Australian Institute of Geoscientists

AIG NEWS

Quarterly Newsletter No 88 May 2007

Metal Equivalents, You and the JORC Code

JORC and Gerry Fahey

RECENT COMPANY ANNOUNCEMENTS to the Australian Stock Exchange (ASX) involving the reporting of mineralization as "Metal Equivalents" raised more than a few eyebrows. The JORC (Joint Ore Reserves Committee) has handed down the following guidelines to the ASX which AIG News reproduces below (with kind permission).

The JORC Code is explicit: *"The assumptions used for any reporting of metal equivalent values should be clearly stated."* Reports must also conform to the principles of the JORC Code which are set out in Clause 4:

"The main principles governing the operation and application of the JORC Code are transparency, materiality and competence.

- ***Transparency*** requires that the reader of a Public Report is provided with sufficient information, the presentation of which is clear and unambiguous, to understand the report and is not misled.
- ***Materiality*** requires that a Public Report contains all the relevant information which investors and their professional advisers would reasonably require, and reasonably expect to find in the report, for the purpose of making a reasoned and balanced judgement regarding the Exploration Results, Mineral Resources or Ore Reserves being reported.
- **Competence** requires that the Public Report be based on work that is the

Cont. Overleaf

INSIDE THIS AIG NEWS:

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responsibility of suitably qualified and experienced persons who are subject to an enforceable professional code of ethics."

In JORC's opinion, the following minimum information is required to accompany any report which includes reference to metal equivalents in order to conform to these requirements:

- individual assays for all metals included in the metal equivalent calculation,
- assumed commodity prices for all metals,
- assumed metallurgical recoveries for all metals and the basis on which the assumed recoveries are derived (metallurgical test work, detailed mineralogy, similar deposits etc.,),
- a clear statement that it is the company's opinion that all the elements included in the metal equivalents calculation will be recoverable, and
- the calculation formula, such as the following, which includes example data based on a public report (Table 1 below).

Should companies consider that the metal prices they have used are commercial in confidence and decline to supply this information, they would, as a consequence, be unable to comply with the transparency principle and hence should not report metal equivalents. In most circumstances the metal chosen to report on an equivalent basis should be the one that contributes most to the metal equivalent calculation. If this is not the case a clear explanation of the logic of choosing another metal should be included.

Unless all this information can be provided, the reporting of metal equivalents is potentially misleading and should, in JORC's view, be discouraged. Estimates of metallurgical recoveries for each metal are particularly important. For many projects at the Exploration Results stage, metallurgical recovery information may not be available or able to be estimated with reasonable confidence. Therefore, for many projects at the Exploration Results stage, reporting in terms of metal equivalents may not be appropriate.

And from another perspective — Competent Person — and what does it mean?

by Gerry Fahey

Being a competent person sounds so very pompous and even more so when we spell it correctly as defined in JORC with capitals "Competent Person". But that's what we are. The Canadian's prefer "Qualified Person" which might conjure up the idea that you need to sit an exam to become qualified. While their definition is slightly different, it is the same in the important areas. For Australians working in companies that report on the ASX or NZX, the key words associated with being a Competent Person are:

1. **competence and relevant experience**
2. **responsibility**
3. **accountability**

So what is competence? The word has its origins in Latin "competere" meaning "fit or proper" and the Oxford Dictionary has several definitions such as "having the necessary skill or knowledge to do things successfully" or "having legal authority to deal with a particular matter" while one of the definitions in the Macquarie Dictionary is "being of a certain age, having a soundness of mind, citizenship etc." not all of which are mandatory.

JORC defines a "Competent Person" as:

“a person who is a Member or Fellow of the Australasian Institute of Mining and Metallurgy, or of the Australian Institute of Geoscientists, or of a 'Recognised Overseas Professional Organisation' ('ROPO') included in a list promulgated from time to time.”

A “Competent Person” must have a minimum of five years experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which that person is undertaking.

If the Competent Person is preparing a report on Exploration Results, the relevant experience must be in exploration. If the Competent Person is estimating or supervising the estimation of Mineral Resources, the relevant experience must be in the estimation, assessment and evaluation of Mineral Resources. If the Competent Person is estimating, or supervising the estimation of Ore Reserves, the relevant experience must be in the estimation, assessment, evaluation and economic extraction of Ore Reserves.

1. Competence and relevant experience

For competence the Code relies on the person being a member of a recognised professional body. This is because these bodies have the ability to scrutinize their membership when you join up. The Australian professional bodies provide information to their members when the rules change or when there is advice from JORC on the interpretation of the rules.

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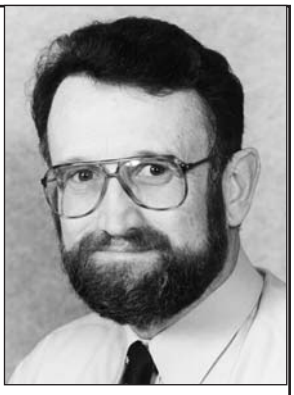
Drill hole (name) from (deposit) report

From	To	(m)	Cut off Cu (%) (Optional)	Au (g/t) Gold	Co (%) Cobalt	Cu (%) Copper	Ni (%) Nickel	Zn (%) Zinc	Value USD/tonne	Cu eq (%) Copper Equiv.	Notes
201	270	69	0.5	1.01	0.25	1.85	0.13	0.56			Intersection grades
Metal Prices (Fin Review 14 April 2007)				USD 677.40	USD 31.50	USD 7,810.00	USD 48,650.00	USD 3,490.50			List (with source) in report
Units for published metal prices				US$/oz Au	US$/lb Co	US$/Tonne Cu	US$/Tonne Ni	US$/Tonne Zn			Cobalt price - COSS April 2007
Grade units				US$/gram Au	%	%	%	%			
Metal price in grade units USD				USD 21.78	USD 694.46	USD 78.10	USD 486.50	USD 34.91			Calculated
Value of grade in intersection in USD				USD 22.00	USD 173.62	USD 144.49	USD 63.25	USD 19.55	USD 423	5.4%	In situ
Possible metallurgical recoveries				87%	35%	89%	75%	35%			Estimate based on similar mineralogy
"Value" possibly recovered USD				USD 19.14	USD 60.77	USD 128.59	USD 47.43	USD 6.84	USD 263	3.4%	Potential value of recovered metal & lower copper equivalent

Note Cu equivalent used as Cobalt recoveries likely to be low.

Table 1 - Metal Equivalent Reporting

From Your President



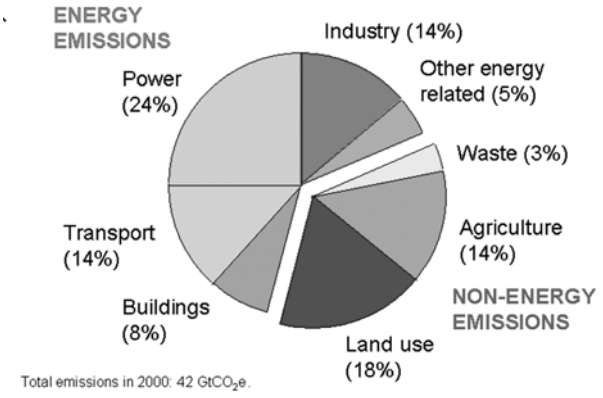
WHAT A CHANGE we have witnessed in the character of the debate about climate change in the last three months! While still a policy-free zone in Australia, the economic approach adopted in the Stern Report has galvanized governments into looking at practical measures to respond to climate change — whatever its causes.

I suspect that a significant percentage of these responses will inevitably involve a focus on social policies that support community and industry adaptations to climate change that need to be addressed at the same time as longer-term economic policies targeting reductions in greenhouse gasses. If the apparent increasing trend in surface temperature is maintained, the market-type (+/- emissions caps) approaches to reducing greenhouse gas emissions being considered need time to yield outcomes.

We will have to wait for the late May release of the Commonwealth Government's report on climate change policy options to see what is in store for us. My only fear is that the instant gratification required by many members of the community will result in a political backlash if the economic pain of increasing prices for most goods and services does not result in a medium-term measurable reduction in the evidence for climate change. I don't think the community has engaged with the reality that tackling climate change is going to hit its hip-pocket nerve. The community will bear most of the economic cost because it is at the end of the industrial supply chain.

Geoscientists have always maintained that climate change is a permanent feature of the Earth's evolution and a friend of mine recently pointed out that in Arthur Holmes' famous tome entitled "*Physical Geology*" published in 1944, there was a section on climate change. Geoscientists now have an even more critical role in identifying sites for CO2 geosequestration to reduce emissions from petroleum and coal production, uranium production, geothermal power production, and possibly increased production of some metals required by a low-emissions economy.

Global Emissions by Sector



National virtual core library on the horizon

In November last year as part of the National Collaborative Research Infrastructure Strategy (NCRIS), Minister Bishop announced funding for two areas relevant to geoscience.

As part of $55.2 million allowing improved monitoring of the ocean around Australia, $5.2 million was earmarked to maintain the RV Southern Surveyor and its operations to the end of 2007-2008. This vessel is used extensively by marine geoscientists both in universities and government.

Included in $42.8 million for research infrastructure for studying the structure and evolution of a continent, an amount was provided for developing a virtual library of drill core and geoscience data network. CSIRO originally developed the state-of-the-art Hyloggers and as part of the funding, will be building more machines that will be deployed in each of the State core library facilities. Funding is also being provided to electronically link these facilities so that the enormous amounts of data generated by the Hylogger machines can be accessed by industry and researchers. The HyLogger core scanner is a rapid spectroscopic logging and imaging system that uses continuous visible and infrared spectroscopy and digital imaging to identify dominant mineral species in core without destroying it in the process.

Complaints and Ethics and Standards Committees members

At its March meeting, AIG's Council appointed the following individuals to the Complaints Panel and the Ethics and Standards Committee.

Complaints Panel: Andrew Grove, Andrew Penkethman, Louis Hissink, Mark Berry, Mike Young, Rick Rogerson and Simon Pooley

Ethics and Standards Committee: Sam Lees (Chairman), Louis Voortman, Jacqui Coombes, and Greg Corbett (alternate)

The Complaints Committee, on a complaint-by-complaint basis, will be made of one or two members of the Complaints Panel with expertise relevant to the complaint. I thank all these members for volunteering to go the extra yard for AIG and to ensure the integrity of the reporting system for exploration results, resources and reserves. They were all appointed after a call for expressions of interest late last year.

A measure of success for AIG's new complaint management system would be a diminishing number of ethical, JORC and VALMIN-related complaints as all of us embrace the concept that in the longer term across investment cycles and a wide range of mineral commodities, it is investors confidence in reporting by competent persons that encourages investment in mineral equities compared to other speculative opportunities.

Closer association with other geoscience associations

Monthly meetings of two executives each from GSA and AIG have been held since March this year to explore options for closer cooperation between the two organizations. Recently, the focus has been on developing a structure for a single umbrella organization that would incorporate the best elements of both organizations. We

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For relevant experience the guidelines in JORC are helpful. The person signing off needs to have the minimum of 5 years of relevant experience in the same style of mineralisation as the deposit that they are signing off on. For example if you have only ever worked in Archaean gold deposits you are probably not going to be able to sign off on a roll-front uranium deposit.

2. Responsibility

   This is a key element in being a Competent Person. Having worked on and off on former Soviet and Sino projects over the past four years I can understand why the above definitions which are derived from a principles' based code (such as JORC's with the three principles of **transparency, materiality and competence**) could be extremely confusing to professionals from these backgrounds.

   As Competent Persons you are not being told what to do, rather to take responsibility for what you do. The benefits of having the individual take responsibility are being recognised all round the world and both China and Russia are now moving towards JORC-style reporting.

3. Accountability

   This implies that Competent Persons should be clearly satisfied in their own minds that they can face their peers and demonstrate competence in the commodity, type of deposit and situation under consideration. If doubt exists then the person should seek opinions from appropriately experienced colleagues or should decline to act as a Competent Person.

How often have you heard it said "it's amazing how small our mining industry is". This works to our advantage in Australia and helps us self regulate our industry and reporting practices. So remember, **YOU TAKE RESPONSIBILITY FOR YOUR CODE**, JORC is not a policeman. If you are not happy with Competent Person's report or announcement, say so. AIG and AusIMM have Complaints Committees in place thatdeal with complaints. Support or help lines are also being put in place. ▲▲

A Pithy Comment

The most merciful thing in the world ... is the inability of the human mind to correlate all its contents... The sciences, each straining in its own direction, have hitherto harmed us little; but someday the piecing together of dissociated knowledge will open up such terrifying vistas of reality... That we shall either go mad from the revelation or flee from the deadly light into the peace and safety of a new dark age.?

H. P. Lovecraft

From Your President

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are hoping that other kindred organizations may join these discussions perhaps initially as observers.

AIG was very pleased when the President of the Australian chapter of the International Association of Hydrogeologists, Philip Commander (an AIG Fellow and RPGeo in the field of hydrogeology) recommended to IAH members in Australia that if they wanted professional registration they should join AIG. Presently, IAH does not support professional registration.

Potential amendments to JORC Code discussed

JORC and its parent bodies (AIG, AusIMM, and the Minerals Council of Australia) have held discussions with the ASX about some trends in public reporting and the need to make all parties involved in reporting — competent persons, Directors and company secretaries, and ASX staff more aware of JORC Code provisions and the role of the AIG and AusIMM. On 3 May in Perth, the ASX, AIG and AusIMM hosted a late afternoon seminar for company directors and office-bearers where these issues were addressed.

