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PREVIEW

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FRONT COVER

Monash student Jesse Savage operates an AGI Super-Sting earth resistivity meter to image suspected gravesites from Lt Collins 1803 settlement at Sorrento, Vic. (see article beginning p. 22; image courtesy of Professor Michael Asten).

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John A. Theodoridis

I am pleased to announce that nominations for the 2013 ASEG Honours & Awards are now being received. On p. 9 of this issue, Andrew Mutton – Chairman of the ASEG Honours and Awards Committee, canvases the award categories and outlines the nomination procedure. I encourage all our readers to view this call as a wonderful opportunity to grant those who have served the ASEG, and contributed well to geophysics, the recognition they deserve.

The exciting new era of e-publishing is upon us; it is of no exaggeration to state that it is one of the most significant milestones in the history of the dissemination of the written word since the Gutenberg Press – or the Underwood typewriter for that matter! So as part of this evolution, the ASEG and SEG shall co-publish and co-brand a new book by David Isles and Leigh Rankin, entitled *Geological Interpretation of Aeromagnetic Data* in e-book format (see p. 12). A full review shall be presented within a future issue.

A new initiative within the ASEG is the publication of a 'contractors table' (see p. 13). The impetus of this ambitious development stems from the success of a similar provision by KEGS. It has been a long time in the making, so I am proud for it to debut within this issue of *Preview* and look forward to it flourishing on the ASEG website.

Our readers are no doubt aware that applications for geophysics extend far beyond the mining industry, for example, civil engineering, environmental monitoring, stellar physics and planetary exploration. Yet, among the most captivating is the application of geophysics to archaeology – the BBC production *Time Team* is one of my favourite shows. Professor Micheal Asten and students Jesse Savage and Lachlan Grose – both part of the Talented Students Program, worked with Alpha Archaeology on two historic sites using equipment provided free of charge by Fugro Instruments: Jesse searched for lost graves, situated at the 1803 Lt Collins Settlement east of Sorrento, using electrical resistivity profiling, while Lachlan performed a ground conductivity survey in an attempt to locate the rubbish dump of the 1839 Viewbank Homestead (see p. 22).

Finally, I'd like to refer our readers to p. 20, so as to learn the history of TESEP and appreciate the difference it makes to school students wishing to learn more about the earth sciences. Please do see the bigger picture: TESEP is seeding to provide the industry with new geophysicists, but requires ongoing support and funding. So if someone ever complains to you that there is a shortfall of qualified personal, do question their stewardship towards geophysics and ask them bluntly, 'How have you supported programs such as TESEP?'.

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It ain't half hot Mum!

I'm writing this as Perth looks like finishing a couple of weeks of temperatures in the high 30s including 8 days straight with maxima over 40°C. Eastern Australia, particularly Tasmania, appears to be on fire and I'm told that it is over 48°C in Oodnadatta. Hopefully, where ever you are, you managed to find a way to keep the beer cold and the barbeque cooking.

Have you paid your membership dues yet? Keen to avoid a repeat of last year, when he was threatened with excommunication for late payment, Jim Allender has done so. Twice! Unfortunately, we can't yet handle payments in advance Jim, but we'll work on it. The carrot of early payment discount has expired, but now we are counting down to the stick of service withdrawal so if you forgot to pay on time, get in quick before you stop receiving membership benefits.

The New Year sees a renewal of State Branch Committees. To all those retiring from committees I take this opportunity to thank you on behalf of the society for your past efforts. To those joining, particularly those joining for the first time, welcome to the ASEG committee structure. I am confident you will get a lot from your involvement and find that time spent working for the committees is rewarded both personally and professionally, with interest. The Federal Executive is also looking towards the start of a new committee year with the society's AGM to be held in Brisbane on 17 April 2013. A call for nominations for positions on the executive will go out shortly so if you are curious about what would be involved or keen to pitch in, contact either myself or one of the other members of the executive and find out what is expected. I look forward to seeing as many of you as possible at the AGM and enjoy some of Henk's artisanal handcrafted, gourmet canapés, which he assures me are a requirement for any ASEG function held in Brisbane.

The Victorians are getting to the pointy end of their conference preparations and I am sure that the next eight months will disappear beneath their feet as they run to turn on the 23rd International Geophysical Conference and Exhibition in August. For the rest of you, start planning your travel to Melbourne now. Registration is already open for those who want to pay before their company undergoes its next corporate restructure. It is shaping up to be another great conference so don't miss out.

In the month prior to the Melbourne Conference, the first joint Pacific conference focussing on Near Surface geophysics is planned for Beijing. The moniker 'Near Surface' is a grey one and its meaning varies depending on who you talk to. The recent consensus on the SEGMIN forum was that it refers to geotechnical, environmental and archaeological surveys. However, there were some within the SEG that view it as almost anything other than production reflection seismic for oil and gas. The ASEG have been keen to try and focus the joint Pacific Near Surface Conference towards the geotechnical, environmental and archaeological end of the spectrum and to this end have volunteered Koya Suto along with Mike Hatch, Binzhong Zhou and Geoff Pettifer to help. In doing this we hope to build a high quality, specialist conference focussing on solving the problems this group and their clients deal with daily rather than having a grab bag for talks that don't involve 3-D seismic for oil exploration. The conference will tour the Pacific on a two year cycle and this could be an opportunity to build a great specialist conference in our region so I would encourage those of you working in the geotechnical, environmental and archaeological fields to get involved. In case that might sound as if I am suggesting you don't consider presenting through the ASEG, I'm not, please do! It is just that for the ASEG, SEG and EAGE these fields struggle for critical mass. This joint conference, supported by the ASEG, offers the opportunity to gain that critical mass and provide you with an event where you can drink from a fire hydrant of knowledge, rather than trying to look busy chasing an olive around a martini glass.

Happy hunting.

Kim Frankcombe
kfrankcombe@iinet.net.au

Full waveform IP and EM processing comparison

How did Figure 1 become Figure 2?

Increasingly IP and EM instrumentation are recording full waveform or streaming data that is stacked and binned to produce a single decay sampled at 10–20 points, or a phasor sampled at five or six frequencies. The stacking and binning process has the potential to change the data significantly and is generally poorly documented and something of a grey area. In an attempt to start a discussion on how it is being done and muster ideas on how we might do it better, I am compiling a suite of real world full waveform time series data and invite anyone with an interest in the field, particularly instrument manufacturers and airborne EM contractors, to use their algorithms to process the data and submit their results.

My intention is to present the results in a standard format for comparison in a discussion poster at the next ASEG Conference in Melbourne (August 2013).

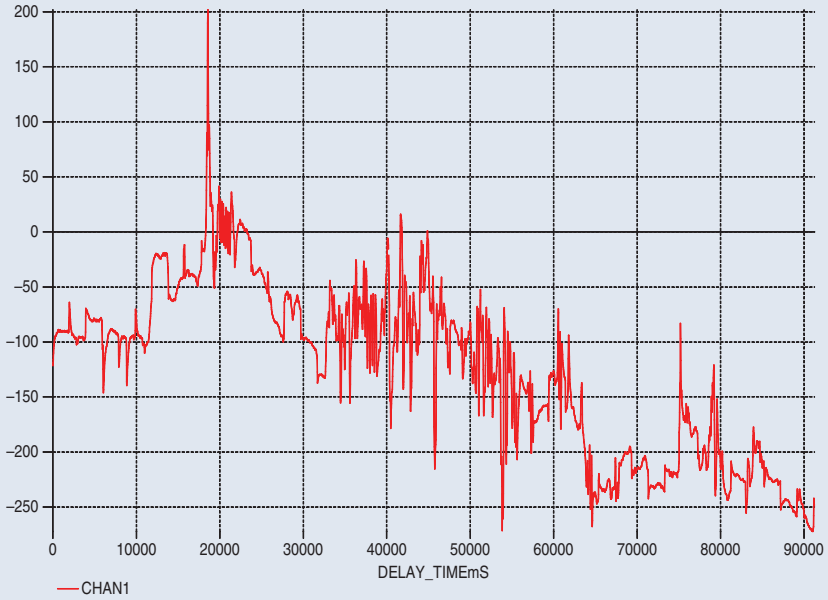

Fig. 1. *Raw IP time series data for 11 full transmitter cycles at 0.125 Hz.*

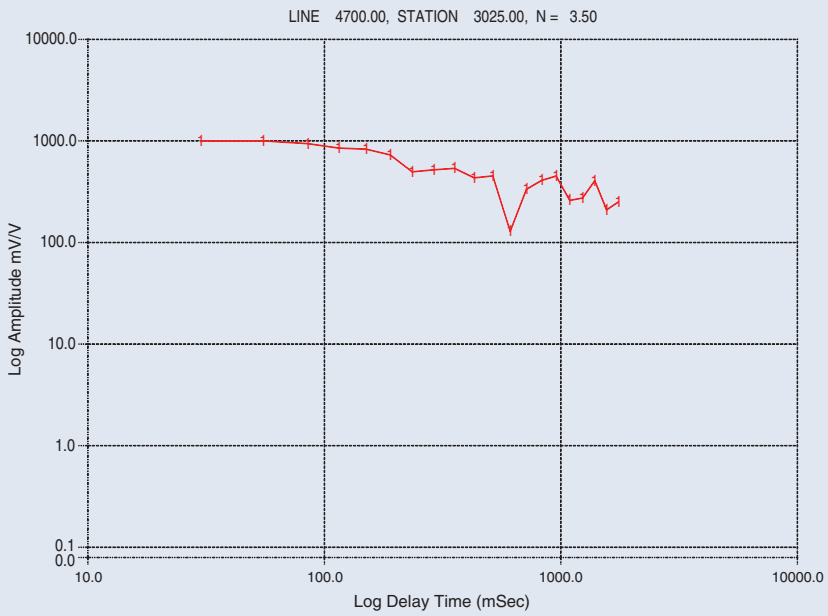

Fig. 2. *A stacked and binned decay resulting from the data in Figure 1.*

Wrapped into a PDF file and made available to interested geophysicists globally, the trial data set could act as a future standard test bench for new algorithms.

