NEWSLETTER

Geoscience Society of New Zealand

Front Graphic:
Haketere/Ashburton River mouth
(Glenn Vallender)

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GEOSCIENCE SOCIETY OF NEW ZEALAND

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FROM THE PRESIDENT

Jennifer Eccles

As I take a breather from my ‘cat herding’ (aka Endeavour Fund Programme bid writing) to work on the agenda for the next GSNZ National Committee meeting I find myself contemplating what people might want from a Society.

It provides a vehicle for community activities such as ensuring we have regular national conferences and a respected platform from which to administer resources to support the community, acknowledge achievement and lobby local and national government when needed. Ideally every geoscientist in the country would be an active member to have a voice in, and give a true mandate to, our activities but when there is a choice about how to spend money what makes an individual join? And stay joined? Our new administrator Nicki Sayers with her broad experience in society governance is proving a breath of fresh air organising a member survey, encouraging us to strategize and question why ‘we do things the way we do’. The statement however that ‘people will join if they feel they are getting value for money’ is easier said than done to implement. Although united by a common love of Geoscience the diversity of the society from students to retirees, which although one of our great strengths, is also a challenge for delivering ‘products’ of universal uptake and value. The traditional hardcopy newsletter began long before we were ‘online’ and was the primary vehicle for sharing what was going on in the community as well as our primary expense. That monopoly has since gone and while this newsletter can still provide a good read and provides a valuable archive of content it has been challenged by the myriad of global sources of bite size, instantaneous communications.

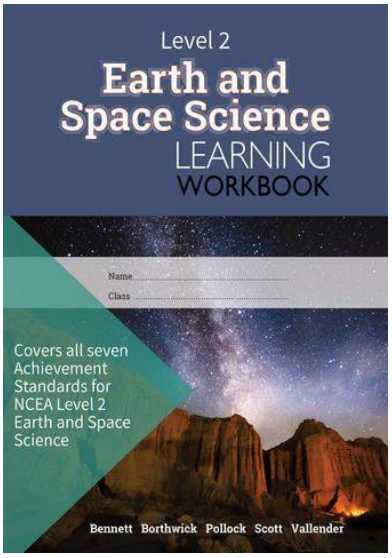
How the society divides its effort and resources in communications to, and ideally facilitating communications within our membership, will prove critical to how we are perceived. At the end of the day we want to share content people actually want to read in the format they want to read it in, but with no full-time content generator/gatherer we are reliant, like all Societies, on members to buy in and voluntarily contribute.

Why is preserving connectivity of the New Zealand Geoscience community so important? Although we operate in what is, in the international context, a pretty competitive funding environment we are still a small community, in a small country with a lot of Geoscience work to be done and limited resources to do it. Science itself relies on community spirit - peer review is pivotal. In New Zealand the collaborations of expertise and equipment, the willingness to share ideas and help out colleagues from within and beyond an institutional silo are crucial in ensuring we continue to punch above our research weight internationally. I’ve been privileged to be involved in several ‘NZ Inc’ endeavours and working with people you know, like and trust certainly makes the process easier. While time, trial and error, and experience can provide this, the GSNZ can also provide a crucial forum for existing, emerging, transferring or diversifying geoscientists to build and sustain networks. A fieldtrip van trip or shared beer at a conference dinner can do wonders! When I think back to how my first opportunity beyond my educational bubble opened, it stemmed from the talk I gave as an MSc student at a Geological Society of NZ conference (Whangarei 2002) and being able to facilitate the growth of the next generation of geoscientists is a great motivator for me. The Geoscience 2018 Napier Conference was a fantastic success in bringing the community together and I’d again like to thank the local organising committee for their efforts.

EDITORIAL


Glenn Vallender

Well, that time has come round again for another ‘editorial’. I am sure this is not the right term but it will do for the moment. As the vaudeville derived saying goes. “A funny thing happened on the way to the forum”. I have never seen the stage show but have read about the plot, which is as relevant today as it was in ancient Roman times. It was 38 years ago that my first ‘letter’ to the GSNZ editor (April 1981 Issue 53, p43 and Roger Cooper as a co-editor) appeared, appealing for resources to assist in the development of the first Ashburton community education programme and a dedicated Year 12 (Sixth form certificate) course in ‘Geology’. I never got a reply though and the formation of the geoscience education special interest group was still two years away. So strange things do happen on the way to the forum and last year saw the publication of a full colour revised edition of a Learning Workbook for Year 12 (NCEA Level 2) catering for the Earh and Space Science Achievement Standards (https://esa.co.nz/collections/learning-workbook/subject_science+ncea-level_level-2) of the national science curriculum. Learning Workbooks are a write on text with content information and exercises and questions for students (and many teachers).What would inspire a geoscientist to take up teaching? For some answers to this, see the article on the status of global Geoscience education (p39).



In an effort to enhance the value of your newsletter, several ideas were put forward at the 2018 conference in Napier (and more fully discussed ta the first committee meeting for 2019) but they all depend on voluntary input as well as targeted ‘solicitation’. Don’t be backward at coming forward, your proactive input will help ensure the survival of the Newsletter. Here are some examples of suggestions:

- Compiling (short) abstracts of theses being (begun or) completed out of your institution
- A Geoscience focused round up of funding-round results including scientific abstracts of successful Marsden, MBIE proposals etc
- Summaries of some of the big science going on e.g. IODP, Endeavour Fund programmes
- Material towards compiling a calendar of upcoming events of interest
- Material towards a “What’s Happening?” section
- Any “how to” advice/experience about common activities such as proposal writing, permitting fieldwork (DOC etc), community outreach, and publishing
- Any other topics of interest.

Geologists have a saying – ‘Rocks remember’ (Neil Armstrong).
Enjoy a high-quality issue #27.

Auckland Geology Club, GSNZ Auckland Branch Fieldtrips for 2018

Bruce W Hayward

In 2018 the Auckland Geology Club ran 12 field trips with an average attendance of 17 people (18 in 2017). Most were one day or half day trips around the Auckland region to:

- Sunset Beach, Port Waikato to see Jurassic marine fossils (Feb); Baylys Beach,
- Dargaville to view a sequence within the North Kaipara barrier of six pulses of sand accumulation separated by periods of dune stabilisation, podsolization and kauri forest establishment (Mar);
- Martins Bay, Mahurangi to examine the Waitemata sequence containing three Parnell Grit beds (Apr);
- Anawhata Beach to see marine stratovolcano deposits from the Miocene Waitakere Volcano (May);
- Thames School of Mines to view collections and historic classrooms (Jun); Howick coastline of early Miocene Waitemata Sandstone (Jul);
- Rangitoto Volcano summit and caves (Aug); Te Puke o Tara/Hampton Park Volcano, east Tamaki (Oct);
- Hamiltons Gap, Awhitu Peninsula where we were amazed at the thickness and continuity of the Potaka “Ignimbrite” (1 Myr) within the sand dune sequence.

We also had two longer trips – the first led by Bruce Hayward to revisit Great Barrier Island’s geology for 7 days in Apr-May. There were many highlights including Whangapoua tsunami deposit in the sand dunes, Windy Canyon obsidian breccia, Te Ahumata fossil geothermal system and plateau, coastal boat trip from Whangaparapara to Port Fitzroy return, and a soak in Kaitoke hot springs.

In November a party of 29 spent 7 days in Kaikoura and Christchurch looking at the landslides, surface ruptures and coastal uplift caused by the Kaikoura Earthquake with the expert guidance of Jesse Kearse and Kate Pedley. We also visited the Quake City display in central Christchurch and noted progress on the city’s rebuild. We also had day trips to the volcanic geology of Quail Island in company of Steve Weaver and to examine the rich Pliocene fossil beds at Motunau and the giant Oligocene Zoophycus at Napenape Beach, north Canterbury. You can read more about almost all of the sites mentioned above on the Geotrips website (https://www.geotrips.org.nz/).

During the Auckland Heritage Festival (Sep-Oct) the Geoclub and GSNZ Auckland Branch hosted ten field trips which visited in excess of 60 of Auckland’s and South Auckland’s volcanoes in 50 hours (average attendance at each 24 people). Several attendees visited more than 50 volcanoes each.

Many thanks to the organisers and leaders of all trips during the year – especially Jesse Kearse, Kate Pedley, Wendy Goad, Hugh Grenfell, Steve Weaver, Christine Major, Maureen Burke and Bruce Hayward.

Fig. 1. Auckland Geoclub members soak in Kaitoke hot springs in Great Barrier Island's forest.

Fig. 2. Jesse Kearse (left) led us up and down for many kilometres following the Kekerengu Fault rupture, north of Kaikoura.

Fig. 3. We wandered amongst the large Cretaceous concretions left exposed by the coastal uplift at South Bay marina, Kaikoura.

Fig. 4. Kate Pedley (right) showed us the “Wall of Waiau” fault trace and sag pond created during the Kaikoura Earthquake.

Fig. 5. A highlight of our Kaikoura Earthquake trip was the Leader River landslide and resulting dammed lake (far left).

Fig. 6. Steve Weaver (second from left) discussing the lava flow features and intrusions on Quail Island.

And to fill in a space, here is my photo of Quail Island just around the Southern corner (behind Steve Weaver) taken on 21/012/2019) on a U3A trip.

Fig. 7. Some of the participants on one of the Auckland Heritage Festival trips ventured into the mangroves and mud at Hobson Bay to examine a Little Rangitoto lava flow.

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The Crown Minerals Amendment Bill – a triumph for conservation or pointless destruction by ideology?

Ray Wood wood-hill@xtra.co.nz

On 12 November 2018 Parliament passed the Crown Minerals (Petroleum) Amendment Bill. The Bill preserves existing permit holders' rights but bans oil and gas exploration outside onshore Taranaki. Rights under existing permits will be protected, but new permits will be limited to onshore Taranaki.
The ostensible purpose of the Bill is to address climate change. The Prime Minister said this Bill is an "important step to address climate change and create a clean, green and sustainable future for New Zealand". According to the New Zealand Parliament website, the "Bill aims to reduce fossil fuel use" and it "marks another step in the Government's long-term plans for addressing climate change".

The real goal of this Bill is to end hydrocarbon production in New Zealand. This Bill is about ideology, not reality. Facts were irrelevant to the decision, a conclusion made obvious by the flagrant disregard for customary Parliamentary Practice and the groundless criticism by Ministers of advice provided by the Government's own experts. The goal of reducing global greenhouse gas emissions is laudable, but the conclusion that the best action New Zealand can take is to end offshore exploration because it will somehow affect consumer behaviour in Europe, America and Asia (and thereby reduce greenhouse gas emissions) is ludicrous.

Anyone with even a basic knowledge of climate change, the oil industry and economics knows that stopping offshore oil and gas exploration in New Zealand would have no effect on the global demand, supply, consumption or price for oil and gas, and therefore would not reduce the levels of greenhouse gas emissions.

Greenhouse gas emissions from oil and gas are primarily a demand problem. The global demand for fossil fuels is driven by the fact that cheap energy, convenient transport and innovative products made from petroleum make our lives better, and at the moment the alternatives are not as good. Demand is a function of price and the global economic cycle. Demand for oil and gas will decline when alternatives such as renewable energy sources are reliable, convenient and affordable.

The global supply of fossil fuels is controlled by factors such as new technologies, investment levels by industry, armed conflict and geopolitics. Regardless of the level of investment in exploration in New Zealand, on a global scale New Zealand's production of oil and gas will always be relatively small. Any of the major oil and gas producing countries could tweak their output to accommodate any change in New Zealand's current or future production. A decision by New Zealand to forego development of its oil and gas resources has no effect on global supply, it simply cedes the benefits of that production to other countries such as Saudi Arabia, Russia or the United States.

Although it will not affect the use of oil and gas, according to a report prepared by the Ministry of Business Innovation and Employment (MBIE) this Bill **will** make a difference to climate change – it will make it worse. The report says that the "net impact on global emissions is uncertain but more likely to be negative than positive. Reductions in emissions from foregone production are likely to be displaced by higher-emission production overseas."

The conclusions based on facts and the experience of energy experts demonstrate that statements such as that of the Green Party that "it's awesome that New Zealand is legislating to protect the environment" are patently untrue. If the claims about its effects on climate change are false, then what about the claims that it will create a sustainable future for New Zealand?

New Zealand's decision to end offshore exploration means that the chances of discovering and producing hydrocarbons here are greatly reduced. MBIE's report predicts that the lost benefits from oil and gas production resulting from this Bill could be between $1 and $23 billion, with a most probable loss of about $8 billion. There is no doubt that a sustainable future for New Zealand will include the transition away from fossil fuels, but that transition will take decades and must be managed in a global context. Even the most optimistic estimates of investments in renewables, with conservative assumptions on energy demand growth, show a high proportion of fossil fuels in the energy mix beyond 2030.

The energy transition will be gradual for several reasons, but probably the most significant is the scale of planning, construction and investment required to achieve it. Transpower has estimated that electrification of New Zealand's transport and industrial sectors will require a doubling of the amount of electricity generated by 2050. New Zealand currently has a total electricity generation capacity of about 8900 MW, and therefore we are likely to need about 8900 MW more capacity to meet the expected demand from the transition from fossil fuels. The capital cost of alternative energy is about $2/watt. The cost of an additional 8900 MW would be about $18 billion.

It is useful to consider the scale of development that may be required to remove oil and gas from the energy mix. One hectare of solar panels generates about 1 MW, so if all the new capacity came from solar energy it would require 8900 hectares of solar panels. A typical wind turbine generates about 3 MW, so if all the new capacity came from wind energy it would require about 3000 wind turbines. In addition, electricity transmission and storage systems would have to be upgraded to handle the increased flow of energy and its increased variability. Planning consents and construction of this infrastructure would take decades.

