are working to improve understanding of Australia’s geology, its mineral potential, and the exploration opportunities it presents.

Industry professionals, researchers, government, sector stakeholders and geoscience students are invited to attend.

Highlights include:

• Survey presentations on research programs from around Australia, including new exploration opportunities
• Geoscience Australia mineral program update
• An update and overview of the UNCOVER initiative
• Details of exploration incentive schemes
• Update from the Deep Exploration Technologies CRC
• Update on CSIRO mineral programs
• Special guest speakers

Further details, including program, will be advertised closer to the date at www.australiaminerals.gov.au

MELBOURNE

28 March 2017
9:00–17:00

Spring Street Conference Centre
Mezzanine Level, 1 Spring Street, Melbourne

Please enter off Flinders Lane

More information
Cameron Cairns,
Geological Survey of Victoria
E: cameron.cairns@ecodev.vic.gov.au
P: 03 9452 8972

Registration

There is no cost for attendance, however numbers are limited, so please register to attend

This will also help us with catering, room set up and name badges.

Sponsors

Supporters
A geophysical study utilising the method of magnetotellurics (MT) was carried out across southwestern Victoria, Australia, imaging the electrical resistivity structure of the lithosphere beneath the Delamerian and Lachlan Orogens. Broadband MT (0.001-1000 Hz) data were collected along a 160 km west-southwest to east-northeast transect adjacent to crustal seismic profiling. Phase tensor analyses from MT responses reveal a distinct change in electrical resistivity structure and continuation further southwards of the Glenelg and Grampians-Stavely geological zones defined by the Yarramyljup Fault, marking the western limit of exploration interest for the Stavely Copper Porphyries. The Stawell and Bendigo Zones also show change across the Moyston and Avoca faults, respectively. Results of 2D modelling reveal a more conductive lower crust (10-30 Ωm) and upper mantle beneath the Lachlan Orogen compared to the Delamerian Orogen. This significant resistivity gradient coincides with the Mortlake discontinuity and location of the Moyston fault. Broad-scale fluid alteration zones were observed through joint analysis with seismic profiling, leaving behind a signature of low-reflectivity, correlating to higher conductivities of the altered host rocks. Isotopic analysis of xenoliths from western Victoria reveal the lithospheric mantle has undergone discrete episodes of modal metasomatism. This may relate to near-surface Devonian granite intrusions constrained to the Lachlan Orogen where we attribute the mid to lower crustal conductivity anomaly (below the Stawell Zone) as fossil metasomatised ascent paths of these granitic melts. This conductivity enhancement may have served to overprint an already conductive lithosphere, enriched in hydrogen from subduction related processes during the Cambrian. A predominately reflective upper crust exhibits high resistivity owing to turbidite and metasedimentary rock sequences of the Lachlan Orogen, representative of low porosity and permeability. Conductive sediments of the Otway Basin have also been imaged down to 3 km depth southwest of Hamilton.

Hugh Merrett
University of Adelaide, 2016 AIG Honours Bursary Winner

Realise the Opportunity

Sponsors
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Science in the Surveys 2017

Impediments to Exploration Success: Solutions and Implementation Strategies

Come along and discover the outstanding science being conducted by Australia’s geological surveys, CSIRO, UNCOVER and the DET CRC. This year’s event will be hosted by the Geological Survey of Victoria. Take the opportunity to directly engage with senior government geoscientists. Learn how their teams are working to improve understanding of Australia’s geology, its mineral potential, and the exploration opportunities it presents.

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Melbourne
28 March 2017
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Please enter off Flinders Lane

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Geological Survey of Victoria
E: cameron.cairns@ecodev.vic.gov.au
P: 03 9452 8972

Registration
There is no cost for attendance, however numbers are limited, so please register to attend https://scienceinthesurveys2017.eventbrite.com.au
This will also help us with catering, room set up and name badges.
The red colouring of rocks is caused by small amounts of finely dispersed hematite. The aim of this research is to investigate the origin of the red pigment and its environmental significance in two representative Late Devonian fore-reef slope to toe-of-slope carbonate successions, from the Canning Basin, Western Australia. There are three major hypotheses for the origin of the red hematite pigmentation present in many Phanerozoic aged limestones; (i) detrital origin, derived from continental weathering; (ii) microbial origin, iron bacterial mediation at the time of sedimentation; and (iii) diagenetic origin in which hematite forms authigenically after deposition by the alteration of iron-bearing detrital grains. Geochemical, petrographic and SEM analysis of the red and buff limestones suggest that multiple controls influenced the accumulation of hematite. The iron contents are comparable between both the buff and red limestones suggesting that it is the mineralogical expression of iron, as hematite in the red limestones, that is responsible for the colour difference. The role of detrital input was evaluated using Ti/Al, K/Al, Zr/Al and Al/(Al+Fe+Mn) ratios. For the Famennian Dingo Gap section, iron was found to be controlled by the aluminosilicate fraction (r=95) and present in both the heavy mineral fraction and the clay fraction and, therefore, is interpreted as largely detrital in origin. At McIntyre Knolls the iron enrichment was found to be related to the excess iron fraction and therefore diagenetic. Iron was also supplied to the Frasnian McIntyre Knolls carbonate sediments by hydrothermal activity. The geochemical indices U/Th, Th/U, V/Cr, Ni/Co and V/(V+Ni) indicate different palaeo-redox conditions existed between the periods represented by the red and buff limestones and likely contributing to the colouration. Enrichment factors of redox sensitive elements (U, V) indicated that the red limestones were depleted, whereas the buff limestones are enriched, suggesting that the red limestones were deposited in an oxic depositional environment. Results suggest that the hematite present in the red limestones of the Canning Basin is both a detrital and an early diagenetic product with the red colour indicating oxidising conditions during deposition and early diagenesis in a marine environment.
In late 2016, a group of 30 energetic and passionate future leaders of the minerals industry travelled to Adelaide, South Australia to attend the inaugural National Exploration Uncover School (NExUS), an initiative funded by the Minerals Council of Australia. The NExUS Program is a three-week intensive mineral exploration summer school, co-ordinated by Graham Heinson and Richard Lilly at the University of Adelaide. The program aims to expose 3rd year undergraduates, honours students and recent graduates to the opportunities and challenges facing the exploration and mining industry as search areas move increasingly under cover. The tools and processes introduced by the program will be required by the next generation of explorers to address these problems in the hunt for the next Tier 1 mineral deposits. The course was designed and targeted to provide Australia’s most promising up-and-coming early career geologists with a head start in their careers within Australia’s crucial mineral exploration and mining sector.

The program was centred on addressing four of the key themes identified by the UNCOVER initiative as being the major knowledge areas to improve the success rate of Tier 1 and 2 mineral system discoveries, particularly under areas of cover. These themes included:

1. Characterising Australia’s cover – new techniques to confidently explore beneath cover.
2. Investigating Australia’s lithospheric architecture for mineral systems exploration.
3. Resolving the 4D geodynamic and metallogenic evolution of Australia to better predict the origins and evolution of ore deposits.
4. Characterising and detecting the distal footprints of ore deposits through the utilisation of a tool kit for minerals exploration.

