Australian Society of Exploration Geophysicists

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PREVIEW

AEGC2019 Data to Discovery

Australasian Exploration Geoscience Conference
2-5 September 2019 • Perth, Western Australia
Incorporating the **AIG**, **ASEG**, **PESA**, and **WABS**

The Leading Exploration Geoscience Conference in Asia-Pacific

Co-Hosted by Australian Society of Exploration Geophysicists · Australian Institute of Geoscientists · PESA Petroleum Exploration Society of Australia

NEWS AND COMMENTARY

CONFERENCE GUIDE

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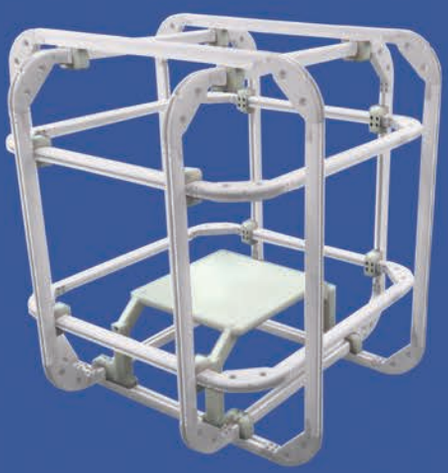

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Editor's desk

This conference issue of *Preview* features a guide to the second Australasian Exploration Geoscience Conference (AEGC 2019), which is being held at Crown Perth in Perth, September 2 – 5. The AEGC 2019 is co-hosted by the Australian Society of Exploration Geophysicists (ASEG), the Australian Institute of Geoscientists (AIG) and the Petroleum Exploration Society of Australia (PESA), and incorporates the 27th ASEG Conference and Exhibition and the PESA West Australian Basin Symposium. An exciting list of presentations is on offer and all ASEG Members are encouraged to attend.

In previous years the conference issue of *Preview* also included short abstracts of all the conference presentations. This is not the case this year. At the end of July 2019 the view of the Conference Organising Committee (COC) was that abstracts will only be made available to conference attendees via a conference app. You will only be able to access the app if you register for the conference. The ASEG is still in negotiation with the AEGC 2019 COC about whether it might be possible, at some stage, to publish the extended abstracts as part of the ASEG's online extended abstract series (https://www.tandfonline.com/toc/texg19/current). If you have a strong opinion about this matter please nobble one of the ASEG Federal Executive or email me at previeweditor@aseg.org.au.

As well as a guide to AEGC 2019, this issue of *Preview* features the latest news from all the geological surveys in Australia and contributions from our usual commentators. David Denham (*Canberra observed*) considers Australia's future, as described in the latest CSIRO National Outlook. Mike Hatch (*Environmental geophysics*) shares his pick of presentations being made at AEGC 2019. Terry Harvey (*Minerals geophysics*) muses about geophysical horses for mineral exploration courses. Mick Micenko (*Seismic window*) delves into machine learning before nominating his AEGC 2019 top five. Tim Keeping (*Data trends*) also reviews what the AEGC has to offer, and Ian James (*Webwaves*) warns readers about predatory publishing practices.

Most of the ASEG publications team will be at AEGC 2019, and the Publications Committee and the *Preview* editorial team will be meeting to review progress and possibilities. If you are interested and would like to attend either of these meetings please contact me (previeweditor@aseg.org.au), Ted Tyne or Danny Burns (publications@aseg.org.au).

Lisa Worrall
Preview Editor
previeweditor@aseg.org.au

Letter to the Editor

Dear Lisa

At least one reader of my *Henderson Byte* on Nikola Tesla in *Preview* **200**, Don Watts from Milan, noticed an error. Where I referenced George Washington in the third paragraph, I should have referenced George Westinghouse, the American inventor and entrepreneur. In 1886 Westinghouse founded the Westinghouse Electric Company, well known today for the manufacture of household appliances. Westinghouse supported Tesla and was in conflict with Thomas Edison in what has become known as the "war of the currents", broadly AC (favoured by Westinghouse) versus DC (favoured by Edison). It is interesting that a movie about this conflict, and including all these protagonists, is to be released in October this year. It is titled "Current Wars" and Edison is played by Benedict Cumberbatch.

Regards

Roger Henderson
rogah@tpg.com.au

Our ASEG – celebrating fifty years

On the front cover of this issue of *Preview* you will see, for the first time, an ASEG logo that celebrates the ASEG's 50th anniversary. This new logo will feature at AEGC 2019. The next 18 months will see a number of 50th anniversary celebration initiatives and events – but more on that over the coming months.

Ted Tyne
ASEG President
president@aseg.org.au

Australian Society of Exploration Geophysicists

President's piece

I would like to take a moment to acknowledge our collective sadness at the news of the death of Professor Keeva Vozoff, a giant of international standing in exploration geophysics research and teaching. Keeva died in Sydney on 18 July. Professor Vozoff was ASEG President in 1976, only four years after arriving in Australia to take up his appointment as Professor of Geophysics at Macquarie University - a position he held with the highest distinction until 1991. Many of us have worked closely with Keeva, and our professional and personal lives have been greatly enriched by his intellect and wisdom, his open sharing of knowledge, his friendship and impish sense of fun. Our deepest sympathies and condolences go to the Professor Vozoff's family.

On a lighter note, I would like to welcome you to the 2nd Australasian Exploration Geoscience Conference (AEGC 2019). This conference, which is being held in Perth, is the largest petroleum and mineral geoscience conference in Australasia, and incorporates the ASEG-PESA International Geophysical Conference and Exhibition and the West Australian Basin Symposium (WABS).

This year marks the 40th year of ASEG exploration geophysics conferences and exhibitions, workshops and forums. Over the years many of our technical conference programs have been co-hosted by exploration geoscience partner societies. Western Australia has always really welcomed our conferences and exhibitions, and this year marks the sixth time we have been to Perth.

It is a pleasure to be collaborating, once again, with the Petroleum Exploration Society of Australia (PESA), their President, Nathan Parker, and the PESA Executive, and with the Australian Institute of Geoscientists (AIG), their President Andrew Waltho, and the AIG Executive. AEGC 2019 Co-Chairs, Tim Dean and John Gorter, and the Conference Organising Committee have worked tirelessly to bring together a great technical and social programme, and a really impressive exploration geoscience exhibition. I hope you find the technical programme and the exhibition energising, and our social and networking events absolutely enjoyable.

Thank you to our *Preview* Editor, Lisa Worrall, and our Associate Editors and contributors, for a great conference issue of *Preview*. This issue features the AEGC 2019 Conference Programme, which has a focus on petroleum, mineral and near-surface exploration geology, geophysics and geochemistry across a rich mix of exploration sub-themes.

The AEGC 2019 overarching theme of "Data to Discovery" spotlights today's big data exploration thinking and methodology, the latest integrated geoscientific and technological advances, and the ever-increasing demand for resources in the world community that can only be sustained through the discovery of new mineral, energy and water resources. With a focus on "data" - this issue of *Preview* also includes the very latest information on new data and mapping coverage releases from Australia's geological surveys and mineral and energy resource agencies in the section *Geophysics in the Surveys*.

I had the pleasure of attending Science in the Surveys 2019 in March – a truly outstanding technical meeting hosted by Australia Minerals, a collaborative partnership of Geoscience Australia, State/NT Geological Surveys, CSIRO, universities, MInEx CRC and Auscope. The one-day programme presented a wealth of new and updated high-resolution high-spatial-sampling national datasets, and new precompetitive geoscience information about our mineral domains and energy resource onshore regions. Given my own background in government geophysics and geoscience, it is fantastic to see our national and state/NT geological surveys and research institutes working in such close partnership, and with a laser-like focus on delivering data and tools for exploration in the 21st century. The strong partnership and collaboration across borders that was evident at Science in the Surveys, together with the strong focus on the importance of new "data" to stimulate exploration, will be one of the elements of the great programme that the Conference Organising Committee have put together for AEGC 2019.

I've mentioned partnerships several times. The ASEG's longest standing partner is the Society of Exploration Geophysicists (SEG). The SEG supported the foundation of the ASEG, and has been a close affiliate for five decades. The ASEG's connectedness with the SEG is demonstrated by our Members holding Associate Editor and Council positions on the SEG, and also by the number of ASEG Members that are also SEG Members – more than 350 at last count.

I am very pleased that the SEG President, Robert Stewart, will be joining us at AEGC 2019, together with senior SEG representatives. There has been a positive view in the ASEG's recent exchanges with the SEG leadership team about re-energising our partnership; collaborating more closely at future SEG and AEGC conferences on "best of geophysics" sessions, and collaborating on webinar style workshops, training and mentoring programmes. We will be finalising and signing a new ASEG-SEG collaboration MoU in Perth, which will set the framework for a number of new partnership programmes. The ASEG will be participating in the upcoming SEG Conference in San Antonio (15 - 20 September 2019), with a presence in the SEG Exhibition.

I am also very pleased that the President of the South African Geophysical Association (SAGA), Reece van Buren, and a number of Members of SAGA will be joining us at AEGC 2019. SAGA Members have joined us at many previous ASEG events and I've had the pleasure, with other ASEG colleagues, of attending SAGA events in southern Africa. The ASEG and SAGA have a long-standing collaborative arrangement in place, and in our recent exchanges we have agreed to formally update this arrangement at AEGC 2019. SAGA has invited the ASEG to participate in the upcoming 16th SAGA Biennial Conference & Exhibition in Durban (8-9 October 2019). The ASEG will have a presence at the SAGA Exhibition and will be actively involved in the Conference.

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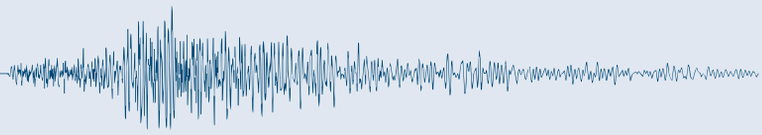

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ASEG Branch news

Queensland

In May **Wayne Stasinowsky** presented an interesting talk on "The Magnetic Tensor: What is it and why should we use it?" Wayne did a great job of explaining the advantages of collecting and using tensor magnetic data for better identification and definition of target magnetic bodies. We look forward to another presentation from Wayne after this technology has been used in Queensland.

In early July **Vince Gerry** from Kore Geosystems was visiting from Canada, and offered to give a talk at a Tech night while he was in Brisbane. Kore kindy sponsored drinks for the night. Vince presented an overview of the work Kore are doing with their SPECTOR core imaging system, and demonstrated how the system can use Artificial Intelligence to prepare and classify lithology and alteration from acquired core image data.

At the end of July **David King** of Marine and Earth Sciences will present on the use of geophysical techniques for geotechnical engineering in the marine environment and, on August 20, **Manika Prasad** will present a one day SEG DISC workshop on "The Physics and Mechanics of Rocks: A Practical Approach". Reminders and registration details will be sent by email.

As well as Technical Talks a number of other initiatives have been underway. Congratulations to geophysics students **Adam Wright** (QUT), **Callum Kowalski** (UQ) and **Harrison Button** (UQ), who were awarded grants by the Queensland Branch of the ASEG to attend AEGC 2019 in Perth. Students were required to submit a letter to the Branch Committee outlining why they wanted to attend the conference, and what they hoped they would get out of the experience. We hope they enjoy the conference and look forward to receiving their written reports.

In July the QLD Branch also held a "mid-term" gathering of the ASEG-PESA mentoring programme, with about half of the participants attending. **Doug Young** of the Australian Institute of Geoscientists (AIG) was the guest speaker, and he explained how the equivalent AIG programme had expanded from humble beginnings to the whole of Australia. It was important, he said, that young professionals recast their professional societies in their own style in order to keep those societies relevant. Participants also took the opportunity to share experiences and tips. There will be one further get together later this year, and hopefully, a new programme set up for 2020.

As always, please get in touch if you are visiting Brisbane and would be interested in giving a presentation to the local Branch. An invitation to attend our meetings is also extended to all interstate or international ASEG Members who happen to be passing through town.

James Alderman
qldsecretary@aseg.org.au

South Australia & Northern Territory

The ASEG SA/NT Branch has had two fantastic speakers since the last issue of *Preview*, with the Australian Geoscience Council's two National Geoscience Champions speaking to our Branch. First, on June 20, Emeritus Professor **David Groves** spoke at the Hotel Richmond about "A Holistic Subduction/Metasomatized Lithosphere Model for Orogenic Gold Deposits". The talk was thought provoking and it was great to see some geologists attend, with an even mix of geophysicists and geologists in the audience. I even managed to score a signed copy of David's first geology novel, "The Plagues' Protocol", part of his aim to popularise geology! You can find his books online if you're interested in a great read.

On August 1 Dr **Marita Bradshaw** spoke about "Australian petroleum exploration – a game for long term players" back at the Coopers Alehouse. Again, this was a geology talk, but the geophysicists were not shy and were there in numbers alongside their geologist colleagues. Marita provided an overview of petroleum exploration in Australia and had some great insights for everyone in the audience.

On August 16 we host our annual Wine Tasting event, where the wine for the annual national ASEG Wine Offer is selected in a blind tasting by a very capable panel of invited guests as a recognition for their current or past contributions to the ASEG. After great success last year with the sparkling wine (107 cases sold), we kept the sparkling category this year along with the reds and whites. As an additional offer this year, you can also purchase a dessert wine from Victoria, which was tasted by the Victorian ASEG Branch and added for distribution in the wine offer. You will receive the heavily discounted wine offers by email, or you can log onto the Members' section of the ASEG website to place your order.

We look forward to a busy end of year, look out for email updates or check www.ASEG.org.au/events. In the last part of the year we have our annual student honours night, Christmas party, and more technical events to round off the year. If you are reading this and you are not a Member, please do come along to one of our events, we would love to see you there and there is usually something for everyone!

For those at AEGC 2019, enjoy. I might see you there! For everyone else, see you soon.

Kate Robertson
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Tasmania

The Tasmanian Branch of ASEG is assisting in bringing one of the Australian Geoscience Council's National Geoscience Champions, Dr **Marita Bradshaw**, to Hobart. She is featuring in two events. The first of these is a National Science Week public outreach event that is also part of Hobart's regular Science in the Pub series. Marita will be regaling the punters on "An Australian Energy Mix for the Anthropocene". The presentation will be in the PechaKucha format (https://www.pechakucha.com/), with which your correspondent has no experience, let alone this version in which "teams of theatre sports actors improvise a scene to each presentation". Your guess is as good as mine, but it promises to be highly entertaining, informative and possibly even provocative. It's being held from 6–7:30 pm on Thursday 15 August, upstairs at the Republic Bar in North Hobart. Hopefully there will be a live stream if you're interested but can't make it.

Marita's second Hobart event will presumably be a bit more conventional, being part of the University of Tasmania's School of Earth Sciences/CODES regular seminar series. All are welcome to get Marita's insights on "Themes in Future Australian

ASEG news

Geoscience", with the presentation likely to be especially valuable to students. It is scheduled for noon on Friday 16 August, in the CODES Conference Room on the Sandy Bay campus.

Thanks to the Australian Geoscience Council and the organisers of National Science Week and Science in the Pub for their initiative and support for Marita's visit.

An invitation to attend Tasmanian Branch meetings is extended to all ASEG Members and interested parties. Meetings are usually held in the CODES Conference Room, University of Tasmania, Hobart. Meeting notices, details about venues and relevant contact details can be found on the Tasmanian Branch page on the ASEG website. As always, we encourage Members to also keep an eye on the seminar programme at the University of Tasmania / CODES, which routinely includes presentations of a geophysical and computational nature as well as on a broad range of earth sciences topics.

Mark Duffett
taspresident@aseg.org.au

Victoria

If you attended the last of our autumnal series of technical meetings and the night felt unexpectedly regal, then you weren't the only one to get that feeling. On this particular night in May you were in the presence of ASEG royalty. It was a who's who of the ASEG monarchy as we revelled in the presence of two former ASEG presidents, King **Mike Asten** III (2009) and King **Phil Harman** IV (2010), both of whom have been awarded honorary ASEG memberships since 2013. We also basked in the presence of one former federal executive treasurer in Prince **Theo Aravanis** (2014–2015), who is now your Victorian Branch Committee support member.

King Mike III is a stalwart of the ASEG in having the rare distinction of being knighted with both a Laric Hawkins Award (twice – once in 1998 and once in 2004) and a Grahame Sands Award (2001). King Phil IV has also been decorated with the responsibility of chairing our Research Foundation since 2001. If you haven't already considered doing so, now is a great time to bestow King Phil IV with your treasure chest of gold coins. It will all be spent on a worthy cause. Not to be unseated, the insatiable dark knight himself, Prince

The wine tasting about to get under way at the May Victorian Branch meeting

Des Fitzgerald, also the recipient of a Grahame Sands Award (2016), was seen wielding a lance while high on his horse amongst the crowd that evening.

Now, back to the fairy tale. The imperial evening started with a presentation given by the recently minted ASEG President himself, King **Ted Tyne** II, whose topic of the night created an air of nostalgia as he reflected on five decades of accomplishments, cooperation and the diversity and passion from Members, past and current, in promoting our great Society. With him, was the beautiful consort, Princess **Lisa Worrall**, whose five years as *Preview* Editor under various monarchies brought a sense of tranquillity to the proceedings. As the ASEG embarked on its 50th year of sovereignty, King Ted II shared his memories and tales, including numerous old black and white photos of a bygone era. Thanks for taking us down memory lane, Your Majesty, we shall remain your humble servants.

As alluded to in our previous Branch news, the postponed old muscat and wine tasting finally happened, and incidentally coincided with the royal episode. Befittingly, Lidia, from Politini Wines of the King Valley region in Victoria, brought a fine selection of her family's aristocratic tipple to the event. The Politini prised old muscat, will be on offer through the ASEG shortly, so save your pennies (His Majesty won't object!) for a noble drink. Lastly, the date for the annual Winter 'Jousting' social affair will be announced in due course so dust off your armour and get back in the saddle for training. This event is not to be missed!

Finally, there is much to hear, see and do at our Technical nights, so if you're galloping around the city, hitch your horse, come into our Great Hall and attend one of our events. It's a great way to make some new friends or reconnect with some old acquaintances. Who knows, you may even run into the Queen (wait, who's that I wonder?)!

Meetings are generally held on the third Thursday of each month from 17:30 in the Kelvin Club, 18–30 Melbourne Place, Melbourne. Meeting notices, addresses and relevant contact details can be found on the Victorian Branch page of the ASEG website.

Hope you all enjoy the 2nd AEGC conference! Try the veal.

Thong Huynh
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Western Australia

The WA Branch held a Tech night on June 12 that featured a comprehensive presentation by **Tim Dean** from Curtin University on "Recent advances in land seismic acquisition technology". Tim's overview of instrumentation and processing techniques was supplemented

Tim Dean addresses the June WA Branch Tech night meeting at the Celtic Club, West Perth.

by his extensive collection of geophones for Members to view after the presentation.

Our July 10 Tech night saw **Andrew Long** from PGS present on the "The Growth of Automation in Marine Seismic Acquisition and Processing". Andrew gave an excellent summary of recent advances in the offshore seismic industry focused on reducing safety risks, reducing data processing time, and implementing new virtual training procedures. Both mid-year events drew larger than average crowds, which we hope continues into the second half of 2019.

Upcoming WA events include:

August 14 – **Andrew Fitzpatrick**, Independence Group

October 9 – **Mark Lindsay**, UWA

November TBC – Annual student presentation night, Curtin & UWA

December TBC – AGM and Christmas party

The Tech night schedule is subject to change due to speaker availability. Please check the website for up-to date information. The WA Branch Committee look forward to seeing all our Members at upcoming events and at AEGC 2019 at Crown Burswood.

Heather Tompkins
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Australian Capital Territory

The ACT Branch has hosted some well-attended talks this year, suggesting that we have highlighted some topics of wide interest. In May **Alex Ip** of Geoscience Australia's Digital Science and Information section, spoke on "Open, Efficient Geophysical Data Encodings – How to Have Your Data Cake and Eat It too". Alex discussed the advantages of emerging scientific container formats and their capabilities in terms of speed, efficiency, rapid data sub-setting and web service functionality. The talk was supported by some real-world examples from Australian mineral provinces and was a window into future directions and possibilities for large open-access datasets.

In June **Anandaroop Ray**, a new member of GA's groundwater group, presented "Towards a Statistical Framework for Geoscientific Inference". This was a broad and interesting presentation that focused on the advantages of Bayesian probability over deterministic inversion algorithms. Examples were shown from seismic, controlled source / magnetotelluric and airborne electromagnetic data and links between optimisation, inversion, joint inversion and machine learning were discussed. Anand also touched on the challenges in obtaining and assessing probabilistic results as well as industry research directions for inversion and interpretation.

Andrew Long addresses the July WA Branch Tech night meeting at the Quest Hotel, East Perth.

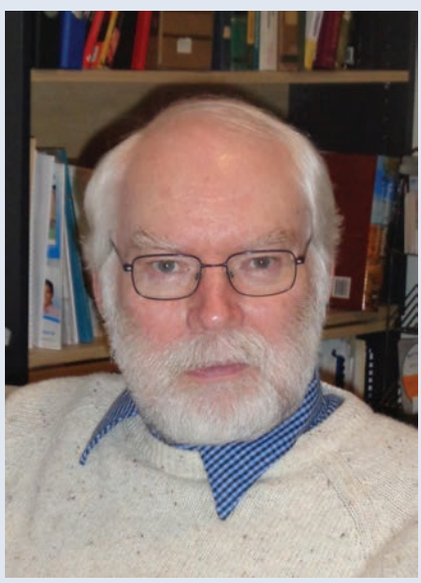
ASEG news

By the time this report goes to print, we will have had another talk by another new GA groundwater staff member, **Klara Steklova**, titled "Hydrogeophysics – Crossing the Boundaries". Klara says that hydrogeophysics is a relatively new discipline that uses geophysical instruments for mapping subsurface features, estimating porous media properties and monitoring processes that are relevant to hydrological studies. She will discuss some computational techniques to solve the coupled problem (such as joint inversion) and different ways to link the groundwater and geophysical models.

In early August we will have another talk to be presented by **Clive Foss** of CSIRO Mineral Resources, titled "The enigmatic 'pimple' magnetic anomalies of the Eucla Basin".

On August 29, GA will host **Manika Prasad**'s SEG Distinguished Instructor Short Course entitled "Physics and Mechanics of Rocks". The course is to also be presented at the AEGC conference in Perth in early September, but this is a good opportunity for those from the eastern states who are not attending AEGC to attend. https://seg.org/Education/Courses/DISC/2019-DISC-Manika-Prasad

New scholarship announcement by the ACT Branch



Dr **Peter Milligan**, a much loved and respected Senior Geophysicist at Geoscience Australia and long-term ASEG Member, passed away earlier this year. Peter had an extraordinary career specialising in the fields of geomagnetism, magnetotellurics, airborne surveying and non-seismic geophysical data processing. To honour Peter's memory, and his significant contributions to geophysics and the ASEG, the ACT Branch has established a $1500 student grant in his name. The Dr Peter Milligan Student Award for Geophysics will be presented to an outstanding undergraduate or postgraduate student studying geophysics or a geophysics-related discipline in the ACT, including honours and postgraduate students engaged on projects using geophysical data or concepts. The award will be conferred annually from November 2019, at an open meeting where the successful student will also give a presentation of the work which has won them the honour. It is hoped that this award in Peter's memory will help to stimulate student interest in the science of geophysics and membership of the ASEG.

Grant Butler
actpresident@aseg.org.au

New South Wales

In May **Doug Morrison** from Southlands Geophysical Services presented a talk entitled "Measuring Terrestrial Magnetism 1784–1949 – The evolution of the airborne magnetometer for Aerial Survey. Part II Measuring on the move. Induction Coils, fluxgates, finding U-boats and orebodies". This talk was Part II of Doug's set of talks on the history of the acquisition of magnetic data. Doug took us through the various development strands of magnetometers that happened before and through WWII. It was quite interesting to learn how the magnetometers that we know developed. Much discussion followed, the talk being enjoyed by all.

In June **John Triantafilis** from the University of New South Wales presented a talk entitled "Digital soil mapping in sugarcane and cotton growing areas using proximal soil (geophysical) sensors and pedometric methods". John presented two case studies which highlighted some of his current research projects. In the first case study John spoke about his research in the highly productive Burdekin valley, which showed how nutrient management farm guidelines for Ca and Mg elements are compared with the efficacy of various proximal sensed gamma-ray spectrometry and electromagnetic (EM) data sets. In the second case stud, issues of water use efficiency associated with storage reservoirs were described in the Ashley irrigated cotton growing area. John showed how EM induction data from a reconnaissance survey of EM38 and EM34 instruments could be used to identify where more suitable locations can be investigated to relocate storages and supply channels. John's talk invoked much discussion.

June's speaker, John Triantafilis, accepting a bottle of red as thanks for his presentation, from Mark Lackie (NSW ASEG President)

An invitation to attend NSW Branch meetings is extended to interstate and international visitors who happen to be in town at the time. Meetings are generally held on the third Wednesday of each month from 5:30 pm at Club York. Meetings notices, addresses and relevant contact details can be found at the NSW Branch website. All are welcome.

Mark Lackie
nswpresident@aseg.org.au

Stephanie Kovach
nswsecretary@aseg.org.au

ASEG national calendar

Date	Branch	Event	Presenter	Time	Venue
14 Aug	NSW	Tech night	Andrea Viezzoli	17:30	99 on York Club, 99 York St, Sydney
14 Aug	WA	Tech night	Andrew Fitzpatrick	17:30	Celtic Club, West Perth
15 Aug	ACT	Tech talk	Andrea Viezzoli	TBA	Geoscience Australia, Symonston, Canberra
15 Aug	TAS	Science in the Pub	Marita Bradshaw	18:00–19:30	Republic Bar, North Hobart
16 Aug	TAS	Tech talk	Marita Bradshaw	12:00–13:00	UTas School of Earth Sciences/CODES, Sandy Bay, Hobart
20 Aug	QLD	SEG DISC	Manika Prasad	09:00	XXXX Brewery (Alehouse), Black Street, Milton, Brisbane
21 Aug	NSW	Tech night	Leonardo Vital	17:30	99 on York Club, 99 York St, Sydney
22 Aug	VIC	SEG DISC	Manika Prasad	09:00	Kelvin Club, Melbourne
27 Aug	SA-NT	SEG DISC	Manika Prasad	09:00	Hotel Richmond, 128 Rundle Mall, Adelaide
29 Aug	ACT	SEG DISC	Manika Prasad	09:00	Geoscience Australia, Symonston, Canberra
29 Aug	WA	Mentoring workshop	Various	TBA	TBA
29 Aug	QLD	Tech night	Sasha Alvazpourporgou	17:30	XXXX Brewery (Alehouse), Black St, Milton, Brisbane
06 Sep	WA	SEG DISC	Manika Prasad	09:00	TBA
18 Sep	NSW	Tech night	TBA	17:30	99 on York Club, 99 York St, Sydney
09 Oct	WA	Tech night	Mark Lindsay	17:30	UWA
23 Oct	WA	IMP	Close out event and wrap up	TBA	TBA
31 Oct	WA	Mentoring workshop	Various	TBA	Engineers Australia, West Perth
Nov	WA	Annual Student Presentation Night	Various	17:30	TBA
Dec	WA	AGM and Christmas party	Various	TBA	TBA

TBA, to be advised (please contact your state Branch Secretary for more information).

The ASEG in social media

The ASEG has just joined Instagram https://www.instagram.com/aseg_news/ – so go on, give us a follow! We'd love to share your photos too, so please email Kate Robertson at communications@aseg.org.au if you have any images you would like featured.

We know not everyone is on Instagram, but you can also find us on a variety of other social media platforms too! We share relevant geoscience articles, events, opportunities and lots more.

Facebook: https://www.facebook.com/AustralianSocietyOfExplorationGeophysicists

LinkedIn company page: https://www.linkedin.com/company/australian-society-of-exploration-geophysicists/

LinkedIn group: https://www.linkedin.com/groups/4337055/

Twitter: https://twitter.com/ASEG_news

Youtube: https://www.youtube.com/channel/UC-dAJx8bXrX5BEudOQp4ThA

Geoscience Australia: The year in review

Under Geoscience Australia's (GA) Strategy 2028, our priorities continue to focus on:

1) building Australia's resource wealth;
2) supporting Australia's community safety;
3) securing Australia's water resources;
4) managing Australia's marine jurisdictions;
5) creating a location-enabled Australia; and
6) enabling an informed Australia.

Geophysics plays a key role across all focus areas. In cooperation with the state and territory geological surveys, GA designs new surveys, develops new approaches, and integrates geophysical datasets with other geoscience information to meet these goals and provide stakeholders with trusted pre-competitive geoscience information.

All our data are available to the public through the GA website. These datasets are evolving through an iterative process, continually enhancing resolution, improving imaging at depth, and increasing spatial coverage, leading to a greater understanding of Australia's geology and geography. Much of our work is focused on assessing the resource - energy, minerals and groundwater prospectivity of the Australian continent. This information enables industry to undertake exploration and investment with decreasing risk and increased confidence.

As previously reported in February 2018 (*Preview* **192**), Exploring for the Future (EFTF) is a $100.5 million program (2016–2020) to provide new pre-competitive data and knowledge to attract exploration investment into northern Australia and parts of South Australia. The program is a collaboration between GA and the governments of Queensland, Northern Territory, Western Australia and South Australia. A large proportion of the budget is being spent on acquiring new geophysical datasets, including large regional and transcontinental surveys of passive and active seismic, airborne electromagnetic, gravity, and magnetotellurics.

Highlights of recently completed and ongoing surveys (Figure 1) include:

1) **AusAEM1** completed in July 2018; consisting of over 59 000 line km at 20 km line spacing and covering an area of 1 400 000 million km^2 of western Queensland and the Northern Territory. The scale of the dataset and inversion represent a global step-change in AEM surveying and will no doubt have as much impact as national magnetic surveys achieved from the 1980s. Data is available for download through the AusAEM EFTF website and located conductivity depth profiles from AusAEM1 will be available through the soon-to-be-released EFTF portal.
2) **Kidson seismic profile** completed in August 2018; the 872 km traverse started along the eastern end of the Arunta Province, spanned the Canning Basin and Paterson Orogen and finished along the eastern margin of the Pilbara Craton (see tables updating progress on geophysical surveys). The data has been released through the Kidson Sub-basin EFTF

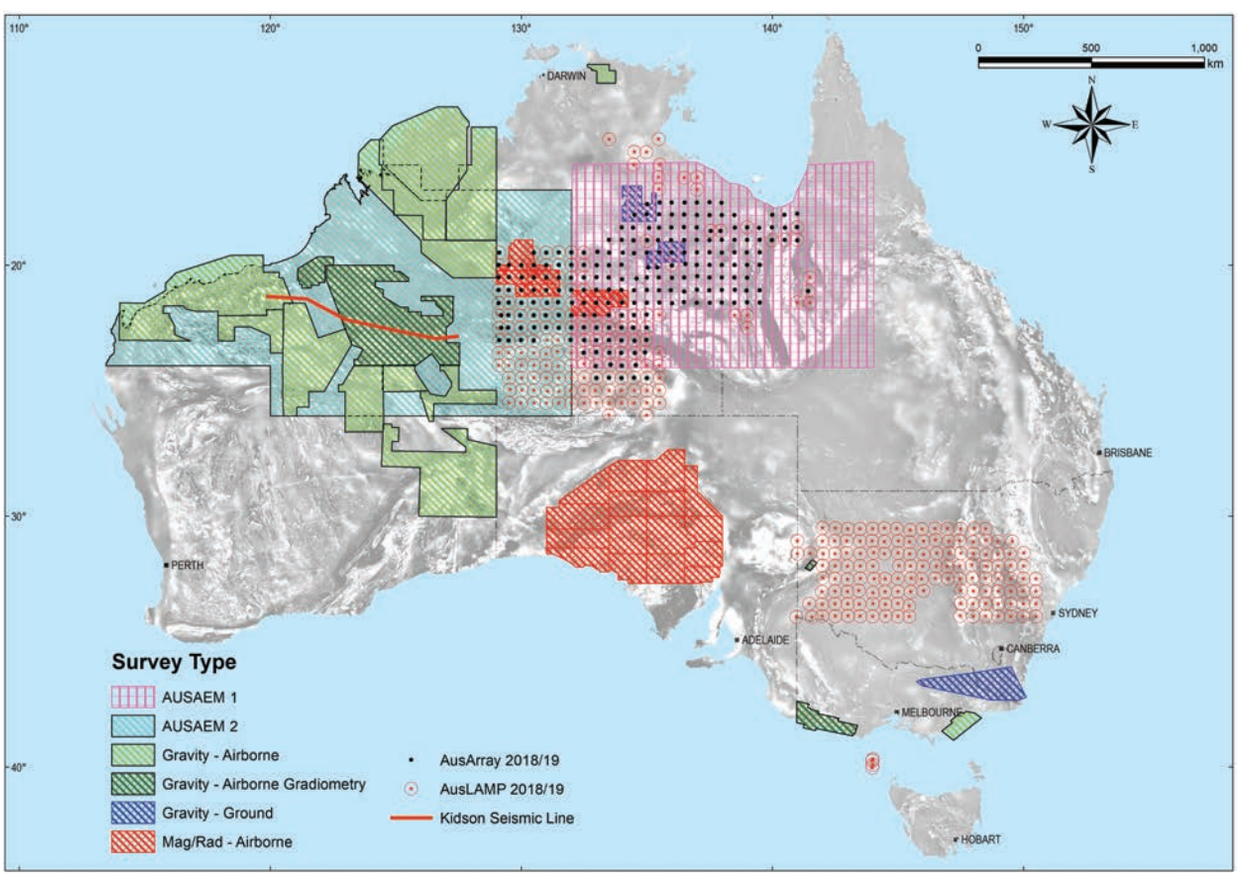


Figure 1. *GA geophysical survey location map, 2018–2019. Collaborative undertakings with State geological survey departments noted in tables recording progress on geophysical surveys.*

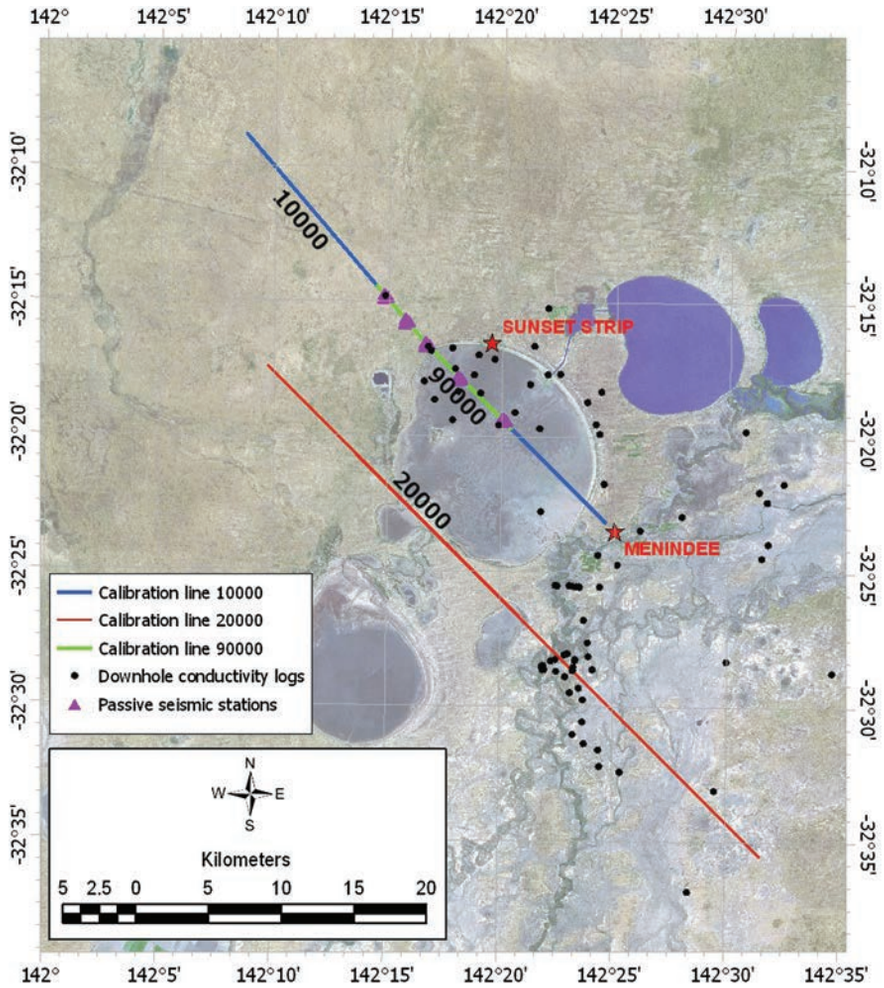


Figure 2. *Menindee AEM calibration range, 2019*

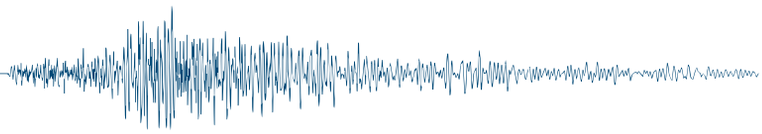
website. An intense collaborative exercise is underway to interpret and integrate results with other datasets for energy, minerals and groundwater investigations.