A number of potential amendments are being discussed in JORC to make a Competent Person's life a little easier. These include:

- reporting of inferred resources
- Competent Person's consent form
- reporting of historical resource estimates
- reporting using metal equivalents

The consent form for competent persons would give the geoscientist signing-off on the report an opportunity to physically sign a certificate in front of a witness attesting that he/she had consented to the attached report being publicly released to the ASX or elsewhere.

Meanwhile, for those mineral companies listed on the UK Alternative Investment Market, new rules are being introduced to improve the quality of public reporting there.

My last President's page

After two years of having the honour of leading AIG, I will be stepping down as President at the May 14 AIG Annual General meeting. I have been fortunate to lead the organization during hopefully the first phase of a protracted investment cycle that is benefiting the organization, our members, the resources industry and Australia as a whole. It has been a very fruitful two years for AIG and its members with a 30% rise in membership numbers and a slightly larger increase in the net assets of the organization, a revamped complaints system, simplification of the way Councillors (Directors) are elected, an increased number of competitively-priced conferences, seminars and workshops, a new e-commerce-enabled website, and more engagement with kindred organizations. Also, along the way, we did a survey to find out more about you — our members. In the next year Council will use results of the survey to identify what additional services you want from AIG.

I thank all the members of AIG and others who have helped make AIG a better organization over the last two years. ▲▲

Cheers, **Rick Rogerson**

For the latest in Geoscientist news, views, codes, events, employment and education visit the AIG website:
www.aig.org.au

PROFESSIONAL DEVELOPMENT TRAINING

MAY TO JULY 2007

Successful Sampling	**17th May**	**Vancouver**
QA QC of Assay Data	**18th May**	**Vancouver**
Geology for Non-Geologists	**25th May**	**Perth**
	3rd August	**Brisbane**
Six Sigma Yellow Belt	**6th-8th June**	**Brisbane**
	20th-22nd June	**Vancouver**
Practical Variography	**7th June**	**Perth**
	7th June	**Vancouver**
Variography Using Visor	**8th June**	**Perth**
	8th June	**Vancouver**
Mining and Exploration ProjectManagement	**TBA**	**Perth**
Sampling High-Nugget Gold Deposits	**21st-22nd June**	**Perth**
Design for Six Sigma	**11th-13th July**	**Perth**
Six Sigma Green Belt	**starts 26th-27th July**	**Perth**
Mining and Sampling Theory for Mine Technicians and Field Assistants	**30th July**	**Perth**

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SNOWDEN

Proterozoic Mineralisation in Western Australia

Monday 11th June 2007, Burswood on Swan (Perth)

A ONE-DAY CONFERENCE to cover the range of Proterozoic mineralisation within Western Australia is being held in Perth on 11 June 2007. It is intended to present economic and geological introductions and then to highlight areas and commodities of future potential by presenting individual case histories of various deposit types.

The workshop will include lunch, coffee and tea breaks followed by a sundowner to give plenty of time for meeting and talking to old and new friends.

For a registration form or further details please contact:

Jocelyn Thomson, Event Manager for the AIG WA Branch
(Jaytee Commercial Enterprises)
Ph: 08 9355 2164;
Email: jaytee@iinet.net.au

PROTEROZOIC MINERALISATION IN WESTERN AUSTRALIA

Monday 11th June 2007

Burswood on Swan (Water Sports Centre)

Camfield Drive, Burswood (Perth)

Cost (GST Included):
Members: $187.00 Non-Members: $220.00

PRELIMINARY PROGRAM (EARLY MAY)

Introductory Session

- *Keynote Address:* Predictive metallogeny in the Australian Proterozoic (Geoscience Australia)
- Proterozoic geological framework of Western Australia (Geological Survey of WA)

Proterozoic Gold Deposits

- Tropicana (Anglo)
- Telfer - an update (Newcrest)

Proterozoic Iron Ore Deposits

- Pilbara iron ore models (RioTinto)
- Southdown (Grange Resources)

Proterozoic Base-Metal Deposits

- Nifty Copper (Birla)
- Koongie Park Copper-Lead-Zinc (CSA)

Other Proterozoic Mineral Deposits and Exploration Targets in Western Australia

- Argyle
- Musgrave Block
- Albany Fraser Orogen

Station Gate Procedure Protocol

The editor was related this interesting anecdote...

The RIGHT Way of Implementing Gate Procedure	The WRONG Way of Implementing Gate Procedure
Passenger alights from vehicle	Passenger alights from vehicle
Passenger proceeds to gate and opens it	Passenger proceeds to gate and opens it
Vehicle passes through gate	Vehicle passes through gate.
Passenger closes gate by positioning him/her self between the vehicle and then closes the gate, looking down the track from where the vehicle came.	Passenger closes gate looking at the vehicle and therefore to where it is going. Closed gate is between passenger and vehicle. Intense mental activity ensues.
NA	Passenger re-opens the gate, then places him/herself between the vehicle and closes the gate, looking down the track from where the vehicle came.
Passenger alights into vehicle which proceeds.	Passenger alights into vehicle which proceeds.

Equatorial Ridge of Iapetus

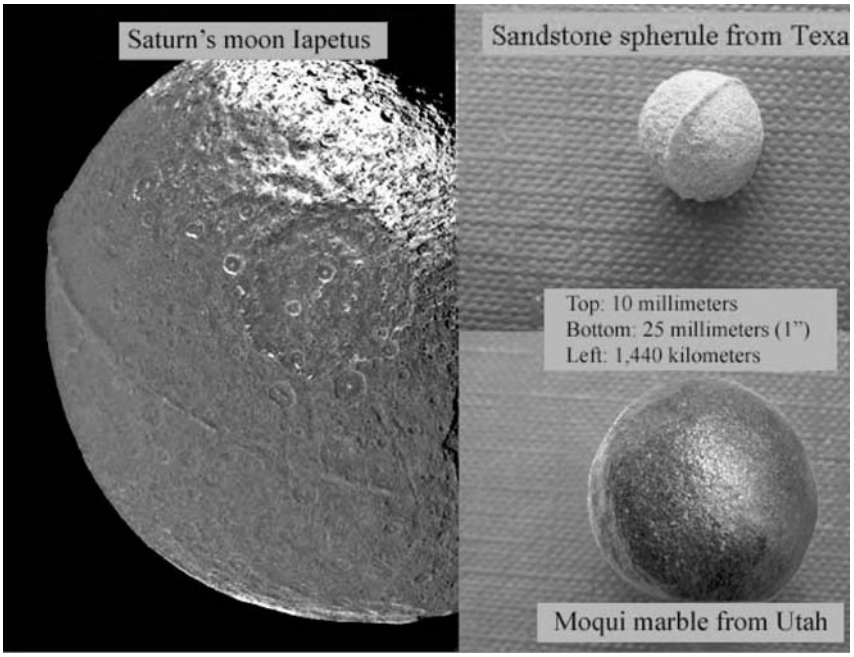
Lifted from the Electric Plasma Site

THE DISTINCTIVE RIDGE around Saturn's moon Iapetus bears an eerie similarity to equatorial ridges around concretions on Earth. In electrical terms, the similarity could be more than coincidence.

Traditional thinking in the sciences would not recognize a significant pattern above, though the three objects reveal an odd similarity. Each sphere possesses an equatorial ridge. But surely the two objects on the right could tell us nothing about the origins of the object on the left!

Astronomers assure us that Saturn's moon Iapetus arose from the "circumstellar cloud" that gave birth to the Sun, planets, moons, and all of the lesser objects of the solar system. The critical event was the "gravitational collapse" of the primordial cloud billions of years ago. Since that event, little has changed in the make-up or in the celestial mechanics of the solar system.

Iapetus is a puzzle, however. The pronounced ridge around its equator has no place in the theory of gravitationally collapsing clouds.



Credit (left): NASA/JPL/Space Science Institute
Credit (upper right): C.J. Ransom Credit (lower right): Mel Acheson

Both objects on the right are called "concretions", and their origins are also puzzling. The sandstone concretion (upper image) was found on a farm near the Red River in Texas, and the hematite Moqui marble was found in Utah (lower image). Concretions occur in abundance on our planet and have produced many speculations about their origins.

Certainly, in a gravity-only universe, there is no way to relate Iapetus to the formative processes of concretions. In size, the two are separated by up to eight orders of magnitude. Gravity is strong enough to form a sphere from a collection of matter the size of Iapetus, but there's a lower limit to gravity's ability to produce spherical shapes.

(Asteroids and comet nuclei are below that limit and therefore seldom spherical.) And while geologists have hypothesized, but never demonstrated, the processes that form concretions, they have never suggested that such processes could give birth to Iapetus!

In the Electric Universe similarities across vastly different scales are to be expected.

Plasma discharge structures do not change with increased size. A microscopic discharge in a lab plasma will have analogs on a galactic scale.

Plasma discharges create spheres. Physicist C.J. Ransom has been making spheres in his laboratory (VEMASAT) by zapping various types of powdered rock with electrical sparks. When he zaps red hematite, he produces tiny grey hematite spheres, an order of magnitude smaller than Moqui marbles, but remarkably similar to the "blueberries" appearing in hematite layers on Mars. When he zaps powdered basalt, he produces obsidian spheres.

The electrical theorists expect analogs on a larger scale because they believe that electric discharge gave birth to stars and planets.

Within this framework, equatorial ridges become an important clue, posing a question for experimental research. Can plasma discharge, acting on loose debris, form ridges around the created spheres? In high-energy electric discharge experiments, an equatorial, donut-like torus typically appears at the focal point of the magnetic "pinch". Similarly, in the hour-glass configurations of various planetary nebulas, a tightly-bound torus appears around the pinch point. Could equatorial ridges on both Iapetus and the concretions above be the signature left by a torus at the higher energy levels of Peratt's experiments, in contrast to the relatively low energy levels of Ransom's experiments?

From an electric point of view, spheres with equatorial ridges underscore the importance of experimental research into the nature of concretions. There are questions to ask, experiments to design, and patterns to look for. Significant patterns already observed include concentric layering of different materials, radial structures, and polar markings.

Similarities with tektites, glassy spherules whose origin is currently unknown, raise intriguing questions and suggest a family of experimental investigations.

One conclusion we can safely draw is this: The mechanical and gravitational theories offered to explain round rocks of various sizes do not warrant the exclusive acceptance they have received from the scientific mainstream. Other possibilities, arising from the plasma universe, must now be considered.

Ransom is planning future experiments with other substrates. The abstract for a paper, showing that electric discharge can produce some of the mysterious spheres found on Earth without water (the usual explanation), can be seen here:
http://absimage.aps.org/image/MWS_APR05-2004-000006.pdf. ▲▲

More Global Warming Alarmism in Greenland but based on incomplete science

Introduction

"A STUDY LAST YEAR by the Jet Propulsion Laboratory of the California Institute of Technology showed that, rather than just melting relatively slowly, the ice sheet is showing all the signs of a mechanical break-up as glaciers slip ever faster into the ocean, aided by the "lubricant" of melt-water forming at their base. As the melt-water seeps down it lubricates the bases of the "outlet" glaciers of the ice sheet, causing them to slip down surrounding valleys towards the sea."

This interpretation of glacier dynamics by scientists working for the Jet Propulsion Laboratory strikes the editor as somewhat problematical. The quote above was extracted from a news report on 24th April 2007 in the UK *The Independent* "An Island made by global warming". Apparently a new island has appeared off the coast of Greenland from the disappearance of glacial ice.

Professor Cliff Ollier has written a good summary of glacial dynamics in a recent issue of New Concepts in Global Tectonics (NCGT 42, March 2007). It suggests that our Climate Alarmists of the glacial ice kind know less of what they speak.

Part 1 — Some extracts from Ollier's Short Note: GLACIERS AND ICE-SHEETS: MODERN PROBLEMS AND TECTONIC ASSOCIATIONS.

Full note available in the NCGT Newsletter Issue 42 (March 2007)

A glacier budget

In general glaciers grow, flow and melt continuously. There is a budget of gains and losses. Snow falls on high ground in the glacier's accumulation area. It becomes more and more compact with time, air is extruded, and it turns into solid ice. A few bubbles of air might be trapped, and may be used by scientists later to examine the air composition at the time of deposition. More precipitation of snow forms another layer on the top, which goes through the same process, so the ice grows thicker by the addition of new layers at the surface. The existence of such layers, youngest at the top, enables the glacial ice to be studied through time, as in the Vostok cores of Antarctica, a basic source of data on temperature and carbon dioxide over about 400,000 years.

When the ice is thick enough it starts to flow under the force of gravity. In a mountain glacier it flows downhill, in an ice-sheet from the depositional high centre towards the edges of the ice-sheet. The flow is generally slow, as expressed in the common metaphor "glacially slow". The Upernivek Glacier in Greenland flows at about

40 metres per day, which is as much as a smaller Alpine glacier covers in a year. When the ice reaches a lower altitude or lower latitude where temperature is warmer it starts to melt and evaporate. (Evaporation and melting together are called ablation, but for simplicity I shall use 'melting' from now on.)

If growth and melting balance the glacier appears to be 'stationary'. If precipitation (snowfall) exceeds melting the glacier grows. If melting exceeds precipitation the glacier appears to recede.

How glaciers move

Flow is by a process called creep, essentially the movement of atoms from one crystal to another, and the size of crystals grows by a thousand times from the tiny crystals deposited as snow to the large crystals found at the glacier snout.

There are three laws of creep:

1. Creep is directly proportional to temperature.
2. Creep is directly proportional to stress (essentially proportional to the weight of overlying ice)
3. There is a minimum stress, called the threshold stress, below which creep does not operate.

