Australian Society of
Exploration Geophysicists

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# PREVIEW


## NEWS AND COMMENTARY



## FEATURES

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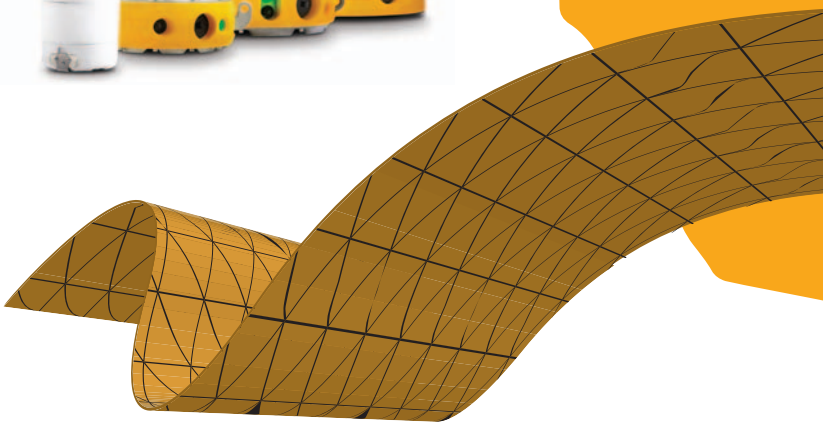

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# PREVIEW

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## FRONT COVER


Large crowds of smiling faces characterise the 2015 ASEG-PESA conference in Perth.


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# Editor's Desk

This issue of *Preview* reports on the ASEG-PESA 2015 conference and features the citations for the ASEG and Conference Awards. The conference, which was held in Perth in mid-February, was remarkably successful. It was attended by a record number of participants, many of whom were geologists and geochemists. The organising committee is to be congratulated on devising a format that broadened the appeal of the conference whilst maintaining its relevance to geophysicists. The session devoted to emerging techniques was one of the most popular. The technique that was under review (ADR) is controversial. It is so controversial that some ASEG Members were concerned that the session might be misinterpreted as an indication of ASEG support for the technique. However, it was clear to everyone present that the ASEG was simply providing a forum for scientific debate. Probing questions by leading experts in the relevant field clarified the issues at hand and gave participants considerable food for thought.

Whilst at the conference I was actively seeking copy as well as actively seeking new members for the *Preview* Editorial Team. In this issue I have the great pleasure of introducing Professor Michael Asten as Associate Editor for Education and Dr Michael Hatch as Associate Editor for Environmental Geophysics. I hope to welcome a new Associate Editor for Minerals Geophysics in the next issue. Michael Asten and Mike Hatch join Mick Micenko, Associate Editor for Petroleum Geophysics (*Seismic Window*), Guy Holmes, Associate Editor for Geophysical Data Management and Analysis (*Data Trends*), David Denham, Associate Editor for Government (*Canberra Observed*), and Ron Hackney, Associate Editor for Book Reviews. As well as producing commentary all the Associate Editors will be actively seeking news of interest to ASEG Members. Their input will ensure that *Previ*ew continues to be a lively forum for the exchange of ideas and information between geophysicists practising in the Asia-Pacific region.

This issue also features the reminiscences of Peter Gunn, a well-known Australian geophysicist who had a remarkable career spanning petroleum and minerals geophysics in both the private and public sectors. His roller coaster career ride will strike a chord with many ASEG members and may hearten some junior members of the profession.

On a personal note, I am writing this editorial from deep within the jungle on the Yucatan Peninsula in Mexico (see photo). I have swapped my Akubra for a sombrero and I am being distracted by spider monkeys, toucans and Mayan ruins. I have discovered that the Maya, who suffered the indignity of being invaded by the Toltec (relatives of the Aztecs) and then by the Spanish, were skilled mathematicians and one of the earliest peoples to explicitly use 'zero'. Unfortunately most of their codices were destroyed by Spanish missionaries who, in the mid 16th century, had very little appreciation of mathematics and astrophysics and a very real appreciation of the power of an Inquisition. Most of the Mayan understanding of the universe was lost when their books were burned, but the history of their persecution by the Catholic Church reminds us that an open mind and the willingness to question dogma is fundamental to the practice of science. In his first column Michael Asten explains how he took inspiration from Professor Sam Carey in this regard. May we all have the courage to 'disbelieve' if we can!

*Lisa Worrall*
Preview *Editor*
*previeweditor@aseg.org.au*

# Letters to the Editor

Dear Lisa,

Firstly congratulations on *Preview* #173 – I especially liked Greg Street's report, the David Denham–Mike Asten opinions, Tim Munday's aggrieved letter, and your student research comments in the editorial. All very vigorous.

Secondly, a couple of Latin misspellings survived the many trawls through the Lodestone Paper. I do not know how they got there in the first place, nor how they escaped my scrutiny. They are minor and perhaps no one will notice. However, I would like them recorded.

They are:

The Lodestone, DW Emerson, ASEG *Preview* No. 173, p. 54 misspellings: Lucretius L 1010 – *arcte* or *arte* = tightly, compactly [not *ar(e)te*]; Propertius quote – *ferrum* [not *ferram*]

Regards
Don Emerson
*systemsnsw@gmail.com*

Dear Lisa,

I would like to compliment you on your production of *Preview* as Editor.

I had intended to congratulate you on seeing, in the electronic version of Issue #173, the inclusion of photos, particularly of the new Federal Executive. It is so good to put faces to names. However, I have just received the hard copy and the impact of the colour and layout is even more striking. There are many more other photos in this issue especially of the research students, unfortunately not all are of good quality but at least the effort was made to have them.

Overall, the recent hard copies are just getting better and better.

Well done and continue the good work.

Roger Henderson
*rogah@tpg.com.au*

P.S. I would be happy for you to publish this email as a 'Letter to the Editor'.

# Sunset clause

Another conference is over and what a great success. Despite, or perhaps because of, the downturn in exploration there was a record attendance for an ASEG-PESA Conference with more than 1200 delegates. Over 200 of these delegates came from outside Australia. Clearly more people recognise the importance of the event, not only if they are exploring in the region but also if they are exploring where Australian companies are active.

The range of countries from which delegates came also shows the importance of Australian exploration geophysics in the global community. Brazil, Cameroon, Canada (36), Chile, China, Denmark, Dubai, Finland, France, Gabon, Germany, Ghana, Hong Kong, India, Italy, Japan, Luxembourg, Malaysia, Mali, Mexico, Mongolia, Myanmar, Namibia, Netherlands, New Zealand, Norway, Russia, Saudi Arabia, Singapore, South Africa, South Korea, Sweden, Thailand, UAE, United Kingdom and USA (31) were all represented.

The West Australian Minister for Mines opened the conference and, following my piece on short-termism in the conference issue of *Preview*, I thought it was an opportune moment to remind him that WA's wealth comes from the ground. The Minister then showed us what a great job the state government is doing with exploration incentives. However, without some government intervention at federal level we are unlikely to break the nexus between exploration investment and commodity prices. We all know that a discovery takes perhaps a decade to come into production, but that is not the way the investment community works. They pump money into exploration, even at grassroots level, when commodity prices are high. While I would hate to see significant government intervention, I believe that some gentle help in the way of some kind of flow through tax concessions for exploration would greatly assist. I know that the Federal Government is considering an Exploration Development Incentive scheme (*Preview* October 2014) but we badly need it now. I have written to the Federal Treasurer (and copied all of the State and Territory Ministers for Mines) asking him to make the EDI a high priority. A copy of my letter is appended to this piece. Sadly we have seen promises of this kind of support for exploration from political parties before but nothing has ever eventuated.

It was pleasing to see a large student contingent at the conference and I was invited to give some motivational talks to students in the exhibition area. It was therefore of some concern to me that I gave these talks knowing that many of my colleagues are out of work. I did address this issue in the opening session. Those of you who are underemployed should now be working harder than ever. There are mountains of data in mines departments around Australia, most of which are freely available for download. Nobody but you has the time to review this data. Develop a concept, perhaps with a few colleagues, and work on the idea with the available data. Get a team together with complementary skills. Perhaps you could try for the inaugural Frank Arnott Award, which has been announced in this issue of *Preview*. If not, there are still companies looking for good projects and they will grow in number over the next year. Even if your project doesn't get financial support it is sure to impress at your next interview. Be ready for the next boom.

I was pleased to see a young Monash graduate working the exhibition room with well-prepared business cards. I understand a job was offered following the conference. Well done!

All I can say for other graduates is to keep trying. I graduated in a major downturn in 1974. It took over eight months to get a job as a field assistant on a geochemistry programme. In the meantime I laid sewerage pipes, built footpaths and stone walls and mowed playing fields but, I have never really been out of work since. For graduates local society branch meetings are a key networking opportunity and, if you have not yet graduated, you should start making yourself known to the industry by attending as many meetings as you can. I don't just mean the ASEG, but AIG and other industry meetings like SMEDG and MEGWA. Remember most jobs in this industry are not advertised. In the current market an advertisement will attract so many replies that it will take an age to evaluate them so many potential employers are happy to employ someone they already know. Unless your CV jumps off the desk at them you haven't got a chance. So, go to meetings regularly and, if you answer an advertisement, make sure you put your picture on the application and also mention you are an ASEG Member!!! I shouldn't need to add that being on an ASEG State Branch Committee is also an advantage. It shows you are a true professional in the field.

There is some concern within the industry about some methods claiming to be geophysical without having demonstrated a solid basis in physics. I have written to the Chief of CSIRO to see whether CSIRO would assist us in evaluating such 'new' techniques. The reply made it clear that CSIRO has neither the mandate nor the resources for such work. It is an area where most people run for cover because of fear of litigation. As the ASEG is a learned society, publishing one of the most respected journals dealing with exploration geophysics, it is believed by many in the Society that the ASEG is the body that should evaluate emerging techniques. Normally this is done through publication in a peer reviewed journal such as *Exploration Geophysics* but some promoters of new techniques do not want to go down that path for various reasons. How do we as a Society evaluate new techniques and in so doing protect 'geophysics' as a profession?

At the conference we introduced a new session on emerging technologies. The ADROK group presented an overview on the Atomic Dielectric Resonance method and a case history from Charters Towers followed. The audience failed to be impressed and a lively session of questions eventuated. The physics behind the method was not explained. I got a similar feeling from presentations on this method that I attended at the SEG in Denver. I believe that unless this group can publish a sound basis for the method in a peer reviewed journal then they cannot claim to be using a geophysical method. ADROK now have papers up on their website that suggest that the ASEG has given some legitimacy to the method. This is not true. Conference papers are not reviewed and these papers were only accepted on the basis that the presentations would be videoed and there would be an extended discussion session. The presenters at the conference did not understand how the method worked and I invite ADROK to submit a paper to

*Exploration Geophysics* on the geophysical basis for their method.

We intend to continue with similar sessions at ASEG conferences. I would like to hear feedback from ASEG members on their feelings about the session at ASEG-PESA 2015 and whether it should be continued at future conferences. Please let us have your thoughts and write to the Society through the *Preview* Editor.

This will be my last presidential piece. I hope you have enjoyed reading these pieces and I believe that I will finish my term as ASEG President with the Society in better shape than I found it. As I drive off into another West Australian sunset I congratulate my predecessors, who have done so well, and I wish the best to future Federal Presidents. This was my second term as President and, as previously, I found the role to be rewarding. Any effort on my part was well repaid.

Greg Street
ASEG President
*president@aseg.org.au*

Letter to the Hon. Joe Hockey, Treasurer of the Commonwealth of Australia, from Greg Street President of the Australian Society of Exploration Geophysics.

Australian Society of Exploration Geophysicists

The Hon Joe Hockey
Treasurer of the Commonwealth of Australia
PO Box 1107
North Sydney
NSW 2059
(J.Hockey.MP@aph.gov.au)

11 March 2015

Dear Mr Hockey

I write to you at a time when many Australian exploration geophysicists, my "constituents", are unemployed. The Australian mining industry has been through boom and bust cycles since the gold rushes of the 1850s. However, the current bust has resulted in a slump in employment that is as bad as when I graduated in 1974. At a recent national conference of Australian Exploration Geophysicists I gave motivational talks to both secondary and tertiary students knowing full well that there are no jobs for them in the mining industry. Not only are individuals suffering but the nation, and your budget, is suffering from the current downturn in the mining industry.

Australia is a land rich in mineral wealth but most of what we can find close to the surface has already been found. The next wave of discoveries will come from using geophysical techniques that can 'see' into the earth and, most particularly, through the deep cover of weathered material that mantles most of the continent. Exploration under cover is difficult and new discoveries at depth will take longer to develop. Currently there is a lag of 10 – 15 years between discovery and development for most successful projects. These lag times will almost certainly increase, especially if the boom and bust cycle of investment in exploration and mining continues.

The primary driver for investment in Australian mineral exploration is commodity prices. These are currently low and, as a consequence, exploration expenditure has fallen to levels not seen for more than a decade (Figure 1). I suspect that most of the exploration that is being carried out is occurring near existing mines and that work on truly new concepts/projects, that might result in the discovery of large deposits is almost non-existent.

A secondary driver of investment in exploration in Australia is investor confidence. The boom bust cycle combined with long lag times between discovery and development mean that if exploration carried out in a boom times results in the discovery of a deposit then development of that deposit will almost certainly be delayed by a bust. A small company may not survive the bust, resulting in a loss of opportunity for investors and for Australia. Eventually investors may shun small exploration and mining companies altogether.

Australian Society of Exploration Geophysicists

In this regard I urge you, as Treasurer of the Commonwealth of Australia, to expedite your proposed Exploration Incentive Scheme. This scheme will encourage investment in small exploration and mining companies by passing on tax credits to investors. If a meaningful amount of money (hundreds of millions) is spent on exploration in coming years then the groundwork will be set for major discoveries and Australia's future prosperity.

Yours Sincerely

Gregory Street
President

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PO Box 576, Crows Nest, NSW 1585
Web: www.aseg.org.au | email: *president*@aseg.org.au

cc State Ministers for Mines SA, WA, NT, NSW, Vic. Tas, Qld.

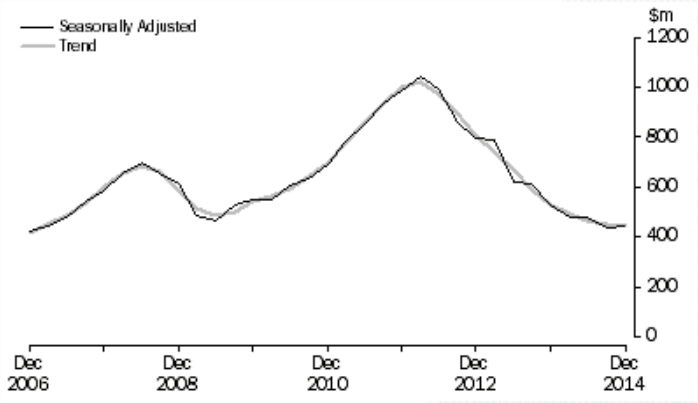


Figure 1: Mineral Exploration; seasonally adjusted and trend. Source ABS

# Welcome to new members

The ASEG extends a warm welcome to 23 new members approved by the Federal Executive at its January and February meetings (see table).

| First name | Last name | Organisation | State | Country | Membership type |
|---|---|---|---|---|---|
| Aidan | McKenzie | Macquarie University | NSW | Australia | Student |
| Allen | Rodeghiero | Woodside Energy Ltd | WA | Australia | Active |
| Andrew | Jaunzems | Rio Tinto Exploration | WA | Australia | Active |
| Andrew | Merdith | The University of Sydney | NSW | Australia | Student |
| Babatunde | Adekoya | University of Western Australia | WA | Australia | Student |
| Carmine | Wainman | University of Adelaide | SA | Australia | Student |
| Colin | Fleming | Geophysical Services Ltd | WA | Australia | Active |
| Doug | Kepert | Fortescue Metals Group | WA | Australia | Active |
| Dragos | Gavriliu | Surtech Systems | WA | Australia | Active |
| Efthymios | Efthymiou | Chevron | WA | Australia | Active |
| Fariba | Kohan Pour | University of Western Australia Centre for Exploration Targeting | WA | Australia | Student |
| Lauren | Swann | Monash University | VIC | Australia | Student |
| Nathan | Freeman | Black Geoscience | VIC | Australia | Active |
| Nicholas | Barnett-Moore | | NSW | Australia | Student |
| Paul | Vickers | Petroleum Geo-Services Asia Pacific | | Singapore | Active O/S |
| Perla | Pina-Varas | University of Western Australia Centre for Exploration Targeting | WA | Australia | Active |
| Rashed | Abdullah | University of Queensland | QLD | Australia | Student |
| Remke | Van Dam | Gap Geophysics | WA | Australia | Active |
| Robert | Adams | Petroleum Geo-Services Asia Pacific | | Singapore | Active O/S |
| Sarah | Firth | Silverlake Resources | WA | Australia | Active |
| Tianyou | Chen | CGG | | Canada | Active O/S |
| Tony | Parks | Quantec Geoscience | NSW | Australia | Active |
| Xiuping | Liu | Curtin University | WA | Australia | Student |

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# 2015 ASEG council meeting: communiqué to members

The Society's Council met on 15 February in Perth, just prior to the 24th Geophysical Conference and Exhibition.

Members of the Federal Executive and representatives of the Branches and the committees that advise the Society on the running of its business attended Council. The Honorary Editors of *Preview* and *Exploration Geophysics* also attended, as did several Past Presidents.

Council is broadly representative of the Society. It is a forum in which the Federal Executive, its committees and the Society's Branches exchange information and consider issues of strategic importance to the Society. While resolutions of the Council are not binding on the Federal Executive, the Federal Executive values the advice of Council.

In the first part of the Council meeting the President and the Treasurer presented reports on the activities of the Society over the last year and indicated key strategic and financial issues that will be dealt with over the next year. Each Branch then reported on its activities since the last Council meeting, its plans for the next year, and highlighted any issues that it considers might lead to the more efficient running of the Society or provide Members with better services.

All Branches asked the Federal Executive to ensure the Society maintains strong ties with the SEG and EAGE in order to ensure an ongoing supply of world class lecturers and courses that the Branches can provide to their Members, and for the Society's OzSTEP programme to continue and be strengthened.

The Society will arrange a questionnaire for Members during 2015 asking, amongst other things, what courses Members would like to see made available.

Several Branches noted that attendance at technical nights can be as low as 10% of the Branch membership. The questionnaire to be circulated in 2015 will also canvass what Members want from their technical nights.

The meeting also noted that the Branches are very much capital-city dominated and that Members in regional centres do not get the same access to regular technical meetings as city-based Members. Council discussed whether Branch meetings could be web cast; this is technically possible but consideration will need to be given to whether it will disrupt the financial arrangements some Branches have in place to support their meetings.

The change of the Society's Secretariat to The Association Specialists (TAS) in Sydney has led to a marked improvement in the robustness and capacity of the Society's membership database. Several Branches indicated that they would like to use the membership database to better understand the demographics of their Members in order to ensure that the services, including technical nights, are relevant to their members.

Branches that host Conferences and Exhibitions are entitled to a share of any surplus from the conference they host, and the Treasurer noted in his presentation that Branches that have hosted Conferences and Exhibitions tend to accumulate significant amounts of money in their accounts. Large bank balances that result from hosting Conferences and Exhibitions would be expected to be run down in the period between conferences hosted by that Branch provided that the funds are spent on activities that are consistent with our Constitution. Other smaller branches that do not have the capacity to host Conferences and Exhibitions tend to have smaller bank balances. The Federal Executive is keen to ensure equity for all members. The Treasurer presented a proposal whereby the amount of funds that can be accumulated by a Branch could be capped in the future. Branches agreed to work with the Treasurer to find an equitable solution for all members.

The second part of the meeting considered a paper that had been circulated in advance of the meeting in which ways to strengthen the Society's education (including professional development) activities and publications strategies were discussed. In general the meeting was in agreement with the proposals in the paper. Key points in the paper that are not included in the discussion points above are:

1. The questionnaire that will be circulated later this year to canvass what courses and speakers members want will also ask what special publications they want, and the form in which they want publications and services delivered.
2. The meeting also endorsed a proposal to consider strategies to expand the geographic reach and readership of *Exploration Geophysics*. This will require discussions with other like-minded societies and Members will be advised when a way forward is clear.
3. We need to develop a holistic promotional strategy for the society. It should cover the benefits of membership stressing the products and services we provide. It should also promote our products and services to non-member geophysicists in Australia and overseas. We also need to prepare display material that promotes careers in geophysics at student nights, and to be used in ASEG booths at conferences run by geophysical societies overseas.
4. We need to market our courses such as OzSTEP and publications, especially our special publications.
5. We need to streamline the sales of our products. A list of our special publications is now available on our website. Because of variable postage rates and discounts for multiple purchases we have found it difficult to attach these to a shopping cart and Members are currently required to download and complete an order form; however, we will work to improve this via a shopping trolley on the website.
6. The range of publications and services that can now be delivered on-line is significant. If we are to use our website to deliver non-traditional material through downloads, e.g. podcasts and webcasts of lectures, we will need to further expand our website. The meeting noted that a session at the Perth Conference and Exhibition was to be video-taped and would be used as a pilot project to deliver video material via our website.

*Barry Drummond*
*Honorary Secretary*
*fedsec@aseg.org.au*

## Tasmania

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.

*Mark Duffett (Tasmanian Branch President)*

## Victoria

On Wednesday 10 December 2014 the Victorian Branch of the ASEG celebrated the festive season at the Annual ASEG-PESA-SPE Societies Christmas Lunch at the Victoria Hotel in Melbourne's CBD. The theme was 'Exploration in Africa'.

On Wednesday 11 February 2015 Members of the ASEG enjoyed the joint ASEG-PESA-SPE Summer Social Function at the Boat Builder's Yard in Melbourne's South Wharf. This was an excellent opportunity to network with fellow geophysicists and to plan the activities for the ASEG-PESA 2015 conference the following week.

On Friday 20 March the ASEG Victoria Branch hosted a technical lunch meeting with the SEG Pacific South Honorary Lecturer **Greg Beresford** presenting 'Some interesting concepts associated with seismic seafloor acquisition' drawing on his many years working with Ocean Bottom Cable seismic. Many thanks to Karoon Gas for providing the venue.

We look forward to seeing many ASEG Victoria Branch members at meetings in the coming months.

*Asbjorn Norlund Christensen (Victorian Branch President)*

## Western Australia

After the Christmas-New Year break, the WA Branch Committee was busy supporting/assisting the Federal Committee with arrangements for ASEG-PESA International Conference-Perth, which was held from 16 to 19 February with a record attendance.

Student Events at ASEG-PESA Conference included the following activities:

- Guiding student groups around the exhibition space to a predetermined group of booths, slots allocated across the day on Tuesday 17 February;
- Conducting mock interviews with students on Tuesday 17 February;
- Mentoring / guiding university students during the conference and taking them around the exhibition and introducing them to other industry professionals;
- Presentations by industry, government and university representatives on career options in geoscience for graduates.

All the student events were organised by a team led by **Adrian Noetzli**. A big THANK YOU to the team, WELL DONE. Also thank you to **Chris Elders** (Curtin University), **Kerrie Deller** (Woodside Energy), and **Millie Crowe** (Geoscience Australia) for donating their time to present at the Careers in Geoscience session.

*Dr Jean Virieux presenting to the WA Branch of the ASEG.*

On Wednesday, 4 March SEG Distinguished Lecturer **Dr Jean Virieux** delivered a very interesting talk on 'Hierarchical seismic imaging: A multi-scale approach'. This event was held at City West Function Centre and was attended by about 50 Members & non-members. The sponsor of this event was CGG's Seismic Imaging Group.

On Wednesday, 11 March we were fortunate to host a second SEG lecturer. This time it was **Dr Greg Bresford**, a SEG HL Lecturer, who presented on some interesting concepts associated with seismic seafloor acquisition. The presentation, which was sponsored locally by Woodside Energy and again held at the City West Function Centre, was followed by a dinner with Dr Beresford.

It seems we are going to have another busy year with many speakers lined-up and more workshops and social event in the pipeline. On 8–9 June 2015 the WA Branch will co-convene a seminar for Water Management for Tight and Shale Gas with the Society of Petroleum Engineers and the International Association of Hydrogeologists. Registrations are now open for early-bird entry, see the website https://www.iah.org.au/events/watershale2015/

*John Joseph on behalf of Kathlene Oliver (WA Branch President)*

## Australian Capital Territory

ASEG ACT held its annual AGM on 4 March at Geoscience Australia with about 20 members in attendance. We congratulate our Committee on their election; **Ray Tracey**, **Eva Papp**, **Bill Jones**, **Ned Stolz** and new comer **Phillip Wynne**. We thank **Millicent Crowe** for agreeing to stay on in her position of Secretary of the Branch, we are very grateful to her for her continued enthusiastic and constructive work for our Branch. Also, thanks to **Ross Costelloe** for agreeing to stay on in the Treasurers role, thank you for your patience in this time of transition. **Marina Costelloe** also is staying on as Branch President.

