Stratigraphic Controls on Structures And Mineralisation in Central Victoria 1: Bendigo

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Abstract
This is the first in a series of papers discussing the stratigraphic controls on structures and mineralisation in Victoria. Veins, joints and faults exploit natural planes of weakness along bedding and cleavage within turbidites. Major faults are continuous across folds. When the faults dip in the same direction as the limb of the fold, slip will preferentially occur along bedding. This is usually within a thick shale and often the fault is seen as a laminated quartz vein. Limb thrusts occur when bedded faults cross the hinge and penetrate through the opposing limb. Symmetrical folding at Bendigo allows west-dipping and east-dipping linked faults systems to cross, interact and provide sites for vein development and gold deposition.

Introduction
Central Victoria is a world class orogenic gold province. Faults and folds within Ordovician turbidites host gold and associated mineralisation. Turbidites occur across most of Victoria and in the field are seen as monotonously interbedded sandstones and shales. At Bendigo nuggety gold is hosted by quartz veins within fault- and fold-related structures. Bendigo is the largest goldfield in Victoria, with a recorded production of 22 million ounces of gold. Bendigo Mining is continuing efforts to reopen the goldfield.

This paper is the first in a series on the stratigraphic controls on structures and mineralisation for the gold deposits shown in Figure 1. These studies draw on work done by the senior author at each of the deposits alongside site staff.

The first stratigraphic project was initiated by Bendigo Mining in 2001 but has since been developed mostly at Fosterville and Ballarat. At these deposits it was found that many common ingredients occur: namely turbidite host rocks, folding and fault styles, and mineralisation types.
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However, despite the similarities, there are significant differences at each deposit. This series of papers will discuss separately how the stratigraphy controls the development of structures and mineralisation at each location.

Previous work

The early miners and authors such as Dunn (1893) and Hermann (1923) recognised the significance of some of the lithological packages at Bendigo and elsewhere in Victoria. This short paper cannot review the details, but Willman (2007) excellently summarises knowledge of the goldfields to the present time. It is fair to say that most studies of the goldfields of Victoria have been strongly biased towards faulting and folding styles.

Stratigraphic research in central Victoria began in an attempt to correlate lithological packages between drill holes, but it was soon found to be important in determining fold geometries, fault positions and offsets, and to gain a better understanding of vein formation (Boucher 2004, Boucher & Thomas 2005). Throughout central Victoria, companies have adopted a detailed sedimentological logging system to capture the data required to enable successful correlation.

Turbidite facies

Turbidite beds average 30 cm thick and lithological logging on a 10 cm scale is necessary to enable successful correlation. Recent research by petroleum companies exploring modern turbidites has provided great insight into depositional processes. Hemipelagic shales, along with channel sands and their accompanying overbank deposits, are clearly recognisable in mine successions throughout Victoria. Channel sands are typically coarse and very coarse amalgamated sands. Overbank deposits are interbedded fine to medium grained sands and shales that are colloquially referred to as ‘shale-topped sands’ (STS). STS make up the majority of the stratigraphy throughout central Victoria and the monotonously interbedded sandstones and shales make correlation difficult.

Shales rarely exceed 10 m thick. When they do, they not only make good marker beds for correlation, but commonly host bedded, laminated quartz veins that link to important faults and are major gold hosts. Often laminated quartz veins occur at the top of the thicker hemipelagic shales. It is possible that these positions are maximum flooding surfaces following major marine transgressions as carbonaceous shales would be expected to develop when clastic input is lowest. These thick host shales should therefore be the best for regional correlation. In contrast, shales that form distal to channels rather than during a major marine transgression will have highly variable thicknesses and won’t necessarily have the carbonaceous facies that will develop laminated quartz veins.

In theory, a channel should exist between two thick hemipelagic shales. However, at mine scale it is most common that only STS facies are seen with the channel itself being away from the local mine area. Otherwise, the channel sands can be near the base, top or centre of the STS succession and the position of the channel sands can provide a good reference for correlation.

Local informal mine stratigraphy has been developed at most locations throughout Victoria. This series of papers will continue to use the informal names. ‘Shale’ is a widely used term throughout central Victoria and is used in this series to describe all siltstones and claystones. However, genuine claystones are rare in the turbidites of central Victoria.

Bendigo stratigraphy

The mine stratigraphy at Bendigo comprises several significantly thick shales, channel sands and overbank deposits (Fig. 2). All units are diachronous. The upper boundaries of the thick shales provide the best regional correlations. Several important shales occur within the succession and host significant laminated quartz veins (Fig. 2). An exception is the laminated quartz vein within the ‘Kingsley Formation’ which occurs in a thin shale between two thick sands. The ‘Big Blue Shale’ has been traced for over 8 km to the northern part of the field. Bendigo Mining define the ‘Big Blue Shale’ as only that shale above a significant laminated quartz vein which lies on a thin sand bed within the shale. However, toward the north and east, the overall package reaches 35 m in width and where the thin sand dies out, the laminated quartz vein and associated structures and mineralisation does too. ‘Rowes Shale’ is over 20 m thick to the south west and thins to only one metre to the northeast where channel sands begin to develop instead. The ‘Western Shale’ is found variably between 10 and 20 m above the ‘Big Blue Shale’. Less is known about the deeper ‘Railway Shale’ and ‘Emily Shale’. Correlating the ‘Railway Shale’ between the the Sheepshead and Deborah anticlines is difficult because two shale intervals occur to the northeast and it is uncertain which one is the ‘Railway Shale’.

The positions of the significant laminated quartz veins are indicated in Figure 2. Typically these are in the shales that are the least diachronous. The laminated quartz vein at the base of the ‘Big Blue Shale’ was significantly worked historically on the Sheepshead line and Bendigo Mining successfully located where it occurred on the Deborah line.

Figure 2. Stratigraphic column highlighting thick shale units and the position of major bedding parallel, laminated quartz veins (*). H = ‘Harris Channel Sands’ and C = ‘Christine Shale’.

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From Your President

WELCOME TO 2008, or the Year of the Rat, and an Earth Rat at that in a large part of the world. There is every indication that the coming year will be at least as dynamic and busy as the last, which is a good sign for career and professional prospects for geoscientists generally.

This doesn't mean that our profession is not going to face some interesting challenges. Arguably the most important of these is education, which is central to the sustainability of our profession. Continued, possibly unsurpassed growth in the resources sector means that geoscientists are in high demand and we are simply not enticing enough talented students to undertake geoscience studies. Why is this? There has been wide discussion of potential causes and solutions over the past few years that has become much more focussed with time, and has started to deliver some very positive actions.

The Australian Geoscience Council (AGC), of which AIG is a member, along with most other leading professional institutes and societies representing the geoscience profession, held a significant forum in Canberra last September, hosted by Geoscience Australia. Academics from most Australian universities and representatives from industry discussed a number of factors contributing to our inability to attract students to geosciences across Australia. A number of interesting points emerged from this, including, in no particular order:

- Most geoscience departments are poorly funded and survive, largely, with the sponsorship of Heads of School or Vice Chancellors who subsidise geoscience programs by directing funds provided by Government or generated by universities themselves for other activities. We could say that these enlightened educators recognise the importance of geoscience in the overall mix of science programs offered by universities generally.
- Most of our university geoscience departments are small, with too few staff to create a "critical mass" of teaching and research expertise spanning the broad range of topics that needs to be covered to provide a rounded educational offering to geoscience students.
- There is a distinct difference between education and training. Students need to be educated, not just in geology, but in fundamental principles and skills that are needed to develop their research and analytical skills, which are central to their ability to identify, interpret and adapt to information and experiences they will be exposed to when they enter the workforce, as skilled professionals.
- Undergraduate students, on mass, don't travel to undertake their studies. Almost all undergraduate students elect to study close to their family and friends.
- Most students have no exposure to geoscience at all prior to entering university. Students take on geoscience studies after being exposed to them during first year university studies.

The latter two points are particularly significant as they demonstrate the absolute necessity of maintaining a wide geographic spread of geoscience departments across Australia, one could argue in all universities.

The Latrobe University experience in Melbourne is a case in point. When the geoscience department at Latrobe closed, geoscience enrolments at the other Victorian universities remained the same. The students who would have studied geoscience at Latrobe simply switched to other courses - they did not seek geoscience studies elsewhere. The same thing could be expected to occur anywhere across Australia if other departments closed. Fewer opportunities for geoscience studies means fewer students, not more students studying at the universities continuing to offer geoscience programs.

A second implication of this is that there is no way, even running down hill with a strong following wind, that the states with the highest levels of exploration and mining activity, Western Australia and Queensland, will ever be self sufficient when it comes to educating the geoscientists needed to sustain development of their local industries. The greatest number of new geoscientists will undertake their university education in the most populous states.

There clearly needs to be emphasis placed on increasing the exposure of high school, and perhaps even younger students, to geosciences. I have a daughter in Year 9 who is rapidly learning to speak and read Mandarin but can't spell seismicity, hasn't a clue what superposition is, and really doesn't have any concept that physical and chemical processes in the atmosphere, at the surface and deeper within Earth combine to shape our environment. Some of her peers don't even have an inkling that rocks decompose and combine with organic matter to produce soil.

