GEOLOGICAL SOCIETY OF NEW ZEALAND (Inc)

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David Smale – An Appreciation

David Smale

At the Kaikoura Conference in December 2005 David Smale stepped down after seven years as the Society's editor. He was responsible for seeing 18 Newsletters distributed to members. During his editorship, David ensured that the Newsletter maintained a high standard and fulfilled its role conveying a wide range of information to members. This he achieved in his characteristically quiet unassuming manner, no one feeling aggrieved at editorial decisions. David often remarked that as Editor he became very well informed about the wider geological community. Except for just prior to printing, it was a task that he could pick up or put aside depending on his mood.

During David's tenure production of the Newsletter became fully electronic, speeding compilation, editing and printing. This was further expedited by it being printed in Nelson, minimizing last minute glitches. There was however, a downside. The previous printer could automatically package the newsletters, and label with addresses provided by Beth Wallace. David however, would collect the printed Newsletters (about 800) and he, his wife Sarah together with at times, Alison and Mike Johnston, would insert the newsletters into paper envelopes and attach the names and addresses received from Beth. David would then transport the lot to the post office. Most of this exercise was accomplished in the Smale's kitchen where boxes of Newsletters, envelopes, stamps, labels and discarded boxes and paper occupied all of the table and much of the floor. The table was seriously challenged by the last Newsletter as this was accompanied by Bruce Hayward's history of the Society, which David had also edited. For the participants in these four-monthly dramas, the time proved enjoyable providing opportunity to reminisce about the old times, with in depth appraisals of local wines.

The Newsletter is vital, in that it keeps members informed about issues facing the Society and in the wider geological community. While the Society has for a number of years used the News Flashes, instituted by Simon Nathan, for more rapid communications there is, as yet, no ground swell to change the present form of the Newsletter. Also the sending out of the News Flashes, under the auspices of Nick Mortimer, is not a simple exercise. It is imperative that the Kerry, the new editor, continues to receive contributions for the Newsletter from members and institutions.

Thank you David for the considerable time and effort you have given the Society, not just as Editor but also as secretary for from 1977-79. Sarah Smale's work too we also acknowledge and much appreciate. **Mike Johnston,** Nelson

If we have seen far – celebrating 50 years

Keith Lewis

It was one of the classics. 50Kaikoura05 was not just successful, it was downright enjoyable. According to one kind enthusiast, the remote location and even the last minute change of venue generated a camaraderie that was contagious and memorable; the same primary school class rooms used in 1955 giving a sense of continuity. Another appreciated being "forced" into an affable mid conference field trip in spectacularly scenic geology. There were some excellent papers, fun social events, and a celebration of our origins and of its early eccentric heroes. But what really came through was just how far we have come in 50 years.

The last Newsletter and Bruce's "History" set the scene. 1955 was an exciting time of renewed vigour in geology, but it was light years away from the concepts and techniques that we now take for granted. The "olde timers" were out there with hammer, pack horse and gun, rather than locked indoors with supercomputers. Positioning was working out which valley you were in and putting a cross on a map, not turning on GPS. It was the heyday of palaeontology, there being no other practical method of dating rocks. There was no unifying theory; continental drift was lunatic fringe at most places in the world, except perhaps Victoria. Harold Wellman's crazy idea about huge lateral shifts on an Alpine Fault was changing thinking, but plate tectonics, with its integration of the oceans, was still more than a decade away. But, if you had a reasonable B.Sc in geology, there was probably a job for you with a career for the next 40 years.

In my own field of Marine Geology, the first full-time marine geologist arrived at the newly formed N.Z. Oceanographic Institute in late 1955, one of the first outside UK and USA. Incredibly, Henry Pantin is still publishing highly innovative science 50 years later; his flume-based, mathematical model of autosuspension (turbidity currents) leaving a few glazed expressions in Kaikoura's 1930s cinema. Looking back it is incredible how much real understanding was achieved with primitive home-made equipment, a sextant much like Captain Cook used, and a laterally thinking brain. Perhaps not everything has improved. Instead of months of "strategic planning", proposal writing and reviewing, there was a one hour discussion with the director (GSNZ and NZOI founder, Jim Brodie) followed by tea-room discussion and horse-trading with colleagues for limited resources, including ship-time.

The fifties was a time when lateral thinkers, onshore and offshore, gave New Zealand geoscience a prominence out of proportion to its numbers. 50th Kaikoura05 was a reminder of Isaac Newton's famous words "if [we] have seen far, it is because [we] have stood on the shoulders of giants". **Keith Lewis, President**

"cm/yr" is now available – what of the next 50 years?

David Kear
34 West End, Whakatane (kear@xtra.co.nz)

This is the text of a paper that was presented at the Geological Society of New Zealand's 2005 50th Anniversary Conference in Kaikoura, with additional text to answer questions raised by members who asked to see the text published. Most diagrams displayed had been published earlier, particularly in Kear 2004; three that had not been, are included here.

"cm/yr"

Our Society has lived up to all the expectations of those of us at its launch 50 years ago. Since then geoscience has staged an unparalleled revolution, with NZ playing a key initial role. At the Rotorua Conference, 7 years before Kaikoura, Harold Wellman launched the Alpine Fault. The BBC saw that as *the* turning point that caused most geologists world-wide to change from disbelief to belief in Continental Drift. "Plate Tectonics", in its widest sense, was born and we acquired this new unit "cm/yr" for movements between and within the plates. I believe that those who wish it can now replace an old *static* view of geology with a new *dynamic* one.

Today most NZ geologists acknowledge a belief in plate tectonics. Some determine today's rates of movement around NZ in cm/yr. I suspect however, that others prefer to ignore the longer-term consequences of the movements involved. A mere 4 cm/yr times a mere 2½ Myr, equals 100 km, and is significant in basin, provenance and comparable studies. More significantly, long term movements must lead to new concepts about NZ's detailed geological history. Concepts are not either right or wrong like data, but they need to evolve as more minds improve them, and make them more universally acceptable. Take the Alpine Fault. Harold Wellman initially thought that all 300 miles of movement was pre-Tertiary. He and others corrected that later, but his concept wasn't invalidated meantime, merely improved.

But what of the next 50 years? NZ is well placed, on a major plate boundary, to contribute further to world understanding of "Plate Tectonics" in its widest sense, but I believe we need to discuss more, and record more in our literature, of the consequences in NZ of "cm/yr".

There was a weighty rearguard action against Continental Drift. Eight years after Kaikoura, & fifteen after Rotorua, the renowned geophysicist Sir Harold Jeffreys still advised: "Forget Continental Drift, it's physically impossible". Here in NZ, Graeme Stevens reminded us that, around the time of Kaikoura, the Professor of Geology at Victoria forbade his most senior member of staff ever to talk about Continental Drift to students again. Then too, Frank Evison (Jeffreys' NZ counterpart) had a concrete block wall built across a fault line at Maruia Springs, presumably to show that fault movement within NZ was a myth.

Perhaps some hang-over remains. Or perhaps, I am wrong and there is no reluctance to accept the full consequences of plate tectonic movements (*sensu lato*) into everyone's everyday thinking, discussion and writing. You must assess your own reaction to the movements

implied by some North Island plate tectonic concepts and to decide whether your thinking needs adjusting for our second 50 years.

Northland Allochthon

Lets start with an accepted concept. At the annual conference at Reefton, three years after Kaikoura, I proposed that a major formation, emplaced as an overthrust or nappe, covered *most* of Northland *deeply* (Kear 1958) - and its recognition would simplify Northland's presumed geological complexity. Larry Harrington apparently had similar thoughts at that time. I didn't expect immediate belief - but I was surprised that for over 20 years, this would be a completely forbidden subject for discussion or correspondence between me and everyone except Barry Waterhouse, a co-author of two "massaging papers".

After 21 years, two imported geologists Peter Ballance & Bernhard Spörli (1979) published their excellent paper on the Northland Allochthon. But the near-universal prohibition of any discussion by virtually everybody delayed by almost half of our first 50 years, the massaging and acceptance of what is now a cornerstone of Northland geological thinking. The lessons for the next 50 years are: that "plate tectonic movement" has commonly not been recognised earlier; that old fixed attitudes may need amending; and that new concepts should be taken seriously, at least briefly, particularly if they appear to simplify the geology, as this did.

Alpine Fault (Kear 2004, fig. 1)

The Alpine Fault is the South Island's most commonly figured tectonic line, and is well known world-wide, but what of the North Island? Jim Cole, Harold Wellman, Graeme Stevens, Nick Mortimer, Bill Watters, Peter Ballance, Chris Adams, and many others, including myself, have all recognised some North Island fault (perhaps inferred) with comparable movement to that on the Alpine Fault. Most show joining in the South Island.

Last year, at our Taupo Conference, I showed the Alpine Fault as moving through the North Island, broadly between 15 & 5 Ma at 3 cm/yr. Much of its trace can be located precisely as bounding the Central Volcanic Region, and seems consistent with all the records I've quoted above. Yet many authors show an extension vaguely into the Pacific (even along the unfaulted Hikurangi Trough). I hope that NZ authors, in the next 50 years, will join the massaging process, select one line consistently, and allow NZ to inform the world unambiguously if, when, and where, the Alpine Fault extended northwards.

The acceptance of movement through both islands implies that the beginning of movement on that fault in the South Island could not have been earlier than 15 Ma, at a time when the Cook Strait area would have been located about the latitude of today's "Central North Island".

Edgecumbe Earthquake and Whakatane (Kear 2004: fig. 5)

After the 1987 Edgecumbe Earthquake, some 30 specialist papers were written. Among the best were those by Sarah Beanland, Kelvin Berryman, John Haines, and Ian Nairn. They and the others collectively gave an opportunity to determine precisely onshore North Island movement at a typically "plate tectonic rate".

After waiting nearly 15 years for one of those involved to take that next step, I did, and reported at Taupo last year, that *their work* showed that Whakatane had been moved southeast

at an average rate of 2½ cm/yr for 400,000 years - creating over 100 sq km of new land where nothing existed earlier. The moral for the next 50 years is to take every opportunity to determine precise "plate tectonic movements" within NZ, particularly from one's own work.

Central Volcanic Region (CVR, Fig. 1)

But I extended those 100 sq km of new land logically: first to the whole of the Taupo Volcanic Zone, and then to the earlier Manawahe and Mangakino Zones as well - thus involving the whole of the triangular Central Volcanic Region (Fig. 1). That Region, approaching 10% of the North Island in area, has been created since 2½ Ma, where nothing existed before.

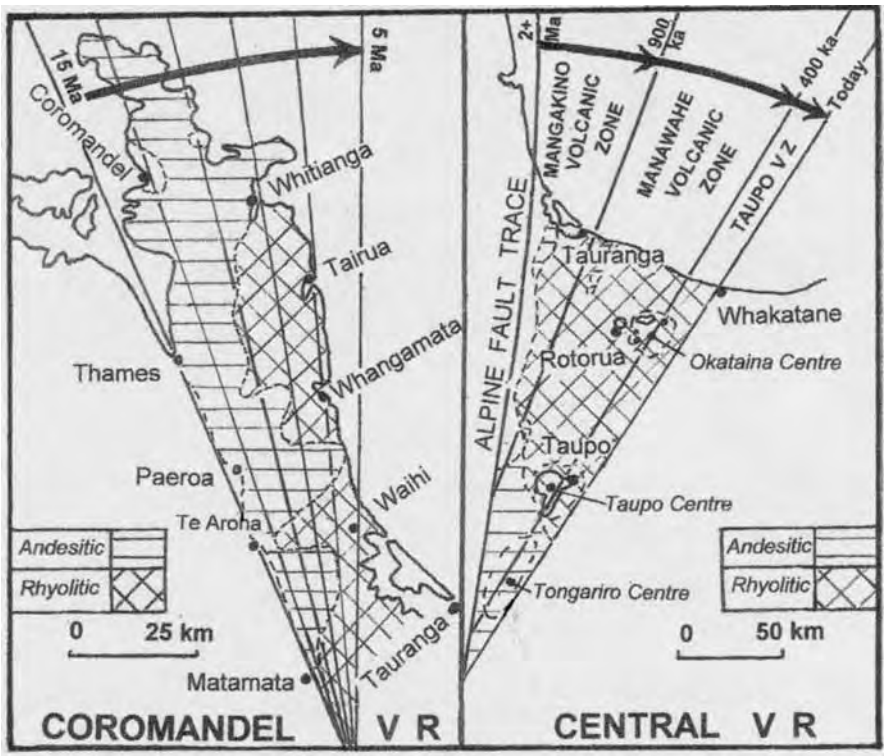

Fig 1 Coromandel and Central Volcanic Regions, showing the broad distribution of andesitic and rhyolitic volcanism, and the rotation imposed on each that led to "fanning out" in the north in each region

I'm not alone in these thoughts. Forty years ago Jim Healy (1962) and Bruce Thompson et al. (1968) provided new definitions. The Taupo Volcanic Zone would be the youngest part only of the Central Volcanic Region - now seen as embracing the last 400,000 & 2½ Myr

respectively. Their nomenclature implied clearly: first, the existence of earlier unnamed zones (but including a zone that Jim, with Tony Ewart 1968, termed the "older Mangakino Basin in the west"); and second, undoubted movement of volcanism with time within the CVR - if only eastwards from Mangakino. It could only have had a "plate tectonic" origin. While most geophysicists use their nomenclature, many geological authors choose to ignore their important advance (and its undoubted "plate tectonic" implications) by showing "Taupo Volcanic Zone" where they clearly mean "Central Volcanic Region". The hard 50 year lesson is that this is not a nomenclatural problem - it reflects essentially the difference between a *dynamic* and a *static* outlook about NZ Geology by the authors.

Tim Stern's diagram (1986), almost 20 years old, also connected, in the reader's eye, the opening of the CVR with that of the Havre Trough. That was also created from nothing in the same last 2½ Myr (on magnetic stripe evidence). Yet few papers dealing with events prior to 2½ Ma have shown the North Island with 10% (the CVR) missing.

A worthwhile 50 year goal could be seeking the universal acceptance that, at the opening of the Quaternary, the land around *and below* Taupo, Rotorua, and Tauranga just wasn't there.

Existing Data - Drifting North Island (Fig. 2)
New data are not essential to formulate such concepts. This 1963 diagram (Fig. 2) of the Drifting North Island, showing the opening of the CVR (and Coromandel), was based solely on volcanic and tectonic data published over 40 years ago, before most radiometric dating. A 50 year goal should be to create more such diagrams, similarly based on existing data.

Tuzo Wilson and "Tectonic Events"
In 1963 Tuzo Wilson concluded that the Pacific Plate passed westwards over one such spot (at a rate George Walker recorded as 9 cm/yr), leaving a trail of Hawaiian volcanic islands and seamounts - younging eastwards. The geological history of Hawaii includes a "tectonic event" - when one tectonic regime with movement broadly northwards (and younging southwards) changed abruptly to today's regime with movement broadly westwards (and younging eastwards).

North Island Tectonic Events
Comparable tectonic events have been identified and named in the North Island, some for over 10 years (Kear 1994, 2004). At roundly 25 Ma the *Waitemata Event* replaced virtual tectonic quiescence with Northland's non-migrating subduction system and consequent andesitic volcanism. At roundly 15 Ma the *Kiwitahi Event* triggered major North Island transcurrent movement (including of the Alpine Fault, probably in both islands), as well as Coromandel volcanism, and some significant rotation. At 5 to 2½ Ma the *Kaimai Event* slowed or stopped transcurrent movement variously, but speeded up rotation remarkably (creating the CVR, and perhaps the Wanganui Basin, in the process).

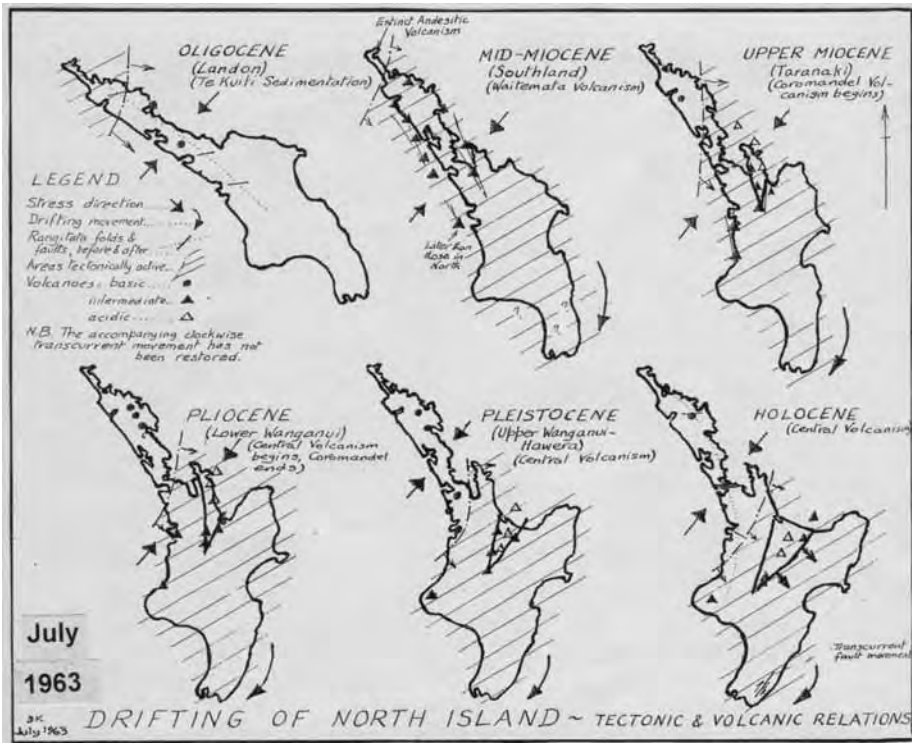

Fig 2 Drifting of the North Island (from Kear 1963, fig101).

