Geoscience Society of New Zealand

NEWSLETTER

Front graphic
Trig H. Lincoln Hills. Ashburton District
(Image: Glenn Vallender)

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GEOSCIENCE SOCIETY OF NEW ZEALAND

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FROM THE PRESIDENT

James Scott

The Geoscience Society of New Zealand committee strives to advance the geosciences in New Zealand. I am therefore pleased to report that the 2020 committee comprises a near-even gender split of 8 males and 7 women, of a range of ages and backgrounds. Following the last meeting in November 2019, new faces are Angela Griffin and Phaedra Upton (GNS), Andrew Lacroix (Waikato), Eleanor Mestal and Jenni Hopkins (Victoria). In our first committee meeting, held at NIWA in Wellington on February 27th, we canvased topics that we hope to develop over the next year. The mains points of that meeting are:

Strategic Plan. With declining membership, GSNZ requires a strategic plan for the future. This should include developing an annual budget, examining the role that GSNZ provides for the community, linking with other geoscience groups, and looking for ways to support members. We will be meeting with a strategic facilitator in early March to examine ways to begin to develop this plan. We'll continue to develop ideas, and I will consult with branches on my President's Tour in June-July. Clearly a lot more to come on this topic.

Branches, Special Interest Groups, student groups. We strive to have stronger linkages with this part of the GSNZ community and are working on ideas on how to do this. More linking of the branches with the Newsletter would be one pathway forward. Several Special Interest Groups are inactive, and interested people are encouraged to contact the committee to see about reactivating these, or forming new groups (e.g., as is the case for Hydrogeology).

Social Media and presentation. The new website is nearing completion, we will unveil a Twitter account shortly, Facebook account is active (thanks to the on-going efforts of Helen Bostock), and we also hope to have a revamp of the Newsletter. We are especially seeking Newsletter articles from younger members of the society and will attempt to incentivise this process.

These committee meetings also cover topics such as supporting annual conference organisers, correspondence with other societies, approving awards, dealing with GSNZ publications, and planning for the year ahead. Best of all, we do it for you! We'll also be meeting more regularly in the year through the use of digital meetings to develop all these things mentioned above. Please contact us if you have any ideas you'd like to share.

EDITORIAL

Glenn Vallender

'Research' is a strange thing. It can lead to nothing or everything but it always leads to more questions than answers. A recent Christmas time 'bucket-list' trip along the Rhine and the Danube (and other places) will ensure that breakfast will never be quite the same again. An eight course Christmas day dinner on board the *Amadeus Star* will be hard to live up to. It didn't snow.

A day visit to the Carisbrooke Castle Museum chasing the question: did New Zealand's pioneer seismologist George Hogben visit Prof. John Milne on the Isle of Wight on his world tour in 1907? A simple question but one fraught with difficulties largely because of that common issue of insufficient and unproven evidence. Despite discovering four images of a person who looks very much like Hogben sitting with Toné and John Milne, the answer at the moment is probably not, or if he did, records of it have been lost or not kept. Crucial evidence concerning his specific itinerary from January 12th to December 12th 1907 is missing but it is hard to imagine that Hogben would not visit if he could as he was a leading seismologist (and Inspector-General of schools) from the other side of the world and in correspondence with Milne since around 1897 when the first of the Milne horizontal pendulum seismographs were established around the world. Oh well, just keep researching! Incidentally, James Hector died just five weeks before Hogben's arrival back in Wellington and the Milne #15 went to the private American University of Beirut – at that time called the Syrian Protestant College of Beirut in 1897. Nobody currently knows where this instrument is. Oh, the #21 went to Cape Town.

You will notice in this issue an attempt to provide a little bit more biographical detail about your newly elected committee members. A common reason for becoming involved in the geosciences was inspiration from home and school that it involves work outside an office, and a realisation that we know very little about the details of how the Earth works. Clearly, it is worthwhile and exciting to explore this and ask meaningful questionssuch as how and why? Besides, who wants to sit in an office all day? This also underscores the importance and values of well-trained geoscience teachers and researchers at all levels of education – and we need more of them! How and why did you get involved in this field of work and research – money, curiosity, fascination, planned or luck?

Enjoy issue 1 for 2020 and thank you to all those who have willingly contributed to this issue. I look forward to receiving many contributions for the next two issues. In this issue, you will notice an advert for a new Newsletter editor. I intend to finish this editorial/compiler task at the end of this year. Don't be backward at coming forward it is a very rewarding task and a priviledge to do. You have until November to think about it and put your hand up.

NICK MORTIMER RECOGNISED AS 2019 GSNZ HONORARY LIFE MEMBER

Bruce W. Hayward and James Scott

At the 2019 GSNZ Conference Awards Dinner, Dr Nick Mortimer, GNS Science Dunedin, was honoured with the award of a GSNZ Honorary Life Membership for his outstanding contribution to the Geoscience Society of NZ and to the advancement of geosciences in New Zealand. Nick was pivotal in initiating and seeing through to successful completion the merger of the Geological Society of NZ and the NZ Geophysical Society. Without belittling the contributions of others, the mutually-agreeable amalgamation would not have proceeded without Nick's vision, determination, organisational skills and procedural awareness. Nick made the merger of the two societies the primary aim of his 2007-2009 term as President of the Geological Society of NZ. The merger was not a simple task. It involved obtaining agreement from both organisations' committees and membership for combining their philosophies, constitutions, funds and prizes under a new Geoscience Society of NZ. In 2010, both societies voted at SGMs to merge. So Nick was the last President of the Geological Society of NZ, and he was succeeded by Jan Lindsay as the first President of the Geoscience Society of NZ. While GSNZ President, Nick also initiated discussions with the NZ Geochemical Group which became part of the Geoscience Society in 2011. In 2008, Nick signed the first MoUs between GSNZ and the Geological Societies of America and Australia, enabling member-rate registration fees at conferences. Another presidential initiative of his at the 2008 AGM was to start the GSNZ Legacy Fund, which exists to reduce the extent to which GSNZ income relies on subscriptions.