Oil and gas will continue to be produced to meet global demand for those decades, and the levels of greenhouse gasses will reflect global decisions that influence that demand. As discussed above, continuing domestic hydrocarbon production would not affect global production or global levels of greenhouse gas emissions because it would just displace less efficient sources. However, continuing domestic hydrocarbon production would provide a buffer against price shocks and supply constraints and revenue that could be used for the benefit of New Zealand, including implementing policies that have meaningful impacts on climate change.

An area where government investment could have a significant impact on climate change is in research to reduce greenhouse gas emissions from our agricultural sector, the source of 54% of New Zealand's total emissions. Another area where government funding could be critical is to provide training for the people who will be needed to design, build and maintain the systems required to transition to a zero-carbon economy.

Finally, a clean, green and sustainable future for New Zealand will be more achievable if we have a diversified economy. Parts of our economy are already threatened: our agricultural industry is faced with competition from artificial milk and a growing global concern about meat consumption, and the tourism industry is struggling with the strains that even existing levels of tourists put on our society. In this context the destruction of the long-term future of the oil and gas industry seems a particularly poor choice.

It is easy for politicians to make a meaningless gesture such as this Bill. It is much harder to design and implement policies that would actually make a difference to climate change. Sending us blindly down an ideological path is not leadership.

New Zealand's period of enjoying the benefits of hydrocarbon production has been remarkably brief. This Bill marks the beginning of the end of the oil and gas industry in New Zealand, less than 40 years since production began in the Maui field. The transition from oil and gas should be welcomed, but not without recognizing what hydrocarbons have done for us. The oil and gas industry has arguably made the greatest contribution to personal freedom and global prosperity of any industry. It is easy to overlook these benefits because they are everywhere and are therefore taken for granted.
Ray Wood
Wellington

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The Gisborne, Waimata Valley mud volcano – December 2018

Murry Cave (Murry.Cave@gdc.govt.nz)

At around 8am on the 15th of December 2018, the Halls who live at the top of the Waimata Valley left home for Gisborne City. On their departure they did not observe anything out of the ordinary on their farm or on the adjacent Uttings farm that they drove past on their way to town.

As they returned home at around 1pm or soon thereafter, things had changed. What had been a raised dome on the boundary between the Hall and Utting properties was now covered by a large area of white mud. As the Halls farm already had a mud volcano elsewhere on their property they knew instantly what had occurred. Soon afterwards I was notified at Gisborne District Council (GDC). I logged on to EO Browser and scanned the area via the Sentinel-2 satellite imagery and located the feature on the boundary. I was not particularly surprised to find that a mud volcano had erupted at this location. On 1 September **2016**, a significant M7 earthquake occurred offshore of Te Araroa in Northern Gisborne/Tairawhiti. The site where the eruption occurred uplifted by around 1 metre after the earthquake (**Figure One**). This was before I arrived in Gisborne but I immediately embarked on a study of the mud volcanoes of Tairawhiti. Two reasons; they intrigued me, and it was a good way to find my way around the district.

But I digress. I established that there were more mud volcanoes than previous reported in the scientific literature and also that the mud volcanoes were merely the intermittent eruptive features on much larger diapiric structures. Further it was clear that certain mud volcanoes reactivated after the September 1st Te Araroa Earthquake while others remained dormant. Mapping showed that mud volcanoes associated with east-west oriented faults reactivated while those associated with more north-south oriented faults did not.

The Waimata Valley mud volcanoes have been relatively well described compared with others as they have a history of repeated activity but the December 15th event was from a new eruptive centre. This is providing an opportunity to do a number of things;

1. It provides an opportunity to study these features from day one of their occurrence,
2. It provides an opportunity to protect it from modification by stock and people and as a consequence, we're helping fund the site being fenced off.
3. As it is visible from the road, we can put interpretation signs up on the road for curious passers by who will no longer feel the need to wander over the farms without asking permission (this has been a big issue).

Drone Mapping

Because of the uplift and rupture after the Te Araroa Earthquake, we generated high resolution orthophotos of the area using a drone which we geo-referenced using several survey points (**Figure Two**). We've now re-flown the area (**Figure Three**). This means we can use the two datasets to generate difference maps to calculate volume and elevation changes using Cloud Compare software.

Sampling

Because it happened in summer it meant we had the benefit of access to the suite of summer student interns GDC employs every year they were enlisted to spent a few hours scanning the mud volcano debris field collecting samples for analysis. A total of 50 rock samples were collected and are shown in **Figure Four**. The largest proportion of rocks are sheared and veined sandstones (33% inferred to be basement metamorphosed sandstones. Indurated interbedded sandstones and mudstones make up the next biggest class (16%), while a chocolate brown shale (?Waipapa Black Shale) and greensand each comprise 13%.

A notable lithology was a grey siltstone to sandstone which were still discharging gas several hours later (9%). A small but interesting component was a grit to pebble conglomerate (7%), while the final rocktype was a homogeneous pale grey mudstone to claystone. Cementing was predominantly calcite where present in the non-basement material and occasional shell fragments were evident. A feature of the mud volcano is that the gas being discharged has a distinct hydrocarbon odour which is different to the adjacent Halls and Savages mud volcanos which are odourless. It would be good to sample the gases and perhaps do this over a period of time to assess whether or not there are changes to gas composition over time. Unfortunately, that is something I don't have a budget for!

Next steps

1. Tracking down any video footage or photographs that forestry truckies may have taken on the day. Nothing has turned up on Facebook which may mean that the actual eruption wasn't observed. We know the eruption occurred over a 5-hour period but we don't know the duration within that 5-hour window.
2. Install some motion-sensor and timelapse cameras to assess possible changes over time.
3. Fence off the feature including the wetland that has now developed immediately to the north.
4. Hopefully get a MSc level student to undertake a more in depth study of the mud volcano.

5. Once the data from a region-wide high resolution LiDAR survey current underway is received, develop a digital terrain model to more accurately assess the overall dimensions of this and other mud diapiric structures in the region.
6.

Figure One. Uplift and rupture on the boundary between the Uttings and Halls properties Waimata Valley 2016.

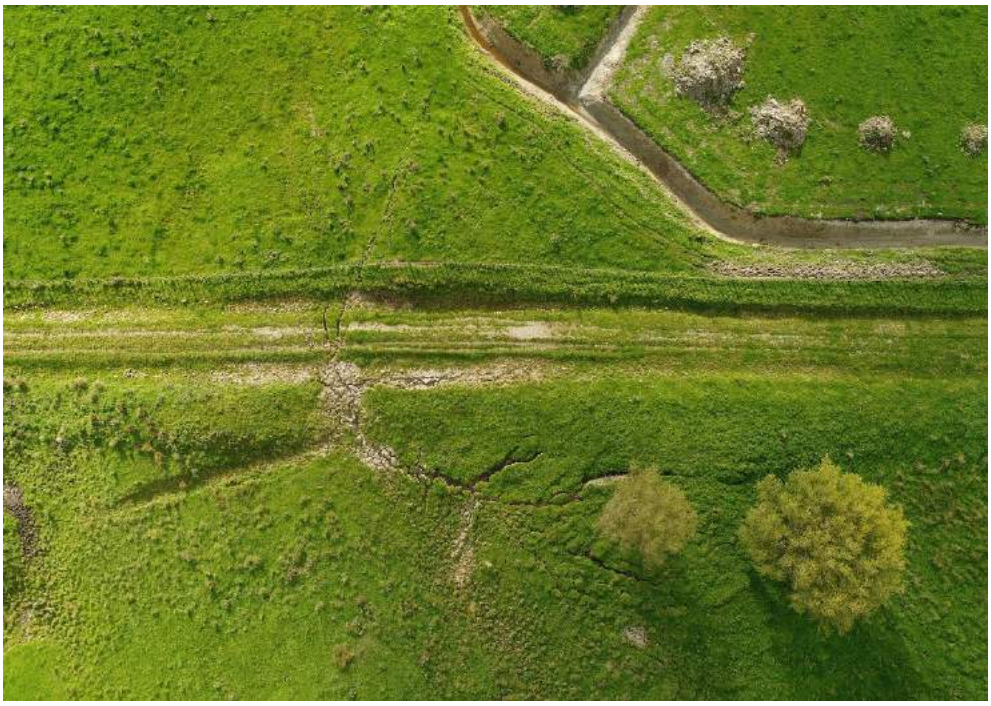

Figure Two. Detail of drone footage of the boundary between the Uttings and Halls properties after the uplift and rupture event that occurred after the Te Araroa Earthquake. Although no prior accurate surveying had been done in this area, the uplift blocked a stream immediately north and the depth of excavation necessary to restore gradient was used to establish that the uplift was at least 1 metre.

Figure Three. Uttings Mud Volcano drone footage, January 2019.

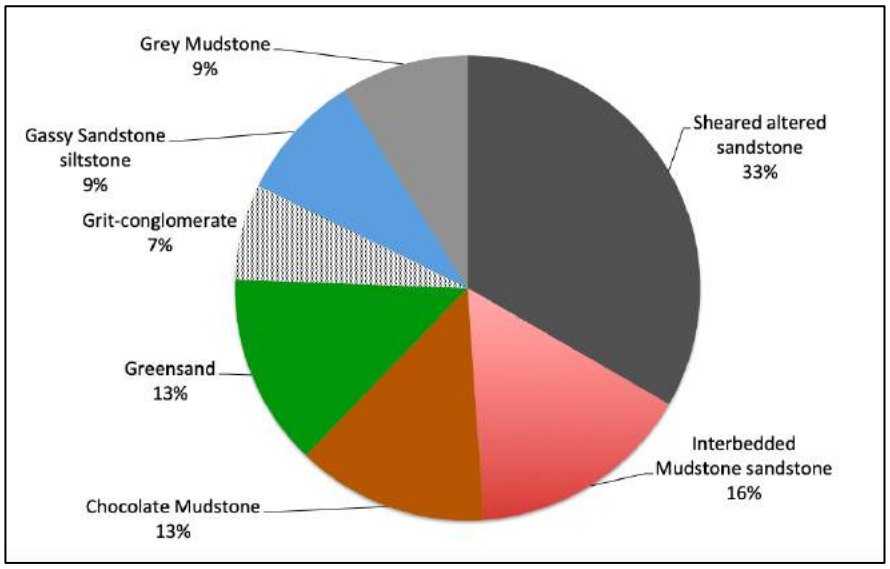

Figure 4. Lithology composition.

(Ed. Please note the unusual spelling of Murry)

Come to the Cretaceous Tectonic Party - Bring a Plate

John Bradshaw john.bradshaw@canterbury.ac.nz

The origin and history of the Alpine Fault has always been a salient topic in New Zealand geology and at the time I was introduced to the Fault its existence and displacement were well established. At that time there were two interpretations of its history; the conservative that considered displacement to be in part late Mesozoic and in part Cenozoic, based on the offset of a dike swarm and the radical alternative. This was advocated by Harold Wellman and posited that the total displace could be achieved in the late Cenozoic by displacement at rates seen on currently active faults in New Zealand. This second view hardened into a generally accepted interpretation, particularly as it was seen to be consistent with the 'new plate tectonics' theory in terms of rates of current convergence. It did not fit so well with larger scale plate tectonic syntheses of the south Pacific margin, however, which typically required a large Cretaceous sinistral offset across New Zealand that juxtaposed the northern South Island against the Wairarapa coast. This was conveniently sited along the line of the Alpine Fault. (Lawver *et al.* 1992, is a good example but there are many more).

Cretaceous tectonics is very relevant to interpretation of the Rangitata Orogeny and the changes that separated the 'basement' from the 'cover'. A plate tectonic interpretation of the Rangitata orogeny was suggested (Bradshaw, 1989) and elaborated on by Luyendyk (1995). It proposed that the Phoenix plate and Phoenix-Pacific ridge converged on the Mesozoic active Gondwana margin leading to collision with the loss of a subduction zone and a ridge around 105±5 Ma (mid-Albian). Relative plate motions were such that the net motion of the Pacific plate was away from the Gondwana margin and the future Zealandia was annexed by the Pacific plate. This resulted in extension, and eventually, to Zealandia breaking away from Gondwana with subsequent spreading in the Tasman Sea and Southern Ocean. Subsequence discoveries, particularly with regard to the Hikurangi Plateau and the details of subduction have modified the original view (Davy *et al.* 2008, 2014).There is a confusing period of as much as 20 million years when the Hikurangi Plateau and south eastern New Zealand might be considered part of either Gondwana, the Australia plate, or the Pacific plate as there is no well-defined Australia-Pacific plate boundary until the beginning of Tasman Sea spreading around 85 Ma. The convention is to regard it as part of the Pacific plate. Prior to 85 Ma that there is a great deal of crustal extension with core complex formation that overlapped in time with the younger Cretaceous granites. Much the same can be said of West Antarctica.

The simpler version of subsequent Late Cretaceous events is that with the commencement of spreading on the mid-Tasman ridge, Zealandia clearly became part of the Pacific plate. In the mid Paleocene, spreading stopped on the mid-Tasman Ridge and the Australia plate annexed most of the eastern Tasman Sea floor and the adjacent Zealandia passive margin zone, with a new plate boundary developing in the SE Tasman Sea. Northwards, within Zealandia, only a poorly defined and weakly extensional active plate boundary is perceived and there is no direct evidence for a well-defined eastern margin of

the Australia plate until the late Oligocene. At that time a clear active plate boundary developed through New Zealand with faulting and oroclinal bending. Many paleogeographic maps have been drawn on this basis (for example King, 2000 and derivatives).