**Dr Peter Milligan** spoke on his career as an ASEG member after the AGM. Peter Milligan joined Geoscience Australia (then the Bureau of Mineral Resources) in 1985. He has experience of every aspect of aeromagnetic survey practice, from field work with the then BMR aircraft (Aero Commander and Twin Otter), to map production and

*Dr Greg Beresford presenting to the WA Branch of the ASEG.*

interpretation, from analogue to working on the National Computational Infrastructure (NCI). His PhD thesis, studying magnetic-field fluctuations with time, was a fantastic grounding in magnetic observations. Dr Milligan has attended and presented at ASEG conferences since 1985. Since the 2005 IAGA meeting in Toulouse, France, he has been associated with, and on the Task Force and Executive Committee of, the World Digital Anomaly Map (WDMAM), which reports to the Working Group V-MOD of IAGA. He was present at the first release of this map in Italy in 2007, and in connection with world map development has attended subsequent meetings of IAGA, IUGG and the International Geological Congress in Brisbane in 2012. Internationally, Peter was the Australian contributor on the executive committee of the International Association of Geomagnetism and Aeronomy (IAGA) and in 2007 the first World Digital Magnetic Anomaly Map was launched at the Assembly of the International Union of Geodesy and Geophysics (IUGG) in Italy.

During the AGM the ACT Branch of the ASEG congratulated our local Branch Members on recent ASEG awards presented at the Perth ASEG Conference.

**Dr Terry Lee** was awarded the ASEG GOLD MEDAL for Distinguished Contributions to Geophysics at the Perth Conference. The ASEG Gold Medal is awarded for exceptional and highly significant distinguished contributions to the science and practice of geophysics by a Member, resulting in wide recognition within the geoscientific community. The award was given to Dr Terry Lee for his theoretical and mathematical developments to exploration geophysics, specifically in the field of transient electromagnetics over many years. Terry's work has received world-wide accolades from a wide and diverse range of geophysicists. Appreciation of this type of work is very rarely seen for an Australian geophysicist. Terry's contributions to geophysics constitute exceptional and highly significant distinguished contributions to the science and practice of geophysics.

*Dr Peter Milligan presenting to the ACT Branch of the ASEG.*

**Dr Barry Drummond** was awarded the ASEG Honorary Membership Award. This award was presented to Dr Barry Drummond in recognition of his distinguished career and outstanding contribution and leadership in geoscience spanning 40 years and nearly every aspect of geophysics, and for his on-going contributions to the ASEG.

**Dr Ken Lawrie** was awarded the best environmental paper/talk at the recent ASEG conference in Perth for his presentation/paper on 'Optimizing airborne electromagnetic (AEM) inversions for hydrogeological investigations using a trans disciplinary approach' (Ken Lawrie[1], Niels B. Christensen[2], Ross S. Brodie[1], Jared Abraham[3], Larysa Halas[1], Kokpiang Tan[1], Ross C. Brodie[1] and John Magee[1]. [1]Geoscience Australia [2]Aarhus University, [3]XRI International).

We would also like to thank our Members who organised, participated in, and contributed to events at the recent ASEG conference as varied as the Student Day, booth duty, poster presentations and technical presentations.

The ACT Branch would like to encourage you to join the ASEG on social media – just search Linked In, Facebook or Twitter for ASEG and join in the conversation.

At the time of publication the ACT branch is inviting applications for two awards for students studying geophysics or a geophysics-related discipline in the ACT. The first award is $2000 for an outstanding undergraduate or postgraduate student (second year or above) studying geophysics or a geophysics-related discipline in the ACT. This includes honours and postgraduate students with projects using geophysical data or concepts (selection criteria apply). The second award is the student registration fee plus pre-approved travel costs to a maximum value of $2000 for a student studying geophysics or a

geophysics-related discipline using geophysical data or concepts in a major project to attend the ASEG conference – the next being in Adelaide in August 2016 (selection criteria apply). Applicants must be a student member of the ASEG or be in the process of applying for membership. Please contact the ACT Branch Secretary (actsecretary@aseg.org.au) if you would like an application form.

*Marina Costelloe (ACT Branch President)*

## New South Wales

In February, we held our AGM and two of the usual suspects (**Mark Lackie** and **Sherwyn Lye**) were elected to the roles of President and Secretary. After many years of service **Roger Henderson** retired from the role of Treasurer and **William Hsin** was elected as the Treasurer for 2015. Roger was thanked for his years of 'treasuring' and for all the effort he has put into the NSW Branch.

Following the AGM, **Bob Musgrave** from the Geological Survey of NSW gave a talk entitled 'The life aquatic and the life aeromagnetic: what two months on a drill ship can tell you about the Macquarie Arc'. Bob spoke about the research he undertook on the research ship JOIDES Resolution during April and May of 2014. The Expedition (IODP 350) studied undersea volcanoes of the Izu–Bonin volcanic arc, south of Japan. Bob discussed geophysical (magnetic and seismic) and geochemical similarities between the Izu–Bonin Arc and the Macquarie Arc near Orange in the NSW gold–copper belt, and implications for the current controversy over the nature of the Macquarie Arc. Bob also showed what life on a research vessel was really like.

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

*Mark Lackie (NSW Branch President)*

## Queensland

Congratulations to our Branch President **Fiona Duncan** and her husband Vince who welcomed their first daughter this March!

The Queensland Branch kicked off the year with a talk and AGM on the 5th March. We welcomed back our President Fiona Duncan, Secretary **Megan Nightingale** and Treasurer **Henk van Paridon**.

The speaker for the evening was **Dr Ross Kleinschmidt** who is head of a team of physicists and radiochemists within the Radiation and Nuclear Science Group at the Queensland Department of Health. Dr Kleinschmidt delivered an interesting presentation on preliminary radon survey results from a historical mine in North Queensland. This March the Queensland branch will also host the SEG Honorary Lecturer **Greg Beresford**. Greg is touring with his talk on 'Interesting concepts associated with seismic seafloor acquisition'. The Queensland branch is also looking forward to our April presentation: 'Reflection Seismic and Mineral Exploration: Time for a New Relationship' by **Greg Turner**.

We invite anyone who is visiting Brisbane to attend meetings of the ASEG QLD Branch and we are currently looking for speakers for 2015. Meeting notices, information about venues and relevant contact details can be found on the QLD Branch page on the ASEG website.

*Megan Nightingale (QLD Branch Secretary)*

## South Australia & Northern Territory

The SA/NT Branch had a late start to the year following the ASEG Conference in Perth in February. We started with our AGM, where a new committee was voted in, including President **Josh Sage**, Secretary **Michael Dello** and Treasurer **Adam Davey**, as well as an assortment of General Members to take the Branch forward. One of the key aims of the Branch in 2015 is to include our NT Members in more Branch activities. We will start by web streaming selected Technical Evenings to a venue in Darwin. The frequency of these events will be dictated by demand. Get in contact with your NT Rep (**Tania Dhu**) if there are any specific talks you like to see, and we'll do our best to accommodate you.

Following the AGM, our first presenter of the year was **Doug Roberts** of Beach Energy. His talk, 'Airborne gravity gradiometer surveying of petroleum systems under Lake Tanganyika, Tanzania' was well received by a diverse audience, and highlighted some of the unique logistical and technical quirks of operating geophysical surveys in Africa.

Our technical events are made possible by our very generous group of sponsors, which in 2014 included Beach Energy, the Department of State Development, Geokinetics, Ikon Science, Minotaur Exploration, Petrosys, Santos, Schlumberger, Statoil and Zonge. We'll be getting in contact with all of our sponsors shortly in the hope that they return for 2015. If either you or your organisation is interested in sponsoring our technical programme, please get in touch with the Branch Committee using the contact details below.

Technical evenings will continue to be held monthly, during the early evening at the Cooper's Alehouse on Hurtle Square in the City. As ever, new members and other interested persons are always welcome to local events. For further details, please contact Josh at joshua.matthew.sage@gmail.com or 8338 2833.

*Luke Gardiner (Retiring SA&NT Branch President)*

# ASEG calendar: technical meetings, courses and events

| Date | Branch | Event | Presenter | Time | Venue |
|---|---|---|---|---|---|
| **2015** | | | | | |
| 15 Apr | FEDEX | ASEG Annual General Meeting | Greg Street | 1730–1900 | Rugby Club, Rugby Place, Off Pitt Street, Sydney (http://www.rugbyclub.com.au/) |
| 30 Apr | WA | Mix-it-up | PESA/ASEG/SEAPEX/FESAus | | TBA |
| 13 May | WA | Technical Night | TBA | 1730–1900 | City West, Function Centre, Perth |
| 19 May | WA | Mix-it-up | IAH/SPE/ASEG | | TBA |
| 8–9 Jun | WA | Water Management for Tight and Shale Gas Seminar | Various | | The Parmelia Hilton Hotel in Perth (https://www.iah.org.au/events/watershale2015) |
| 10 Jun | WA | Technical Night | TBA | 1730–1900 | City West, Function Centre, Perth |
| 25 Jun | WA | Mix-it-up | PESA/ASEG/SEAPEX/FESAus | | TBA |
| 8 Jul | WA | Technical Night | TBA | 1730–1900 | City West, Function Centre, Perth |
| 30 Jul | WA | Mix-it-up | PESA/ASEG/SEAPEX/FESAus | | TBA |
| 12 Aug | WA | Technical Night | TBA | 1730–1900 | City West, Function Centre, Perth |
| 27 Aug | WA | Mix-it-up | PESA/ASEG/SEAPEX/FESAus | | TBA |
| 9 Sep | WA | Technical Night | TBA | 1730–1900 | City West, Function Centre, Perth |
| 29 Sep | WA | Mix-it-up | PESA/ASEG/SEAPEX/FESAus | | TBA |
| 14 Oct | WA | Technical Night | TBA | 1730–1900 | City West, Function Centre, Perth |
| 29 Oct | WA | Mix-it-up | PESA/ASEG/SEAPEX/FESAus | | TBA |
| 11 Nov | WA | Technical Night | Student Presentations | 1730–1930 | City West, Function Centre, Perth |
| 20 Nov | WA | Satellite InSAR Data: Reservoir Monitoring from Space (EET 9) | Alessandro Ferretti | | CSIRO, Perth |
| 24 Nov | WA | AGM and Christmas Party | | 1730 till late | TBA |
| 26 Nov | WA | Mix-it-up | PESA/ASEG/SEAPEX/FESAus | | TBA |

*TBA, to be advised (please contact your state branch secretary for more information).*

# DSc award for Derecke Palmer

In November 2014, Derecke Palmer received a Doctor of Science degree from the University of New South Wales. The DSc degree is awarded for a distinguished contribution to a field of science, and it is usually based on published works. In Derecke's case, the DSc was awarded for his distinguished contribution to near surface refraction seismology. Other distinguished Australian geophysicists who have received this award include Ken McCracken, Doug Finlayson, Stewart Greenhalgh and Terry Lee.

Derecke's contribution includes the traveltime inversion algorithms, widely known as the generalised reciprocal method (GRM) and full waveform methods with the refraction convolution section (RCS). The late Harold Mooney described the GRM as a generalisation from which most refraction methods can be derived, as well as a practical inversion method in its own right. Neil Goulty described the original SEG monograph in which the GRM was first published as a classic. Ken Larner stated that Derecke's contribution extended beyond the GRM to include the full scope of data acquisition, processing and interpretation of refraction data. Don Steeples stated that Derecke's more recent work on full waveform methods will ultimately prove to be even more significant than the GRM from a scientific and engineering standpoint.

Derecke's contributions to near surface refraction seismology have been recognised previously by the ASEG with the Grahame Sands Award for Innovation in Applied Geoscience in 1992, and by the SEG in 1995 with the Reginald Fessenden Award 'for one of the most significant advances in refraction seismology in more than 50 years.' Furthermore, the GRM and the RCS were included on the Exploration Geophysics – Petroleum Industry Timeline, which was compiled as part of the 75th anniversary celebrations of the SEG. Derecke is the only Australian exploration geophysicist to appear in that comprehensive compilation.

Although the GRM has been included in most recent text books on exploration geophysics and within industry standard codes of practice, such as those of the ASTM, Derecke's contributions have not been without their critics. Criticism of both the GRM and the RCS, both of which were first described in Derecke's MSc thesis in 1976, started with the external examiners of that work. The 40-year controversy shows little indication of being resolved in the near future.

In recent years, Derecke's research has focussed on non-uniqueness and the need to recognise the fundamental differences between accuracy and precision. He also remains a passionate advocate of full waveform refraction methods. It seems likely that Derecke's contributions to near surface refraction seismology will continue into the foreseeable future.

The ASEG congratulates Derecke on a distinguished contribution to exploration geophysics.

# Water Management for Shale and Tight Gas Resources Seminar, Perth, WA, 8–9 June 2015

On 8–9 June 2015 a two-day educational Seminar on 'Water Management for Shale and Tight Gas Resources' is to be held in The Parmelia Hilton Hotel in Perth. The Seminar focuses on Western Australia but draws on worldwide industry experience. The Seminar is being organised jointly by:

- International Association of Hydrogeologists WA Branch (IAH-WA)
- Society of Petroleum Engineers WA Branch (SPE-WA)
- Australian Society of Exploration Geophysicists WA Branch (ASEG-WA)

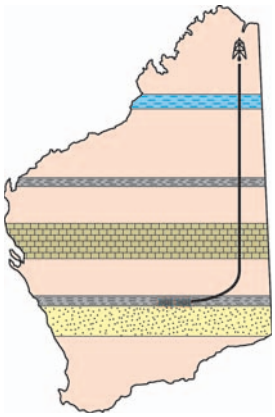
The 'Water Management for Shale and Tight Gas Resources' Seminar has been designed to bring together water and petroleum industry professionals, educate them in tight and shale gas exploration and development and water and environmental management, through a structured educational seminar, including case histories from Australia and overseas. The seminar will provide a mutual learning and understanding about useful scientific and engineering knowledge of each other's disciplines, risk management procedures and workflows, as well as the new WA Government Legislation and Regulations (Petroleum and Geothermal Energy Resources (Environment) Regulations 2012) and policies and intent behind the Regulations.

Among other purposes, the seminar is being designed in consultation with key industry practitioners and officers of the WA Department of Mines and Petroleum (DMP) and the Department of Water (DoW) to provide a comprehensive, balanced, focussed and guided educational programme for water and petroleum industry professionals including ASEG members. Programme sessions and the Seminar format are designed to cover and provide for ASEG, IAH, SPE and PESA members and other participants:

- Case Histories – WA, Australia-wide and Lessons from overseas
- Shale Gas prospectivity and water regime characterisation using geophysics, geochemical and other methods
- Groundwater and Surface Water Management and Workflows to meet Regulatory Requirements
- Monitoring and Risk Management
- Petrophysics and Geomechanics of Shale and Tight Gas Reservoirs
- Petroleum Engineering, Testing and Development Well Completion Aspects
- New Policies and Legislation from the WA Regulators – explained
- Policy/Regulation Development Considerations
- Open Forum Technical Discussion
- Oil & Gas and Water professionals networking opportunities

The Seminar website is open (with regular updates of the programme to be posted) for registration for the Seminar. Full planning is underway and up to 320 delegates are expected to attend.

Visit https://www.iah.org.au/events/watershale2015 or contact: Geoff Pettifer, Organising Committee Chair, IAH-WA/SPE-WA/ASEG Joint Seminar 'Water Management for Shale and Tight Gas Resources', 0407 841 098, geoff.pettifer@ghd.com



IAH

SPE International

Western Australian Section

Australian Society of Exploration Geophysicists

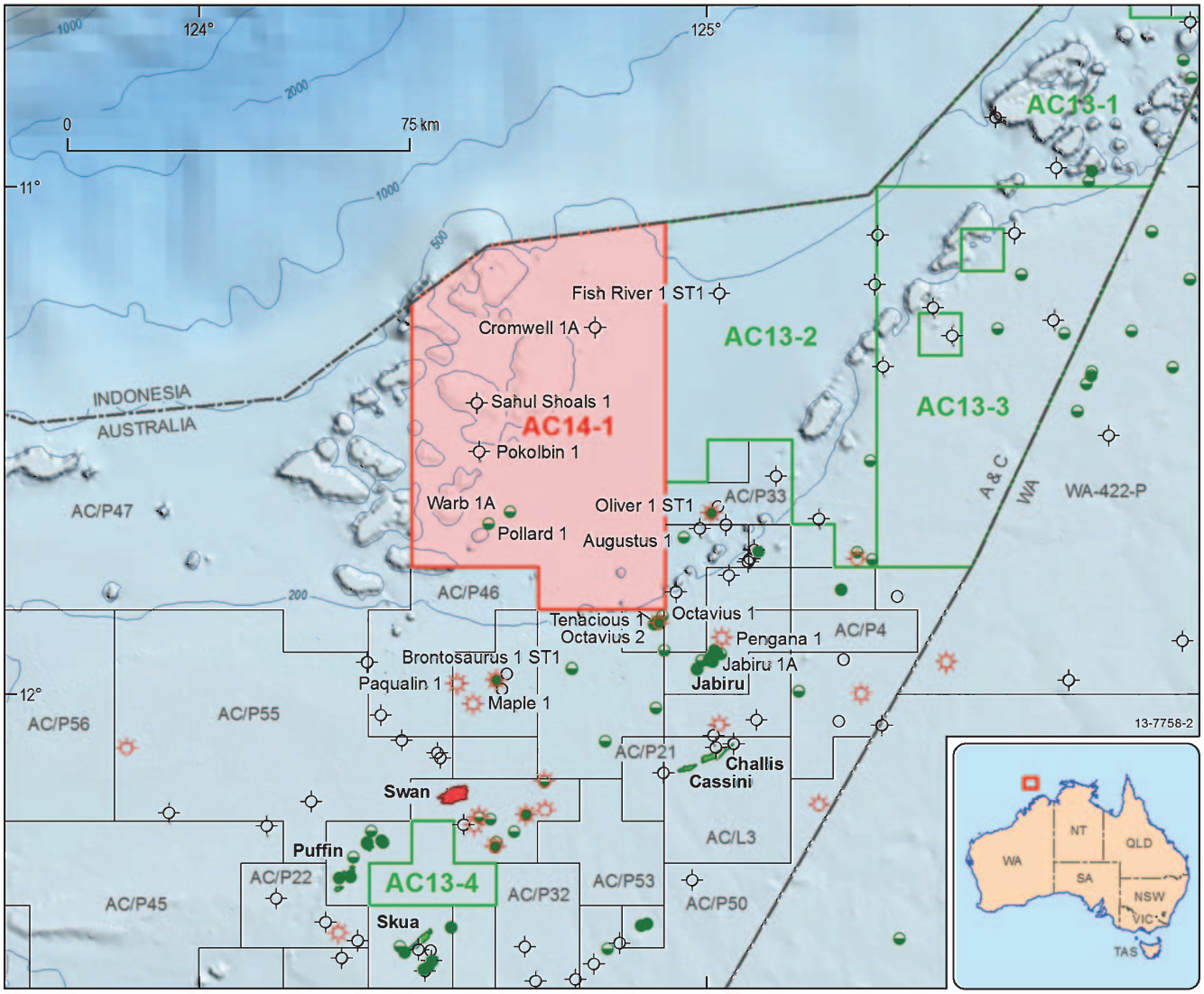
# Bids invited for exploration in 14 offshore areas

Thursday 2 April 2015 was the closing date for bids for 12 new areas and two re-release areas from round one of the 2014 offerings by the Australian Government. All the areas are offshore West Australia and the following table and figures show the locations of the 14 areas.

For more information go to: http://www.petroleum-acreage.gov.au/

Given that the price of oil at ~US$50/bl is about half what it was a year ago, it will be interesting to see what bids will be made for these areas. I just hope that the government holds it's nerve if the response to the invitations to bid are poor, because (and this is just my view) eventually the price of oil will re-bound to at least US$80/bl.

*David Denham AM*
*denham1@iinet.net.au*




*Well symbol information is sourced either from "open file" data from titleholders where this is publicly available as at 1 November 2013 or from other public sources. Field outlines are provided by Encom GPinfo, a Pitney Bowes Software (PBS) Pty Ltd product. Whilst all care is taken in the compilation of the field outlines by PBS, no warranty is provided re the accuracy or completeness of the information, and it is the responsibility of the Customer to ensure, by independent means, that those parts of the information used by it are correct before any reliance is placed on them.*

- *2014 Offshore Petroleum Acreage Release Area (work program bidding)*
- *2013 Offshore Petroleum Acreage Release Area*
- *Existing petroleum title*
- *Oil field*
- *Gas field*
- *Scheduled area boundary (OPGGSA 2006)*
- *200 Bathymetry contour (depth in metres)*
- *Petroleum exploration well - Oil discovery*
- *Petroleum exploration well - Gas discovery*
- *Petroleum exploration well - Oil and gas discovery*
- *Petroleum exploration well - Oil show*
- *Petroleum exploration well - Gas show*
- *Petroleum exploration well - Oil discovery with gas show*
- *Petroleum exploration well - Oil and gas show*
- *Petroleum exploration well - Dry hole*
- *Petroleum exploration well - Not classified*

**Figure 1.** *Release Area AC 14-1 Vulcan Sub-basin, Bonaparte Basin.*

Table 1. Fourteen areas available for cash-bidding on 5 February 2015

| Area | Basin | Sub-basin |
|---|---|---|
| AC14-1 | Bonaparte | Vulcan (Fig. 1) |
| W14-1 | Bonaparte | Petrel (Fig. 2) |
| W14-6 | Northern Carnarvon | Rankin Platform (Fig. 3) |
| W14-8, 9, 10, 11, 12 and 13 | Northern Carnarvon | Exmouth Plateau (Fig. 4) |
| W14, 17 and 18 | Northern Carnarvon | Exmouth (Fig. 5) |
| W14-19 | Bight | Eyre (Fig. 6) |
| | **Re-release areas** | |
| W14-3 | Browse | Caswell (Fig. 7) |
| W14-14 | Northern Carnarvon | Barrow (Fig. 8) |

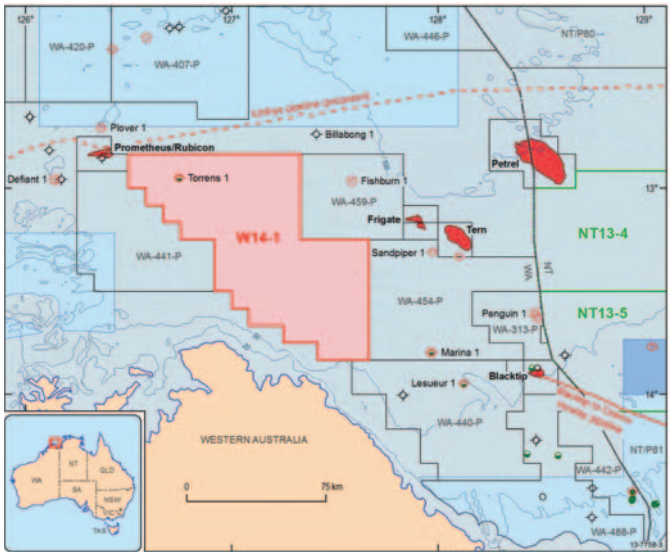



**Figure 2.** *Release Area W 14-1 Petrel Sub-basin, Bonaparte Basin. Legend same as for Figure 1.*

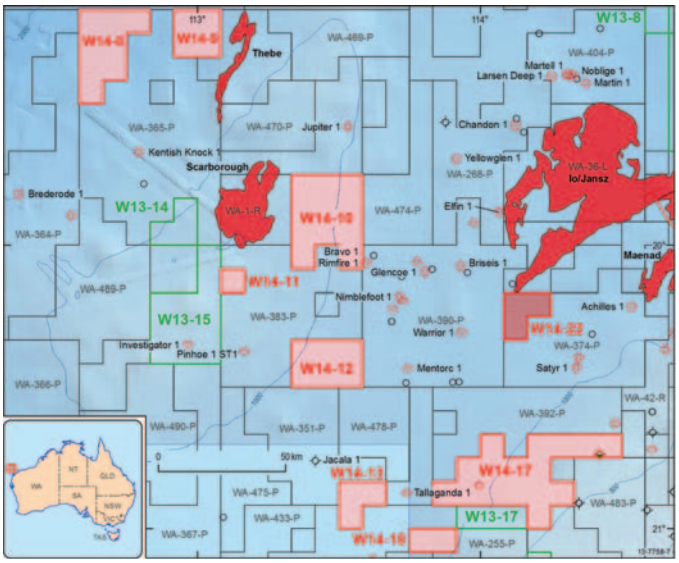



**Figure 4.** *Release Areas W14-8, 9, 10, 11, 12 and 13, Exmouth Plateau, Northern Carnarvon Basin. Legend same as for Figure 1.*