Above: Figure 1. NExUS officially kicked off with a welcome event at the final evening session of the third test between Australia v’s South Africa at the Adelaide Oval. Welcome to Adelaide!
Participants were selected from every state and territory of Australia with 13 different universities being represented. The group also represented diverse backgrounds and previous experience including early career geoscientists from state geological surveys, Geoscience Australia, and students with prior experience in mining and mineral exploration. The common thread for all participants was a strong and demonstrated passion and enthusiasm for geology and a willingness to learn at every opportunity.

The first week of the NExUS program was hosted at the state of the art South Australia Drill Core Reference Library at Tonsley, SA, with presentations from senior industry representatives including Gavin Lind (MCA), Robbie Rowe (NextGen/UNCOVER), Steve Hill (GSSA), Stephan Thiel (GSSA), Carmen Krapf (GSSA), Malcolm Sheard (GSSA), Ross Cayley (GSV), Jon Huntington (CSIRO), Ravi Anand (CSIRO).

Figure 2. A) Week one was hosted by the Geological Survey of South Australia (GSSA) at the state of the art South Australia Drill Core Reference Library at Tonsley, SA. B) NExUS students working on interpreting hyperspectral data of drill cores in a HyLogger workshop coordinated by Adrian Fabris (GSSA), Alan Mauger (GSSA) and Jon Huntington (CSIRO). C) Networking opportunities were provided with senior industry geoscientists each day. D) NExUS students receiving instruction of appropriate regolith sampling techniques by Ravi Anand (CSIRO).

HECTOR PROSPECT
Murchison Region W.A.

OUTCROP GEOLOGY
- Acid Volcanics - and differentiated, including some quartz-sericite schists
- Dolerite and Gabbro - re-cells
- Banded Iron Formation - quartz-magnetite with silicate and/or carbonate

SOLID GEOLOGICAL INTERPRETATION
from detail Airborne Magnetic and Radiometric Survey (2006)
- Acid and intermediate volcanics, incl. sulphide-chert units
- Unconformities and unconformity-bounded units
- Acid volcanics, mainly dolerite and gabbro, includes mag units that may be minor BIFs, cherts or basaltic layers
- BIF: intervals dominated by major, continuous BIF units
- Felsic igneous package, mainly dolerite and gabbro, includes mag units that may be minor BIFs, cherts or basaltic layers
- Sedimentary package including greywacke, siltstone, shale, less black shale chert, tuff, dolerite BIF
- Acid and intermediate volcanics, incl. sulphide-chert units

The prospect, first defined in the early 1990’s by Guardian Resources, has been significantly upgraded by recent exploration activity. A ground search for outcropping ‘BIF’ over extensive colluvial covered areas, successfully identified a small siliceous breccia o/c which returned assays of 3.4g/t and 1.96g/t Au, and a revised interpretation of newly acquired detailed aeromagnetic data confirmed and enhanced the target zone.

Hector lies within the Weld Range, 60km NW of Cue. The two ELs cover a sequence of interbedded BIF units, cherts and basalt, intruded by dolerite-gabbro, with extensive sequences of sediments and felsic volcanics to the NW, and sediments and mafics to the SE. The Weld Range is metamorphosed to greenschist facies. Past explorers have sought gold mineralisation at Ryansville, Ulysses and Ulysses East amongst others, and routinely commented on the large scale 1km offset at Hector, but did not drill test the key area north of the Ulysses Shear. The multiple NNWly trending structures suggest good widths of brecciation of richly ferruginous host. This remains the stand out target in the area.

The Tenement Holders are seeking Expressions of Interest in developing the prospect. Please contact John Cooke at john.cooke@chironex.com.au
Workshops included regolith characterisation and mapping interpretations, a HyLogger hyperspectral data workshop, core logging and 3D visualisation of the South Australian geology database and geochemical dispersion in regolith. During the evenings, chances for networking were abundant with senior industry professionals flying in specially to meet with and share career tips with of the NExUS students. Industry representatives came from many organisations including BHP Billiton (Laura Tyler, Kathy Ehrig and Jamie King), Newmont (Philippa Siwwright), Heathgate Resources (Nima Sherpa), AIG (Kaylene Camuti), Olympus (Aaron Baensch) and Investigator Resources (John Anderson). A reoccurring theme when these senior professionals were asked about the future role of geologists is the move towards interpretation and compilation of multiple historic and modern data sets. The first week of NExUS concluded by attending the South Australian Explorers Conference (SA EMC) where students continued to build their networks and learn about the existing and future opportunities of the minerals industry in South Australia.

After gaining the theoretical knowledge in the classroom and at hand-sample scale, during the second week students went exploring in the Adelaide Hills. Hillgrove Resources supported the program by providing ground access and data resources to one of their exploration tenures in the area. Participants carried out detailed mapping and practiced acquiring ground based geophysical data (including magnetics, gravity, magnetotellurics (MT), induced polarisation (IP) and Nano TEM) across the historical Wheal Ellen Cu (Zn-Pb) deposit. Soil geochemistry and an awareness of the different approaches for regolith sampling were also on the agenda for the students. During the evenings students processed the geophysical data acquired in the field. Soil samples were analysed with a pXRF, followed by creation of thermatic geochemical dispersion maps of the results using GIS software. Data was then collated which allowed students to determine potential further exploration targets. Hillgrove Resources also provided the opportunity to visit the Kanmantoo Cu Mine and kindly laid out grade control drill core for the NExUS students to log and practice their mineral identification skills. To conclude Week Two, students were privileged to gain exclusive access and a tour of the Deep Exploration Technologies Collaborative Research Centre’s (DET CRC) prototype coiled tube drill rig and Lab-at-Rig at their Brukunga facility by David Giles (UniSA).

For the final week, NExUS headed for the historic ‘Copper Coast’ of the Yorke Peninsula, SA. The focus for the start of the week was identification of ore and gangue minerals, hydrothermal alteration and breccia textures and mineral paragenesis. Building from the skills gained over the past two weeks, students were again provided with a practical learning exercise of logging and interpreting the mineral paragenesis of exploration drill core with senior geologist Craig Went at REX Minerals Hillside Cu deposit, which was discovered under alluvial cover. Steve Hill (Director of GSSA) provided a one day field-based workshop on biogeochemistry and regolith, explaining the potential for exploration companies to use vegetation to better define targets before moving in with a drill rig. He also encouraged students to accurately describe the regolith and the importance of understanding it as well as
possible to ensure exploration activities, such as soil sampling, are conducted as effectively as possible. As the end of the three week course was fast approaching, the program moved from exploration into resource estimation and project feasibility. Students were introduced by Gavin Springbett (G&S Resources) to 3D ore body modelling in Vulcan and the process of resource and reserve calculations in accordance with the JORC Code. This process took the NExUS course full circle from conceptual exploration models to highlighting the importance of detailed reporting and ore body modelling.