There is however evidence that all is not right with this view, particularly with respect to oroclinal bending *(*Bradshaw *et al*. 1996*;* Turner *et al.* 2012; Mortimer, 2014) and Mortimer includes modest pre-Cenozoic oroclinal bending in his outline.

Further, evidence from the northeast of the North Island, suggests that subduction continued through to at least 100 Ma (Cawood *et al.*1999). More recently, a growing body of evidence indicates that the Cretaceous and Paleocene sedimentary and igneous rocks of the Northland and East Coast allochthons are supra-subduction in character (Nicholson *et al*. 2000; Toy & Spörli, 2008; Cluzel *et al*. 2010) and indicate a back-arc basin origin. Given a common pattern of Pacific subduction and roll-back in Late Cretaceous to recent times, a southwest dipping subduction zone below the back-arc basin is very likely, as shown by Cluzel *et al. (*2010, Fig 13). (See also Schellart *et al.* 2006, Fig. 3 though NZ is hard to identify). Though they do not name the over-riding plate, but it cannot be the same 'Pacific plate' as the one that includes the South Island because a plate can't subduct under itself, nor can it be the Australia plate because during the critical period in the Late Cretaceous and Paleocene (~85-55 Ma) the Australia plate ended at the crest of the mid-Tasman Sea spreading ridge. The solution may be a small independent plate that incorporates part of the North Island and at least the east side of the New Caledonia Basin. (The alternative of a northeast dipping subduction zone does not help.) Figure 12 of Cluzel *et al (2010)* shows a transform through New Zealand with a sinistral displacement and an active convergent plate boundary northeast of the North Island.

A more recent paper by Lamb *et al.* (2016) also propose a large Cretaceous sinistral displacement across New Zealand along the line of the Alpine Fault. They do not refer to the work in northern New Zealand although this would significantly supports their hypothesis. Their suggestion seems to have surprised some people but is consistent with the evidence cited above and with all plate rotation data. My preference is for a Cretaceous plate boundary somewhere to the southeast of the present Alpine Fault, and now buried below the Pacific crust as a result of later westwards thrusting (though I admit a hypothesis that conceals the evidence are not good science). Placing most of Marlborough north of this Cretaceous boundary would also be consistent with the similarities in the Cretaceous in Marlborough and the Cretaceous of the western sub-belt of Moore (1988) in southeast North Island. Lamb *et al.* (2016) figure three plates in their pre-break-up configuration; Australia plate including, Northwest Zealandia, Southeast Zealandia including west Antarctica and an implied Pacific plate, but show no subduction zones (their Fig 10).

The remarkable discovery of considerable areas of schists with mid-Cretaceous protolith ages and an ophiolite near the Alpine fault in Westland (Cooper *et al.*

2015) also require an active plate margin to the west and a revision of concepts Cretaceous paleogeography and tectonics. A supra-subduction setting for the protoliths of the allochthons means there has to be a plate boundary somewhere through Zealandia in the Cretaceous to early Paleocene and this too requires an extra plate. It seems we have been astride two plates for longer than we have thought (though necessarily not the same two plates). What should the new plate be called?

One may or may not accept the very larges sinistral displacement and there is no data on or timing for the restorative dextral deformation before the Miocene. Is there any evidence of an older sinistral oroclinal bend? Is there evidence for very large sinistral shear? If the western terranes of the North Island were not part of either the Australia plate or the Pacific plate between 85 and 55 Ma, what impact does this have on the orocline debate? How significant is the new Paleocene spreading in the Southeast Tasman Sea ocean crust accommodated? Did the nameless plate rotate clockwise or counter-clockwise? Is it a coincidence that magmatism in the Northland back-arc seems to have stopped about the same time as Tasman Sea spreading ended?

There appears to be no consensus and the present situation provides new choices and new problems. I am aware of strong and conflicting views about this topic, but do we need an open debate and perhaps the identification of critical areas for future research.

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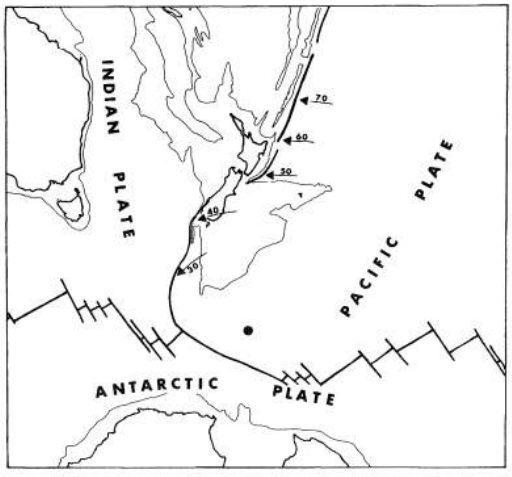


FIGURE 1: PLATES AND PLATE BOUNDARIES NEAR NEW ZEALAND. THE ARROWS SHOW THE DIRECTION AND RATE (IN MILLIMETRES PER YEAR) OF THE MOTION OF THE PACIFIC WITH RESPECT TO THE INDIAN PLATE BACED ON THE CHASE (1978) POLE – THE POSITION OF WHICH IS SHOWN BY THE SOLID CIRCLE

(Ed. note)

R I Walcott's plate tectonic map of 1978 in: *New Zealand Earthquakes and Plate Tectonic Theory* (https://www.nzsee.org.nz/db/Bulletin/Archive/12(2)0087.pdf). Note the labelling of our West neighbour plate as the *Indian Plate*.

Humble beginnings – Micropaleontology and applied foraminiferal biostratigraphy

Martin Crundwell M.Crundwell@gns.cri.nz

From humble beginnings

The establishment of micropaleontology (applied foraminiferal biostratigraphy) in New Zealand can be traced back to a letter from Jack Marwick, written in November 1932, that led to the appointment of Harold Finlay to the Vacuum Oil Company in Gisborne in 1933. During his 14-month contract and without any prior knowledge of foraminifera, Finlay developed a useful biostratigraphy for their eastern North Island lease.

Harold Finlay

Norcott Hornibroo

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH
– GEOLOGICAL SURVEY BRANCH.

All communications to be addressed to the "Director."

Geological Survey Office,

156 The Terrace, Wellington, N.Z, Nov. 24, 1932

Dear Harold,

We have just had a visit from Dr E. Jablonski, the head Geologist of the Vacuum Oil people in New Zealand. They have just taken over the Gisborne and East Coast activities of the Taranaki Oil Fields Ltd. He is very anxious to get some one to take up the forams and I think it is a good chance to pick up a few quid. Perhaps he has written to you but if not, I think it would be worth your while to write to him, address, Vacuum Oil Co, Gisborne will find him. There will be at least 3 years work I should think and probably many more even if they have no luck with the oil. Then if they get a producer you would be home & dried. Of course, as far as they are concerned you don't need to do the job from the nomenclatural point of view. There are many American workers

who work on a numerical system; but anyhow, you could get the literature & do the job properly I am quite sure. I don't know what money they would be prepared to pay but oil Companies generally are liberal payers & in addition would buy your necessary literature in the U.S.A. where they are the big noise in the Oil World. It would be necessary for you to go to Gisborne I should think & make that your headquarters, you could probably examine many of their sections in the field. I think that is almost necessary. The Taranaki people sent some stuff to Chapman, but the results weren't too good.

I think this is a good chance to get on to a good thing. Think it over & then try what money they are prepared to pay. They would probably give you a man & a car in addition to say £500 for a start. Don't ask for less & have the understanding that if satisfactory your salary would go up.

We can of course help you with literature for a start off.

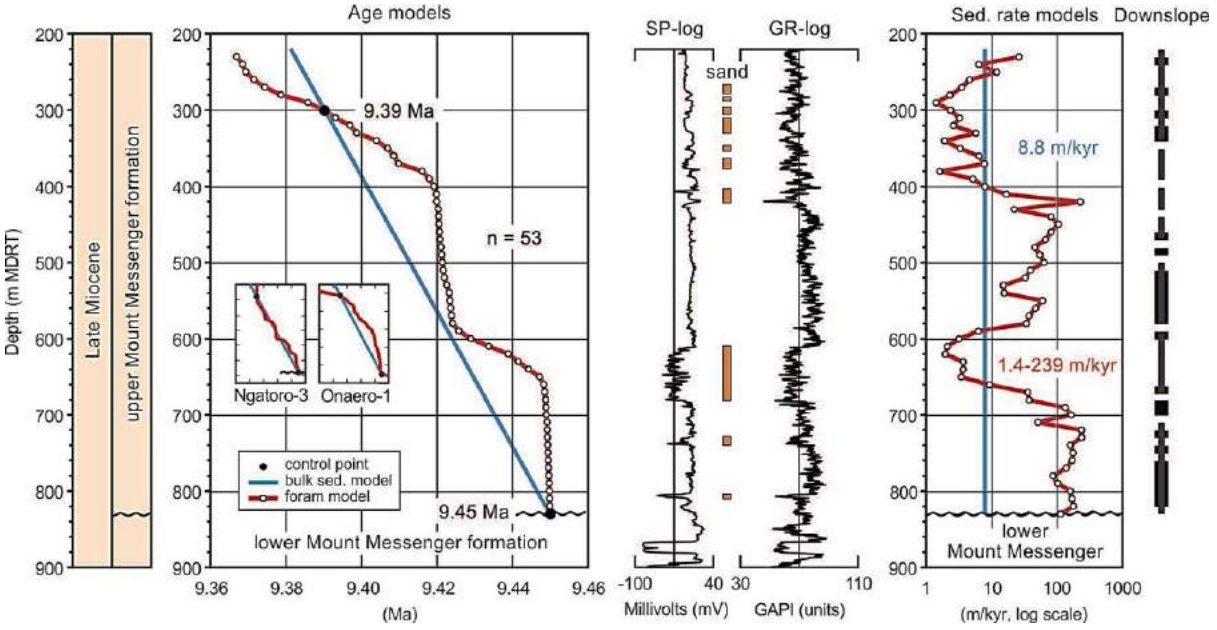
Best of Luck
J. Marwick

Advertising stall for Vacuum Oil Company (the fore-runner of Mobil Exxon) at an industrial exhibition in 1910, probably in Christchurch. Other names advertised include: Pratt's Motor Spirits and Benzine, White Rose Kerosene, and Mobil Oils. Photograph taken by Steffano Francis Webb. Photo from the collections of the Alexander Turnbull Library.

Finlay was subsequently appointed to the New Zealand Geological Survey (NZGS) as a micropaleontologist in 1937. His publications in the following 11-years contributed to major advances in the taxonomy of foraminifera and their application to New Zealand stratigraphy and the development of the New Zealand Stage classification.

Following Finlay's death in 1951, Norcott Hornibrook who had been Finlay's laboratory assistant, was appointed as Chief Micropaleontologist and later Chief Paleontologists at the New Zealand Geological Survey. During the golden years of post-World War II funding that followed, the NZGS Micropaleontology Section expanded from a one-man operation to a staff of six scientists and four technicians, in order to service the dating requirements of the NZGS four-mile and one-mile projects in the 1960s and 1970s and the boom in New Zealand petroleum exploration in the 1970s and 1980s.
During the heyday of foraminiferal micropaleontology, the advent of deep sea scientific drilling and the development of the Scanning Electron Microscope (SEM) contributed to a major increase in global planktonic foraminiferal research. With new data on planktonic foraminifera emerging from the Deep Sea Drilling Project, Hornibrook recognised their potential for vastly improved international correlation and increased understanding of global paleoceanography and paleoclimate. He also recognized the value of locally calibrated planktonic foraminiferal events for improved biostratigraphic dating.
Since the 1990s, my personal foraminiferal research has focused on improvements to the New Zealand Geological Timescale. For example, during the last 20 million-year Neogene and Quaternary period that is subdivided into 20-stages, I have identified more than 200 locally calibrated planktonic foraminiferal events, including first and last occurrences, and changes abundance and coiling. In addition to providing better dating, it has been possible to show that many of the benthic foraminiferal events that have traditionally been used to recognize New Zealand Stages are diachronous (time transgressive) and unreliable for dating.

I have also developed a new biostratigraphic dating method that assigns interpolated ages to horizons between two calibrated control points based on foraminiferal concentrations. The method makes the basic assumption that foraminiferal productivity is uniform, and low concentrations of foraminifera indicate high rates of sediment accumulation, and high concentrations of foraminifera indicate low rates of sediment accumulation. Previously, interpolated ages had been assigned on the assumption of a uniform bulk sedimentation rate. The results of both dating methods are shown in the illustrated example of late Miocene sedimentation in the Pukearuhe-1 well in north Taranaki.



Age and sedimentation-rate models and wireline logs (SP and gamma-ray), sands, and foraminifera reworked downslope, from the Late Miocene (upper Mount Messenger section) in Pukearuhe-1. Two models are shown: one is an age and sedimentation-rate model that assumes that sediment accumulation rates are uniform between calibrated control points (blue line), and the other is a model that assumes that foraminiferal accumulation rates are uniform between control points (red line). Calibrated control points that constrain the age model are shown as black markers, sampled horizons that are assigned estimated ages in the age model are shown as white markers, sandstone units that are depicted in the wireline logs are shown as orange bars, and the amount of foraminifera that have been reworked downslope into deeper water is indicated by the width of the black bars: narrower bars meaning less reworking, and wider bars meaning more reworking. Figure from Crundwell M.P. (2016): A new method of interpolating ages between calibrated control points based on foraminiferal concentrations, Journal of Sedimentary Research, p. 438-447.