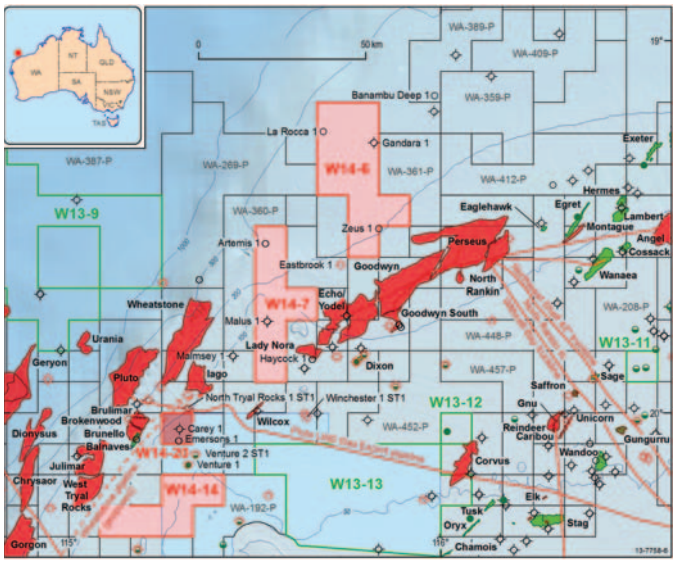



**Figure 3.** *Release Area W 14-6, Rankin Platform, Northern Carnarvon Basin. Legend same as for Figure 1.*

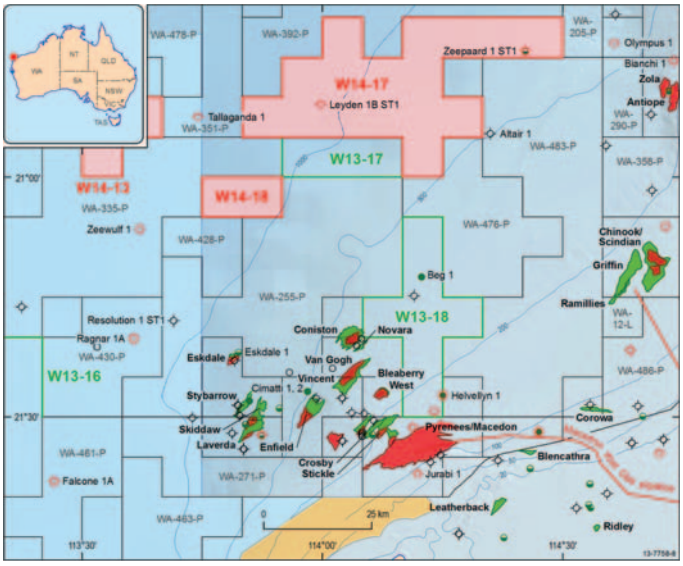



**Figure 5.** *Release Areas W14, 17 and 18, Exmouth Plateau, Northern Carnarvon Basin. Legend same as for Figure 1.*

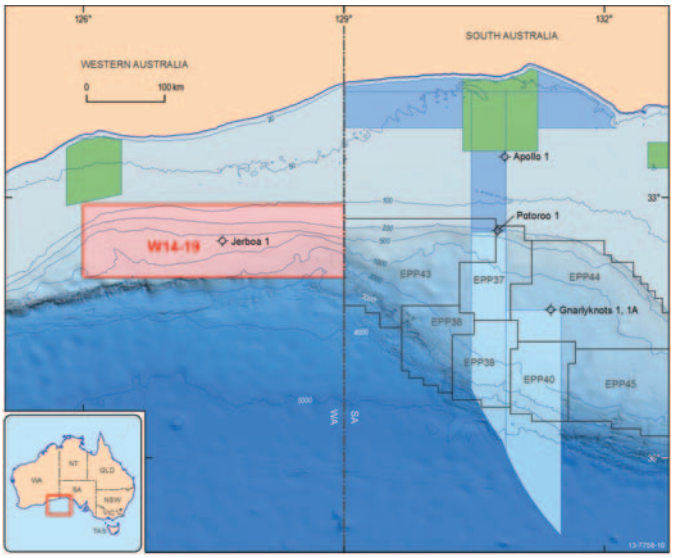



**Figure 6.** *Release Area W14-19, Eyre Sub-basin, Bight Basin. Legend same as for Figure 1.*

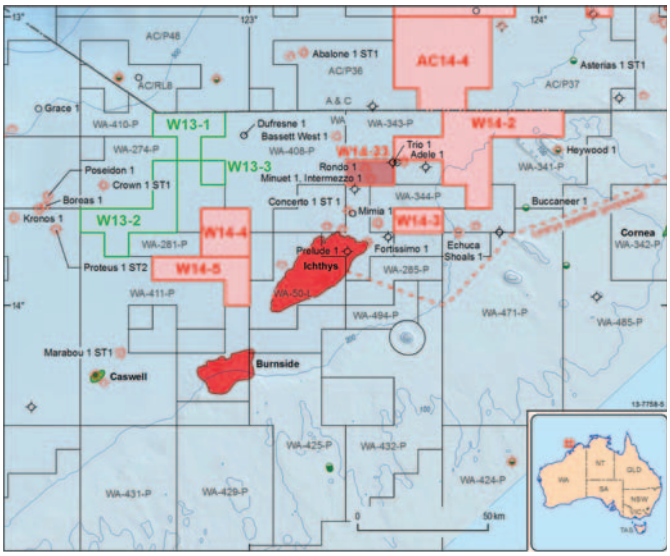
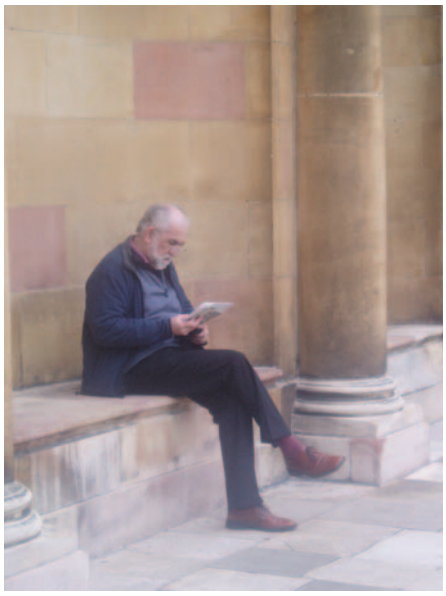



**Figure 7.** *Release Area W14-3, Caswell Sub-basin, Browse Basin. Legend same as for Figure 1.*


**Figure 8.** *Release Area W 14-14, Barrow Sub-basin, Northern Carnarvon Basin. Legend same as Figure 1.*

# Announcing the Frank Arnott Award for 2017



Frank Arnott (1951–2009) was an exceptional exploration industry leader. He championed innovative techniques that maximise the value of the multidisciplinary data that underpin modern exploration campaigns. Frank always looked for new and innovative ways to improve data processing methodologies and integrate multi-disciplinary exploration datasets. The development of his GeoExpress 2000 product was the culmination of many years of hard work. It is fair to say that Frank was at least a decade ahead of the industry in his thinking, with many of the concepts he was advancing coming to fruition today.

Frank was never constrained by convention and he was just as happy working on global datasets as he was working at the prospect scale. He was equally comfortable engaging with academia as he was with industry and often sought innovation in unfamiliar areas such as biomedical imaging, bringing back ideas to help solve exploration problems. His enthusiasm was infectious and he was a wonderful mentor, a talented scientist, always passionate and committed to geophysical exploration.

Recognising that effective data integration and visualisation of our data sets remains one of the biggest challenges explorers face today, this article in *Preview* announces a 'collaborative' challenge for **innovation in visualisation and data integration** in Frank's honour.

This global challenge is open to both industry and academia with categories defined as follows:

**Experienced** >5 years since obtaining undergraduate degree
**Apprentice** <5 years since obtaining undergraduate degree

Any individual participants must hold or be completing a geoscience degree. As collaboration in data integration is a key theme, team entries are preferred with a mix of **geophysics**, **geology** and **geochemistry**.

Participants are invited to work on one of five high quality data packages assembled for districts with exploration potential from around the globe. These data packages will be available for download from www.frankarnottaward.com after April 2015.

- **Broken Hill** Proterozoic Ag, Pb, Zn in intracratonic rift setting, NSW, Australia
- **Gawler Craton** Proterozoic IOCG, Au in multiple tectonic subdomains, SA, Australia
- **Kevitsa** Layered ultramafic Ni-Cu-PGM deposit, Lapland, Finland
- **Quesnel Trough** Alkalic porphyry Cu-Au terrain, BC, Canada
- **Yukon Plateau** Epithermal Au/porphyry Cu terrain, Yukon, Canada

Whilst each data package contains an extensive array of data types, the ability to find and utilise additional data will contribute to the assessment. These may include data from government agencies or completely independent multi-disciplinary datasets.

Final submissions are due 31 December, 2016. The results of all participant **submissions must be available for publication**.

Independent judges will evaluate the **submissions in early 2017** using the following four criteria:

1. **Innovation** in data integration and visualisation. Visualisation can include existing or new methodologies. Data integration should focus on disparate geoscience methods and disciplines
2. **Exploration significance**: Demonstrate how the approach would improve exploration outcomes
3. **Impact**: Benefits on workflow and productivity with global exploration significance
4. **Collaboration**: Demonstrate how the team collaborated and as a consequence resulting in an improved result.

The finalists will be encouraged to deliver oral presentations at **Exploration 2017** (6th Decennial International Conference-September 2017; www.exploration17.com) in Toronto, Canada where the awards will be formally presented. The prize pool is growing and now is in excess of C$40 000.

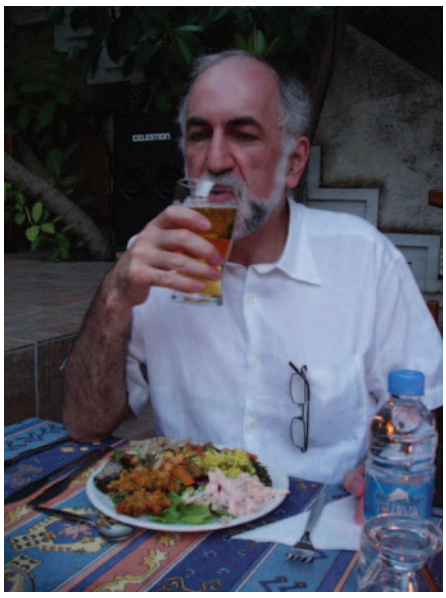
For further information, explore www.frankarnottaward.com or contact the FAA organising committee:

Theo Aravanis, Rio Tinto Exploration
theo.aravanis@riotinto.com

Tim Dobush, Geosoft Inc.
tim.dobush@geosoft.com

Dave Pratt, Tensor Research
david.pratt@tensor-research.com.au

Ken Witherly, Condor Consulting
ken@condorconsult.com



# Update on Geophysical Survey Progress from the Geological Surveys of Western Australia, South Australia, Northern Territory, New South Wales, Victoria and WA Department of Water (information current on 13 March 2015)

Further information on these surveys is available from Murray Richardson at GA via email at Murray.Richardson@ga.gov.au or telephone on (02) 6249 9229.

Table 1. Airborne magnetic and radiometric 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Coompana | GSSA | GA | GPX Surveys | 7 Feb 2015 | 255 265 | 400 m 80 m E–W | 85 910 | 15% complete at 13 Mar 2015 | TBA | 173 – Dec 2014 p. 24 | TBA |
| Dunmarra | NTGS | GA | GPX Surveys | 28 Jun 2014 | 103 985 | 400 m 80 m N–S | 36 280 | 100% complete at 10 Oct 2014 | Final processed data were received for assessment in Nov 2014. | 170 – Jun 2014 p. 24 | Released via GADDS 12 Feb 2015 |
| Delamere/ Spirit Hills | NTGS | GA | TBA | TBA | 96 500 est. | 400 m 80 m N–S | 33 690 | TBA | TBA | The proposed survey covers parts of the Fergusson River, Delamere, Victoria River Downs and Auvergne standard 1:250 k map sheet areas | TBA |
| Yalgoo | GSWA | GA | TBA | TBA | 108 000 est. | 100/200 m 50 m E–W | 11 200 | TBA | TBA | The proposed survey covers parts of the Badja, Thundelarra, Rothsay and Ninghan standard 1:100 k map sheet areas | TBA |

Table 2. Gravity surveys

| Survey name | Client | Project management | Contractor | Start survey | No. of stations | Station spacing (km) | Area (km²) | End survey | Final data to GA | Locality diagram (*Preview*) | GADDS release |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gippsland | GSV | GA | Atlas | 30 Jun 2014 | 1440 | 12 traverses at 500 m station spacing | 8358 | 100% complete to 21 Jul 2014 | Final data expected to be released via GADDS before the end of 2014 | 170 – Jun 2014 p. 25 | TBA |
| North McArthur Basin | NT | GA | Atlas | 16 Sep 2014 | 7175 | 4 km regular grid with areas of 2 km infill; 1 area of traverses spaced 4 km apart with a station spacing of 1 km | 71 030 | 100% complete at 4 Nov | Preliminary final data were supplied to GA at the end of Nov | 171 – Aug 2014 p. 39 | The survey covers all or part of Arnhem Bay, Gove, Mt Evelyn, Mt Marumba, Blue Mud Bay, Katherine, Urapunga and Roper River standard 1:250 k standard map sheets |
| Northern Wiso Basin | NT | GA | TBA | TBA | TBA | 4 km regular grid with areas of 2 km and 1 km infill | 83 240 | TBA | TBA | The proposed survey covers parts of the Waterloo, Victoria River Downs, Limbunya, Wave Hill, Newcastle Waters, Beetaloo, Birrindudu, Winnecke Creek, South Lake Woods and Helen Springs standard 1:250 k map sheet areas | TBA |

Table 3. AEM 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Musgrave Region | SA | GA | TBA | TBA | TBA | TBA | TBA | TBA | TBA | The survey area is being defined in the north-west part of SA | TBA |

*TBA, to be advised.*

## Australian Rock Properties Database

The latest national database developed by Geoscience Australia (GA), the Australian Rock Properties Database (http://www.ga.gov.au/explorer-web/rock-properties.html), was launched at the 2015 ASEG Conference on 17 February. The web application provides a customisable interface to view, select and download data via Lithology Group, Physical Property (density, resistivity, magnetic susceptibility, natural gamma, remanent magnetisation, velocity, porosity) Province Name, Sample Type and Stratigraphic Unit Name. The data can be chosen for delivery in csv, kml or shape file formats. Please contact Dr Ian Roach (+61 2 6249 9683) at Geoscience Australia for further information.

## Airborne Magnetic and Radiometric Grids of Australia

Geoscience Australia recently released the latest versions of the Magnetic Anomaly Grid and Radiometric Grids of Australia (Figs 1, 2). The magnetic grid is in its 6th edition and is a TMI composite grid of the continent with a cell resolution of 3 seconds of arc. The radiometric grids are in their 3rd edition and contain significant improvements in coverage over previous editions. The radiometric grids have a 100 m resolution. The gridded data for the national magnetic and radiometric datasets are available for extraction via GADDS or if the full resolution dataset over the entire continent is required please contact Murray Richardson (+61 2 6249 9229) at Geoscience Australia for further information regarding access.

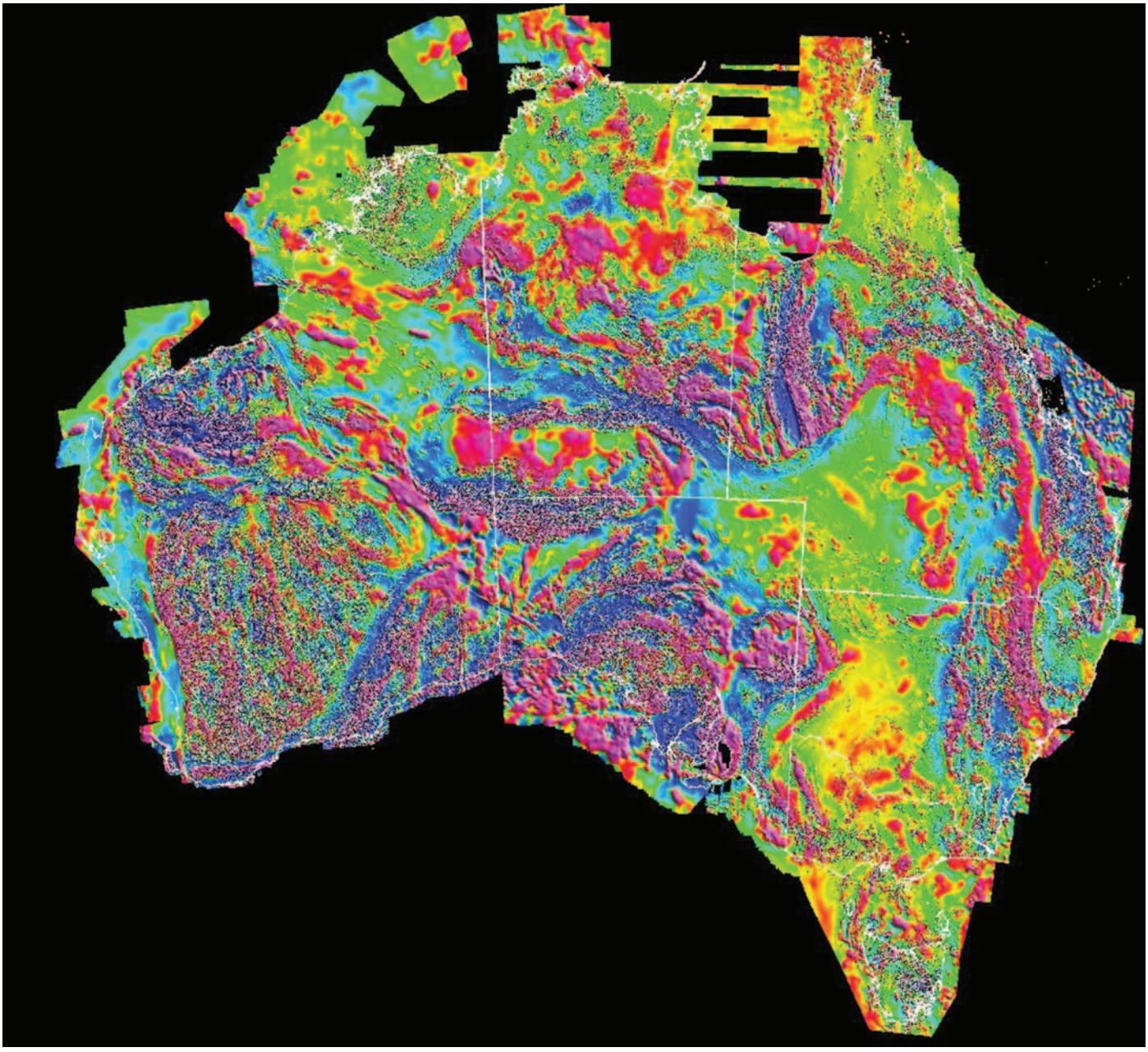


**Figure 1.** *Magnetic map of Australia Version 6.*

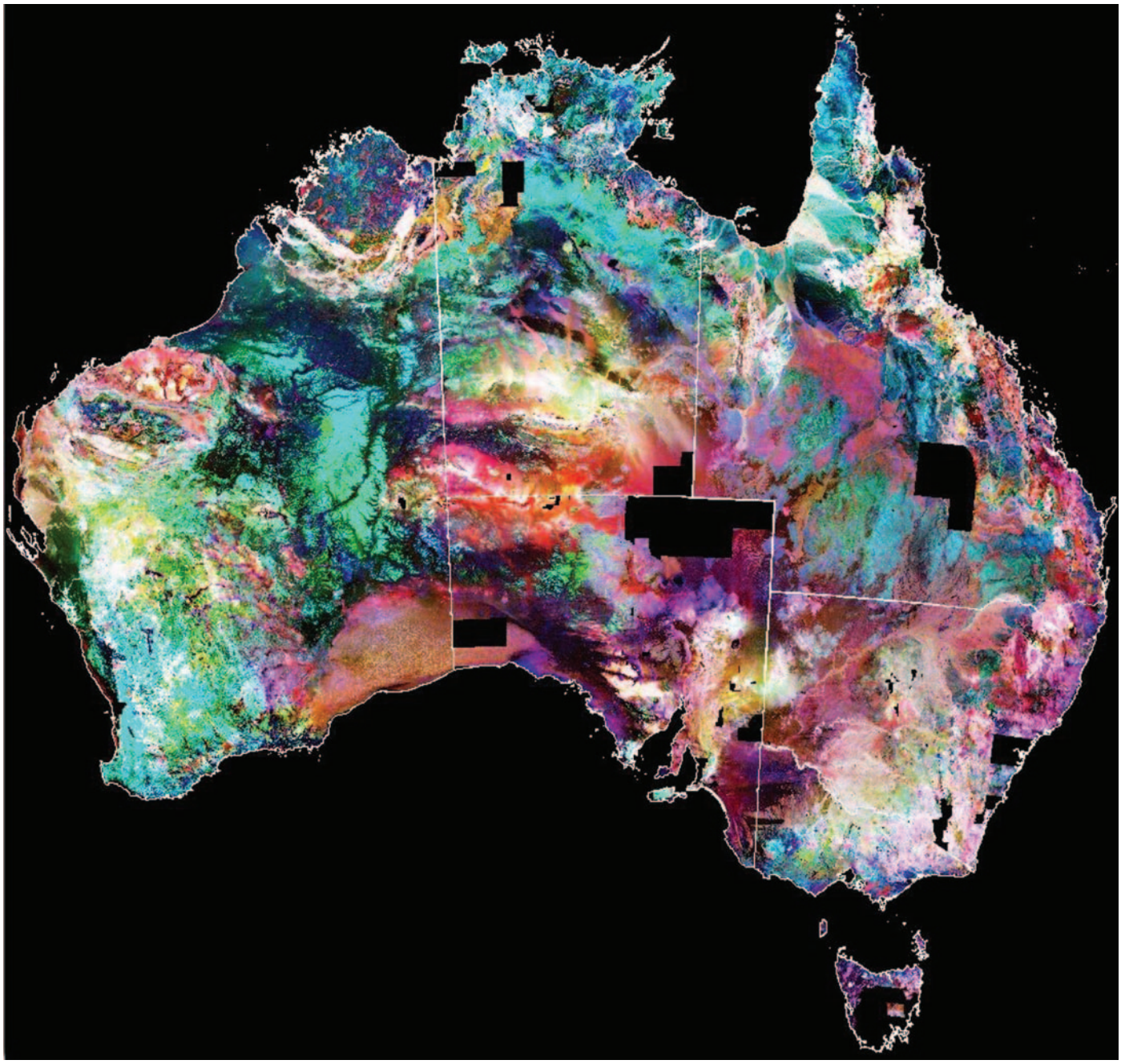


**Figure 2.** *Radiometric map of Australia Version 3.*

# New data from old in South Australia

The South Australian Government is custodian of a large amount of geophysical data. Recent changes to the Mining Act allow – under certain conditions – for previously confidential data to be released to the public domain. Prior to the changes in the Mining Act, geophysical data acquired under an Exploration Licence (EL) would remain confidential for the duration of the Licence, and for the duration of any subsequent licences. While the changes in the Act allow for the release of data after 5 years, the large amount of data involved means that the process is not automatic.

ELs containing data to be released to the public domain are announced in the quarterly MESA journal (Mines and Energy SA). Selection of ELs is based on demand. SA Government Geophysicists prepare the data for download via the SARIG website (https://sarig.pir.sa.gov.au/Map). The award-winning SARIG allows a user to search for geophysical information using online GIS tools, and download the data free of charge.

Recent additions to the downloadable geophysical data collection include the 1998 Rio Tinto magnetics and radiometrics survey undertaken at Pine Ridge in the Musgrave Province, and the 2005 Teck Cominco magnetics and radiometrics survey undertaken over the Carrapateena prospect. Examples from these surveys are shown in Figure 1. Other highlights include the ultra-high resolution Teetulpa and Lewis surveys, and a new suite of ground magnetic surveys. Over 130 GB of geophysical data is available for download, with more to come.

For more information contact Phil Heath philip.heath@sa.gov.au

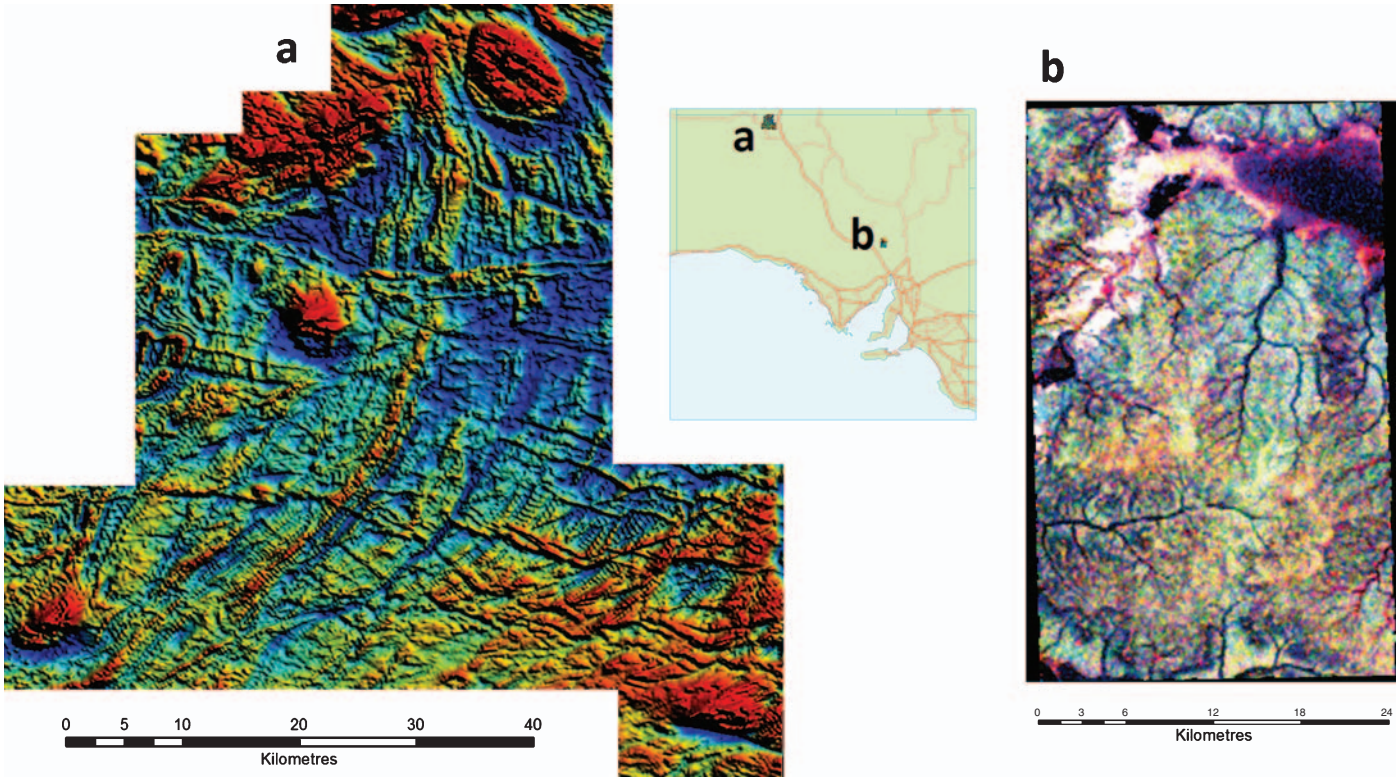



**Figure 1.** *(a) Gridded magnetic data from the 1998 Musgrave survey and (b) a red-green-blue radiometrics image from the 2005 Carrapateena survey.*

# ASEG-PESA 2015: reflections

The numbers grew and grew: geologists and engineers and geochemists joining geophysicists in registering for the 24th ASEG-PESA Geophysical Conference and Exhibition. In the end, 1232 geoscientists from 25 countries came together in the Perth Convention and Exhibition Centre for six days of workshops and conference sessions. The fantastic turn-out was testament to the efforts of the volunteer conference organising committee, the professional conference organisers EECW, workshop organisers, and the great sponsorship and exhibition support at all levels. Special recognition goes to our Platinum Sponsor Western Geco and our Gold Sponsor BHP Billiton.

