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Preview

August 1997

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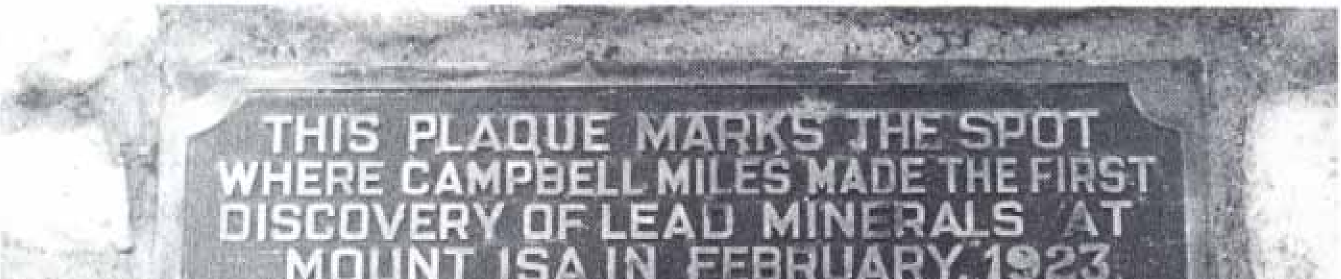
Special Feature:



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Editor's Desk

I felt quite pleased with my efforts on my first *Preview*. Thanks to a generous inheritance from Mike Shalley there was plenty of good stuff to publish. I have to admit that I all but spent this inheritance and had to do the hard yards myself for this issue.

The art of the editor is to attract stories, articles and news briefs from wherever possible. To that end I have been emailing just about everyone I suspect has a lurking story. If you haven't heard from me yet... don't worry you will!

The last issue was delivered about 2-3 weeks after I would have hoped. Not too bad but it ran up against the deadline for this issue (15 July). Thus there was precious little time for people to respond to anything they may have read.

How to break this cycle? After the last deadline I received plenty of phone calls asking me when the deadline was... not the published deadline but the real one! It seems everyone has the same idea and whilst it is possible to make last minute edits and additions it is tough when the majority of copy comes in late.

Please help me by honouring the deadline. Further it would be appreciated if you could let me know in advance if you are planning to submit something.

A special note to all the petroleum geophysicists out there. Please help me to increase the petroleum content of your magazine. I am looking for both associate editors and other less regular contributors.

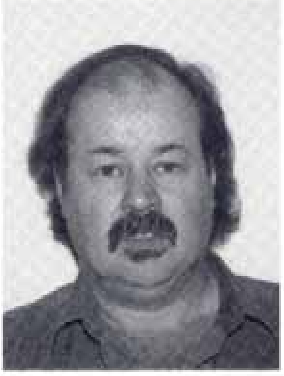
In the feature article this issue Mike Shalley writes about Geophysical Exploration at Mt Isa in what I'm sure will become a much referred to story. Not only this but also a sequel on the way. Look out John Grisham. In an earlier edition of *Preview* John Denham recalled the early exploration of the Gippsland Basin. Are there any more stories out there? I would like to hear from anyone with interesting tales from the past and the not too distant past with plenty of pictures to go with it.

Regards
Henk van Paridon, Editor

ERRATUM

The advertisement that appeared in *Preview* 68 on page 28 for **Zonge Engineering & Research Organization** should read ***"15 years in Australia, 25 years Worldwide"*** and not as previously stated.

President's Piece



I am not certain what rights I do have within the confines of this column. Will the Editor's discretion preclude the President's right of reply to vocal society members ? If this column is blank then the Editor is all powerful !

Our Society is charged with promoting Exploration Geophysics in Australia and from membership applications every month (estimated at about 15 - 20 per month) there must be a perception in the community that we must be succeeding. There is no way our society "has reached its zenith" - as per suggestion of Derecke Palmer in the last edition of *Preview*. The ASEG is possibly one of the most active Geophysical "Chapters" of the SEG around the globe and the Society's predicted demise is probably a severe miscalculation based on some very whimsical evidence - basically he believes there is a decline in the number and calibre of student intake; we have an ageing geophysical population and technical innovation is declining. I would like to briefly give my views on these assertions.

Obviously Derecke has better statistics on student numbers and the calibre of the intake of students into university. I would contend, however, that today's Graduates are of a far higher education with a much wider knowledge base than the Geophysical Geriatrics that pervade Derecke's geophysical world - I only wish I had their well rounded education when I left University (so does my employer no doubt).

On the subject of Geophysical Geriatrics or to Derecke's - "An Ageing Membership". We do not have the statistics currently available but even if our membership is "skewed towards the senior citizen end of the community", is this not consistent with the Baby Boom Generation and is this not consistent with other professions? This age gap does not prohibit information exchange between sage and pupil. Our senior citizens often learnt as they went and often did not have the mentor availability. I would contend that at the same number of years level the "Geriatrics" were often behind today's geophysical explorers in experience level. I would say the younger geophysical set are in a much more advanced geophysical position and will do more for this profession and society than a bunch of old f—t's bemoaning bygone tails of cunning and daring.

Technical innovation may appear to have declined particularly in the eyes of the Academic. This is not so, as currently there is a trend toward in-house R & D which precludes the open displays of innovation of the past. This industry based work is tailored toward discovery, which is industries success measure, and not publication. The "in-house" trend is fairly cyclical and will soon pass and some, if not all, of the work will be revealed which will then promote a new round of collaborative R&D.

Our overall profession unfortunately is still a boom and bust industry with the cycles largely out of our control and market forces will dictate numbers required. Within the confines of these cycles we must maintain a healthy environment for education and research, we must as, Derecke explains, promote our science to attract good quality students at high school level. Perhaps the ASEG through its local branches should be helping the Educators at career evenings or visit schools - are we doing enough to promote the cause that :

a) the world still requires natural resources and geophysics is an integral part of the discovery process.
b) the world is increasingly reliant on environmental engineering and hence geotechnical geophysical solutions to clean up previous discretion's (mining and others) and the world will rely on our science to help maintain a relatively healthy environment in the future.
c) geophysics is a fun job with possibly very good rewards.

I am sure that Derecke's letter will produce some good discussion. I do believe his catastrophic warnings are pessimistic but nevertheless they do serve to minimise complacency and hopefully will produce some constructive solutions to the Australia wide problem noted by most Science bodies of the lack of quality intake.

In conclusion I would like to suggest that Australia has produced some exceptional geophysicists and from what I see in today's younger geophysicist there is no doubt that we will continue to do so.

S.N. (Nick) Sheard
ASEG President

Sneak Preview

A prelude of things to come in *Preview*.

- *Geophysical Exploration at Mt Isa – Part II*
- *The Geophysics of the East SparGas Field*
- *Directions of Magnetisation and Vector Anomalies*

Preview Deadlines – 1997/8

October	September 15
December	November 15
February	January 15

Executive Brief

The new secretariat, Karen Foreman at Enterprising Events, is operational and we have all breathed a sigh of relief. Thanks to both Janine Verganadis and Karen, the changeover was achieved with very little fuss. We are still feeling our way with the which duties we want the secretariat to take on but hope that Karen's group will help with some of the Treasurer's work and the WWW management for starters!

There is much interest in the ASEG's WWW page. Why not take a look at it? The address is http://www.met.unimelb.edu.au/~aseg/. Lindsay Thomas, Bob Cornect, Koya Suto, Karen Foreman and a swag of interested parties are formulating ideas so get in touch with them if you have some suggestions. Some ideas so far include educational and promotional material from past conference student sessions, an Industrial News Update e.g. new products, acreage releases, people movements and scanning some Preview features such as "Women in Geophysics" and "Life as a Geophysicist".

To promote the ASEG internationally, we are co-sponsoring the SEG Japan International Symposium in December 1998 in conjunction with the SEG. There is no financial involvement except to promote the Symposium in our journals and to encourage our members to attend. In return, we will receive reciprocal promotion from the SEGJ for the ASEG conferences. John McDonald, the WA Branch Secretary is representing the ASEG on this matter.

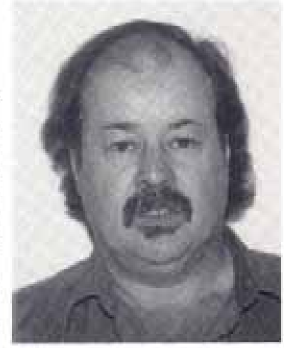
On financial matters, Peter Fullagar has tied up loose ends relating to the 1996 Financial Tax Return for the Society and provisional accounts have been passed to the auditor. The Society's financial status at 20th June, 1997:

Cheque account (0080 0044) balance	$ 60,568
Cash management account (0079 1483) balance	$ 26,797
Term deposit (CBA commercial bill)	$154,153
Cash management (Sands) account (0079 1475) balance	$ 9,536
Term deposit (Sands 5008 4219) balance	$ 40,000
Net cash:	~$291,054

Robyn Scott
Honorary Secretary

Personality Profiles

S.N. (NICK) SHEARD
ASEG PRESIDENT



Like many others Nick came to geophysics by chance Coming to Australia for a years' break between school (in WALES) and University in the UK he got a job with Mac Phar Geophysics as an IP Field Assistant in Kalgoorlie. This was great fun and highly educational for a Welsh country boy.

He took up a place at Flinders University in South Australia (1969) and after a false start of one year buckled down and managed a BSc Hons (1974).

He finally got a job with the BMR (now AGSO) and worked in Papua New Guinea doing seismic and magnetic observatory work for three years Returning to Australia (Canberra) he worked in the Airborne section doing Airborne Magnetic and Radiometric Surveys all over Australia for 5 years.

Private enterprise beckoned and in 1981 he joined Carpentaria Exploration Company (wholly owned MIM subsidiary). Working in Adelaide and Perth doing fairly standard geophysical exploration for gold and base-metals.

For a period of two years Nick joined CRAE at Broken Hill but finally rejoined MIM Exploration to take up his current position as Chief Geophysicist - supervising global geophysical exploration and their current R & D initiatives (1991).

After living in Mt Isa for a while Nick has been living in Brisbane since 1992 .Nick's family consists of his wife Dianne three teenagers, a dog and a cat.

His interests outside of work include fishing and following cricket and rugby. His particularly generous nature to others is demonstrated by his willingness to bet on Wales whenever they are playing.

KAREN FOREMAN
GENERAL MANAGER
ENTERPRISING EVENTS
ASEG SECRETARIAT OFFICE

Astute members will know the ASEG Secretariat has moved to Brisbane. Karen Foreman is the principal officer and owner of Enterprising Events. When members contact the secretariat they will likely encounter Naomi Kelly or Sandra Dunne. In future editions I will introduce both of them to you. Ed.

Unlike many in Brisbane Karen is a local. At high school Karen's focus was on the "hard sciences" ie physics, maths, biology. However after six months at university she decided that the business world was her true calling. In 1989 Karen graduated with a bachelor of Business - Communications from the Queensland University of Technology with a major in Public Relations.

Before and after graduation Karen gained four years experience in the hospitality industry working in hotels, restaurants and function centres. After graduation (and after deciding she didn't wish to work with the media on a daily basis) Karen moved directly into a position as a professional conference manager. Karen spent five years in this position. During this time she was heavily involved in the organising of the 1992 ASEG Conference at the Gold Coast.

In early 1995 Karen took the plunge and started her own business, Enterprising Events. In a little over two years the company has grown from an operation of one to employing eight fulltime and three part time staff. Enterprising Events provides management services for conferences,special events and association secretariats.

Karen has been married for two years to Lloyd Taylor. Karen & Lloyd have recently moved to a unit in St Lucia, a riverside suburb in Brisbane. They decided that the renovation of their traditional "Queenslander" house was a little too much when trying to run a business. Enterprising Events keeps Karen away from her many outside interests. When she is not in the office she enjoys an eclectic mix of sewing, fishing, cooking, entertaining & music.

Calendar Clips

September 4-5 1997
Funafuti to Mururoa
Stability or Chaos in Coral Reef Research - A Symposium
Sydney NSW Australia

September 14-18 1997
Exploration '97 4th Decennial Conference on Mineral Exploration. Toronto Canada

September 17 1997
PESA Queensland Petroleum Exploration Symposium

September 28 - October 2 1997
The Fifth International Congress of the Brazilian Geophysical Society (Call for Papers). Sao Paulo Brazil

September 29 - October 1 1997
South African Geophysical Association Conference '97
Swakopmund, Namibia

November 2-7 1997
SEG 67th International Exposition and Annual Meeting. Dallas, Texas, USA.

November 8-12 1998
Australian Society of Exploration Geophysicists 13th International Conference and Exhibition. Hobart Tasmania Australia

February 23-25 1998
International Conference on Airborne Electromagnetics
Airborne EM Conference

Details and more events on Pages 36-37.

ASEG Branch News

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The Branch Committee held a productive committee meeting on Wednesday, 4th June. Key issues discussed were the development of a local borehole calibration facility, and the introduction of a prestigious student award. Other issues discussed were the Christmas Party, A golf day, and contribution by the Queensland Branch towards the federal ASEG web site that will be coordinated by Bob Cornect. Members are welcome to contribute ideas towards any of these matters.

The Branch held one technical meeting on Wednesday, 9th July. Troy Peters, from Velseis Processing, presented the applications of the Mini-Sosie seismic acquisition technique for high-resolution subsurface imaging.

A meeting scheduled for August will feature "dry run" presentations from speakers attending an upcoming mineral exploration conference in Canada.

Andrew Davids
Branch Secretary

New South Wales

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The NSW branch continues to hold meetings on a regular monthly basis at the Rugby Club in Sydney. The June meeting was held in conjunction with SMEDG with a talk by Mike Fogarty and Steve Collins on the Geological and Geophysical exploration of Girilambone and Tritton Copper Deposits. This was a very interesting talk and gave a good overview of the project.

Keeva Vozoff's talk on EM was postponed for a month or so and will be held in the near future.

Timothy Pippett
NSW Branch President

ACT

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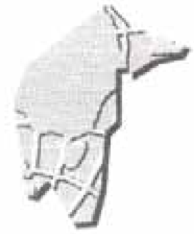

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Western Australia

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People

David Howard, Geophysicist from the Western Australian Department of Minerals and Energy, is having a sojourn as General Manager for airborne contractor Kevron Geophysics Pty Ltd.