I've asked several groups who are currently collecting these data and already have a healthy quorum of contractors, consultants and practitioners who are prepared to take part in a comparison of their results from a test data set.

The aim of the exercise is to ascertain the size of the set of answers and to initiate a discussion about how we might do it better – not to belittle the instrument manufacturer or contractor who produces what is perceived as a poor result. I am sure that regardless of the results of the comparisons, all concerned will be keen to reassess their own methodology. This comparison follows in the footsteps of the low latitude reduction to the pole comparison and seismic data processing comparison held at ASEG conferences in past years. As with these comparisons the data set will be authentic and not synthetic. Thus, there is no known answer to measure responses against. However, there will be repeat readings at the same station included in the mix to get some measure of consistency. The absence of an actual answer should steer the focus of discussion from correctness of result to differences and methods, thereby remove barriers to participation for those with thin skin. The comparison would form two parts: stacking and binning results; and a description of methodology. The second part might be a hurdle too high for some and so while desirable that part would not be a requirement of participation. However, before opting for silence on the method, I'd ask you to consider an open discussion on how we might improve each of our own methods, rather than simply protecting our private 'black box' methods regardless of their performance. A great chef will always share their recipes, because they know it takes more than a recipe to make a great meal.

If you are interested in participating please contact me for download details and response formats.

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ASEG website update: www.aseg.org.au

The new ASEG website has been live for a few months now; thank you to those who submitted positive feedback. Unfortunately, we continue to have ups and downs as we work to improve it – I apologise for all the gremlins. We are working towards making this site an invaluable resource for our members. Please make it your homepage and continue to monitor and suggest improvements for the future. Don't hesitate to contact me at asegwebmaster@gmail.com with your problems, feedback or suggestions.

Carina Kemp
ASEG Webmaster

New members

The ASEG extends a warm welcome to 24 new individual members to the society (see table). In 2012, the Federal Executive approved 14 new members at the 29 November FedEx meeting and 10 in December via email.

Name	Organisation	State/Country	Member grade
Sahereh Aivazpourporgou	Monash University	VIC	Student
Heather Carey	Fugro Airborne Surveys	WA	Active
Simon Cook	Macquarie University	NSW	Student
Anthony Cornish	Macquarie University	NSW	Student
Marina Den Hartog	Frogtech Pty Ltd	TAS	Associate
Batbaatar Erdene	Oyo Tolgoi LLC	Mongolia	Associate
David Burnham Farquhar-Smith	Fugro Ground Geophysics	WA	Active
Steven Frank Johnson	GroundProbe Geophysics	QLD	Active
Aurore Joly	St Barbara	WA	Active
Mohammad Jarad Khoshnavaz	Curtin University	WA	Student
Jai Kinkela	HiSeis	WA	Active
Jan Klein		Canada	Retired
Kristian Madaschi		WA	Active
James Meintjes	Macquarie University	NSW	Student
Surya Pachhai	ANU	ACT	Student
Cameron Perks	Macquarie University	NSW	Student
Zenon Platritis	Curtin University	WA	Student
Martin Robert	HiSeis	WA	Active
Peter Maurice Trewhella	University of Melbourne	VIC	Student
Jarrad Lachlan Trunfull	Rio Tinto Iron Ore	WA	Active
Stephanie Tyiasning	University of Adelaide	SA	Student
Fiona Wedenig	GPX Surveys Pty Ltd	WA	Associate
Ian Wilson	Macquarie University	NSW	Student
Phillip Edward Wynne	Geoscience Australia	ACT	Active

Nominate a colleague for an ASEG Honour or Award for 2013

An important role of the ASEG is to acknowledge the outstanding contributions of its individual members both to the profession of geophysics and to the ASEG. The society has a number of different Honours and Awards across a range of categories. The next Awards are scheduled to be presented at the ASEG Melbourne Conference 11–14 August 2013.

All ASEG members as well as State and Federal executives are invited to nominate those they consider deserving of these awards. A list of the various available awards is set out below as well as a 'Nomination Procedure'.

Some awards carry considerable prestige in the eyes of the ASEG and therefore require detailed documentation to support the nomination. Please contact the Committee Chairman, Andrew Mutton, if you require further guidelines on what is required.

ASEG Gold Medal

For exceptional and highly significant distinguished contributions to the science and practice of geophysics, resulting in wide recognition within the geoscientific community. The nominee must be a member of the ASEG.

Honorary Membership

For distinguished contributions by a member to the profession of exploration geophysics and to the ASEG over many years. Requires at least 20 years as a member of the ASEG.

Grahame Sands Award

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 nominee does not need to be a member of the ASEG.

Lindsay Ingall Memorial Award

For the promotion of geophysics to the wider community. This award is intended for an Australian resident or former resident for the promotion of geophysics (including but not necessarily limited to applications, technologies or education), within the non-geophysical community, including geologists, geochemists, engineers, managers, politicians, the media or the general public. The nominee does not need to be a geophysicist or a member of the ASEG.

Early Achievement Award

For significant contributions to the profession by way of publications in Exploration Geophysics or similar reputable journals by a member under 36 years of age. The nominee must be a member of the ASEG and have graduated for at least 3 years.

ASEG Service Awards

For distinguished service by a member to the ASEG, through involvement in and contribution to State Branch committees, Federal Committees, Publications or Conferences over many years. The nominee will have been a member of the ASEG for a sustained period of time. All nominations will be considered for the award of an ASEG Service Certificate. Where the nomination details outstanding contributions to the shaping and the sustaining of the Society and the conduct of its affairs over many years, consideration will be given to the award of the ASEG Service Medal to the nominee. Honorary Members are not eligible for nomination.

Nomination procedure

Any member of the Society may nominate applicants. These nominations are to be supported by a seconder, and in the case of the Lindsay Ingall Memorial Award by at least four geoscientists who are members of an Australian geoscience body (e.g. GSA, AusIMM, AIG, IAH, ASEG or similar).

Nominations must be specific to a particular award and all aspects of the defined criteria should be addressed. To gain some idea of the standard of nomination expected, nominees are advised to read past citations for awards as published in *Preview*. If required, pro forma nomination forms are available from the Chairman, Andrew Mutton.

Nominations including digital copies of all relevant supporting documentation are to be sent electronically to:

Andrew Mutton
Chairman, ASEG Honours and Awards Committee
Email: andrew.mutton@bigpond.com

Application deadline:
Friday 21 June 2013.

Australian Capital Territory

The year 2012 ended in a flurry for the ACT branch. On 4 December 2012, Professor John Close from the ANU's Department of Quantum Science presented a fascinating overview of the potential (pun intended!) future of gravimetry – gravity measurements using cold-atom lasers. John explained the principles of the system that he and his team are developing: from falling atom clumps at less than 10 nK, to measuring mismatches between standing waves. John's expectation is that such instruments will eventually have a sensitivity of g/g ~ 10^{-10}, weigh less than 150 kg and be no larger than 75 cm on a side. Developments in this space will no doubt be closely watched by many. A tour of John's lab will be arranged in the near future.

Having met kangaroos and emus at Tidbinbilla Nature Reserve outside Canberra, Dr Rick Miller, SEG Near Surface Honorary Lecturer, gave his presentation 'Near-surface seismic: more than a problem of scale' on 10 December 2012 to an audience of approximately 30. The depth and breadth of the material covered in Rick's presentation is certainly evidence of his 30-odd years of experience in near-surface seismics. Over that time, Rick has lamented the decline in the use of coloured pencils in seismic interpretation, has learned to appreciate surface waves and, as was clear from his presentation, has learnt a thing or two about near-surface seismics. Attendees are no doubt reminding themselves that when it comes to processing near-surface seismic data, noisy data can sometimes be the best data; you can't always assume the same old processing steps, high frequency isn't everything, and topography isn't the only influence on statics.

Our year ended the following day at a Christmas BBQ together with 50 odd ASEG, GSA and AusIMM members and their families. Upcoming events for the start of 2013 include the EAGE course by Jörg Herwanger (WesternGeco Research and Engineering Group) on 'Seismic geomechanics'. The ACT branch AGM is scheduled to take place in the late afternoon/evening of Friday 22 February 2013. The AGM will be followed by a social event for members and their families.

Ron Hackney

South Australia/Northern Territory

The SA/NT branch held its annual Christmas Party at Tusmore Park on Saturday 8 December 2012. A total of 30 people came along to enjoy a splendid barbecue (courtesy Peter Crettenden from Swagabout Tours), a round or two of cricket, and an opportunity to catch up with friends and meet members' families. The weather behaved all afternoon and in what is becoming a tradition the leftover food was donated to hungry Geophysics PhD students.

Our final event for 2012 was held on the 11 December. Dr Richard Miller from the Kansas Geological Survey presented 'Near-surface seismic: more than a problem of scale' as part of the SEG 2012 Near Surface Honorary Lecturer program – 20 people came along to this excellent talk.

We hold technical meetings monthly, usually on a Tuesday or Thursday, at the Coopers Alehouse in Adelaide beginning at 5:30 pm. New members and interested persons are always welcome. For further details, or if you are interested in presenting a talk to the local group, please contact Philip Heath (philip.heath@sa.gov.au). If you are a SA/NT member and are not receiving emails regarding events, please update your details through aseg@casm.com.au.

Richard Miller chats to local ASEG members in Adelaide as part of the 2012 SEG Near Surface HL program.

Beautiful weather for our annual Christmas Party.

Philip Heath

Victoria

Despite the festive season and the holidays it has been a busy month for the ASEG Victorian Branch.

The silly season was already in full swing when we joined our society siblings from PESA and SPE for the annual Christmas luncheon on 5 December 2012 at the Victoria Hotel. Good cheer was had by all, and Simon Davey of Woodside Energy presented 'The influence of geology on soil and their vines and wines' – a subject (with tastings!) much appreciated by all.

