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Stratigraphic Controls on Structures and Mineralisation in Central Victoria 5: Nerrina

R. K. Boucher, Linex Pty Ltd & La Trobe University
F. J. Makin, Linex Pty Ltd & La Trobe University

Abstract

This is the fifth in a series of papers discussing the stratigraphic controls on structures and gold mineralisation in Victoria. The Nerrina (or Little Bendigo) goldfield is the northern third of the Ballarat goldfield. However, despite being practically along strike from the Ballarat East goldfield, the stratigraphy, structures and quartz veining at Nerrina are completely different. The tight folding at Ballarat East is not seen at Nerrina. Instead the entire goldfield lies on a broad west-dipping fold limb. This limb is devoid of significant faults, unlike Ballarat East where west-dipping and crosscourse faults are common. Quartz at Nerrina is stratabound within shales 2-25m thick. Such shales are virtually absent at Ballarat East. The mineralisation within the west-dipping shales continues well below the historic workings. Only 3% of more than 1,000 mapped shafts have recorded production. While historic records show that only 120,000 oz of gold came from the Nerrina goldfield, the vast alluvial workings and large number of primary workings suggest that this grossly underestimates the gold endowment of the area. The alluvial workings link to major deep lead systems flowing southwards into Ballarat and northwards into the Berry leads system that produced 1.7 Moz of gold. The well-rounded and spherical quartz on the Berry dumps can be traced back to Nerrina, but it is uncertain how much of the alluvial gold can too.

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Introduction

Central Victoria is a world-class orogenic gold province where faults and folds within Ordovician turbidites host gold and associated mineralisation. Such turbidites occur across most of Victoria and in the field comprise monotonously interbedded sandstones and shales, although facies variations and lateral discontinuity of individual beds are characteristic at a local scale. This study of Nerrina (Fig. 1) follows reviews of Bendigo, Ballarat East, Fosterville and Lockington by Boucher *et al.* (2008a, b, c, d).

The Nerrina (or Little Bendigo) goldfield was intensely worked for alluvial and reef gold. However, the majority of this work occurred in the 1850's and 1860's and there are virtually no records.

Figure 1. Location map showing turbidite-hosted gold deposits discussed in this series of papers.

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32 primary workings are recorded in the Geological Survey of Victoria's database, however over 1,000 shafts have been mapped in the field. The 120,000 oz of reef gold quoted for Nerrina probably grossly underestimates production from the area. Outcropping quartz reefs originally stood to just over 3 m high and could be traced for several hundred metres along strike (Whitelaw, 1901). Production came from numerous lines, but most of the mining occurred within the Dimocks Main Reef (Figs 2-4) and the Monte Christo Reef (Figs 2 & 4). These reefs are 550 m apart on the west limb of the Monte Christo Anticlinorium.

The Nerrina tenements are held by a private company, North Ballarat Pty Ltd, which embarked on an intensive field mapping campaign to accurately survey the positions of the shafts and alluvial workings. This work enabled the geological controls on mineralisation to be established and these were confirmed by diamond drilling in 2008.

As at Fosterville and Lockington, no attempt has yet been made to formally name stratigraphic units at Nerrina. Instead a coded numbering system has been used to identify units (Fig. 3). The Nerrina units surrounding the Dimocks reefs are given the prefix 'DI', with thick shales denoted 'SH' and amalgamated channel-sands 'CH'. The 'shale-topped sands' (STS) above and below the channel-sands are designated 'TS' and 'LS' respectively. A package from the top of a shale to the top of the next shale above is considered analogous to a formation and is assigned a number for the combined LS/CH/TS/SH facies (Fig. 3).

Gold workings at Nerrina and in the surrounding region

Field mapping has revealed over 1,000 primary workings and a significantly larger number of alluvial potholes plus intensely sluiced gullies up to 10 m deep and 100 m wide (Fig. 2). Over 90% of workings were too shallow to reach the water table at 30 m and only 18 shafts are considered to have exceeded 100 m depth. About half of the larger shafts have some written records, but only two brief geological summaries have been written (Whitelaw, 1901; Bradford, 1904). Given the paucity of recorded data, a great deal was revealed by detailed field mapping of the tenements. The continuity of the workings and the geological information in the open shafts, small open cuts and adits revealed that quartz veining occurs mainly within west-dipping shales. Aside from minor parasitic folding and some very small faults with displacements of less than a metre, few structures were seen at the surface. The most significant shale, the 25 m thick 'Dimocks Main Shale', contains veins aligned on bedding and cleavage and an enormous tonnage beneath the shallow workings.

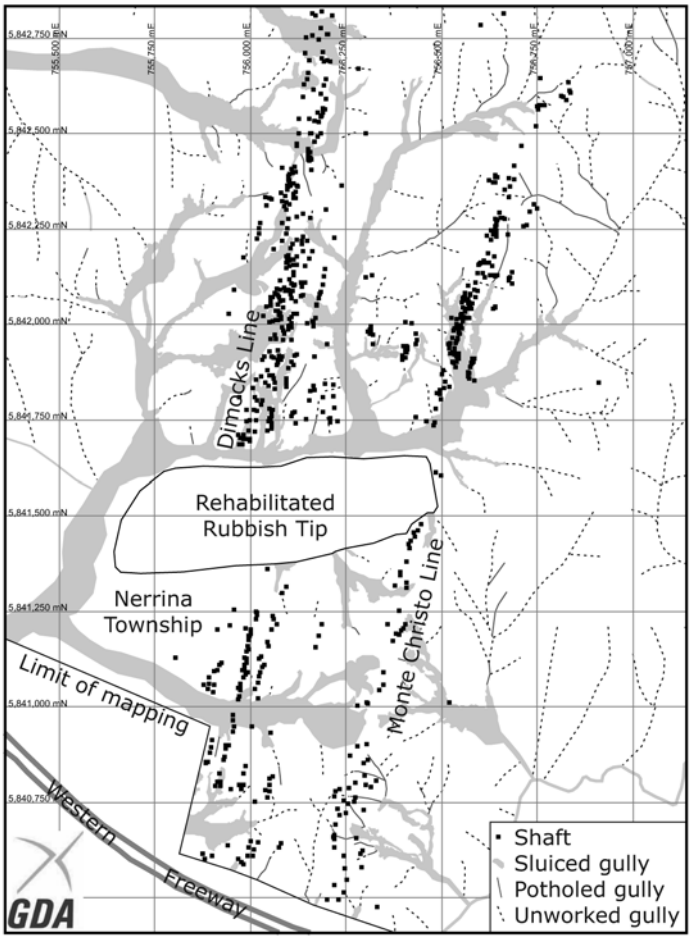

Figure 2. Gold workings near the Nerrina township. Primary workings form two continuous bands punctuated by cultural features and alluvial cover. The alluvial workings provide good vectors to the primary mineralisation

Recorded grades are rare, but some production at a grade of 13.7 g/t was reported from the Dimocks Line. Drill intercepts up to 170 g/t occur.

The alluvial workings provide good vectors to the primary mineralisation (Fig. 2). There is excellent correlation between the upstream limits of the alluvial workings and the reef positions. These data are valuable in understanding the geology of the main reefs and confirming that there was significant up-dip eroded gold mineralisation within the thick shales. This gives extra confidence in the likelihood of gold endowment down-dip.

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From Your President

To merge or not to merge [1]

It is unarguable that a decision to merge with the GSA would be the most important in the history of the AIG. It is also unlikely that any other topic in the history of the AIG has polarised members' opinion more - except perhaps the greenhouse debate, but we'll put that aside for now.

The idea of a possible merger between the AIG and GSA has been around since about 2004, although discussions to more formally examine the possible advantages and disadvantages of such a merger only commenced in 2008 with the establishment of a Merger Committee comprising GSA and AIG members.

The Merger Committee subsequently developed the discussion paper that was recently circulated to AIG and GSA members. The objectives of the discussion paper were threefold:

(i) To bring members up to date with discussions,

(ii) To facilitate informed discussions amongst members, and

(iii) To seek feedback from members.

Openness and transparency are core values of the AIG and the discussion paper was issued in the spirit of maintaining open and transparent communications with members on the merger debate.

Two points should, however, be stressed:

(i) No decision about a merger has been made, and

(ii) The discussion paper does imply endorsement by Council of a merger.

Additionally, given the potential implications to AIG members of a merger, the decision process must necessarily be extensive, measured and inclusive.

As expected, the discussion paper has precipitated debate and analysis amongst members and there is a wide diversity of opinion, which is also unsurprising given that vigorous debate is central to the scientific process; and we are, after all, scientists first and foremost. Moreover, to their credit, geoscientists have never been backward in expressing an opinion.

Feedback has started flowing in and the blog is carrying several discussion threads that make worthy reading (for an interesting conversation about the terms "geoscientist", I refer you to the blog topic "What's in a name?") The opinions expressed, and potential advantages and disadvantages identified by members in their feedback thus far are many and varied. All, however, are highly valued and will be treated equally.

An unexpected, but I believe positive, consequence of the merger debate (in retrospect perhaps it shouldn't have been unexpected, although we're geoscientists, not psychologists) has been that it has caused members to reflect deeply and personally about what it means to be a geoscientist, what the AIG means to them, and how they wish to interact, at both personal and professional levels, with the rest of their profession and the society within which they live and work. I believe such introspection, or re-grounding of values, is immensely beneficial, not only to the individuals concerned (albeit sometimes a somewhat uncomfortable experience), but also in helping to guide the future decisions and directions of professional organisations such as the AIG.

I would therefore once again like to encourage you to read the merger information presented, engage in the debate and offer your feedback on this important issue, using any (or indeed all) of the available feedback mechanisms. The opportunity to provide your input is now. Feedback will be compiled and presented to Council for consideration at the next Council Meeting in September.

Reporting with a difference

Many of you (probably most of you) are familiar with the Australasian Code for Reporting of Mineral Resources and Ore Reserves (JORC) Code, which sets out minimum standards, recommendations and guidelines for public reporting of exploration results, mineral resources and ore reserves in Australasia. It is satisfying to know that the JORC Code is highly regarded and has been widely accepted or used as a framework elsewhere in the world (most recently by Australia's geothermal energy industry).

The main principles of the JORC Code are (i) transparency, (ii) materiality and (iii) competence[2]. In essence, the Code was developed to ensure the veracity of public reports prepared for the purpose of providing sufficient and suitable information to investors and their advisers so they can make informed decisions about mineral resource issues. The JORC Code also provides a framework which allows a level of comparability between reports.

In the interests of maintaining high standards of professionalism within the geoscience industry and high levels of confidence in the industry by the general public, there is a need to ensure the veracity of all reports completed by AIG members, including those that are not related to mineral resource evaluations. Examples include geophysics surveys, regional geological mapping, hydro-geological investigations, environmental impact assessments, land contamination studies and geotechnical investigations.

Some measure of confidence in professionalism is provided through the Institute's Code of Ethics, to which AIG professionals at all levels of membership are bound. Additionally the JORC Code is recommended as a minimum standard for all reporting.

It's a short hop in the JORC Code from "investors" to "stakeholders", from "advisers" to "regulatory agencies" and from "mineral resources" to "natural resources" (indeed, when

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1. Apologies to Shakespeare.
2. Transparency — "reader of a public report is provided with sufficient information, the presentation of which is clear and unambiguous, to understand the report and is not misled".
   Materiality — "Public report contains all the relevant information which investors...would reasonably require, and reasonably expect…for the purposes of making reasonable and balanced judgement regarding mineralisation being reported."
   Competence — "Public report is based on work which is the responsibility of a suitably qualified and experienced person who is subject to an enforceable professional code of ethics."

Stratigraphic Controls on Structures and Mineralisation in Central Victoria 5: Nerrina

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The leads shown in figure 2 flow towards the southwest and combine with material eroded from the Ballarat East and Ballarat West goldfields to form the rich shallow and sub-basaltic alluvial deposits that produced 11 Moz of gold. To the north of the area shown in figure 2, a series of older leads are preserved adjacent and sub-parallel to the present drainage system. Up to six older leads are preserved on adjacent terraces. To the north these leads converge into the Berry leads system that produced 1.7 Moz of gold. Well rounded and spherical quartz makes up almost all the clasts found on the mine dumps along the Berry lead, over 20 km from Nerrina. Boucher (2009) demonstrated that the quartz clasts can be tracked back the entire length of the lead to Nerrina. While the quartz appears to have been transported this distance, it is uncertain how much of the gold has. There are new quartz populations appearing in the leads from time to time and large nuggets were found within the alluvials that are unlikely to have been transported far. Yet gold is known to be transported considerable distances in central Victoria. Alluvial gold was worked at Huntly, 20 km downstream from the Bendigo goldfield.

Nerrina stratigraphy

The best exposures occur within adits and sluiced gullies along the Dimocks Line (Fig. 2) and the mapped stratigraphy (Fig. 3) was confirmed by diamond drilling in 2008. The Dimocks stratigraphy is dominated by thick shales, the largest being the 'Dimocks Main Shale' which reaches 25 m. While this is not as thick as some of the shales seen at Fosterville (Boucher *et. al.*, 2009c) or Bendigo (Boucher et. al., 2009a), it is thicker than any shale units in the Ballarat East goldfield immediately to the southwest. The 'Big Slate' that reaches 15 m in the northern part of the Ballarat East goldfield (Boucher *et. al.*, 2009b) and may be a potential candidate for correlation.