Pat Cunneen, Managing Director of World Geoscience Corporation Ltd, has announced his retirement. His executive position will be assumed by fellow director Ray Steedman, recently of the EPA [Environmental Protection Authority].

Kim Chatfield, formerly from the Queensland Branch of the ASEG, has now arrived in Perth to take up office at Woodside Offshore Petroleum.

Back in May, we had technical presentations by petroleum speakers Jayson Meyers and Matthew Lamont. It was intended to be a quiet session, with many regular members away at the concurrent APEA conference. As a one-off, we had moved venue to The Witch's Cauldron in Subiaco, a restaurant renown for its wine cellar and culinary expertise with garlic prawns. And a good time was had by all. Such a good time, in fact, that we're hard at work to find reason to repeat the occasion.

Technical

New Reporting Policy for Airborne Geophysical Data

The Geological Survey of Western Australia [GSWA] has a new policy for reporting of digital data from airborne geophysical surveys acquired by WA explores.

The aim of the policy, formulated by the Mining Industry Liaison Committee, is to simplify reporting requirements and promote the concept of multiclient surveys.

Essentially, companies will make one of three choices [of survey type] when planning for an airborne survey:

Multiclient: where the data is available for resale while copyright of the data remains with the client enterprise;

Open Range: where the survey area includes less than 30% of tenements held by the client enterprise;

Tenement: where 30% or more of the survey area are tenements of the client enterprise.

For Open Range and Tenement surveys, the data will remain confidential for five years. However, it may be requested by the GSWA Director twelve months after the completion of acquisition, in the form of final gridded and located data.

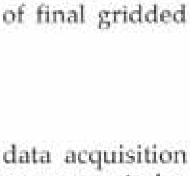
The Register

A register of airborne geophysical data acquisition will be maintained by GSWA. This will serve as an index of survey boundaries of all WA surveys flown, or proposed to be flown, each associated with a record indicating the location of the data.

This index is included with the GIS database called MAGIX, which also contains MAGCAT, the old index of airborne geophysical surveys.

The end result is that more exploration dollars are freed up for other activities without compromising the pace of geophysical data acquisition.

South Australia



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Things have still been fairly quiet for the South Australian Branch of the ASEG for the past few months, although things will be getting a bit more interesting as wine selection approaches. Look out for order forms by early to mid September.

Our June meeting featured Professor David Boyd of the University of Adelaide, who gave an interesting talk on the interpretation of high quality aeromagnetic data from the Eromanga Basin and its application to hydrocarbon exploration.

Our last meeting, held on the 15th July was the annual Industry highlights Night. It was an evening of diversity as Haines Surveys, Normandy Exploration, Preview Geoservices, Euro Exploration, Western Geophysics, beach petroleum, and Desmond Fitzgerald and Associates all gave short presentations on what was new in their geophysical niches.

The Adelaide Branch is sorry to see both Craig Gumley, as well as Grant Asser transfer to "greener pastures". Craig is heading for SANTOS in Houston, while Grant is switching to OCA in Brisbane. Both have contributed greatly to the Adelaide branch and will be sorely missed.

Michael Hatch
Branch Preview Scribe

Victoria

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The Victorian Branch met on the 24th of June 1997. Joe Cucuzza (Business Unit Leader - Exploration at AMIRA) presented a talk entitled: "Are we seeing the demise of exploration multi-client collaborative Research and Development in Australia?"

Joe's talk was well attended, and answered some of the questions frequently asked of AMIRA, the collaborative research organisation. Joe outlined the changing face of AMIRA, indicating that AMIRA needs to 're-invent' itself in the future, following avenues and possibilities that extend beyond the traditional collaborative research area currently adopted. The research community too needs to develop and encourage 'new blood' with broader horizons and innovative ideas, so that AMIRA's role can complement industry requirements. Industry needs to be more pro-active in working with AMIRA and look beyond 'competitive-myopia' (or lose the R&D technology focus that has taken decades to build).

Research is cyclic and R&D does fluctuate as a function of economic growth. In general there is a broad equilibrium between $$ for research and collaborative (multi-client) investors, but in Australia things could be slowing – it is only the overseas expenditure that is alluring and reassuring to "Research Organisations". Joe ended by warning that AMIRA, researchers and mining companies all need to adopt to change to make sure we don't weaken Australian developments in geophysics which are renowned throughout the world. A lively and passionate discussion then followed.

The Victorian Branch would like to take the opportunity to thank Janine Cross for her input to the branch. Janine has provided the Victorian Branch with enthusiastic assistance in her role in the Federal Secretariat. We wish her well in her future endeavours.

The Victorian Branch met on the 15th of July 1997. Professor Michael Zhdanov (Professor of Geophysics, University of Utah) presented a talk entitled "Advanced Methods of Underground Electromagnetic Imaging" based on his research with C.E.M.I. (Consortium for Electromagnetic Modelling and Inversion).

Inversion of EM data has been limited by the enormous amount of time required to compute a single forward model. The Born approximation had previously been offered as an option since its computational time compared to the full integral solution is very small. However the results of the Born approximation compare poorly with the true solution. Professor Zhdanov described the Quasi-Linear Approximation which was developed at the University of Utah. Like the Born approximation, the Quasi-Linear approximation can be quickly calculated; but unlike the Born approximation, the results are quite accurate. The non-linear forward problem is then converted into three consecutive linear problems. Since the Quasi-linear approximation is both reasonably accurate and swift, it can be used in inversion algorithms which arrive at the solution by iterative forward modelling. Michael Zhdanov went on to present inversion results from a Japanese MT survey.

Zhdanov showed movies which demonstrated the passage of electric fields within different conductivity models: 2 layer case, 3 layers where a body is within a conductive host, an Oil-Water contact model, etc.

Further information about the CEMI projects can be found at their web site:
http://www.mines.utah.edu/~wmcemi

The 1997/1998 Victorian ASEG Committee are:

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ASEG Library

The following is a summary of journals in the ASEG library. This library is held by the AMF on behalf of the society. For a more detailed list contact Koya Suto. Anyone wishing to borrow from the library should contact Julia Weir at the AMF. If you have suggestions about the library please contact Koya or send a letter to the editor of *Preview*.

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Abstracts of EGS Anuual Meeting	4
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Enhancement of Aeromagnetic Data Using Grey Level Co-Occurrence Matrices

Mike Dentith, The University of Western Australia
Duncan Cowan, Cowan Geodata Services

Introduction

Imaged processed high-resolution aeromagnetic data have become an essential tool in mineral exploration throughout the world and are also widely used in petroleum exploration. Where there are rock types with relatively large contrasts in magnetisation the method provides an extremely effective and cost efficient means of mapping geology in the absence of outcrop. However, where exploration is in geological environments where the rocks are only weakly magnetised the magnetic anomalies are much smaller and and even major geological structures may have only a very subtle expression.

To enhance subtle features in aeromagnetic data it is standard practice to calculate the spatial derivatives of the data. This approach is frequently very successful at highlighting subtle features not clearly apparent in the original data. A disadvantage of the use of derivatives is their susceptibility to noise. For example, levelling errors often create spurious gradients orthogonal to the flight direction and such effects are emphasised in the gradient data. Processing and enhancement techniques that involve the combination of multiple gradient calculations are thus particularly prone to such effects. However, improvements in data quality associated with precise positioning using differential GPS have led to significant improvements in the quality of airborne geophysical data and it is now possible to enhance such data based on relatively sophisticated analysis of the gradient information it contains.

A new, to aeromagnetics, processing methodology based on the statistical analysis of the spatial variations in gradients within the data has been shown to be extremely effective at enhancing detail in datasets where gradients are smooth. This approach, based on "grey level co-occurrence matrices" (GLCM), has the capability to extract vastly more geological information from aeromagnetic data that existing methodologies. Also, the methodology is extremely robust and does not emphasis flight line effects within the data.

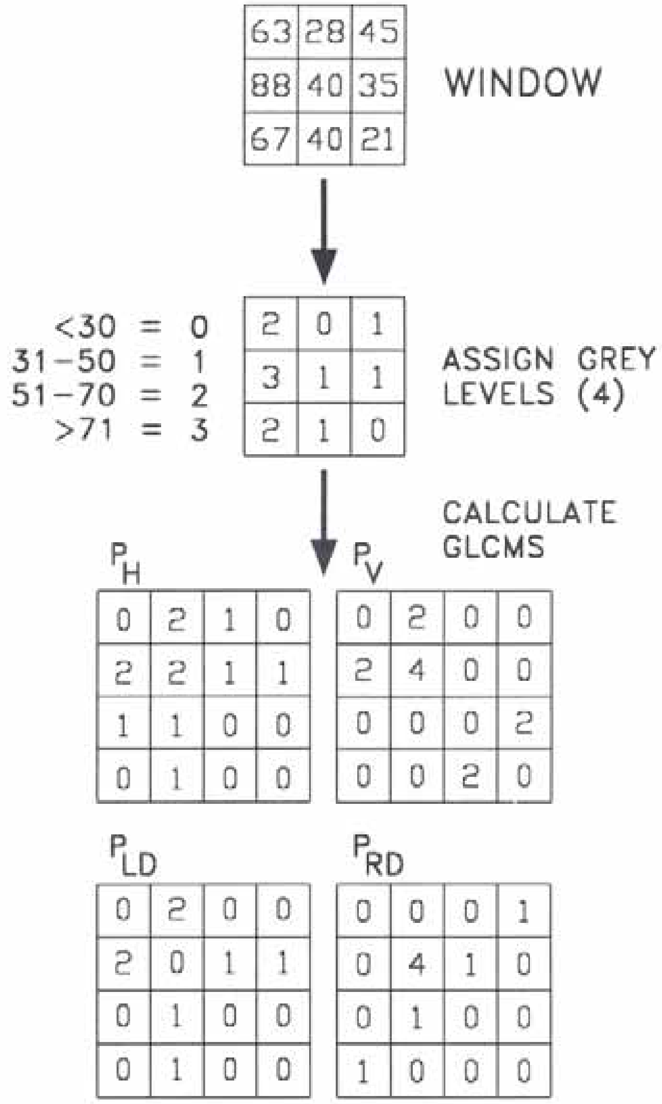

Figure 1. Simple example illustrating the calculation of GLCMs from a 3 x 3 data window. Redrawn from Dentith (1995).

Methodology

The calculation of grey-level co-occurrence matrices was first described by Haralick et al. (1973) who developed them as a method for quantifying textures as required for automated image classification. Preliminary results of their use in the enhancement of aeromagnetic data are described by Dentith (1995). The GLCM method quantifies the relative frequencies at which two pixels (grid cell values) of given amplitude occur separated by a given distance and in a given direction. These relationships are quantified in four matrices, corresponding to parallel to the grid lines within the data, and at 45° to the grid lines. These matrices are referred to as P_H -the horizontal direction, P_V -the vertical direction and P_{LD} and P_{RD} for left and right diagonal directions respectively. As applied to aeromagnetic data, GLCMs are calculated for a window which is progressively moved across the grid. Values assigned to each cell within the window are assigned to one of N_g grey-levels. In the example shown in Figure 1, the values within a 3 x 3 window are assigned to one of only four grey level (0 to 3). This results in 4 x 4 GLCMs. Each position within each matrix is filled as follows. Consider the element in the (0,1) position of the P_H matrix. The value, in this case 2, is assigned because grey scale values of 0 and 1 occur horizontally next to each other this number of times. For the (0,2) position pixels with values 0 and 2 occur horizontally next to each other once and hence the value in the P_H matrix at this location is 1. This process is

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Introduction

Imaged processed high-resolution aeromagnetic data have become an essential tool in mineral exploration throughout the world and are also widely used in petroleum exploration. Where there are rock types with relatively large contrasts in magnetisation the method provides an extremely effective and cost efficient means of mapping geology in the absence of outcrop. However, where exploration is in geological environments where the rocks are only weakly magnetised the magnetic anomalies are much smaller and and even major geological structures may have only a very subtle expression.

To enhance subtle features in aeromagnetic data it is standard practice to calculate the spatial derivatives of the data. This approach is frequently very successful at highlighting subtle features not clearly apparent in the original data. A disadvantage of the use of derivatives is their susceptibility to noise. For example, levelling errors often create spurious gradients orthogonal to the flight direction and such effects are emphasised in the gradient data. Processing and enhancement techniques that involve the combination of multiple gradient calculations are thus particularly prone to such effects. However, improvements in data quality associated with precise positioning using differential GPS have led to significant improvements in the quality of airborne geophysical data and it is now possible to enhance such data based on relatively sophisticated analysis of the gradient information it contains.

A new, to aeromagnetics, processing methodology based on the statistical analysis of the spatial variations in gradients within the data has been shown to be extremely effective at enhancing detail in datasets where gradients are smooth. This approach, based on "grey level co-occurrence matrices" (GLCM), has the capability to extract vastly more geological information from aeromagnetic data that existing methodologies. Also, the methodology is extremely robust and does not emphasis flight line effects within the data.

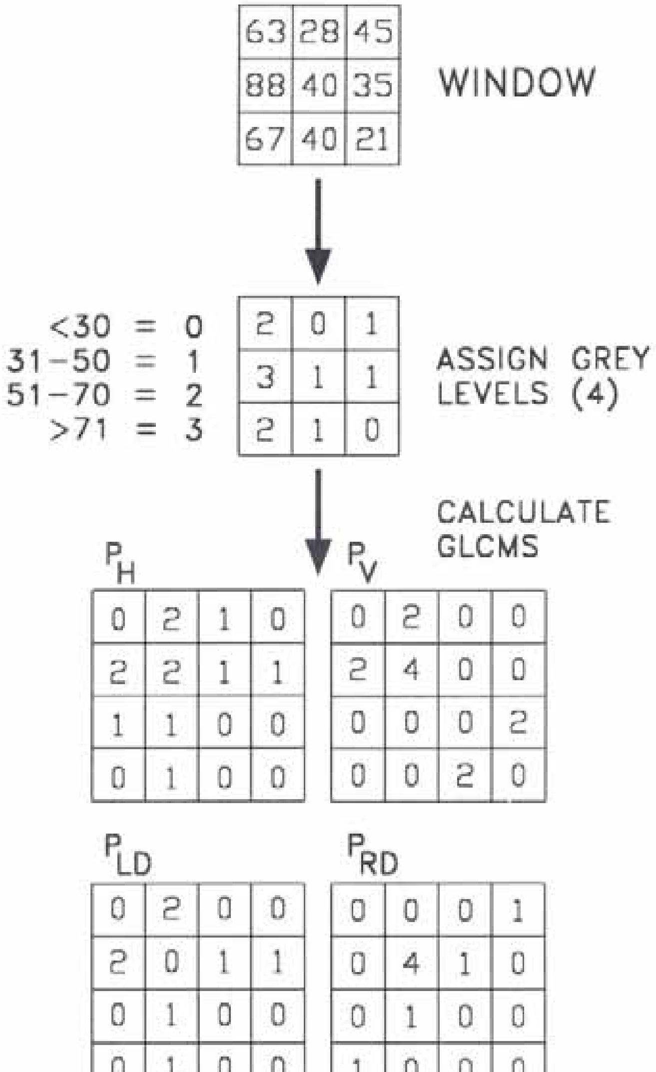

Figure 1. Simple example illustrating the calculation of GLCMs from a 3 x 3 data window. Redrawn from Dentith (1995).