Here is a quick statistical snapshot of the conference:

- 1232 delegates from 25 countries
- 90 exhibitors
- 21 conference sponsors and 11 workshop sponsors
- 29 oral keynote papers, 164 regular oral papers, and 130 posters (all abstracts are now available via http://www.publish.csiro.au/nid/268/issue/8090.htm)
- 12 workshops, of which three were 2 days long
- 6 official social events and an untold number of unofficial ones!

We were spared the scorching days always possible in Perth in February, and the conference began with an outdoor icebreaker on the lawn of the convention centre. The good food and drink continued for three more days, including a conference dinner at the summit of Kings Park with a night-time view over the city and the Swan River.

The 2015 conference chose to showcase the interpretation side of geophysics – the effort to turn data into geological information via the theme 'Geophysics and Geology together for Discovery'. This theme was taken to heart by the technical papers committee, and whole days were fashioned in this mould, helped by a stellar line-up of keynote speakers in all streams, many of whom were not geophysicists. Workshops ran independently from the main conference, with no requirement to register for the conference in order to attend a workshop. This helped to draw in local delegates, who pushed the numbers to over 435 people across the three days of pre- and post-conference workshops.

The publicity effort helped draw many local non-geophysicists in the last weeks before the conference, swelling the delegate numbers and reinforcing not only that geophysics is interesting to non-geophysicists as well, but that we do all need and want to work together for the common discovery goal. Twenty percent (243) of delegates came from overseas, continuing the international status of


*Large crowds of smiling faces characterise the 2015 ASEG-PESA conference in Perth.*


*The 2015 Conference Organising Committee on stage during the closing plenary. (Left to right) Adrian Noetzli (Students), Chris Wijns (Minerals Co-Chair), Michael Lees (Exhibition), Kristian Madaschi (Social), Paul Bouloudas (Petroleum Co-Chair), Mike Dentith (Minerals Technical), Ian James (Near-surface Technical), Andrew Long (Petroleum Technical), Katherine McKenna (Sponsorship), Amanda Carreno (Social), Lena Thrane, Tobias Colson (Publicity), Dave Annetts (Workshops and USB Editor). Absent: Andrew Fitzpatrick (Treasurer).*

these conferences and the view that it is worth travelling around the world to attend. The exhibition is a big part of any conference, and with 90 exhibitors this year, including some from overseas, we filled most of two halls, even driving in a couple of seismic trucks.

Students received a large focus. During a dedicated high school student day, volunteer professional geophysicists and university students gave talks and led the high schoolers around the exhibition floor. Support from the EAGE meant that the three winners of the university student quiz night are off to Madrid very soon for the next EAGE conference, all paid for by the EAGE. Talk about incentive to remember those facts from the lectures!

One more round of applause to the 2015 organising committee for putting such a lot of personal time into a tremendously successful conference. Another show of thanks goes to a host of sponsors, without whom a conference could not eventuate, and the speakers and poster presenters who gave their time in ensuring the great technical content. And, a final but resounding acknowledgement of all the delegates, who together, gave the buzz and excitement to this conference.

We hand the baton and best of luck to the 2016 Adelaide conference committee, where we look forward to seeing everyone gathered again.

*On behalf of the 2015 Conference Organising Committee, Chris Wijns (Minerals Co-Chair)*

## ASEG-PESA 2015: ASEG Honours and Awards

### *ASEG Gold Medal: Dr Terry Lee*

*Dr Terry Lee.*

Dr Terry Lee has been awarded the ASEG Gold Medal for his theoretical and mathematical developments to exploration geophysics, specifically in the field of transient electromagnetics. The ASEG Gold Medal is awarded from time to time for exceptional and highly significant distinguished contributions to the science and practice of geophysics by a Member, resulting in wide recognition within the geoscientific community. Terry has been a Member of the ASEG since 1971.

Terry was awarded a Doctor of Science degree from the University of Tasmania in 1986 for published work that was

recognised by scholars in the field of transient electromagnetics as a distinguished original contribution to scientific knowledge, so as to give the candidate authoritative standing in that field. Previously he was awarded a BSc. Melbourne; BSc. Hons. Tasmania; MSc. New England; PhD Macquarie; and BA Hons (Art History) Sydney.

From 1975 to 1983 he was employed as research geophysicist with geophysical consultants L.A. Richardson and Associates in Sydney, later incorporated into Geopeko Ltd, where he was responsible for all theoretical research into exploration geophysics, including gravity, magnetic, radiometric, electrical and in particular transient electromagnetic methods. During this time he was also a Visiting Fellow at the Cooperative Institute for Research in Environmental Sciences at the University of Colorado. In 1983 he joined Bureau of Mineral Resources in Canberra where his responsibilities included research into potential fields, heat flow, remote sensing and transient electromagnetics. He has consulted in theoretical geophysics to exploration companies and in 1991 he was invited to be a member of the Editorial Board of the Journal of Applied Geophysics.

Terry has been a pre-eminent contributor to the field of useful analytical solutions to problems in electromagnetic prospecting. This work provided checks for numerical solutions and has practical applications in their own right. Important contributions include formulations for the response of half spaces, layered earths, and spheres, in addition to fundamental contributions to the understanding of the effects of polarisable bodies and superparamagnetism in TEM. He has also made theoretical contributions in remote sensing, potential field theory and resistivity. Terry's work has influenced science outside exploration geophysics.

Some of these contributions were recognised by the ASEG with the Grahame Sands Award for Innovation in Applied Geophysics in 1991. Previously in 1976 the EAGE awarded him their Van Weelden Award for the best paper by a person under 30 years of age for two papers on transient electromagnetics. Terry has also received the Primary Industry and Energy Achievement Award in 1993 for Outstanding Technical or Design Innovation for Coastal Geoscience using remote sensing.

Following his retirement from BMR Terry continued to be active in research, publishing 13 papers in scientific journals after 1991. Seven of these utilise the concept of the 'moments of the impulse response' published with several co-authors, although the concept is acknowledged as solely Terry's idea. The concept is used routinely in airborne EM processing resulting in software programmes of significant use to exploration geophysicists by making 3D EM inversions practical on desktop computers.

Terry has been a quiet achiever often working in the background to the mainstream explorationist. Theoretical geophysics is not regular currency among the vast majority of exploration geophysicists and often taken for granted. So it is probably true that there is not a wide range of applied, exploration geophysicists that know about and could understand the intricacies of the body of work comprising 57 papers that Terry has written or co-authored. Many would be surprised to learn that this work covers time and frequency domain electromagnetics, in addition to resistivity, gravity, magnetics, radiometrics, remote sensing, heat flow, crustal deformation, geomorphology and mathematics. By any measure this body of work in itself is exceptional and significant.

Terry's work has received accolades and support from a wide and diverse range of geophysicists in Australia and around the world, including industry geophysicists, consultants and contractors, and researchers. Such appreciation of this type of work is very rarely seen for an Australian geophysicist. Terry's remarkable volume of contributions to Australian and world-wide geophysics, and the wide recognition this work has gained within the geoscientific community, readily constitute the Gold Medal criteria for exceptional and highly significant distinguished contributions to the science and practice of geophysics.

### *Honorary Membership of the ASEG: Barry Long*

*Barry Long.*

ASEG Honorary Membership has been awarded to Barry Long for his significant contribution to seismic data acquisition, and distinguished contribution to ASEG over many years.

Barry studied at University of NSW, originally in Physics, where he obtained a 1st Class Honours Degree. He then became the first student ever at the University to change faculties during his Ph.D. He moved to the Geology Department and started a PhD in Geophysics, which was never submitted as he chose to pursue his consulting work, subsequently joining Velocity Data as a one-third shareholder in the late 1970s.

Barry has been heavily involved with seismic acquisition throughout a career spanning over 40 years. During his time at Velocity Data Barry grew their high resolution seismic acquisition business through the implementation of Mini-SOSIE on shallow coal prospects. In 1984 Barry headed up this business as owner and founding Managing Director of the new entity, Velseis Pty Ltd, which is now a major provider of integrated seismic services in Australia and overseas.

During his time at Velseis from 1984 to 1992, Barry directed the development of Mini-SOSIE acquisition. This involved modifications to existing acquisition systems to allow increasing the number of channels available for recording, and enabling real time PC display of shot records, and ultimately leading to field brute stacks. Barry's significant contribution to writing the software code together with his professional staff meant that Velseis was able to develop their own in-house seismic processing capability.

After leaving Velseis in 1992, Barry started Geocon Pty Ltd, a seismic acquisition company based in Thailand. He was able to continue development of new PC based seismic acquisition systems with real time processing to record Mini-SOSIE data and display field brute stacks in real time. Geocon has been active recording Mini-SOSIE data in Thailand as well as Laos, Philippines, Mongolia and Turkey.

Barry has an extensive history of commitment to the ASEG, having been an active Member since incorporation in 1971. He

served on the Federal Executive committee in Sydney in the late 1970's.

After moving to Queensland in 1980, Barry was Branch President in 1984/85 and he remained a Branch Committee member until his departure overseas. During this time he was Chairman of the 1983 Brisbane Conference.

He was a member of the Honours & Awards Committee from its inception in the 1980's to 2013, and is a member of the ASEG History Committee.

Of particular note is Barry's active participation in every ASEG conference since the inaugural conference in 1979. Attendance at the conference has always been an important part of Barry's commitment to the ASEG, even after he re-located to Thailand. Barry also contributed much time and enterprise to many of the conferences as the white suited Master of Ceremonies at the conference dinners.

For his distinguished contribution to and achievements in the business and practice of exploration geophysics, and for his significant contributions to ASEG over 40 years, Barry is a worthy recipient of Honorary Membership of ASEG.

### *Honorary Membership of the ASEG: Kim Frankcombe*

ASEG Honorary Membership has been awarded to Kim Frankcombe for his significant contribution to exploration geophysics and distinguished contributions to the ASEG over many years.

Kim is a prominent figure in the minerals exploration industry in Australia. After graduating from the University of Tasmania with honours in 1978, his past positions included Field Geologist in Stockdale Prospecting Ltd, Geophysicist with Mobil Energy Minerals Australia, Manager of Ground Geophysics and Airborne Electromagnetic Divisions with World Geoscience / Aerodata, Senior Geophysicist with Normandy Group, and Senior Consulting Geophysicist with Southern Geoscience Consultants. He is currently director of ExploreGeo, the consulting firm he established in 2011.

Kim has been a member of ASEG since 1978 and has always been actively engaged in ASEG activities wherever he was based. He is one of the very few Members who has been President of two state branches: South Australia in 1988 and Western Australia in 1992. He became an active member of the WA committee on moving to the West in 1989.

He was a Convenor of the joint ASEG and Australian Geomechanics Society seminar on Engineering Geophysics in 1988, and Co-Chair of two ASEG Conferences – in 1994 and again in 2000. He was also actively involved on committees for the ASEG conferences in 1988, 2007 and 2015. With his experience in organising conferences, Kim has been an advisor and at times Chairman of ASEG's Conference Advisory Committee for 20 years, freely giving advice and support to all the conference organising committees through these years.

He is a member of the Technical Standards Committee and contributed significantly to the ASEG's recently released 'ASEG-ESF: Format for exchange of Electrical Survey Data'.

Kim joined the ASEG Federal Executive in 2011 and served as President 2012–13. He has represented ASEG on the Australian Geoscience Council since 2011. In 2013, Kim led the subcommittee to select the new secretariat. With his organisational skill and leadership, the selection process was completed smoothly.

In addition to his very extensive and ongoing service to the ASEG, Kim often gives technical presentations at many of the ASEG/AIG seminars in Perth. He also was co-editor of the UWA book 'The Geophysical Signatures of Western Australian Ore Deposits' and co-authored four articles in that volume. He has a strong presence in geophysical forums such as SEGMIN. He speaks without fear or favour on many subjects, some controversial. He is very generous with his time and knowledge, in particular mentoring young graduates.

For his achievements in the profession and his significant contribution to the ASEG over many years, Kim is a most worthy recipient of the award of Honorary Membership of the ASEG.

*Kim Frankcombe receiving his ASEG Honorary Membership from ASEG President Greg Street.*

### *Honorary Membership of the ASEG: Dr Barry Drummond*

ASEG Honorary Membership has been awarded to Dr Barry Drummond in recognition of his distinguished career and outstanding contribution and leadership in geoscience spanning 40 years and nearly every aspect of geophysics, and for his on-going contributions to the ASEG.

Barry's work in relation to the application of seismology to hard rock terranes is widely recognised throughout Australia and overseas, as is his role in the design and construction of the earthquake monitoring element of the Australian Tsunami Warning Centre (ATWS), which was established jointly by Geoscience Australia, the Bureau of Meteorology and Emergency Management Australia following the devastating Indian Ocean tsunami of December 2004. Barry was appointed head of the Earth Monitoring Group of projects in Geoscience Australia. Other projects in the Earth Monitoring Group during Barry's leadership included monitoring the Earth's magnetic field, screening for nuclear explosions, and volcano monitoring in Papua New Guinea and Indonesia. The national geodesy programme was also part of the group.

Before moving to the Earth Monitoring Group in 2004, Barry led a number of programmes that used seismic reflection and refraction techniques and potential field data to image many aspects of Australian geology. He was instrumental in the

establishment of ANSIR – The Australian National Seismic Imaging Resource Research Facility and was the foundation Director of the facility from 1997 to 2002. More recently Barry has worked in the area of Coal Seam Gas and submitted a background paper on Seismicity and induced earthquakes to the Independent Review of Coal Seam Gas Activities in New South Wales.

His leadership role in Geoscience Australia also included oversight of many other aspects of GA's programmes including the Australia-wide data acquisition programme that ultimately delivered the first complete gravity, airborne magnetic and radiometric coverage of the continent.

Barry's foresight drove many national scale projects forward by uniting the earth science disciplines and strategically aligning priorities with the national interest. His extensive publication list is testament to the breadth of the scientific work in which he was involved. Barry spoke at many conferences, often as a Key Note, and mentored many young geophysicists.

Barry has been a long time pro-active Member of the ASEG and GSA, and he was a Member of PESA and SEG until his retirement from Geoscience Australia in 2011. He was a member of the editorial board of the Australian Journal of Earth Sciences. He has been an active local ASEG branch member over many years. In recent years, he has served on the ASEG Federal Executive in the most important role of Honorary Secretary from 2012 to the present.

Barry is highly respected in the geoscience community. His work has promoted the science of geophysics throughout Australia and worldwide, and developed closer understanding and co-operation between geophysicists and other earth scientists. The ASEG is pleased to acknowledge Barry's significant contributions to the profession and the Society with this award of Honorary Membership of the ASEG.

*Barry Drummond receiving his ASEG Honorary Membership from ASEG President Greg Street.*

### *ASEG Service Certificate: Anne Tomlinson*

An ASEG Service Certificate for distinguished contributions by a Member to the ASEG is awarded to Anne Tomlinson, through her involvement in and contribution to the WA Branch committee, Federal Committee, ASEG Conferences, and other ASEG activities over many years.

Anne studied at the University of Auckland graduating with a BSc in Geophysics in 2002 and MSc in Geology in 2004. She became an Active Member of the ASEG in 2003, and has actively participated in the WA Branch activities since moving to Perth in 2005. She became a member of the WA State branch committee in 2009 and served as President over several years. During this term, she was involved in the organisation of special meetings and events, including WA's Junior Geophysicists Forum. Student nights in Western Australia have grown strong with Anne's leadership. She implemented a joint society committee comprising ASEG, PESA, AIG and ESWA representatives to organise the major annual Careers in Geoscience event. She has also organised numerous ASEG talks for state meetings and annual general meetings held in Perth, and was an organiser of ASEG's Airborne Electromagnetic Workshop in 2012.

Anne has made significant contributions to the management of the ASEG, and her efforts have resulted in transformations to the WA branch, as well as other important contributions including management of the WA branch events on the ASEG website, introducing an online event registration system, and establishing regular e-newsletters. In 2014, she led the WA committee to terminate the Branch's management contract with the existing secretariat, resulting in substantial cost savings to the state branch.

Anne always worked extremely hard to achieve goals and has given a huge amount of her time to ASEG. Anne has also dedicated a significant amount of personal time to the AIG organisation, particularly in her role as Federal Councillor for Membership, a position which she has held since 2012.

*Anne Tomlinson receiving her ASEG Service Certificate from ASEG President Greg Street.*

### *Lindsay Ingall Memorial Award: Michael Dentith and Stephen Mudge*

The Lindsay Ingall Memorial Award is intended for an Australian resident or former resident for the promotion of geophysics within the non-geophysical community, including geologists, geochemists, engineers, managers, politicians, the media or the general public. The award honours the memory of an ASEG founder, past President and Honorary Member, the late Lindsay Ingall for his capacity to cross geoscience boundaries, his ability to relate technically and effectively with other professionals, regardless of their own understanding of the principles of geophysics, and for his enduring commitment to assist geoscientists across Australia. It is awarded generally to

an individual who has actively promoted geophysics to the wider community.

This year the award is, for the first time, made jointly to two prominent Members of the ASEG, Michael Dentith and Stephen Mudge, for their combined effort in promoting geophysics to the wider community through their authorship of the new textbook 'Geophysics for the Mineral Exploration Geoscientist' published by Cambridge University Press in 2014.

Mike Dentith is Professor of Geophysics at The University of Western Australia. He has been an active researcher and teacher of university level applied geophysics for more than 25 years, and he also consults to the minerals and petroleum industries. Mike's research interests include geophysical signatures of mineral deposits, petrophysics and terrain scale analysis of geophysical data for exploration targeting. Mike has also been a great contributor to the ASEG over many years, having been part of the technical papers committee for ASEG conferences in 1994, 2000, and again this year, and editor of the conference edition of Exploration Geophysics in 2000 and the ASEG Special Publications: 'Geophysical Signatures of WA Mineral Deposits', and 'Geophysical Signatures of SA Mineral Deposits'. He has also been a Board Member of the ASEG Research Foundation since its inauguration to the present.

Steve Mudge has worked as an exploration geophysicist in Australia for more than 35 years, and currently works as a consultant in his own company Vector Research. He has worked in many parts of the world and has participated in a number of new mineral discoveries. Steve has a keen interest in data processing techniques for mineral discovery and has produced several publications reporting new developments. Through his series of 'Excitations' articles on geophysical techniques that were published in ASEG's *Preview* magazine over several years, Steve was able to present an understanding of the techniques in a way that both geophysicists and geologists could readily comprehend. Steve has also been a Board Member of the ASEG Research Foundation since its inauguration to the present.

Whilst the new textbook explains how geophysics may be used in the search for mineral deposits, the importance of this contribution lies in the careful linking of geology and geophysics. Mike and Steve advise that this book was specifically written for geologists who would like to know more about using geophysics and also for geophysicists who would like to know more about the interpretation of geophysical data. It presents modern practice in geophysics in a way that will undoubtedly assist exploration geologists to better communicate their aims and goals to geophysicists. At the same time, the books helps geophysicists to better understand the geological and commercial implications of their results. But above all, it is a book directed at the wider geological community to facilitate mutual understanding of both the benefits and pitfalls of geophysical surveying.

For Mike and Steve this book has been a labour of love. Their dedication to the project, extending over more than a decade, demonstrates a strong commitment and passion by both authors to educate the wider geoscientific community about the great benefits of applying geophysics in mineral exploration.

Like the career of Lindsay Ingall, this book succeeds comfortably in crossing traditional geoscience boundaries. The writers have shown that they also share Lindsay Ingall's capacity to relate technically and effectively with other professionals. Mike Dentith and Steve Mudge are worthy recipients of the ASEG Lindsay Ingall Memorial award.

*Steve Mudge and Mike Dentith receiving Lindsay Ingall Memorial Award from ASEG President Greg Street.*

### *Grahame Sands Memorial Award: Dr Phil Schmidt (MagneticEarth Pty Ltd)*

This award is based on an endowment made by Members of the ASEG and the geoscience profession in memory of the late Grahame Sands, who was tragically killed at the prime of his life in an aircraft crash in 1986, whilst developing and testing new equipment for geophysical survey aircraft. Because of Grahame's abilities to turn scientific theory into innovative application, the award is made 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.

The Grahame Sands Award for 2015 is made to Phil Schmidt from MagneticEarth Pty Ltd for his unique and practical development of the Qmeter for in-field measurement of the magnetic remanence properties of field samples. The Qmeter provides geophysicists with a practical and affordable method for investigating the magnetic remanence and magnetic susceptibility properties of field samples collected from outcrop, drill core, mine open cuts and quarries.

Phil is an adjunct Professor at Macquarie University, NSW, and an Honorary Fellow at CSIRO. Since 2005, he has been a member of the Federal Executive of the ASEG. As Publications Chairman during that time he has been instrumental in raising the profile of ASEG's publications Exploration Geophysics and Preview.

The development of the Qmeter is the result of years of investigation of the magnetic properties of rocks, their relationship to mineralisation systems and theoretical methods for the analysis of field data. Phil has made a significant contribution to our knowledge of the magnetic properties of many mineralisation systems through his prior research at CSIRO and collaboration with other global research organisations, and through more than 120 professional publications that he has authored or co-authored ranging from rock magnetism, instrumentation and magnetic survey interpretation to palaeomagnetism.

The Qmeter was developed from the concept first published in 1973 by Sheldon Breiner in a booklet entitled 'Applications

manual for portable magnetometers' as a practical field guide for total field magnetometers. Phil has adapted the hand held method suggested by Breiner and turned it into a practical portable system that uses a miniature flux gate magnetometer and associated electronics that is directly powered from the USB port on a laptop computer. The new theoretical development required for use with the flux gate magnetometer is published in the ASEG special publication on magnetic remanence and demagnetisation: Schmidt, P.W. and Lackie, M.A. 2014, Practical considerations: making measurements of susceptibility, remanence and Q in the field (*Exploration Geophysics* 45(4), 305–313).

The Qmeter is an elegant and simple machine which fills an important niche. Interpretation of aeromagnetic surveys have often made the simplifying assumption that anomalies are produced only by induced magnetic fields proportional to the magnetic susceptibility, a property that can be readily measured in the field with small simple instruments. However, the fact is that most rocks, and especially economically interesting rocks, hold a permanent or remanent magnetisation as well as their induced magnetisation. For the companies that do recognise the importance of remanence, current practice is to submit rocks to laboratories, with significant time and cost factors involved.

The Qmeter is an inexpensive instrument which permits rapid measurement of magnetic susceptibility and remanence in the field. The hope is that by making it possible for companies to produce their own magnetic remanence data in real time during exploration, they will perform more complete and realistic magnetic survey interpretations, leading to more efficient and successful discovery strategies.

Given the emergence of magnetic remanence as an important rock property for assisting in the exploration of many mineralisation systems, Phil's development of the Qmeter is a significant step forward by providing geophysicists with a practical tool for the direct field measurement of the magnetic remanence properties of rock samples. The ASEG is pleased to present the Grahame Sands Award to Phil Schmidt in recognition of this unique and practical contribution to our industry.

### *Shanti Rajagopalan Memorial Award: Andrew Pethick*

The Shanti Rajagopalan Memorial Award, inaugurated in 2013, is presented for the best paper published by a Student Member of the ASEG in *Exploration Geophysics* in the period prior to each ASEG Conference.

The award is named in memory of the late Dr Shanti Rajagopalan, who passed away in 2010. Shanti was one of the best known and respected Members of the ASEG, and was well known within the geophysical profession for her outstanding contributions and service to the profession and the ASEG.

Shanti was a major contributor to the ASEG in many ways. She was Victorian branch President, and was actively involved in the organisation of ASEG conferences in Hobart and Melbourne. She was also Managing Editor of *Exploration Geophysics* in 2000 and 2001.