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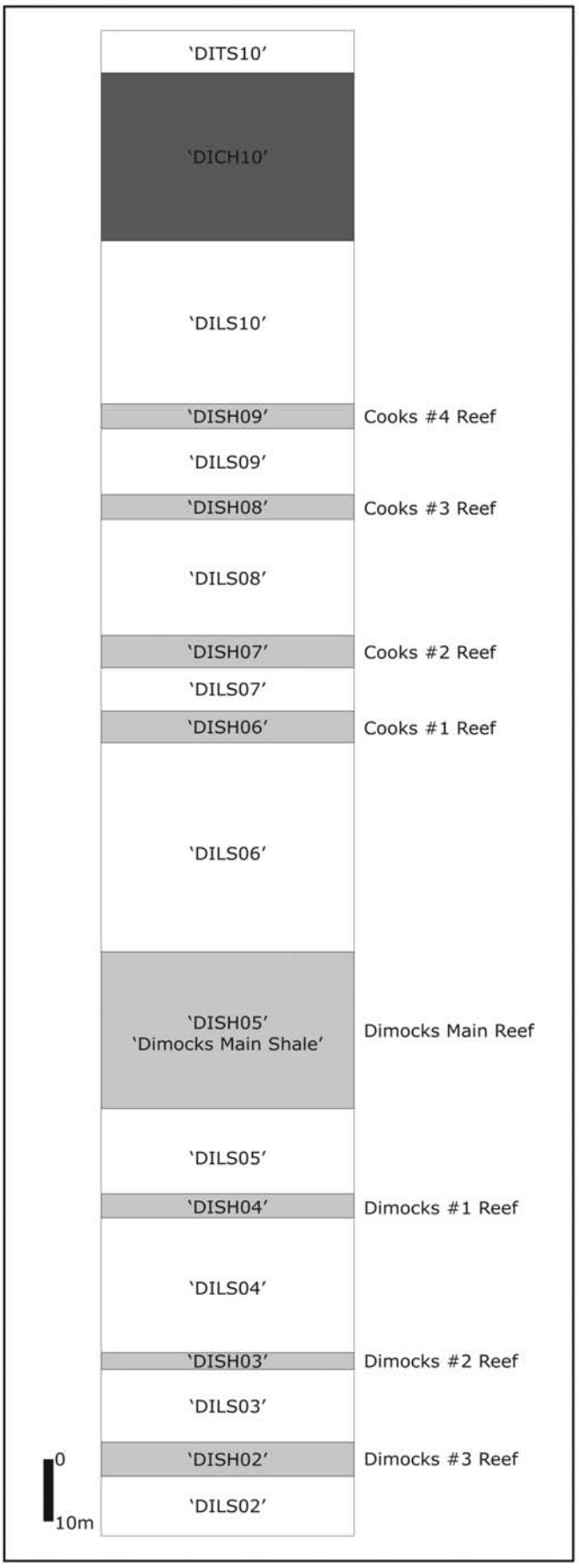

Figure 3. Stratigraphic column highlighting thick shale units (pale grey), channel sands (dark grey) and major quartz reefs.

From Your President

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substituting the latter words for the former, the JORC Code still makes remarkably sensible reading). Additionally, whilst the JORC Code was designed specifically for public reporting, its three fundamental principles are, or at least should be, relevant to all reporting. The direct application of the JORC Code to non-mineral industry related reporting is, however, somewhat problematic because there are aspects of the Code that clearly only make sense in relation to mineral resources.

Both the Code of Ethics and the JORC Code therefore have inherent weaknesses in relation to ensuring confidence in the level of professionalism of non-mineral industry related reports and/or enabling some level of consistency of approach. This last point is not to say that a hydrogeology report should be directly comparable with an environmental geology report or a geophysical report. All should, however, be comparable at a fundamental level (Transparency and Materiality) and should be written, or at least signed off, by appropriately qualified and experience practitioners (Competence).

In the absence of a formal guideline for non-mineral resource reporting, and given that AIG's fastest growing membership is from non-mining related geoscience disciplines, it would appear to make sense, at least at face value, that an approach to reporting which explicitly incorporates the three JORC principals would be beneficial to members, employers, clients, regulatory authorities and the general public; indeed might even improve perceptions of, and confidence in, the geoscience industry in general.

Some options might include adopting the JORC Code along with some minor modifications to the Code, developing a new "general code of reporting" based on JORC principles, adopting and modifying as necessary an existing reporting guideline from elsewhere, or amending the AIG Code of Ethics to include clauses that strengthen non-minerals reporting. Any decision would, however, need to satisfy a cost-benefit analysis.

Hot air rising

The following is an excerpt from Wikipedia:

"The science is settled" is a slogan attributed by opponents of the Kyoto Protocol and global warming theory to supporters notably in the Clinton administration.

The phrase is vague, and people who use it may not elaborate what exactly is settled. Certain aspects of climate change are widely accepted: that human actions have increased the amount of Carbon Dioxide (CO2) in the atmosphere, for example. Other aspects-the exact degree of climate change to be expected within the next century, if any-are not settled. In between are issues such as how much the earth has warmed recently and how much of this is due to human activity.

Opponents of global warming theory have said: "There is an idea among the public that 'the science is settled.'" How many times have we heard from Al Gore and assorted European politicians that 'the science is settled' on global warming?

Wikipedia may not be the most authoritative reference on... well, anything much, but in this instance there is an echo of truth about the question, "How many times...?"

There is probably no more contentious debate in Australia, including within the AIG, than climate change and it is likely that the opinions of AIG members are equally split on whether climate change is being driven by anthropogenic processes, or whether we are simply experiencing a natural climate cycle. Interest in the debate is intense. Indeed, many of you will have attended the public debate on climate change that was held by the AIG's Western Australia branch, which drew an audience of over 600 people (most of whom were not AIG members) and which was a success by any measure (a video of the debate will soon hopefully be available on the AIG's website).

It is important, however, that the climate change debate remains scientific, that it is not hijacked by partisan groups in order to achieve political gain and that it is not used simply as a means of developing and imposing a new and innovative tax.

It is also important that anyone who has an opinion on climate change can freely and without fear of harassment express that opinion. In this respect it has been a little disappointing to observe the practice of publically dismissing a contrary opinion as merely the view of a "non-believer" or "denier" (in this instance, specifically a "climate change denier"). This behavior should be more than a little disconcerting to both science and democracy - after all, it's not so long ago that non-believers and deniers were burned at the stake (and in case you're thinking that burning at the stake would be a fitting conclusion to your climate debate opponent, I would remind you of the carbon dioxide it would generate).

Challenging dogma is a central tenet of the scientific process and it is good to see AIG members entering the climate debate with passion. It is important, however, that regardless of their point of view, AIG members continue to express their opinions scientifically, professionally and ethically.

The AIG has a clear role in promoting balanced discussion of the climate change issue. Indeed, this is a role that should be shared by all scientific organizations. No matter how intellectually exciting the debate about causation is, however, a worthy topic for discussion by AIG members would be the implications of any new regulatory framework on the geoscience industry; for example, the implications for the mineral resources and energy (oil, gas, coal, geothermal) industries of the proposed Emissions Trading Scheme (ETS), or the implications of the proposed ETS on mineral resource evaluation and reporting. These are areas where the AIG members can make the greatest contributions and in which AIG should be taking a leadership role.

Martin Robinson

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Below the 'Dimocks Main Shale', the stratigraphic succession is shale dominated. In between the thick shales, the STS are dominated by shales with interbedded fine- and very fine-grained sands. In contrast, the STS above the 'Dimocks Main Shale' are sand dominated, reaching medium-grained size.

Genuine channel sands occur at the top of the stratigraphic succession shown in figure 3. Unlike the 'Big Sandstone' at Ballarat East that is medium-grained (Boucher *et. al.*, 2009b), 'DICH10' consists of coarse- and very coarse-grained sandstone.

Stratigraphic controls on the development of veins, faults and folds

Bedding-parallel, laminated quartz veins are absent at Nerrina, despite the prevalence of thick shales that are good hosts for such veins at Bendigo, Fosterville and Lockington. Instead, massive quartz veins occur parallel to bedding and on axial-planar cleavage in the thick shales. As a result, it is common to see the 25 m thick 'Dimocks Main Shale' containing a network of west-dipping and upright veins averaging 10% of the width of the shale.

The Cooks reefs are stratabound, boudinaged, massive quartz veins within shales separated by sand-dominated STS. In contrast, the Dimocks #1-#3 reefs contain bedding-parallel and cleavage-parallel veins. The latter commonly take a sinusoidal path through adjacent sandstone beds, as demonstrated by Boucher *et. al.* (2009a).

Diamond drilling in 2008 revealed that the gross geometry of the west-dipping shales inferred from surface mapping holds true. However, some west-dipping faults were found to ramp from bedding-parallel positions within a thick shale and transgress the adjacent STS package before returning to a bedding-parallel position in an overlying thick shale. The exact nature and significance of these faults is undergoing evaluation. Additionally, small east-dipping faults occur. These usually have displacements of less than a metre but often contain quartz and are significantly mineralised.

The Nerrina goldfield was worked prior to the development of the large underground mines at Ballarat East and so predates the concept of 'indicator beds' (Boucher et. al., 2009b). As a result, there is no discussion of 'indicators' in the Nerrina literature with the exception of Whitelaw (1901) who shows flatmakes on the Monte Christo Line (Fig. 4) intersected by the Jarvis Indicator.

Folding and fault styles at Nerrina

Unlike Ballarat East where tight, upright to overturned chevron folds occur, Nerrina occurs on the broad west limb of the Monte Christo Anticlinorium (Fig. 4), although the data in between the main worked zones are sparse. Dips tend to shallow towards the west and are as low as 50° in the 'Dimocks Main Shale'.

Faults are rare and mostly small. Small east-dipping faults, usually with displacements of less than a metre were found in adits and from

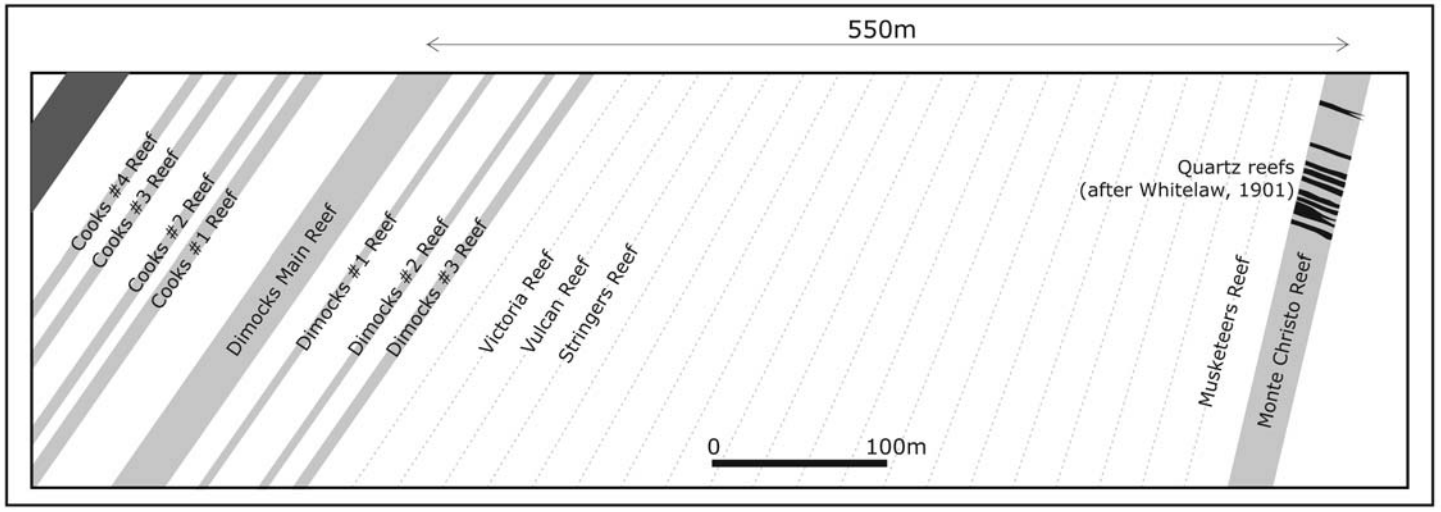

Figure 4. Cross section through the Nerrina goldfield showing the positions of the reefs within the thick shale units (Fig. 3). Quartz reefs depicted by Whitelaw (1901) are shown at the top of the Monte Christo Reef.

diamond drilling. West-dipping faults of uncertain displacement were interpreted from the drilling. These faults are bedding parallel in the thick shales, but ramp up through overlying STS before returning to a bedding-parallel position in an overlying shale. Small crosscourse faults were described in the literature and observed in field mapping. These are usually discrete faults with only a few metres of displacement. Minor parasitic folding occurs within the main west limb, but this is very rare.

