Australian Institute of Geoscientists

AIG NEWS

Quarterly Newsletter No 96 May 2009

New Ideas in Science

The Late Dr Thomas Gold, Dept of Astronomy
Cornell University, Ithaca NY 14853

(From the J. of Sci. Exploration, Vol. 3, No. 2, pp 103—112, 1989 (c)1989 Society for Scientific Exploration : http://www.scientificexploration.org)

Abstract - *The pace of scientific work continues to accelerate, but the question is whether the pace of discovery will continue to accelerate. If we were driving in the wrong direction — in the direction where no new ideas can be accepted — then even if scientific work goes on, the progress would be stifled. This is not to suggest that we are in quite such a disastrous position, but on the other hand, all is not well.*

New ideas in science are not always right just because they are new. Nor are the old ideas always wrong just because they are old. A critical attitude is clearly required of every scientist. But what is required is to be equally critical to the old ideas as to the new. Whenever the established ideas are accepted uncritically, but conflicting new evidence is brushed aside and not reported because it does not fit, then that particular science is in deep trouble — and it has happened quite often in the historical past. If we look over the history of science, there are very long periods when the uncritical acceptance of the established ideas was a real hindrance to the pursuit of the new. Our period is not going to be all that different in that respect, I regret to say.

I want to discuss this danger and the various tendencies that seem to me to create it, or augment it. I can draw on personal experiences in my 40 years of work on various branches of science and also on many of the great controversies that have occurred in that same period.

I will start very naively by a definition of what a scientist is. He is a person who will judge a matter purely by its scientific merits. His judgment will be unaffected by the evaluation that he makes or the judgment that others would make. He will be unaffected by the historical evaluation of the subject. His judgment will depend only on the evidence as it stands at the present time. The way in which this came about is irrelevant for the scientific judgment; it is what we now know today that should determine his judgment. His judgment is unaffected by the perception of how it will received by his peers and unaffected by how it will influence his standing, his financial position, his promotion — any of these personal matters. If the evidence appears to him to allow several different interpretations at that time, he will carry each one of those in his mind, and as new evidence comes along, he will submit each new item of evidence to each of the possible interpretations, until a definitive decision can be made. That is my naive definition of a scientist.

I may have reduced the number of those whom you think of as scientists very considerably by that definition. In fact, I may have reduced it to a null class. But, of course, we have to be realistic and realize that people have certain motivations. The motivation of curiosity is an important one, and I hope it is a very important one in most scientists' minds. But I doubt that there are many scientists to whom the motivation of curiosity about nature would suffice to go through a lifetime of hard struggle to uncover new truths, if they had no other motivation that would drive them along that same path. If there was no question about appealing to one's peers to be acknowledged, to have a reasonably comfortable existence, and so on, if none of this came into the picture, I doubt that many people would choose a life of science.

When the other motivations come into the act, of course the judgment becomes cloudy, becomes different from the ideal one, from the scientific viewpoint, and that is where the main problem lies. What are the motivations? If there are motivations that vary from individual to individual,

Cont. on Page 2

INSIDE THIS AIG NEWS:

New Ideas in Science

Cont. from Page 1

it would not matter all that much because it would not drive the scientific community as much to some common, and possibly bad, judgment. But if there are motivations that many share, then of course that is another matter; then it may drive the whole scientific community in the field in the wrong direction. So, we must think: what are the communal judgment-clouding motivations? What is the effect of the sociological setting? Is our present-day organization of scientific work favorable or unfavorable in this respect? Are things getting worse, or are they getting better? That is the kind of thing we would like to know.

The pace of scientific work continues to accelerate, but the question is whether the pace of discovery will continue to accelerate. If we were driving in the wrong direction — in the direction where no new ideas can be accepted — then even if scientific work goes on, the progress would be stifled. This is not to suggest that we are in quite such a disastrous position, but on the other hand, I am not going to suggest that all is well.

What are the many factors that many people might share that go against the acceptance of scientifically valid new ideas? One obvious factor that has always been with us is the unwillingness to learn new things. Too many people think that what they learned in college or in the few years thereafter is all that there is to be learned in the subject, and after that they are practitioners not having to learn anymore. Of course especially in a period of fairly rapid evolution that is very much the wrong attitude; but unfortunately it is shared by many.

I can give you there an example from my own experience where, when I was still very green and naive, just after the war, I had worked on the theory of hearing: how the inner ear works. As I had just come from wartime radar, I was full of signal processing methods and sophistication and receiver techniques and all that, and there I found myself discussing the physiology of hearing in those terms. I thought it was very appropriate because it is a very fine scientific instrument that we were discussing, the inner ear. But I had to address myself to an audience of otologists — the doctors and medical people who deal with hearing — the only ones who were doing any kind of research in this field. The mismatch was obvious; it was completely hopeless. There was no common language, and of course the medical profession just would not learn what it would take to understand the subject. On the other hand, they sure made their judgments about the matter, without having any basis at all.

So it just essentially forced me out of the field. The theory of hearing which I proposed then involved an active — not a passive — receiver, one in which positive feedback, not just passive detection is involved.

We now have very clear evidence, after these 36 years, that indeed an active receiver is at work, but we still have not got a receptive group of physiologists who deal in this field. The medical profession still hasn't a clue as to why 15 kilocycles should be coming out of somebody's ears. Thirty-six years is not yet enough to get that learning into the profession.

A motivation which is in a way more serious and more avoidable than the nonlearning one, a motivation that hones out new ideas, is what I brutally call the "herd" instinct. It is an instinct which humans have. It presumably dates back to tribal society. I am sure it has great value in sociological behavior in one way or another, but I think on the whole the "herd instinct" has been a disaster in science. In science what we generally want is diversity — many different avenues need to be pursued. When people pursue the same avenue all together, they tend to shut out the other avenues, and they are not always on the right ones.

If a large proportion of the scientific community in one field is guided by the herd instinct, then they cannot adopt another viewpoint since they cannot imagine that the whole herd will swing around at the same time. It is merely the logistics of the situation. Even if everybody were willing to change course, nobody individually will be sure that he will not be outside the herd when he does so. Perhaps if they could do it as neatly as a flock of starlings, they would. So this inertia-producing effect is a very serious one.

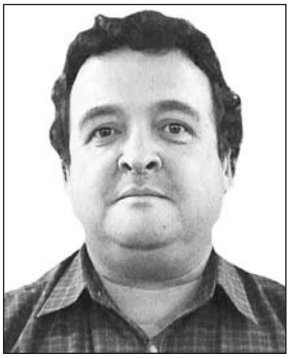
It is not just the herd instinct in the individuals that you have to worry about, but you have to worry about how it is augmented by the way in which science is handled. If support from peers, if moral and financial consequences are at stake, then on the whole staying with the herd is the successful policy for the individual who is depending on these, but it is not the successful policy for the pursuit of science.

Staying with the herd to many people also has an advantage that they would not run the risk of exposing their ignorance. If one departs from the herd, then one will be asked, one will be charged to explain why one has departed from the herd. One has to be able to offer the detailed justifications, and one's understanding of the subject will be criticized. If one stays with the herd, then mostly there is no such charge. "Yes, I believe that because doesn't everybody else believe that? " That is enough justification. It isn't to me, but it is to very many other people. The sheep in the interior of the herd are well protected from the bite in the ankle by the sheep dog.

It is this tendency for herd behavior that is greatly aggravated by the support structure of science in which we believe nowadays. I will read

Cont. on Page 6

From Your President

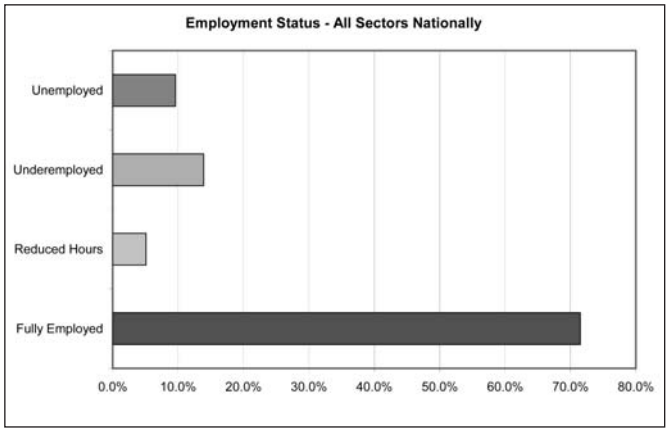


THERE IS NO DOUBT that the current financial downturn and its impact on the ability of companies to raise capital to fund exploration and reduced demand for commodities, as economic activity around the world slows, are having a profound impact on geoscientist employment. Again, the exploration sector felt the impacts of the downturn first, and has suffered most.

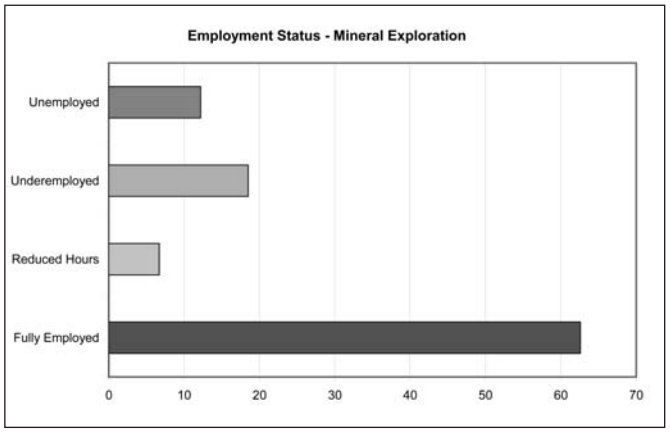
The response to the employment survey conducted by AIG in February was little short of excellent. More than 1,000 geoscientists responded to the survey over a period of several days, providing an excellent sample to support conclusions that have already been used in representations to both Federal and State governments on the impacts of the economic downturn on the geoscience profession, seeking timely action on measures to support mineral and energy exploration and maintain Australia's resource project pipeline.

Where are we now?

Nationally, in March 2009, more than 30% of Australian geoscientists were either unemployed, forced to reduced hours or not achieving their desired level of self employment — a substantial turnaround from the conditions evident, on anecdotal evidence, at the same time in 2008. Little variation in this rate was evident nationally, with results varying between 26% in Western Australia to 32% in Victoria.

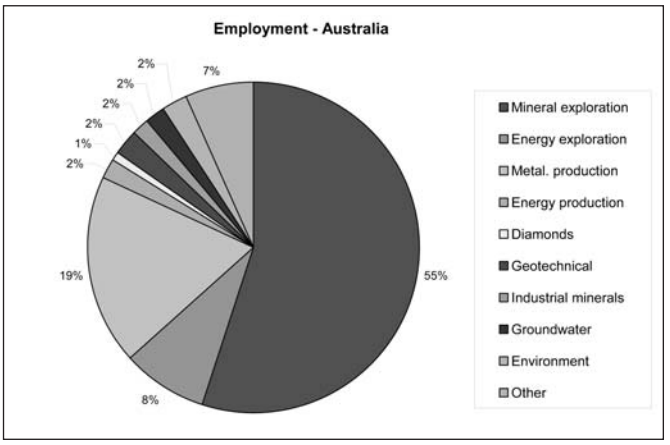


On an industry sector basis, the national unemployment andunderemployment rate amongst mineral exploration geoscientists was 38%, although metalliferous mining (19%), energy resource exploration (17%) and energy resource production (10%) have also been hit hard.



Unemployment or under-employment rates already exceed the Federal government's much publicised worst case scenario (10%) for the Australian economy as a whole.

The survey confirmed that mineral exploration has been the hardest hit sector of the geoscience profession. Nationally, 55% of geoscientists are employed in mineral exploration, followed by metalliferous mining, energy resource exploration and energy resource production.



The proportion of geoscientists employed in metalliferous exploration and mining varies markedly between Western Australia (56%) to Victoria (34%), with more geoscientists employed in groundwater management, teaching and research, industrial minerals and government in Victoria and New South Wales than in other states.

Nationally, some 54% of employers were reported to have retrenched geoscientists within the six months prior to the survey, with this figure highest in Victoria at 62%.

A similar level of employment confidence was evident across Australia, with 50% of geoscientists feeling that they were not confident of being employed in 12 months time.

Where do we want to be?

AIG has stated to government, in conjunction with other organisations representing both exploration and mining companies and professionals throughout Australia, that urgent action is needed to support mineral and energy resource exploration, in the form of a flow-through shares scheme.

The cyclicity affecting exploration sector employment in Australia is also, clearly, a factor that reduces the appeal of geosciences as a career to students commencing university studies. This situation must be addressed if Australia is to maintain, let alone build its geoscience capabilities. Geoscience skills are required in the resource industries, which will play a critical role in Australia's economic recovery from the current

Cont. on Page 5

PROFESSIONAL DEVELOPMENT TRAINING

Resource Estimation Our Resource Estimation course is now bigger and better than ever! A team of our consultants have put their years of experience into redeveloping this highly-practical course and comprehensive reference manual.	**Johannesburg**	**8-12 June**
Resource Estimation Using Datamine	**Perth**	**22-25 June**
Managing Mine Contracts	**Perth**	**28-29 May**
Geology for Non-Geologists	**Perth** **Brisbane** **Johannesburg**	**10 June** **11 June** **13 July**
Mining for Non-Miners	**Perth** **Brisbane** **Johannesburg**	**11 June** **12 June** **14 July**
Metallurgy for Non-Metallurgists	**Perth**	**12 June**
Six Sigma Green Belt	**Perth**	**10-11, 24-25 June** **15-16 July**
Practical Variography	**Vancouver** **Perth**	**11 June** **23 July**
Variography Using Visor	**Vancouver** **Perth**	**12 June** **24 July**
Assessing Confidence in Coal Resource Estimates	**Brisbane**	**18-19 June**
Report Writing	**Johannesburg**	**15 July**
Mining & Sampling Theory for Mine Technicians & Field Assistants	**Perth**	**24 July**
SEMINAR: Managing Risks & Realising Opportunities This seminar will be presented by 14 of Snowden's consultants and associates.	**Perth**	**20-21 August**

STAFF RETENTION INITIATIVE: PROFESSIONAL DEVELOPMENT COURSES IN BEAUTIFUL BALI

Training courses to look forward to! To encourage staff retention within the mining industry we are once again offering our professional development courses in beautiful Bali. (You will be pleasantly surprised to see that it can cost the same to fly from Sydney to Perth as it would cost to fly from Sydney to Bali… and the accommodation is cheaper!)