But it is most noteworthy in the context of this award that, in 1987 as a Student Member, Shanti was awarded the inaugural Laric Hawkins Award for the most innovative use of a geophysical technique from a paper presented at the ASEG Conference. It is therefore very appropriate that an award to encourage technical excellence by our Student Members is named in honour of Shanti.

There were two papers selected by the adjudication panel that were in close contention for the award. The papers were of very similar quality and both addressed topics of importance and of current interest. The selection committee had difficulty separating the papers but one paper was judged to be slightly better constructed and more informative.

The runner up for the award is Konstantin Tertyshnikov from Curtin University for his paper co-authored with A. Bóna and R. Pevzner entitled: 'Prestack time imaging algorithm with simultaneous velocity estimation in hard rock environments'.

The winner and recipient of the Shanti Rajagopalan Memorial Award for 2015 is Andrew Pethick of Curtin University, for his paper co-authored with Brett Harris entitled: 'Bathymetry, electromagnetic streamlines and the marine controlled source electromagnetic method'.

*Phil Schmidt receiving the Grahame Sands Memorial Award from ASEG President Greg Street.*

*Andrew Pethick receiving the Shanti Rajagopalan Memorial Award from ASEG President Greg Street.*

## ASEG-PESA 2015: Conference and Exhibition Awards

*Best Paper: Minerals Geophysics*

Matthew Hope, 'Geophysical Response of the Atlántida Cu-Au Porphyry Deposit, Chile – An Undercover Discovery in an Old District'

*Best Poster: Minerals Geophysics*

Phillip Schmidt, 'The Qmeter – a portable tool for remanence and susceptibility'

*Best Student Paper: Minerals Geophysics*

Seogi Kang, 'Restoration of distributed IP information in airborne-time domain electromagnetic data'

*Best Student Poster: Minerals Geophysics*

Tom Horrocks, 'Evaluation of Automated Lithology Classification Architectures using Highly-Sampled Wireline Logs for Coal Exploration'

*Best Paper: Energy Resources Geophysics*

Olga Zdraveva, 'Anisotropic depth imaging in presence of stress: transversely isotropic or orthorhombic?'

*Best Poster: Energy Resources Geophysics*

Zhijun Du, 'North Sea case study: Heavy oil reservoir characterization from integrated analysis of Towed Streamer EM and dual-sensor seismic data'

*Best Student Paper: Energy Resources Geophysics*

Alexander Robson, '3D seismic analysis of normal fault growth and interaction within a gravitational detachment delta system in the Ceduna Sub-Basin, Great Australian Bight'

*Best Student Poster: Energy Resources Geophysics*

Muhammad Mudasar Saqab, 'Neogene oblique extensional system in the north-western Bonaparte Basin, Australia'

*Best Paper: Engineering-Environmental Geophysics*

Ken Lawrie, 'Optimizing Airborne Electromagnetic (AEM) Inversions for Hydrogeological Investigations using a Transdisciplinary Approach'

*Best Poster: Engineering-Environmental Geophysics*

Markku Montonen, 'SPM Effect in Glacial Till'

*Best Student Paper: Engineering-Environmental Geophysics*

Michael McMillan, 'Parametric 3D inversion of airborne time domain electromagnetics'

*Best Student Poster: Engineering-Environmental Geophysics*

Adrian Barford, 'Geostatistical analysis of the relationship between airborne electromagnetic data and borehole lithological data'

*Best Small Exhibitor*

GPX Surveys

*Best Large Exhibitor*

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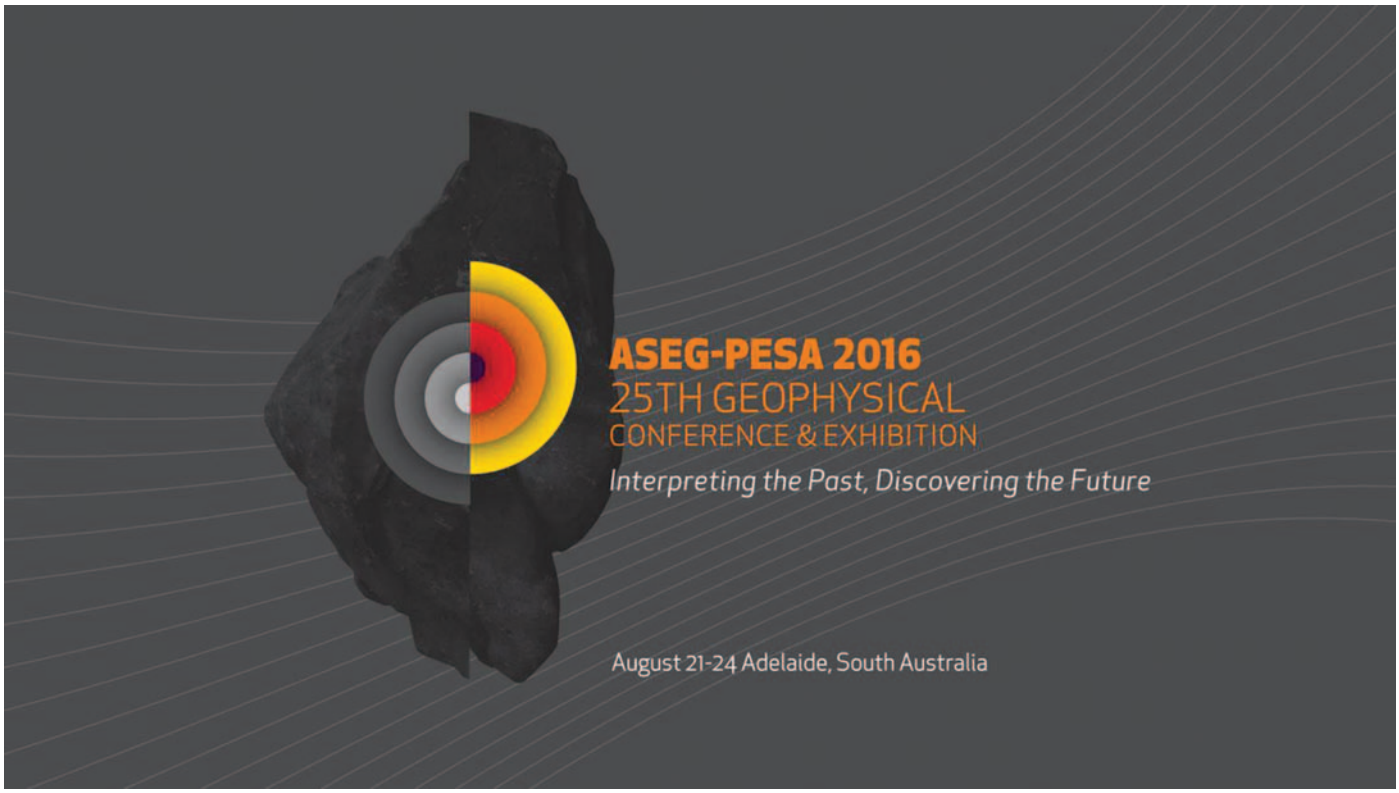
Geophysics and Geology together for Discovery

# ASEG-PESA 2015

24th International Geophysical Conference and Exhibition
**15–18 February 2015**
Perth, Western Australia

# ASEG-PESA 2016




Congratulations to the ASEG-PESA 2015 conference organising committee for organising a record-breaking conference! A great effort!

The next International Geophysical Conference and Exhibition for the ASEG will be held in Adelaide, South Australia from 21 to the 24 August, 2016.

This will be the 25th Conference and Exhibition – a landmark occasion – and it is fitting that the conference will be held in Adelaide where the first conference was held in 1979. Our conference theme is 'Interpreting the Past, Discovering the Future': a nod to our past and a view to our future. It also encapsulates the nature of our industry: we frequently revisit past data, and new discoveries are made from new interpretations.

The call for papers has not yet been announced, but please do start planning your technical papers and posters. Our conference organising committee (see table) has been formed and has been working hard to ensure that the 25th conference is a success. Information and paper submission will be available via the conference website (conference.aseg.org.au). Delegates are encouraged to join the conversations on social media: Facebook, LinkedIn and Twitter. Look out for #ASEGPESA2016!

Adelaide has been voted one of the top ten cities in the world to visit by Lonely Planet. It boasts a recently renovated Exhibition Centre, the largest Fringe festival in the Southern Hemisphere, the National Wine Centre, and of course Adelaide Oval. The conference dinner is already booked in at the Adelaide Oval so don't miss out! Adelaide is a stone's throw from major wine regions: the Barossa, McLaren Vale and the Clare Valley to name a few. It's from these regions that the wine for the annual ASEG wine offer is selected.

Please join us in Adelaide in August 2016 and in the meantime please stay tuned to the website for all the latest news. Sponsorship and Exhibition opportunities are ready to be discussed now with Claudia Fintina and Rod Lovibond respectively.

*Philip Heath*
*Co-chair Minerals*
*www.conference.aseg.org.au*

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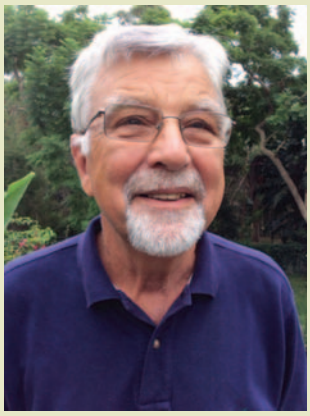
# Peter Gunn remembers his life as a geophysicist

## History, adventure, romance, hydrocarbon and mineral discoveries, amazing mathematics and tectonic theories, social commentary and a happy ending



Dr Peter Gunn
*gunngeo@iprimus.com.au*

It seems that there is another depression in the cycle of mineral and hydrocarbon exploration. Your geophysical correspondent has seen several of these and, during a career from age 21 to 69.5, has experienced seven job 'disappearances'. Despite this I consider that geophysics has provided me with a wonderful career. The following rambling recollections may offer some insights as to how to survive life as a geophysicist.

**1963–64** I finished a three year degree with a physics major at Melbourne University in 1963. I built a portable Geiger counter for a physics project. I did my first geophysical prospecting with this instrument. Not being excited by available prospects in physics, I did an extra year of undergraduate studies during which I completed majors in geophysics and mathematics plus a first year geology course. Four days after I received my final exam results, BHP sent me to lead a seismic refraction crew in a peat bog in northeast Tasmania. My experiences on this survey, where I was a danger to myself, the crew, and the environment, have been described in *Preview* previously (Gunn, 2012).

After the Tasmanian survey, BHP sent me to South Australia to conduct gravity and magnetic surveys over the Middleback Range iron formations. BHP had been surveying the Middleback Ranges for 7 years. Their aim was to map iron formations containing about 30% iron. I arrived there just after the Hammersley iron formations, which contained 60% iron, had been discovered and BHP no longer regarded the Middleback Range iron as a priority. At the start of 1965 the Geology Department of Melbourne University offered me a two year scholarship to do an MSc degree by research. I made a deal with BHP to interpret their seven years of accumulated gravity and magnetic data from the Middleback Ranges as my thesis project.

**1965–67** My MSc scholarship and conditions were very generous. I had my own office, was paid enough to rent an apartment, support a wife and run a car. I also got to go to Departmental sherry parties.

Melbourne University had just bought an IBM 7044 computer with 32K of memory. The computer filled a room and apparently cost $2 million. This was perfect timing because I was able to write a suite of computer programs to help interpret the gravity and magnetic data. I had programs for two dimensional gravity and magnetic models, gravity and magnetic terrain corrections and two dimensional filtering. To provide a basis for my modelling I did rock property measurements including density, susceptibility and remanence plus demagnetisation calculations. The Department had a very good workshop whose staff helped me build a portable diamond drill to allow me to collect palaeomagnetic samples and they also helped me build a susceptibility meter. I used a spinner magnetometer built by another MSc student for the remanence measurements. The Department had its own specialist library and I basically read every relevant publication on gravity and magnetics that had been published. My MSc supervisor was the urbane Colin Kerr-Grant. Colin pretty much left me alone, but early in my project he handed me a reprint of Talwani's original paper on modelling of magnetic data (Talwani and Heirtzler, 1964). This paper, which had been published in a very obscure location, was the inspiration that lead me into a later career related to geophysical data processing and modelling. Colin also managed to extend my MSc research period to 2.5 years by having me act as geophones on islands in Bass Strait and at the top of the Cape York Peninsula for crustal seismic programs, namely, the Bass Upper Mantle Program (BUMP) and the Carpentaria Upper Mantle Project (CRUMP). My MSc gave me a grounding that underpinned my career.

I eventually published my MSc results (Gunn, 1975a). Significant portions of this paper were republished in Mike Dentith's compilation of the geophysical responses of South Australian ore deposits Dentith (2003).

When I finished my thesis the famous nickel boom was just starting and BHP wanted me to work full time for them. My problem was that I had a beard and BHP did not allow beards. I accepted a job with the oil company West Australian Petroleum (Wapet) in Perth. I told BHP that my choice was based on their beard policy. To be honest, the fact that Wapet were offering 50% more pay than BHP was an incentive. I believe that BHP changed its policy on beards shortly after. I remember a BHP manager telling me 'Peter, BHP does not pay a lot but staff have a job for life'. Subsequent events showed this statement to be half true.

My supervisor and contact with BHP was a remarkable man called Peter Taylor who was the first geophysicist employed by BHP. He organised the original aeromagnetic and seismic surveys that led to the discovery of the prolific Gippsland Basin oil and gas fields. He later got BHP into many other profitable projects including the Telfer gold deposit. We are still in contact. He has had a beard for many years.

**1967–68** Wapet was a big oil company that held about one third of the prospective oil basins in Western Australia. It had just discovered the large Barrow Island oil field. Wapet was operated by the American oil major Chevron. Frankly, I thought the Wapet office was a horrible place to work. All the

geophysicists had tiny little cubicles with no doors and we had to put all documents in lockers every night so every morning we would arrive to completely empty cubicles. The Chief Geophysicist used to wander around the corridors between cubicles. Staff would cease chatting when they saw him. I went through a training program. I am probably the last person living who has had to calculate synthetic seismograms manually. I spent a lot of time supervising offshore seismic surveys. While this had an element of adventure, the work did not appeal to me. I investigated options and obtained a scholarship to do a PhD in geophysics at the University of Manitoba in Canada. I resigned from Wapet almost exactly 12 months after I started. Wapet employed 12 young geophysical graduates like me. Only one stayed more than 2 years. Just before I left Wapet I was sent on a course on digital filtering and deconvolution. This was one of the luckiest events of my life. The training formed the basis of my eventual PhD project.

**1968–69** On arrival at the University of Manitoba, in Winnipeg, the coldest major city in Canada, I learned that the professor who was to be my supervisor was on a year of sabbatical leave. He had suggested a research project involving second arrivals from a crustal seismic survey of Hudson Bay. Somebody had already interpreted the easy first arrival data. I decided that the project would be a dud and did not start it. I learnt that the normal system in Canada was for universities to only give scholarships for the 7 month academic year. Geology and geophysics students would spend the summer working for exploration companies in the far north of Canada. As a result, the average duration of a PhD was about seven years. My wife was not excited about this scenario. Me either. We had another problem due to the fact that the University had stuffed around with our documentation and my wife was not permitted to work so we were using up our savings. PhD students in North America do extra undergraduate studies to round out their training. I took advantage of the situation to complete a geology major. I simultaneously studied second, third and fourth year geology subjects plus a couple of graduate geophysics courses. I found the courses fairly easy and did more than normal ending up with the equivalent of 1.5 academic years of subjects. At the end of this period I had, thanks to my previous undergraduate studies at the University of Melbourne, full majors in physics, mathematics, geology and geophysics. I have never regretted this effort.

**1969** At the end of the academic year I started a summer job in the Theoretical Geophysics Section of the Geological Survey of Canada in Ottawa. I was working with Bihmal Bhattacharyya who at the time was one of the gods of mathematics as applied to aeromagnetic surveys. The Society of Exploration Geophysicists (SEG) has since published a review paper describing the most significant developments in the fields of processing and interpreting aeromagnetic data (Nabighian *et al*., 2005). Bihmal Bhattacharyya and Richard Hansen together had the most citations with six for each of them. I only got five citations.

My project at the Geological Survey was writing computer programs to adapt bicubic spline theory to gridding routines. After a couple of months I told Bihmal that I did not want to return to university and asked would it be possible to stay on at the Geological Survey. He said he would consider the request. As my original tenure got close to the end date and I had not heard anything, I started looking for other jobs. I wrote four application letters and got four positive responses from companies wishing to interview me. I had two interviews lined up when one Thursday Bihmal told me that the Director of the Survey had agreed that I could stay on. I cancelled my interviews. The next day, Friday, the Canadian Government announced that all non-permanent employees would be terminated. My last day at the Survey would be the following Monday. I rang up the Canadian geophysical contractor, Geoterrex, who were based in Ottawa and with whom I had cancelled an interview. They offered me a job.

**1969–70** Geoterrex was a subsidiary of the large French contractor Compagnie Général de Géophysique (CGG). CGG had produced advanced software for processing high sensitivity caesium vapour aeromagnetic surveys and Geoterrex had obtained this software to process their airborne data. The problem was that they could not make it work. Geoterrex sent me to the IBM office where their processing was done to see if I could fix a current problem. The problem turned out to be a full stop in the wrong place of computer code. This was easily fixed and, as a result, I was put in charge of their data processing group. After a few weeks I was told that CGG had more programs available in Paris and that they wanted me to go to France to collect software. The programs had been developed by Henri Naudy, another of the gods of aeromagnetic algorithms. The code used French abbreviations and the documentation was in Naudy's handwritten French. At the time I did not speak French (believe it or not I am now a French citizen). I managed to get the programs working back in Ottawa and made several other pleasant trips to Paris. I got on well with Naudy. I think this was because I was one of the few people who could get his software to work in the non-French world. The programs were advanced for their time and included computer contouring, the production of derivative and reduction to the pole maps and automatic interpretation algorithms. The Geoterrex staff included Mike Reford, a good guy, who was one of the most respected aeromagnetic interpreters in the world at the time. His interpretation of Bass Strait aeromagnetic data led to the discovery of the Gippsland Basin. Peter Taylor of BHP had told me about him and how he had stayed in the best hotel in Melbourne when he came from Canada to Melbourne to interpret the data. Interpretation at the time consisted of ruling straight lines along analogue records of magnetic profiles. I thought this sounded like a fantastic job. In later times I managed to live a similar life.

While all the above was very stimulating I felt annoyed at not having completed a PhD.

I had told the University of Manitoba that I was working with Geoterrex to get enough money to be able to live while finishing my PhD. To entice me to return, the University of Manitoba offered me a Canadian National Research Council scholarship, which at the time was probably the best scholarship available in Canada. It paid a full 12 month stipend. Rather than accept this scholarship I decided to do a PhD at Durham University in the UK. I didn't have a scholarship for Durham. Salaries in the UK were very low compared with Canada and I figured that the money I had saved in Canada would allow us to live very well in the UK where I planned to finish a PhD in 2 years. I set off for Durham in 1970 with a wife and a 3 week old baby.

**1970–72** Durham University at the time was arguably the best university in the UK to study geology and geophysics. The Head of Geophysics was Professor Martin Bott, well respected in gravity and magnetic circles and one of life's gentlemen. There were about twenty PhD geophysics students. Durham is a classic medieval town.

For a thesis topic I decided to adapt Wiener filter theory related to deconvolution and filtering as applied to seismic data processing to the processing of gravity and magnetic data. The starting point for this work would be the course I had done while working with Wapet. I had also picked up the basis of Fourier transforms while working with Bihmal Bhattacharyya. Bihmal was one of the pioneers of adapting Fourier transform theory to gravity and magnetic problems. He published many papers in relation to these issues. I started my thesis by producing a simplified, unified version of the contents of Bihmal's work. I eventually reduced the problem to two equations that explained how to do virtually all the known one and two dimensional filter transformations that applied to gravity and magnetic data, plus a few that were previously unknown. I published my mathematics for this in Gunn, 1975b. This paper has received considerable recognition with people making comments such as 'This was the first time that the application of Fourier transforms to gravity and magnetic data has been clearly explained'. I have often wondered if Bihmal (now deceased) never saw the big picture or if he deliberately did not make the big picture clear so that he could produce more publications.

The next step was to develop mathematics to adapt Wiener filter theory as known in seismic data processing to the processing of gravity and magnetic data. I did this by creating two sided operators and making the problem a two dimensional process in the case of map data. At the end of 12 months I had software producing my transformations. From this work I published two papers in *Geophysical Prospecting* (Gunn, 1972, 1975b), one in *Geophysics* (Gunn, 1975c), one in *Geoexploration* (Gunn, 1976) and one in the *Bull. Aust. Soc. Explor. Geophys*. (Gunn, 1974). I considered that I had done enough for my PhD.

Martin Bott told me that it was not allowed to finish a PhD in 12 months and I had to continue for another 12 months. I would be allowed to finish in less than the normally required 3 years because I had previously been enrolled for a year for a PhD in Canada. I was given a project to interpret gravity and magnetic data over the Midland Valley in Scotland and Northern Ireland. The Midland Valley, which contains Glasgow and Edinburgh is a topographically depressed area flanked by major faults containing ultramafic rocks. The Valley overlies a gravity high and several major axial magnetic anomalies. Plate tectonics had only been invented a few years before my studies and tectonic theories were very fashionable at the time. It was generally accepted that England and Scotland had originally been different continents and that an ancient 'Iapetus Ocean' had closed in a manner that caused them to fuse together. The main conclusion of my study was that the Midland Valley was the suture zone. I published my conclusions in *Nature* (Gunn, 1973). I also published a 3D non-linear inversion of one of the large axial magnetic anomalies in the *Scottish Journal of Geology* (Gunn, 1975d). I once actually met someone who had read this paper. Eventually I was allowed to submit my thesis after 23 months work.

By the time I was ready to submit my thesis, I realised that the Midland Valley was a failed rift. The significance of such features was just beginning to be realised. While I still consider my suture zone concept to be correct, I felt that I missed an opportunity to do some significant early research on rift formation. The result of being annoyed with myself was that a few years later rifts became a hobby that resulted in me doing private research on the subject. I concentrated particularly on the gravity and magnetic signatures of rift systems. I subsequently published seven papers on rifts. The world has ignored these papers. The concepts that I developed proved extremely useful in the hydrocarbon and mineral exploration projects I became involved with. Eventually I made significant amounts of money out of my rift ideas.

While at Durham I consulted for the English geological/geophysical contractor Hunting Geology and Geophysics. Huntings had an association with CGG and were installing Naudy's software. Huntings could not get the software to work. I helped make it work. I eventually gave Huntings my own software in exchange for a 'PhD scholarship'. I also sold my Midland Valley interpretation to another organisation.

At the end of 1972 I decided to return to Australia. The late 60s – early 70s resource boom, commonly called the 'Nickel Boom' in Australia was, in many ways, more spectacular than the recent resources boom in Australia. I missed most of it by being overseas. By the time I finished my PhD the boom was well and truly over and there were no available jobs for geophysicists. So I arrived back in Australia with a wife, a 2 year old child and no job. My wife promptly had another baby.

**1972** Out of the blue I received an offer of a CSIRO post-doctoral fellowship from David Boyd, Professor of Geophysics at the University of Adelaide. David was an ex Huntings employee and one of the senior Huntings management had kindly made a recommendation, without my knowledge, on my behalf. So I went to Adelaide. I had to leave my family with the in-laws in Melbourne as I was not paid enough to support them in Adelaide.

The financial situation improved somewhat when I managed to get a consulting job supervising an airborne survey for an Italian company aimed at detecting uranium in the East Alligator River area of the Northern Territory. At this stage of my career, despite all my high level knowledge of processing airborne data, I knew nothing about supervising airborne surveys. I knew even less about uranium exploration. To help solve the second problem I borrowed a book on uranium deposits from the University library. On the way to the Northern Territory my plane was delayed in Alice Springs so I started reading the textbook. I was approached by a man holding the same textbook who said 'We seem to be in the same business'. He turned out to be a government geologist who had done the key geological mapping of the area of the survey I was to supervise. He kindly filled me in on the geology to the extent I had a good general knowledge of the situation. On arrival in Darwin I checked into the motel where the survey crew were meant to be staying. I asked reception where I could find the survey crew. I found a survey crew but it was the crew of a competitor to the company carrying out my survey. They were very happy to tell me about all the issues to check out during my supervision. I eventually found my crew and was now ready for the project to commence. All we needed were the airphotos showing the flightline positions. These were being sent from Sydney by Ansett Airlines. Ansett lost the airphotos and for several days I had to tell an increasingly agitated client 'Sorry Fabio, they have not arrived yet'. I was being paid the fabulous sum of $100 per day and staying in what I considered to be a luxurious motel so I was not unhappy. Eventually the maps turned up and the survey was flown. I produced an interpretation report and rather guiltily sent in my bill. When I received my payment I realised that the client had rounded the amount up to fulfil an expenditure commitment. The client offered me a full time job but at the time the Whitlam Labour Government was busy discouraging foreign mineral companies. I turned down the job saying that I

did not think the client would stay in Australia for long. I was right in this judgement.

Because of the consulting job I was able to buy our first house within 6 months of finishing my PhD.

David Boyd, as a professor of geophysics, did not publish many geophysical papers. Despite this, through his enthusiasm, he inspired a significant number of students to complete PhDs on aeromagnetic topics. Many of these students have made important contributions to exploration in Australia.