Conclusions

The Nerrina goldfield contrasts remarkably with the Ballarat East goldfield immediately to the southwest. Quartz veins at Nerrina are stratabound within thick shales on a broad west-dipping fold limb that is otherwise devoid of major structures. In contrast, Ballarat East lies within a tightly folded and faulted sandstone-dominated succession. Despite the sandstone dominance at Ballarat East, the sands only reach medium grain size whereas they can be very coarse-grained at Nerrina. While the workings at Nerrina are continuous along strike over significant distances, they are mostly shallow and the mineralisation is open at depth. Where the shales are large, such as the 25 m thick 'Dimocks Main Shale', they provide an enormous tonnage target. This differs markedly from the majority of Victorian goldfields where the targets are narrow targets and of restricted height. Nerrina provides a new type of target for Victoria that may not demand the high grades required elsewhere.

Careful field mapping has been integral to understanding the Nerrina goldfield as the existing data were not sufficiently detailed to understand the geology. Mapping of alluvial workings revealed the vectors to the gold source and demonstrated that high volumes of gold had been from eroded, up-dip shale positions. The quartz from Nerrina can be followed as far as the Berry leads system over 20km to the north. It is uncertain how much of the 1.7 Moz of gold mined from the Berry leads came from Nerrina. Likewise it is uncertain how much of the 11 Moz of alluvial gold at Ballarat was sourced from Nerrina. ▲▲

Acknowledgements

This paper is published with the permission of North Ballarat Pty Ltd which has enthusiastically encouraged the detailed mapping necessary to interpret the Nerrina geology and mineralisation. Thanks go to Allan Rossiter for assistance with the final editing.

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AIG Climate Debate between Professor Ian Plimer and Gary Warden

ON JULY 9 2009 the WA Branch of the AIG held a public debate over anthropogenic global warming between Professor Ian Plimer, representing the sceptical position, and Gary Warden, representing the pro-warming position, at the Golden Nugget Room at Gloucester Park in Perth.

It was an outstanding success with standing room only and within excess of 600 interested people attending. Most of the audience were from the older demographics, though by no means were younger people absent. Moderator and master of ceremony was well known media trainer Thomas Murrell. AIG WA Branch chairman Gerry Fahey introduced the speakers and explained the AIG's role, noting that we now had over 2000 members.

Professor Plimer won the toss and elected to allow Gary Warden to start the debate. Gary Warden emphasised the need to believe the peer reviewed science literature summarised by the IPCC, stressed that the Earth is overpopulated with humanity and that if population levels continued to increase, critical shortages of commodities could be expected, apart from environmental catastrophe. He had a momentary lapse when an ad hominem was directed to Plimer's latest book. As a geologist and Al Gore's Pin-up Boy, Gary Warden was rather reticent in presenting any geological evidence supporting his debating position, giving the general impression that the climate change argument was largely emotionally based. He also relied on the IPCC as an authority, exemplified by the quote "the brightest science minds researching climate change". He debated well but when questioned simply fell back on the IPCC's published statements and commenting that they were peer reviewed whereas Plimer's book wasn't. His underlying theme is changes to occur in the industrialised economies to attain a sustainable lifestyle on this planet, bearing in mind the rapidly increasing human population. Global warming is his catalyst and wake-up call for this worthy goal to be to be enacted.

Ian Plimer *Gary Warden*

Ian Plimer, on the other hand, stuck to his science and stressed the errors of ignoring geological facts — in short, what warming that has occurred can be totally attributed to natural variability. Professor Plimer expressed some consternation that science was not the core of the debate and he wondered whether discussion of the science would ever be enough to convince those with the anthropogenic global warming viewpoint.

After presenting their debating positions, Thomas Murrell announced a twenty minute break after which a question and answer period would occur. At the start of the moderated debate and at the request of one of the audience, Thomas Murrell asked how many of the audience were geoscientists by a show of hands, and after a few more questions, it became evident that the audience represented a good cross section of the community. Mike Miller from Willeton asked the first question — a somewhat technical one and both debaters admitted ignorance of the Beer-Lambert law.

Ian Plimer and Gary Warden on stage

The second question by John Garvey (geophysicist) was directed to Gary Warden and asked why there was no proof in the IPCC documentation that CO_2 leads to global warming. Gary Warden replied that there were hundreds of papers proving it in the IPCC report while Plimer disagreed and supported the questioner that there was no direct proof. Ray Wills of UWA, and from the WA Sustainable Energy Association, asked Plimer how many tens of millions of years did it take for carbon and oil and gas reserves to suck CO_2 out of the air, and then how many decades has it taken to re-release this CO_2 back into the atmosphere. Plimer replied that human emissions are small compared to natural emissions, and that most of the current CO_2 emissions are from other processes but as we know so little about this topic it would be foolhardy to base public policy on such a poor understanding of the science.

Another questioner pointed out that while a volcano could emit an enormous amount of CO_2, it also would emit an equally large amount of aerosols, and would not those cause a dimming effect? Plimer's replied that he would be fascinated to observe the emission of such large quantities of aerosols into the atmosphere from submarine volcanoes that represent about 85% of the world' s active volcanic eruptions. Other questions were dismissed as politics, and generally the Q & A session went well.

AIG News received some correspondence and phone messages after the debate, some of which are reproduced below:

"*Just wanted to say what a fantastic event it was last night. Well Done! I was thoroughly entertained by both the speakers and the audience members. It was so interesting to note the different opinions on a topic I had thought was universally accepted. I hope we can do something similar again in future. Fantastic.*"

"*Thanks for a terrific night. I am very glad I went. My wife an d I both were really got to thinking by it.*"

"*The climate change debate last night was excellent. Well done for the AIG for having the courage to do a public debate. When will the video be available on the web as I know lots of people that would be interested in watching it. Can you please send me the link?*"

(Ed: Video is now available on the AIG Website). ▲▲

Harry Mason asking a question

Gerry Fahey *Thomas Murrel*

Gary making a point

Over 600 people attended the debate

New Ideas in Science — a Geologist's Perspective

David Pearcey

AIG NEWS 96 PUBLISHED an article by Dr T Gold outlining problems with current research methods in science which concluded that some fields of science would become stagnant unless those problems are addressed. The main cause of intellectual stagnation was the herd instinct which causes many scientists to stay with mainstream ideas and concepts rather than risk alienating their peers by investigating controversial new ideas. The peer review system thus tends to maintain the intellectual status quo by rejecting new ideas.

For example Gold mentioned Continental Drift which, when Wegener first presented it, was generally thought to be a crank theory. Continental drift, now refined as plate tectonics, has become the mainstream model of earth dynamics but ideas questioning it encounter the same problems Wegener experienced in his time.

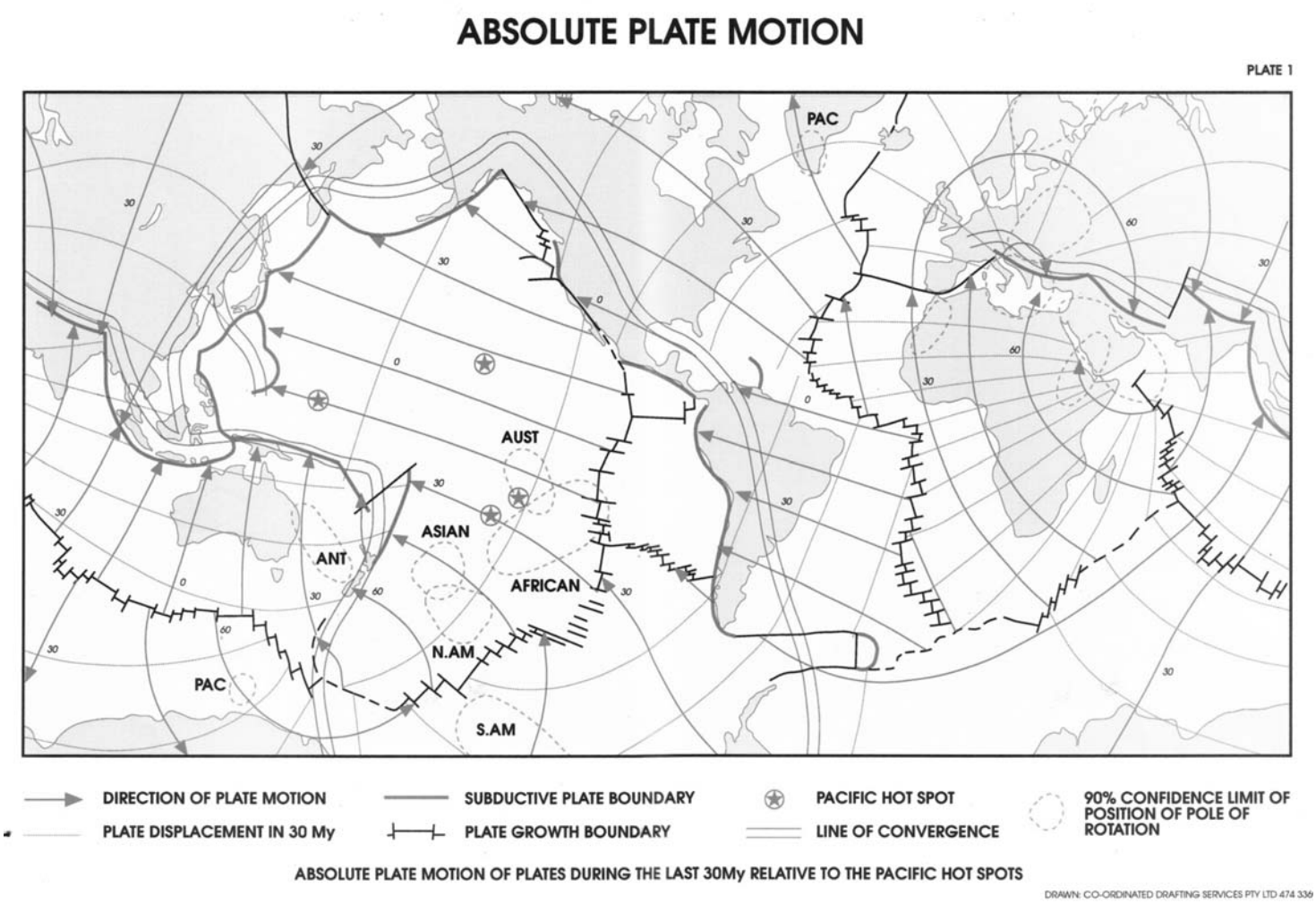
Today most of geology and tectonics is interpreted through the plate tectonic model, and extended to the Proterozoic and even the Archean without due consideration whether plate tectonics was active during those times.

The diagnostic features of plate tectonics, such as andesitic volcanics, green and blueschist paired metamorphic belts, and ophiolite and alpine ultramafic belts, are generally found in tectonic zones of the Phanerozoic, but rarely in the Proterozoic and this implies that the tectonic style of the Proterozoic was significantly different from present day tectonics. It is also possible that the geological boundary between the Proterozoic and the Phanerozoic was recognized as a distinct global transition in the geological history of the Earth, likewise the boundary between the Proterozoic and the Archean which was also associated with a distinct change in tectonic style from granite greenstone terrains to the development of intracratonic orogenic basins during the Proterozoic.

The idea that plate tectonics is caused by mantle convection is a strongly held concept and may be an example of scientific stagnation identified by Thomas Gold. That is, mantle convection as the driving force of plate tectonics has not been proven as a scientific fact but is a deduction from the observations of magnetic patterns extending from the oceanic ridges, and accepted as fact by consensus.

The mechanics of Plate Tectonics is conventionally shown by a cross section across an ocean ridge with convective uprising of mantle derived material under the ridge which then moves laterally away from the ridge back into the mantle via the subduction zones. However as convection cells have spherical symmetry, plotting a longitudinal cross section along the oceanic ridge immediately raises difficulties which I recognized as a student and which still exist today.

The central issue is therefore the nature of the dynamics within the Earth that causes plate tectonics and how that mechanism evolved into plate tectonics. It is my contention that by limiting geodynamics solely to mantle convection and maintaining this process as the sole



cause of geodynamics by the peer review system has resulted in a stagnation of geological thought.

Hence I would like to recall some of my experiences developing new ideas in geology which ran up against the stone wall of academia which Gold described in his article. I also feel there is a possible solution to the problem in the present academic system which may allow any inspired professional geologist to present their ideas.

When I was a student we were initially taught the geosynclinal theory of tectonics (developed by Hall in 1859), but this was replaced by plate tectonics a year later. The geosyncline theory explained tectonics as a sedimentary orogenic cycle with different classes of geosynclines becoming tectonically active as the sedimentary pile became thicker. The accreted island arcs of plate tectonics were called eugeosynclines and intracratonic geosynclines called miogeosynclines.

I became excessively interested in plate tectonics and became brash, ridiculing the older geosyncline theory as a theory that had no causal reasoning behind it; I thought plate tectonics was a theory that explained all. At the time current research was focussed on the Pacific Ocean hot spots and the plate motions associated with those hotspots. Papers being published showed static hotspots generating linear chains of volcanic islands as the Pacific plate moved over them.