All these laws have significant effects on glacier movement, and on how glacial behaviour might be interpreted.

Creep is directly proportional to temperature

In valley glaciers the ice is almost everywhere at the prevailing melting point of ice, so it is not an important feature. In ice-sheets the temperature gets very much below freezing point, so flow is very limited in most of the very cold ice. At the base of the glacier the ice is warmed by the Earth's heat, and the flow is concentrated at and near the base of the glacier. This is why the stratified layers of ice are preserved in the upper ice, and can be recovered in cores like the Vostok cores. Stratified ice has been found to a depth of about 3300m, below which the ice is deformed.

Creep is directly proportional to stress

Stress is essentially proportional to the weight of overlying ice. This means that the thicker the ice, the greater the stress at depth, and the faster the flow. In a valley glacier there is frictional drag at the base, and no flow at the top because it is below threshold stress (explained below), so the maximum flow is somewhere in the middle. In an ice-sheet the greatest stress will be at the base under the thickest ice. Again we see that the upper ice will be preserved, which we already know from the many cores.

There is a minimum stress, the threshold, below which creep does not operate.

At the surface there is no stress, so the ice does not flow: at a certain depth the weight of ice is sufficient to cause flow. Between these two limits the ice is a brittle solid being carried along on plastic ice beneath. Since the flow is uneven (greatest in the middle in valley glaciers) the solid, brittle ice is broken up by a series of cracks called crevasses.

Some results of the laws of glacier flow

These simple rules allow us to understand some observations on glaciers. The speed of valley glaciers has been measured for a long time, and is rather variable. Sometimes a valley will flow several times faster than it did earlier. Suppose we had a period of a thousand years of heavy precipitation. This would cause a thickening of the ice, and more rapid glacial flow. The pulse of more rapid flow would eventually pass down the valley. It is important to understand that the *increase in flow rate is not related to present day air temperature, but to increased precipitation long ago*.

Melting and climate

In the case of ice-sheets it may take many thousands of years for ice to flow from the accumulation area to the melting area. The balance between movement and melting therefore does not relate simply to today's climate, but to the climate thousands of years ago.

Glaciers and precipitation

We have seen that glaciers and ice-sheets are in a state of quasi-equilibrium, governed by rates of melting and rates of accumulation.

For a glacier to maintain its present size it must have precipitation as snowfall at its source. This leads to a slightly complex relationship with temperature. If the regional climate becomes too dry, there will be no precipitation, so the glacier will diminish. This could happen if the region became cold enough to reduce evaporation from the ocean. If temperatures rise, evaporation is enhanced and so therefore is snowfall. *Paradoxically a rise of temperature may lead to increased growth of glaciers and ice-sheets.* Today, for example, the ice-sheets of both Antarctica (Davis et al., 2005) and Greenland (Johannessen et al., 2005) are growing by accumulation of snow.

Icebergs

Where ice-sheets or individual glaciers reach the sea, the ice floats and eventually breaks off to form icebergs. This is inevitable so long as glaciers reach the sea. In the southern hemisphere Captain Cook saw icebergs on his search for the great south land. Icebergs have long been familiar to sailors in the northern hemisphere, and the *Titanic* struck one that had drifted farther south than usual in 1912. The actual break is a sudden, one-off event, but can be built into a typical greenhouse-horror scenario. Some weeks ago, when a piece of the Greenland ice shelf broke away, the scientists interviewed all said they were surprised at how suddenly it happened. But how else but suddenly would a piece of ice shelf break off! And this was an area that was ice free before the Little Ice Age. Arctic explorers used to get their ships a lot closer to northern Greenland than you can now.

Hansen's view of glacier collapse

In a television interview in Australia on March 13, 2007, Jim Hansen claimed that a rise in temperature of a few degrees in the next few years would cause 'collapse' of the ice-sheets and a rise of sea level of many metres.

Hansen's view of ice-sheet 'collapse' is untenable. Ice-sheets do not melt from the surface down - only at the edges. Once the edges are lost, further loss depends on the rate of flow of the ice. The rate of flow of ice does not depend on the present climate, but on the amount of ice already accumulated, and that will keep it flowing for a very long time. It is possible that any increase in temperature will cause increased snowfall thereby nourishing the growth of the ice-sheet, not diminishing it. While Hansen concentrates on ice-sheets, evidence of glacier recession is more obvious in alpine glaciers. In many parts of the world glaciers have been receding since 1895 and with increasing pace since. This is the wrong time scale to be associated with Hansen's hypothesis, and the dates have no counterpart in carbon dioxide records."

Continued Overleaf

More Global Warming Alarmism in Greenland but based on incomplete science

Continued from Previous Page

Part 2 — So what about Warming Island and the coast of Greenland?

by Louis Hissink

"The map of Greenland will have to be redrawn. A new island has appeared off its coast, suddenly separated from the mainland by the melting of Greenland's enormous ice sheet, a development that is being seen as the most alarming sign of global warming."

The problem here is (see images below) that the Island is surrounded by sea ice. Land surrounded by glacial ice means explicitly that it isn't an island, though it might be metaphorically called an such.

"Several miles long, the island was once thought to be the tip of a peninsula halfway up Greenland's remote east coast but a glacier joining it to the mainland has melted away completely, leaving it surrounded by sea."

Glacier? It is sea ice — glaciers when they reach the sea start calving, depending on how much push the glacier is receiving from upstream.

"Shaped like a three-fingered hand some 400 miles north of the Arctic Circle, it has been discovered by a veteran American explorer and Greenland expert, Dennis Schmitt, who has named it Warming Island (Or Uunartoq Qeqertoq in Inuit, the Eskimo language he speaks fluently)."

What "Warming Island" has to do with the Inuit phrase "he speaks fluently" remains a total mystery to the editor.

"The US Geological Survey has confirmed its existence with satellite photos, that show it as an integral part of the Greenland coast in 1985, but linked by only a small ice bridge in 2002, and completely separate by the summer of 2005. It is now a striking island of high peaks and rugged rocky slopes plunging steeply to a sea dotted with icebergs.

As the satellite pictures and the main photo which we publish today make clear, Warming Island has been created by a quite undeniable, rapid and enormous physical transformation and is likely to be seen around the world as a potent symbol of the coming effects of climate change."

The article referred here was 'sans' pictorial evidence but searching the internet yielded the data. Here are the various images from the Landsat site (Reference http://landsat.usgs.gov/gallery/detail/441/) for 1985 to 2005. The last one, 2007 was obtained from Google Earth.

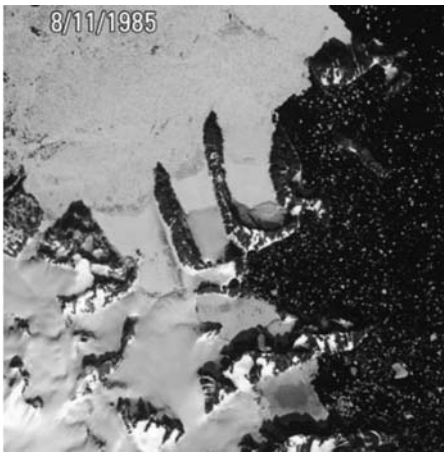


Figure 1: Warming Island 1985

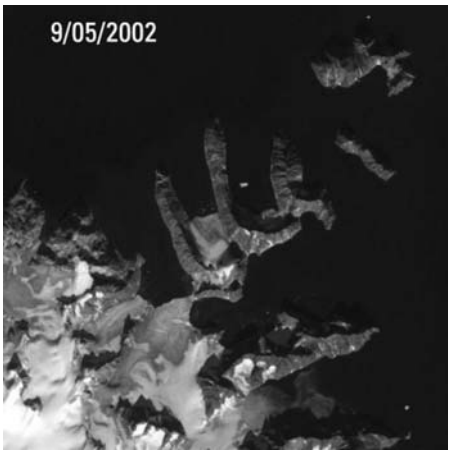


Figure : Warming Island 2002

Figure 3: Warming Island 2005

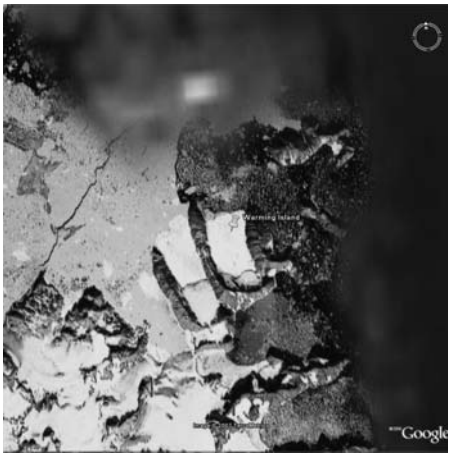


Figure 4: Warming Island 2007

Glacial ice? How about sea ice? Or is the editor being a little disingenuous?

And why use the year 2005 as the latest, or do later images of the area cause problems? Admittedly no month is given for the Google Image but as Greenland during winter sees no sun, one can probably conclude that the 2007 image was taken during spring/summer given the light observed.

So in 1985 there were large extents of sea ice, then it waned till 2005 and if Figure 4 is any indication, it's returning.

What intrigues the Editor is the tour "A Voyage of Discovery to Warming Island, Greenland" being promoted by Betchart Expeditions, with prices starting from $4995 plus air (http://www.betchartexpeditions.com/antarctica_warmIs.htm).

The expedition is from September 25 to October 6, 2007. Presumably this is the tourist season when the likelihood of any tour being subject to the vagaries of weather will be at a minimum. Greenland has three seasons, winter being November to February, spring from March to May and summer from June to October; so the advertised tour will be in the summer season. ▲▲

TIP OF THE ICEBERG - Seems a few members of AIG have expressed strong opinions about German Biologist E. Beck's CO2 article initially published in AIG News 86. It has since been published in a peer-reviewed journal ENERGY & ENVIRONMENT VOLUME 18 No. 2 2007. Additional data that could not make it into the E&E document are posted at this web address http://www.biokurs.de/treibhaus/180CO2_supp.htm.

This seems the veritable tip of the data iceberg in terms of historical scientific data that has escaped scrutiny. ***Editor***

Upcoming Conferences

28 May 2007
AIG(WA): WORKSHOP — DRAFTING PUBLIC REPORTS THAT CONFORM TO THE JORC CODE
Burswood on Swan, Perth
Contact: Jocelyn Thomson jaytee@iinet.net.au

11 June 2007
AIG(WA): PROTEROZOIC MINERALISATION IN WESTERN AUSTRALIA Burswood on Swan, Perth
Contact: Jocelyn Thomson jaytee@iinet.net.au

12-13 June 2007
MINE WATER MANAGEMENT Perth WA
Short course presented by the Australian Centre for Geomechanics
Link: www.acg.uwa.edu.au/events_and_courses/current_courses

14-15 June 2007
PLANNING FOR MINE CLOSURE Perth WA
Short course presented by the Australian Centre for Geomechanics Link:
www.acg.uwa.edu.au/events_and_courses/current_courses

19-20 June 2007
PROJECT EVALUATION CONFERENCE 2007
Link: www.ausimm.com/events/upcoming.asp
Contact: dedwards@ausimm.com.au

26-27 June 2007
EGRU BRECCIA SYMPOSIUM, James Cook University, Townsville EGRU, School of Earth & Environmental Sciences, JCU Tel: 07 4781 4597 Link: http:\\www.es.jcu.edu.au/breccia
Contact: egru@jcu.edu.au

20 - 21 September 2007
NSW GEOLOGICAL SURVEY, AIG AND SMEDG: MINES & WINES, Orange NSW
Link: www.smedg.org.au

8 October 2007
AIG(WA): URANIUM EXPLORATION SEMINAR
Burswood on Swan, Perth
Contact: Jocelyn Thomson jaytee@iinet.net.au

18 - 22 November 2007
ASEG AND PESA: 19TH INTERNATIONAL GEOPHYSICAL CONFERENCE AND EXHIBITION
Perth Convention and Exhibition Centre, Western Australia
Link : www.aseg.org.au

Important Book

THE SUN KINGS:THE UNEXPECTED TRAGEDY OF RICHARD CARRINGTON AND THE TALE OF HOW MODERN ASTRONOMY BEGAN

Stuart Clark

Cloth | 2007 | $24.95 / £15.95 | ISBN13: 978-0-691-12660-9
224 pp. | 6 x 9 | 15 halftones.

IN SEPTEMBER OF 1859, the entire Earth was engulfed in a gigantic cloud of seething gas, and a blood-red aurora erupted across the planet from the poles to the tropics.

Around the world, telegraph systems crashed, machines burst into flames, and electric shocks rendered operators unconscious. Compasses and other sensitive instruments reeled as if struck by a massive magnetic fist. For the first time, people began to suspect that the Earth was not isolated from the rest of the universe. However, nobody knew what could have released such strange forces upon the Earth — nobody, that is, except the amateur English astronomer Richard Carrington.

In this riveting account, Stuart Clark tells for the first time the full story behind Carrington's observations of a mysterious explosion on the surface of the Sun and how his brilliant insight — that the Sun's magnetism directly influences the Earth — helped to usher in the modern era of astronomy. Clark vividly brings to life the scientists who roundly rejected the significance of Carrington's discovery of solar flares, as well as those who took up his struggle to prove the notion that the Earth could be touched by influences from space. Clark also reveals new details about the sordid scandal that destroyed Carrington's reputation and led him from the highest echelons of science to the very lowest reaches of love, villainy, and revenge.