On the final night students were given the opportunity to reflect and share what they learned during the 3 week course and to thank one another for their friendship, encouragement and teamwork during the course. The professionalism and comradery between all the NExUS students was observed by all involved and commented on by industry professionals throughout the program, with some saying that they are happy to leave the mineral exploration industry in the hands of such talented individuals.

The NExUS program was conceived and developed by Professor Graham Heinson and Dr. Richard Lilly at the University of Adelaide. NExUS participants would like to thank Graham and Richard, the Minerals Council of Australia for the financial support and everyone who took part in and supported the program for pushing the boundaries and looking for alternative ways to develop the skillset of the next generation of geoscientists with leading edge technologies and techniques. NExUS is a prestigious and exceptional master class which is gaining momentum in both academia and industry across the country and is also gaining international attention.

"NExUS is a prestigious and exceptional master class which is gaining momentum in both academia and industry across the country and is also gaining international attention."

Figure 4. NExUS students at their final field location of the 2016 NExUS Program. The background represents coastal exposures of the regolith that characterises majority of the cover sequences overlying the mineralised basement rocks through the Yorke Peninsula.

2016 National Exploration Undercover School Attendees

- Courtney Anders (UniMelb)
- Christopher Doran (UniWollongong)
- Jack Maughan (UoFA)
- Warrick Tunmer (Curtin)
- William Bardwell (ANU)
- Anna Edgar (Dacian Gold Ltd)
- Genna McDonagh (New Hope Group)
- Leavania Vignesvaran (UWA)
- Charlotte Barry (GS-NSW)
- Lachlan Furness (UoFA)
- Martin Nguyen (Monash)
- Edwina Walker (Federation Uni)
- Tegan Beveridge (JCU)
- Lachlan Hallett (NT GeolSurv)
- Verity Normington (NT GeolSurv)
- Justin Ward (UQ-RioTinto)
- Tobin Bischoff (JCU)
- Lauren Harrington (Uni Syd)
- Craig Pereira (UQ)
- Bradley Williams (GS-NSW)
- Stefanie Cesile (UTAS)
- Stephanie Hawkins (Macquarie)
- Kurt Steffens (JCU)
- Georgia Wulf-Rhodes (UTAS)
- Natasha Chilekwa (Curtin)
- Jeremy Lee (Uni Melb)
- Ava Stephens (UoFA)
- Allison Cooke (Monash)
- Chris Lewis (GA)
- Amy (Yu-ting) Tao (UWA)

Demonstrators:
Christine Thompson, Luke MacKay, Georgie Stewart (UoFA, Flinders)
Some of the direct feedback from the participants included:

“NExUS provided the opportunity to diversify my skillset and learn new techniques particularly in regolith and mineral exploration. As our mining industry changes we need to be on the lookout for ways to be more efficient and effective with our exploration techniques particularly those undercover. The knowledge on tap was phenomenal over the three weeks thank you to everyone that stopped in to share their story.”

– Genna McDonagh, AIG National Graduate Group.

“The opportunity to learn from some of Australia’s leaders in the Earth Sciences and from fellow NExUS attendees was invaluable. The diversity of experiences and material was inspiring as were the industry professionals who came to speak with us.”

– Allison Cooke, Monash Honours Graduate.

“The NExUS program provided me with exposure to new technology and exploration techniques that have the potential to be game changers when exploring undercover. I am extremely grateful for the opportunity to attend this program where I have been able learn the exploration process from successful exploration geologists and also diversify my skillset. This program provided me with the space to network and become good friends with some of the top young geologists in the country. We all hope to make a positive input to the mineral exploration and mining industry in the future.”

– Craig Pereira, AIG National Graduate Group.

Applications for NExUS 2017 will open soon and it is hoped that NExUS will become a firm feature on the Australian geoscience landscape, helping to train some of the best and most enthusiastic young mining industry professionals. For more information on NExUS please visit the website: www.nexus.org.au or email: nexus@nexus.org.au.

SAVE THE DATE!

AEGC2018 FIRST AUSTRALASIAN EXPLORATION GEOSCIENCE CONFERENCE

18-21 FEBRUARY 2018 | SYDNEY AUSTRALIA

EXPLORATION • INNOVATION • INTEGRATION
Field work is a cornerstone of geological education programs. Nothing can fully replace the tactile experience of holding and manipulating an object or the insight gained by exploring, touching and documenting a field site. However, it is not possible to expose students to a fully comprehensive range of field experiences.

Significant localities are widely dispersed and important sites are often situated in inaccessible or dangerous locations where student visits are not practical. In addition, financial, safety, legislative and logistic issues also impact on geological field programs.

The AusGeol virtual geological resources have been developed to address these issues and to augment, but not replace, conventional field based Earth Science programs.

The Virtual Library of Australia's Geology delivers free, downloadable visualisations of geological features as 3D photo-realistic models, full spherical panoramas, 'gigapixel' images and virtual tours. The virtual library provides a diverse selection of well-documented examples of important geological features to assist in the development of student geological field skills.

Recent technology and software developments facilitate rapid and cost effective generation of a range of photorealistic virtual geological objects that are distributed through the AusGeol website http://www.ausgeol.org/. These objects provide more intuitive and immersive depictions of geological outcrops than can be provided by conventional photography.

The intention of the AusGeol program is to document a representative selection of Australia's geological heritage and develop educational resources to accompany these visualisations.

The AusGeol program is funded by an Innovation and Development Grant from the Australian Government Office for Learning and Teaching with additional contributions from Australian universities, government geoscience agencies and TESEP.

The Teacher Earth Science Education Programme (TESEP) has been working collaboratively with the AusGeol project (www.ausgeol.org) to provide digital geological teaching and learning resources and in particular to develop a database of paleontological specimens.
Some examples of 3D visualisations of a range of fossils can be found at: https://sketchfab.com/MichaelRoach/collections/tasmanian-fossils

A collection of trilobites that can be viewed in 3D from both Australian and international localities can be found at: https://sketchfab.com/MichaelRoach/collections/trilobites

Commencing in 2017, TESEP will be presenting workshops to enable teachers to confidently use and incorporate the resources available from the AusGeol project into their geological teaching programmes.

"Significant localities are widely dispersed and important sites are often situated in inaccessible or dangerous locations where student visits are not practical."
On behalf of the Conference Organising Committee, we would like to invite you to attend the First Australasian Exploration Geoscience Conference in Sydney, to be held from February 18-21, 2018. The event will be jointly hosted by ASEG, PESA and AIG.

The theme of the meeting is Exploration, Innovation and Integration.

The Conference will also incorporate the Eastern Australia Basins Symposium normally managed by PESA and the rolling 18 months Conference of ASEG and will be home to the highest quality technical program and Exhibition that members will have grown accustomed to from our three organisations.

Discover Sydney, Australia’s famous harbour city and capital of New South Wales. Plan your Sydney visit with beautiful sundrenched beaches and much more.

See you in Sydney in 2018!