Resource Estimation	**Bali**	**3-7 August**
Introduction to Geostatistics	**Bali**	**10 August**
Grade Control and Reconciliation	**Bali**	**11-14 August**

The venue for this training is the **Hotel Padma Bali** (www.hotelpadma.com)
For further details about the Bali courses, please contact Diana Titren, Snowden Training Manager.

SNOWDEN'S MENTORING PROGRAMME

- allows you to learn while working on your own data

Snowden provides technical mentoring to individuals or small groups either onsite where you work or in our Snowden offices. This is a great way for you to learn from the experts while you work on your own data!

FOR MORE DETAILS OR TO REGISTER ONLINE
Visit www.snowdengroup.com
or call Diana Titren on +61 8 9211 8670
or email training@snowdengroup.com

SNOWDEN

From Your President

Cont. from Page 3

crisis, and to address new challenges from emerging fields of practice such as urban and environmental geology, water resource management, and improving the science underlying concerns about climate change.

Some positive news was received from the Deputy Prime Minister and Education Minister, Julia Gillard, about improved funding and reduced HECS contributions for geoscience students. AIG members may view the Minister's letter on the web site and the AIG Council will be following the government's actions on this issue.

How are we going to get there?

AIG has also written directly to the Treasurer, Finance, and Resources ministers calling on them to introduce a flow-through shares scheme, effective June 30 this year. Similar calls were also made to members of the Shadow Ministry and I know, from the many emails received from AIG members, that Members of the House of Representatives and Senators from each state have been called on by members to act on this issue. If you haven't written to your local member yet, please take the time to do so. Template letters are available on the AIG web site and will be updated regularly.

The responses received from the Government to date have not been encouraging. The Government has stated that the issue of a flow through shares scheme is one for the Henry Review of Australia's taxation system, due to report to the Treasurer by December 2009. This takes no account of the dire state of Australia's exploration sector, and most importantly the people who sustain it who need action now. This point will continue to be brought to the attention of government in coming months.

A major economic study of the costs and benefits of a flow through shares scheme, coordinated by the Queensland Resources Council and to which AIG contributed along with major industry and professional groups, will have been presented to the Federal government prior to the 2009-2010 budget being tabled in Parliament. The report will be delivered to Government in advance of the budget, and appropriate Ministers will be briefed on its conclusions and recommendations.

I recently participated in a meeting with officials of the Queensland Deaprtment of Employment and Industrial Relations organised by a Brisbane-based AIG member, where we discussed how none of the measures and strategies implemented by the Queensland Government to help people displaced by the downturn in the state's mining industry to find alternate employment worked. The officials agreed that geoscientists were not catered for by any of the measures implemented by the government and undertook to assist by consultating with their peers at the Federal level and by looking at ways to make exploration more attractive in Queensland (Employment and Mines and Energy are now part of one of the new "super-ministries" in Queensland). The meeting demonstrated that government inaction can sometimes be due to being unaware of the needs and role of our profession, something that we need to continue to work to correct.

Analysis of survey data and other information received since the employment survey was conducted suggests that the employment situation for geoscientists has continued to deteriorate. Follow-up surveys will be conducted at three month intervals during 2009 in an attempt to monitor the situation and ensure that trends are brought to the attention of governments throughout Australia. The first of these follow-up surveys is on-line now and all members are asked to take a minute of their time to complete the survey, and encourage their colleagues to contribute, irrespective of whether they contributed to the original survey.

On other fronts, presentations from the WA Branch's *"Surviving the Downturn"* seminar held in Perth recently are now available on the AIG web site, with videos of most of the presentations from the seminar. This is the first time AIG has attempted to deliver information to members in this form. I believe that it provides AIG with a highly effective means of delivering information and professional development opportunities to members. Feedback on the initiative would be most useful. The concept could be extended to other seminars and talks presented by AIG branches around Australia.

Development of a member directory, where AIG members will be able to promote their skills, services and capabilities, whether seeking work or self employed, is nearing completion and will be rolled out in the next few weeks, accompanied by publicity to launch the directory as a valuable resource when seeking geoscience skills.

AIG has accepted an invitation to represent Australia on an IUGS working party to examine geoscientist employment globally, one of the aims of which is to improve the understanding of geoscientist education and training in different parts of the world. The group will be convened by the American Geological Institute. A face to face meeting will be held in August with representatives of the Canadian Council of Professional Geoscientists to explore greater cooperation between AIG and CCPG, of benefit to members in both countries.

You will be aware of a potential merger between the Geological Society of Australia (GSA) and AIG has been the subject of discussions between the two societies for some months. Discussions between AIG and GSA are continuing, but have not yet progressed to a stage where a proposal can be put to members. About one in three AIG members are also currently members of GSA. Members will be kept informed of progress.

The AIG Annual General Meeting will be held in Perth towards the end of May. Sam Lees, a long standing Councillor from New South Wales will be stepping down from Council at the AGM and I would like to express special thanks to Sam for his contributions, especially in the revision of the VALMIN Code and his work on the Ethics and Standards Committee. Sam will continue to be a member of the New South Wales branch committee. I will also be stepping down as AIG President and would like to express my sincere thanks to all Councillors and State Branch members for their commitment and support over the past two years. AIG would not be the organisation it is today without their efforts.

We are clearly facing a number of challenges over the months ahead and, as always, we're listening to members and are committed to achieving outcomes that improve the status and perception of the varied and valuable contributions professional geoscientists make throughout Australia every day.

Andrew Waltho

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

New Ideas in Science

Cont. from Page 2

out just one passage here to show that other people than myself have recognised the herd problems: David Michland writes in the REVIEWS OF ASTRONOMY:

> *"I sometimes wonder if the much encouraged and proclaimed interaction among western astronomers leads to a form of mental herd behavior which, if it does not actually put a clamp upon free thinking, insidiously applies the pressure to follow the fashion. This makes the writings of our Soviet colleagues who have partly developed ideas in comparative isolation all the more valuable".*

Yes, I have wondered whether one should in fact pursue subjects with a big wall between two groups that are working in the same field, so that they absolutely cannot communicate, and see a few years later whether they come even approximately to the same conclusion. It would then give some perspective of how much the herd behavior may have been hurting. But we don't have that. Even with our Soviet colleagues, unfortunately, we have too much contact to have a display of real independence, to see where it would have led.

This question of how the support of science — and I don't mean only the financial support but also the journals, the judgment of referees, the invitations to conferences, acknowledgments of every kind — how that interacts with the question of herd behavior, is what I will now discuss.

It is important to recognize how strong this interaction really is. Suppose that you have a subject in which there is no clear-cut decision to be made between a variety of opinions and therefore no clear-cut decision to be made in which direction you should put money or which direction you should favor for publications, and so on. No doubt opinions would need a multidimensional space to be presented, but I will at the moment just represent them in a one-dimensional situation.

Suppose you have some curve between the extreme of this opinion and the extreme of that opinion. You have some indefinite, statistically quite insignificant distribution of opinions. Now in that situation, suppose that the refereeing procedure has to decide where to put money in research, which papers to publish, and so on. What would happen? Well, people would say, "We can't really tell, but surely we shouldn't take anybody who is out here. Slightly more people believe in this position than in any other, so we will select our speakers at the next conference from this position on the opinion curve, and we will judge to whom to give research funds," because the referees themselves will of course be included in great numbers in some such curve. "We will select some region there to supply the funds."

And so, a year later what will have happened? You will have combed out some of the people who were out there, and you will have put more people into this region. Each round of decision making has the consequence of essentially taking the initial curve and multiplying it by itself.

Now we understand the mathematical consequence of taking a shallow curve and multiplying it by itself a large number of times. What happens? In the mathematical limit it becomes a delta function at the value of the initial peak. What does that mean? If you go for long enough, you will have created the appearance of unanimity. It will look as if you have solved the problem because all agree, and of course you have got absolutely nothing. If no new fact has come to light and the subject has gone on for long enough — this is what happens. And it does happen! I am presenting it in its clearest form, and it is by no means a joke. If many years go by in a field in which no significant new facts come to light, the field sharpens up the opinions and gives the appearance that the problem is solved.

I know this very well in one field, which is that of petroleum derivation, where the case has been argued since the 1880's. At the present time most people would say the problem is completely solved, though there is absolutely nothing in the factual situation that would indicate a solution. It is also very clear there that the holding-in that has taken place has been an absolute disaster to research. It is now virtually impossible to do any research outside the widely accepted position. If a young man with no scientific standing were to attempt this, however brilliant he might be, he wouldn't have a hope.

I believe that our present way of conducting science is deeply afflicted by this tendency. The peer review system, which we regard as the only fair way we know of to distribute money (I don't think it is, but it is generally thought to be) is an absolute disaster. It is a completely unstable method. It is completely prone to this tendency; there is no getting out of it. The more reviews you require for a proposal — now the NSF requires seven reviewers for a proposal — the more you require, the more certain it is that you will follow the statistical tendency dictated by this principle. If you had noise in the situation, it would be much better. There used to be in the United States many different agencies, and there was perhaps an odd-ball over here who gave out some money for one agency, and a funny fellow over there for another. This was a noisy situation, and it was not driving quite as hard towards unanimity. But now we have it all streamlined and know exactly to whom we have to go for a particular subject and, of course, it is an absolute disaster.

Why is it thought that the peer review system would work for science? How about trying to make a peer review system work for other forms of endeavor? Suppose we had a national foundation for the arts, and

every painter had to apply to it to get his canvas and his brushes and his paints. How do you suppose that would work? I can imagine some of the consequences, but better than that, we can look them up in historical examples. If you want to read such, in the book The Experts Speak , you can do that. There is a long list of them that you can read — it makes marvelous reading.

Eduard Manet wrote to his colleague Claude Monet, of Renoir: "He has no talent at all, that boy. Tell him to give up painting."

"Rembrandt was regarded as not comparable with an extraordinarily gifted artist, Mr. Ripingill."

William Blake spoke of Titian and the Venetians as "such idiots are not artists."

Degas regarded Toulouse-Lautrec as "merely a painter of a period of no consequence." One wonders how art would have fared in a peer review system.

Or would it be different in music? We can read what was said of Beethoven's compositions by musicians of his time:

"An orgy of vulgar noises" was the verdict of Beethoven's Fifth Symphony by Mr. Spore, a German violinist and composer.

On Tchaikovsky's appreciation of Brahms, "I played over the music of that scoundrel Brahms. What a giftless bastard. It annoys me that this jumping, inflated mediocrity is hailed as a genius." But one could go on almost endlessly with such quotations. Music would not have fared any better.

So we see that the herd instinct is a tendency in the human makeup, which is itself a severe handicap for science. Instead of combating it as best we can, we have arranged a method of nurturing science which actually strengthens it enormously — makes it virtually impossible to depart from the herd and continue to have support, continue to have a chance of publication, continue to have all the advantages that one requires to work in a field.

If in a subject there was initially a diversity of opinions, the review system will assure a very short life for that condition, and soon the field will be closed to all but those who are in the center.

Once a herd is established, by whatever historical evolution this has come about, it obtains such firm control that it is extremely difficult to do anything about it. And even if it were appreciated that that is the situation, one just doesn't know how to interfere. Where then is the right to free speech if every journal has to send each article out to a number of people to review, and the bulk of the people are with the herd? Usually with just one-third of the reviewers very negative, the paper does not get published.

So there is no free speech in the sense that you cannot publish diverse viewpoints. There is also no free speech at conferences because the same is true there. Would all those who have a divergent opinion be able to organize their own conference? Very rarely. We (note: meaning the Society for Scientific Exploration) represent perhaps an example here showing that it is possible, but it is pretty rare that one can raise funds to run conferences. Essentially once the herd is established, it will interfere in any one of the activities that one would need to further that science.

Would the Dean of a university be willing to promote somebody to tenure who was outside the pack? He can't, because he has to send out letters to the leading persons in the field — he may inquire from 20 people before he gets permission to appoint somebody to tenure — and how can he get that when the pack is running in another direction than this person? It is absolutely hopeless! So you establish the situation more and more.

Once a herd has been established in a subject, it can only be broken by the most crass confrontation with opposing evidence. There is no gentle way that I have ever seen in the history of science where a herd once established has been broken up.

In many subjects such clear evidence is very hard to come by. In the complex subjects, especially I always think of the earth sciences in this respect, there are always different ways of interpreting any one fact; so many complicated things have taken place that any one fact can have three or four interpretations and the crass confrontation is very rare.

So then when you have a herd, all the money that you spent on it may be wasted, or worse than that, it may actually serve to cement further the bad situation. So it is very likely that money is often spent in science in a way that is absolutely detrimental to that science.

What does the refereeing procedure really look like? How does it really go on? If, for example, an application was made in the early 60's or late 50's suggesting that the person wanted to investigate the possibility that continents are moving around a little, it would have been ruled out absolutely instantly without questions. That was crack- pot stuff, and had long been thought dead. Wegener, of course, was an absolute crack-pot, and everybody knew that and you wouldn't have any chance.

Six years later you could not get a paper published that doubted continental drift. The herd had swung around — but it was still a firm and arrogant herd.