The Sun Kings transports us back to Victorian England, into the very heart of the great nineteenth-century scientific controversy about the Sun's hidden influence over our planet.

Stuart Clark is a former editor of the United Kingdom's best-selling astronomy magazine, *Astronomy Now*. He currently writes for the European Space Agency and is a regular contributor to such magazines as *New Scientist* and *BBC Focus*. He is the author of several books, including *Journey to the Stars* and *Universe in Focus: The Story of the Hubble Telescope.*

Endorsements

"In this sprightly and spirited narrative, a few determined scientists set out to correlate the pattern of dark spots on the Sun's face with the igniting of earthly aurora, the interruption of telegraph (later satellite) transmissions, and even the price of wheat in England. Of course, the world thought them mad. The 'sun kings,' as Stuart Clark so aptly names these pioneers, persevered through ridicule, animosity, and personal tragedy to forge a link across space and fathom the true nature of the Sun. I found myself captivated by the characters, the colossal problems they tackled, and the stunning conclusions they finally reached. I commend Clark for combining so many interesting ideas into a single, fast-paced, beautifully crafted story."

Dava Sobel, author of *Longitude, Galileo's Daughter*, and *The Planets*

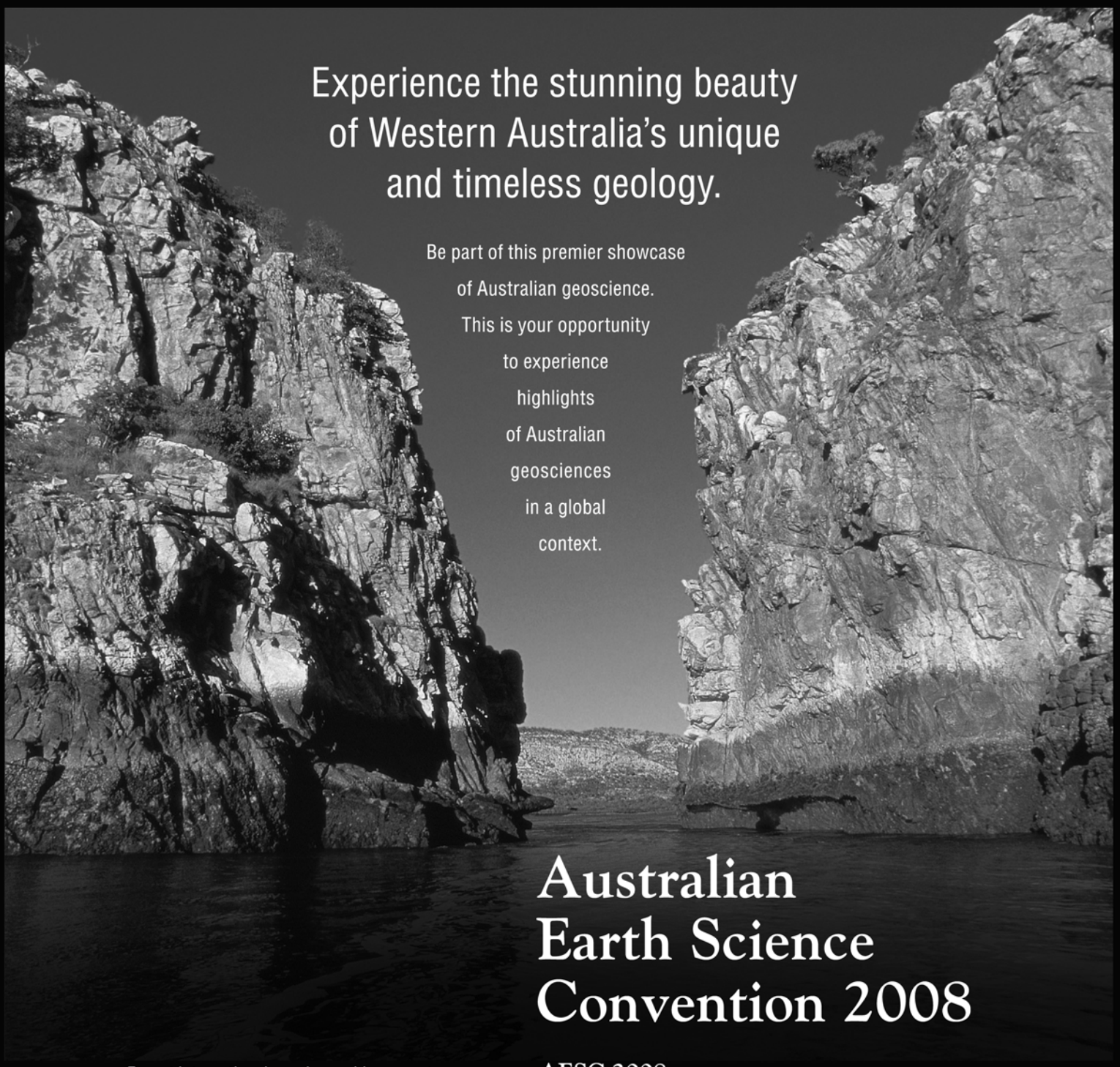
"Herein lies the tale of intrepid astronomers, across time and cultures, who were the first to observe, identify, and document our misbehaving Sun. But by the time you are done, you realize that the story's main protagonist — the one with all the personality — is not any one of the scientists, but the Sun itself. A delightful, informative read."

Neil deGrasse Tyson, astrophysicist, American Museum of Natural History, author of *Death by Black Hole: And Other Cosmic Quandaries*

"Stuart Clark illuminates the dawn of astrophysics by tracing the rise and fall of Richard Carrington, the man who first glimpsed how events on the Sun affect our lives on Earth. No faceless automatons, the scientists in this tale blend a passion for their work with the more worldly passions of pride, jealousy, greed, and lust."

Robert P. Kirshner, Clowes Professor of Science, Harvard University.

Ed: Let's also remember this was the time of Charles Lyell and his hatchet job on the clerical geologists of the time for covert political purposes might need to be revisited. And any similarities between then and now concerning climate scepticism has to be merely a coincidence, no?



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Selected Ni sulfide deposits and exploration targets in southern and central Africa

W.D. Maier, Centre for Exploration Targeting, University of Western Australia

Ore formation

Many of the world's large Ni sulfide deposits (Noril'sk, Voisey's Bay, Pechenga, Kabanga) are thought to have formed through four main processes:

(i) Relatively large degree partial melting of a mantle plume to form vast volumes of relatively primitive (magnesian and Ni-rich) magmas.

(ii) Rifting of the lithosphere so that the mantle magmas can ascend to the upper crust without undergoing significant differentiation en route that might result in S saturation and Ni extraction. Furthermore, rifts tend to contain S bearing sediments that may provide an external S source to the magmas.

(iii) Heating and ultimately assimilation of S bearing country rocks to trigger S saturation of the magma and the formation of droplets of immiscible sulfide melt.

(iv) Entrainment of suspended sulfide droplets by the ascending magma and precipitation and concentration of the sulfide droplets in flow dynamic traps, e.g. within magma conduits or lava channels.

The Bushveld Complex and related intrusions

The 2.05 Ga Bushveld Complex of South Africa is the largest layered intrusion on Earth and hosts the bulk of the world's PGE reserves, in the form of stratiform reefs, within and at the base of the intrusion. Like most large layered intrusions, the Bushveld Complex is very S poor, with most of the rocks having < 500 ppm S (i.e. no visible sulfides). Only once magnetite appears, in the uppermost portion of the Complex, do sulfides become somewhat more abundant. Ni is an important byproduct during PGE mining, notably in the contact-style Platreef. The Bushveld event produced many satellite intrusions, the largest being the 13,500 km^2 Molopo Farms Complex in Botswana that equally contains low-grade PGE reefs.

Some of the smaller satellite intrusions contain Cu-Ni sulfides. Amongst them is the tubular Uitkomst Complex that has been interpreted as a magma conduit. It is located stratigraphically some 10 km below the Bushveld and hosted by dolomite and S-bearing shale. The lower portion of the intrusion contains 3 lenses of massive sulfides (combined 2.3 mt, 2.7% Ni, 1.4.% Cu, 6.4 ppm PGE) as well as disseminated sulfides (72mt, 0.6% Ni, 0.22% Cu, 1.1ppm PGE)(Maier et al., 2004).

Notably, the association of the most abundant sulfides with the smallest intrusion in a magmatic province is equally observed at Voisey's Bay and Kabanga and reflects the importance of dynamic systems in ore formation.

The Karoo flood basalts and the Mount Ayliff Complex (RSA)

Flood basalts are major targets for Ni-Cu sulfide ores because the Siberian traps host the largest Ni-Cu deposit on Earth. Thus, portions of the 180 Ma Karoo flood basalt province, notably in South Africa, have been explored for Ni-Cu sulfides by several companies. The 0.18 Ga Mount Ayliff Complex of South Africa represents a feeder chamber to the flood basalts. A small sulfide deposit occurs at Waterfall Gorge, Insizwa lobe (0.5 Mt, 0.3% Ni, 0.25% Cu, 0.88ppm PGE).(Lightfoot et al., 1983) PGE tenors of the sulfides are high (up to 40 ppm). Olivines in part of the intrusion are strongly Ni depleted, prompting speculation about vast hidden sulfide ores. However, as a whole, the Karoo igneous rocks (at least in South Africa where they have been studied in most detail) are characterized by a paucity of magmatic sulfides, possibly because the sedimentary host rocks contain little S. The Mount Ayliff area remains a target, but more work needs to be done in poorly explored Zambia and Zimbabwe.

Selebi-Phikwe - Dikoloti (Botswana)

The sulfide ores occur in intrusions of unknown age (ca 2.1-2.7 Ga) within the Limpopo mobile belt. The ores are hosted by tectonized amphibolites and may have formed in gabbroic magma conduits. Selebi Phikwe hosts significant amounts of sulfides (50Mt, 1.04% Ni, 1.12% Cu), but the sulfides are of relatively low tenor (1-2% Ni and Cu, up to ca 100 ppb PGE), possibly due to sulfide segregation at depth. Sulfides at Dikoloti are more PGE rich (1.2 ppm), but Ni and Cu tenors are broadly similar to Selebi Phikwe. The occurrence of spatially closely associated sulfides of variable metal grade suggests a dynamic igneous system with localized sulfur sources and multiple magma conduits that were exploited by several magma batches.

Phoenix-Selkirk-Tekwane (Botswana)

The sulfides are hosted by relatively small intrusions occurring within the ca. 2.7 Ga Tati greenstone belt. Metal tenors of the sulfides are generally high (5-9ppm at Phoenix, 3-5 ppm at Selkirk). Phoenix and Selkirk are of gabbroic composition (Pd/Ir > 100) and may represent magma conduits. Tekwane is a poorly studied troctolitic intrusion, characterized by high metal tenors (ca 50 ppm PGE, > 5% Ni, 10% Cu) and Pd/Ir ratios (700). This implies delayed S saturation and suggests that Tekwane is additionally a PGE target.

Both the Selebi-Phikwe and Tati deposits have trace element patterns that suggest emplacement in oceanic island arc settings. Orogenic settings have so far attracted relatively little exploration effort, based partly on theoretical considerations. Most mantle magmas in orogenic settings form by flux melting of mantle wedges overlying subduction zones. The process probably results in relatively lower volumes of mantle-derived magmas, and in less primitive magma compositions, than adiabatic melting of a mantle plume. Furthermore, the predominantly compressive environments of orogenic belts may result in relatively few dilatant sites through which magmas can ascend, and orogenic belts tend to contain fewer S-bearing sedimentary strata than rifts.

Until recently, this exploration model seemed consistent with empirical observations, i.e. most magmatic sulfide deposits in plate margin settings are relatively small. Examples that come to mind are those in the Early Devonian Appalachian orogenic belt of North America (e.g. St Stephen, ca. 1 mt at 1.05% Ni, 0.53% Cu, Paktunc 1990), the Silurian-Devonian Caledonide orogenic belt of Norway (e.g. the Bruvann deposit in the Råna intrusion, 43 mt at 0.33% Ni, Boyd and Mathiesen, 1979), and the Early Proterozoic Vammala belt of Finland (combined 7.5 Mt at 0.66% Ni and 0.42% Cu, Peltonen, 1995). However, evidence for an enhanced sulfide potential of magmatic arc settings has begun to accumulate in the last two decades, with the discovery of Ni-Cu ores in the Early Proterozoic Sally Malay intrusion

Cont. Overleaf

Selected Ni sulfide deposits and exploration targets in southern & central Africa

Cont. from Previous Page

of Australia (ca. 4 Mt at 1.8% Ni and 0.73% Cu, Hoatson and Blake 2000) and the Early Carboniferous Aguablanca intrusion of Spain (16 Mt at 0.66% Ni and 0.46% Cu, Pina et al., 2006). The identification of an increasing number of sizeable magmatic Ni-Cu ore deposits in orogenic environments (including the Selebi-Phikwe and Tati belts) suggests that the currently used exploration models for such deposits are incomplete, and that many orogenic belts should be revisited with regard to their Ni-Cu potential. Of particular exploration interest are transtensional zones that may allow mantle magmas to ascend to upper crustal levels.