The following day, on 6 December 2012, we hosted the 2012 SEG Near Surface Honorary Lecturer Dr Rick Miller from Kansas Geological Survey presenting 'Near-surface seismic: more than a problem of scale' at the Kelvin Club – he attracted a good number of 14 guests. It was a delight and honour to receive Dr Miller; his friendly affable persona made for an enjoyable evening – not to mention his account of a seismic line through a family home as part of a sinkhole risk assessment! His talk inspired many questions and follow-up conversations over finger foods. Our only regret is that his stay was cut short by his whirlwind tour of Australia. Curiously, famed dinosaur hunter Dr Thomas Rich of Museum Victoria also attended. Coupling his presence with the topic of the talk, I immediately thought of the opening scene in the 1993 film *Jurassic Park*, in which palaeontologists imaged a complete skeleton with a single shot gun source. Alas, Dr Miller's talk didn't offer much hope!

On 16 January 2013 Dr Manika Prasad, 2012 Fall SEG/AAPG Distinguished Lecturer, from Colorado School of Mines presented 'Shales and imposters: understanding shales, organics, and self-resourcing rocks'. This presentation was a joint noon lunch meeting with our PESA colleagues at The Victoria Hotel and attracted nearly 60 attendees – a very large turn-out for the otherwise quiet month of January.

On 6 February 2013 we will co-host the 'Annual ASEG-PESA-SPE Summer Social' with drinks, nibbles and plenty of networking opportunities at the riverside Terrace@Feddish by Federation Square from 5:00 pm to 7:00 pm. For catering purposes RSVP is mandatory to John Theodoridis, ASEG Victorian Branch secretary, at jthe1402@bigpond.net.au, by COB 1 February 2013.

We look forward to seeing many ASEG Victorian Branch members at this first meeting of the 2013 autumn season.

Asbjorn Norlund Christensen and John Theodoridis

Notice of Annual General Meeting

The 2013 Annual General Meeting (AGM) of the Australian Society of Exploration Geophysicists (ASEG) will be held in Brisbane on Wednesday 17 April 2013. The venue and time of the AGM will be advised closer to the meeting.

The business of the AGM shall include:

- To confirm the minutes of the last preceding general meeting;
- To receive from the Federal Executive reports on the activities of the Society during the last preceding financial year;
- To receive and consider the financial accounts and audit reports that are required to be submitted to members pursuant to the Constitution and to law;
- To report the ballot results for the election of the new office holders for the Federal Executive; and
- To confirm the appointment of auditors for 2012.

Invitation for candidates for the Federal Executive

In accordance with Article 8.2 of the ASEG Constitution *'…The elected members of the Federal Executive are designated as Directors of the Society for the purposes of the* [Corporations] *Act.'*

The Federal Executive shall comprise up to 12 members, and shall at least include the following four elected members:

(i) a President;
(ii) a President Elect;
(iii) a Secretary; and
(iv) a Treasurer.

These officers are elected annually by a general ballot of members. Koya Suto was elected as President Elect in 2012 and as such will stand for the position of President.

The following offices are recognised:

(i) Vice President;
(ii) the Immediate Past President (unless otherwise a member of the Federal Executive);
(iii) the Chairman of the Publications Committee;
(iv) the Chairman of the Membership Committee;
(v) the Chairman of the State Branch Committees; and
(vi) Up to three others to be determined by the Federal Executive.

These officers are appointed by the Federal Executive.

Nominations for all positions are very welcome. Please forward the name of the nominated candidate and their respective position, along with the names of two members who are eligible to vote (as Proposers), to the Secretary:

Barry Drummond
c/- ASEG Secretariat
PO Box 8463, Perth Business Centre,
WA 6849, Australia
Tel: +61 8 9427 0838
Fax: +61 8 9427 0839
Email: secretary@aseg.org.au

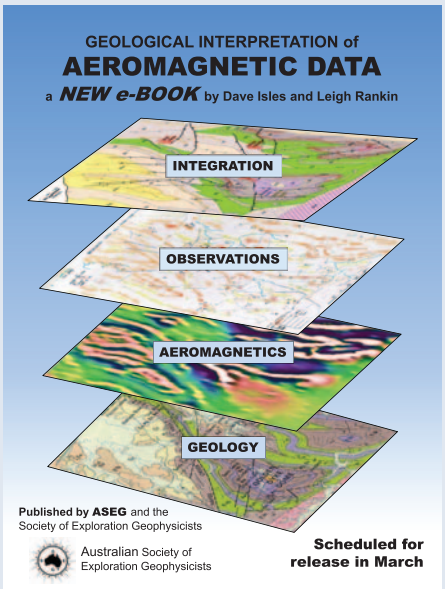
Nominations must be received via post, fax or email **no later than COB Tuesday 19 March 2013**. Positions for which there are multiple nominations will then be determined by ballot of Members and results declared at the AGM.

e-Book launch of *Geological Interpretation of Aeromagnetic Data*: a joint ASEG–SEG publication

by David Isles and Leigh Rankin

David Isles

Leigh Rankin



It is with much pleasure that I announce the forthcoming publication of *Geological Interpretation of Aeromagnetic Data* by David Isles and Leigh Rankin, an e-book based on both authors' well known workshop on magnetic interpretation. It is to be co-published and co-branded by both the ASEG and SEG and has thus been peer-reviewed by both societies. This book fills a niche between more mathematical treatments such as Rick Blakely's *Potential Theory in Magnetic and Gravity Applications* and overviews such as Lewis Nettleton's *Elementary Gravity and Magnetics for Geologists and Seismologists*. I take this opportunity to acknowledge the considerable time and effort of Lu Pellerin, Ted Bakamjian, Tien Grauch and Alan Reid (for SEG), David Moore and Michael Asten (for ASEG) and Briana Melideo (for CSIRO Publishing) in guiding the many versions towards the finished work. I am confident that this book will become a benchmark for explorationists and university course work alike. Co-marketing by the SEG will ensure wide exposure through the SEG Book Mart and SEG digital library of geophysical publications.

It is a significant first for the ASEG and SEG to have a joint publication of this type. Aspiring authors scattered around Australia, take note – we would be delighted to hear from you!

Chapter listing

§1 Introduction
§2 Basic Physics
§3 Magnetisation of Rocks
§4 Structural Analysis from Aeromagnetic Data
§5 Data Acquisition and Processing
§6 Observation Methodology
§7 Integrative Methodology
§8 Quantitative Techniques and their Role in Interpretation
§9 Interpretation Strategies
§10 Aeromagnetic Data in Sedimentary Basins
§11 Menzies – Comet Vale –Goongarrie Case Study – Archaean Granite – Greenstone Terrain
§12 Pine Creek – Golden Dyke Case Study – Folded Sedimentary Sequence with Mineralising Granites
§13 Amadeus Basin Case Study – Palaeozoic Sedimentary Basin with Complex Thrust Margin

Phil Schmidt
ASEG Publications Chairman

Table of contractors

Please note, this is a preliminary table in an early stage of development. Additional detailed information for those listed and future contributors is pending. A web page on the ASEG site devoted to this table is available: www.aseg.org.au/contractor-list; the page is to be developed and maintained by Carina Kemp (Webmaster). Contractors that want to be added to the Table are encouraged to contact either Carina Kemp (Carina.Kemp@ga.gov.au) or Ken Witherly (ken@condorconsult.com). – Ed

Starting in 1964 the Geological Survey of Canada (GSC) undertook an annual tabulation of major advancements in the fields of exploration geophysics and geochemistry; these reviews were entitled 'Minerals exploration; trends and developments' or now shortened to 'Exploration trends and developments' or simply 'Trends'. Dr Peter Hood inaugurated these reviews and carried them out in 1991, whereupon Dr Pat Killeen stepped in and has continued the reviews to the present day. The current publisher of the *Trends* is the Northern Miner press, who produces a *Trends* supplement for their PDAC edition (early March) of the Northern Miner weekly paper. In 2007, the Canadian Exploration Geophysical Society (KEGS) took over the role of primary patron for the *Trends* from the GSC, while the Northern Miner remains the publisher. With the formal *Trends* reviews, a series of factual lists (Tables) started to be produced – initially within the *Trends* publication, but later as a separate 'hand-out' that complemented the main *Trends* publication. The focus on the Tables was initially on service groups within Canada that produced geophysical instruments and provided aerial services. Over time this was expanded to include groups from around the world. However, never covered explicitly were groups offering ground geophysical services. In 2012, the management committee for *Trends* decided that the tables should be expanded to include a list of global ground geophysical services companies. The list provided here is the current set of contractors with basic contact information compiled to date. In April 2013, a set of primary capabilities for these companies will be added and made available on the ASEG website along with the current edition of *Trends*.