Shortly after the discovery of pulsars I wished to present an interpretation of what pulsars were, at this first pulsar conference —

Cont. Overleaf

New Ideas in Science

Cont. from Page 7

namely that they were rotating neutron stars. The chief organizer of this conference said to me, "Tommy, if I allow for that crazy an interpretation, there is no limit to what I would have to allow." I was not allowed 5 minutes of floor time, although I in fact spoke from the floor. A few months later, this same organizer started a paper with the sentence, "It is now generally considered that pulsars are rotating neutron stars."

I will tell you about a recent application to the Department of Energy by a colleague of mine and myself for some money to investigate the chemistry of hydrocarbons at high pressures and high temperatures in the conditions in which they might be at some depth in the earth. We had the referee's reports because you are allowed to get them, but not signed. We got one voluntarily from one of the referees, so we know who he was. He wrote, "This proposal must be funded. In science every research project is a risk, but here the risk is negligible because even if the hypothesis is not correct, this research proposal will contribute strongly to fundamental science in petroleum engineering, the thermodynamics of fluids, and geochemistry. If the hypothesis is correct, the Department of Energy will have hit the jackpot beyond its wildest imagination." And he continued with the detailed questionnaire with top marks in every part: the competence of the proposer, the institution, the test, the facilities, and all that. He gave it top marks on every point.

There was a second referee who also gave it top marks for all the questions that are posed on the form. But then the last question is: "Should this proposal be funded?" and he wrote, "No." And then there was just a single word after that where it said "If no, why not?" And he wrote down, "Misguided." It was not funded despite the fact that most of the referees in fact gave it very high marks, due to the "misguided," and also similar words were used by two or three other referees. No reason given; just "don't touch it."

It wasn't the only such that I have submitted over the years now, and they have all been turned down both at NSF and DOE. It is absolutely hopeless to get any money in contravention of the opinions that are so firmly established in the petroleum business now.

That brings me to another problem. If in a subject you have a large number of people because it has economic applications, that immediately aggravates the problem. And, of course, in petroleum related matters there are a huge number of people involved at every step. This means firstly that a lot of mediocrity is brought into the field and overpowers the field by sheer numbers; and it also means that much more commitment to a particular viewpoint has been made by many people. Do you suppose that the petroleum geologist who has been advising Exxon to drill for hundreds of millions of dollars for maybe 30 years, will go to his bosses at Exxon and say, "I am sorry, Sir, but I have been wrong all those years. We have been finding the petroleum, but if we had searched for it in another way, we would have found 10 times as much." It is very unlikely that they will do that.

In fact, even if his methods and his understanding were completely, clearly wrong — even if you had the crassest confrontation in this case — I don't think that it would be acknowledged. A very small proportion of people would have that stature that they would turn around and say, "All my life I have taught or struggled with these problems on the wrong lines, and now I understand the right thing." So, in this case, the herd is so firmly established that one cannot think of converting it. A quotation from Tolstoy comes to mind:

I know that most men, including those at ease with problems of the greatest complexity, can seldom accept even the simplest and most obvious truth, if it be such as would obliged them to admit the falsity of conclusions which they have delighted in explaining to colleagues, which they have proudly taught to others, and which they have woven, thread by thread, into the fabric of their lives.

Another area where it is particularly bad is in the planetary sciences where NASA made great mistakes in the way in which they set up the situation. NASA made the grave mistake not only of working with a peer review system, but one where some of the peers (in fact very influential ones) were the in-house people doing the same line of work. This established a community of planetary scientists now which was completely selected by the leading members of the herd, which was very firmly controlled, and after quite a short time, the slightest departure from the herd was absolutely cut down. Money was not there for anybody who had a slightly diverging viewpoint. The conferences ignored him, and so on. It became completely impossible to do any independent work. For all the money that has been spent, the planetary program will one day be seen to have been extraordinarily poor. The pictures are fine and some of the facts that have been obtained from the planetary exploration with spacecraft — those will stand but not much else.

So yes, it is possible to make what is a bad tendency in humans in the first place (for science at least a bad tendency) that much worse with a lack of understanding of how the inward looking effect can be controlled or at least how it should not be augmented by the method of nurturing of science.

You may think that what I am saying is that the support for science poses this intrinsic problem, and that if you want to be fair you have to go for an unstable system which doesn't work. At first it looks like that. So should you go for something that's fair — makes people reasonably happy — but that doesn't work? Or should you go for something that is not so obviously regarded as fair but does work? It is a difficult decision to make, but you know there is nothing that says that things that are fair must also be the things that work. The world is just not so benign to us. Life is not that easy.

Is there another way of doing it? I suppose that the best that I can think of is roughly on the lines of what my friend, Arthur Katrowitz proposed at least for major decisions: The "science court" idea is the best one. Where a lot is at stake, where a subject has been driven into an alley, one must set up a science court where the different viewpoints would be heard, would be argued by the protagonists of each one, with carefully prepared work. The different viewpoints could be judge, not by others working in that same field, which would merely take you back to the herd, but would be judged by a group of very knowledgeable and very competent scientists distributed over other fields, but with enough general competence to be able to listen and understand the detailed arguments of the field in question. I would be much happier to have subjects surveyed every now and again by a jury of that kind. It has to be a scientific jury because it would have to understand detailed scientific arguments, but they do not have to be —and should not be — from the field in which the decision is to be made.

That is the avenue which I would advise the NSF and such organizations to pick at this time. I would say that in every field they should set up such a science court to hear all the different opinions on a reasonably regular basis. It is true that you cannot do it for every application that comes along, but it is true that you could do it

Cont. Overleaf

New Ideas in Sciencce

Cont. from Page 9

sufficiently often for major decisions to break, or at least spoil somewhat, the herd system. As it is at the moment, the situation seems not to be understood at all. I have discussed the herd problem with many people in the funding agencies, and found no understanding of that problem at all.

I could give you many more examples from my own life of the difficulties of getting subjects funded. At the present time I am struggling with the oil and gas business, and after being turned down very firmly by DOE and NSF, I finally was able to get money from he gas industry itself to do research which is in good progress now. In this area, which is one of the worst because no really significant facts have come to light and everything has been interpreted time and again in the time-honored fashion, and everyone believes they know in detail now how oil and gas come to be where they are. And the fact that we find that oil and gas exist on the other planetary bodies, obviously not due to biology, is completely ignored. They say there was no oil or gas here, and all that happened on the Earth was something that was completely specific to Earth. Of course, it is a peculiar attitude, but that is one that is widely accepted.

There is one more point I should make. When in a subject a general attitude or a viewpoint has become established, then it is very easy to obtain funds to do work in that subject on the bases of what I call "shoehorn science." I think you will understand what I mean by that. If you make your proposal which says: "I will demonstrate how this fact and that fact, that apparently is difficult to see in the accepted framework, can be figured into that framework," they are all delighted to give you money. And by the time that has gone on for a long time, so much work of the shoehorn kind has been diligently done to force the facts into the pattern that is preordained, that it then looks to many people as if it all was firmly established. What happens is that they build a superstructure on what may be no foundation — if I may invent a "Confucius say" sort of proverb, "Never judge the strength of foundation by size of building."

In the field of petroleum geology that is really what has happened. The moment you dare to look at the foundation, you are a scoundrel. I have made people absolutely wild, shaking their fists at me, when I proposed in my talks that there was some uncertainty about the origin of petroleum. One fellow actually wrote a paper that got published, that there must be life on Jupiter because hydrocarbons have been seen on Jupiter.

That is my sad story. I believe that we could do something about it, that we could propose that this kind of a situation be understood in high quarters — that we could try and have something in the nature of science courts established, or at any rate some review by independent persons and not by the herd; but as it is at the moment, I feel that we are dealing with a large proportion of science funding very firmly in the wrong hands, and much of it is therefore counterproductive. ▲▲

Volcanic Tornados

Spotted in the popular science press

THE COLUMNS OF ASH and gas that spew from erupting volcanoes behave just like another force of nature, tornados, a new study suggests.

Volcanic plumes have been known to spawn waterspouts and dust devils, as well as sheaths of lightning around their roiling debris clouds, but scientists didn't know why.

Images of the 2008 eruption of Mount Chaiten in Chile and a 200-year-old report of an eruption in the Azores by a sea captain that described these features have helped scientists at the University of Illinois solve the puzzle. This evidence indicates that the volcanic plume rotates like a tornado system, a phenomenon the researchers call a "volcanic mesocyclone."

"What happens in tornadic thunderstorms is analogous to what happens in strong volcanic plumes," said lead author of the study, Pinaki Chakraborty, a postdoctoral researcher at Illinois.

A volcanic plume consists of a vertical column of hot gases and dust topped by an umbrella-like structure. A volcanic mesocyclone sets the entire plume rotating, causing it to spawn waterspouts or dust devils and group together the electric charges in the plume to form a sheath of lightning.

Satellite images of the 1991 eruption of Mount Pinatubo in the Philippines confirm the rotation of strong volcanic plumes, the researchers found. The hourly images show that Pinatubo's umbrella was rotating about its center.

They also show that the umbrella shape became distorted as it rotated, morphing into a more lobe-like structure. Such lobate umbrellas have also been seen in satellite images of other volcanic eruptions, including Mount Manam in Papua New Guinea, Mount Reventador in Ecuador and Mount Okmok in the Aleutian Islands of Alaska.

Using satellites to image future eruptions will help scientists better understand the evolution of the umbrella shapes. Tools commonly used to study thunderstorms could also be used to study volcanic eruptions.

"The structure and dynamics of volcanic mesocyclones, as well as the presence of lightning sheaths, might be verified with Doppler radar and lightning mapping array, two technologies that have been scarcely used in volcanology," said study team member Gustavo Gioia.

The researchers' findings are detailed in the March 26 issue of the journal Nature. *Their work was funded in part by the National Science Foundation and Walgreen Chair funds.* ▲▲

Letter Sent to the Australian Financial Review Recently

Carbon: Sub-prime Potential

Andrew Clark's account of American Intenational Group's demise was timely ("Hotel of broken dreams", Features, March 11). "The models suggested the risk was so remote, that the fees were almost free money", said a former financial products division president. Revenue agendas based on dodgy models — be they financial or climatic — invariably end in disaster.

As one toxic sub-prime market collapses, another is being conjured from its ashes ("Labor braces for emissions fight", March 11). Is the government unaware that monetising carbon and deeming carbon emissions permits to be financial instruments will create not only a volatile artificial "currency" but also a financial weapon of mass destruction? Securitising carbon has the potential to create our next big sub-prime crisis.

It is no surprise banks and investment institutions are keen to introduce carbon derivative products, given the depressed outlook for financial services. Yet emissions trading will do little more that enable the government (and trading intermediaries) to profit unjustly from public fear, while creating another (uncosted) bureaucracy.

What will businesses, carbon traders and their counter parties do when Australian emission unit prices inevitably fall to zero, as new knowledge about the real causes of climate change makes them worth less than a Zimbabwean dollar? Will the government carbon bank intervene in a vain effort to maintain "value" and credibility?

We are witnessing a process of politicisation of flawed science unparalleled in the discipline's history. Guesstimates about future climate are being promoted as statements of fact. Why is there no genuinely independent scientific due diligence on alarmist claims? The public should demand greater scrutiny from its MPs.

M G Kile, Crawley WA

Dear Editor

After reading (and trying to understand) the article by Jenkins et al in AIG Newsletter No 95, I found myself wondering whether or not the expression "fundamental constant" should be viewed as an oxymoron.

If nuclear decay rates do not remain constant under all conditions eg with varying Sun - Earth distances, then where does this leave the radiometric age determinations which increasingly are viewed as "holy writ" by the geological fraternity? Perhaps "constancy" is a word which needs to be treated as anathema or at least with caution in the geological vocabulary.

One thing I do know for dead set certain, sure, the passage of time brings ever greater comfort with the expression "all is flux." It's the consolation process of the geological grizzling and greying process. It's also an expression which fits Old King Sol's perturbations, regular and otherwise.

Old verities and certainties? Cases of "bah, humbug" maybe.

Tony Hosking, Dover Gardens SA

Analysis of the 20th Century Australian Temperature Trend

Tom Quirk

IT IS POSSIBLE to explain much of the temperature rise in Australia during the twentieth century as being due to one event, the Great Pacific Climate Shift of 1977 when the temperature jumped by 0.5^{0}C. This has no connection with anthropogenic carbon dioxide and such future changes cannot be predicted by present climate models.

Analysing temperature behaviour in Australia and on a global scale has become the bellwether of global warming analysis. Deep suspicions are voiced over the results from the five groups that analyse global temperatures from ground stations, balloons and satellites. In fact it is probably remarkable that there is so much agreement on measurements and in science it is not surprising that there is so much disagreement on interpretation.

It is comforting to know that in Australia much the same game can be played. But the game here is played on one set of measurements, that of the Bureau of Meteorology, so it is all about interpretation.

In the paper "Observed climate change in Australia over the past century" Nicholls and Collins, of the Bureau of Meteorology, state:

> *"...It seems likely that much of the warming is due to increased atmospheric concentrations of greenhouse gases...."*

This statement draws on modelling results by Karoly and Braganza that indicate most of the temperature rise is compatible with increasing anthropogenic CO_2.

The analysis is worth examining by returning to the data.

In the Nicholls and Collins paper, annual temperature anomalies are analysed from 1910 to 2003. The temperatures shown there are annual mean minimum and maximum temperatures, together with continuous curves showing a five year running mean of both series.

Figure 1 is drawn from the same data set but shows annual mean temperatures. In addition it shows the five year running mean. The eye is led by the running mean, but statistically, with average fluctuations of 0.3^{0}C from year to year and no strong correlation of year on year temperature change for most of the data, this has no value.

If a six sided die were cast to simulate a random series and a running mean of five consecutive casts plotted, then the result would be as shown in Figure 2.