Methodology

The calculation of grey-level co-occurrence matrices was first described by Haralick et al. (1973) who developed them as a method for quantifying textures as required for automated image classification. Preliminary results of their use in the enhancement of aeromagnetic data are described by Dentith (1995). The GLCM method quantifies the relative frequencies at which two pixels (grid cell values) of given amplitude occur separated by a given distance and in a given direction. These relationships are quantified in four matrices, corresponding to parallel to the grid lines within the data, and at 45° to the grid lines. These matrices are referred to as P_H -the horizontal direction, P_V -the vertical direction and P_{LD} and P_{RD} for left and right diagonal directions respectively. As applied to aeromagnetic data, GLCMs are calculated for a window which is progressively moved across the grid. Values assigned to each cell within the window are assigned to one of N_g grey-levels. In the example shown in Figure 1, the values within a 3 x 3 window are assigned to one of only four grey level (0 to 3). This results in 4 x 4 GLCMs. Each position within each matrix is filled as follows. Consider the element in the (0,1) position of the P_H matrix. The value, in this case 2, is assigned because grey scale values of 0 and 1 occur horizontally next to each other this number of times. For the (0,2) position pixels with values 0 and 2 occur horizontally next to each other once and hence the value in the P_H matrix at this location is 1. This process is

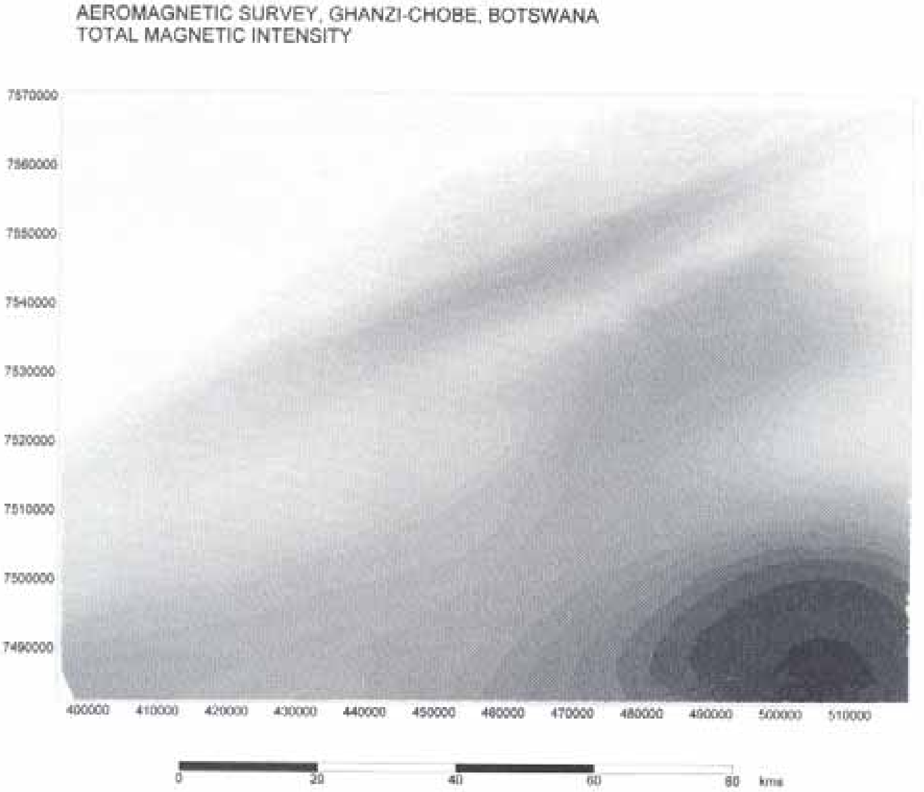

Figure 2a. Aeromagnetic data from the Ganzi-Chobe area, Botswana, a) TMI.

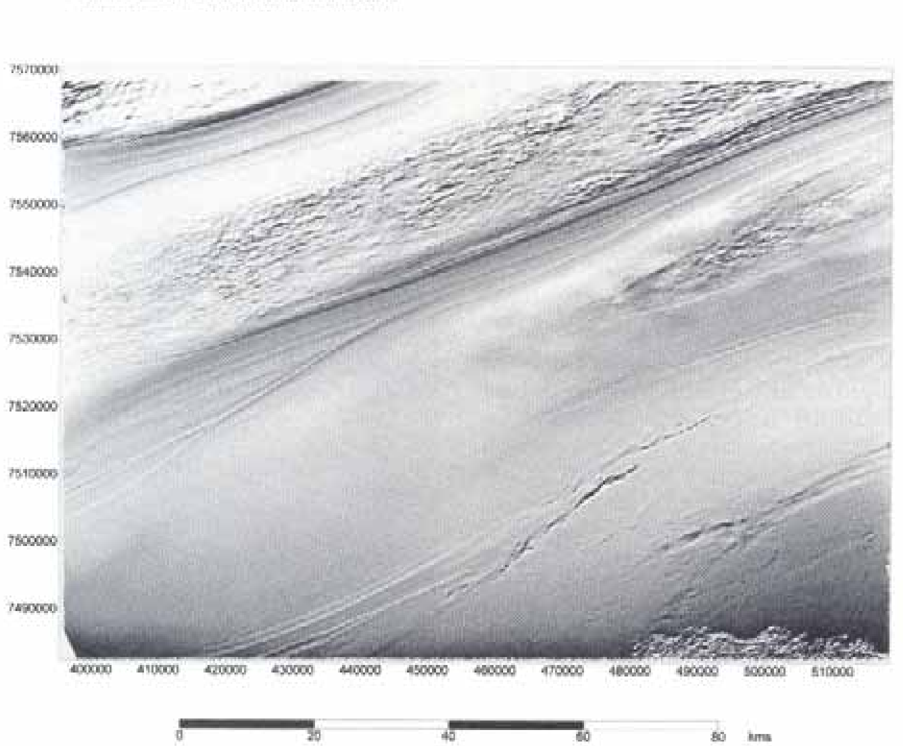

Figure 2b. Aeromagnetic data from the Ganzi-Chobe area, Botswana, b) 1st vertical derivative

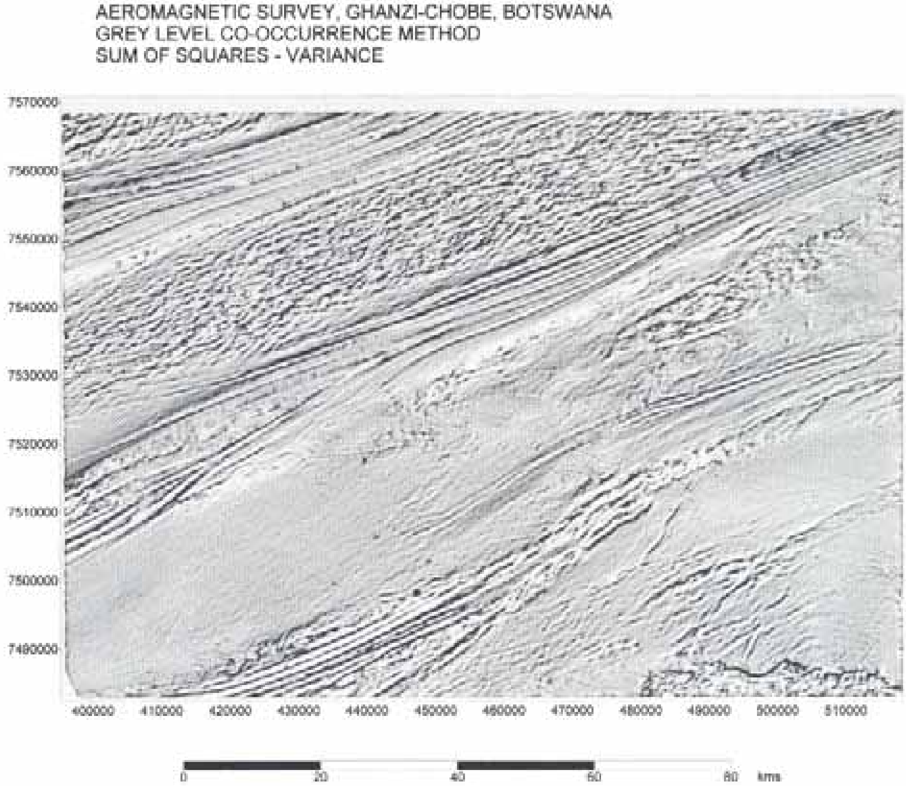

Figure 2c. Aeromagnetic data from the Ganzi-Chobe area, Botswana, c) sum of squares parameter calculated from GLCMs.

continued until values have been assigned to all the positions in all four GLCM matrices. These matrices are then used to calculate one or more textural measures/ parameters/statistics. Note that each parameter is calculated for each of the four matrices. The output from the GLCM filtering process may be any one of these four or the mean or range of the four. Haralick et al. (1973) suggest many different textural measures, but for reasons of space only one will be illustrated here, the sum of squares - variance parameter. To calculate the sum of squares, firstly the entries in the GLCMs are normalised by the total of all the entries in the GLCM, $p(i,j)$. i is the vertical index in the GLCM and j is is the horizontal index, (is the mean across the GLCM. The output of the GLCM filter is then claculated accordig to the following equation:

$$f = \sum_{i=1}^{Ng}\sum_{j=1}^{Ng}(i-\mu)^2 p(i,j) \qquad (1)$$

Sum of Squares: Variance

Example

Preliminary work applying GLCM-based filters to aeromagnetic data by Dentith (1995) produced best results in those parts of the survey area underlain by sedimentary rocks with comparatively low magnetisation. Subsequent work has confirmed that the GLCM-based methods are most effective when applied to areas of relatively subdued magnetic relief. This is illustrated using data from a survey flown in the Ghanzi-Chobe fold belt in northwestern Botswana.

The data from Botswana are public domain data collected during a survey financed by the European Development Fund (project no.7-ACP-BT-001). The survey was flown at a mean terrain clearance of 80 m, with 250 m flight lines oriented at 305° (McMullan et al., 1995). Figure 2a shows TMI data, and it is clear that little geological information can be extracted from the data. After calculation of a 1st vertical derivative more detail is apparent, for example, what are probably drainage features in the southeast of the image and lithological contacts in the south and southwest (Fig.2b). Also shown is an image of the sum-of-squares - variance textural parameter which has been calculated from GLCMs (Fig.2c). A great deal more detail is apparent in all areas of the image, including fold structures in the centre and clearer definition of the drainage features and lithological contacts over the entire image.

Discussion

Work so far completed has demonstrated that GLCM-based processing methods compare favourably with conventional filtering techniques. However, exactly how such filters respond to particular scenarios, e.g. local anomalies, edges, anisotropy etc. is not well understood. Also, there are multiple parameters associated with each the calculation of each parameter and the selection of the optimum combination remains a matter of trial and error. Research into the development of GLCM-based methods to enhance aeromagnetic data is currently the subject of a research proposal being developed through AMIRA. Companies interested in participation should contact Joe Cucuzza, Tel (03) 9679 9958, Fax (03) 9679 9900, email joe@amira.com.au.

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Early Geophysical Exploration at Mount Isa
Part I: The Beginnings

Mike Shalley

I am indebted to the many people who contributed to the early geophysics at Mount Isa and to Dave Crabb, Tim Bennett, Bill Murray and Bill Langron for sharing their memories of the old days. I thank librarians Robin Carlile (MIM Exploration Pty Ltd) and Helen Hooper (Mount Isa Mines Limited) for access to old reports, magazines and photographs. Finally I thank the management of MIM Exploration Pty Ltd for permission to publish the article and the photographs. Knowing that articles of this type are commonly subject to the "unreliable memoir" syndrome (apologies to Clive James) I urge readers to feel free to comment or correct if necessary.

The Big Find

The Mount Isa Mine was discovered in 1923 by Campbell Miles (Figures 1 & 2) and, to claim it as a geophysical discovery, we would have to establish that he was a geophysicist - a troublesome task with history firmly stacked against us. Campbell was not keen on formal education and ran away from school to work in a Melbourne boot shop, later employment including ploughman, miner, carter, railway navvy, wild pig hunter and windmill repairer (Blainey, 1960). Blainey notes that he was curious, observant and careful so it is not surprising that, after some years of mining, fossicking and prospecting, he was sensitive to physical property contrasts and knowledgeable about their application to wealth making.

