Australian Institute of Geoscientists

AIG NEWS

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The Dyke that Sank the Goldfield that Saved Queensland

J.S. Dugdale

Abstract

The discovery of gold at Gympie is claimed to have saved Queensland's statehood and from 1867 to 1927 four million ounces of gold were mined, with the region becoming famous for its fabulously rich gold specimens.

Historically, 20% of hard-rock gold was sourced from the subvertical Inglewood Structure, a 10-20m wide structure comprising auriferous quartz veining, dolerite dykes, and two post-mineralisation microdiorite dykes.

The Scottish Gympie company, historically the goldfield's greatest producer, and the West of Scotland company misidentified the 'Devex Dyke' microdiorite as the Inglewood Structure, leading to the downfall of those companies and the end of the historical phase of gold mining in Gympie in the 1920's.

This geological error enabled a modern phase of mining at Gympie, with >350,000 ounces of gold produced from 1992 to present.

Introduction

With the impending 150th anniversary of Queensland's statehood (1859-2009), it is pertinent to remember that the discovery of the Gympie Goldfield helped the state survive and flourish in its early days.

Gympie's catchcry as 'the town that saved Queensland' arises from the dire financial position of the fledgling state government in 1867 when the Gympie Goldfield was discovered. The ensuing rush to Gympie and taxation of the newfound wealth boosted the state coffers and averted the re-amalgamation of Queensland back into New South Wales.

In the sixty years since discovery, the Gympie Goldfield produced over four million ounces of gold and became famous for the abundance of visible gold contained in the carbonaceous siltstone-hosted quartz reefs. Phenomenally rich patches of reef were termed 'jeweller's shops'

Below: Inglewood Reef

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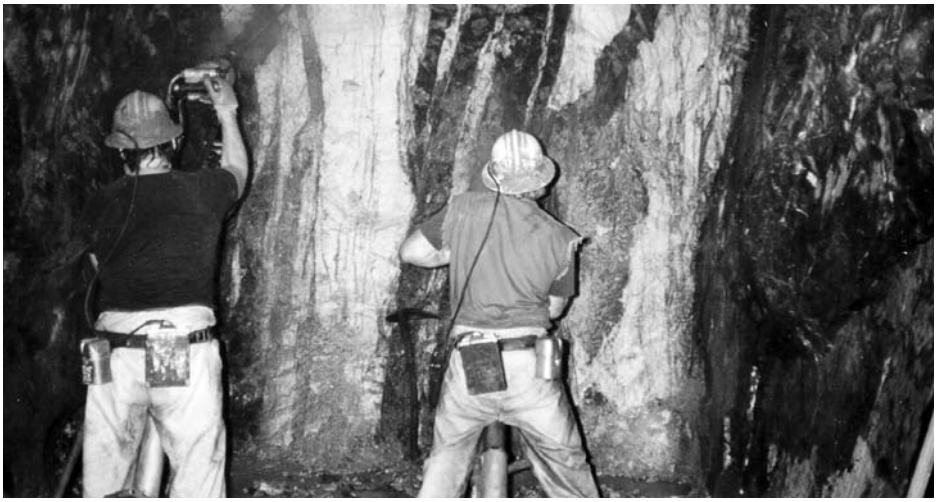

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by the historical miners and rich specimens were displayed in Brisbane, Sydney, and London.

The vast majority of gold was sourced from 'Gympie veins': a quartz vein set with a moderate westerly dip, perpendicular to the shallow east-dipping Permian stratigraphy. However, at the south end of the goldfield, the subvertical and north-west striking Inglewood Reef was discovered, and although lower grade than the Gympie veins, became an important source of gold in the waning stage of the field (1907-1927).

However, the Inglewood Structure confused the historical miners, with dire consequences for the historical phase of gold mining in Gympie.

Local Geology

The Gympie Goldfield, located 150km north of Brisbane, is hosted by the Early Permian to Middle Triassic Gympie Province portion of the New England Fold Belt. The Gympie Province, in the Gympie area, comprises the Gympie Group, the Triassic Keefton Formation and the Kin Kin Beds. Essentially all economic gold mineralisation is confined to the Early to Late Permian Gympie Group, with the stratigraphy at the south end of the field consisting of (from oldest to youngest, Figure 1):

1. Highbury Volcanics: 400m+ ankaramatic basalt lavas, overlain by 250m of dominantly fine sediments and ashfall tuffs, overlain by 300m of basaltic to andesitic lavas and fragmentals.
2. Rammutt Formation: 200m sediment-dominated package including the 60m variably calcareous, pyritic, and carbonaceous siltstone that hosted most economic mineralisation.
3. South Curra Limestone: 80m grey micritic to sparry bioclastic limestone.
4. Tamaree Formation: 800m interbedded siltstone, shale, and lesser coarse sediments; carbonaceous, pyritic, calcareous.

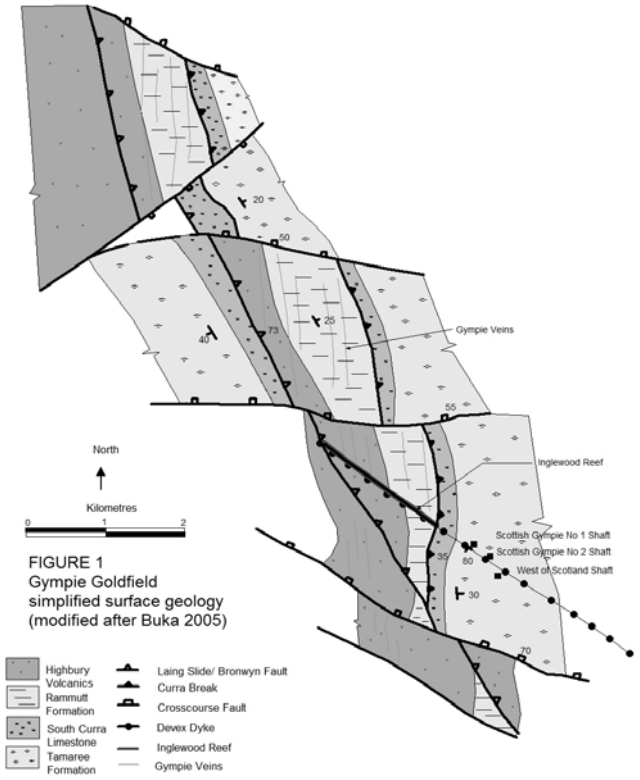

FIGURE 1
Gympie Goldfield
simplified surface geology
(modified after Buka 2005)

Figure 1: Gympie Goldfield

The Inglewood Structure

The Inglewood Structure is typically 10-20m wide, comprising a 0.5-2.0m wide quartz-calcite vein, often accompanied by a dolerite dyke, and two phases of post-mineralisation microdiorite dykes (See photograph on page 1).

At the top of the Rammutt Formation the Inglewood Structure splays into a number of structures and terminates at the base of the South Curra Limestone (Figure 2). This transpressional flower system formed during the sinistral main episode of movement of the structure from mid-Permian to Early Triassic (Witham, 1993), with later transtensional vein and mineralisation emplacement (Arnold, 2000).

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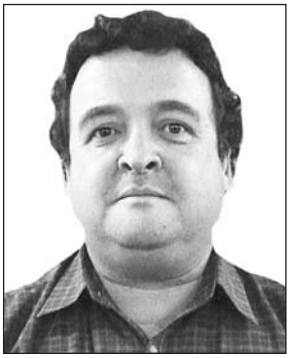
From Your President



WELCOME TO 2009.

After nearly a decade of solid demand for resources and sustained investment in exploration it seems almost unbelievable that the resource industries are looking at conditions that match those seen during the worst years of the 1990s, almost without warning.

The speed with which the current downturn has occurred is little short of staggering and early predictions that Australia would ride out the downturn in better shape than many other countries, which may still turn out to be correct to some extent, but the global nature of the resources sector is ensuring that the impacts of the downturn are being well and truly felt. Predictions that the gold sector or the energy resources sector may avoid experiencing the full impact of the downturn, on the evidence to date, do not appear to be correct.

It makes you wonder about the professionalism and ethics of some individuals in the banking and finance sector whose actions have contributed significantly to a dramatic, further loss of confidence in our financial system.

Governments around the world are taking swift action to stimulate their economies to return to economic growth and it can only be hoped that these actions have the desired outcomes in both the short and longer term.

The exploration and resources sectors have been recognised as being critical to economic recovery in Australia but have seen little in the way of support in any of the initiatives announced by Australian governments, state and federal, to date.

What is AIG doing about it?

Concrete actions to support members commenced during the latter months of last year and several, concrete actions have been put in place.

In the short term:

- We believe strongly that a flow through shares (FTS) scheme would reduce the cyclicity evident in exploration investment in Australia and are actively promoting the introduction of FTS as a means of promoting investment, geoscientist employment and, indirectly, additional employment opportunities in the broader community. Every geoscientist employed in exploration or mining results in a further four other jobs. That represents remarkably effective job creation. The ALP went to the last election with FTS in their party platform. It needs to be implemented now.
- In the next week or two, potentially before you read this newsletter, you will receive an email asking you to participate in a "60 second poll", on-line, to provide hard, factual information about current employment conditions. Please complete the poll when you receive this email, and ask your colleagues to complete it. We need hard facts to bring the full impact of the geoscientist employment and exploration investment issue home to politicians.
- We have been writing to relevant Federal Government Ministers to draw their attention to the importance of a strong geoscience profession in Australia, not just to sustain exploration and mining, but throughout the economy as a whole.
- Again, in the very near future, template letters will be available from the AIG web site with contact information for all Members of Parliament throughout Australia. Please use these to write to your local member. Every letter or email across a politician's desk counts at the moment.
- We are well down the path of establishing a self maintained professional directory on the web site where members can post contact information, and more importantly, unemployed members can promote their availability for employment and both self employed geoscientists and consultants can promote their services. This will be backed by advertising, media releases and direct approaches to both employers and employment agencies promoting the directory as an excellent resource for finding the right person for any opportunities. This resource will be available for use by AIG members exclusively.
- The WA Branch already has a one day seminar to be held in Perth on 19th March for geoscientists facing unemployment or considering their future career development opportunities. We hope to record the talks from this seminar for members outside Perth to view on the AIG web site. Unemployed members and final year students will receive concessional registration for this seminar. Watch the AIG web site for further information.

Taking a longer term view:

- AIG has been consistently and actively promoting improved geoscience education at both secondary and tertiary level and the role of geosciences in society generally. Improved community perception and recognition of the role and importance of geosciences is important in securing support for the profession. Australia needs comprehensively educated geoscientists to tackle many diverse issues, from the sustainable development of energy and mineral resources, to water resource management, improvements to agricultural practices and understanding and effectively dealing with climate change. Because such a high proportion of geoscientists are employed in the resources sector, the decision of many talented students to take on geoscience studies is influenced by the prospects in this sector; even they may eventually pursue careers in other fields. These efforts will continue.
- We will also continue to work to advance the public perception of geosciences in the community in an effort to ensure ongoing community interest and support for the profession.