Much massaging is needed on the detail and correlation of these events, but the wider recognition of "tectonic events" could help studies of NZ's post-Oligocene geological history during the next 50 years.

That leads on to the fact that the North Island's outline changed most between those Kiwitahi and Kaimai Events (from 15 to 5 Ma). Nick Mortimer's 1995 diagram (one of several to choose from) shows offshore Northland moving and rotating between 15 & 5 Ma to become the North Island's East Coast. The subduction system moved similarly.

As an example of the consequences of this, an eastern part of the Northland Allochthon (Hayward et al. 2001, Kear 2004: fig. 3) was moved southeast to become the now separate "East Coast Allochthon". The former was emplaced during a rare event - the establishment of the Northland Subduction System. No comparable system was being established at that time near the northern East Coast that could have allowed a comparable genesis for the East Coast Allochthon there – it could only have been created as an original part of the Northland Allochthon.

The long-term constancy of movement and rotation, a virtual recognition feature of "plate tectonic activity" in its widest sense, allows a fine subdivision of steadily changing geographic location and the regimes of tectonism and volcanism within the North Island, since 15 Ma.

North Island Rotation

Major North Island clockwise rotation since 15 Ma has been recognised now for 20 to 30 years. Peter Ballance estimated 70° from his broad geological knowledge. Dick Walcott calculated 60° on paleomagnetic grounds. My estimate, based on volcanic alignments was 65°. More recently Lionel Carter has reported 55° since just 10 Ma, using Peter King's fascinating tectonic reconstructions. An average value of about 65° since the Kiwitahi Event of 15 Ma seems fully justified, and is not incompatible with the recent 2-4°/Myr reported at this conference by Nichol & Wallace (2005).

It is assumed that the clockwise rotation was caused by the southern part of the North Island being subjected to westward or southwestward plate tectonic thrusting, while the northern part of the Island was held firmly.

Hopefully, the next 50 years, will see more maps, diagrams, texts, and thinking that reflect these increasingly accepted very large rotations, with the special challenge of reconciling such rotation between the two islands.

Single Subduction System (Fig. 3)

North Island volcanism since around 25 Ma (covering the Northland, Coromandel, Central & Taranaki, and Western Offshore Regions) demands only a single subduction system, that has been moved by the amounts indicated by Nick Mortimer and others, and rotated by that average of 65°. Thus the original Northland Subduction System, by those movements, has migrated progressively to become the Hikurangi System of today (Fig. 3). This proposal is in keeping with Benioff Zone studies, initially by Trevor Hatherton and Nick Brothers, which helped identify three zones downslope (remembering that the "downslope" direction has changed progressively through those same 65°).

The zones are bounded by: the first appearance of volcanism above a Benioff Zone depth of around 80 km; the change from rhyolite to basalt as the major accompaniment to andesite at 120-140 km; and the appearance of high-potash volcanics at over 200 km. A competing suggestion linking Coromandel volcanism with the Hikurangi System (oriented as it is today) has to be rejected because it ignores steady rotation, and implies changes in volcanism across-slope in the Benioff Zone, not down-slope as good geological sense, and this diagram demand.

Rhyolitic Volcanism

A single example of what might be useful and achievable in the next 50 years, would be a NZ contribution to world studies of magma generation - particularly in rhyolitic volcanism and related geothermal activity, where our field examples and research records are among the World's best. Our growing ability could be vital - of determining, reasonably precisely, the

times of change in tectonic and volcanic regimes, and of the consequent movements (particularly of rotation).

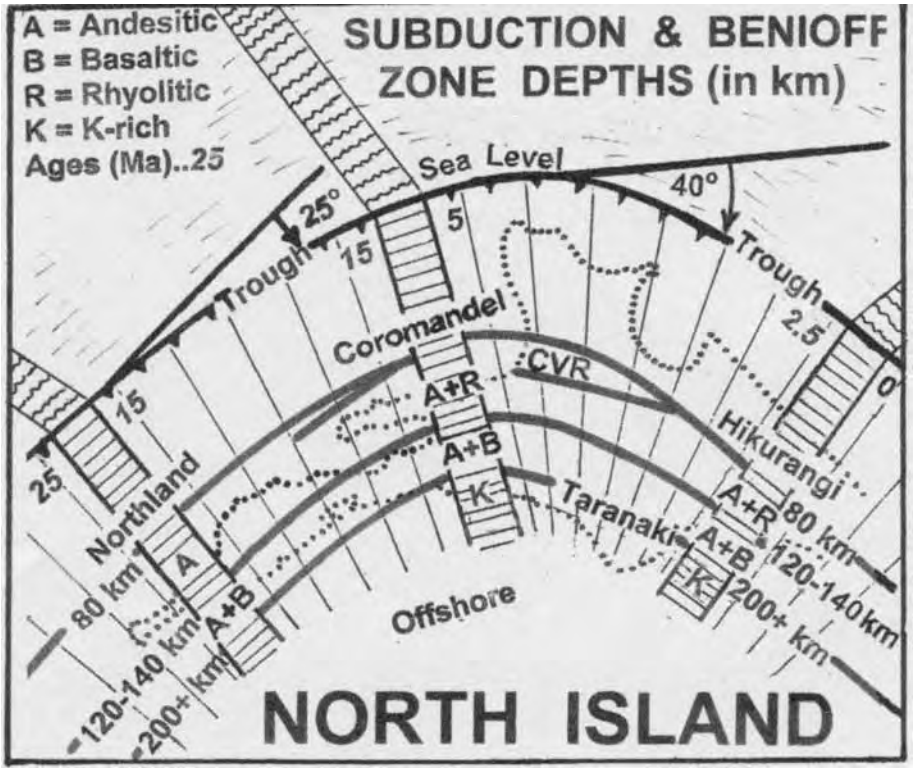

Fig 3 The single North Island subduction system and it's Benioff Zone, initiated 26-25Ma, which has been moved southwards transcurrently by 200-300 km and rotated through 65 degrees. It was active during Northland, Coromandel, Central & Taranaki (as today's Hikurangi system) and Western Offshore Region volcanism

Northland experienced neither rotation nor (perhaps as a consequence) true rhyolitic volcanism. Initial Coromandel volcanism was andesitic, which world-wide, occurs above the areas of highest compression within subduction systems. Rhyolitic volcanism arrived in Coromandel some 5 Myr later. Current studies assess that some 12^{o} of rotation took place during those 5 Myr, which would have caused a "fanning out" in the northern part of Coromandel (and comparably later in the CVR – Fig.1), reducing the tectonic compression in northern areas sufficiently: to create a faster route for basalt magma towards the surface; to establish a pool of that magma at a high crustal level; to heat intensely its roof of continental rock, producing dough-like rhyolitic magma; and to cause (as the manufacture of perlite

Atiamuri showed us) a sudden, massively expanding, explosion which in nature would have erupted pumice, ignimbrite and the rest, rapidly and in vast quantities.

Through this mechanism, the rhyolites in both regions were erupted alongside earlier andesites, with contemporary andesites having by then migrated further south where compression was still intense. (The location of the rhyolites, east of the earlier andesites, was due to subduction regression).

Marlborough, and Wellman's Alpine Fault

I must apologise for leaving the South Island so long, particularly because this is where NZ "Plate Tectonics" really began. It is heart-warming to see both the appearance of valuable tectonic reconstructions following the work in Marlborough by James Crampton, Malcolm Laird, and the rest, and the consequent tectonic flavour of this conference's fieldtrips.

Essentially Wellman's maps (1952) showed the 300 miles movement of part of the Red Hills of Marlborough to become the Red Mountains of West Otago. The 300 mile's metric equivalent of 450 km, coupled with the North Island conclusion that the Kiwitahi Event of 15 Ma triggered Alpine Fault movement in both islands, gave an average long-term movement rate on that fault of around 3 cm/yr. It is encouraging that the same figure also results from South Island work.

North Island Staged Movement since 15 Ma (Kear 2005: fig. 3)

It would be good to see, in the next 50 years, this surge of South Island work, leading to comparable maps to those that show steady movement of the North Island at 1-2 Myr intervals since the Kiwitahi Event of 15 Ma - due to transcurrent faulting and rotation. Those North Island maps could well do with vigorous massaging, particularly with a South Island input.

Finale

I hope that the next 50 years will see a greater discussion and acceptance of continuous movements in *cm/yr*, and rotations at ^{o}*/Myr*. Together they have changed the shape of New Zealand markedly, most rapidly in the last 2½ Myr. All our thinking, discussion and writing should reflect that.

Finally, I hope that the next 50 years will be as exciting and rewarding to those who are young geologists now, as the last 50 were to us, due very much to our new "Dynamic View of Geology".

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MEMBERS FORUM

Conference Fieldtrip extends Knowledge of Sequence!

Jack Grant-Mackie, Geology Dept, University of Auckland.

Conference fieldtrips are times when quite a group of eyes and geological expertise concentrates on parts of a section and when new data can thus be gathered. The Kaikoura Conference Fieldtrip 5B was one such trip.

The field guide (Browne et al. 2005) makes no mention of macrofossils at the first locality (Late Cretaceous Herring and Mead Hill Formations) and we were told that none had been found there. Soon after passing up from the Herring into the Mead Hill Formation, however, a couple of brachiopods, some bryozoan-like things, a bivalve impression, and echinoid spines were seen. Some participants, especially Daphne Lee with her eyes on the brachiopods, arranged to return later, and did so, finding a few more brachiopods.

Having a short time to spare at the end of the conference because of the cancellation of the planned paleontology meeting, I went back to the same section with Rhiannon Daymond-King and Mike Eagle. We searched again the lower part of the Mead Hill Formation, collected more macrofossils, and began to wonder what the bryozoan-like things really are. More careful lens work suggested they may be sponges, so I collected a variety of shapes. The next day I returned alone and looked more carefully at the basal sequence, which I had not studied earlier, noting masses of these irregular spongy masses standing out from the rock face.

I realized that I was looking at the accumulation of a hard-bottom fauna in the lower levels of a very soft-bottom deposit. The basal two metres of the Mead Hill is packed with sponges of many forms – globular, basket-like, conical, short cylinders, laterally extensive irregular masses, etc. They seem to represent the remnant of a sponge "garden" that had been attached to a hardground formed on the top of the Herring Formation and then incorporated into the lowest portion of the encroaching Mead Hill sediment.

Further consideration showed that the more diverse hard-bottom fauna, with the brachiopods, echinoids, etc. occurred in the overlying strata 2-5 m above the Herring Formation, with the sponges a much smaller proportion than in the underlying zone. Here, then, is the fauna of the hardground living a bit further away and incorporated later as the seas deepened. As far as we could determine, Bryozoa are *not* members of the Mead Hill macrofauna, although they could be expected in a hardground situation.

Above this level, i.e., 5+ m above the base, no macrofossils were seen at all. It is significant that chertification is strongest also in this basal zone. The field guide suggests that the silica has been derived from radiolaria and diatoms. I would suggest that siliceous sponges, perhaps more voluminous than these, are likely to have played a very important part in this process!

One wonders if a taxonomic study of these sponges could provide data on the paleobathymetry, which most of the microfauna does not.

Of the brachiopods collected during these visits, terebratulides greatly outnumber rhynchonellides (only two of the latter, compared with >10 of the former). This suggests that the predominance of terebratulides that Lee & MacFarlan (2005) documented for the Cenozoic in their talk at the conference may have been achieved by the Late Cretaceous.

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Amoeba Tell of Earthquake Risk in Hawkes Bay

Bruce Hayward, *a press release from Geomarine Research, Auckland*

Microscopic amoeba that grow small shells and live in tidal lagoons have provided new evidence of the risk of extremely large earthquakes in Hawkes Bay, according to the results of a new study presented last week at the Geological Society of New Zealand's Conference in Kaikoura. Auckland geologist Dr Bruce Hayward of Geomarine Research, said that thousands of these microscopic shells found fossilised in cores of sediment from Napier's Ahuriri Lagoon record seven sudden changes in sea level in the last 7200 years. Each sea level change was the result of major earth movements that accompanied a major earthquake. The youngest recorded sea level change was the 1.5 m of uplift that occurred during the 1931 Napier Earthquake which drained much of Ahuriri Lagoon. Napier Airport and some of Napier's newer suburbs are built on the reclaimed mud flats that were pushed up out of the sea at that time.

Studies by Geomarine Research show that the Napier Earthquake uplift was unusual, and that in general Hawkes Bay is subsiding. The amoeba shells indicate that the six earlier large earthquake displacements to have hit Napier all resulted in subsidence and consequent sea level rise throughout most of Hawkes Bay. Coastal land in southern Hawkes Bay has subsided by 8 m in the last 7200 years. These subsidence-related earthquakes appear to have occurred every 1000 to 1200 years with the most recent about 600 years ago.

The Napier Earthquake was produced by movement on a shallow fault that runs beneath Napier city. "Unlike the 1931 earthquake, the more common subsidence-related earthquakes appear to have resulted in widespread land movements throughout coastal Hawkes Bay", said

Dr Hayward. "This suggests that they may have been caused by slip on the boundary between the Pacific and Indian crustal plates, which lies beneath Napier at a depth of about 30 km. Earthquakes produced by slip on plate boundaries like this have not occurred in New Zealand in historic times, but elsewhere in the world they have produced the largest recorded earthquakes, such as the 1960 Chile Earthquake and 1964 Alaska Earthquake. Thus these six earlier earthquakes were likely stronger than the devastating Napier Earthquake, which destroyed most of Napier and Hastings with the loss of 256 lives." Bruce Hayward said that the positive news from this study was that if the frequency of these giant earthquakes remained the same, then the next real big quake in Hawkes Bay might be 400-600 years away. This does not mean however that southern Hawkes Bay may not be hit by damaging earthquakes sourced from other shallow faults in the meantime.

These new findings have implications for civil defence planning in Hawkes Bay. Large earthquakes accompanied by substantial widespread land and seafloor movements have a high probability of generating tsunami, say Geomarine scientists. Locally-generated tsunami hitting the Hawkes Bay coast have been modelled, but these models now need to include the possibility of 1-2 m of land subsidence occurring at the same time. Dr Hayward said that Napier city in particular, needs to look closely at the possible long-term impact that this amount of subsidence will have on low-lying parts of the city, like those built on the floor of Ahuriri Lagoon that was uplifted in 1931, as inevitably the area will continue to subside in future earthquakes.

Western Corridor Transportation Study

This is a copy of a letter sent 15 November 2005 to Peter Matich of the Porirua City Council in the name of the Society by then president, ***Mike Johnson.***

1. INTRODUCTION

Thank you for the opportunity to review the geotechnical report prepared for the Porirua City Council by the Institute of Geological & Nuclear Science (GNS) and titled *Western Corridor Transportation Study: Review of geological hazards affecting the proposed Coastal Highway Upgrade and Transmission Gully Motorway route*[1]. The Geological Society of New Zealand understands that your Council engaged GNS to prepare the report because of concern within the wider Wellington Region that various documents released to the public did not fully document the geotechnical issues with respect to the two alternative options. The most

[1] Hancox, G. T.; Dellow, G. D.; Perrin, N. D.; McSaveney, M. J. 2005: *Western Corridor Transportation Study: Review of geological hazards affecting the proposed Coastal Highway Upgrade and Transmission Gully Motorway route*. Unpublished Institute of Geological & Nuclear Science Client Report 2005/161 Project Number: 430W1187, dated October 2005, prepared for the Porirua City Council. Since completion of our review the Geological Society has received the Summary for the final GNS report dated 14 November 2005.

western option, known as the Coastal Route, involves the upgrading of the existing highway SH1 between Porirua and Paekakariki and is favoured by the Wellington Regional Council and Transit New Zealand. The other option, known as Transmission Gully Route, is to construct a completely new highway to the east of SH1.

The Geological Society became involved after a Wellington resident approached the Royal Society of New Zealand and expressed concern that the geological hazards (geohazards) that could affect the Coastal Route had been underestimated. In turn the Royal Society forwarded this concern to our Society. After discussion, it was agreed with the Porirua City Council that the Geological Society would not make a submission to Council on the proposed upgrade of the coastal route. Instead the Society could, through its expertise, make a more meaningful contribution by undertaking firstly a desktop assessment of the geohazards that could affect both routes followed by a review of the GNS report. This assessment and review was undertaken by Dr Mike Johnston[2], a geological consultant with over 40 years experience specialising in geological mapping, engineering geology and geohazards. He has undertaken geotechnical investigations in the Wellington Region and, on contract to GNS, was co-author of the Wellington 1:250,000 geological map.