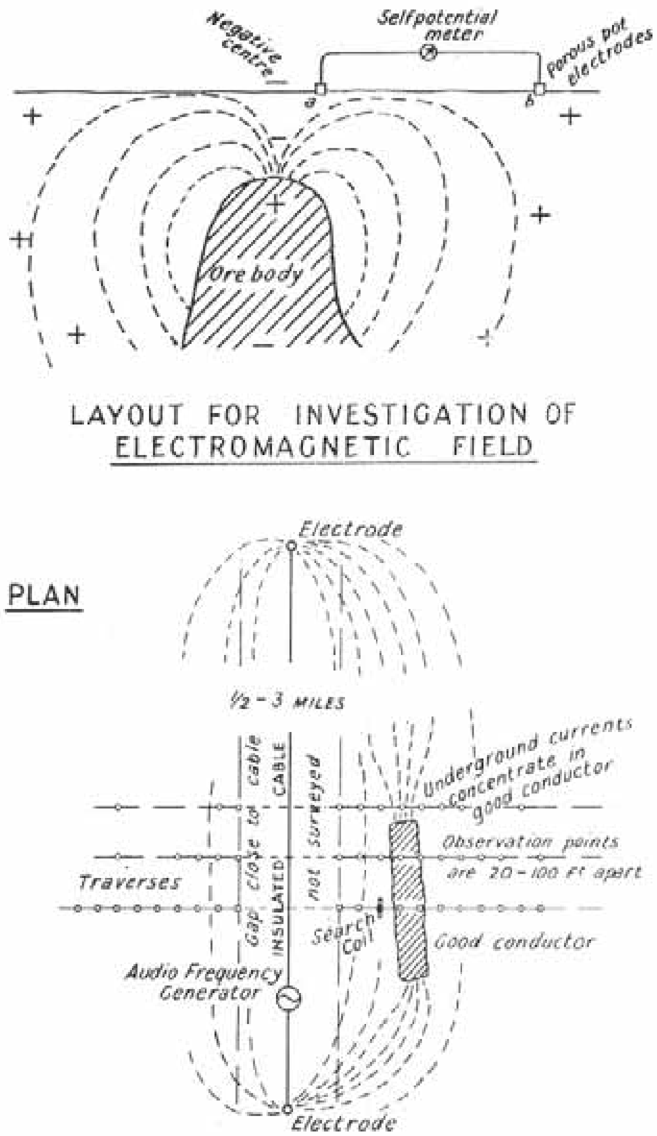
Figure 1. Campbell Miles returns, in the 1960s, to the scene of his momentous discovery.

Figure 2. Plaque commemorating the discovery.

There can be no argument that physical property contrasts had a lot to do with the discovery. The first clue was the spectral characteristics (visible reflected light) of the rocks on a low range of hills near that memorable crossing of the Leichhardt River. Campbell was attracted by the hills and, stopping to tap a yellow-brown rock with his farrier's hammer, was surprised at the weight of the sample. That was the second clue - the density contrast of the rock. So, we might claim that Campbell Miles was a self taught geophysicist but always admitting that there would be plenty of other groups to claim him as their own, e.g. mineralogists, geologists, physicists etc.

Development of Geophysics

Australia was among the most progressive countries of the world in the development and application of exploration geophysics with serious work beginning in the '20s. The work of the Imperial Geophysical Experimental Survey has already featured in the pages of *Preview* (Issues 51 and 52/53, 1994) in articles by Ken McCracken so it is sufficient to say here that the survey was conducted under the joint auspices of the British Empire Marketing Board and the Commonwealth Government, each contributing £16 000 ($32 000) towards the cost. Australia was chosen as the test area because it was "fairly characteristic of many parts of the British Empire".



Figures 3a and 3b. The self potential and turam methods as illustrated by Sepp Horvath in 1936.

This was followed by the massive Aerial Geological and Geophysical Survey of Northern Australia (AGGSNA) in the 1930s. Although Mount Isa itself did not feature, a number of prospects in the region, such as Trekelano (copper) and Dugald River (silver/lead), were covered by geophysical surveys. Sepp Horvath of the Swedish geophysical company ABEM was a leading light in the introduction of geophysics, while J. M. Rayner and P. B. Nye ran several of the early surveys. Both the experience gained and some of the personnel from those operations flowed later into the Bureau of Mineral Resources Geology and Geophysics (BMR, now known as AGSO) which was formed after the second world war and began operations in about 1946/47. Two surveys at Mount Isa were conducted in the '50s by the BMR and these will be mentioned below.

The chosen group of methods included self potential (SP), resistivity and other variations of electrical methods, electromagnetics (EM) including turam, and of course, magnetics. Figures 3a and 3b from Sepp Horvath's 1936 report show details of the application of the SP and turam methods as used at the time. Although limited success might be claimed the results were generally not exciting and many of the problems we were later to confront were already becoming evident. In particular conductive bodies, such as schist and graphitic slate, often produced stronger responses than the target ore.

But we begin the operational part of our story with something quite different and more exciting.

The Great Uranium Rush

I'm sure that many of you will remember the nickel boom in Western Australia in the late '60s and early '70s but I wonder how many will remember the great uranium rush of the '50s in Queensland. I myself was leading a moderately quiet life in Victoria at the time and was blissfully unaware of such things as geology and geophysics, the existence of Mount Isa or the fact that the Australian Government had offered a reward of £25 000 ($50 000) for significant deposits of radioactive minerals. The reward had, in fact, already been won by Jack White, a prospector who had discovered uranium at Rum Jungle in 1949 while searching for other minerals.

In the early '50s Berger Schultz, a Mount Isa prospector, brought a sample to MIM which proved, on analysis, to contain uranium and possibly gave rise to the name "Glowing Hills". Soon afterwards the town became the centre of a very serious and competitive search.

Tim Bennett, who had had previous experience with the BMR in the regional mapping of the Mount Isa area, had joined MIM to assist the then Chief Geologist, Clem Knight, with mapping projects. He was assigned, almost immediately, to the uranium search and began by setting up the first significant airborne geophysical survey in Queensland and the second in Australia. The first in Australia had been commissioned by the South Australian Government, also in the search for radioactive minerals, and Tim visited that state to study the methods being used there.

Instrumentation available at the time was very primitive by today's standards. The radiation detector was a Halross 939 scintillometer with a one inch NaI crystal and an 840V dry battery serving as the HT supply. It was designed for ground use but, for this survey, was mounted in an Auster J5, a three passenger monoplane powered by a Gypsy engine. It was a light weight aircraft, fabric covered with tubular airframe and timber (spruce) main spar. The crew for the survey comprised Tim Bennett (navigator/recorder), Ken Findlay (instrument observer) and the pilot. The original pilot was an English chappy but he didn't last long and was replaced by an Australian, Reg Burrows who, according to one informant, had experience as a crop dusting pilot.

The parameters of the survey were simple but demanding. Navigation was by aerial photograph (RAAF 1:25 000), terrain clearance was "tree-top height" (looking up at the galahs), instrument observation was visual and verbally communicated, and recording was by hand-written chinagraph annotation direct to the aerial photographs. For survey planning the country around Mount Isa was divided into single photograph blocks and flight paths were pre-drawn on each photograph. To make use of the best flying conditions the team set out at first light but flew two sessions during the day to complete the required coverage. Work began with the "winter" months of 1954 and continued through to October when conditions were getting quite uncomfortable and thermals made flying much more difficult. Anecdotal evidence suggests that there was, at times, nothing to spare between the treetops and the aircraft undercarriage as samples of twigs and leaves sometimes returned to Mount Isa with the plane.

A large number of small uranium occurrences were discovered during the programme and ground crews were constantly updated on results of the airborne work to facilitate the timely pegging of appropriate areas. The ground crews were equipped with portable Geiger counters to fix the position of interesting anomalies and test their extent before pegging. Among the occurrences located were "The Three Brunettes" named after the wives of the three crew, "The Six Kangaroos" for obvious reasons I guess, and Leyden's Ridge from Tim's mother's maiden name.

Although the company had no competition in the air, the survey was keenly observed from the ground by opposition pegging crews who took a great interest in the locations being pegged by MIM. It was this activity that created the rush mentality. The position of the aircraft was also monitored closely by compass triangulation, and this may have been a factor in the discovery of the big prize, Mary Kathleen, which fell to a local consortium headed by Clem Walton.

At the critical time the MIM survey was operating a little to the north of the then unknown Mary Kathleen and the aircraft was due for its 40 hour service so, after completing the day's work, the plane and crew were returning to town with the prospect of a week-end off. The flight path took the explorers right over the virgin deposit but, presumably with some relief after a hard day in the air, the scintillometer was turned off so nothing was registered. The deposit was discovered by Clem Walton's ground crew and the news hit the town during the weekend. All hell broke loose but it was too late for MIM and an unhappy ending for the crew which had forged new records in the timely development and operation of new exploration methods.

Early Ground Geophysics

The application of ground geophysics at Mount Isa was less dramatic than the great airborne survey described above. The first serious work was done by the BMR in 1953 and is reported by J. (Sepp) Horvath and W. J. (Bill) Langron (1956) in BMR Record Nos. 118 and 119. Bill Langron also reported on the surveys to the local population through the pages of Mount Isa Mines magazine "Mimag". The first survey covered a limited part of an area then known as the Northern Prospect or Northern Leases but now much better known as the Hilton Mine. Methods used included EM (turam), SP and vertical force magnetics, a similar combination to that adopted by the AGGSNA surveys, and quite possibly with some of the same instrumentation.

The large loop transmitter of the turam survey gave it some chance of reasonable penetration but the results gave early warning of the problems of carbonaceous shale which haunted us in later years. However there was some degree of success and the Hanging Wall Pyrite, close to the known mineralisation, was probably the source of one anomaly. SP was not successful over the mineralisation but produced good anomalies (about 200mV) over the Magazine Shale, a carbonaceous unit. The magnetic results showed a distinct rise to the west of known mineralisation and was attributed at the time to buried Templeton Granite. We now know that the response was due to a faulted section of Eastern Creek Volcanics west of the Mount Isa Fault. Figure 4 shows a typical magnetic response from the survey.

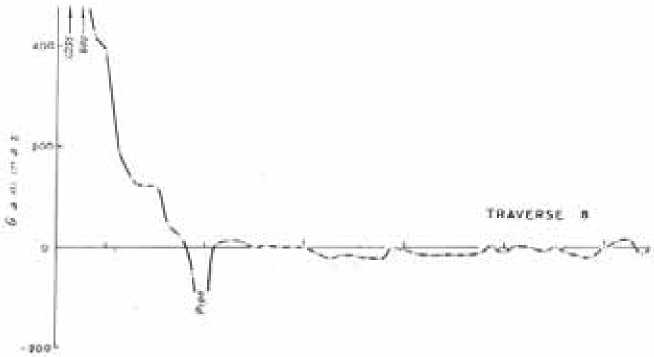


Figure 4. Typical magnetic response over the Northern Prospect, Mount Isa (Horvath and Langron, 1956).

The second survey, of even smaller extent, was conducted over the Mount Novit prospect, south of Mount Isa, with the same suite of methods. The results proved to be disappointing and no follow-up was recommended.

Early methods used by MIM included magnetics with a Hilger and Watts vertical force variometer, self potential (SP) with a Cambridge pH meter, and electromagnetics (EM) with a portable dip angle slingram system designed and built by ASARCO (American Smelting and Refining Company) MIM's then majority shareholder . Some gravity work was also done, but using the services of the legendary Lou Richardson who was best known for his world beating mathematical formulation of the magnetic anomalies of ellipsoidal bodies.

The early geophysicists were recruited from the discipline of physics and included Gary Hughes (MIM) and Roy Stubbs (CEC, or Carpentaria Exploration Company). Experienced geophysicists were few and far between and advice was actively sought from the few available sources including Lou Richardson and ASARCO geophysicists in the USA, Bob Lacy (Chief Geophysicist) and Cal Moss.

Surviving records of early surveys include a moderately successful SP survey over the Black Rock secondary copper body (Gary Hughes) and SP, EM and magnetic surveys at McArthur River (Roy Stubbs). The latter were a mixed bag and showed the problems of SP caused by black soil and late season desiccation of the surface. The magnetic method was deemed successful in defining structure although the low anomaly level of 10 to 20 gamma (now nT) was a concern, especially in view of problems with magnetic storms. The EM, though not short on anomalies, was judged to be very short on penetration. A limited gravity survey at McArthur River by Lou Richardson was judged to be successful.

Induced Polarisation (IP)

IP, the new geophysical technique for the detection of metallic minerals (particularly sulphides) became available in the late '50s and was quickly adopted by Australian explorationists. ASARCO, who had an active geophysical exploration group at Salt Lake City in Utah, USA, had designed their own IP system and, as part of the group, MIM were supplied with instrumentation and expertise to get things moving in Mount Isa.

Roy Stubbs, assisted by instrument engineer Owen Ahnfeldt, scored the trip to Salt Lake City to learn the basics of the instrumentation and the method. That was in mid 1962 and Stubbs reported that, in the US, the design and production of instrumentation was already well advanced. The two camps representing time and frequency domain were already in place, represented by Newmont and MIT in the first case and McPhar in the second. Cal Moss, who designed the ASARCO system went with the time domain and that was what was delivered to MIM in August 1962.

After the arrival of the equipment MIM set about a program of testing and instrument modification to suit the local circumstances. It quickly became apparent that there were problems of instrumentation and/or procedure to be sorted out since there were strange results, including unexplained negative responses, to cope with. However Stubbs left the company in early 1963 providing me with the opportunity of graduating into geophysics.

I arrived in the town in March 1961, taking up my first posting with MIM, after graduating with a geology major from the University of Melbourne. I was met by Tim Bennett, now Chief Geologist, whose first question to me was "What do you know about geophysics?". Well, I was able to tell him that I'd done a unit at university called 'Elementary Geophysics' but could hardly call myself a geophysicist. There was not much more said about it at the time and I went about my assigned duties as a mine geologist until my big break came with the departure of Roy Stubbs. Geophysicists were not easy to come by at that time and I was offered an Honours year upgrade in geophysics at the university of my choice following a satisfactory year as instrument operator with MIM's geophysics section. This was a generous offer and easy to accept.

The solution of the IP problem was not quite so simple, but with assistance from the US and MIM's Instrument Workshop, a workable system was put into place and earlier recommendations by Stubbs, including tank modelling, were implemented. Other players at the time were Lindsay Duus, also seconded from Geology, and Le Furlong, an Alaskan migrant of considerable presence, who had worked with Stubbs in McArthur River.

The construction of the IP instrument and its deployment in the field are of some interest historically. The power and potential modules, though housed separately, were connected by insulated rods to form a single operating unit. Instrument power was supplied by a nickel/cadmium battery while transmitter power was supplied by dry batteries housed in four boxes with nominal potentials of 450V DC each (on-load potential was, of course, somewhat less). In those early days the batteries were the big old 45V jobs which some of you might remember as the B supply batteries used in the valve operated radios of remote farms not connected to the state electricity grids. A four second timing switch controlled the power pulse and a large vacuum switch was used to eliminate the arcing which is normally associated with high voltage DC switching. Current reversals were achieved manually using an external reversing switch.

The heart of the potential module was a 1 megohm impedance electrometer with switching circuitry and pre-amplification to provide maximum sensitivity of 0.002 volts (full scale deflection) in the measurement of the secondary voltage. There was also a synchronising system comprising a light in the power module, a transparent connecting rod, and a photo diode with timing circuitry in the potential module. The net effect was a 0.45 second delay between the measurement of the primary and secondary voltages by the electrometer.