Unemployed AIG members are eligible for concessional membership fees for up to three years. The AIG Council believes it is critical that members with employment difficulties remain in contact with their profession and aware of the actions being taken to try to improve their prospects. The Council also strongly believes that RPGeos should be encouraged and supported wherever possible to maintain their individual professional development efforts. All members should take another look at the RPGeo

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The Dyke that Sank the Goldfield that Saved Queensland

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Historical mining of the Inglewood Structure produced ~700,000 ounces of gold with an estimated mined grade of 12.1g/t Au (Cunneen, 1996). This forms 20% of the 3.5 million ounces of gold (Buka, 2005) from the Gympie Goldfield's historical hard-rock production. Conversely, 60-65% of the total 352,000 ounces of gold production from modern mining (1994 to 2005) has been sourced from the Inglewood Structure (Buka, 2005).

Post-mineral microdiorite dykes

Two post-mineralisation microdiorite dykes have intruded the subvertical part of the Inglewood Structure. Both dykes are 3-8m wide, strongly magnetic, and clearly crosscut the Inglewood quartz±dolerite lode. The older phase, named 'BHP Dyke' by modern miners, is an aphanitic, amygdaloidal, green microdiorite dyke that departs the Inglewood in the flower structure portion and continues undeformed in the Curra Break (Figure 2), to the west of the Inglewood Structure.

The younger phase, named 'Devex Dyke' by modern miners, has been described by Sivell and McCulloch (2001) as a red-brown hornblende-bearing and plagiophyric microdiorite-shoshonite dyke with geochemical links to lamprophyres.

The Devex Dyke also departs the Inglewood in the flower structure portion, although continues up through the Curra Break (Figure 2), penetrating the South Curra Limestone and Tamaree Formation (Dugdale, 2004). At the southern end of the goldfield, this steeply south-west dipping dyke has been displaced by a late-stage 'crosscourse' fault, and has been traced in outcrop mapping for several kilometres to the south where it intrudes the Triassic Kin Kin Beds.

Although clearly post-mineralisation, post-Curra Break thrusting, and pre-crosscourse faulting, the microdiorite dykes have not yet undergone isotopic dating. They may be related to Triassic igneous activity such as the late diorite phase of the Early to Middle Triassic Goomboorian igneous complex, or related to the Jurassic-Cretaceous hornblende-phyric diorite intrusions of the Bauple Province, described by Cranfield (1999).

The Scottish Gympie and West of Scotland companies

The Scottish Gympie company formed in 1895 and went on to be Gympie's greatest gold producer, with 495,000 ounces of gold recovered from 1.6 million tonnes of ore at an average head grade of 10.6g/t , from 1898-1924 (Cunneen, 1993). Most gold was initially sourced from Gympie veins, although from 1907 the Inglewood Structure was the dominant ore source, due to depletion of the higher-grade Gympie veins.

The Inglewood Structure, being subvertical and relatively wide, was easy to mine, and the efficient Scottish Gympie company profitably mined down to a grade of 5 pennyweights (~7.5 grams) gold per tonne from 1907 to 1917 (Cunneen, 1993). It was a common belief, at the time, that the Inglewood Structure was defined by the presence of 'the diorite' (two post-mineralisation microdiorite dykes).

The Glasgow-backed West of Scotland company formed as a result of the success of the Scottish Gympie company, holding a mining lease immediately south of the Scottish Gympie workings.

The dyke that sank the goldfield

From 1899 to 1903 the West of Scotland shaft (Figures 1 & 2) was

mined by the West of Scotland company to explore for Gympie vein and Inglewood mineralisation.

The shaft was sunk to a depth of 3136' (956m), the deepest in Queensland at the time, then a primitive and expensive diamond drill rig was utilised for exploration, as the atrocious ventilation prevented further development mining. To test the Inglewood Structure, a horizontal hole was drilled from the 2,918' level of the shaft (Figure 2). The hole intersected the Devex Dyke with no auriferous quartz veining present, and the company believed that the Inglewood had been tested and found barren in this location.

In the early 1990s modern miners found that the Devex dyke on the 2918' level had diverged to the east of the Inglewood Structure, and that the auriferous splay of the Inglewood Structure was only a short distance further south-west of the Devex Dyke (Figure 2). Queensland's (then) deepest shaft produced a grand total of three ounces of gold, although it provided an excellent platform for later generations of miners to access the south end of the goldfield.

In late 1912, when the goldfield was in decline, the Scottish Gympie company tried to locate more mineralisation on the Inglewood Structure. The company's #2 shaft was extended, and the 2,510' level was mined south from the shaft to locate the Inglewood. The drive intersected the barren Devex Dyke and the company concluded that the Inglewood was uneconomic. As was the case ten years earlier with the West of Scotland company, the Devex Dyke had diverged from the splay part of the Inglewood Structure. The auriferous 7m wide quartz-dolerite splay was only 25m to the west of the Devex Dyke, as discovered by modern miners eighty years later.

Conclusion

The subvertical Inglewood Structure historically yielded ~700,000 ounces of gold and comprised quartz veining, dolerite dykes, and two phases microdiorite dykes. Despite the microdiorite dykes clearly cross-cutting and post-dating the vein-hosted mineralisation, the historical miners believed 'to find the diorite was to find the Inglewood'.

This geological error in 1903 and 1913, sealed the fate of not only Gympie's most successful historical mining company, but of the historical phase of gold mining in Gympie. It is likely that, had the West of Scotland and Scottish Gympie companies not made this error, most of the >350,000 ounces of gold mined to date in the modern phase of mining at Gympie (1992-2008), would have been discovered and mined during the historical phase. ▲▲

Acknowledgements

Thanks to Buka Gold Ltd for permitting access to some unpublished material and to M Bizzell for drafting the diagrams.

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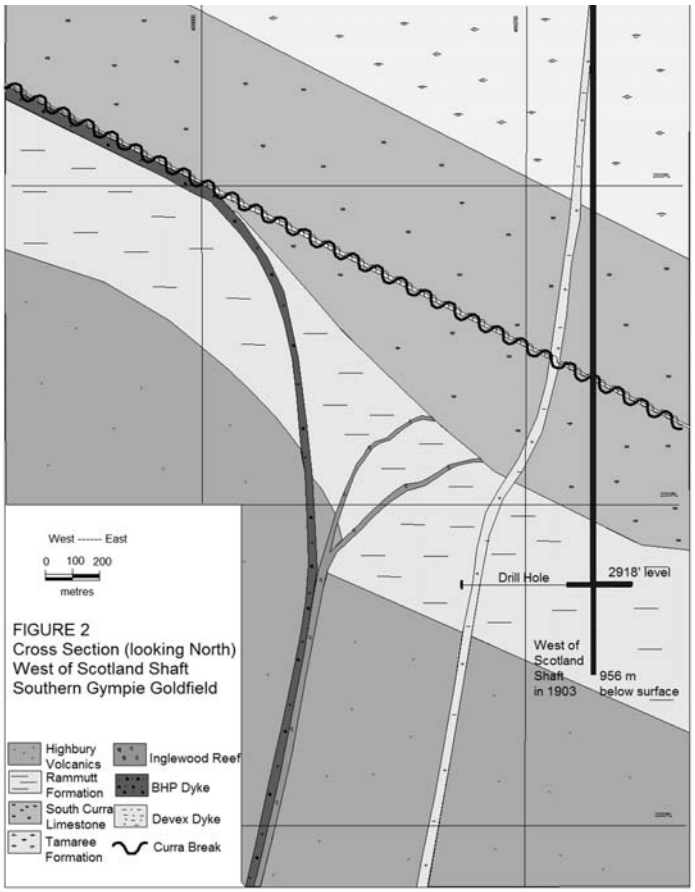

Figure 2: Cross-section

From Your President

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programme and what it offers in terms of independent verification of continued professional development that is viewed positively by employers. Keep an eye out for the 60 Second Poll email.

All AIG members are urged to complete the 60 Second employment survey on www.aig.org.au.

Write to your local member

Please get in touch with any other ideas for initiatives that may benefit your colleagues in these difficult times. AIG continues to benefit from the hard work of members, in particular State Branch committee and Council members who try hard to be as approachable and responsive as possible.

As always, we're listening.

Andrew Waltho

Geological Walks in the East Africa Rift Zone

Greg Corbett

The East Africa Rift, Tanzania, famous as the site of investigations into the birth of mankind at Olduvai Gorge, contains the popular tourist attractions of Mt Kilimanjaro and Mt Meru, which we climbed in January 2008. Unfortunately we were prevented from climbing the more active Ol Doinyo Lengai carbonatite volcano. Nevertheless, some great geology is to be had in any drive around the rift valley. It is best to avoid the March-May and October-November wet seasons and northern hemisphere summer holidays. The walks are deliberately staged to aid in acclimatisation to the increasing altitude and so cater for those AIG members whose enthusiasm outstrips fitness.

Mt Meru

Mt Meru is a volcano which has undergone a Mt St Helens style sidewards sector collapse followed by development of a central cinder cone and lava flows which are reported to have been active as recently as 6600, 1800 and 120 years ago. The collapse provides an excellent exposure of the volcano's anatomy. There is a standard 4 day walk to the top of the caldera rim staying in comfortable National Parks huts with four (double bunk) beds per room. One is expected to use commercial tour guides, porters and cook for the walk. National Parks provides an additional armed guide to protect against wild animals (buffalo). Walkers from the USA, who are more enthusiastic about guns than myself, were horrified at the early model and small calibre of the firearm.

Day 1 begins with the 1-2 hours drive from hotels at the towns of Moshi (recommended) or Arusha, near the Arusha National Park. Close to Mt Meru, grassland grazed by Masai cattle gives way to coffee plantations containing huge Australian grevillea robusta (silky oak) shade trees planted by German settlers during the 19th century. Monkeys abound in the park rain forest. Preliminary information is provided at Gate One prior to the 30 minute drive to Park Headquarters. The first day's walk is a steady 3 hour climb from grassland (1500m) with abundant buffalo and giraffe, through scrub then onto spectacular moss forests to Miriakamba Hut (2500m). Limited vehicle access allows this hut to be especially well equipped. There are wonderful afternoon views to Kilimanjaro through the mist and clouds.

Day 2 walking follows an especially well formed path (with new steps under construction) and climbs steadily through moss forest with glimpses of Kilimanjaro, to higher level scrub, and finally alpine grassland close to the Saddle Hut at 3500m. The limited access here means that the facilities are more modest but are still entirely acceptable - bottled water is for sale. It is curious to see furniture made from Australian silky oak. The Saddle Hut should be reached after only 3 hours of a steady climb from Miriakamba Hut. In the afternoon the further 1 hour climb to Little Meru (3810m) provides an additional opportunity to acclimatise to the increasing altitude. Little Meru Peak is a resistant basaltic dyke which is emplaced into less coherent volcanic breccias and lavas.

Day 3, the final assault on Mt Meru, features a custom that I still don't quite comprehend. One leaves the hut at 2 am, in the dark, for the 5 hour

walk to the summit (4265m) in the dark, arriving for a clear and spectacular sunrise with views of Kilimanjaro towering into the clouds. The summit itself is rather small, and so one is not encouraged to stay, especially in the cool of early morning. The track is rather rough and so a good head torch with fresh batteries is recommended. The walk down is a geological delight with good views of the interlayered lavas and breccias of the dissected volcano. These rocks are cut by numerous dykes, and there are huge blocks collapsed from the crater wall. The views of the cinder cone and adjacent recent lava flows continue from track, which follows the crater rim. The guides received a geology lesson whether they needed it or not! One should be back at the Saddle Hut for a late breakfast and then there is a downhill stroll through the rain forest to the luxury of Miriakamba Hut in time for lunch followed by a lazy afternoon enjoying the late afternoon mountain sun and views.