Max Williamson and Mark Lackie (Co-Chairs)
Welcome Moruya Tonalite
As part of National Earth Science Week celebrations in October, an inauguration ceremony was held at the National Rock Garden to welcome an impressive 10-tonne block of Moruya Tonalite. This iconic granite was used in a number of important structures in Sydney, including the base of the Captain Cook statue in Hyde Park, the columns of the GPO, St Mary’s Cathedral and the pylons of the Sydney Harbour Bridge. The ceremony included a welcome to country by Agnes Shea OAM, senior elder of the Ngunnawal Traditional Owners and speeches from Malcolm Snow (Chief Executive, National Capital Authority) and Liz Innes (Mayor, Eurobodalla Shire Council).

Progress on the Education Pavilion
The next major step in developing the NRG will be construction of the Education Pavilion. As previously reported architects Tonkin Zulaikha Greer (TZG) were commissioned to prepare plans and a detailed cost breakdown on the works program for the cut and fill excavation for the pavilion, outdoor rock gallery and amphitheatre, as well as construction of the pavilion itself. This planning has now been completed with the aid of a grant from the Australian Geoscience Council and provides the first reliable indication of the cost of major elements of the NRG. The total cost of these Stage 1 works is estimated to be $4.1M, of which $2.3M is for construction of the pavilion. This does not include the cost of procuring, delivering and preparing the NRG rock specimens.

To date, steady progress has been made on developing the NRG, but the next stages of the vision will require significant funding. 2017 will be a critical year for establishing and building sponsorship.

When you come to Canberra don’t forget to check out the National Rock Garden, down the hill from the National Arboretum at the western end of Lake Burley Griffin, near Yarramundi Reach.
In 2016, with great support of many friends, colleagues and institutions, HiSeis organised PencilRaising – a project which aims to improve the quality of the education by donating school material for the region where we are doing our business. At the beginning, we couldn’t imagine how much momentum this project would get. We started off with a few pencils and notebooks, and ended up with four suitcases of equipment. The generous donations of the community, not only friends but also colleagues and institutions from Australia, resulted in us carrying over 5000 pencils, 400 notebooks and other school material such as chalk, erasers, sharpeners, rulers, etc. Half of this material came from Orana primary school in Perth where a number of students have pledged to make a difference in their world by forming a Mini Vinnies group based on the ideals of the St Vincent de Paul Society: ‘Although their hands are small, they realise together they can make positive, incremental changes to the lives of others.’

In order to get the all the donated school material to Geita, it must travel between two continents, taking three flights and then a 5 hour drive and ferry ride through Tanzania’s outback. The equipment was divided among our small crew and with some luck on our side, we managed to get everything to the mining camp. The second mission was to organise a visit to the community and school during our already tight survey schedule. We had a full support of our client, but often things do not go as planned. By the time community gave us permission to visit the schools, I had already left the site. Luckily, my colleagues found the time, and together with local geologists and community representatives, visited two schools in the Geita region. Some of their experiences are shared opposite.

Robert Martin:
“It was an amazing feeling to visit the remote schools in Tanzania. The conditions at these schools were nothing like I had ever seen before. There were very limited facilities; it appeared that there were no books, no pens and none of the educational materials that we are accustomed to, just some chalk and a blackboard. As we arrived at the school, we visited the principal first and explained what we were doing. At each school, the principal was so grateful and pleased with our generosity they often seemed lost for words (we couldn’t understand them anyway), but the translation was that it would have an amazing positive impact on the students. After we went through the donated equipment, a bunch of students came in to take out the schools supplies and present them to the rest of the school. We were told this was a way of being accountable to all...
the students so everyone knew what was equipment was there and what was to share. The entire school came out to the yard for the presentation. There was a gratitude demonstration (of sorts) by the students and the principal, which was incredibly moving. To see these children with next to nothing receive such a small token of donation from us was something truly special to witness. I would like to thank to all involved in organising the PencilRaising, and to those that donated, and wish you could have all been there to witness the happiness of these underprivileged children. It really goes to show how lucky we are in this country and to never take any of our luxuries (such as education) for granted’.

Many thanks to Orana Catholic Primary school, Australian Institute of Geoscientists, CSA, The Awkwardstra and my company (HiSeis) for supporting PencilRaising. Also, a big thanks to all of you who sent the material (signed or anonymous parcels).
Geo Tourism

Report on Geotourism Developments in Australia

Mike Freeman
AIG representative on the Geological Society of Australia’s Geotourism standing committee

This is being compiled by me as the recently-appointed AIG link to the Geotourism Standing Committee of the Geological Society of Australia (GSA). This Standing Committee, which evolved from a Sub-Committee of the Standing Committee for Geological Heritage established in 2011, is chaired by Angus M Robinson, a very capable coordinator and motivated supporter of the endeavour of getting geology into the public arena.

Firstly, have you heard of geotourism and appreciate its scope and implications? To quote the GSA ‘Geotourism is tourism which focuses on an area’s geology and landscape as the basis for providing visitor engagement, learning and enjoyment’. It focuses on such things as geoparks and geotrails.

There have been concerns over a number of years about geoscience being ignored or not being taken seriously in high-level government decision-making processes. For example the diminution of geology in high-school teaching has been of concern to many of us over the years. If we can get better exposure of the science within the broader community, then perhaps it will be better recognised for the values and importance for the benefits it can bring to the community. After all, geology is one of the two most fundamental environmental sciences.

In recent times, a number of initiatives have been embarked upon through Australia to develop an interest within the tourist market. Various local groups are starting to get up a bit of a head of steam to bring geology more to the fore in their local areas with initiatives under the umbrella term of geotourism. The Standing Committee is there to support, foster and encourage these groups as well as lobbying high-level decision-makers to note geotourist ventures and potentially secure a more positive approach to funding of them.

Here in Western Australia funding has been obtained to look at the concept of a Murchison geotrail, conceptually between Yalgoo and Wiluna. The seed funding will examine the concept and determine direction under the auspices of the Midwest Development Commission.

Central Australia has not been left out with development of the concept of the Red Centre Georail, focusing on Uluru (Ayers Rock) and Katajuta (The Olgas) but including the Mereenie Loop via Kings Canyon to pick up Larapinta Drive and all the marvellous and geologically fascinating gaps and gorges along the western MacDonnell Ranges.
Tasmania features with an initiative to develop a West Coast Geotrail that has the theme “landscape-forming processes of the Living Earth”.

The Standing Committee has been informed that both Etheridge Shire (Far North Queensland) and the three Councils of Warrumbungle, Coonamble and Gilgandra in north-western NSW have set up steering committees for their Pre-Aspiring UNESCO Global Geopark projects with the aim of lodging formal nominations in October/November this year. The Etheridge Shire Council has strongly supported the Savannah Way project to develop a geotrail across the north, from Townsville to Broome! While taking in a range of mining centres, it will have a very significant focus on the Undara lava tubes.

These are large-scale developments for geotourism. But what about smaller sites? A group at Kalgoorlie is looking to develop a smaller scale geotrail to coincide with the centre’s 150th anniversary. And nearby the Shire of Leonora is looking at developing a local geotrail. There are probably more local initiatives as the nature of the concept spreads amongst tourism-related entities.