The equipment was mounted in a Land Rover (mainly to accommodate the rather heavy battery power supply) and electrode placements were handled by a crew of field assistants (Figure 5). Current electrodes in those early days were stainless steel pegs and potential electrodes the usual copper/copper sulphate non-polarising type. The Wenner electrode array was used initially with spacings of 250 and 500 feet. Three electrode arrays and variations were added later.

Interpretation aids were very basic but ASARCO was able to supply us with 2D calculation charts, similar to the well known gravity dot charts, for the calculation of the anomalies of reasonably simple 2D bodies. The chart elements were fairly coarse so precise definition of target bodies was not possible. Another limitation was that no resistivity contrast was allowed. In order to model bodies that were both chargeable and conductive we used tank modelling with plaster of Paris bodies containing various mixtures of crushed pyrite and chalcopyrite.

Control of experimental conditions was a significant problem because the calcium sulphate matrix of the body began to dissolve as soon as it was suspended in the water-filled tank, but, fortunately, that was a slow process. It had the effect of reducing the resistivity contrast between body and background, a problem also associated with the copper sulphate filled non-polarising electrodes used. There was also the problem of the size limitations of the tank, especially in the case of the three

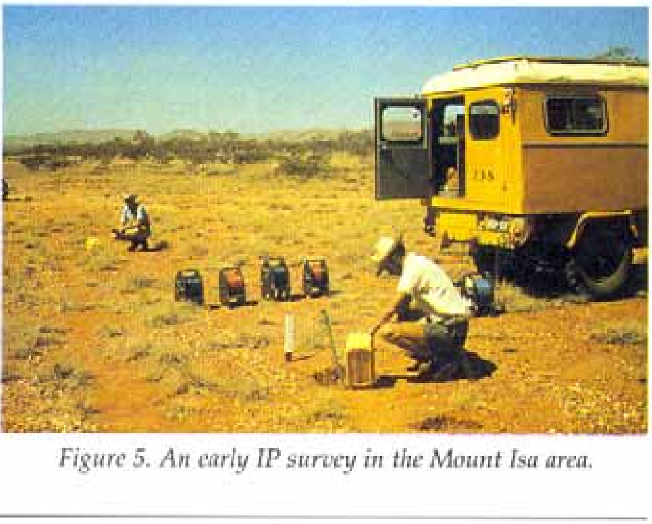


Figure 5. An early IP survey in the Mount Isa area.

electrode array which required an "infinite" current electrode. The same problem gave very little scope for comparing electrode spacings over a target body. Nevertheless, the results were very useful and gave us a reasonably sound basis for interpreting our field data.

Part II of this story will continue in a forthcoming issue with some modelling and field results from the Mount Isa area as we confronted the problems of exploring for sulphide mineralisation in a black shale environment.

Further Reading

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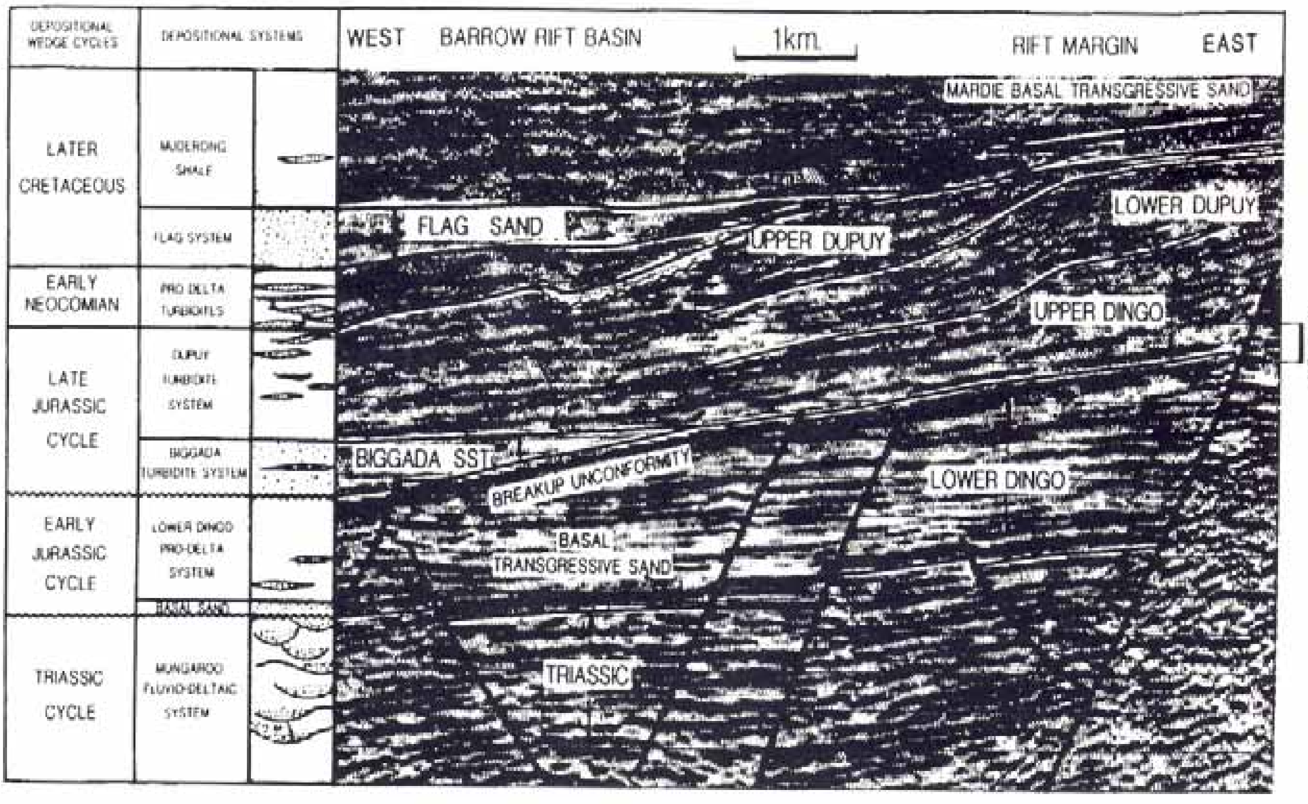
Seismic Window

with

Rob Kirk
BHP Petroleum

The following Example is taken from the Carnarvon Basin, Western Australia

Carnarvon Basin, Western Australia. Seismic character of Late Jurassic sequences in vicinity of major localised elastic entry point into the Barrow Subbasin, east of Barrow Island. Georgette 1 drilled the Biggada low stand fan pinchout, but was dry.



Clean and Green

Airborne Geophysics for Salinity

Geoff Pettifer, Geo-Eng Australia Pty. Ltd.

Introduction

The Clean and Green column has been in abeyance for a while and with pressure of other duties, Derecke Palmer, former Associate Editor has entrusted the care of this column to me. We hope to bring you some stimulating articles on groundwater, engineering and environmental geophysics in the coming issues of *Preview*. Thankyou Derecke for your past efforts.

This issue is devoted to salinity, Australia's No 1 environmental problem affecting the land. Geophysics is leading in mapping the problem and recently the Commonwealth Government with support of the States, has funded a major initiative, the National Dryland Salinity Program (NDSP) airborne geophysics project, to fly a number of catchment areas in Australia with airborne EM systems, magnetics and radiometrics to assess airborne EM and it's capability in mapping catchment salinity, in conjunction with other datasets. Overseas, these high resolution EM, magnetic and radiometric data sets are regarded as vital tools for providing quantitative information on which to base the development of sustainable land and water management programs. In Australia, although the rising groundwater problem and subsequent salinization of land has been apparent to land holders for decades, it is only over the last 10 years that Australia has really started to come to terms with these problems and to use airborne geophysics.

Two very different airborne EM systems which are applied to salinity mapping, predominate in Australia - the Australia developed World Geoscience Corporation (WGC) SALTMAP fixed wing system and the Canadian technology based Geoterrex-Dighem Pty Ltd DIGHEM$_{LANDCARE}$ helicopter system. Both systems were tendered and were successful in participating in the NDSP, with five areas being flown (three by SALTMAP and two by DIGHEM$_{LANDCARE}$.

This article, has a brief description of the NDSP and of both airborne EM systems. The article was put together with major contributions from: Greg Street (Agraria, a division of WGC); Peter Jackson, Mike Hallett and Steve Kilty (Geoterrex-Dighem Pty Ltd); Ross Brodie (AGSO); and Peter Woodgate and Isabel Coppa (NDSP Project Co-ordinators - Natural Resource Systems).

Figure 1. Extent of saline land in Australia is hard to estimate due to unreliable reporting statistics. ABARE used the percentage of farmers reporting a salinity problem as a more reliable indicator (Courtesy WGC).

Figure 2. Farmers can implement farm plans incorporating shallow drainage banks as seen here and trees with a higher degree of confidence if sub-surface processes are better understood (Courtesy WGC).

Salinity Problem Overview

Although Australia's landmass is vast, only about 10% of the continent is suitable for agriculture. Today, these agricultural areas are under threat from a silent, and increasingly costly, hazard - rising groundwater levels leading to dryland salinity. Many thousands of hectares have already succumbed and the problem is predicted by all authorities to continue to increase in magnitude unless there is concerted action to reverse the situation.

The problems associated with land salinization are becoming more urgent and even urban areas, such as Wagga Wagga, and their water supplies are now under real threat. The problem has become so significant that it now commands national political and media attention. Predictions from the latest independent "State of the Environment" Report commissioned by the Federal Government points, for example, to one-third of Victoria's irrigated region becoming too saline for agriculture within just 20 years. Also in Western Australia alone around 9% of once productive land is now salt-affected and this will grow to around 15% in 15 years. Figure 1 shows the extent of the dryland salinity problem in Australia.

The understanding of the storage and mobilisation of salt in the Australian landscape is fundamental to the development of remedial action to treat Australia's major environmental problem, the salinisation of agricultural lands. The loss of land due to salinity and other degradation of farming land has spawned the Landcare Movement in Australia, a unique development to alert the community to the problems and their solutions. The rapid growth of Landcare illustrates the perceived urgency for remedial action that is the perception of rural Australia. Figure 2 shows one type of remediation carried out in WA. The first decade of Landcare has resulted in increased awareness of the size of the problems. The need to maximise the effectiveness of every dollar spent on remedial work has resulted in a call for better information particularly about the sub-surface processes that control land salinisation. In the next decade of Landcare farmers will need better information to make their remedial decisions.

National Dryland Salinity Program

The airborne geophysical survey for salinity detection project is managed through the National Dryland Salinity Program (NDSP) and is funded through the National Landcare Program administered by the Commonwealth Department of Primary Industries & Energy (DPIE). The Land and Water Resources Research and Development Corporation (LWRRDC) of DPIE is managing the NDSP. LWRDDC have appointed Peter Woodgate (assisted by Isabelle Coppa) of Natural Resource Systems as the Project Co-ordinator. AGSO and the CSIRO are also participating.

AGSO (as part of DPIE), through geophysicist Ross Brodie, is supervising the acquisition component of the project. AGSO's role is technical adviser to the LWRRDC. AGSO prepared the technical specifications and tendering documentation for the airborne geophysical data acquisition and processing component, which will be carried out under contract. AGSO made a technical evaluation of the tender bids and presented these to a selection committee comprising representatives from each of the Commonwealth and State agencies. AGSO is also administering the contracts. This includes inspecting the contractors' data-acquisition and -processing quality controls, and distributing and archiving the resultant maps and datasets.

State agencies are contributing ground-based datasets and follow-up field-checking to facilitate interpretation and evaluation. The contributing State agencies are the Queensland Department of Natural Resources, the New South Wales Department of Land and Water Conservation, the Victorian Department of Natural Resources and Environment, and Agriculture Western Australia.

The objectives of the airborne geophysics project under the NDSP, are to assess the contribution that airborne geophysics data (specifically time domain EM, frequency domain EM, magnetics and radiometrics) can make, in conjunction with existing datasets, to the understanding and management of dryland salinity. This will be achieved through trial evaluations in five selected catchments.

The focus of the project will be to evaluate the usefulness of airborne geophysics in conjunction with other datasets to define geological characteristics and to measure three dimensional variability in conductivity and in the regolith system. Furthermore the spatial variability in soil characteristics will be observed. The analysis will allow the derivation of products such as maps showing salinity hazard, soils, regolith conductivity & thickness, structural controls on hydrogeology and geological interpretation. These derived products will be integrated with other datasets to specifically assist with the development of land management plans at appropriate scales and to contribute to the understanding of hydrogeological processes.

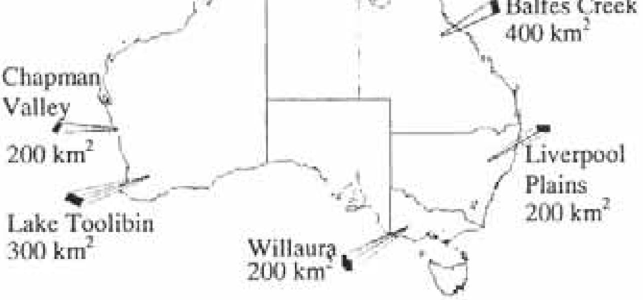


Figure 3. The areas selected for airborne geophysical surveying under the NDSP (Courtesy AUSGEO News - AGSO)

The experience gained in the project will enable cost benefit analysis and confidence level estimates associated with the use of airborne geophysical and other data to be made.

The improvement of the skills and experience of land managers in dealing with geophysics datasets and the effective communication of outputs and benefits is a further task of the airborne geophysics project. The final output will be guidelines for land managers to combat dryland salinity using geophysical and other data sets.

Areas to be Surveyed

Areas in five catchments will be surveyed (Figure 3). The data acquisition and processing will be carried out by Geoterrex-Dighem Pty Ltd (GD) and World Geoscience Corporation Ltd (WGC) as follows (survey dates subject to rescheduling if the weather is inclement):

- Liverpool Plains (15 km west-southwest of Quirindi), 12 May to end May (GD);
- Willaura (3 km west of Willaura), late May to early June (WGC);
- Balfes Creek (20 km southwest of Charters Towers, early-mid June (WGC);
- Chapman Valley (15 km northeast of Geraldton), early-mid September (GD); and
- Lake Toolibin (30 km east-northeast of Narrogin), late July and Sept-Oct (WGC).