This demonstrates the use of running means can be quite misleading as a representation of trends. It also shows that substantial multiple year variations are possible in a system such as the Australian climate-weather system with 0.3^{0}C random annual temperature variations.

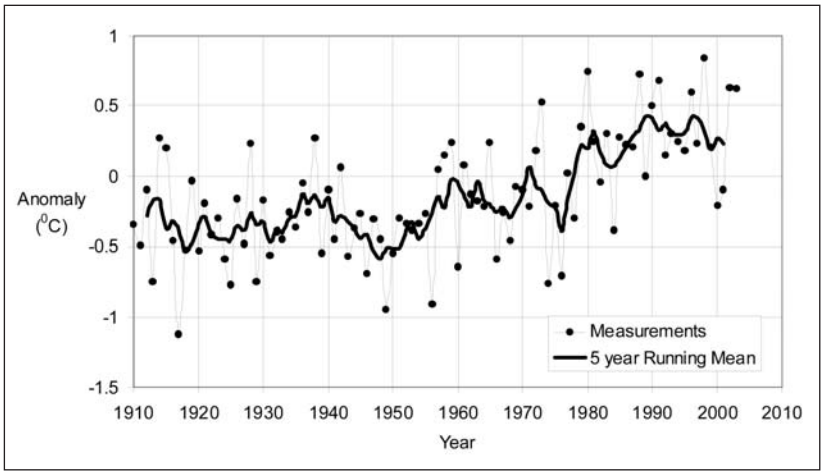
Keeping to the spirit of five year averages, Figure 3 shows the annual temperature anomalies as separate five year annual means: that is 1910 to 1914, 1915 to 1919 and so on.

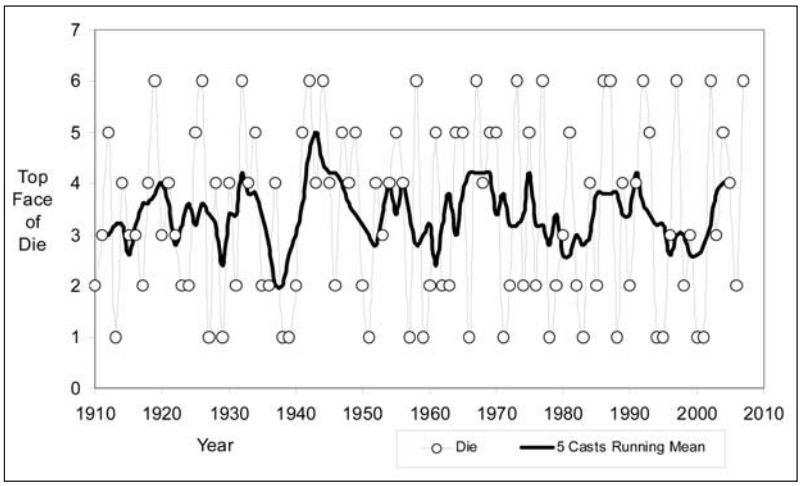
A constant temperature anomaly of -0.30^{0}C would fit all the measurements up to 1980. In fact the straight line shown is a best fit for 1910 to 1975 and gives a rise of 0.34 +/- 0.17^{0}C per century. The errors shown are standard errors of the mean values. They cover, as you would expect, the running mean values of Figure 1.

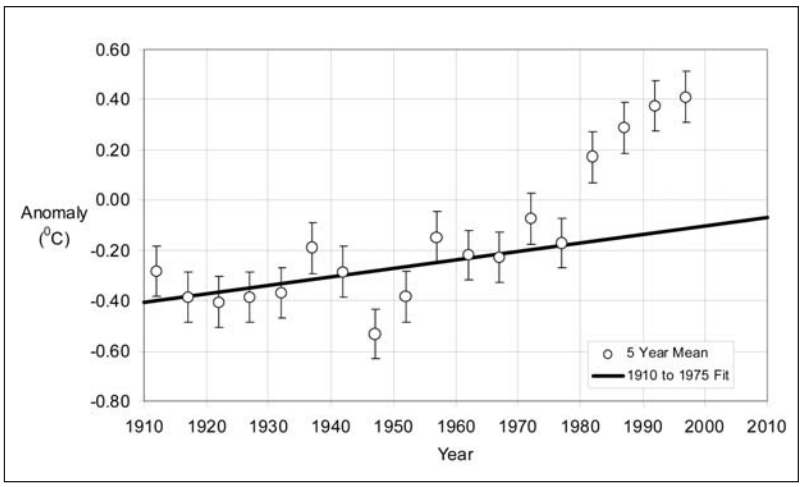
Figure 1 (right): Annual Mean Temperature Anomalies for Australia as departures from the mean of 1961 to 1990. The 5 year running mean is represented by the continuous curve.

Figure 2 (below): Random casts of a die where the die is cast once a year from 1910 to 2007. The 5 year running mean is represented by the continuous curve.

Figure 3 (far below): Annual Mean Temperature Anomalies for Australia as departures from the mean of 1961 to 1990. 5 year means and a straight line least squares fit for 1910 to 1975.







The most remarkable feature in Figure 3 is the difference of the temperatures after 1980 from the projected temperature trend. The difference is some four standard errors and is statistically very significant. There is an apparent temperature shift of 0.5°C in the late 1970's

The temperature step is connected with the Great Pacific Climate Shift of 1976, an event whose origins are uncertain but widely acknowledged, even in IPCC reports.

Back in 1976, the Pacific Ocean underwent a major transformation in sea surface temperature patterns. Suddenly warm water replaced cold water that had dominated the sea surface for most of the prior three decades near the west coast of North America and along the equatorial eastern Pacific.

In 1997, researchers at the University of Washington reported that a multi-decadal oscillation in Pacific sea surface temperature and pressure had been discovered, while trying to explain decadal changes in salmon fishery production. They called it the Pacific Decadal Oscillation. They noted that a major shift had taken place after 1976 from what they termed the cold mode to the warm mode of the oscillation.

It is often discussed as a possible source of Australia's temperature change.

This interpretation shows that for Australia the best description of the warming in the twentieth century is the major contribution of 0.5°C coming from the Great Pacific Climate Shift. The causes of the balance of the temperature change, 0.3°C, remain uncertain.

The temperature shift has nothing to do with anthropogenic CO_2 nor could such changes be predicted by present climate models. ▲▲

Hansen Mars Challenge

— A Challenge to Hansen et al 1988:

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 93, NO. D8, PAGES 9341–9364, AUGUST 20, 1988

Global Climate Changes as Forecast by Goddard Institute for Space Studies Three-Dimensional Model

J. HANSEN, I. FUNG, A. LACIS, D. RIND, S. LEBEDEFF, R. RUEDY, AND G. RUSSELL
NASA Goddard Space Flight Center, Goddard Institute for Space Studies, New York
P. STONE
Massachusetts Institute of Technology, Cambridge

Norm Kalmanovitch, P Geoph
Calgary, Alberta, Canada

NO MATTER WHAT scientific facts are presented to challenge the AGW ideology it is impossible for scientists to sway public opinion on this issue because the issue is political. It is very easy for high profile people who quote a scientific consensus that is supported by sophisticated computer models to convince the general public of anything that they want.

Even though the computer models have never yielded a single result that matches observations, any criticism of the models is met with some sort of complex justification that is beyond the comprehension of the general public so it is readily accepted by the masses and those questioning the validity of the models are vilified by the promoters of the AGW agenda as skeptics and deniers who are in the pockets of big oil.

The sole support for AGW is the climate models, and the sole support for the climate models with respect to CO_2 is the forcing parameter. There is no actual physical rational for the forcing parameter, because it was simply contrived from the assumption that observed warming of 0.6°C was due entirely to a 100ppmv increase in atmospheric CO_2 concentration. There was never any verification of this parameter either by theory or observation. There is no justification for this parameter based on the physical properties of CO_2, because the molecular configuration of the CO_2 molecule precludes any significant effect from CO_2 beyond a concentration of 300ppmv, and the current concentration is 386ppmv.

There is no justification for this parameter based on observation because the observed notch in the spectrum created by CO_2 is virtually identical for both the Earth and Mars, and Mars has over 9 times the physical concentration of CO_2 in its atmosphere than the Earth has in its atmosphere.

Even the reference temperature value for the parameter is faulty because the maximum temperature increase possibly attributable to human CO_2 emissions is 0.1°C per century; not the 0.6°C that is used in the forcing parameter.

The climate models use a forcing parameter based on the equation:

CO_2 rf = f * ln([CO_2]/[CO_2]prein)/ln(2)

where f= rf for CO_2 doubling

In further documentation according to the IPCC, the "Radiative Forcing" ÄF, in watts per square meter, due to additional carbon dioxide in the atmosphere, can be calculated from the formula:

ÄF = 5.35 ln C/Co

The value **5.35** in this equation and the term **[CO_2]prein** in the generalized equation demonstrate that the forcing parameter is based on the 100ppmv increase from the preindustrial value of 280ppmv and the 0.6°C of measured temperature over the time period that this 100ppmv increase occurred.

Further documentation in the IPCC reports states that the forcing of **each watt/m² raises the global temperature by 0.75°C + 0.25°C.**

The Nimbus 4 satellite measured the thermal radiation spectrum of the Earth in 1970, when the CO_2 concentration was 325ppmv as measured at Mauna Loa.

Mars has an atmosphere that is 95% CO_2 with virtually zero water vapour and the remaining 5% of the atmosphere is comprised of O_2 N_2 and Ar, so CO_2 is essentially the only "greenhouse gas".

The atmosphere on Mars is so thin that the 950,000ppmv concentration of CO_2 only represents about 9 times more actual CO_2 than is in the Earth's atmosphere in absolute terms.

Recent measurements of the thermal radiation spectrum from Mars should show a spectral notch from CO_2 that representing an increase in forcing representing the 9 times difference in CO_2 according to the equation:

ÄF = 5.35 ln C/Co

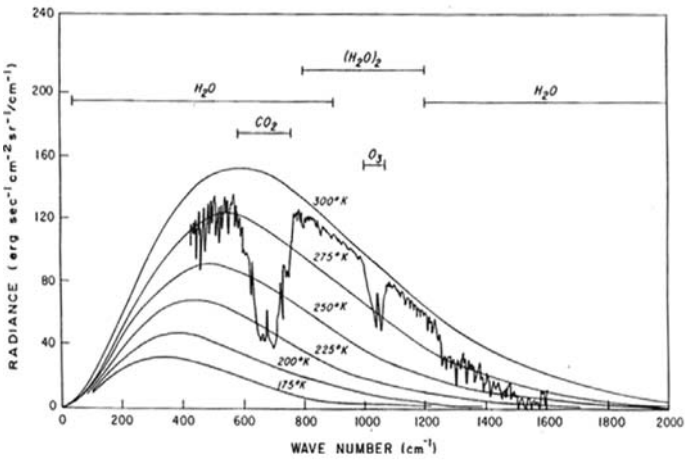
Considering that this formula gives a forcing value of 3.708watts/m2 for just a doubling of CO_2, this value of 11.755watts/m2 for a 9-fold difference should be readily visible on the two measured spectra.

The spectral notch is virtually identical on both the 1970 Earth spectra with a 325ppmv and the Mars spectra from at least 9 times the concentration indicating that there is virtually no effect increases in CO_2 beyond 325ppmv.

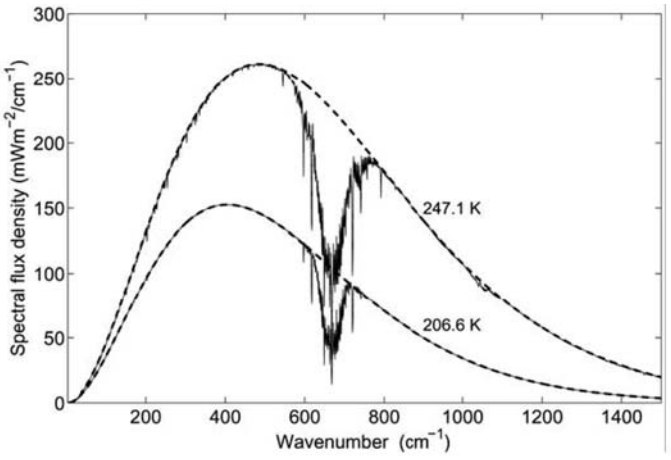
This clearly falsifies the equation and the numerical values used to determine the forcing parameter of the climate models that support the AGW hypothesis.

In addition to this physical evidence of an invalid assumption forming the basis for the forcing parameter, there is a blatantly obvious error in the actual values used in determining the magnitude of the forcing parameter. The temperature record shows that the global temperature has been increasing naturally at a rate of about 0.5°C/century since the Little Ice Age. The forcing parameter is based on the full measured

Cont. Overleaf



Earth Thermal Radiative Spectrum



Mars Thermal Radiative Spectrum

Hansen Mars Challenge — A Challenge to Hansen et al 1988

Cont. from Page 15

0.6°C/century without subtracting the natural warming of 0.5°C/century giving a forcing parameter that is 6 times larger than can be attributed to the measured increase in CO_2.

Far less obvious, but the major fatal flaw of the forcing parameter is that it is based on an observation of temperature and CO_2 concentration without taking into account the actual physical properties of CO_2 and its limited effect on thermal radiation as defined by quantum physics.

As you are aware, certain gases can be caused to rotate and vibrate by thermal radiation. The rotation mode is relatively independent of wavelength but the vibration mode is limited to specific resonant wavelength bands. The rotation mode results from the interaction between the thermal energy and the dipole moment of the gas molecule. The carbon dioxide molecule is formed from two oxygen atoms equidistant from a central carbon atom and all three atoms are in a perfectly straight line. This configuration and symmetry eliminates any dipole moment, limiting the CO_2 molecule to vibration modes only.