Ken Witherly

Contractors: Australia	Website	Address
Absolute Geophysics	www.absolutegeo.com.au/	6/9 The Avenue, Midland, WA 6056, Australia
Altas Geophysics	www.atlasgeo.com.au/	U38, 507 Walter Road, East Morley, WA 6062, Australia
ASST (Pty) Ltd	www.asstgroup.com	Unit 6,10 O'Connor Way, Wangara, WA 6065, Australia
Baigent Geosciences Pty Ltd	www.bgs.net.au	7 Owsten Court, Banjup, WA 6164, Australia
Borehole Wireline Pty Ltd	www.borehole-wireline.com.au	PO Box 21, Black Forest, SA 5035, Australia
Daishat Geodetic Pty Ltd	www.daishsat.com/	PO Box 766, Murray Bridge, SA 5253, Australia
Elliot Geophysics Pty Ltd	www.geophysicssurveys.com	PO Box 1307, Booragoon, WA 6954, Australia
Fender Geophysics Pty Ltd	www.fendergeophysics.com.au	Suite 203, 283 Alfred Street, North Sydney, NSW 2060, Australia
Fugro Ground Geophysics	www.fugroground.com	
Gap Geophysics Australia Pty Ltd	www.gapgeo.com/	9/170 Montague Road, South Brisbane, Qld 4101, Australia
GBG Australia Pty Ltd	www.gbgoz.com.au	18 Fennell Street, North Parramatta, NSW 2151, Australia
Geophysical Resources Pty Ltd	www.consultgrs.com.au	PO Box 549, Sumner Park, Qld 4074, Australia
GPX Surveys Pty Ltd	www.gpxsurveys.com.au/	4 Hehir Street, Belmont, WA 6104, Australia
Groundwater Imaging Pty Ltd	www.groundwaterimaging.com	279 Fitzroy Street, Dubbo, NSW 2830, Australia
Haines Surveys Pty Ltd	www.hainessurveys.com.au/	1 Hagan Court, Bullcreek, WA 6149, Australia
Khumsup Pty Ltd	www.khumsup.com/	NA
Moombarringa Geosciences Pty Ltd	www.moombarriga.com.au	Box 1184, West Perth, WA 6872, Australia
Outer-Rim Exploration Services Pty Ltd	www.outer-rim.com.au	42 Christable Way, Lansdale, Perth, WA 6065, Australia
Planetary Geophysics Pty Ltd	enimrac.wix.com/ planetarygeophysics	350 Prince Henry Drive, Toowoomba, Qld 4350, Australia
Quadrant Geophysics Pty Ltd	quadrantgeophysics.com/	PO Box 360, Banora Point, NSW 2486, Australia
Search Exploration Services Pty Ltd	searchex.com.au/	49 William Street, Norwood, SA 5067, Australia
Terra Search Pty Ltd	www.terrasearch.com.au/	PO Box 981, Castletown, Hyde Park, Qld 4812, Australia
Ultramag Geophysics Pty Ltd	www.ultramag.com/	21 Cowmeadow Road, Mount Hutton, NSW 2280, Australia
Vortex Geophysics Pty Ltd	www.vortexgeophysics.com.au	PO Box 3215, Lesmurdie, WA 6076, Australia
Zonge Pty Ltd	www.zonge.com.au	39 Raglan Avenue, Edwardstown, SA 5039, Australia
ZZ Resistivity Imaging Pty Ltd	www.zzgeo.com	6a Hender Avenue, Magill, Adelaide, SA 5072, Australia

Table *Continued*

Contractors: North America	Website/email address	Address
Abitibi Geophysics Ltd	www.ageophysics.com	Abitibi Geophysics 1746, chemin Sullivan Val-d'Or, Quebec J9P 7H1 Canada
Aurora Geosciences	www.aurorageosciences.com/	3506 McDonald Drive Yellowknife, NT X1A 2H1
Big Sky Geophysics Ltd	www.bigskygeo.com/	PO Box 353 Bozeman, Montana 59771 USA
Caralcle Creek International Consulting Inc.	www.cciconline.com	34 King Street East, 9th Floor Toronto, ON Canada, M5C 2X8
ClearView Geophysics Inc.	www.geophysics.ca	12 Twisted Oak Street Brampton, ON L6R 1T1 CANADA
Crone Geophysics Ltd	www.cronegeophysics.com/	Crone Geophysics 2135 Meadowpine Blvd. Mississauga ON L5N 6L5 CANADA
DGI Geoscience Inc.	www.dgigeoscience.com	119 Spadina Avenue, Suite 405 Toronto, Ontario Canada M5V 2L1
Discovery Int'l Geophysics Ltd	www.discogeo.com	14342 Geencrest Drive Surrey BC V4P 1M1 Canada
Dan Patrie Exploration Ltd	dpatrie@inorth.on.ca	PO Box 45, Massey ON P0P 1P0 Canada
Eastern Geophysics Ltd	www.easterngeophysics.com/	819, Hwy 335, West Pubnico, NS CANADA B0W 3S0
EM Pulse Ltd	www.empulse.ca/	EMpulse Geophysics Ltd PO Box 968 Dalmeny, SK., Canada S0K 1E0
Frontier Geosciences Inc.	www.frontiergeo.com/	237 St Georges Ave. North Vancouver, B.C. V7L 4T4 Canada
Geophysics GPR International Ltd	www.geophysicsgpr.com/	2545 Delorimier Longueuil (Québec) Canada J4K 3P7
Géophysique TMC	www.geotmc.com	
Geosig Inc.	www.geosig.ca/	3700 boulevard de la Chaudière Bur. 202 Sainte-Foy, Québec Canada, G1X 4B7
Geotronics Consulting Inc.	www.geotronics.ca	Geotronics Consulting Inc.6204 125th Street Surrey, B.C.V3X 2E1
Hayles Geoscience Surveys Ltd	www.haylesgeoscience.ca	511 Robinson Ave., Selkirk, MB R1A 1E5 Canada
Koop Geotechnical Services Inc.	Dave Koop-koopgeo@gmail.com	Koop Geotechnical Services Inc. Box 164 Flin Flon, MB, R8A 1M7
Lamontagne Geophysics Ltd	www.lamontagnegeophysics.com/	115 Grant Timmins Drive Kingston ON Canada K7M 8N3
Matrix GeoTechnologies Ltd	www.matrixgt.com/	2311-7 King Street East Toronto ON, M5C 3C5
MEG Systems Ltd	www.megsystems.ca/	#5, 27 Silver Springs Drive NW, Calgary, Alberta Canada T3B 4N3
MWH Geo-Surveys Ltd	www.mwhgeo.com/	3104 - 30th Avenue, Suite 388 Vernon, BC Canada V1T 2C2
Pacific Geophysics	Paul Cartwright-pacgeo96@aol.com	4508 WEST 13TH AVE. VANCOUVER BC V6R 2V4 CANADA
Quantec Geoscience Ltd	www.quantecgeoscience.com/	146 Sparks Avenue Toronto, Ontario M2H 2S4 Canada
RDF Consulting Ltd	www.rdfconsulting.ca/	26 Blue River Place St. John's, Newfoundland A1E 6C3
Scott Geophysics Ltd	www.scottgeophysics.ca/	Scott Geophysics Ltd 4013 W 14th Avenue Vancouver, B.C. V6R 2X3 CANADA
Sigma Geophysics Ltd	www.geosigma.com/	1400 Marie-Victorin street, suite 200, St-Bruno (Quebec) Canada J3V 6B9
SJ Geophysics Ltd	www.sjgeophysics.com/	11966 95A Avenue Delta, BC, Canada V4C 3W2
Walcott Geoscience Ltd	www.geofisica.com/	111 - 17 Fawcett Rd. Coquitlam BC, Canada, V3K 6V2
ZAPATA Inc.	www.zapatainc.com/	ZAPATA / Blackhawk Geophysics Division 6302 Fairview Road, Suite 600, Charlotte, NC 28210
Zonge Inc.	www.zonge.com/	Zonge Engr. & Res. Org. Inc 3322 E. Ft. Lowell Rd. Tucson, AZ 85716

Contractors: South America	Country	Website	Address
Arce Geofísicos	Peru	www.geofisicos.com.pe	2011 - Av. Petit Thouars 4380 Miraflores, Lima 18, Perú
Argali Geofisica	Chile	Joe Jordan	NA
GRS	Chile	www.consultgrs.com.au/grschile.html	Encomenderos 231, Of. 602, Las Londes Santiago Chile
KTTM Geophysics	Colombia	kttmgeophysics.com/	Bodegas La Regional Carrera 49 # 61 SUR 540, bodega 107, Colombia
Real Eagle Explorations	Peru	Gloria Fernandez	NA
Zonge Ingenieria y Geofisica (Chile) S.A.	Chile	info@zonge.cl	Eduardo Orchard 1351, Antofagasta, Chile
AFC Geofisica	Brazil	www.afcgeofísica.com.br	Av. França 1161 - 90230-220 Porto Alegre - RS
HGEOINTERGEO	Brazil	www.hgeointergeo.com.br	SCLN111 Bl.C Sala 220 - Asa Norte 70754-530 Brasilia - DF
RECONSULT GEOFISICA	Brazil	www.reconsult.com.br	Rua Dr. Guilherme Bannitz 126 CJ 92 - 04532-060 Sao Paulo - SP
MICROSURVEY	Brazil	www.microsurvey.net	Est. Rodrigues Caldas 299 R. 301 - 22713-372 - Rio de Janeiro - RJ
TRV GEOFISICA	Chile	Tony Rojas: trojas@adexus.cl	Miraflores 383, piso 21 - 832-0149 Santiago