1. ROUTE OPTIONS

Briefly, the options involve an upgrade of the existing SH1 or a new route further to the east through Transmission Gully.

2.1 Coastal Route

SH1 extends north from Porirua City, along the shores of Porirua Harbour before heading inland to reach the coast at Pukerua Bay. From the bay to Paekakariki the highway is at the toe of steep wave cut slope. The Coastal Route is also utilised by the NIMT Railway. The railway lies to the west of SH1 except north of Pukerua Bay where it is to the east and passes through a number of short tunnels. Between Pukerua Bay and Paekakariki slope movement has previously affected both the highway and the railway. A number of geotechnical investigations have been completed and, in places, mitigation measures have been implemented.

2.2 Transmission Gully

The Transmission Gully route branches off SH1 just south of Porirua and crosses low hills to reach Pauatahanui at the head of Porirua Harbour. From Pauatahanui the route follows a relatively straight course to the head of Transmission Gully and, after passing through Wainui Saddle, it descends on the east side of Te Puka Stream to terminate at the existing highway at Paekakariki. This route, which approximately follows a high-tension electricity transmission line, has been discussed for many years. Some geotechnical investigations have been undertaken and various design parameters have been mooted. The route has received formal designation, which allows for its construction should a decision be made to proceed with it.

2. GEOLOGY

The geology of the part of the Wellington Region containing the two routes is relatively simple and consists dominantly of grey sandstone and mudstone basement rocks referred to as "greywacke". Although hard, the greywacke is commonly affected by planes of weakness, such as bedding, joints, fractures and shears. Locally overlying the greywacke basement are areas of unconsolidated and commonly soft sediments including estuarine sands and muds, windblown sand, peat, alluvial fan and scree deposits and landslide debris. These sediments are only of significant extent around Porirua Harbour, and in the vicinity of Paekakariki. In addition, the weathering of the basement rocks has produced a widespread, but generally very superficial, regolith of greywacke debris. The Wellington Region is traversed by a complex system of active faults that largely trend between NNE and ENE. Evidence of surface rupture is present on many of the faults and rupture along the Wairarapa Fault in 1855, which bounds the east side of the Tararua Range, resulted in the largest earthquake (M=8.0-8.2) ever documented in New Zealand. The reason for the region having such a high earthquake risk is the proximity of the boundary between the Indo-Australian and Pacific plates along which movement averages approximately 40 mm/year. The plate boundary lies at a depth of about 28 km beneath Porirua City.

3. PREVIOUS GEOTECHNICAL INVESTIGATIONS

It is not proposed to comment in detail on previous work, except to note that there has been considerable investigation of the geohazards that could affect both routes. These investigations go back specifically to 1997 for the Transmission Gully Option and, because of the existing road and railway, even longer for the Coastal Option. In addition, the risk to the Wellington Region posed by severe earthquake induced ground shaking arising from rupture of one of the many active faults in and close to the Wellington Region, including the Ohariu Fault, has been progressively refined over several decades.

4. GEOHAZARDS

5.1 Severe earthquake ground shaking

The 1855 Wairarapa Earthquake, centred on the east side of the Tararua Range, produced ground shaking levels of MM9 or MM10, as measured on the Modified Mercalli Scale, in the Wellington Region. Similar levels of shaking, reaching up to MM10 in the epicentral area, can be expected in the future. While both options will be equally at risk to the occurrence of such shaking, the intensity of its effects will differ.

Coastal Route - The Coastal Route crosses within Porirua Harbour soft, waterlogged sediments or reclaimed land that will respond more readily and adversely to ground shaking, in a process called amplification, than hard greywacke basement rocks. In addition to compacting or spreading laterally, water logged sediments have the potential to liquefy. Including clay-rich sediments between Porirua Harbour and Pukerua Bay some 7.5 km of the coastal route, to varying degrees, is potentially at high risk from compaction and in places liquefaction.

Transmission Gully - In contrast to the Coastal Route, the known geology along the Transmission Gully Route indicates that it would cross only localised areas of soft sediment. It is anticipated that the localised risk posed by this hazard can be mitigated by adopting appropriate construction methods, including where necessary by bridging or piling or, perhaps less expensively, by re-routing short sections of the designated highway.

Paekakariki - The Paekakariki area is underlain by unconsolidated sediments, largely sand with pockets of peat but, as these sediments are crossed by both routes, the susceptibility to geohazards would appear to be similar. However, as the Transmission Gully Route is closer to the greywacke hills it may be that it is underlain by sediments containing some gravel, which would be expected to provide better founding than that beneath the existing SH1.

5.2 Fault Rupture

In addition to ground shaking arising from an earthquake, a fault can rupture causing displacement of the ground surface across the fault. The displacement is likely to have both a horizontal and vertical component. In the Wellington Region the rupture histories of the active faults are relatively well known although, as investigations into the hazard progresses, this is being continually refined. Both routes cross the active Ohariu Fault and the Transmission Gully route also crosses the less active Moonshine Fault. The less well documented Pukerua Fault apparently lies just to the west of SH1 south of Pukerua Bay. Investigations independent of the GNS report indicate that the Ohariu Fault moves on average every 2000 years with the last movement approximately 1000 years ago. The Ohariu Fault on rupturing could result in a displacement horizontally in the order of 3.7 m. The amount of vertical movement is likely to be significantly less than the horizontal component.

Coastal Route - The position of the Ohariu Fault where it is crossed by the Coastal Route is not known but it can only be beneath Porirua Harbour at the Paremata Bridge or the soft sediments marginal to the bridge. Rupture on the fault would cause significant disruption to the route with the likelihood of the Paremata Bridge being severely damaged or destroyed. Because of the nature of the sediments, with the lateral spreading of soft sediments and the possibility of liquefaction, replacing the bridge and its approaches could be a lengthy task.

Transmission Gully – Away from Porirua Harbour, the Ohariu Fault crosses hills of greywacke and its position is constrained. In addition, its precise location and characteristics can be readily determined by shallow subsurface investigation. It appears that the Transmission Gully Route will cross the fault by way of a bridge in the gully of Te Puka Stream just to the north of Wainui Saddle. Such a bridge, unlike the existing structures on the Coastal Route, can be designed to accommodate fault rupture. If the fault is crossed by the road, rather than by a bridge, then it could also be readily reopened provided a contingency plan to do so is in place. As well as the Ohariu Fault the Transmission Gully Route, southeast of Porirua East, crosses the Moonshine Fault in two places. The Moonshine Fault is a much less active than the Ohariu Fault. While there is a possibility of re-routing the road to avoid the fault, in view of its lower activity it may be more economical to adopt similar strategy as for the Ohariu Fault.

5.3 Large Landslides

Earthquake ground shaking and severe rainstorm events are the cause of most slope failures in New Zealand. However, very large scale failures are almost certainly the result of severe earthquake ground shaking, MM8 or greater, and although not initiated by rain, groundwater can be a contributing factor. In this section only large earthquake induced failures are considered.

Coastal Route - It is clear from the geology and topography that the area traversed by either of the two routes that is at greatest risk from large scale landsliding is the coastal section from Pukerua Bay to Paekakariki. The slope is up to 300 m in height and is cut into greywacke bedrock, which in places is masked by superficial deposits including those arising from slope failures. The greywacke contains numerous planes of weakness and the slope is a much modified fault-line scarp of the Pukerua Fault. Slopes are gentler elsewhere along the route and in the greywacke bedrock the intensity of rock defects, where slopes are steeper, appears to be generally low.

Transmission Gully Route – Along the Transmission Gully Route the risk of earthquake induced large-scale landsliding is considerably lower as the steepness and height of natural slopes are gentler than on the Coastal Route between Pukerua Bay and Paekakariki. Although not confirmed the topography, namely a lack of any present indications of significant failure, also indicates that the greywacke basement is relatively competent along the Transmission Gully Route. It is possible that the risk of large scale failure could increase following removal of toe support to allow construction of a road, particularly if zones of weak rock, perhaps associated with the Ohariu Fault, are encountered. However, provided cuts are minimised as much as possible and the road is constructed to an engineering design appropriate for the prevailing ground conditions, the risk of large scale failure is unlikely to be significantly altered by road works.

5.4 Other Slope Failures

The extent of any failure is dependent on a number of factors, such as the nature of the underlying geology, steepness of slope and rainfall, particularly high intensity rainstorms which can be very localised, and as discussed above earthquake ground shaking. The susceptibility to failure can also alter, usually detrimentally, as a result of oversteepening of slopes by river or sea erosion, construction of roads and railways, building platforms or quarrying. Conversely placement of compacted and drained fill at the toe of a slope commonly lessens the risk of failure.

Coastal Route – Between Pukerua Bay and Paekakariki the high steep fault-line scarp of the Pukerua Fault has been oversteepened by sea erosion, quarrying and construction of both SH1 and the railway at its toe. The greywacke rock is generally shattered and has in a number of places been involved in earlier slope failures including to the northeast of Paekakariki, a moderate sized landslide initiated by the 1855 Wairarapa Earthquake. Consequently, there is a high risk of slope failure, ranging from coherent landslides to rock falls and debris flows. Such failures are generally minor although moderately sized landslides can occur. They have the potential to disrupt traffic flows for anywhere between several hours and many months.

Transmission Gully Route - On this route the steepest slopes are on either side of the Wainui Saddle but they are less that at Pukerua Bay and also are not as high. The potential for slope failure is therefore less than along the Coastal Route. The risk could be elevated if cut and batters are excessive and/or poorly designed or constructed.

5.5 Tsunami Hazard

The tsunami hazard in New Zealand is poorly understood but the west coast of the Wellington Region is at risk. Tsunamis that could affect New Zealand can originate locally or anywhere around the Pacific. However, the west coast of the Wellington Region is relatively protected from distant originating tsunamis and the greatest risk is probably from ones generated by movement on one of a number of active faults immediately off shore or by underwater landsliding. The latter is likely to arise from severe earthquake ground shaking, including fault rupture on one of the offshore faults thereby compounded the effect of the resulting tsunami. Because of its proximity to the coast, sections of the Coastal Route are significantly at risk from tsunami whereas the Transmission Gully Route would not be affected.

5.6 Disposal of Debris

Following a severe earthquake producing ground shaking of MM8 or greater, landsliding will be widespread. The debris arising from landslides will be significant and depending on where such material is to be dumped or otherwise disposed of, this could become a significant factor in the time it takes to reinstate communications.

Coastal Route - On the coast the material could be simply dumped into the sea where wave action and longshore drift would dispose of it. Before doing so it would be prudent to know where such material was likely to end up and that it would not result in ongoing problems. However, it is likely that the material would be beneficially accreted to the coast immediately to the north. Alternatively, the material may be required to reinstate the sections of road and railway across Porirua Harbour where damage from lateral spreading and liquefaction is likely to be both widespread and extensive. Depending on the configuration of any large landslide that may arise between Pukerua Bay and Paekakariki it may be possible to route the road over it with relatively minimal earthworks. While the landslide, and the road, may be subject to settlement, and require on going maintenance, this may be sufficiently manageable not to seriously compromise traffic use. For the rail link this would not be an option and tunnelling through unaffected greywacke bedrock may be the only alternative.

Transmission Gully Route - The amount of debris arising from landslides and batter collapses will be significantly less than for the Coastal Route and the road should be able to be reopened for traffic relatively quickly. Nevertheless, the debris will either have to be side cast into Transmission or the Te Puka Stream gullies or transported elsewhere. The Transmission Gully Option also has the advantage that as most of the debris will be generated either side of Wainui Saddle it can be transported downhill for disposal.

For both the Coastal and Transmission Gully routes there is the option of stockpiling suitable debris that could be reused for construction purposes throughout the greater Wellington area

where, following a severe earthquake, there could be a high demand for it. This would require suitable areas being set aside now for stockpiles.

5. GNS REPORT

The GNS report has been prepared by geologists who are recognised experts in their fields of research and the lead author is a very experienced engineering geologist. The report follows a standard format for such documents, being divided into the following sections:

1. Introduction - which outlines the purpose of the report.
2. Review of WCTS Documents.
3. Review of Geology and Geological Hazards.
4. Conclusions.
5. References.

The content of the GNS report is well balanced with no obvious omissions. The Summary provides a synopsis that accurately reflects the contents of the report and the references consulted are comprehensive. The GNS report fully explains and discusses the geohazards that both routes are likely to be subject to and, on the information currently available, objectively assesses the risk that the hazards present along with the scale and extent of the resulting damage. This in turn provides a realistic quantification of the time, and indirectly an indication of the cost, in restoring communications between Porirua and Paekakariki. The geohazards, and their effects on the two routes, are succinctly summarised in Table 1 of the GNS report. It is noted in the Summary for the final GNS report, dated 14 November 2005, that mitigation measures are included.

6. DISCUSSION

This review concurs with the GNS conclusions that the geohazards, and the mitigation of those hazards, has been underestimated in the WCTS documentation, particularly with respect to the Coastal Option. In the Coastal Option transportation links are subject to a greater range of hazards and the resulting damage from those hazards will be greater. Geohazards with the potential to disrupt the Coastal Route are fault rupture, damage due to severe earthquake ground shaking such as slope movement, lateral spreading and liquefaction, rain induced failures and tsunami.

In contrast the Transmission Gully Option is not at risk from tsunami. Also the risk from liquefaction and lateral spreading of weakly consolidated materials is very significantly lower, as the sediments that could react adversely are of very limited extent. Landsliding, including collapse of batters, is also very much lower for the Transmission Gully Route compared to the Coastal Route. While further geotechnical investigation of both routes would undoubtedly refine the hazards and their effects, it would not, in the opinion of the Geological Society, alter the over all assessment arrived at in the GNS report.

7. CONCLUSIONS

Both routes are at risk from geohazards although the Coastal Option is at risk from a greater range of them than the Transmission Gully Route, which is unlikely to be affected by tsunami, large-scale landsliding, lateral spreading or liquefaction. The Transmission Gully Route has the advantage, as a completely new road, of being designed to the highest engineering standard with specific design for any potential defects identified following site specific geotechnical investigation. To bring the Coastal Route up to a similar engineering standard would require considerable expenditure and there are sections were the geohazards risk would still remain high. Such sections are between Pukerua Bay and Paekakariki, which would remain at risk to large and lesser scale landsliding as well as in parts to tsunami damage. The section around Porirua Harbour would also be at risk from tsunami, albeit probably less so as far as impact on the road is concerned than further north. It is unlikely, except at very high cost, that the risk from lateral spreading and liquefaction could be entirely mitigated within Porirua Harbour. The Transmission Gully road would also have the advantage over the Coastal Route in that it could be more readily re-opened following a catastrophic earthquake. There would also likely be less debris to be disposed of and cartage distances could be less although for the northern part of the Coastal Route disposal to the sea is an obvious solution. In summary, the Geological Society fully concurs with the GNS assessment and the conclusions reached in it, including the quantification of the risks to both routes.

The content of Geology

Thoughts on David Smale's editorial (GSNZ Newsletter 137)

My *Penguin Dictionary of Physical Geography* (Whittow, 1984) describes **geology** as "the study of the origin, structure, composition, and history of the Earth, together with the processes which have led to its present state. It comprises: crystallography, geochemistry, geomorphology, geophysics, mineralogy, palaeontology, petrology, sedimentology, stratigraphy, structural geology."

Earth science is defined as: "cartography, climatology, geochemistry, geodesy, geomorphology, geophysics, hydrology, meteorology, mineralogy, oceanography, palaeontology, petrology, remote sensing, sedimentology, soil science, stratigraphy, structural geology, surveying." There is also a reference to physical geography, which appears to cover everything except, as David has it, "godly things". I've underlined the common ground.

Of course, I argue with these definitions. For instance, Quaternary geologists would view much of oceanography today as a field of geology; also glaciology. But my quarrel is with the omission of *pedology* ("the scientific study of soils, taking into account their method of formation, their composition and their distribution ..."). This is also a geological enterprise.

The American Geological Institute's *Dictionary of Geological Terms* (1976) has **geology** as "the science which treats the earth, the rocks of which it is composed, and the changes which it has undergone or is undergoing." Thus geology can embrace pedology. But if geology is what geologists do, then pedology is excluded, as soil papers don't appear in the GSA *Bulletin* or in *Geology*.

There were no vacancies at the Survey when I graduated. The Director said I should try the Soil Bureau. Why not? Soils are weathered rocks. N.H. Taylor, who was trained by a geologist (H.T. Ferrar), and read widely, stressed the five soil-forming factors -- parent rock, topography, climate, soil life, and time. My years in the field confirm these connections. The first, second and fifth factors are clearly geology. This was accepted in Soil Bureau: geologists (for instance, John McCraw, Alan Pullar) were teamed with agriculturalists (e.g., Charles Harris, Colin Vucetich) because -- to state the obvious -- nature prepared the soil, and mankind used its products.