Neil Williams, Geoscience Australia's Chief Executive Officer, made the point that we have expended considerable energy promoting careers in mining and exploration, but we haven't been targeting the ideals and aspirations of young people who basically are looking for careers that will enable them to make an impact on the world. This is what geoscience education, of course, provides. First and foremost, students develop an understanding of the processes that shape our planet and the timescale in which these processes operate. Students graduate as geologists sought by, and valuable to, the exploration and mining industry because mineral and energy resources accumulate and are concentrated by the most complex interactions of these processes.

There are some really excellent initiatives in geoscience education already underway, particularly in Western Australia, where there is a program making a real difference when it comes to exposing high school students to geosciences. These programs must, however, have a truly national scope. The new Federal government, as part of its "education revolution" has initiated the development of a national high school curriculum in which geosciences must feature, and will only get a guernsey if curriculum materials can be developed and teacher training provided to make geosciences more prominent in school science programs.

A submission has also been prepared by the AGC, presenting the case to have geosciences funded in the same manner as agriculture.
beneath old workings (Fig. 3). A localised reef was mined by Bendigo Mining in the small zone where thickening of the 'Christine Shale' enabled the development of a laminated quartz vein. Diachronous shales, such as the 'Western Shale' or 'Rowes Shale', do not contain the carbonaceous material that is most favorable for laminated quartz vein development. Historically, miners on the Bendigo goldfield sought the thicker shales knowing they hosted the significant laminated quartz veins and accompanying faulting and vein development at anticlines. Likewise, Bendigo Mining's exploration strategy developed in the late 1990s was significantly based on targeting the thicker shales, particularly where they met anticlines and limb thrusts developed.

The 'True Grit' is the only genuine channel sand within the defined mine sequence (Fig. 2). Mostly it occurs close to the 'Big Blue Shale'. However towards the northeastern part of the mine it occurs deeper within the succession and in some holes it occurs twice. This reflects meandering of the channel. The 'True Grit' is usually at least 10m thick and is composed of coarse and very coarse sands and granules with occasional shale flake breccia beds. In the northeast, sands within the 'Harris Sandstone' can be seen coarsening, thickening and become amalgamated indicating approach to a channel environment.

**Stratigraphic controls on the development of veins, faults and folds**

As a result of the more detailed lithological logging there is now a greater understanding of the development of quartz veins. Most notable are the veins that align with cleavage/jointing within beds. Veins commonly exploit planes of weakness along axial planar cleavage in shales and spaced cleavage/radial jointing in sandstones. Hence veins are commonly vertical in shales and perpendicular to bedding in sandstones (Fig. 4).
An important vein type throughout most of Victoria is the bedding parallel, laminated quartz vein. Bedding parallel, laminated quartz veins form during early folding and are continually reactivated during subsequent folding. Some laminated quartz veins survive folding. Occasionally extra dilation occurs at the hinge to create simple saddle reefs. With continued folding, slip can translate up the bedding planes, then up the axial planes to producing neck reefs (Fig. 3). More commonly, when the folds lock up, faults propagate from laminated quartz veins, across the hinge and through the opposing limb (Fig. 3). This was defined by Ramsay (1974) as a limb thrust. However, there have been various names used to describe this feature in Victoria, such as dilatant jog, fissure reef, conjugate thrust, or low-displacement strike-parallel fault. Limb thrusts should theoretically dip at 45° in response to regional horizontal stress. However their paths are ultimately governed by where they meet another laminated quartz vein on the adjacent fold. Tension vein arrays can form on limb thrusts, most commonly in the sandstone beds, especially the thick channel sands. Tension veins commonly follow the pre-existing planes of weakness developed along the spaced cleavage/jointing within the sandstones (Fig. 4). As a result, some cleavage veins are linked to faults and others are not. It has not been established which veins systems are connected to mineralised "plumbing systems" and which veins are more likely to contain gold. It is difficult to establish from drilling alone how the veins link between holes and to the major structures which makes correlation difficult.

From Your President

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and thereby recognising the relatively high costs associated with delivering geoscience courses, due at least in part to the cost of taking students into the field to develop their geological observation and interpretation skills, first hand. This is something on which there can be no compromise if students are to receive rounded and comprehensive education in geoscience.

This issue will be receiving considerable attention during the coming year.

Another challenge facing exploration and mining is its environmental credentials. The Federal government has ratified the Kyoto Protocol and initiated a national greenhouse gas emission reduction strategy. Professor Ross Garnaut, who is conducting this review and is scheduled to deliver his report to the government towards the middle of this year was reported in "The Australian" of December 12, 2007 as being of the view that coal fired electricity generation has no long term future in Australia.

International Energy Association (IEA) statistics show that Australia depended on coal for 80% of its electricity in 2006, when coal supplied 24% of the world's primary energy. The proportion of primary energy supplied by coal is projected by IEA to remain at this level until at least 2030, during which time world demand for energy will increase by 60%. The basic mix of energy sources in the next 20 years or so, based on IEA research is not going to change significantly. There is projected to be a decline in oil fired and nuclear energy generation, and a slight increase in energy generated using natural gas, but no increase in the proportion of energy generated using alternative technologies such as landfill gas or renewables including solar, wind and geothermal energy. There will be much more electricity generated from these sources, but no substantial increase in their contribution to the mix of the world's sources of energy. This appears to be contrary to Professor Garnaut's reported view.

If greenhouse gas emission cuts are to be achieved, we will need to rapidly develop practical and effective technologies to facilitate this. It doesn't matter whether, as individuals, we believe that humans are contributing to increased greenhouse gas concentrations in the atmosphere or we believe that it is the product of a normal, natural Earth process. Few would argue that if emissions that can be reduced without increasing the cost of energy markedly, and threatening economic development world-wide as a consequence, then it is a reasonable and sensible thing to do. Community perception of mining and geosciences generally can only be enhanced as a result.

For the first time in many years, we have a U.S. presidential candidate who has been reported by "New Scientist" as being an advocate of "Intelligent Design" in Mike Huckabee, one of the three leading Republican candidates. What would happen to government geoscience programs and science education in the U.S. with a president of this persuasion in the White House?

It's certainly going to be an interesting year.

Andrew Waltho
Thick, amalgamated channel sands are favorable sites for vein development. Brittle failure occurs in the thick sands and accompanying vein development is common, especially near faults. Boucher (2004) demonstrated that the 'True Grit' channel sands are significantly thicker to the north than they are to the south on the Sheepshead Anticline. Where the sands are thickest and show good vein development, Bendigo Mining had small resources delineated within the sands. However, these were found to be low grade and patchy. To the south as the sands thin, the veining diminished also. Unfortunately, understanding vein systems from drilling data means that resource delineation in these facies is difficult. However, there is scope for lithostratigraphic correlations to assist to understand the cleavage and fault related vein distribution in the channel sands.

Folding and fault styles at Bendigo

Folds at Bendigo are symmetrical and upright with axial planes dipping steeply to the east. Hinge lines are usually sub-horizontal but plunge gently to the north and south producing a series of elongate domes and basins. Chevron folds have an interlimb angle of 50°. Saddle reef, neck reefs and limb thrusts all occur where laminated quartz veins intersect the hinges of folds. Neck reefs are better developed at Bendigo than in other goldfields and they can reach 30 m high and 3 m wide. Bendigo is famous for its saddle reefs, but limb thrusts are much more common than simple saddles. Displacement on limb thrusts rarely exceeds 40 m. Faults with as little as 5 m of displacement are often significantly mineralised. The symmetrical nature of the folding means that both east- and west-dipping limb thrusts develop at Bendigo. East-dipping faults commonly offset the west-dipping ones (Fig. 3).

Conclusions

Laminated quartz veins occur mostly within thick shales at Bendigo and provide sites for major reefs where they intersect anticlines, especially where they develop into limb thrusts. East- and west-dipping limb thrusts occur and are the primary exploration targets for Bendigo Mining. Elsewhere, channel sands provide good environments for brittle deformation and veining. However, their distribution varies with the migration of the channel. High resolution stratigraphic logging has enabled recognition of veins that form on cleavage within shales and sands. However, work needs to be done to link the "plumbing systems" of these veins to laminated quartz veins and faults in order to understand gold distribution. Detailed lithological logging throughout central Victoria has enabled good correlation and interpretation and provided a good understanding of structures and mineralisation.

Acknowledgments

Numerous geologists over the last two decades have contributed a significant amount of research, data collection and modelling to assist to understand the geology and mineralisation of the Bendigo goldfield. Bendigo Mining continues to actively put significant effort in its attempts to understand the complex geology of the goldfield. The senior author is particularly indebted to Dean Turnbull who contributed a great deal of the structural analysis and target generation for Bendigo Mining, initiated the first stratigraphic study and provided over a decade of thoughtful discussions on the geology of Bendigo. He and Dave Garrard constructed the first series of regional cross sections that provided a bench mark for all subsequent work. Jim Jago, Allan Rossiter and Fons VandenBurg are gratefully acknowledged for their assistance in shaping the content of this series of papers.