The future of foraminiferal micropaleontology

Since the heyday of New Zealand foraminiferal micropaleontology there has been a decline in the number of employed professional foraminiferal specialists, from nine in 1980, to two in 2019. Alarmingly, there are no foraminiferal specialists currently employed by New Zealand universities, and with changes in New Zealand science funding there has been a major swing away from the use of foraminifera to assist in geological mapping. Major technological advances in geophysical exploration methods and changes in government policy have also contributed to a significant downturn in the demand for petroleum related foraminiferal micropaleontological services. If these trends continue it is unlikely that we will be able to commemorate 100-years of foraminiferal micropaleontological service to the petroleum industry, but foraminiferal micropalaeontology will adapt and survive.

A more detailed account of the history of NZ foraminiferal micropaleontology is given by Hayward Bruce Hayward and George Scott, in Bowden, A.J., Gregory, F.J. & Henderson, A.S. (eds) 2013. Landmarks in Foraminiferal Micropalaeontology: History and Development. The Micropalaeontological Society, Special Publications, Geological Society, London, p. 271–283.

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Analysis of Hydrothermal Sedimentary Facies and Spicular Sinter, Hell's Gate, Taupō Volcanic Zone

Michaela Dobson

The generous support from the Hornibrook award aided me in conducting my research for my BSc (Honours) dissertation at the University of Auckland with supervisor Kathleen Campbell. The research was in *Facies Mapping and Analysis of Diverse Hydrothermal Sedimentary Facies and Siliceous Spicular Sinter at Hell's Gate, Tikitere Geothermal Field, Taupō Volcanic Zone, New Zealand.* This award assisted me with the travel and accommodation expenses, enabling me to perform thorough water sampling at my site without time constraints caused by the lack of funds.

This study was based in Hell's Gate/Tikitere, Rotorua, and focused on mapping and analysis of hydrothermal sedimentary facies to enabled spatial and stratigraphic reconstruction of their distribution and formation. In particular, analysis of distinctive, biomediated, spicular, siliceous hot spring deposits (sinter) developing contemporary in pool rims and spring outflow channels in the Cooking Pool area occurred. These have broadly similar textures to other spicular siliceous hot spring deposits forming throughout the Taupō Volcanic Zone suggesting a rather ubiquitous occurrence of these morphologically distinctive textures. Previous studies have analysed the formations of these deposits in alkali-chloride, acid-sulphate, and acid-chloride geothermal fluids. The geothermal fluids that spicular sinter is forming in at Hell's Gate are bicarbonate-sulphate dominant.

These deposits are present in the ancient fossil record, including in the ~3.48 Ga Dresser Formation, Western Australia, suggests that early terrestrial life originated in hot springs. Therefore, analysis of these spicular sinter and associated hydrothermal sedimentary facies, allows analogues for the formation of these deposits.

Figure 1. Tikitere spicule sinter.

Ten hydrothermal sedimentary lithofacies were identified in the Cooking Pool area, including spicular sinter, sulphur mounds, silica residue, oncoids, rotten ground, mud, and alluvium. Fourteen spicular sinter sub-facies were identified based on textural variations. Analysis of hot spring temperatures (24.2-97.7 °C), pH (pH 2-7.6) and water chemistry (bicarbonate-sulphate) provided insight into environmental variations and controls on the formation of these deposits. All spicular sinter associated pools and discharge channels are undersaturated with respect to silica. Therefore, silica formation is inferred to occur from cooling and evaporation of spring discharge, and/or dilution and cooling from meteoric inputs. Spicular sinter formation in this study indicates various morphologies which may be attributed to spray or splashing, fluid discharge variation, steam condensate, and/or capillary rise/wicking processes. Entombed microbes in sinter examined by optical microscopy suggests a microbial component to their formation. Higher densities of spicular deposits are found in areas of increased slope angles leading to terracing. This is due to accelerated spray/splashing and wicking promoted by this elevation change.

Seven representative spicular facies were analysed by optical light microscopy. Six microfacies within the spicules were identified, including clotted texture, wavy laminae, bioturbation, detrital remains, desiccation, and microstromatolites. Facies variations at the microscale indicate that the formation of spicules are episodic, with detrital remains from the surrounding environment becoming incorporated in sinter during periods of hiatus. Furthermore, formation of these deposits often occurs in cooler temperature environments, which is expected as cooler temperatures promote silica precipitation.

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A visit to the Australian Synchrotron

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With the generous support of the GSNZ Young Research Travel Grant, I had the honour of attending the New User Symposium at the Australian Synchrotron in Melbourne. The opportunity to participate in this event, while enlightening all on its own, had the added benefit of preparing me to conduct my own research at the Synchrotron this past month. The symposium included talks explaining synchrotron science, the variety of analysis methodologies available using this technology, and the myriad experimental applications associated with each.

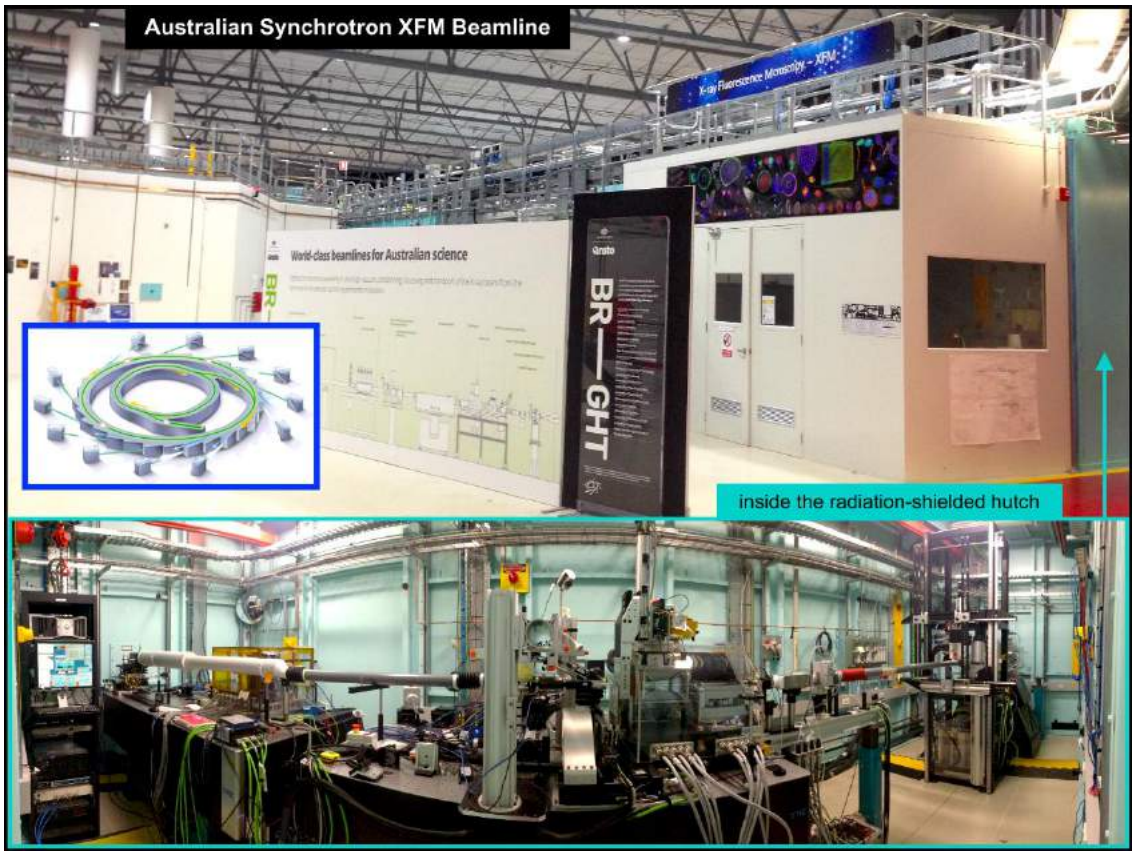
For those not familiar with the fascinating workings of Synchrotron science, the fundamental principle is based around the production of an intense beam of light, more than a million times brighter than the sun. The Australian research facility is a large and impressive wheel-shaped building with a series of laboratories and 'beamlines' extending like spokes from along the inner circumference. The centre is comprised of rings where the light is produced—a gun shoots high-energy electrons that are then accelerated to nearly the speed of light (about 299,792 kilometres per second) in a forced orbit inside the inner synchrotron ring by the 'synchronised' application of powerful magnets. The magic happens when those electrons are forced to change direction, in this case 'bent' in an arc after travelling through a straight section of the outer ring, causing a physical phenomenon that results in the emission of photons—light energy. Because the electrons are travelling at such high speeds, that light energy (or radiation) is produced at the wavelength of X-rays and Infrared light. Each beamline workstation is equipped with instruments that focus pipelines of these

light beams for specific experimental techniques, producing extraordinary scientific results.

The Australian Synchrotron currently has nine active beamlines: the *Imaging and Medical* beamline which boasts the world's widest synchrotron X-ray beam for the production of dynamic high-res phase contrast 3D X-ray imaging; an *Infrared Microscopy* beamline for shallow microscopic analyses; the *Far-Infrared* beamline that allows for a variety of gas phase experiments, among other applications; a *Powder Diffraction* beamline that is well suited for time resolved and in situ experiments; *Macromolecular Crystallography* beamlines capable of determining chemical and biological structures; a *Soft X-ray Spectroscopy* beamline set up primarily for investigations into elements of low atomic number; the *Small and Wide Angle X-ray Scattering* beamline used for geometric structural analyses; an *X-ray Absorption Spectroscopy* beamline which is a versatile technique used across chemistry, biology and material science to reveal the local structure around selected atoms; and finally the *X-ray Fluorescence Microscopy* beamline, which is the method I recently utilised in my research and is a particularly powerful tool for geochemical investigations.

X-ray Fluorescence Microscopy (XFM) has a multitude of capabilities and applications and is commonly used for experiments in biology, geology, cultural heritage, and industrial materials as it is particularly well suited to the study of metallic elements. At the XFM workstation, the synchrotron beamline focuses intense X-rays onto a sample that causes atoms of a determined suite of elements to 'fluoresce,' meaning it excites the molecules, and when they relax again, they emit light. As the equipment scans the sample, each element gives off light at a unique wavelength, like a fingerprint, so when the emissions hit the detector the instruments can identify, quantify, and spatially resolve the elements of interest. For me, that translated into high resolution, fine sensitivity maps of gold in New Zealand mantle rocks, along with an extensive suite of additional metals of interest such as Pt, Ir, Ni, Co, Cu and Fe. My time at the Synchrotron produced an impressive bank of data, unattainable by other forms of analyses and without causing damage to my samples, linked to visually rich (and aesthetically exquisite) images, unearthing some of the geochemical mysteries of Zealandia's deep-Earth materials.

A tremendous thank you to GSNZ and its members for facilitating opportunities such as my experience at the Australian Synchrotron by providing funding availability through the **Young Research Travel Grant.** Such support is invaluable to student and early career scientists as we endeavour to propel our research forward in the exciting field of geology.



Composite image of the Australian Synchotron facility.

CoV10 Conference

Mirja Heinrich mhei725@aucklanduni.ac.nz

The Cities on Volcanoes 10 conference in Naples, Italy was an amazing experience. Six simultaneously running sessions with a great number of exciting talks had me running in between session rooms many times. Having the opportunity to talk to leading scientists in my field and learn from their experience was incredibly helpful. The conference spanned many disciplines and demonstrated the diversity within volcanological research. I enjoyed the cooperation between earth science, social science, historical science and emergency management. The poster sessions were interesting and super busy due to the high quality of posters presenting relevant research. Over an early career researcher event at the first night we exchanged experience, problems, solutions and contact details.

I submitted a photo for the CoV10 photo contest showing the Tongariro Alpine Crossing packed with people, which made it to the best 24 and was printed on a canvas. This raised awareness regarding the management of National Parks and Cultural Value in relation to the tourism sector.

The mid-conference field trip led us to the historical observatory of Vesuvius. The developing knowledge, understanding and vision of the chief volcanologists who ran the observatory over the years was explained to us and showed how advanced Italian earth science studies already were in ancient times. The visit

to Mount Vesuvius was my personal highlight. The crater walls of Monte Somma were impressive and pervaded by dykes and layers of lava. The crater of Mt. Vesuvius showed partial collapses at the rims and cold fumaroles. Knowing about the Plinian eruption of 79AD, the crater looked peaceful but scarily powerful at the same time. The last stop of the mid-conference field trip was Herculaneum, a formerly, mainly Greek, rich resort used as a trading post. The catastrophic eruption from 79AD covered the resort in pyroclastic fall and the citizens tried to escape via ship, but the sea was too rough. While waiting for the sea to calm down the Plinian eruption column collapsed and a lethal pyroclastic flow covered the place and everyone died. Replicas of the skeletons can still be seen in the ruins which were partially excavated underneath the modern city.

More meetings, talks and posters followed, amongst it the Volcanoscar, where short videos in different categories were shown and voted for. At the closing ceremony my three minute movie about my PhD won in the category ‘movies made by researchers/scientists’. This presented another opportunity to grab the attention of an international audience to show them New Zealand’s beautiful and active landscape at the other side of the word.

This first international conference introduced me to a group of people which is spread all over the world connected through their passion for volcanoes, driven by their desire to increase our understanding, preparedness and resilience. Now I am one of them!

Herculaneum with Vesuvius in the background.

Monte Vesuvius crater (Left) Group shot in front of the Monte Vesuvius Observatory (Image: Giulianai Alessia.