3) **AusAEM2** in progress, over the western Northern Territory and northwest Western Australia. As of July the 60 000 line km survey was 30% complete. Along with AusAEM1, the survey structure has allowed for third parties to include sections for in-fill; an opportunity that has been enthusiastically taken up by industry. Acquisition is expected to be completed by November with products available in the second quarter of 2020.
4) The **Australian Lithospheric Architecture Magnetotelluric Project (AusLAMP)** data acquisition continues. As part of the Exploring for the Future program, long-period magnetorelluric (MT) data were acquired at a further 147 locations across northern Australia in the 2018–19 financial year. These data will provide significant additional information about Australia's deep electrical resistivity structure, geodynamic framework and mineral potential. New resistivity models across the region from Tennant Creek to Mt Isa will be released through the AusLAMP EFTF website.
5) The **Australian Passive Seismic Array Project (AusArray)** data acquisition continues. A new year-long deployment of 135 broadband seismometers is currently underway southwest of Tennant Creek. Data will be used to create a 3D model of subsurface velocity variations and inform the assessment of resource potential and natural hazards. Release of the Australian plate velocity model focused on northern Australia is expected early in 2020 through the AusArray EFTF website. Recent use of passive seismic velocity models to map the lithosphere-asthenosphere boundary has revealed break-through controls on sediment-hosted mineral deposits (check it out at the AEGC 2019 GA booth).
6) **Energy Systems Offshore Seismic Program** focussed on horizon interpretation, integration to well logs and conducting organic geochemical studies of previously acquired and processed data. Geological and prospectivity assessments have been completed for the Cooper Basin, Isa Superbasin and Beetaloo Sub-basin, with assessments soon to be released via the Bioregional Assessments website.

In addition, the Menindee AEM calibration range was formalised in May of this year under a collaborative project agreement between GA and the Geological Survey of NSW. Located 100 km southeast of Broken Hill, it is a geophysical calibration range for the evaluation and comparison of airborne electromagnetic systems in an area where Geoscience Australia has significant geological and conductivity information from previous studies. There are 3 lines covering a total distance of 100 km (Figure 2), GA has set out a series of operational procedures and line repeats so that all AEM systems can be compared and tested on an equal footing. This data will be used to check system integrity prior to being accepted for government agency AEM surveying. Further details can be obtained from Yusen LeyCooper, Activity Leader, Airborne Electromagnetic Survey Acquisition and Processing, Yusen.LeyCooper@ga.gov.au.

GA invites you to attend the multitude of GA presentations at AEGC – covering innovative AEM inversion techniques, IOCG mapping using potential field data, through to the structural architecture of the central NW shelf to name just a few – and also invites you to visit our booth and networking space during the conference. For more details contact Mike Barlow, mike.barlow@ga.gov.au

Mike Barlow
mike.barlow@ga.gov.au



Update on geophysical survey progress from Geoscience Australia and the Geological Surveys of Western Australia, South Australia, Northern Territory, Queensland, New South Wales, Victoria and Tasmania (information current on 10 July 2019).

Further information about these surveys is available from Mike Barlow Mike.Barlow@ga.gov.au; (02) 6249 9275 or Laura Gow Laura.Gow@ga.gov.au 02) 6249 9605.

Table 1. Airborne magnetic and radiometric surveys

Survey name	Client	Project management	Contractor	Start flying	Line km	Line spacing Terrain clearance Line direction	Area (km²)	End flying	Final data to GA	Locality diagram (*Preview*)	GADDS release
Tasmanian Tiers	MRT	GA	TBA	Jan 2020	Up to an estimated 66 000	200 m 60 m N–S or E–W	11 000	Apr 2020	TBA	TBA	The National Collaborative Framework Agreement between GA and MRT is being updated.
Gawler Craton	GSSA	GA	Various	2017	1 670 000	200 m, various orientations depending on structure	294 000	26 Jun 2019	TBA	Various	Anticipate QC and processing completion by end of 2019. Will be released shortly afterwards.
Tanami	NTGS	GA	Thomson Aviation	14 Jul 2018	275 216	100/200 m 60 m N–S/E–W	48 267	2 Dec 2018	Jun 2019	195: Aug 2018 p. 16	TBA
Mt Peake	NTGS	GA	MAGSPEC	10 Jul 2019	136 576	200 m N-S	24 748	TBA	TBA	Aug 2019	TBA

TBA, to be advised.

Table 2. Ground and airborne gravity surveys

Survey name	Client	Project management	Contractor	Start survey	Line km/ no. of stations	Line spacing/ station spacing	Area (km²)	End survey	Final data to GA	Locality diagram (*Preview*)	GADDS release
Kidson Sub-basin	GSWA	GA	CGG Aviation	14 Jul 2017	72 933	2500 m	155 000	3 May 2018	15 Oct 2018	The survey area covers the Anketell, Joanna Spring, Dummer, Paterson Range, Sahara, Percival, Helena, Rudall, Tabletop, Ural, Wilson, Runton, Morris and Ryan 1:250 k standard map sheet areas	TBA
Little Sandy Desert W and E Blocks	GSWA	GA	Sander Geophysics	W Block: 27 Apr 2018 E Block: 18 Jul 2018	52 090	2500 m	129 400	W Block: 3 Jun 2018 E Block: 2 Sep 2018	TBA	195: Aug 2018 p. 17	TBA
Kimberley Basin	GSWA	GA	Sander Geophysics	4 Jun 2018	61 960	2500 m	153 400	15 Jul 2018	TBA	195: Aug 2018 p. 17	TBA
Warburton-Great Victoria Desert	GSWA	GA	Sander Geophysics	Warb: 14 Jul 2018 GVD: 27 Jul 2018	62 500	2500 m	153 300	Warb: 31 Jul 2018 GVD: 3 Oct 2018	TBA	195: Aug 2018 p. 17	TBA
Pilbara	GSWA	GA	Sander Geophysics	23 Apr 2019	69 019	2500 m	170 041	18 Jun 2019	TBA	The survey area is in the Pilbara region in the northwest of Western Australia. Data acquired will be compiled into an update of the gravity anomaly map of Western Australia and help characterise regional geological elements in the area.	TBA
SE Lachlan	GSNSW/ GSV	GA	ATLAS Geophysics	May 2019	303.5 km with 762 stations	3 regional traverses	Traverses	Jun 2019	TBA	TBA	TBA
TISA	NTGS	GA	Atlas Geophysics	2 Jul 2019	7821	2 km × 2 km grid	31 285	Sep 2019	TBA	TBA	TBA

TBA, to be advised

Table 3. Airborne electromagnetic surveys

Survey name	Client	Project management	Contractor	Start flying	Line km	Spacing AGL Dir	Area (km²)	End flying	Final data to GA	Locality diagram (*Preview*)	GADDS release
East Kimberley	GA	GA	SkyTEM Australia	26 May 2017	13 723	Variable	N/A	24 Aug 2017	Nov 2017	TBA	TBA
Surat-Galilee Basins QLD	GA	GA	SkyTEM Australia	2 Jul 2017	4627	Variable	Traverses	23 Jul 2017	Nov 2017	188: Jun 2017 p. 21	TBA
Stuart Corridor, NT	GA	GA	SkyTEM Australia	6 Jul 2017	9832	Variable	Traverses	12 Aug 2017	Nov 2017	188: Jun 2017 p. 22	TBA
AusAEM2, NT-WA	GA	GA	CGG Tempest	May 2019	59 098 with areas of industry infill	20 km	1 074 500	TBA	TBA	This issue	TBA

TBA, to be advised

Table 4. Magnetotelluric (MT) surveys

Location	State	Survey name	Total number of MT stations deployed	Spacing	Technique	Comments
Northern Australia	Qld/NT	Exploring for the Future – AusLAMP	147 stations deployed in 2018 - 19	50 km	Long period MT	The survey covers areas of NT and Qld. *Ongoing*
AusLAMP NSW	NSW	AusLAMP NSW	201 stations deployed to date out of 320	50 km	Long period MT	Covering the state of NSW. *Ongoing*
Southeast Lachlan	Vic/ NSW	SE Lachlan	Deployment planned to commence in February 2020	~4 km	AMT and BBMT	~160 sites in the Southeast Lachlan
AusLAMP TAS	TAS	King Island MT	4 stations deployed in Jun 2019	<20 km	Long period MT	Covering King Island
East Tennant	NT	East Tennant MT	Deployment expected to commence in late Jul 2019	1.5 - 10 km	AMT and BBMT	132 sites planned covering an area northeast of Tennant Creek. Part of the MinEx CRC National Drilling Programme.
Cloncurry	QLD	Cloncurry Extension	Deployment planned for late Aug 2019	2 km	AMT and BBMT	Approximately 500 sites planned in the eastern concealed margin of the Mount Isa Province. This survey is an extension of the 2016 Cloncurry MT survey.

TBA, to be advised

Table 5. Seismic reflection surveys

Location	State	Survey name	Line km	Geophone interval	VP/SP interval	Record length	Technique	Comments
South East Lachlan	Vic/NSW	SE Lachlan	629	10 m	40 m	20 s	2D – Deep crustal seismic reection	The survey covers the South East Lachlan Orogen crossing the Victorian–New South Wales border. The data acquisition phase of the survey commenced on 5 Mar 2018 near Benalla in Victoria. The survey completed data acquisition south of Eden in NSW on 29 Apr 2018. Data will be released late 2019.
Kidson	WA	Kidson Sub-basin	872	20 m	40 m	20 s	2D – Deep crustal seismic reection	Within the Kidson Sub-basin of the Canning Basin extending across the Paterson Orogen and onto the eastern margin of the Pilbara Craton. The data was released in May 2019.

Table 6. Passive seismic surveys

Location	Client	State	Survey name	Total number of stations deployed	Spacing	Technique	Comments
Northern Australia	GA	Qld/NT	AusArray Phase 2	About 135 broad-band seismic stations	50 km	Broad-band 1 year observations	The survey covers the area between Tanami - Tennant Creek –Uluru and West Australian Border. The first public release of transportable array data is expected by end 2019. See location map in this issue

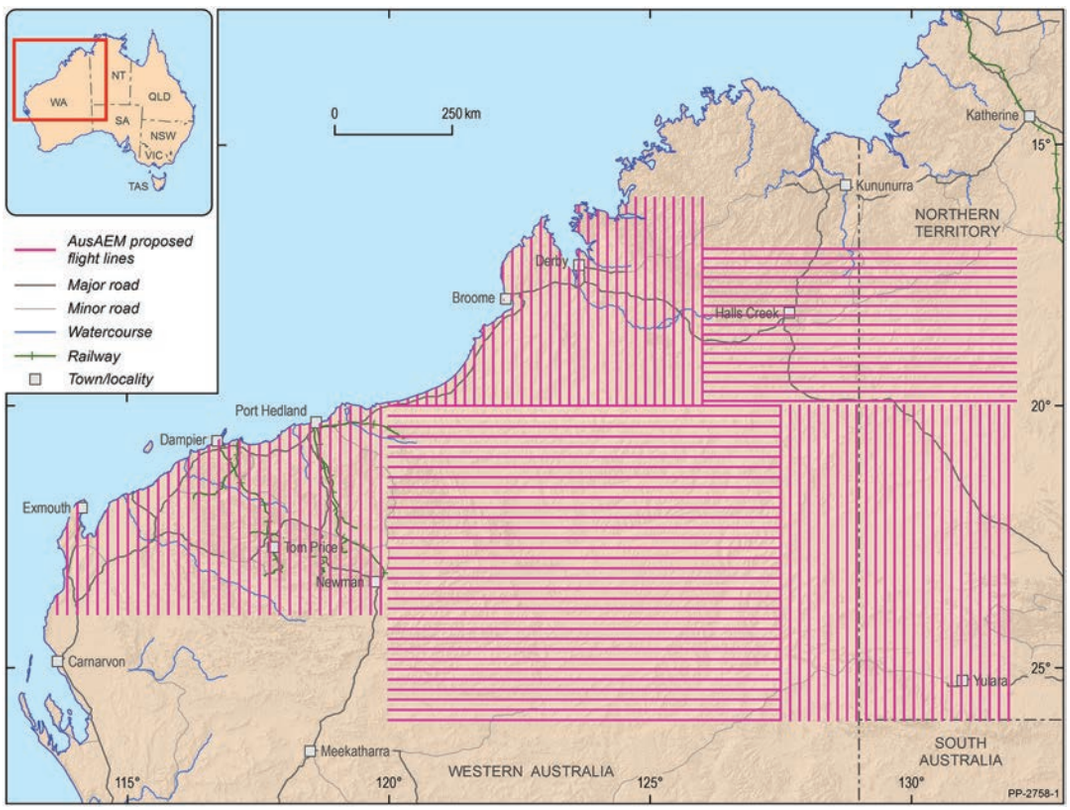


Figure 1. *Map of the airborne survey planned between May and November 2019 in northern Western Australia and south-west Northern Territory.*

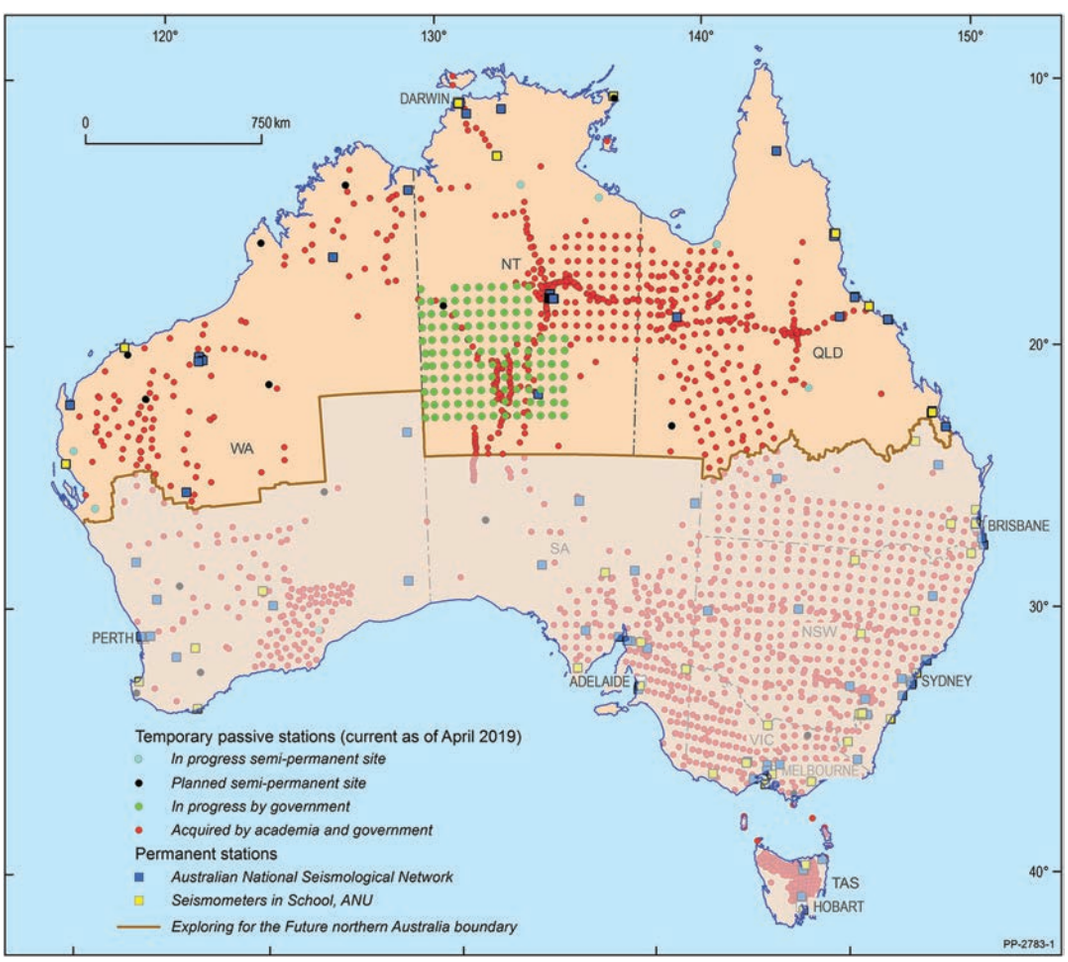


Figure 2. *Map showing the locations of 135 broadband seismic stations, arranged in a grid pattern, spaced ~55 km apart across northern Australia.*

Geological Survey of Western Australia: Regional and crustal-scale geophysical programmes in 2019

Since 2009, the Government of Western Australia's ongoing Exploration Incentive Scheme (EIS) has enabled the Department of Mines, Industry Regulation and Safety's (DMIRS) Geological Survey of Western Australia (GSWA) to extend its programme of regional and crustal-scale geophysical data acquisition projects throughout the State.

These projects are an integral component of GSWA's strategy to enhance Western Australia's precompetitive and public-use information-base with state-wide "surface-to-mantle" geoscience information at the best resolution affordable.

Figure 1 illustrates the variety and extent of existing datasets, and the current geophysical programmes that GSWA is undertaking with active assistance from its national counterpart, Geoscience Australia (GA), and leveraging support from a number of other international, national and state institutions.

Since the last publication of this graphic in the AEGC 2018 conference issue of *Preview* **192** in February 2018, the following new work has been completed or is underway:

- Airborne gravity surveys at 2.5 km line spacing over the Kimberley and central Canning Basins in 2018 (*Preview* **197**, December 2018; data released in April 2019), and in the Pilbara in 2019 (*Preview* **200**, June 2019). The Pilbara survey essentially brings to completion GSWA's objective to create a "second-generation" gravity coverage of the state, with up to 16 times higher resolution than the first generation gravity coverage of the Australian continent by GA's predecessor, the Bureau of Mineral Resources, Geology and Geophysics between 1959 and 1975. Preliminary data were released in July (Figure 2). The gravity coverage complements the airborne magnetic and radiometric coverage of the state at sub-500 m line spacing.
- A GSWA/GA jointly funded 872 km seismic transect across the Kidson Sub-basin (data released in May 2019, Figure 3) has added to the repository of crustal-scale reflection seismic transects across key geological regions of the State.
- The deep seismic transects are being complemented with EIS-funded reprocessing of legacy government and exploration company seismic data. Reprocessed data from an aggregate 2 852 km along 66 lines from 11 surveys in the Canning, Carnarvon and northern Perth Basins were released in February 2019. New reprocessing projects are under consideration.
- GA has extended its Exploring for the Future AusAEM programme of broad-reconnaissance AEM traverses at 20 km line spacing to cover most of northern Western Australia. Data acquisition is in progress with estimated completion in November 2019 (www.ga.gov.au/eftf/minerals/nawa/ausaem). GSWA and GA are presently considering the viability (funding-dependent as always) of extending the AusAEM programme to cover the remainder of Western Australia as part of an ambitious country-wide programme.
- New stations have been added to the broad-spectrum passive seismic network (AusARRAY) and the long period magnetotelluric (MT) network

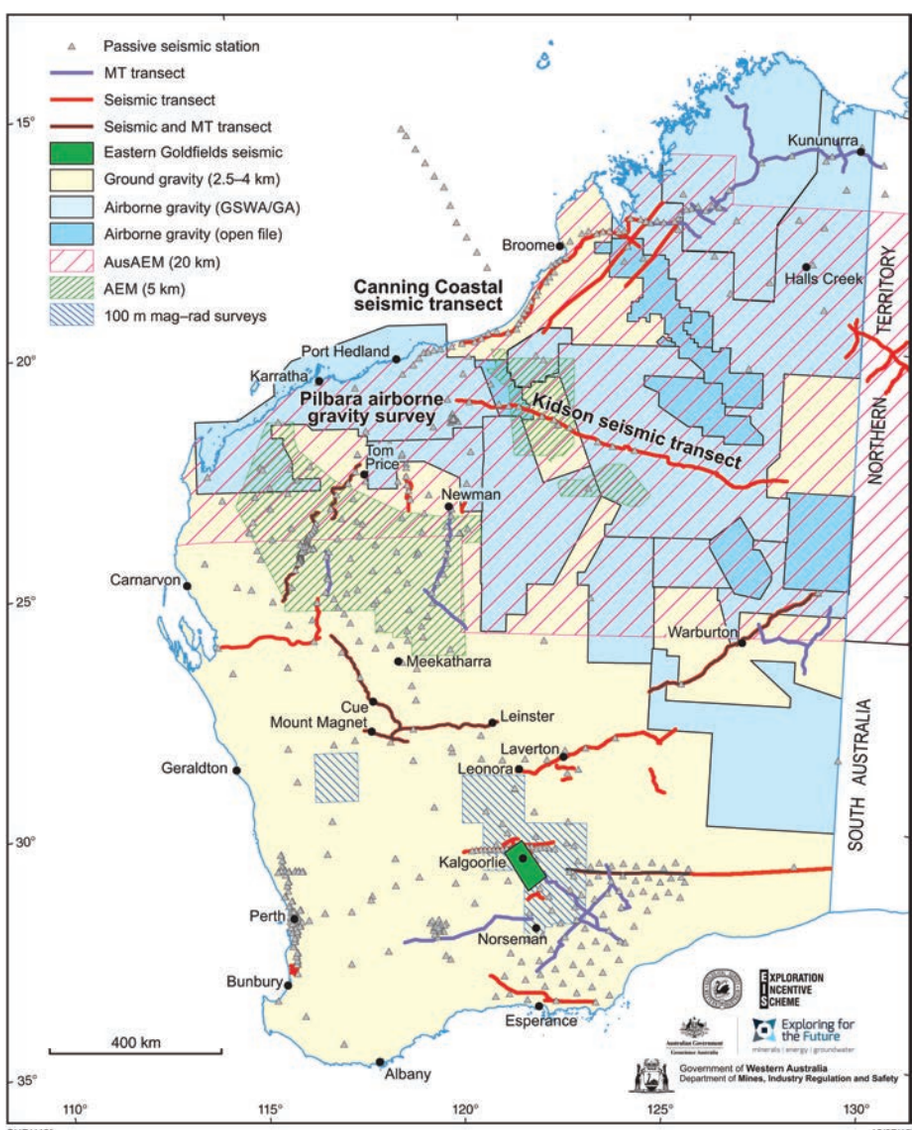


Figure 1. *Regional and crustal-scale geophysical programmes in Western Australia in 2019.*

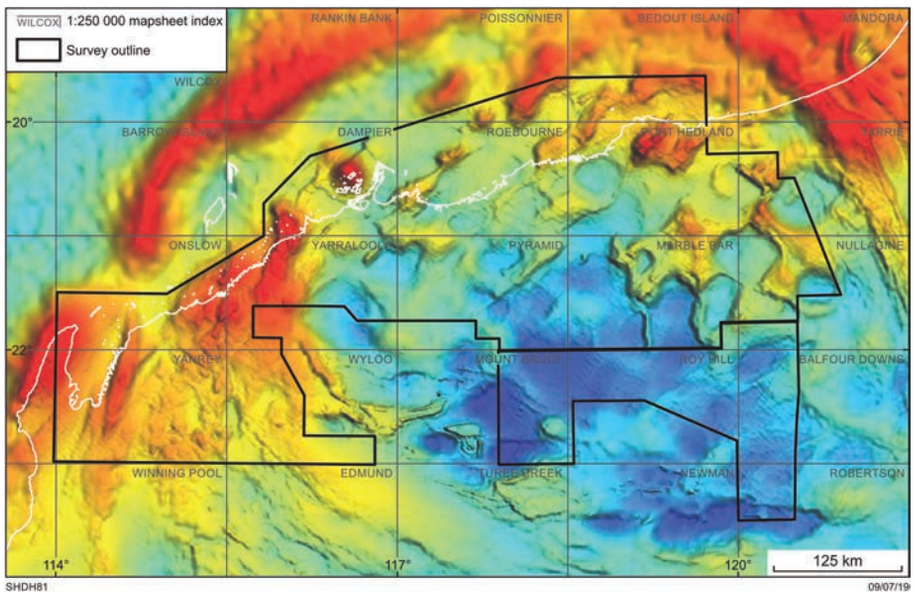


Figure 2. *Pilbara 2019 airborne gravity survey. Preliminary terrain-corrected Bouguer gravity image from decorrugated field data (survey was flown without tie lines) merged with WA gravity anomaly grid 2019 version 1. Line directions: east–west in northwest block; north–south in southeast block.*

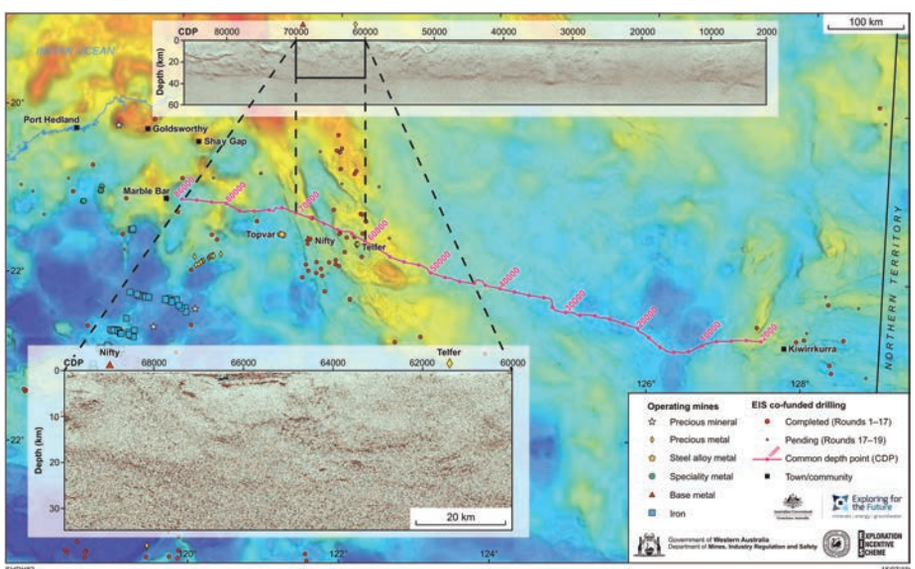


Figure 3. *Kidson deep crustal seismic transect over image of Bouguer anomaly gravity.*

(AusLAMP) for crustal and lithosphere scale interpretation. Current passive seismic surveys are taking place along the Canning Coastal seismic line; the western end of the Kidson seismic line; and, together with MT surveys, in the Goldfields region. In 2019–20 a new ARC Linkage project will see the deployment of 25 broadband seismometers for improved passive seismic coverage in the southwest of WA.

- Acquisition and processing have been completed on GSWA's Eastern Goldfields seismic high-resolution 2D seismic survey (*Preview* **200**, June 2019). All raw and processed data will be released as soon as an initial interpretation has been prepared, estimated to be in September 2019.

These and other datasets are publicly available online through GSWA's or GA's various data delivery systems and the Australian Geoscience Information Network (AusGIN):

- GeoView.WA — www.dmp.wa.gov.au/geoview
- WAPIMS — www.dmp.wa.gov.au/wapims
- GADDS — www.ga.gov.au/gadds
- GA eCat Product catalogue — ecat.ga.gov.au/geonetwork
- AusGIN — www.geoscience.gov.au

Analyses and geological interpretations of these data by GSWA and its partners are available from the various project pages on the GSWA website at www.dmp.wa.gov.au/gswa.

For more information please email geophysics@dmirs.wa.gov.au.

David Howard
Geological Survey of Western Australia
David.HOWARD@dmirs.wa.gov.au

Geological Survey of Queensland: Strategic Resources Exploration Program

The Queensland Government's Strategic Resources Exploration Program (SREP) has just crossed the half-way point with a variety of work underway.

Data acquisition will shortly commence for the Cloncurry Extension Magnetotelluric Survey. This survey builds on the success of the 2016 Cloncurry MT survey, extending data coverage to prospective undercover sequences to the northwest (Figure 1). MT sites will be collected by Zonge Engineering on a 2 km grid with a bandwidth of 1000 Hz to 1000 s. Data acquisition is expected to take four months, with data release in 2020 and modelling to follow.

Data acquisition for the Camooweal 2D seismic survey started in July and and was competed in early August. The survey consists of 300 km of 2D seismic lines and was being conducted along existing roads and tracks around Camooweal by Terrex Seismic (Figure 2). The survey covers part of the Georgina Basin, South Nicholson Basin, and Isa Superbasin and aims to extend the understanding of the regional geology and structural and depositional architecture of these basins following on from the release of the updated SEEBASE regional model in 2018. Data will be released once final processing has undergone all required QA/QC checks.

Another major focus of the SREP is enabling exploration success through delivery of high quality geoscience data to the exploration community. The Geoscience Data Modernisation Project (GDMP) aims to unlock the value of the geoscientific data and enable resources industry success by streamlining the process of acceptance, storage and delivery of data. GDMP is creating a data lake to support integrated searching and lifecycle management of all data within a single repository, with a catalogue to store metadata about objects to support searching across data types and formats. A pilot of the GSQ Open Data Portal data lake and CKAN catalogue is now accessible at https://horizon.gsq.digital/. This pilot currently holds a selection of open-file seismic and geochemistry data, but more data and data types are progressively being added.

Finally Matt, Janelle and Roger will all be attending the AEGC so come and find us if you want to discuss any of our upcoming or ongoing projects.