The hand-in-hand roles of geology and agriculture were also recognized in Australia. Here, however, agricultural graduates dominated staff ratios. The five soil-forming factors were viewed as cant -- "Sure, we know about the soil-forming factors," Australian field workers would say with some impatience, "let's get on with the mapping." And soil profiles would then attract all the attention, and authoritative pronouncements (the "thick, all-purpose glue ... the reality of academe" (Oppenheimer, 2003)), became field explanations. No-one looked at the soil in relation to the soil-forming factors.

In New Zealand, geology grades easily to pedology. Rocks are soft, many are particulate and easily weathered; the relations of rocks to soils and landforms are well expressed in scenery and exposure; geomorphology and Quaternary events are well understood. This is not so in Australia: weathering and Quaternary sediments hide the perceived real geology. In landscapes of low relief, outcrops are shallow and the sediments are poorly exposed. Hills may have so little relief that they are officially accepted as plains. Bruce Butler, an agriculture graduate who became Australia's best soil scientist, said that geologists had never been able to help him understand soil patterns. He therefore re-invented a geology for the soft rocks of the Riverina.

The differences persist in universities. At Victoria we were taught geology and geomorphology by the same teachers in the same classroom, weathering was on the reading list. Likewise in other New Zealand universities. Soils are a large component at Waikato. In Australia, at least in the universities I know, they teach hard rock geology; geomorphology is in Geography, in the Arts faculty. Agriculture is a quite separate discipline where students might occasionally attend a geological lecture. Separate disciplines in separate faculties in separate buildings. How can pedology prosper? Soil scientists fall in the chasms between departments.

The five soil-forming factors in New Zealand are all clearly evidenced by their effects. In Australia one can get by with three: parent rock, topography and time. Together, they define soil variety at Adelaide (South Australia), in east Gippsland (Victoria), on the slopes and plains of Narrabri (NSW), and in coastal Queensland. Topography includes geomorphic landform and, in coastal Queensland, landscape relief (i.e., the geographic landform).

Pedology thus has much common ground with geology. In New Zealand there is some overlap with edaphology; in Australia pedology is almost entirely a geological field.

Oppenheimer, S., 2003. *Out of Eden - The Peopling of the World*. Constable, London, p 280.

Live and Learn

Bryce Wood

The Greek Legend of Jason and the Argonauts.

In Greek legend, the Argonauts were a band of 50 heroes who went on an expedition with Jason in the ship Argo to fetch the legendary Golden Fleece. Jason's uncle Pelias had usurped the throne of Iolcos in Thessaly, which rightfully belonged to Jason's father, Aeson. Pelias promised to surrender his kingship to Jason if the latter would retrieve the Golden Fleece from Colchis, an ancient settlement on the eastern shore of the Black Sea near the present Kutaisi.

The fabled Golden Fleece had originated in the following manner. Jason's uncle Athamushad had two children, Phrixus and Helle, by his first wife, Nephele, the cloud goddess. Ino, his second wife, hated the children of Nephele and persuaded Athamas to sacrifice Phrixus as the only means of alleviating a famine. But before the sacrifice, the shade of Nephele appeared to Phrixus, bringing a ram with a golden fleece on which he and his sister Helle tried to escape over the sea. Helle fell off and was drowned in the strait, since called the Hellespont. Phrixus safely reached the eastern side, and, proceeding to Colchis, he sacrificed the ram, hanging its fleece in the grove of Ares, guarded by a sleepless dragon.

Jason, having undertaken the quest of the fleece, called upon the noblest heroes of Greece to take part in the expedition. When the Argonauts finally reached Colchis after a long and difficult voyage, they found that the king, Aeetes, refused give up the fleece until Jason had yoked Aeetes fire-breathing bullocks and sowed his field with dragon's teeth from which armed men were to spring. Aeetes' daughter, the sorceress Medea had fallen in love with Jason, gave him a salve that protected him from the bulls' fire and advised him to cast a stone at the newborn warriors to cause them to fight to the death among themselves. After these tasks were accomplished, Aeetes still refused to give over the fleece. Medea, however, put the dragon to sleep, and Jason was able to abscond with both the golden fleece and Medea. Various accounts are given of the homeward course; eventually the Argo reached Iolcos and was placed in a grove sacred to Poseidon in the Isthmus of Corinth. The story of the expedition of the Argonauts was known at least as early as Homer, and the wandering of Odysseus may have been partly founded on it. In ancient times the expedition was regarded as a historical fact, an incident in the opening up of the Black Sea to Greek commerce and colonization by the lure of gold.

Update
In August 1992 I was working in the Caucasus Mountains reviewing a very large Russian molybdenite mine for an Australian Company that was proposing to undertake a partnership. I discovered that there was a gold-rich zone in the rocks alongside the molybdenite orebody, which the Russians had not exploited, but which extended for many kilometers across the mountains to the lowlands near Kutaisi.

In the course of tracing this zone over the mountains I met up with a shepherd who spoke a little English and offered me some of his lunch and showed me a small bottle of alluvial gold flakes . After lunch we walked down to a stream where he had obtained them, and where I expected he would pan a few more. But No ! – he threw some rocks aside and lifted out a large sheepskin, woolly side up and washed into a bucket a very respectable cloud of gold flakes, the accumulation of several weeks. When I expressed surprise he smiled and said in broken English "That's the real story of Jason and the Golden Fleece!"

Editors Comment on the "Golden Fleece"

How much more of Homer's story is geological and historical fact with a poetic twist?
It seems obvious that Jason and the Argonauts were the best of the young of Greece, emptying towns in an ancient gold rush across the Black Sea. Surely Phrixius and his wife Helles were adventurers returning with the first stories of fabulous wealth to be taken from "golden fleece" recording the initial discoveries of a placer gold field. Was the fiery smoky dragon guard a geothermal field? Were dinosaur bones and sharks teeth years later morphed into dragons and dead warriors, breathlessly described by the returned gold rushers to their hushed audiences of nieces, nephews and grandchildren? How can it not be that the task given Jason if he wanted to unlock the wealth, was to learn to mine and smelt the rock ores (plough and yoke the fiery bullocks)? This records how the placer field evolved to a hard rock enterprise with the discovery of the source rocks and the introduction, or discovery, of smelting-- a story of evolving early science and technology. And what of the warriors teeth? These have to be the comb-texture quartz crystals that line vein cavities, first dug up then fed into the smelter with the addition of a flux, "the stone thrown in" who fought among themselves until the gold appeared! Sheer poetry, but we could find out how true! Were not the other figures various robber barons or assorted ancient Marshall Matt Dillons, and claim-jumpers. Is it merely fantasy to speculate that perhaps Jason was a kind of Cecil Rhodes who amalgamated the various mining enterprises—ploughed them under as it were? Jason obviously represents a combination of several peoples, one at least a rockhound. It seems too that the first metallurgist was a woman, Medea, who perhaps learned her secrets (while the men slept) blowing into the dinner's burning embers and cooking rocks into the night.
These conclusions seem so obvious to someone familiar with mining and geology; surely someone has already written an exegesis on this legend. Moreover, who says enterprising geologists, metallurgists and investors cannot become folk heroes? Not Homer!

More on the Anthropogenic Global Warming Debate

Peter Ballance

Like all major developments in scientific thinking, the concept of man-induced climate change through release of stored greenhouse gases has its opponents. Newsletters 137 and 138 contain statements by both sides.

I've been following the debate for some time, and the conclusion I've come to is that, while there is still much uncertainty in the predictive science, and while the opponents have some valid points, for example the concern that a large number of scientists have a vested interest in continuation of climate change research, the opponents have so far failed to address the fundamental issues. These are —

1. Incoming solar radiation, as determined by Milankovitch astronomical cycles, reached a post-glacial maximum between 10,000 and 11,000 years ago, of around 500 watts/m^2 at 65°N. Since then it has fallen steadily to around 460w/m^2. Global temperatures, however, have remained more-or-less constant for the past 10,000 years.

2. This pattern is different from all previous glacial-interglacial cycles recorded in ice cores, when temperature followed solar radiation very closely.

3. The same is true for global CO_2 and methane levels. In all previous cycles they followed the solar radiation-temperature graph very closely, but during the Holocene they departed from this trend — CO_2 at 8ka and methane at 5ka. Since then both greenhouse gases have risen (W.F.Ruddiman, Scientific American March 2005).

4. This pattern coincides in time with the beginning of deforestation and the development of agriculture.

It seems to me difficult to avoid the conclusion that man-induced greenhouse warming has been in progress for around 8,000 years. If that is the case, one cannot argue logically that the greatly increased rate of greenhouse gas emission over the past 200 years is not having/going to have a marked effect.

Much of Gerrit van der Lingen's critique of climate change/global warming (Newsletter 138) is off the point. The "hockey stick" temperature graph is no longer a central issue. Historic warm and cold intervals (Little Ice Age etc) were apparently not global in extent. Economic considerations — sure, the Kyoto Protocol is only a tentative beginning, and sure, cutting emissions will entail far-reaching change in the way we do business (peak oil will push us in the same direction, anyway) — are social consequences, not science. And sea level change in the Maldives tells us nothing — relative sea level change is being monitored in many oceanic island groups, and it's rising in some and falling in others.

Finally, CO_2 is, as Gerrit points out, an essential gas for plant growth. That fact does not, as he seems to think, prevent it being a greenhouse gas at the same time. This is one of the many ironies of man-induced climate change. We are actually doing mother nature a service by releasing some of the CO_2 which she has assiduously stored over the millennia. It is unfortunate that it is going to be to our own inconvenience.

Paleo Potpourri 4 – more random notes on fossils and related stuff

Phil Maxwell

Best news of 2005?
The decision of Judge John E. Jones III in the Kitzwiller vs Dover court case would have to be in the running for this honour. This was the case brought by a group of parents against the Dover Area School Board (Pennsylvania), which had decided in its wisdom to allow the teaching of Intelligent Design in school science classes. The case attracted considerable media attention, and not only in the United States. One of the highlights (if that is the correct term) of the trial was the appearance of Michael Behe, whose book "Darwin's Black Box" kick-started the modern ID movement. His poor showing did no favours for the defence.

Judge Jones issued his decision on December 20 th in a 139 page document that is a model of clear-headed legal thinking. He correctly identified the religious underpinning of ID, and concluded "it is unconstitutional to teach ID as an alternative to evolution in a public school science classroom." Jones is a Bush-appointee but it's clear any conservative convictions he may hold did not get in the way of his legal opinion. The IDists were totally gob-smacked by the decision, and there were predictable mutterings about "judicial activism", a term that is almost as popular as "political correctness" among American Right-wing commentators. According to John Wilkins (http://evolvethought.blogspot.com/) Jones "shortly afterwards was informed in public that he had better not expect a promotion, from a ranking government official," so he may yet learn the error of his ways.

Of course, Jones' decision has not stopped the IDists, but it has slowed them down a bit while they lick their wounds.

Only No #46?
The January 18 – February 1 issue of The Beast (http://www.buffalobeast.com/91/50.htm) features a list of the "50 Most Loathsome People in America, 2005." This includes many of the usual suspects, e.g. Tom Cruise, Hillary Clinton, Karl Rove, Michael Jackson, Ann Coulter and Spammers, with Pat Robertson in number one spot and Dick Cheney close behind (this was before Cheney shot that lawyer of course). Bruce Chapman comes in at number 46. His entry reads:

"Charges: Founder of the misnamed "Discovery Institute." Despite its pioneering title, Chapman's organization seeks to make one of the world's oldest, dumbest ideas the prevailing ideology, to "undiscover" evolution and set us back more than a century. Seems to believe a petition signed by 400 PhDs and professors is convincing proof of Intelligent Design's widespread acceptance, when more scientists named "Steve" endorse Darwin. A lazy dissembler, he blames the lack of actual research and peer-reviewed articles on ID on academic "blackballing." Right, 'cause Galileo had it easy. Chapman's sole trailblazing achievement in the field of academic inquiry has been in proving scientists can be even smugger--when driven by theology.

The best paleo blog …

… is Palaeoblog (http://palaeoblog.blogspot.com/), which is hosted by Michael J. Ryan, and is now one of my favourite science blogs. Palaeoblog is particularly well-designed and attractive, and most important, new posts appear on a regular basis, pretty well every day. There is a distinct bias toward vertebrates, particularly dinosaurs, but other groups get a look-in as well. In addition there are posts along the lines of "Born this day: …" or "Published this day: …." or "Discovered this day:…." that draw attention to historically important events (well, important to paleontologists.)

Anning's Song

One of the posts on Palaeoblog concerned a LA-based rock-music group with the unlikely name of "Artichoke." (On second thought this is a very sensible name compared with those adopted by other contemporary groups!) Last year they put out a CD titled "26 Scientists Vol. 1: Anning – Malthus". Songs about scientists are a bit thin on the ground, although mathematician Tom Lehrer wrote the less-than-reverential "Werner von Braun" more than 40 years ago. And that's the problem – it's easier to demonize scientists than to portray them as humans. Songwriter Timothy Sellers' decision to choose Mary Anning to represent the letter A is bound to generate some discussion, but she has mythic status among paleontologists. Most of the alternatives, such as Philip Abelson, Louis Agassiz, Anaxagoras, Svante Arrhenius and Amedeo Avogadro are far less well-known. Some lines from the song:

she put the bones together for the collectors
and science was the province of men of noble birth
but I'd take Mary Anning over those stuffed white shirts

Reply to Gerrit van der Lingen

I had wondered what was needed to get a discussion going in these pages. For Gerrit van der Lingen (November 2005) it was apparently my "diatribe" against Michael Crichton and Bjorn Lomborg (July 2005) that did the trick. I stand by everything I wrote about Crichton – I find it incredible that anyone could regard this science fiction writer (without any scientific credentials as far as I can make out) as some sort of instant pundit on climate change, but that is the way he has been marketed by the American Right. It's bad enough that he has become the poster boy for assorted conservative commentators, but it gets worse - in September 2005 Senator James Inhofe (R-Oklahoma) invited Crichton to advise a Senate Committee (Environment and Public Works) on climate change! Inhofe (who has a degree in economics from Tulsa) is a leading lobbyist for the petroleum and gas industries. Nothing wrong with that, but earlier in the year he appeared on Pat Robertson's TV show. (Robertson is the evangelist who claimed the stroke suffered by Ariel Sharon was divine punishment for dividing the Holy Land, and called for the assassination of President Chavez of Venezuela. He was ranked Number 1 in the Beast's list of the most loathsome Americans – see above.) Now I don't subscribe to "guilt by association" but would anyone choose to appear on Roberston's show unless he or she was in substantial agreement with his bizarre ideas?

A pity Ron Hubbard is dead, otherwise he could have advised Senate committees on psychiatric care. After all he was a science fiction writer too and never hesitated to air his opinions on all sorts of things. There have been a number of bona fide scientists who have also written decent science fiction – Hal Clement, Fred Hoyle and Gregory Benford come to mind - but Crichton is not a scientist.

Gerrit describes my comment that many of the GW sceptics are "elder members of the scientific community" as "snide." I agree this was a bit OTT, but I'm hoping Wayne Mapp will award me some Brownie Points for Political Incorrectness. Anyway, as I'm sure Gerrit knows, I'm hardly in the spring chicken category myself!

I am also accused of indulging in "gratuitous name-calling and insults." Moi? My criticism of Crichton may have been a trifle trenchant but I plead Not Guilty to this charge. Perhaps Gerrit could elaborate? Gerrit himself is not above a bit of abuse when he refers to the "one-eyed IPCChypothesis."

At least Gerrit has been inspired to put down his (very useful) thoughts on climate change, but underlying his article is the same old assumption: one side (the "sceptics") is motivated purely by a desire to discover the Truth, whereas the other (the "believers") has a political agenda. (I haven't been able to find out what their political goals are but if they include the elimination of SUVs they can be sure of my support.) He also indulges in a bit of special pleading when he defines the adjective "independent" as applied to scientists as meaning those not getting "funding from the public purse." This implies that if there are any climate scientists who receive support from ExxonMobil (and I'm not saying there are, of course – perish the

thought!) they can claim to be "independent." How convenient! Gerrit is correct in saying the debate has become politicised, but it's a tad more complicated than he seems to think. In the United States many of the most vocal GWDs are right-wing commentators who resent any restrictions on making money, and I see a similar tendency in comments by New Zealand pundits and letter-writers. (And please, don't try to make me out as implying Gerrit or any of the other scientists he mentions are right-wingers.)

I agree entirely with the comment "scientific truth is not determined by consensus." Crichton is very fond of saying the same thing; unfortunately, it can hardly serve as a general guiding principle for choosing between rival hypotheses. Some (dare I say most?) fringe concepts and minority opinions in science stay that way until they fade away completely.

Nowhere did I describe carbon dioxide as a "pollutant" but it has to be asked at what concentration a useful substance becomes deleterious. Increasing CO2 can lead to increased plant growth, but my understanding (and I'm open to correction) is that for many plants it can restrict the uptake of nitrogen and therefore slow down growth. In any case, industrial processes that produce CO2 through combustion are likely to produce less desirable substances as well, including carbon monoxide, nitrogen oxides and a whole suite of organic compounds.