Anyway, I would like to hear from any members who have any local knowledge of geotourism initiatives in their local areas, or that you think the Geotourism Standing Committee should be and may not be aware of to keep up-to-date on them and possibly to assist or encourage the developments. Your help, please, by E-mail to me at mike.j.freeman@bigpond.com would be appreciated.
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The Australasian Mining History Association

Ken McQueen, President AMHA

The Australasian Mining History Association is a not for profit organisation formed in 1995 to foster the exchange of information about our extensive and fascinating mining past. Membership is open to anyone who has an interest in mining history and its various related aspects. Currently the AMHA has 210 members, who meet regularly at the annual Australasian Mining History Conference, generally in an historic or current mining centre, complete with field trips. The very successful 2016 conference was held in Cobar, NSW and other conferences have been held in most of Australia’s well known mining districts and in New Zealand.

The Association has also held joint meetings with other organisations, including the International Mining History Association and the Australian Historical Association. The AMHA publishes the Journal of Australasian Mining History and a quarterly newsletter. Membership rates are very reasonable at $35 p.a., including the Journal.

Are you interested in the history of: mining, mining engineering, metallurgy, mineral economics, mineral deposits or mining heritage?

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Contact: Mel Davies Economics, Business School, M251, University of Western Australia, Crawley, WA. 6009

Members of the AMHA at the historic Mt Boppy gold mine during the 2016 Cobar conference. Photo by Ken McQueen.

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AIG NEWS Issue 127 - March 2017
Another exceptional year for AIG Mentoring in WA

Sophie Hancock, 2016 WA Mentoring Program Manager
Esther Harris
2017 WA Mentoring Program Manager
Heidi Pass
AIG National Mentoring Chair

For the second year, AIG has run a highly successful face to face Mentoring Program in WA through 2016 which has drawn positive ratings from its mentor and mentee participants and program sponsors alike.

Dr Sophie Hancock the 2016 WA Mentoring Program Manager and her committee would like to thank our generous sponsors who have enabled such a positive educational and community activity, including S2 Resources, Ranger Drilling, Iluka Resources, AIG WA State Committee, AIG NGC Committee, and Reflex. We acknowledge Gnomic Resources a National AIG Mentoring sponsor also.

The benefits of one to one mentoring are anticipated to be long lasting and several of our cohort plan to keep up regular meetings with their mentor/mentee beyond the formal conclusion of the 2016 Program. But you don’t have to take our word for how good the mentoring experience was! On the day feedback at program events and an online feedback survey showed that the majority of respondents agreed or strongly agreed that they had a quality relationship with their mentee/mentor. Further with a high indicated reapplication rate amongst our superstar mentors you can expect more of the same in 2017. Overall group satisfaction demonstrates
the value of being well-matched to a mentee/mentor who can trust and confide in each other to explore their career problems and opportunities. This is so important as it is not until a sympathetic ear is reached that progress can begin – so we placed great importance on our matching process, and we were very happy to see that many pairs hit it off straight away. Learning from situational sharing from personal experience from inspirational mentors really helps our mentees progress. We value the time and energy our fabulous mentors put into making this program a success and want to acknowledge their pivotal role again here; some very special mentors supported two mentees this year.

Most mentoring pairs host five private mentoring sessions through the five-month program, on top of the four formal program events held in Perth. Some major topics of conversation to our mentees across the program included:

1. Goal identification and setting support
2. Career guidance and opportunity identification pointers
3. Networking opportunities
4. CV proofing, preparing for job/education transitions, and funding applications
5. Career planning for success in a downturn

Dr Hancock noted that all mentor respondents reflected that they had personally gained something and grown as a result of participating in this program, in a process of “reverse mentoring”, as well as the feel-good satisfaction of giving back to our geoscience community, and watching a young geoscientist develop their skills and confidence. Further several mentors commented on their satisfaction in involvement in a consistently professional and high quality mentoring program, and planned to sign up for a third time building on the positive feedback received from the inaugural program in 2015 and again in 2016.

On the part of the mentees, we have also had great engagement and have been thoroughly impressed by the calibre of young geoscientists in our community. Some of our mentees are currently contracting in less than perfect roles due to a difficult jobs market, and have commented that being part of such a geoscience community has inspired them to stick at it and look for further opportunity. A number of mentees were able to secure employment supported by the mentoring process, some gaining international postings that sound very exciting. We are thrilled to know that the scheme has supported the development and aspiration of 38 future industry leaders.

"Full house for the Kick Off Mentor Program Compulsory Training and Objective Setting Session."

Keynote on personal and company success building from sponsor Mark Bennett, CEO of S2R our Sponsor.

Insider Tips from a returning 2015 mentor Meghan Ritchie from Iluka Resources and 2015 mentee and 2016 mentoring program committee member Shane Culwell from Curtin University.
Mentoring Program in WA

Formal Program Events in 2016

Pictures tell a thousand words so they say, and mentoring is about relationships not reports, so a season summary in AIG news is always going to fall short of conveying what a wonderful experience being part of the mentoring cohort is – so please take time to look through some selected event photos which tell the story of 2016 WA mentoring better than I can hope to do here.

Since many of our cohort have not participated in any formal mentoring experience before, our Kick Off event provides a high-level briefing for expectations, ground rules, and tips for maximising the benefits of a mentoring relationship. We were very lucky to secure a glamorous venue to begin our mentoring journey in the heart of Perth at Perth Concert Hall – a fitting venue to help elevate the aspirations of all involved.

Our keynote speaker at the kick off was Mark Bennett from S2R (see photos) who told us about his struggles to get a job early in his career, and on the flip side how he made a significant discovery and sold it for $1.8 billion. Dinner and drinks concluded a high-energy event with the cohort formally inducted to the program upon submission of their signed objectives sheets. Mentors were also invited to a bespoke mentor only training with tapas to refresh on essential soft skills like constructive feedback, listening and questioning run by Tim Craske on behalf of the program.

Half way through the program we reconnected our WA cohort with a more light-hearted networking session known as the Mid Term Social hosted in Subiaco. Here we invited another sponsor, Ranger Drilling to present a topic to our mentees as some of them reach work-readiness. The personal presentation by Stuart Baird, HSEC manager enhanced the program content and helped deliver some lessons from the field before the games and shared plates of food arrived. Finding out who licks rocks, spits on rocks, or does both was a hoot, and prizes were given for several networking challenges. The Midterm event was also the opportunity for the mentoring committee to announce the Discovery Day prize winners – please see the other AIG news article.

The Discovery Day was a money can’t buy experience for 10 of our lucky mentees to visit S2R and meet Mark Bennett’s discovery team, and to learn how to interact with senior technical and commercial staff – in the board room, in business development discussions, learning how fundraising works, and working through regional and camp scale targeting from first principals in geoscience to explore for minerals. We wound down for the afternoon on the terrace outside the office watching the sun set over the Indian Ocean, raising a beer in toast to the future discoveries we hope to motivate.