References

Rickard, T. A., 1892. The Bendigo gold-field: Ore deposits other than saddle reefs. Transactions of the American Institute of Mining Engineers 21:686-713.
Complaints, Complaints, Complaints

Reporting on in situ leach uranium deposits

Reporting exploration results, resources or reserves for uranium deposits that may be developed using in situ leaching has been assisted by a recent technical report issued under the auspices of the Uranium Industry Framework Steering Group established by the Commonwealth Government. The report, entitled Resource estimates for in situ leach uranium projects and reporting under the JORC Code by McKay and others addresses a critical need to provide guidance on the reporting of exploration targeting sandstone-hosted roll-front uranium deposits occurring beneath the water table. Although the report focuses on the reporting of resource estimates, some of the guidelines provided apply to earlier stage exploration and hence are pertinent to the reporting of exploration results.

In particular, the guidelines stress that:

• radiometric probes and hand-held devices need to be calibrated and correction factors applied to raw measurements
• the extent of disequilibrium between uranium and its daughter products needs to be quantified to estimate uranium grades based on gamma methods
• it is critical that an adequate number of check assays of representative samples is obtained

Although the report has not as yet been adopted by the Joint Ore Reserves Committee, the guidelines it contains address materiality and transparency issues and therefore should be of great assistance to competent persons compiling public reports on uranium deposits amenable to in situ leaching. Copies of the report can be obtained from http://www.jorc.org/pdf/uraniuminsitu.pdf

Current complaints

Another quiet period for complaints — but the Complaints Committee is not complaining.

Science and Innovation Grants

2008 Round of International Science Linkages Competitive Grants


Applications will soon be sought for the 2008 round of International Science Linkages (ISL) Competitive Grants. The 2008 round will open 11 February 2008 and will close 5:00 pm (AEDT) 11 April 2008. Competitive Grants provides support for Australian researchers to participate in strategically focussed, leading edge, S&T collaborations.

The online application form will be made available on the ISL website (http://www.dest.gov.au/science/isl/) from 11 February 2008. Before applying, applicants are strongly encouraged to read through the ISL Guidelines (https://sciencegrants.dest.gov.au/ISL/Pages/Guidelines.aspx) for information regarding the eligibility criteria and the application process.

Further inquiries can be directed by email to isl@dest.gov.au or phone (02) 6240 5465.
Pre Budget Submission 2008 — Policy Issue:
Funding Mechanisms under the Higher Education Support Act 2003 (Commonwealth)

To: The Hon Wayne Swan MP, Treasurer of the Commonwealth of Australia, Parliament House, Canberra
From: Dr Trevor Powell FTSE, President, Australian Geoscience Council

THIS SUBMISSION FROM the Australian Geoscience Council (AGC – see Attachment A) is written in support of the position taken by the Australasian Institute of Mining and Metallurgy regarding university training of geoscientists.

However the AGC believes the issue transcends the mineral sciences in that there is a fundamental problem with the way educational polices and funding mechanisms address occupational needs, particularly where relatively small number of graduates (on a national scale) are required to fill vital occupational roles.

As I am sure you are aware the minerals and petroleum industries are facing a critical skills shortage at a time when the opportunities for growth and wealth creation in the sector have never been stronger. A particular concern of the AGC is the supply of geoscientists to industry and AGC’s growing alarm at the ‘Plight of University Earth Science Education in Australia’.

In 1990 there were 28 earth science departments around the country and at the end of 2007 these had reduced to five. The other departments have either closed or been merged (11 departments) with biology, geography, physics, maths or environmental science to the detriment of the maintenance of a supply of appropriately trained earth science graduates. This decade, the number of Honours graduates and students currently enrolled in Honours courses in earth science has more than halved. At the same time geosciences share of national research effort has dropped by 22%.

There is anecdotal evidence that some employers are refusing to take graduates from some universities where the degree in geoscience is not seen as being of an appropriate standard. In other cases companies are willing to employ partly trained graduates to meet their immediate short term needs. Neither case is sustainable - further the supply of graduates willing to employ partly trained graduates to meet their immediate short term needs. Neither case is sustainable - further the supply of graduates is seen as being of an appropriate standard. In other cases companies are willing to employ partly trained graduates to meet their immediate short term needs. Neither case is sustainable - further the supply of graduates willing to employ partly trained graduates to meet their immediate short term needs.

As stated in the AusIMM 2008-09 Pre-Budget Submission:

The steep decline in the number of minerals related courses is largely due to the funding arrangements instituted under the Higher Education Support Act 2003 (Cth). The Act providing funding for Universities on the basis of the number of students enrolled in a particular subject. The per student allocation is based on general assumptions about costs of teaching a subject within a ‘cluster’, the formula took no account of the differences in course content requirements, infrastructure needs, location or any other course or institution-specific factor. Under this funding formula, small, capital intensive courses such as mining engineering and field and laboratory intensive courses such as geoscience were particularly disadvantaged and for many Universities it was simply not viable to run them.

The 2007 Australian Geoscience Council Summit and survey have confirmed that overall geosciences continues to lose status and visibility through merger of departments and reduction in staffing levels. Many of the sixteen ‘geoscience departments’ identified as having the capacity to teach geosciences are uneconomic for the universities on a teaching basis. The problem is structural with too few students per teaching academic at current funding levels. Furthermore, differentiation in degree types has emerged where some universities have created ‘geoscience degrees’ from a blend of geography or environmental courses and traditional earth science subjects of relevance to the resources industry - graduates from these degrees are poorly equipped to meet the requirements of the resources industry.

The reliance on student demand, interacts with the ‘economics of universities’ to count against universities maintaining courses in disciplines which are high cost and have relatively low numbers of students. Geoscience and other degrees of relevance to the petroleum and minerals industries fall into this category. Universities themselves are under no obligation to maintain teaching or research areas that are strategically critical to Australia’s economy. Once university teaching and research capability declines, it takes an extremely long time before it can be re-built.

There is no national perspective on these issues which are complex. AGC believes the Commonwealth Government should take a national strategic approach to Tertiary educational policies and programs to address occupational needs, such as those for the minerals and petroleum industries, and that funding of university places should ensure that basic occupational needs for these industries are being met. The current funding mechanisms under the Higher Education Support Act 2002 (Cth) do not achieve this.

AGC supports the AusIMM’s concept in the policy recommendation ‘Establish mission-based contracts with…higher education providers in …geoscience to be reviewed on a triennial basis’ and believes it has wider application.

It also strongly agrees with the recommendation ‘Review of the funding formula established by the Higher Education Funding Act 2003 (Cth)’. Following a summit in September 2007 on the “Plight of University Earth Science Education” and the completion of its survey report, AGC will be continuing to address to address all aspects of the problem that is resulting in market failure of the education system to supply an appropriate number of trained geoscientists.

New AIG Web Site

AIG'S NEW INTERNET web site will be launched during February 2008. After a few hiccups along the way, development of the web site, using modern systems for managing content, has been completed.

The new site will deliver members and visitors an expanded range of information and member services including access to both the latest and back issues of AIG News on-line, in downloadable (pdf) format, an ability to renew their membership on-line using a secure electronic payment facility, notification of changes of address and other contact details, and of course, access to membership application information and forms, details of the Registered Professional Geoscientist program, information regarding meetings, conferences and seminars, and the latest news affecting the geoscience professions both locally and nationally. The secure information and payments facility of the new site will be expanded to include the ability to purchase publications and register for meetings, seminars and conferences on-line.

The old web site served AIG well for many years, but maintenance of the site and management of content was becoming onerous because most work needed to be performed by one person. The new site allows content to be added easily by a range of contributors and will feature pages managed by AIG's state branches, providing better coverage of local news and events for members.

Add the new site at [www.aig.org.au](http://www.aig.org.au) to your favourites in your Internet browser. Let me know what you think, or suggest content and features you would like to see added to the web site. 

Andrew Waltho

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For the latest in Geoscientist news, views, codes, events, employment and education visit the AIG website: [www.aig.org.au](http://www.aig.org.au)

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Lights... Camera... Action!

Celebrating the Mining Industry
Snowden's photo competition runs from 1 January - 30 June 2008

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In the right light, your camera, and mining action could win you AU$10,000

For the first time this year, 3 category prizes of $3,000 each will also be awarded. Information and entry details available at [www.snowdengroup.com](http://www.snowdengroup.com)
Congratulations to AusIMM CEO Don Larkin On Retirement

Mike Smith, Chairman, Australian Geoscience Council

DON LARKIN was the CEO of the AusIMM from mid-1999 until December 2007. Recognition of Don's role in the AusIMM is given by AusIMM President Peter McCarthy and Past-President Ian Gould in the November/December issue of the AusIMM Bulletin. In this brief note of appreciation, I would like to thank Don for his significant contribution to the development of positive relationships with other professional and learned societies. Don has been particularly supportive of a very constructive relationship between AIG and AusIMM.

Don Larkin also served as the Treasurer of the Australian Geoscience Council from 1999 to 2007 under AGC Presidents Bob Day, David Denham, Mike Smith and Trevor Powell. Don made himself available to attend almost every teleconference of the AGC and participated in the face-to-face meetings of the representatives of Australian geoscience societies. He provided sound financial management for the AGC with the support of the staff of AusIMM, and consistently offered wise advice to the society representatives, with a focus on increased collaboration between the societies.