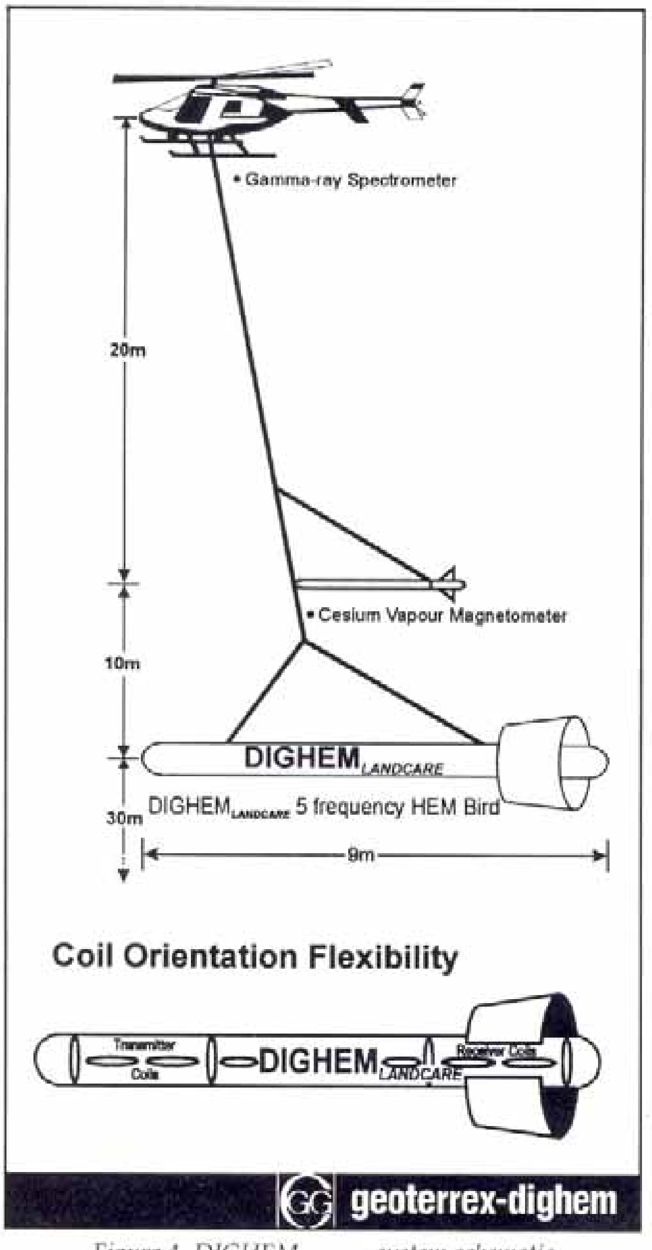


Figure 4. DIGHEM$_{LANDCARE}$ system schematic (courtesy Geoterrex-Dighem)

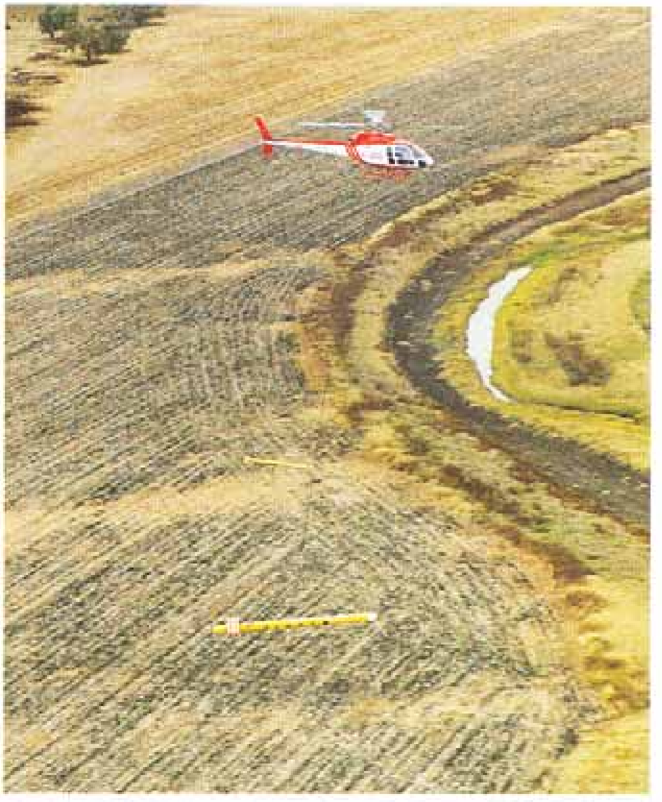


Figure 5. The DIGHEM$_{LANDCARE}$ system on survey (courtesy Geoterrex-Dighem)

For more information on the NDSP airborne project, contact Ross Brodie, AGSO Tel. (06) 249 9607

DIGHEM

For the past 25 years, DIGHEM helicopter EM systems have been helping people understand groundwater, salinity and environmental processes and assisting their efforts to introduce programs to develop sustainable land and water management practices.

Geoterrex-Dighem is using the DIGHEM$_{LANDCARE}$ system for these surveys; a five-frequency EM system that is ideally suited to this Land Management application. The system (Figures 4 and 5) operates with two towed birds. The larger, 9 metre long bird contains five EM transmitter/receiver coil pairs and flies 30 metres above the ground, whilst the smaller bird 10 metres above contains a magnetometer. The system also includes a spectrometer installed in the helicopter flying 60 metres above the ground.

The DIGHEM$_{LANDCARE}$ system uses a range of frequencies from 56,000 Hertz through the mid range of 7,200 and 5,500 Hertz, and down to the lower frequencies of 900 and 400 Hertz. The higher frequencies provide information about the very near surface and the lower frequencies about progressively deeper parts of the sub-surface. Map products include both apparent conductivity maps and conductivity depth slices as well as conductivity cross-sections. In this way a 3D view of the ground's conductivity can be generated.

Geoterrex-Dighem claim many distinct and significant advantages to using the $DIGHEM_{LANDCARE}$ system for these type of surveys:

- **Rapid Surveys**
  A $DIGHEM_{LANDCARE}$ survey provides a "Snap-Shot" of the conductivity variations in the survey area. $DIGHEM_{LANDCARE}$ surveys take only a few days to complete whereas ground methods can take months to cover the same area. Surveys can also be quickly repeated a few years later to compare and evaluate the effectiveness of programs and changes to land management practices.

- **Small Footprint Size**
  The small "footprint" of the $DIGHEM_{LANDCARE}$ system provides information at a "paddock scale". Detail at this scale is vital for effective planning of remedial action at the farm or sub-catchment scale.

- **Root Zone Accuracy**
  The highest frequency can measure the conductivity in the vital "root zone" (the top 2 to 3 metres) highlighting possible areas of near surface salinity requiring immediate attention.

- **Cross-Sectional Detail**
  Cross sections detailing the sub-surface conductivity are easy to produce with the $DIGHEM_{LANDCARE}$ system and can pinpoint areas that potentially are at threat from salinity in the future.

- **Multi-Sensor System**
  The $DIGHEM_{LANDCARE}$ system is the only system able to collect high resolution EM, magnetics, radiometrics and digital terrain model data all on the same flight. This provides immediate comparability of different data sets.

- **Comparable to Ground Conductivity Meters**
  The $DIGHEM_{LANDCARE}$ system uses exactly the same principles as the GEONICS ground conductivity meters but whereas each ground conductivity meter operates with a single frequency, the $DIGHEM_{LANDCARE}$ system collects data using 5 different frequencies. In effect, the $DIGHEM_{LANDCARE}$ system is 5 ground conductivity meters in one. This is a major advance over the limited capabilities of instruments like the EM38 and EM31.

- **3-D Mapping Capability**
  Using 5 frequencies allows the $DIGHEM_{LANDCARE}$ system to create not only the standard apparent conductivity maps but also conductivity cross-sections ("Sengpeil Sections") of the sub-surface from the near surface to depths in excess of 100 metres depending on the conductivity of the ground. This allows a 3-D perspective of the survey area to be generated.

A comprehensive and collaborative interpretation and integration of the data sets will be undertaken in conjunction with the State Agencies. To bring additional hydrological and hydrogeological expertise to bear on the project, Geoterrex-Dighem has formed a strategic alliance with Sinclair Knight Merz, a leading groundwater consultancy group. Geoterrex-Dighem will fly the survey areas and process the data at their Sydney Processing Centre whilst Sinclair Knight Merz will study, amongst other things, the hydrogeology, undertake groundwater modelling, recharge/discharge mapping, and a statistical analysis and classification of the radiometrics to generate soil characteristics maps. The two companies will integrate these studies with both the existing data and the newly acquired geophysical data and make it accessible to a wide range of users through the GIS systems of the State Agencies involved.

Figure 6. SALTMAP aircraft a Britten Norman Trislander with transmitter loop strung around extensions to nose tail and wing tips (Courtesy WGC).

The data contained in these GIS databases will include maps, cross sections and interpretive products that will enable landholders, community and catchment management groups access to all the available data and implement better farm and catchment planning and sustainable land and water use practices.

For further information on DIGHEM contact: Peter Jackson, Geoterrex-Dighem Pty Ltd, Tel: (03) 9418 8077.

SALTMAP

In April 1996 World Geoscience Corporation (WGC) was presented with the BHP National Landcare R&D award for the development of SALTMAP (Figure 6), a new airborne electromagnetic system designed for mapping conductivity variations in the near surface to assist in environmental and regolith mapping studies. The design and building of SALTMAP has been a three year joint program by WGC in collaboration with CSIRO funded by a Generic Technology grant from the Department of Industry, Technology and Commerce through it's GIRD scheme.

The project has had a heavy emphasis on hardware development because although initially it was flown on the same aircraft as the WGC QUESTEM system SALTMAP is a completely new instrument. QUESTEM and other comparable systems derived from the Barringer INPUT system pulse the transmitter loop and have an off time to measure the secondary field whereas SALTMAP does not. The task of accurately processing signals from the near surface requires both a high transmitter frequency and a high sampling rate of the secondary field. Thus transmitted signal of 500 Hz is significantly higher than other systems. Combined with a rapid sampling rate of the secondary field at 10 microsecond intervals out to 1 millisecond good definition of the conductivity variation in the top 50 metres of the ground is possible.

SALTMAP as the name implies was primarily developed to assist in the understanding of the storage and mobilisation of salt in the Australian landscape. WGC has been researching the application or airborne geophysics for dryland salinity since 1987 when the first surveys using magnetics and VLF-EM were flown at Yornaning and Cartmeticup in the south-west of Western Australia (Street, 1992a). Since 1987 some 30 catchments with salinity problems in all Australian states have been investigated

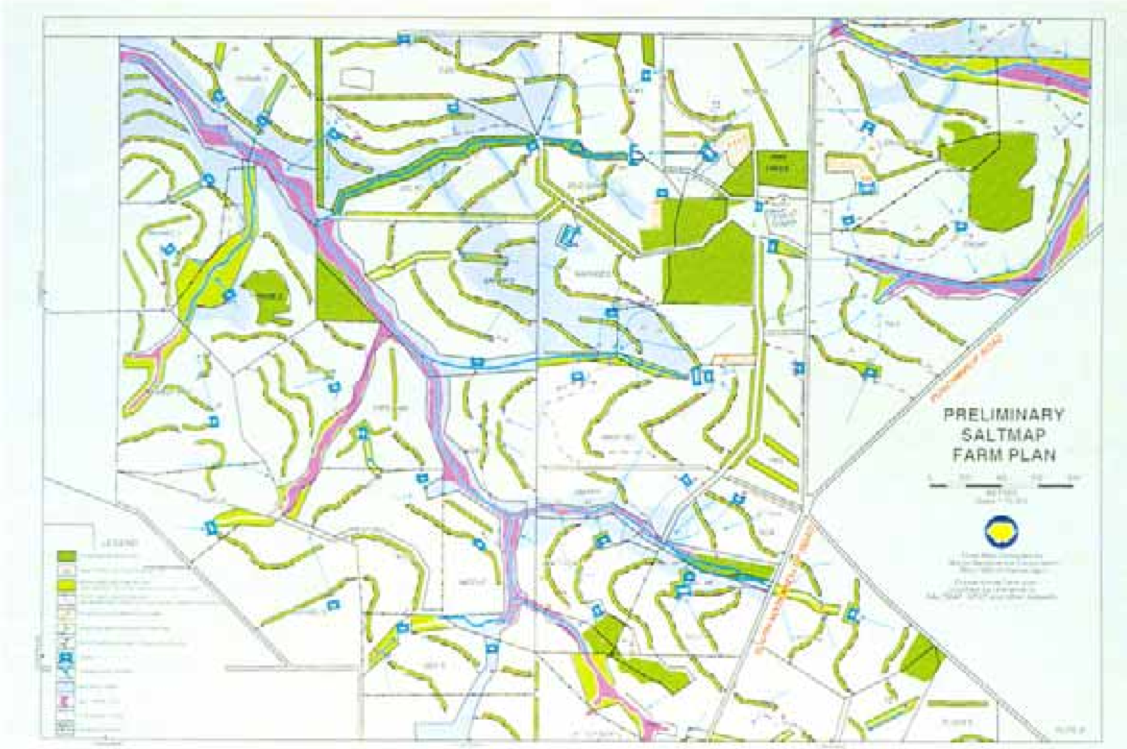


Figure 7. Farm plan developed using SALTMAP and other ancillary data (Courtesy WGC).

under joint programs with the National Landcare Program (Anderson et al 1993), State Departments of Agriculture, mining companies and farmers.

While ground conductivity can be related to the amount of salt in the ground other information is needed to understand how that salt may be mobilised by groundwater and concentrate in the surface to produce saline scalds. Other datasets that are typically used by a mineral exploration geologist such as satellite images, airphotos, magnetic data, radiometric data, and opography all assist in understanding the processes that lead to areas becoming saline. Because understanding salt movement is closely tied to understanding geochemistry and the processes of regolith formation, a study of a saline catchment has many parallels with an exploration program.

The end result however is not a mine but a new design for the landscape that will allow farming to continue in a sustainable way (Street, 1992b).

At Broomehill in the south-west of Western Australia where the first SALTMAP survey was flown the farmers have developed farm plans based on the results of a project that combined SALTMAP with all other available data both reflecting surface and sub-surface conditions.