The formal closing ceremony was hosted in Floreat, with a very personal set of lessons shared by three diverse speakers who managed to inspire both our mentors...
Mentoring Program in WA

as well as the mentees with their resilience, reinvention, and realness. We thank Dr Steve Beresford of CET, Miriam Stanborough of Iluka Resources, and Drew Bellamy of Autotec for their entertaining words of wisdom.

Following the program presentations, my final responsibility and privilege as WA Mentoring Program Manager was to present certificates of thanks to the mentors who volunteer their time and energy, and to the sponsors whose funding and support makes the program possible. As the Final event evening continued, program participants took the opportunity to network and judging by the level of buzz around the room and business card swapping, new links were forged all round. At every stage this is the program that keeps on giving.

Looking Forward to 2017

AIG is currently planning its 2017 Mentoring Program and there are several associated opportunities being advanced as listed including roles:

- to become state champions spearheading parallel mentoring programs in currently non-active states;
- to join the national mentoring subcommittee to help us transition and mature our national vision for mentoring within AIG over the next few years at federal level;

Please contact Dr Heidi Pass, National Chair - AIG Mentoring Subcommittee via aigmentoringprogram-nationalchair@aig.org.au for further details on these opportunities.

Stuart Baird HSEC Manager for Ranger Drilling shares the personal side of what safety means in their company.

Icebreaker games at the Midterm Social - geologists self group into lickers, spitters and both.

Midterm Social catch up half way through drilling season.

Icebreaker games at the Midterm Social - geologists self group into lickers, spitters and both.
Specifically within WA, preparations are underway for our third mentoring season in 2017 with sponsorship arrangements and event planning being advanced. Mentee applications are expected to open in early April and will remain open until early/mid-May prior to program launch in May.

Lastly, we hope to run additional special programs as part of the 2017 WA mentoring program offering our mentees some money-can’t-buy opportunities to engage with explorationists as part of their industry networking and career planning experience to match the development offered in our Discovery Day this year. Any companies or individuals interested in supporting our 2017 program in WA as sponsors or for involvement in other associated special events should contact Esther Harris and Sophie Hancock at aigmentoringprogram-wa@aig.org.au. Thanks for helping build our successes and wider community – it is vital we keep growing and having fun doing it!
As mentoring continues to mature in AIG, the WA Mentoring committee delivered their second annual mentoring program during 2016. Within the WA program 38 mentees worked towards their personal career objectives supported by 24 mentors over 5 months. Within this, a special essay competition was run for 2016 WA mentees only – as a special program event supported by one of our sponsors, S2 Resources.

Ten mini essay winners were selected from our 2016 WA mentee cohort, based on a 250 word submission answering the question “What will successful exploration in the future look like?” Three judges selected the 10 lucky winners, evaluating submissions for originality and maturity with credit also given where mini essays reflected aspects of the cornerstones of exploration – people, fieldwork, data and technology.

The two part prize comprised of publication here in AIG news plus a special invitation only event at the S2R offices in Scarborough, WA. The Discovery Day was hosted by Mark Bennett and the S2R team was held on October 13th and included technical sessions and a networking sundowner overlooking the beach. It was wonderful to participate with company geoscientists on a range of important topics including business development, financing exploration in companies, regional geology and geophysics, and camp to deposit scale targeting.

Sophie Hancock, 2016 WA Mentoring Program Manager
Esther Harris, 2017 WA Mentoring Program Manager
Heidi Pass, AIG National Mentoring Chair
Mentees were very engaged and asked lots of perceptive questions, fielded by the S2R team who were very generous with their knowledge. We hope you enjoy reading the creative and varied submissions!

Three of the ten mini essays were selected for special commendation: congratulations to

- Georgia Wulf-Rhodes
- Ben Walsh
- Liam Oliver

The other winning essays were from

- Andrew Cawley
- Adam Oehlman
- Anthony Benn
- Al Harvey
- Jack Adams*
- WeiMin Jin
- Daniel Doran
- Elliot Kahn

*Jack’s submission also acknowledged his peer Haydn White’s contribution to discussions of exploration philosophy.

We hope to run additional special programs as part of the 2017 WA mentoring program offering our mentees some money-can’t-buy opportunities to engage with explorationists as part of their industry networking and career planning experience. Any companies interested in supporting our 2017 program as sponsors or for involvement in other associated special events should contact Esther Harris and Sophie Hancock at aimentoringprogram-wa@aig.org.au
AIG Mentoring Program - 2016 Mini Essay Competition – Top 3

“What will successful exploration in the future look like?”

Georgia Wulf-Rhodes, UTAS
Gradually the hunt for a mineralised prize is increasing in difficulty, leading to successful exploration moving to different corners of the Earth and solar system. Unexplored areas are set in more challenging locations, ignored previously by explorers who ‘cherry-picked’ deposits within rich continental crust. Several stages of geological investigation will still be required in the future, however the exploration geoscientist will become more persistent, resilient and adaptable as they spend more time in the field and working in unfamiliar environments.

Leaders of exploration teams will be required to guide their colleagues like never before. Thinking ‘outside the-box’ and encouraging positive team morale as drill programs come back with unsatisfactory results. Pressure will be felt as announcements generate restlessness amongst shareholders. Collaboration, determination and internal support will move the exploration team forward. Successfully discovering new mineral resources will become more rewarding as the probability of finding undiscovered deposits decreases.

Geological knowledge of ore genesis and mineral occurrence and assemblages will increase in importance. The geoscientist, with skills encompassing geology, with modern geochemical and geophysical tools and knowledge will piece together information to determine whether a location holds the prize. Superior tools will have to be utilised to map the deposit at depth in more detail to evaluate grade and tonnage. Advanced interpretation and imagination will be embraced as low-cost, low-precision drilling techniques are used to cover more ground to save valuable financial resources.

The prize will become more precious as the geoscientist adapts and moves forward with the challenges future exploration brings.

Ben Walsh, Cameco Australia
Future success in exploration will look a lot like it does today. In a world of dwindling near surface, tier-one discoveries, opportunity identification will reward visionary explorers with the ability to overcome current exploration presumptions and shortcomings. Opportunities will exist in many facets of mineral exploration. An obvious example is deep drilling. Taking a risk by drilling one thousand vertical meters will only ever be overcome by an active and uncompromising understanding of the opportunities that lie at depth.

Recent history tells us that opportunities exist in open source data. A number of recent significant deposits were ultimately realised by analysis of free historic and public surficial geochemical data. How many more minable mineral deposits lie unrealised in digital data centres?

Future success will lie in the ability of geologists to challenge current model-type paradigms. Some of history’s most significant discoveries were made by unearthing unexpected rock types, alteration and mineralisation. It will take vision, knowledge and guts to positively shift the tides of current exploration paradigms.

Finally, future exploration success will be brightest during downturns. Taking advantage of long term economics over short-sighted shareholder desires will lead to optimal exploration and increased discovery frequency.

In short, Future success will come to those who walk the left-hand path, and those who recognise opportunity through a sea of risk.