Matthew Greenwood, Janelle Simpson and Roger Cant
Geological Survey of Queensland
Geophysics@dnrme.qld.gov.au

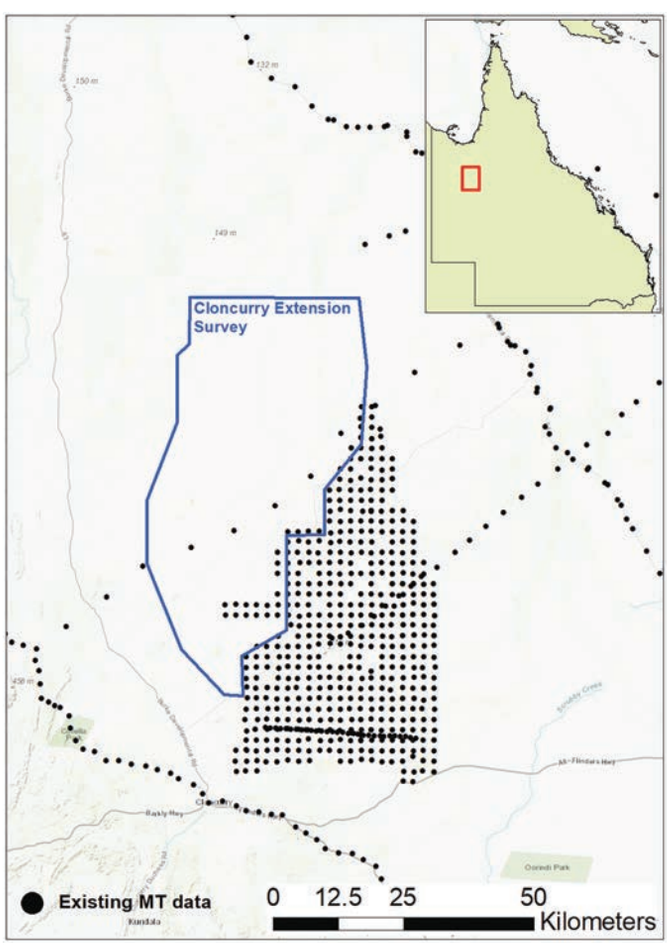


Figure 1. *Location of the Cloncurry Extension Magnetotelluric Survey (blue outline). Black dots show existing magnetotelluric data locations.*

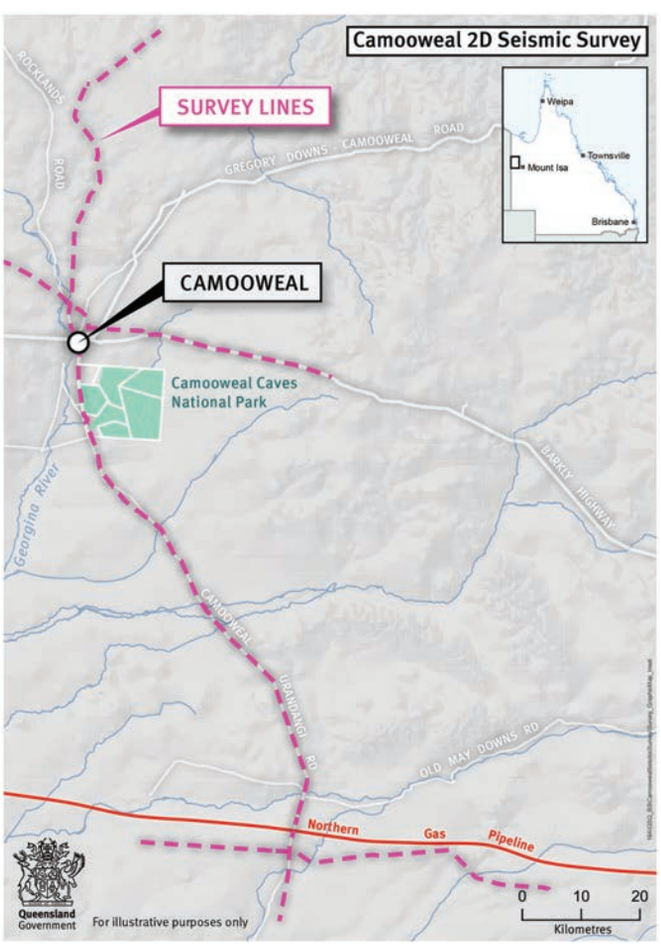


Figure 2. *Location of the 2019 Camooweal seismic survey.*

Geological Survey of New South Wales: New products and data

The Geological Survey of New South Wales (GSNSW) collects, manages and distributes geological, geophysical, geochemical and geospatial data to inform government, resource industries and the community about the state's geology, and mineral and energy resources.

Important regional projects are supported by the New Frontiers Initiative, which is funded by industry through mineral and petroleum annual rental fees. The initiative aims to improve knowledge of under-explored areas within NSW, which includes acquisition of precompetitive geophysical data that provides essential support for geoscience mapping and mineral exploration.

Some GSNSW key achievements from the past year are outlined below.

Cobar MinEx CRC airborne EM survey commencing soon

GSNSW has committed $16 million over ten years towards the MinEx CRC National Drilling Initiative. Mineral Allocation Areas have been declared in five undercover regions around Cobar, Dubbo, Mundi and Forbes. GSNSW will acquire new data in these areas to learn more about the mineral potential of the underlying bedrock. As part of the first project, a regional-scale airborne electromagnetic (AEM) survey will be flown over the greater Cobar Basin between Lake Cargelligo and Bourke (Figure 1). The survey will be flown along east–west lines spaced 2.5 km and 5 km apart, and may also incorporate closer spaced infill lines funded by industry. The survey is being managed by Geoscience Australia and will start in September.

Contact: astrid.carlton@planning.nsw.gov.au (02) 4063 6611.

For more information about GSNSW MinEx CRC activities, please visit: https://resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/minexcrc

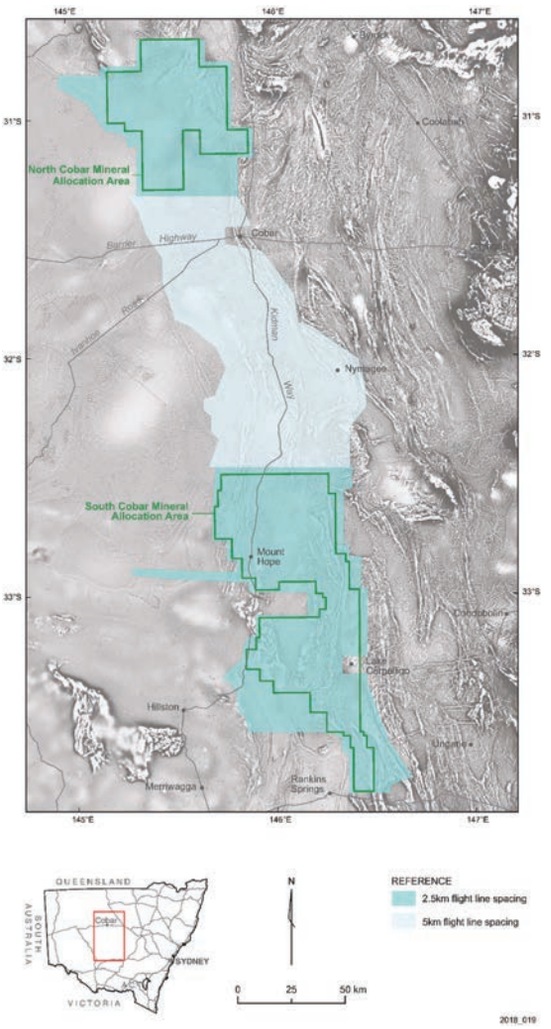


Figure 1. *Area of the Cobar MinEx CRC AEM survey over first vertical derivative magnetics image. Green lines outline the Mineral Allocation Areas and major roads and towns are shown in grey.*

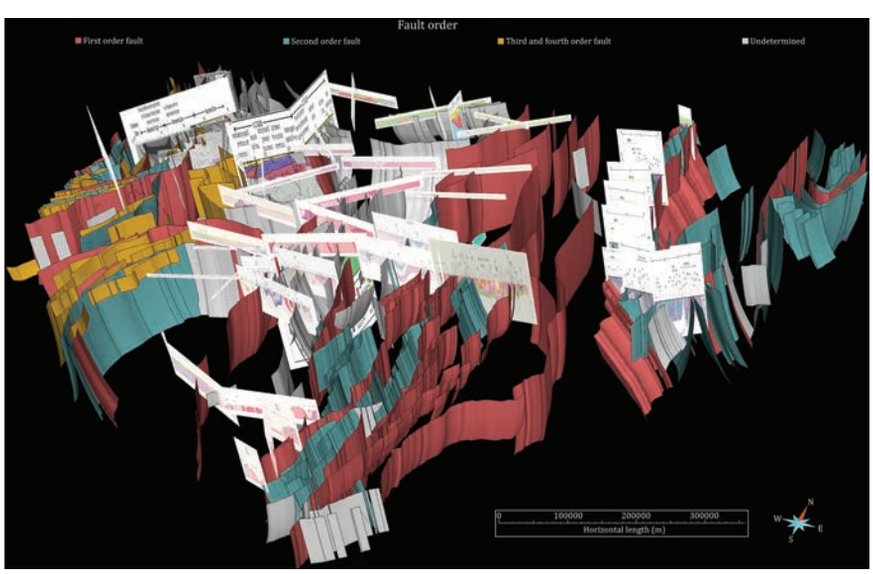


Figure 2. *The statewide 3D fault model showing the fault architecture and constraining seismic profiles and cross-sections.*

Statewide 3D fault model released

A new statewide 3D fault model has been released (Figure 2). It integrates all available geological and geophysical data to map the faults and structures

that define the architecture of the orogens in NSW. Constraining datasets include surface mapping, geological cross-sections, well data, digital elevation models, seismic, gravity and magnetic data, and 2D forward models (Spampinato 2018).

The statewide 3D fault model was constructed using data compiled as part of the GSNSW Seamless Geology Dataset (Colquhoun et al. 2018), which provides a compilation of the best available NSW mapping data in an internally consistent format. The 3D fault model aims to match the seamless geodatabase as closely as possible, within software processing and interpretation limitations.

The statewide 3D fault model was released as four separate 3D models:

- Curnamona Province and Delamerian Orogen model
- Western Lachlan Orogen and southern Thomson Orogen model
- Eastern Lachlan Orogen model
- New England Orogen model.

The 3D fault models are available as Geoscience ANALYST projects, GOCAD® and DXF compressed files. The models include fault and topographic surfaces and incorporate fault attribution consistent with the seamless geology geodatabase. All fault surfaces in the models are attributed with dip direction, dip angle, fault depth, fault kinematics, fault order and fault name.

The statewide 3D fault model will provide a regional-scale geological framework for future detailed modelling. Updates will be ongoing, with the addition of lithological and structural infill of the model as new constraining geological and geophysical data become available. The model will advance the understanding of the crust, tectonic setting and Phanerozoic geodynamic evolution of eastern Australia, and aid greenfields mineral exploration.

Contact: giovanni.spampinato@planning.nsw.gov.au (02) 4063 6655.

Statewide depth to basement 3D model update

The statewide post-Carboniferous cover thickness 3D model released in 2016 (Robinson 2017) aimed to constrain the thickness of consolidated and unconsolidated cover that overlies the crystalline basement across NSW, as well as define the geometry of the overlying basins. The study resulted in the statewide depth to basement 3D surface model.

The first-pass version of the 2016 model was constrained by interpreted lithology from approximately 150,000 water bores, combined with pre-existing seismic picks, basement contours and magnetic-source depth models. The information was validated by collating and interpreting lithological logs from approximately 25,000 mineral, petroleum and coal drillholes (Robinson 2017). The 2016 depth to basement and basement outcrop models were also constrained using the line work from the Seamless Geology Dataset (Colquhoun et al. 2018) and the "Surface Geology of New South Wales 1:1,500,000" map.

As with any model, the resulting surfaces were highly dependent on the scale, quality and density of the constraining data, and the model development procedure. Newly acquired datasets, re-evaluation of geological and geophysical data, and new 3D modelling have led to a better understanding of basin geometries and rock distribution across the southern Thomson Orogen and the Sydney, Gunnedah and Bowen basins (Oliveira and Davidson 2018). These refinements have been incorporated into an updated statewide depth to basement 3D model (Spampinato 2019).

The updated statewide depth to basement 3D model (Figure 3) is released as SKUA-GOCAD™ objects and CAD data file format (.dxf) and is available in four different coordinate projections; GDA94 NSW Lambert, and GDA94 zones 54, 55 and 56. This allows the most appropriate depth to basement surface to be imported into any project, depending on its location and the coordinate system used. The refined model aims to improve the confidence of exploration companies when estimating the depth to prospective basement rocks within their project areas.

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MinView updates

New functionality has been incorporated into the GSNSW data discovery and viewing tool, MinView, which will improve versatility and enhance the user experience:

- the default base map satellite imagery service now has access to more recent imagery across most locations in NSW. The NSW Spatial Services aerial imagery service is still available for comparison.
- new 3D-mode improvements provide the ability to alter vertical exaggeration and adjust shadows. A quick help guide popup explaining navigation in 3D has also been included.
- users' exported CSV selections can now be reimported using the "Add local" spatial data tool.

In addition, several key datasets have been added or improved:

- a new geophysics download view conveys the optimal publicly available geophysics data in the state (Figure 4).

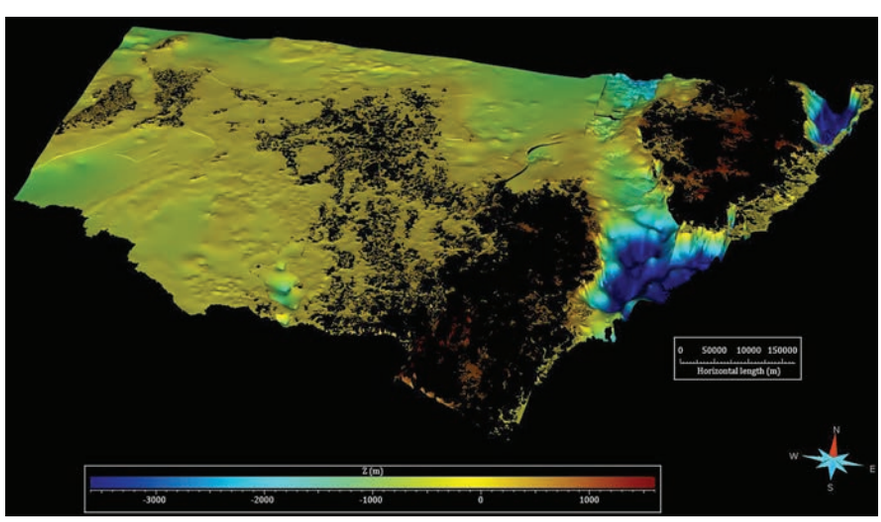

Figure 3. *Perspective view of the 2019 updated statewide depth to basement 3D model showing the top of basement surface with a 10X vertical exaggeration. Colour scale bar indicates depth. Black voids indicate areas of outcropping basement.*

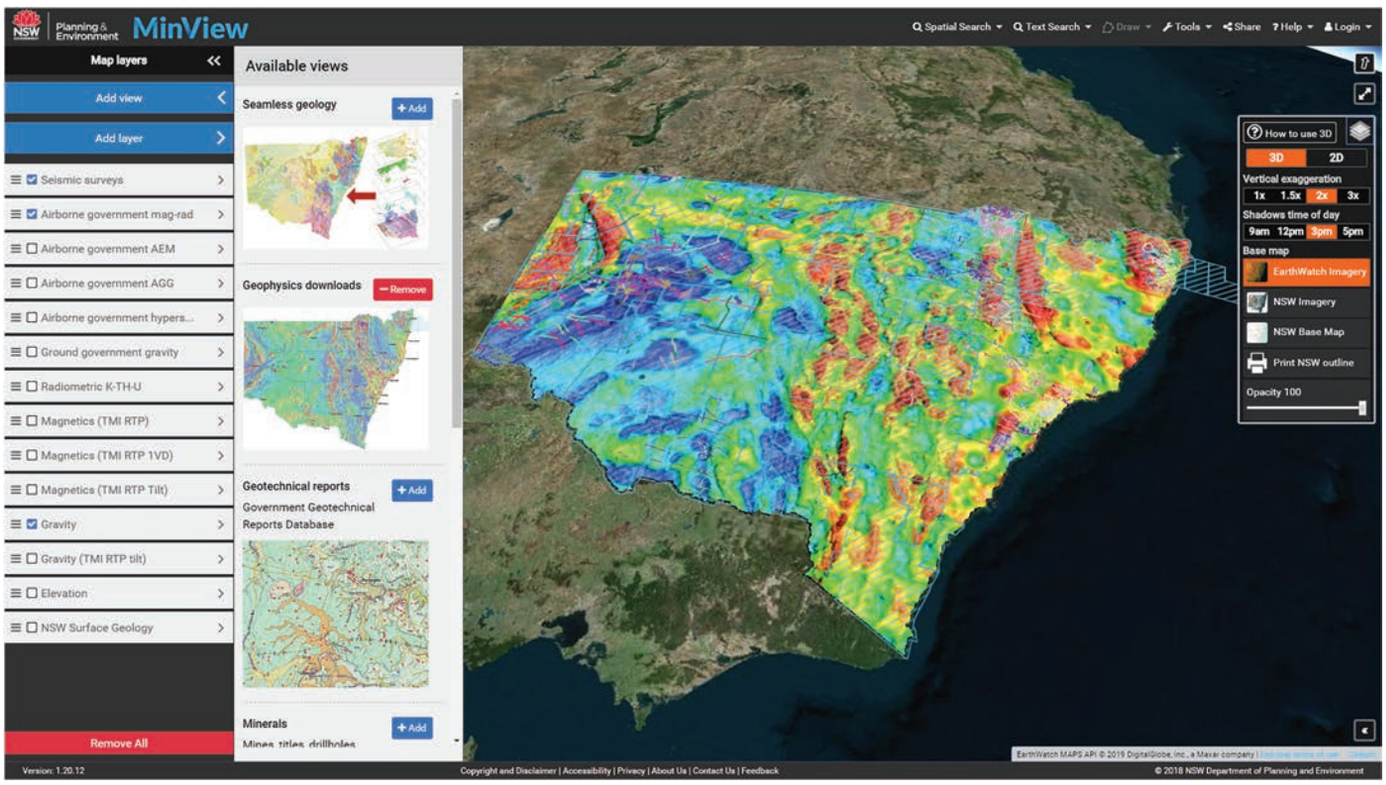

Figure 4. *Screenshot of MinView showing the geophysics download view layers. The map window is in 3D mode and shows a statewide gravity image overlain by government mag rad survey downloads (shown with a blue hatching pattern).*

Using this view, users can spatially or textually select NSW Government mag-rad survey areas and download a zipped file containing grids, images and reports for each survey. A similar layer for onshore seismic surveys contains download links for SEGY/ASCII data and reports.

- a new release of the statewide seamless geology geodatabase (version 2 April 2019) has been included with updated geology in the southern Thomson Orogen and new fault attribution in the eastern Lachlan Orogen. Statewide bedrock exposure and soils data layers have also been added under "Cover Characteristics".
- NSW Government Public Works Advisory geotechnical reports are now available under the Government Geotechnical Report Database (GGRD) initiative. The report locations in MinView are linked to documents in DIGS. A total of 3399 reports are available for download, including borehole logs.

New features and data can be viewed at: https://www.resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/services/online-services/minview

Contact: trisha.moriarty@planning.nsw.gov.au (02) 4931 6598.

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Geological Survey of Victoria: News

New Victorian Government Earth Resources website

The Victorian Department of Jobs Precincts and Regions' Earth Resources branch launched a contemporary, user-friendly website in May 2019: www.earthresources.vic.gov.au. The site has a topic-based navigation function and an improved search tool providing easy access to priority information, tasks and tools.

Victorian Gas Program

The Victorian Gas Program is a suite of geoscientific and environmental programs assessing the potential for further discoveries of conventional gas in the Otway and Gippsland basins. The risks, benefits and impacts of a prospective resource being developed are also investigated.

The Geological Survey of Victoria's Otway Basin Airborne Gravity Survey (Figure 1) is a key part of the program. It comprises 32 000 line km of Full Spectrum Falcon® gravity gradiometry and magnetic data. The survey was flown by CGG Aviation (Australia) Pty Ltd at 500 m line spacing and 150–300 m terrain clearance between August 2018 and January 2019.

The final processed survey data and report is available from www.earthresources.vic.gov.au/projects/victorian-gas-program

The Victorian Gas Program is also investigating opportunities for underground gas storage in depleted and unproduced gas fields in the Port Campbell Embayment of the onshore Otway Basin. A study has been conducted of 18 local wells to derive a holistic petrophysical model for the principal reservoir, the Waarre Formation, across the area (Aldred *et al.*, 2019). The deterministic techniques used in the study highlighted the importance of gas bearing shaly intervals when modelling reservoir performance.

Southeast Lachlan Crustal Transect

The Geological Survey of Victoria, Geological Survey of New South Wales, Geoscience Australia and AuScope Limited have collaborated to acquire new geophysical data across the Southeast Lachlan Crustal Transect in southeast Australia (Figure 2).

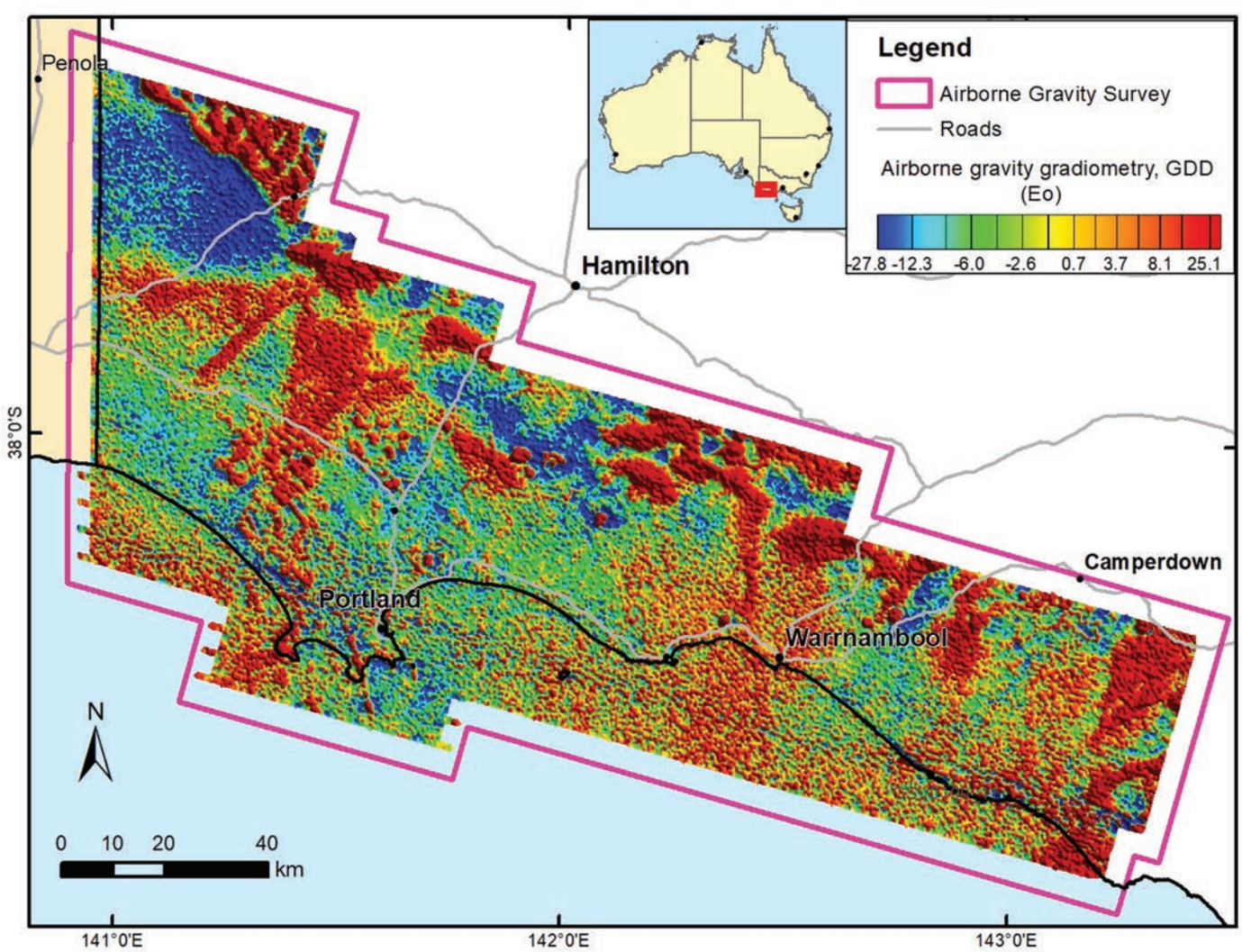

Figure 1. *Map showing gravity gradiometry results (GDD, terrain correction density 1.8 g/cc) from the Otway Basin Airborne Gravity Survey.*

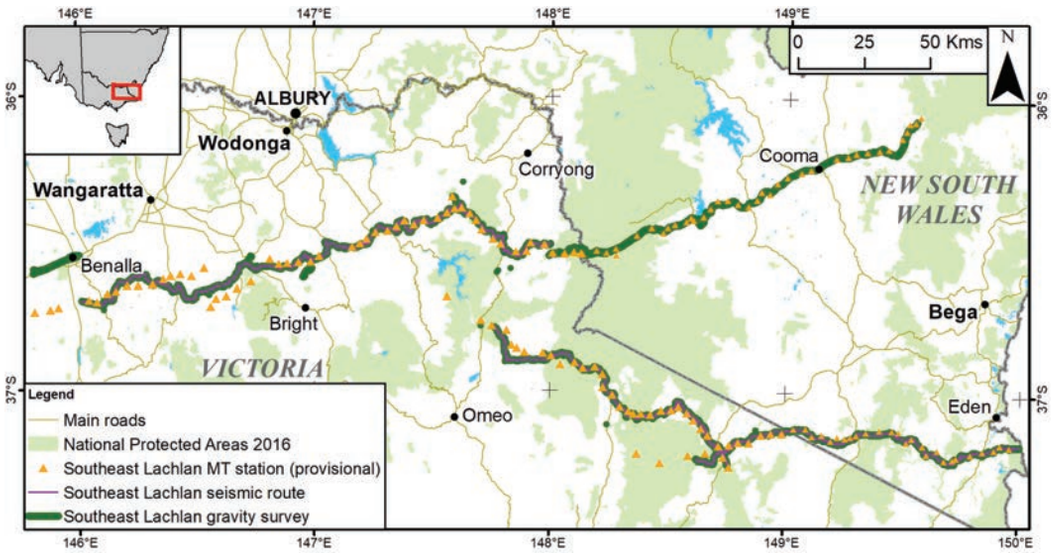

Figure 2. *Map showing the location of deep crustal seismic reflection and gravity surveys and planned magnetotelluric sites across the Southeast Lachlan Crustal Transect.*

Deep crustal seismic reflection data were acquired by Terrex Seismic in 2018. The seismic data are available from Geoscience Australia as L208 Southeast Lachlan Seismic Survey 2018.

Ground gravity data were acquired by Atlas Geophysics in 2019 and are available from Geoscience Australia at www.geoscience.gov.au/gadds and at www.earthresources.vic.gov.au.

Planning is underway for a magnetotelluric survey along the transect.

Preliminary project results will be presented at Discoveries in the Tasmanides, 25–28 September 2019, in Wagga Wagga, NSW. Ross Cayley (Geological Survey of Victoria) will describe planning, acquisition and some preliminary results from the deep crustal seismic reflection profile across the Australian Alps, on behalf of the project partners.

Stavely Project – western Victoria

An extensive geoscience program in western Victoria - the Stavely Project - was completed in 2018. The program found that the Stavely Arc has the geological potential for new copper, gold and possibly other metals discoveries. Encouraging results in the project area have been recently reported at Thursday's Gossan (up to 5.05% Cu and 6.06 g/t Au, Stavely Minerals ASX Announcements, 18 June 2019) and the Glenlyle Prospect (up to 390 g/t Ag and 4.0 g/t Au, Navarre Minerals ASX Announcements, 21 Mar 2019).

The new pre-competitive data and findings have been published as a series of geoscience data packages, technical reports and a regional (full crustal-scale) 3D geological model. These products are available through www.earthresources.vic.gov.au/projects/stavely/geological-data-and-information.

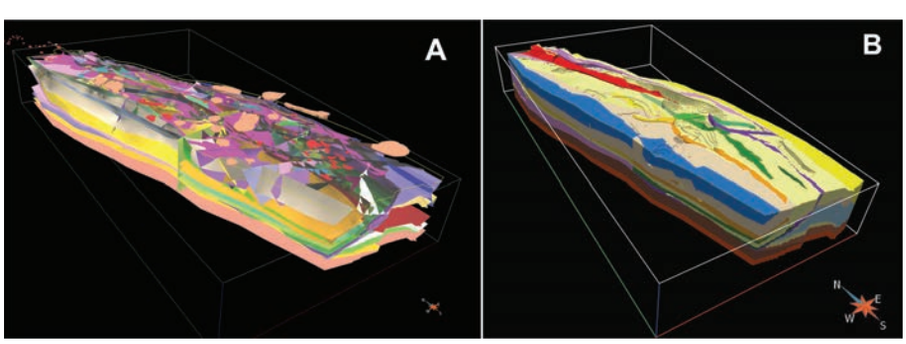

Figure 3. *Stavely 3D geological model showing modelled A) surfaces and intrusives, and B) volumes. Spatial distribution and geometries have been informed by geophysical data and constrained by petrophysical property values.*

Geological Survey of Victoria's Philip Skladzien will present a case study at AEGC 2019 that describes the workflow, from acquisition to application, of the large petrophysical dataset compiled during the Stavely Project. These data were used to constrain modelling and interpretation that informed the development of the Stavely 3D geological model shown in Figure 3 (Cayley *et al.*, 2018).

The results of the Stavely Project have helped delineate the prospective volcanic belts of the Stavely Arc and have established the nature of their relationships with the old and younger cover rocks, which will assist explorers generate new targets and reduce risk.

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Cayley, R. A., M. A. McLean, P. B. Skladzien, and C. P. Cairns. 2018. Stavely Project - Regional 3D Geological Model. Stavely Project Report 3. Geological Survey of Victoria. Department of Economic Development, Jobs, Transport and Resources.

Mineral Resources Tasmania: Geophysical activities in 2019

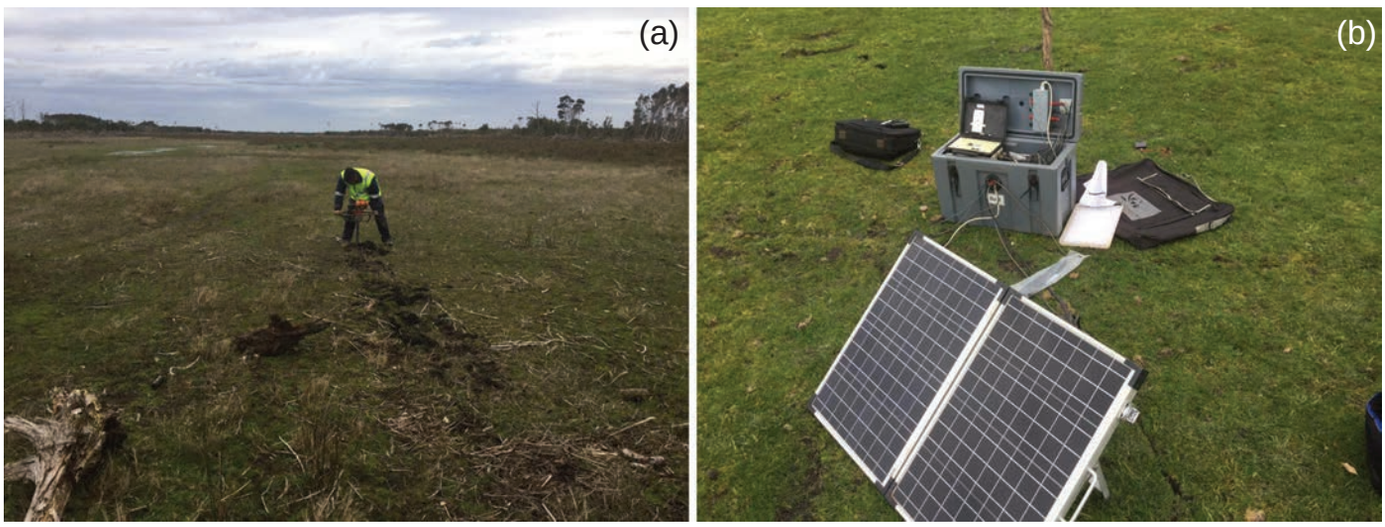

Figure 1. *(a) Geoscience Australia geophysicist Darren Kyi prepares the ground for electrode placement at an AusLAMP MT site near the northern end of King Island, auguring well for insights into lithospheric conductivity. (b) Long-period MT recording equipment approaching readiness for barricading against livestock depredations, southern King Island.*

Geophysical activities at Mineral Resources Tasmania (MRT) continue to be broad ranging and the Tasmanian component of the AusLAMP continental magnetotelluric coverage is of national significance.

MRT staff assisted Darren Kyi and Tanya Fomin from Geoscience Australia in deploying the final Tasmanian stations on King Island in June 2019 (Figure 1a and b). However the lion's share of AusLAMP in Tasmania has been conducted as part of Thomas Ostersen's PhD research at the University of Tasmania. Tom is being supervised by Anya Reading and Matt Cracknell and supported by GA and MRT with co-supervision and assistance from Graham Heinson, Stephan Thiel and Kate Robertson at the University of Adelaide and the Geological Survey of South Australia.

Full results will be released following the imminent submission of Tom's thesis, however a tantalising taster is given in Figure 2 (9.4 km depth slice). An association between conductive zones in the upper crust and highly serpentinised ultramafic slices previously interpreted in 3D modelling on magnetic and geological grounds is among the many intriguing features revealed.

Mineral Resources Tasmania's suite of 3D geological models driven by potential field inversion and structural modelling continues to be expanded and refined,

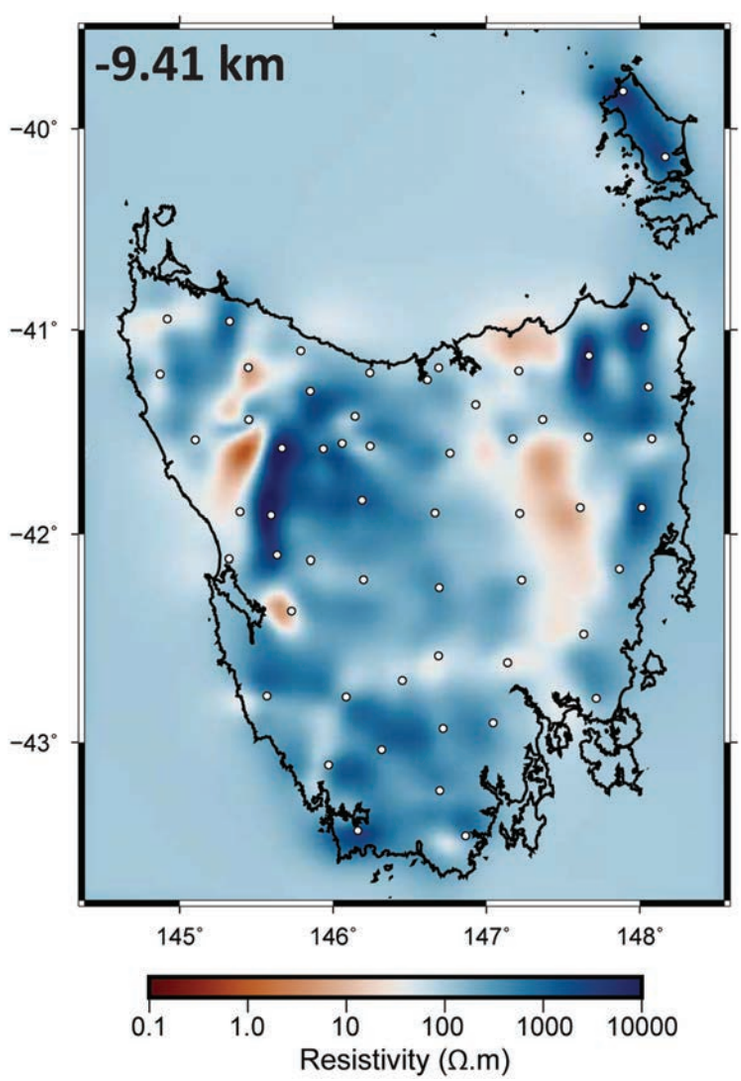

Figure 2. *Conductivity depth slice, courtesy of Tom Ostersen (PhD thesis in prep.).*

and is being increasingly taken up by explorers.