There is only a single vibration mode of CO_2 that resonates within the thermal spectrum radiated by the Earth (and Mars). This bend vibration resonates with a band of energy centred on a wavelength of 14.77microns (wavenumber 677cm-1) and the width of this band is quite narrow as depicted on the spectra from Earth and Mars.

It only takes a minute amount of CO_2 to fully "capture" the energy at the resonant wavelength, and additional CO_2 progressively captures energy that is further and further from the peak wavelength. At the 280ppmv CO_2 preindustrial level used as reference in the forcing parameter, about 95% of the energy bandwidth that could possibly be captured by CO_2 has already been captured. There is only 5% of this limited energy available within the confines of this potential "capture" band left to be captured.

The greenhouse effect from CO_2 is generally stated as 3°C, so an additional 100ppmv above the 280ppmv level is only capable of generating a maximum 5% increase or 0.15°C. The forcing parameter is based on a full 0.6°C which is four times the 0.15°C absolute physical limit of warming from CO_2. Furthermore if this 0.15°C increase has used up the full 5% of the remaining possible energy as the concentration reached 380ppmv, there is zero warming possible from further increases in CO_2.

This is why the CO_2 notch is virtually identical in the two spectra; the CO_2 band was virtually saturated at the 325ppmv concentration level, so even nine times more CO_2 has almost no appreciable effect.

Unless all these points can adequately be addressed, the climate models based on this forcing parameter must be declared invalid, and all work based on these models as a reference for global warming mitigation must also be declared invalid. ▲▲

Dr Michael Leggo Becomes AGC President

AT THE ANNUAL GENERAL MEETING of the Australian Geoscience Council (AGC) on 27 May 2009, Dr. Michael Leggo will become the AGC's President for a two year term. He has been President-Elect since May 2008.

Dr. Leggo served as the President of the Australian Institute of Geoscientists from 1991-1993 and an AIG Councillor from 1990 to 1994. He is currently a member of the Registration Board of the AIG, a role held since 1997, and was a member of the Joint Ore Reserves Committee (JORC) for several years.

He is a Fellow of the AIG, a Fellow of the AusIMM, a Fellow of the Association of Applied Geochemists, and a member of the Environmental Institute of Australia and New Zealand. He holds a B.Sc. (Chemistry, Geology); M.Sc. (Geology); Ph.D. (Pure Geochemistry), and a Diploma of Imperial College (Applied Geochemistry).

Dr, Leggo has enjoyed an extensive career in International minerals exploration and development management, and also in International corporate sustainable development and environmental management. He is currently the Managing Director of Silver City Mining Limited.

From 1997 to 2008, Mike Leggo served variously as Technical Director and earlier as Non-Executive Director of Pegmont Mines Limited in Sydney. During 1995 to 2006 he held the position of General Manager, Environmental Services at Boral Limited. He also worked as Manager - Quality, Safety and Environment at Burns, Philp & Company Limited during 1992 - 1995, Director of Mineral Resources with Pennant Holdings Limited, Senior Outplacement and Career Management Consultant with Davidson & Axmith Pty Ltd, Visiting Scientist with CSIRO's Division of Exploration Geoscience, General Manager, Minerals Exploration and Development Group at CSR Limited, and Project Manager and Senior Geologist for AMAX Exploration Inc.

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
sponsoring the
Bonwick-AIG Geoscience Student Bursaries

Platinum Sponsors

CONSOLIDATED MINERALS LIMITED
sponsoring the
Consolidated Minerals-AIG Geoscience Student Bursary

DIGIROCK PTY LTD
sponsoring the
Digirock-AIG Geoscience Student Bursary

GEOCONFERENCES (WA) INC
sponsoring the
Geoconferences-AIG Geoscience Student Bursary

OFFICE OF MINERALS & ENERGY PIRSA
sponsoring the
Office of Minerals & Energy PIRSA-AIG Geoscience Student Bursary

Platinum Sponsors (cont.)

SYDNEY MINERAL EXPLORATION DISCUSSION GROUP
sponsoring the
SMEDG-AIG Geoscience Student Bursary

TERRA SEARCH PTY LTD
sponsoring the
Terra Search-AIG Geoscience Student Bursary

Gold Sponsors

AIG NSW State Branch
AIG QLD State Branch
AIG VIC State Branch
AIG WA State Branch
Cryptodome Pty Ltd

Silver Sponsors

Gnomic Exploration Services Pty Ltd

Tales of a Survivor — Surviving the Downturn - Getting Set for the Future

Ray Cary
Northwind Resources Pty Ltd
AIG Seminar, 19 March 2009

ABSTRACT

This chat aims to illustrate that the current downturn is nothing new or unusual in the longer term context by recounting some of the speaker's experiences over 39 years in the industry, including the last 14 as a sole trader consultant. The speaker draws on a history of having been retrenched/fired four times, quit three times, survived once because he could out-drink the other guy and allowing the first attempt at consulting to wither on the vine to trace a rather ramshackle history of our industry and his participation in it since 1970. A number of anecdotes and tales of fortune/misfortune are presented, along with some advice and lessons learned from his various experiences. The underlying tone is one of reassurance and encouragement.

--------oooo0oooo------

Over the course of this talk I would like to relate a few of my personal experiences and lesser achievements over the course of my professional career, and in the process, deliver a bit of homespun advice and illustrate that it is possible to survive the current, and future downturns that will no doubt occur.

1969 marked the peak, or the beginning of the end of Western Australia's "Nickel Boom", whichever way you like to look at it. Other than a couple of sizeable Australian companies, a few mid ranking diversified companies and a clutch of what we would call junior explorers today, the majority of prospective employers for new graduates were overseas majors, mostly north American. I remember well receiving three or four job offers, all promising salaries well in excess of twice those being offered in my principal discipline, chemistry, and accepting a position with a huge American corporation that at the time of interview, promised to pay me "a salary that would enable my wife to live in the manner in which she would like to become accustomed". Ah…. Heady days.

I began my professional career as a geologist on January 5th 1970. I haven't been clean shaven since that morning, either from lack of time, or lack of money! Rarely have I had a surfeit of both at once. Over the intervening 39 years, my beard has progressively whitened with each successive change in both my and our industry's fortunes, both of which, as I am sure you will appreciate, are inextricably linked. There weren't very many grey haired "Senior Citizens" in the ranks of geoscientists in those days, as modern mining and exploration were still only very much in their relative infancy in the West. The progeny of that era are the poor old grey haired buggers you now see attending AIG and AusIMM seminars and meetings - living, some would say fossilised, proof that it is possible to survive in the mining industry!

On January 8th, I flew to Roebourne to commence field work. My first plane ride - photos of the wheels coming up, photos of the wheels coming down, photos of the shadow of the plane on the clouds, dozens of photos! Like I expected that I would never have the opportunity to fly again!

For those of you who have experienced the Pilbara, particularly Roebourne in January, it will not be hard to imagine the shock that was January 9th and the ensuing few months. With no field training or induction, I was met by my staff of three field assistants, taken out to the project area, shown the survey grid they were constructing and briefed on their activities. The following morning, I set about mapping the project tenements and "supervising" their activities. Talk about the blind leading the blind. Late morning, I bogged my vehicle (a Mini Moke) in a creek bed, and thinking my fieldies were only a couple of kilometres away across the hills, took a big drink of water and set out for assistance. Needless to say, the boys weren't where I thought they would be so I kept walking, in what was now quite rugged country, without water. At least I knew the local geography, and could see a radio tower on the hill behind town, so I walked east to a road leading into town, and then stumbled into Roebourne several hours later. The first house on the edge of town happened to be occupied by one of the policemen and his family. Parked outside was a Falcon station wagon with the driver's window down. I reached through the window, grasped the horn ring and steering wheel and collapsed against the side of the car with the horn blaring. The policeman's wife ran out, was able to comprehend what I was trying to tell her, loaded the kids into the car, and carted me off to hospital, where the elderly matron pinched my arm and drily remarked "we lose most of your cases", and I believed her! I think I worked out that I had walked 15 or 20 kilometres in the middle of a +45° day without water, straight out of the city. Once again, living proof that it is possible to survive in the mining industry - if you are very lucky!

Over the next few years, there were several similar incidents around the State, several unfortunately ending in tragedy. One such incident, out near Telfer I believe, was the trigger for Newmont I think, and the Chamber of Mines to jointly produce a Field Guide to Survival, a little

yellow booklet which marked a turning point in employer and individual responsibility for safety and survival in the field. Up until the early 1970s, there had probably been very little grass roots, company sponsored exploration in remote and hostile areas of the State. Much of the work conducted in the early 1970s was of a reconnaissance nature, with minimal logistical support, save for the Flying Doctor radio network, or perhaps a regular radio sked back to an office in Perth or wherever. This system relied on two factors - your being near the radio, or being able to reach the radio when a sked was due, and the party on the other end being able to respond in the case of an emergency (if such could be reported). Often a missed sked was simply dismissed as being due to poor radio reception, off doing something else, didn't want anyone else to know what you were up to, slept in or whatever. I rather suspect that there were a good many more near misses than anyone was ever aware of. Fortunately, safety of personnel in the field and the appropriate support are now taken a lot more seriously.

In those days regular field breaks were almost unheard of, and the concept of a field season was similarly foreign, other than in the Kimberley where practical considerations mitigated against doing much during the wet season. In the latter half of my first year in the field, my then fiancée was due to celebrate her 21st birthday, and my attendance at her party was of course expected, not the least because I was to be some sort of returning hero from some far flung remote corner of the State that no-one ever heard of unless it had been flattened by a cyclone. I was in the middle of a diamond drilling program and hadn't been home for months. My American boss in Perth sensed that I was not happy and flew up to deliver the news that there would be no break until the drilling had been completed. Over a lot of beer I explained my situation, to which he responded "well hell Ray, if you're needed up here and she's not needed in Perth, then bring her up here", which I did. Remember this is 1970. I don't know what our parents thought, but I do know the scandal that swept around the pub when the housemaids found the beds in our room pushed together every morning, despite their separating them again every morning.

Early in 1973, or thereabouts, the Chilean Government nationalised most of the country's copper industry. At the about the same time, the Whitlam Government introduced a policy whereby a proportion of any capital imported into Australia had to be deposited with the Reserve Bank. These two factors, together with the collapse of the nickel bubble, led to an almost immediate shut-down of overseas funded exploration and much of the locally funded exploration. In mid-April 1973, with a six week old daughter, I found myself with no assets and no job, as did many, many others. I had been retrenched (a term virtually unknown to me at the time), due to a combination of circumstances completely external to Australia and completely beyond my control.

The take-away from all of this? The current down-turn is nothing new. Notwithstanding, no matter which way you look at it, or whatever it is called, you no longer have a job and in the current climate (as then) it is going to be very difficult to find another, at least in the short term. Remember - it is not your fault, although it is very difficult not to go through a lot of personal recrimination and soul searching to try and work out why me? There is no answer, because it wasn't you. Stay focussed on what you have done and achieved in your career, and what you can bring to the next opportunity.

In truth, my entry into the industry was accidental; I was a soldier of fortune. As I mentioned earlier, at the end of 1969 geologists were being offered starting salaries more than twice those being offered to chemistry graduates, so it wasn't really a difficult decision to make. After being retrenched, I went through the same soul searching, including, do I really want to do this for a long term career? My conclusion was to explore all possibilities, but the reality was that I had a seven year investment in what I had been doing, and it would be stupid to turn my back on that. I would recommend that you think about that as part of a longer term plan if short term success in the job hunt does not come your way.

With renewed vigour, I resumed my search, with seemingly little prospect of success. No such thing as outplacement services, management consultants etc. in those days. In search of some advice, a mentor if you will, I met with a fellow who had left a different division of my former employer a few months before me and was now managing director of one of the very few very junior explorers of the day. I did not know him particularly well, but regarded him as a friend and fairly wise. We chatted for a couple of hours, which seemed to lead nowhere, at which point I asked "well Bryan, what is the upshot of all of this?" "In short my boy (he was a rather large South African with a big black beard and a deep, commanding voice), I'm offering you a job." He then spent the next two hours telling me why I should not work for such a small company and how limited the career opportunities would be. His only two requests were that if I accepted the job, I was not to use it as a six month base whilst a looked for a better one, and if I decided not to take the job, never accept another at a lesser salary than the previous one. Both were very sound pieces of advice.

The job lasted 15 years, during which time I progressed from Exploration to Senior to Chief Geologist, before being transferred into

Cont. Overleaf

Tales of a Survivor

Cont. from Page 19

a project development group that saw about eight projects advanced to development in about as many years. Although I was very miffed at being seemingly demoted from Chief Geologist at the time of a merger with the company's biggest shareholder, the new role provided me with an absolutely unbelievable professional opportunity that brought to me a whole new range of skills and experience. It is this experience that formed the foundation for the rest of my working life.

The moral of this story? Don't leave any stone unturned, no matter how unlikely you think there may be a positive outcome. Even if it's only a suggestion as to where else to try, who to talk to, a word of mouth referral, whatever. Every opportunity to talk to someone is an opportunity to present yourself, and every presentation should be as good as any other.

There are a couple of little anecdotes that come from this story. A few months after accepting the position offered to me by Bryan, he left the company to retire to a farmlet in the hills and breed pigs. Shortly afterward, he died in a rather tragic accident on his farm. When I finally left the company, 15 years to the day after joining, one of my first thoughts was Bryan's words about not making the job a temporary stepping stone to something better somewhere else. All I really wanted to do was ask him if 15 years satisfied his request!