Liam Oliver, Curtin University
Exploration is a particularly exciting aspect of mine development. The potential for discovering something completely new and untouched can be both exhilarating and an incredible driving force. The explorers of old; Christopher Columbus and Marco Polo were able to channel this force into enabling the identification and documentation of the unknown. Exploration teams today operate on this same fuel – managing the personal and financial risk of businesses in the hope of finding the next big thing.

In the past, successful mining exploration has been achieved by teams of diligent, likeminded individuals working as one to achieve something great. Time and time again, this has been proven, with more recent examples consisting of discoveries such as the Tropicana Gold Mine and the Nova and Bollinger Nickel Deposits.

When looking towards the future; it is important to consider and learn from our past. As such, history shows that there is simply no substitute for that brilliant blend of strong teamwork and an indomitable, zealous spirit. However, as more discoveries are made and we are required to look harder and dig deeper – the development and implementation of new technologies that tackle this problem is of utmost importance.

The future of exploration looks promising, though not much different from the present. Passionate, hardworking crews of men and women will continue to achieve the most favourable of outcomes. Though, it is my belief that the companies whom decide to arm themselves with technology will reap the rewards and make the greatest of discoveries yet to be made.
Andrew Cawley, Curtin University

Advances in technology are continually improving the way businesses operate and the efficiency at which they can complete their objectives. This essay will examine the statement "What will successful exploration in the future look like" and how the advances in technology will shape successful exploration.

In relation to the mining industry developments in technology have changed how we explore and extract mineral but many of the locations have remained the same. The next frontier for mining could be far from land based exploration. Space is becoming more accessible with privately owned companies recently appearing making space the next frontier for mining. Companies such as Deep Space Industries plan to launch their first prospecting mission in 2017 targeting Asteroids. This has become a real possibility for the future exploration.

Another frontier for mining exploration is the ocean floor and the search for precious metals around hydrothermal vents. Companies such as Nautilus Minerals already have licences to commence mineral exploration on the sea bed around Papua New Guinea. Although production may still be a while off with the technology still needing to be developed to extract the minerals.

Furthermore issues involving businesses social licence to operate may stop the future of this exploration method.

Asteroid mining and deep sea mining are two of the possible frontiers for future successful exploration. We will likely see these two frontiers explored in the near future.

Adam Oehlman, Northern Star Resources

As the worlds population grows at an alarming rate, the demand for technology and material possessions grows exponentially. These items which we have grown accustomed to, phones, cars, laptops, clothes all aren't possible without the naturally occurring resources found in limited supply on earth.

As the successful scientists and entrepreneurs before us have done, we too will adapt and improve our methods of practice and technology to try stay ahead of the all too real possibility of mining the world of all its resources.

With deposits becoming increasingly difficult to discover, we are forced to increase our search deeper, revolutionize our practices, increase recoverability, think outside the box in effort only to delay the inevitable.

Once the earth's resources are all discovered and mined, or traditional earth based mining becomes an uneconomical practice we will be forced to the stars. With multiple space exploration mining companies already established like Deep Space industries and Planetary Resources. These companies are gearing up to mine space and make the unimaginable a reality.

These radical mining companies endeavored to use thousands of tiny remotely operated spacecraft to mine the almost infinite amounts of energy, metals, minerals found in space. Technological advancements are vital in making the impossible a reality. Enabling the first successfully mined asteroid, and its pay load descend onto earth.

Successful exploration in the future will contain advance technologies that to most of us seem works of mere fiction. Technological developments in drones, spacecraft and robots are essential for effective mining and exploration of the future.

Anthony Benn, Rio Tinto

The cluster of drones flew through the nothingness of space at close to the speed of light. The array of lasers and spectral scanners equipped to each drone were constantly scanning ahead. They were looking for precious metals. What lead to this interstellar exploration for metals was a rapid expansion in human technology in the mid 21st century. Technology boomed and the one restriction to its growth was access to materials, that for time-eternal were extracted from the Earth's crust. Prices for Gold, Silver, Iridium, Palladium, Cobalt and Manganese (to name a few) rose exponentially. As prices for these commodities rose so to did the gazes of exploration geologists. After decades attempting to peer beneath the earth they looked to the heavens and their thoughts settled on those bodies of rock and precious metals that were flying across the night sky.

The heavens that were once thought to be the limit of man's domain had held the key to humanities march forward all along.

In his workstation on Earth, Gary an Exploration Geologist surveyed the data his drones were collecting. The asteroid they had recently targeted looked quite promising. The first pass gravity results showed that the asteroid had a significant density. Soon he would be able to analyse the spectral data to see if the signature of this asteroid fit into the known range for what the team were looking for.

He hoped it was viable. Gary was well aware of the importance of his task. The future of humanity depended on it.
Al Harvey, Evolution Mining

Successful exploration in the future will look much the same as it does today; if you find something that is economic, you’ve been successful. What will be different is the definition of an economic discovery, and how that successful discovery is made. With the global population increasing, and the rate of discovery of ore deposits declining, it is likely that metal prices will rise through the forces of supply and demand. As metal prices rise, marginal projects will become viable, particularly deposits at greater depths, smaller size and/or with lower grades. This will encourage the development of more efficient mining and metallurgical techniques, which will bring new exploration environments into play.

There is no doubt that big data and data mining will yield the next wave of discoveries, much like the development of geophysical techniques did in the 19th century. Multivariate datasets are already being queried to identify the characteristics of prospective regions, favourable geochemistry and mineralogy, using data that is publicly available. The vast data held in historic exploration reports will be unlocked through automated text mining to highlight missed opportunities in brownfield terranes. These huge quantities of open source data and data science tools effectively levels the playing field, allowing individuals with access to a computer and the right skills to make groundbreaking discoveries.

Geologists of the future will need to be skilled in data science, GIS and programming in order to better integrate geology, geochemistry and geophysics. Look out for the data geoscientist!

Jack Adams, Rio Tinto contractor and Haydn White, contractor

Imagine a world where fifty thousandsamplers work for free, working from sun up to sun down requiring no PPE. We picture a future where the honeybee joins the exploration tool kit. Before visiting the future we shall first look to the past. Geobotany was one of the first exploration techniques used to discover mineral deposits. The association between plant species and geology was identified and used to discover areas of metal concentration since the times of antiquity. Biogeochemistry is a modernised term for these types of techniques, incorporating elemental analysis of biota to reveal vectors to mineralisation, as with today’s vegetation and soil sampling. The nature of the honeybee is to cover large areas gathering pollen and nectar from a region’s flowering plants and deliver their ‘samples’ back to a single point, the hive. These low impact portable hives make bees the perfect sampling team. The samples could then be collected and run through chemical analysis to unearth anomalous element concentrations associated with mineral deposits.

Real innovation will come from the development and integration of novel ideas such as honeybee sampling into established exploration techniques. With the multitude of various datasets available, we will also require a powerful but user friendly spatial data display to combine complex interrelated data, generating hot spots on which to focus.

If after the honey bee exploration program you find nothing, you will at least have some honey to sweeten the disappointment!