I also see no reason to alter my description of Bjorn Lomborg as "the darling of anti-environmentalists everywhere." I think it is significant that Gerrit didn't quote the succeeding sentence in my article: "Before anyone reaches for their pen, I don't claim Lomborg himself is an anti-environmentalist, but many of his supporters certainly are." Obviously I should have written "key-pad" rather than "pen"; I'm still trying to come to terms with the 21st century! I deplore the name-calling to which Lomborg has allegedly been subjected, and I certainly haven't joined in.

Reply to John Elliott

In the same issue (138) John Elliott claims that in an earlier Paleo Potpourri (Newsletter 136) I was allegedly "astonished that people still question climate change." I have read and re-read the item on Crichton and am unable to see where I expressed such an opinion. I did say: "What is staggering is that many people take him [Crichton] seriously," which is not the same thing at all. Then I am accused of making "sneering comments equating global warming critics with supporters of Intelligent Design." Again, I said nothing of the sort, but I did say "the GW deniers are often IDists as well." I still think this is a fair claim.

Stray Quote

"It isn't Global Warming … it's Intelligent Defrosting!" ……..John Wilkins.

Geological Exports

Mark Lawrence

Having read the two articles that mention science funding in Newsletter 137 ("The Road Ahead: the role of the Royal Society" and "Fahrenheit 482"), I thought the following (possibly "jaundiced") comments might be of interest or stimulate discussion.

In 1990 I came to the UK to do post-doctoral research in geology with a view to returning to New Zealand after a few years. A naive view perhaps as indicated by the fact that I am still in Scotland, puttering around in the oil industry. During my time here I have kept an eye out for geological jobs in New Zealand which has also involved at least a passing interest in science policy and the funding thereof. To me, these discussions on science policy are just another one of these things that seem to occur fairly regularly and seem little more than government justification to the science community that it is trying to do the right thing. In addition, they are trying to show the general public that their tax money is not being wasted. Essentially, policy reviews are management exercises until the next election. In reality, I doubt that science funding of any sort will improve in real terms until governments rise and fall on their science policies. Science funding and policy will probably never be improved until the public perception of science is changed. The general public appears to have little understanding of science and scientists may be viewed by many as an educated elite. Elitism is very unfashionable politically and is a good way of losing votes. In contrast, the general public will always have an understanding of medicine for example, because it relates directly to them. It is always a hot election issue, and quite rightly.

Educating the general public about the benefits of science, particularly fundamental research is extremely difficult. The following I hope might illustrate this point. My job a geologist is to provide geological interpretations of acquired data which are then supplied to the customer. Our corporate propaganda says this adds value to the data and in the long run helps improve the data acquisition business (which actually happens believe it or not). However, certain management have looked at the business from a purely short-term financial perspective and in two years the group in which I work has been decimated by 75%. This was done by a manager who has spent his working life in the oil industry. During this geoscience group "purge" he publicly made statements such as "Geoscience is polluted by too many geologists". My simplistic concept of the oil business is that the geology determines where the oil is, how it got there and how you get it out. Mention of this to manage tends to have effects associated with lead and balloons. If oil industry professionals cannot or refuse to grasp the significance of science in their industry, then we may have little show with the general public. No voter is going to want to pay taxes to support a bunch of people in white coats wielding spatulas (a typical scientist stereotype) doing things that they do not understand, that have no perceptible relevance to them, or simply do not care about.

The "Fahrenhiet 482" article mentions the loss of funding to the Geothermal Institute. Funding cuts usually mean staff reductions and a concomitant loss of expertise. Destruction of skilled teams for short-term financial goals is very easy and replacing the expertise is not. It usually causes problems for the future, as the company I work for is discovering. We no

longer have the people to cope with the work that we have now, or the work we know is going to appear in the future. This generally results in furrowed brows and finger-pointing by the very same management responsible for the initial "down-sizing". In similar fashion, the NZ government (and sporadically the UK government) periodically bemoans the so-called brain drain, although my perception is that this never occurs at the same time they review science funding. There certainly does not appear to be any direct connection from a governmental point of view. I have never quite managed to work out if those "brains" include scientists. I would suggest that it refers to people who will make money relatively quickly and not those who do science that may have long term benefits. It seems that NZ will train scientists in it's universities but is not particularly interested in paying to employ them afterwards.

The above musings are (very unscientifically) based on a gut feeling, a cynical frame of mind and limited data. Anyway, the upshot of all this is that I am left stranded in the UK oil and gas industry with little or no prospect of doing any geology in NZ. I hope the oil does not run out for a while……

Editor's comment: *New Zealand's sons and daughters, particularly geologists, initially lured away to see the big wide world, become trapped-overseas, for economic reasons. I was one of them for 32 years.*
The basic problem is a lack of economic activity in Aotearoa; a lack of enterprise and productivity. We either generate insufficient surplus wealth to sustain the population we generate and educate, or we invest it poorly. We are not as successful as Australia or North America, who better manage to keep, and even attract more people. Comparatively poor funding for science and technology, outside of agriculture, is one manifestation of this.
No, it is not lack of resources nor of market size, nor is it isolation. Poor investing and poor regulation cause this relative lack of enterprise. We have yet to work out a legal framework for stewardship and ownership of the land. To much is in dispute. NZ'ers tend to invest in real estate and travel, not creative, risky enterprises. A prevailing attitude believes that all natural resources "belong to the people". This should not be so. An unrecognized or undiscovered earth resource is just a rock. (In the previous article Mark says "geology determines where the oil is…and how you get it out"—these facts however do not make the oil a resource or reserve—it is still a "rock".) The enterprises that convert rock into resource (crude, gold, electricity, wine) must own them, not "the people". The people are stewards not owners. In regard to stewardship, NZ appears not to be guided by the rule of law and thus a poor place to invest ones time and genius. If a Minister has final say on a resource consent why use the judiciary at all! Over-riding the judiciary implies the law is inadequate, poorly conceived. If political winds of the moment, not a body of predictable law decide matters then why would any intelligent person invest their time and genius here?
While NZ vexes over 'who owns what' and 'how much of the past can we continue to live in' elsewhere, as in Mark's workplace, people are heeding Darwin's law of successful life and are adapting. We cannot afford to stand perplexed. Our children, enterprise and investments are fleeing.

Presidential Bio

Keith Lewis *writing at the request of the editor*

I was born during an air raid in 1941 in Wolverhampton, UK, My interest in geology was stimulated by coal miners fossil collections and by the small Silurian brachiopods I used as ammunition for catapults. I won a free evening course in Geology at Birmingham University in exchange for a trilobite found while collecting "ammunition". In 1963 I obtained a B.Sc Special (Hons) at Reading University.

Later in 1963 I took a short contract with BP Exploration Research Unit working on the sediments and microfauna of the Isle of Wight as part of a programme to look at hydrocarbon prospects in the Hampshire Basin.

In November 1963 I was appointed micropalaeontologist with the New Zealand Oceanographic Institute, who sought to to use microfaunas to trace sediment dispersal off the East Coast of North Island.

My first published papers describing the size of forams as an indicator of temperature, were followed by a tedious attempt to sort out names for living foram faunas based on depth ranges.

In 1968 I started PhD at Victoria under Paul Vella with the idea of studying forams as indicators of sediment and tectonic movement off southern Hawkes Bay. First field work coincided with the Wahine Storm that destroyed almost all sampling gear and very nearly NZOI's newest Marine Geologist. But NZOI had just commissioned its first seismic profiler - a lethal home-made boomer system and this was used in a follow-up cruise later the same year. The first records that come off were like the light on the road to Damascus. I was an instant convert (and so was Harold Wellman who immediately took an interest in what I was doing - becoming an unofficial supervisor). I don't think I ever looked at another foram. These first records showed a simple seismic stratigraphy, apparently related to onshore/offshore migrations of shore-parallel zones of erosion and prisms of near-shore sediment, which in turn could be correlated with dated glacio-eustatic changes of sea-level, giving rates of sedimentation and Quaternary tectonic folding. Some profiles also showed the effects of slope failure on what was then believed to be impossibly low slopes of only 1 degree. This was all published in the early 70s.

After a period of working around the Pacific Islands, the 80s heralded a new phase of work on the East Coast based initially on a piece of anomalous foram data that indicated that the rocks of offshore ridges had been uplifted from abyssal depths, when it was then widely assumed that the faulted ridges resulted from deep seated collapse of the continental margin. The first papers on accretionary prisms at convergent margins provided a quite different and

initially controversial answer., Trying to understand the nature of the overall onshore/offshore system lead to cooperation with Jim Cole and later Jarg Pettinga.

This work led to documenting, and trying to explain, seeps along the margin, the Kaikoura Canyon and its continuation into the 2000km long Hikurangi Channel. In the mid 90s, joint work with the French, using a deep-water swath-mapping system, the first to be used in New Zealand waters, showed the complexity of the margin north of Hawkes Bay. A complexity that includes the huge Ruatoria Avalanche off East Cape.

I had a brief spell on local Geological Society committees in the late sixties and was elected to the National Committee of the GSNZ in 1999. I retired in 2003 from NIWA (which incorporated NZOI), after the 40 fascinating years I signed on for, back in 1963 - coinciding with a nomination to be Vice- president of the GSNZ - as if the list of things to do wasn't long enough already.

In the next year, I hope to continue an initiative Mike Johnston began. We need to think about how the society is, or should be changing, with the continually changing nature of geoscience (and it's funding) in crown research institutes, academia and industry.

More on "The Lillie Spy Affair"

Mary MacEwan

While researching for my biography of my father Charles Fleming (recently published), I transcribed many family letters. Graeme Steven's article 'A Geological Spy Story' in Newsletter No. 138 marking the 50th Anniversary of your society reminded me of letters sent by Charles to his fiancé Peg Chambers from Hawkes Bay in the summer of 1940/41. They were to be married in Auckland at Easter.

[December 1940, close to Christmas.]
c/o P.O. Wdvlle.
Thursday
……tonight, they told us how last year when in Dannevirke, Dr L. [Dr Lillie] had been accused of being a spy - chiefly because he employs a German, & also because he was alleged to have dropped his Geol hammer in Dannevirke main st & said 'Ach, Gott!' It caused a nasty newspaper controversy…

Thursday evening 8.30 [late January 1941]
The spy business is all rather a joke & noone we know or have spoken to even (ie. trades people), seem to do anything but laugh at it & say how silly it is. You needn't worry about it…

[February or March 1941]
Monday morning.
Dr. Lillie returned at 11 o'clock & Martin [Te Punga] this morning, [with] a whole lot of good food - including 2 young hens, plucked & prepared, in response to desire of L. (big joke, really; he said wouldn't it be nice to have a chicken & M. brought 2!) (M's parents have a big garden & there are also plums & jam & peas). We're in doing office work today & as there's bread to be bought I will finish...
The latest is that Martin is a Jap. spy & L. a German - I haven't heard where I fit in…

[Probably March 1941; they often wrote about the movies they had seen.]
Friday night
I saw 'Emile Zola' once - who with? I don't know - can't have been so long ago either. I envy you the possibility of seeing 'Wings' again.
To be likened to a Dutch Professor is nothing to what I might get here! So far, though, I seem to be giving the local tongue waggers a hard time - they can't fit me into the spy set up & all they say is that I speak English but not New Zealand English! Don't get worried dear, everyone we know here thinks it's a great joke & we ask the latest bulletins from those 'in' with the news…

C/o Norsewood P.O.
Sunday night 16th
Well, darling, we've arrived,
A terrific struggle. L. & Mrs. arrived back for lunch on Saturday & decided that it was clearing sufficiently to shift. So we started packing & by 3 o'clock one load in a borrowed trailer plus M. & I & L. driving set off for here - 30m. At the first bowser we stopped for benzene & up rolled an American oil man with Marwick who had gone on to him from us. They started talking & it was 4 before we got away. We soon ran into rain which got worse & by the time we arrived here it was terrific. M. & I & the gear were dumped while L. returned for the rest. We pitched 2 tents on the soaking ground & got the gear stored...
The place is a 3rd class Motor Camp - i.e. is labelled such but has few conveniences. There is a patch of totara-rimu-kahikatea bush & a stream & swimming pool & an open area with dressing sheds & a brick copper for boiling water but no caretaker - plenty of tuis but little else in birds. M. & I got soaked of course. Remember to add a pair of gumboots to your trousseau. Then at 7.45 - dark - the caravan & others arrived - we were quite hungry & had had only a piece of log-cake. The rain stopped & we had a hasty meal in the caravan, & stored more gear…
Monday morning.
The family are off to town to see the Police - to put us right officially - we always make a point of contacting them - & to buy stores etc…
Monday night
It was a rather glum breakfast & then the whole lot of them [Mrs Lillie, the two girls and Marie, the young German woman] went off to look for a policeman for Marie to report to & buy stores…

Alan Mason *wrote (December 2005)*

Graeme Stevens account in Newsletter 138 of the experience of Arnold Lillie's field party when mapping in the Dannevirke area makes interesting reading particularly for those of us who knew the participants.

Prior to Graeme's article nothing was ever published on the event in deference to the feelings of Arnold and his wife, Rhoda. Up to the time of his death mention of the episode upset Arnold and I have known him to absent himself from functions through fear that one of the guests might raise the subject. Rhoda once told me that at the time, Arnold visited the editor of the Dannevirke Evening News and threatened to punch him on the nose – an indication of Arnold's feelings at the time for, as Graham says "Arnold was a kind, considerate and caring man" As far as Rhoda was concerned, she seldom, if ever, again accompanied Arnold into the field.

One player not mentioned by Graeme is Robin Oliver. Robin wrote to me in August 1999 with the following information –

Summer vacation employment in the Dannevirke Subdivision with Arnold Lillie of the N.Z.Geological Survey, accompanied by his wife Rhoda, and two small children, plus an attractive female children's nurse called Marie from Saarbrucken, terminated my first university year (1939) and filled two or three months with an exciting introduction to the art of field mapping and being cared for as one of the Lillie family.

Saarbrucken is a German town near the French border. Marie's spoken German-accented English in the shops of parochial Dannevirke, a small country town, combined with Arnold's (and mine, I suppose) apparently secretive roaming of the countryside in search of one-knew-not-what aroused the suspicion of the more observant and more deductive who put two and two together and triumphantly concluded that Arnold was a spy. This hysteria peaked a few months after I had returned to University studies and created official concern extending to quite high levels.

Marie was a "girlfriend" for a year or two after the summer of 1939-40- ballroom dancing, motor-bike rides in the country etc.

In a letter to me in April 2005 Larry Harrington said that he heard of the episode from Martin Te Punga who "was a born raconteur able to make most events hilarious". Larry also told me of several other wartime spy affairs involving New Zealand geologists.

Macpherson was shot at on Coromandel Peninsula and then subject to citizens' arrest. A similar thing happened to Norman Taylor.

Whilst Larry himself was working on his Masters thesis on the south side of the Hokianga Harbour at a time when Japanese submarines were reported to be operating around the Northland coast, a sergeant and a constable came from Kaikohe to "investigate the spy" Larry was saved by the fact that his father was a member of the police force.

I myself recollect the time when a chinese fellow geology student, Peter Wong, was subject to investigation as a Japanese spy when on a field trip.

Obituaries

For N. D. Newell, J. M. Dickins, N. W. Archbold

Bruce Waterhouse, Oamaru

The year 2005 saw the death of three international paleontologists who, amongst other fields of research, concerned themselves with New Zealand fossils and stratigraphy.

Norman D. Newell spent most of his career at the American Museum of Natural History, New York, where he taught paleontology to generations, of whom many became distinguished paleontologists and geologists. Nils Eldredge, who succeeded Norman at the museum, recorded in a (New York) Times obituary how Norman, contrary to at least some expectations, hammered the theme of extinctions rather than evolution: eventually Nils and Stephen Gould realised the significance of Norman's message, in proposing their theory of punctuated equilibria for explaining the spasmodic changes in life, separated by often long still-stands. Norman naturally helped organise the Permian/Triassic conference in Calgary in 1971 (Canadian Society of Petroleum Geologists, Memoir 2, 1973) that marked a significant step towards full recognition of the extinction shock at the end of the Permian Period. And he undertook the defence of evolution against the creationist muddlement. But most of his career, apart from an innovative time studying Permian reefs, was absorbed in describing bivalve fossils, mostly Permian, many Carboniferous or Triassic, especially from the United States, but also from Japan, Brazil, Australia, with attention to European and even New Zealand fossils (Fossils of the then-Soviet Union figured little!). He co-operated in several outstanding studies, such as with Keiji Nakazawa, and Bruce Runnegar, and since the 1970's, worked closely with Donald Boyd of Wyoming, scrutinizing generally new material, patiently and luminously unravelling the course of evolution amongst bivalves.
What is most extraordinary about Norman's contributions is the sheer number of years devoted to research. After early days interpreting aerial photographs, he launched into two still highly regarded and seminal studies on "Pectinacea" and "Mytilacea" mostly from US Carboniferous, the first published in 1937. In 1995 he published with Donald Boyd a study on chiefly Permian Pectinida, daring in its innovations in classification, when in his mid-eighties. The last paper sent to me is dated 2002. So there have been more than 65 years of new and intriguing discoveries. There have been few who can match such a record, and we can salute the mental alertness, the drive, the discipline in going on, instead of turning to an easier and less demanding life style.