In about 1976/77 there must have been another downturn of sorts. We had just finished building our first home, and I recall being on leave to do something around the house when I was called into the office for an interview with the MD, then a rather humourless and nervous mining engineer. The discussion began along the lines of "things are tight and we cutting back on our geological staff "(four of us). Shit, here it comes again! He continued "I was going to let the senior geologist go, but then the chief geologist stuck on a show about how unfair it was, so I got rid of him and kept the other guy. That leaves you and so-and-so. We are going to change the emphasis of our activities and spend a lot more time sitting in the pub talking to prospectors to find opportunities. So-and-so doesn't drink, so I guess that leaves you." This is the first and only time in my life that my propensity for excessive drinking has been seen as a positive attribute!

The job I eventually left for was Australian/Asia-Pacific Business Development Manager for the minerals division of one of the major US oil companies. I had never had a role such as this, and the only way that I could see to approach it was to look to what unique attributes the company had that could be used to develop and bring opportunities to fruition. Without going into what they were, I think that this approach is one that anyone in the job hunt should use - what do/can you do that is particularly tailored to your prospective employer, or your potential role within his organisation. Try to think outside the square, try to think laterally about how you can make this work for both of you.

It took several months for my appointment to be sanctioned from San Francisco, as it was a "Group 1 Earth Sciences Position", which required a minimum of a PhD, which I don't have. Finally I was deemed to have the relevant experience in the absence of the qualification and was appointed under the "PIP" rule - "Person in Position". Within a matter of months, I was being sounded out for transfer to San Francisco, and early in 1989 was appointed Chief Development Geologist for the minerals division, based in San Francisco, with global responsibility, including a series of big name projects in South America and Ireland. Salary and expatriation allowances meant a US$ tax protected package well into six figures, Business class travel all over the world, limitless career opportunities, you name it.

After spending six weeks in San Francisco, meeting my new secretary, supervising the decoration of my new office (I had moved up to huge office and solid oak furniture with my accession to a Group 1A position), looking at million dollar real estate and choosing the colour of my new Corvette, I returned home to await the completion of my transfer and the issue of a US work visa. About six weeks later, the company car was stolen from work on Tuesday, my visa arrived on Wednesday and on Thursday, I was telephoned from San Francisco to be told that the company had decided to exit the minerals industry and I was to be made redundant. Shit - again. This time the big career move had lasted about 10 months. As the old saying goes - "Today a rooster, tomorrow a feather duster." One of the Americans retrenched at about the same time, a rather dry Texan, commented "hell, I was lookin' for a job when I found this one, so nothin's changed." Perhaps that's not as silly as it sounds.

Many years later, I met up with a former colleague from the same company (a Canadian) and the discussion got around to the prerequisite qualifications for my appointment. He had obviously encountered a similar problem at some stage and remarked "Bloody Chevron and their four year degrees", to which I responded, "Hell, I wished they'd said what they meant, I have a four year degree - I failed second year and had to repeat!"

No sooner was I out on the street, than, as a result of chance meeting whilst out at lunch (there, drinking again), I was approached to take on the position of Chief Geologist/Group Exploration Manager/cum stand-in General Manager of Operations for a fairly large gold producer. For almost two years I worked my butt off to try and create some organisation and cohesiveness as the company teetered on the brink of organisational and financial collapse. Finally, a change of board and management occurred when the controlling shareholder had to sell out, the share price having collapsed in the wake of numerous companies conducting "confidential" due diligence and the true state of affairs becoming apparent to all who cared to look. It took the new management about six weeks to conclude that it was all too hard and to take the decision to get rid of the four most senior executives, which included me. F**k! What now? Fortunately, by this time, I had a degree of financial security, but it still didn't do much for my ego and mental well being to be turfed out yet again through no fault of my own.

Probably the funniest episode in this period was a few months in after I had realised that there were virtually no ore reserves as such underpinning the budgets, bank loans, you name it. One morning a rather attractive young lady from the external auditor's team approached me and said that she was having trouble with the depreciation schedule for such and such a site, as she could only find four years' ore reserves, and the schedule extended over five. I put a fatherly arm around her tender young shoulders (as you do) and congratulated her, adding that I was the Chief Geologist, and I could only find three months' ore reserves. I got the impression it went over her head!

At this time, it was about mid-1991, and we were in the midst of yet another downturn. If I recall, Australia was busy enjoying "the recession it had to have". In the absence of any possible job opportunities, I turned to consulting as an individual, a paradigm change after over 20 years of life in the corporate environment. I deliberately didn't use the term "permanent employment" for reasons which should be pretty obvious by now. Despite the state of the industry, the endeavour was quite successful. However, I hate, and still do, marketing, cold calling, trying to find work. I made the typical mistake. Out of sheer convenience, I allowed the business to shrink to a single client, which is fatal for a consulting business. Inevitably, nine months in, my single client made me an offer I couldn't refuse - either take a permanent position, or there is no more consulting work. With little choice, I accepted and got screwed. From the moment of accepting the position, my sole priority became finding another job of my own choosing from the relative safety of a regular pay cheque. The good thing about games is that they are generally something that two can play.

My endeavours paid off about three months later when I secured a position with a merchant bank. Whacko - big salary, huge bonuses, big expense account, lots of travel, mix at the big end of town, learn lots, new career, set for life. Unfortunately the reality rarely lives up to the dream (ever seen that gorgeous babe you met in the bar late at night the next day?), and this was no different. After about two years I managed to engineer an exit back into the mining industry to escape the "banking culture", accepting a position as Business Development Manager with an emerging large gold producer, and the promise of grooming for the MD's position. Alas, three months later to the day, I was advised that with a change in control of the company, a regional Business Development Manager was no longer considered a necessity and my position was redundant. This time, I didn't complete all my outstanding projects and tasks, tidy my desk, purge my files, give my secretary a hug and use my notice period to look for another job. Instead, I filled out my last expense claim form, demanded immediate payment, and was outa there inside two hours! The MD couldn't understand why I didn't want to stick around for a couple of weeks or so!

The score so far? Fired four times, quit three times, kept a job because I could drink more than the other guy and let one business die! Not bad for nearly 25 years in the business. Now what? All I was sure about was that I had had enough! Time to lick my wounds, stand back and think about all this. This was December 3rd 1994, and with Christmas approaching, might as well have a couple of months off and work out what to do in the New Year. Probably have another go at consulting maybe.

The next day, the phone rang with a call from the MD of a company with whom I had worked on a couple of deals in the preceding three months. "Heard you left so-and-so. What are you going to do? Can you come in and see me? I need you to do something for me." "Can't come in today, I'm still in bed and going to finish reading the paper, and then I might go and paint the fence or pat the dog or something." "Get your arse into here this morning - I need to talk to you." And that Ladies and Gentlemen, is how Northwind Resources began on the 4th December 1994. Out of sheer cussedness, I was kind of planning to wind it up on December 3rd 2009, 15 years to the day since going out by myself. The reality is, it was never going to happen, downturn or no downturn.

My consulting business has been running for over 14 years now, and has seen several cycles affect the industry. It would be fair to say that the business has had to reinvent itself, or more correctly morph into something else, every few years as market conditions and the nature of the work on offer have changed, and my experience has grown and diversified. The first few years were tough and a lot of hard work as the business was built up, but always financially rewarding. Not all the work is interesting or professionally rewarding, but heck, what full time position offers full time professional stimulation?

Cont. Overleaf

Tales of a Survivor

Cont. from Page 21

From the outset, I made one fundamental decision, rightly or wrongly. This was to have no overhead and no staff, that is, no outgoings and no staff to retrench if the business suffered a downturn. I wanted responsibility for no-one but myself. This has had two outcomes - I have survived and survived well as a sole practitioner, but I have no asset other than my own skills and intellectual property. In other words, when I decide to shut up shop, that's it, there is no asset to sell, so what I earn now is all that I can take with me. My decision has however, given me a great deal less worry than would have been the case had I attempted to build a large consultancy, although many others have succeeded admirably by taking that path, and eventually selling out to a much larger organisation.

The other important strategies were to keep the business debt free, so that there were no outgoings when things got tight, and to put some hurt money in, that is spend some money on capital items such as computer, fax, mobile phone (remember this was 1994) and so on. I also bought a shelf company that became Northwind Resources within the first couple of weeks, believing that this would add a bit more credibility to what I was trying to do. Indeed, I think that the majority of clients prefer to deal with a "company" rather than an individual for the type of assignments that I conduct. There were also at that time, some financial advantages to operating through a company structure, although these are now largely non-existent. I work from home, so no office rent, no secretary, no professional staff, and no outgoings means there is no requirement for working capital, which can and does kill small businesses when the going gets tough. The alternative of course is a partnership or association with others, but these bring their own difficulties, not the least of which is personalities.

So what can I give you out of all these ramblings?

- First and foremost, being retrenched is not the same as being fired, whether it be justly or unjustly. Trust me, I have experienced both. The end result in terms of loss of self esteem and loss of income is none-the-less the same. It's bloody hard to deal with, although after the third or fourth time your hide gets a little thicker.
- Secondly and foremost, it's not your fault. Extreme cyclicity is unfortunately a characteristic of our industry, although I am sure that is of little solace at the moment. The largest employer of exploration geologists (and I am assuming here that most of you who have been affected by the downturn are exploration geologists) is the junior exploration sector. These companies rely on continual access to new equity or favourable joint ventures to survive. Survival is difficult at the moment and is likely to be so for some time. For the survivors, including those with producing assets, a takeover or merger is often a reality that must be faced in order to continue to exist. Retrenchments invariably accompany consolidation.
- You will survive, there are plenty of precedents. I have been extremely fortunate, but it has come with a lot of hard work.
- Consulting or contracting is a valid way to make a living. It is not for everyone - even I am still not comfortable with the day to day uncertainty after 14 years in the game. Few are. Very few people,

even those in senior positions in the corporate environment, are comfortable with marketing and cold calling.

- If you decide to go out contracting or consulting, or if you are obliged to take alternative employment, make sure that you keep up your contacts, networking, professional experience and professional development. In the mid 1980s there was a real gold exploration boom which saw dozens of relatively junior geologists paid quite lucrative daily rates to sit on drill rigs. I encountered many of these people in later years and concluded that we had a whole "lost generation" of professionals who had no skills outside chip logging, and certainly no experience in management and supervision, or in the corporate environment. And it wasn't just the geologists who were to blame for this. Don't fall into this trap.
- If you decide, or are obliged to temporarily leave the industry, always retain the option of returning when things pick up, unless you decide that is not what you want to do. Make sure you make that decision, don't let it happen by default.
- If you decide to go out on your own, put some capital into the business - it creates more commitment to success.
- Assemble and analyse your skill set. When talking to people about a possible position or assignment, try to think laterally about how you can contribute something different or extra. Try to leave more on the table than asked for.
- Don't be afraid to take on something that is outside your direct experience, but be very careful not to provide a professional opinion on something that you know little about - there are significant liability issues.
- Run your business as a business - set up systems for record keeping, templates etc. Present yourself as a business person, not someone looking for work. Don't be afraid to shoot the breeze for no immediate outcome. This is very difficult when you are really trying to make a quid.
- Whether you have work or not, keep up the marketing and networking. No-one does, but the strategy is good. The unfortunate part about being a sole trader is that your income is limited by the fee level that the market will support, and the number of hours that you can physically work. The last thing you need when you are flat out is more work, but all too often a run of work comes to an end and you are left high and dry. I truly don't know what the answer is.
- Approach your marketing as an essential part of your business, but don't make it an obsession when you are not working. Make sure you have some other outlet, project or hobby to keep you occupied when you have no work. Do your marketing/job seeking for a few hours, then try and forget about it for a while by doing something you enjoy. Unfortunately, this is easier said than done.
- Working from home as a sole trader takes a lot of self discipline. Being driven by fear and greed helps! Probably the biggest drawbacks are the lack of peer contact/peer review of your work, and the lack of social interaction that the office environment offers.
- A few years ago, someone described his goal as becoming a consultant, charging $2,000 a day and only having to work two days a week. That is not the reality, attractive as it may sound. The reality is that no client is going to engage you for two days a week and have you sit on your backside for the other five whilst they wait the work to be completed. Despite being able to micro manage the activities of dozens, if not hundreds of employees, very few clients can see far enough ahead to plan for a consulting assignment that doesn't have to be done yesterday.

So where am I now?

- I am utterly unemployable because I am too old, too grumpy, don't get on with people any more, can't get to work on time and don't like getting dressed up for work.
- I still can't handle the uncertainty of an irregular work flow, and still do a very poor job of marketing/looking for work.
- I have not done any real geology as such for donkey's years, and have no formal training in mining engineering, metallurgy, process engineering, financial analysis or management. As a result, I now have to make up almost everything as I go along!

Thank you.

NSW AIG Branch Seeks Applications for Funding to Assist Local Young Geoscientists to Attend Field Trips

Limited funding is available to provide NSW AIG members in the early stages of their careers with opportunities to participate in professionally organised geological field trips. The field experience is intended to develop the practical knowledge of young geoscientists and increase their understanding of the geological setting, mineralizing controls, economic significance, environmental and community impact or other aspects of the site.

CRITERIA: Applicants must hold a recognised degree in geoscience, be a resident of NSW, be a member of the AIG and be not more than 10 years into their careers as a professional geologist. Priority may be given to contract or underemployed geologists who might not otherwise receive support of an employer.

USE OF FUNDS: This funding is intended for travel expenses to and from the trip site, the fee for attending the field trip and related meals and accommodation. It is not intended to cover the registration fee for any related conference or symposium, or any cost not directly related to the field trip.

LOCATION: The field trip may be located in Australia or overseas, but should be at a site of recognised relevance to the economic development of natural resources where the participant's personal safety will not be at risk. Preference will be given to field trips organised by learned or professional geoscientific societies, or by state or national geological institutes. Other organised trips will be assessed on their merits.

APPLICATION PROCESS: Application forms and instructions are available by mail request to the Chairperson, NSW AIG, Post Office Box 956, Crows Nest, NSW 1585. Applications will be assessed in batches of applications at intervals of around 4 months. Due to the limited funds available, not all applications can be approved. The selection panel may approve the full amount sought by an applicant, or may negotiate with a candidate to award a lesser amount.