During 2004, Don travelled to Florence, Italy, and assisted with the ultimately successful Australian bid to hold the 34th International Geological Congress in Brisbane 2012. He remained a strong supporter of the participation of all geoscience societies in the 34th IGC.

The new AusIMM CEO is Michael Catchpole, who has extensive experience in business and association management, and in government, media and community relations. Michael has accepted appointment as Treasurer of the Australian Geoscience Council.

Mike Smith, Chairman, Australian Geoscience Council

AGC/AIG Past-President Mike Smith, Retiring AusIMM CEO Don Larkin and Joint Ore Reserves Committee Chairman Peter Stoker, pictured at the AusIMM President's Dinner and Farewell to Don Larkin on 6 December 2007.

PACE

‘...we in South Australia are pro-business, pro-jobs and pro-mining’

South Australian Premier, Mike Rann
ON DECEMBER 12, 1956, the front page of the New York Times announced: "Physicist 'Creates' Universe in a Test Tube; Atom Gun Produces Galaxies and Gives Clues to Creation".

Just over 50 years ago, plasma physicist Winston H. Bostick made the kind of news headlines that many a scientist dreams. In his laboratory experiment Bostick created a simple "plasma gun" consisting of a 4-inch diameter glass jar around which he wound a wire carrying an electric current that created a small magnetic field. Most of the air was removed from the jar and two titanium wires were connected to a high-voltage, high-current electric power source.

On flicking the power switch, a 10,000 ampere electric current passed through the titanium wires, instantly vaporizing them and creating a puff of ionized gas (a plasma) travelling at 450,000 miles per hour. Bostick noted that the puffs of plasma formed distinctive shapes that resembled galaxies at various stages of aging and formation. Bostick called his laboratory produced plasma entities, "plasmoids".

Over the next thirty years, Bostick, a Professor of Physics at Stevens Institute of Technology in Hoboken, New Jersey, investigated plasmoids further and found that "not only the morphology [shape] but the controlling dynamic elements, electric and magnetic fields, are the same in the laboratory as in the galactic phenomena".

Bostick's theory describes galaxies as analogous to series-wound homopolar generators (a kind of motor) that convert gravitational energy of rotation into increasing magnetic energy that causes galaxies to expand away from each other. Furthermore, Bostick suggested that such a model could produce a concentration of current perpendicular to the galactic disk that would be a cosmic-sized "plasma focus" - a device that produces high energy, relativistic (near the speed of light) particle beams, or jets.

(Left: Two plasmoids in a magnetic field producing similarities to the shape of barred spiral galaxies. Right: Winston H. Bostick makes the news headlines in 1956.)
Upcoming Conferences and Seminars

Australian Earth Sciences Convention 2008
Hosted by GSA & AIG
Link: http://www.iceaustralia.com/aesc2008
Contact: aesc2008@iceaustralia.com

The Geological Society of Australia (GSA) and the Australian Institute of Geoscientists (AIG) are delighted to invite you to participate in the Australian Earth Sciences Convention 2008. This is your opportunity to experience the stunning beauty of Western Australia's unique and timeless geology, and join an outstanding selection of international speakers, industry leaders, and key decision makers in Perth, home to a globally significant mining and petroleum industry dependent on leading edge geoscientific data and technology.

Be part of this premier showcase of Australian geoscience and participate in our program of sessions designed to address contemporary Earth Science issues during the International Year of Planet Earth!

Drilling for Geology Conference
Venue: Royal on the Park, Brisbane  08/10/2008 - 10/10/2008
Contact: mberry@amcconsultants.com.au

First Circular and Call for Papers - see attached flyer

The Australian Institute of Geoscientists (AIG) is pleased to host a new technical conference focused solely on the collection and analysis of geological information from drilling. Be it grassroots exploration, mining operations or engineering projects, drilling is the prime method used for geological data collection and is often the biggest single cost centre for exploration and mine geology budgets.

ABSTRACTS are now invited and must address the main conference themes. DEADLINE - 29 FEBRUARY 2008. Drilling for Geology 2008 will also host a poster and trade exhibition in parallel with the conference as well as pre/post-conference workshops. AIG is seeking expressions of interest from companies wishing to run pre/post conference workshops and

North Qld Exploration and Mining Conference (NQEM) in conjunction with the AIG/GSAQ biennial field trip to the Charters Towers district
Hosted by AIG Queensland
Venue: Townsville  04/06/2009 - 08/06/2009
Contact Kaylene Camuti for more information - lantana@beyond.net.au

February 2008
09 Phoenix, AZ, Resource Investment Conference Phoenix Arizona

March 2008
12 WALIS International Forum 2008 PERTH Australia
17 Annual Geoscience Exploration Seminar (AGES) Alice Springs Australia
31 2nd International Salinity Forum Adelaide, Australia

Valmin 2008

FOLLOWING ON FROM the successes of MinVal ’89, VALMIN '94 and VALMIN '01 the Board of the Minerals Industry Consultants Association (MICA) will hold VALMIN' 08 in Sydney on the 7th 8th August this year.

At this VALMIN Conference will be two days of peer-reviewed, invited valuation papers that focus on the pitfalls associated with valuing mining businesses and mineral resource exploration prospects, particularly the lessons to be learned. Prestigious speakers practising in this specialist mineral valuation field throughout Australia and Overseas will also address the limitations of the main valuation methodologies (Cost, Market and Income Methods), and Commodity Price forecasting.

For further information along with booking details, please contact Megan Stevenson on megans@optusnet.com.au or 02 9299 1403.

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Challenge Our Myths

AAPG & AAPG European Region Energy Conference and Exhibition
18-21 November, 2007
Megaron, Athens International Conference Centre, Greece
General Chairman: Geir Lunde
Un-Traditional Theories and Ideas in Global and Large Scale Geology
Co-Conveners: Stavros T. Tassos and Karsten M. Storetvedt

The "Challenge Our Myths" AAPG Athens conference, under the inspired general chairmanship of Geir Lunde, was attended by more than 1200 international participants. During the three days, and in 25 parallel sessions, more than 300 oral and poster presentations were delivered. The whole conference, including sessions like Un-Traditional Theories and Ideas in Global and Large Scale Geology, Unconventional Resources — The Modern Theory of Abiotic Genesis of Hydrocarbons and Unconventional Heavy Oil Resources — Advances, Challenges and Case Studies, mark a turning point for the Geosciences.

It is the first time such themes have been raised at a larger Western geological conference. The general slogan - Challenge Our Myths — directly challenges both plate tectonics and the long-held view (in the West) that the mass of petroleum is "fossil fuel". It is the first time at an important international geological conference that a session like Un-Traditional Theories and Ideas in Global and Large Scale Geology — in which fundamental geological and physical concepts were challenged and in their place comprehensive new propositions were presented in their place — was considered a highlight of the whole conference.

The session had 25 presentations, 15 orals and 10 posters, covering a wide range of topics, from fundamental issues such as matter and energy, myth and para-myth, large and small scale tectonic movements, generation and propagation of earthquakes, oil and salt generation and exploration, the close association of petroleum provinces with the global tectonic pattern, to tsunami implications.

In the oral session, except for one presentation that was clearly pro platetectonics, and another one that did not address the issue of global and large scale geology specifically, there was general consensus that subduction, and therefore plate tectonics (New Concepts in Global Tectonics Newsletter, no 45, December 2007 61), is mechanically impossible. The alternative propositions varied from constant size to changing size (expanding) Earth. The importance of horizontal versus vertical movements, as well as of heat/molten Earth interior versus a solid Earth interior were debated, either as combined or independent issues.

The poster session also covered a wide spectrum of subjects, from "hot" shales, sedimentary basins, interpretation of magnetotelluric and seismic surveys, the need for cooperation between geoscientists and engineers, great circles and expanding Earth, igneous diapirism, vertical tectonic movements, deep oil and gas reservoirs, to oil in granites. ▲▲

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MINERALS
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Australian Earth Sciences Convention 2008

Sunday 20 July - Thursday 24 July 2008
Perth Convention Exhibition Centre

The AESC Committee is pleased to announce the following KEYNOTE SPEAKERS

BARRY DRUMMOND
Barry Drummond was appointed head of the Earth Monitoring Group of projects in Geoscience Australia following a decision by the Australian Government to establish an Australian Tsunami Warning System (ATWS) after the devastating Indian Ocean tsunami of 24 December 2004. The ATWS is being established jointly by Geoscience Australia, the Bureau of Meteorology and Emergency Management Australia. Other projects in the Earth Monitoring Group monitor the Earth's magnetic field, screen for nuclear explosions, and contribute to capacity building for volcano monitoring in Papua New Guinea and Indonesia. The national geodesy program is also part of the group. Before moving to the Earth Monitoring Group, Barry led a number of programs that used seismic reflection and refraction techniques and potential field data to image many aspects of Australian geology. He was foundation Director of the ANSIR Major National Research Facility. He is a member of the GSA, ASEG, SEG and PESA, and a member of the editorial board of the Australian Journal of Earth Sciences.