On Day 4 we took the loop trail around the wooded inside of the crater close to the cinder cone. Here we saw elephants, giraffes, monkeys, buffaloes and various types of antelope as we traversed through scrub/grassland back into rain forest festooned with hanging moss and reached the park headquarters by lunch time. Tell your guides you want to take the fig tree route, as the track passes through the middle of two joined parasitic fig trees, made extremely gnarled by the elephants peeling the bark.

In conclusion, the walk to the top of Mt Meru comprises a straight-forward up hill wander followed by a rough section to the top, and then a particularly interesting half day of geology as you walk back down the rim of the collapsed volcanic edifice.

Kilimanjaro

The majestic mountain of Kilimanjaro, rising to 5896 metres from a 30 km wide base, dominates the region physically and historically. I refer you to the attached box for an interpretation of the geological setting of Kilimanjaro and also an article by Neil Phillips, in the AusIMM Geoscience Group Newsletter, on the receding glaciers. Kilimanjaro is a composite volcano with 3 main peaks. From west to east these are: Shira Peak, Uhuru Peak (summit) and the more eroded Mawenzi (Hans Meyer) Peak. These are roughly aligned EW at a high angle to the overall NS trend of the rifts in this area. Kilimanjaro lacks the volcanic breccias present at Mt Meru but is dominantly porphyritic pyroxene-feldspathoid lava flows in which the feldspathoid megacrysts display prominent flow alignment. The lava flows of different hardness have differentially eroded to provide a distinctive step-like topography to the volcanic slopes. The local

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Looking from the top of the Mt Meru crater rim into the crater showing the ash cone and adjacent lavas

Mt Meru summit on the crater rim with slide blocks below and ash cone and adjacent recent lavas in the foreground.

Geological Walks in the East Africa Rift Zone

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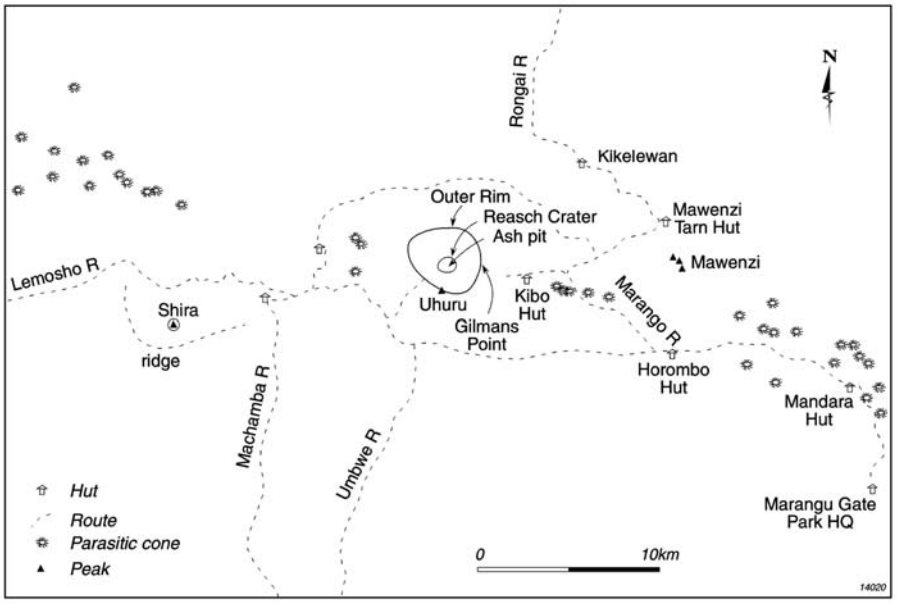
drainages contain spectacular euhedral pyroxene crystals and megacrysts of feldspathoid minerals up to several cm in length (see photograph).

There are several routes which ascend Mt Kilimanjaro varying from the most popular and best appointed Marangu Route to the Western Breach which is considered a technical climb and which is often closed because of the danger of rock falls. We walked up the Rongai route from the north, expecting it to be less populated, to join the Marangu route near Kibo Hut and then descended via the Marangu track to the Park HQ (see figure). While it is recommended to ascend and descend the mountain by different routes, use of the Rongai route on the north side requires a several hour drive from the park Headquarters on the eastern side. The camp sites along all the routes are deliberately staged to facilitate acclimatisation to the increasing altitude.



Map of Kilimanjaro showing the major volcanic centres as peaks, parasitic cones and walking tracks

Day 1 for us featured an easy 2 hour walk along an especially well maintained Rongai track through rain forest (in which many of the trees had botanical names on plaques) passing into scrub land before reaching Simba camp at 2300m. The short day is just as well as one can expect a late start by the time all the gear is packed and weighed to ensure the porters are not overloaded. Our party of 4 required 15 porters plus 2 guides, a cook and a waiter, and so the camp sites resembled small villages.

Day 2 we awoke to magnificent views of Uhuru peak straight ahead and Mawenzi peak to the left, which towered above us for most of the morning. The track is in excellent condition despite the heavy traffic and comprises mostly a gentle walk with some steep sections to Kikelewan Cave camp site (3600m) which should be reached by 2.00 pm.

Day 3 we continue on the straight-forward walk through low heath to reach the Mawenzie Tarn camp site (4300m) which should be reached by lunch time. The steady rise of about 1000 metres each day allows for good acclimatisation to the increasing altitude. The Mawenzie volcanic edifice is well exposed by erosion with dipping lavas on either side of a central peak in which subvertical dykes no doubt provide a reflection of the original feeder vent. Fresh basalt with feldspathoid phenocrysts has been exposed by building works to construct the toilet block.

Day 4 climbs steadily to reach the wide alpine desert region of the saddle between Mawenzie and Uhuru peaks. We joined the Marangu track not long before the Kibo Hut camp site at 4700 metres altitude. Registration is required at Kibo hut, which is the intersection of several tracks before the final ascent on the mountain. Kibo Hut comprises a village made up of concrete dormitories, toilet blocks and a sea of tents. An early night is recommended prior to the assault on the summit next morning.

Day 5 began with another episode of this strange night walking custom, although this time we benefited from a full moon. I am told part of the reasoning is that frozen scree remains stable in the cool early morning. We left camp at midnight for the solid slog (about 1000m) up a series of switchbacks to Gilman Point at 5685 metres and from there it was a gentle walk along a crater rim to Uhuru Peak (5895m), where we arrived at 5.30 am, well before sunrise. The ridge top is very exposed to wind and can be bitterly cold (reported -20 to -30 degrees C), so go appropriately equipped, and although there was plenty of space at the summit one is not encouraged to linger. While the track is well developed, the first party of the day (night) may have to push through thick snow. There must have been at least 200 people heading up the track as we came down, although one could use a scree slope to head quickly down from Gilman's Point to camp, returning in time for breakfast. For the return walk home, the Marangu route provides a virtual 6 lane highway to the Horombo camp complex (3720m), where we had the luxury of flush toilets.

As the alpine desert passes to scrub with lower altitude we noticed many birds and chameleon lizards amongst the abundant flowering

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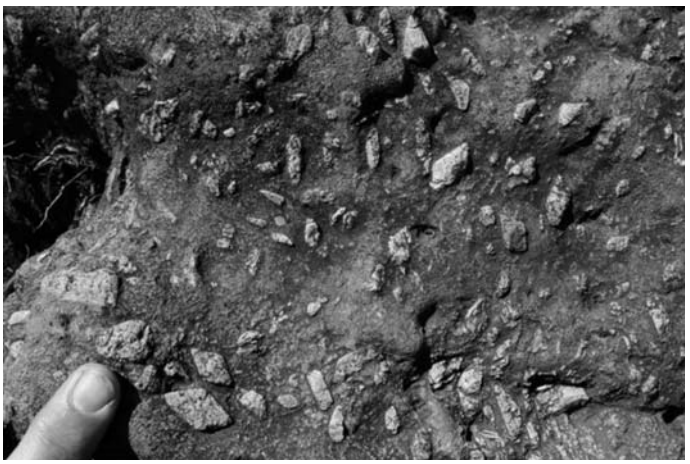
Neil Phillips and Greg Corbett on the track to Kilimanjaro which is in the background.



Kilimanjaro feldspathoidal lavas with alignment of feldspathoid megacrysts.

Mawenzei Tarn camp site showing the eroded Mawenzei volcanic edifice

Geological Walks in the East Africa Rift Zone

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plants. An afternoon kip was in order at Horombo camp as we sheltered from an afternoon tropical shower.

Day 6 comprises a very easy 10-12 km downhill stroll from Horombo to Mandara Huts and then another 11.7 km walk in delightful rainforest to the park headquarters at Marangu Gate, which we reached by lunch time. For the enthusiasts, a nature trail could add another 1.5km to the rainforest walk. The weather becomes deceptively hot as one looses altitude, on what is a long walk compared to previous days, and then there is the 1-2 hour drive in topical heat back to the hotels, and so watch out for dehydration.

In conclusion, the Kilimanjaro walk includes several relatively easy days of uphill strolls followed by a half day hard stretch in darkness. The countryside, vegetation and views are delightful. Once you've had a look for yourself you can decide whether to believe the climatologists about the receding glaciers. ▲▲

Looking east across the saddle from Kibo hut towards the east side to the eroded Mawenzei volcanic edifice. The main Kilimanjaro peak limmediately behind the photographer.

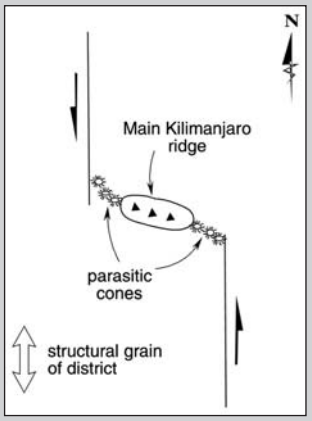
Acknowledgement

Neil Phillips is acknowledged for his geological suggestion of the dilatant fault control to Kilimanjaro used herein and along with Ray Merchant commented on the text. My party included Neil and Michael Phillips and Andrew Ashton. Denese Oates painstakingly drafted the figures as usual.

Why is Kilimanjaro so big?

Kilimanjaro rises some 4 km above the plateau from a 80 x 40 km base, yet it is located off the local trend of the rift structures. The central portion of the mountain is dominated by three roughly EW trending peaks: from west to east Mt Shira, Uhuru on the south margin of the main crater, and the more eroded Mt Mawenzi. From Mt Shira a line of parasitic cones trends NW to meet the regional NS structural grain and a similar line of parasitic cones trends SE from Mawenzi in the east to meet the regional trend on that side (see figure).

Consequently, it is speculated the atypically large Kilimanjaro volcanic edifice, might have developed within a dilatant fault jog formed as a result of a component of sinistral strike-slip movement on the regional rift related fault system.