Table *Continued*

Contractors: Africa	Country	Website	Address
Earthmaps Consulting	Namibia	www.earthmapsconsulting.com/	PO Box 2670, Bismarck Street, Flat 14, Haus am Meer Swakopmund Namibia
EXIGESA	RSA	www.exigesa.com/	PO Box 262 Ifafi, 0260 South Africa
GAP Geophysics	RSA	www.quiklog.co.za	PO Box 2347, Saxonwold, 2132 South Africa
Geophysical Surveys and Systems	RSA	Neville Brown-nevb@tiscali.co.za	PO Box 2681, Pinegowrie, 2123 RSA
Geophysics GPR	Zimbabwe	Penias Mpofu-gpr@iwayafrica.co.zw	NA
Geoprospecting Services	Botswana	Lucian Maziwisa-gsb@it.bw	NA
Global Resource Exploration & Mining [Pty] Ltd	RSA	www.resourcexploration.com/	Box 11106 Die Hoewes 0163 Pretoria
Gregory Symons Geophysics	Namibia	Gregory Symons: gsymons@ geonamibia.com	NA
MeerCAT Geophysics	RSA	J Trickett: jtrickett@global.co.za	NA
Poseidon Geophysics	Botswana	www.poseidon-geophysics.com/	Plot 3423 Matima Crescent, Extension 12 P Bag X018, The Village Gaborone Botswana
SAGAX Africa	Burkina Faso	sagax@fasonet.bf	SOCOGIB Zone de bois Rue: Lampe Porte No: 412 01 B.P. 1167 Ouagadougou 01 Burkina Faso
SNG Societe Nouvelle de Geophysique	Cote d'Ivoire	Agnaramon Koutoua: kagnaramon-ci@sng.com	NA
Spectral Geophysics	Botswana	www.spectralgeophysics.com/	PO Box 26285 Game City, Gaborone Botswana
terratec Mali SARL	Mali	www.terratec-geoservices.com/mali.html	terratec Mali SARL Rue 28, porte 112 Cité du Niger Bamako Mali
Universal Geoscience Solutions	Zambia	ugeoscience.solutions@gmail.com	Plot 41, Joseph Mwila Rd Rhodes Park Lusaka, Zambia
Vision Geophysics	Botswana	Enkelbert Chinwada-echinwada@ gmail.com	NA
Contractors: Europe	**Country**	**Website**	**Address**
Enerson Geopysical Explorations Co., Ltd	Turkey	www.enersonengineering.com	Cetin Emec Bulvari, 8.Cad. 1305.Sok. No: 5/5 A.Ovecler/Ankara Turkey
Terratec	Germany	www.terratec-geoservices.com/	Schillerstr. 3 D-79423 Heitersheim Germany
Contractors: Other	**Country**	**Website**	**Address**
Logantek Mongolia LLC	Mongolia	www.logantek.com	Rokmon Building, Room # 1001, Level 10 Ulaanbaatar, Mongolia
'Dash Mag Eng' LLC	Mongolia	dashmageng.mn	#604, 6th floor, Express Tower, Peace avenue-4, Chingeltei District, P/O Box-2265, UB-15160 Ulaanbaatar 976 Mongolia
Geosan Ltd	Mongolia	www.geosan.mn	Sukhbaatar district, 6th khoroo Baga toiruu, University street-8 Ulaanbaatar-210646a Mongolia
JEB Minerals LLC	Mongolia	jeb-mineral.mn	Baga toiruu-37B, #702 Constitutional Street, Sukhbaatar district, 6-r khoroo, Ulaanbaatar, Mongolia
Khumsup Ltd	Thailand	www.khumsup.com/	NA
IndiGEO Consultants Pvt. Ltd	India	www.indigeo.com	MM Corner, 3rd Floor #58, Banaswadi Main Road Bangalore 560033 India

Update on UNCOVER – January 2013

Some of you may have seen references to UNCOVER in previous issues of *Preview*. UNCOVER is an initiative of geoscientists in the industry, research (both academic and CSIRO) and government sectors, is supported by the Australian Academy of Science, and has the vision of identifying and facilitating the geoscience that will underpin exploration under cover in Australia in the future (http://www.science.org.au/policy/uncover.html/). As such, UNCOVER is an initiative that could have profound consequences for the ASEG, which has members in all sectors: industry, research and government.

Early indicators suggest that only a few in industry are familiar with UNCOVER; this is expected given the initiative's infancy. Within this article, UNCOVER will be approached in the context of two previous initiatives that made major impacts on the way explorers go about their business: on the research that is done to underpin their work; and on the government surveys that provide much of the fundamental data.

I spent my working life in a geological survey. Given my view of geoscience is coloured accordingly, I shall explain UNCOVER from this perspective. However, I worked closely with industry and the research community, and I hope therefore that my explanation will demonstrate UNCOVER's relevance to geoscientists in those sectors.

During my career, I saw the impacts of two technical innovations on the way geoscience is undertaken. They impacted geological and geophysical mapping, and thereby exploration, because all exploration starts with and continues to use maps in one form or another.

The first technological innovation was the realisation by geologists that topography carries the signature of the underlying geology, and that a lot of geological insight can therefore be derived from stereo aerial photographs. When this happened is unknown to me, for I trained in interpreting aerial photographs in the late 1960s and early 1970s. Rather than walk every part of every outcrop, geologists could develop draft maps in the office, and then do spot checking in the field. This cut down field time and greatly accelerated the production of geological maps.

The second technological innovation started with the development of image processing technology. I first became aware of it during the Landsat satellite missions in the 1970s (first launched 23 July 1972). Prior to the advent of image processing, geophysical maps showed contours of the data, and stacked flight line profiles in the case of data collected from the air. The image processing allowed the more subtle features in the geophysical data to be highlighted. Dedicated computers, with bolted on black boxes that manipulated the data, produced these initial images. The introduction of fast computer work stations allowed image processing software to be portable and accessible. Additionally, the development of de facto standards for image data allowed geophysicists to manipulate the data prior to image production. For example, vertical and horizontal derivatives could be produced rather than just the measured total field, and gravity and magnetic data could be mixed in one image, with, say, magnetics adding grey scale texture and gravity coded in colour. Australian geophysical service providers were at the forefront of implementing this technology. GIS technology became commonplace in the late 1980s and into the 1990s, and images could be imported easily and integrated with many other data types.

UNCOVER seeks to exploit a third new technological innovation. Many users of mobile internet gadgets speak of 'the Cloud' and 'grid computing' – a network of 'hidden' computers that enables users to work anywhere, store data offline without thought and access it from anywhere on the planet by virtue of the web. Pilot projects to test the efficacy of grid computing in the geosciences have been conducted in Australia as part of the AuScope collaboration between government surveys, researchers in universities and CSIRO, and the geophysics industry, including some software service providers. Put simply, when this technology becomes universal explorers anywhere will be able to access data and software at an unprecedented scale. Data manipulation and interpretation will occur in ways currently not available.

Without the corresponding focus from government designed to assist industry, the first two technological impacts (aerial photography and image processing) would not have made the same impact. The Australian Government established the Bureau of Mineral Resources, Geology and Geophysics (BMR) in 1948 to map the geology of the continent. The impetus for which being simple: Australia had entered World War II with no knowledge of its reserves of strategic minerals, including such basic commodities as iron ore.

Exploitation of the obvious advantages of image processing followed the 1989 Woods Review of the BMR. The systematic geological mapping of Australia had been completed. The review recommended that the BMR formally join with the state and territory surveys in a National Geoscience Mapping Accord (NGMA) to undertake new generation mapping of Australia using geophysical as well as geological data. Funding to support the NGMA, and its successor National Geoscience Agreement, came from exploration initiatives in each of the states and the Northern Territory – South Australia was first. Two decades later South Australia is starting to see the results of this funding as mining projects come on stream.

How is UNCOVER to be funded? In November 2012, the Federal Minister for Resources and Energy announced new funding for Geoscience Australia, with $26 million per annum earmarked for initiatives consistent with the objectives of UNCOVER. In December 2012, the Standing Council on Energy and Resources (SCER), which is the Council of Federal, State and Territory Ministers for energy and resources, produced its National Mineral Exploration Strategy (http://www.scer.gov.au/workstreams/geoscience/national-exploration-strategy/). The strategy adopts UNCOVER as its National Geoscience Research Initiative. Thus, with ministerial endorsement, geological surveys will pursue the UNCOVER initiative, thereby resulting in a likelihood of approaches for state and territory government funds. Funding for supporting research in the universities and CSIRO is likely to be sought from traditional sources (Australian Research Council, Cooperative Research Centres Program, National Collaborative Research Infrastructure Strategy, AMIRA, etc.). The UNCOVER Steering Committee has had preliminary discussions on ways to support bids for these funds – the

prominence given to UNCOVER in SCER's strategy will be significant in demonstrating that UNCOVER is in the national interest.

Given that experience tells us that underpinning geoscience mapping and research undertaken today may not lead to mining profits for a number of decades, how can the research and industry sectors work with the surveys to ensure a healthy exploration industry in the coming decades?

The Academy of Science's Steering Committee for UNCOVER has broad representation from the industry, research and government sectors. The Steering Committee consulted widely during 2012, and produced a strategic plan that lists five major activities that will help focus the community:

- Characterising Australia's cover—new knowledge to confidently explore beneath the cover.
- Investigating Australia's lithospheric architecture—a whole-of-lithosphere architectural framework for mineral systems exploration.
- Resolving the 4-D geodynamic and metallogenic evolution of Australia—understanding ore deposit origins for better prediction.
- Characterising and detecting the distal footprints of ore deposits—towards a toolkit for minerals exploration.
- Establishing a research network that encourages collaboration across sectors.

These are broad objectives that require further detail. In 2013, several conferences and workshops will bring together representatives of all sectors to help shape the future of UNCOVER. The first will be a session at the ASEG-PESA 23rd International Geophysical Conference to be held in Melbourne, 11–14 August 2013. Convened with the theme 'Deep Exploration', this session will attempt to tease out lessons learnt from exploration in covered areas of Australia, while considering potential contributions by leading-edge scientific research. Outcomes of this session will be inputs to an UNCOVER conference being planned for November 2013, at which invited attendees will try to define industry's needs and match them with research and government program initiatives. Details of the UNCOVER conference will be announced early in 2013.

Please contact the author if you wish to learn more about UNCOVER: barrydrummond@bigpond.com.

Barry Drummond
Secretary of the ASEG and member of the UNCOVER Steering Committee

Mineral exploration peak has passed

Indefinite growth is unsustainable, and after three years of continuous growth, the investment in mineral exploration has now peaked. For the second quarter in succession exploration activity has declined.

According to the Australian Bureau of Statistics, the trend estimate for total mineral exploration expenditure fell 6.0% (or $58.9M) to $921.4M in the September quarter 2012. The largest contributor to the fall was Western Australia (down 6.5% to $512.7M), (http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/C8F3145448902749CA257AC60012C32F/$File/84120_sep%202012.pdf). However, WA still accounts for 55.5% of the Australian total, with Queensland a distant second at $211.3M.

Exploration on areas of new deposits fell 15.3% to $303.0M and expenditure on areas of existing deposits fell 15.9% to $597.1M

The largest fall, by commodity, was for iron ore (down 16.6% to $ 280.5M). The next largest fall came from coal exploration (down 19.4% to $170.6M). Gold exploration also fell, from $215.0M to $194.4M.

Although there may be some concern about the decrease in mineral exploration expenditure, as can be seen from Figure 1, it is still at a considerably higher than at any other peak in the past 25 years.

Petroleum exploration surges to over $1 billion

Unlike the mineral sector, petroleum exploration expenditure continued to grow. It rose 17.0% to $1084M in the September quarter 2012 and is now 39% higher than it was in the September quarter 2011. Without making CPI adjustments petroleum exploration is now at its highest level ever, and the fourth highest on record if corrections are applied to allow for inflation. Figure 2 shows the investment trends since the end of 1985.