Having just learnt how to use stereonets to solve problems in structural geology I saw that these could also be used to determine the motion of tectonic plates adjacent to the Pacific plate and thus with respect to the hotspot reference frame. It was just a matter of plotting up the linear magnetic reversal patterns, the spreading ridges and the transform faults to work out the pole of rotation (plate motion is defined by the rotation axis of the plate) of an adjacent plate bounded by a spreading ridge. Once I had determined the motion of the adjacent plates I could then extend the method to find the motion of other plates where they were bounded by spreading ridges. This procedure enabled me to determine the absolute motion of most plates, in terms of average motion, for the last 20 MY. This was not a new idea as instantaneous plate motion was also being worked out by professional academics using computer modelling. However I took

Cont. Overleaf

New Ideas in Science, a Geologists Perspective

Cont. from Page 11

my plots a stage further by presenting the motion of the plates as a map with each plate's lines of latitude representing plate direction and the longitude as movement timelines showing the plates speed (Fig 1).

This presentation method was not used in the published literature for plate motion analysis. From my reconstructions it was evident that the subduction systems were generally stationary with respect to the Pacific hotspots and with respect to themselves, but on the other hand spreading ridges were quite mobile and had relative motions between themselves and the hotspots. I also noticed that if the Benioff zones were contoured for depth, the 650 kilometre contour linked all the Benioff zones around the world, even the South Sandwich Islands and the Caribbean subduction zones. I called this contour the "line of plate convergence" which wrapped around the Pacific and with a subsidiary branch extending out from the South East Asian area of the Pacific, eastward across to the Mediterranean.

Plate motion analysis also indicated that the driving force behind plate tectonics lies in the subduction process, which given that all Benioff zones are linearly related to each other at the upper-lower mantle boundary, the causal process of plate tectonics is global and imbedded within the lower mantle.

This implies that plate tectonics is not caused by mantle convection and cold slab subduction because, on one hand, plate motion is not driven by spreading ridges, and on the other, plates do not randomly subduct but have a global subduction pattern at the upper-lower mantle boundary.

Much later in life, I carried out further analyses of the surface patterns of various models of convection in the upper and lower mantle, including different coupling models between them, and found that these patterns also had little resemblance to plate tectonics produced ones.

Some years after graduating I tried to publish my ideas with the help from a librarian at the Geological Survey of Western Australia, only to have it rejected because I failed to quote a reference that the referee thought was relevant to the topic, even though the paper had 150 references. I gave up in despair as it was a mammoth job for one individual to undertake the research and to then write the paper in spare time. In my opinion the only way to publish a paper on such a controversial topic would require a team effort rather than an individual one. (Ed: So the herd instinct does have its place?)

When I finally found work after graduation I spent the next ten years working in the Pine Creek Geosyncline, the Kimberley and the Tanami regions where similar rocks of early Proterozoic age are found. I could not wait to develop a plate tectonic interpretation of the geology of the region, but I soon discovered that the characteristic features of plate tectonics I learnt at university were just not there and it took me quite some time to accept this. I also discovered there was a clear change in tectonic style between the Lower Proterozoic rocks of the Pine Creek Geosyncline and the under lying domed Archean rocks. From reading about the geology of the Lower Proterozoic domains elsewhere in the world I discovered a remarkable global similarity of tectonic and sedimentary styles in domains of the same geological age.

This suggested to me that the Earth is dynamically evolving in a global sense and that Archean and Proterozoic tectonics cannot be explained by Plate Tectonic Theory which seemed to be limited to the later stages of geological evolution. The main stumbling block to the development of new tectonic explanations for the Archean and Proterozoic seems to be in the monolithic dominance of Plate Tectonics in academia, reinforced by the peer review system.

Industry geologists are not as constrained by the herd mentality as their academic counterparts and it is from this group that new ideas should sought. However many industry geologists do not have the training to present their ideas within the constraints of the academic system, and of course academia is generally wary of publishing new ideas outside the academic milieu in any case.

One outlet for publishing one's own research is the Independent Scholars Association of Australia (ISAA - http://isaa.org.au) where they state "The Independent Scholars Association of Australia Inc is a network of scholars pursuing interests in the broad streams of the humanities and sciences. Their work is produced in a variety of forms including book and journal publications, films and documentaries, script writing and journalism. As an association ISAA has no political affiliations but seeks to encourage all who, independently of institutions, offer well-founded studies of society, in the humanities and the sciences, or ideas of cultural significance. Scholarship and enthusiasm need to be supported, particularly at a time when governments, and therefore government-funded institutions, tend to regard scholarship as an economic commodity rather than the fabric of civilization." The ISAA accepted one of my articles.

So there are solutions to the problem of publishing new ideas and concepts at variance with the established paradigms maintained by the academic system of peer review. A possible system to allow this is described below

Firstly academia must recognise that it's the scientists outside the academic system who are most likely to produce fresh approaches in a stagnant science and, secondly there needs to be a system where a scientist in industry, or in any other pursuit, can receive training (course work) in research methods, and be provided with a publishing platform that is open to novel ideas. This would require the university system to provide an external studies department which provides courses in research methods and to provide supervisory help relevant to the project that the scientist is pursuing. The courses would require fees to be paid, and an online journal could be set up with a policy to promote new avenues of scientific thought and fresh ideas as a priority over the scientific peer review system.

The present academic system is a well tried and proved system which produces a reliable foundation of science that has been used to develop technology that provides us with present high standard of living. The system does, however, have some failings as outlined by Gold in his article.

While the existing system is not one that can be easily changed, the forces for self preservation are, after all some of the strongest of human instincts, it does work reasonably well irrespective of Dr Gold's criticisms, so the system needs to be added to, rather than forcibly changed. 'The present scientific academic system of a rigidly controlled research methodology needs to be a collaboration with a secondary system whose policies allow broad scientific ideas and new ideas from scientists outside academia to be published. While not to the rigorous standards of academia, these secondary publications would, hopefully, initiate new avenues for further research in the established scientific system. This secondary system would be a sort of multidisciplinary one in which scientists might be able to publish their ideas about areas of science peripheral to their main interests. ▲▲

Announcement of Planned Revision of the 2004 JORC Code

AT ITS RECENT MEETING JORC decided that the time was right to commence a revision of the 2004 JORC Code.

As in the past this process will involve the development of an exposure draft and a request for submissions from interested and involved parties. Following consideration of the submissions and incorporation as necessary, the final draft will be forwarded to JORC's parent bodies (MCA, The AusIMM and AIG) for approval. Following their approval the draft will be forwarded to ASX and by ASX to ASIC for their final approval.

JORC envisage a two stage process for this revision.

1. A "tidying up" of the 2004 JORC Code to incorporate appropriate matters from recent ASX Companies Updates 05/04, 03/07 and 03/08). Several other minor inconsistencies will be rectified at the same time. It is not envisaged that material from Companies Update 11/07 dealing with historical and foreign estimates will be incorporated in this review as it deals with matters outside the operation of the JORC Code.

   An exposure draft will be issued for comment, expected to be in October this year, with comments restricted to the matters amended, prior to finalisation of this version of the "2004 JORC Code amended 2009", which will be issued later in the year. JORC does not envisage any material changes in this first stage.

2. Immediately following the finalisation of the above JORC will call for public submissions on matters relating to the JORC Code. JORC would expect to consider matters for review ranging from recent revisions to other Codes and matters of concern to the exploration, mining and investment communities using the Code within Australia and New Zealand and those reporting in Australasian jurisdictions.

JORC note that there was a period of extensive public consultation in 2005 shortly after the release of the 2004 JORC Code on matters related to Inferred Resources and the results of this consultation were incorporated into ASX Companies Update 03/07.

JORC has established a number of sub-committees to undertake the initial review.

Peter Stoker, Chairman, JORC

21 July 2009

Modern Times — Modern Solutions

Louis Hissink

DECADES AGO WHEN THE editor donned standard brown overalls, wellingtons with steel caps, miner's lamp and standard round hard hat to work underground at Kambalda, little attention was paid to ensuring the safety of life and limb.

In those days it was nothing to crawl on top of cut and fill stopes with the mine foreman to check out mined zones, or drive down the development decline only to find on the way back that our exit was blocked by an inconvenient lump of "backs" that fell onto the decline, or to those members unfamiliar with old school terms, a large lump of rock that fell from the top of the tunnel.

Ventilation was adequate but sometimes it became hot and steamy, and occasionally one would find oneself in stygian darkness when the battery died on the miner's lamp, usually somewhere inconvenient in the mine, far away from the charging stations on surface.

Underground collapse of the workings was always an imminent danger, though some mines were safer than others, the risk was always there. In those days we knew how to recognise unsupported rock — when tapped with a G-Pick a dead "drummy" sound was

heard and indicated that some "scaling" needed to be done to make the workplace safer.

Mine collapses, though infrequent, were not events one wanted to be in — those days one had to exist on the available air supply, there wasn't any communication with the surface, and as the lamp batteries only lasted a shift, it soon turned into a dark oppressive situation from hell minus the fire.

But things have changed and these days underground rock collapses, while as unpredictable as ever, are more easily coped with since the introduction of Mine Safety refuges.

Each unit has all the necessary resources to sustain human life for up to 96 hours, more than enough time for the mine safety divisions to respond. The units have communications with the surface, and from what the editor hears, have accommodation standards close to 5 Star rating. (I wonder if they come with ash trays since in the good old days most of us used to smoke cigarettes underground. I suspect not these days — and yes, the editor stopped that habit in 1982). ▲▲

From the Editor

This issue of AIG News contains the latest in the Victorian Gold Series, as well as a thought provoking article from one of our members. The Letters Page has suddenly expanded with letters about climate change, and the future of the AIG as an organisation in light of the idea of a possible merger between AIG and the Geological Society of Australia — strong opinions are evident.

AIG News also reports on the recent AIG sponsored debate about Climate Change between Professor Ian Plimer and Gary Warden — as well as a factual article on the geology of polar ice sheets by Professor Cliff Ollier and Colin Pain.

The American Chemical Society (ostensibly the largest professional scientific society in the world) is experiencing a revolt by its members concerning editorial policy of its C & E News — and a short extract is published on page 31. The main cause of the revolt was the unbalanced reporting of the climate change debate in C & E News, and it's pretty serious with calls for the dismissal of the editor-in chief Rudy Baum. More about the situation can be read in the supplied link to the internet.

Historian Naomi Oreske has pointed out, as she sees it, a problem with scientific truth: *"The history of science demonstrates, however, that the scientific truths of yesterday are often viewed as misconceptions, and, conversely, that ideas rejected in the past may now be considered true. History is littered with the discarded beliefs of yesteryear, and the present is populated by epistemic corrections. This realization leads us to the central problem of the history and philosophy of science: How are we to evaluate contemporary sciences' claims to truth given the perishability of past scientific knowledge? ... If the truths of today are the falsehoods of tomorrow, what does this say about the nature of scientific truth?" — Naomi Oreskes, historian, 1999".*

There is a good case to be made for the view that what Oreskes is describing is not so much science per se but pseudoscience, (See AIG News February 2007) in which the intellectual paraphernalia of the scientific method is used to derive conclusions from an initially unsubstantiated assumption of some agreed on perceived universal truth. The problem is one of "What if the original assumption is found to be wrong". The late Fred Hoyle pointed out that when a scientific fact becomes established it very quickly becomes an engineering problem and is universally accepted because it works. But he also noted that when vast amounts of money are thrown at a scientific problem involving the work of many scientists over a long period of time and the scientific "problem" remains controversial, then it is in all likelihood that the wrong ideas are being used to study that scientific problem.

Climate change or the anthropogenic global warming hypothesis is ultimately based on Svante Arrhenius' idea that a reduction in atmospheric CO_2 caused ice ages, leading to the corollary that increasing atmospheric CO_2 causes warming. This hypothesis has never been verified and to this day we, as geologists, still do not know what causes ice ages. Equally the corollary, known as climate sensitivity, has also not been empirically verified, but has been agreed on to be, more or less, correct with disagreement centring on how much warming is being caused by a specific increase in atmospheric CO_2 levels.

So what if the idea of climate sensitivity, that a doubling of atmospheric CO_2 causes a specific rise in atmospheric temperature, is wrong? And if this hypothesis is replaced by some other, agreed upon other hypothesis, leading to a Kuhnian paradigm shift, are we then dealing with science, or pseudoscience.

Louis Hissink

Climate Issues

AS VICTORIAN MEMBERS may know, we had Professor Bob Carter in Bendigo the last week in June refuting the IPCC conclusions, and pointing out the global cooling that has been going on since 1998.

Lately I have been using carbonate assays to act as a proxy for alteration halos in the search for gold undercover in central Victoria. In unmineralised country (i.e. Ordovician turbidites) the carbonate content is around 0.1 to 0.2% measured as CO_2 (and higher in mineralised areas). The carbonate is found as calcite in quartz-calcite veins, and as diffused carbonate (calcite, dolomite) within the porosity of the sandstones.

0.1% means around 3,000,000 tonnes of CO_2 in each cubic kilometre of rock. The CO_2 was emplaced in the rock at depths with enough pressure to maintain dissolution of the CO_2 in the ground water during tectonic activity. Near surface, this CO_2 would escape to the atmosphere.

So how much CO_2 is released during earthquakes? Forget volcanoes. Even though there are 600 active volcanoes being monitored, and there are far more along the mid-ocean rifts, each hot spring releases the equivalent CO_2 as a 1000 MW coal burning power station, each and every day and earthquakes are happening all over the planet, every day.