Talks with 3D ‘glasses’

S. J. Hastie Research Award Report

Alex Davidson MSc Candidate
School of Environment, University of Auckland

Research Project

This research project aims to characterise the geochemical behaviour of recycled base course aggregate material sourced from the Auckland region through a series of soaking experiments. Increasing demand for premium road aggregates within the Auckland region has exhausted local aggregate sources, resulting in an ever-increasing amount of imported material to address this deficit. This has major economic drawbacks, including the additional cost of transporting aggregate material to the Auckland region, along with the increased wear on current infrastructure networks. A shift towards increasing utilization of recycled aggregate material not only addresses this deficit in readily available material, but also addresses the construction and demolition waste disposal issues that the city is currently facing. The long term weatherability of the material and the susceptibility to degradation greatly influences the application of recycled aggregates, and constrains the conditions under which they can be utilized. At present, the long-term performance of this material is poorly understood as the current methods for testing the aggregate materials fail to encapsulate the aging characteristics in situ. Previous research has highlighted that due to the variability in composition of recycled aggregate materials, it is essential to identify the nature of the chemical interactions in order to implement the appropriate conditions to achieve optimum performance.

This is a comparative project where geochemical techniques will be applied to the sample before and after soaking, with the fluid samples obtained through the duration of the soaking tests to provide an indication of the processes occurring throughout. Comparisons will be made pre and post soaking in both mechanical properties and the geochemical nature of the material, in order to correlate the nature of the geochemical degradation to the changes in the mechanical behaviour. Fluid analyses will assist in the identification of exsolution processes occurring and highlight vulnerable mineral phases under the differing conditions (pH and temperature).

This research is a MBIE-funded project with concurrent research projects under the Engineering Faculty, predominantly focused on the mechanical performance of recycled aggregates. The completion date for this research is 14 February, 2019.

Supervisor statement:

Alex continues to make good progress on her thesis, working full time. She has worked hard to develop and modify her experimental routine as problems have emerged and remains on track to complete her MSc on schedule.

Aggregate separations in the lab waiting for analysis

Aggregate collection (Image: Doug Wilson)

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We continue to damage our heritage

Bruce W. Hayward and Greg H. Browne

Taking 1-inch diameter core plug samples is a routine way to collect unweathered or oriented outcrop samples for a range of sedimentological, petrophysical. paleomagnetic or micropaleontologic studies. Portable, hand-held battery-powered machines are widely available and these, and their earlier petrol-powered predecessors, have been used for over 40 years in New Zealand. Often the cores are taken in pairs or multiples close together. We recognise that this is an easy and reliable method for taking precisely-located or oriented samples. Often, however, this sampling can be done with a hammer and leave no tell-tale artificial holes behind. BWH spent a week with Japanese paleomagnetists sampling hard igneous rocks all around Northland. From the start they were aware of my concerns about core holes being left and in the finish they took all 50 or so oriented samples using the natural jointing, a hammer and a marker pen to mark the orientation on the sample. Their corer went back to Japan unused. We do recognise however that in some instances the rock to be sampled may lack joints, be a flat surface and may be so hard that using a hammer (and chisel) is not feasible.

As geologists travelling around looking at outcrops we see core holes in many places and there seems to more of them than was the case twenty or so years ago. Unfortunately, cores have been taken in very public places or within some

of the most valuable geoheritage sites. In many instances there were clear alternative less-public or less-damaging places the cores could have been taken or alternatively, less-obvious means of sampling could have been used. It is just over thirty years since the first plea was made through the pages of this newsletter for drill operators “to select unobtrusive sites or plug their holes” (Hayward, 1988). Unfortunately, the damage continues and we have a whole new generation of geoscientists, some of whom may be less aware of the damage they are causing to the rocks and to the public reputation of our discipline.

The most recent case has been the coring of an intertidal Cretaceous sedimentary exposure less than a metre from one of New Zealand’s best examples of dinosaur footprints in North West Nelson (Browne, 2009: Fig. 1). In this instance there is no reason why samples could not have been taken away from the valuable site at one of numerous alternative outcrop locations.

Yes, core holes in soft rocks in exposed conditions may naturally abrade and erode away within a decade, but the majority of cores are taken in hard rocks where they are still likely to appear fresh and ugly even in a century’s time. Sad examples of these situations include the core holes in the multiple dike on the Summit Rd near the Sign of the Kiwi (Christchurch; Fig. 2), the swiss-cheese texture of drill holes at the Cretaceous-Paleogene boundary at Woodside Creek (Marlborough; Fig. 3), and the prominent holes in pillow lavas beside the road in Red Rocks Scientific Reserve (Wellington, see GSNZ Newsletter 25, p.40, 2018). All these examples were created in the 1980s and are as fresh and obvious today as they were then. Admittedly the Woodside Creek cores are now part of the history of our science internationally for the part they played, as the first Southern Hemisphere record of the iridium anomaly, in the bolide impact theory for the extinction of the dinosaurs. As such we would probably now argue that the core holes at Woodside Creek are part of our heritage and should be preserved, but not those in any other place in New Zealand.

Plugging the holes with colour-matching cement, plaster of paris or gluing back in place the surface end of the core are other methods of remediating damage but have not gained favour in this country because of the extra effort and cost of undertaking them. An alternative might be to hammer the drilled area from the outcrop following the drilling, but this is not always feasible. A far-better option is not to core in places that are clearly visible for people to see.

A VOLUNTARY CODE FOR DRILL CORE SAMPLING

Maybe it is time for the geoscience community to adopt a voluntary code for drill core sampling. At the least, the institutions in charge of such equipment should advise the operators of not only the safety but also their environmental responsibilities as part of such a code. Documentation on the equipment and education are key. If you know of overseas’ visitors with a core drill, please make them aware of such a code of conduct. Such a code might say:

BEFORE YOU CORE, PLEASE STOP AND THINK ABOUT THE DAMAGE YOU WILL LEAVE BEHIND

Do you absolutely need to core? Could samples be taken by some other means using natural jointing in the rock or a chisel? If there is no alternative to coring, then please choose the least publicly-visible place and a place where you are not damaging any valuable geological, archaeological or biological features. Take the time to remediate the site if at all possible, by in-filling the hole with similar rock or hammering out a block which was drilled. Sample collecting, including core plug sampling, in any reserve requires a permit, and the landowners' permission should be obtained before coring on private land.

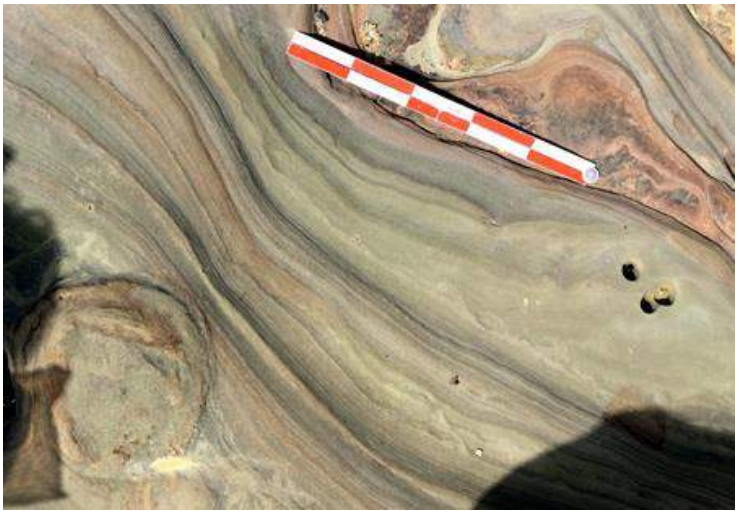

Fig. 1. Recent drill hole damage to one of New Zealand's best dinosaur foot print (bottom left) exposures, Whanganui Inlet, Northwest Nelson.

Fig. 2. Photos of the same core holes, 30 years apart (in 1988 above and 2018 below) in the much-visited multiple dike on Summit Rd, Banks Peninsula.

Fig. 3. The internationally-famous Woodside Creek Cretaceous-Paleogene boundary exposure in 2011 is easy to recognise because of the intensive core sampling undertaken in the 1980s. Compare with 1980s photo (Hayward, 1988, p.3).

References:

Browne, G.H. (2009). First New Zealand record of probable dinosaur footprints from the Late Cretaceous North Cape Formation, northwest Nelson. *New Zealand Journal of Geology and Geophysics 52*: 367-377.

Hayward, B.W. (1988). Editorial - Plug your holes. *Geological Society of New Zealand Newsletter 82*: 2-3.

If we don't take action now to reduce the visual impact of our sampling then concerned citizens and land management agencies are likely to establish bureaucracy to ensure that we do.

Bruce Hayward

(Ed. Copied from Hayward, (1988). GSNZ Newsletter 82:2-3. (31 years ago).

A code of conduct for rock coring is available here: https://www.geolsoc.org.uk/~/media/shared/documents/education%20and%20careers/GARockCoringGuide.pdf?la=en)

and here: https://geologistsassociation.org.uk/codesofconduct/

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The language of Science, fear and courage

Chris Uruski urusic@gmail.com

I've just returned home from the excellent 2018 Geosciences conference in Napier and I'd like to congratulate the organising committee on a most successful conference.
I feel that I need to get some impressions down in print. Some of my impressions are:

1. That the technical competence of most students and researchers appears to me to be at an all-time high.
2. That the attitudes of some senior researchers appear to be at variance with the results of their work.
3. That some researchers are prepared to stand up for what they see as right.

Geology is getting more complex with the application of a wider range of scientific techniques than ever before. While nobody can be expert in all branches of geology, there is a great deal to learn from other branches that may be applicable to one's own. I'd like to make a plea for more clarity in presentations. This is not an easy thing to do, particularly for students who have been faced with having to master complex techniques in a short time and want to display their expertise. But I'd expect better from established researchers. When speaking to a group of peers and instructors who share TLAs, it is reasonable to use such short cuts, but to others, who may be equally adept at the language of their own speciality, acronyms and terminology may be a foreign language. All can benefit from clarity; the presenter will get their message across to a wider audience and that audience will more readily see connections with their own work. The end result cannot fail to help a wider understanding of the science.

One of the more memorable papers was Friday morning's plenary given by Nick Golledge. It is obvious that Nick is a supremely competent researcher and an excellent presenter, but he is trapped by a paradigm of negativity. In essence, his paper described how climate models are continually improving and that the good news for us all is that sea-level is likely to rise by only 25 cm by the end of this century rather than the 1m that was previously predicted. However, the language he used was much more negative, he was "concerned for his children's future", he was "worried, afraid and alarmed". All of these words are designed to influence the audience to build on fear for the future. Throughout history, governments have found that inducing fear in the population allows them to manipulate the country more easily and the same technique is being used today with climate change as the focus.

Despite possible dire consequences of global warming, the archaeological and historical records show that human populations expanded during every warm period and contracted during cold periods. Despite the loss of some productive coastal lands during warm periods, more land is brought into production by a warming climate than is lost and growing periods increase. Conversely, cold

periods result in a decrease in productivity, widespread hunger and famine. In some ways, today's world may be more fragile as we have more to lose, but we also have far greater technological capability to protect us from harm.

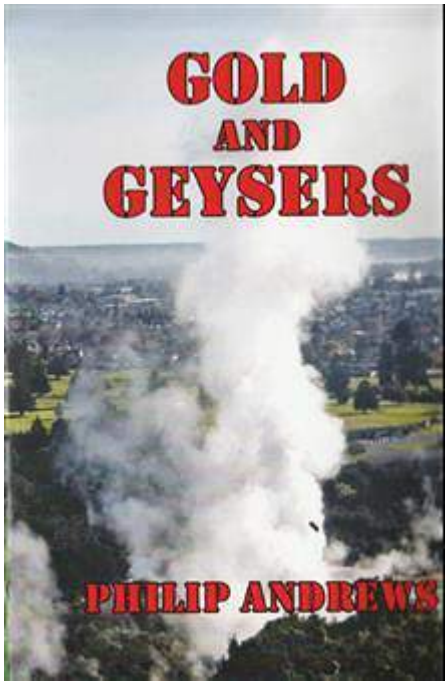
Improvements in modelling techniques commonly result in a decrease in estimates of sea-level rise and its consequences, but this is not how the science is presented. There is no doubt that measurements show that the planet is warming and would do so even without human industry. There is also little doubt that, as Nick Gollenge stated, the 2-degree target will certainly be exceeded and temperature rise is much more likely to be 3 to 4 degrees. In Wellington, Nick estimates that around 3,000 buildings will be threatened by rising sea-level along with many kilometres of roads and other infrastructure. This doesn't seem like an insurmountable problem to me. Nick's results indicate a mean rise of about 2.5 mm/year over the next century. By comparison, the average sea-level rise for the last 12,000 years has been 10 mm/year. The design life of a house is fifty years, so many buildings will be in need of replacement anyway and for those that can't be replaced, perhaps some protection can be engineered. The Dutch have been coping for centuries. For all the problems that warming creates, many opportunities will open up. Contracting companies will be all too willing to build new buildings, roads and infrastructure. Yes, there will be a cost and to cover that cost we must have a robust economy. Now is not a time for fear but for planning. While the technological and industrial capacity of the developed nations should be well able to cope, the third world is a different matter. Poverty, such as in the delta country of Bangladesh will not allow internal technical solutions, the world community will have to help and I'd hope we can be generous.