Expenditure on production leases rose 39% to $328M and expenditure on all other areas rose by 10% to $756M.

The largest contributor to the rise was Western Australia, where expenditure increased by 20.8% to $753.9M. This comprises 69.5% of the Australian total.

The Northern Territory is a distant second with $114.1M. No wonder Western Australia is dominant in all the resource sectors.

Notice how onshore exploration has been growing steadily over the last 10 years and now accounts for more than a quarter of the total expenditure. It grew by 20% since the June 2012 quarter to reach $275.7M. This is an increase of 11% over the 2011 September quarter.

The offshore expenditure is much more lumpy because of the high cost of both individual geophysical surveys and exploration wells. However, from an expenditure of $531.6M in the September 2011 quarter, it has risen to $808.3M in the September 2012 quarter – a very impressive increase.

Overall, although there might be some concern in the decline in mineral exploration levels, both sectors appear quite healthy. And why shouldn't they be, with a quarterly investment of $1.9 billion.

David Denham

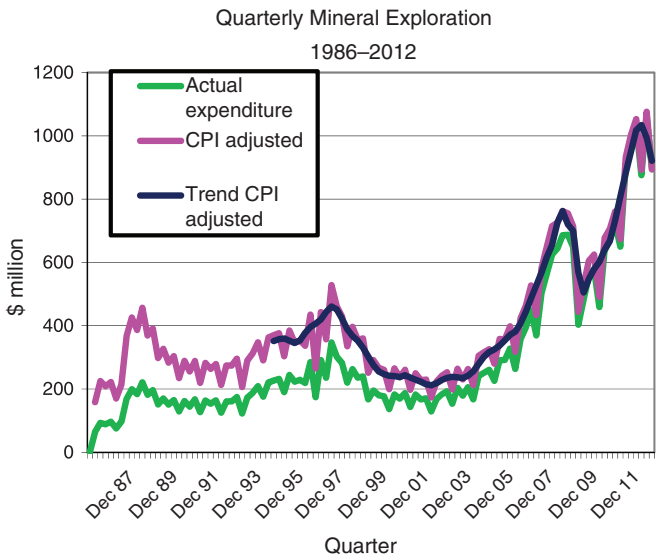


Fig. 1. *Australian quarterly mineral exploration from March 1986 to September 2012. The green curve represents actual dollars spent, the purple curve shows the CPI-adjusted numbers to 2012 levels and the black line is the trend line (provided courtesy the Australian Bureau of Statistics).*

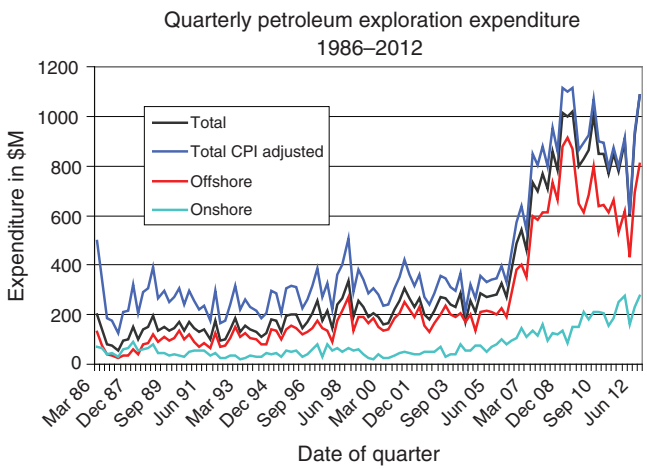


Fig. 2. *Actual quarterly petroleum expenditure from March 1986 to September 2012. The individual offshore and onshore numbers represent actual dollars spent at the time, not CPI adjusted. The black graph shows the contemporary dollars spent and the blue curve shows the CPI-adjusted number to 2012 dollars for all petroleum exploration expenditure.*

Update on Geophysical Survey Progress from the Geological Surveys of Queensland, Western Australia, Northern Territory and New South Wales (information current at 10 January 2013)

Tables 1 and 2 show the continuing acquisition by the States, the Northern Territory and Geoscience Australia (GA) of the airborne magnetic, radiometric and gravity data of the Australian continent. All surveys managed by GA.

Table 1. Airborne magnetic and radiometric surveys

Survey name	Client	Contractor	Start flying	Line (km)	Spacing AGL Dir	Area (km²)	End flying	Final data to GA	Locality diagram (*Preview*)	GADDS release
Grafton – Tenterfield	GSNSW	GPX	16 Jun 11	100 000	250 m 60 m E–W	23 000	100% complete @ 6 Nov 11	Dec 12	151 – Apr 11 p16	Data released via GADDS on 20 Dec 2012
Perth Basin South (Perth Basin 2)	GSWA	Fugro	22 Mar 11	88 000	400 m 60 m E–W	27 500	100% complete @ 23 Dec 11	Dec 12	150 – Feb 11 p20	Data released via GADDS on 20 Dec 2012
South Pilbara	GSWA	GPX	14 May 12	136 000	400 m 60 m N–S	42 500	97% complete @ 23 Dec 12	TBA	150 – Feb 11 p21	TBA
Cape Leeuwin – Collie (South West 3)	GSWA	Fugro	25 Mar 11	105 000	200/400 m 50/60 m E–W	25 000	100% complete @ 23 Dec 11	TBA	150 – Feb 11 p22	Data released via GADDS on 20 Dec 2012
Mt Barker (South West 4)	GSWA	GPX	24 Apr 11	120 000	200 m 50 m N–S	20 000	87% complete @ 23 Dec 12	TBA	150 – Feb 11 p22	TBA
Galilee	GSQ	Aeroquest	11 Aug 11	125 959	400 m 80 m E–W	44 530	100% complete @ 10 Jun 12	TBA	151 – Apr 11 p15	Data released via GADDS on 12 Nov 2012
Thomson West	GSQ	Thomson	14 May 11	146 000	400 m 80 m E–W	52 170	100% complete @ 20 May 12	TBA	151 – Apr 11 p15	Data released via GADDS on 12 Nov 2012
Thomson East	GSQ	Thomson	14 May 11	131 100	400 m 80 m E–W	46 730	100% complete @ 20 May 12	TBA	151 – Apr 11 p16	Data released via GADDS on 12 Nov 2012
Thomson Extension	GSQ	Aeroquest	22 Jun 11	47 777	400 m 80 m E–W	16 400	100% complete @ 10 Aug 11	TBA	151 – Apr 11 p16	Data released via GADDS on 12 Nov 2012
Thomson North	GSQ	Thomson	11 Mar 12	21 900	400 m 80 m E–W	7543	100% complete @ 20 May 12	TBA	157 – Apr 12 p32	Data released via GADDS on 12 Nov 2012
Marree	GSSA	UTS	29 Oct 12	130 473	400 m 80 m N–S	46 169	22.3% complete @ 20 Dec 12	TBA	160 – Oct 12 p16	TBA
Widgiemooltha – Norseman	GSWA	Thomson	15 Nov 12	131 900	100 m 50 m E–W	11 520	25.2% complete @ 20 Dec 12	TBA	161 – Dec 12 p16	TBA

TBA, to be advised.

Table 2. Gravity surveys

Survey name	Client	Contractor	Start survey	No. of stations	Station spacing (km)	Area (km²)	End survey	Final data to GA	Locality diagram (*Preview*)	GADDS release
Esperance	GSWA	TBA	TBA	TBA	2.5 km and 1 km along roads/tracks	TBA	TBA	TBA	158 – Jun 12 p23	The survey is expected to proceed but will not be conducted until the 2013/14 fiscal year
West Murchison	GSWA	Atlas Geophysics	2 Sep 12	11 897	2.5 km regular	TBA	100% complete @ 11 Nov 12	TBA	158 – Jun 12 p22	Data released via GADDS on 20 Dec 2012

TBA, to be advised.

News

Introducing TESEP – making a difference in the classroom

The following TESEP article has been reproduced in part from oral presentations and abstract given by Greg McNamara at the IGC and Jill Stevens at the ***PESA Eastern Australia Basins Symposium (EABSIV) Brisbane, 12–14 September 2012*** *(see conference booklet).*

The history

In 2002–2006, there was a significant Australian shortfall in supplying resources industry staff. Attracting young people to the Sciences, and Earth and Environmental Science (EES) in particular, was an issue. To address this need in Western Australian (WA), the Earth Science Western Australia (ESWA) teacher and classroom education program was initiated. Earth Science WA has significantly increased educator and student numbers in Earth and Environmental Science (2007–2012) and also the number of schools teaching year 11–12 EES as an elective in WA. However, in the eastern states, in late 2006, the need was unaddressed.

The need

TESEP, the Teacher Earth Science Education Programme, was started in 2007 after agreement by representatives from geological groups across Australia that we needed to 'Teach-the-Teachers' in eastern states and territories. Since then, with the partnership support of industry, government, geological societies and universities and with a dedicated, skilled team of educators, TESEP has run 112 one-day professional development (PD) workshops on seven themes of the eight-part 'The Challenging Earth' series in 27 locations (urban and rural) in all eastern Australian states and territories. Over 34 fieldtrips and site visits have also been run. Topics are mapped to the new national Australian curriculum and have been chosen to address a 2007 Teacher Survey of requested 'difficult topics' about issues such as our energy future, mineral resources, climate change and groundwater, as well as planetary geoscience.

The new national curriculum

A key incentive for teachers participating in TESEP workshops is to gain knowledge on topics that are now part of the significantly higher component of Earth and Environmental Science in the new national Australian curriculum. This curriculum will be implemented in 2014/2015. Teachers from upper primary, through year 12, as well as trainee teachers (in Science, Environmental Science and Geography) are keenly attending the TESEP PD workshops. The flow-on effect of over 1340 teacher one-day attendances at TESEP PD workshops (112 workshops run so far, August 2008 to December 2012) impacts over 350 000 students , and over a five-year period, these student impacts could be as many as 1–2 million.