This depicts a structural model derived in discussion with Neil Phillips that the large Kilimanjaro volcanic centre developed in a dilational jog constrained at a high angle to the trend of the rift faults, which may have undergone a transient component of strike-slip movement.

Evidence for Correlations Between Nuclear Decay Rates and Earth-Sun Distance

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UNEXPLAINED PERIODIC FLUCTUATIONS in the decay rates of ^{32}Si and ^{226}Ra have been reported by groups at Brookhaven National Laboratory (^{32}Si), and at the Physikalisch-Technische-Bundesandstalt in Germany (^{226}Ra).

We show from an analysis of the raw data in these experiments that the observed fluctuations are strongly correlated in time, not only with each other, but also with the distance between the Earth and the Sun. Some implications of these results are also discussed, including the suggestion that discrepancies in published half-life determinations for these and other nuclides may be attributable in part to differences in solar activity during the course of the various experiments, or to seasonal variations in fundamental constants.

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Following the discovery of radioactivity by Becquerel in 1896 [1] an intense effort was mounted to ascertain whether the decay rates of nuclides could be affected by external influences including temperature, pressure, chemical composition, concentration, and magnetic fields. By 1930, Rutherford, Chadwick, and Ellis [2, p. 167] concluded that "The rate of transformation of an element has been found to be a constant under all conditions." (For decays resulting from K-capture, or for beta-decays in strong ambient electromagnetic fields, the situation is slightly more complicated, since these decays are influenced by the electron wave functions which can be affected by external pressure or fields [3, 4, 5].) For ^{32}Si and ^{226}Ra, which decay by beta- and alpha-emission, respectively, fluctuations in the counting rates (in the absence of strong external electromagnetic fields) should thus be uncorrelated with any external time-dependent signal, as well as with each other. In what follows we show that neither of these expectations is realized in data we have analyzed for ^{32}Si and ^{226}Ra, thus suggesting that these decays are in fact being modulated by an external influence.

Between 1982 and 1986, Alburger, et al. [6] measured the half-life of ^{32}Si at Brookhaven National Laboratory (BNL) via a direct measurement of the counting rate as a function of time. If N(t) denotes the number of surviving atoms starting from an initial population N_0 at t = 0, then the familiar exponential decay law, $N(t) = N_0 e^{-\lambda t}$, leads to $N \equiv dN/dt = -\lambda N_0 e^{-\lambda t}$ where $\lambda = \ln(2)/T_{1/2}$. A plot of ln h [N(t)] as a function of time is then a straight line whose slope is λ, which then gives the half-life $T_{1/2}$. At the time this experiment was initiated, the ^{32}Si half-life was believed to be in the range of $60 \leq T_{1/2} \leq 700$ yr, and hence a multiyear counting experiment was needed to obtain a measureable slope. As in other counting experiments, the counting rate for ^{32}Si was continually monitored in the same detector against a long-lived comparison standard, which in the BNL experiment was ^{36}Cl ($T_{1/2}$=301,000 yr). Since the fractional change in the ^{36}Cl counting rate over the four year duration of the experiment was only $O(10^{-5})$, which was considerably smaller than the overall uncertainty of the final result, $T_{1/2}(^{32}\text{Si})=172(4)$ yr, the ^{36}Cl decay rate was assumed to be constant. Any time dependence for ^{36}Cl beyond the expected statistical fluctuations was then presumed to arise from various systematic effects, such as drift in the electronics. By computing the ratio $^{32}\text{Si}/^{36}\text{Cl} \equiv N(^{32}\text{Si})/N(^{36}\text{Cl})$, these apparatus dependent systematic effects should have largely cancelled, and hence this ratio was used to obtain the half-life of ^{32}Si. On the other hand, barring an accidental cancellation, time-dependent contributions to the ^{32}Si and ^{36}Cl decay rates themselves would not cancel in the ratio $^{32}\text{Si}/^{36}\text{Cl}$.

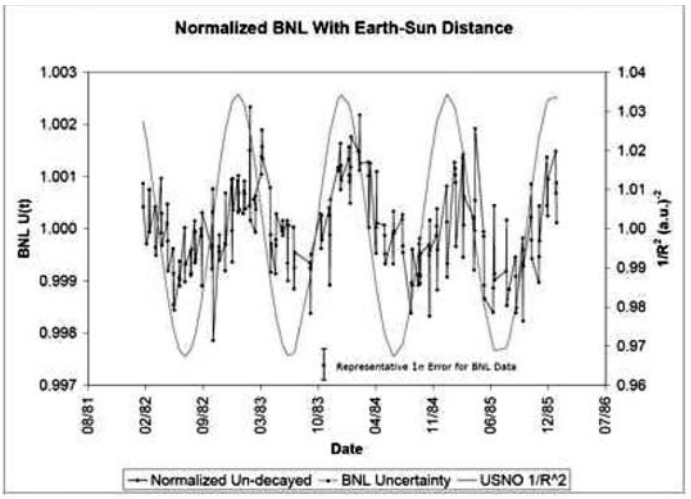

FIG. 1: Plot of U(t) for the raw BNL ^{32}Si/^{36}Cl ratio along with $1/R^2$ where R is the Earth-Sun distance in units of 1/(a.u.)². U(t) is obtained by multiplying each data point by $\exp(+\lambda t)$ where $\lambda = \ln(2)/T_{1/2}$ and $T_{1/2}$=172 yr for ^{32}Si. The left axis gives the scale for the normalized U(t), and the right axis denotes the values of $1/R^2$ in units of 1/(a.u.)² obtained from the U.S. Naval Observatory (USNO). The fractional change in ^{32}Si counting rates between perihelion and aphelion is approximately 3×10^{-3}. As noted in the text, the correlation coefficient between the BNL data and $1/R^2$ is r=0.52 for N=239 points. The formal probability that the indicated correlation could have arisen from uncorrelated data sets is 6×10^{-18}.

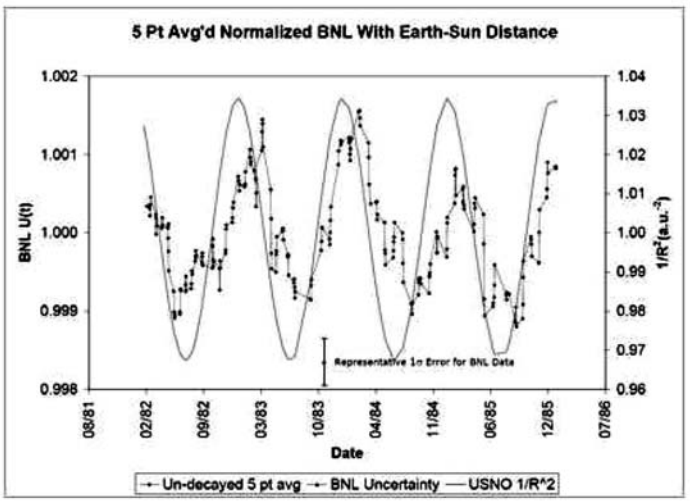

FIG. 2: Plot of the 5 point rolling average of U(t) for the BNL ^{32}Si data shown in Figure 1. Each data point represents the average of 5-points centered on the original datum, which serves to smooth short term fluctuations in the ^{32}Si/^{36}Cl ratio arising from influences other than a possible annual $1/R^2$ variation. As noted in the text, the correlation coefficient between the BNL data and $1/R^2$ is r=0.65 for N=235 points. The formal probability that the indicated correlation could have arisen from uncorrelated data sets is 1×10^{-29}.

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The BNL data for the ratio $^{32}Si/^{36}Cl$ revealed an unexpected annual variation of $^{32}Si/^{36}Cl$ which could not be accounted for by the known effects of temperature, humidity, or pressure variations in their detector[6]. We obtained the raw data from the BNL experiment in conjunction with an independent effort to apply a new randomness test [7, 8] to nuclear decays, and the BNL data are shown in Fig. 1. When comparing the results from experiments on different nuclides, it is convenient to study the function $U(t) \equiv [N(t)/N(0)] \exp(+\lambda t)$ rather than N(t) itself, since U(t) should be time-independent for all nuclides. For ^{32}Si, we used $\lambda = 4.0299 \times 10^{-3} yr^{-1}$ from Ref. [6]. Figure 1 exhibits U(t) for the $^{32}Si/^{36}Cl$ BNL data, along with a plot of $1/R^2$, where R is the distance between the Earth and the Sun. An annual modulation of the $^{32}Si/^{36}Cl$ ratio is clearly evident, as was first reported in Ref. [6]. The Pearson correlation coefficient, r, between the raw BNL data and $1/R^2$ is r=0.52 for N=239 data points, which translates to a formal probability of 6×10^{-18} that this correlation would arise from two data sets which were uncorrelated. As shown in Figure 2, the correlation coefficient increases to r=0.65 for N=235 data points when a 5 point rolling average is applied. There is also a suggestion in Figs. 1 and 2 of a phase shift between $1/R^2$ and the BNL data, which we discuss in greater detail below.

The strong correlation between the BNL decay data and the annual modulation of the Earth-Sun distance suggests that the $^{32}Si/^{36}Cl$ ratio may be responding to some influence originating from the Sun. If this is indeed the case, then the effects of this influence would be expected to be present in other decays as well. Although there are hundreds of potentially useful nuclides whose half-lives have been measured, the data from many of the experiments we examined were generally not useful, most often because data were not acquired continuously over sufficiently long time periods. However, we were able to obtain the raw data from an experiment carried out at the Physikalisch-Technische Bundesandstalt (PTB) in Germany [9, 10] measuring the half-life for ^{152}Eu, in which ^{226}Ra was the long-lived comparison standard. This experiment, which extended over 15 years, overlapped in time with the BNL experiment for approximately 2 years, and exhibited annual fluctuations in the ^{226}Ra data similar to those seen at BNL. Figure 3 exhibits the PTB data as a 5 point rolling average, and it is evident from the figure that the PTB data closely track the annual variation of $1/R^2$. The Pearson correlation coefficient r for the data in Fig. 3 is r=0.66 for N=1968 data points, corresponding to a formal probability of 2×10^{-246} that this correlation could arise from two data sets which were uncorrelated. As in the case of the BNL data, there is also a suggestion of a phase shift between $1/R^2$ and the PTB data (see below), although this phase shift appears to be smaller than for the BNL data.

Since the BNL and PTB data each exhibit strong correlations with the annual variation of $1/R^2$, it is not surprising that these data correlate with each other. Figure 4 exhibits this correlation along with the annual variation of $1/R^2$. The Pearson correlation coefficient for the BNL and PTB data is r=0.88 for N=35 points, which corresponds to a formal probability of 4×10^{-12} that this correlation could have arisen

from two uncorrelated data sets. Moreover, the difference in latitude between BNL and PTB, as well as the difference in their climates, argues against an explanation of this correlation in terms of seasonal variations of climatic conditions such as temperature, pressure, and humidity etc., which could have influenced the respective detection systems. As an example, radon concentrations are known to fluctuate seasonally, as has been noted in Ref. [10], and it was suggested that the decay of ^{222}Rn could lead to a seasonally dependent charge distribution on the experimental apparatus. However, this effect is extremely small given the low counting rates that typically arise from radon background [11], and in any case, the PTB data shown in Fig. 3 were corrected for background.