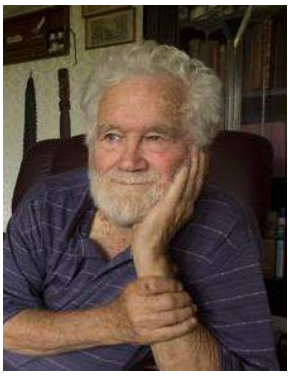
This brings me to two other plenary papers; the first by Rupert Sutherland and the second by Vaughan Stagpoole. Both of these presenters showed courage in questioning the government's illogical policy of attempting to stop oil and gas exploration. In Vaughan's case, his stand was the more poignant as, after previous governments had spent millions in treasure and many years of scientific effort, New Zealand was this year finally rewarded with the acquisition of 1.5 million square kilometres of what our present government has deemed to be useless territory. Useless because the only rights we have to our extended continental shelf are to exploit resources below the sea-bed and to regulate that exploitation. I am confident that future administrations will reverse the current policy, but meanwhile much damage has been done to our country's reputation. A system that allows us to develop our understanding of our environment in parallel with exploitation of our resources is essential. We need to be sensitive to waste of all kinds and to seek the most efficient use of resources. We need the resources to generate the wealth needed to solve problems, to protect cities and to build for extreme weather and sea-level rise. If electric cars are to be the best solution for transport, we need to plan a much more robust generation and transmission system than we now have and we need to plan for changes that may be necessary for agriculture. Other sectors need overhaul too, it is unlikely that defence has ever been weaker than today, we put our trust in allies and hope that a power that does not respect the rule of law is not eyeing up the resources of our marine territories.

Scientific consensus (if that is not a tautology!) is that climate change will continue as it always has, although accelerated by human activity. There is no going back. The world's population is too great for us all to revert to a pre-industrial lifestyle without massive extinctions of human populations. The only fix is technological. We can think and work our way through future problems as we have through past changes. We need the resources that Zealandia undoubtedly contains in order to do so. We also need the future scientists and leaders that young students are shaping up to be.

The world is becoming an intensely challenging place and scientists have a responsibility to tell it as it is. Fear can be counter-productive, so let us drop those negativities and follow the lead of those who face the truth with courage and honesty.

BOOK REVIEW and NEWS





Gold and Geysers

Philip Andrews QSM. Intabook. Christchurch.

Available from McClouds booksellers (Rotorua) or **direct from the author.** philjoce@slingshot.co.nz

Reviewed by Glenn Vallender

Well known Rotorua author and historian Philip Andrews has written a winner in his biographical treatment of one of New Zealands pioneers, entrepreneur and public servant, Jean Michelle Camille Malfroy (Chev.L.H.) (1839-1897). Andrews has answered the call of E. S Dollimore for *"a veracious account of the remarkable career of this most devoted public servant"* in not only depth but also in style. But as Mark Twain stated and quoted by Andrews, *"Biographies are but the clothes and buttons of the man. The biography of the man himself can not be written".* How true this is, but Andrews does a sterling job of bringing out hints of the man and his work and like all biographies, there remain those tantalising questions for which there may never be an answer, but as Malfroy's epitaph states: "His works follow him".

A contemporary of early New Zealand geologists Hochstetter, Hector, Hutton, Von Haast, McKay and others, Malfroy, born in France, cut his teeth firstly on the goldfields of Victoria in Australia and then on the wild West Coast of New Zealand. Malfroy and his associates then went on to develop ways in which water could be delivered to not only the goldfields but also to the fledgling township of Ross. The story of his involvement and move into politics is expertly described by Andrews. Despite litigations and the machinations of political life, Malfroy was highly respected and he eventually, in 1885, made his way to Rotorua where he found himself involved again with water supply and a little later, geysers and hot water. September 14th 1885 was the date in which seismologist Prof. John Milne visited the White Terraces and stayed in the Palace Hotel at Ohinemutu. This was just after the Tarawera eruption of 1886. It was on September 14,1885 that seismologist Prof. John Milne found himself in the Palace Hotel at Ohinemutu. Malfroy became the chairman of the Rotorua Town Board and one of his duties was to write monthly reports. The illustrated report of 1895 on p101 is a great example and certainly more readable than anything by his contemporary geologists! This example illustrates the detail that Andrews has managed to glean from his extensive research and the ably filling in of a historical gap for one of New Zealands great pioneers: certainly, one that everyone and especially Rotorua, should know about. A man ahead of his time, Malfroy deserves his bronze statue in the Government Gardens. Genealogists will enjoy Chapter fourteen which outlines some family history about his brothers, wife Ellen and adopted daughter May. Malfroy died of tuberculosis in 1897 with Hobart born wife Ellen outliving him by twenty-nine years.

This biography did not just happen and reveals a great deal of effort and painstaking information gathering especially from that wonderful resource *PapersPast,* is plain to see. The back cover neatly summarises Malfroy – “Gold miner and manager, engineer, Mayor, inventor and geyser creator”. For historians and geoscientists this book is worth its weight in gold and like Malfroy, deserves its place on your library shelf. Thank you to the author for bringing attention to this New Zealand pioneer of early gold mining technology, water engineering, local politician and the harnessor of geothermal energy for tourism.

Just as George Hogben was gathering non-instrumental data on seismic activity in 1891, Camille Malfroy published his only paper with the Transactions and Proceedings of the Royal Society *“On Geyser action at Rotorua”* (Vol. 24, 1891, p579). Hogben and Malfroys papers are next to each other in the ‘Transactions’.

And from the author of: Gold and Geysers”:

FREE to a good home:
Paleontological Bulletins 1-52. Courier cost will have to be paid, otherwise they are all yours for nothing. Ex-Alan mason library.
Contact Phil Andrews at:
philjoce@slingshot.co.nz

And feel free to purchase a copy of **Gold and Geysers** as well.

Geoscience Education News

Glenn Vallender

The International Geoscience Education Organisation (IGEO) http://www.igeoscied.org/ was formally constituted in 2000 at the third international conference in Sydney and aims to promote geoscience education at all levels across the globe. If you want to know why many geoscience educators entered the Geoscience education world, you can enjoy reading about their peronal stories here: http://www.igeoscied.org/activities/my-earth-science-educator-story/ .What is your story of your entry into the geoscience world?

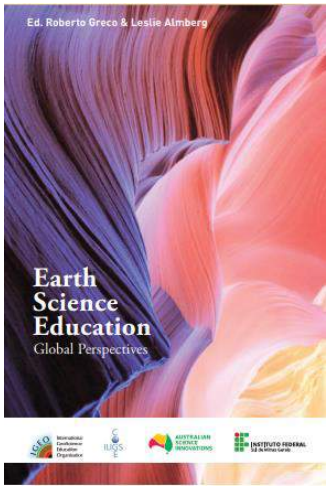
You might be interested to read the latest international collection of 'essays' in a **freely available E-Book** produced by IGEO and edited/compiled by Roberto Greco and Leslie Almburg. It makes for sobering reading on the state of Geoscience education across the globe. Endorsed by IGEO and IUGS-COGE this 'handbook' was begun in 2015 (as an update to a previous 2013 status report) and published in December 2018. To quote from the introduction by Nir Orion of the Weisman Institute:

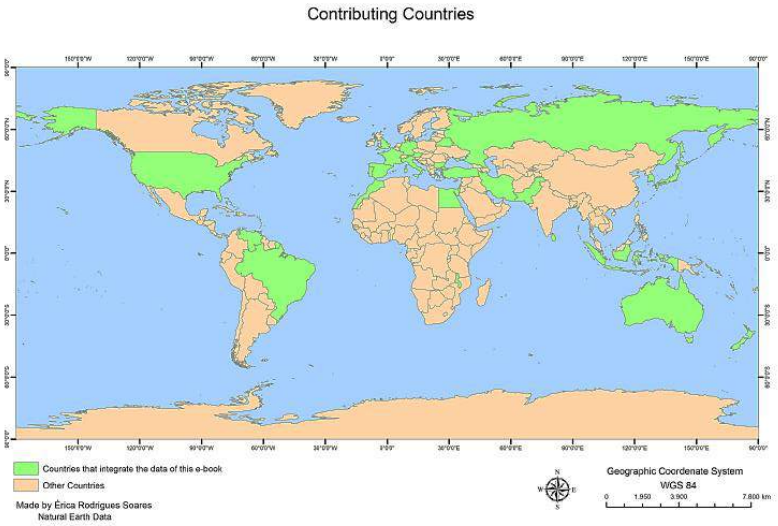
> *"This [E]book describes a huge and disturbing gap between the importance of Earth Science to the fate of huankind and ts low status in schools worldwide. The 27 chapters include an impressive introduction concerning the involvement of Earth Science in almost every critical component of our lives, underscoring how crucial this understanding is for the future of humankind. Some chapters highlight the central role that Earth Science plays in developing higher order thinking skills. Learners can develop the ability to overcome cognitive barriers to spatial and temporal thinking, retrospection, and understanding phenomena across scales of many orders of magnitude, integrate diverse subjects and develop the cognitive capacity for systems thinking. Earth Science can endow citizens with knowledge and abilties to draw conclusions for effective and proper use and conservation of energy, water and other natural resources. Citizens who understand the environment and its processes are better able to judge and behave in a more scientifically aligned way"*

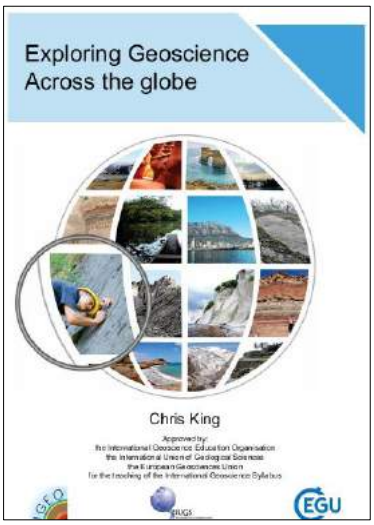
https://www.dropbox.com/s/iqkn5gqiqu6be3f/Earth%20Science%20Education%20Global%20Perspectives%202018%20E%20Book.pdf?dl=0

Or

http://www.igeoscied.org/wp-content/uploads/2018/12/Earth-Science-Education-Global-Perspectives-2018-E-Book.pdf







GSNZ members may also be interested to know that the International Geoscience Education Organisation (IGEO) has recently published, online, a textbook, **'*Exploring Geoscience Across the Globe*',** written by Chris King.

The textbook, published with the approval of the International Union of Geological Sciences (IUGS) and the European Geosciences Union (EGU), can be **freely downloaded** from the IGEO website at: http://www.igeoscied.org/teaching-resources/geoscience-text-books/.

The textbook is written in accessible English, to be as jargon-free as possible and using a wide range of photographs and diagrams to provide explanations and examples.

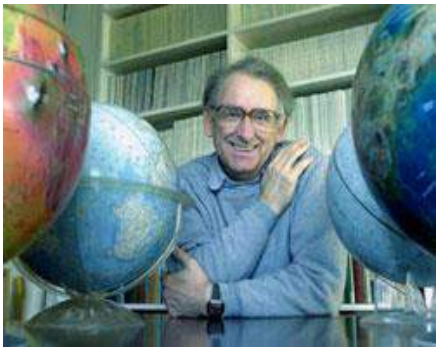
The textbook is focused on **the International Geoscience Syllabus** published at: http://www.igeoscied.org/activities/international-geoscience-syllabus/ which covers all that an able sixteen year old student should know and understand about Earth Science on leaving school. It will be a valuable source of information for students and their teachers and also for writers of science and geography textbooks.

ISBN 978-9996264-0-2.

GEOSCIENCE QUIZ 27
by Aenigmatite

1. In the British honours system, at any one time there are only 65 Companions of Honour. Who is the only geoscientist to have ever been made a Companion of Honour?
2. Which British mathematician wrote a 1967 Nature paper that is generally credited to be the first to use Euler poles to describe plate tectonics?
3. Which Cambridge geophysicist developed 'a simple model for the development and evolution of sedimentary basins' that related lithospheric extension to subsidence, and which explains many features of Zealandia?
4. In 1984 a seminal paper 'The generation and compaction of partially molten rock' in the Journal of Petrology described quantitative principles of mantle melts and their residua in different tectonic settings. Who was the author?
5. Who went to Scripps Institute of Oceanography as a PhD student on an immigration visa, was served military draft papers and promptly left the US?

Answers 1-5: Dan McKenzie (1942 -



And from the 2018 NZQA Level 2 external examination for Earth and Space Science (Abridged). https://www.nzqa.govt.nz/nqfdocs/ncea-resource/exams/2018/91191-exm-2018.pdf

QUESTION TWO: FIORDLAND – DUSKY SOUND EARTHQUAKE

On Wednesday 15 July 2009, a severe shallow earthquake struck along the edge of the Pacific and Australian plate boundaries. This quake was felt throughout the South Island and bottom of the North Island. The earthquake's epicentre was in the transition zone, where the plate boundary changes from a transform boundary (Alpine Fault) to a subduction zone (Puysegur Trench). Scientists accept that this earthquake was caused by the Australian Plate thrusting forward by up to 5 metres.

Explain in detail how a rupture and its release of energy along the edges of this plate boundary could lead to a magnitude 7.8 earthquake. How would **you** answer this?

Interestingly, the author(s) of question 3 are not sure of the difference between faults and joints!

PACRIM 2019 follows a tradition of successful technically-focused themed meetings which run every ~4 years which have become the premier Congress specifically on Pacific Rim exploration geology. The conference will showcase the most recent advances in academic research and geological understanding, regional surveys by government agencies and the industry's latest discoveries and projects highlighting the importance of the Pacific Rim for global mineral wealth and investment. Its appeal extends far and wide to geologists, geophysicists, geochemists exploring in the Pacific Rim, people interested in the mineralisation processes of active tectonic margins and those developing projects that follow discovery in these regions.