The amount of CO_2 released by human activity is peanuts compared to natural events. So human CO_2 emissions cannot have any noticeable effect on climate, and to maintain we can stop global warming, or enhance the present global cooling, is nonsense from arrogant people with delusions of grandeur.

Back to Bob Carter. About 80-100 people attended the presentation in Bendigo. No-one was under 40, and probably 2 people under 50. I asked Bob if this was common in his presentations around the country, and he answered, "unfortunately, yes. Apart from the isolated events when young people associated with green groups came with the sole intention of disruption, rather than information.". (again, a touch of arrogance).

One of Bob's principal objectives at the moment is to make people aware of the folly of an Emissions Trading Scheme. This is really a tax on energy use, which will be passed on to every consumer, not only of fuel and electricity, but of everything that is grown, mined and manufactured. But the younger generations are not interested in listening. I don't care. By the time the taxes really start to bite, I will be retired, and getting pensioner discounts on electricity and gas. Gen X and Gen Y have a whole lifetime to suffer these taxes.

Geoff Turner

More on Climate

THANKS FOR ANOTHER interesting AIG news. I enjoy reading it, and I like the fact that you publish articles that are of general interest as well as industry specific.

I read with interest the 'letter from the editor' and your comments about the climate change debate. While I think your heart was in the right place, I don't think using snide language to refer to the climate change 'Herd' and their 'nonsense' does anything to enhance the opposing view.

I loved Ian Plimer's book 'Telling Lies for God' and although I have not read his new book on climate change, I have read a number of his articles in the press. Unfortunately he also used the same kind of patronising language, and that disappointed me. Perhaps this is a response to mud slinging from the other side, as it's hard not to use emotional language when being unfairly criticised. I do think, however, that as professional scientists we should always try to take the moral high ground when debating and not be drawn into childish name calling. It does nothing to bolster the argument.

I think it's very easy as geologists to be flippant or unemotional about the climate change debate because we are so used to seeing evidence of natural climate change and mass extinctions in the geological record. But I think that misses the point. I don't think the point of the current debate is 'So what, climate change has happened before' but 'To what extent is society contributing to climate change, and if we can't be sure, should we bother doing anything about it or not?' In saying this I don't want to come across as a climate change apologist, because I'm not. It's like the nuclear power debate. I want to know the facts before making a decision, and not rely on emotion and preconceptions.

To be honest, I found Ian Plimer's articles reassuring. They took away a lot of the 'guilt' about climate change, and it was refreshing to have the holes in the man-made climate change theory exposed (e.g. the role of H_20 as a greenhouse gas being largely ignored). I'm much more likely to side with a scientist who can back up their opinions and argue rationally than some conservative shock jock or religious fundamentalist MP, neither of whom seem terribly well qualified to comment on the topic (but who seem to get all the press).

I'd just ask that we try to attack the ball and not the man in this debate. Rather than just giving the other side more of a reason to be upset, it might convince some of them to look at the argument in a calm, rational manner and perhaps change their minds.

Regards
Dan Walding

What it Means to be an MAIG

WITH DISCUSSIONS OF the proposed AIG/GSA merger in the forefront it has become clear to me that there is a growing passion for our current AIG. There are also some misconceptions about the benefits of this proposal.

The AIG does not need to merge with another entity in order to increase its numbers — we are a growing organisation (membership reached 2000 in February 2009). The AIG does not restrict our membership to a narrow field of our profession. We have a wonderful diversity of membership from fields such as hydrogeology, geotechnical and engineering, environmental science, geochemistry, geophysics and information geoscience.

Every professional who is accepted as a member of the AIG acquires the postnominal MAIG that gives status and professional recognition, which is derived directly from our strong eligibility criteria. An immediate consequence is that MAIGs may sign off on exploration reporting as a Competent Person, subject to meeting criteria relevant to the contents of the report. Many choose AIG over AusIMM because the fees are much lower, the bulletin/newsletter more relevant, it appears to be a less formal organisation and the conferences convened by AIG generally more relevant and lots cheaper.

The process for acceptance of members for the AIG is thorough. Applicants must provide evidence of a tertiary degree from an acceptable institution and evidence of not less than 5 years of professional experience as validated by a Proposer and Seconder. AIG's Registered Professional Geoscientist (RPGeo) program is Australia's most rigorous recognition program for continuous professional development by Australian geoscientists. Membership of the AIG has earned the respect of the ASX, ASIC, AusIMM and many reciprocal international bodies and companies.

The AIG supports emerging geoscientists through geoscience bursaries awarded to students at Australian universities each year, by promoting interaction between students and industry with career nights and by offering very low student fees to conferences, workshops and functions.

The AIG actively promotes and enforces professional standards in public reporting through JORC and VALMIN and our own ethics and complaints committee. AIG has continued to support its members during one of the worst downturns the profession has experienced by actively lobbying politicians with employment statistics and by supporting proposals such as the flow-through-share scheme to invigorate the exploration industry.

I think it would be excellent to develop closer ties with GSA but there is no need to wind up a fully functional, vibrant organisation in order to achieve this goal. The stated advantages to the merger can all be achieved by maintaining separate bodies that work together when expedient. Being a member of AIG really means something important to professional geoscientists. The current merger proposal allows graduates with no experience to join as a full member, whereas MAIG requires confirmation of 5 years progress along a professional career path. Save our AIG, and retain the benefits of the grade of MAIG — don't be apathetic, email the AIG or a councillor today with your opinion on the proposed merger.

Kind regards
Wendy Corbett

AIG-GSA Merger. A Mistake?

WE THE UNDERSIGNED are current and former AIG Councillors, including past Presidents who believe the discussed merger with the Geological Society of Australia (GSA) is not in the best interests of the members of the AIG.

Some of the risks, downsides or alternatives to the possible amalgamation with the GSA, which we consider have not been adequately addressed in the merger discussion document, are presented below:

The GSA and AIG comprise quite different groups. The GSA is a learned society dominated by academic and government geoscientists. The AIG is a professional institute with a strong code of ethics administered by an ethics committee, which provides recognition of career development through both membership records and professional registration, and is dominated by industry sector geoscientists. AIG and GSA have very different cultures, run different styles of conferences/symposia and, in our opinion, should be preserved as uniquely functional separate bodies which are capable of close co-operation when appropriate.

With respect to the lobbying power of a merged organisation — The Australian Geoscience Council (AGC) is the peak body for geoscience and represents a considerably larger number of geoscientists than the AIG and GSA combined, and therefore has more potential to be an effective lobbying body. Both the AIG and GSA currently pay capitation to the AGC, which also represents six other geoscientific organisations in this country. Members should be aware that the AIG and GSA already co-operate to organise conferences such as the 2012 International Geological Convention through membership of the AGC. We believe that if the effort and expense of the merger were devoted to improving the AGC, then the combined efforts of all the AGC geoscience bodies would be much greater than the efforts of a merged AIG-GSA body. The current AGC President and the current AGC Chairman are former AIG presidents, so we are well represented.

The status of your AIG membership will definitely be reduced by the current merger proposal because the basic level of membership will require no professional experience (the AIG requires five years). Your membership of the AIG has earned the respect of the ASX, ASIC, AusIMM and many international professional institutes and regulatory authorities. Under the planned merger structure, your AIG membership will no longer be equivalent to membership of the AusIMM. There is no guarantee that membership of the merged body will qualify for competent person status under the JORC Code. This diminution of the status of AIG membership should be rejected by all AIG members.

Any economic benefits of the merger have not yet been clearly demonstrated to AIG members. The sum of the GSA and AIG would be a larger body that may not benefit from the abundance of voluntary labour that has made the AIG such a great success. Similarly, we do not know how responsive a larger body will be to individual members.

Your AIG has been a successful organisation and continues to grow. The merger plan involves the winding up of the AIG with AIG members transferred to a re-named GSA, which is an effective take-over. The discussion document provided to you contains no explanation as to why the AIG should be the institution that is to be wound-up rather than the GSA. We believe the easier option has been chosen because of the AIG's simple structure which functions well, whereas the GSA's structure is complicated by the many autonomous groups. Do we really want to shut our Institute down?

There is a risk that the character of the body that represents us as professional geoscientists will change and that important aspects of the AIG relevant to the recognition of our professional experience and qualifications in hydrology, geotechnical engineering, environmental geology and exploration and mining (JORC Code) may become administered by a council no longer controlled by industry geoscientists. The status of Professional Registration could be placed at risk.

We recommend that AIG Members retain the AIG as the successful body it is and co-operate with the GSA where of benefit to both groups, and utilise the AGC where appropriate. There is a precedent for closer co-operation as the GSA facilitated the birth of the AIG when, after the shenanigans of the 1970's Ni boom, the AIG founders felt there were insufficient controls on malpractice or representation to government available to geoscientists, and the GSA declined to take on some AIG responsibilities. Many of us therefore wish to continue to be members of both bodies.

Greg Corbett - AIG Councillor and past AIG President. GSA member

Wendy Corbett - AIG Councillor

Kaylene Camuti - AIG Councillor and GSA member

Graham Teale - AIG Councillor and GSA member

R.N. (Sam) Lees - former AIG Councillor and GSA member

Ian Levy - past AIG President and past Vice-Chairman of JORC Committee

Geoff Turner - former AIG Councillor and GSA member

John Bishop - former AIG Councillor and GSA member

Perhaps we Need the "Geoscience Institute of Australia"?

IN HIS REPORT to the AGM of the Australian Geoscience Council (AGC) held in Canberra on 27 May 2009, the out-going President Dr. Trevor Powell commented on the capacity of the AGC to meet its goals. He noted that the stated objectives of the AGC are:

- To provide expert apolitical advice to governments on matters involving the geosciences and their application,
- To promote the development of scientifically sound policies for effective geoscience education and research; and
- To provide the Australian public with a greater appreciation of the economic, environmental and cultural values of the geosciences.

Dr. Powell advised that the AGC is able to respond to major reviews and announcements of government in regard to the first two goals, despite the somewhat limited capacity of the AGC to engage as fully as desired in all debates.

In regard to the last objective, Dr Powell stated that the AGC lacks any significant capacity, and raised the question of whether the geoscience community is too fragmented to provide an appreciation of the economic, environmental and cultural values of the geosciences. He commented "that the geoscience community is not well served by idiosyncratic views being put forward by individuals on some matters, and the profession as distinct from the industry is pretty well invisible in some difficult debates. Member societies have to think of a way they can co-operate more effectively".

The fragmentation of geoscience effort in Australia has been a constraint on the effectiveness of the AGC for many years. Understandably, the member societies place primary focus on the growth and efficient functioning of their own organisations. While the AGC representatives of the societies have always shown a strong willingness to present a unified approach in responses to government inquiries on individual matters, this process is led by the incumbent AGC President, with his draft submission modified by the particular views of representatives of the day. The AGC would be more influential if it was capable of sustained advocacy from a consistent team of society representatives, who could maintain a constant campaign to ensure effective communication on behalf of all Australian geoscientists.

This writer suggests that the numerous geoscientific bodies in Australia should give serious consideration to combining their operations to ensure better delivery of services to members, and to provide the Australian public with a greater appreciation of the economic, environmental and cultural values of the geosciences.

Two geoscience bodies, the AIG and the GSA, are currently considering a merger proposal which has generated discussion on web sites (and in this issue of AIG News). The AIG is a professional institute which represents geoscientists across all fields of practice including geologists, geophysicists, geochemists, hydrogeologists, engineering geoscientists, environmental geoscientists and specialist geologists of many kinds, and members of the AIG are not restricted to any particular group of resource commodities. The GSA is a learned society of geologists which is focused on the delivery of high quality publications, major international conferences and local meetings primarily targeting the academic progression of the science of geology.

The current proposal for amalgamation with a society of geologists does not maintain the interests of AIG's members who are not geologists — that is, those who are geophysicists, geochemists, hydrogeologists and other specialist geoscientists. If the AIG deems a merger with a geological learned society to be beneficial, then it should also be beneficial to move towards a merger with Australia's learned geophysical society, the ASEG. An alignment with the Australian members of the learned geochemical body, the AAG, as well as the Australian chapter of the International Hydrogeological Society (IAH) could also be beneficial. The Australian Geomechanical Society represents geotechnical geologists and engineers, while AGIA represents Australian specialists in geoscience information.

While debate within the AIG is currently based on the potential risks and benefits of the proposed model for a merger with the GSA, this writer believes that the debate should address "Is this the best form of merger for Australian geoscientists?" The answer is that it is not.

Readers will ask "Is it possible for 5 or 6 separate bodies to become a single organisation conducting both learned and professional aspects of society operations?" The answer here is yes, and the model is the Spatial Science Institute of Australia (SSIA). The SSIA formed in 2003 by the merger of five distinct societies functioning in separate fields of surveying in Australia. The particular interests of those former societies are maintained through five Commissions within the SSIA. The SSIA provides a strong program of accreditation for professional surveyors, comparable to the AIG's RPGeo program.

The solution to Australia's fragmented geoscience community might be a new body with a name such as the Australian Union of Geoscientists, within which a "commission" would retain the name AIG in order to preserve the recognition of AIG by the ASX, JORC, ASIC and international legislations.