Norman and I first met in 1964, in Calcutta, India, where we were examining the great collections of Permian fossils kept at the Geological Survey of India. There we joined by **Mac (J.M.) Dickins** from the Bureau of Mineral Resources, Geology & Geophysics , Canberra. Mac and I had known each other since the mid-fifties. We three then teamed up to go to the Salt Range in Pakistan, and the adventures we shared are relayed in an early N. Z. Geological Society newsletter (about 1965). Read it and believe it! Mac was another bivalve specialist. I

still recall Charles Fleming warning me in horrified tones that Mac was a communist. Whether so, I have no idea: we seemed to find more immediate concerns to talk about. What remains memorable about Mac was his quiet manner, shrewd if perhaps iconoclastic or even idiosyncratic approach, and delightful self-deprecating smile. Mac came out with his finest study in 1963 on west Australian molluscs, a still outstanding work, and later spent considerable time using bivalves to characterize Permian stratigraphy in east Australia. He assumed an important role in Gondwana geology, serving as President of the Gondwana Symposium organisation for many years. He also delighted in poring over nineteenth century collections of British Carboniferous bivalves, being convinced (like me) that they contained the forebears of Australian Permian bivalves. He further paid scrupulous attention to Soviet studies (ah ha??) and combined in an excellent study in 1992 with Noel Morris and Kira Astafieva-Urbaiitis on the evolution of anomalodesmatan bivalves world-wide.

Neil W.Archbold was much younger than the other two: he died during a Gondwana field-trip in Argentina, and Hamish Campbell told me at the Kaikoura conference that he was not well, and we learned on leaving the conference that he had died. Neil had had to struggle against ill-health all his working life, even in the early seventies when I first met him as a student of George Thomas at Melbourne University. Despite these difficulties, Neil was courteous, good-humoured, insightful, with a wide range of interests, as displayed by his historical researches and the important role he played in the Royal Society of Victoria. In paleontology, Neil shaped an outstanding career, on mostly Permian brachiopods. First he delivered an impressive array of papers on brachiopods (especially Productida and Spiriferida) from Western Australia, and later he extended his researches first into Timor and Indonesia, then into South America and into southeast Asia, mostly Thailand and Tibet. Becoming a Professor in a college of Deakin University, Melbourne, he set up a dynamic group of excellent staff, and brought in advanced and brilliant students especially from China and South America, as well as Australia. He named numerous new genera, the agreed mark of a significant contribution in paleontology according to R. E. Grant (1980, in *The Human Face of the Brachiopod*, Presidential Address for the Paleontological Society, Journal of Paleontology 54: 499-507). He also named as well new species and family group categories. There was more to Neil in his record of service. It was he who helped fund from his resources an important publication by David Briggs on east Australian brachiopods as a memoir for the Association of Australasian Palaeontologists. He also showed considerable courage and integrity, for he was not always well treated by his peers. Shamefully, papers were rejected or severely refereed because he refused to join the witch-hunt that ludicrously sought to remove the controversial V. J. Gupta from the scientific record. With his growing knowledge of Himalayan brachiopods, Neil was aware that Gupta, whatever his faults (and they were surely many), had been involved in publishing valid taxa from the Himalayas, and such taxa, no matter who authored them, should not be ignored

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As a mark of the esteem in which he was held, he was asked at the last brachiopod conference (in 2005) to host and organise the next conference at Deakin. All at the meetings were thrilled that Neil should be so chosen. Alas, too late.

NEW ZEALAND ROCKS

Disappearing Sand Dunes

Bruce Hayward, *Geomarine Research, Auckland*

The Society's Geopreservation Inventory (http://homepages.ihug.co.nz/~bw.hayward/NZGI/) is now the first port of call for many Councils seeking to determine whether Resource Consent applications will have an adverse effect on any outstanding natural earth science features. Thus it is becoming increasingly important that we keep the inventory up to date and as comprehensive in its coverage as possible.

Active sand dunes and ventifact areas are categories of landforms that have greatly diminished in area throughout New Zealand in the last 50-100 years. This largely results from human activities that have stabilised the moving sand by planting vegetation and then using it for exotic forest plantations, farmland or coastal subdivisions. One aim of the inventory is to protect the best examples in each part of the country of active land-forming processes, as well as relict dune landforms. Like swamps and wetlands, we now have far less than 10% of the original natural areas of active sand dune remaining. But unlike wetlands (which greenie conservationists are actively restoring and enhancing), active sand dunes have few friends with "coastal care" groups doing their best to stabilise every bit of actively moving sand dune by planting with native dune vegetation. Recreational activities in active dune areas (four-wheel drive buggies, dune bikes, dune surfing) can significantly impact on the natural dune landforms and these become more significant, as the area of active dunes around the country continues to be reduced. Amateur and commercial collecting of ventifacts has decimated the best examples of these fields in New Zealand, such that publicising their whereabouts may do more harm than good.

In this short article I have listed all the sites currently in the inventory for their sand dune morphology (active 26 sites, fixed 5 sites), dune lake (11 sites) and also dune ventifact (4 sites) values. There are additional sites that I have not listed here that are in the inventory as beach ridges, tombolos and sand and gravel barriers and barrer islands. Clearly the best dune areas are along the west coasts of both islands, but are there really no decent examples from East Cape to Cook Strait ?

You will notice that the list contains 1 site (Farewell Spit) assessed as being of international scientific importance (classified A); 16 sites of national importance (B) and the remainder regional (C). If you have an interest in sand dune systems you might like to look over the list and check whether you think it is comprehensive and whether you know of any additional sites of equal or better quality that should be nominated for inclusion. If you have any suggested additions please email them to me at b.hayward@geomarine.org.nz, together with a sentence of two on their significance and location (grid reference).

ACTIVE SAND DUNES

Northland
Hokianga sand dunes, DoC Reserve, O06, B.
Parengarenga silica sand dune barrier. The largest unvegetated sand dune spit in New Zealand and most extensive and highest grade silica sand deposit. N02, B.
Pouto sand dunes, DoC Reserve, Q09, B (Fig. 1).
Te Paki sand dunes, DoC Reserve, M02, B (Fig. 2).

Auckland
Papakanui dune field, Kaipara South Head, DoC Reserve, Q09, B.
Wainamu sand dune, QEII Trust Reserve (in part), Q11, C.
Whatipu dune flats, Scientific Reserve, DoC. Large area of sand flats and low dunes, most of which were deposited 1900-1930. Q11, B.

Waikato
Aotea dune field, Scientific Reserve, DoC. R15, B.
Awaiti dune field. Unusual inland pumiceous sand dunes formed by fluvial and aeolian processes. T13, C.
Mataora Beach and abandoned beach ridges. A bayhead beach associated with a Pleistocene barrier dune. T13, C.
Otama abandoned beach ridges. Abandoned Pleistocene dune barrier. Classic example, the best on Coromandel Peninsula. T10, C.
Taharoa dune field, R16, C.

Taranaki
Oaonui dune field. A large area of relatively unmodified coastal sand dunes. P20, C.

Manawatu
Foxton Beach parabolic dunes, S24, C.
Hokio Beach dune field. Part of the most extensive areas of sand and related aeolian features in New Zealand. S25, B.
Manawatu dune field. Part of largest Holocene dune area in the country. S24, B.

Wellington
Whareroa dune fields, R26, C.

Marlborough
Waima dune field, P29, C.

Nelson
Cape Stephens wind-funneled sand dune, D'Urville Island. Unusual landform for the region. P25, C.
Farewell Spit, Scientific Reserve, DoC. Internationally significant, actively growing sand spit complex; largest in New Zealand. N24, A.

West Coast
Haast dune sequence. One of the best New Zealand examples of a dune system that has gradually advanced seaward over the last 8000 years. F37, B.
Mahinapua dune field, J33, C.
Waita River mouth lagoon and dune barrier. Excellent example of a deflected river mouth, dune sequence and former mouths. F37, C.

Otago
Sandfly Bay dunes, Reserve. Excellent example of multicoloured coastal sand dune system. I44, C.

Southland
Big Hellfire Beach sand pass, Stewart Island, National Park, DoC. A very well defined example of an extensive dune system rising to 220 m asl. D48, C.
Mason Bay sand passes and dunes, Stewart Island, National Park, DoC. An extensive area of dunes and sand passes. D48, B.

FIXED SAND DUNES
Bay of Plenty
Ohope barrier spit and dune ridges, W15, C.

Te Teko relict dune. Only one dune remaining from a former dune field. V15, B.

Wanganui
Santoft parabolic dunes. Extensive field of relict parabolic sand dunes and associated features. S23, B.

Marlborough
Riverlands sand dunes. Sand dunes marking the arc of the former coastline stretch parallel to the present coast. P28, C.

Canterbury
Linwood relict dune. A relict dune from an ancient dune field. M35, C.

DUNE-DAMMED LAKES
Northland
Kai Iwi dune-dammed lakes. Includes the two deepest dune lakes in New Zealand. O07, B.

Auckland
Ototoa dune lake, Q10, C.
South Kaipara dune lakes, Q10, C.
Tomarata dune lakes. Best examples of dune-dammed lakes on the east coast of Auckland or Northland. R08, C.
Wainamu dune lakes, Q11, C.

Wanganui
Lake Virginia dune-dammed lake, R22, C.

Manawatu
Omanuka dune-dammed lake, S24, C.
Papaitonga dune-dammed lake. One of few remaining examples with surrounding natural forest. S25, C.

Nelson
Kaihoka dune-dammed lakes, M24, C.
Lake Otuhie dune-dammed lake, M25, C.

Otago
Lake Wilkie dune-dammed lake. Excellent example in a natural forested setting. G47, B.

VENTIFACTS
Wanganui
Waitotara ventifacts. Area of abundant ventifacts, the best example in the country. R22, B.
Wanganui River mouth pumice ventifacts. Unusual pumice ventifacts. R22, C.
Canterbury
Clarence River delta ventifacts. Limestone cobble ventifacts. P30, C.
Otago
Sandfly Bay lag surface, ventifacts. Lag surfaces with actively-forming ventifacts. I44, C.

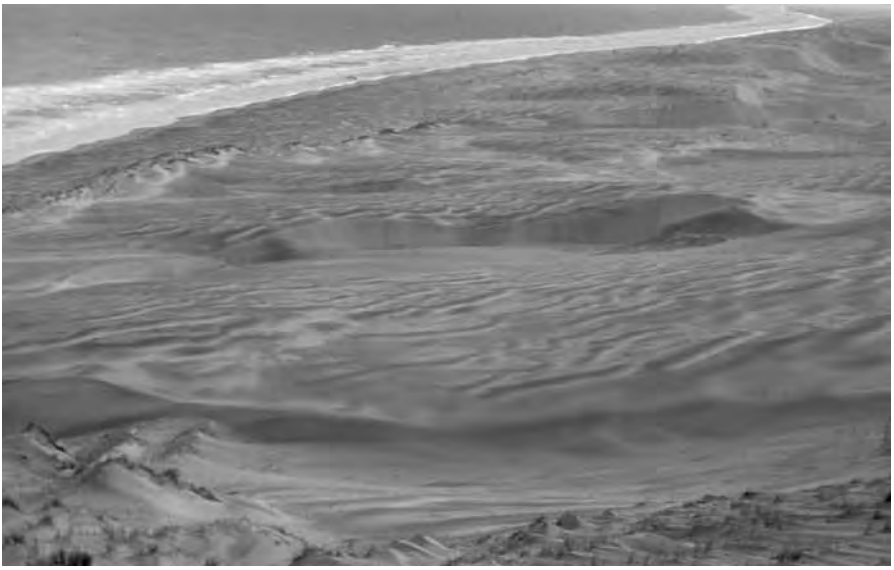

Fig. 1. Pouto sand dunes, on the tip of Kaipara North Head is one of the largest reserves of active dunes in the country.

Fig. 2. Te Paki sand dunes are alongside Te Paki Stream which provides vehicle access for tourists to the north end of Ninety-Mile Beach, near North Cape.

Editors comment: *Over the past 35 years I have explored the world for coastal titanium and zircon mineral sand placer deposits. My studies show that the Taharoa dunefield is the largest placer mineral deposit on Earth!! The controversial Witswatersrand gold may be the world's richest 'heavy' mineral deposit, but at Taharoa we have the worlds largest tonnage accumulation of economic placer mineral—as titanomagnetite. From Mozambique and Russia claims are made for the title with ilmenite zircon and leucoxene placers but the claimants there are mere pretenders. At Taharoa we have well over 300 million tonnes of mineral with a specific gravity greater than quartz. The best the other two can each muster is about 100million tonnes. Australian sand placers are much smaller, but have more valuable minerals.*

The fixed dunes on the Awhitu Peninsula and the North and South Heads of the Kaipara are world-scale fossil dune features. In fact their size argues for a much larger hinterland source region than the present Northland, some time in the mid Tertiary.

All of this arises courtesy of the southern hemisphere circum –polar air and water circulation system. Because of this world-scale origin our North Island west coast fixed and mobile dune systems may make up the world's largest coastal dunes. Worth investigating.

REVIEWS

50th Anniversary Conference

David Smale, *Nelson*

The 50th anniversary conference of the Society had to be by its nature a memorable one. Its setting in Kaikoura, and the presence of eight foundation members (David Kear, Pat Suggate, Alan Beck, Bruce Waterhouse, Bruce Thompson, Larry Harrington, Alan Mason, and Bryce Wood) alone wuld have ensured that.
Apart from those, many involved in the early stages of the Society added to the sense of occasion - Henry Pantin (all the way from UK), Peter Andrews, Ian Speden, Jack Grant-Mackie, Heather Nicholson, etc.

The number of delegates was inevitably larger than either the 1955 or 1975 conferences, so it was something of a challenge to the organisers (Jarg Pettinga, Keith Lewis, Kari Bassett, and their crew) to make sure accommodation and lecture rooms were available. All members had been duly warned that in order to hold a conference in Kaikoura concessions would have to be made, and we should not expect the facilities of a university centre. The venues settled on were the Kaikoura Memorial Hall and the Takahanga Marae.

The resourcefulness of the organisers was well and truly tested when the Marae had to be taken over at the last minute for a funeral. A rally around resulted in the local cinema and primary school being pressed into service (note that it was not yet school holidays!). It was especially appropriate that we were able to use the school, as it was the venue for the 1955 conference. We used part of a building that resembled that in the 1955 photograph (as in the GSNZ 50th anniversary History), but it was not the actual building, which had perhaps been replaced by a new classroom block.

But fate did not leave it at that. At 10am on the Thursday (the last day of sessions), all power in Kaikoura went off for half an hour. Fortunately (for
delegates) this almost coincided with morning tea, and caused little concern - but I suspect the organisers and caterers had less opportunity to be relaxed about it.

Another memorable event? An activity of Harold Wellman at the 1955 conference is famous in Society lore, and in honour of it an appropriate effigy had been placed in a tree outside the hall. Reliable sources noted that late on Wednesday evening some other visitors to Kaikoura, naturally entirely ignorant of the figure´s true significance, concluded that it was their civic duty to try to prevent what might have been a suicide attempt (though the figure was not hat far up the tree - unlike Harold, fom all accounts), and called the fire brigade.

But what of the real business of the conference? It started on Tuesday morning after a welcome by the President and the Mayor with plenary historical sessions.
Simon Nathan spoke on "Voices from the Past" - but unfortunately hastily rearranged facilities to replace those of the Marae did not include sound, so we had to be content with photos and descriptions- a pity, in view of the effort Simon has put in to collecting voices over the years. Of great amusement was an advertisement he had unearthed from the 50s for "Uranium-flavoured ice cream".

Lionel Carter, aided by Jarg Pettinga, spoke on "Uncovering the face of the eastern New Zealand margin - a view from the sea". They described major work done by three innovative marine geologists over the last 50 years - Henry Pantin, Bob Carter, and Keith Lewis - who were afterwards given tokens of the Society´s appreciation of their work.

The historical theme continued into one of the later concurrent sessions, with talks by David Kear, Mark Sirling, Heather Nicholson, and Peter Barrett. One by T. Rahiman on the 1953 earthquake and tsunami in Suva also struck a topical chord.

My retired status resulted in spasmodic attendance thereafter, but climate change clearly stimulated a number of reports, in particular its effects on paleoceanography. Unfortunately I missed Chris Uruski´s description of developments in the East Coast Basin, as I was chairing another session, and anxious to ensure that people were able to get to the AGM following. I needn´t have worried, the speakers kept to time admirably.

Weather for the half-day intra-conference field trips was just OK - not as good as the start of the day promised. As with some of the pre-conference field trips I heard about, one of the main memories of those attending might have been how cold the wind was.

The time-honoured tradition of having the conference dinner after the AGM is a great stimulus for keeping the latter brief - it lasted 40 minutes. The dinner was at Donegal House; the food, wine and ambience were great, and the presentation of awards outside the house before we started was a good way of doing things - even if not everyone could hear properly. Those who did not get their food until after 9pm (when most had finished) may have moderated their appreciation. Increase in the noise level later in the evening can be taken as an indication of the general enjoyment - as at the barbecue at a local winery the night before. Those who find it a little wearing always have the option of an early departure.