In this project more than 15 different sets of data were collected. These included data that reflect man's influence on the landscape such as cadastre and the extent of remnant vegetation as well as a rectified airphoto mosaic, SPOT satellite imagery data, digital topography and a map of the soils. All these datasets reflect the surface condition of the landscape but give little insight into the subsurface processes. Using these data a farmer is likely to concentrate his remedial work on the symptoms of salinity without an understanding of the causes. Many large scale tree plantings of saline areas fail because the water and salt continue to accumulate in the surface around such plantings.

At Broomehill WGC used airborne geophysics to lead to a better understanding of sub-surface processes. Thus airborne geophysical surveys using the SALTMAP system and magnetics/radiometrics were an integral part of the project. The conductivity information obtained combined with the geological interpretation showed the geological controls on salinity while the radiometrics was used to interpret the regolith and weathering process that formed the landscape.

Combined with surface information these data were used to formulate a catchment scheme and farm plans (see example in Figure 7) with a high degree of confidence in their success in combating land degradation.

For more information contact: Greg Street, Agraria Ltd (A division of World Geoscience Corporation),
Tel: (08) 9273 6400.

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Making Data Readily Accessible

Peter Harvey, Queensland Supercomputing Laboratories, Brisbane, Australia
Graham Farebrother, Pacific Resource Information Centre, Brisbane, Australia

Many geophysicists report spending less than half their time imaging, modeling, interpreting, and analyzing data. The majority of their time is spent searching for, loading, formatting, and correcting data. Exploration is slowed, extending time-to-market, delaying cash flow, and imposing direct and indirect costs (including scientists' salaries).

Further, inefficient data management squanders time and attention scientists could otherwise devote to refining their interpretations. This adversely affects drilling risk and recovery economics by reducing the quality of exploration and production decisions.

Solutions to the data challenge are emerging in the form of databanks - facilities that organize, digitize, preserve, integrate and correlate large quantities of data, and make these data readily accessible. By clicking on a map display users can browse terabytes of data nearly in real time and summon data entry by project, location, vintage and/or other parameters.

Perhaps a half dozen databanks are being implemented worldwide; others are in planning stages. In simplest terms a databank infrastructure consists of a high -performance data server with a high I/O capacity, tied to a high-capacity robotic tape storage/retrieval unit and high-speed tape drives. The server runs data management software capable of managing very large 3-D seismic data sets and disparate data types including seismic and well data in various formats, maps, observers' logs, and other scanned (imaged) and digitized data.

The Pacific Resource Information Centre (PRINCE) databank at Queensland Supercomputing Labor-atories (QSL), Brisbane, Australia, is typical. QSL is a business unit within the Division of Exploration and Mining of Australia's Commonwealth Scientific Industrial Research Organization; PRINCE is a joint project of QSL and the Queensland state Department of Mines and Energy (DME), plus three technical partners: Hewlett-Packard (which supplied the data server), Petroleum Exploration Computer Consultants (the software for transcription, quality assurance, meta data capture, archiving, and data browsing); and Storage Technology Corporation (the robotic silo, a tape storage and retrieval unit).

By making seismic data and related information readily accessible, PRINCE, is designed to attract exploration teams to Queensland. Additionally, once the data are easy to retrieve, explorers can periodically reprocess Queensland seismic using new, more effective algorithms and techniques. This has the potential to reveal overlooked hydrocarbon traps. For example, in August 1996 an E & P company requested a dozen lines, of 1982 vintage - 230 km in western Queensland - for reprocessing.

Scalable infrastructure

The PRINCE databank has a highly scalable infrastructure. Scalability enables the facility to handle virtually any quantity of data over the long term while maintaining or improving the databank's performance, and while preserving QSL's hardware and software investment.

A databank installation requires tremendous I/O and storage capacity plus robust data management software to load and manage large 3-D seismic data sets. QSL's data server - an Exemplar scalable parallel processing system with eight RISC processors - has an I/O capacity of 250 megabytes per second (Mbytes/s) scalable to 2 gigabytes per second (Gbytes/s).QSL has equipped the server with 1 Gbyte of memory and 100 Gbytes of disk storage, both readily scalable.

The databank has a current storage capacity of 28 terabytes (Tbytes), scalable to 300 Tbytes by fully populating the silo. By adding silos and tape drives QSL can further scale the system's capacity to thousands of terabytes. However, the current capacity will hold all of Queensland's current E & P data plus other large data initiatives in which QSL is involved.

Flexible resource allocation. Besides managing E & P data, QSL provides high-performance computing resources for other applications. In support of Queensland's extensive mining industry, for example, researchers use the system as a parallel-processing compute server for modelling the propagation of microcracks through rock and for sampling coal slurries.

The system runs any combination of parallel processing and data-throughput jobs simultaneously, up to the limit of the available processors. This can be done "on the fly." The systems administrator can, from a graphical interface, redeploy processors with a few mouse-clicks even while these processors are running applications. This provides extraordinary flexibility in configuring computer resources to fit QSL's changing requirements. Further, running the databank and multiple high-performance parallel applications in one machine has made the facility more economically attractive.

Data management challenge

Queensland has been explored since the 1890s... its first documented seismic was shot in 1949... the first commercial oil field was discovered in 1961... 2763 wells have been drilled and approximately 310,000 km of seismic shot. The state government requires that a copy of all seismic and well information acquired in the state be delivered to DME. The department has been collecting and storing this E & P data since exploration began.

As a result, PRINCE faces a daunting challenge: Approximately 50,000 reels of 1/2-inch 9-track tape holding roughly 4 Tbytes of seismic data languish in cardboard boxes stacked on pallets in a warehouse near Brisbane. The 6,000 m^2 multistory warehouse also stores well logs, maps, film and sepia sections, company reports, core samples, and other documents and artifacts pertaining to Queensland E & P projects over the past century.

Perhaps as many as 50,000 additional tapes belong in the warehouse but are missing: data loaned out and never returned, and seismic surveys never delivered to DME in the first place. PRINCE recently began contacting companies to recover the missing digital data and related information.

Many companies - especially those that have changed hands - often don't know what data they have stored away in boxes. Many have willingly delivered their unknown data collections to DME, thereby reducing their storage cost. These data are all but useless in their current undocumented state, but PRINCE has endeavoured to transform them back into accessible assets.

The transcription of data began in February 1996 and the "scrubbing" - transcribing, quality-assuring and correction - of the first 30,000 tapes should be finished in three years. As of late August 1996, 18 seismic surveys had been transcribed and associated documents scanned into the databank, occupying 450 Gbytes and 80 Gbytes respectively.

Data are being reproduced in the format in which they were originally recorded, including SEGB data, SEGD multiplexed and demultiplexed, SEGY raw and stacked, and UKOOA navigation data. There are also LIS and LAS format well tapes, and CGM+ files submitted in lieu of film or sepia sections.

The PECC software complies with the Record Oriented Data Encapsulation data standard adopted by SEG; this enables modern high-density tape systems to accommodate legacy record-oriented data formats such as SEGB.

PRINCE is scanning company reports, seismic sections, observers' logs, survey notes and any other support data submitted by explorers. PetroVision software logically links the resulting images to the digital data. Documents are scanned in TIFF Group IV format. Items are tied to a survey name, well name, location and/or permit number. This allows users to specify a permit number and vintage range, for example, and quickly access all relevant seismic, well data and documents. Data can also be accessed intuitively by clicking and zooming on a map display. The software includes a map-based browser with a digitized geographical map of Queensland installed, along with co-ordinates, well locations, seismic lines and their vintages, and ATP - Authority to Prospect - permit boundaries. Many of these data were transported from DME's MERLIN database.

Quality assurance has become a major part of the job. Labelling errors have been found in up to 50% of the surveys being transcribed. Common errors include tapes labelled with the name of the area rather than the survey name.

File ranges and shot points are often wildly inaccurate. ATP permit numbers often are wrong. Sometimes a half dozen legacy databases must be searched to determine the data's correct identity.

Eventually all data will be transcribed, scrubbed, stored and managed as they are submitted. For the present, however, transcription efforts are focused on rescuing data from tapes made in the early to mid-1980s. Tapes from this era use an oxide-binding material that absorbs moisture, rendering the tapes almost unusable. PRINCE "bakes" them in a specially designed oven at 65° C to drive out moisture and harden them, then reads the delicate tapes using a tape drive custom-modified to extract and verify the data.

Summary and conclusion

E & P data management remains a significant stumbling block to efficient geoscience, imposing major costs on explorers. However, emerging databanks are integrating often-chaotic legacy data and make these terabytes of data readily accessible. The databanks also will enable users to leverage the emerging high-performance Internet and high-band-width communications, the increasing use of multimedia techniques to add value to data, and the burgeoning data volumes generated by higher-resolution acquisition.

A typical databank configuration consists of a scalable parallel processing data server, a robotic silo, and software for map-based browsing, data management, archiving and QA. As such databanks proliferate, geoscientists will devote more time and attention to what they do best: adding value to E & P projects.

Acknowledgments

Many thanks to the following for their editorial assistance: Peter Green, senior geologist, Queensland Department of Mines and Energy, and Graeme Hart, business development manager, Integrated Systems, Asia-Pacific Region, Hewlett-Packard Corporation.

1997 AGC President's Report

Registration of Geoscientists

At the 1996 Annual Meeting of Council I identified registration of geoscientists as an issue of continuing priority for the Council.

Over the last 12 months, AGC has focussed on a facilitating role in discussions of key aspects of the professional registration issue.

During November, a major survey of 196 individuals and organisations was undertaken to obtain an indication of their understanding and possible implications of registration for geoscientists. The high return rate of 37 percent reflected very strong interest in this topic, with returns showing a high level of general awareness of the issue of registration. As to the perceived impact of registration on individual organisations, the main areas of impact were identified as reserve/resource reporting, stock exchange reporting, and training.

Survey responses reflected wide recognition of the value of professional registration and general rejection of a punitive,restrictive approach to it.

Following strong support in this survey for more extensive discussion of the registration issue, in March 1997 AGC sponsored fora in Perth and Sydney to consider various aspects of registration for geoscientists, including the benefits, costs, ethical standards, competency, continuing development and reciprocity. The CEO of The Institution of Engineers Australia presented a valuable paper on their experiences with professional registration.

Positive outcomes from these fora included informal agreement between AusIMM and AIG that it is in both their interests that registration schemes are as similar as possible and that close cooperation will lead to mutual benefits. Other professional societies are recognising the benefits that come through cooperation.For example, PESA recently decided to approach AIG to assist in registering geoscientists in the petroleum field of practice under the AIG registration scheme.

AGC has been commended by several participants for taking the initiative in arranging the fora. AGC recognises that it has an ongoing role in facilitating discussion of professional registration with government, industry and the community.

MARINE GEOSCIENCE : PLAN FOR DEVELOPMENT (*see postscript)

In the early 1990s, in a major study of geoscience in Australia entitled Towards 2005, AGC identified marine geoscience as a key area for national development. Subsequent reviews by other groups confirmed these findings.

In the 1996 budget, one bright spot for marine geoscience was the government's decision to retain a national marine geoscience mapping and research capability. Following sustained lobbying by key groups, including AGC, the Government decided to continue funding over a further two years to enable basic mapping by AGSO of the Australian Ocean Territory.

Later in 1996, Science Minister McGauran announced the formation of an expert Working Group to assist development of Australia's National Marine Science and Technology Plan. Several geoscientists were included in this group and AGC nominees also contributed to the initial draft of a FASTS marine science policy.

In March 1997, following a Marine Geoscience and Technology meeting in Perth which was co-sponsored by AGC, it was decided to set up an AGC working party to develop a Marine Geoscience and Technology Plan.

The AGC plan will be presented to the 1997 Annual Meeting for adoption before it is submitted to the national Working Group set up by the Minister. It is hoped the AGC submission will lead to a government commitment to sustained support for a vigorous, innovative and efficient marine geoscience sector.

SUBMISSIONS TO WEST AND STOCKER REVIEWS

In its submission to the West Review of Higher Education, AGC recommendations focussed on the need to link resourcing in the university sector with community and industry needs. AGC recommended recognition through adequate resourcing of existing centres of specialisation and excellence in earth science research, inclusion of Geology/Earth Science in programs of secondary science teacher education, development of funding models which take account of graduate employment outcomes, and recognition of the significance of applied geoscience to the Australian economy.

AGC also provided input to a FASTS submission to the Stocker Review of Science and Technology in Australia.

ACTIVITIES OF FASTS

AGC is a member of a national science federation representing 40,000 scientists - FASTS, the Federation of Australian Scientific and Technological Societies. Our membership enables geoscientists to maximise their access to and influence on national science decision-makers. The importance of FASTS for AGC was highlighted in late 1996 when the Prime Minister announced that FASTS would be a member of his new Science and Engineering Council, PMSEC.

Following input by several peak bodies including AGC, in January FASTS announced an updated list of Top Ten Policies for Australian Science and Technology into the 21st Century; these policies are:

1. A National Vision for Australia to 2020 and Beyond

FASTS urges the Government to determine a national vision for Australia's sustainable development, and to establish what science and technology is needed to support that future. This process, working through a national summit, should set broad national priorities.

2. The Differential HECS Fees and Science

FASTS recommends that the Government monitors science enrolments in universities and the impact of differential HECS fees, and takes immediate remedial action should there be any significant decline in numbers.

3. Science and Mathematics Teaching

The Government must address the decline in the quality and quantity of teachers in science and mathematics, and the lack of rigour and substance in

Australia's science and mathematics curricula and teaching practices. All students should be taught by appropriately qualified teachers. HECS charges for teaching education should be in the lowest bracket.

4. Encouragement of Private R&D

Funding for private R&D should be increased to internationally competitive levels. Peer-reviewed competitive grants should be used as a mechanism to distribute funds and ensure the quality of research, and the Government should address the shortage of long term venture capital by encouraging superannuation funds to invest in R&D.

5. Restructuring the Universities

Australia has too many universities to be able to offer high-quality science courses in all disciplines at all institutions. FASTS advocates a restructuring process that guarantees access to high-quality science education and research, and which may involve amalgamation or shared teaching.

6. Provision of Career Paths for Scientists

Too many young scientists face uncertain careers on short term funding. More talented people, especially women, need to be attracted into scientific careers through better remuneration and more secure career paths, with real opportunities to obtain competitive research funding.