**1973–75** I wrote a couple of papers while I was at the University of Adelaide but realised that because of my domestic situation I needed to get a proper job in Melbourne where we had family. I got a job as a groundwater geologist with the Geological Survey of Victoria. I had done a very good course on groundwater while at the University of Manitoba. Groundwater is probably Australia's most important resource. Problems of supply, salinisation and pollution were just beginning to be recognised at this time. My first task was to produce a three dimensional, time varying, model of groundwater flow in the Westernport Basin. I did this by adapting the code of an Israeli finite element program. I only half believed my results. I was horrified when some government officials used my results to withdraw water rights from several farmers.

The Survey did not have a geophysics section however I started introducing geophysical ideas and managed to purchase some geophysical equipment. One of my contributions was arranging a grant for a young University of Melbourne Honours student called David Isles to conduct a gravity survey of the Western Port Bay area, east of Melbourne, as part of an environmental study. I participated in the French Island part of the project. This consisted of David and I taking gravity measurements in what was then a prison farm. David has since had a successful career and recently produced an ASEG sponsored manual on aeromagnetic interpretation (Isles, D.J. and Rankin, L.R., 2013)

I progressively became disillusioned at the incompetence of the Victorian Public Service, the rivalry between all the state agencies involved with water issues and the machinations of politicians to use water issues for their own purposes. Despite this milieu, some geologists managed to do important works. Several of them became lifelong friends.

**1975** Between when I arrived back in Australia at the end of 1972 and the middle of 1975 no jobs were advertised for geophysicists. Suddenly two appeared at the same time. Both positions were in Sydney. One was with the Uranium Exploration Division of the Australian Atomic Energy Commission. At the time the Whitlam Labor Government was attempting to nationalise exploration in Australia through a Petroleum and Minerals Authority. They were having problems in getting their legislation through the Senate but, through an obscure 1950s Act of Parliament, they had the right to control all uranium exploration. I applied for a position and was offered one in charge of data processing. The second position was with the mineral exploration branch of a large French oil company. They also offered me a job. I accepted the Atomic Energy position because I expected that the French company would be forced to leave Australia. Within six months of me starting with the Atomic Energy Commission Prime Minister Whitlam had been dismissed by the Governor General and an election had been called. One of the stated policies of the Liberal Party, which appeared certain to win a forthcoming election, was the abolition of the Uranium Exploration Division of the Australian Atomic Energy Commission. Conveniently at around this time I was recontacted by a young Personnel Officer (nobody had heard of Human Resources in those days) of the French company asking if I would reconsider their offer. I accepted their job and began a wonderful 17 year association. The young Personnel Officer with initiative eventually started his own recruitment company with a partner. A few years ago they sold their business for $400 million.

I didn't get to do much real work with the Atomic Energy Commission Exploration Division. I am not sure that anybody did. I had access to good computer resources however and produced software that allowed deconvolution to element concentrations of airborne radiometric surveys. I also developed mathematics for upward and downward continuation of radiometric data (Gunn, 1978).

**1975–89** I joined the French oil company in 1975. I will refer to the French company as Elf Aquitaine but, like many organisations, it existed with various names at different times and in different places. Elf Aquitaine has since been absorbed into Total. I was appointed as a mineral exploration geophysicist. This was fortuitous. At the time all the big oil companies were moving into mineral exploration. They had lots of money and their mineral exploration divisions had bigger budgets to spend than the conventional mineral exploration companies. The oil companies were more open to research and innovation than most non-oil exploration companies.

I was 31 years old and, as anybody reading this article would realise, I had not really done much mineral exploration. I had no problems with magnetic and gravity interpretations but at the time I had effectively no knowledge of how to meaningfully interpret induced polarisation (IP) and electromagnetic data (EM). Looking back after several decades, I am not sure that many other people in Australia had any real competence in these fields then. Computer modelling of IP and EM responses was almost non-existent. I solved my problem by doing a lot of reading and compiling case history examples of responses. I published a paper in *Exploration Geophysics* that compared IP and EM responses over a series of known massive sulphide deposits (Gunn, 1980). This paper was more for my benefit than for any other readers.

Elf Aquitaine had a wide range of mineral exploration projects throughout Australia and the Pacific. I was exposed to many different deposit types. Initially, as was the fashion at the time, the company geologists generated all the projects and I did surveys and interpretations where they wanted me to. As time went on and I read more on ore deposit models this situation was reversed.

Many of my projects involved electromagnetic surveys for base metals. Transient EM surveys were just beginning in Australia. I made an enquiry to a Canadian company about the Crone pulse electromagnetic system (PEM). About three weeks later the receptionist in the office said several large boxes had been delivered to me. Crone Geophysics had shipped a unit without me ordering it. I was horrified. The situation was resolved when the French Exploration Manager said 'Let's keep it'. On the first survey with the unit I got results that resulted in the discovery of two new ore lenses of the Sorby Hills Mississippi-type lead-zinc deposit. With hindsight this was probably due to responses of saline groundwater in a fracture zone associated with the mineralisation rather than responses of the mineralisation.

I did a lot of PEM surveys. It was therapeutic to be out in remote exotic areas with crews of alimony dodgers, people just released from prison and others with a range of life problems. I discovered a lot of uneconomic massive sulphide deposits and proved that EM does not always respond to massive sulphide deposits. I published a paper in *Exploration Geophysics* showing this to be a fact (Gunn and Chisholm, 1984).

Anyway, while I was enjoying myself in the bush, my wife back in Sydney fell in love with the local butcher and as a result we divorced.

Shortly after these events Elf Aquitaine decided to expatriate me to their head office in France to be in charge of their worldwide potential field activities related to mineral and hydrocarbon exploration. At the time I was living with a nice French girl who was working as a receptionist in the Elf Aquitaine office. The deal with Elf Aquitaine was that she could come to France with me as a 'concubine' which would entitle her to certain benefits. The benefits were not as good as those of a proper wife so we decided to get married. We are still together 36 years later.

We lived in Pau in Basque country in the south of France at the foothills of the Pyrénées Mountains. Elf Aquitaine in Australia offered free weekly French lessons to its staff. I followed the course for six months and was good enough in French when I arrived in France to never have to speak English while at work.

Elf Aquitaine was the largest French oil company at the time. Like all big oil companies then it had a large research division and most of what it needed was produced through in-house projects. For example it had its own seismic reflection data processing system, it had developed its own seismic interpretation work station and produced its own equipment for doing magnetotelluric surveys. I was in charge of their in-house research in gravity and magnetics. This was not very significant but we got a system up and running for producing enhanced maps of magnetic and gravity data plus a visually interactive modelling package for magnetic data. Life was interesting with onsite projects in Cameroon, Canada and Spain plus interpretation projects using data from all over the world. As mentioned previously, Elf Aquitaine had formed a mineral exploration division. This venture started very well. They commissioned an airborne electromagnetic survey using the INPUT system. The first survey showed a significant coincident conductive and magnetic response. Their first mineral exploration drill hole targeted this feature and discovered the 100 mt Rouez massive sulphide deposit. After this success Elf Aquitaine were very enthusiastic about airborne EM and magnetic surveys. To add a bit of interest to my life I managed to become a party leader doing ground follow up of airborne EM anomalies recorded by various fixed wing and helicopter surveys. The follow up was all over France. This was geophysical tourism at its best. I became an expert at finding buried pipelines. Despite what might seem like a wonderful life, I became annoyed because I was not receiving any pay rises. France said that it was Australia's responsibility, and Australia said it was Frances's responsibility. I asked to go back to Australia. France wanted me to stay but they did not offer me a pay rise. I intended to quit when I got to Australia but when I arrived I was offered a pay rise of more than 100% so I did not quit.

In Australia the mineral group had expanded considerably because Elf Aquitaine had taken over the Australian company Triako. This significantly expanded the portfolio of exploration interests. I was Chief Mineral Geophysicist of the combined group. By this time, I had developed my rift ideas to the extent that Elf Aquitaine believed in my concepts for targeting mineral deposits. The company started checking out areas I recommended. I published the first summary of my rift ideas in *Exploration Geophysics* (Gunn, 1984).

Three significant life events occurred at the end of this period. The first was when a field trip to Western Australia scheduled for a Saturday was cancelled due to a cyclone. My wife and I used that day to purchase a house which has turned out to be the best investment we ever made. The next event came when I was out in the field in northern Yilgarn Craton of Western Australia; in a desolate campsite, surrounded by dead sheep, in the company of a field crew of not very interesting drunks. I was 40 at the time. I decided that it was time to move on in life. The final significant event involved Elf Aquitaine trying to develop a mine at the site of the Sorby Hills lead zinc deposit. They decided to put down a decline tunnel to the ore. This proved to be difficult. Sorby Hills is just onshore from the Joseph Bonaparte Gulf in Northern Australia. The project started during the wet season which made access almost impossible. Then the limestone they were tunnelling through had a rectangular fracture system which resulted in cubes of limestone falling almost continually from the roof of the tunnel. The real killer, however, was water influx. They could never beat it. I think the water may even have been connected to the Joseph Bonaparte Gulf. The decline tunnel had to be abandoned. Shortly after this experience Elf Aquitaine decided to close its mineral division in Australia. This meant I was facing redundancy. I asked to be transferred to their surviving oil division and Elf Aquitaine agreed. I was about to be resurrected as a petroleum geophysicist. This was in 1984.

Elf Aquitaine sent me on a lot of training courses to get me up to speed as a petroleum geophysicist. The oil industry has a much better range of professional training courses than the mineral industry. A few things had changed since my 1968 year in the petroleum industry with Wapet. Processing had advanced considerably but because of my physic/mathematics background it was easy to catch up. Processed seismic sections showed more information but because sequence stratigraphy had not really arrived interpretation still consisted of using a coloured pencil to trace a line on paper between two black seismic events and then sending the section off to be digitised. I have known consultant geophysicists to get their wives to trace the coloured lines in some basins with simple geology. Initially I did a lot of interpretation in the Cooper Basin where the coloured line approach was still resulting in significant discoveries. I participated in several of these. At the time Delhi was the operator of virtually all the Cooper Basin permits. I would attend joint venture meetings at the Delhi offices in Adelaide. Bottles of wine would come out for morning tea and never go away.

Eventually I became Chief Petroleum Geophysicist. I was put in charge exploration in the Joseph Bonaparte Gulf where Elf Aquitaine had been exploring since 1965. They had found two large gas deposits there but no oil. After studying the excellent available geological, seismic and gravity data of the area I realised that this area is a perfect example of my rift model. I published a paper presenting these ideas (Gunn, 1988). Since this paper was published Geoscience Australia and others have published a large amount of work on the area that included detailed tomographic inversion of seismic refraction data, acquisition of new deep penetrating seismic reflection data, acquisition of magnetic data and detailed modelling of gravity

data. All these works confirm the structural model I published in 1988. Nobody ever said 'Peter Gunn got it right'.

My climax in the Joseph Bonaparte Gulf came when one of my interpretations identified a prospect with two target horizons. The deeper one had the potential to contain 50 million barrels of oil. A shallower one had the potential to contain about 10 million barrels. Elf Aquitaine had to drill a commitment well so they drilled my prospect with the Barnett 2 well. The deeper target was intersected at almost exactly the depth I predicted. Log analysis showed that it was saturated with oil. Unfortunately the permeability was so low that hardly any oil came out on testing. Maybe someday someone will frack the structure. Anyway, the shallower structure did contain oil that flowed. This was the first oil flow ever in the Joseph Bonaparte Gulf. Normally I would have expected the Elf Aquitaine management to be very happy with this result. They were not. The oil flow happened on a Sunday. Elf Aquitaine had previously decided to sell its hydrocarbon assets in Australia and bids were due in on Monday, the day after my oil flow. The Elf Aquitaine management did not know what to do. After prevaricating for several days they accepted a bid from Santos.

This meant I was about to lose my job. I got a good redundancy and an immediate offer to work in the Elf Aquitaine office in London.

**1990–92** In London I worked under a French Chief Geophysicist. He spent most of his time on the phone to France and preparing elaborate slides for weekly and monthly meetings. I took care of all the seismic acquisition and processing contracts, lead interpretation groups and attended an enormous number of joint venture meetings. Shortly after I arrived in London Elf Aquitaine commenced drilling a 5.7 km deep exploration well. I was given the task of organising a down-hole VSP survey and using the VSP data to decide if the well had reached its objective which consisted of a characteristic group of seismic reflections. This was not as simple as it sounds because when the VSP results came in there were no sign of the reflection package anywhere near the time they were on the conventional seismic reflection data. The VSP showed a package with the right sort of characteristics albeit at a completely different depth than expected. I studied the original reflection data and noted that the target was beneath a very steeply dipping unconformity. I decided that refraction had caused a time offset between the VSP and conventional seismic data. I stopped the well and on testing it proved a major discovery. I had made the correct call. The Chief Geophysicist disappeared from the office while this was happening. The well cost £50 million. I would have been the patsy if I had stuffed up by terminating the well above the objective.

At the time exploration activity in the North Sea was probably at its peak. Virtually all major oil companies and associated contractors were in the UK. It was an exciting environment. Corporate hospitality was impressive. For example, I remember being flown to the Silverstone Grand Prix by helicopter in a swarm of helicopters flying other lucky people to Silverstone. London had a very active Petroleum Exploration Society of Great Britain. (PESGB) with great Christmas parties limited to the first 1000 members who booked. One of the best of these was in the Natural History Museum in London. This is the museum with the giant dinosaur skeletons. The party had a Scottish theme. They had bagpipers playing and girls doing highland flings around illuminated dinosaurs. They had whisky bars, unlimited supplies of Scottish beers and various food options including haggis, salmon and venison. All this only cost members of PESGB a heavily subsidised £10.

Eventually Elf Aquitaine management got the brilliant idea of merging their London office with a British company based in Aberdeen. London staff had the option of going to Aberdeen or collecting a redundancy. I chose the latter option. By then we had a baby born in London and figured we could make a better life back in Australia.

Before I left for London I commenced a Graduate Diploma in Applied Finance and Investment conducted by an organisation called the Securities Institute of Australia. I completed this diploma by distance education while I was in London. The course included subjects such as accounting, financial theory, stock analysis, corporate law etc. The diploma gave me useful information to manage my financial affairs in later life. The diploma also qualified me to be a stock broker. I could have entered the world of finance but, although it is a fascinating industry, I decided not to pursue this option.

**1992–93** So, I arrived back in Australia from the northern hemisphere for the second time with a wife, a young child and no job. I spent four weeks marketing myself as a geophysical consultant. One Friday night I became rather despondent because I had not received any responses. The next day, Saturday, I received a 7am phone call from a company saying that they wanted me to be in New Plymouth in New Zealand that evening to interpret some seismic data. My consulting career was away. Back in Australia I accepted a contract on a miserable daily rate with the Adelaide based oil company Santos. This was to interpret seismic data in the Cooper Basin. When I arrived in Adelaide Santos asked me if I had experience using seismic interpretation work stations. I truthfully answered in the affirmative. In fact I had fiddled with a Landmark workstation for a couple of hours while working for Elf Aquitaine in London. This impressed Santos who showed me to my workplace in front of a Landmark seismic interpretation workstation. I immediately recognised that the workstation was a later version than the one I had used in London. Santos staff said 'That's not a problem we can show you how to use this one'. They did, and two hours later I was the seventh person using seismic interpretation workstations in the Santos office. I ground away for five months with Santos. I would work 20 days straight and go home to my family in Sydney for three or four day breaks. At the end of the year Santos offered me a permanent position. I turned it down, terminated my interpretation contract, and returned to Sydney.

Back in Sydney, completely burnt out from doing so much seismic interpretation, I decided to do something completely different and write a book. After 3 months I produced a self-published book with the snappy title 'Magnetic Signatures of Gold-Copper-Zinc-Lead-Silver Massive Sulphide Deposits in Extensional Sedimentary Basins'. This book merged my ideas on rifts with the fact that many massive sulphide deposits could be recognised by their magnetic anomaly patterns. At the time of researching this book university libraries and the CSIRO library still had hard copy books and journals that I could access.

I decided to sell the book for $1500 a copy. I did this by ringing up exploration companies. I had such success in Australia that I went on a sales tour through Vancouver, Toronto and London. I eventually sold 48 copies. As a bonus, many companies contacted me to give courses on the book to staff members who

were too lazy to read it. At a later stage in my life I made a substantial amount of money by applying the principles outlined in the book to successfully identify exploration targets.

Interspersed with my literary activities I variously consulted with seismic interpretations, mineral exploration projects and writing software for companies. A memorable experience of this time was being an expert witness in the Ernest Henry court case in the Supreme Court of New South Wales. The background to the Ernest Henry case was that Western Mining (WMC), at the time one of the largest Australian mining companies, had done a transient electromagnetic survey across a magnetic anomaly in an area held under permit by a very small company called Savage Resources. WMC did not have permission for this access. They obtained a significant conductive response. Without disclosing this information, WMC negotiated a joint venture deal with Savage Resources on terms that were very favourable to WMC. When, six weeks later, WMC had drill intersected a major copper-gold orebody Savage Resources became very suspicious and these suspicions resulted in the Supreme Court action. I was an expert witness for Savage Resources.

WMC engaged one of the best known geophysical experts on electromagnetic surveys in the world as their expert witness. His affidavit said that electromagnetic anomalies almost never indicate economic mineral deposits. While this is probably true, my return affidavit stressed the significance of coincident electromagnetic and magnetic anomalies citing theoretical reasons and case history examples. Eventually WMC settled out of court and gave Savage Resources the Ernest Henry deposit.

Not long after the court case I was shortlisted for a position as Professor of Exploration Geophysics at a West Australian university. The opposing expert witness was on the interview panel. I was not successful in my application. I understand that candidate appointed by the university proved so unsatisfactory that he was refused tenure.

I was surviving well as a geophysical consultant when one Saturday morning I saw an advertisement for a Senior Principal Research Scientist to head the Geophysical Mapping Group of the Australian Geological Survey Organisation (AGSO) in Canberra. AGSO was a rebadged name for the Bureau of Mineral Resources (BMR) and AGSO itself has since been rebadged as Geoscience Australia. In the following text I will collectively refer to these organisations as Geoscience Australia. The advertised position appeared to offer the chance to do serious research in the fields of magnetic and gravity surveys and would at last be a chance to profit from my hard earned PhD. In addition, at this stage of my life, I was full of idealism and wanted to contribute to Australia. I submitted a successful application for the position.

**1994–2000** The Geophysical Mapping Group of Geoscience Australia and its antecedents had been conducting aeromagnetic, radiometric and gravity surveys in Australia since the 1950s. When I arrived in Canberra the group consisted of 28 professionals and support staff. The Group operated its own aeromagnetic survey plane and processed the resultant data with its own internally developed software. The Group were very advanced in the field of image processing and had just produced the first versions of the now well-known magnetic and gravity maps of Australia. At the time I arrived the Group was mainly concentrating on technical aspects of magnetic and gravity surveys and was largely ignored by the geologists in Geoscience Australia. I like to think that I changed this situation. Probably

*The pass Peter Gunn used to inspect a survey plane at Hurghada airport on the Red Sea coast.*

the first major change was that we started using the INTREPID processing software developed by Desmond Fitzgerald and Associates Pty. Ltd based in Melbourne. Geoscience Australia had been collaborating on the development before I arrived in Canberra. This comprehensive processing package was significantly superior to the software previously used by Geoscience Australia. INTREPID has a very good suite of filtering and data enhancement routines many of which are based on formulations I published in Gunn (1975b). We immediately began publishing various enhanced maps and images such as derivative and reductions to the pole. These greatly increased the utility of our data. Next I broadened the skill base of our Group by purchasing various modelling and GIS packages and we branched out into producing interpretations of our data. I trained our group in interpretation techniques.

Just as I arrived in Canberra the government of the day decided that government agencies should contribute to their upkeep be earning what was called ‘external earnings’. This policy enabled to Group to win projects in Argentina, Brazil, Vanuatu, Fiji, Norway, Taiwan, Oman, Austria, South Africa, Canada, Indonesia and the United States. We also did external earnings work in Australia. We made significant amounts of money by selling our data at high prices. My understanding is that we were the most successful group in Geoscience Australia in the external earnings business.

We initiated and ran the ‘MAGMAGE Project’, which was a joint venture with Desmond Fitzgerald sponsored by 12 other organisations with the objective of developing new techniques for processing and interpreting aeromagnetic data. Several techniques we developed became very useful. One of these is the fractional vertical derivative (Gunn *et al*., 1997). Isaac Newton only developed integer derivatives such as the first and second derivatives. We were able to calculate derivatives for any fraction. The utility of such a technique is that while a first derivative enhancement may not give the maximum resolution of a dataset and a second derivative of the same dataset my exaggerate noise to an unacceptable level, an intermediate derivative such as the 1.4 derivative may give an optimal result. Des Fitzgerald is another remarkable Australian geophysicist. We had many interesting collaborations while I was with Geoscience Australia and later when I became a geophysical consultant.

We also ran a project to establish international standards for processing airborne radiometric data. Brian Minty was the lead technical person from the Geophysical Mapping Group. We consulted widely with contractors, government agencies and exploration companies. This successful project concluded with two very well attended conferences.

I edited a special volume on 'Airborne Magnetic and Radiometric Surveys' (Gunn, 1997a) that contains 17 specially commissioned papers on all aspects of aeromagnetic and radiometric surveys. This volume became the best- selling Geoscience Australia publication for at least two years in a row.

I was a prolific author at the time. In 1997 I authored and co-authored 14 geophysical papers that were published in the thematic volume, *Exploration Geophysics* and various conference proceedings. I gave twenty one courses and workshops to external clients on magnetic survey issues both in Australia and overseas. I produced my own training manual. I had many invited paid trips to address overseas conferences and workshops. It has been commented that I was receiving more such offers than the CEO of Geoscience Australia.

I could not have managed much of the above without the support of my mate, Ian Hone, the Manager of the Geophysical Mapping Group, a knowledgeable geophysicist in his own right. Ian looked after all the administration issues and left me free to think about broader issues.

At its peak the Geophysical Mapping Group was acquiring, with its own survey aircraft, and by contract, up to 500 000 line km of airborne magnetic and radiometric data each year plus various gravity surveys and publishing approximately 350 maps and images each year. In my opinion we were the best group of its type in the world at the time.

In 2000 the Australian Government decided that Geoscience Australia should not be conducting aeromagnetic surveys and that the Group's survey aircraft should be sold. As a consequence several members of the Group had to find other activities. My position was abolished and I had to reapply for a new position in a management spill. I was informally told that I would be given a senior specialist function. I was scheduled to give an invited talk at an EAGE conference in Helsinki at the time of the interviews. I arranged to have a phone interview on my way back to Australia. While I was in Finland the scope of the available jobs were significantly changed. I had my phone interview in a French friend's apartment in central Paris at 5am. This was after a memorable dinner party in the apartment that ended at 3 am. I was probably more honest with my opinions on various issues than most people in my position would have been. When I arrived back in Australia I learnt that I did not have a job. I was not too disappointed. After six years in Canberra I had lost my idealism. I think the senior management of Geoscience Australia were happy to see me leave.

**2001** So we left Canberra to return to our house in Sydney. We did not return directly to Sydney. We took our nine year old daughter out of school and went backpacking as a family for six months through Egypt, Greece, Turkey, Spain, the UK and France. During this time we 'educated' our daughter who eventually obtained a university entrance score of 97.3.

**2001–13** So, for the third time in my life I arrived back in Australia from the northern hemisphere with a wife, a young child and no job. I was 58 at the time and had minimal relevant hands on computing skills. While at Geoscience Australia I was able to ask competent young people to carry out all the computing tasks I required.

Although exploration activity was depressed at the time, and the resources boom had not really begun, I had two lucky events which set me up for twelve years of consulting. The first of these was that I persuaded a large diamond exploration company to give me a consulting project identifying the locations of ancient mantle plumes in Archean cratons. There was a general acceptance at the time that diamond bearing kimberlites are spatially related to mantle plumes. I had become familiar with mantle plume concepts through contacts with staff of the Research School of Earth Sciences at the Australian National University in Canberra. I had developed ideas on how to recognise fossil mantle plume locations using magnetic data while working with Geoscience Australia. Central to my ideas was that many of the large red semi-circular magnetic anomalies visible in the Magnetic Map of Australia are due to large mid crustal sills caused by mantle plumes. My client was so happy with my original project that the contract was extended to study all of Australia and most of southern Africa. I spent a year variously studying magnetic, gravity, topographic, geological and heatflow data plus various images of tomographic inversions of seismic S wave velocities. My client applied for several permits based on my concepts. They found diamond bearing kimberlites.

This project gave me time to get my computer skills and software up to the standard I needed to be a modern consultant. The mantle plume work also allowed me to refine my rifting ideas as plumes appear to be the main initiators of rifts. I also eventually developed ideas that mantle plumes are the generators of a variety of Cu-Fe-U-REE, Cu-Ni, Cr, Pt and Ti deposits and used my ideas on the magnetic responses of mantle plumes to target such deposits.