The first benefit of such a broad merger would be the establishment of a scientific journal of international stature, serving all disciplines of the geosciences, and selectively downloadable according to interest. At present, specialised journals in the fields of exploration geophysics, exploration geochemistry, hydrogeology and engineering geology suffer from low rankings which deter publication of papers by Australian researchers.

A second major benefit would be the cost savings in the replacement of five separate administrative systems by a single secretariat. Other benefits would be improved conferences, joint symposia and workshops (as well as regular events focused on particular fields of practice), highly coordinated advocacy to government and better representation of the importance of the geosciences to the public.

This is not a new concept. The unification of our professional and learned geoscience societies was raised at the "Future Directions Symposium" held on 7 February 2004 during the 17th Australian Geological Convention held in Hobart. The achievement of the various surveying bodies in forming the Spatial Sciences Institute was raised by Geoscience Australia Director Neil Williams as a positive example for the geosciences. At that time the recent formation of the SSIA did not provide a persuasive example. With six years of operation, the SSIA is now a more positive model for amalgamation of geoscience societies.

On the other hand, if the Australian geoscience societies choose to preserve their individual and specialised functions, then the national executives of these societies might consider increasing the financial and organisational effectiveness of the Australian Geoscience Council in order to improve the Council's capacity to fulfill its objectives as stated at the front of this discussion.

Mike Smith
AIG Past President & ASEG Past President

Why the Greenland and Antarctic Ice Sheets are Not Collapsing

Cliff Ollier
School of Earth and Geographical Sciences, The University of Western Australia, Crawley, WA 6009, Australia.
cliffol@cyllene.uwa.edu.au
Colin Pain
803/222 City Walk, Canberra City ACT 2601, Australia.
colinpain@internode.on.net

Global warming alarmists have suggested that the ice sheets of Greenland and Antarctica may collapse, causing disastrous sea level rise. This idea is based on the concept of an ice sheet sliding down an inclined plane on a base lubricated by meltwater, which is itself increasing because of global warming.

In reality the Greenland and Antarctic ice sheets occupy deep basins, and cannot slide down a plane. Furthermore glacial flow depends on stress (including the important yield stress) as well as temperature, and much of the ice sheets are well below melting point.

The accumulation of kilometres of undisturbed ice in cores in Greenland and Antarctica (the same ones that are sometimes used to fuel ideas of global warming) show hundreds of thousands of years of accumulation with no melting or flow. Except around the edges, ice sheets flow at the base, and depend on geothermal heat, not the climate at the surface. It is impossible for the Greenland and Antarctic ice sheets to 'collapse'.

In these days of alarmist warnings about climate warming, the ice sheets of Greenland and Antarctica have an important role. Many papers have described their melting at the present times, and dire predictions of many metres of sea level rise are common. Christoffersen and Hambrey published a typical paper on the Greenland ice sheet in *Geology Today* in May, 2006.

Their model, unfortunately, includes neither the main form of the Greenland Ice Sheet, nor an understanding of how glaciers flow. They predict the behaviour of the Ice Sheet based on melting and accumulation rates at the present day, and the concept of an ice sheet sliding down an inclined plane on a base lubricated by meltwater, which is itself increasing because of global warming. The same misconception is present in textbooks such as *The Great Ice Age* (2000) by R.C.L. Wilson and others, popular magazines such as the June 2007 issue of *National Geographic*, and other scientific articles such as Bamber et al. (2007), which can be regarded as a typical modelling contribution. The idea of a glacier sliding downhill on a base lubricated by meltwater seemed a good idea when first presented by de Saussure in 1779, but a lot has been learned since then.

In the present paper we shall try to show how the mechanism of glacier flow differs from this simple model, and why it is impossible for the Greenland and Antarctic Ice Sheets to collapse. To understand the relationship between global warming and the breakdown of ice sheets it is necessary to know how ice sheets really work. Ice sheets do not simply grow and melt in response to average global temperature. Anyone with this naïve view would have difficulty in explaining why glaciation has been present in the southern hemisphere for about 30 million years, and in the northern hemisphere for only 3 million years.

A glacier budget

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

When the ice is thick enough it starts to flow under the force of gravity. A mountain glacier flows mainly downhill, but can flow uphill in places, as in the rotational flow that creates cup-shaped cirques. In an ice sheet the flow is from the depositional high centre towards the edges of the ice sheet. The flow of ice is generally slow, as expressed in the common metaphor "glacially slow", but the rate is variable. The Upernivek Glacier in Greenland flows at about 40 metres per day, which is as much as a smaller Alpine glacier covers in a year.

When the ice reaches a lower altitude or lower latitude where temperature is higher it starts to melt and evaporate. (Evaporation and melting together are called ablation, but for simplicity we shall use 'melting' from now on). If growth and melting balance, the glacier appears to be 'stationary'. If precipitation exceeds melting the glacier grows. If melting exceeds precipitation the glacier recedes.

How glaciers move

Flow is mainly by a process called creep, essentially the movement of atoms from one crystal to another. The first clues to this came from the study of lake ice, which can flow at a stress much lower than the shear strength of 'regular' ice if the stress is applied parallel to the lake surface. This results from the crystal properties of ice. Ice is a hexagonal mineral with glide planes parallel to the base. Lake ice is almost like a sheet of columnar basalt, with the c-axes vertical and the glide planes all parallel to the lake surface, so a push parallel to the glide planes deforms the ice readily. Much greater stress is needed to deform ice perpendicular to the glide planes.

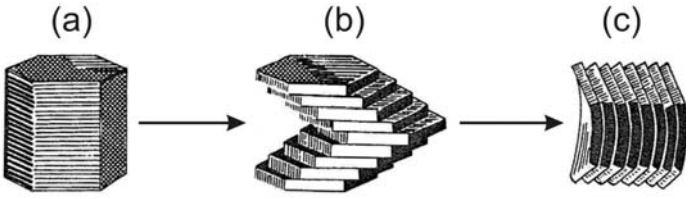


Fig. 1. (a) Hexagonal ice crystal with glide planes parallel to the base. In lake ice the c-axes of the crystals are vertical and the glide planes parallel to the water surface. (b) Crystal deformed plastically by shear stress parallel to the glide planes. (c) Elastic deformation of crystal by strain normal to the glide planes.

Another method of flow is important in 'regular' ice. There is constant gain-and-loss of atoms between different crystals in a mass of ice, and in the absence of any stress an individual grain of ice will lose about the same number of atoms that it gains, and so remain unchanged. But if a crystal is stressed it will lose more atoms than it gains and so shrink, while a nearby unstressed grain will gain more than it loses and so grow. In this way there will be preferential growth of those ice

crystals which are oriented in such a way that their glide planes are parallel to the stress, and grains in other orientations will tend to disappear. This is observed in glaciers, where it is found that not only does a marked crystal orientation appear with distance down-valley, but the ice crystals at a glacier snout may have a volume about a thousand times greater than that of the first-formed ice crystals at the source of the glacier. These observations cannot be explained by mechanisms that ignore the crystal structure of ice.

The flow of material in a solid crystalline state is known as creep.

There are three laws of creep relevant to the flow of ice:

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

All these laws have significant effects on glacier movement, and on how glacial behaviour might be interpreted. Alpine glaciers differ significantly from ice caps like Greenland and Antarctica, even though the laws of physics remain the same, and care is needed to transfer knowledge of one kind of glacier to the other.

Creep is proportional to temperature

The closer the temperature comes to the melting point the greater the creep rate. In experiments at a fixed stress it was found that the creep rate at -1°C is 1000 times greater than at -20°C. In valley glaciers the ice is almost everywhere at the prevailing melting point of ice, because the latent heat of ice is very much greater than its specific heat. Very little heat is required to raise the temperature of an ice block from -1°C to 0°C; it takes about 80 times as much heat to turn the same ice block at 0°C into water at 0°C.

Because the temperature does not vary in valley glaciers they are not affected by this first law of creep. But ice caps are very different. They are cooled to temperatures well below freezing point, which reduces their capacity to flow very greatly. Ice caps can be kilometres thick, and their warmest part is actually the base, where the ice is warmed by the Earth's heat, and where flow is concentrated. The drilling of the Northern Greenland Ice Core Project (NGRIP) was stopped by relatively high temperatures near the base and new equipment had to be designed to drill the core from 3001 m to 3085 m. Because ice flows only at the base, great thicknesses of stratified ice can accumulate, as revealed in the ice cores.

The reports about some Greenland cores claim no flow at all! This is presumably the result of cold-based ice. A large geomorphology literature describes delicate landforms such as tors and patterned ground in areas that were formerly covered by an ice sheet. The general view is that cold-based ice essentially preserves any pre-existing landforms, and the erosion potential of cold-based ice is zero or minimal. Importantly for ideas of 'collapse', the ice is not sliding. Indeed it is not moving at all.

Greenland differs from Antarctica in that the ice sheet spills out through gaps in the mountain rim, and the glaciers overlie deep narrow valleys. According to van der Veen and others such valleys have higher than usual geothermal gradients, so it might be geothermal heat, rather than global warming, that causes some Greenland glaciers to have higher than usual flow rates. The overspills have some of the characteristics of alpine glaciers, where evidence of glacier recession is more obvious. In many parts of the world glaciers have been receding since 1895 and with increasing pace since 1930. There is no obvious explanation for this and these dates have no clear counterpart in temperature or carbon dioxide records.

Creep is proportional to stress

Stress in this context is essentially proportional to the weight of overlying ice. This means that the thicker the ice the faster the flow, but a great stress is required if the ice is very cold. This is shown by the huge thicknesses of ice that are undisturbed, as revealed by the ice cores that are used to work out palaeoclimates. In Antarctica, in the Vostok cores the undisturbed ice that provides the desired information continued to a depth of 3310 m or 414,000 years, but below this the ice starts to be deformed.

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

At the surface there is no stress, so the ice does not flow. However, at a certain depth the weight of ice is sufficient to cause flow, and all the ice below this limit must flow. The threshold boundary between non-flowing ice and flowing ice marks the yield stress level. The brittle upper ice is a solid being carried along on plastic ice beneath. In a valley glacier there is frictional drag at the base and sides, so the maximum flow is somewhere in the middle. This was proved long ago by placing stakes or stones in a line across a glacier, and noting how those in the middle moved furthest. Since the flow is uneven the solid, brittle ice is broken up by a series of cracks called crevasses. The base of crevasses marks the position of the yield stress and the transition from brittle to plastic ice.

In Antarctic and Greenland ice sheets crevasses occur where the ice is flowing towards the edge, but not in the areas of accumulation.

Some results of the laws of glacier flow

These simple rules of creep allow us to understand some observations on glaciers.

Glacial surges

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

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Why the Greenland and Antarctic Ice Sheets are Not Collapsing

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Melting and climate

On July 21, 1983, the lowest reliably measured temperature ever recorded on Earth was at Vostok with -89.2 °C. The highest recorded temperature at Vostok is -19° C, which occurred in January 1992, and during the month of July 1987 the temperature never rose above -72.2° C. At these temperatures ice cannot flow under the pressures that prevail near the surface. Warming has no effect at such low temperatures because ice will not flow faster at -60°C than at -70° C.

In the case of ice sheets it may take many thousands of years for ice to flow from the accumulation area to the melting area. That is why meteorites such as the one from Antarctica that was thought to contain Martian fossils take thousands of years to reach places where they can be collected from the surface. The balance between movement and melting therefore does not relate to today's climate, but to the climate thousands of years ago.

Glaciers and precipitation

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

Icebergs

Where ice sheets or individual glaciers reach the sea, the ice floats and eventually breaks off to form icebergs. This is inevitable so long as glaciers reach the sea. In the southern hemisphere Captain Cook saw icebergs on his search for the great south land. Icebergs have long been familiar to sailors in the northern hemisphere, and the Titanic struck one that had drifted farther south than usual in 1912. The actual break is inevitably a sudden event which can be built into a typical Greenhouse-Horror scenario. Early in 2007, when a piece of the Greenland ice shelf broke away, the scientists interviewed all said they were surprised at how suddenly it happened. How else but suddenly would a piece of ice shelf break off? And this was an area that was ice-free before the Little Ice Age. Arctic explorers used to get their ships a lot closer to northern Greenland than you can now.

The point to remember is that the release of icebergs at the edge of an ice cap does not in any way reflect the flow of ice in the deep interior basin.

The age of ice sheets

In the Greenland ice sheet several cores have more than 3 km of undisturbed ice which go back in time for over 105,000 years, much less than the Antarctic equivalent. The Vostok cores in Antarctica provide data for the past 414,000 years before the ice starts to be deformed. Dome F core reached 3035 m and Dome C core 3309 m,

and both date back to 720,000 years. The Epica core in Antarctica goes back to 760,000 years, as does the Guliya core in Tibet. But what is more important than the age is that vast thicknesses of ice are preserved, and they retain complete records of deposition, in spite of the fact that temperatures at times during that period have been warmer than now. They do not fit the model of surface melting, either now or then. After three quarters of a million years of documented continuous accumulation, how can we believe that right now the world's ice sheets are collapsing!

The collapse of ice sheets

Some of the present-day claims that ice sheets 'collapse' are based on false concepts. Ice sheets do not melt from the surface down — they melt only at the edges. Once the edges are lost, further loss depends on the rate of flow of the ice. The rate of flow of ice does not depend on the present climate, but on the amount of ice already accumulated, and that will keep it flowing for a very long time. It is possible that any increase in temperature will cause increased snowfall thereby nourishing the growth of the ice sheet, not diminishing it.