An interpreted sub-surface granite intrusion identified by preliminary modelling in the northern Rosebery-Lyell region (described by Bombardieri and Duffett in *Preview* **183**) was subsequently targeted by exploration drilling. It intersected the serpentinites predicted by the model but was terminated by technical difficulties before reaching the target depth (Bombardieri *et al.* AGGC 2018, *Preview* **192**).

However information obtained from the new core including rock property and Hylogger data have been used together with revised gravity data to produce a refined model of the area. Improved uncertainty characterisation is a feature of the new model. The example west-east section depicted in Figure 3a-b indicates the distribution of model physical properties between and within geological units in one of the thousands of models deemed acceptable in the ensemble. Zones of low contrast tend to be where voxels fail to meet the threshold of retaining the same geological unit membership in at least 99% of acceptable models. These voxels, coloured black in Figure 3c, thus indicate regions of greater uncertainty (at least as far as potential field responses are concerned) in the 3D model geometry.

The most recent 3D model released by MRT is of the Alberton-Mathinna 'gold corridor' in NE Tasmania (Figures 4–7). A significant outcome of this modelling was gravity-derived delineation of a granite cupola in the vicinity of the Golden Gate mine, the most richly endowed in the goldfield historically. Subsequently the company awarded the exploration licence for the area have indicated that they are using the model in their assessment. Further details of the Alberton-Mathinna modelling are in *Preview* **195**. All models produced by MRT are being made available as Gocad™ projects, viewable via Mira Geoscience's free Geoscience Analyst software.

MRT's 3D geophysical modelling is underpinned by a database of rock physical properties that continues to expand steadily, in response to the need for better constraints. A strategic approach opportunistically targeting drill core in areas and stratigraphic units hitherto poorly characterised has enabled significantly improved petrophysical definition of Tasmania's geological constituents with a minimal commitment of resources. There

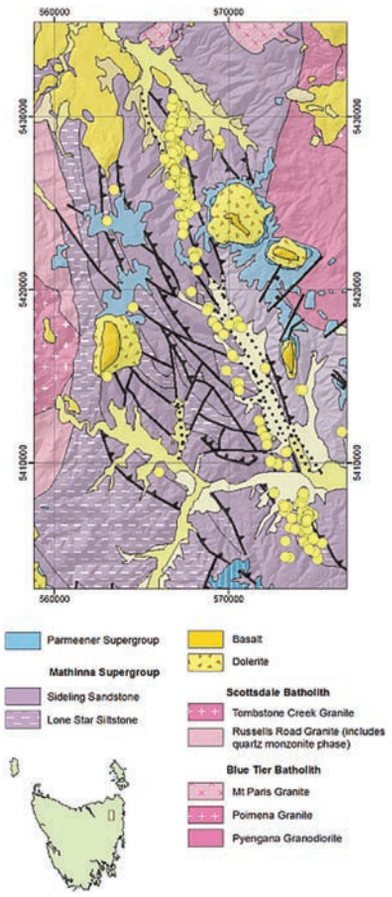

Figure 4. *Alberton-Mathinna geology. Known gold occurrences indicated by yellow circles.*

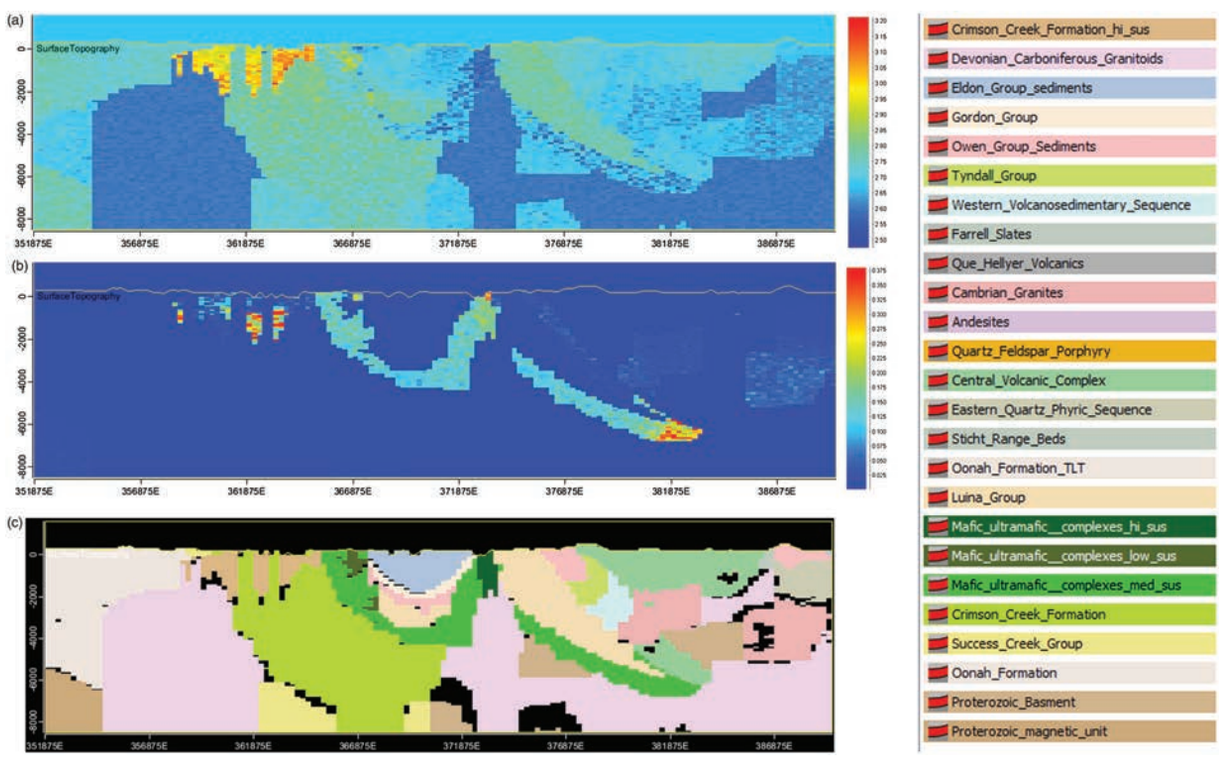

Figure 3. *Density (a, t/m3), magnetic susceptibility (b, SI) and geological units (c) present in at least 99% of acceptable models on representative west-east section of northern Rosebery-Lyell model.*

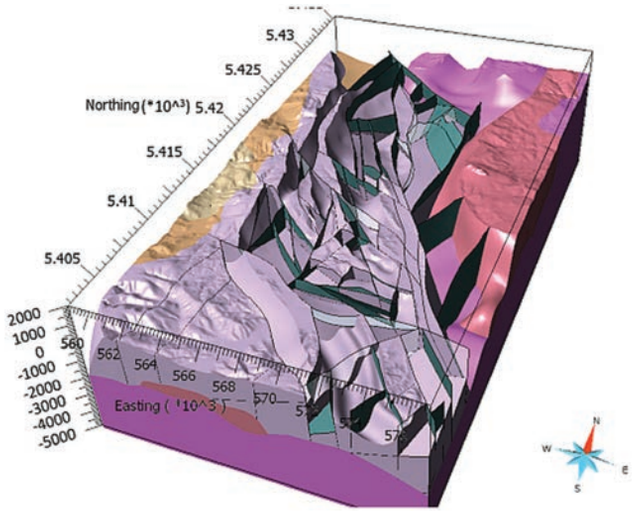

Figure 5. *Alberton-Mathinna 3D model with Sideling Sandstone removed to partly reveal structurally interpreted 3D fault network.*

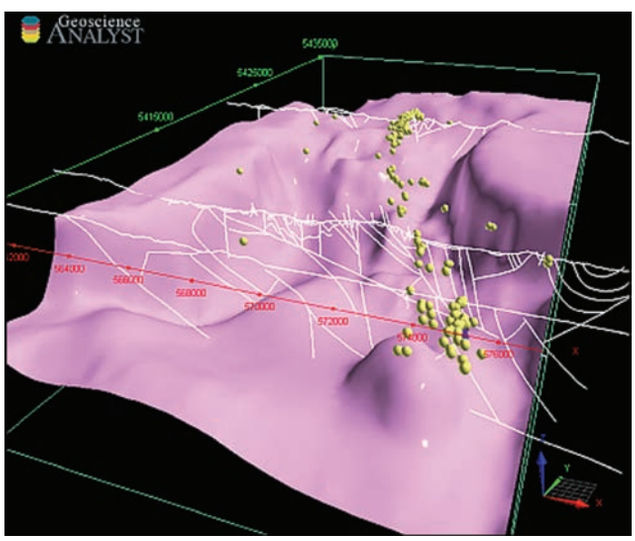

Figure 6. *Alberton-Mathinna modelled granitoid surface with representative structural construction sections and gold occurrences. The Golden Gate mine within the foreground cluster (SE corner) has produced over 260 000 ounces of gold.*

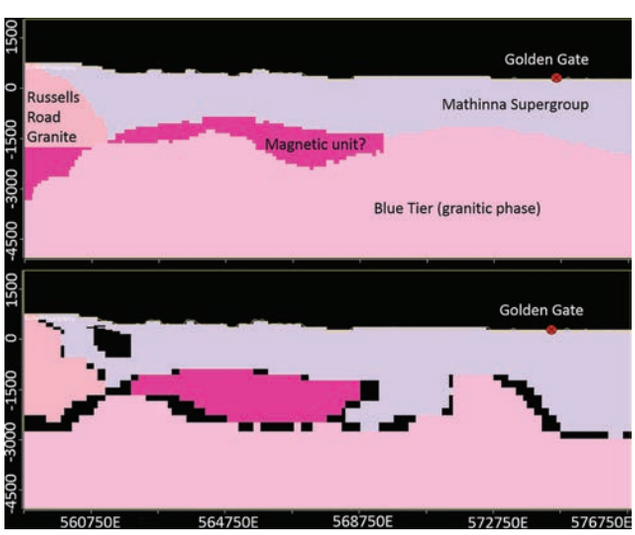

Figure 7. *Starting model (top) and final ensemble inversion summary model (bottom) showing voxels with the same geological unit assigned above a 99% threshold of acceptable models, on a west-east section through the Golden Gate mine.*

are now 5345 density determinations on drill core in the database, together with 18 107 core magnetic susceptibility readings (Figure 8), in addition to many hundreds

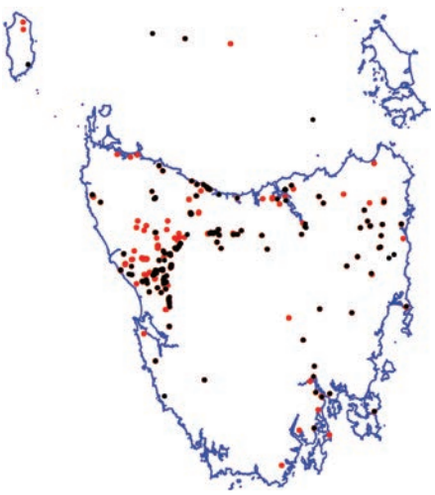

Figure 8. *Distribution of density (black) and magnetic susceptibility (red) measurements on drill core recorded in MRT's petrophysical database as of July 2019.*

of sonic velocity (mostly P- with some S-wave), electrical resistivity, chargeability and magnetic remanence measurements. These can all be supplied on request, also in due course online via GA's Rock Properties database.

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Geological Survey of South Australia: An update

Gawler Craton Airborne Survey

The Geological Survey of South Australia and Geoscience Australia are pleased to announce the completion of the acquisition phase of the 1.67 million line kilometre Gawler Craton Airborne Survey (GCAS) Figure 1, covering 294 000 km^2 with high resolution magnetic and radiometric data over the Gawler Craton in northern South Australia (put into perspective, the survey covers an area the size of Italy with the distance flown being equal distance to travelling to the moon and back twice, or around the world at the equator 41 times!). Flown at 60 m clearance and 200 m line spacing, the survey employed four contractors using 11 different aircraft over a period of two years without a significant safety incident.

The Gawler Craton hosts the world-class iron oxide copper-gold (IOCG) province that includes the copper-rich Olympic Dam, Prominent Hill and Carrapateena deposits, the Challenger gold deposit, and iron ore deposits of the Middleback Range. Geologically young sediments overlying the Gawler Craton host the giant Jacinth-Ambrosia heavy mineral sand deposits, which are major sources of titanium and zirconium.

Airborne magnetic and radiometric data are key tools for directly detecting the signatures of ore-forming systems. The data are also used in mapping the surface and subsurface geology, particularly in areas with extensive cover sediments such as the northern Gawler Craton. Approximately 45% of the land within the GCAS area is currently occupied by minerals exploration leases and exploration lease applications.

The Gawler Craton Airborne Survey has set new standards across a range of benchmarks including landholder communications, community information, and data delivery via the Gawler Craton Airborne Survey Community Information Website. There have been over 2200 GCAS

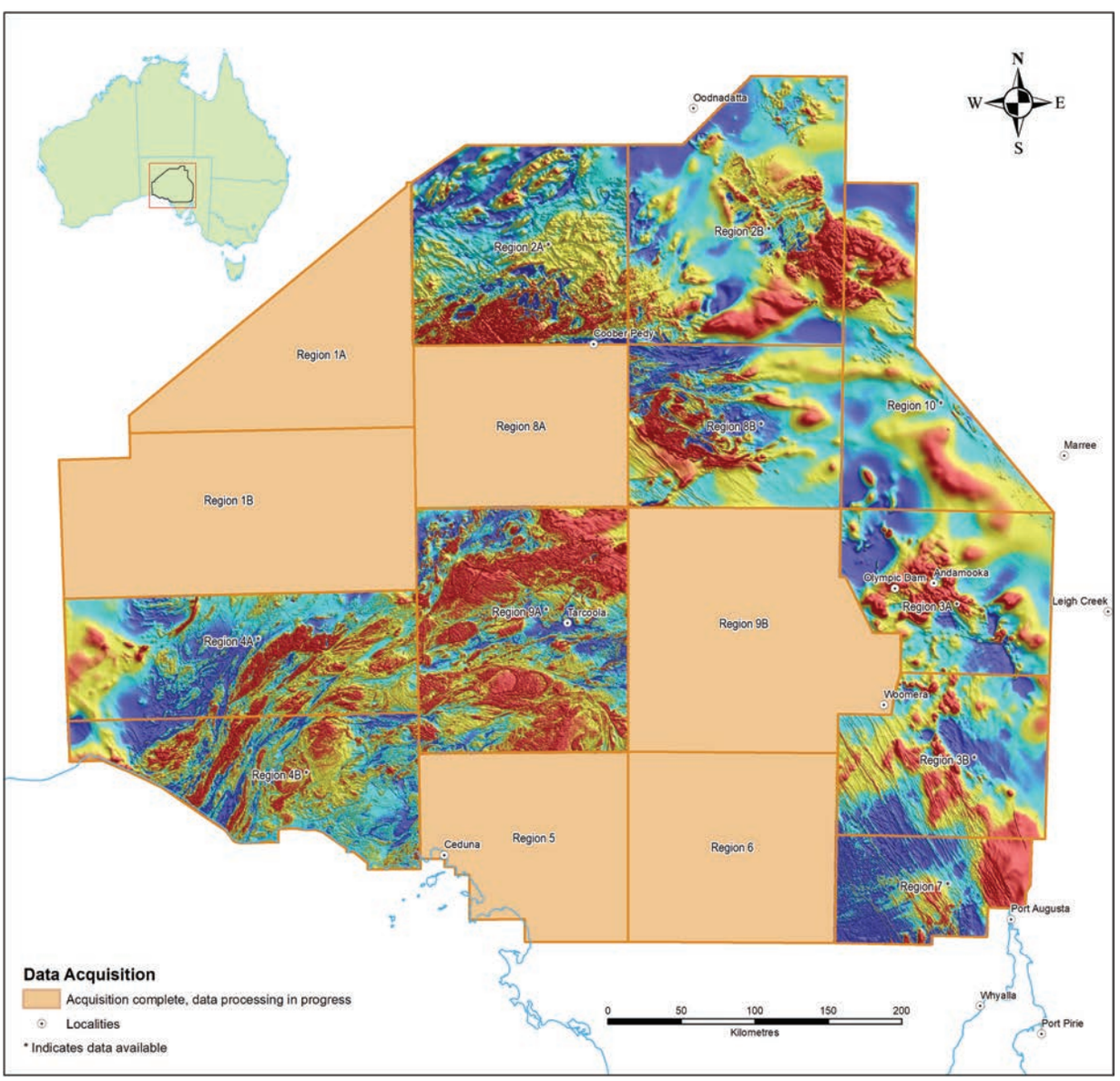

Figure 1. *Acquisition for the GCAS is complete with data becoming available over the coming months.*

data downloads, 1672 of these are downloads of the new survey data and 536 downloads are the value-added and depth-model data packages. GCAS data has more than 28 000 views on the Department for Energy and Mining (DEM) Website. While 60% of the GCAS data is already available to the public as free downloads, DEM expect to release 100% over the coming months.

In addition to the data releases, DEM have partnered with CSIRO to provide a comprehensive suite of value-added data products derived from the GCAS data. These products include filtered magnetic images and magnetic modelling that predicts the depth to economic rocks below the surface. To date, these value-added releases have provided new information and data across some 72 000 km^2.

The Department for Energy and Mining would like to thank and congratulate the airborne geophysics suppliers and contractors to the GCAS: MagSpec Airborne Surveys Pty Ltd, Sander Geophysics, Thomson Aviation Airborne Geophysical and Survey, GPX Surveys, Baigent Geosciences and Minty Geophysics. The Department would also like to acknowledge the cooperation of the Department of Defence and the assistance of collaborative partners Geoscience Australia and CSIRO.

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Gravity

Geophysicists from the GSSA and CSIRO recently undertook a short fieldtrip to examine two types of geophysical features that have been well defined by the GCAS. The first of these feature are the "pimples" seen throughout the magnetic 1VD images over the Nullarbor Plain. These pimples are particularly noticeable in GCAS region 4b (see Figure 2). The pimples extend throughout the Nullarbor and well into Western Australia, and little is known about them. Their distribution is not random, it is patterned, but the material causing the magnetic signal is unknown. There is some correspondence between their distribution and the distribution of surficial sandy features, but the relationship isn't consistent. In conjunction with CSIRO, we undertook ground magnetics and microgravity over a selection of the pimples and

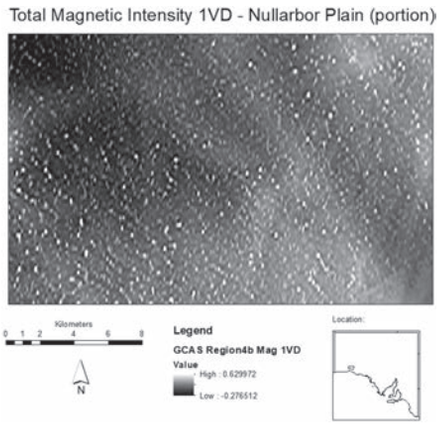

Figure 2. *The pimples on the Nullarbor Plain are short-wavelength features prominent in the 1VD magnetics.*

carried out some modelling work. The gravity stations were spaced at 10 m intervals and magnetic stations at 5 m intervals along traverses over each of the selected pimples.

The second feature we examined was a Gairdner Dolerite. These dykes are a prominent geophysical feature in South Australia and are often seen as a hindrance to exploration as they mask the prospective geology. They are long, linear, northwest-southeast striking features that cover much of central South Australia. We undertook a detailed ground magnetic and gravity profile over the top of one prominent dyke near Lake MacFarlane. The data allows us to model the dyke with a higher level of confidence than from airborne data, and the gravity data allows us to see if there is a coincident gravity anomaly. Gravity stations were acquired at 50 m intervals with a 25 m infill directly over the magnetic anomaly, and ground magnetic data was acquired at 25 m intervals for the length of the 3.5 km line. Stay tuned to future ASEG publications for the full report!

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Magnetotellurics

The final EDI files (combined audio-magnetotelluric and broadband magnetotelluric) are available on SARIG (https://map.sarig.sa.gov.au/Shortcut/MTInterpreted) for the Olympic Domain Magnetotelluric Survey. This project was funded by PACE Copper, and the tender process was managed by Geoscience Australia. There are 333 sites available for download, including six sites funded by Investigator Resources. The survey area covers the Carapateena IOCG deposit and the recently discovered Oak Dam is on the northern edge of the array, and other prospects and deposits include Emmie Bluff, Punt Hill and Mt Gunson. The results of 3D and 2D magnetotelluric (MT) inversions of the data will be presented at the Australasian Exploration Geoscience Convention (Thiel, Robertson & Jiang, "Scale reduction using Magnetotellurics – a mineral exploration example from the Olympic Domain, South Australia") and at Discovery Day on 28 November at the Adelaide Convention Centre. (Figure 3)

A further seven AusLAMP sites have been acquired in the far west coast region of South Australia, to replace existing sites with poor data quality. These have now been incorporated into the AusLAMP data package that is available for download on SARIG.

In October we will set sail for an exciting endeavour with the planned acquisition of 24 marine MT sites (Figure 4), a collaborative and co-funded project by the Geological Survey of South Australia, the University of Adelaide, Geoscience Australia and Scripps Institute of Oceanography, with instruments loaned from the Scripps Institute of Oceanography, San Diego, United States by Professor Steve Constable. This survey will build upon the resistivity model across the Gawler Craton provided by AusLAMP, and will help to constrain

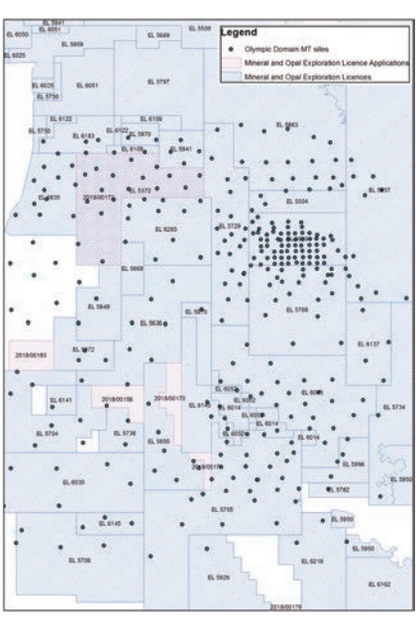

Figure 3. *Locations of MT sites across the Olympic Domain infill region.*

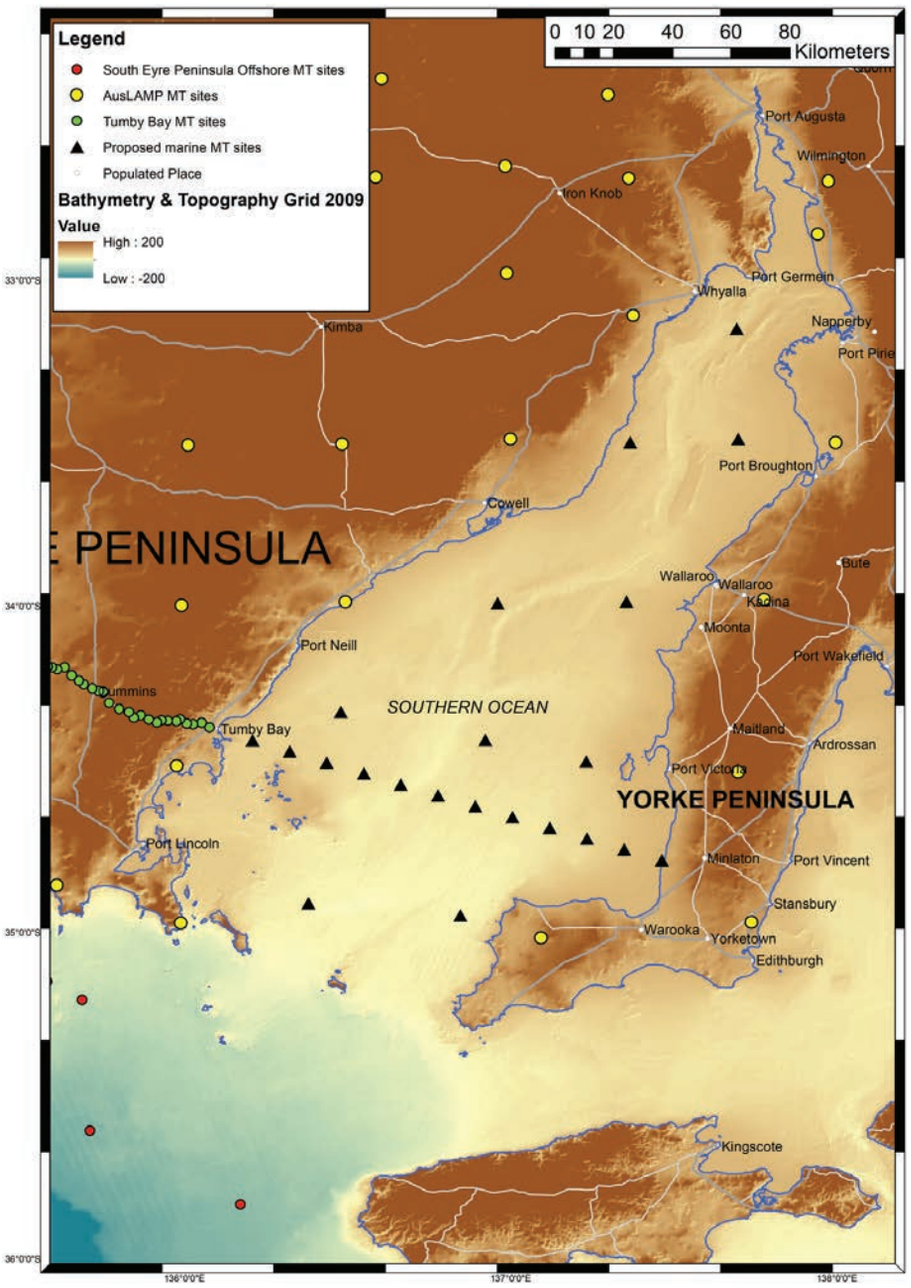

Figure 4. *Black triangles show planned locations of marine magnetotelluric sites.*

the tectonic setting of the prospective eastern margin of the craton.

You can always find details on the latest magnetotelluric surveys and the products available for download on the AusLAMP page of the Department for Energy and Mining website (http://www.energymining.sa.gov.au/minerals/geoscience/geological_survey/gssa_projects/auslamp) or by contacting Stephan Thiel (Stephan.Thiel@sa.gov.au) or Kate Robertson (Kate.Robertson2@sa.gov.au).

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Northern Territory Geological Survey: Geophysical and remote sensing projects

The Northern Territory Government's *Resourcing the Territory* initiative provides $26 million over 4 years (2018–2022) to support long-term sustainability of the Territory's resource sector. The initiative aims to increase exploration activity within the NT through a range of pre-competitive geoscience programmes including regional scale geophysical data acquisition and exploration stimulus programmes.

The pre-competitive geophysical programme focusses on upgrading the quality and resolution of older airborne magnetic and radiometric datasets. The first survey acquired under this programme is the NTGS Tanami Region Airborne Magnetic, Radiometric and Elevation Survey. This survey covers more than 42 000 square km extending from the Western Australian border to approximately 300 km west of Tennant Creek (Figure 1). The survey was flown at 200 m line spacing with more than 240 000 line km acquired. Industry partners funded an additional 30 000 line km of infill data at 100 m line spacing. Preliminary magnetic and elevation data was released publically in June 2018 (Figure 2).

The NTGS Mount Peake – Crawford Airborne Magnetic, Radiometric and Elevation Survey is the second survey to be acquired under this programme. Commencing in mid-2019, the survey is centred 250 km north-north east of Alice Springs (Figure 1). With 200 m spaced north-south lines, this dataset will be a significant improvement on the existing 500 m spaced regional data acquired during the 1980s and 1990s. Industry has also partnered to infill areas of interest to 100 m line spacing. Both geophysical surveys are being managed by Geoscience Australia.

The NTGS Geophysics and Drilling Collaborations (GDC) programme has also been continued under the *Resourcing the Territory* initiative. This programme provides co-funding to industry to undertake geophysical or drilling projects in the Northern Territory in greenfield areas. Round 11 of the GDC awarded funding to six geophysical projects, four magnetic and radiometric surveys, one Falcon airborne gravity gradiometry survey and one airborne electromagnetic survey. Two surveys were completed in

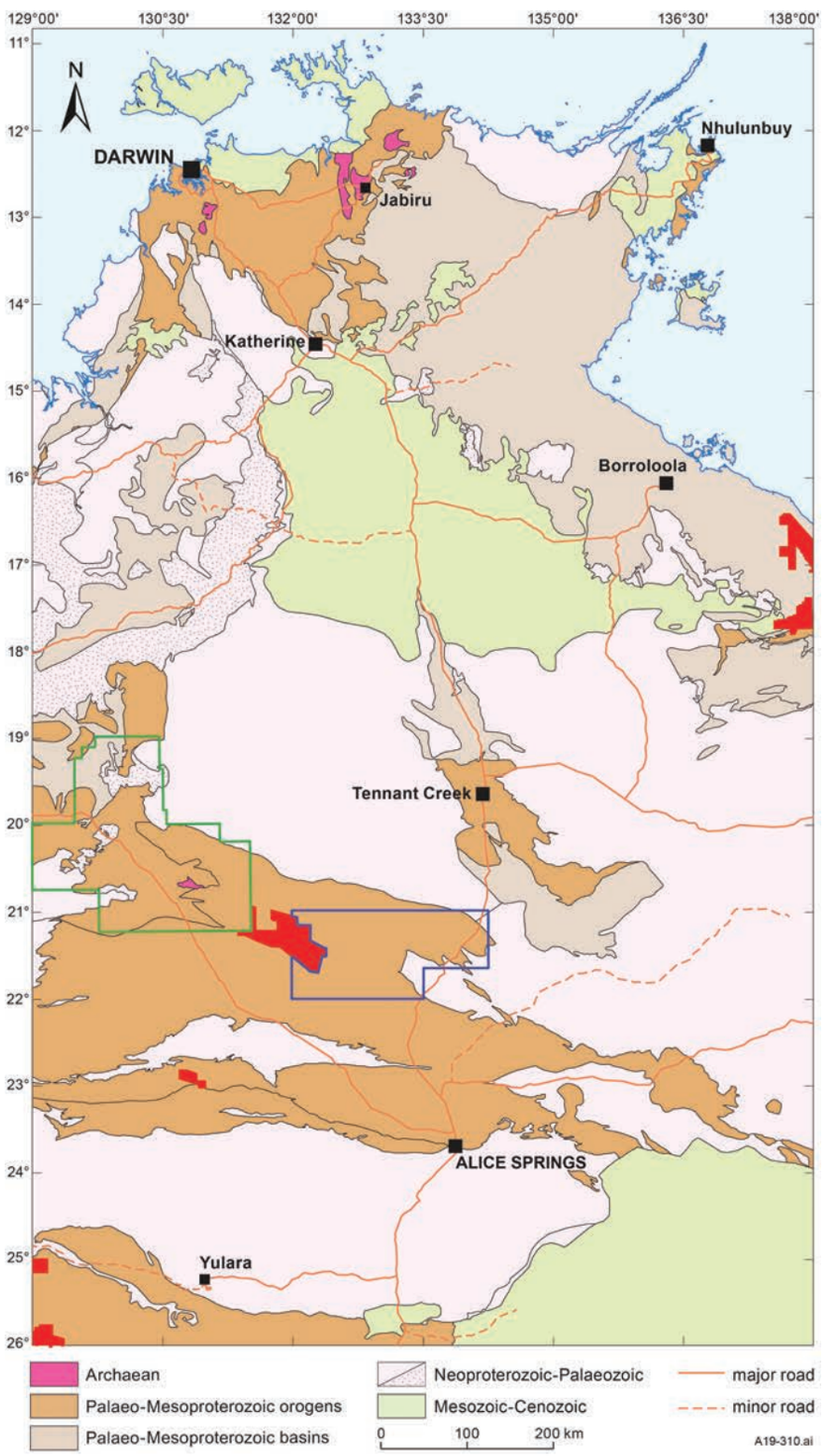

Figure 1. *Location of the NTGS Tanami Region Airborne Magnetic, Radiometric and Elevation Survey (green boundary), NTGS Mount Peake – Crawford Airborne Magnetic, Radiometric and Elevation Survey (blue boundary) and GDC Round 11 geophysical projects (red polygons).*

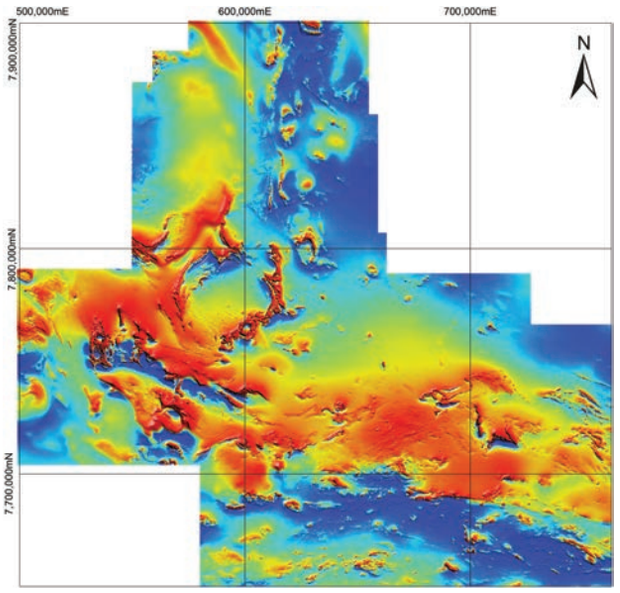

Figure 2. *Image of the preliminary NTGS Tanami Region Airborne Magnetic, Radiometry and Elevation Survey total magnetic intensity.*

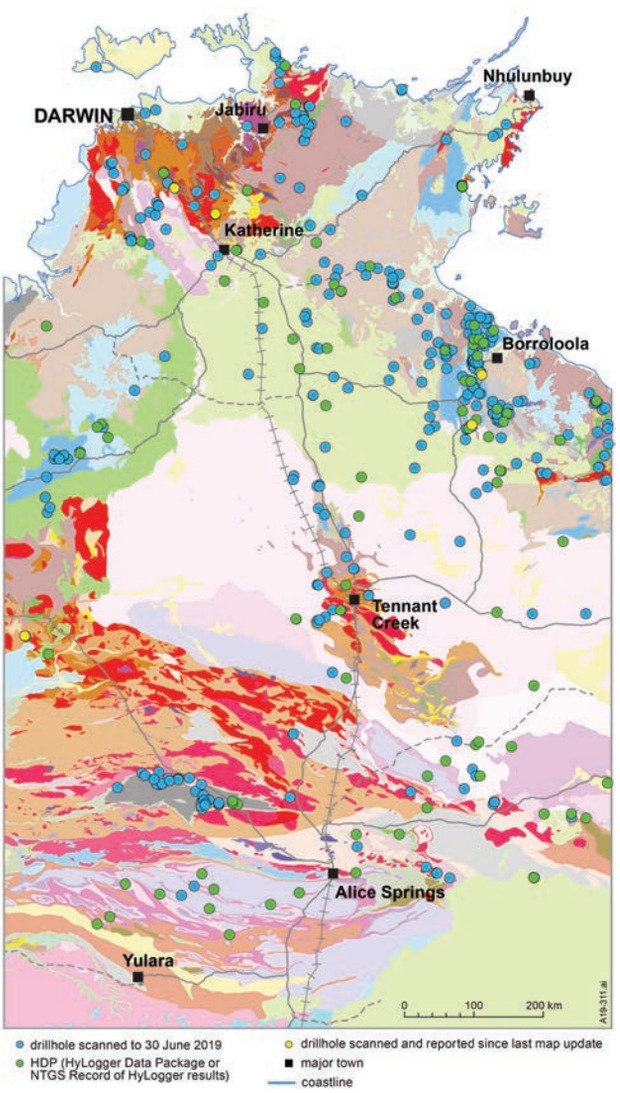

Figure 3. *Location of HyLogged drill holes in the Northern Territory.*

the Musgrave Province, two in the Aileron Province and two more in the McArthur Basin (Figure 1). Geophysical data and associated reports acquired through the GDC programme will be open filed six months after field acquisition.