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Mike Johnston ONZM

It was great to hear that Mike Johnston has been recognised in the New Year's honours list. He has made a huge contribution to New Zealand geology and mining history over the last 40 years. Since he moved to Nelson as resident geologist for the NZ Geological Survey, Mike has produced ten detailed geological maps that include Nelson City and a huge area of rugged mountainous country to the east. As well as its obvious local importance, this mapping has been widely used in interpreting the junction between the eastern and western provinces of New Zealand and the evolution of Zealandia.
As well as his geological work Mike is well known as a historian of the mining industry, having produced eight books and numerous articles. His first book, on the Dun Mountain railway has become a classic, and in recent years he has produced publications on the journeys of pioneer geologists Ferdinand Hochstetter and Julius Haast, and he is currently working on a history of the West Nelson goldfields.

Few people can match Mike's 16-year term on the national committee of the Geological Society between 1993-2009, including a 2-year stint as president, when he ably represented those outside the main centres. He was also Convenor of the Historical Studies Group from 2001-2009. You can read more about Mike's career at:

https://www.stuff.co.nz/nelson-mail/news/109614709/nelsonian-receives-new-year-honour-for-service-to-geology

Hamish Campbell

Nick Mortimer and James Crampton, GNS Science Dunedin and Lower Hutt

On Friday 9 Feb 2019, colleagues and some family of GNS paleontologist and science communicator Hamish Campbell assembled in the café at GNS Science in Lower Hutt. The occasion was to mark 40 years of Hamish's many contributions as a full-time employee with GNS Science and its predecessor organisations (Hamish joined the NZ Geological Survey in 1979). Hamish branded the event 'A Mark in the Sand' and it consisted of several short laudatory speeches, reciting of anecdotes, presents, signed cards, gifts, a large decorated cake, sundry snacks, liquid refreshments and much conversation of our involvement and experiences with Hamish.

Images courtesy of Margaret Low/GNS Science

Mention was made of Hamish's inspiring personality and diverse legacy: in Permian and Triassic paleontology and stratigraphy, the NZ Geological Timescale monograph, in Chatham Islands, New Caledonia and Zealandia geology, the Geoscience Society, Te Papa and science communication. Hamish has become the recognisable face and voice not just of GNS but of New Zealand geoscience.

The event was a bittersweet occasion as Hamish's full-time employment with GNS Science ceased because of recent GNS restructuring. However, the good news is that Hamish is now an Emeritus Scientist with GNS. Therefore, his GNS Lower Hutt contact details will remain the same and he will be able to continue with his ongoing projects in the same work environment. A more comprehensive account of Hamish's many achievements will appear in a future newsletter.

Dr E I Robertson cuts the 100th Anniversary Cake for 2019 RSNZ Academy Centennial Dinner

Fred Davey

The 53rd AGM of the Academy of the Royal Society of New Zealand (Te Apārangi) was held on 14th February 2019 at The Royal Society Te Apārangi in Thorndon. The meeting marked the 100th anniversary of when the first twenty Fellows were elected to the Society (1919, when the Society was called the New Zealand Institute). Besides Earnest Rutherford, Included in the first twenty were several earth scientists such as Clinton Coleridge Farr (geomagnetism), George Hogben (seismology), Patrick Marshall (geology including petrology and volcanology), Robert Speight (geology including geomorphology), James Allan Thompson (paleontology and petrology) There are now 430 Fellows and 56 Honorary Fellows and the scope of the Academy has expanded to include all branches of science, medicine, engineering, technology, the arts and humanities. The Academy confirmed 20 new Fellows at the AGM after which they gave short seminars on their research. In the evening, a special Academy Centennial Dinner was held for Fellows at Te Papa at which the new Fellows were inducted into the Academy. During the dinner, Dr E I Robertson (formerly of DSIR), the oldest Fellow (since 1963) was asked to cut the celebratory cake.

Dr Eddie Robertson had an outstanding career in the former Department of Scientific and Industrial Research. He was the first Director of Geophysics Division of DSIR when it was formed from existing units within DSIR that had a geophysical interest: Geomagnetic Observatory, Christchurch: Geophysical Observatory, Christchurch; Seismological Observatory, Wellington, Geophysical Observatory, Wellington (later NZ Oceanographic Institute; Geophysical Survey (ex NZ Geological Survey). It also included the observatories at Apia, Samoa, and Rarotonga.

During his tenure he was responsible for implementing the New Zealand contribution to the International Geophysical Year in 1957/8 at stations from the equator to Antarctica. A major effort during IGY was in Antarctica at Scott Base

and Hallett Station led by Dr Trevor Hatherton, one of Eddie's staff. When the Transantarctic Expedition departed from Scott Base in March 1958, Eddie was responsible for the running of Scott Base until DSIR set up a separated Antarctic Division in May 1959 with responsibility for running the base. He took a leading role in the Ross Dependency Research Committee (RDRC) and was the first NZ delegate to SCAR (Special, later Scientific Committee for Antarctic Research). In 1964 he was promoted to Assistant Director General of DSIR before becoming Director General, later retiring in 1980. He retained his interest in research, publishing his last paper, a short report, in NZJGG in 2018. It was, perhaps, appropriate that he was asked to actively participate in the Dinner as he also celebrated his 100th birthday in late January this year.

Academy Chair Professor Richard Blaikie FRSNZ, Oldest Fellow Centenarian Dr Eddie Robertson OBE CBE (elected FRSNZ in 1963) and Royal Society Te Apārangi President Professor Wendy Larner FRSNZ (Images with permission RSNZ).

https://royalsociety.org.nz/news/national-academy-of-top-researchers-and-scholars-turns-100/

Young Researcher Travel Grant (YRTG)

We have some residual approved Young Research Travel Grant funds for the 2018-2019 financial year so are extending the call for applications until Friday 8th March. See http://www.gsnz.org.nz/information/awards-i-34.html#YRTG for application rules.

We have just approved funds for the June round under altered rules:

"Applications will be considered on merit in a maximum of two rounds during the course of the year. Applications are due on **June 1st** and **September 1st**. After the June round, the grant pool is not recharged until the following year and therefore the September round will proceed at the GSNZ committee's discretion ".

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Membership Survey preliminary results 2018-2019

National Committee

The inaugural GSNZ membership survey was conducted informally at the Napier GSNZ conference in November 2018 and online using *Survey Monkey* in January and February 2019.

At conference, members were invited to provide their views on ''post it' notes on posters on the walls of the GSNZ booth. Segmentation was by length of membership (5 years or less; 6-19 years; and 20 years or more).
Members were asked to post their responses to four questions:

- What do you like best about GSNZ?
- What can we do better?
- Other benefits you'd like?
- Are you willing to get more involved?

Members were encouraged to take part by Nicki, the GSNZ Administrator who initiated the survey. Whilst no formal count of how many members took part was kept, she estimates between and 20 and 30 members shared their views.

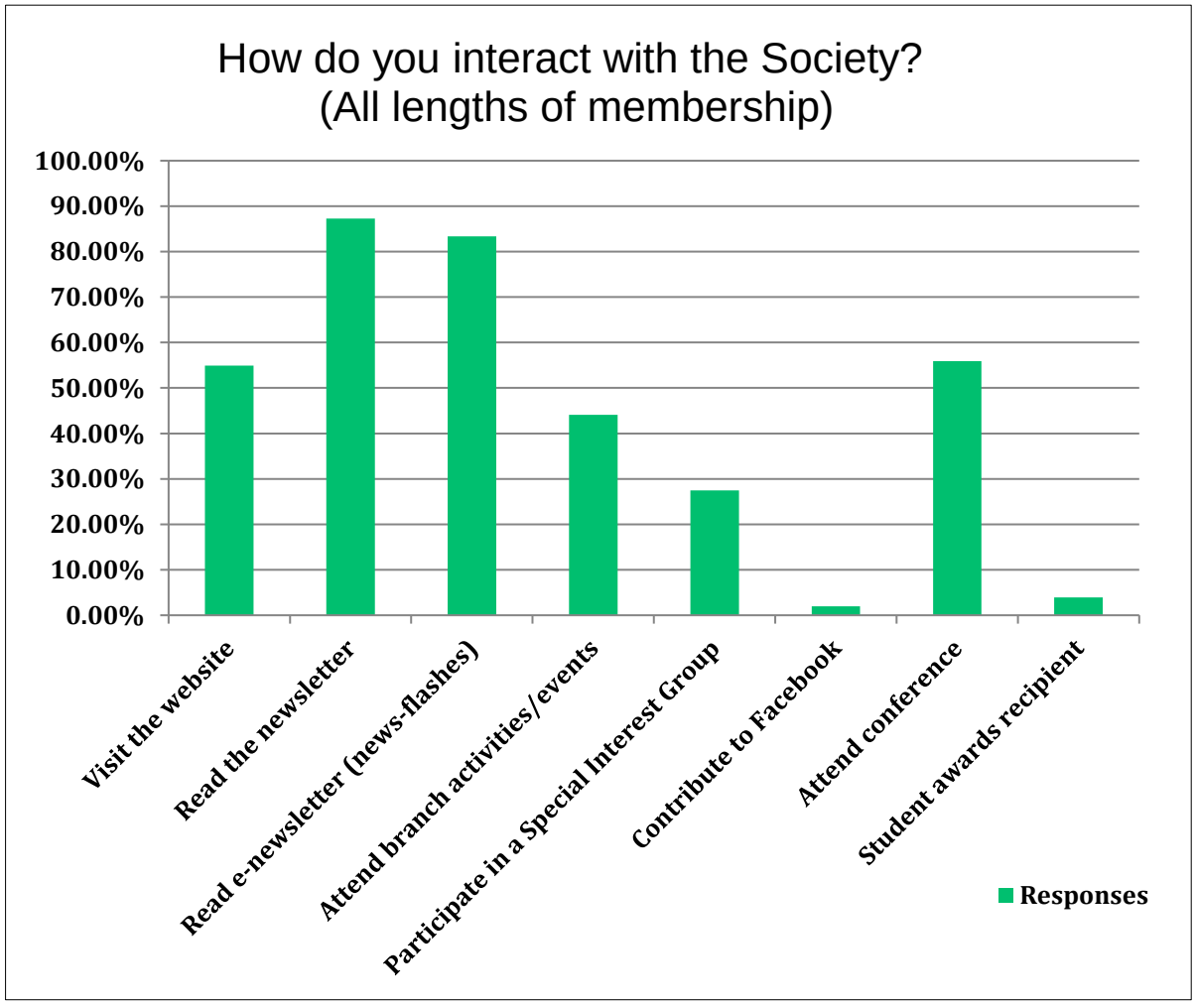
The second round (asking the same questions, with one addition asking how members currently interacted with the Society) was conducted online using Survey Monkey, to capture the views of members who had not been at conference. This was successfully delivered to 640 members via a Newsflash on 16 January. A reminder was sent on 31 January (again as part of a Newsflash). The survey closed on 10 February and we received 102 responses (16% response rate).

Who responded?

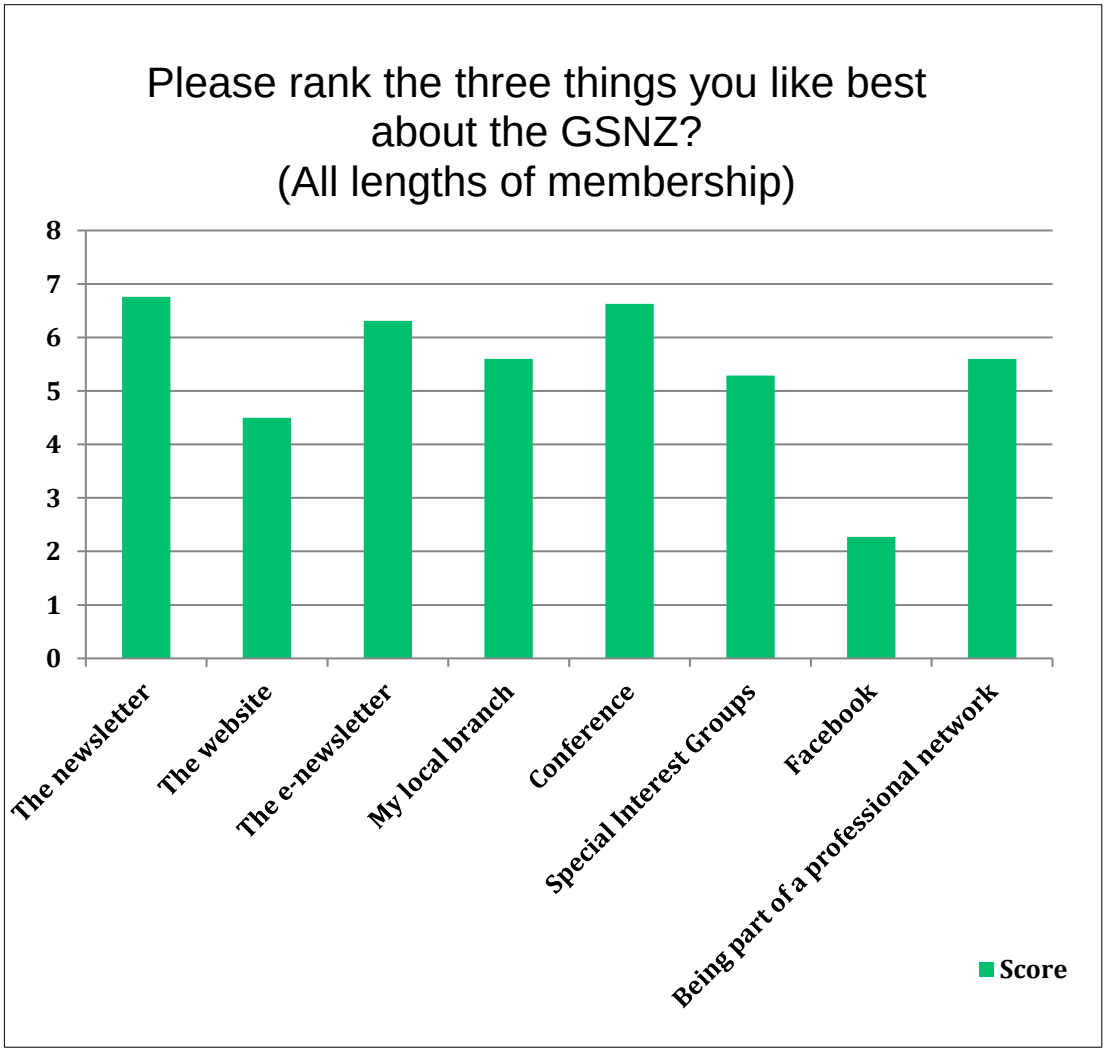
From the online survey we received responses from the following members:

Responses received by **membership type**		Responses received by **length of membership**	
Student	7%	0-5 years	21%
Full member	64%	6-19 years	25%
Retired	25%	20 years or more	54%
Honorary	4%		

Responses



Across all lengths of memberships, the top four ways of interacting (website, newsletter, e-news/newsflashes, conference) remained constant. Compared with the result shown above, the conference was the main way of interacting in the 0-5 years category; the newsletter and e-news/newsflashes were ranked more highly with the 6-19 years and the 20 year or over cohorts.