Our sincere congratulations and gratitude go to the organisers. We rely on such people for our conferences year after year, and the results seem thoroughly worthwhile and enjoyable. This one also benefitted from just the right touch of regard for our history.

INHIGEO Symposium Report

Mike Johnson, *Nelson*

The International Commission on History of Geological Sciences (INHIGEO) Symposium on History of Geophysics and Field-Trips:
Prague and Czech Republic: July 2nd – 12th July 2005

INHIGEO members Mike Johnston, Simon Nathan and Rodney Grapes beside complexly folded Devonian limestone at Barrande's Rock. Photo: Judith Nathan

The 30th INHIGEO Symposium, annual meeting and associated field trips were held in the Czech Republic from 2-12 July 2005. With the theme being "History of Geophysics" it was appropriately hosted by the Geophysical Institute of the Czech Academy of Sciences (GFU) in a suburb of Prague. The convenor was Jan Kozák of GFU. The symposium attracted 42 participants from 18 countries, including New Zealanders Rodney Grapes, Simon Nathan and Mike Johnston.

The symposium commenced with a two day field trip to Eger-rift Graben in West Bohemia, noteworthy for it numerous late Cenozoic basaltic cones, mineralised hot springs, including those at the spa town of Karlovy Vary (Carlsbad) in the appropriately named Tepla valley. The second day of the field trip concentrated on thermal springs beginning at the Soos National Nature Reserve in the Cheb Basin. Although the basin is the smallest of three in the Eger-rift Graben, it is geologically the most complex. Carbon dioxide is the dominant gas although one spring discharges helium derived from the mantle. Then followed a visit to the Frantiskovy Lazne Spa, whose springs contain Glauber salt rich in sodium, iron and magnesium chlorides and sulphates. The final stop involved a climb to the top of the geologically young (400,000 years) Komorui Hurka volcano where the debate between the "neptunists" and "plutonists" finally culminated. On the suggestion of Johann Goethe, an adit that was dug into the mountain conclusively demonstrated its volcanic origin.

The symposium formally commenced on 4th July at GFU with an introduction by Jan Kozák, an opening speech by the president of INHIGEO Philippe Taquet and a welcome from Dr Ales Spicak of GFU. Then followed a wide range of papers spread over two days. Rodney presented a paper on the Marlborough earthquakes and the recognition by Alexander McKay of dextral offsetting of basement rocks units. Another paper with New Zealand connections was by Martina Martina Kolbl-Ebert which described the work of Inge Lehmann in clarifying the structure of the earth's core using seismic data from the 1929 Murchison Earthquake. Later in the symposium, Simon gave an informal viewing of the BBC Horizons documentary on Harold Wellman "The Man who Moved Mountains".

The first of the post papers field trips was to the Ceske Stredohzi Mountains adjacent to the Eger-rift Graben to examine Cretaceous, Tertiary and Quaternary rocks. Small basalt cones, many with ruined castles on their summits, are a characteristic feature of the landscape. Some of the volcanism has carried up xenoliths of ultramafic granulites which contain the blood-red pyrope garnets for which West Bohemia is famous. The history of the garnet mining was explained in the Ceskeho Granata Museum

The following day comprised a half-day excursion to the geologically and historically important Barrande's Rock exposing Ordovician to Devonian rocks of the Barrandien Basin of Prague. A road cut into the west bank of the Vltava River revealed richly fossiliferous rocks that were described, in 22 volumes, by Frenchman Joachim Barrande (1799-1883). The sequence comprises pyroxene-rich basalt, deepwater graptolitic mudstone and brachiopod-dominated limestone. In the afternoon participants independently explored the medieval centre of Prague.

During the remainder of the symposium there were two field trips to the eastern Czech Republic. The first visited the medieval silver mining town of Kutna Hora where gnessic rocks are exposed in inliers due to erosion of the cover of the younger sedimentary rocks. As well as in the town's mining museum, evidence of past mining is everywhere evident as many buildings show structural stress due to ground subsidence. How subsidence is mitigated was explained during a visit to the Geofond Institute in the town. The second trip, of three days, concentrated on southeast Moravia. At Brno, the second largest city in the Czech Republic, participants were shown around the Mendel Museum before visiting the world renown Moravian Devonian karst. The next morning was devoted to an INHIGEO business meeting

with in the afternoon a visit to the archaeological museum in the village of Vostonic which displays relics dating back 30,000 years. The final day of the trip was a return to Prague by way of Trebic and Telc. The geological collections at the Museum Vysocing Trebic contain a great variety of regional samples from the Proterozoic and Paleozoic as well as a huge assemblage of locally collected moldavites arising from a meteorite impact in Bavaria in the Miocene (14.8 Ma). A post-symposium field trip examined the Silurian-Devonian rocks of the Bohemian Karst between Prague and the Beroun valley. This included the Nova Vec volcano near Butovice, where four generations of pyroclastics and outpourings of basalt are recognised. After crossing a Cretaceous peneplain, the field trip wound through valleys entrenched in Silurian and Devonian limestones. Lunch near Schomasty was held in the shadow of a monument marking the adjacent Klonk cliff section, the stratotype for the Silurian-Devonian boundary.

A well organised symposium with a good balance between papers and field trips. The field trips ranged over a large part of the Czech Republic and with the assistance of knowledgeable leaders gave participants an in depth overview of the country's varied geology as well as providing opportunity to become acquainted with Czech culture, architecture and cuisine.

A fit old bugger.....**book review**

Harold Wellman: a man who moved New Zealand, by Simon Nathan. *Victoria University Press, 2005. Soft cover, 272 pages.* ***Reviewed by John Rhodes***

All day we walked up and down creeks. …. He gashed his leg early in the day and he got his dirty old handkerchief out and wrapped it around his leg to stop the bleeding. I remember getting back …. absolutely knackered. I was 19 years old and this 65-year old man with a gash in his leg had walked us off our feet. …. He was a fit old bugger and he got our grudging admiration.

This (from Alan Hull) is one of a host of quoted memories in this biography of geologist Harold Wellman, who became a legend long before his death at age 90 in 1999.

It is often said that to understand history one should read biography; and Simon Nathan's *Harold Wellman* proves that to understand science one should read biographies of scientists – at least if they are as comprehensive and well written as this. Starting the project a year before Wellman died allowed Nathan to mine rich lodes of extant memory. However, he does much more than trace the life of one of this country's most colourful, controversial and brilliant earth scientists. He mirrors, in a most readable way, a half century of the development of geological thought in this country. *Harold Wellman* is three accounts in one: the man, the geology and the history of the geology, all of which do New Zealand earth science an enormous service.

Wellman emigrated here from England with his parents in 1927 at the age of 19. He worked as a surveyor in the North Island and as a gold prospector in the South Island. In 1935 he gained work with the Department of Scientific and Industrial Research, trialling geophysical methods to find gold; and thus began a long and remarkably productive career with the DSIR and Victoria University, and briefly with Shell Oil and BP.

As well as gold, Wellman's interests included coal, archaeology, faulting, earthquakes, stratigraphy, petroleum geology, Antarctica, moas, vegetable gardening and home brew. When plate tectonics burst upon the geological world in the 1960s he rapidly became one of its evangelists. Bringing to his science the graphical and numerical skills of a surveyor, he described his geological solutions with diagrams which regularly brought this reviewer more despair than understanding. One of the strengths of this biography is that it explains Wellman's ideas more clearly than he ever did himself.

Harold Wellman is best known for the results of his trek in the winter of 1941, by service car and on foot, down the West Coast with Dick Willett. Officially they were looking for mica for wartime radio capacitors; but as a spin-off the pair discovered a major fault down the western flank of the Southern Alps. Having reached Haast they confirmed its southward continuation by walking the coast to Martins Bay and locating the fault where it crosses Lake McKerrow, exactly as they had predicted. Like ants crawling over the hide of an elephant, Wellman and Willett had revealed by painstaking observation a major feature of the earth's crust - which within thirty years was to become instantly recognisable on satellite photographs. Later, Wellman's deductions (from similarities between rock sequences on opposite sides of the fault in Nelson and Otago) that his Alpine Fault had shifted 300 miles and that this had happened in as little as 20 million years, challenged accepted views; but he was never one to avoid debate. These ideas are now mainstream thinking.

Harold Wellman offers much more than the Alpine Fault story. It portrays a family making ends meet in the post-war years. It provides insights into the lives, times and characters of Wellman's Geological Survey and university contemporaries. It shows the geologist pursuing his goals not unkindly but with an enthusiasm that took little account of his impact on others. He was a delightfully flawed character: bluff, gauche, and un-refined. The book's first five chapters, based closely on Wellman's own incomplete memoir of his life up to 1938, bring the reader as close to the man as one could hope to get, as do many excerpts from taped interviews in later chapters.

Harold Wellman is rich in anecdote, not all of which puts Wellman in a good light. However, because Nathan (a Canterbury man) had relatively little contact with his subject he approaches the biographical task without bias. I suspect nobody at Victoria University could have done it objectively, because if you spent any time around Wellman a part of him entered your spirit.

Wellman became, despite his British origins, a New Zealander in the quintessential number 8 wire tradition. To trace a significant magnetic anomaly in the Nelson region in 1965, without funding for an airborne survey, he took readings with an ordinary compass all the way up Lake Rotoroa (fortuitously across the area of interest), while his wife Joan paddled the canoe.

Harold Wellman not only tackled geological problems with energy, insight and determination, but (more importantly and rarely) had a mind with the fertility to identify them in the first place. A lively, fearless intelligence gleamed under his drooping eyelids. Associates variously cursed, loved and admired him; but they ignored him at their peril. Those who, as students, had the mental agility to keep pace with his lightning reasoning and who could argue with him over a beer launched distinguished scientific careers from the stimulus of his mentorship.

Anyone with an interest in this mobile part of the earth's crust will find Simon Nathan's biography of Wellman compulsive and highly informative reading. A friend of mine with no formal geological training describes it as "a gathering together of all that was going on in New Zealand geology in an understandable way." Is it a coincidence that the design (with bold centred headings) is an exact throwback to that of Arthur Holmes' *Principles of Physical Geology*, on which generations of students cut their teeth? One of Holmes' students, Bob Clark, became the professor of geology who appointed Wellman to the staff of Victoria University, a decision which caused him occasional anguish but never regret.

Harold Wellman, well illustrated and exhaustively researched and referenced, ranks as a work of biography with Chris Maclean's celebrated *John Pascoe*. (Harold once told me that he met Pascoe in a West coast pub when the latter was researching Charlie Douglas. Pascoe eagerly asked what Wellman thought of Douglas as a geologist, and was bitterly disappointed at Wellman's low opinion of him).

Harold Wellman was a towering figure and an extraordinary human being, and reading this book raises him still further in my estimation. He has long been one of my heroes. Now, with this biography, Simon Nathan risks becoming one too.

Charles Fleming: Environmental Patriot..... book review

A biography by Mary McEwen. *Craig Potton Publishing. 382 pages. Hardback. $49.99*
reviewed by David Smale

Biographies have appeared recently of two of the most prominent and stimulating New Zealand geologists – Harold Wellman and Charles Fleming; long-time colleagues, but it would be hard to imagine two more disparate characters. Wellman was largely self-taught, abrasive, and from a not especially privileged background. Fleming was highly educated, the "last of the gentleman scientists", a naturalist and ornithologist first and foremost, and almost incidentally a geologist, though it was as a geologist that he spent all his professional life.

Can a member of his family be expected to write an unbiased, warts-and-all biography that is readable and fully informative? Charles' daughter, Mary McEwen, has done a remarkable job here. The book contains much varied material, and though one might feel that it couldn't ever be dull, because Charles did such interesting things, like his visits to outlying islands, its interest still reflects well on the author. She includes but never dwells unduly on family insights. An unrelated biographer might have preferred to be more circumspect about the

courtship of Charles and Peg, and even about excerpts from love letters. It was an ideal marriage, helped by the fact that Charles and Peg were partners in science as well as in family.

Mary aptly describes a highly intelligent and well-educated man whose insatiable curiosity and thirst for knowledge made him an ideal natural scientist. Yet he was frequently apprehensive about presenting his information in a public or scientific forum. After he found he was able to do so convincingly, and became Chief Paleontologist at the New Zealand Geological Survey, he was viewed by some as becoming somewhat arrogant (p.141), but even in later life he remained nervous about public speaking. He had an enviable capacity to communicate with people (especially younger ones) on a personal level that was sincere and genuine, and more than just superficial chat.

What distinguished him was that in addition to his mainstream paleontological activities with the Survey, he was always fully occupied with many other natural science investigations, notably of course his first love, birds, but also cicadas. He seems to have kept records of nearly every bird he saw. He was a student of languages, an appreciator and practitioner of music and art, and a member of enough committees for Peg to be worried for his health,

He never wanted to take on administrative responsibility in his professional life; he didn't ever apply for the position of Director of NZGS, or professor of Geology at a university (p.165), or Director of the Auckland Museum (p.223) though each of these was recommended. It is to the credit of DSIR that it recognised his usefulness in the purely scientific sphere, and recompensed him as well for being a scientist as it would have if he had been as an administrator. Clearly he did not lack administrative skills, as can be seen from his long association with the Royal Society. He nevertheless came up against bureaucracy within DSIR, when they wanted to bond him after some of his overseas visits, even though he had paid for them himself. He was not especially reticent about his philanthropy, but it seems likely that he was more philanthropic than he let on.

The biography has as part of its foundation an enormous amount of preserved personal detail and correspondence - he must have been quite a hoarder! How will biographers manage with emails; do people keep them? Are they worth keeping, in the way letters used to be?

There are four parts. The first two, "Born Lucky" and "Forging a Reputation", follow the logical sort of sequence one would expect. The third and fourth, "Living with Achievement" and "In Shining Armour", cover the later part of his life – again as one would expect, but the latter two, though divided into internally logical chapters, are not quite so logical in their sequence. The book is subtitled "Environmental Patriot", and it is in the later part of his life that most of his conservation activity took place. Perhaps because I am a geologist, I found the geological aspects, and the science in general, more interesting; my spirits sagged slightly as I got on to some of the conservation bits. Doubtless those who are more specifically conservationists will find the reverse. But maybe it is easier to structure scientific sections satisfyingly; conservation sections relate to human relations, strengths and failings, political manipulation, etc, which are much more difficult to approach logically.

Poetic excerpts are conspicuous (several by Peg's brother-in-law R.B. Sibson, who like Charles was an ardent lover of birds and an erudite classicist), and little gems of his personal philosophy tend to explain his reputation and why he eschewed administration,

" 'Scientific advances and original ideas in any sphere of human thought always spring from minorities, and generally from individuals.' A prime function for scientific organisations therefore 'is to nurture the heretic'. While many scientists will earn their reward by struggling for humanity in practical ways, others by their seemingly less useful work are helping to keep humanity worth struggling for." (p.171)

In 1964 he adamantly opposed a proposal to change the Survey's name as the current name had prestigious historical significance, threatening to resign if the change proceeded. (p.172)

"Most of the world's problems are not capable of technical solutions, but require changes in human or moral values. It would not be physically possible for exponential growth in biological systems to continue indefinitely." (p.205)
"'One cannot organise research, but one can create conditions under which fundamental research will flourish'" - R.A. Smith. (p.265)
"Science above all else is the great triumph of our age ranking with art music and literature as a high achievement of human culture." (p.332).

Geological Society members will note his rather low-key association with this Society; he never held office in it. This probably reflects his wide interest in natural science, and his consequent strong involvement with the Royal Society. Indeed, he spoke against the formation of the Geological Society when it was founded in 1955, because of the effect it might have on the Royal Society. Nevertheless he was a foundation member of the Geological Society, and remained active in it for the rest of his life. He contributed frequently to the Newsletter – and incidentally his collection of Newsletters forms the basis of that which now serves its Editors. He regularly attended its conferences, and meetings of his local branch – which was also the local branch of the Royal Society.

Charles had some surprising weak points – his spelling and writing remained poor throughout his life. (p.7, 200), and various examples of the spelling are quoted in passing. Yet he delighted in language (p.157), and when necessary showed considerable literacy skills, as when he was explaining his behaviour and intentions to Peg's parents before getting married (p.57-58). The same weaknesses have apparently not been passed on to the biographer (or else the editor has done a good job!); errors are very few. Newell and Newall occur on p.334, and (surprisingly) Dr C.T. Madigan (Mawson's Antarctic companion) is referred to as Dr C.T. Maddigan (p.26, 144).

Illustrations are profuse, with maps, drawings, many old photographs, and many characteristic and distinctive Fleming Christmas cards. Sources are all referenced methodically, references are quoted, and the index is thorough. However, in the reference sources two abbreviations commonly used apparently for archive material , ANZ, ABLP, had no explanation.

This is a quality publication – the cover, the paper, the printing, the detailed references, and written with appropriate academic rigour. It looks good, it is good, and its price is good value.