The Northern Territory Geological Survey (NTGS) owns and operates a HyLogger-3 instrument. This instrument captures high-resolution imagery and measures reflectance spectra of drillcore. These data can be processed to identify minerals from the reflectance spectra. Processed datasets from the HyLogging programme are publically available through the National Virtual Core Library (NVCL). Since NTGS' HyLogging programme commenced in 2010, over 145 km of drillcore from more than 500 drillholes has been collected (Figure 3).

In addition to processed HyLogger datasets, NTGS also delivers HyLogger Data Packages (HDP). Each HDP provides a written summary of the major findings from an individual HyLogged drillhole. This summary is accompanied by a processed dataset integrating complementary data such as published stratigraphy or rock property measurements. Seventy-five HDPs have been published to date (Figure 3).

A new edition of Digital Information Package (DIP) 013 – Rock property dataset of the Northern Territory was released in December 2018. This DIP contains a compilation of rock property measurements published by academia and submitted by the exploration industry through statutory reporting. Also included are new data acquired by NTGS from drill core housed in NT Government drill core repositories. The DIP contains approximately 8300 bulk density and 40,000 magnetic susceptibility measurements from over 1000 locations across the Northern Territory. Stratigraphic or lithological data is also published where available. This DIP is updated annually.

Geophysical and hyperspectral datasets can be located through the STRIKE web mapping system (www.strike.nt.gov.au). All data and products are discoverable on GEMIS: Geoscience Exploration and Mining Information Centre (www.geoscience.nt.gov.au/gemis); datasets smaller than 1 GB are available for download while larger datasets can be requested for delivery through GEMIS.

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MinEx CRC: A new frontier in mineral exploration

There has been a dramatic decline in the discovery of significant, new mineral deposits in Australia since the late 1990s. Mineral and energy resources contributed ~50% of Australia's exports and ~7% of GDP in 2017–2018. The future of this contribution is at risk if we are unable to improve our rate of discovery. There are few, if any, significant new mineral deposits with a clear surface expression remaining to be found in Australia, and exploration is being driven toward the 70% of the Australian landmass where prospective rocks are buried by post-mineralisation cover. Our knowledge of the geology and mineral prospectivity of these covered regions is low, and our ability to explore within them is limited.

Mineral exploration through deep cover is expensive and carries high technical risk. In the last two decades, exploration has moved from low sovereign risk/high technical risk areas such as Australia, to higher sovereign risk/less explored/lower technical risk regions such as western Africa, South America and central Asia. This trend has seen Australia's share of global expenditure on mineral exploration drop from ~1/4 in the 1990s to ~1/8 currently. Over the same period there has been a decline in exploration devoted to making new greenfield discoveries. At present 70% of all drilling is conducted in the vicinity of existing deposits (brownfields exploration) and in drilling-out known deposits (to constrain their distribution in order that a mine can be planned), and this figure is rising, up from 62% in just the last 11 years. Only 30% of metres drilled are conducted in exploration remote from known deposits (greenfields exploration), including in areas of deep cover. This trend toward less exploration drilling is particularly concerning because of the positive long-term correlation between drilling and mineral discovery. Under cover, mineral deposits cannot be discovered without drilling and, when discovered, deposits cannot be brought into production without further drilling.

Australia's declining share of exploration spend, drilling and discovery put at risk our future as a mining country. In the absence of significant, new discoveries, progressively lower grade material is mined from deposits. Average mined grades (amount of metal per tonne of rock) in Australia have halved over the last ~30 years for gold and ~20 years for copper. This has been the key factor in the reduced productivity of the Australian mining industry in recent decades. Productivity will continue to be challenged, and Australia's existing mines will become less competitive if the mining industry continues to "mine down the grade" of known deposits as opposed to making major, new high-grade discoveries.

A measure of the urgency of this situation is that the long-term average time from discovery to mine production is currently 13 years, and is likely to increase in future as deeper deposits with greater technical risk are mined. These long lead times have a significant negative impact on the net present value (NPV) of Australia's mineral assets, which would be improved by the application of cheaper and more rapid drilling technologies to deposit drill-outs. More importantly, the long lead times demonstrate that the investment in technologies to reverse trends of declining discovery, increase productivity, and replace our mineral resource inventory with new, large, high-grade deposits, must start now.

Mineral exploration would undoubtedly return to Australia if the tools (most importantly drilling and associated sensing technologies) existed with which to explore through deep cover cost-effectively. More drilling will lead to a greater understanding of the covered search space and ultimately to discovery. Discovery in areas of previously unknown geology will de-risk exploration, which will encourage further investment and interest, thus promoting a virtuous cycle capable of breaking Australia out of its mineral exploration malaise.

The Mineral Exploration Cooperative Research Centre (MinEx CRC) was established in 2018 under the Australian Government's CRC Programme. The Cooperative Research Centres (CRC) Programme supports industry-led collaborations between industry, researchers and the community. As of February 2019, there are 34 CRCs, all of which address major challenges that require medium to long-term collaborative efforts.

The MinEx CRC aims to:

- improve the competitiveness, productivity and sustainability of Australian industries, especially where Australia has a competitive strength and in line with government priorities.
- foster high quality research to solve industry-identified problems through industry-led and outcome-focused collaborative research partnerships between industry entities and research organisations.
- encourage and facilitate small and medium enterprise (SME) participation in collaborative research.

The MinEx CRC is the world's largest mineral exploration collaboration bringing together industry, government and research organisations, backed by: $50M cash from the CRC Programme; $41M cash from geological surveys and industry; $49M non-staff in-kind; and $78M or 311FTE staff in-kind, totalling $218M

Led by industry participants, the MinEx CRC will create new opportunities for mineral discovery by delivering; (1) more productive, safer and environmentally friendly drilling methods; (2) new technologies for collecting data while drilling and; (3) exploration data on never before sampled rocks that are hidden but prospective for minerals. The outcomes will also grow the high-value Mining Equipment, Technology and Services (METS) sector. MinEx CRC's research agenda is defined by three programme streams listed below.

Program 1: Drilling technologies

Program 1 will extend the capability of Coiled Tubing (CT) drilling so that it can drill deeper, is steerable and delivers the highest quality sampling. Coiled tubing technology promises drilling at 1/5th the cost of conventional diamond drilling and thus has the potential to drive a revolution in mineral exploration whilst delivering significant health, safety and environmental benefits. Drilling tasks that are more suited to conventional drilling will also be tackled by the MinEx CRC, developing technologies for optimising the performance and increasing the productivity of Reverse Circulation (RC) and diamond drilling techniques.

Project 1 aims to improve drilling optimisation and automation by (a) engineering modelling of various processes involved in drilling operation, (b) systematic and reliable recording of drilling data, which can be used directly for real-time and post-mortem optimisation, (c) developing engineering algorithms that can be used for optimisation of the drilling operation and

autonomous analysis of drilling data, and (d) developing a modular autonomous optimisation system that can pave the way towards complete automation.

In the first three years of the MinEx CRC, drilling processes will be studied in the lab and field, engineering models and algorithms will be created to characterise each method, and prototype optimisation modules will be developed.

Project 2 aims to develop existing Coiled Tubing (CT) drilling technology to be suitable for the discovery and definition of mineral deposits (including brownfields, resource definition drilling and greenfields drilling to depths of >500 m). The Deep Exploration Technologies CRC (DET CRC) has previously developed a CT Rig for greenfields mineral exploration, delivering a platform for low-cost, rapid, safe and environmentally-friendly drilling, meeting key technical challenges of coil durability, drilling hard rocks with low weight-on-bit and good sample fidelity. Project 2 aims to deliver additional capability to this CT drilling platform, which will enable it to access a much larger share of the drilling market. The research will deliver improved sample integrity, the precise location and steering of the drill bit, and increasing the reach of drilling.

Research in Program 1 will be undertaken by Curtin University, CSIRO and UniSA. Program 1 industry sponsors include Anglo American, BHP, Epiroc, Geotec Boyles, IMDEX, LKAB Wassara, McKay Drilling, Minerals Research Institute of WA (MRIWA), Sandvik and South 32.

Program 2: Data from drilling

Program 2 will develop technologies for capturing geochemical, petrophysical and seismic data either during drilling or within the drilling workflow. The programme will also deliver software that will enable drilling data to be integrated into 3D geological models in real-time, delivering timely data to inform decisions on drill holes during drilling. This will contribute to drilling productivity through more efficient targeting, by minimising mobilisation costs and by allowing modifications to the drilling programme during deployment.

Project 3 aims to deliver a downhole assay technique that will provide rapid results, remove the reliance on representative cuttings return, will have a small surface footprint and will be cheap to operate. The sensor (or sensors) will be either driller deployable or incorporated in an automated drilling process and will enable informed decisions to be made whilst drilling campaign is ongoing. The tool will be deployed and tested through the National Drilling Initiative. Project 3 will involve explicit collaboration with Partner METS companies who will contribute technical expertise and capability in functional design and fabrication of sensors and will provide a pathway to commercialisation for the technology.

Project 4 will develop the capacity for real-time vectoring during drilling into a new generation of lightweight coil tubing (CT) drill rigs built for the minerals industry. New geophysical logging-while-drilling (LWD) sensors and real-time subsurface reconstruction algorithms will be designed to integrate within exploration or mining workflows. The research has two linked components; (i) development of new sensors for real-time multi-parameter LWD with a CT drill rig and (ii) automatic subsurface reconstruction for steering towards a target (geo-steering) based on geophysical sensing while drilling. This research will extend the reach and value of every metre drilled into a 3D search space ahead of and around the drill bit.

Project 5 aims to reduce the cost and logistic difficulties associated with borehole and surface seismic acquisition to the point where it is considered a routine mineral exploration and deposit definition technique. The characterisation of subsurface properties with high spatial resolution using non-invasive methods is one of the "holy-grails" of mineral exploration. While currently used seismic methods provide the highest resolution among the remote sensing methods, they often considered expensive, lack direct interpretability and depth control. To fully utilise seismic measurements, we need to correlate them with borehole measurements. If this is successful, high spatial resolution 3D mapping of mineral deposits will be possible using many fewer drill holes than are currently required. MinEx CRC will develop methods for rapid data processing and updating of subsurface geological models for resource mapping, mine planning, and safe operation.

Project 6 aims to develop an automated workflow, including algorithms and software, for the integration and first-pass interpretation of geologically characterised drill hole data and other data routinely used to build 3D geological models. The resulting workflow will facilitate rapid 3D model building processes that draw upon multiple geological datasets, are reproducible, provide uncertainty estimates, offer various geological hypotheses, and allow timely model updating. These models will enable uncertainty analysis and multiple geological scenarios to be developed as inputs to support resource estimation and data acquisition strategies.

Research in Program 2 will be undertaken by Curtin University, CSIRO, UniSA and the University of Western Australia. Program 2 industry sponsors include Anglo American, BHP, South 32, HiSeis, IMDEX, Olympus, MRIWA and Sandvik.

Program 3: National Drilling Initiative (NDI)

The National Drilling Initiative (NDI) will manage and deliver drilling programmes in multiple case study areas proposed by MinEx CRC's partner geological survey organisations. The NDI vision is to drill multiple holes in a region to map the regional geology and architecture and define the potential for mineral systems in 3D. A range of drilling methods may be used, however it is intended that the NDI will take advantage of new low-cost Coiled Tubing (CT) drilling technology and associated sensing, in order to maximise the number of drill holes and the volume of data collected.

Project 7 aims to deliver a single point of access to NDI drilling data for all stakeholders, inclusive of a data management and delivery system, geospatial and data analytical tools and drill target optimisation algorithms. The NDI will generate a vast amount of new data and add value to existing data. These data will need to be appropriately managed throughout the life of the MinEx CRC to maximise the value from the NDI. Current methods for managing drilling data require multiple software packages and data delivery systems and are generally undertaken after the completion of the programme.

A streamlined approach to managing and integrating the many layers of complex drilling data, which provides an objective analysis of the data, would result in significant efficiency gains and the ability to modify drilling programmes in real time.

Project 8 aims to provide new geoscience data and knowledge in the NDI case study areas via integration of geophysics and petrophysics, regolith and hydrogeology, alteration signatures, basin analysis, and igneous and metamorphic analysis. These new data will aid in the construction of 3D geological models and 4D reconstructions of the geological evolution of the case study areas and aid in the identification of known and potential mineral systems within. New technologies and methodologies will be developed and leveraged to change mineral exploration practices in under-cover regions. Project 8 will provide advice to assist programme design for future drilling in covered terranes, including within the NDI case study areas.

Project 9 aims to develop and deploy a mineral system analysis and exploration workflow within the NDI case study areas. The NDI provides an opportunity to change our approach to mineral exploration targeting – taking advantage of MinEx CRC's national collaboration, ten-year life, continent-scale perspective and access to many thousands of metres of drilling. The NDI provides a unique opportunity to (1) systematically collect large (multi-scale), comprehensive, and diverse data sets; (2) deploy fit-for-purpose data- and geoscience analytical techniques designed to identify and map mineral system footprints within cover and underlying basement; and (3) apply a suite of mineral systems mapping tools designed to identify and prioritise areas of high prospectivity.

Research in Program 3 will be undertaken by CSIRO, Curtin University, the University of Adelaide, Australian National University, the University of South Australia, and the University of Newcastle. Program 3 Geological Survey Participants include, the Geological Survey of New South Wales, the Geological Survey of South Australia, the Geological Survey of Western Australia, Geoscience Australia, the Geological Survey of Queensland, the Geological Survey of Victoria, Mineral Resources Tasmania and the Northern Territory Geological Survey.

Education and Training Program

MinEx CRC's Education & Training (E&T) programme will have a critical role in the development of next-generation mineral exploration skills in PGR (postgraduate research) and Vocational Education and Training (VET) students. The CRC has an ambitious target of graduating 50 postgraduate students

from participating universities. The CRC will also assist in the training of 200 Vocational Education and Training (VET) students in specific aspects of drilling and mineral exploration technologies.

MinEx CRC utilises the unique position of CRCs at the nexus between industry and university research to add value for PGR students working on its projects. Specifically, MinEx CRC:

- Ensures all PGRs have a co-supervisor from a mining company, geological survey, CSIRO or METS company.
- Offers a voluntary mentoring scheme for PGR students with senior industry staff.
- Financially supports internships within mining companies, geological surveys or METS companies during PGR research.
- Provides networking opportunities with industry representatives, including at the MinEx CRC annual conference.

A copy of the MinEx CRC Postgraduate Booklet can be found on the education webpage www.minexcrc.com.au/education

MinEx CRC has allocated A$150 K of its education and training budget to the VET sector to assist in the training of 200 VET students. MinEx CRC will work in partnership with industry organisations to identify skills gaps related to the drilling and mineral exploration industries.

Discovery is the ultimate reward

MinEx CRC's research outcomes will result in; (1) more efficient and productive drilling technologies which will reduce the cost and time of exploration drilling, which in practice will lead to more metres drilled; (2) downhole geochemistry and geophysics that will reduce the cost of data acquisition and, delivered in real-time, will lead to better informed targeting and timely decision making reducing the time and cost of drilling programmes; (3) geological data that will de-risk previously underexplored regions and encourage significant additional exploration and drilling, and (4) commercialisation opportunities for METS companies that will gain competitive advantage in the global exploration market.

This combination of impacts will serve to greatly increase the volume and efficiency of exploration under Australia's deep cover, with increased mineral discoveries as the ultimate reward. Specific impacts from the proposed MinEx CRC have an expected cost: benefit ratio of 2.24, not including the significant upside benefit of the discovery of new mineral deposits extending well past the life of MinEx CRC.

MinEx CRC participants include:

Industry participants:

- Anglo American
- Barrick
- BHP
- Epiroc
- Geological Survey of Western Australia
- Geoscience Australia
- Geotec Boyles
- HiSeis
- IMDEX
- LKAB Wassara
- McKay Drilling
- Minerals Research Institute of WA (MRIWA)
- Geological Survey of New South Wales
- Olympus
- Sandvik
- South 32
- Geological Survey of South Australia

Research participants:

- Australian National University
- CSIRO
- Curtin University
- University of Adelaide
- University of Newcastle
- University of New South Wales
- University of South Australia
- University of Western Australia

Affiliates:

- Datacode
- Geological Survey of Queensland
- Geological Survey of Victoria
- Government of South Australia, Department of State Development (DSD)
- Major Drilling
- Micromine
- Minalyze
- Mineral Resources Tasmania
- Minotaur Exploration
- Northern Territory Geological Survey
- Snowden
- Strategic Energy Resources
- Southern Geoscience Consultants

Further information on the MinEx CRC:

Website: www.minexcrc.com.au

LinkedIn: https://www.linkedin.com/company/17923289

Twitter: https://twitter.com/CrcMinex

Further information on the CRC programme:

www.business.gov.au/assistance/cooperative-research-centres-programme

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What will Australia be like in 2060?

CSIRO's *Australian National Outlook 2019 Technical report* articulates the challenges, but will the Government take any notice?

It is impossible to forecast the future, but it helps if you have a plan that identifies visionary goals and the key issues that need to be addressed in order to reach those goals. This is where CSIRO's report on the *Australian National Outlook 2019* makes a significant contribution (https://www.csiro.au/en/Showcase/ANO) to Australia's future wellbeing. The 422 page document follows on from the 2015 Outlook. A group comprising of over 50 leaders from 22 leading Australian organisations in the industry, the not-for-profit and education sectors, collaborated on articulating a view about Australia's future. Their report provides connectivity between four key goals and five key issues to analyse what could happen if the *status quo* (and Slow Decline) continues or if the Outlook Vision is achieved.

The four key goals, or the shared vision, are:

- Prosperous and globally competitive industries
- Inclusive and enabling communities
- Sustainable natural endowments
- Strong public and civic institutions

The ANO argues that to realise these visionary goals there needs to be:

- An ***Industry*** shift to enable a productive, inclusive and resilient economy, with new strengths in both the domestic and export sectors.
- An ***Urban*** shift to enable well-connected, affordable cities that offer more equal access to quality jobs, lifestyle amenities, education and other services.
- An ***Energy*** shift to manage Australia's transition to a reliable, affordable, low-emissions energy economy that builds on Australia's existing sources of comparative advantage
- A ***Land*** shift to create a profitable and sustainable mosaic of food, fibre and fuel production, carbon sequestration and biodiversity.
- A ***Culture*** shift to encourage more engagement, curiosity, collaboration and solutions, and should be supported by inclusive civic and political institutions.

The ANO compares a Slow Decline scenario with the Outlook Vision. For example, the diagram below shows emissions projections for the Slow Decline and the Outlook Vision (Figure 1).

There are several other modelling results for example for electricity generation, population distributions in our major cities and land use.

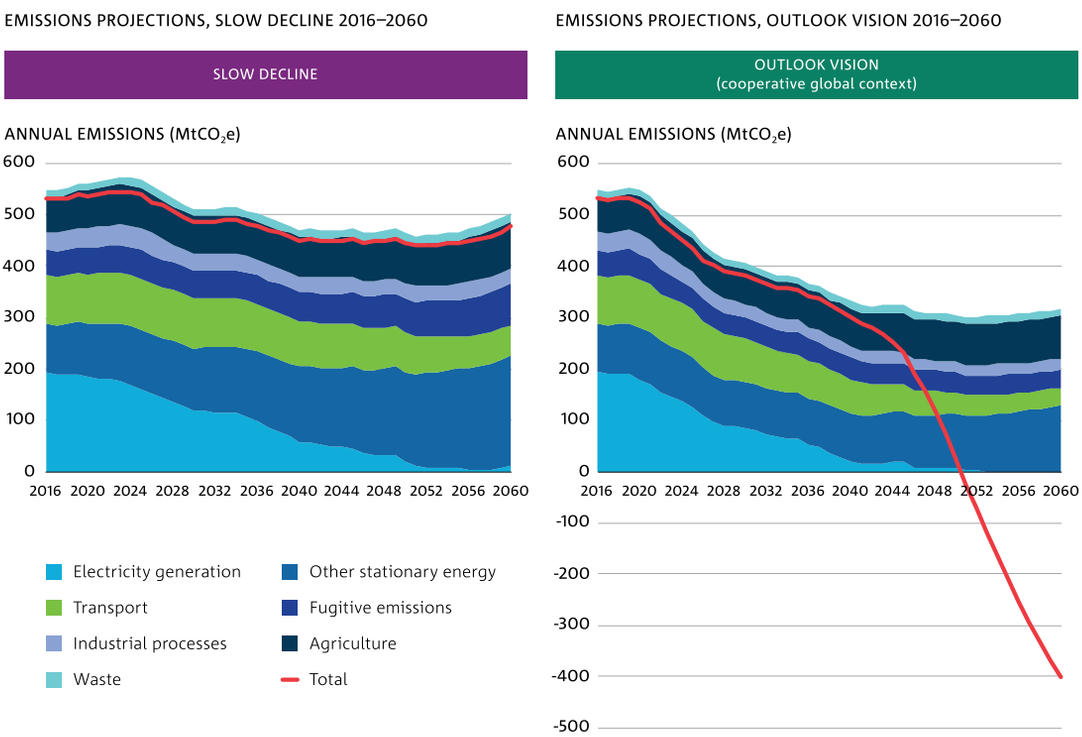

Figure 1. *Emissions projections for a Slow Decline and the Outlook Vision, measured in millions of tonnes of CO_2 equivalent ($MtCO_2e$). Other stationary energy is the consumption of energy other than in electricity generation or for transport fuel. It is mostly the direct use of fuels by industry, the majority of which is for the provision of heat by gas combustion. The red line represents "net emissions" (i.e. the amount of carbon released minus the amount sequestered or offset. For more details, see the Australian National Outlook 2019 Technical report.*

As is apparent, the vision articulated by the ANO 2019 is highly commendable. However, what must be done by governments, industry and the community in order to address the issues identified and achieve the visionary goals is missing from the document. For the Energy issue, for example, the ANO just states:

- **Manage** the transition to renewable sources of electricity, which will be driven by declining technology costs for generation, storage and grid support.
- **Improve** energy productivity using available technologies to reduce household and industrial energy use.
- **Develop** new low-emissions energy exports, such as hydrogen and high-voltage direct current power.

The hard work or heavy lifting (in political speak) involved in **managing**, **improving** and **developing** is not discussed. The report is thin on what must be done and what the Commonwealth and the State governments should do to help, in terms of policy and legislation.

I can imagine the Minister's staffers putting out a press release praising the CSIRO for producing this important report and then doing nothing.

In fact, in the 2019 Budget, the ANO vision of having strong public and civic institutions has already been attacked by funding cuts, through the "death by a thousand cuts" of the annual efficiency dividend. The national science agencies such as Geoscience Australia, the Australian Institute of Marine Science and the Australian Bureau of Statistics, and in the social/cultural sector, the National Parks managed by the Commonwealth, the National Library of Australia, the National Gallery of Australia and the Australian Museum have all been allocated reduced funding.

The Government will need to change course if public and civic institutions are to stay strong and the vision articulated in the Australian National Outlook 2019 is to be realised.

Environmental geophysics

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What not to miss in Perth

Welcome readers to this issue's column on geophysics applied to the environment. This column is dedicated to consideration of the upcoming Australasian Exploration Geoscience Conference (AEGC 2019), to be held in Perth from September 2 to 5 (shew, still lots of time to get my talk ready!). I've had a look at the preliminary programme, and there are quite a few talks that I think will be interesting to geoscientists concerned with applying geophysics to environmental problems. And not just in the obvious streams. Needless to say, much of what I will recommend reflects my own interests and biases – which is why they pay me the big bucks!

As you might expect, there are a number of talks in the Groundwater section that I think will be intriguing. Dave Allen from Groundwater Imaging is speaking on the use of towed EM systems on the farm scale (a subject in which, as we all know, I have an abiding interest). Carmen Krapf from the Geological Survey of South Australia will speak on the use of AEM (plus complementary information) to unravel the location of palaeovalleys in the aboriginal APY lands of remote north western South Australia. Ken Lawrie and KP Tan from Geoscience Australia will talk on some of the important work that that GA is doing to geophysically/geohydrologically characterise large swaths of northern Australia.

I am very interested in passive seismic, but have never even seen the equipment in use – I will definitely be attending a few talks on this technique. I really need to get my hands on some equipment and to see what it is all about. Every time I turn around I get an unexpected plug for these data sets – time for me to get in on the action.

I am also very interested in hearing the talk being given by CSIRO's Aaron Davis on *Making EM systems and bore logs speak the same language*. The issue of scale between different surveys is crucial, so I am hoping to hear that real progress is being made on this front.

In the Remote Sensing section I see that there are at least three talks on IP, with two on IP contamination (or is that information?) in TEM/AEM data sets. I have collected TEM data in the last year with an amazing amount of what appears to be IP effects, and that has sparked my interest in how to recognise these effects in the data, and then maybe even trying to figure out how to use them. I will definitely be having a look at these talks. To some extent I wonder how much of our TEM data is contaminated by small amounts of "IP" that we don't even recognise. "Hmmm, pretty good inversion results, but for some reason the late-time modelled results don't match the data as well as I expected" – I've said that before.

And finally I see that the ever-interesting Alan Jones from Complete MT Solutions will be here to talk about alternatives to the L2 norm in inversions (this may not strictly qualify as environmental geophysics). I have not seen the abstract, but am pretty sure that he is not going to suggest L1 – so am curious to see where he goes with this.

The ASEG in social media

The ASEG has just joined Instagram https://www.instagram.com/aseg_news/ – so go on, give us a follow! We'd love to share your photos too, so please email Kate Robertson at communications@aseg.org.au if you have any images you would like featured.

We know not everyone is on Instagram, but you can also find us on a variety of other social media platforms too! We share relevant geoscience articles, events, opportunities and lots more.

Facebook: https://www.facebook.com/AustralianSocietyOfExplorationGeophysicists

LinkedIn company page: https://www.linkedin.com/company/australian-society-of-exploration-geophysicists/

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Twitter: https://twitter.com/ASEG_news

Youtube: https://www.youtube.com/channel/UC-dAJx8bXrX5BEudOQp4ThA

Minerals geophysics

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Horses for courses

In mineral exploration is the selection of an appropriate geophysical technique as straight-forward as it first seems? EM for massive sulphides (VMS), IP-resistivity for disseminated sulphides (porphyry copper), magnetics for magnetite (iron ore), gravity for massive iron oxides (IOCG), and radiometrics for uranium minerals and monazite (beach sands) all seem pretty straightforward. But, in the real world, things can get a bit complicated. There may be factors at work that can generate difficulties or provide opportunities – a bit of innovative thinking might be called for. The geological environment, geological processes associated with the mineralisation, the weathering regime, depth of burial and nature of overlying materials, presence of man-made features and even site access considerations can all play a part. You may have to resort to indirect detection using associated features rather than direct detection of the mineralisation itself.

Consider EM surveying for massive base metal sulphides in an electrically conductive environment such as carbonaceous pyritic shales. It may not be possible to discriminate an otherwise recognisable target conductor response in this highly electrically anomalous environment, but the disposition of the conductive shales themselves might provide clues. Are your targets structurally controlled, say in fold hinges, or associated with disruptive features? Mapping the distribution of the conductive carbonaceous shales themselves may allow you to focus your efforts in particular areas. Your target may then be a specific environment considered favourable for mineralisation rather than a discrete conductor.

Silicification and carbonate flooding associated with mineralisation can render the adjacent country rock more resistant to weathering and erosion, resulting in mineralisation being associated with topographic highs. In one prospective region with negligible outcrop and subdued topographic relief we seriously considered using detailed elevation maps as an initial targeting tool. Where younger transported sediments cover the old land surface, geophysical techniques that estimate depth to bedrock (e.g. EM and refraction or passive seismics) may be used to map out the palaeo-topography. As a bonus, these techniques could provide information on the properties of the bedrock as well.

Weathering processes can provide opportunities to vary your exploration method. IP-resistivity is the go-to exploration method for disseminated sulphides, but circumstances such as restricted surface access or unfavourable ground conditions can confound its use. Disseminated sulphide mineralisation may show little electrical conductivity or density contrast with the country rock, but preferential weathering and supergene enrichment will render this section of the mineralisation more conductive and, in some parts, less dense. Both EM and gravity may then have application in locating the near-surface weathered expressions of these targets where conditions are unfavourable for IP-resistivity. Widespread and rapid geophysical exploration for disseminated sulphides from the air with EM, or detailed exploration in an electrically challenging environment with gravity may be possible.

The depth of burial and nature of the cover materials can influence your choice of geophysical technique and the way that you apply it. Less than a metre of cover will effectively obscure radioactivity, but other processes may come to your aid to get radioactive materials to the surface: radon gas diffusion, ground water movement of dissolved salts, even physical movement of material such as occurs in glaciated terrain. In areas of no outcrop, radiometrics may also have mapping applications. Where there is residual cover, will radiometric mapping of the surficial material reflect the distribution of underlying rock types? Where there is transported cover, will radiometric mapping of the surficial materials have application in the normalisation of mobile metal geochemistry results?

A greater depth of burial may put the target beyond the reach of your preferred geophysical technique. Time domain EM is the conventional choice for conductive targets, but there are depth of investigation limitations. It could be that one of the deeper penetrating frequency domain EM techniques such as CSAMT, AMT or MT may merit consideration. Or perhaps you will have to resort to indirect detection – would magnetics (magnetite association) or gravity (density contrast) work for you?

The presence of man-made features can limit the application of an otherwise appropriate geophysical technique. This is particularly relevant on mine sites, where unwanted responses from mine infra-structure can interfere with the results of geophysical surveys. Attention to detail in planning and executing the survey will be required. Perhaps you will have to resort to less than ideal survey parameters and coverage, or even try a different method. Gravity, which arguably is less affected by man-made structures than magnetics, EM and electrical techniques, may be worth considering if measurable and recognisable responses from your targets could reasonably be expected in the survey results.

So, the mantra that "mineral geophysical exploration can only be successful if there is a physical property contrast between the target and its environment which produces a measurable and recognisable response in the geophysical survey" holds in most cases, but sometimes a bit of lateral thinking may be needed.

I look forward to catching up with you at the upcoming AEGC 2019 Data to Discovery Conference in Perth – if you are planning to attend. As always feedback on past *Preview* articles and suggestions for topics for future issues would be very welcome.

Seismic window

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Machine learning takes off

The "flavour of the day" at this year's EAGE Conference in London was Machine Learning.

This is something new to me so I set off to find out what Machine Learning (ML) actually is. What I found was that almost all the vendors had rebadged their existing software with the buzz words "Machine Learning". They may have modified the code a bit but if you are familiar with neural networks or waveform classification you already know something about ML, which is a subset of Artificial Intelligence (AI), a branch of computer science. ML is growing in importance in the petroleum geosciences because we need to extract information from vast data sets. So we let computers do the work because machines, apparently, can capture uncertainty and are consistent but, more importantly, they are fast.