The very ice cores that are used to determine climates over the past 400,000 years also show that the ice sheet has accumulated over that period by stratigraphic layers of snow, and has not been deformed or remelted. The mechanism portrayed by Christoffersen and Hambrey, of meltwater lakes on the surface finding their way down through cracks in the ice and lubricating the bottom of the glacier is not compatible with accumulation of undisturbed snow layers. It might conceivably work on valley glaciers, but it tells us nothing of the 'collapse' of ice sheets.

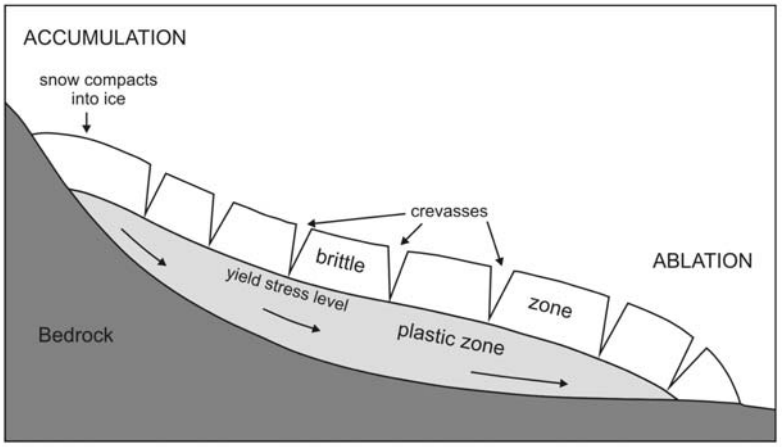

Fig. 2. Diagrammatic long section of a glacier showing the effect of yield stress. Ice stressed beyond yield stress will flow plastically; ice with stress below yield stress will remain brittle, so motion forms cracks (crevasses).

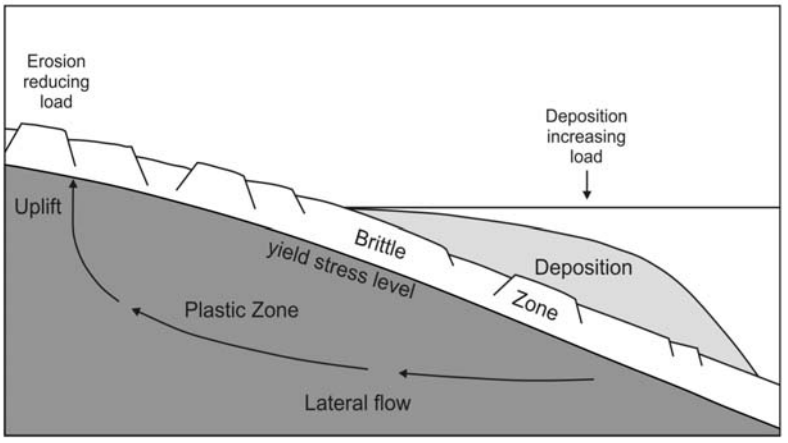

Fig. 3. The analogy of a continental margin with a glacier. Erosion inland and deposition offshore cause isostatic adjustment, which indicates flow in the plastic zone at depth. The upper, brittle zone may be faulted.

Geological associations

This discussion of ice sheets raises two other geological matters.

Continents and ice sheets

It may be helpful for geologists to compare the general structure of continents with that of ice sheets (Figures 2 and 3). Both have a brittle zone over a plastic zone. In valley glaciers the lower zone is flowing by plastic flow, and the upper part is carried along as a brittle body. As the flow is faster in the centre than at the edges stresses are set up that cause the ice to break up. The cracks are crevasses. The depth of the bottom of the crevasses marks the threshold boundary between brittle and plastic zones. In continents brittle tectonics dominates the upper part of the crust, but the lower part may flow. This is the realm of gneisses and schists. Of course, glacier ice is a mono-mineralic metamorphic rock.

Ice sheet basins

Another problem of the Greenland and Antarctic ice sheets is this: Did the ice sheet fill a pre-existing basin, or did the weight of the ice create the basin?

It is generally assumed that the increasing weight as an ice cap grows will cause an isostatic sinking of the underlying rocks, and ever-increasing thickness of ice will cause ever more subsidence.

Alternatively, since many continents have mountains on their edges and lowlands in the middle (Fig. 4), Antarctica and Greenland may have had a similar depression even before ice started to accumulate. An initial basin would provide ideal conditions for the collection of ice if the climate was right. Isostasy could enhance the effect, but does not have the problem of initiating it. This idea might be relevant to the problem of why the Canadian and Scandinavian ice sheets melt frequently while the Greenland and Antarctic ones do not. The former do not have a deep basin in which ice can accumulate and gain sufficient thickness to cause isostatic feedback.

The reverse scenario is that melting of an ice sheet will cause uplift of the land. This is happening in Hudson's Bay and Scandinavia. Stockholm is rising at about a millimetre per year, and Viking ports are now up to 9 km inland. This isostatic response means that the crust must be flowing at depth, in the plastic zone, by creep. Creep in the mantle takes time, so Scandinavia is still rising, thousands of years after the ice load was removed. In the same way the flow of ice-caps is responding to the ancient build-up of potential energy, despite current melting at the ice front. The melting of a few decades is no indication of 'collapse' of the ice sheets.

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Why the Greenland and Antarctic Ice Sheets are Not Collapsing

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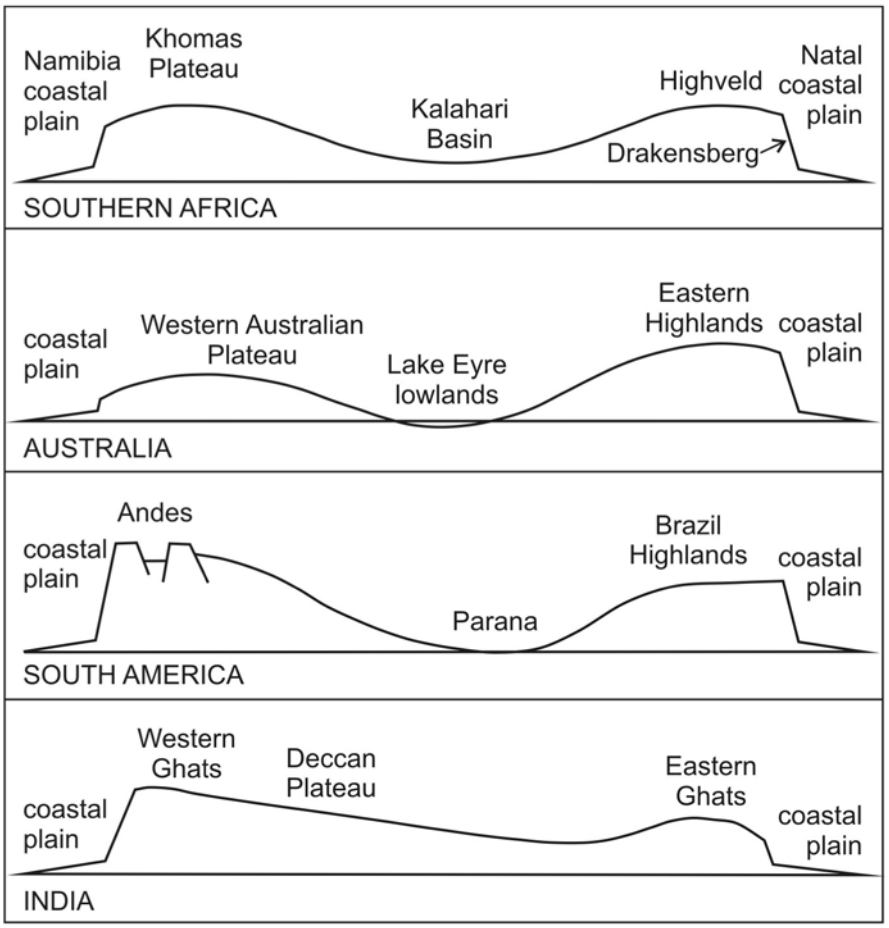

Fig. 4. Simplified cross sections of continents showing that a central depression may be a general feature. Greenland and West Antarctica are roughly similar to the Southern Africa in cross section, but with an ice cap in the depression.

Conclusion

The global warming doomsday writers claim the ice sheets are melting catastrophically, and will cause a sudden rise in sea level of many metres. This ignores the mechanism of glacier flow which is by creep: glaciers are not melting from the surface down, nor are they sliding down an inclined plane lubricated by meltwater. The existence of ice over 3 km thick preserving details of past snowfall and atmospheres, used to decipher past temperature and CO_2 levels, shows that the ice sheets have accumulated for hundreds of thousands of years without melting. Variations in melting around the edges of ice sheets are no indication that they are collapsing. Indeed 'collapse' is impossible. ▲▲

Suggestions for further reading

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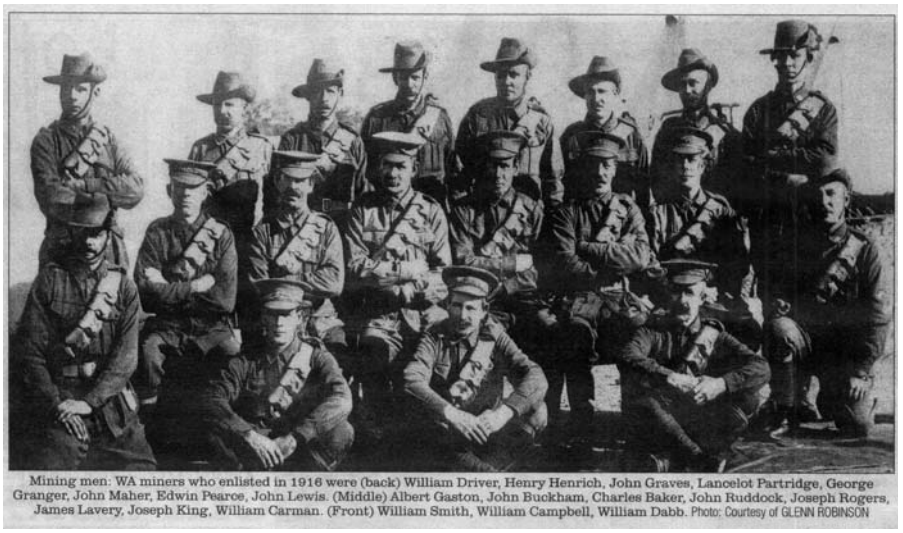
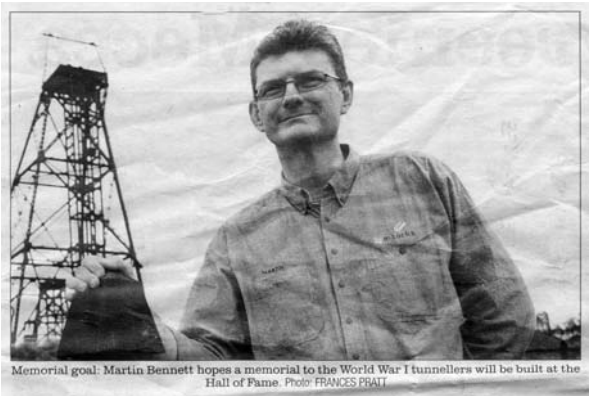
Tunnelers of Yore



Mining men: WA miners who enlisted in 1916 were (back) William Driver, Henry Henrich, John Graves, Lancelot Partridge, George Granger, John Maher, Edwin Pearce, John Lewis. (Middle) Albert Gaston, John Buckham, Charles Baker, John Ruddock, Joseph Rogers, James Lavery, Joseph King, William Carman. (Front) William Smith, William Campbell, William Dabb. Photo: Courtesy of GLENN ROBINSON

WHILE MOST OF US WOULD have thought that digging tunnels was something miners did, AIG News was recently alerted to an older tunneling job, this time in the fields of the Western Front of France and Belgium when many men from the West Australian Goldfields took their mining skills to war as the 1st Australian Mining Corps.

The Kalgoorlie Miner ran an 2009 ANZAC day article "On The Men Who Moved Mountains" recently and move is afoot to establish a memorial to these brave Diggers at the Australian Prospectors and Miners Hall of Fame in Kalgoorlie. Martin Bennett, former exploration manager of La Mancha Gold is on a mission to honour these old war miners who literally undermined the German positions at the Western Front, culminating in the famous blasting of the Messines Ridge on June 7, 1917, breaking the German stranglehold of the Ypres section of the Western Front. Apparently the blast was heard as far away as Dublin, Ireland.



Memorial goal: Martin Bennett hopes a memorial to the World War I tunnellers will be built at the Hall of Fame. Photo: FRANCES PRATT

Of the 300 who enlisted from Western Australia in March 1916, the largest quota from any of the states, most were from the Eastern Goldfields, and few returned, many repatriated dying from tuberculosis shortly afterwards, whether months or at best some years.