Key TESEP projects 2013–2015 are: to continue face-to-face PD workshops in new and existing locations; to work with ESWA to supplement their new year 11–12 EES textbook with national case studies; to tailor field excursion guidebooks for teachers; and to develop and trial online, interactive webinars.

A geophysics demonstration exercise for teachers, developed by Dr Michael Roach, University of Tasmania, is being presented at many TESEP workshops nationally. Using ASEG funding, TESEP has filmed this exercise for distribution to teachers, along with free geophones donated by industry.

Also, a remote sensing workshop, designed to demonstrate gravity and magnetics acquisition, is being developed by Philip McClelland, with assistance from ASEG. Local, Hunter Valley, NSW geophysicists from ASEG, AusIMM and PESA plan to assist in the pilot of this exercise in early May 2013.

TESEP presenter – Philip Sansom, demonstrating the use of the geophone in a geophysics exercise for teachers at a Melbourne workshop, December 2012 (exercise designed by Dr Michael Roach UTas). Using ASEG funding, TESEP has filmed this exercise for distribution to teachers, along with free geophones donated by industry.

Teacher comment: 'Having the blinkers lifted'; and 'Having industry experts present the course materials – and almost ready-to-go teaching material'.

Teacher comment: 'A new way to look at the landscape'; and 'To see and have someone talk about what has happened at the (field) location is invaluable'.

Teacher comment: 'It gives you confidence to pass on knowledge gained to both teachers and students'; and 'Greater depth of understanding of this topic'.

Teacher comments: 'One of the best training and development days I have attended'; 'Thank you for a wonderful experience that I can share with my students'; 'Attending this allows me to go outside the classroom and get an understanding of how a mine operates and the diversity of roles involved in mining'; and 'This was a really valuable first-hand visit'.

Support is needed in the development of the textbook case studies supplement (details on topics, regions and format can be provided). Examples from across Australia for the 19 chapter topics (Energy, Minerals, Water, Weather, Plate Tectonics, Fossils and Geologic Time, etc.) are planned. Each case study can be built around a paper, publicly available research work, field notes, etc.: line diagrams, photos and text, with final products comprising up to four A4 pages are envisaged. Development can be done by you or by TESEP staff.

For information, or to offer in-kind support, please email TESEP Chairperson, Jill Stevens: cp@tesep.org.au, or Executive Officer Greg McNamara: eo@tesep.org.au.

Funding and in-kind partnership support is still needed to enable this important program to continue. Make a difference in the classroom – be a TESEP partner. Website: www.tesep.org.au.

Jill Stevens
TESEP Chairperson

Monash students dig Melbourne's history

Michael Asten

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Two Monash students teamed up with archaeologists last year to use geophysical sensing technology in the search for 'lost sites' important to 19th century Melbourne. The students were part of the Science Talented Students Program (available within BSc advanced degrees and double degrees), which provides opportunities to place students in industry for a project offering challenge beyond the standard curriculum. Alpha Archaeology provided two positions and projects, Professor Michael Asten in the School of Geosciences provided the specialist supervision and Fugro Instruments provided the equipment rent free.

1803 Lt Collins Settlement – Jesse Savage

One project involved the search for Melbourne's oldest non-indigenous gravesites, believed to be on the coastal hill-slopes east of Sorrento (Port Phillip Bay) dating from the earliest white settlement of 1803 led by Lt Collins. The settlement was brief; the ground is hugely sought after today for summer holiday retreats, but two centuries ago the immediate requirements of producing food suffered from the poor sandy soil. Less than two years later the settlement was moved to Tasmania leaving behind 19 graves. The site has previously been surveyed by Professor Jim Cull using ground-probing radar, but the method suffered from dual limitations of rough vegetated terrain making a GPR grid difficult, and conductive soils associated with salt sea-spray adjacent to the coast reducing radar penetration. Student Jesse Savage was keen to try electrical resistivity profiling (electrical resistivity tomography) and set up a grid to follow up on a few weak features identified in GPR images.

Eight resistivity profiles with line spacing 1 m were conducted with 25 m strings of electrodes at 0.5 m spacing. The conceptual target is a conductive feature of order 0.5 to 1 m wide, 2 m long and 1 or 2 m deep (we don't know whether the recorded graves of convicts and freemen were all individual or a mix of individual and common graves). A grave is expected to be indicated by a resistivity low due to disturbance of sediments, but any signature is likely to be subtle since such a settlement would probably not have used coffins (certainly not metal lined

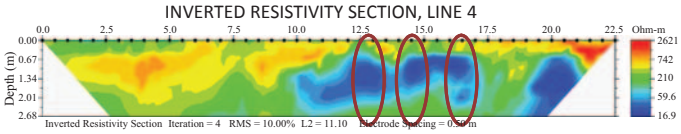


Fig. 1. *Inverted 2D resistivity section for Line 4, Sorrento survey, showing three low resistivity zones which Jesse rates as worthy of excavation as possible grave sites from Lt Collins' 1803 settlement. (Jesse Savage and Michael Asten, December 2012.)*

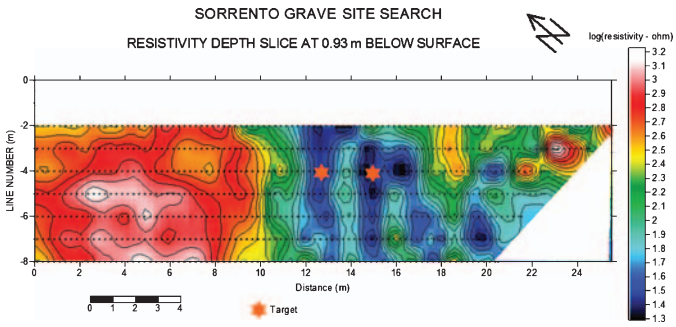


Fig. 2. *A resistivity slice at depth 0.93 m constructed from 2D inversions of seven lines of the Sorrento survey. (Jesse Savage and Michael Asten, December 2012.)*

coffins), and decomposition of a corpse is likely to be complete over the span of two centuries.

Figure 1 shows a 2-D resistivity inversion on Line 4. There are two or three prominent resistivity lows of target size that extend onto adjacent lines and are considered to be targets for excavation as possible graves. A resistivity depth slice at depth 0.9 m (Figure 2) shows the spatial regularity of these features and adds to their interest as targets. Jodie Mitchell, Director of Alpha Archaeology, plans excavations in February 2013 and said, 'If the graves are found it will be one of the most important archaeological finds in recent years in Victoria.'

1839 Viewbank Homestead – Lachlan Grose

Student Lachlan Grose chose a project to survey the surrounds of the heritage site of the former Viewbank Homestead, overlooking the confluence of the Yarra and Plenty rivers in Melbourne's north-eastern suburbs. The homestead, constructed in 1839, was a bluestone manor (now demolished) and home of a 19th century character by the name of Doctor Martin. The object of the survey was to locate the rubbish dump for the home, such sites being potentially rich sources of artefacts from days of yore. Lachlan chose a Geonics EM31 ground conductivity meter, which is effective in finding excavated filled areas where digging plus refill with introduction of organic waste is expected to produce high conductivity values. The EM31 instrument also measures the frequency-domain in-phase response, which provides a measure of variations in magnetic susceptibility, thus detecting zones of repeated burning such as an open incinerator, and metallic rubbish – such as tin cans, old machinery or blacksmith's discards. After surveying an area 50 by 30 m containing the site of a previous archaeological dig, Lachlan found surprisingly little variation in conductivity

response, but imaged a clear magnetic signal in the vicinity of the previous excavation that was centred some 6 m south-east of the dig. Jodie Mitchell is now organising a second community archaeological excavation in conjunction with the Archaeological and Anthropological Society of Victoria.

Lessons learnt

How much have we learnt so far? It's a great success for the pilot program being run by Monash; Jesse describes the exercise as 'challenging, but gave a good insight into working as a geophysicist and learning the practical side of such field work'. Lachlan adds, 'The project was an excellent way to apply the skills which I was shown in the lab class to a real world application and it highlighted that geophysics is not looking for a specific detail but looking for a significant difference'.

None of this would be possible without industry support for rent-free use of appropriate instrumentation. But as John Peacock of Fugro Instruments remarks, 'I believe it is in the industry's best interest to expose students to the most modern instrumentation possible'.

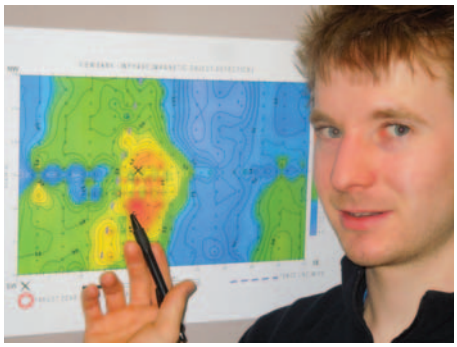
Gerry Rayner, co-leader of Monash Science Student Industry Placement Program, describes the projects as excellent examples of the industry placements we hoped our talented students would engage in.

'The projects provide hands-on opportunities for our students to apply their learning, showcase their skills and capabilities, and provide a capstone experience in their final undergraduate years. The placement program has also built bridges between the University and a range of industry partners, which will form the basis for ongoing partnerships in teaching and research.'

Now the students have opportunity to learn another great geophysical experience; waiting for a hole in the ground to prove their model right.

Monash student Jesse Savage records the layout of electrodes for electrical resistivity imaging of suspected grave sites from Lt Collins 1803 settlement at Sorrento, Vic.

Monash student Jesse Savage operates an AGI Super-Sting earth resistivity meter to image suspected grave sites from Lt Collins 1803 settlement at Sorrento, Vic.



Monash student Lachlan Grose shows an image of ground magnetic response near the site of the 1839 Viewbank homestead and selects a new target 6 m south-east of a previous archaeological dig.

Predictions and resolutions

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We all make them. Even if we do them in our heads without telling anyone, we all do it. The first cab off the rank this year would have been a resolution to survive the apocalypse, and I am sure none of us told anyone that we were secretly wondering if the world would actually end.