Kunene Complex (Namibia-Angola)

The ca. 1.3 Ga Kunene Complex is one of the world's largest anorthosite massifs (ca 18,000 km^2), consisting of up to 13 large troctolitic-anorthositic intrusions and numerous small ultramafic-mafic satellites. Prior to the discovery of Voisey's Bay in the 1990's, anorthosites were considered to be poor Ni targets because they are though to ascend as relatively cool crystal mushes with little capacity to assimilate country rocks, and because any sulfide liquid that formed would not be able to segregate through the viscous magma. No sulfide deposits have yet been found in the Zebra Mountain massif in Namibia, but up to 5% disseminated Ni sulfides (with relatively high Ni tenors) have been intersected in some of the associated satellites, e.g. Ohamaremba. This indicates potential for Voisey's Bay type mineralization in the Kunene magmatic province. PGE contents of the sulfides are low (0.5 ppm in 100% sulfides), analogous to Voisey's Bay, possibly due to lower crustal contamination and sulfide extraction.

Kabanga (Tanzania)

The intrusion forms part of the 1.4 Ga, > 500km long Kabanga-Musongati- Kapalagulu belt in Tanzania and Burundi (Evans et al., 1999). Recent age data (Kokonyagi et al., 2005; Maier et al., 2007) indicate that the belt continues into the DRC. The belt contains Ni deposits (e.g. Kabanga, 47Mt at 2.6% Ni, 0.3% Cu, mostly < 0.1 ppm PGE; possibly also Kapalagulu), as well as PGE reef-type mineralization (e.g. at Kapalagulu and Musongati) and laterites (Musongati). The factors that determine whether an intrusion contains irregular but locally significant concentrations of massive and disseminated sulfides or laterally extensive, but sulfide-poor PGE reef-type deposits remain unclear. However, lithogeochemical data indicate that the most sulfide rich intrusions (Kabanga, Luhumo) have a strong crustal signature, whereas the relatively less S rich intrusions (Kapalagulu, Musongati) have less pronounced crustal signatures. This suggests that in the K-M belt, lithogeochemistry can be used as an exploration tool to discriminate PGE from Ni targets.

Summary of exploration strategy

Global-regional exploration: Identify cratons and their margins, greenstone belts, oceanic island arcs, rifts and flood basalts. Exploration relies mainly on geophysics, mapping, stream and soil sediment geochemistry. Lithogeochemistry can help to distinguish contaminated and primitive belts from less contaminated and more differentiated belts, identify particularly contaminated intrusions within individual belts, pervasive metal depletion within igneous provinces, identify coeval intrusions and igneous events, characterize the S source and thus home in on other bodies intruding the contaminant.

Local exploration: Identify drilling targets. Exploration relies on geophysics (coincident gravity-EM-magnetic anomalies), mapping

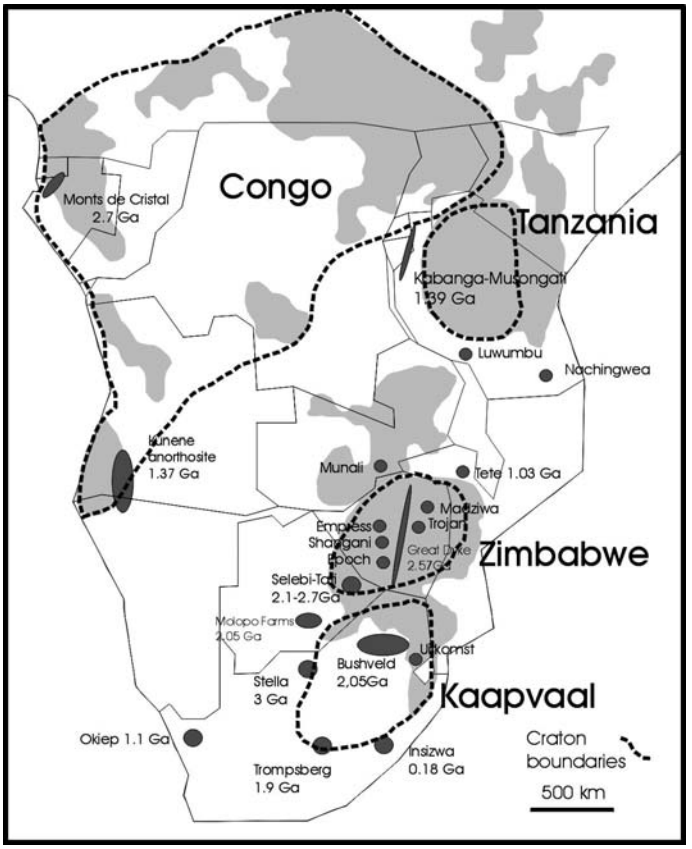

Figure 1: Selected Ni-Cu-PGE deposits and targets in southern and central Africa. Shaded area indicates exposed Archean crust (adapted from Bleeker, 2003).

(constrain stratigraphic and geometric relationships), soil and stream sediment geochemistry. Lithogeochemistry is particularly important to constrain the stratigraphy of intrusions (i.e. what's the bottom and the top) and thus locate massive sulfides, evaluate possible migration of sulfides into floor rocks using mass balance of metals, and to calculate sulfide tenors of disseminated sulfides to evaluate economic potential of undiscovered massive ores. ▲▲

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Complaints, Complaints, Complaints

Welcome to members of the Complaints Panel

The following members have been appointed to investigate complaints made under the Code of Ethics, and the JORC and VALMIN codes: Andrew Grove, Andrew Penkethman, Louis Hissink, Mark Berry, Mike Young, Rick Rogerson and Simon Pooley. Together their experience spans a wide variety of professional practice areas, commodities, mineralization styles, and stages of resource development.

Current complaints

Since the February 2007 edition of the AIG News, one complaint concerning an allegation that a member as a competent person had breached Clause 17 of the JORC Code in a report to the ASX has been resolved. The report was found to be highly promotional but lacked details on the nature of the mineralization and its distribution - resulting in a reprimand for the member concerned.

A new complaint relating to a member as a competent person alleged to have provided insufficient information on a mineral resource in an ASX report, thereby breaching Clause 19 of the JORC Code, has been dealt with by the Complaints Committee. The Ethics and Standards Committee is currently (late May) considering the report by the Complaints Committee and the Respondent's reply to the allegation.

My copy of the JORC Code is missing a few pages

"*JORC-compliant resource*", a term frequently used in public reporting by competent persons and journalists, is misleading on several counts! Firstly, it could mislead the investing public — potentially a breach of Clause 19 of the JORC Code, into thinking that the resource estimate has been approved by the Joint Ore Reserves Committee. Secondly, JORC is a committee and presumably the competent person means the JORC Code. Even in this context, what the competent person really means is that he/she has classified parts of the resource or reserve using the categories in the JORC Code. Whether or not the report is JORC Code-compliant is another issue!

Reporting metal equivalents in public reports requires particular care. The overriding guidelines are provided in the JORC Code under Clause 25 and Table 1. Clause 25 states in part "Mineral Resources must not be reported in terms of contained metal or mineral content unless corresponding tonnages and grades are also presented." Table 1 states that "The assumptions used for any reporting of metal equivalent values should be clearly stated".

To ensure that your report does not breach the JORC Code when reporting metal equivalents, first report the estimate in terms of grade and tonnage for individual metals and then, if you think it really will enhance transparency and materiality, re-calculate in terms of a metal equivalent clearly stating the price of all commodities used, the reason why the particular equivalent commodity was chosen, and any other assumption that was made. ▲▲

More Interesting Ideas from an Engineering Viewpoint

(Ed: This introduction was lifted from New Concepts in Global Tectonics Newsletter No 41 when I was told about its existence. Your editor admits error by not being vigilant since he obviously missed it and was only targeted to it by another scientist. The ideas expressed in this new book clearly relegate climate alarmism to the same place the Eugenics idea of a previous era was.)

A New Book of Importance

A VOYAGE OF DISCOVERY

A history of ideas about the earth, with a new understanding of the global resources of water and petroleum, and the problems of climate change.

The book presents an integrated analysis of the origins of the earth's resources of water and petroleum. The analysis leads into discussion of the action of volcanoes, the mechanism of deep earthquakes, the concept of an expanding earth, and climate change.

At the heart of the analysis is the concept, originally by Arrhenius, that the molten rocks below the crystalline crust of the earth are in the form of an ionised hydro-siliceous solution. Molten silica has a high capacity to absorb water into solution, and also other volatiles such as carbon dioxide, methane and sulphur dioxide. The volatiles are not present as molecules, but dissociated, as ions.

These features are noted in volcanoes. When a volcano explodes, there is a sudden release of pressure leading to the spontaneous disintegration of a volume of molten rock. Great clouds of fine dust are created, with steam and other gases such as carbon dioxide, and sulphur dioxide. Methane may be liberated, catching fire on contact with the air. An explosive volcanic eruption can release far more energy than any man-made explosion, for example, the explosion of Krakatoa in 1883 was heard in Alice Springs.

The presence of water in volcanic rocks was recognised by Judd in 1880. However, it was not recognised by the geologists at the time, and that has continued to the present day. The prevailing belief in mainstream geology is that the steam in volcanic eruptions comes from rainwater percolating down fissures in the surface rocks, or from wet rocks carried down into the mantle by subduction. In both cases it is assumed that the original source was rainwater.

A century ago, J.W. Gregory, Professor of Geology at the University of Melbourne, was adamant that the waters of the Great Artesian Basin were not recharged from surface rainfall. His explanation was sound, and quite right. Gregory deplored the free-running bores, and the wasteful use of groundwater. The waste has continued.

The plunder of groundwater over the past century has now led to the drying up of the world's deep water wells.

About three billion people around the world depend on groundwater from deep wells as an important source of drinking water.

Almost all of the resources of deep groundwater are not replenished from rainfall. They are fossil resources. The result has been a one-time raid on the water bank.

Food and Agriculture Organisation even suggested that the rapid exploitation of groundwater had saved the world from a food crisis. They were assuming that the groundwater would be replenished from surface rainfall. But the groundwater will not be replenished from rainfall, and now the world faces an even greater food crisis.

There are very serious problems in India, Bangladesh, Pakistan, China, Mexico, the Middle East, Africa, and the United States. The leading world experts on groundwater hydrology are all silent, and that is because the present practical reality contradicts their theories.

At the heart of the problem is the misconception about groundwater dating. The practice of dating of groundwater is based on the fundamental assumption that the groundwater was originally rainfall. But in most cases the results do not actually prove that the dated water was originally rainfall, only that if the water was originally rainfall, then the age would be that as determined. Thus, in most cases, the final result is only an assumption. The mistake is causing serious misunderstanding, and thereby immense harm, in many countries.

Acceptance that the molten rocks of the earth are in the form of an ionised hydro-siliceous solution permits a new understanding of the properties of the Moho, a frictionless interface between the brittle crystalline rocks of the crust and the hydro-siliceous mantle. The interface is remarkably smooth. The Moho exhibits no shear resistance, even to the shortest period shear waves. This is the property of a gas, and it indicates that the Moho must be a layer of ionised gases on the surface of the molten rock, and below the crystalline crust.

Mendeleev, in 1878, published a paper on the origin of petroleum, suggesting that natural gas and petroleum were products of exudation from the molten interior of the earth, and not products of decomposition of surface plant matter. For the past 50 years this view has been accepted by Russian petroleum geologists, with remarkable success. However, the geologists of the western world still adhere to the idea of petroleum from decomposition of plant matter.

The mechanism of deep earthquakes is discussed. It is explained that deep earthquakes in molten rock probably occur by shear-induced

ordering in the hydro-siliceous solution, leading to migration of ions of the volatile gases (plasma) into planar features which have no shearing resistance. It is concluded that much of the shearing displacement in these deep shear zones occurs without seismicity, indicating sliding without fracture. Seismicity is less frequent, and indicates 'sticking' and subsequent fracture. Seismologists have recently begun to refer to silent earthquakes.

The shear-induced ordering in the geotectonic shear zones leads to the "pumping" of volatiles to the surface of the earth. The release of volatiles at the ground surface is a normal feature of major earthquakes. This also helps to explain the close proximity of petroleum resources and deep earthquake zones.

The study in the book of the mechanics of volcanoes and deep earthquakes, and the recognition of the properties of the Moho, leads to a consideration of subduction. This is a concept which was proposed to explain the combination of sea-floor spreading and plate tectonics on a constant size earth. It is considered by the author that subduction is physically impossible.

The geotectonic behaviour of the earth is influenced by the sun. Solar perturbations, such as sunspots, solar flares, and the great variations in solar magnetic behaviour, all appear to have a strong influence on the geotectonic behaviour of the earth, and thereby, on climate.

The study of the ice-core records from Greenland and Antarctica reveal a major dislocation in the pattern of behaviour from about 20,000 years ago. It is suggested in the book that the pattern of behaviour during the ice ages is consistent with a dynamic system comprising the sun and the earth. Over the past 10,000 years, the pattern of behaviour is consistent with a dynamic system comprising the sun, the earth and the moon. Thus it seems evident that the earth captured the moon only recently. The addition of the moon brought about the end of the last ice age. The greater tidal influence of the moon would certainly have changed ocean circulation, and led to the Gulf Stream.

The capture of the moon at this stage in human history seems to be in keeping with the folklore of the ancient Egyptians, Greeks, Romans, Babylonians, Japanese, the Eskimos, and natives of North and South America.

The book was written to encourage thought, debate and understanding of the earth's dynamic systems. ▲▲

Lance ENDERSBEE
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Electrical Journey to Center of the Earth

Source : Http:// www.thunderbolts.info

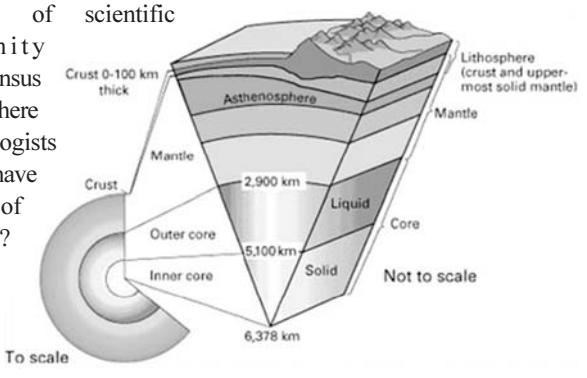
BECAUSE THE EARTH is a small charged body moving in a large cell of plasma, explanations of all physical phenomena in, on, and near the Earth must take the electrical behaviour of plasma into account.