The second break came while I was playing with open file GIS and magnetic data from the Northern Territory and noted a Ni occurrence that was associated with an interesting circular magnetic anomaly. I considered this association to be prospective. I took the idea to Rio Tinto who applied for a permit over the area. In return I was to receive $20 000 for each year that Rio held the permit plus a royalty if ever a deposit was mined in the area. This transaction inspired me and from then on project generation became a lucrative sideline. I eventually had twenty one joint ventures based on projects that I developed. I did not have to spend my own money in any of these deals. I variously received cash, shares, options, carried interests, royalties and success fees. Two companies were listed on the Australian Stock Exchange solely on the basis of my ideas. My concepts covered Cu, Pb, Zn, Ni, precious metals, Ti, beach sands, coal, oil, uranium and rare earths. At this stage of my life my hobby reading comprised economic geology textbooks and economic geology journals. My project generation activities became much simpler with the advent of broadband internet and the free availability of magnetic and gravity datasets and detailed GIS datasets of geology, drill hole information, mineral occurrences and permit locations through Geoscience Australia and various state Geological Survey websites.

The most satisfying of these projects was when I identified an area in northwest New South Wales as being prospective for massive sulphides and precious metals using the concepts of my self-published 1993 book about how to find base and precious metals in rifts. The main target I identified, using magnetic data, was in an area never previously held under a mineral exploration

lease and 50 km from the nearest mineral drill hole. There were no basement outcrops for tens of kilometres in any direction. The first drill hole into the target area (Cuttaburra B), based on my interpretations, hit pyrrhotite and copper and silver at a depth of 75 metres.

About 2 years after I started consulting the resource boom started in earnest and I was flooded with work from both mining and oil companies. At first I did a lot of work for mineral exploration companies. However, after largely ignoring potential fields for several decades, many oil companies started to use them again in the early 2000s. Because I had worked extensively in the oil industry I was able to relate well with oil company staff and eventually developed a consulting niche where most of my consulting involved gravity and magnetic projects for oil companies. They had bigger projects that paid more and often involved very good trips.

Airborne gravity began to be used extensively around this time. Much of the processing and interpretation for airborne gravity involved the types of transformations I had described in Gunn (1975b). My best application of such a transformation was in a project I did for an American oil company. I was given an airborne gravity dataset over an area in Papua New Guinea. The original data consisted of a series of semi-parallel contour lines due to a strong regional gravity gradient. I applied a derivative operation to the data which revealed a significant gravity closure. My client shot seismic across this feature and the results showed that my gravity residual was due to a large carbonate reef. When my client drilled this feature they obtained a very large gas flow (Antelope 1). I understand that they submitted the results to the Guinness Book of Records. Recent negotiations involving interests in the field imply a present day value of the undeveloped field of around $4 billion.

As well as interpreting the results of airborne surveys my clients would often insist that I did on site supervision of survey acquisition. Initially I thought that this was a bit unnecessary but I did manage to rectify a large number of issues that did not meet specifications. I went to many fun places such as Angola, Banana, located at the mouth of the Congo River in the Democratic Republic of Congo, the Sinai, Madagascar, the Gulf of Suez in Egypt, the highlands of Papua New Guinea, Sarawak and Brunei. Brunei was very tame after the other places. Prince Charles was responsible for my easiest day of work in Brunei. He arrived from England to plant a symbolic tree in the middle of the Brunei rain forest. We were not allowed to fly our survey that day.

I did many interpretations. My rift ideas applied in many cases. One example was the situation where I interpreted all available gravity and magnetic data over the Cuvette Centrale (central basin) of the Democratic Republic of Congo (DRC). This basin covered about 80% of the area of the DRC. I had access to a limited amount of seismic data from surveys shot along rivers. There had been no oil exploration in the area since the 1980s because of wars in the country. My client had an exclusive right to study the basin for twelve months and then to choose specific areas for detailed exploration. A condition was to make progress presentations every three months to the DRC government. I was part of the second such presentation. The night before we were due to leave for Kinshasa, the capital of the DRC, I received a call from my client telling me that he had just seen a report on the BBC News that there had just been a coup in the DRC and that there were 600 dead people lying around the streets of Kinshasa. We had to wait several weeks until things had calmed down before we could make our presentation. My interpretation was that the Cuvette Centrale was a sag basin formed over a failed rift and that the original rift had been inverted to form a structural ridge in the middle of the area. My client believed this interpretation, which had several important implications of where prospective areas were likely to be located. I made a presentation to DRC officials in my best French backed up by an impressive set of Powerpoint slides all suitably annotated in French. At the end of our presentations the DRC authorities said that they needed to buy some toner to be able to print the minutes of the meeting. They asked for $1000 to buy the toner. Not long after the presentation the DRC authorities reneged on the contract with my client and made some sort of new deal with another oil company. They apparently sold my report to the other company.

By the time I got to be 65.5 years old I had been working six and seven day weeks for the previous 4 years. I was exhausted. I decided that in the future I would only accept interesting and well paid jobs that preferably involved an interesting trip somewhere. The last really big project I ever did fitted these criteria. It involved the interpretation of a $15 million full tensor airborne gravity gradiometer (FTG) and aeromagnetic survey over the East African Rift in Ethiopia and northern Kenya, just south of the Afar Triangle mantle plume. This was a dream project for me. The gravity and magnetic data were almost exactly what I expected. At the time I was fortunate to have a University of Sydney library card that gave me electronic access to virtually every journal in the world. The many studies of the area, especially those involving tomographic seismic inversions, appeared to confirm my ideas on structuring and magmatic activity related to rifts.

The reason I had the library card was because I had become an Honorary Associate of the Department of Earth Sciences of the University of Sydney. I was researching mantle plumes and rifts and how sedimentary basin formation and structuring and mineral deposit locations can be predicted by understanding magnetic and gravity anomalies. One day I noticed that the Department's web page had a significantly shorter list of Honorary Associates than previously. My name was not on the list. I learnt that the central administration of the University had decided to charge the Department of Earth Sciences a $3000 administration fee for each Honorary Associate. This resulted in anybody not writing lots of papers or bringing in grant money being purged.

I did my last consulting job when I was 69.5. I was ready to stop. One month later my 7 year old laptop computer died and took most of my geophysical software with it. I had expected this to happen for some time and had bought a new laptop but, for a whole range of reasons, most of my software could not be transferred.

With the demise of my laptop and the loss of my university library card my researches on rifts and mantle plumes effectively ended.

I would like to think I had reached a stage where I could use gravity and magnetic data to identify locations of rifts and intracontinental sedimentary basins and to delineate their extents, degrees of extension and define their internal structuring. The key to be able to do this is to understand that rifts and intracontinental sedimentary basins are commonly underlain by large igneous bodies that cause significant gravity and magnetic anomalies. The amplitudes of the anomalies are related to the

degree of extension and subsidence. The igneous bodies are commonly compartmentalised along rift axes and have a significant influence on structuring in rifts. They may be the source of the necessary heat and mineralising fluids to create ore bodies. Recognition of compartmentalisation in rifts and the knowledge that maximum subsidence occurs over the axial igneous intrusions allows predictions to be made of facies distributions within rifts. I was able to map the distributions of volcanic rocks in the sediment section and to identify hydrocarbon prospects such as anticlines, tilted blocks, carbonate reefs and palaeochannels.

I also believe I made significant progress on being able to identify prospective localities for VHMS massive sulphide deposits, SEDEX massive sulphides, Mississipi Valley Pb-Zn deposits and deposits related to layered intrusions (Cu, Ni, Cr and Pt) in rifts. In the case of the VHMS deposits I developed criteria for recognising the magnetic signatures of such deposits.

I did not make the same degree of progress with mineral deposits related to mantle plumes. I did however come up with a successful set of criteria for identifying areas potentially containing diamond bearing kimberlites in the proximity of fossil mantle plume localities and I discovered a hard rock Ti deposit under cover that I believe was related to a mantle plume. The high tide of my investigations was trying to relate the FeO-Cu-Au-U-REE deposits of the Stuart Shelf area in South Australia to large the regional magnetic anomalies they overlie.

The last publication on my rift ideas was Gunn, 1997b. If I were to write a sequel only minor detail would change in the fundamental ideas of this paper. I would however include various case history examples from around the world that support my ideas. I would also elaborate, with examples, on the above claims of how I can use gravity and magnetic data to explore for hydrocarbons and minerals. This is not going to happen. The field is left open for some enthusiastic PhD students who would have a high likelihood of producing useful theses.

**NOW**: For the first seven years of my life I lived in a small town in western Victoria called Balmoral. Electricity had not reached the town at this time. We did, however, have kerosene fuelled street lights and an active blacksmith. The only present for my sixth birthday was a rabbit trap. These days we live in another place called Balmoral in Sydney. Our house is surrounded by rainforest and 200 metres from one of the best beaches on Sydney Harbour. It is a good life. It has been a long and windy road but, we got here.

## Addendum:

Peter Gunn was President of the NSW and ACT branches of ASEG. He was the Technical Chairperson for the 1985 and 2004 ASEG Conferences in Sydney and edited the 1985 Conference Proceedings.

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# Are commodity price fluctuations predictable?

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The large falls in commodity prices during 2014, as described by David Denham in the last issue of *Preview*, came as a surprise to many people. However, I predicted this fall five years ago after carrying out an econophysical analysis (Moriarty, 2011). Econophysics is a relatively new field in which physicists apply proven statistical techniques suited to complex non-linear systems with positive feedback. In contrast, economic theory largely pre-supposes a linear financial world, hence its predictions fail all too frequently.

The econophysical analysis I carried out during 2010 and published in 2011 (Moriarty, 2011) forecasted that the then high commodity prices would be much lower by 2014–15. This analysis did not try to forecast short-term prices; monthly, annual, or even transient gyrations. It focused on the underlying 1–3 year trend for prices; is it upwards, sideways or downwards? The key to any successful prediction is to disregard factors that have minimal influence on commodity price trends and to focus on what does have major influence. In brief, it was established that demand/supply and economic health have little influence on the trend for commodity prices (refer Moriarty, 2010, 2011) and it was demonstrated that the underlying trend for commodity prices is inversely related to valuation of the US dollar. A probabilistic approach was used to predict the 5-year valuation range for the US dollar, the inverse of which implies the trend for commodity prices. While it is not a new proposition that the US dollar is inversely related to commodity prices, what is new is the scientific forecasting approach for the US dollar based on an econophysical algorithm (for details see Moriarty, 2011).

To elucidate, the common explanation for the recent fall in commodity prices, particularly the oil price, is a significant oversupply during 2014. An examination of oil supply and demand does not support that contention. Figure 1 shows that supply and demand has been closely matched in the last three years, including during the last six months, yet the oil price fell by 50%. Given there was not a huge change in supply, the fall in oil price must be caused by another factor. If the US dollar valuation during last three years is considered (Figure 2), a strong inverse relationship is apparent between the US dollar valuation and oil price. We know that one-off correlation does not imply causation. Our contention that the US dollar is a significant contributor to the trend for commodity prices (oil, gold and base metals) has been established from an analysis of commodity prices since 1980 – over 30 years (Moriarty 2009, 2010, 2011). The inverse relationship between US dollar valuation and commodity prices is likely to be a consequence of the behaviour of commodity producers who, when the US dollar is at a low (high) valuation, raise (lower) the price of commodities in order

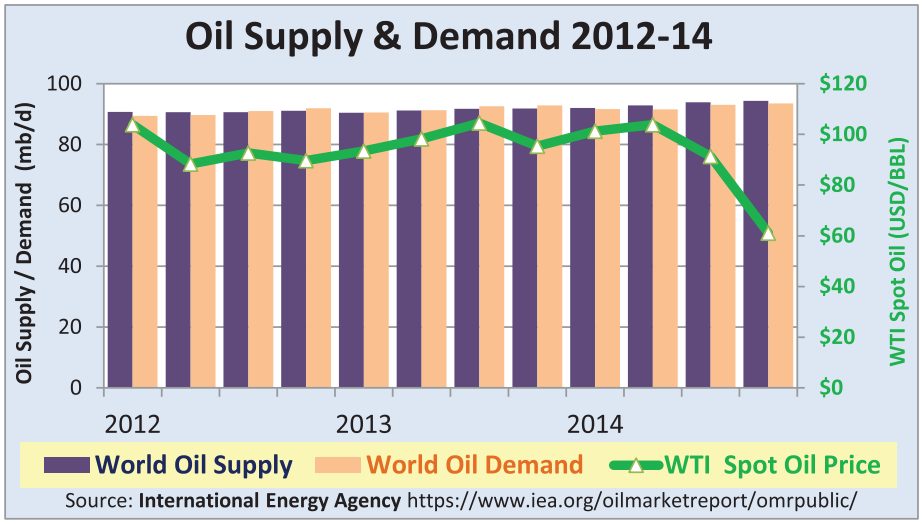


**Figure 1.** *Quarterly values for world oil supply and demand are closely matched during last three years, yet oil price fell by 50% (right hand scale). Oversupply cannot have been the main cause of the large fall in oil price.*

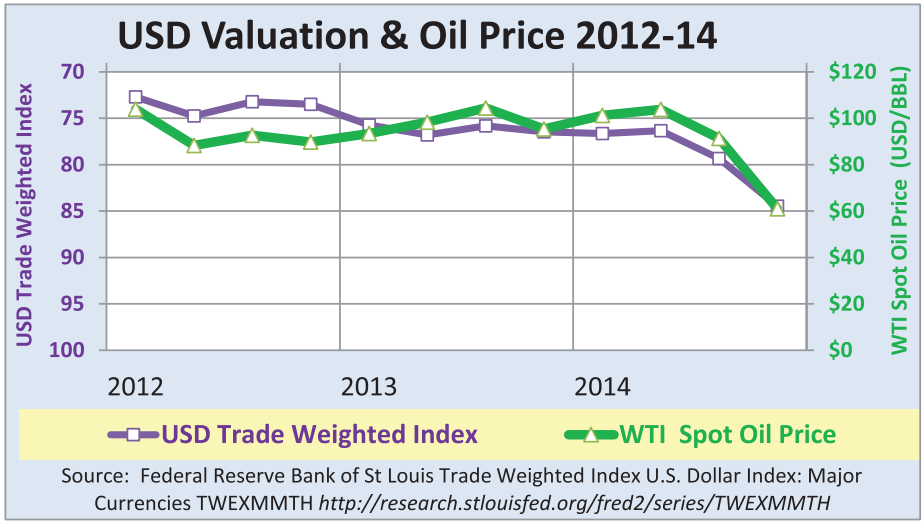


**Figure 2.** *Quarterly values for US Dollar valuation (inverse left hand scale) and WTI Spot Oil (right hand axis) are closely matched during the last three years. The recent rise in US dollar valuation has coincided with the large fall in the oil price.*

to get a stable return in their own currency.

To recap the prediction from five years ago, Figure 3 shows the US dollar valuation and prices of oil and gold for the years 2000–10. It also shows the five year probabilistic range projection for the US dollar, based on a mean reversion algorithm. It is apparent that the trend of commodity prices was well matched with an inverse valuation of US dollar for the period 2000–06. During the Global Financial Crisis, commodity prices decoupled from the US dollar. Our scientifically based projection of the US dollar valuation, which in 2010 was near an all-time low value, indicated that in the coming years there was a high probability of a major turning point and subsequent strengthening of the US dollar (despite the prevailing gloom about the health of US and world economies). Figure 3 shows the predicted P10, P50 and P90 valuations for the US dollar. Keep in mind that a strengthening US dollar would most likely result in falling commodity prices.

Figure 4 shows the subsequent US dollar valuation during 2011–14 and commodity prices, including the Reserve Bank of Australia base metals index and iron ore metric ton. It is apparent that the US dollar valuation has stayed in the predicted range, mostly around P50 and has strengthened from its value 5 years ago. The recent strengthening is regarded as a statistical fluctuation, not a consequence of end of Quantitative Easing (see Moriarty (2011) for a review of what does/does not affect the US dollar valuation). The modelled strengthening of the US dollar has caused downward pressure on commodity prices – oil and base metals are now regarded as in 'fair value' range, while gold is still assessed as overvalued.

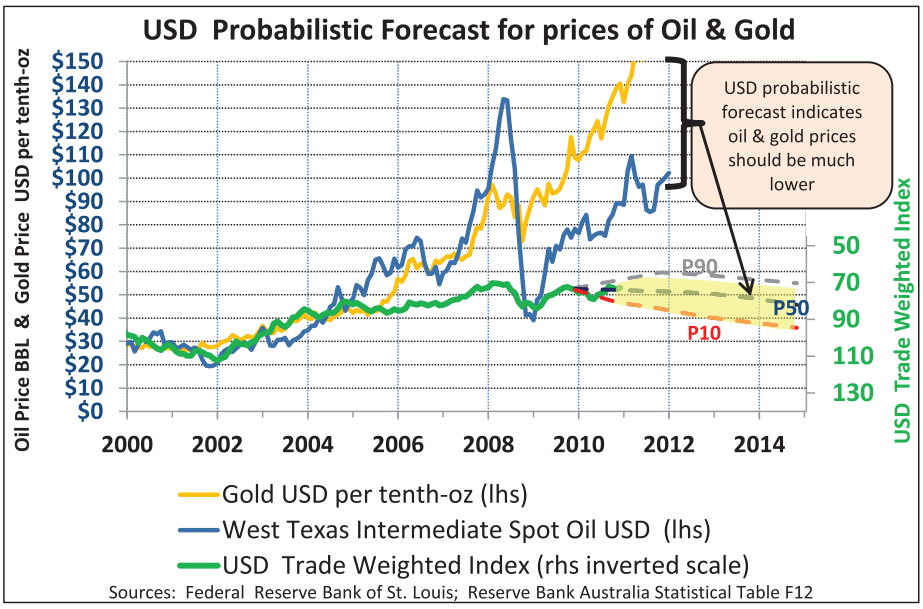


**Figure 3.** *Prediction published in 2011, based on probabilistic valuation range for the US dollar, forecasted the high probability that oil and gold prices should be lower by 2014–15.*

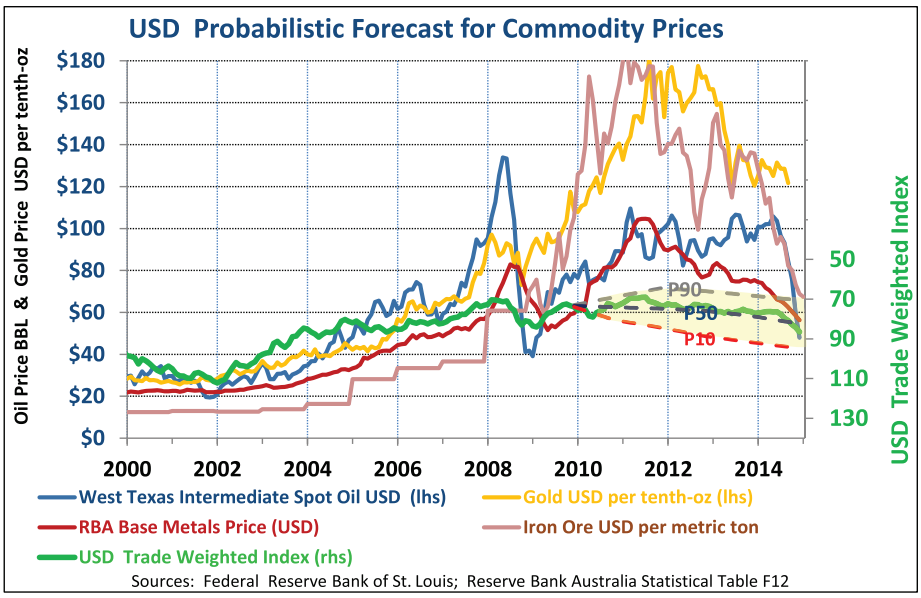


**Figure 4.** *At December 2014, commodity prices of oil, base metals and iron ore had fallen to the level predicted in 2011; observe gold still is over-valued on our assessment.*

If we accept that the US dollar does control the trend for commodity prices, how do we predict when the US dollar is likely to weaken? Also, how quickly will it weaken and what is the outlook for commodity prices? Figure 5 shows US dollar valuation since 1972 with the main inferred trends for commodity prices. The recent strengthening of the US dollar is not likely to continue – it is approaching one standard deviation above average valuation. We are currently modelling the probabilistic range for the next major turning point, which is when the US dollar should start to fall. This will result in upward pressure on commodity prices. We expect to publish the results of this modelling later this year.

Many economists approach economic forecasting by extrapolating the current trend, which proves embarrassing when the inevitable turning point occurs. I contend that it is possible to have a scientific basis for forecasting volatile time series (not just commodity prices, but also financial series such as stock markets). Firstly an observer has to gather empirical data to support contentions about which variables matter, and which ones do not. Mean-reversion statistical techniques can predict the range and associated probability for the outcome in 1–5 years. Having a rationally derived probability goes a long way in evaluating when to invest and how much, providing an important advantage over the majority of the public.

In summary, low commodity prices and the subsequent downtown in the exploration and mining in 2014–15 was predicted by an econophysical analysis I carried out in 2010. The next question for me to ponder is when will commodity prices bottom and how quickly will they rise? Stay tuned for the outcome of my deliberations!

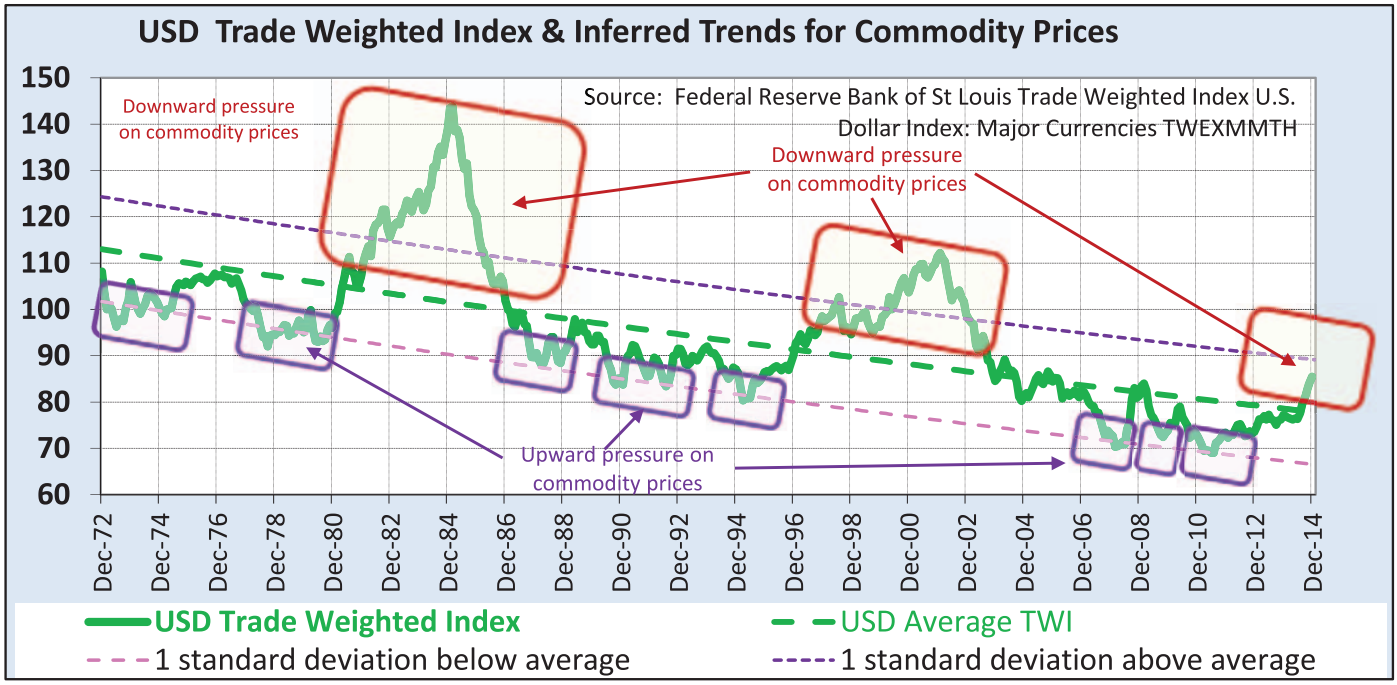


**Figure 5.** *US dollar valuation index and inferred trends for commodity prices. There is broad agreement between the US valuation and trend for commodity prices. This raises the question – when is the US dollar likely to weaken and commodity prices rise?*

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***Noll Moriarty's** M.Sc. (Hons) qualifications are in geophysics; during 1982–99 he applied seismic acquisition, processing and interpretation skills in petroleum exploration and development projects for Delhi Petroleum and Origin Energy. In 2000 he founded Archimedes Financial Planning, which provides financial advice with a scientific basis to resources industry personnel around the world.*

# Pyne backs down on cuts to tertiary education funding – for now

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## The Minister's threats did not work

In the 2014 Budget last May, the Government planned to cut the funding to the Commonwealth Grants Scheme by 20 per cent and to deregulate fees charged by universities, as part of a Higher Education and Research Education Bill. This was all part of a plan to save $4 billion over four years. However, when it was clear that the Senate would not pass this legislation, Minister Pyne announced that funding for the $150 million/year National Collaborative and Research Infrastructure Strategy (NCRIS) was, as he said, 'inextricably linked' to the passage of fee deregulation and its funding would be cut off if the whole Bill was not passed. 'You can't do one without the other', he said.

This is when the science community and business, started to lobby hard about the state of science funding. They warned that the uncertainty over funding from 1 July 2015 meant that over $2 billion of public investment was at risk and several NCRIS facilities would have been shut down. It is not clear what effect these submissions had on the Government.

However, the Senate defeated the Bill 34 votes to 30 and the uproar, not only in the Senate, but throughout the Tertiary Education sector and in industry was such that the Minister changed his mind and he has preserved the NCRIS funding for another year. Furthermore, the 20 per cent cut to the Commonwealth Grants Scheme will not be applied until this is considered by the parliament as a separate Bill. And the deregulation of university fees will be assessed in another Bill at a later date.