Brian Russell (CGG) described ML as "nothing mystical – it's actually just a transform of the input data". In a similar vein, Paul de Groot (OpendTect) describes ML as "finding complex relationships in data from a variety of sources … using statistical techniques". ML gives computers the ability to learn from data without being specifically programmed. To do this the machine needs a large amount of data so it knows what to look for. One thing we never have is enough data to represent a complete range of possibilities, but this shortfall can often be filled with synthetic or modelled data.

Machine Learning can be either supervised or unsupervised. Supervised learning occurs where the data being evaluated has already been interpreted and facies classification and seismic prediction of rock properties such as porosity or shale content are available. Unsupervised learning occurs when the data is examined and grouped without preconceptions (this grouping is done in multi-dimensional space – in 2D it's like fitting a straight line to a set of points and using this line to predict a missing value). Examples of this are waveform classification and attribute clustering. Some of the applications of Machine Learning presented at the EAGE conference are shown in Table 1. As you can see there is a diverse range of geological and geophysical applications for ML.

Table 1. Some geological and geophysical applications of Machine Learning.

1. Automated detection of micro-seismic events
2. Seismic inversion using a deep neural network
3. Ground roll attenuation
4. Predicting gas content of shale gas reservoirs
5. Efficient seismic data interpolation
6. Porosity prediction
7. Texture based classification of seismic patches
8. Assignment of biostratigraphic age ranges

The trained eyes of interpreters have been recognising textures in seismic data for a long time, but can only describe the process with phrases like "I know it when I see it but can't describe exactly what I'm seeing". This is how I would describe Deep Learning. The computer has a vast data library that it compares to the input data and assigns a probability or weight to particular outcomes. While AI has been around since the 1950s, Deep Learning is relatively new and has relied on the increase of GPU power and computational speed over the last 5 years.

There are many more applications and several algorithms to choose from and the key is to find the best method for a specific task. I'll finish with these words of wisdom, again from Brian Russell, "if the process doesn't work on a simple case it sure won't work on a complicated one".

Heads up on AEGC 2019

You should all know by now that AEGC 2019 is being held in Perth between the 2nd and the 5th of September. This conference is being jointly organised by the ASEG, PESA and AIG and replaces the very popular and successful ASEG Conference and Exhibition.

I was recently sent a list of papers that will be presented and after looking through the titles I have come up with some statistics (Table 2) and my top five papers for seismic interpreters.

Table 2. AEGC 2019 statistics.

Number of papers accepted:	253
Number of papers with a seismic/ petroleum content:	97
Number of petroleum papers from companies:	44
Number of papers from oil companies:	26
Papers from contractor / service companies:	14
Number of papers that are of interest to interpreters:	All of them

Top five papers (based on titles and in no particular order):

In the absence of a fully-fledged conference handbook my top five list of presentations could be handy for deciding where you need to be whilst at the conference (Note: I am excluding my excellent talk on the Cimatti Field to keep things as unbiased as possible).

Regional stratal slice imaging of the Northern Carnarvon Basin, WA. Tony Marsh, Chevron.

Pyxis: a study in cost efficient near field exploration, discovery and appraisal. Peter Thomas, Woodside.

The road to Dorado: Factors leading to a play opening hydrocarbon discovery. Dr Frederick Wehr, Wehr Advisory.

Eromanga oil traps –a multi field post mortem. Keith Martens, Martens Petroleum Consulting.

Dude, where's my AVO? A case study from the Browse Basin, Northwest Shelf, Australia. Dr Said Arimibeshell, Discover Geoscience.

Of course there are other good papers being presented so get along and support the authors and the conference– even if it's just for a day. And yes, there is a session on Artificial Intelligence and Machine Learning.

Data trends

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AEGC 2019 – what's not to enjoy?

There are many geoscientific disciplines represented at AEGC 2019, and the result is a comprehensive series of talks that will address your next exploration decision – wherever you are at in the exploration cycle. You can hear about what Mark Rieuwers from SRK Consulting aptly calls "Modern Mineral Exploration" from every angle. For example, Louise Schoneveld from CSIRO pinpoints indicator minerals in mineral systems, Kate Selway from Macquarie University talks about the appearance of mineral systems in MT, and then Joe Cucuzza from AMIRA hypothesises about how early in the game you can assess if a mineral system is of economic value. If you are starting from the beginning with your Exploration Licence, then presenters from Geoscience Australia and most state/territory geological surveys are showing off their updated digital data delivery systems – data that the various presenters in the Artificial Intelligence (AI) stream can show you how to crunch into an exploration model.

Highlights from my perspective include Alex Ip's talk and workshop detailing the extensive changes to GADDS and the additional services that Geoscience Australia are implementing to their data delivery system. Instead of downloading and merging multiple surveys, more web services and functions will focus on the data you want. Alex also references variants of the HDF5 database file format for working with very large geo-located datasets, such as are acquired by passive seismic and MT surveys, and as previously discussed in this column.

David Pratt from Tensor Research leads the minerals AI charge with two talks on deriving value from magnetic datasets. One on the holy grail of automated gradient tensor depth picking, and another on formation mapping by magnetics. David has studied, applied and furthered these techniques for over 40 years in the petroleum as well as minerals industries, so his opinions and programmes are well respected and widely used.

Innovations in surface and downhole electrical techniques are a major theme in geophysical streams at this conference, and it is good to see downhole logging getting more air time across the Groundwater, EM and Iron Ore sessions, including a presentation by Kazimierz Trofimczyk from BHP on using NMR – you might need to book a seat for that one! The petroleum Rock Physics session also has presentations on methods relevant to minerals exploration such as inverting EM while drilling, or creating 3D maps around a drill hole using new resistivity tools.

Marrying measurements taken above the surface of the earth with those taken from below has developed as an interesting minor theme in EM. IP has its own session, and includes a presentation by former ASEG Best Presenter Regis Neroni, who is living dangerously by IP mapping pyrite around a shed.

MT has matured into an exploration tool and its application is discussed in a number of sessions. In particular, MT magician Alan Jones from Complete MT Solutions conjures a statistical misfit method to solve an apparently impossible MT problem. Alan's talk should be of interest to anyone using statistics, and is a window into the inner workings of machine learning and inversion functions. He expands his objective function to test fitting high order polynomials with the Durbin-Watson test statistic. The improvements over Chi-squared are demonstrated with three examples including discerning the special case of an usually undetectable thin resistive layer between two conductive layers.

The AEGC presentations are bookended by 27 workshops that expand and expound on the conference themes. As previously mentioned, GA is offering a how-to for their new data service. In addition, and on the electrical theme, Marina Costelloe and other presenters from GA will spend two days taking you through the two large scale electrical techniques and passive seismic for defining basement.

Ranjit Shaw has a petroleum workshop that looks like a great short introduction to probability and geostatistical modelling for the uninitiated. The power of geostatistics is often overlooked amid grids and models, and is usually left to mining engineers, but it is an inexpensive way for explorers to visualise general trends in an area and to gauge mineral correlations.

Finally, I am particularly looking forward to Mark Jessell's forum on uncertainty in exploration, drill targeting and the QGIS open source programme for using all those shape files government keep producing, and hearing Jim Austin from CSIRO on the neglected field of minerals petrophysics. What's not to enjoy?

Webwaves

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Think, check, submit/ attend: predatory publishing and conferences

Welcome to the *Webwaves* column in this conference issue of *Preview*. In this issue we take a look at predatory publishing and conferences, and some resources to help identify misleading practices.

What is predatory publishing?

Predatory publishing is the process of exploiting researchers by touting publication of material in journals that do not use an appropriate peer-review process nor sufficiently qualified editors. Commonly, the Open Access model is abused by charging additional or excess publishing fees to the author that are often not disclosed publicly.

Similarly, predatory conferences are meetings commonly run by companies to generate profit by taking advantage of researchers. There is often little or no peer-review. False advertising may be run indicating that prominent figures in the discipline will be presenting when, in fact, they have no involvement.

Why is this a problem?

In his 2013 article in *Science*, "Who's Afraid of Peer Review", John Bohannon discussed what happened when he submitted a seemingly credible scientific paper containing obvious errors to test the peer review processes of selected journals. A series of obviously flawed experiments were conducted to "show" that a lichen species was able to inhibit the growth of cancer. This paper was submitted to 304 journals for review and publication. Journals were chosen from the DOAJ (Directory of Open Access Journals) and Beall's list of predatory journals[1], and all had a model of charging a publishing fee after the acceptance of the paper. The majority of journals accepted the paper, with only 36 of the 304 submissions receiving comments highlighting scientific issues with the paper. This demonstrates the importance of choosing the right journal for your work. Bohannon's complete article is linked at the end of this column[2].

Not only is predatory publishing a risk for the author, but a danger to the readership of such articles. One can easily find journal-published material on theories such as the flat earth theory or expanding earth theory. To the layperson, these publications provide an air of authenticity to research that is a detriment to our field. It allows others to cite articles that the vast majority of our profession would immediately discredit. When researching, it is important to perform due-diligence using the steps mentioned below to ensure that material is current and has been published in a reputable, peer-reviewed journal.

Identifying predatory journals

There are numerous resources on the internet that are available to check the credibility of a publication, some of which are listed below in the online resources section. Think, Check, Submit (https://thinkchecksubmit.org/) maintain a checklist to help researchers identify an appropriate journal for their research. Below is a shortened version of this process:

THINK:

- Are you submitting your research to a trusted journal?
- Is it the right journal for your work?

CHECK:

- Do you know the journal?
- Can you easily identify and contact the publisher?
- Is the journal clear about the type of peer review it uses?
- Are articles indexed in services that you use?
- Is it clear what fees are being charged?
- Do you recognise the editorial board?
- Is the publisher a member of a recognised industry initiative?

SUBMIT:

If you can answer 'yes' to most or all of the questions above, you should be safe to submit your article.

You will find additional information on the ASEG website where there is a webpage on principles of publication for *Exploration Geophysics* and *Preview*[3]. The editorial board is easily identified and there is a strict peer review process to ensure a high standard of content. Aspiring authors in *Exploration Geophysics* can find instructions for authors at the following link: https://www.tandfonline.com/action/authorSubmission?journalCode=texg20&page=instructions&#peers

Online resources

https://thinkchecksubmit.org/

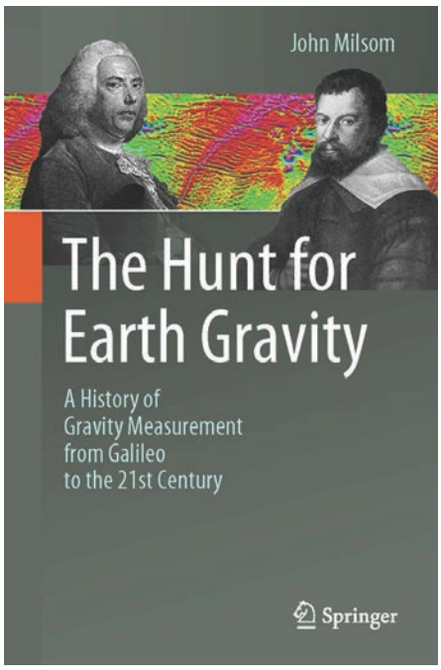
https://publicationethics.org/ (Committee on Publication Ethics)

https://doaj.org/ (Directory of Open Access Journals)

Notes

1. https://predatoryjournals.com/journals/ (from Beall's list)
2. https://science.sciencemag.org/content/342/6154/60.full
3. https://www.aseg.org.au/publications/principles-publication

The hunt for Earth gravity: A history of gravity measurement from Galileo to the 21st Century



By Dr John Milsom
Springer International Publishing AG, part of Springer Nature 2018, 416 pp.
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ISBN 978-3-319-74959-4 (eBook) https://doi.org/10.1007/978-3-319-74959-4
Library of Congress Control Number: 2018934918

Dr John Milsom was awarded a PhD in geophysics in 1971, whilst a lecturer at Imperial College, London. His thesis was entitled: *The structure of Eastern Papua, an approach via gravity and other geophysical methods.* Milsom worked in Australia and PNG in the 1960s and some of his experiences in those countries are recounted in this book on the hunt for gravity. Milsom is also the author of *Field Geophysics*, a 304 page paperback now in its 4th edition that explains optimum ways to conduct various geophysical methods in the field, with detailed descriptions of current instrumentation. It is a text book for university geophysics departments, including the department at the University of Sydney. However, his latest book is definitely not a text book. For one thing, it is written in a casual, folksy style. One of many examples of this style is, "It was into this swamp of accusation and counter-accusation that Kepler splashed puppy-like, with his tail wagging".

After an introductory Chapter 1 about Galileo and his weight drop experiments in the 16th and 17th centuries, Chapter 2 jumps to the 1960s and "is out of sequence, because its aim is to give readers an early feeling for where the book is heading". It is, in fact, a description of the trials and tribulations of doing field work in PNG (with some political history added).

Chapters 3 to 7 revert to the 16th to 19th centuries with a history of the use of pendulums involving Copernicus, Brahe, Kepler and later Newton and Hooke, plus a very interesting portrayal of Bouguer who lent his name to one of the corrections made to gravity measurements. Those interested in history will find this section informative and entertaining. For example, one learns that Tycho Brahe's elk from his private zoo "got drunk one night, fell down some stairs, broke its leg and had to be destroyed". The end of Chapter 7, *The Pitfalls of Pendulums*, explains why pendulums were abandoned in favour of the more accurate and quicker ways of measuring gravity. In fact, around half of the book is devoted to the subject of pendulums which, as a measure of gravity, are now literally history.

Chapters 8 to 13 are about developments in the 20th and 21st centuries, from torsion balance gradiometers to modern ground and airborne gravity meters and airborne gradiometers.

Chapter 14 is a final section of seven 'Codas', included "for those who not only feel comfortable with graphs and equations, but would like to read about them". The implication is that some readers may choose not to read any or all of this chapter.

As well as the fourteen chapters, there is an *Introduction* not shown in the Table of Contents, but numbering five pages and providing some fundamentals related to the measurement of gravity such as units used and typical values.

In general, the figures are well chosen and the number of figures is adequate. Excluding Chapter 14 as special, there are an average of six figures per each chapter with an average chapter length of 27 pages. However, some figure captions are very long. The caption to Figure 3.4 is one of the longest, and includes over 130 words. In some cases the caption gives information not referred to in the text. There are a small number of footnotes and no endnotes. This circumstance suggests that all information is presented as part of the text - or in figure captions.

One concern I have with this book is the wide scope of the subject matter, which spans six centuries, and hence the type of reader to which it will appeal. However, it is possible to consider the book as being made up of three distinct sections that can be read independently. In my opinion these sections are roughly: the early history of pendulums from the 16th to 19th century and their use in measuring the (gravity) shape of the Earth; the non-pendulum instruments of the 20th century; and, descriptions of actual field surveys from the author's "own memories", which, in addition to appearing in Chapter 2, are interspersed in other chapters in the second section.

The publisher's description of the book claims, "for the more general readers", that the book provides insights … "that most would not even have known existed" and that for "practitioners", it provides a historical background "that is not available elsewhere" (*sic*). Of course, this is a certain amount of publisher's hype with claims that are yet to be proved. However, it is apparent in the *Preface* that the author is also concerned with the type of readership and, in fact, claims suitability for a wide readership with, "If this book has any readers, they may be people who know something about physics but little geology, or people who know geology but not physics, or people with only a layman's knowledge of either." We also learn that Milsom is writing for "people who know little about the Earth's gravity field" and that all aspects of measurement methods are being covered.

Where does an exploration geophysicist, especially one experienced in gravity methods, stand in this? Is he or she to read only the history section, as the publishers suggest? Oddly, the *Preface* begins with disparaging remarks about exploration geophysicists, but hopefully tongue-in-cheek. They are distinguished from "proper physicists" as "people of uncouth lifestyles and suspect intelligence who abuse … gravity … by treating it as a mere tool for looking at rocks". Such people, we are told, are apparently not concerned with the more recent understanding of gravity courtesy of Einstein and others since, and the

recent developments of quantum gravity, the existence of the Higgs boson, etc.

There are, of course, many serious publications that cover the field of this book. The seminal paper in *Geophysics*, **70** (6), 2005, "Historical development of the gravity method in exploration" by Misac Nabighian and nine others formally reviews the history of the gravity method in the language of geophysicists. That paper deals with all the main topics covered in Milsom's book, and more. However, it does only deal with the subject up to 2005 and one might hope that a book published in 2018 would cover subsequent progress. Unfortunately, apart from a brief acknowledgement of the very latest (2016) developments in gravity meters with micro-electromechanical (MEM) accelerometers, other earlier types of modern meters in use since 2005, such as super-conducting quantum interference devices (SQUIDS), are not mentioned.

Readers with a good knowledge of the gravity method will also notice the absence of a few important developments. For example, in *Meters at Sea*, the placing of meters on the sea floor is not mentioned. Such deployments have been carried out by Scintrex (a company whose business affairs are described in detail in this book) since 2010. The use of borehole gravity meters is another omission. Borehole gravity meters, which are necessarily small in order to fit into slim boreholes, have been used in hard rock situations since 2008.

In *Meters in the Air*, the history of the development of airborne non-gradient meters is described, including the famous paper by Sigmund Hammer, *Airborne gravity is here*. This section ends with the remark that only the Russians are currently using these meters, as "none of the US companies were very interested". However, Australian and Canadian companies have recently been providing a service using these meters in Australia.

In the case of airborne gradiometry, the most recent reference for the relevant chapter is dated to the year 2000. However, there have been helicopter and airship deployments since then. Other types of gradiometers that have been under development for over a decade are also not mentioned. These include the super-conducting types such as those using vibrating strings or niobium bars.

Of course, publishing constraints mean it can be difficult for any book to include the latest information about a rapidly evolving field. In this context the inclusion of details about commercial matters that occurred decades ago can seem irrelevant. This particularly applies to information supplied about the company Scintrex, where, "Accounting irregularities appeared, auditors resigned and in May 2000, Rybak was forced out". Why do we need to learn about Rybak's departure from Scintrex more than 18 years after it occurred? Many new developments have taken place in Scintrex since 2000, but the latest discussed by Milsom is a reference to the CG-5 meter, which first became available in 2002.

Well informed Australian geophysicists, and in particular readers of ASEG's *Preview*, will notice some shortcomings in parts of this book of relevance to them. For example, when reading about the development of spring–type meters in Chapter 9, *The Rise and Fall of Springs*, they will remember that the first meter of this type was built at the University of Sydney in 1893, pre-dating the ones referred to in this book by nearly four decades.

Chapter 9 also describes the development of a revolutionary electronic type of meter, which was named CG-3 by Scintrex. Australians will know that the design of this meter was foreshadowed in the PhD thesis of Andrew Hugill (not "Hurgill" as here). Andrew was awarded his PhD by Flinders University in South Australia in 1984 for his design of the 'Flinders' gravity meter. The Flinders meter was succeeded by the CG-3, then the very popular CG-5, and, in 2016, the CG-6 (Andrew Hugill pers. comm. March, 2019).

In addition, when reading about types of gravity gradiometers in operation, some Australians will be surprised to find that the super-cooled meter built at the University of Western Australia using an innovative system involving two crossed niobium strips kept at 4°K is not mentioned.

In conclusion, this book is not a comprehensive coverage of the history of gravity measurement. However, it could be a useful introduction to the subject for "people with only a layman's knowledge of" physics or geology and "people who know little about the Earth's gravity field ". Much of the content is related to Milsom's own working experience between the late 1960s to late 1970s. There is not a great deal of new material for experienced geophysicists well versed in the gravity method. However, as the publishers claim, such 'practitioners' are likely to enjoy the history section.

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CONFERENCE GUIDE

AEGC2019
Data to Discovery
Australasian Exploration Geoscience Conference
2-5 September 2019 • Perth, Western Australia
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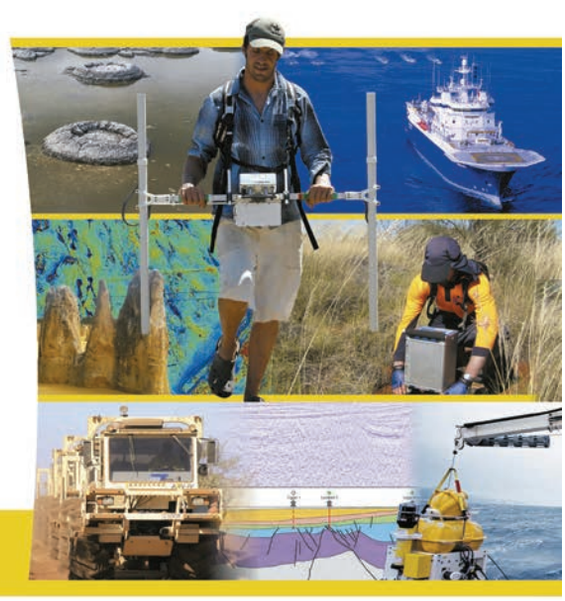

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The Leading Exploration Geoscience Conference in Asia-Pacific

The Australian Society of Exploration Geophysicists, the Australian Institute of Geoscientists and the Petroleum Exploration Society of Australia, would like to welcome you to the second Australasian Exploration Geoscience Conference (AEGC 2019). This year's conference incorporates the 27th ASEG Conference and Exhibition and the PESA West Australian Basin Symposium. The conference will be held at Crown Perth, Western Australia's premier resort.

This year the conference theme is 'Data to Discovery' with a focus on geology, geophysics, and geochemistry and how these are applied in exploration for both petroleum and mineral systems in Australasia and the wider Asia-Pacific region. The conference features concurrent streams covering a diverse range of topics such as environmental and archaeological studies, petrophysics, geochemistry, stratigraphy, CO_2 sequestration and exploration. These sessions feature supplemented by keynotes from some of the world's leading experts. In all, over 300 oral papers will be presented during the conference, along with more than 70 posters displayed during a series of dedicated poster sessions. The exhibition will feature over 80 exhibitors covering all aspects of geoscience.

We offer 18 workshops held on the days preceding or following the conference. The workshops cover topics as varied as programming languages, machine learning, presentation skills, and chemo-stratigraphy. In addition, between 6 and 8 September, there is a field trip to the North Perth Basin to examine the beautifully exposed, regressive to transgressive, Early Permian sequence along the Irwin River in the Coalseam Conservation Park. The excursion will focus on sedimentology and ichnofacies within a predictive sequence stratigraphic context, and how these relate to depositional environment, lateral facies changes and changes in relative sea-level.

An important and continuing focus of the AEGC is to foster student and young professional participation and showcase the geoscience community. Two days of interactive presentations, career-insight talks, and guided exhibition tours, will be run concurrently with the AEGC 2019 proceedings – high school students will be hosted on Wednesday September 4, and tertiary students on Thursday September 5. Several early career geoscientist tailored workshops, with affordable student prices, are also planned at the AEGC 2019. The AEGC 2019 young professional committee has planned one of the biggest geoscience community social events in 2019 – the **Fortescue Metals Group Early Career Geoscientist Networking Evening** will be held at Australia's largest pub, The Camfield, located on the banks of the Swan River, on September 2. Heavily subsidised tickets are available to AEGC registered students and early career geoscientists. Don't miss out – purchase your ticket today!

Finally, a big thank you to our Titanium Sponsor **WesternGeco**; Platinum sponsors **Woodside** and **Chevron**; our Gold sponsors **CSIRO**, **Qteq** and Shearwater; Silver sponsors **Seequent**, **MPC Kinetic**, **Terrex Seismic**, **Velseis** and **BHP**; Bronze sponsor **Gold Fields**, and our other sponsors **Anglo American**, **OZ Minerals**, **IMDEX**, **Geoscience Australia**, **Wireline**, **CGG**, **Kalatyst**, **First Quantum**, **IGO**, **LabWest**, **Sandfire**, and **Portable XRF Services**. We also acknowledge the support of the **Perth Convention Bureau**, **Crown Perth** and the **City of Perth**.

John Gorter
Co-Chair (PESA)

Tim Dean
Co-Chair (ASEG)

AEGC 2019: General information

Venue

Crown Perth

Great Eastern Hwy, Burswood WA 6100

Conference App

The Conference App is sponsored by

To download the Conference App, please follow these instructions:

1. Search "Events by Encanta" on the App Store or Google Play and download.
2. Using the search tool, please enter "AEGC 2019" and press "Join"
3. Create your profile

The Conference App will provide you with information on the conference programme with real time updates, ability to share photos, general information including the social programme and messaging between delegates. Please note, you will need Wi-Fi connectivity to access the App.

Catering

All morning tea, lunch and afternoon tea breaks will be provided in the exhibition area. For break times please refer to the programme.

Dietary requirements

If you have advised the Conference Secretariat of special dietary requirements, please speak to a member of the catering staff during the breaks, or at any of the functions that you may be attending.

Photography

No photos are to be taken in the session rooms to ensure the presenter's data is protected. An official photographer will be present at various times during the conference to capture the essence of the event.

Dress code

Smart casual

Exhibition

The Conference Exhibition will be located in the Grand Ballroom, Crown Perth and will be open from the following times:

Monday 2 September 6.00 pm – 8.00 pm

Tuesday 3 September 7.30 am – 6.30 pm

Wednesday 4 September 7.30 am – 6.30 pm

Thursday 5 September 7.30am – 3.30pm

Name badges

The name badges and lanyards are sponsored by Wireline Services Group

For security purposes, delegates are always requested to wear their name badge during the conference, as it is your official pass and must be worn to obtain entry into programme sessions and social functions.

Mobile phones

Delegates are asked to switch their mobile phones to silent when in sessions.

Pre and post conference workshops

Pre-conference workshops will be held from Thursday 29 August to Monday 2 September.

Post conference workshops will be held on Friday 6 September at Crown Perth.

Workshops are an additional cost and you must be pre-registered to attend.

Pocket programme

Each delegate will receive a pocket programme upon registration.

Every endeavour has been made to produce an accurate programme. The organisers reserve the right to change the conference programme at any time without notice. Delegates will be notified of programme updates during the conference via the conference app.

Chairpersons

Chair packs will be emailed to all session chairs. The Conference Secretariat will also have a printed copy for chairs to collect at the registration desk.

Speakers preparation room

Location: PCO Suite

All presenters will be required to bring their presentation on a USB into the speaker's preparation room located in the PCO Suite of Crown Perth at least two (2) hours prior to the session. There is no requirement to email your presentation prior to the conference.

Closer to the conference, all authors will be notified personally regarding the operating hours for this room. Please be advised that at the conclusion of the conference, all presentations will be deleted to ensure protection of your data.

Posters

Poster location

Posters will be displayed in the Meeting Rooms 1 - 4 for the duration of the conference. During the three days of the conference, you will be allocated a specific time to be by your poster to allow delegates to meet with authors and discuss your research.

Poster set up

Authors are required to hang their posters on Tuesday morning by 10.30. Posters should be hung next to their allocated poster number. Although there will be limited fixing materials available, we advise that you should bring your own supplies i.e. velcro dots. Please do not fix posters to any place other than the board to which it has been allocated.

Registration desk

The registration desk is located at the Crown Perth Convention Centre, next to the theatre ticketing office and information desk.

Opening hours:

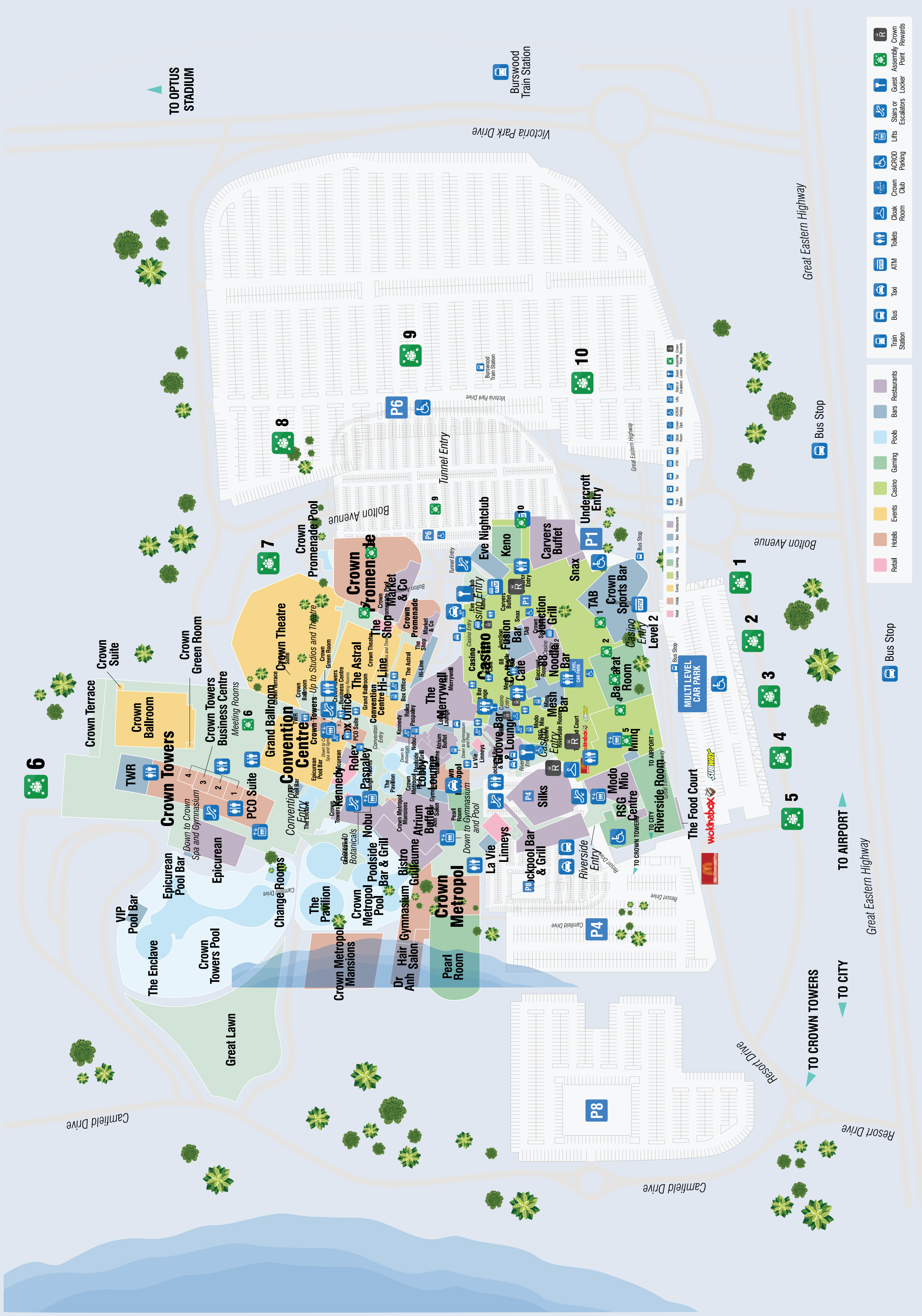
Monday 2 September 1.00 pm – 7.00 pm

Tuesday 3 September 7.30 am – 6.00 pm

Wednesday 4 September 7.30 am – 5.30 pm

Thursday 5 September 7.30 am – 4.30 pm

AEGC 2019: Venue maps



Crown Perth, Great Eastern Highway, Burswood, Perth. Rooms being used by AEGC 2019 are shown in the map on the following page.