SUCCESSFUL APPLICANTS: The young geoscientists who are awarded a field trip grant must agree to use the funding for the purposes specified and to write a report of approximately one A4 page length (including photo) for publication in AIG News and on the AIG web site.

AIG Events

June 2009

03 Northern QLD Exploration and Mining 2009, Townsville QLD. For further information contact: http://www.aig.org.au/events/18

03 Northern QLD Deep Crustal Seismic Survey Workshop, Townsville QLD. For further information contact: http://www.aig.org.au/events/79

06 Charters Towers Field Conference, Charters Towers QLD. For further information contact: http://www.aig.org.au/events/18

10 International Uranium Conference, Darwin Convention Centre NT. For further information contact: http://www.aig.org.au/events/63

17 MEGWA - Husab Uranium Project, Irish Club, Perth WA. For further information contact: http://www.aig.org.au/events/76

22 Mining in India, Vancouver, Canada. For further information contact: http://www.aig.org.au/events/88

29 Maximising the value of Geochemical Data, Perth WA. For further information contact: http://www.aig.org.au/events/84

July 2009

01 Advances in Geothermal Systems in non volcanic environs, The Theodore Club, Brisbane QLD. For further information contact: http://www.aig.org.au/events/87

01 Bi-annual Joint ACARP-BBGG Meeting and Leichhardt Award Ceremony, Central QLD University. For further information contact: http://www.aig.org.au/events/82

13 Statutory Compliance for Exploration in WA – a guide to navigating the regulations, Perth WA. For further information contact: http://www.aig.org.au/events/85

15 MEGWA - The Mutangi Uranium Deposit, Zambia. For further information contact: http://www.aig.org.au/events/77

August 2009

15 National Science Week, Australia. For further information contact: http://www.aig.org.au/events/64

17 Seventh International Mining Conference, Perth WA. For further information contact: http://www.aig.org.au/events/36

September 2009

05 5th International Archaean Symposium, Perth WA. For further information contact: http://www.aig.org.au/events/86

11 Recent Practical Advances in Mineral Exploration Technology, Kirribilli Club, Sydney NSW. For further information contact: http://www.aig.org.au/events/67

29 Broken Hill Exploration Initiative, Broken Hill NSW. For further information contact: http://www.aig.org.au/events/69

October 2009

26 October 09 Sustainable Development SD09, Adelaide SA. For further information contact: http://www.aig.org.au/events/72

2010

8 July 10 Australian Earth Sciences Convention, Canberra. For further information contact: http://www.aig.org.au/events/60

2012

02 August 12 34th International Geological Congress, Brisbane QLD. For further information contact: http://www.aig.org.au/events/19

Geoimage Announces WorldView-2 Launch Winner

Geoimage and DigitalGlobe, announce the winner of their exciting competition to witness the launch of DigitalGlobe's Worldview-2 satellite from California, USA later this year. Entry to the competition was by placing an order for either QuickBird or WorldView-1 satellite imagery from Geoimage, an Australian authorised reseller of DigitalGlobe imagery products.

Gil Norrie, DigitalGlobe's Australian representative, drew the competition on 1st May, 2009 in Sydney. The lucky winner of the competition was **Dr. Arko Lucieer from the University of Tasmania.** Arko, a lecturer and researcher in Remote Sensing and Geographical Information Science had tasked the QuickBird satellite to capture imagery over Macquarie Island. The QuickBird imagery is used for mapping and monitoring of vegetation and examining change detection on sub-Antarctic Heard and Macquarie Islands.

The WorldView-2 satellite is scheduled to launch in September or early October 2009. It is the first high-resolution satellite to offer an increase in spectral diversity with the addition of four new bands (coastal, yellow, red-edge and near-infrared 2) along with the industry standard of blue, green, red and near-infrared.

Geoimage Press Release

From the Editor

This issue of AIG News was compiled between Perth, Port Hedland and Darwin while also juggling multiple ideas at the same time. One of the editor's nightmares is to discover that an issue had a couple of not so minor errors that slipped under the scrutiny not only of the editor, DTP section but also the gimlet-eyed diligence of AIG's communication committee. What did we all miss? The authorship of the lead article in Issue 94 of December 2008! The authors were R. K. Boucher, Linex Pty Ltd & La Trobe University; G. R. Turner, Exploration Management Services Pty Ltd; and A. G. Rossiter, Rosscraft Minerals Pty Ltd.,and AIG News apologises for this collective lapse.

Ian Plimer's latest book "Heaven and Earth - Global Warming; The Missing Science" has been a resounding success and is in its fifth print run, (25,000 copies now have been printed and marks an Australian record for this type of book). It has also received predictable reactions from the usual suspects in the national print media and progressive blogs to which Ian responded to his critics in the Australian Newspaper after recovering from being beaten by a feather.

AIG held a Surviving The Downturn seminar in Perth recently and one of the speakers recounted such an interesting career development that we reproduce it in this AIG News.

The AIG Website has been thoroughly revamped and should be fully operational by the time you receive this issue of the AIG News.

Criticism of Anthropogenic Global Warming by the geological fraternity continues apace and we reproduce Norm Kalmonovitch's penetrating anaylsis that, unsurprisingly, continues to be ignored by the Climate Change Herd. Speaking of which we also reproduce the late Tommy Gold's insights on the ailments of modern science - quite germane to the present clamour over climate and the nonsense that CO2, an atmospheric trace gas, is the principal driver of the Earth's climate.

Louis Hissink

NQEM 2009
— North Queensland Exploration & Mining Symposium

3rd June
1 day workshop by GA and the GSQ in Townsville (free)

4-5th June
2 day AIG Symposium in Townsville

6-8th June
3 day GSAQ
Field Conference in NE Queensland

During six days in June the AIG, GSA and GA are collaborating to offer a symposium, field conference and workshop that will provide opportunities for geoscientists to get together and discuss new discoveries, new concepts, new data, and new developments in north Queensland economic geology.

The two-day symposium organised by the AIG Queensland Branch will run from Thursday 4th June to Friday 5th June. Delegates to the symposium will have the chance to hear some of Queensland's most active exploration and mining companies talk about their projects and recent developments. On Wednesday, 3rd June, Geoscience Australia will be offering a one-day pre-symposium workshop in Townsville, in collaboration with the Geological Survey of Queensland. The workshop will discuss the results and implications for mineralisation arising from the recent deep crustal seismic surveys, and will include the release of new data.

Immediately following the symposium the GSA (Queensland Branch) will again run its popular field conference over the three days of the Queen's Birthday long weekend. The field conference will focus on gold mineralisation styles of the Charters Towers region, and will include visits to Conquest Mining's Mt Carlton high sulphidation Au-Ag-Cu deposit near Collinsville, Resolute Mining's Mt Wright breccia-hosted Au deposit near Ravenswood, and Citigold's deep high grade Au deposits at Charters Towers. NQEM 2009 will also host a trade exhibition. Sponsors and exhibitors include:

ALS Laboratory Group	Exploration Services	Quantec
Cloncurry Metals	Golder Associates	Geoscience
CSA Global	Hellman & Schofield	Resource & Exploration
Economic Geology Research Unit (EGRU)	Ivanhoe Australia	Mapping
	Krucible Metals	Sandvik
Genalysis Intertek	Map to Mine	SGS Australia
Gnomic	Metallica Minerals	Sietronics
		Terra Search

Registration, exhibition and sponsorship information is available on the AIG web site at: **http://aig.org.au/events/18**

Metal Resources Announced in 2008: Do they Replenish the Mined-out Tonnages?

Peter Laznicka
SEG 1987, Total Metallogeny Consulting
Adelaide, Australia

WORKING ON MY proEXPLO 2009 short course about future metal supplies, I needed to test numerically the often heard sentiment that we are running out of metals and that the newly added resources do not replace the mined out ores.

Uniform and reliable data are hard to get; the SEG Exploration Reviews are one of the handy information sources which, although incomplete and nonuniform, at least provide data sufficient to indicate a trend (for example, the U.S. correspondents provide virtually no reserve figures whereas the Russian correspondents quote generously even the notoriously unreliable P-class resources). I have selected, recalculated and added tonnages of metals in resources (all categories) announced in the four SEG News issues that cover the year 2008 (Numbers 72-75), and partially filled the gaps from other sources. The announced resources do not necessarily mean resources discovered in 2008 as there is sometimes a long gap between discovery, resource calculation and announcement. Announcements just tell us that a certain quantity of metals in ores has been newly added (some resources have been merely reconfirmed) to the existing resources so the results are an indication of existing resource replenishment or a lack of it. All figures assembled in Table 1 below are quoted in metric tons of contained metal (t=tons; kt=kilotons; mt=million tons). The first column is the metal; the second column is the resource tonnage derived from information in SEG News; the third column figures have gaps filled from other sources; the fourth column is the number of deposits (the number of giant deposits, as defined in Laznicka 1999, is in brackets); the fifth column is the world's 2008 metal production (from the U.S. Geological Survey Commodity Summaries, 2009); the sixth column is the number of years covered by the announced resources at the 2008 production rate. Fe tonnages represent 50% of quoted "Fe ore", Cr tonnages are 25% of chromite.

The "giant" deposits store the highest proportion of the newly announced resources: Au, 62.84%; Ag, 53.62%; Cu, 90.3%; Zn, 52.75%; Pb, 70.1%; Mo, 89.71%; Ni, 73.19%; W, 57.47%; U, 90%; Sn, 81.66%; Sb, 100%; Bi, 100%, and they will likely remain the mainstay of metal supplies at least in this century.

The past five years terminating in 2008 have been exceptionally good times for exploration, with prices of many metals at all-time highs reached in 2007. The financial crisis, however, put an end to this and another downturn in commodity demand, production and exploration seems to have commenced. The metal tonnages added to the existing resources in 2008, sufficient for 0.56 to 697 years (hey, use more indium!) seem to indicate that the industry is able to find and develop new metal resources, if the price is right. That is, at least for now, while some of the relatively easier to find orebodies are still there.

Metal	SEG tonnage	SEG + gaps	No of deposits	2008 production	Years to last
Au	14,259 t	14,259 t	177 (15)	2,330 t	8.41 y
Ag	109,162 t	134,905 t	61 (4)	20,900 t	6.455 y
Cu	70.2 mt	135.5 mt	62 (15)	15.7 mt	8.63 y
Zn	39.4 mt	42.1 mt	34 (2)	11.34 mt	3.71 y
Pb	17.4 mt	18.05 mt	27 (4)	3.8 mt	4.75 y
Mo	3,179 kt	5,394 kt	28 (14)	212 kt	25.44 y
Ni	12,296 kt	12,296 kt	15 (1)	1.61 mt	7.64 y
W	348 kt	348 kt	8 (1)	54.6 kt	6.3 y
Fe	6,622 mt	7,772 mt	6 (1)	2,200 mt	3.53 y
U	78 kt	78 kt	9 (1)	36.72 kt*	21.2 y
Co	138 kt	138 kt	6	71.8 kt	1.92 y
Sn	338 kt	338 kt	5 (1)	333 kt	1.015 y
Cr	12 mt	12 mt	1 (1)	21.5 mt	0.56 y
Sb	120 kt	120 kt	2 (2)	165 kt	0.72 y
Bi	35 kt	35 kt	1 (1)	5,800 t	6.034 y
PGE	2,162 t	2,162 t	9	406 t	5.32 y
In	396 t	396 t	1	0.568 t	697 y

Figure 1. Tonnages of selected metals in resources announced during 2008

** 2006 production*

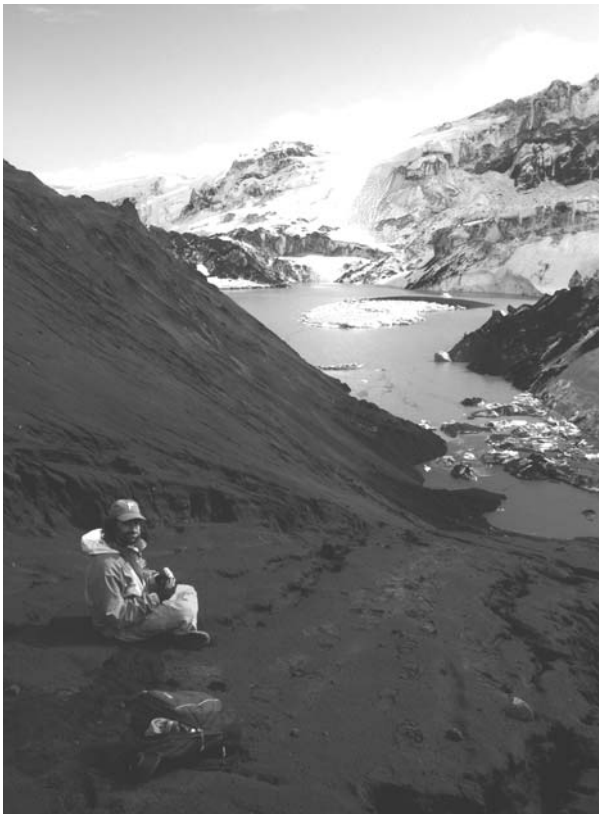
AIG POSTGRADUATE BURSARY ABSTRACT:
Understanding Volcanoes

Ryan Portner
PhD Student
Earth & Planetary Sciences, Macquarie University
2008 AIG Postgraduate Bursary Winner

PhD Project: Sedimentology of volcaniclastic facies in a mid-ocean ridge spreading environment, Macquarie Island.