JEFF TAYLOR
G. Jeffrey Taylor received his undergraduate degree in physics from Colgate University and his Ph.D. in geology and geophysics from Rice University. He is currently a research professor in the Hawai‘i Institute of Geophysics and Planetology at the University of Hawai‘i. Dr. Taylor has done extensive work on the mineralogical and chemical makeup of lunar samples and meteorites, publishing over 160 refereed articles. His main scientific interest is in understanding the processes involved in planetary evolution, with emphasis on magmatism and impact on the Moon, Mars, Mercury, and asteroids, and aqueous alteration processes on Mars. He is a member of the Mars Odyssey Gamma-Ray Spectrometer Team. Jeff Taylor also has extensive experience in education and public outreach. He and Linda Martel (Hawai‘i Institute of Geophysics and Planetology) publish an online science magazine, Planetary Science Research Discoveries (www.psrd.hawaii.edu).

AESC 2008 Fieldtrips
The following fieldtrips will be on offer:

PRE CONVENTION TRIPS
• Archean Crustal Evolution and Mineralization of the Northern Pilbara Craton
• Eastern Goldfields Superterrane, Yilgarn Craton
• Paleozoic Geology of the Canning Basin

POST CONVENTION TRIPS
• Kalgoorlie, Youanmi and Narryer Terranes of the Yilgarn Craton
• Geology of the Halls Creek Orogen
• Geology and History of the Shark Bay Area
• Mines And Wines Of south-west Western Australia

DAY TRIPS
• Meckering Fault Scarp
• Of Cores
• Geology and Landforms of the Perth Region: I
• Geology and Landforms of the Perth Region: II

Further updates including costs and duration of Fieldtrips will be available on the Convention website shortly.

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If you are interested in becoming a sponsor or an exhibitor please visit the link below and complete the relevant online 'Expression of Interest': http://www.iceaustralia.com/aesc2008/sponsor.html, alternatively do not hesitate to contact the convention organiser, ICE Australia, (see details below.)

Need More Information?
Please visit the conference website or contact the conference organisers: International Conferences & Events (ICE) Aust. P/L
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Email: aesc2008@iceaustralia.com
Website: www.iceaustralia.com/aesc2008
Australian Earth Sciences Convention

The overarching theme of the conference is *New Generation Advances in Geoscience* with five particular areas of thematic focus that are most relevant to cutting-edge geoscience in the early 21st Century.

**Perth, 20th to 24th July 2008**

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**“Geoscience in the Service of Society”**

is a theme which focuses on the increasing number of ways that Geoscience is becoming integral to the effective functioning of our communities. This theme includes geohazards, environmental management, land-use planning, education and geoscience information provision.

**“Resources – Foundation for our Future”**

is a theme which recognises the central role that the resource industry plays in the Australian economy and how innovative geoscience is making a critical contribution to maintaining its international competitiveness. Resources are broadly defined to include petroleum, coal and groundwater together with minerals. Important sub-themes will include a focus on exploration targeting and prospectivity analysis, and a mineral systems approach to economic geology.

**“The Evolution of Life and the Solar System”**

seeks to synthesize the recent exciting scientific developments relating to the geological record of early life on the earth and the explosion of geological data from other planets; particularly Mars. An important objective of this theme is to put the evolution of the earth and its life-forms into a broader comparative perspective.

**“Earth’s Environments – Past, Present and Future”**

seeks to draw together a geological perspective on what is perhaps the most important global issue of our time – Climate change. This objective of this theme is to integrate the “deep time” perspective on earth’s environmental changes and its drivers, particularly those of a geological nature, with the current explosion of knowledge in this field. The role that geoscience fulfills in providing proxies for paleoclimate will be a significant focus of this theme.

**“The Dynamic Earth – From Crust to Core”**

focuses on our emerging understanding of the platetectonic processes and the dynamic mantle, the supercontinent cycle; time, tectonics and the evolving landscape; cratons and basins: indicators of continental processes; formation and evolution of crust and mantle.

In addition to the above themes, the Plenary sessions at the convention will recognize that 2008 is the International Year of Planet Earth through a series of invited key-notes that address major themes of the IYPE. For more information about the program, contact aesc2008@iceaustralia.com

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The Conference will have dynamic Pre-Conference and Post-Conference field trips

**Pre-Conference from July 13th**

**Canning Basin Paleozoic**
World famous Devonian reefs as well as other interesting Ordovician to Permian successions. Of interest to sedimentologists, petroleum geologists and mineral explorers. Maximum 14

**Hammersley Basin Iron Ore Province**
One of the of the worlds great iron ore provinces examined from outcrop to mine site. TBA

**Archean crustal evolution and mineralization of the northern Pilbara Craton**
Contrasting tectonic styles and mineralization during the Paleo- and Meso-Archean history of our planet, and the development of early life upon it. Maximum 30

**Eastern Goldfields Superterrane, Yilgarn Craton**
New insights into brownfields gold exploration in the Yilgarn Craton with a structural geology bias. Maximum 14

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**Post Conference trips from July 26th.**

**Geology and history of the Shark Bay region**
Shark Bay, famous for it’s stromatolites. Looks at its geology, neotectonics and history in the context of the Quaternary of Western Australia. Maximum 14

**Geology of the Halls Creek Orogen**
Tectonics and mineral systems of the North Australian Craton, and the applicability of plate tectonics to the assembly of Proterozoic Australia. Maximum 14

**Kalgoorlie, Youanmi and Narryer Terranes of the Yilgarn Craton**
Geology and mineral systems of classic, highly mineralised Archean granite-greenstones and gneisses. Maximum 14

**Mines and Wines from Perth to Margaret River**
World class mines and wines for wine lovers, young and old! Maximum 30

**Geology and landforms of the Perth region**
Climate change revealed as sea level changes in eolian and marine units from Swan River to Cape Peron. Maximum 30

**Geology and landforms of the Perth Hills**
Yilgarn Craton and Proterozoic geology exposures on the Darling Ranges. Maximum 30

**Geology and landforms of the Meckering Fault Scarp**
Mockering is the biggest and best preserved intraplate surface rupture in WA and one of 12 recorded worldwide. Maximum 30

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For detailed information about the field trips go to: www.iceaustralia.com/aesc2008
Register your interest aesc2008@iceaustralia.com
Australian Earth Sciences Conference, Perth 20th to 24th July 2008.

www.iceaustralia.com/aesc2008
**PROFESSIONAL DEVELOPMENT TRAINING**

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**STAFF RETENTION INITIATIVE:**

**RESOURCE ESTIMATION**

Bali 21-24 July

A training course to look forward to… To help address the problem of staff retention within the mining industry, Snowden has decided to hold the popular 4-day Resource Estimation course in the tropical paradise of Bali… what could be more enticing!

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Peru: Eighth International Gold Symposium

20-22 May 2008, Lima

The Peru: Eighth International Gold Symposium constitutes one of the events of major international relevance to the mining - metallurgical and financial fields. This Symposium seeks to promote and disseminate knowledge of the natural resources potential and its significance for developing countries, as well as contribute to generating new investments and business opportunities, not only in Peru but also throughout the entire Latin American region.

In addition, this event will be an excellent occasion to obtain first-hand information about new projects in the region, the market situation, price perspectives, as well as an integral view of their influence on world economy trends. Furthermore, it will contribute to joining entrepreneurs together through strategic alliances in today’s globalized world, and exchanging knowledge at the institutional and academic levels.

Organisation and Promotion

The Peru: Eighth International Gold Symposium is organized by the Gold Committee of the National Society of Mining, Oil and Energy (SNMPE).

The Gold Committee is a group of members of the National Society of Mining, Oil and Energy, with more than twenty years of active and fruitful work aimed at contributing to the development of the Peruvian gold industry. The Committee is made up of major gold producers and mining companies with interesting gold projects and prospects.

The Eighth International Gold Symposium has the backing of the Ministry of Energy and Mines, Central Bank of Peru and the National Society of Mining, Oil and Energy and the sponsorship of prestigious national and international companies.

Organising Committee:

Veronica Marsano, Chair; Guillermo Albareda, Eva Arias, Isac Burstein, Domingo Drago, Hans Flury, Juan Gonzales Vigil, Salvador Gutierrez, José Miguel Morales, Félix Navarro-Grau, Caterina Podesta, Marisol Valdez and Noe Vilcas.

International Advisors: Andre Gauthier (China), Leonard Harris (U.S.A.) and Victoria Vargas (Canada)

Advisory Counsil:

- Roque Benavides, President & CEO, Cia. de Minas Buenaventura S.A.A.
- Igor Gonzales, President South-America, Barrick Gold Corporation
- Oscar Gonzalez Rocha, Executive President, Southern Peru Copper Corporation
- Eduardo Hochschild, Vice-President and CEO, Cia. Minera Ares S.A.C.
- Carlos Santa Cruz, Vice-President South America Operations, Newmont Mining Corporation

About the Program

The presenters at the Peru: Eighth International World Symposium will be world-class executives and specialists involved in the gold mining industry, as well as Peru’s political authorities, among others.