While I didn't build an underground bunker or put on a tin foil hat, I did clean the local supermarket out of SPAM and canned baked beans (just in case). I did that over a course of a few weeks though, so that no one at the supermarket knew the real reason I was buying it. As far as they know, I am just a bean and SPAM loving guy from Virginia, and in no way concerned about the end of the world. Fools…

With my reputation in-tact and a lifetime supply of SPAM in the garage, life as I know it must continue. That long awaited hope that maybe the world would end so that I didn't have to go into the office is over, and it is time to start thinking about what we are going to do to make this planet a better place to live. From my point of view – what better way to start than by looking at data management.

I think the best way to derive resolutions is to try and predict the things that will likely happen in your life that you want to prevent, and then come up with resolutions to prevent them from actually happening. So I read articles from Gartner and IBM, a few Twitter and Facebook posts, and many other reputable sources to see what the consensus is on the big issues for 2013 in the data management space.

Prediction #1 – Data management will remain the red-headed step child of the oil and gas industry. For whatever reason, data management in the resources sector still does not get the attention it deserves. And when I say attention, I mean quite a few things. Budget for one would be nice wouldn't it? To be taken seriously would be a huge bonus. And for people within the oil and gas industry to realise that the data managed by these teams is the life blood of the organisations certainly would not go astray. In fact I would take these in any order they come, as one will ultimately lead to the others.

My Resolution #1 – Dye my hair blonde from red, get my freckles removed, buck-teeth fixed and find my real parents – then spend the first three weeks of 2013 putting the best possible business case together for my employer to achieve change (and Resolution 1a – hold my ground and actually resign when my business case fails and I don't get the budget that I requested).

Prediction #2 – The data management team will continue to be the source of blame rather than the source of information it is intended to be. Like most things, blame is better to give than to receive, and in the resource sector, and in particular the IT area of resources, you can be damn sure that blame is waiting to be handed to you at the next meeting with management.

My Resolution #2 – Don't go to meetings with management.

Prediction #3 – Data management professionals in the resource sector will continue to ignore the 'Big Data' issues facing every other industry in the world and will fail to look at the solutions that are being created to deal with them.

My Resolution #3 – 'Big Data' means different things to different people, but we can no longer ignore that the resources industry has faced 'Big Data' issues for a lot longer than most of the other industries in the world, yet outside the resource sector, 'Big Data' is getting massive attention and resources because they know how important this will be to deal with. If we bring together the mainstream 'Big Data' solutions being created in major corporates and the 'Big Data' problems we see every day in the resource sector, I think I can make myself a real hero this year.

I will check back on these predictions later in the year with you to see if I was right. (That is of course unless I hold true to Resolution 1a, and resign.) For now, I have a double shot, decaf, full cream, SPAM latte to get stuck into.

Seismic window

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Not seismic but CSEM and magic

A cup full of dice noisily scattered across the floor of the posh 'White Chimney Sweep' restaurant in Vienna. The waitress was far from impressed as she almost tripped on them. My mates from *Petrosys* were in stitches. The magic trick had failed…again.

Several years ago I received a letter (Fig. 1) while at the Melbourne company where I once worked. The writer informed me that he was a successful water-diviner in Victoria and had recently flown from Melbourne to King Island. I have reproduced the text below:

14/4/87
Dear Sir,
Re oil exploration
For the past 4 years I have gradually changed over to the profession of water divining. I am world ranking Re my profession and am obtaining 100% on all occasions. Particularly in the last 6 months since I have been travelling interstate and country centres I have swung over to gold with complete success and I think I've got a cat by the tail there and I think I've almost have myself contracted out in that regard.
Re oil,
Last week I did four farms for water on King Island and decided to check out for oil on the way over. At seven thousand feet I was quite surprised to find oil for approx. 10–20 km at least in length. I checked the ocean depth only once and it was 190 ft. The oil field averages 1000 ft in depth below sea level and is approx. 500–1000ft in depth. Its height occasionally humps up to 500ft from floor level. I forgot to check it for pressure, which I use all the time to find the core of the underground streams. As I've never flown over a proven field with proven data to assist me I am a novice as to its potential. All I know is that it is oil and I can find it as easy as MY other targets. My talents MAY be of interest to you. Yours sincerely

An interesting letter – I liked the bit about pressure. Has anyone found this oil field in the intervening 25 years?

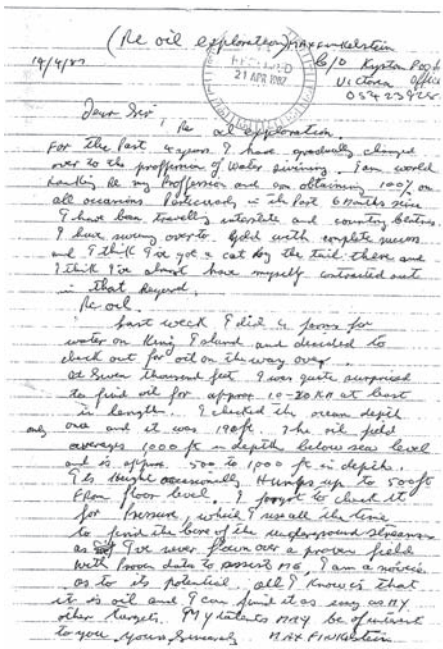

Fig. 1. *The water-diviner's original hand-written letter.*

Anyway, I did two things. I invited the gentleman to visit our office and I sent his letter on to Shell who held the acreage he'd flown over. I never heard from Shell but I did get a visit. The dowser said he could work from maps and could find anything if he was tuned in. So I laid several large maps on the floor and he walked across them with his sticks. It worked and almost immediately he had a stick pointing at the Tintaburra oil field. Next I showed him the huge map of Australia on the board room wall and he proceeded to walk past it saying he was looking for gold: 'is that where Kalgoorlie is? I've always wanted to know' he said when I told him where his stick was pointing.

Is there a place for these funny (biosensory) methods? Maybe. Here is an edited extract from an SEG user forum on sub basalt exploration:

> *Instead of blowing $200 000 to $1 000 000 per day on an array of the latest hi-tech wizardry in the broad search for hydrocarbons, this method, called Geodivining, comes in at a very affordable $10 000 per day. E&P companies with a serious interest in discussing applications of this non-conventional technology are welcome to message me.*
> *This survey method is a great low-cost multi-tool kit to add to your exploration tool-box, and wherever difficulties with conventional geophysics are encountered, it provides an excellent means of improving resolution and certainty levels prior to drilling.*
> *The method has been in use in various forms for longer than any other geophysical system, and it has been highly refined through decades of innovative research and practice, with successful applications all around the world.*

This brings me back to the dice. No doubt many of you have seen them. They were a magic trick handed out at a conference by EMGS and I had practiced all day. EMGS specialise in acquiring CSEM surveys for hydrocarbon exploration in offshore areas. Their method is based on science and the principles are well understood in the mineral exploration industry. CSEM responds to resistivity so, unlike seismic, it has 'potential' to discriminate reservoirs with high hydrocarbon saturation from those with low saturation even though it lacks the resolution of a seismic survey. I have seen many CSEM results from offshore areas of Australia, but only recently did I see my first convincing CSEM anomaly across an interpreted oil prospect. Shell tells me it has been used successfully in several areas around the world and I don't disagree.

I wonder if they ever drilled on the diviner's prospect?

March			**2013**
25–29 Mar	Tyumen 2013: New Geotechnology for the Old Oil Provinces http://eage.org/events/index.php?evp=8159&ActiveMenu=2&Opendivs=s3	Tyumen	Russia
26–28 Mar	International Petroleum Technology Conference (IPTC) http://www.iptcnet.org/2013/	Beijing	China
April			**2013**
10–12 Apr	SPE 2013: Unconventional Resources Conference http://www.spe.org/events/urc/2013/	The Woodlands, Texas	USA
16–18 Apr	IOR 2013: From Fundamental Science to Deployment http://www.eage.org	Saint Petersburg	Russia
22–26 Apr	Engineering Geophysics 2013 http://eage.ru/ru/conferences/detail.php?id=75	Gelendzhik	Russia
25–28 Apr	SEG/AAPG/EAGE 4th International Geosciences Student Conference http://www.igsc-2013.com/	Berlin	Germany
May			**2013**
10–13 May	SEG/AAPG African Geosciences Student Conference http://www.agsc2013.org/	Lagos	Nigeria
13–16 May	Geoinformatics 2013: XIIth International Conference 'Geoinformatics: Theoretical and Applied Aspects' http://www.eage.org	Kiev	Ukraine
June			**2013**
10–13 Jun	London 2013: 75th EAGE Conference and Exhibition incorporating SPE EUROPEC2013 http://www.eage.org	London	UK
August			**2013**
11–14 Aug	ASEG-PESA 2013: 23rd International Geophysical Conference and Exhibition http://www.aseg-pesa2013.com.au/	Melbourne	Australia
September			**2013**
8–11 Sep	Near Surface Geoscience 2013 http://www.eage.org	Bochum	Germany
30 Sep–4 Oct	Sustainable Earth Sciences 2013: Technologies for Sustainable Use of the Deep Sub-surface http://www.eage.org/events/index.php?eventid=960&Opendivs=s3	Pau	France
October			**2013**
6–11 Oct	SAGA 13th Biennial Conference and 6th international AEM 2013 http://www.saga-aem2013.co.za/	Mpumalanga	South Africa
7–10 Oct	7th Congress of the Balkan Geophysical Society http://www.eage.org	Tirana	Albania
November			**2013**
24–27 Nov	Second International Conference on Engineering Geophysics http://www.eage.org	Al Ain	UAE
January			**2014**
20–22 Jan	International Petroleum Technology Conference http://www.iptcnet.org/2014/doha/	Doha	Qatar
June			**2014**
16–19 Jun	76th EAGE Conference and Exhibition incorporating SPE EUROPEC 2014 http://www.eage.org	Amsterdam	The Netherlands

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