The preceding considerations, along with the correlations evident in Fig. 4, suggest that the time-dependence of the ^{32}Si/^{36}Cl ratio and the ^{226}Ra decay rate are being modulated by an annually varying flux or field originating from the Sun, although they do not specify what this flux or field might be. The fact that the two decay processes are very different (alpha decay for ^{226}Ra and beta decay for ^{32}Si) would seem to preclude a common mechanism for both. However, recent work by Barrow and Shaw [12, 13] provides an example of a type of theory in which the Sun could affect both the alpha- and beta-decay rates of terrestrial nuclei. In their theory, the Sun produces a scalar field ϕ which would modulate the terrestrial value of the electromagnetic fine structure constant α_{EM}. This could, among other effects, lead to a seasonal variation in alpha and beta decay rates, both of which are sensitive to α_{EM} [14]. We note from Fig. 3 that the fractional difference between the ^{226}Ra counting rates at perihelion and aphelion is $\approx 3 \times 10^{-3}$, and this would require that the coupling constant k_α of ϕ to α_{EM} should be k 3 × 106. However, this is substantially larger than the value $k_\alpha = (-5.4 \pm 5.1) \times 10^{-8}$ inferred from a recent trapped ion experiment [12, 15]. Although the specific model of Refs. [12, 13, 14] would not account for the ^{32}Si and ^{226}Ra data quantitatively, variants of this model might work. This includes models in which separate scalar fields ϕ1 and ϕ2 couple, respectively, to EM and to the electron-proton.mass ratio m_e/m_p.

Another interesting possibility is that terrestrial radioactive nuclei are interacting in a novel way with the neutrino flux Φ_ν emitted from the interior of the Sun. This flux also varies with $1/R^2$, and the resulting seasonal modulation of Φ_ν has been observed by Super-Kamiokande [16, 17]. This possibility is supported by the data we report in Ref. [18] in which we present evidence for the possible detection of a change in the decay rate of ^{54}Mn during the solar flare of 13 December 2006. As noted in Ref. [18], the coincidence in time between the change in the ^{54}Mn counting rate and the solar flare, along with other observations, is consistent with a mechanism based on a change in Φ_ν during the solar flare.

We note that irrespective of the origin of the solar flare data, or of the correlations evident in Figs. 1-4, the existence of these effects may explain discrepancies in various half-life determinations reported in the literature. Examples are ^{32}Si, ^{44}Ti and ^{137}Cs, among many others [6, 19, 20, 21]. If nuclides such as ^{32}Si, ^{36}Cl, and ^{226}Ra respond to changes in the solar neutrino flux due to the time-dependence of $1/R^2$, then they can also respond to changes in intrinsic solar activity which are known to occur over time scales both longer and shorter than one year. Thus, depending on when half-life measurements were made, and on the specific techniques employed, it is possible that some of the half-

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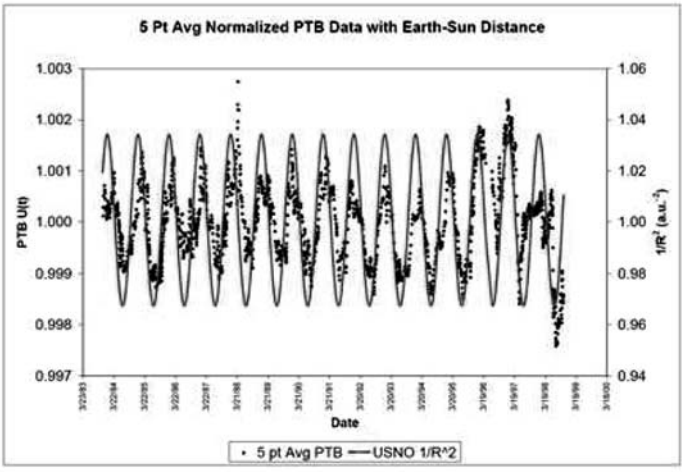

FIG. 3: Plot of U(t) for the PTB ^{226}Ra data along with $1/R^2$, where R is the Earth-Sun distance. See caption to Fig. 1 for further details. The fractional change in the ^{226}Ra counting rates between perihelion and aphelion is approximately 3 × 10^{-3}. As noted in the text, the correlation coefficient between the PTB data and $1/R^2$ is r=0.66 for N=1968 points. The formal probability that the indicated correlation could have arisen from uncorrelated data sets is 2 × 10^{-246}. Note that the 1σ error bars for the PTB data lie within the data points themselves.

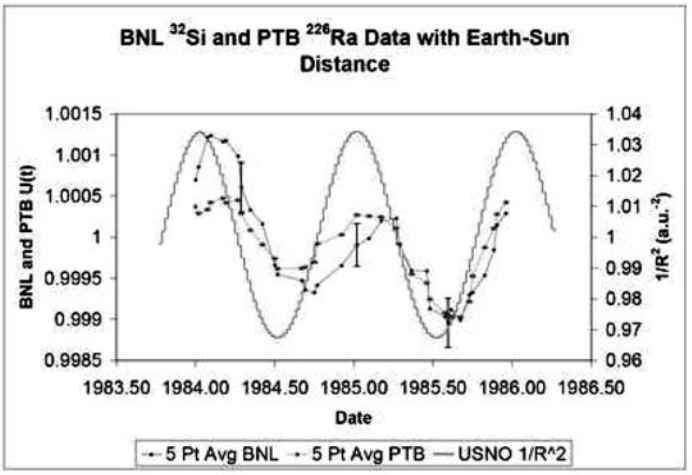

FIG. 4: Correlation between the decay rates of ^{32}Si at BNL and ^{226}Ra at PTB. The BNL and PTB data for U(t) have been averaged in common weekly bins for purposes of comparison. The correlation coefficient between the BNL and PTB data is r=0.88, which corresponds to a probability of 4×10^{-12} that the BNL/PTB correlation could have arisen from uncorrelated data sets as a result of statistical fluctuation. Error bars are shown for representative BNL data points, and the error bars for the PTB data lie within the points themselves.

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life discrepancies reported in the literature could be reconciled if appropriate data on solar activity become available.

Returning to Fig. 4, we briefly explore the suggestion noted above of a possible phase shift of $1/R^2$ relative to both the BNL and PTB data. Although this may be an experimental artifact arising from binning effects, etc., such a phase shift could also arise from other smaller contributions to periodic variations in neutrino flux. Possibilities for such contributions were explored in Ref. [17], where a search was made for short time variations in the observed flux at Super-Kamiokande arising from either the 7.25° inclination of the solar axis relative to the ecliptic, or from fluctuations in the temperature of the solar core. A modulation of the neutrino flux arising from a coupling between a neutrino magnetic moment and a latitudinally inhomogeneous solar magnetic field [22] could also account for a possible phase shift. Although there is no compelling evidence at present for such short time variations at Super-Kamiokande[16, 17], the statistical power of the BNL, PTB, and similar data sets may prove to be a useful tool in the search for such effects. Yet another possible explanation for the apparent phase shift could be a seasonally-varying velocity-dependent effect similar to that observed by the DAMA/LIBRA collaboration [23].

In summary, we have presented evidence for a correlation between changes in nuclear decay rates and the Earth-Sun distance. While the mechanism responsible for this phenomenon is unknown, theories involving variations in fundamental constants could give rise to such effects. These results are also consistent with the correlation between nuclear decay rates and solar activity suggested by Jenkins and Fischbach [18] if the latter effect is interpreted as possibly arising from a change in the solar neutrino flux. These conclusions can be tested in a number of ways. In addition to repeating long-term decay measurements on Earth, measurements on radioactive samples carried aboard spacecraft to other planets would be very useful since the sample-Sun distance would then vary over a much wider range. The neutrino flux hypothesis might also be tested using samples placed in the neutrino flux produced by nuclear reactors. ▲▲

Acknowledgements

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December, 1975—Optical Spectra

10

The greenhouse effect in truth

To the Editors:

Recent articles in *Optical Spectra* correctly emphasize the contributions of optics toward solving the world energy problem. Important elements are solar collectors, such as those discussed by R. M. Winegarner in the June issue. I feel the article expresses a fundamental, widespread scientific misconception about the mechanism of solar trapping under the label "greenhouse effect." Because of the importance of solar trapping, a clarification is worthwhile.

The fact that the collector covers, commonly glass, are transparent to the incident solar radiation and strongly opaque to the radiation from the heated solar absorbers is not the basis of the "greenhouse effect" (as often claimed) and is almost irrelevant to the solar collection process. The physics of this type of solar collector involves suppression of convection rather than spectrally selective absorption. A proper understanding of the collection mechanism is crucial to the design of efficient collectors.

As early as 1909 R. W. Wood demonstrated that glass and rock salt (transparent in the thermal IR) model greenhouses reach approximately the same temperature (see Fleagle and Businger, *Atmospheric Physics*, Academic Press, 1963, page 153ff for example). Selective absorption cannot be the most important contributor to the "greenhouse effect." Rather, convection is reduced by the transparent enclosure. Such an enclosure allows more complete suppression of convective heat removal if the space next to the solar absorber is evacuated.

Physically, an IR absorbing cover glass should be in approximate radiative thermal equilibrium with the hot solar absorber. The outer surface of the cover will then serve as just an effective radiator as the uncovered absorber, and there is no radiative trapping at all, in contrast to the usual understanding of "greenhouse effect" solar collection. Actually the glass does insulate, so that the outer surface of the cover is slightly cooler than the inner surface and overall radiation from the covered absorber is somewhat less than a radiatively unprotected absorber. This relatively weak radiative trapping (compared to convection suppression) can be enhanced by spectrally selective reflectors, which Winegarner discusses, that trend to make the outer surface of the cover cooler, and by spectrally selective absorbers with IR emissivity.

While clever optical design can reduce radiative losses, convective loss reduction is the primary (though relatively easy to satisfy) design consideration for a solar collector. Spectrally selective absorbers for cover plates have a relatively negligible effect on overall efficiency and can lead the unwary into misunderstanding the important physical process.

Ronald L. Schwiesow
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Environmental Research Labs.

Zombie Science: A sinister Consequence of Evaluating Scientific Theories Purely on the Basis of Enlightened Self-interest

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Summary

Although the classical ideal is that scientific theories are evaluated by a careful teasing-out of their internal logic and external implications, and checking whether these deductions and predictions are in-line-with old and new observations; the fact that so many vague, dumb or incoherent scientific theories are apparently believed by so many scientists for so many years is suggestive that this ideal does not necessarily reflect real world practice. In the real world it looks more like most scientists are quite willing to pursue wrong ideas for so long as they are rewarded with a better chance of achieving more grants, publications and status. The classic account has it that bogus theories should readily be demolished by sceptical (or jealous) competitor scientists. However, in practice even the most conclusive 'hatchet jobs' may fail to kill, or even weaken, phoney hypotheses when they are backed-up with sufficient economic muscle in the form of lavish and sustained funding. And when a branch of science based on phoney theories serves a useful but non-scientific purpose, it may be kept-going indefinitely by continuous transfusions of cash from those whose interests it serves. If this happens, real science expires and a 'zombie science' evolves. Zombie science is science that is dead but will not lie down. It keeps twitching and lumbering around so that (from a distance, and with your eyes half-closed) zombie science looks much like the real thing. But in fact the zombie has no life of its own; it is animated and moved only by the incessant pumping of funds. If zombie science is not scientifically-useable – what is its function? In a nutshell, zombie science is supported because it is useful propaganda to be deployed in arenas such as political rhetoric, public administration, management, public relations, marketing and the mass media generally. It persuades, it constructs taboos, it buttresses some kind of rhetorical attempt to shape mass opinion. Indeed, zombie science often comes across in the mass media as being more plausible than real science; and it is precisely the superficial face-plausibility which is the sole and sufficient purpose of zombie science.