In essence, the original proposal tabled in May last year has unravelled and the Government will have to start all over again. This may not be a bad thing, because it will provide an opportunity to examine in more detail precisely what sort of higher education system we need and how best to fund it. The real tragedy is that the Government did not seem to realise the importance of the Australia's science research programmes. And that is a real worry.

## The Australian Academy of Science welcomed the back down

The Australian Academy of Science (AAS) was one of the first agencies to welcome the government's back down. But while the decision to fund NCRIS for another year was welcomed, it is obvious that long term science research budgets are in a precarious position. For the moment the funding for 2015–16 will allow the continued operation of 27 facilities established under NCRIS. These support fundamental and applied research in everything from astronomy to deep-ocean measurement and medical research.

According to the AAS 'These facilities are used by more than 35,000 researchers in Australia and overseas and directly employ 1,700 highly trained staff'.

However, it is totally unsatisfactory for the funding of science research to be considered on an *ad hoc* year by year basis. There needs to be a long-term funding commitment for the essential infrastructure that gives researchers and industry in Australia the certainty they need. As the Chief Scientist Ian Chubb said earlier in the week, many of the brightest and best are applying for jobs overseas because of the uncertainty in Australia. This situation must change if Australia is to advance as a nation.

## Government needs to prioritise funding allocations

Ironically in 2013 Australia's median per capita wealth of $US 219,500 was the highest in the world (Credit Suisse Research Institute, October 2013) and yet in 2014 the Government cut programmes and services as though we were going broke. We have the wealth, but we are not making the best use of it. We should be able to afford top quality health and education systems that do not discourage people from visiting their GP and provide educational opportunities for people from all socio-economic backgrounds. These goals do not appear to be at the centre of the government's thinking.

A good dose of prioritisation would benefit government thinking, because no overall plan to provide funding has been released across the whole of government.

For example, why do we need eight submarines? Why are we spending more than 500 million/year to help one side of a Sunni/Shia civil war? How is it that we can find hundreds of millions of dollars to commemorate a battle we lost 100 years ago? Why do we have to cut our foreign aid budget? Why has the Commonwealth ceased to fund the sealing of water bores in the Great Artesian Basin? Has a cost benefit analysis been done on the money that has been and will be spent on spy agencies? And, why would we be funding a $250 million chaplaincy scheme when there is not enough legal aid money to support the very poor when they have to go to court? These are just some of the questions that need answering.

The government should sit down and work out what its priorities are, articulate how these will benefit the nation and how the programmes can best funded. Furthermore the results of the prioritisation should be presented so that the community can see the reasoning behind the decisions. To date the whole plan appears to be 'we must fix the mess that Labor left us and get rid of the debt'. There is very little talk about what 'we' are trying to achieve, other than to balance the budget. If we are not careful we could finish up with a second rate manufacturing industry and having to rely more and more on the resource and agriculture industries. These are good stalwarts, but we should be doing more, otherwise we may become a nation of baristas and bartenders.

# Disbelieve if you can

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A word of congratulation is due to all students who presented papers at the recent Perth ASEG Conference. There were 120 student registrations, with 26 students presenting oral papers and 34 presenting posters. Special congratulations to the six students who gained best paper/poster awards in the minerals, petroleum and environmental-geotechnical streams, and also to Andrew Pethick of Curtin University who won the award and cash prize for Best Student Paper in Exploration Geophysics in the past year (see details of all Awards elsewhere in this issue).

After recently accepting the role of editing a page for *Preview* on Education, I have been contemplating what advice has influenced my career choices, and whether such advice may be useful to the current generation of students. The words in the title here are remembered as a trademark of Sam Carey AO, Professor at the University of Tasmania 1947–76. Carey was one who advocated and developed Wegner's theory of continental drift through the time when it was regarded as geological heresy in North American academia, up until approximately 1965. Senior and emeritus members of ASEG and our various geosciences departments will remember stories of those years when students were discouraged by academic hierarchies from spending time on 'rubbish'.

In 1969 the great geophysicist and one of the founders of modern seismology, Sir Harold Jeffreys, published a letter in *Nature*, decrying recent publications on the new 'plate tectonics', pointing out that he had demonstrated that the anelastic properties of the Earth indicated it behaved as a Lomnitz solid (having a property of logarithmic flow under stress). Since his numerical models showed that a Lomnitz solid cannot support convection, then Jeffreys argued that plate tectonics without a mechanism was fallacious. With a measure of undergraduate brashness based on erudition acquired in my physics major and first-year geology, I waved the issue of *Nature* at Carey after a lecture, seeking explanation. He spent 45 minutes on an in-depth discussion on evidence for fluidity of the Earth over geologic time, and of differences between observational evidence and mathematical models. It stimulated my interest sufficiently that I continued on to gain degrees in geophysics, although paradoxically I never worked in solid-earth global geophysics.

I recall at my first geosciences conference, held at ANU in Canberra in February 1972, one session on what had by then become the accepted science of plate tectonics developed into a discussion. The legendary Professor J.C. Jaeger (the first professor of geophysics in Australia) reminisced that when the then young research fellow Ted Irving arrived at ANU in the 1950s to develop his science of measurement of palaeomagnetism and movement of continents, Jaeger advised him 'When you visit other universities, don't tell them you believe in continental drift, or they will think you a rat-bag and they won't tell you where the outcrops are.' The exception, of course, being when visiting Sam Carey in Tasmania. Irving's work over a decade became a cornerstone of the new plate tectonics, and his PhD submission to Cambridge University in 1954 (which had been failed, because apparently the examiners could not accept the idea of rock-solid continents moving on the Earth's surface) was replaced by award of a meritorious ScD in 1965.

Healthy disbelief of established wisdom was again demonstrated in the 1980s when I was involved in early trials of the new 'in-seam seismic method' whereby channel waves (analogous to Rayleigh and Love surface waves, but trapped in a low-velocity coal seam) were developed for detection of faults in coal seams. BHP trialled the method in collieries in NSW, and the data was processed by both the British National Coal Board and the German equivalent, these being two groups who had parallel but quite separate major programmes in this emerging technology. Processing by the German group failed to find a known target, because models produced by the distinguished father of German exploration seismology Professor Theodor Krey predicted that the useable frequencies would be at relatively high Airy wave frequencies, and filters were set accordingly. Perhaps due to a characteristic fabric of Sydney Basin coal, wave attenuation wiped out the Airy-phase signals. The British approach was more pragmatic; open the filters and see what can be found. Their result imaged up reflections using less-attenuated relatively low frequencies that corresponded more closely to a guided head-wave in the coal seam than to a true seam wave, and a decade of in-seam seismic methodology followed in Australia. (It ended when in-seam drilling technology made those seismic methods redundant).

Richard Feynman, the Nobel-prize winning nuclear physicist, might have been addressing students when he said 'Science is the belief in the ignorance of the experts'. Models today are an essential and growing part of our geophysical practice. But the most significant advances will probably happen when today's students understand their observations sufficiently well to break then reconstruct the models. *Disbelieve if you can.* And may we professors know when to stand back.

# Students wowed with earthy programmes at ASEG Perth

The student events at the ASEG-PESA 2015 conference consisted of a programme for high school students, kindly sponsored by Woodside, and a variety of events for university students. The activities were well received and valuable to all who participated.

## High school student day

On Tuesday 17th February the high school student day kicked off at 9:30. We had attendance from four schools with a total of 48 students, with one keen school driving up all the way from Bunbury, about 2 hours south of Perth. After a brief introduction from Darryl Harris at Woodside, Koya Suto presented his infamous Hitchhikers Guide to Geophysics, which gave the students a well-rounded introduction to geophysics.

After a short morning tea break it was straight on to some hands on experiments. This was coordinated by Dominic Howman from Curtin University and run by a small army of student volunteers from KEGS (Kurtin Exploration Geophysicists Society), GPX Surveys and Geoscience Australia. On the lawns at the entrance to the convention centre, the students conducted a GPR experiment where they found pipes and ground water. They learned that GPR can even be used to find bodies, enabling some geophysicist to moonlight in forensic work and assist graveyard managers to manage plots (did you know that bodies are not always below their headstones?). A handheld spectrometer unit was used to demonstrate the principles of radiometric surveys, and that larger versions of this instrument were used in the airborne surveys that make up the radiometric map of Australia. Inside, the students learnt about magnetic bodies using a fluxgate magnetometer and a pen plotter that sounded like it was going to take off at any moment. One student bravely put their phone in the clutches of the instrument and got themselves a magnetic profile of an iPhone. In the last experiment, the students measured the conductivity and magnetic susceptibility of four different core samples. This was followed by conductivity and magnetic measurements of three boxes containing sand, brass and iron, and they were able to work out what was in each one.

There was a quick lunch and then the students had a tour of the exhibition halls. Thank you to HiSeis and Terrex who respectively brought in a Univibe and a Harvester receiver truck, as part of the demonstrations, and thank you to all the booth holders for taking time to engage with the students.

After the tour, there was a presentation by Prue Leeming on *Life as a Geoscientist*. There were photos from across the world where Prue has worked and it certainly reinforced the idea of travel (and adventure!) as a given in our industry.

Feedback from the students and teachers was excellent. As I was taking a group from the indoor to the outdoor experiments, one of the students said 'I didn't know anything with the word *science* in it could be so interesting'. And from another school, all 14 students said they would consider a career in the geosciences. Thank you to Woodside and all the volunteers who made this day such a positive experience for the students.

*High-school student Jake Wood gains 'X-ray eyes' using a GPR under the tutelage of Dominic Howman.*

## University student events

This year's ASEG-PESA conference had a range of activities on offer for university students. There were mock job interviews, a mentor programme, a *Careers in Geoscience* presentation, and a Student Social Function and EAGE GeoQuiz.

*Student Day Volunteers (L-R): Mark Lowe, Dominic Howman, Dane Padley, Aldo de Rooster, Danny Husodo, Adrian Noetzli, Sandy Jones, Rebecca Tung, Rebecca Abel, Zenon Platritis, Xiuping Liu. Missing: Tristan Kemp (Geoscience Australia), Jay Ridgewell (Curtin University).*

The *Careers in Geoscience* presentation was hosted by Kathlene Oliver (ASEG WA Branch President) and there was a range of presentations across academia, industry and government. Thank you to the presenters Chris Elders (Curtin University), Kerrie Deller (Woodside) and Millicent Crowe (Geoscience Australia). Students who attended the session found it extremely valuable, and many stayed on to ask questions and chat with the presenters.

The mock job interviews were an opportunity for students to practice their interview skills and get feedback on their performance. The calibre of the candidates was very high and several of the interviewers said if given the opportunity they would have hired one or two on the spot! Thank you to Marina Costelloe and Murray Richardson (Geoscience Australia), Kate Dodd (Apache), Richard Haines (Haines Surveys) and Audrey Leonard (Woodside) for helping to provide this invaluable opportunity.

A number of students made use of the mentor programme. Thank you to Kim Cook for introducing the students to industry professionals, all of whom provided excellent career advice and guidance, and helped to bridge the gap towards industry for the students. I encourage more students to take advantage of this programme the next time it is run.

The Student Social Function and EAGE Geoquiz, sponsored by the ASEG, was held on Tuesday night at Bob's Bar on the rooftop of the Print Hall. Over 60 students attended from across Australia and internationally, as well as representatives from DownUnder GeoSolutions, Terrex, Geoscience Australia, and Woodside. The EAGE Geoquiz donated a first prize for the winning team to attend the 77th EAGE Conference and Exhibition in Madrid (1-4th June 2015). Needless to say there was fierce competition and a very close finish – the top three teams had points of 717, 729 and 731.

Congratulations to Aaron Girard, Benjamin Witten and Lee Tasker from UWA for taking out the prize. A spot prize for a genuine Akubra hat (thanks to DownUnder GeoSolutions) was won by Simone de Morton. Thank you to Rachel Moo (EAGE) for your tremendous organisation, Professor Peter Lloyd (EAGE) for the witty antics as Quiz Master and Gerard Wieggerink (EAGE) for providing the ASEG the opportunity to run the EAGE Geoquiz and all the hard work behind the scenes. It was a pleasure.

*Troy Thompson (DownUnder GeoSolutions) with (at left) student Simone de Morton, winner of the Akubra hat.*

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*Careers in Geoscience Session.*


*Winners of the EAGE GeoQuiz travel prize: from left, EAGE's Gerard Wieggerink, prize winners Aaron Girard, Benjamin Witten and Lee Tasker, EAGE's Rachel Moo, Quiz-master Professor Peter Lloyd, and organiser Adrian Noetzli.*

Commentary

# A new era at *Preview*

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Welcome everyone to a new era at *Preview* (maybe it's not quite that momentous 'era-wise'). Your *Preview* Editor, Lisa Worrall, was very busy at the recent Perth conference digging up lots of new content for upcoming issues of *Preview*. As part of this process she also recruited a number of people to be Associate Editors to go out and help her in her search for the latest and greatest on a range of subjects and then to spread the word. One of these Associate Editorships is in *Environmental Geophysics*, and she has persuaded me to take on that portfolio. I am quite excited about this as there is a lot to report on.

For those of you who don't know me, I'm a researcher at the University of Adelaide, working primarily on a greenhouse gas (GHG) project, measuring GHG fluxes from various sources, both natural and anthropogenic (I like to call this very-shallow geophysics). My background is in electrical geophysics, having started with Zonge Engineering in the US many years ago. After a few detours along the way I became the Managing Geophysicist for Zonge Engineering (Australia), working in that role for most of 10 years, until about 2004. Since then I have completed a PhD at the University of Adelaide, specialising in the use of near-surface geophysical techniques to characterise the near-river environment on and around the River Murray. While my experience is biased towards electrical geophysics, I will do my best not to let that get in the way of reporting on the width and breadth of geophysical techniques that are used in environmental geophysics.

In the upcoming issues I will be bringing you pieces from a number of sources. These include, for example, reports from CSIRO and Geoscience Australia on some of the exciting things that they have been doing recently; the latest and greatest in the world of nuclear magnetic resonance (NMR) and the search for water; work that has been done over the years to use geophysics to improve agricultural practices (for example, did you know that there is a regulation in parts of New South Wales to classify soils under new paddocks to determine their suitability for rice farming? This is most often done using 'old fashioned' terrain conductivity meters); developments in shallow seismics, including from the world of multi-channel analysis of surface waves (MASW); and a whole lot more. I am also open to suggestions on content. Please email me if there are environmental geophysics issues that you are dying to tell the world about, or subjects that are of interest to you…

There is a lot to report on, so look forward to the next edition of *Preview* edition, with updates on recent projects from Tim Munday's group at CSIRO.

# The quiet achievers in the oil and gas industry

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Last year in the October issue of *Preview* (172), I wrote a column entitled 'Where has all the data gone?' It was an article containing a summary about the many changes in the various administrative agencies that have at one time or another had something to do with managing oil and gas exploration data and titles in Australia. In that article I made mention of the newly formed NOTPA and their role in the industry.

It was recently pointed out that I had made a boo boo in my article regarding the assertion that NOPTA took over title administration of petroleum acreage from Geoscience Australia. The correct position is that Geoscience Australia was never the 'titles administrator', the designated authorities for titles administration were the states and territories, and I apologise for this error.

Back in 2012 when NOPTA was first created, there was a reasonable amount of negativity concerning this new entity. Some of which was probably just because NOPTA was new and a bit of an unknown quantity, and some of which was scare mongering from those who like to complain about government bureaucracy. The transfer of responsibility from one government agency to another is always done in the face of some complaining is it not? But now, three years on, NOPTA is here to stay and most if not all of the negativity has been washed away and, in my view, has been replaced with a new sense of optimism. My personal experience with NOPTA has been more than pleasant, and one of the things that strikes me about how they run the show at NOPTA is that they have solid and focussed objectives and are sincerely driven to meet them, while at the same time keeping a close eye on what the industry wants and needs from them – finding ways to meld the two together 'on the fly'.

NOPTA has spent considerable time quietly making things easier and more transparent for industry, regularly seeking feedback on how they perform and seeking new and better ways to handle their role.

Since their inception, NOPTA has started (and in some cases completed) massive projects including the transfer of existing records held by the states, the establishment of the national core store and data repository and the establishment of the national offshore titles register. Each of these projects were significant in size and done with a minimum of interruption to the industry and all completed in only 2–3 years.

In my books, NOPTA has been one of the industries quiet achievers.

Speaking of quiet achievers, let's talk about Frank Arnott. As you will see in this issue of *Preview*, there is a great opportunity to become the inaugural winner of the Frank Arnott award for innovation in visualisation and data integration.

Frank was a man that would have been the type of guy that I would have wanted to be around. His way of thinking was always outside the common sphere, with many of his concepts and developments being well ahead of his time.

The Frank Arnott award is a great chance to put to use some of his pioneering work in the industry, while at the same time giving yourself the opportunity to showcase your own industry prowess and take home some serious prize money. I know I am going to submit a project!

# Physics AND geology make geophysics

Michael Micenko
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Seismic interpreters often forget the physics part of geophysics.

At the ASEG-PESA 2015 conference I attended an interesting keynote talk given by Mike Glinsky. When I spoke to people afterwards I found there were mixed reviews – several people commented that there was too much physics and maths. Come on … what do you expect at a geophysics conference!

This year the conference and exhibition was held in Perth, which allowed me to attend, but also allowed me to do a few hours in the office each day – out of town conferences are much more fun. A highlight at this conference was the quality and number of keynote speakers, especially in the oily sessions. There were some excellent presentations by prominent presenters and I commend the organisers for arranging such a high quality line up (details can be found in the last issue of *Preview*). Now back to Mike Glinsky.

Mike is a plasma physicist but has worked for exploration companies for many years. His keynote address 'Geophysics of Stratigraphic facies identification: emergent phases of self organisation and the Mallat scattering transform' had a super geeky title. But the talk can be summarised with a single slide (Figure 1). Actually some heavy maths was required and it has been a long time since I had much to do with partial differential equations so I was struggling. Mike began describing the concept he researched while working at the CSIRO, and developed further after he spent some time in France. Whilst the title is rather academic the concept is quite exciting because Mike can describe a geological system with a couple of partial differential equations and only four parameters and some boundary conditions. Why is this interesting? It means that without having to specify much, it is possible to describe a geological system with mathematics and make predictions. Each geological system has a unique set of parameters and these parameters are unique to the geological system.

To do this doesn't require knowledge of plasma physics, whatever that is. We already have the tools on most interpretation workstations and just have to develop a workflow. Perhaps this is the ultimate metric as Mike describes it. A video of Mike presenting this work can be found at:
http://online.kitp.ucsb.edu/online/geoflows-c13/glinsky/

Another more understandable example of where our physics needs to improve is seen in some of the interpretation software I regularly use. One company recently announced they were providing a wavelet extraction and other wavelet processes using depth domain data as input. They know it is wrong but say their user base requested it. That's OK, but do the users realise there may be pitfalls?

Seismic is recorded in time. Seismic waves are generated at a source point and propagate away over time. But modern data is increasingly being delivered in the depth domain following pre-stack depth migration processing. The depth domain is easier for geologists, engineers and managers to understand and they struggle with seismic in the time domain. But the basis behind most wavelet processing is time based because in the depth domain the wavelet shape varies as velocity varies and velocity is still subject to uncertainty. If you use these processes in the depth domain because it is convenient be aware that there may be traps for the unwary.

Now I've looked at the physics I should give the geology a plug. I'm a big fan of geology field trips for interpreters. I've been on several trips in exotic places like the Taranaki coast, the Pyrenees, Bay St Michel and the Flinders Ranges, just to name a few. They all help to understand the environment and sedimentary processes involved and they don't have to be long – day trips are really interesting. As a geophysicist I don't have to examine everything like a geologist with a field lens and compass but I do look at the rocks and observe the structures.

Perhaps my favourite geology field trip was held in conjunction with the ASEG conference in 2009. Named 'Rocks, soil and wines of the McLaren Vale region' and led by Nick Lemon it also included chemistry. After spending a morning checking out different soil types in this wine region we adjourned to a local pub and got to taste a wine grown in each terroir. If you get a chance to do this trip, take it.

**Feedback**: My article on Nintendo geos has sparked a bit of correspondence mostly along the lines of 'you idiot – the picture was of an Xbox controller'. But there was some lamenting the art of hand contouring and that may be the subject of a future article.

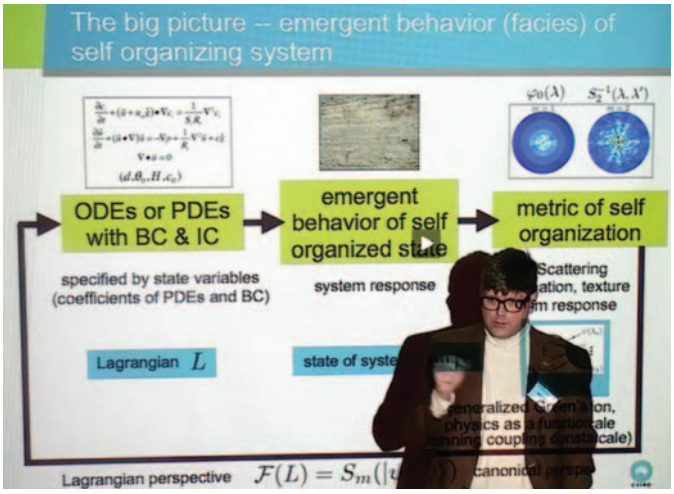


**Figure 1.** *Mike Glinsky in front of the answer to the universe.*

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|---|---|---|---|
| **April** | **2015** | | |
| 19–22 | SEG/CGS Workshop: GEM Chengdu 2015 Gravity, Electrical and Magnetic Methods and their Applications<br>http://www.seg.org/events/upcoming-seg-meetings/gem-chengdu-2015 | Chengdu | China |
| **May** | **2015** | | |
| 15 | 2nd Great Basin and Western Cordillera Mining Geophysics Symposium being held in association with the Geological Society of Nevada Symposium<br>http://gsnv.org/2015-symposium/ | Reno, Nevada | USA |
| 17–22 | 20th Caribbean Geological Conference<br>http://www.thegstt.com | Port-of-Spain | Trinidad & Tobago |
| **June** | **2015** | | |
| 1–4 | 77th EAGE Conference and Exhibition 2015<br>http://eage.org | Madrid | Spain |
| **July** | **2015** | | |
| 7–10 | 2nd Near-Surface Geophysics Asia-Pacific conference (NSGAP)<br>http://www.seg.org/events/upcoming-seg-meetings/2015/ns-asia-pacific-2015 | Hawaii | USA |
| **September** | **2015** | | |
| 6–9 | South African Geophysical Association 14th Biennial Conference and Exhibition<br>www.saga2015.co.za | Drakensburg Mountains | South Africa |
| 6–10 | 1st European Airborne Electromagnetics Conference and 21st European Meeting of Environmental and Engineering Geophysics – Near Surface Geoscience 2015<br>http://eage.org/event/index.php?eventid=1325&Opendivs=s3 | Turin | Italy |
| 13–16 | AAPG/SEG International Conference and Exhibition 2015 Incorporating PESA's Eastern Australasian Basins Symposium<br>http://www.aapg.org/events/conferences/ice/ | Melbourne | Australia |
| **October** | **2015** | | |
| 5–8 | 8th Congress of Balkan Geophysical Society<br>http://www.eage.org/event/index.php?eventid=1313&Opendivs=s3 | Chania | Greece |
| 7–9 | Bowen Basin Symposium<br>www.bbsymposium.com.au | Brisbane | Australia |
| 18–23 | SEG International Exhibition and 85th Annual Meeting<br>http://www.seg.org | New Orleans | USA |
| **November** | **2015** | | |
| 18–20 | 12th SEGJ International Symposium<br>http://www.segj.org/is/12th/ | Tokyo | Japan |
| **December** | **2015** | | |
| 7–9 | 9th International Petroleum Technology Conference<br>http://www.iptcnet.org | Doha | Qatar |
| **May** | **2016** | | |
| 30 May–2 June | 78th EAGE Conference and Exhibition<br>http://www.eage.org/ | Vienna | Austria |
| **October** | **2016** | | |
| 16–21 | SEG International Exhibition and 86th Annual Meeting<br>http://www.seg.org | Dallas | USA |
| **June** | **2017** | | |
| 12–15 | 79th EAGE Conference and Exhibition 2017<br>http://www.eage.org/ | Paris | France |
| **July** | **2017** | | |
| 2–17 (TBC) | 3rd Near-Surface Geophysics Asia-Pacific Conference (website TBA) | TBA | Australia |

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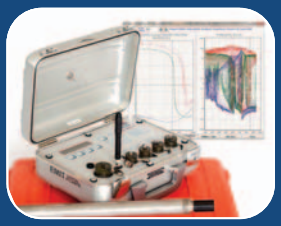

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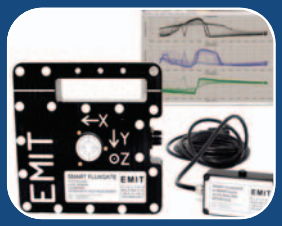


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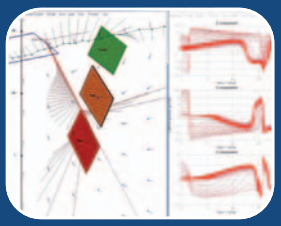

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