The Symposium Program is as follows:

**Tuesday, May 20, 2008**

- Opening Session
- Opening of the Mining Exhibition
- Perspectives and Trends in Gold Mining – Large Scale Producers
- Gold Projects in Peru
- Investing in Gold Companies – Price of Gold and Gold Stocks

**Wednesday, May 21, 2008**

- Gold and Precious Metals Prices
- Gold Mining Perspectives – Medium Scale Producers
- The World’s Major Projects
- Mining, Gold and the Stock Exchange
- Exploring Gold in Latin America
- Advances in Gold Mining

**Thursday, May 22, 2008**

- Gold Market
- An Overview of Mining in Latin American
- Mining Business
- Mining Advancements
- Closing Ceremony with the participation of the Keynote Speaker and the President of the Republic of Peru, Dr. Alan García Perez.

Update

Presenters that have already confirmed their participation:

- Alan García Pérez, President of the Republic of Peru
- Juan Valdivia, Minister of Energy of Mines of Peru
- Gregory Wilkins, President and CEO, Barrick Gold Corporation
- Richard T. O’Brien, President and CEO, Newmont Mining Corporation
- Roque Benavides, President & CEO, Cia. de Minas Buenaventura S.A.A.
- Igor Gonzales, President South-America, Barrick Gold Corporation
- Trevor Turnbull, Director of Gold and Precious Metals Markets, Scotia Capital
- Philip Klapwijk, Executive Chairman, Gold Field Mineral Services
- Fernando Sánchez Albavera, Director for the Natural Resources and Infrastructure Division, CEPAL

▲▲
Carbon Dioxide is not the Primary Cause of Global Warming: The future can not cause the past

by Allan M.R. MacRae, Calgary Alberta Canada

THE INTERGOVERNMENTAL PANEL on Climate Change ("IPCC") stated in its 2007 AR4 report:

“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

... Carbon dioxide (CO\textsubscript{2}) is the most important anthropogenic GHG. Its annual emissions grew by about 80% between 1970 and 2004.

... Most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations. It is likely there has been significant anthropogenic warming over the past 50 years averaged over each continent (except Antarctica).”

However, despite continuing increases in atmospheric CO\textsubscript{2}, no significant global warming occurred in the last decade, as confirmed by both Surface Temperature and satellite measurements in the Lower Troposphere (Figures CO\textsubscript{2}, ST and Figure 1). Contrary to IPCC fears of catastrophic anthropogenic global warming, Earth may now be entering another natural cooling trend.

Earth Surface Temperature warmed approximately (~) 0.7 degrees Celsius (°C) from ~1910 to ~1945, cooled ~0.4°C from ~1945 to ~1975, warmed ~0.6°C from ~1975 to 1997, and has not warmed significantly from 1997 to 2007.

CO\textsubscript{2} emissions due to human activity rose gradually from the onset of the Industrial Revolution, reaching ~1 billion tonnes per year (expressed as carbon) by 1945, and then accelerated to ~9 billion tonnes per year by 2007. Since ~1945 when CO\textsubscript{2} emissions accelerated, Earth experienced ~22 years of warming, and ~40 years of either cooling or absence of warming.

The IPCC’s position that increased CO\textsubscript{2} is the primary cause of global warming is not supported by the temperature data.

In fact, strong evidence exists that disproves the IPCC’s scientific position. Figures 2 and 4 show that variations in atmospheric CO\textsubscript{2} concentration lag (occur after) variations in Earth’s Surface Temperature by ~9 months. The IPCC states that increasing atmospheric CO\textsubscript{2} is the primary cause of global warming — in effect, the IPCC states that the future is causing the past. The IPCC’s core scientific conclusion is illogical and false.

There is strong correlation among three parameters: Surface Temperature (“ST”), Lower Troposphere Temperature (“LT”) and the rate of change with time of atmospheric CO\textsubscript{2} (“dCO\textsubscript{2}/dt”) (Figures 1 and 2). For the time period of this analysis, variations in ST lead (occur before) variations in both LT and dCO\textsubscript{2}/dt, by ~1 month. The integral of dCO\textsubscript{2}/dt is the atmospheric concentration of CO\textsubscript{2} (“CO\textsubscript{2}”) (Figures 3 and 4).

Natural seasonal variations in temperatures ST and LT and atmospheric CO\textsubscript{2} concentrations all considerably exceed average annual variations in these parameters. For this reason, 12 month running means have been utilized in Figures 1 to 4. All four parameters ST, LT, dCO\textsubscript{2}/dt and CO\textsubscript{2} are global averages. ST and LT have been multiplied times 4 in Figures 1 to 4 for visual clarity.

Figure 1 displays the data before detrending, and shows the strong correlation among ST, LT and dCO\textsubscript{2}/dt. Detrending removes the average slope of the data to enable more consistent correlations, as in Figures 2 to 4. In Figure 3, the atmospheric CO\textsubscript{2} curve is plotted with the three existing parameters, and lags these three by ~9 months. This lag is clearly visible in Figure 4, with the CO\textsubscript{2} curve shifted to the left,
9 months backward in time.

The period from ~1980 to 2007 was chosen for this analysis because global data for LT and CO₂ are not available prior to ~1980. This period from ~1980 to 2007 is also particularly relevant, since this is the time when most of the alleged dangerous human-made global warming has occurred.

In a separate analysis of the cooler period from 1958 to 1980, global ST and Mauna Loa CO₂ data were used, and the aforementioned ~9 month lag of CO₂ behind ST appeared to decline by a few months.

The four parameters ST, LT, dCO₂/dt and CO₂ all have a common primary driver, and that driver is not humankind.

Veizer (2005) describes an alternative mechanism (see Figure 1 from Ferguson and Veizer, 2007, included herein). Veizer states that Earth's climate is primarily caused by natural forces. The Sun, modulated by cosmic rays (Svensmark et al) primarily drives the Earth's water cycle, climate, biosphere and atmospheric CO₂.

Veizer's approach is credible and consistent with the data. The IPCC's core scientific position is disproved — CO₂ lags temperature by ~9 months — the future can not cause the past.

While further research is warranted, it is appropriate to cease all CO₂ abatement programs that are not cost-effective, and focus efforts on sensible energy efficiency, clean water and the abatement of real atmospheric pollution, including airborne NOx, SOx and particulate emissions.

The tens of trillions of dollars contemplated for CO₂ abatement should, given the balance of evidence, be saved or reallocated to truly important global priorities.

**Excerpts from Veizer (GAC 2005):**

Pages 14-15: The postulated causation sequence is therefore: brighter sun => enhanced thermal flux + solar wind => muted CRF => less low-level clouds => lower albedo => warmer climate.

Pages 21-22: The hydrologic cycle, in turn, provides us with our climate, including its temperature component. On land, sunlight, temperature, and concomitant availability of water are the dominant controls of biological activity and thus of the rate of photosynthesis and respiration. In the oceans, the rise in temperature results in release of CO₂ into air. These two processes together increase the flux of CO₂ into the atmosphere. If only short time scales are considered, such a sequence of events would be essentially opposite to that of the IPCC scenario, which drives the models from the bottom up, by assuming that CO₂ is the principal climate driver and that variations in celestial input are of subordinate or negligible impact....The atmosphere today contains ~ 730 PgC (1 PgC = 1015 g of carbon) as CO₂ (Fig. 19). Gross primary productivity (GPP) on land, and the complementary respiration flux of opposite sign, each account annually for ~ 120 Pg. The air/sea exchange flux, in part biologically mediated, accounts for an additional ~90 Pg per year. Biological processes are therefore clearly the most important controls of atmospheric CO₂ levels, with an equivalent of the entire atmospheric CO₂
Carbon Dioxide is not the Primary Cause of Global Warming:
The future can not cause the past

budget absorbed and released by the biosphere every few years. The terrestrial biosphere thus appears to have been the dominant interactive reservoir, at least on the annual to decadal time scales, with oceans likely taking over on centennial to millennial time scales.

Excerpt from Ferguson & Veizer (JGR 2007):

The connections between the various components are proposed as a hypothesis for coupling the terrestrial water and carbon cycles via the biosphere. Galactic cosmic rays and aerosols are included, although their roles are more contentious than other aspects of the Earth’s climate system.

References and Acknowledgements:
IPCC Fourth Assessment Report, Climate Change 2007, Synthesis Report
Svensmark et al, Center for Sun-Climate Research, Danish National Space Center, Copenhagen www.spacecenter.dk/research/sun-climate
Veizer, “Celestial Climate Driver: A Perspective from Four Billion Years of the Carbon Cycle”, Geoscience Canada, Volume 32, Number 1, March 2005

Considerable insight and/or assistance have been provided by Roy Spencer of University of Alabama, Ken Gregory of Calgary and others.

Conclusions, errors and omissions are the sole responsibility of the writer.

Data sources are gratefully acknowledged:
Surface Temperatures: Climatic Research Unit, University of East Anglia, Norwich, UK http://www.cru.uea.ac.uk/
Lower Troposphere Temperatures: The National Space Science and Technology Center, University of Alabama, Huntsville, USA http://www.atmos.uah.edu/
Atmospheric CO2 concentrations: NOAA Earth System Research Laboratory, Global Monitoring Division, Boulder CO, USA http://www.esrl.noaa.gov/gmd/ccgg/trends/
From The Editor

THIS IS THE FIRST EDITION of AIG News for 2008 and we start off with a new series of geological lead articles describing the controls of gold mineralisation in Victoria with Rodney Boucher writing the first one.