How do scientists decide whether a theory is 'valid'?

In contrast to the ideal of impartial and objective analysis, in the real world it looks more like most scientists are quite willing to pursue wrong ideas – so long as they are rewarded for doing so with a better

chance of achieving more grants, publications and status.

Thus is 'enlightened self-interest' a powerful factor in scientific evaluation. 'Self-interest' because the primary criterion of the 'validity' of a theory is whether or not acting-upon-it will benefit the career of the individual scientist; 'enlightened' because the canny career scientist will be looking ahead a few years in order to prefer that theory which offers the best prospect of netting the next grant, tenure, promotion or prestigious job opportunity.

When a new theory is launched upon the population of scientists, it is unlikely to win converts unless the early-adopters are rewarded in a fairly obvious fashion – usually with a greater chance of generous research funding, the opportunity to publish in prestigious journals (plus a raft of new second-string specialist journals – to provide a home for the more modest and less-important papers), and the hope of increased status exemplified by interest, admiration and respect from other scientists.

How do bogus theories survive?

While it is simply human nature to respond to immediate incentives, this phenomenon does imply that theories may become popular or even dominant purely because of their association with immediate incentives – and despite their scientific weaknesses.

In terms of the classical theory of science; bogus theories should be readily demolished by sceptical (or jealous) competitor scientists, who will denounce the weaknesses of merely-fashionable theories in conferences and in print. However, in practice it seems that even the most conclusive 'hatchet jobs' done on phoney theories will fail to kill, or even weaken, them when the phoney theories are backed-up with sufficient economic muscle in the form of funding. Scientists will – at the margin – gravitate to where the money is; and the paraphernalia of specialist conferences (to present results at), journals (to publish in), and academic jobs (to work in), will follow as day follows night; so long as the funding stream is sufficiently deep and sustained.

Classical theory has it that a bogus hypothesis will be rejected when it fails to predict 'reality' as determined by controlled observations and experiments. But such a catastrophe can be deferred almost indefinitely by the elaboration of secondary hypotheses to explain why not fitting the facts is not – after all – fatal to the theory; but instead merely implies the need for a more complex theory – which then requires further testing (and generates more work for the bogus believers).

Furthermore, since the new version of the bogus theory, with its many auxiliary secondary hypotheses, is so complex – this complexity makes it that much harder to test: further putting-off the time when the bogus theory needs to be abandoned.

(Meanwhile, a much simpler rival theory – i.e. that the first theory is phoney, and always was phoney, and this is why it so singularly fails to predict reality – is regarded as simplistic, crass, merely a sign of lack of sophistication . . .)

And anyway, there are massive 'sunk costs' associated with the phoney theory including the reputations of numerous scientists who are now successful and powerful on the back of the phoney theory, and who by-now control the peer review process (including allocation of grants, publications and jobs) so there is a powerful disincentive against upsetting the apple cart.

False theories, theories which never did have anything in their favour except careerism, can therefore prove very long-lived. However, they are probably not immortal. Eventually, the branch of science which is underpinned by a bogus hypotheses will be evaluated as a whole.

People will ask: what is the good of all this activity, effort and expense? And the answer will be – no good at all. An area of science underpinned by a bogus theory is really only a species of job-creation or make-work. Perhaps there will be some byproducts – for example the development of new methods and technologies. But since these are an accidental spin-off, they do not serve to justify the field as a whole. And the plug may be pulled – so a

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whole branch of science goes down the drain.

The zombification of science on the other hand, when a branch of science based on phoney theories is serving a useful but non-scientific purpose it may be kept-going by continuous transfusions of cash from those whose interests it serves.

For example, if a branch of pseudo-science based on a phoney theory is nonetheless valuable for political purposes (e.g. to justify government policies) or for marketing purposes (to provide a rationale for sales) then real science expires and a 'zombie science' evolves.

Zombie science is science that is dead but will not lie down. It keeps twitching and lumbering around so that (from a distance, and with your eyes half-closed) zombie science looks much like real science. But in fact the zombie has no life of its own; it is animated and moved only by the incessant pumping of funds.

Proper science finds its use, and gets its validation, from being deployed in technology. So proper medical science is underpinned by the effectiveness of medical treatments based upon its theories and results; proper physics is underpinned by successful engineering – and so on. But the findings of zombie science do not have value for technology because any technology built using bogus theories would likely not work in the first place; and if it did happen to survive construction then would soon fall from the sky, collapse, or otherwise crash and burn.

(Of course, such technical disasters can sometimes themselves be explained-away – and thereby covered-up – by yet further phoney theoretical elaborations, especially when there is monopolistic control of information. However, so long as there are rival competing technologies being chosen by those who use them and depend on them, the inferiority of technologies based on bogus science is usually apparent.)

So, zombie science is not useable by applied science. What, then, is its function? In a nutshell, zombie science is supported because it is useful propaganda. Zombie science is deployed in arenas such as political rhetoric, public administration, management, public relations, marketing and the mass media generally. It persuades, it constructs taboos, it buttresses some kind of rhetorical attempt to shape mass opinion.

Indeed, zombie science often comes across in the mass media as being more plausible than real science; and it is precisely the superficial faceplausibility which in actuality is the sole and sufficient purpose of zombie science.

Can zombie science be killed?

Zombie science can be seen as the ultimate consequence of the practice of scientists evaluating theories in terms of their propensity to enhance scientific careers in the short- to medium-term – when this propensity is unconstrained by the imperative to use science in applied technology. Immediate personal careerist benefits seem easily able to overwhelm the more theoretical and abstract scientific benefits of trying to establish and adhere to the 'real world' truth.

What does this mean and what can be done about it? For one thing it suggests that the process by which science moves towards the truth may be much slower and coarser than it apparently used to be. In current science, there seems to be a greater possibility that large scale change may be fashion rather than progress, and such change may be serving propagandistic goals rather than advancing scientific understanding.

The emergent slowness in self-correction may perhaps be a consequence of the greatly increased size of the scientific enterprise as it has grown over recent decades – science now has a great deal of inertia. Science in the past was fast, light and nimble; and as easily redirected as a fleeing antelope. By comparison modern science may have a lumbering pace, but its vast bulk means that once it has begun moving in a particular direction, trying to deflect its path is like stopping a charging rhinoceros.

Any realistic prospect of reversing the expansion of zombie science would seem to involve greater competition among the suppliers of research grants. Where science funders are few, it is easier for a bogus theory to survive uncontested – whereas in situations where there are many potential sources of funding there is likely to be some competition among funders to debunk and replace bogus theories supported by rival grant givers. (This model assumes that grant-awarders are engaged in some kind of competition to become the agency that supports the best, most revolutionary and most technologically useful scientific research – however, it is uncertain whether funders do in fact operate in this way. Certainly it would be desirable if grant agencies did compete to fund the best science and scientists – but perhaps funders cooperate, coordinate and collude, and therefore should instead be regarded as a cartel.)

In a world of competition among science funders, a particular research foundation (so long as it was sufficiently large and influential) could use its resources to help build-up a rival new theory to challenge, then supplant, an old and scientifically unsuccessful (because phoney) theory. By backing a winner and thereby triggering a scientific revolution, a competitive research foundation could expect to grow in fame and influence.

The natural desire of one scientist to thrive, even at the expense of another scientist's reputation and livelihood, would in this instance be additionally fuelled by the incentive of new sources of research support.

The resulting combination of individual ambition and acquisitiveness should ensure a sufficient supply of would-be debunkers to keep the gardens of science weeded of bogus theories, and to banish the zombies of science to the graveyards where they belong. ▲▲

Drilling For Geology 2008 Conference Round-Up

The AIG Queensland Branch ran the inaugural Drilling for Geology 2008 Conference in early November 2008 at the Royal on the Park hotel in Brisbane.

The conference, attended by 200 delegates, focused on the collection and analysis of geological information from drilling and related activities. It brought together drillers, geologists and related service providers and this was a key aspect of the conference's appeal and ultimate success. It was deliberately designed to combine technical presentations in association with a diverse trade exhibition over the first two days, with opportunities to participate in professional development workshops on the third day.

Six key-note and eighteen technical talks were presented over the first two days, grouped into themes covering drilling methods, data, geophysics, structure, quality, applications in the oil and gas industry, R&D and general issues The talks ranged from specific case studies to broad ranging reviews of past activities leading into discussion of future issues.

The third day was dedicated to running professional development training and was enthusiastically supported. Six workshops were run - two full day and four half day; and a total of 180 people attended. The workshops covered everything from drilling methods, survey technologies, drill hole geophysics, structural analysis, QA/QC principles and drill program auditing.

There was plenty of time to network and socialise with drinks sessions at the end of day one and day two, together with the conference dinner. Professor Chris Moran from the Sustainable Minerals Institute at UQ gave a thought provoking and entertaining discussion focused on why any of us should bother to be sustainable if the world is going to end soon!

The organisation of these events takes a substantial effort and I would like to acknowledge and thank everyone who assisted; particularly the conference sub-committee comprising Graham Pope, Doug Young, John Siemon, Julius Marinelli and Lloyd Hamilton; as well as Michele from EMENEM Event Management.

I was very proud to be associated with Drilling for Geology 2008 and we received tremendous support from sponsors, exhibitors and service providers; guaranteeing a successful, and importantly, affordable conference. We will have to wait and see if there is to be a second conference in a couple of years - any volunteers?

Mark Berry
Conference Convenor and AIG Qld Branch Chairman

AIG Federal President Andrew Waltho with the Queensland Minister for Mines and Energy, the Honourable Geoff Wilson, MP.

Conference delegates in the trade exhibition area.

Conference Delegates enjoying the evening.

Key-note speaker Scott Thomson discussing directional drilling and sensing in the global coal and coal seam methane industries.

Key-note speaker Matthew Spotkaeff presenting an overview of the capabilities of drill hole geophysics in the oil and gas industry.

Conference dinner guest speaker Professor Chris Moran from University of Queensland, posing the question 'why be sustainable if the world is going to end soon?'.

Business development in action at the trade exhibit!

Delegates enjoying the conference dinner at the majestic ballroom of Brisbane City Hall.