Traditional geology has over many years gradually built up a picture of the Earth's interior. Geologists assumed that gravity pulled upper layers of rock onto lower layers, uniformly increasing the pressure toward the center. Laboratory experiments provided some indications of how rocks responded to increasing pressure and temperature, and theoretical extrapolations from these values provided a basis for guessing what could be going on far beneath the deepest drill holes.

A thin crust of light rock floats on the denser material of the mantle, which in turn surrounds an even denser core. At critical values of pressure, temperature, and/or composition, the material may change states, from solid to plastic at the asthenosphere, from solid to liquid at the outer core. Extrapolations of seismic wave behavior and deductions from theory (with appropriate adjustments) justify an interpretation of earthquake waves that confirms the expectations of pressure and temperature theories. The anomalies can probably be explained if enough funding is allocated to study them.

But becoming aware of plasma changes everything. Because gravity can distort atoms and because pressure can preferentially "squeeze" electrons out of lower layers, (*Ed: the piezoelectric effect*) rock can become susceptible to electromagnetic forces. Because plasma cables and sheets (i.e., electrical currents) have been detected flowing between Earth's magnetosphere and the surface, the circuit must close by passing through the Earth. Because magma is liquid plasma, it will preferentially carry currents. Because electrical currents in plasma pinch into filaments and tend to form "double layers" (capacitor-like formations), the distribution of currents inside the Earth will be highly inhomogeneous. Electrical heating will cause temperature discontinuities in "lines and lumps." Electromagnetic forces between current filaments and between the layers of double layers will cause enormous and sudden pressure variations.

Why doesn't this show up in seismographs of earthquakes? Or does it show up, and then go unrecognized because researchers have no concept of plasma behaviour? No one has ever investigated how seismic waves act in different plasma conditions. The seismograph scrawls a single wavy line, but the geologist must interpret it according to a choice among several competing theories. With the awareness of plasma, seismographs no longer provide reliable — or even understandable — information about conditions at depth. Plasma geology is a virgin field for curious and enterprising investigators. In this age of scientific conformity and consensus truth, are there any geologists left who have a sense of adventure? ▲▲



AWOL Oceanic Crust

Louis Hissink

Slab of Oceanic floor found under America - 2006

Back in June 3, 2006 Science Daily reported that a "Slab Of Sunken Ocean Floor Found Deep Within Earth".

Deep within Earth, halfway to its centre in an area where Earth's core meets its mantle, lies a massive folded slab of rock that once was the ocean floor, reports a team of researchers (including one from Arizona State University) in the current issue of Nature.

The slab, which sank beneath North America some 50 million years ago, holds important clues as to the behaviour and composition of the deep interior of Earth and it could help explain how surface features such as volcanos and earthquakes form, the researchers say.

The research team, led by seismologists at the University of California, Santa Cruz, detected the slab by analyzing seismic waves reflected from the deepest layer of the mantle beneath an area off the west coast of Central America. The team includes Edward Garnero of Arizona State University, Alexander Hutko and Thorne Lay of UC-Santa Cruz, and Justin Revenaugh of the University of Minnesota. They describe their discovery in "Seismic detection of folded, subducted lithosphere at the core-mantle boundary," in the May 18 issue of Nature.

Full article here:
(http://www.sciencedaily.com/releases/2006/06/060603092903.htm)

And then we have:

Ocean Crust Missing in Atlantic - 2007

Science Daily then on 2 March 2007 reported that a Cardiff University team were setting sail for the Atlantic on a voyage of exciting discovery - apparently "scientists have discovered a large area thousands of square kilometres in extent in the middle of the Atlantic where the Earth's crust appears to be missing. Instead, the mantle - the deep interior of the Earth, normally covered by crust many kilometres thick - is exposed on the seafloor, 3000m below the surface.

Marine geologist Dr Chris MacLeod, School of Earth, Ocean and Planetary Sciences said: "This discovery is like an open wound on the surface of the Earth. Was the crust never there? Was it once there but then torn away on huge geological faults? If so, then how and why?"

To answer some of these questions Dr MacLeod with a team of scientists, led by marine geophysicist Professor Roger Searle, Durham University, will travel to the area which lies mid-way between the Cape Verde Islands and the Caribbean.

The expedition will be the inaugural research cruise of a new UK research ship RRS James Cook. The team intends to use sonar to image the seafloor and then take rock cores using a robotic seabed drill. The samples will provide a rare opportunity to gain insights into the workings of the mantle deep below the surface of the Earth.

Progress of the cruise can be monitored via a live web link to the ship: http://www.noc.soton.ac.uk/gg/classroom@sea/JC007/

Full article here:
http://www.sciencedaily.com/releases/2007/03/070301103112.htm

(Ed: I wonder if there is a connection…)

Prehistoric Ground Sloth Footprints Found

NINE FOOTPRINTS OF the huge prehistoric ground sloth scelidotherium been found on an Argentinian beach.

"The prints are about 55cm long," said Vicente Di Martino, the director of the Natural Science Museum in Monte Hermoso, who found the prints on a beach south of Buenos Aires.

He said the tracks had been covered with sand, which eroded away. "The scelidotherium was a herbivore who lived here some 15,000 years ago, measured about 3m long, was short, weighed about 600kg and had a long, thin skull," he said.

Explorer Charles Darwin reported in his journal of travel aboard the Beagle finding a scelidotherium fossil in Punta Alta near Bahia Blanca, south of Buenos Aires, in 1832. Another Briton, Richard Owen, identified the scelidotherium based on Darwin's find in 1839.

Argentine experts have set to the task of making casts of the footprints with polyester resin, which will allow them to make moulds that can be displayed in the museum.

"We can work on the prints about four hours a day, because they are covered by the tide the rest of the time," Mr Di Martino said.

The same beach yielded 7000-year-old human footprints in the 1990s.

(Ed: Given the horizontal velocity a Sloth could muster, it's remarkable that such a record actually exists).

From the Editor's Desk

THE EDITOR WAS A LITTLE SURPRISED when offered a short drilling contract at the daily rate of A$900 recently, and prior to that an offer to take over management of a fluorite project in the East Kimberley with the sales pitch inferring that millions could be made from this prospect. Both were turned down for various reasons but were plain evidence of an apparent skills shortage in the mining and exploration industry.

Information from others show that unskilled 19 year old field hands are now being employed to do the usual drill rig sampling that more experienced fieldies used to do, with the expected errors in sample numbering, and sampling using inexperienced staff. Of course wages rates for experienced field hands are also exploding but it does depend where the exploration is being conducted and pay rates. I personally know of one experienced field assistant who preferred to work for less in a warmer climate than for more in a colder one. So money isn't the only factor in attracting recruits.

One conspicuous observation is that many young geologists refuse to do field work, preferring to sit in front of computers under the assumption that this is how new mineral deposits are found. Other tales involve young geologists getting involved with daily administrative chores, effectively taking over the work of senior field-hands with the usual incidents occurring. Other tales relate young geologists pointing out that possessing a university degree makes them more intelligent than seasoned field hands - and the list goes on and on. Little wonder exploration success seems to have stalled somewhat these years if these situations are widespread in the industry.

Another reason companies might be finding it hard to find workers may not be due to a lack of skilled staff but, as one fieldy called it, the "anal" corporate attitudes some companies have towards their workers. There are companies fieldies just will not work for, just as the editor is also un-willing to work for some companies. So if you cannot find skilled workers, have a close look at the corporate attitudes and more importantly, the bureaucratic hoo-haa associated with mineral exploration that affects your exploration departments. It could well be that it's the bureaucratic hoo-haa that is the reason some find it hard to fill vacancies. In other words "It's the HR departments, stupid", not a worker shortage, that is the problem.

The Skills shortage is a complex issue but as the following editorial from the Asia Miner Magazine shows, there might be solutions.

Asia Miner On-Line Editorial April 23-29 2007

"Skilled worker shortages have become a world-wide phenomenon in the western world, especially resources rich countries where new mining projects are finding it difficult to attract talent to their operations and stoking wage rate hikes.

Speaking to my colleagues in Australia, Africa, China and the US, our conversations keep focusing on the same continuing mine-site problems - long lead times in getting equipment and infrastructure delivered to sites, and lack of skilled workers to get the jobs done.

It is Asia's voracious appetite for raw materials which has prompted the great revival to build new mines, oil rigs, railways, roads and ports. Last year alone, Australia experienced the fastest job growth in 17 years.

Recruitment companies such as the newly created Artemis International Executive Search and Swann Global (both sponsors of The ASIA Miner Investing in Mining conference being held in Sydney on May 7-8) and the many others who have a focus on recruiting for the mining sector have no easy task in their quest, nor a large selection pool in which to source their next mining executive, but looking in marketplaces that were not traditionally seen as a talent pool will give them the edge and Asia with the world's largest concentration of population is where the talent pool lays.

Mining investment grew 57% last year from. This was triggered by a 54% surge in commodity prices over the past two years.

Growth in the mining sector has fuelled massive growth in construction companies such as Leighton Holdings, which currently has a record A$20.1 billion work in hand. The building industry employs almost one-tenth of Australia's workers".

Dear Editor,

I feel compelled to take issue with some of the statements made in the article adapted from D.E. Scott's book in AIG News # 87. It goes on at some length on what constitutes "science" with the view expressed that archeology, geology and astronomy (or astrophysics) are not "sciences" because their practitioners are not "able to produce results" (hypotheses may be a better word) "that can be tested experimentally."

It appears from the article that geology is included in the "non-science" (my wording) grouping because "theoretical geologists also tell impressive stories about how the continents have shifted and when the mountains formed." This seems to me a rather narrow view of geology (and science in general) but it is the only description of geologist's work that I have been able to find in the article.

While I don't have accurate figures at hand, I estimate that at least half the geological fraternity is employed in Industry including exploration, where geological observations are made, models and interpretations developed and then frequently tested by drilling or other appropriate means. This lack of understanding of what it is that practitioners in another discipline actually do combined with an apparent willingness to "bag them anyway" causes me to speculate on whether Dr Scott's knowledge is any better regarding the other "sciences" he writes about.

Stuart Robinson

(Ed: I suspect Dr.Scott wasn't describing exploration geologists, and thus the best exponents of the empirical method of science, but rather the arm-flaying grand narrators of the geological litany).

Dear Editor

I compliment AIG on the quality of its Quarterly Newsletter.

When I joined AIG at about the time of its incorporation, I thought that the Institute's main focus would be on industrial issues. And AIG has certainly not disappointed in delivering that service. And now AIG News is also giving me very informative, constructive, and unbiased information on the current topic of debate, namely climate change. Indeed such contents of AIG News are far more science-based than anything I read in the publications of so-called learned societies, too many of which are succumbing to the 'science by consensus' virus.

Well done AIG and keep up the good work.

Aert Driessen

Dear Editor,

Thank you very much for publishing the article Science and Pseudo-Religion which I am copying to a lot of people. Also, thank you for your article Intensive Variables. Re that article, may I give you an exception that proves the rule that averaging assays to produce a mean assay multiplied by the total mass of ore will produce the wrong result.

Having being directly involved in many copper, gold and uranium ore reserve and resource calculations since 1956, I don't need convincing. But, in 1976, as Director of Planning of the Australian Atomic Energy Commission, I had to re-do the reserves of the Mary Kathleen uranium deposit. To my amazement, I found no serial correlation down-hole nor between holes which had been plotted as intersecting did (even they obviously not). In desperation I tried working in plan, cross-section and (?) long-section, still with no sensible assay continuity nor geological control evident. As a final straw, I took all of those thousands of assays, including the zeros and below detection values, treated each equally, averaged the lot and gave that as the mineable grade for the one continuous volume and hence mass determined in three dimensions by best guess on the data available. Several months later, a senior geologist of the company phoned me from Mary K to ask a series of questions about the assumptions I had made and the method adopted. At the end of the conversation I asked him how close I had come to the company's figures and he said that he was amazed (as was I) that I was within 3% of their answers. So this is the rare case of random numbers in huge bulk being useful.

Hope you are as amused by the situation as I was!

Congratulations again on your sterling efforts for AIG..

Colin C. Brooks

(Ed: Indeed I was and Koch and Link, 1972, noted that despite theory, sample-volume variance seemed not to stand up to empiricism as Colin here notes; as also the issue of intensive variables it seems. One suspects that in this case, the uranium grades might have been unaffected by either sample-volume variance issues or the intensive variable issue. Maybe the original samples were all of equal volume, and hence the problems negated. The issue of intensive variables becomes irrelevant when sample masses or volumes are standardised as is usually the case in the mining industry these days but what does seem to have occurred is that the assays were truly random ones and thus a simple arithmetic average as accurate as a more expensive geostatistical one).