7. Infrastructure in Research Organisations

The Government is urged to accelerate its program of replacing worn-out equipment, libraries, computer facilities and buildings in research organisations.

8. Basic Science

A higher proportion of Government funding for science should be directed to basic science, to underpin future developments in applied science.

9. The Australian Ocean Territory

Australia needs to boost its scientific exploration of the AOT in order to exploit marine and seabed resources in a sustainable manner. Government should ensure adequate funding is directed the research agencies in this area, including the provision of a scientific marine fleet.

10. Protection of Intellectural Property

The protection of Australian intellectual property is as vital as its discovery and development. Patent costs should be an allowable R&D expenditure.

OTHER DEVELOPMENTS

Apart from some promising signs on marine geoscience, national geoscience development continues to be downgraded. The Coalition's two budgets and Forward Estimates identify funding cuts which will bite deeply across many earth science departments. The Australian Geological Survey Organisation (AGSO) has been cut. CSIRO has been hit with an "efficiency dividend".

The immediate challenge for all involved with geoscience is to convince government that science and technology based knowledge is essential for our survival in a globalised economy.

COUNCIL MEMBERSHIP CHANGE

I regret to advise that the Australian Geomechanics Society (AGS) terminated its membership of the Council in December 1996.

The AGS was a member of the Australian Geoscience Council for some 15 years and I have written to them to express our appreciation for their sustained and significant support over that time. AGS provided the Council with the important and distinctive perspectives of a key discipline within the geosciences. AGC will miss that input in future.

NOTABLE CONTRIBUTIONS

I want to thank all members of the Executive Committee who have put considerable effort into progressing several major issues over the past year. I particularly want to thank my predecessor as President while the Committee was based in Perth, Professor Chris Powell; his involvement this year as Past President and AGC representative on the FASTS Board has been of great value.

I especially wish to note the generous support and assistance of AGSO. By making the time and travel costs of Mr Geoff Wood and Dr Clinton Foster available in their roles as Secretary and Treasurer, AGSO has made a major contribution to the work of the Council. Despite major budget cuts in 1996 which forced some curtailment in the level of secretariat support available in early 1997, AGSO recently have reaffirmed their commitment to provide AGC with the secretariat support without which key activities would need to be cut severely.

FUTURE ACTIVITIES AND EXECUTIVE ROTATION

Over the next year, AGC will build on its facilitating role on the issue of registration while endeavouring to meet the challenges posed by a growing range of government/industry taskforces/reviews and inquiries. All Adelaide-based members of Committee have agreed to continue for another year, which will take AGC through to the mid-1998 biennial move to a new Committee based in Brisbane.

I thank all incoming officeholders for their continuing support and hope that the Council will continue to prove effective in its work as the peak body for geoscience in Australia.

Dr G R T Hudson
President
Australian Geoscience Council

Please note that at the 1997 Annual Meeting on 17 June, Mr Jon Hayes of AGSO was elected as the new AGC Secretary; if you have any queries on AGC issues, Jon can be contacted at:

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Letters to the Editor

Editor's Notes

The AGC conducted two fora during March in Sydney and Perth to establish the interest levels in professional registration of geoscientists. I asked some ASEG members to attend these meetings on behalf of the society and report back via letters to *Preview*. Members interested in the specifics of the AUSIMM and AIG schemes should refere to the July 1995 edition of Preview for more details.PESA has decided to cooperate with the AIG with regard to registration of petroleum geoscientists. Check PESA NEWS for details.

The Registration Debate: The Good, the Bad and the Ugly:

Why the need for professional registration in Australia?
What will professional registration of Geoscientists in Australia achieve?
What form should professional registration take?

I would encourage every professional geoscientist to ponder and discuss these questions. Why?.. In my opinion, the registration of professional geoscientists is inevitable and will eventually become legislated in Australia as it has in other countries. Consequently, all geoscientists working in this country, should take the opportunity to make themselves heard on the issue and help to develop a scheme that is both realistic and representative of the views of the majority of Australian geoscientists and not a vocal minority or government body.

My thoughts regarding professional registration are biased and based on more than seventeen years of experience working as a petroleum geophysicist in North America and the Australasian region. Currently, these thoughts are as follows:

The Good: A registry of Geoscientists should

1. ensure all registered members have obtained basic academic and work experience requirements.
2. provide members with a code of ethics and ensure that all members are familiar with those codes. Investigate and discipline breaches of those codes.
3. provide members with a set of "best practice" procedures to be followed when reporting reserves or potential reserves to the Public.
4. endeavour to educate those outside the profession of the technically challenging, interpretative and innovative nature of our profession.
5. serve the "best interests" of all geoscientists and the public
6. eventually develop into a single scheme for all geoscientists. The scheme could be independent or associated with another professional registry

The Bad: A registry of Geoscientists should not

1. develop restrictive practices regarding registration requirements of new members compared to existing members
2. create a large number of sub-categories of registration (ie. interpretation, processing, manager, operations, research, etc.,)
3. develop restrictive practices strictly for the benefit of members only and adversely effect the growth of our profession The Ugly: A registry of Geoscientists must not

1. become or be seen as an "old boys" club
2. discriminate against geoscientists with "different" backgrounds
3. create a complicated bureaucracy requiring the specialised services of "political geoscientists" or "bureaucratic geoscientists"

To conclude, I would encourage the members of our society and our Federal Executive to support and participate in developing a single Australian geoscientist registration scheme that is simple, fair, workable and is of benefit to geoscientists, the public, educational institutions and the mineral/petroleum industry.

Jim Dirstein
Petroleum Geophysicist

Discussion points on the Registration of geophysicists

1. There is a need for the establishment of a level of professional ethics when geophysicist's statements can affect the share market price of a mining company.
2. Geophysicists working in mineral exploration can be requested to provide statements of resource size and economic potential, where a single geophysicist may work on a single deposit. This does not tend to be a requirement of the petroleum geophysicist, who works more generally in a team. Minerals geophysicists are therefore more affected by registration than petroleum geophysicists.
3. Registration allows geophysicists approved by the Registration Board to practice the profession, in similar manner to that of the AMA.
4. Where a geophysicist is considered to have breached ethics, the Registration Board may deregister the person, who cannot practice thereafter.
5. If registration were to commence in Australia, all current practicing geophysicists would be automatically registered if they were a member of the ASEG. This would mean that any 'charlatan' would pass through the gate as such, who would continue practising therafter whether or not that person was registered (i.e. to such people, registration makes no difference).
6. Once registration commences, each new aspirant to registration would be required to have a minimum academic level, such as a Bachelor's degree in an approved subject (such as geophysics,geology, physics, engineering), with a stated term of practice in geophysics for different registered levels. For example, the Institute of Physics (UK) has a Chartered Physicist (CPhys) as the highest level, and it is this level which is sought to represent the Physics profession.
7. The highest level in geophysics- that of Chartered Geophysicist (CGeophys), would be the only level allowed to provide information to the market place.
8. The majority of current geophysicists would qualify for CGeophys if they have the prescribed minimum years of experience. In engineering, this is often two years practice after Honours degree award, followed by five or more years in a decision making, management capacity.
9. A direct benefit is to the society which registers the geophysicist in terms of increasing its membership, making that Society more financially stable.
10. Another beneficiary is the educational sector which then has a more persuasive argument for students to take the Honours year. This then raises the educational level of all graduates entering the profession, which can only be regarded as good for the profession.

11. In having such Registration, only geophysicists can perform professional geophysical work, and their level of responsibility and standing in the community is then recognised by the other professions. For example, a Chartered Engineer would prefer to deal with a Chartered Geophysicist.
12. Like it or not, since the other professions are moving towards Registration, there is little alternative for geophysics but to move in the same direction in the future.
13. Registration is only feared by those who were unable to take either a geophysical qualification, or those who have not been through any formal form of geophysical training (eg. left school and joined a crew, worked their way up getting hands-on experience, and now fear that registration will reveal their lack of qualifications to the world and cast doubt on their credentials). They in fact, would be allowed through the gate on registration commencement, but thereafter proper qualifications would be required.

B.J. Evans
J.A. McDonald

The Registration Debate – the case against

α...

Why am I against Professional Registration?

Because REGISTRATION...

- always begins with a grandfather clause whereby present practitioners do NOT have to sit exams, pass tests, be assessed by a registration board, etc. This means that the crooks, charlatans and incompetents, already practising in the profession, continue to do so.
- is abused so as to oppress minorities: engineers – who generally favour registration – make life tough for scientists; geologists make life difficult for geophysicists whose background is computing or mathematics; males make it difficult for females to enter the profession; older members place obstacles in the path of young graduates wishing to make a career in the profession; established members discriminate against prospective migrants who may hope to practise their profession in a new country; etc, etc, etc.
- is NOT designed to clean up the profession; it is designed to clean up the IMAGE of the profession. It has no substance; it is nothing but window-dressing.
- if challenged, is likely to be found to be a restriction to trade by the Australian Trade Practices Commission.
- is an attack on individual freedom – a restriction on the freedom to work.

Andre Lebel

The following letter was received by the Federal Executive which raises any interesting concept. The FE is aware that several of the state branches have student awards in one form or another and the publishing of this letter is to promote a discussion amongst members. *Ed*

Ms Robyn Scott
Honorary Secretary ASEG
8 June 1997

Dear Robyn

I am writing in response to the April issue of *Preview*, in which ideas were invited concerning how the growing funds of the Society might be used for the benefit of the membership. Firstly congratulations to the Federal Executive, for bringing the Society to this happy position. I would like to bring to the attention of the Executive the Prize in Geophysics at ANU, known as the Australian Society of Exploration Geophysicists (ACT Branch) Prize for Geophysics which has been established by the ACT Branch.

Realising that a quite fortunate opportunity existed to support such a prize, in a Geology Department where there were many prizes for Geology but none for Geophysics, the ACT Branch took this initiative in 1995. The prize was first awarded in 1996 (to Ms Gem Manning), and first appeared on the program of a University Graduation Ceremony just this year.

Much has thus been achieved concerning the prize, however its position and stature would be further strengthened if it were backed by a greater endowment of funds. The ACT Branch established it with an endowment of $750, estimated as three separate prizes of $250 each. It would be accorded greater status if it could acquire "in perpetuity" status. I understand a further endowment of some $3000 would achieve this worthy objective (those funds, and the interest they accrue, to be devoted entirely to the support of the ASEG Prize in the future). Would the Federal Executive see fit to back the initiative of the ACT Branch in this way?

A major point I realised, when doing the "groundwork" for setting up the prize, is how much work the University does (at no cost!) in the administration of such prizes. From the lectures and examinations upon which the prize-winner is selected, to the printing of the prize name in the Conferring of Degrees programme and on the official transcript of the prize-winner's University record, a Society such as ours receives very good public relations value from supporting a prize.

However the greatest benefits come from the encouragement which such a prize gives to bright young students to try Geophysics, and to be rewarded when they do very well at the subject. Such a prize raises the profile of Geophysics in the University, and in society generally. We may well expect that winners of this prize will contribute in a prominent way to Australian Geophysics. Further, every time that the CV of a prize-winner is scanned, the ASEG will be listed prominently there.

I enclose a copy of the programme from the recent ANU Conferring of Degrees Ceremony, which shows (on page 34) the listing of the ASEG Prize for the first time. Such a programme maintains well the tradition of prestige and distinction associated with such prizes.

Yours sincerely,
Ted Lilley F.E.M.
Research School of Earth Sciences (which is a different part of ANU from the Geology Department, where the ASEG Prize is awarded).

PS: *"Situations may differ from state to state (and the ACT is a relatively small branch) different schemes to encourage and reward students may be appropriate for different places. However generally I am sure there would be wide support for a federal executive backing local branches which have taken an initiative of which the federal executive approves. Depending on the funds available, and the calls upon them, the establishment of further "ASEG Prizes in Geophysics" could be a most effective way of encouraging students."*

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Calendar of Events

September 4-5 1997
Funafuti to Mururoa
Stability or Chaos in Coral Reef Research - A Symposium
For further details:
The General Manager
The Earth Resources Foundation, Edgeworth David Building FO5 The University of Sydney NSW 2006

September 14-18 1997
Workshops Sept 7-14 Tours & Seminars Sept 19, Exploration '97 4th Decennial Conference on Mineral Exploration.
Toronto Canada
For further details:
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101-345 Renfrew Drive
Markham Ontario Canada
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Fax: 0011-1-905-513 1834
Email: 103214.545@compu-serve.com

15-18 September 1997
Moskba'97 / Moscow'97
International Geoscience Conference & Exhibition
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Fax: +31 30 696 2640
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http://www.accu.nl.eage

Sept 17 1997
PESA Queensland Petroleum Exploration Symposium
For further details:
PESA QLD
GPO BOX 2323
Brisbane Q 4001
Steve Mackie (Chairman)
Tel: (07) 3228 6666

Sept. 28 - Oct. 2 1997
The Fifth International Congress of the Brazilian Geophysical Society (Call for Papers). Sao Paulo Brazil
Deadline for extended abstracts is May 30 1997
For further details:
Vitorello, Icaro
Tel: +55-123-25-6784
Fax: +55-123-25-6810
email: icaro@dge.inpe.br

Sept 29 - Oct 1 1997
South African Geophysical Association Conference '97
Swakopmund,Namibia
For further details:
c/o Dept of Geophysics
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South Africa
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fax 21 11 339 7367

November 2-7 1997
SEG 67th International Exposition and Annual Meeting, Dallas, Texas, USA. The theme of this year's convention – The Next Dimension reflects the SEG's central leadership role in fostering the development and usage of new acquisition, processing and interpretation technologies.
For further details: see SEG's home page on the World Wide Web at http://www.seg.org/seg97 or Tel: 918 497 5500 Fax: 918 497 5557 Email: dallas97@seg.org

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Secretariat c/- Well Done Events PO Box 1758, North Sydney NSW 2059 Australia Tel: +61 (044) 460 318 Fax: +61 (044) 460 319 email: judyp@welldone.com.au Web updates on: http://crc.crcamet.mq.edu.au

November 8-12 1998
Australian Society of Exploration Geophysicists 13th International Conference and Exhibition. Hobart Tasmania Australia
For further details: ASEG Conference Secretariat, 93 Victoria Avenue, Albert Park VIC 3206 Tel: +61 3 9690 6744 Fax: +61 3 9690 7155 email: wsm@latrobe.edu.au

If you wish to place your event in our Calendar, contact:

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