*Jack’s submission also acknowledged his peer Haydn White’s contribution to discussions of exploration philosophy.

WeiMin Jin, Curtin University

As the internet world is entering an era of big data so will be the further exploration programs. The mineral industry has massive amount data acquired through historic exploration and mining activities. However, many of these are under appreciated due to the lack of good data management system. Many of the quality data before 90’s are simply not computerised hence not taken into consideration sometimes when young generation geologists ponder for mineral perceptivity. I do forecast a change in this with more advanced computer programs to consolidate all available data to assist geologist to make sound decisions. However, field work has and will always remain a critical component for the exploration activities although automation is advancing its way rapidly. There are some fundamental things that will need human analysis based on experience and understanding of complex earth dynamics given the uniqueness of each deposit and variability of earth crust. I am predicting a more automated data acquisition process including technology such as advanced GIS system, smart rigs, hand held geochemistry instrument, portable laboratory, unmanned pilot for geophysical investigation etc. Nevertheless, with more data available than ever, a well trained, computer savvy geoscientist will be needed to manage the influx of information in a non mechanical way in order to deliver meaningful analysis and sound decisions. Finally, with diminishing deposits at surface level, successful exploration will see a shift of focus towards seafloor, outer space because these places hold potential bonanza metal grade and due to technology constraints in the past we were not able to explore these terrains in details but now it is getting more and more feasible to do so.

About the authors: Jack Adams and Haydn White are both recent geology graduates from UWA. Throughout their degrees they had continuous discussion as to the honeybee sampling concept, triggered by their mutual interests in… you guessed it… bee keeping, native flora and geology.
Daniel Doran, Northern Star Resources

The mantle of successful exploration geologist looms as one of the more difficult aims for future industry. Current and future exploration geoscientists face the challenge of a continued decline in the discovery of world-class orebodies due to a number of well documented factors, most notably being a) a heavy focus on brownfields exploration and b) an increasing depth of cover to new discoveries (Schodde and Guj, 2012, Koch et al., 2015). It is clear that both factors relate to the same variable; cost of discovery. It is expensive, both in money and effort, to explore in greenfields terrain and discovery of blind deposits entails relatively expensive drilling techniques. The only way to mitigate these factors is to develop technologies that enable quicker and cheaper data collection, which in turn enable geologist to spend more time on interpreting results.

One rapidly advancing example of this scenario is the development of remote drone operations. It is highly conceivable that the future will see drones equipped with a range of sensors (e.g. XRF, XRD, PIMA) conducting mapping and sampling programs of remote greenfield terrains while geologists are left to interpret the data collected.

Elliot Kahn, BHP Billiton
Title: Exploring the past... the key to future success

The industry often speaks of the golden era of exploration; the surficial deposits, the shallow drilling and the discoveries that built our nation. This time of success drove a glacial pace of innovation and data analysis; resulting in the recent lackluster success of the exploration industry. With many keystone deposits nearing their end of mine life, this has driven the industry into a renewed period of innovation and exploration, offering the opportunity to re-define the exploration wheel.

“Information is the oil of the 21st century, and analytics is the combustion engine.” - Peter Sondergaard, Senior Vice President, Gartner Research.

The future state of exploration will see a surge of attention directed towards processing and analysing the vast swaths of data that have been collected and under utilised. The step change required to turn data into information and ultimately, insight will be driven by teams who value innovation and embrace the necessary shift in strategy. Recent examples of companies opening up their databases for analysis by thousands of professional and amateur prospectors embodies this and shows that the past may hold the key to future success.

The title, ‘exploring the past’ serves to respect the success of historic explorers and to leverage their success to guide the vision of future exploration in which historic districts become prime targets and where the industry enables the shift of focus from growing data sets to understanding them.

Drilling will be deeper, operations more remote and regulation more constrictive; thus, the industry must collaborate to innovate in the big data space to realise the future of exploration.

Advancements in drill technology provides another clear avenue to future exploration success with work already advancing at the Deep Exploration Technologies CRC, however this is based on traditional drill methods. Potential exists in powerful laser technology to develop a quick and cheap subsurface sampling technique. Analysis of lithology and minerals by spectral emission as a laser hole is bored may not resemble traditional sampling methods but may come at a fraction of the cost.

Clearly large technological advances need to be made in a number of disciplines before the scenarios outline above come to eventuate. However technology is advancing at a greater rate than ever before and will provide the future tools for a successful exploration geologist.


Events calendar

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

March 2017

EduMine: Mine Planning - Strategy
March 1-3, 2017
Live Webcast

GeoPub Tasmania – March 2017
March 6, 2017
Shipwrights Arms Hotel, Battery Point TAS

GeoPub Melbourne - 10th March 2017
March 10, 2017
Little Mule Café, Melbourne VIC

March 14-16, 2017
Live Webcast

QLD March AIG Tech Talk – Michael Agnew: Topic TBA
March 14, 2017
Transcontinental Hotel, Brisbane QLD

GPIC Bendigo March 2017: Mineralisation of the Lachlan Orogen
March 14, 2017
Basement on View, Bendigo VIC

April 2017

GPIC Bendigo April 2017: Recent changes to Victorian legislation
April 11, 2017
Basement on View, Bendigo, VIC

GeoPub Melbourne - 14th April 2017
April 14, 2017
Little Mule Café, Melbourne VIC

Target 2017
April 19-21, 2017
University of Western Australia, Cawley WA

40th Sydney Basin Symposium
April 27-28, 2017
The Mercure Resort, Pokolbin NSW

May 2017

Minesafe International 2017
May 1-2,2017
Perth – to be advised, Perth WA

PETROLOGICAL (CONSULTING) SERVICES
Roger G Taylor (PhD, DIC, MAIG)
Descriptive and overview interpretation of:-
• Ore Textures
• Breccias
• Alteration
• Paragenetic sequencing
• Gossans-leached outcrops/supergene enrichment
Porphyry copper, IOCG, Skarn, Carbonate replacement, Tin-Tungsten
Epithermal and Granite related gold systems
roger-taylor@bigpond.com
Mobile 0417621273 Phone 0363265562

June 2017

FUTORES II
June 4-7, 2017
Rydges Hotel, Townsville, South Townsville QLD

GeoPub Melbourne - 9th June 2017
June 9, 2017
Little Mule Café, Melbourne VIC

QLD AIG Friday Seminar: Porphyry systems incl. OK Tedi & Grasberg with Peter Pollard
June 23, 2017
TBA, Brisbane QLD

July 2017

Australasian Groundwater Conference 2017
July 11-13, 2017
University of New South Wales, Kensington NSW

GeoPub Melbourne - 14th July 2017
July 14, 2017
Little Mule Café, Melbourne VIC

Iron Ore 2017
July 24-26, 2017
Perth Convention and Exhibition Centre, Perth WA

Drilling for Geology II
July 25-28, 2017
Royal on the Park, Brisbane Qld
AIG NEWS

AIG News is published quarterly as per the following table. Avoid disappointment by contacting the Editor at least several days beforehand to advise submission of items for the newsletter.

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