Dear Editor,

I enjoyed reading the article "Science and Pseudo-religion" as it once again reminds us of the fragility of the peer review system and addresses the problems we face in publishing our heresy of today, whatever that might be and wherever it might lead. My own particular heresy questions the entire basis of our cosmology, which seems to lead to the ultimate singular stupidity of the "big bang", or infinite density and no time and space, which is a concept best left to religion. It seems to me that the entire construct of our cosmology rests on one observation and one theory. The observation is Hubble's red shift of the galaxies; the theory is that the properties of light, or electromagnetic radiation, do not change with the distance and time it has travelled. What if this theory is wrong? A lot of cosmologists' faces shift to the red with embarrassment, or perhaps to the blue with apoplexy?

It is a question to which I have never found an answer; 13 billion light years from the edge of the observable universe is a long way and time for light to travel, and in which there is plenty of time for it to change, to perhaps "wear out". I have neither the maths nor the background to examine this idea-any comments from your readers would be welcome. *(Contributions welcome — Ed).*

Anthropogenic global warming and its effects is another idea that cannot be tested as it still lies ahead of us; but what is the harm in reducing our energy consumption and finding other means of energy production, such as a hydrogen economy, rather than wasting oil on trivial travel in overweight cars? Even if the global warming pundits are wrong, we have a great deal to gain in the long term by taking on board sensible, non-nuclear, options for energy rather than wasting fuel in traffic jams and burning an extremely valuable and non-renewable chemical resource in ill-planned commuter travel, or in wastefully either heating or cooling our houses and factories simply because we have been too lazy and stupid to build-in proper insulation, or have put them in the wrong orientation to take full advantage of our sunlight.

If nothing else, the global warming scaremongering may yet drive us to use sound empirical common-sense in future designs for travel and for our cities, rather than opting for expensive and socially useless solutions such as building 6-lane highways for traffic jams populated by the increasingly shiny and non-utilitarian 4x4 battle-wagon of the day.

Regards,

Bob Findlay (Tasmania)

(Ed: Seems AIG News is also read by others as the previous letter shows).

Introducing the AGC Geoscience Education E-Newsletter - GeoEdLink

(an initiative of the Australian Geoscience Council)

The Geoscience Education Newsletter aims to:

- provide a vehicle for the reporting and discussion of geoscience education news, and of activities aimed at generating interest in geoscience;
- facilitate communication about the geosciences between individuals and groups involved in primary and secondary science education;
- promote collaboration on education issues relating to the geosciences;
- promote a stronger awareness of geoscience education issues to a wide and diverse readership.

The newsletter will be distributed as widely as possible amongst teachers, teacher organizations, geoscience organizations, universities and interested individuals. It will be produced three or four times a year and contain a mixture of relevant news, views and reviews as well as links to good online resources.

Content suggestions are welcomed. Please send them to geoservices@geoed.com.au with GeoEdLink the first word in the subject line.

To subscribe to the newsletter simply put the word subscribe in the subject line and send an email to agc_edlist@geoed.com.au with no words in the body of the email.

Obituary: Terry Moorhouse Leach (1948-2007)

ON THE TWENTY-EIGHTH OF FEBRUARY 2007, the scientific world lost a pioneering spirit in applied geological research, but moreover, the world lost a truly outstanding human being. At his funeral on the third of March, a number of his closer colleagues and friends celebrated the life of Terry Leach, remembering in fondness his quirky character, his unconventional approach to his work, and his spiritual core that remained fundamental to his entire life.

Terry was born in Yorkshire England to parents Lewis and Margaret Leach, both rather radical free thinkers and who encouraged lateral thinking in Terry as a youth. His early school was in the UK until the family immigrated to Canada where Lew envisioned a land of better opportunities for his two children. Terry excelled at schoolwork but also shone, as his father had before him as a champion tennis player; Terry was the under 13 tennis champion.

Terry graduated with a bachelor's degree in chemistry and geology from Carlton University Ottawa in 1969. He continued to excel at tennis representing Canada in an international tennis event at Wimbledon. He also made the Canadian Davis Cup team.

In 1971-1972 Terry was a professional tennis coach in Spain for a year, after which he lived in Paris delivering bread at night in a van through the streets of Paris. These years were one of intense soul searching for Terry, searching for his sense of self and to understand the life he was living.

In 1973 he followed his parents to NZ and Terry enrolled in a Master's degree in Geology at Auckland University. He was a rather rebellious soul at this stage but despite his willingness to experience everything and anything going, he passed his Masters Papers with honours and in 1975 presented a thesis on serpentinite metasomatism which displayed his creative genius.

In 1976- 1980 his life changed with his discovery of his Buddhist Master Lama Zopa, with the birth of his daughter Tam and several jobs at Auckland University that led him to a position as geothermal geologist and petrologist with Auckland based consulting group KRTA Ltd. The company had major geothermal contracts with PNOC in the Philippines, where Terry and his family lived for several years. It was the work done on these geothermal areas in the Philippines that forged the concepts to later become the cornerstone of his work on porphyry and epithermal systems in active tectonic and magmatic arcs.

After leaving KRTA in 1985, Terry set up a consulting petrology group that became CMS Ltd via which he gained exposure to a raft of porphyry and epithermal mineralization systems in the circumPacific. It was here that the genius of the man emerged as he was able to extend petrology into a significant exploration tool; he showed the importance of overprinting of thermal episodes in dead geothermal systems and showed us that these where once dynamic pulsing heat engines subject to continual change and disruption over time. He especially noted the role of fluid mixing and boiling via evidence seen in petrographic sections.

He began teaming up with a gifted structural geologist Dr Greg Corbett who had spent many years in the exploration industry also working on these types of systems. Together they developed a number of exploration models which they then collated into workshop/ seminar courses for both exploration companies and academia. Over 30 of these were run by the team over about 5 years and their work culminated in the publication by the Society of Economic Geologists Special Publication No6 in 1998, a publication warmly received by explorers and researchers in the West Pacific but less well embraced by workers in the US and UK.

Terry had been working as Terry Leach and Co since the break-up of CMS in 1995; in the late 1990's he had a thriving business employing as many as 15 geologists. As his life changed after 2000, Terry scaled back his work in favour of a more spiritual lifestyle and limited himself to a handful of clients. He had a major input to the understanding of the Carlin District Mineralization at this time, and he worked tirelessly on assembling a defence of John Felderhof, the central figure in the Bre-X Busang scandal in Indonesia. In all Terry wrote two books, well in excess of 30 scientific papers, and in excess of 30 workshop courses.

Terry became ill in July-August 2006 and underwent surgery for an oesophageal tumour which tragically had taken hold of his lymphatic system and was aggressively invasive. In his last few weeks, he achieved a life-long wish to become initiated as a novice monk and was given the new title of Jampa Tashi (auspicious love).

Terry was a fine human being who lived his Buddhist beliefs whilst practising as an innovative mineral exploration consultant to companies around the globe. We pay tribute to, honour and celebrate the life of Terry Leach. He will be sadly missed.

Ray Merchant

Honours Thesis Abstract:
Plio-Pleistocene sediments of the Murray Basin

Laura Gow
2006 AIG Honours Bursary Winner
Melbourne University

THE KANAWINKA ESCARPMENT extends across the entire Murray Basin from the Mount Lofty-Flinders Ranges to Portland. Initially identified as a series of relay faults, this structure has more recently been interpreted as a coastal erosion feature. Two stratigraphic units in the Portland region, the Werrikoo Limestone and Bridgewater Formation were deposited on the escarpment. The origin of the escarpment can therefore be deduced by obtaining ages and depositional environments for these two units.

Several outcrops of the Werrikoo Limestone and Bridgewater Formation were stratigraphically measured, sampled and photographed in the Portland-Casterton area. Stratigraphic sections were produced for each locality and correlations made between sections. Foraminifera were used to provide ages, while the lithology and palaeontology assisted in determining depositional environment.

The Bridgewater Formation was deposited in coastal aeolian conditions, and the Werrikoo Limestone was deposited in open to shallow marine, estuarine and intertidal conditions. An age of 1.66-0.73 Ma has been assigned to the Bridgewater Formation and a Plio-Pleistocene age between 2.22 and 0.73 Ma can be applied to the Werrikoo Limestone. The occurrence of planktonic Globorotalia puncticuloides and Globorotalia truncatulinoides further constrain these age ranges.

The development of Lake Bungunnia, a giant lake produced by tectonic damning of the Murray River, appears to have influenced the coastal environment during the period 3.5-0.7 Ma. A consequence of lake formation was a lack of sediment supply to the coast, which in turn produced erosional conditions. This erosion produced the Kanawinka Escarpment during the Plio-Pleistocene and provided the sediment necessary for the deposition of open marine Werrikoo Limestone. Deposition of the Bridgewater Formation was possibly influenced by the breaching of Lake Bungunnia. The combination of decreasing sea level and an influx of sediments resulted in the exposure of the previously deposited Werrikoo Limestone, thus providing a platform for deposition of the shoreface sediments.

The discovery of the Werrikoo Limestone and the interpretation of the Kanawinka Escarpment east of Portland provide strong evidence for the palaeoshoreline origin of the escarpment. ▲▲

Honours Thesis Abstract:
Latest Jurassic-Early Cretacous Depositional History of the Eastern Margin of the Exmouth Sub-basin

Matthew T. Strika
School of Earth and Geographical Sciences
University of Western Australia
2006 Bonwick-AIG Bursary Winner

THE EXMOUTH SUB-BASIN, in the offshore Northern Carnarvon Basin, hosts a number of hydrocarbon reservoirs in the Early Cretaceous Barrow Group. The depositional history of the Barrow Group along with the underlying Dingo and Dupuy Formations, and overlying Mardie Greensand Member of the Muderong Shale, was examined via logging of cored intervals from several wells situated on the eastern margin of the Exmouth Sub-basin.

The Dupuy Formation sandstones are quartzarenites, subfeldsarenites and sublitharenites. The Barrow Group sandstones are predominantly quartzarenites. Provenance analysis of the modal composition of these sandstones indicates a cratonic source dominated by alkali igneous rocks. In addition subrounded to rounded populations of quartz and heavy mineral grains suggest recycling of a quartz-rich sedimentary source. Prior to the deposition of the Barrow Group in the Early Cretaceous faulting at the margins of the Exmouth Sub-basin resulted in the uplift of Triassic material. It is likely that the Triassic Mungaroo Formation was uplifted and eroded to form the source of the Barrow Group sediments.

The stratigraphic succession in the five wells of the study area has been divided into twenty facies and five facies associations. FA1, FA2, FA3 and FA5 are characterised by highly bioturbated fine sandstones and sandy siltstones with Helminthopsis, Palaeophycus, Thalassinoides and Planolites. These facies associations represent deposition on lower shoreface to inner shelf settings. FA4 is characterised by unbioturbated, medium to coarse sandstones with scoured pebbly bases, minor planar cross bedding arranged in fining upwards trends and represents deposition of fluvial channel fills. Interpreted depositional environments are distributary channels (FA4) on a delta plain and lower shoreface to inner shelf settings (FA1, FA2, FA3, FA5) on a delta front. Sandstones in the Macedon-Pyrenees field located to the west are compositionally similar to the Barrow Group sandstones and a similar mixed provenance is interpreted. Integration of seismic and biostratigraphic data with the sedimentological data is used to interpret deposition of the Macedon sandstones on a more distal portion of the lower shoreface to inner shelf of the delta front. ▲▲

Education Report

Kaylene Camuti (Chair, Education Committee)

AIG Geoscience Student Bursaries

Over the last few weeks the 2007 AIG bursary application form was sent to students and academics around Australia. Applications for the bursaries are invited from Honours and Postgraduate students, and the application closing date is the 31st May. Last year we awarded bursaries to seven Honours and Postgraduate students, and in this issue of AIG News we include abstracts by 2006 bursary winners Matthew Strika and Laura Gow on page 27. Matthew was an Honours student at the University of Western Australia and has since joined the Graduate Program with Woodside Petroleum. Laura did her Honours project at Melbourne University, and this year joined Geoscience Australia in Canberra.

Our Bursary Sponsors

This year the AIG Bursary Program has received continuing support from 2006 bursary sponsors, and the welcome support of a new sponsor — Kagara Zinc Limited. In this education report we would like to acknowledge all our sponsors, as their help is essential in maintaining the Bursary Program.

Since 2003 the Bursary Program has awarded four Bonwick-AIG bursaries to Australian geoscience students. The AIG is grateful for the continuing support of **Chris Bonwick**, Managing Director of the Independence Group, a Western Australian-based mining and exploration company. The Independence Group acquired the Long Nickel Mine in Kambalda in September 2002 and began producing nickel in October 2002. The company currently produces about 9,000 tonnes of nickel per year from the Long Nickel Mine, and has active near-mine and regional nickel exploration programs. In addition, the Independence Group also has a 30% interest in the Tropicana gold discovery, north east of Kalgoorlie.

This year **Kagara Zinc Limited** has joined sponsors of the AIG bursaries, offering the Kagara-AIG bursary to geoscience students. Kagara is a Perth-based mining and exploration company that listed on the ASX in 1999. Since listing, the company has explored and developed base metal projects in northern Queensland, and has recently expanded its exploration activities to include nickel and lead-zinc projects at, respectively, Forrestania and Admiral Bay in Western Australia. Kagara has operations at Mt Garnet, Thalanga and Balcooma in northern Queensland, and is forecast to produce around 25,000 tonnes of copper and 50,000 tonnes of zinc this financial year, along with lead, gold and silver. The company is also developing the Mungana Cu-Zn-Au deposit near Chillagoe.