An abundance of photographic evidence of members participating in the two annual AIG Christmas river and harbour cruises was received but while we have the photos, we don't the names of many, but perhaps members might be able to advise the AIG secretariat of the names of some of our missing members who might have been inadvertently caught by our roving happy snappers. (I was near Whim Creek with a drilling rig at the time). One thing I do observe, especially on the Sydney Cruise was the stark absence of the suits — and we are in the middle of an enormous mining boom!

Andrew Waltho makes an important observation that we, as a profession, face a long-term crisis because our numbers are simply not being replaced by new graduates from the rapidly diminishing number of Australian Universities, principally because geosciences are no longer taught in our secondary schools. I discovered geology at first year high school and for the next five years had a tussle with two school mates, Derek Carter and John Boag, over who would win the coveted geology prize each year; only Derek and I remain as practising geologists. We all won it, but not at the same time though.

CO₂ Sequestration

AIG Membership who wish to comment or put their views about a proposed “Regulatory Framework for the Long-Term Underground Geological Storage of of Carbon dioxide in Victoria discussion paper being prepared by the Victorian Department of Primary Industries should note the following timetable:

Discussion paper released: 14 January 2008

Community consultation forums held:
late January early February 2008

Responses to discussion paper received:
By 5.00 pm 29 February 2008.

The discussion paper may be downloaded from the DPI website here http://www.dpi.vic.gov.au/DPI/dpinenergy.nsf/9e58661e880ba9e44a256c640023eb2c/4b4fe459128ac29bca2573e1000a2e3f/SFILE/CCS_web_version.pdf.

(ED: The Victorian DPI reference merely suggested one look at the DPI.vic.gov.au website to find the discussion paper and I expected to find a link on the front webpage. Silly me and where perchance would one find it? Not at the DSE that is linked at the bottom of the webpage, (and noo, it is not Dick Smith Electronics) but in their energy section, and then at the bottom of a list. Quite frankly the link to the discussion paper is one of the more complex URL’s I’ve come across and I suspect that it might be a suitable target for Principal Components Analysis. Who knows what effect brown coal proxies might have on CO₂ geosequestration methodology.)

More to the point is the realisation that there appears to be some sort of relationship between the demise of geoscience education and the growth of pseudo-science in society — where our young children just simply don't know how soil is formed, as one example from many — that Andrew laments in his presidential notes for this issue.

A recent article analysing global temperatures and CO₂ emissions is published and the latest news reported in the media is the sudden discovery of a lull in solar activity and the equally sudden realisation that we might be in for a bit of cooling. A short article on some experimental work with electric plasmas and galaxy formation was found to be of interest as well, since it was reported in 1952 — how things have changed since then. And of course plenty of news on the education front as well as some statistics on exploration expenditure are found in this AIG News, but it seems Australia has lost its ranking somewhat.

And we hear that Kennecott and Barrick Gold have ideas of increasing the size of the Kalgooorlie Superpit but there seems to be some concern by those who live nearby who stand to lose their homes if this proposal goes ahead. The Weekend Australian of 9 February reported the issue. While the Complaints Committee has been gratefully inactive, your Editor recently spotted some ‘heads-up’ announcements to the ASX concerning the drilling of some prospect in Northern Australia during the monsoonal wet season. Wonders never cease how 40 tonne RC rigs manage to navigate the dirt roads during the rainy season and caused some head scratching in the AIG editorial office. So I'm pretty sure AIG News would love to publish how to get large drilling rigs onto drill sites during the northern monsoon reason, for this would imply that our working season could be increased from the miserable 6 months we have to put up with at present — and of great interest to those of us who work in the northern topics of Australia.

Finally this issue of AIG news is lagging a little as I made the mistake of delaying the deadline and that resulted in many miles being lost for inches of late submissions. But wonders never cease in this area either, so when potential advertisers ask about rates or deadline dates for articles, some surprise occurs when they are told to read the back page of AIG News!

Your Editor will be based in Halls Creek for the rest of the year supervising an ore-reserve drill-out of an interesting base-metals project, but due to the wonders of modern communication AIG News will continue to come out in a timely manner. Just take the time to read the bottom left hand corner of the back page for publication deadlines and advertising rates.
Harbour Cruising
The poor old Editor is supposed to be able to manage most things but trying to work out the names of the AIG Sydney Harbour Cruise isn’t one of them — so perhaps AIG members who recognise themselves might send the Editor a note? (Well he did recognise John Cramsie and Sam Lees)
River Cruising
And while Grant Boxer, Margaret Ellis, Ed Dronseka, Bill Peters, Anne Fitton enjoyed the WA AIG Christmas River Cruise, your Editor was attached to a drilling rig south of Whim Creek. The rest of the AIG and GSA members might also send the Editor a note identifying themselves.
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A RECENT REPORT FROM Metals Economics Group (MEG) indicates that the nonferrous exploration budgets of 1,821 companies increased from $9.99 billion in 2007—the fifth consecutive yearly increase since the bottom of the cycle in 2002 and the highest total since the study series began in 1989. MEG estimates that the budgets of the companies covered by the study (using a $100,000 cutoff) account for more than 95% of worldwide commercially-oriented nonferrous expenditures.

When the remaining 5% is added, estimated spending for commercial nonferrous metals exploration reached $10.5 billion—a 40% increase over last year's estimated total and more than double the estimated $5.2 billion at the height of the last exploration cycle in 1997.

MEG said it does not adjust its historic exploration figures for inflation to attempt constant-dollar comparisons, but informal calculations show more is being invested in exploration today than a decade ago. However the report states that it is "certain that in most parts of the world, today's exploration dollar does not go as far as it did a decade ago."

Increased demand for services such as drilling and assaying and rising input costs on everything from fuel to geoscientists have significantly increased the costs of exploration in the current cycle. As a consequence, it is unlikely that the substantial increase in exploration budgets over the past few years has resulted in a proportionate rise in actual activity on the ground, the study concludes.

This year's report—the 18th in the series—includes uranium exploration budgets for the first time, with 363 companies (159 of which are exploring solely for uranium) allocating $936 million to uranium in 2007. Inclusion of uranium budgets increased the total number of companies surveyed to 1,980 and the aggregate exploration budgets to almost $10.93 billion; including estimates for budgets that MEG said it could not obtain, its estimate of worldwide 2007 exploration expenditures including uranium totals more than $11.4 billion.

Excluding these uranium exploration expenditures, however, the study notes that companies at all levels of the industry have substantially increased their budgets over the past five years, but the junior sector is clearly driving the current exploration upswing. In fact junior exploration spending has increased 909% since the bottom of the cycle in 2002, accounting for more than half of the overall year-on-year increase in each of the last four years, and for more than half of the 2006 and 2007 worldwide total.

With prices for copper, nickel and zinc at or near their all-time highs, the percentage of overall exploration spending attributable to base metals (which have maintained an inverse relationship to gold over the past decade) has increased substantially in recent years. Since 1994, Latin America has been the most popular destination for exploration, with just under 24% of worldwide spending in 2007. About 83% of this year's $2.4 billion allocation is directed to traditional big five Latin American countries—Mexico, Peru, Chile, Brazil and Argentina. Canada has held the second spot since overtaking Australia in 2002 and represents about 19% of worldwide spending in 2007.

The rest-of-world region, which includes most of mainland Asia, Europe and the Middle East, holds third place for the second year in a row, accounting for 17% of total 2007 expenditure. Close behind is Africa at 16%; major exploration destinations on the continent include South Africa, Democratic Republic of Congo, Angola, Tanzania, Botswana and Ghana, which collectively account for almost two-thirds of the continent's 2007 exploration total.

Although in fifth place by region for the fourth year in a row, Australia recorded the largest relative year-on-year increase this year (up 57%), increasing its share of worldwide spending from 11% to 12%.

The United States remains in sixth place, falling within the same range of 7%-8% of worldwide spending it has held for the past seven years. In the Pacific/Southeast Asia region, allocations rose 55% over last year's total, with Papua New Guinea, The Philippines and Indonesia collectively contributing almost three-quarters of the total. The region's 4% of the worldwide total ranks it last among all the regions.

Grassroots spending maintained its 39% share of the worldwide budget for the second consecutive year, while minesite allocations increased the most on a year-on-year basis (up 57%) at the expense of late-stage budgets to account for about 20% and 41%, respectively, of the total allocations this year. Nonetheless, aggregate late-stage budgets continue to outweigh grassroots allocations for the third consecutive year after surpassing grassroots budgets for the first time in 2005.