Again, the responses were broadly similar across all the lengths of membership, with being part of a professional network scoring more highly with 0-5 years and 6-19 years. Facebook was the least popular across all groups.

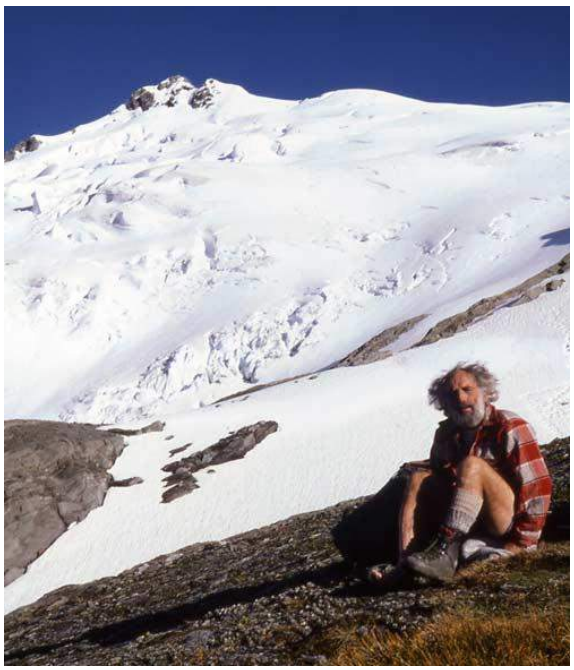
Areas for improvement and additional benefits

The overarching themes from these two open ended questions were around improvements in communication across all channels (primarily the website and newsletter); a younger voice being heard and more diversity; and more support and better publicity for branch activities.

There was a great deal of data collected in the survey which was presented to the committee at their February meeting. As this meeting was just ten days after the survey closed the results are still being considered. Watch this space.

Thank you to everyone who took part. For further detail please contact the national committee administrator Nicki Sayers and President Jennifer Eccles.

Obituaries



Trevor Chinn (1937 – 2018)

Simon Nathan

With sadness we record the passing of Trevor Chinn, widely regarded as the godfather of New Zealand glaciology. In the 1970s Trevor identified 40 key glaciers through the Southern Alps, and has photographed these regularly ever since, providing a unique and irreplaceable record of the changing snowline. He recently took part in the 2018 glacier survey, now undertaken annually by NIWA.

You can read more about Trevor's career at:
https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12181104
https://i.stuff.co.nz/science/109547095/new-zealand-science-loses-a-national-treasure
https://sirg.org.nz/2018/12/21/trevor-chinn-1938-2018/

.....

Ron Keam (1932 -2019)

Katherine Luketina Katherine.Luketina@waikatoregion.govt.nz

Associate Professor Ronald Frank Keam had a MSc and Dip Hons from Auckland University College (as the University of Auckland was known then), a BA from Cambridge University, and a D. Phil from Oxford University. He was an academic staff member at the University of Auckland from 1958 to his official retirement in 2006, and he continued on staff in honorary roles until his death on 6 February 2019. He taught undergraduate and post-graduate geophysics courses at the university from 1974 to 2006 and supervised numerous post-graduate theses on geothermal topics. He published widely in peer-reviewed journal papers and conference proceedings, mostly on the behaviour of the Waimangu thermal system, and had also published many booklets, books, popular periodic articles and scientific reports on geothermal topics generally. Ted Lloyd and Ron were largely responsible for alerting the country to the decline of the geysers at Whakarewarewa in the 1970s, and for this work, the Royal Society of New Zealand's Science and Technology Silver Medal was

awarded jointly to them in 2002 for their *"outstanding contribution to the understanding and conservation of geothermal features in New Zealand".* For further information on this, see http://www.gsnz.org.nz/info_page/nomination-eflloyd-rkeam-zealand-science-technology-medals-i-12.html

In 1989 Ron received the New Zealand Book Award for Non-Fiction for 'Tarawera'.

He had also been successful in a legal challenge to prevent geothermal drilling and extraction at Waimangu in the 1970s. He has recently published papers with Cornel de Ronde on the location of the Pink and White Terraces.In addition to being a fantastic geothermal geophysicist, not only did he have a geology degree, but also introduced quantum mechanics to NZ on his return from acquiring his D Phil from Oxford, having been taught by none less than Paul Dirac himself. This led on to The University of Auckland Physics Dept. becoming one of the premier schools for quantum science internationally. Ron's knowledge and intuitive understanding of physics was such that he was the one lecturer who could teach any physics subject, often called upon at short notice to fill in for someone. At my post-grad level, he took me under his wing and with much kindness and dedication turned me into someone with what it takes to make a difference in guardianship of the nation's geothermal resource. He also supervised the PhD of my work colleague here at Waikato Regional Council, Senior Geothermal Scientist Dr Jim McLeod. Jim and I maintained a close working and personal relationship with Ron and had the honour of taking him out in the field with us a couple of years ago to monitor the site of a recent hydrothermal eruption. Although frail he managed the difficult terrain and added a great deal of insight and knowledge to the field work.

His massive intellect, warmth and decency will be sorely missed. A mighty kauri has fallen and the forest resounds with sadness.

……

George Grindley (1926 – 2019)

It is with sadness that the Society records the death of George Grindley, Foundation member of the Geological Society of New Zealand, a long-term member of the Geoscience Society and FRSNZ, has passed away peacefully at home.

There was a special tribute to George in GSNZ Newsletter 22 (July 2017), pp. 31–59, which is online at:

https://securepages.co.nz/~gsnz/siteadmin/uploaded/gs_downloads/Newsletter/GSNZ%20Newsletter%2022%20July%202017.pdf

Letters to the Editor

A response to Roger Brand (Newsletter#26 November 2018)

Roger Brand, (*Rise and Fall of Unconventional*), produces no evidence for his claim that the US oil companies using fracking are engaged in a Ponzi scheme. He appears to argue that if OPEC drives the price of oil up to around US$150 then the fracking industry will crash. Figures from the oil industry claim that the break-even cost for fracked oil is now around US$30 per barrel. Any increases in the oil price as a result of OPEC policies can only benefit the fracking industry which is now producing oil, making profits and has changed world politics for the better and will continue to do so. His argument appears to be that what he refers to as the "chicanery of the oil sector" has resulted in unsustainably low oil prices, which are obstructing progress to, in his words, "the inevitability of the low carbon economy..". In other words, his whole argument is based on an unproven premise. There are numerous reputable scientists who argue that policies directed to a low carbon economy are economically destructive, to no good end. Further, not one of the dire climate predictions of the climate warming industry has come to pass. Instead cheaper energy, produced by coal, oil and gas is enabling millions in Asia to move out of poverty and the increase in atmospheric carbon dioxide is leading to a greening of Earth.

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Reply to John Elliot, re 'The Rise and Fall of the Unconventional'

Roger Brand (retired petroleum Geologist)

Thank you John Elliot for questioning my assumption that the oil price for Brent crude was headed for US$150/BBL. At the time of writing in September 2018 the oil price had been steadily rising for the previous 32 months and no end was in sight. Then, a few weeks later the oil price fell from US$86/BBL to a new low at US$51/BBL on 28 December 2018. This price fall has had less of an impact on the oil industry than the catastrophe seen in 2014/2016 when prices fell from US$108/BBL to US$29/BBL.

Nonetheless, instability in the commodity price is detrimental to investment and since the New Year there have been numerous articles (e.g. Wall St Journal 2 Jan, Bloomberg 3 & 24 Jan, SRSrocco 20 Jan, Forbes 23 Jan, Reuters (World Economic Forum) 25 Jan, OilPrice 27 & 28 Jan) warning of the precarious nature of the shale oil industry. Not only is there volatility in the oil price but as reported in AAPG Explorer magazine in January (The Permian Primacy) there are problems with pipelines, rigs, labour, sand and water.

The unconventional shale oil play is undoubtedly at the forefront of the US oil industry with rapidly evolving new extraction technologies and extraordinary reserves being quoted; for example, the USGS gives 46.3billion BBLs oil and 281TCF gas as technically recoverable from the Wolfcamp and Bone Spring formations of the Permian Basin in the US southwest. Assuming a total EUR per well of 0.6MMBO, then another 77,000 wells costing US$9mill each are needed to recover this reserve.

In a review of 33 independent oil exploration and production companies, OilPrice (1 Nov 2018) found that only nine reported positive free cash flow during the first half of 2018, when prices were comparatively high. The combined cash flows for all 33 E&P companies over the years 2016 and 2017 were negative US$18.3 billion and negative US$15.5 billion respectively, thus highlighting the extent to which production is not yielding returns on capital investment. In order to keep production growing and to be able to service debt these companies must continue drilling. However as crude prices slumped last October the source of capital began to dry up with just three bond sales by exploration companies that month and none at all since November (Financial Times Jan 2019).

A further drawback for the shale oil industry is the average production per well has been falling since mid 2018, not only in the Permian Basin of the US southwest, but also in the Williston basin of the Northern Great Plains. EIA's January 'Drilling in America' quotes an average of 555BOPD per rig site, down from 758BOPD in 2016 for the Permian Basin. On a company basis, Pioneer Natural Resources spent US$1.7 billion on drilling 130 wells in the first half of 2018 which resulted in an additional 10,832BOPD; averaging just 83 BOPD per well. There have also been an increasing number of drilled but not completed (DUCs) wells; uneconomic under present oil prices.

Break-even prices for shale wells vary between individual plays but are quoted (Financial Times 20 Nov2018, Bloomberg 19 Dec 2018) for the Permian Midland Basin at US$43/BBL and for the Permian Delaware Basin at US$38/BBL. At the current price for West Texas Intermediate (WTI) of US$52/BBL this doesn't leave much room for asset growth (more drilling) let alone debt repayment.

I feel it is unfortunate that no geology has been discussed in this article when so much research effort is devoted to shale technology. But the economic and geopolitical realities of the resource industry are what drives commerce, as enunciated by Raoul LeBlanc, executive director and head of the IHS Markit Performance Evaluator recently about the (Permian) potential, "How far will the rocket go and how much fuel will you give it?",

Whether you consider the actions of shale oil E&P companies unscrupulous ('chicanery') in promoting such an apparently fraudulent investment ('ponzi') scheme is obviously open to individual moral standpoint, but I would consider those funds better spent on alternative energy projects.

REMEMBER US!

The Geoscience Society of New Zealand gratefully accepts donations and bequests. These can be applied to specific funds or awards (see full list on website http://gsnz.org.nz) or can go into the growing Legacy Fund, interest from which is used for general purposes. All donations and bequests will be acknowledged and a receipt sent.

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Donations enable those 'extra' things to be achieved. They are always gratefully received and can be sent upon membership renewals online on *www.gsnz.org.nz.* Donations of more than NZ$5 can qualify for a 33% tax credit from Inland Revenue (you will need to keep the receipt you get from us and fill in an IRD tax credit claim form at the end of the tax year). See the IRD website for more details.

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*I give to the Geoscience Society of New Zealand (Incorporated) the sum of $_____ * for general purposes**, for which a receipt from the Secretary, Treasurer or Administrator of the Geoscience Society of New Zealand (Incorporated) shall be a full and sufficient discharge to my trustees.*

* or "% share of the residue of my Estate absolutely"
** or nominate a particular fund or award

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GEOSCIENCE SOCIETY OF NEW ZEALAND NEWSLETTER

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DEADLINES:	**March Issue**	**February 15**
	July Issue	**June 15**
	November Issue	**October 1**

This is your newsletter and the editor seeks correspondence, news items, interim or preliminary reports of current research, reviews of books and of recent geological publications and other topical articles. Reviews of New Zealand geology or geophysics published overseas are particularly welcome.

We suggest a limit of 1000 words or one to four pages in the current format for most contributions with minimal but key referencing. Depending on space, longer articles suitable as feature articles with illustrations are often published.

Email copy in any text format is acceptable. The newsletter is formatted for A5 in Arial 13 with 2.0cm side margins and full justification. Coloured graphics often lose their impact and readability when in greyscale.

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