WA Xmas Cruise - joint AIG-GSA event


Vyriot Pty Ltd (Licensee)
Andrew McKellar Campbell (Manager)

Conferences in the Near Future

February 2009

19 WA Geological Survey Seminar and Poster Display: Fremantle Australia

23 Mine Tailings & Environmental Management: Perth Australia

24 Gladstone Resources Industry Update: Brisbane Australia

25 Best Practices in Process-Affected Water Management: Toronto Canada

26 Mine Max 2009: Perth Australia

March 2009

03 Mine Feasibility 2009: Perth Australia

16 Developing and Managing Contracts in Mining: Brisbane Australia

16 Contract Mining & Engineering Services: Brisbane Australia

16 Resource Development in the North West & Kimberley Region: Broome Australia

24 Queensland Power: Brisbane Australia

26 Queensland LNG Developments: Brisbane Australia

April 2009

19 European Geosciences Union: General Assembly 2009: Vienna Austria

28 Mine Site Emergency Management 2009: Brisbane Australia

29 Crushing & Grinding 2009: Brisbane Australia

May 2009

26 Mine Closure & Rehabilitation: Brisbane Australia

26 Mine Safe 2009: Perth Australia

June 2009

09 IV Industry Summit on Mining Performance: Sustainable Business Process Improvement: Toronto Canada

10 Mining the Pilbara: Karratha Australia

14 International Multidisciplinary Scientific Geo-Conference and Expo - SGEM (Surveying Geology & Mining Ecology Management): Albena Resort Bulgaria

16 Physical Separation 09: Falmouth United Kingdom

22 Dust & Noise Management in Mining: Brisbane Australia

July 2009

06 Sustainable Development Indicators in the Minerals Industry: Gold Coast Australia

14 The 7th International Conference on Field and Service Robots: Cambridge Massachusetts

September 2009

01 Mining NSW: Orange Australia

07 AMIREG 2009 - Towards sustainable development: Assessing the footprint of resource utilization and hazardous waste management: Athens Greece

09 Mining the Territory: Darwin Australia

September 2009 (cont.)

15 Water in Mining 2009: Perth Australia

October 2009

15 Mining North Queensland: Townsville Australia

November 2009

17 Mining the Isa: Mount Isa Australia

30 Mines and Money: London 2009 London United Kingdom

December 2009

02 Mining South Australia: Whyalla Australia

GSWA 2009 Seminar and Poster Display

Geological Survey of Western Australia

Event Outline

GSWA's (Geological Survey Western Australia) Seminar and Poster Display will again showcase to mineral and petroleum explorers, early results of its ongoing work program. GSWA will also demonstrate current exploration data and software available online.

In addition to our regular mapping program update, focus will be on products from the WA Government's major programs of airborne geophysical surveys, regional gravity surveys and new geochronological data.

Throughout the day there will be geological presentations on GSWA activities and an extensive poster display. A feature of the day will be a panel discussion on the role and work programs of GSWA.

There will also be presentations from leading GSWA experts on topics such as the Gascoyne Complex, western Musgrave Complex, gold and base metals mineralisation in the Edmund Basin and uranium mineralisation in Western Australia.

Event Details

Event Type: Seminar and Poster Display

Date: 19/02/2009

Venue: Esplanade Hotel, Fremantle

Location: Cnr Marine Tce & Essex St, Fremantle

Cost: $80

Contact Details: Nell Stoyanoff
Phone: 08 9222 3168
Fax: 08 9222 3633
Email: nell.stoyanoff@dmp.wa.gov.au

NQEM 2009 — North Queensland Exploration & Mining Symposium

3rd June
1 day workshop by Geoscience Australia in Townsville

4-5th June
2 day AIG Symposium in Townsville

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

New discoveries, mineralisation styles and advances in understanding ore deposits will be the theme for six days in June in north Queensland. During the six days, the AIG, GSA and GA are collaborating to offer a symposium, field conference and workshop that will provide opportunities for geoscientists to get together and discuss the geology and resource potential of northern Queensland.

The two-day symposium organised by the AIG Queensland Branch will run from Thursday 4th June to Friday 5th June, with the symposium dinner on the Thursday night. The preliminary symposium program includes presentations on recent north Queensland mineral discoveries and advances in the understanding of mineralisation styles, including Mt Wright breccia-hosted Au, Cu +/- Au mineralisation in the Cloncurry region, Anastasia porphyry-related epithermal Au, porphyry-related Au-base metals in the Chillagoe region, Drummond Basin porphyry-Mo, and VHMS base metal mineralisation.

On Wednesday 3rd June, Geoscience Australia will be offering a one-day pre-symposium workshop in Townsville. The workshop will discuss the results of the Mt Isa-Georgetown-Charters Towers seismic transects, and will include the release of new data.

Immediately following the symposium the GSA (Queensland Branch) will again run its popular field conference. This year the field conference will be held over the three days of the Queen's Birthday long weekend, from the 6th to 8th June, in the Charters Towers area. The field conference will focus on gold mineralisation styles of the region, and will include visits to Conquest Mining NL's Mt Carlton deposit near Collinsville, a high level epithermal gold/silver/copper project deposit; Resolute Mining Ltd's Ravenswood and Mt Wright breccia pipe deposit, and to Citigold Corporation Ltd's deep high grade gold deposits at Charters Towers. Features of the regional geology will be seen during the excursion along with historic features of the Charters Towers field. Recent releases by Geoscience Australia and the GSQ of seismic data in the area will also be reviewed.

Further information on registration, accommodation, sponsorship and exhibitor opportunities will be available soon from:
Doug Young at d.young@findex.net.au and
Kaylene Camuti at lantana@beyond.net.au.

Regolith Science

REVIEW BY LOUIS HISSINK

Edited by Keith M Scott and Colin F Pain

AU$145 Published CSIRO Publishing, October 2008, Hardback, 472 pages

This is a handsome book summarising the latest developments in regolith science which the accompanying review notes states as "a comprehensive reference on the fundamentals of regolith science", describing the evolution of regolith from parental rocks with emphasis on the physical, chemical, hydrological and biological processes in regolith formation. It is the culmination of research carried out by CRCLEME over a period of thirteen years and comprises 14 chapters taking 376 pages, two appendices, Appendix 1 a glossary, and Appendix 2 regolith geochemistry of the elements and an index of some seven pages. The book is split into two parts divided by a colour section between chapters seven and eight, presumably to reduce printing costs, which complements the chapters on geophysics and GIS and 3D visualisation of regolith geology.

This book should be a must have for many AIG members insofar that most of the Australian continent that hosts tomorrows mines is blanketed by a pervasive sheet of obscuring regolith. The book will be of enormous assistance to those of us who need to know regolith science, or dare I say, geology, to unravel the subtle geochemical and geophysical anomalies in our data sets.

The chapters include a useful introduction followed by Chapter two by Brad Pillans, the development of regolith over the long periods of geological time.

Chapter three by Graham Taylor summarises the various landscape and regolith types in a standardised manner and concludes that regolith should be viewed as an overprint on prior material, with the oldest features generally being topographically highest, but unless reliable age determinations are used to date regolith ages, "dangerously misleading" ages could be assigned.

Chapter four by Richard Eggleton details regolith mineralogy and is comprehensive — and the reader needs a sound understanding of mineralogy as well — not for the "mineralogically challenged". There is a useful section quantifying clay minerals in a sample, but while it is possible to get an accurate estimate by a combination of quantitative phase separation followed by electron microscopy and micro-analysis, XRD, sub-sample chemical analysis, infra-red analysis, this procedure is hardly useful for day to day drill sample logging. XRD interpretational software assumes clays diffract as 3-D crystals but many of the alumino-silicate clays don't. The last section deals with hyperspectral techniques which some AIG members might be familiar with as it often involves the use of PIMA or ASD portable instruments and the ability to capture many field measurements.

Regolith geochemistry is dealt with by Kenneth McQueen in chapter five, and most of it would be familiar to AIG members, with a useful section on determining geochemical anomalies using statistical methods.

Chapter six deals with rock weathering and regolith structure by Kenneth McQueen and Keith Scott. This chapter is an important one as many secondary ore bodies are hosted in regolith and it's important to be aware of the structural complexity of the potential host material. This fact came to light recently with the drilling I was involved with at the Koongie Cu-Zn deposit near Halls Creek — supergene enrichment in a structurally complex setting. Idealised profiles for the regolith are presented, with a good discussion of what to expect over various broad rock types ranging from mafic to felsic. Some field examples are given as well, including sedimentary and carbonate rocks. Weathering regimes are discussed as a section on geochemical dispersion under these regimes. Discriminating parent rock types forms another section in which geochemistry is shown to have some utility. *(This raises an interesting issue because most junior explorers are loathe to assay no more than is necessary, severely limiting this approach, but if portable XRF analysers such as the Niton or Innov-X devices are used, then this method will become more routine to identify regolith provenance - Ed).*

Chapter seven, a joint effort by Frank Reith, Mira Durr, Susan Welch and Stephen Rogers, deals with geomicrobiology and the carbon cycle. It assumes the earth is a chemically closed system and from that proceeds to discuss in some detail the various element cycles, carbon, nitrogen and sulphur. Detailed descriptions of the elemental dispersion follows, including useful isotopic bio-signatures. Case studies are discussed and a useful section on the application of molecular tools and techniques finishes this chapter.

While chapter seven dealt with the micro-biological environment, chapter eight by John Field and David Little deals with the macro-biological side of regolith development. Figure 8.1, for example, lists the scale at which biota affect the regolith, from the atomic scale at one end, to the macro biota at the other including trees and elephants and buffalo, and then everything in between. The treatment is somewhat technical with a profusion of technical terms that should not frighten potential readers too much, however. There are very useful treatments on animal burrowing (bioturbation is the proper term) with specific treatments on refugia (no this does not mean refuse but places of animal subterranean habitation) , foraging, animal tracks and terracettes (looking this up in the glossary shows that it's those small parallel terraces on steep hillsides caused by animal traffic, ie sheep), nests and mounds, earthworms and finally saliva, corpses, gastroliths, excreta and gut flora, the latter treatment describing some of the less obvious interactions between the regolith and biota.

Chapter nine, by Tim Munday, deals with regolith geophysics and most AIG members would be familiar with some of the techniques though I wasn't aware that there were so many techniques available to mineral explorers — Table 9.1 lists some thirty-seven methods all identified by jargon rich acronyms. Typical geophysical characteristics of various regolith types are listed, and most of the surveying techniques are discussed in more detail. The whole purpose of using geophysical techniques is to map the regolith, and this chapter deals with the utility of each geophysical technique under the heading "geophysical technologies, principles and applications".

Chapter ten by Richard Cresswell and Paul Shand discusses the role of water in regolith development, and it was of interest to learn that of the world's total water only 2% is locked up in icecaps and glaciers, with 97% in the oceans, and hence 1% on or within the landmasses. (It might an interesting exercise to calculate what a potential sea level rise would be if the 2% melted). It's a detailed treatment of water and bound to become more important given the little publicised drying up

Cont. Overleaf

Regolith Science

Cont. from Page 27

of the world's water bores as alleged by Lance Endersbee AO recently. Water is, after all, a mineral, and should be part of our commodity targeting efforts.

One of the primary geological tools is mapping and getting the regolith mapped accurately should be uppermost on AIG members minds since outcrop is only about 15% of Australia's land area. However, it appears that our time honoured methods are not appropriate for regolith mapping and this chapter tells us why. Given the decreasing number of new mineral deposit discoveries, one wonders whether this is because we have been using the wrong methods to begin with. Chapter eleven by Colin Pain is therefore a "must be read and studied chapter" for AIG members if we need to develop the necessary skills to understand the regolith hiding tomorrow's mines. There is a useful treatment of regolith nomenclature, especially the map codes which should be used. Emphasis is placed on defining the purpose of regolith maps as the character of a regolith map depends on what it has been produced for.