Crown Perth, details of rooms being used by AEGC 2019

AEGC2019
Data to Discovery

Australasian Exploration Geoscience Conference
2-5 September 2019 • Perth, Western Australia

Incorporating the **AIG**, **ASEG**, **PESA**, and **WABS**

AEGC 2019: Conference programme

Monday 2 September

AEGC Conference 2019 programme

1300 - 1900	*Registration Open*	*Crown Conference Convention Centre*
1100 -1730	Exhibitor Bump in commence	*Exhibition Hall, Grand Ballroom*
1800 – 2000	**Welcome Reception** **Fortescue Metals Group Early Career Geoscientist Networking Event**	***Exhibition Hall, Grand Ballroom*** ***The Camfield***

Tuesday 3 September

AEGC Conference 2019 programme

0730 - 1800	*Registration Open*	
0830 – 1010	Opening Plenary	
1010 – 1040	**Morning Tea**	***Exhibition Hall, Grand Ballroom***

	WABS NCB/Exmouth 1	Shallow Seismic Investigations	Coal	Petroleum exploration and dev case studies	Exploration Strategy/ Innovations	Magnetotellurics I – General	Mineral Case Studies: Geophysics – Seismic	Deep Crustal Studies I
Room								
1040 – 1105	**Shooting for the stars. Unravelling a late Jurassic deepwater petroleum system - frontiers for the next generation of petroleum exploration** **Darren Ferdinando**	**A 10 kN portable electromagnetic vibrator for near-surface studies** **Tim Dean** *Curtin University* *Paper# 36*	**Electromagnetic and electrical methods applied to mapping coked coal – A case study from the Bowen Basin, Eastern Australia.** **Jonathan Lowe** *BHP* *Paper# 206*	***Keynote: Dave Moffat***	**The Science of Discovery – From Exploration 1.0 to Discovery 2.0** **Tim Craske** *Geowisdom* *Paper# 48*	***Keynote: Alan Jones***	**Maximising the value of 2D hard rock seismic acquisition at Escondida Porphyry Copper Mine** **Heather Schijns** *BHP* *Paper# 147*	**Moho structure of Australia from probabilistic inversion of teleseismic P-wave coda autocorrelation** **Mehdi Tork Qashqai** *CSIRO* *Paper# 244*
1105-1130	**Ginger - a little spice on the shelf: supra-slump stratigraphic trapping in the Barrow Sub-basin** **Steve Moss**	**Surface passive seismic monitoring by the local use of semblance** **M. Javad Khoshnavaz** *The University of Tehran* *Paper# 167*	**Lithology characterisation of the roof and floor of the Moranbah measures coal seam using post-stack and pre-stack seismic inversion** **Margarita Pavlova** *BHP* *Paper# 109*	***Keynote: Dave Moffat***	**The power of the crowd & open data – learnings from the OZ Minerals Explorer open innovation challenge** **Holly Bridgwater** *Unearthed* **Ian Anderson** *OZ Minerals* *Paper# 107*	***Keynote: Alan Jones***	**Case studies on the application of passive seismic horizontal to vertical spectral ratio (HVSR) surveying for heavy mineral sand exploration** **Nigel Cantwell** *Resource Potentials* *Paper# 282*	**Integrating fault kinematics into implicit 3D modeling of fault networks** **Lachlan Grose** *Monash University* *Paper# 118*
1130-1155	**The variation of Mesozoic rift impact on the Exmouth Plateau and the depositional response.** **H.R. Rohead-O'Brien**	**The effects of seismic anisotropy on mining seismology** **Andrew King** *CSIRO* *Paper# 362*	**High-productivity, high- resolution 3D seismic surveys for open-cut coal operations** **Eric Battig** *BHP* *Paper# 151*	**The geology of the Brecknock, Calliance and Torosa gas fields, Browse Basin, Western Australia** **Robert Seggie** *Woodside Energy* *Paper# 19*	**What will it take to improve the characterisation of deep mineral deposits in order to assess "economic value" early in the discovery process?** **Joe Cucuzza** *AMIRA International* *Paper# 57*	**The Geosciences DeVL Experiment: New information generated from old magnetotelluric data of The University of Adelaide on the NCI High Performance Computing Platform** **Nigel Rees** *National Computational Infrastructure* *Paper# 138*	**Refraction tomography at the Nova Ni-Cu mine** **Ian James** *Hiseis* *Paper# 293*	**Metasomatic/depletion events affecting Cratons and "cratons"** **Tom Wise** *Geological Survey of South Australia* *Paper# 49*
1155-1220	**Morphometrics of Channel Belts from the Mungaroo Formation, NWS, Australia** **Tobi Payenberg**	**An assessment of array types and processing algorithms for microtremor observations, via the COSMOS Blind Trials** **Michael Asten** *Monash University* *Paper# 184*		**The Road to Dorado: Factors Leading to a Play-Opening Hydrocarbon Discovery** **Frederick Wehr** *Wehr Advisory* *Paper# 208*		**Estimating interpretation uncertainty from magnetotelluric inversion** **Janelle Simpson** *Geological Survey of Queensland* *Paper# 278*	**Direct Imaging of Alteration With High Resolution Hard-Rock 3D Seismic Data at the Darlot Gold Mine** **Graeme Hird** *Hiseis* *Paper# 345*	**Imaging a mafic underplate in 3D: an example from the East Albany-Fraser Orogen and Yilgarn Craton margin** **Lucy Brisbout** *Geological Survey of Western Australia* *Paper# 199*
1220 – 1320	Lunch							*Exhibition Hall, Grand Ballroom*
1320 – 1340	Poster Session							*Meeting Rooms 1 - 4*

	WABS NCB/Exmouth 2	Tectonostratigraphy	Seismic processing (O+G) 1	New plays and areas	Mineral Case Studies: Geology – I – Gold	Magnetotellurics II Modelling	Mineral Case Studies: Geophysics - Cross-Disciplinary	Deep Crustal Studies II
Room								
1340 – 1405	**Sequence stratigraphy of the Wheatstone and Iago fields; implications for reservoir characterisation** **R.B. Ainsworth**	***Keynote: Ken McClay***	**New insights into the Exmouth Sub-basin: Seismic acquisition, processing and imaging** **Alex Karvelas** *Westerngeco* *Paper# 46*		***Keynote: David Groves*** ***Orogenic gold deposits: part of a global dynamic conjunction between subduction and gold*** *Orebusters*	**Reliable 1D magnetotelluric probabilistic inversion considering modelling assumption violations** **Hoel Seille** *CSIRO* *Paper# 250*	**Geophysical expression of the Meyers Crater, a new meteorite impact crater discovered in the Coolgardie Goldfield of Western Australia** **Jayson Meyers** *Resource Potentials* *Paper# 186*	**The lithospheric structure and deep processes of the Mesozoic mineral systems in east China: constrained from integrated geophysical data** **Qingtian Lu** *Sinoprobe Center, Chinese Academy of Geological Science* *Paper# 395*
1405-1430	**Sequence stratigraphy of the Wheatstone and Iago fields; implications for reservoir characterisation** **R.B. Ainsworth**	***Keynote: Ken McClay***	**Application of high-end seismic imaging technologies for field development in NWS Australia** **Min Lee Chua** *CGG* *Paper# 264*	**The Paleozoic Prospectivity of the offshore Canning Area, Australia** **Said Amiribesheli** *Discover Geoscience* *Paper# 92*	***Keynote: David Groves***	**Inversion of Magnetotelluric Data with Enhanced Structural Fidelity** **Federico Golfré Andreasi** *Schlumberger* *Paper# 263*	**Structural controls of the Ernest Henry IOCG deposit: Insights from integrated structural, geophysical and mineralogical analyses.** **Jim Austin** *CSIRO* *Paper# 303*	**A statewide 3D geological model for New South Wales** **Ned Stolz** *Geological Survey of New South Wales* *Paper# 371*
1430-1455	**3D Seismic Analysis of ancient subsurface fluid flow in the Exmouth Plateau** **Tayallen Velayatham**	**The Bight Basin, Evolution & Prospectivity I: gravity, deep seismic & basin morphology** **Jane Cunneen** *Curtin University* *Paper# 260*	**Processing the first full azimuth OBN survey in Australia: a step change in imaging quality** **Unnikrishnan Chambath** *CGG* *Paper# 302*	**Exploring for the future: Kidson Sub-basin seismic interpretation** **Chris Southby** *Geoscience Australia* *Paper# 129*	**The Pilbara Mesoarchean conglomerate gold versus Quaternary colluvial gold: are they genetically linked?** **Sam Spinks** *CSIRO Mineral Resources* *Paper# 359*	**Using finite dipole lengths in complete earth 3D MT modeling** **Wolfgang Soyer** *CGG* *Paper# 269*	**Update on the geophysical expression of the Abra sedimentary replacement Pb-Ag-Cu-Au deposit, Western Australia** **David Stannard** *Resource Potentials* *Paper# 351*	**Basin-scale fluid-flow models of the McArthur River mineral system: Constraints from geochemistry, geophysics and sequence stratigraphy** **Peter Schaubs** *CSIRO Mineral Resources* *Paper# 344*
1455-1520	**Imaging past depositional environments of the NWS: lesson from 3D seismic data** **Victorien Paumard**	**The Bight Basin, Evolution & Prospectivity II; seismic, structure and balanced sections.** **Kevin Hill** *University of Melbourne* *Paper# 234*	**All that wobbles isn't necessarily azimuthal anisotropy** **Helen Debenham** *Debenham's Geophysical Consultancy* *Paper# 377*	**What lies beneath? Prospecting for Hydrocarbons under a metamorphic allochthon, Timor-Leste** **Mike Bucknill** *Geovision Exploration Services* *Paper# 365*	**Characterisation of the Neoarchean Fortescue Group Stratigraphy – Integrated downhole geochemical and mineralogical correlation from new diamond drilling** **Jessica Stromberg** *CSIRO* *Paper# 350*	**Magnetotelluric inversion strategies** **Ralf Schaa** *Curtin University* *Paper# 309*	**3D Interpretation of Geological, 3D Seismic, and Conventional Geophysical Data from the Darlot Gold Mine** **James Reid** *Mira Geoscience* *Paper# 356*	**Sub-basin architecture of the Proterozoic McArthur Group, southern McArthur Basin** **Teagan Blaikie** *CSIRO* *Paper# 217*
1520 - 1550	**Afternoon Tea**							***Exhibition Hall, Grand Ballroom***

	WABS Bedout	Tectonostratigraphy II	Seismic processing (O+G) 2	Petroleum exploration and dev case studies II	Mineral Case Studies: Geology – II - Gold	Magnetotellurics – III – Case Studies	Induced Polarisation	Regional tectonic studies
Room								
1550 - 1615	**Tectonics of the Bedout Sub-Basin and deposition of the Lower Keraudren Formation; influence of tectonics in a rapidly deposited succession** **Jon Minken**	**Structural and lithological controls on the geometry and morphology of igneous intrusions: a 3D seismic case study from the Exmouth sub-basin, NW Shelf** **Simon Holford** *University of Adelaide* *Paper# 72*	**Understanding the causes of low frequency shadow below gas hydrates** **Ayman Noor Qadrouh** *King Abdulaziz City for Science and Technology (KACST)* *Paper# 44*	**Eromanga Oil Traps – A Multi Field Post Mortem** **Keith Martens** *Martens Petroleum Consulting* *Paper# 58*	**The Mineral Factory: How to Build a Giant Quartz Reef** **Lisa Tannock** *University of New South Wales* *Paper# 115*	**Scale reduction using Magnetotellurics – a mineral exploration example from the Olympic Domain, South Australia** **Stephan Thiel** *Geological Survey of South Australia* *Paper# 39*	**IpeX: A lower-cost superior reconnaissance RES/IP/MT survey** **Steve Boucher** *FQM Exploration (Chile) S.A.* *Paper# 103*	**Exploring for the Future: new U–Pb geochronology for the South Nicholson region and implications for stratigraphic correlations** **Jade Anderson** *Geoscience Australia* *Paper# 127*
1615-1640	**Unravelling the Lower Keraudren Petroleum System in the Bedout Sub-basin: Some Early Observations** **Melissa Thompson**	**New Insights into the Exmouth Sub-basin: Tectono-Stratigraphic Evolution** **Robbie Benson** *BHP* *Paper# 125*	**Imaging challenges at Gulf of Papua (PNG) and their solutions through high-end imaging technology** **Zongying Gong** *CGG Singapore* *Paper# 207*	**Managing uncertainty to deliver complex development wells** **Peter Van Ruth** *Woodside Energy* *Paper# 242*	**Yamarna Geology: Foundations for Further Discoveries** **Janet Tunjic** *Gold Road Resources* *Paper# 372*	**Defining the Eyre Conductivity Anomaly with the Tumby Bay MT transect** **Kate Robertson** *Geological Survey of South Australia* *Paper# 111*	**Induced Polarization Chargeability Calibration Standards** **Peter Rowston** *Geophysical Resources and Services* *Paper# 283*	**Tectonic Analysis of regional potential field data** **Peter Betts** *Monash University* *Paper# 145*
1640-1705	**Integrated Sedimentological, ichnological and palynological analysis etc etc of the Bedout Sub-basin** **John Lignum**	**The structural architecture of the central North West Shelf – insights from regional scale mapping of the Triassic succession** **Claire Orlov** *Geoscience Australia* *Paper# 152*	**4D Seismic Bandwidth and Resolution Analysis for Reservoir Fluid-flow Model Applications** **Rafael Souza** *UWA* *Paper# 288*	**Pyxis: a study in cost-efficient near-field exploration, discovery and appraisal** **Megan Slade** *Woodside Energy* *Paper# 247*	**The genesis of Carlow Castle: A unique Australian orogenic Cu-Co-Au deposit in the Archean Pilbara Craton** **David Fox** *CSIRO & Curtin University* *Paper# 162*	**Resistivity structure of the Link East MT transect in the Southern Curnamona Province** **Ben Kay** *University of Adelaide* *Paper# 116*	**Sensitivity-based data reduction of large 3D DC/IP surveys** **Ken Witherly** *Condor Consulting* *Paper# 379*	**U-Pb ages of the Himalayan foreland basin Northeast India: Implications for the India-Asia collision (V2)** **Upendra Baral** *Institute of Tibetan Plateau Research, Chinese Academy of Sciences* *Paper# 254*
1705-1725	**Quantitative Interpretation in the Bedout Sub-Basin - The value of seismic inversion when seismic data quality is poor** **Margarita Kongawoin**	**Rift initiation on Australia's southern margin: insights from the Bremer Sub-basin** **Jane Cunneen** *Curtin University* *Paper# 323*	**Fracture identification by reflected guided borehole radar waves** **Binzhong Zhou** *CSIRO Energy* *Paper# 56*	**Carbonate reservoir development in the Canning Basin, Western Australia** **Moyra Wilson** *University of Western Australia* *Paper# 268*	**Geological investigations with high spatial resolution WV-3 satellite imagery and regional geophysics at the Haib Cu porphyry, Namibia** **Robert Hewson** *University of Twente – ITC* *Paper# 224*	**MT conductivity signatures of mineral systems: 3D MT over the Eastern Goldfields Super Terrane, Yilgarn Craton** **Kate Selway** *Macquarie University* *Paper# 297*	**"Is it pyrite, or a shed?": intricacies of Induced Polarisation surveying near grounded metallic infrastructure** **Regis Neroni** *Fortescue Metals Group* *Paper# 388*	**Modelling the Palaeozoic tectonic evolution of the Lachlan Orogen** **Thomas Schaap** *University of Tasmania* *Paper# 262*
1730 – 1830	Happy Hour							*Exhibition Hall, Grand Ballroom*

Wednesday 4 September

AEGC Conference 2019 programme

0700 – 1730	*Registration Open*							*Crown Conference Convention Centre*
	WABS Regional and Historical	**CO2 Monitoring and modelling 1**	**Experimental and digital RP**	**Stratigraphy & Sedimentology Western Margin II**	**Mineral Case Studies: Geology – III – Base Metals**	**Groundwater & Near Surface I**	**Regional Targeting Studies Using Machine Learning**	**Regional Potential Field Studies**
Room								
0830-0855	**New observations on paired end Permian impacts craters in the Bedout Sub-basin, offshore Western Australia: relevance to local prospectivity and global plate tectonics** **Dariusz Jablonski**	***Keynote: Linda Stalker***	**Keynote:** **Complete gas-brine imbibition relative permeability curves increase confidence in gas field performance** **Michael Clennel** *CSIRO* *Paper# 332*	**New insights into the offshore Canning Basin using a seamless onshore/offshore seismic stratigraphic model.** **Christopher Yule** *James Cook University* *Paper# 163*	**Century Zn deposit – the world's largest meteorite impacted orebody** **Finbarr Murphy** *Fractore* *Paper# 64*	**Backing up the AEM – unravelling a palaeovalley fill for groundwater exploration in the APY Lands** **Carmen Krapf** *Geological Survey of South Australia* *Paper# 239*	***Keynote: Sandy Occhipinti***	**Utilising potential field modelling to better inform on the 3D structural architecture in regions of excellent structural control** **Robin Armit** *Monash University* *Paper# 161*
0855-0920	**New observations on paired end Permian impacts craters in the Bedout Sub-basin, offshore Western Australia: relevance to local prospectivity and global plate tectonics** **Dariusz Jablonski**	***Keynote: Linda Stalker***	***Keynote: Michael Clennel***	**Palaeogeographic evolution of the Triassic succession, central North West Shelf** **Steve Abbott** *Geoscience Australia* *Paper# 192*	**Litho-structural Controls on Mineralisation at the Pillara Carbonate-hosted Zn-Pb Deposit, Lennard Shelf District, Western Australia** **Dennis Arne** *Telemark Geosciences* *Paper# 84*	**Mapping the hydrostratigraphy and groundwater salinity of the Ord Bonaparte plains from AEM and NMR data** **Kok Piang Tan** *Geoscience Australia* *Paper# 313*	***Keynote: Sandy Occhipinti***	**Mapping IOCG-related Alteration using 3D Gravity and Magnetic Inversion: An example from the Tennant Creek – Mount Isa region, northern Australia** **James Goodwin** *Geoscience Australia* *Paper# 214*
0920-0945	**Permo-Triassic hydrocarbon source potential of the NWS: new insights from regional palaeogeographical analyses and source kitchen modelling** **Jarrad Grahame**	**In-Situ Laboratory for CO2 Controlled-Release Experiments and Monitoring in a Fault Zone in Western Australia** **Ludovic Ricard** *CSIRO* *Paper# 354*	**The sample boundary effect in the low- frequency measurements of the elastic moduli of rocks** **Vassily Mikhaltsevitch** *Curtin University* *Paper# 193*	**Significance of Early Triassic Conodont Zones from Western Australia** **John Gorter** *Consultant* *Paper# 256*	**Hydrothermal dolomite distribution in the Emanuel Range as a constraint on timing of fault movement during mineralisation on the Lennard Shelf, Western Australia** **Heather Middleton** *DPI* *Paper# 140*	**A series of confusing measurements in the search for water** **Chris Wijns** *First Quantum Minerals* *Paper# 204*	**Integrating a Minerals Systems Approach with Machine Learning: A Case Study of 'Modern Minerals Exploration' in the Mt Woods Inlier – northern Gawler Craton, South Australia** **Mark Rieuwers** *SRK Consulting* *Paper# 301*	**Magnetic and gravity source models of the Gairdner Dolerites** **Philip Heath** *Geological Survey of South Australia* *Paper# 227*
0945-1010	**The Forgotten Story of Australia's First offshore Wells – Princess Royal Harbour, Albany, 1906.** **Don Poynton**	**Transforming an abandoned well into a permanent downhole receiver array: Harvey-3 case study** **Evgenii Sidenko** *Curtin University* *Paper# 168*	**Ultrasonic wave velocities measurements and seismic anisotropy at Karari gold deposit: Implications for gold exploration** **Andre Souza** *Curtin University* *Paper# 132*	**The Foura Sandstone type section (Samaropollenites speciosus Zone, Carnian–early Norian; early Late Triassic), Timor-Leste: preliminary correlation between Timor and the Bonaparte Basin** **Daniel Peyrot** *UWA* *Paper# 291*	**Nova – Bollinger Ni – Cu Sulfide Ore Deposits, Fraser Zone, Western Australia: Petrology of the Host Intrusions, Sulfide-silicate Textures and Emplacement Mechanisms of the Ores** **Valentina Taranovic** *CSIRO – Mineral Resources* *Paper# 202*	**AEM, Seismic and Power-lines: A hydrogeological case study in Peel, Western Australia** **Andrew Pethick** *Curtin University* *Paper# 300*	**Orogenic gold prospectivity mapping using machine learning.** **Mike Mcmillan** *Computational Geosciences Inc* *Paper# 143*	**Mapping Sub-Volcanic Geology Using Magnetic Data** **Stephen Markham** *Archimedes Consulting* *Paper# 352*
1010- 1040	Morning Tea							*Exhibition Hall, Grand Ballroom*

	WABS Geophysics and tectonics	CO2 Southwest Hub Case Study	Experimental and digital RP II	Stratigraphy & Sedimentology-Western Margin I	Mineral Case Studies: Geochemistry I – Applications	Groundwater & Near Surface II	Artificial Intelligence in Minerals Exploration	Regional Geophysical Surveys
Room								
1040-1105	**Reviving an old Buffalo – breathing new life into an old dataset with modern technology** **R. McGee**	**The South West Hub: Carbon Storage in the Lesueur Formation in the South West of Western Australia** **Deidre Brooks** *Department of Mines, Industry Regulation and Safety* *Paper# 397*	**Experimental acid and scCO2 reactions of Roseneath, Epsilon and Murteree gas shales: Opening or closing of gas accessible pores and metal release to water** **Julie Pearce** *University of Queensland* *Paper# 306*	***Keynote: Simon Lang***	***Keynote: Steve Garwin*** **The geological characteristics, geochemical signature and geophysical expression of porphyry copper-(gold) deposits in the circum-Pacific region.**	***Keynote: Michael Hatch***	**Using machine learning to interpret 3D airborne electromagnetic inversions.** **Mike Mcmillan** *Computational Geosciences Inc* *Paper# 96*	**Collaborating on pre- competitive geophysical projects in the Northern Territory, Australia** **Tania Dhu** *Northern Territory Geological Survey* *Paper# 274*
1105-1130	**Tectonic, geodynamic and surface process driving forces of Australia's topography since the Jurassic** **L. Harrington**	**Time Lapse In-Hole Electrical Resistivity Surveying during a Shallow Release of CO2 Gas: Harvey Western Australia** **Brett Harris** *Curtin University* *Paper# 316*	**Investigating rock micro-structure of sandstones by pattern recognition on their X-ray images** **Ankita Singh** *UNSW Sydney* *Paper# 308*	***Keynote: Simon Lang***	***Keynote: Steve Garwin***	***Keynote: Michael Hatch***	**Artificial Intelligence Techniques to the Interpretation of Geophysical Measurements** **Desmond Fitzgerald** *Intrepid Geophysics* *Paper# 121*	**Regional Airborne Gravity Surveys in Western Australia: Considerations for the End User** **Martin Bates** *Sander Geophysics* *Paper# 94*
1130-1155	**Strike-slip Earthquake focal mechanisms on the North West Shelf – implications for reactivation** **V. Holloway**	**Reservoir flow modelling to constrain CO2 plume- fault interaction. South West Hub Carbon Capture and Storage Project, WA.** **Laurent Langhi** *CSIRO* *Paper# 70*	**Rock Physics for Multiscale, Multiphysics Data Assimilation from molecular to laboratory scale** **Klaus Regenauer-Lieb** *UNSW* *Paper# 346*	**Regional Stratal Slice Imaging of the Northern Carnarvon Basin, Western Australia** **Tony Marsh** *Chevron* *Paper# 194*	**The role of geochemistry in understanding mineral systems** **Carl Brauhart** *CSA Global* *Paper# 18*	**A practical approach used to quantify and qualify effective clean-up strategy** **Benjamin Birt** *QTEQ* *Paper# 261*	**An AI approach to automated magnetic formation mapping beneath cover** **David Pratt** *Tensor Research* *Paper# 122*	**Geological insights of Northern Australia's AusAEM airborne EM survey** **Yusen Ley-cooper** *Geoscience Australia* *Paper# 312*
1155-1220	**Tectonostratigraphy and structure of the southern Perth Basin** **Charmaine Thomas**	**Subsurface characterisation for future CCS applications using uncommon 3D surface and borehole seismic survey geometries at Harvey, Western Australia** **Milovan Urosevic** *Curtin University* *Paper# 331*	**X-ray Computerized Tomography for fracture and facies characterization and slab orientation in cores stored within aluminium tubes** **Lionel Esteban** *CSIRO* *Paper# 387*	**Jurassic Igneous Activity in the Exmouth Sub- basin: Insights from new 3D Seismic** **Gerry O'Halloran** *BHP Petroleum* *Paper# 47*	**Application of multi-element geochemistry in the weathered environment: Controls, considerations and implications for exploration** **Fiona Best** *South32* *Paper# 374*	**Groundwater applications of towed TEM in diverse geology at farm scale.** **David Allen** *Groundwater Imaging* *Paper# 148*	**Efficient borehole targeting for ground-control of airborne electromagnetic (AEM) survey results** **Yusen Ley-Cooper** *Geoscience Australia* *Paper# 226*	**Supporting data-driven exploration in NSW** **Keith Gates** *Geological Survey of New South Wales* *Paper# 391*
1220-1320	Lunch							*Exhibition Hall, Grand Ballroom*
1320-1340	Poster Sessions							*Meeting Rooms 1 - 4*

	WABS Canning	CO2 Monitoring and Modelling	Use of RP for seismic Interpretation and Basin Modelling	Maximising Value From Existing Data	Mineral Case Studies: Geochemistry II – Applications & Signatures	Groundwater & Near Surface III	Mineral Case Studies: Industrial & Strategic Minerals – I	Regional Mineral Exploration Under Cover I
Room								
1340-1405				**Adapting Agile Workflows to Accelerate Geoscience Study Results** **Lendyn Philip** *Woodside Energy* *Paper# 165*	**Using Zircon Geochemistry to Map Alteration in the Gawler Craton, South Australia** **Adrienne Brotodewo** *Future Industries Institute/ University of South Australia* *Paper# 149*	**Multi-physics, Inter- disciplinary approaches for Groundwater System Investigations and Hydrogeological Assessments in Northern Australia** **Ken Lawrie** *Geoscience Australia* *Paper# 342*	***Keynote: David Turvey***	***Keynote: Simon Johnston***
1405-1430	**Placing key casing points using wellsite chemostratigraphy in the Ungani 1 Field, Canning Basin, Western Australia** **Anne Forbes**	**Assessment of the permanent seismic sources for borehole seismic monitoring applications: CO2CRC Otway Project** **Sinem Yavuz** *Curtin University* *Paper# 299*	**Statistical Rock Physics Analysis and Modelling in The Browse Basin** **Shuichi Desaki** *INPEX* *Paper# 60*	**Faster play-based exploration, Petrel Sub- basin, Australia** **Laura Phillips** *Woodside Energy* *Paper# 173*	**Mineralization signatures of the magnetite-dominant Acropolis prospect, Olympic Dam IOCG district, South Australia** **Marija Dmitrijeva** *The University of Adelaide* *Paper# 180*	**Geophysics used to help find good quality groundwater in the Vientiane Plain, Lao PDR** **Michael Hatch** *Flinders University* *Paper# 361*	***Keynote: David Turvey***	***Keynote: Simon Johnston***
1430-1455	**Seismic interpretation of salt occurrences in the southern Canning Basin, Western Australia** **Alex Zhan**	**Pore-scale study of fluids flow and fluid-fluid interactions during near-miscible CO2 EOR and storage in oil reservoirs** **Mojtaba Seyyedi** *CSIRO* *Paper# 120*	**A Geological Pressure Model for the Browse Basin and the southern Vulcan Sub-Basin, NWS Australia** **Shi-Yuan Toh** *Ikon Science* *Paper# 34*	**Maximising value from seismic using new data and information management technologies** **Jess Kozman** *Woodside Energy* *Paper# 237*	**Indicator minerals for magmatic sulfide mineralisation** **Louise Schoneveld** *CSIRO* *Paper# 230*	**Realtime analysis and well planning using wireline logs in a hydrogeological context** **Benjamin Birt** *QTEQ* *Paper# 238*	**Pilgangoora Lithium-Tantalum Project: Deposit geology and new constraints on rare-metal pegmatite genesis** **John Holmes** *Pilbara Minerals* *Paper# 182*	**Strategic electromagnetic geophysical prospecting across a belt – an example over the Albany Fraser Orogen** **Andrew Fitzpatrick** *Independence Group* *Paper# 215*
1455-1520	**Paleozoic to Triassic continental scale sediment provenance of the Canning, officer and Northern Carnarvon Basins, Western Australia** **Sara Moron**	**Feasibility of the quantitative time-lapse seismic characterisation of a heterogeneous CO2 injection** **Roman Isaenkov** *Lomonosov Moscow State University* *Paper# 341*	**Assessing mineral composition and permeability of a shale seal** **Marina Pervukhina** *CSIRO* *Paper# 322*	**Colour Amplifies Relief Shading** **Peter Kovesi** *Centre for Exploration Targeting, University of Western Australia* *Paper# 178*	**Old Data, Changed Times, New Resource? A Case Study. Barrytown New Zealand, Ilmenite Garnet Gold Zircon** **Graham Lee** *Graham Lee & Associates* *Paper# 67*	**Determining petrophysical and hydrogeological parameters from historical bore logs for the Leederville-Parmelia aquifer, northern Perth Basin, using regression methods** **Olga Filiptsova** *Department of Water and Environmental Regulation* *Paper# 252*	**The Discovery and Geology of Sinclair, Australia's first Caesium Deposit.** **David Crook** *Pioneer Resources* *Paper# 88*	**The Geological Survey of NSW's approach to the MinEx Cooperative Research Centre's National Drilling Initiative** **Astrid Carlton** *Geological Survey of NSW* *Paper# 307*
1520-1550	**Afternoon Tea**							***Exhibition Hall, Grand Ballroom***

	Exploration Strategy	DAS and VSP imaging part1	RP and Machine Learning	Maximising Value From Existing Data II	Mineral Case Studies: Geochemistry III – Cross Disciplinary	Mineral Case Studies: Geophysics - Electrical Methods	Mineral Case Studies & New Technologies: Industrial & Strategic Minerals – II	Regional Mineral Exploration – Under Cover II
Room								
1550-1615	**Keynote: Jason Crusan**	**DAS seismic monitoring of the shallow CO2 controlled-release experiment at the South West Hub In-situ Laboratory** **Konstantin Tertyshnikov** *Curtin University* *Paper# 38*	**Facies classification with different machine learning algorithm – An efficient artificial intelligence technique for improved classification** **Partha Pratim Mandal** *Curtin University* *Paper# 22*	**The Mineral Systems Atlas — delivering greater value from precompetitive geoscience data** **Sidy Morin-Ka** *Geological Survey of Western Australia* *Paper# 357*	**Integrating hyperspectral and radiometric remote sensing, spatial topographic analysis and surface geochemistry to assist mineral exploration** **Alicia Caruso** *The University of Adelaide* *Paper# 117*	**Delineating cobalt targets using galvanic and inductive source Sub-Audio Magnetics (SAM) at the Carlow Castle project Western Australia** **Daniel Eremenco** *Gap Geophysics Australia* *Paper# 76*	**Characterising Lithium Host Minerals within the Lateritic Duricrust, Greenbushes, Western Australia** **Sophie Vuleta** *CSIRO* *Paper# 221*	**Which anomaly should I drill? Using spatial statistics to inform exploration in covered IOCG terranes.** **Laszlo Katona** *Department for Energy and Mining* *Paper# 183*
1615-1640	**Keynote: Jason Crusan**	**Subsurface seismic imaging using drill bit noise** **Mehdi Asgharzadeh** *Curtin University* *Paper# 106*	**Log Dependent Approach To Predict Reservoir Facies and Permeability In A Complicated Shaly Sand Reservoir** **Rahman Elkhateeb** *Curtin University of Technology* *Paper# 33*	**Petrophysical "Big Data" – case study from the Stavely Project, western Victoria** **Phil Skladzien** *Geological Survey of Victoria* *Paper# 198*	**A multi-disciplinary approach for defining nickel and gold mineral systems; Halls Creek Orogen, Western Australia** **Fariba Kohanpour** *The University of Western Australia* *Paper# 51*	**Co-operative inversion of geoelectrical data sets acquired from different electrode arrays** **Duy Thong Kieu** *Hanoi University of Mining and Geology* *Paper# 236*	**Rapid field identification of LCT pegmatite mineralogy: Application of portable Raman spectroscopy** **Sophie Perring** *Portable XRF Services* *Paper# 164*	**Application of Audio-Magnetotelluric Method to Cover Thickness Estimation for Drill Site Targeting** **Wenping Jiang** *Geiscience Australia* *Paper# 191*
1640-1705	**Why storytelling matters … especially in mineral exploration** **Ahmad Saleem** *Exploration Radio* *Paper# 375*	**Resolving Structural Uncertainty using DAS VSP Survey in Central Australia** **Konstantin Galybin** *Schlumberger Australia* *Paper# 248*	**Identification of Deep Coal Seam Families using Machine Learning** **Tauqir Moughal** *CSIRO* *Paper# 119*	**Discovering and Using Geophysical Data in the 21st Century** **Alex Ip** *Geoscience Australia* *Paper# 336*	**New insights on chimney growth model and native gold enrichment in modern seafloor hydrothermal chimneys** **Siyu Hu** *CSIRO* *Paper# 59*	**The Discovery of the Bumblebee and Grapple Mineralisation and Impacts on Exploration at the Lake Mackay Project** **Mike Whitford** *Independence Group* *Paper# 270*	**Application of micro-XRF to characterise diamond drill-core from lithium-caesium-tantalum pegmatites** **Naomi Potter** *Portable XRF Services* *Paper# 279*	**Biochemical and mechanical dispersion mechanisms of Au and As in areas covered by Permian glacial sediments and aeolian sand** **Walid Salama** *CSIRO* *Paper# 61*
1705-1725		**Anisotropy analysis from 3D VSP surveys acquired at Otway site** **Sofya Popik** *Curtin University* *Paper# 259*	**Using Machine Learning to Predict Total Organic Content– Case Study: Canning Basin, Western Australia.** **Russell Menezes** *RadixGeo* *Paper# 381*	**Legacy Data – Hidden Opportunity** **Keith Reeves** *L & T Technology Services* *Paper# 392*	**Access to geological structures, density, minerals and textures through novel combination of 3D tomography, XRF and sample weight** **Mikael Bergqvist** *Orexplore AB* *Paper# 286*	**Frequency and Current Analysis of Non-Linear Electrical Effects in Mineralised Rocks** **Alan Oertel** *Fender Geophysics* *Paper# 390*	**The Butcherbird High Purity Manganese Project** **Justin Brown** *Element 25 Limited* *Paper# 389*	**Geochemical dispersion processes in deep cover and neotectonics in Coompana, Nullarbor plain, South Australia** **Ignacio Gonzalez-alvarez** *CSIRO* *Paper# 98*
1730 – 1830	Happy Hour							*Exhibition Hall, Grand Ballroom*
1900 – 2200	AEGC 2019 Conference Dinner							*Crown*

AEGC 2019 PROGRAMME– SUBJECT TO CHANGE
The Organising Committee reserves the right to alter the programme as circumstances dictate