The Minerals and Energy Division of the Department of Primary Industries and Resources South Australia — **PIRSA** — was the inaugural sponsor of the Bursary Program and continues to sponsor bursaries for South Australian geoscience students. This ongoing support for geoscience education is one of the many ways in which PIRSA is actively and successfully supporting geoscience and exploration in South Australia. Since April 2004, with the initiation of the $22.5 million PACE initiative (Plan for Accelerating Exploration) to stimulate exploration in South Australia, South Australia's share of national exploration spending has increased from less than 4% to 13%. Acknowledging the success of the PACE initiative, the South Australian government announced a further $8.4 million in funding for PACE in April this year, extending the program from five to seven years.

The Sydney Mineral Exploration Discussion Group — **SMEDG** — is also a continuing bursary sponsor, supporting student projects related to mineral exploration. SMEDG started life in October 1972 when a group of geologist geologists decided they wanted a forum for presenting and discussing mineral exploration activities. They felt that, although the Sydney area was well served by interdisciplinary societies such as the AusIMM and GSA, there was a lack of suitable informal professional communication between geologists primarily interested in the techniques and concepts of mineral exploration. So SMEDG was born. A $5 contribution was requested of all those wanting to be the mailing list. This was later bumped up to $20, but waived in 2002 because SMEDG could cover its running expenses with profits from its highly successful annual Symposia, generally run in collaboration with the AIG (coming up in September this year is the Mines & Wines Symposium in Orange, complete with a wine tour). SMEDG holds monthly meetings at the Sydney Rugby Club, and information is available from the SMEDG web site (www.smedg.org.au). The SMEDG harbour cruises are legendary.

This year Terra Search also continues as a Platinum sponsor of the bursary program, offering the Terra Search-AIG bursary to geoscience students. Terra Search provides services to exploration and mining companies from offices in Townsville, Perth, Bathurst and a field depot in Charters Towers. The company is continuing to develop both its field and data services in response to increasing demand, and recently upgraded services with the addition of a GEMSYS walking magnetometer, DGPS with experienced surveyor, and a spectrometer and scintillator. Field personnel, equipment, and a fleet of 22 field vehicles (including heavy duty remote area vans), are available to assist with field programs. The provision of geological services is also expanding, and Terra Search provides consultancy services to the Cudeco project at Rocklands, the Liontown Resources base metal project near Charters Towers, and the Diatreme mineral sands project at Eucla.

We also welcome back Cryptodome as a bursary sponsor this year. Cryptodome is a Perth-based company run by Marcus Harris, with a focus on investing in Australia's future resources. Marcus is the former Managing Director of Dalrymple Resources, and a member of AIG Council and Chair of the AIGWA Branch Committee. Marcus commits a great deal of time to geoscience education and is the AIG representative on the Earth Science Western Australia (ESWA) education consortium.

Gnomic Exploration Services is also a long-time supporter of the bursary program, and continues its support in 2007. Gnomic was established in Townsville in 1985 and is the longest standing provider of geoscience and geotechnical personnel to the minerals industry in North Queensland. The company has a wide network of industry contacts, and sources skilled and experienced contract personnel to meet clients' requirements. Gnomic takes pride in providing personal service and building long-standing working relationships with both clients and personnel. The management and staff at Gnomic Exploration have been consistent supporters of educational opportunities for geoscience students and graduates.

We also welcome ActivEX Limited as a returning bursary sponsor. ActivEX is a Brisbane based exploration company committed to the acquisition, identification and delineation of new resource projects

through active exploration. The company is focused on copper and gold projects, concentrating on mid-to-advanced properties with clearly defined targets. While the company's principle commodity focus will be copper and gold, other attractive base and precious metal properties are also considered and the ongoing identification of new prospects is a key focus.

The AIG would like to thank all our bursary sponsors.

The Hellman & Schofield Terry Leach PhD Scholarship

Hellman & Schofield is offering a scholarship to the value of A$20,000 to honour the life and work of Terry Leach, who passed away in February this year. Details of the scholarship are given on page 26, and a tribute to Terry Leach by Ray Merchant is included on the same page.

New Geoscience Education Newsletter - GeoEdLink

This month the Australian Geoscience Council (AGC) launched Australia's first geoscience education newsletter — GeoEdLink. The AGC is the peak body representing nine major Australian geoscience organisations (including the AIG). The launch of the newsletter reflects the concern of these organisations about the critical state of geoscience education at all levels of the Australian education system, and the lack of community awareness of the importance of geoscience to Australia. The newsletter will provide a vehicle for reporting and discussing geoscience education news and activities, promoting collaboration and facilitating communication about geoscience education matters at the primary and secondary level, and promoting awareness of the issues to a wide and diverse readership.

The newsletter will be distributed as widely as possible amongst teachers, teacher organizations, geoscience organizations, education organisations, university academics and administrators, government departments, and interested individuals. It will be produced three or four times a year and will contain a mixture of relevant news, views and reviews as well as links to good online resources. Content suggestions are welcomed and can be sent to geoservices@geoed.com.au with GeoEdLink the first word in the subject line.

If you would like to subscribe to the newsletter simply put the word subscribe in the subject line and send an email to agc_edlist@geoed.com.au with no words in the body of the email. ▲▲

SPONSORS of the AIG GEOSCIENCE BURSARIES

The AIG wishes to thank the following individuals and organisations for their support of the Geoscience Student Bursaries

Diamond Sponsor

Chris Bonwick
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Kagara Zinc Limited
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Office of Minerals & Energy PIRSA
sponsoring the
Office of Minerals & Energy PIRSA-AIG Geoscience Student Bursary

These bursaries are offered to geoscience students at South Australian Universities.(General eligibility criteria and guidelines also apply.)

Sydney Mineral Exploration Discussion Group
sponsoring the
SMEDG-AIG Geoscience Student Bursary

This bursary is offered to geoscience students working on projects related to mineral exploration. The successful applicant must give a presentation on her/his research project to SMEDG at a Sydney meeting within 12 months of being awarded the bursary. (General eligibility criteria and guidelines also apply.)

Terra Search Pty Ltd
sponsoring the
Terra Search-AIG Geoscience Student Bursary

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Know Your Councillor: Martin Robinson (Victoria)

MARTIN ROBINSON JOINED the AIG about 7 years ago and served on the Council for the last 4, his current role being Membership Director. He is also involved on the Bursary Evaluation sub-committee. Martin is a passionate supporter of the AIG and in particular its Professional Registration scheme and would like to see many more RPGeos in the groundwater industry.

Martin was born and schooled in Zimbabwe (formerly Rhodesia), and being an out-door person and loving camping, hiking and wild life, he knew all along that he would be a geologist.

His earliest exposure to geology had occurred at age 7. Accompanied by his Aunt, who studied a year of geology as part of her Arts degree, Martin went on a hiking trip along the Great Dyke (an amazing 10Km wide, 500Km long, layered ultramafic intrusion which is host to vast metal and mineral ore deposits including gold, silver, chromium, platinum, nickel, tin, mica and asbestos). Martin's aunt was a great teacher — and he was hooked.

At high school Martin took the scenic route to matriculation and had an amazing amount of fun playing sport at school, including rugby (Union — the *real* rugby), squash, water polo, swimming, diving, fencing, karate, cricket, tennis, volleyball, badminton, gymnastics and horse riding.

Just in case he was bored he also studied classical music (piano) from the ages of about 6 to 18, half of which time was spent as a student at the Rhodesian College of Music. Martin's time at the College expired quietly when he was forced to admit to his teachers that he never had any intention becoming a music teacher, but (horror!) a geologist.

Martin went to university in South Africa where he grew a beard and studied geology. A beard was, after all, an obligatory part of the image of a geology student back then — even the girls grew beards!. So he was attracted to a new course on offer — groundwater hydrology, which fitted hand in glove with the geology major, leading to specialising in hydrogeology in his final year. Being fond of music he also spent several years singing in and touring with the University Chamber Choir.

Hydro Geo to be

After graduating Martin returned to Zimbabwe and worked for a small hydrogeological consultancy for 4 years, mostly doing groundwater development work in Zimbabwe and Malawi. It was nearly all "hard rock geology". The routine was stereo photographic interpretation to identify lineaments, followed by a site inspection, field mapping and finally ground-based geophysics (usually, but not exclusively, resistivity) to accurately locate and determine the depths of the fractures, joints, contact zones, etc, in which differential weathering had created zones of high secondary porosity which were the drilling targets.

Fieldwork Hazard

During this time Martin did a lot of travelling in some very remote parts of Africa (there was one village where he had to build road in and where the children had never seen a "Marungu", a white person, before). He also had some wonderful field camps in parts of Africa which would have seen more than a few human footprints since the dawn of time. And he quickly learned that it was more than a simple courtesy for geophysics traverses to give way to elephants and buffalo, even if it did mean fieldwork wouldn't be completed by sundown.

In 1989 after a few "rough" experiences in His Excellency the Honourable Comrade Robert Magabe's Zimbabwe, Martin decided to leave and migrate to the United States. Work as a photogrammetrist on 3D stereo photographic digital terrain mapping and environmental projects wasn't hydrogeology (unless you call counting ducks on ponds groundwater related), but as groundwater resource development and management skills weren't in favour at the time (contaminated sites and Superfund were all the rage), Martin went on a holiday — to Australia.

Three months later he immigrated — there was a dearth of trained and experienced hydrogeologists in Australia.

Martin started with a small hydrogeological consultancy in Victoria where most of the work was on contaminated sites. This was followed by three or four years with the groundwater group of the Rural Water Commission where Martin was exposed to the magnitude of the salinity problem in southern Australia.

But the fast pace of consulting called and Martin joined Sinclair-Knight Mertz 10 years ago where he has held various roles, including managing its Environmental, Groundwater and Geo-environmental (contaminated land and geotechnical engineering) technical groups in Adelaide and Melbourne. He is now a Principal Hydrogeologist and a Partner of the Company, but is still actively involved in technical work.

Martin's personal interest is groundwater risk and vulnerability (evaluating, remediating, mitigating) — projects generally require a mix of hydrogeological and contaminated site skills; for example groundwater impacts from dryland salinisation, sewage treatment ponds, deforestation, agrochemicals, tailings dams, effluent re-use schemes, landfills, chemical storages; dewatering impacts from mining operations and well-field extraction; resource development including bore, well-field and spear point design, evaluation of aquifer parameters, numerical modelling of groundwater flow and

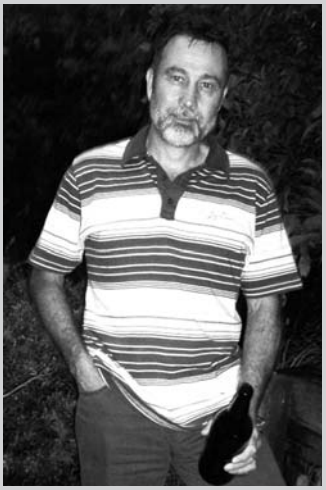
solute transport, watertable trend analysis; exploratory drilling, development of water-level and chemistry monitoring programs and hydrogeological mapping — this is starting to sound like a CV, so I'll stop right here.

Two years after he arrived in Australia Martin married Christine, a Melbourne girl that he met on a skiing trip to Austria. They have two boys (Corey, 9 and Tristan, 12), two cocker spaniels, and live in the outer eastern suburbs of Melbourne — about as far from the city as it's possible to get without actually leaving Melbourne.

In his free time (joke!) Martin grows orchids (main interest is Paphiopedilum species — slipper orchids) and bonsai. Music is still a very important part of his life (late renaissance / early baroque polyphony) and he still plays the piano occasionally.

And yes, Martin still has the beard. It's only ever come off twice, and on both occasions it reappeared quickly afterwards. ▲▲

Twenty Something Hydro Geo



Forty Something Hydro Geo

RPGeo Approval and Applicants

NEW CANDIDATES PUBLISHED FOR PEER REVIEW BY THE MEMBERS OF THE AIG

Mrs Andrea Madden of Sutherland, NSW, in the field of Hydrogeology

Membership Update

New Members and Upgrades at the ??? Council Meeting 2007

MEMBERS

CASSIDY	Kevin	Francis	WA
FLETCHER	Damian	Gregory	WA
LUFT	Joao	Luiz	VIC
McDONALD	Andrew	Jack	WA
MURPHY	Sarah	Catherine	VIC
ROBERTSON	Ruth	Elizabeth	VIC
WESLEY	Glendon	William	WA
CORLETT	Graham		NEW ZEALAND
DOYCHEV	Plamen		BULGARIA
GRINGINGER	Peter		VIC
HAWKES	Graham	Erneest	NSW
HELGELAND	Gavin	Scott	SA
JOHNSTONE	Andrew	Lorne	QLD
KARA	Zafer		TURKEY
MARCOS	Danilo		WA
MARTIN	Michael	James	WA
MAWDESLEY	Clare	Allison	TAS
NICOLSON	Peter	James	NEW ZEALAND
PATTERSON	Murray	Dyce Cameron	QLD
SHANKAR	Deeep	Jagddish	WA
SPURGEON	Phillip	James	WA
WILSON	Philip	James	WA
CHAMBERS	Cameron	John	WA
GOH	Hilary	Kwee	NSW
ROBERTSON	Richard		NSW

We welcome new members to the AIG.

AIG FEDERAL COUNCIL FOR 2006 – 2007

AIG NEWS

CONTRIBUTION DEADLINES

AIG News is published quarterly, in February, May, August and November.All items for inclusion in the newsletter for a particular issue should reach the Editor by the end of the preceding month. Avoid disappointment by contacting the Editor at least several days beforehand to advise submission of items for the newsletter.

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Supporting Geoscientists

The **AIG Website** in currently undergoing a major update. Comments on content suggestions or new features should be directed to Andrew Waltho (andrew.waltho@bigpond.com