IAVCEI (International Association of Volcanology and Chemistry of the Earth's Interior) held its general assembly entitled "Understanding Volcanoes" in Reykjavík, Iceland from August 17 to 22, 2008 at the University of Iceland. Days were filled with too many sessions to go to including a mid-week field trip to the active rift valley Þingvellir, also where the first Icelandic parliament was held in 930 AD. Of particular interest to my research on Macquarie Island was an entire session on submarine explosive volcanism, an emerging field of research. Modern day submersible studies have documented pyroclastic material and explosive eruptions in abyssal deep-marine environments. There are remarkable similarities between some of these studies and rarely exposed pyroclastic facies on Macquarie Island, which I presented at the conference. In addition, the unique Icelandic environment has numerous examples of subglacial volcanism that are analogous to submarine eruptions. In both eruptive environments the overburden of the water/ice column impedes the explosive expansion of volatile gases.

I was fortunate enough to participate in a 3 day excursion to the remote Grimsvötn volcano in the center of Iceland's largest glacier, Vatnajökull. On leaving Reykjavík we drove northeast into the barren glaciated landscape and up through recessional moraines of recent years. Grimsvötn and several other volcanic edifices occur with in the main volcanically active swath that runs down the center of the island and joins with the mid-Atlantic ridge. Only during summer does enough snow and ice melt to reveal exposures inside the caldera.



Pyroclastic deposits in Grimsvötn caldera

Pillow basalt preserved along caldera walls were juxtaposed against recent pyroclastic deposits that erupted in 2004 and mantled the ice carapace with in the caldera. After a days work down in the caldera we stayed in an Icelandic glaciological society hut built on the caldera rim. Festive nights were accompanied by Icelandic folk songs and a steam bath in a sauna that utilized the geothermal heat generated by the volcano.

Iceland has a unique power grid where electricity and hot water for the country is primarily generated from geothermal energy. Icelandic people say if the water doesn't smell like sulfur you aren't getting clean!

HONOURS ABSTRACT:
Volcanic Facies Architecture and Geologic Controls of the Mount Coolon Epithermal System, Central Queensland

Michael Hawtin
School of Natural Resource Science
Queensland University of Technology
2008 Kagara-AIG Bursary Winner

The Mount Coolon low sulphidation epithermal system is located within a broader epithermal mineral field in the Late Devonian to Late Carboniferous Drummond basin, central Queensland. Gold in the Mount Coolon area has been recognised for almost a century.

The geology of the Mount Coolon area comprises a volcanic terrain of andesite, dacite and rhyolite ignimbrites formed during the opening phase of the back-arc Drummond basin. Facies analysis of the volcanic rocks suggests a volcanic architecture dominated by the eruption of a large caldera, consistent with extensional tectonics and crustal melting. Structural fabrics defined by magnetic lineaments are related to differential movement of faulted caldera blocks.

Epithermal gold mineralisation is hosted by andesite which underlies an extensive rhyolite ignimbrite. An intracaldera fill model in which the rhyolite provides a ~500 metre cap coupled with movement of faulted caldera blocks leading to dilation best explains the origin of the epithermal system. The timing of the mineralisation is poorly established, but must occur after the andesite (~347Ma). A nearby granodiorite (308Ma) could provide a possible source of fluids; if so, mineralisation occurred up to 30Ma after the caldera formation.

Complaints, Complaints, Complaints

Rick Rogerson
Chairman, Complaints Committee

Positive feedback from ASX

On 14 May 2009, the Australian Securities Exchange (ASX) released a report (www.asx.com.au/about/pdf/mr_140509_jorc_code_review.pdf) summarising the degree to which listed entities complied with the JORC Code. This is the first time that one of these normally internal reviews has been publically released. ASX Markets Supervision (ASXMS), which reviews company reports lodged via the ASX Company Announcements Platform, compiled the compliance statistics for the six months ending 31 March 2009.

Overall, the report confirms that the vast majority of the approximately 800 mining entities listed on the ASX, and therefore their Competent Persons, made announcements that complied with the JORC Code. This is particularly so if the instances of failing to include a Competent Person statement are treated as sins of omission rather than commission.

Large numbers of breaches were also recorded in relation to reporting of Exploration Targets and combining resource and/or reserve categories.

The Executive Summary of the report made the following points:

- "An estimated 5,200 Public Reports (announcements) were reviewed by ASXMS for compliance with the JORC Code during the six-month period of the review ending 31 March 2009.
- 312 (6.0%) of those announcements were found by ASXMS to contain a total of 333 instances of material non-compliant reporting.
- The 333 breaches were made by 246 entities.
- The most common breach was a deficient or missing Competent Person Statement - 176 instances or 52.9% of total breaches.
- ASXMS took immediate action to correct the material breaches once identified, in most cases requiring replacement or clarifying announcements to be made to the market."

A table in the report set out the detail of the non-compliance.

JORC code clause	Issue	Instances of non-compliance
8	Competent Person Statement - deficient or missing	176
17	Insufficient information on results e.g. lack of drill hole information	12
18	Exploration target statements reported incorrectly	41
25 and 33	Combined or unspecified categories of resources and/or reserves	91
	Use of in-ground values or insufficient information to explain metal equivalent calculations	5
	Reporting historic and/or foreign resources and reserves	5
Various	Other	3
	Total	333

ASX Company Updates

(www.asx.com.au/professionals/companies/companies_updates.htm) contain more information on requirements for metal equivalent calculations and reporting of foreign or historical resource estimates.

Education Report

2009 AIG Geoscience Student Bursaries

The 2009 bursary application form will be sent to universities and students in the next few weeks, and will also be available on the AIG web site. This year we again invite applications from Third Year, Honours and Postgraduate geoscience students.

Last year we awarded bursaries to ten students. Since 2001 the AIG Bursary Program has awarded bursaries to 64 students and, with the help of our sponsors, we hope to continue to support and encourage the next generation of geoscientists. Our bursary sponsors are listed on page 17. Their support is particularly appreciated in these challenging economic times, given the increase in geoscience students over the last few years, and the resultant increase in high quality applications to the AIG bursary program.

The new AIG Education Foundation - which is an ATO endorsed charitable fund - is now up-and-running, and individuals who wish to support the AIG's bursary program can now make fully tax deductible contributions.

Discounted Symposium Fees for Students

The AIG Queensland branch is offering heavily discounted student registration fees to the first 20 AIG student members to register for the NQEM 2009 symposium in Townsville in June. Registration fees for early bird students have been reduced to $50 for the two days, and include the symposium dinner. Students who wish to take advantage of this offer should contact the symposium secretariat; contact details are available at http://aig.org.au/events/18.

Kaylene Camuti, Chair, Education Committee

Membership Update

New Members and Upgrades at the February Council Meeting 2009

MEMBERS		
ALLCHURCH	James	Peter
BOOGAERDT	Mijndert	Andriaan
BROOKS	Samuel	Richard
DAVIS	Toby	Patrick
DESMOND	Lisa	
FARCICH	Brian	Anthony
GRANT	Brentan	Peter
GROVES	Iain	Michael
JACKSON	Michael	Gerard
JEFFRIESS	Dylan	John
LOUW	Grant	John
MCCARTHY	Rebecca	Lee
MACKENZIE	Phillip	Charles
MUELLER	Dominicus	
MYADZEL	Volodymyr	
OWEN	Stuart	Richard
PERETYATKO	Oleksandr	Ivanovich
PERTZEL	Bruce	Arthur
SOMERS	Andrew	Michael
VAARWERK	David	
WILLIAMSON	Anthony	James
WILLIAMSON	Dean	James
YOKOI	Oscar	Yosnitaka
GRADUATES		
BLACKWELL	Emer	
FERGUSON	Scott	Archie
MAKIN	Fiona	
MARTIN	Adam	Paul
RUARO	Eduardo	
COOMBE	Venessa	Louise
HOLMES	Gillian	
THORNBURROW	Blair	Richard
STUDENTS		
BROOKS	Allen	
GHIMIRE	Shyam	
LUKOMSKYJ	Alex	
MARSHALL	Angela	Claire
PRYOR	Ian	James
RETIRED		
MCLEOD	Raymond	Lex

We welcome all new members to the AIG.

New Members and Upgrades at the March Council Meeting 2009

MEMBERS

ARNDT	Christopher	David
BATES	Sally	Amber
DABIRE	Bohino	J
DAHL	Niels	
DE KEVER	Nicole	Louise
FRENCH	Tara	
FURSEY	Hollie-Amber	
GOOFREY	Stephen	Alan
MARKS	Charles	Kevin
MCKAY	Brett	Stephen
MURPHY	David	Michael
MURPHY	Travis	Edward
STANDISH	Tony	Ross
STERK	Rene	
SWANE	Ian	Philip
TUFFIN	Todd	Matthew
WARE	Phillip	
WILDE	Andrew	Robert

FELLOWS

GILLIGAN	Lindsay	Bernard
YANG	Kaimui	

GRADUATES

BRABHAM	Ria	Bianne
DANGERFIELD	Philip	James
DE LEON	Melanie	

STUDENTS

LANE	Martin	
PALMER	Jade	
VALE	Timothy	Ryan

RPGeo Approval and Applicants

CANDIDATES APPROVED BY AIG COUNCIL IN FEBRUARY AND MARCH 2009

Mr. Andrew Hunter of Sydney, NSW, in Geotechnical and Engineering

Mr. Chen Zilong of Perth, W.A. in Mineral Exploration

Dr. Mark Hutchison of Darwin, N.T. in Geochemistry & in Mineral Exploration.

Mr. Fergus O'Brien of Lawnton, Queensland, in the field of Mineral Exploration

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

Mr. Max Foweraker of North Ryde, New South Wales, is applying for registration in the field of Geotechnical and Engineering

Mr. Bret Ferris of Canberra, ACT, is applying for registration in the field of Mineral Exploration

Mr. Stephen Tyson of Melbourne, Victoria, is applying for registration in Geotechnical and Engineering

New Members and Upgrades at the May Council Meeting 2009

MEMBERS

ALLEN	Geoffrey	Stuart
BROWNLEE	Martin	
CHEN	Yuan	
COLGAN	Elizabeth	Anne
CROAKER	Mawson	Richard
EVES	Alexander	Edward
FOWERAKER	Maxwell	Joseph
FOX	Michael	Anthony
GAUNT	George	Franklin
GODBER	Kate	Elizabeth
GRAEFE	Kirsten	
HAY	Keith	Robert
HENDERSON	Robert	George
HUGHES	Duncan	Paul
KNIGHT	Christopher	Noel
KRASNYKH	Andrey	
LEWIS	Robger	James
MENDOZA	Arnel	
MILLS	Anthony	Barry
PALADI	Sreenivas	
PATTSION	Christopher	Ian
PIRLO	Mark	Christopher
REEVES	Zeffron	Charles
REYNOLDS	Lachlan	John
STEWART	Dane	
SVENSSON	Hans	Peter
TROWBRIDGE	Rebecca	Susan
VOS	Marco	
WATKIN	Thomas	
WILLIAMS	William	C
WORLAND	Rohan	James

GRADUATES

DWYER	Paul	Anthony
JACKSON_HICKS	Caroline	Rose
KING	Rodney	John
SEABERT	Andrew	James
STOY	Sandra	
WITTEN	Reece	Brian

STUDENTS

BENINCASA	Aaron	James
JACOBS	Natasha	
KUR	Anyuat	
MALDEN	Andrew	
MISCHLER	Philipp	Daniel
PHILPOTT	Robert	
THOMAS	Allison	Rebecca
TOWNEND	Daniel	
WEBLEY	Duncan	Edward
WORKMAN_DAVIES	Cheryl	Maxine

ASSOCIATE

JONES	Judith	Angela

AIG FEDERAL COUNCIL FOR 2008-2009

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.

AIG News is published by the Australian Institute of Geoscientists to provide information for its members and a forum for the expression of their professional interests and opinions. Observations, interpretations and opinions published in AIG News are the responsibility of the contributors and are not necessarily supported by the Australian Institute of Geoscientists or the Editor of AIG News.

While the Editor and the Australian Institute of Geoscientists have taken all reasonable precautions and made all reasonable effort to ensure the accuracy of material contained in this newsletter, they make no warranties, express or implied, with respect to any of the material published in AIG News.

The BUSINESS ADDRESS of AIG News is:

PO Box 8463, Perth Business Centre, Perth WA 6849
Tel: (08) 9427 0820
Fax: (08) 9427 0821
Email: aignews@fgservices.biz
Web: http://www.aig.org.au

Please use these contacts for all matters relating to advertising accounts, changes of address, AIG News distribution, or membership.

The EDITORIAL ADDRESS is:

Editor: Louis Hissink
Email: aignews@fgservices.biz
Tel: (08) 9427 0820

Please submit all articles, letters and advertisements to the above email address.

SUBMISSION FORMATS

Text: Word Files (Please DO NOT EMBED pictures in Word, supply as separate files.)

Pictures, Logos, Maps, Diagrams: Resolution 300dpi. Photoshop EPS, Tiff, Jpeg or press-optimized PDF files in Grayscale/Bitmap. Please provide images of all pictures separate to text. Please EMBED ALL FONTS in EPS and PDF files.

ADVERTISEMENTS

AIG News provides an ideal opportunity to advertise your company and services to the AIG membership throughout Australia (and some overseas), There are about 1,300 members who receive the newsletter four times per year. Please contact the Editor for further details or to book advertising.

Prices are inclusive of GST

Size (Dimensions – w x h)	**Per Issue**
Full page (18 x 26.4 cm)	$545
Three quarter page (18 x 20 cm)	$458
Half page (18 x 13 cm or 9 x 26.4 cm)	$372
Third page (l8 x 9 cm)	$273
Quarter page (18 x 7.5 cm or 9 x 13 cm)	$198
Business card - Members (9 x 5.5 cm)	$25
Business card - Non Members (9 x 5.5 cm)	$125
Inserts	
Pre-printed (1 page)	$453
Pre-printed (2 pages)	$495
Pre-printed (3 or more pages)	By negotiation and weight
Including printing	By negotiation

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