Thursday 5 September

AEGC Conference 2019 programme

0730 – 1630	*Registration Open*							*Crown Conference Convention Centre*
	Stratigraphy & Sedimentology Bight	**Seismic Acquisition Onshore**	**Artificial Intelligence in Energy Exploration**	**Petroleum Systems & Basin Modelling II**	**Mineral Case Studies: Geochemistry IV - New Technologies**	**Electromagnetics – I – Innovation and Limitations**	**Iron Ore Exploration II: Mine Scale**	**Developments in Inverse Modelling**
Room								
0830-0855	***Keynote: Marita Bradshaw*** **The seven rocks that made Australia** *National Rock Garden Steering Committee*	**Drones as a support tool for seismic acquisition** **Shaun Strong** *Velseis* *Paper# 23*	**Viability of Long-Short Term Memory Neural Networks for Seismic Refraction First Break Detection – A Preliminary Study** **Tasman Gillfeather-Clark** *University of Western Australia* *Paper# 91*	**Overpressure Transmission through Igneous Intrusions: An unrecognized drilling hazard in volcanic affected basins?** **Nick Schofield** *University of Aberdeen* *Paper# 232*	**PhotonAssay – Efficient & Bulk Gold Analysis in the Modern World** **Chenoa Tremblay** *CSIRO* *Paper# 205*	**Target detectability in regional-scale AEM surveys** **David Annetts** *CSIRO* *Paper# 144*	**Drillhole Rugosity Correction for Gamma-Gamma Density Tools – A Space Modelling Approach** **Dragos Gavriliu** *Terra Logging Data Services* *Paper# 21*	**Application of growing- body potential-field inversion from drillholes** **Kristofer Davis** *Mira Geoscience* *Paper# 63*
0855-0920	***Keynote: Marita Bradshaw***	**Quaternary buried valley characterization on the Canadian Prairies using a Shear Land-streamer.** **Robert Hearst** *Southern Geoscience Consultants* *Paper# 95*	**An AI approach to using magnetic gradient tensor analysis for quick depth and property estimation** **David Pratt** *Tensor Research* *Paper# 124*	**Gippsland Basin 3D forward modelling in Badlands** **Xuemei(Linda) Yang** *Curtin University* *Paper# 240*	**Driving the paradigm shift of near surface exploration geochemistry using ultrafine soils** **Ryan Noble** *CSIRO* *Paper# 195*	**Making EM systems and bore logs speak the same language** **Aaron Davis** *CSIRO* *Paper# 212*	**Machine Assisted Drillhole Interpretation of Iron Ore Resource Evaluation Holes in the Pilbara** **Daniel Wedge** *Centre For Exploration Targeting, The University of Western Australia* *Paper# 42*	**Beyond chi-squared: Additional measures of the closeness of a model to data** **Alan Jones** *Complete MT Solutions Inc.* *Paper# 87*
0920-0945	**Seismic Evidence for Seal and Reservoir in the Late Cretaceous Ceduna Delta, Great Australian Bight** **Benjamin Tredrea** *Murphy Australia Oil* *Paper# 383*	**Observations of Geophone Spurious Resonance** **Steve Hearn** *Velseis* *Paper# 339*	**Geophysics and neural networks: learning from computer vision** **Mark Grujic** *Solve Geosolutions* *Paper# 246*	**Understanding the variability of sedimentary basin's gravity response through stratigraphic modelling** **Vincent Crombez** *CSIRO* *Paper# 276*	**pXRF assessment of new magmatic fertility indicators in the Macquarie Arc** **Tristan Wells** *University of Tasmania* *Paper# 81*	**AusAEM Year 1: Some aspects of quality control and calibration** **Ross Brodie** *Geoscience Australia* *Paper# 272*	**A high resolution seismic investigation for shallow iron ore.** **Ashley Grant** *BHP* *Paper# 315*	**Smart stitching: adding lateral priors to ensemble inversions as a post-processing step** **Gerhard Visser** *CSIRO* *Paper# 209*
0945-1010	**New insights on the Upper Cretaceous Tiger Supersequence of the Bight Basin from International Ocean Discovery Program Hole U1512** **Carmine Wainman** *University of Adelaide* *Paper# 146*	**Recent advances in nodal land seismic acquisition systems** **Tim Dean** *Curtin University* *Paper# 382*	**Deep neural networks for 1D impedance inversion** **Vladimir Puzyrev** *Curtin University* *Paper# 330*	**Probabilistic modelling of sedimentary basin evolution using Bayeslands** **Danial Azam** *University of Sydney* *Paper# 324*	**A framework for multi- sensor image segmentation using fuzzy collaborative clustering** **Tauqir Moughal** *CSIRO* *Paper# 153*	**Low-Base Frequency Helicopter AEM Data from a Square-Wave System – Helitem Squared** **Adam Smiarowski** *CGG MultiPhysics* *Paper# 294*	**Using Corona to test NMR response of iron ore chip samples** **Kazimierz Trofimczyk** *BHP* *Paper# 349*	**Bayesian joint inversion of controlled source electromagnetic and magnetotelluric data to infer presence of a freshwater aquifer offshore New Jersey** **Anandaroop Ray** *Geoscience Australia* *Paper# 75*
1010- 1040	Morning Tea							*Exhibition Hall, Grand Ballroom*

	FWI	Stratigraphy & Sedimentology Permian	QI2 – Seismic inversion – case studies	Petroleum Systems & Basin Modelling	Australian Ore Deposit Volume: Mineral Case Studies I – Overview Papers	Electromagnetics – II – Modelling	Iron Ore Exploration I: Regional	Groundwater & Near Surface IV
Room								
1040-1105	***Keynote: Denes Vigh WesternGeco***	**Sea level controls on buried geomorphology within the Swan River Estuary during the Late Quaternary** **Giada Bufarale** *Curtin University* *Paper# 187*	**Depth conversion and seismic inversion of the Scarborough gas field** **Joseph Kremor** *Woodside Energy* *Paper# 110*	**Using mud gas components to quantify hydrocarbon liquid yields for gas zones in the Patchawarra Formation of the Western Flank, Cooper Basin** **Belinda Wong** *Beach Energy Ltd* *Paper# 30*	***Keynote: Neil Philips*** **Geology of Australian Ore Deposits** *University of Melbourne & Stellenbosch University RSA*	**Augmenting 1D conductivity depth sections to include information pertaining to 2D/3D conductors** **Magdel Combrinck** *NRG* *Paper# 99*	**Hyperspectral imaging of sedimentary iron ores – Beyond borders** **Lionel Fonteneau** *Corescan* *Paper# 348*	**Passive seismic HVSR surveying for groundwater exploration at the Chilalo Graphite Project, Tanzania** **Sharna Riley** *Resource Potentials* *Paper# 296*
1105-1130	***Keynote: Denes Vigh WesternGeco***	**Internal Architectural Analysis of Mass Transport Deposits to Unravel Deepwater Dispersal Fairways; A Novel Approach to an Old Challenge** **Roland Dashti** *QTEQ* *Paper# 203*	**Integrating Seismic Inversion in Static Models to Capture Geological Heterogeneity and Improve Exploration Outcomes** **Cristina Angheluta** *Woodside Energy* *Paper# 213*	**New insights into the Exmouth Sub-basin from basin and petroleum system modelling** **Oliver Schenk** *WesternGeco* *Paper# 79*	***Keynote: Neil Philips***	**Overly steep decays in airborne TEM data and their link to charge-ability: example from the Howards East District, NT, Australia** **Klara Steklova** *Aarhus University* *Paper# 223*	**Preliminary Dating of Martite Goethite Iron Ore in the Hamersley Province (Western Australia)** **Erick Ramanaidou** *CSIRO Mineral Resources* *Paper# 229*	**Dude, Where's My Gun? A near-surface geophysics case-study** **Tim Dean** *Curtin University* *Paper# 14*
1130-1155	**Resolving complex velocity and gas absorption features with full-waveform inversion in the Taranaki Basin, New Zealand** **Yuelian Gong** *Schlumberger - Westerngeco* *Paper# 210*	**Are stromatolites in the northern Perth Basin following the End Permian mass extinction?** **Liam Olden** *Curtin University* *Paper# 314*	**Dude, where's my AVO? A case study from the Browse Basin, North West Shelf, Australia** **Said Amiribeshli** *Discover Geoscience* *Paper# 166*	**Triassic petroleum systems on the central North West Shelf – Learnings from the greater Phoenix area seismic mapping and geochemical studies** **Nadege Rollet** *Geoscience Australia* *Paper# 177*	**Known, absent and potential mineral deposit types in Australia** **David Groves** *University of Western Australia* *Paper# 83*	**Insight from AIP modelling of VTEM ET data from Colorado** **Andrea Viezzoli** *Aarhus Geophysics Aps* *Paper# 320*	**From a Mining Mindset to Regional Discovery: A Case Study for Hematite Iron Ore Exploration in Mauritania** **Bert De Waele** *SRK Consulting* *Paper# 285*	**Geophysical investigation of mine waste in the King River Delta, Macquarie Harbour, Tasmania** **Matthew Cracknell** *University of Tasmania* *Paper# 50*
1155-1220	**Full Waveform Inversion of simultaneous long-offset data** **Andrew Long** *PGS* *Paper# 43*	**Formation of Very Thick Permian Coal Seams, Cooper Basin, Australia** **Gregory Smith** *Curtin University* *Paper# 363*	**Using Recursive Inversion as input for gross-rock volume extraction from lithology prediction volumes: How bad can it be?** **James Shadlow** *KUFPEC* *Paper# 396*	**Building a 3D Geomechanical Model for the Fitzroy Trough** **Oliver Gaede** *Queensland University of Technology* *Paper# 273*	**Structural setting and controls on ni-cu sulphide mineralisation at nova-bollinger, fraser zone, w.a.** **Jonathan Standing** *Model Earth* *Paper# 245*	**Handling noise in AEM inversion – implications for subsurface characterisation** **Shane Mule** *CSIRO* *Paper# 326*		**Analysis of Geophysical Datasets for Coastal Vulnerability and Asset Management** **Peter Eccleston** *GBGMAPS* *Paper# 281*
1220 – 1320	**Lunch**							***Exhibition Hall, Grand Ballroom***
1320 - 1340	**Poster Sessions**							***Meeting Rooms 1 - 4***

	Seismic Aquisition offshore and FWI	Petrophysics and borehole technologies	QI1 - Machine learning and attributes	Unconventionals	Australian Ore Deposit Volume - Mineral Case Studies II – Commodities	Mineral Case Studies: Geophysics – Electromagnetics	Regional Geophysical Case Studies	Potential Fields: Innovations and Limitations
Room								
1340-1405	**Improved HSEQ and survey efficiency demonstrated with a new remotely operated streamer cleaning tool** **Andrew Long** *PGS* *Paper# 41*	**Quantified Detection of Carbonate Cementation in Sandstones using Standard Wireline Log Data** **Mark Bunch** *University of Adelaide* *Paper# 328*	**Cimatti Field - An example of using seismic amplitude to determine in-place resource** **Michael Micenko** *Mitsui E&P Australia* *Paper# 90*	***Keynote Manika Presad***	**West Australian Gold Resources: Crisis or Hubris?** **Julian Vearncombe** *SJS Resource Management* *Paper# 181*	**DHEM at Las Cruces, Spain – Successes and Failures** **Gavin Selfe** *GeoFocus* *Paper# 85*	**Metal Earth: role of multidisciplinary geophysical methods to improve knowledge of mineral deposition across Precambrian rocks** **Esmaeil Eshaghi** *Thomson Aviation* *Paper# 26*	***Keynote: Clive Foss***
1405-1430	**Current and future multicomponent towed streamer design** **Timothy Brice** *Shearwater Geoservices* *Paper# 378*	**Recent advances on the inversion of deep directional borehole resistivity measurements** **Vladimir Puzyrev** *Curtin University* *Paper# 155*	**Bayesian geophysical inversion with Gaussian process machine learning and trans-D Markov chain Monte Carlo** **Anandaroop Ray** *Geoscience Australia* *Paper# 77*	***Keynote Manika Presad***	**Gold metallogeny of the northern Capricorn Orogen** **Imogen Fielding** *Geological Survey of Western Australia* *Paper# 179*	**A brief description of the Andromeda Zn-Cu prospect in the Albany-Fraser Orogenic belt: A geophysical discovery using HT SQUID** **Paul Polito** *Independence Group* *Paper# 93*	**What Lies Beneath? A Reflection on the Porphyry Copper Exploration Model** **Ken Witherly** *Condor Consulting* *Paper# 380*	***Keynote: Clive Foss***
1430-1455		**What You Need To Know To Drill A HPHT Well** **Jonathan Slade** *Woodside* *Paper# 189*	**Porosity Distribution Prediction of Untapped Gumai Formation by Applying Multi-Attribute Analysis: A Case Study in South Sumatra Basin** **Mohammad Risyad** *Petrochina International Companies In Indonesia* *Paper# 27*	**Using network topology to constrain fracture network permeability** **Rowan Hansberry** *University of Adelaide* *Paper# 131*	**Structural modification of the Jaguar VHMS Zn-Cu-Ag deposits, Yilgarn Craton, W.A.** **Jonathan Standing** *Model Earth* *Paper# 280*	**The Borden Gold Deposit, northern Ontario: Contributions of VTEM helicopter time-domain EM and magnetics leading to discovery** **Jean Legault** *Geotech* *Paper# 100*	**Combined potential field and airborne electromagnetic interpretation to unravel the geological history of the Curaca Valley Region, Bahia, Brazil** **Jean-Philippe Paiement** *Mira Geoscience* *Paper# 311f*	**Full Spectrum Falcon – Measuring wide broadband airborne gravity data** **Chris Van Galder** *CGG* *Paper# 292*
1455-1520		**3D Inversion of Electromagnetic Logging-While-Drilling Data** **Nigel Clegg** *Halliburton* *Paper# 233*		**Fraccing Onshore Australia 2019** **Max Williamson** *Wiltax Consulting* *Paper# 135*		**VMS and Ni-Cu exploration using an integrated geophysical and drilling method** **Flemming Effersø** *Skytem Surveys Aps* *Paper# 158*	**Application of passive seismic and AEM to 3D paleochannel imaging: Capricorn Orogen** **Sara Jakica** *GSWA* *Paper# 200*	**Learnings from the Gawler Craton Airborne Survey Quality Control** **Matthew Hutchens** *Geoscience Australia* *Paper# 310*
1520 - 1550	Afternoon Tea							*Exhibition Hall, Grand Ballroom*
1550 - 1730	**Closing Plenary**							

AEGC 2019: ASEG Business meetings

All meetings will be held in the The Studio or Studio 2 (see venue maps). Please contact organiser for more information.

	Monday	Tuesday	Wednesday	Thursday
Morning tea		ASEG Finance Committee Danny Burns treasurer@aseg.org.au ASEG-SEG Ted Tyne president@aseg.org.au	ASEG History Committee Roger Henderson history@aseg.org.au ASEG Conference Advisory Committee Jim Austin james.austin@csiro.au	ASEG Publications 1 Ted Tyne publications@aseg.org.au
Lunch		ASEG Research Foundation Phil Harman research-foundation@aseg.org.au	ASEG Technical Standards Committee Tim Keeping technical-standards@aseg.org.au ASEG-SAGA Ted Tyne president@aseg.org.au	Presidents (ASEG / PESA / AIG) Ted Tyne president@aseg.org.au
Afternoon tea		ASEG *Preview* Associate Editors Lisa Worrall previeweditor@aseg.org.au ASEG Young Professionals Megan Nightingale ypadmin@aseg.org.au	ASEG Near Surface Specialist Group	ASEG Publications 2 Ted Tyne publications@aseg.org.au
Happy hour	Registration /Ice breaker	ASEG Council Megan Nightingale fedsec@aseg.org.au	ASEG State Branches Marina Pervukhina branch-rep@aseg.org.au	
Evening		ASEG President's dinner	Conference Dinner	

AEGC 2019: ASEG Honours and Awards

The following ASEG Honours and Awards will be conferred during AEGC 2019. All Members will be advised about the timing of, and venue for, the ASEG Honours and Awards ceremony immediately prior to the conference.

ASEG Gold Medal

The ASEG Gold Medal is awarded a Member "for exceptional and highly significant distinguished contributions to the science and practice of geophysics by a Member, resulting in the wide recognition within the geoscientific community".

Honorary Membership

ASEG Honorary Membership is awarded to a Member "for distinguished contributions by a Member to the profession of exploration geophysics and to the ASEG over many years"

Lindsay Ingall Memorial Award

The Lindsay Ingall Award is conferred "for the promotion of geophysics to the wider community"

Grahame Sands Award

The Grahame Sands Award is conferred "for innovation in applied geophysics through a significant practical development of benefit to Australian exploration geophysics in the field of instrumentation, data acquisition, interpretation or theory".

ASEG Early Achievement Award

The ASEG Early Achievement Award is conferred "for significant contributions to the profession by a Member under 36 years of age, by way of publications in *Exploration Geophysics* or similar reputable journals, or by overall contributions to geophysics, ASEG Branch activities, committees, or events".

ASEG Service Award

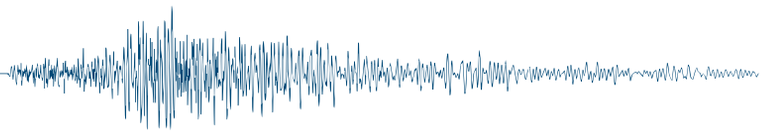
The ASEG Service Award is conferred "for distinguished service by a Member to the ASEG, through involvement in and contribution to State Branch committees, Federal committees, conferences, publications, or other ASEG activities over many years"

Shanti Rajagopalan Memorial Award

Awarded to a Member for the best paper published in *Exploration Geophysics* whilst a student Member in the 18 months prior to the conference.

Laric Hawkins Award

For the most innovative use of a geophysical technique from a paper presented at the conference (note this award will be presented as part of the Conference Awards at the Closing Ceremony at the conclusion of the conference)

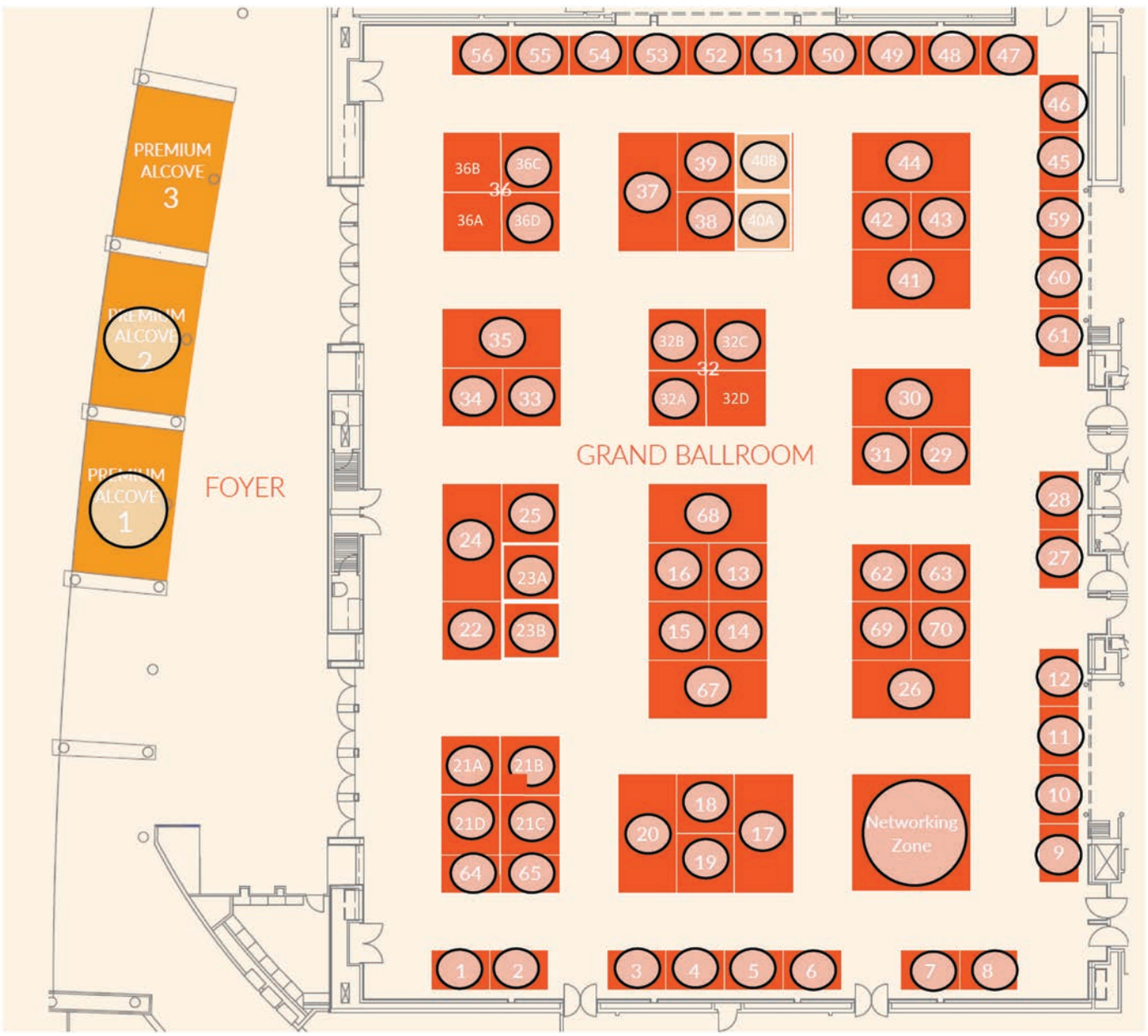


AEGC 2019: List of exhibitors

Exhibitor	Stand Number
Aarhus Geophysics ApS	047
Aarhus GeoSoftware	022
Advanced Logic Technology SA	050
ALS	023A
ANSIR Research Facilities for Earth Sounding	070
Archimedes Financial Planning	041
Auscope	069
BHP	025
Borehole Wireline	001
Carnarvon Petroleum	027
CGG Services	068
Chemostrat & MGPalaeo	007
CoRMaGeo Instruments	055
CSIRO	035
Curtin University	059
Dataco	061
Delft Inversion	019
Department for Energy and Mining	048
Department of Mines, Industry Regulation and Safety	016
DMT GmbH & Co. KG	049
Downunder Geosolutions	063
Eage	Pod 2
Earth Signal Processing	031
EMIT	PA1
Exploregeo	Pod 3
Fender Geophysics	036C
Gap Geophysics Australia	004
GEM Systems Advanced Magnetometers	039
Geological Survey of New South Wales	032C
Geophysical Resources & Services	009
Geoscience Australia	026
Geosensor	051
Geovista	002
GPX Surveys	028
Hiseis	021A
IMDEX	PA2
Inova Geophysical	046
Instrumentation GDD	012
Intrepid Geophysics	003
Katalyst Data Management	038

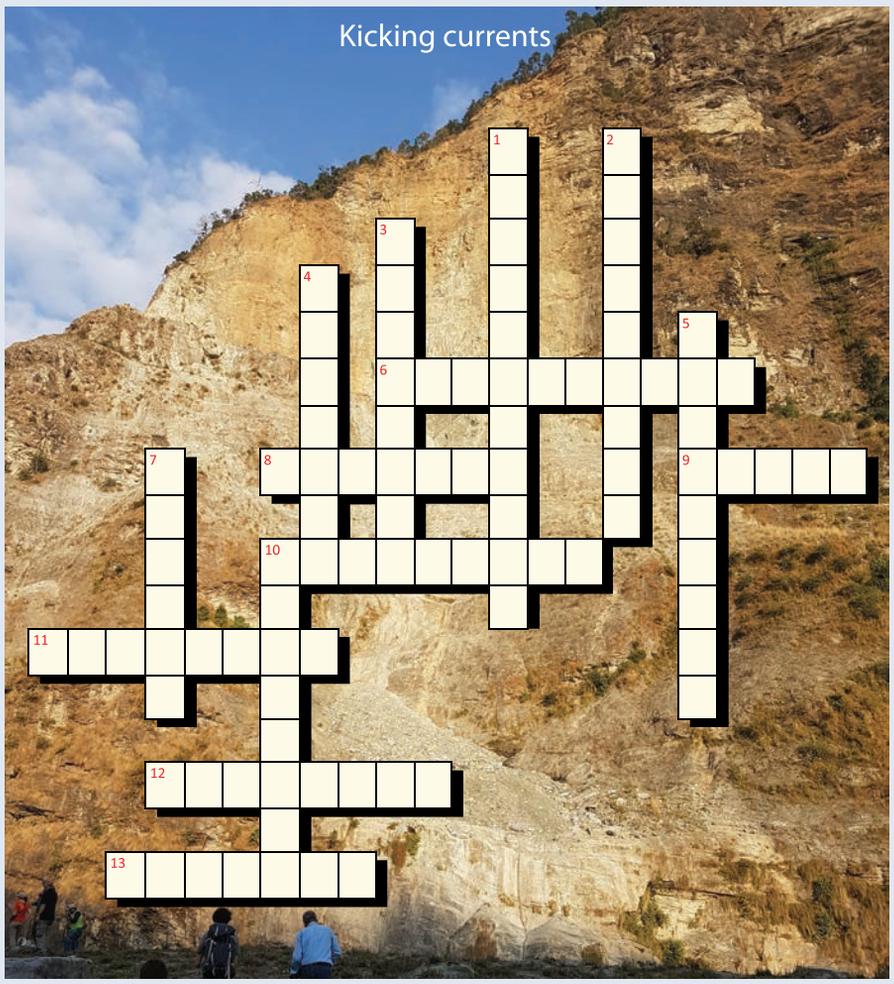
Exhibitor	Stand Number
Kinetic Logging Services	067
Laurentian University	014
MAGSPEC Airborne Surveys	013
Mala GPR Australia - ABEM	062
Minalyze	060
Mira Geoscience	029
Moombarriga Geoscience/Complete MT Solutions	054
Northern Territory Geological Survey	045
NRG Australia	040B
Nuvia Dynamics	053
Orexplore Australia	008
Oyo Corporation	042
Oyo Corporation	043
Oyo Corporation	044
Phoenix Geophysics	032B
Pioneer Resources	064
Planetary Geophysics	036D
Portable Spectral Services	010
QTEQ	017
Radiation Solutions	006
Resource Potentials	021B
Scintrex Limited	052
Seequent	037
SEG	Pod 1
Shearwater GeoServices	024
SkyTEM Australia	040A
Southern Geoscience Consultants	005
Spectrem Air	056
Task Fronterra Geoscience	030
Tensor Research	018
Terrex Seismic	015
Thomson Aviation	065
UTS Geophysics / Geotech	023B
Velseis	034
Vista Clara	021C
West Core Drilling	021D
WesternGeco	020
Wireline Services Group	032A
Zonge	033
ZZ Resistivity Imaging	011

AEGC 2019: Plan of exhibition space



AEGC 2019 exhibition space Crown Perth. See venue maps for location.

Preview crossword #3



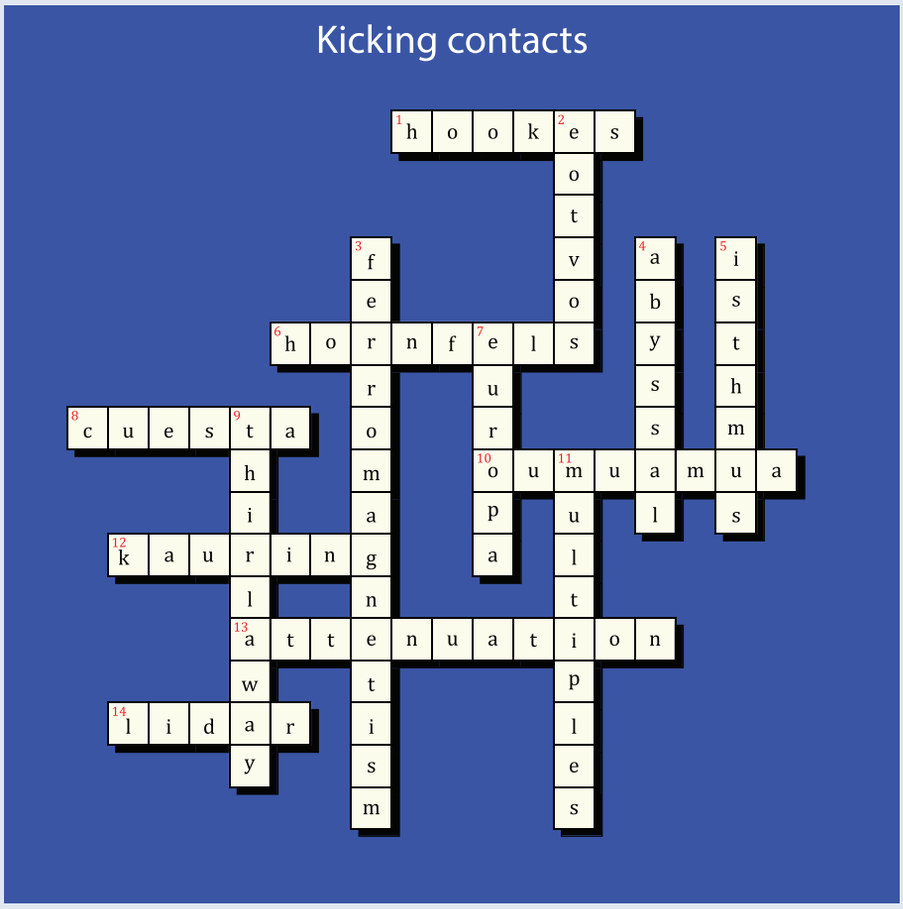
Across	Down
6. A material which does not conduct electricity but in which an applied electric field displaces charge rather than causing it to flow. **8.** Australia's first locally invented TEM system **9.** A reference equipotential surface around a planet where the gravitational potential energy is defined to be zero. **10.** In acoustics, this is known as the product of velocity and density. **11.** The point in an elliptical orbit around the sun that is farthest from the sun. **12.** The distortion of frequency introduced by inadequately sampling a signal, which results in ambiguity between signal and noise. **13.** A hypothetical subatomic particle that travels faster than the speed of light.	**1.** A near horizontal basal detachment zone between distinct bodies of rocks. **2.** The process responsible for the emplacement of Ophiolites. **3.** The angular region of magnetometer orientation in which the instrument produces inaccurate or no measurements. **4.** Geological deposits and soils that are derived by *in situ* weathering or weathering plus gravitational movement or accumulation. **5.** A type of foreland mini-basin that forms in the wedge-top depositional zone of a moving thrust sheet as part of a foreland basin system. **7.** A type of short-path seismic multiple that has been reflected successively from the top and base of relatively thin reflectors. **10.** The process of compensation or hydrostatic equilibrium by which the densities of elevated mountain ranges are compensated by the low density of depressed crustal roots

Play to win!!

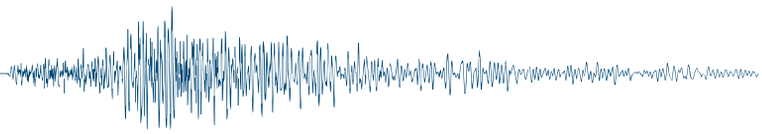
Send your answers to *previeweditor@aseg.org.au*. The first correct entry received from an ASEG Member will win two Hoyts E- CINEGIFT passes. The answers and the winner will be published in the next edition of *Preview.*

Good luck!

Preview crossword #2 solution



Business directory



August	2019		
18–23	Goldschmidt 2019 https://goldschmidt.info/2019/	Barcelona	Spain
19–22	16th International Congress of the Brazilian Geophysical Society https://sbgf.org.br/congresso/	Rio de Janeiro	Brazil
September	**2019**		
2–5	AEGC 2019: Data to Discovery http://2019.aegc.com.au/	Perth	Australia
8–12	Near Surface Geoscience Conference and Exhibition 2019 https://events.eage.org/2019/Near%20Surface%202019	The Hague	The Netherlands
15–20	SEG International Exposition and 89th Annual Meeting https://seg.org/Annual-Meeting-2019	San Antonio	USA
18–22	10th Congress of the Balkan Geophysical Society http://www.bgs2019.org/	Albena	Bulgaria
22–25	2019 GSA Annual Meeting https://www.geosociety.org/GSA/Events/Annual_Meeting/GSA/Events/gsa2019.aspx	Phoenix	USA
October	**2019**		
6–9	SAGA 16th Biennial South African Geophysical Association Conference and Exhibition http://sagaconference.co.za/	Durban	South Africa
21–24	Fifth International Conference on Engineering Geophysics (ICEG) https://seg.org/Events/ICEG-2019	Al Ain	UAE
29–30	Asia Petroleum Geoscience Conference & Exhibition (APGCE 2019) www.apgce.com	Kuala Lumpur	Malaysia
29–31	OTC Brazil http://www.otcnet.org/Brasil	Rio de Janeiro	Brazil
November	**2019**		
5–7	SEG 3rd International Workshop on Mathematical Geophysics: Traditional vs. Learning https://seg.org/events/mathgeo	Beijing	China
14–15	Dorothy Hill Women in Earth Sciences Symposium https://absoluteevents.eventsair.com/dorothy-hill-women-in-earth-sciences-symposium-2019/	Brisbane	Australia
18–22	GSA Specialist Group in Tectonics and Structural Geology and Specialist Group in Solid Earth: Convergence on the Coast https://www.sgtsg.org/	Port Lincoln	Australia
18–19	SPE/AAPG/SEG Asia Pacific Unconventional Resources Technology Conference https://www.spe.org/events/en/2019/conference/19apur/spe-aapg-seg-asia-pacific-unconventional-resources-technology-conference.html	Brisbane	Australia
December	**2019**		
9–13	American Geophysical Union Fall Meeting https://www2.agu.org/fall-meeting	San Francisco	USA
March	**2020**		
15–20	International Symposium on Deep Seismic Profiling of the Continents and their Margins (SEISMIX 2020) http://www.seismix2020.org.au	Fremantle	Australia
11–16	SEG International Exposition and 90th Annual Meeting	Houston	USA
May	**2020**		
3–8	European Geosciences Union https://www.egu2020.eu/	Vienna	Austria
September	**2020**		
7–11	ISC (International Conference on Geotechnical and Geophysical Site Characterization) conference www.isc6.org	Budapest	Hungary

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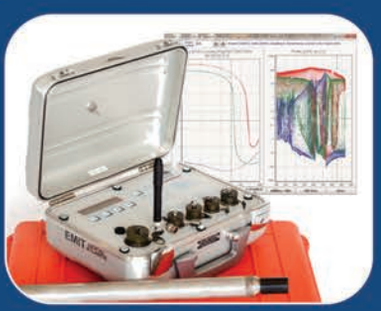
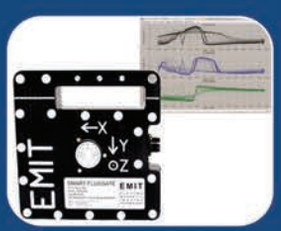


DigiAtlantis

3-component digital borehole fluxgate magnetometer system in a 33mm tool for EM and MMR with simultaneous acquisition of all components, time-series recording and powerful noise rejection. Compatible with a wide range of transmitter systems and EMIT's Transmitter Multiplexer for increasing productivity. Samples the whole waveform providing on and off-time data. Magnetometer DC signals are recorded to give 3-component and total-field geomagnetic data. Orientation data gives hole inclination and azimuth in real-time without additional surveys. Designed to be used with industry-standard winches with 2-core and 4-core cable.



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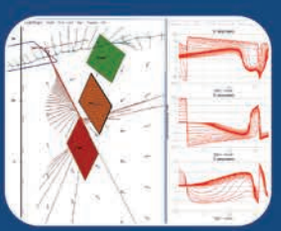

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