Chapter twelve by Robert Fitzpatrick deals with soils and resource management, and "examines the role of soil processes forming saline, sodic, acid, eroded and acid sulphate soils", further developed in the next chapter, chapter thirteen. The chapter reviews established concepts of pedology that relevance to resource management with brief examples and case studies.

Chapter thirteen by Charles Butt, Keith Scott, Matthias Cornelius and Ian Robertson on regolith sampling for geochemical exploration was of particular interest, for it impinges on the basic exploration — sampling. The section on sampling procedures points out that in order to sample the regolith correctly, resort to drilling is required and here there is a serious problem — ground access and the various impediments to, what is defined sensu-strictu as ground disturbing activities. Air drilling, whether RAB, RC or AC, is rather difficult to implement these days on greenfield exploration projects. The legislative impediments put in front of mineral explorers in the form of black, green and red tape is such that wild cat regolith drilling will never be done under the present legislative climate. The authors seem not aware of this factor. Otherwise, this chapter contains much useful information. Given this current restriction to exploration activities, it is none the less a must read chapter for AIG members.

The last chapter deals with the extraterrestrial regolith, and while of peripheral interest, I wonder why it was needed. It certainly won't be of any immediate use to mineral explorers, even in the distant future, but perhaps the more we understand the Earth, the easier it might be to make sense of the other planets in our solar system.

All in all this a well written book with a wealth of up to date information — personal experience with it suggests it needs to be read a few times to absorb all within it. It is a must purchase for AIG members who intend to remain at the coal face of modern mineral exploration — field work. ▲▲

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

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

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

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

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

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

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

NEW BOOK: Heaven and Earth: Climate change — the real science

by Ian Plimer

— challenges every single assertion made by advocates of climate change, showing the existence of a huge body of scientific information contrary to what we read and hear in the public arena.

After the Introduction, the chapter on History shows that climates have always changed in historical, archaeological and geological time. These past changes have been faster than anything at present and have given a far warmer world than now. The chapter on the Sun shows how the Sun, the Earth's magnetic field and cosmic radiation are the drivers of climate, points that are conveniently forgotten. In the Earth chapter, all the the previous drivers of climate are discussed — the role of tectonics, how CO_2 derives mainly from natural processes and how one volcano can ruin your whole day. The chapter on Ice shows how ice sheets wax and wane, that the rates of change are now slow, how ice is a poor guide to climate and how ice has huge lags so features we see today are an expression of the past. The chapter on Water shows how surface heat is in the oceans, that scaremongering on sea level changes and ocean acidity can only be made in the absence of a knowledge of history and geology. In Air, grave concerns are aired about how temperature and CO2 is measured, massaged and used in science are aired. In the final chapter, Plimer gives his own views on the environmental movement. The cover notes are written by Dr Vaclav Klaus (2009 EU President) and Lord Lawson (Chancellor of the Exchequer in the Thatcher government).

The book is ~400 pages long, 48 diagrams and has 2,269 scientific references. The book is at three levels. Questions, answers and summaries of each chapter for those in a hurry, journalists and those wanting a flavour of the text. The chapter text is written for the general reader. The references that readers can use to validate the science in the book. The book will retail for $39.95, pre-publication cost is $29.95.

Education Report

Student Bursaries

The application form for 2009 AIG bursaries will be available in early April. The application form will be distributed to students and academics throughout Australia and will also be available on the AIG web site and from the AIG secretariat.

Student Employment — New AIG Web Page

In late January the AIG launched a Student Employment page on the AIG web site. We recognise that employment opportunities for students are likely to be very limited this year, but we hope the new web page will help enthusiastic students who are looking for vacation work. The page allows students to enter their contact details, employment preferences, and availability for work. If you're a geoscience student who will be looking for vacation work this year, please register on the new web page at http://aig.org.au/. If you're a potential employer, we encourage you to keep in touch with students via local AIG student-industry functions, and browse the student employment web page and consider hiring a student or two this year if budgets permit.

Kaylene Camuti, Chair, Education Committee

SPONSORS of the AIG GEOSCIENCE BURSARIES

The AIG wishes to thank the following individuals and organisations for their support of the
GEOSCIENCE STUDENT BURSARIES

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

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

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

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

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Presentation of AIG Bursaries — NSW

NSW'S THREE ENTHUSIASTIC bursary recipients were presented with framed awards at the SMEDG-AIG meeting in Sydney on January 29.

From left to right - Steve Collins (SMEDG and AIG member), Glen Diemar (SMEDG Bursary winner), Wendy Corbett (NSW AIG Branch Chair), Ryan Portner (NSW AIG Bursary winner) and Vashti Singh (NSW AIG Bursary winner).

Each recipient gave an excellent talk on their work. The eclectic mix of topics and the professionalism of each speaker (despite some computer glitches on an overloaded laptop) made for a most interesting meeting. Glen Diemar (University of Western Sydney), the SMEDG bursary winner, described his honours work on the supergene dispersion of antimony and how this relates to exploration for antimony ore deposits. His work showed that antimony just sits tight close to its source. Glen has just started work at Olympic Dam. Vashti Singh (University of Sydney), NSW AIG bursary winner, gave all the mineral exploration people a heads up on her honours thesis that involved studying oil migration in the Roper Basin referring to some exciting finds of cyanobacteria. Vashti is moving to Perth to start work with Woodside. Ryan Portner, NSW AIG bursary winner, is completing his PhD at Macquarie University this year and has been examining different rock facies on Macquarie Island and their potential implications in a dying Miocene spreading ridge. All three were most appreciative of the support from AIG and SMEDG. Many colleagues of the speakers attended the presentation evening and older AIG participants appreciated being outnumbered by young people at a technical meeting.

CSIRO Scientist Discovers Natural 'Invisible' Gold

CSIRO Media Release, June 2008

NANOPARTICLES OF GOLD too small to be seen with the naked eye have been created in laboratories, but up until now, have never been seen in nature.

The search for these natural but 'invisible' nanoparticles is important. If they can be proved to exist, the knowledge will help give us a deeper understanding of how gold can be transported and deposited by geological processes, and therefore help explorers to find new gold deposits in Australia. Now, hard evidence that gold nanoparticles have finally been seen in nature is presented in a paper published in GEOLOGY and authored by CSIRO Scientists from the Minerals Down Under National Research Flagship and CRC LEME, in collaboration with scientists from Curtin University and the University of Western Australia.

"The gold nanoparticles have not been identified earlier because they are transparent to electron beams and effectively invisible" CSIRO's Team Leader Mineral-Water Interactions, Exploration and Mining, Dr Rob Hough Lead author, CSIRO's Dr Rob Hough, explains that the particles were discovered in Western Australia. "In the southern areas of the State, groundwater is very salty and acidic. This water dissolves primary gold and re-deposits it as pure gold crystals on fracture surfaces and in open pore spaces," he says.

"On investigation of these crystals, there appeared to be a dark band across them. However, high magnification imaging showed the band was in fact, a mass of gold nanoparticles and nanoplates. These are identical to those being manufactured in laboratories around the world for their unique properties."

Clays from the fracture surface were then analysed. There was no gold visible, but analysis showed the clays contained up to 59 parts-per-million of gold. The research team concluded that the nanoparticles of gold they had imaged represented the 'invisible' gold in the clay, and that this nanosized gold was common in similar environments.

"The gold nanoparticles have not been identified earlier because they are transparent to electron beams and effectively invisible," Dr Hough says. "However, they are probably a common form of gold in this type of natural environment worldwide, where saline water interacts with gold deposits. They also provide the first direct observation of the nanoscale mobility of gold during weathering."

With gold fetching around (AU) $950 an ounce and expected to rise, this research is good news for Australia's gold explorers.

Complaints, Complaints, Complaints

How accurate are your measurements?

The first Complaints column for 2009 focuses on reporting of measurements in exploration reports and announcements. A number of recent announcements contain measurements of depth down-hole, or elemental abundances that imply a much higher level of accuracy that the measurement technique would suggest. For instance, the Complaints Panel has seen copper, base metal, and uranium abundances quoted to two decimal points, average grades and total tonnages to the second decimal point and nearest tonne respectively, and depth down drill holes to two and three decimal points. Competent Persons should be aware of the limitations of the measurement technique and round measurements appropriately. Implying a higher degree of accuracy than is justified could be a breach of Transparency, and in relation to public reports, Clause 24 of the JORC Code encourages discussion of the relative accuracy of Mineral Resource estimates.

JORC training courses

Some of you may have attended courses for Competent Persons run by the WA Branch of AIG - these are half-day, hands-on courses that use real examples to assist our members to draft better reports.

I am pleased to announce that the Australian Securities Exchange (ASX) using funding generated from fines imposed by its Disciplinary Tribunal will support the AIG and the AusIMM to educate Competent Persons in drafting reports which comply with the JORC Code. The ASX identified AIG's workshop as an effective measure to increase compliance in listed entity reporting on JORC Code matters. Accordingly, the ASX has agreed to support up to 20 similar workshops all around Australia run by AIG and AusIMM.

Rick Rogerson
Chairman, Complaints Committee

RPGeo Approval and Applicants

CANDIDATES APPROVED BY AIG COUNCIL IN NOVEMBER 2008

Dr Wendy McLean of Sydney, New South Wales, in the field of Hydrogeology

Mr Justin Legg of Petrie, Queensland, in the field of Mineral Exploration

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

Mr Murray Brooker of Pyrmont, New South Wales, has applied in the fields of Mineral Exploration, Hydrogeology and Environmental Geoscience

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

Membership Update

New Members and Upgrades at the November Council Meeting 2008

MEMBERS		
ALLEN	Christopher	Anthony
AUSTIN	Grant	Edward
BROWN	Petert	
CAREY	Michelle	Lisa
CLOSE	Robert	James
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FRYAR	Joanne	Heather
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LINDSAY	Richard	Pelham
MACKAY	Wallace	Gordon
MATHESON	Mathew	Dougald
NIND	Maxwell	Alan Pitt
POLITO	Paul	Antonio
RANDELL	Jeffrey	Peter
REPACHOLI	Felicity	
SANTOS	Geraldo	G V
SOMUAH-BOATENG	Nana	Frempong
TOMS	Bradley	Ronald
VALLANCE	Stephen	Adam
VAN NOORT	Erik	Neil
WEGNER	Stephen	Richard Bruce
WILSON	Bruce	Hamilton
ZUCCOLO	Richard	Andrew
TAIT	Mark	Adam
FELLOWS		
BOURNE	Barry	Trevor
DE WAELE	Bert	Noel
O'BRIEN	Reginald	Thomas
ASSOCIATES		
HILGENDORF	Peter	Ross
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HASELDEN	Troderick	John
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KALHORO	Javed	Ali
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RETIRED		
BRINK	Gysbertus	Barend

We welcome all new members to the AIG.

AIG FEDERAL COUNCIL FOR 2007-2008

AIG NEWS

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

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