NOTICES

Joint International Conference on Radiolarians and Triassic Stratigraphy, *March 19-24, TePapa, Wellington*

***Chris Hollis and Hamish Campbell**, convenors.*

Interrad 11, *the 11th international meeting of radiolarian researchers*, will be held at Te Papa, Wellington, March 19-24, in conjunction with a Symposium on Triassic Stratigraphy hosted by IGCP project 467, "Triassic time and trans-Panthalassa correlations".

Triassic time and radiolarian microfossils have particular significance forWellington. The rocks the city is built on are mainly of Triassic age – 250 to200 million years ago - and radiolarians are the most common fossils found inthese rocks. Radiolarians are a diverse group of marine plankton that construct ornate shells of opaline silica or glass. They have a rich evolutionary history, stretching back 500 million years, but are also common in the modern ocean. Particular species are characteristic of narrow slices of time and so they areone of the most effective ways of dating ancient sedimentary rocks, especiallythose from the deep ocean floor such as Wellington's greywacke cliffs and shoreline. Particular species are also characteristic of specific oceanconditions, so the group is an important guide to past and present ocean changes.

The conference has attracted leading international and local experts inTriassicand radiolarian research who offer the following series of free public talks in Soundings Theatre, Te Papa:

Monday, March 20, 16.00-17.30
"New Zealand's Triassic heritage" Dr Hamish Campbell (Te Papa GNS Science, Lower Hutt)
"Zealandia: evolution of the New Zealand continent" Dr Nick Mortimer (GNS Science, Dunedin)
"Triassic catastrophes and their consequences" Prof. Ian Metcalfe (University of New England, New South Wales)

Tuesday, March 21, 16.00-17.30
"40 years of deep-sea drilling: from the Deep-Sea Drilling Project to the Integrated Ocean Drilling Program" Dr William R. Riedel (Scripps Institution of Oceanography, emeritus) and Prof. Kozo Takahashi (Kyushu University)
"Radiolarian guides to Cenozoic ocean/climate change" Dr David Lazarus (Museum für Naturkunde & Humboldt University, Berlin)

Wednesday, March 22, 16.00-17.30
"Early Cretaceous accretion in the Northwest Pacific Subduction Factory: offset production or exported goods?" Dr Sergey Zyabrev (Russian Academy of Sciences,Khabarovsk)
"How marine plankton found their way to the roof of the world: radiolarians implicated in India-Asia collision" Prof. Jonathan Aitchison (University of Hong Kong)

"Fossil evidence for the southward march of North American Jurassic terranes during the late Mesozoic" Emeritus Prof. Emile Pessagno (University of Texas at Dallas)

The conference is run as a series of three symposia: Triassic Symposium (March 20), Nigrini Symposium on biological indicators of ocean change (March 21), Biosilica Symposium on applications of radiolarian studies for facies analysis and age determination of deep-sea sediments, paleogeographic reconstruction, and evolution studies (March 22 & 24).
Additional plenaries associated with these symposia are:

Morning Plenary lectures (symposium registration required)
TRIASSIC SYMPOSIUM - Monday, March 20, 10.00-11.30 pm
"The Waipapa Terrane of New Zealand: a treasure trove of Permian-Jurassic ocean floor". Assoc. Prof. K. Bernard Spörli (University of Auckland)
"How radiolarians have helped to explain the Permian-Jurassic stratigraphy of Northland". Assoc. Prof. Yoshiaki Aita (Utsunomiya University, Japan)

NIGRINI SYMPOSIUM - Tuesday, March 21, 9.00-10.20 am
"Islands in the stream: biological productivity of modern and paleo-ecosystems from a NZ perspective". Drs Helen Neil and Scott Nodder (NIWA)
"Radiolarian-based sea-surface temperature estimates for the last 35,000 years, offshore eastern New Zealand". Dr Chris Hollis (GNS Science)

BIOSILICA SYMPOSIUM 1 - Wednesday, March 22, 8.50-10.00 am
"Radiolarian biodiversity through time". Prof. Patrick De Wever (Muséum National d'Histoire Naturelle, Paris)
"Needles in the haystack of history": biostratigraphy and biodiversity. Dr James Crampton (GNS Science)

BIOSILICA SYMPOSIUM 2 - Friday, March 24, 8.50-10.00 am
"Hydrocarbon potential in New Zealand's deep-water basins". Chris Uruski (GNS Science)
"Radiolarian biostratigraphy of hydrocarbon-rich Mesozoic basins in the Russian Arctic and Pacific Rims". Dr Valentina Vishnevskaya (Russian Academy of Sciences, Moscow)

http://www.gns.cri.nz/interrad or contact the conference organisers at interrad@conferences.co.nz

Auckland Islands Bicentenial

Mary MacEwan

European discovery of the Auckland Islands occurred on 18 August 1806. To celebrate the bicentennial of this discovery various events are being planned in Wellington by an organising committee including Kevin Jones (kljones@doc.govt.nz), Paul Dingwall

(dingwall@paradise.net.nz), Carol West (cwest@doc.govt.nz), Murray Williams (mwilliams@vuw.ac.nz), Martin Cawthorn (cawthorn@xtra.co.nz), Ken Scadden (kenscadden@paradise.net.nz) and Mary McEwen (mary.mcewen@xtra.co.nz). Please note that there is no budget for the planned events and they must be self funding.

On 18 August 2006 the Royal Society will hold a one day symposium on the Auckland Islands in Wellington. Papers will cover the discovery itself, Auckland Islands' archaeology and history, geology (speakers include Ian Turnbull and Chris Adams) and some biology. A full programme of papers has already been arranged, but there may be the opportunity for further oral presentations if some speakers have to withdraw. Offers of posters for this symposium are welcomed. Posters should be 1.5m wide and 2.0m high or smaller. Please contact Mary McEwen (mary.mcewen@xtra.co.nz).

Other proposed events include a welcome function at Science House, Turnbull Street, Wellington on the evening of Thursday 17 August; a function hosted by the New Zealand Antarctic Society, at Turnbull House, Bowen Street on the evening of Friday 18 August; film showings at the New Zealand Film Archive on Saturday 19 August (to be confirmed); a Writers' forum at the Stout Research Centre on Saturday 19 August (to be confirmed) and one or more exhibitions concerning the Auckland Islands. Drinks and a closing dinner will be held at Science House, Turnbull Street, from 6 pm – 10 pm on Saturday 19 August.

In addition to these functions, a subantarctic symposium will be delivered within the combined NZ and Australian Ecological Society conference at Victoria University 28 August - 1 September 2006. Murray Williams (murray.williams@vuw.ac.nz) is the contact person for that symposium, see conference web site: www.vuw.ac.nz/ecology06 for all of the details.

Energy Panel of The Royal Society of New Zealand

The Royal Society of New Zealand (RSNZ) has recently developed an ŒEnergy Panel' that aims to keep energy research issues to the forefront of the debate on New Zealand's energy future. Terms of Reference of the Panel, and some issues identified by the Panel in a draft position statement, are summarized. ***Thanks to Jez Weston of RSNZ for supplying this text.***

Terms of Reference

The aim of the RSNZ Energy Panel is to provide scientific and technological leadership for a secure and sustainable energy future for New Zealanders and the economy.

The panel's Terms of Reference are:

1) To develop a broad view of energy resources and opportunities;
2) To complement this with an assessment of the efficiency of energy use;
3) To produce a strategic plan for a secure and sustainable energy future;
4) To determine needs for future energy research;

5) To provide ongoing independent advice and recommendations on energy research and development, and business opportunities to the public, business and government;
6) To promote education and understanding about energy issues

Why a Sustainable Energy Panel? …The Problem

Globally, demand for all forms of energy has continued to rise in the face of energy supply limitations. A significant proportion of our energy, particularly in the form of transport fuels, comes from fossil fuels and today we are seeing changes in our biosphere as a result. The current energy infrastructure in New Zealand, as in most developed countries, has developed from a position of surplus energy and seemingly unlimited natural resources.

The economic, social and environmental risks of being unprepared for future major supply constraints are immense. Secure and sustainable energy services are vital to New Zealand¹s future prosperity. The system must now move from surplus to constrained energy resources, and from extraction and consumption to environmental stewardship.

This evolution will require an unprecedented clarity of leadership, based on sound science in the social and cultural context.

We Need to Act Now

The growing demand for energy, chronic current account deficit, and climate change are all interlinked problems which cannot be considered in isolation.

They will affect all New Zealanders. The magnitudes of the problems are huge and solutions are urgent.

Towards a Solution

To provide scientific and technological leadership for a secure and sustainable energy future for New Zealanders and our economy, the Royal Society of New Zealand has established an Energy Panel.

In the context of New Zealand's aspirations, growth, innovation and security, the panel will develop a broad view of sustainable energy resources and opportunities to determine needs for future energy research.

The panel will provide ongoing independent advice and recommendations on energy research and development, and business opportunities to the public, business and government, and promote education and understanding about energy issues.

We strongly advocate that New Zealand set bold national targets to become completely self-sufficient and sustainable in energy use by 2025, reaching 50% self-sufficiency by 2015.

Growing New Industries

New Zealand needs to participate in energy technology development, and should share some of the risks involved. Energy technology solutions to New Zealand¹s energy needs will emerge from science and technology, and we must invest in it to benefit from the emergence of what will be a ³technology sellers² market. New Zealand needs to follow examples being established in North America, Europe and elsewhere and better utilize the resources we have, such as wind power, solar power, biofuels and wave/tidal power.

New Investment Needed

A major new energy policy needs to be put in place to focus on new energy development and innovation, demonstration of new and improved energy conversion technologies and their rapid deployment. International collaboration and leveraging and supporting industrial R&D investment will be key factors, but we will need creative thinking and innovation to implement options that can balance availability of finite resources with health and well-being.

The Benefits

A sustainable energy industry is vital for our economy to be able to support the well-being of New Zealanders and provide new alternatives for primary production and land use. Without this, energy insecurity will lead to economic depression, social deprivation and the erosion of our national security. No-one else will do these things for us. This must be the inheritance we leave for future generations of New Zealanders.

Panel Members

Chair: Dr Jim Watson, President of the Royal Society of New Zealand.
Sir Ian Axford Professor Tom Barnes
Professor Gerry Carrington Dr Richard Forster
Dr John Huckerby Assoc. Professor Hicham Idriss
Dr Susan Krumdieck Dr Ian Maxwell
Dr Mike Packer Dr Jim Salinger
Professor Ralph Sims Professor John Buckeridge (RSNZ Councillor)
George Jones (RSNZ Councillor) Assoc. Professor Caroline Saunders (RSNZ Councillor)
Paul White (RSNZ Councillor)

***Editor's Comment** : Is there a real downside to not belonging to the Royal Society? Is there a geologist on the panel? Is the energy panel really a <u>renewable</u> energy panel? Even renewable energy sources require geotechnical input for proper siting. Economics may dictate farms producing energy from biomass will need mined fertilizers, whether from natural gas or rock, whatever their site or soil.*

The panel's terms of reference imply a "sustainable" energy panel. To argue that the geological fuels, oil, gas, coal, uranium, geothermal and soil are "unsustainable" is a presumption of perspective. How long is long enough? All physical investments have a limited economic use time. The newly enlarged lignite resources of Southland, if converted to liquid hydrocarbon fuel, have the resource equivalent of 25 Maui gas fields fuel enough for many generations of people and machines. If conservation, recycling and combustion free of carbon and sulphur release are the sought goals then surely a 'clean' burning of lignite would fit the need as well as any solar plant? Are we assuming that New Zealanders cannot invent such clean burners? What of rock sequestration of noxious gases? Geologists could help here too. These are the kinds of enterprises such a panel should enthuse scientists, inventors and investors to seek. Does our Society have the expertise or interest to ask to be included?

SOCIETY BUSINESS

At its next Meeting in June, the National Committee will be devoted a day to "brainstorming" The Future of the Society. We have done The Past. Who are we now? What is our role? Where are we going? What are the best ways of getting there? If you have opinion on these topics, a letter or email to Keith Lewis, 12 Ventnor Drive, Paraparaumu keithlewis@paradise.net.nz would be very welcome; several hundred minds are better than ten.

THE GEOLOGICAL SOCIETY OF NEW ZEALAND (Inc)

Minutes of the 50th Annual General Meeting held in Kaikoura Cinema, Kaikoura at 5.10 pm 30th November 2005

President Mike Johnston welcomed 55 members and made reference to the importance of the meeting as it marked the 50th anniversary of the founding of the Society in Kaikoura in 1995.

1. **Apologies**: Barry Waterhouse, Don Gregg, Peter Ballance, Pat Browne, Nick Mortimer, Tony Hocken, Helen Neil, Julie Palmer, Mike Isaac, Vince Neall, Roger Briggs, Peter Kamp

   Moved: Mike Johnston/David Skinner that these apologies be sustained. **Carried**

   The chairman asked for a moment of silence to remember the following who had died in 2005: Frank Evison and George Walker. The meeting stood as a mark of respect.

2. **Minutes of 2004 AGM**

   Moved: Keith Lewis/Penny Cooke – that the minutes, taken as read, are a true and accurate record of that meeting. **Carried**

3. **Matters arising from the Minutes**

   There were no matters arising

4. **Official reports**

a **President's Report**
The report is printed in Newsletter No. 138, November 2005 and the only additional matter was the recent preparation of a report and peer review of a Institute of Geological & Nuclear Sciences report concerning the Wellington Western Corridor Transportation Study.

b **Treasurer's Report**
David Skinner presented his report and confirmed that there was no necessity to change subscriptions for the coming year.

c **Administrator's Report**
Beth Wallace presented her report on membership of the Society.
Mike thanked David Skinner and Beth Wallace for their excellent work.

Moved: Mike Johnston/David Skinner that the president's, treasurer's and administrators report for 2005 be accepted. **Carried**.

d **Subcommittees**
The reports have been circulated in GSNZ Newsletter 138.
Fossil Record File Hamish Campbell and Ian Raine

e **Special Interest Groups**
Special Interest Groups reports are printed in GSNZ Newsletter 138

f **Branches**
Branch reports are printed in GSNZ Newsletter 138.

5. **Election of officers and committee for 2005**

Office		**Moved**	**Seconded**
President	Keith Lewis	Mike Johnston	Jarg Pettinga
Vice-President	Nick Mortimer	Bruce Hayward	Penny Cooke
Treasurer	David Skinner	Penny Cooke	Ian Speden
Secretary	Helen Neil	Penny Cooke	Keith Lewis

Committee:	Hugh Grenfell	Murray Gregory	Murray Baker
	Ursula Cochran	Simon Nathan	Bruce Hayward
	Penny Cooke	Ursula Cochran	Cam Nelson
	Kari Bassett	Jarg Pettinga	Norton Hiller
	Alan Palmer	Bob Stewart	Rachel Crimp

Mike acknowledged the huge contribution made by retiring committee members Julie Palmer and David Smale. Julie is one of only two members to have successively held the positions of secretary, treasurer, vice president and president of the Society. David was Newsletter editor for the past seven years.

6. *Awards Trust – election of Trustees*

Mike thanked the outgoing trustees Julie Palmer and David Smale and nominations were called for new trustees.

Moved: David Skinner/Penny Cooke that Nick Mortimer and Ursula Cochran be the new Trustees for the Awards Trust. Carried.

7. **Any other business**:

a) **Digitising NZ Journal of Geology and Geophysics**. Moved Simon Nathan/Ursula Cochran "That this meeting asks the National Committee to investigate the most appropriate way of encouraging SIR Publishing to digitise the New Zealand Journal of Geology and Geophysics and other SIR Journals." **Carried**.

b) **2006 Conference**. Mike advised that the next conference would be organised through the Manawatu Branch.

c) **50th Anniversary Publication**. Alan Mason made reference to Bruce Hayward's outstanding history of the Society and his remarks were endorsed by acclamation.

Keith Lewis thanked the outgoing president for his work for the society, which commenced with Mike's election to the committee in 1993.
In closing the meeting Mike acknowledged the huge effort put in by Jarg Pettinga and Keith Lewis and the organising committee in ensuring that conference was a resounding success. He also expressed his appreciation of the work and assistance provided by the committee and thanked Society members for their attendance at the AGM.
The meeting closed at 6.00pm.

50th ANNIVERSARY05 KAIKOURA IN COLOUR

Outside the main Venue

Founding Fathers

Pat Suggate Alan Beck Larry Harrington David Kear Bryce Wood

See Harold Wellman
"Up his tree"
To loose a hail of water.

But police did frown,
"Take dummy down!"
Seeming suicide's not laughter.

First happened 50 years ago,
Re-enacted 50 after,
Seeking fun needs permits now
Which incident was dafter?

Field trip with Jarg Pettinga

Cool oldtimers
Brent Alloway & Geofroy Lamarche

Roger Cooper and femme fatale

At the "OLD TIMERS" dinner at DONEGALS on WEDNESDAY

Four fiery fifties redheads Laura Wallace, Ursula Cochran, Janet Simes, Kate Wilson

….plus…Heidi Schlumpf and Jane Smith

Heidi Schlumpf again

David Skinner, Larry Harrington and Alan Beck

At the Kaikoura VINEYARD BBQ on Tuesday