Martin Bennett is looking for industry support to help fund this important part of our mining heritage by starting a photographic display as a tribute to those tough old miners but hopes that a more permanent display, and perhaps even a model of a WW1 tunnel could be built as a memorial to them. ▲▲

34th International Geological Congress (IGC) AUSTRALIA 2012

Brisbane, Australia 2-10 August 2012

The 34th International Geological Congress (IGC), or AUSTRALIA 2012, will be held at the Brisbane Convention and Exhibition Centre (BCEC), from 2nd-10th August 2012. The IGC is generally held every four years and has a proud 140 year history. Recent IGCs have attracted 4,500-7,000 delegates, many more than attended the Sydney IGC in 1976.

AUSTRALIA 2012 Organisation

The legal entity responsible for AUSTRALIA 2012 is the Australian Geoscience Council (AGC) Incorporated, the peak representative body of Australia's geoscientists. Individual societies are investing in the IGC.

Core Organising Committee (OC)

The OC for AUSTRALIA 2012 comprises:

President - Neil Williams (GA)

Secretary General - Ian Lambert (GA/GSA)

Deputy Secretary General, Coordination - Paul Kay (GA)

Deputy Secretary General, International - Paulo Vascencelos (U. Qld.)

Treasurer - Miriam Way (AusIMM)

Scientific Program Co-ordination - Lynton Jaques (GA/GSA)

Exhibitions - Andrea Rutley (ASEG)

Sponsorship - Shalene McClure (PESA)

Field Trips - Dave Mason (GS Qld)

Australian Geoscience Council - Michael Leggo

New Zealand representatives - Des Darby, Hamish Campbell (GNS New Zealand)

A Brisbane-based Professional Conference Organiser — Carillon Conference Management — has been appointed.

Geoscience Australia is contributing financially, providing senior staff for the OC and promotion of the event internationally, and facilitating delivery of products for the 34th IGC. State and Northern Territory geological surveys and GNS New Zealand are contributing financially and organising field trips.

Scientific Program

A wide-ranging scientific program under the theme 'Unearthing our Past and Future' will highlight the crucial contributions of geoscience in meeting societal needs and sustaining planet Earth — with particular emphasis on future mineral and energy supplies in a carbon-constrained world, climate change and its impacts on land and water management, mitigation of geohazards, and geoscience information and standards.

The major contemporary issues will be highlighted in plenary 'theme-of-the-day' sessions. Some 25-30 concurrent symposia on a wide range of topics are proposed for each of the 7 full days of technical sessions. Individuals will only be permitted one oral presentation, and there will be strong complementary poster program.

Nominations are currently being sought by experienced conference program organisers to join the Technical Program Sub-committee, chaired by Lynton Jaques.

Field trips

The 34th ICG is planning approximately 30-35 pre- and post-Congress field trips, which offer diverse opportunities to see the fascinating geology of the region. Collectively, these field visits will take in all Australian states and the Northern Territory. Field trips are also being planned to New Zealand, Malaysia and New Caledonia/Vanuatu. A preliminary list of possible trips will be available on the congress web site: www.34igc.org.

There will also be a range of 1 day tours available during the conference.

Nominations are currently being sought for the Field Trip Sub-committee, and for trip leaders. At this stage, field guides are planned to be published on line, based on a template using Google Earth, to be prepared by GA.

Sponsorship and Exhibition

The financial support of Queensland Events Corporation (QEC) for the promotion of the 34th IGC is gratefully acknowledged. This is the first time a scientific Congress has been supported by QEC. The professional and learned societies under the AGC are investing in the Congress. Sponsorship from industry will begin in earnest when the financial climate improves, with Patron sponsorship pitched at $500,000. Specific leads on sponsorship opportunites — particularly to support a GeoHost program for worthy developing country geoscientists — would be welcomed.

A large GeoExpo (trade show) is expected to occupy two exhibition halls. It is planned to offer a complete exhibition hall for petroleum, energy and minerals industry exhibitors, in the first half of the IGC, to be complemented by aligned symposia during the same period. International exhibitors will also include geological surveys, professional/learned societies, scientific publishers, consultants and technical services/products providers.

Involvement of societies

Individual member societies of the AGC are invited to consider how they will participate in the IGC.

It is crucial that the societies appreciate the wonderful opportunity that this prestigious event offers the geoscience community of the region. In acknowledgement of that, some societies have elected not to have their normal scientific business meeting in 2012, but to focus their efforts on the IGC. Others are looking into conducting their normal meetings within the IGC, with enhanced international participation.

The Organising Committee will endeavour to accommodate whatever participation model a society prefers, as long as the link to the IGC is clear.

The societies are urged to suggest as many symposia topics as they would be able to take responsibility for convening with international co-convenors. The Technical Program Sub-committee will ensure provide overall coordination, to minimise unnecessary overlaps and conflicts of topics.

Individuals may wish to include an IGC promotional slide in appropriate presentations.

Further information:

Ian.Lambert@ga.gov.au

Up Coming Conferences and Events

Please visit the AIG Web site (http://www.aig.org,au) for further details of these events

Recent Practical Advances in Mineral Exploration Technology

When: Friday, September 11, 2009, 08:00AM - 05:00PM

Where: The Kirribilli Club, Milsons Point, Sydney

Broken Hill Exploration Initiative

When: Tuesday, September 29, 2009 - Thursday, October 01, 2009, 08:00AM - 05:00PM

Where: Broken Hill Entertainment Centre, Broken Hill NSW

APCOM 2009

When: Tuesday, October 06, 2009 - Friday, October 09, 2009, 08:00AM - 05:00PM

Where: Vancouver Canada

Sustainable Development SD09

When: Monday, October 26, 2009 - Friday, October 30, 2009, 08:00AM - 05:00PM

Where: Adelaide Convention Centre, South Australia

Geoscience for Global Development (GEODEV) 2009

When: Monday, October 26, 2009 - Saturday, October 31, 2009, 08:00AM - 05:00PM

Where: Dhaka Bangladesh

Handheld XRF Workshop – Sydney

When: Friday November 6 2009, 10am to 4pm

Where: Rugby Club, Sydney

WA AIG-GSA Christmas Cruise

When: Friday, December 04, 2009, 12:00PM - 05:00PM

Where: Perth WA

Australian Earth Sciences Convention 2010

When: Sunday, July 04, 2010 - Thursday, July 08, 2010, 08:00AM - 05:00PM

Where: Canberra ACT

5th International Archean Symposium - Evolving Early Earth

When: Sunday, September 05, 2010 - Thursday, September 09, 2010, 08:00AM - 05:00PM

Where: Burswood Entertainment Complex Perth, Western Australia

34th International Geological Congress

When: Thursday, August 02, 2012 - Friday, August 10, 2012, 08:00AM - 05:00PM

Where: Brisbane Qld

For the latest in Geoscientist news, views, codes, events, employment and education visit the AIG website:

www.aig.org.au

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New Partnership Fosters Growth in Geosciences

www.newcastle.edu.au/news/.../newpartnershipfostersgrowthingeosciences.html

THE UNIVERSITY OF NEWCASTLE is joining with the NSW Department of Primary Industries (DPI) to help cement the future viability of the minerals and energy sectors in NSW.

The new venture — the NSW Institute for Frontier Geosciences — will build on the established research strengths of the University in earth sciences, foster increased research collaboration with industry, and boost support for students embarking on a career in the minerals sector.

Vice-Chancellor Professor Nicholas Saunders said the Institute would make a substantial contribution to skills development and training in the geoscience field.

"The Institute will leverage the skills and knowledge of the University, and its research strengths in mineral processing and exploration, sequestration, geology, geophysics and geochemistry," Professor Saunders said.

"Students will benefit through a degree program aligned to the needs of the minerals sector, access to the latest technology and expertise, and industry support for study, work placement and on-the-job training.

"The Institute will take advantage of the natural synergies provided by proximity of the University to long-term suppliers of large tonnage coal deposits, coal-fired power stations and the expertise of DPI's Coal and Petroleum Development group and geological surveyors at Maitland."

The University will appoint a Chair of Geosciences to provide strategic direction, and to promote industry and entrepreneurial engagement to develop the Institute.

DPI will offer students vacation work placement in areas such as research and mapping and graduate employment opportunities. Staff from the University and DPI will also benefit from employment and career growth opportunities. The initiative is supported by the Mine Safety Training Facility, through Doyles Creek.

The NSW Institute for Frontier Geoscience will be located within the School of Environmental and Life Sciences and builds on a recently signed Memorandum of Understanding between the University and DPI.

Professor Saunders said the partnership with DPI also bodes well for future collaborations with other research areas at the University including in water, energy, bio-security, reproduction and marine resources. ▲▲

Education Report

Kaylene Camuti
(Chair, Education Committee)

AIG Student Bursary Program

Applications for the 2009 student bursary program will close in early August and the bursary committee has started to review the applications. At the time of writing we had received applications from over twenty Third Year, Honours and Postgraduate students from twelve universities across Australia.

Teacher Earth Science Education Program (TESEP)

TESEP has continued to provide Professional Development (PD) workshops and teaching resources for science teachers in the eastern states. Although the sponsorship support received to date has not been sufficient to fully fund the program, the continuing hard work and commitment of the TESEP executive have resulted in some positive developments in the last couple of months, including:

- A successful funding submission to the National Water Commission (NWC) for support of workshops module of TESEP. The NWC has joined TESEP at Principal partner level and will provide $250,000 to support the "Wet Rocks" teaching module.
- The addition of the Victorian Department of Primary Industries as a Bronze level partner. The DPI will contribute $15,000 for the development of PD workshops for the coal module of TESEP.

National Science Curriculum Review

Earlier this year the AIG made a submission to the National Curriculum Review of science, in support of a detailed submission prepared by the GSA. The main objective of the GSA submission, and of those from the AIG and AGC, was to call for Earth and Environmental Science to be adopted as the fourth science subject in the proposed National Science Curriculum for senior years. The early draft of the science curriculum framework did not include Earth Science as a core subject in years 11 and 12, although it was included up to year 10.

It is good to report that the submissions did have an effect, and the final frameworks established for the development of the National Science Curriculum now include Earth and Environmental Science. ▲▲

Editorial Woes at American Chemical Society (ACS) C & E News

There is a serious revolt among the members of the American Chemical Society against the editorial policy of their editor in chief of C & E News Rudy Baum and spearheading the revolt is longtime ACS member Steven J. Welcenbach.

He has allowed some of his email exchange into the public domain and it's interesting to read what other scientists think about the Anthropogenic Global Warming Theory as members of a scientific professional society, the largest in the world so it appears.

The main gripe is over the pro anthropogenic global warming editorial slant of C & E News,

"One example that comes to mind is that you published in July of 2007 that "the arctic Ice is melting" in concentrates implicating AGW. But you never published the fact that the Ice has more than returned since to a 50 year high. You also have not published anything about the fact that global temperatures have been decreasing since 1998 and plummeting in the last two years. So there is an excellent example supporting my grief. You did publish something about the cooling sea temps but the article was highly skewed with excuses dismissing the data by AGW advocates. But that's OK. You published it and we could draw our own conclusions."

Source

<http://www.climatedepot.com/a/2248/Update-Scientist-Accuses-American-Chemical-Society-Editor-of-censoring-of-articles-and-letters-that-reject-manmade-global-warming-claims>

RPGeo Approval and Applicants

CANDIDATES APPROVED BY AIG COUNCIL IN MAY AND JULY 2009

Dr. John Bean of Morley, Western Australia, in the fields of Hydrogeology

Mr. Samuel De Beer of Bedfordale, Western Australia, in the field of Mining

Mr. Pierre Rousseau of Como, Western Australia, in the fields of Environmental Geoscience and Geochemistry

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

Ms. Kaylene Camuti of Townsville, Queensland, is applying for registration in the fields of Other Specialist Geoscience (Mineralogy) and Mineral Exploration

Mr. Michael Edwards of Annadale, NSW, is applying for registration in the field of Environmental Geoscience

Mr. Graham Teale of Prospect, South Australia, is applying for registration in the fields of Mineral Exploration, Mining and Other Specialist Geoscience (Mineralogy)

Mr. Jeff Webster of Bayswater, WA, is seeking registration in the fields of Mining and Industrial Minerals.

Membership Update

New Members and Upgrades at the July Council Meeting 2009

MEMBERS

HOGRELIUS	Anders	Bengt
BOYD	Andrew	
FIELDING	David	Clive
MEADE	David	
LARGE	Penelope	Annette
LARGE	Christopher	Perry
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TURNER	Peter	
ONG	Noel	
STYLES	Philip	Clyde
ALLARDYCE	Wendy	
KULDKEPP	Reedik	
CAMERON	Graeme	David
WIPF	Helene	Suzanne

GRADUATES

COOPER	Jessica	Shannon
KWANTES	Ellen	Eveline
WELLARD	Jeneta	Ann
FREWER	Barnabus	Arthur
PATERSON	Gilbert	
DANIEL	Vivien	
STEVANOVIC	Mladen	
SAUNDERS	Blake	Adam
KOEK	Emilie	Elize
GAGNON	Matthieu	

STUDENTS

KLINGBERG	Laura	Lillian
HANSRA	Balraj	Singh
SUTTON	Alexander	James
HORNE	Patric	
GRAHAME	Jarrad	Paul
TALSMP	Aedon	Scott

We welcome all new members to the AIG.

AIG FEDERAL COUNCIL FOR 2009-2010

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.

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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.

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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