"If you don't read the newspaper you are uninformed, if you do read the newspaper you are misinformed."
Mark Twain

Suppose you were an idiot, And suppose you were a member of Congress.... But then I repeat myself.
Mark Twain

I contend that for a nation to try to tax itself into prosperity is like a man standing in a bucket and trying to lift himself up by the handle.
Winston Churchill

A government which robs Peter to pay Paul can always depend on the support of Paul.
George Bernard Shaw

A liberal/social democrat is someone who feels a great debt to his fellow man, which debt he proposes to pay off with your money.
G Gordon Liddy

Democracy must be something more than two wolves and a sheep voting on what to have for dinner.
James Boward, Civil Libertarian (1994)

Foreign aid might be defined as a transfer of money from poor people in rich countries to rich people in poor countries.
Douglas Casey, Classmate of Bill Clinton at Georgetown University

Talk is cheap...except when Congress does it.
Unknown

Giving money and power to government is like giving whiskey and car keys to teenage boys.
P.J. O'Rourke, Civil Libertarian

Government is the great fiction, through which everybody endeavors to live at the expense of everybody else.
Frederic Bastiat, French Economist (1801-1850)

I don't make jokes. I just watch the government and report the facts.
Will Rogers

If you think health care is expensive now, wait until you see what it costs when it's free!
P.J. O'Rourke

In general, the art of government consists of taking as much money as possible from one party of the citizens to give to the other.
Voltaire (1764)

Just because you do not take an interest in politics doesn't mean politics won't take an interest in you!
Pericles (430 B.C.)

No man's life, liberty, or property is safe while the legislature is in session.
Mark Twain (1866)

The government is like a baby's alimentary canal, with a happy appetite at one end and no responsibility at the other.
Ronald Reagan

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We have offices in Townsville, Perth, Bathurst (NSW) and a field depot in Charters Towers. Our geological and support staff are a highly motivated professional team available on an as need basis; thus avoiding the enormous costs of under-utilising staff, field equipment and branch office facilities remote from head office. Terra Search has the equipment and technical expertise to manage an entire exploration program on any scale, from ground generation and acquisition through to resource evaluation. Our field crews are particularly suited to work throughout remote areas of Australia.

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- DGPS with experienced surveyor
- Ground radiometric capability with spectrometer and scintillometer

Recent client GEMSYS magnetometer production (Eucla Basin, SA)

- 4 week field programme
- 700 line kilometers
- Over 1 Million data points!
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THE AIG’S STUDENT BURSARY Program has continued to develop and expand over the last few years with continuing support from a growing number of sponsors, including State AIG Branches, and an increasing student interest in the program.

AIG is very grateful to all the companies and organisations whose support over the years has contributed to the success of the program, including our current external bursary sponsors:

ActivEX Limited, Chris Bonwick — Independence Group NL, Consolidated Minerals Ltd, Cryptodome Ltd, Gnomic Exploration Services, Kagara Ltd, Lantana Exploration Pty Ltd, Primary Industry and Resources South Australia, SMEDG, and TerraSearch Pty Ltd.

AIG’s Council agreed late last year to establish a Trust that includes a Gift Fund to provide these bursaries or scholarships to Australian residents enrolled in a program focussed on geoscience at an Australian tertiary education institution. This means that existing sponsor funds will be rolled into the Gift Fund and that, from now on, sponsor contributions to the fund will be tax deductible.

The trust, to be known as the AIG Geoscience Education Foundation, will exist by the end of February 2008. Accounts for the fund will be published annually.

There are two types of AIG bursaries available each year to geoscience students who are AIG Members and are currently engaged in either full or part time studies:

• Undergraduate Bursaries are available to honours students and may be used to help offset the costs of completing an honours thesis. Bursaries may be used in any way by recipients.
• Postgraduate Bursaries must be used by applicants to undertake an activity that will enhance their postgraduate studies and would otherwise not be possible to undertake without the contribution made by bursary funds (e.g. travel to attend a conference to present research results, or to work with prominent geoscientists in a particular field).

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Office of Minerals & Energy PIRSA-AIG Geoscience Student Bursary

These bursaries are 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.

(Geeral eligibility criteria and guidelines also apply.)

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**Education Report**

**Student Bursaries**

In this issue of AIG News we include an abstract from 2007 student bursary winner, Robin Armit. Robin completed his honours project "Geodynamic evolution of a Proterozoic crustal-scale shear zone: Constraints from deformation, metamorphism and geochemistry" at Monash University last year and was awarded a Bonwick-AIG Honours bursary. This year Robin will be starting a PhD on Pre-Cambrian terranes of South Australia.

The application form for 2008 AIG Honours and postgraduate bursaries will be available around late March — early April. The application form will be distributed to students and academics throughout Australia and will also be available on the AIG web site and from the AIG Secretariat.

**Teacher Earth Science Education Program (TESEP) — Update**

TESEP is underway and currently looking for additional partners. TESEP is an initiative designed to raise the profile of geology and geoscience careers amongst high school students. The program will assist teachers to better understand the geoscience subject areas, and to more effectively teach the Earth Science components in the school curricula.

TESEP has developed a national plan to run teacher professional development workshops on key geoscience areas of topical interest and curriculum relevance between 2008 and 2010. The Professional Development workshop series is designed to:

- Spark student interest in Earth and Environmental Science (EES) topics across Australia
- Motivate and educate keen science teachers and raise the profile of EES in secondary schools nationally
- Address the critical shortage of young people in trades and professions in the Energy/Minerals/Environmental Sciences industries
- Assist students in making informed choices regarding subject and trade/professional career choices in the Energy/Minerals/Environmental Sciences Industries
- Address requested topics based on a 2007 Survey of teacher needs

Operating under the auspices of the Australian Science Teachers Association, and with the guidance of an advisory board of senior personnel from all sectors of the Australian geoscience community, TESEP is seeking partners to help fund and operate the programmes. To date TESEP has received partnering support from PESA, several exploration and mining companies, a number of university groups and expressions of interest from many others. However, to make TESEP work effectively and reach teachers nationally further support is needed. If your company or organisation is interested in supporting this initiative please contact Greg McNamara, TESEP Executive Officer, who can provide detailed information on the program, and a business plan and a budget summary. Greg's contact details are: geoservices@geoed.com.au, Tel 03 5155 0330.

**Education Report**

**Kaylene Camuti**

Chair, Education Committee

**2007 Bonwick-AIG Honours Bursary Winner:**

**Geodynamic evolution of a Proterozoic crustal-scale shear zone:**

**Constraints from deformation, metamorphism and geochemistry**

**Robin Armit**

School of Geosciences, Monash University

THE PARALANA FAULT ZONE is interpreted as a crustal-scale shear zone. Preserved within this shear zone is a record of protracted activity at varying crustal levels since at least the Mesoproterozoic.

An early ductile sinistral transpressive regime is related to D3 NW-SE shortening and retrograde metamorphism. The Radium Creek Metamorphics preserved in the hangingwall of the shear zone records rapid burial (~3 km/myr) post ca. 1592 Ma to sillimanite grade (upper amphibolite facies) recording peak metamorphism M1 during D2 NW-SE shortening. Rapid exhumation (~3-4km/myr) of these rocks occurred between ca 1582-1575 Ma, prior to the emplacement of the Mount Neill Massif at shallow crustal levels (~2km). The A-type affinity Mount Neill Massif was emplaced in a within-plate tectonic environment ca 1575 Ma (Elburg et al. 2001) probably along the active crustal-scale shear zone. A change to a brittle dominated regime occurs with the onset of extension during the deposition of the Adelaidian Rift Complex. Basin inversion related to the Delamerian Orogeny (D4) leads to the exhumation of the Mount Painter Inlier along a brittle, sinistral strike-slip Paralana Fault Zone with subsequent late Tertiary uplift.

**RPGeo Approval and Applicants**

**CANDIDATES APPROVED BY AIG COUNCIL IN JANUARY 2008**

Mr Graham Ernest Hawkes, of Sydney, NSW, in the field of Hydrogeology

Mr Richard Tristam Jeremy May, of North Perth, WA, in the field of Mineral Exploration

Mr Marcus John Willson, of Ross moyne, WA, in the field of Mineral Exploration

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

Dr Oliver Kreuzer, of Rockingham, WA, in the field of Mineral Exploration
## Membership Update

### New Members and Upgrades at the November Council Meeting 2007

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<td>Nigel Howard</td>
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| ADAMOPOLOUS   | Sophia Maree  |
| BOLADERAS     | Jason Leonard  |
| EDDISON       | Fiona Jane     |
| GOBBETT       | Simon John     |
| HENDERSON     | Ivan James     |
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| SHACKLETON    | Ian            |
| STOCKWELL     | Richard Glen   |
| WAHDAN        | Essam          |
| WEBB          | Keith Erik     |
| YAGO          | Joel Vincent   |

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| AJAYI         | Olywatosin Ezekiel |
| HAMES         | Benjamin Philip   |
| HEPPLE        | Robert Alexander  |
| JOHNSON       | Kobie Jai        |
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| TEDESCO       | Adam             |
| WIMBERLEY     | Meg Louise       |

### New Members and Upgrades at the January Council Meeting 2008

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| BRYANT        | Michael Charles |
| CULVER        | Kirsty Elizabeth |
| GARRAD        | Paul Douglas |
| GREEN         | Micholas Paul |
| HUSSEY        | Kelvin James |
| JOMBWE        | Nathan Fredrick |
| KENWORTHY     | Shane Ernest |
| MC IVER       | Ralph Gerard |
| MORWOOD       | David Alan |
| RAFTY         | Denis John |
| REINHARDT     | Mario Conrado |
| RODRIGUEZ     | Porfirio Cabaleiro |
| TUBA          | Timothy |
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CONTRIBUTION DEADLINES

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