Nick was an active member of the GSNZ National Committee during his 9 year term, 2002-2011. He has also been a driving force in keeping the Otago Branch running, as the branch convenor for 19 years (1988-89, 2003-present). He was also convenor of the GSNZ Tectonic Studies Special Interest Group for seven years (1989-1996). He has given his time for two national lecture tours to GSNZ branches – firstly as President in 2008 and again in 2015 as Hochstetter Lecturer (talking about Zealandia). He was awarded the McKay Hammer in 1994 for his research on Haast Schist. Since 1987, Nick has contributed 33 articles to Geological, Geophysical and Geoscience Society NZ newsletters. It is either a little-known secret that he is also the author of the regular *Aenigmatite* quiz in the GSNZ newsletter, now up to quiz #30. Other behind the scenes work that Nick has done for the society include website coordinator from 2004-2006, and

producing the 50th anniversary update of the GSNZ field wallet in 2005, and its 3rd edition in 2010. Over the years, Nick has run fieldtrips at six GSNZ conferences. Ironically, in 2011, Nick designed and arranged the production of the polished dunite and wood GSNZ Honorary Membership awards. For many years he had a box of them in his office - and now he has one with his name engraved on it!

Nick Mortimer has made two other major contributions to advancing all of New Zealand geoscience and not just that of his employer GNS Science. These were in his five year term as senior editor of NZ Journal of Geology and Geophysics, 2013-2017 and three years as an associate editor, 2010-2012. He went well above the normal duties of a senior editor in innovative promotion of NZJGG at annual GSNZ conferences and establishing mentoring sessions for first time authors. Nick also established the NZ national rock catalogue and geoanalytical database called Petlab. This was Nick's brainchild in the late 1990s and early 2000s. The Petlab database is a globally unique, online database of multi-institutional NZ rock and mineral samples and their associated open file geochemical, isotopic, age, volumetric and petrophysical analyses. It is a testament to Nick's vision as Petlab curator, 1992-2011 (and to the coding skills of GNS programmers) that Petlab was designed, implemented, grew and became so popular is such a short time. Since 2004, Petlab has progressively unlocked institution's physical rock collections, and made analytical data readily searchable and downloadable. As of 2019, Petlab contains over 210,000 sample records from 20 separate NZ rock collections, 60,000 of which have associated analytical data. Google analytics logs ~50,000 views per year. Some might say that Petlab now replicates the globally unique NZ Fossil Record File that was established initially by Harold Wellman back in the 1940s.

Nick at Creekfest 2018 Image: Roslyn Nijenhuist

Nick has made significant contributions to the advancement of public appreciation and understanding of geoscience in NZ. He has published two very different books specifically for the public – *A Photographic Guide to NZ Rocks and Minerals* in 2011, and a coffee table book *Zealandia: Our Continent Revealed* in 2014. The magnificent Zealandia book (with co-author Hamish Campbell) attests to Nick's scientific breadth and amazing skill in illustrating and communicating complex science in a comprehensible manner to the interested public. Thanks to Nick, many of us are the proud owners of Zealandia fridge magnets, microfibre cloths or coasters. He frequently answers media and public enquiries about rocks and Zealandia, and gives talks to local clubs and societies, runs field trips and has been a major contributor to the web-based site Geotrips, posting more than 30 sites of interest, mainly in Otago and Southland. He has a special relationship with Te Hikoi-Southern Journeys Museum in Riverton

where he has advised on exhibits, given talks and run field trips. Along with other GNS colleagues, he has provided input and validation for petrology- and Zealandia-related objects and commentaries in Te Papa's Awesome Forces and Te Taiao exhibition zones.

Some people think Nick is a native Dunedinite and attended the University of Otago. Others correctly identify his English accent. As was noted in Geological Society Newsletter 145 p. 38-39, Nick actually grew up in Watford, near London, and got his BSc in Geology from Imperial College in 1980. This was followed by a PhD from Stanford in 1984 and a post-docs at UBC. He came to New Zealand in 1986 on his second post-doc, working with Graham Bishop at NZGS (GNS's predecessor) in Dunedin. He's never looked back.

The Honorary Member award is not intended for a person's research excellence but it should be noted that Nick is also a leader in NZ geoscience research. He has an international and national reputation for his ongoing research on the petrology, metamorphism, structural geology and tectonic history that have firmly established the scientific credentials of Zealandia: the world's eighth (and most recently recognised) continent. His original field and laboratory research has been pivotal in understanding how terranes (continental fragments) form the complex geology of Zealandia. His publications are prescribed reading in graduate courses around the world. Internationally, Nick is regarded as a leading expert on the basement geology of New Zealand and the south-west Pacific because of his ability to integrate the results from many different disciplines into sound syntheses For his outstanding geological research in NZ Nick has already been recognised through his election to Fellowship of the RSNZ in 2017.
We all congratulate Nick Mortimer as a most worthy GSNZ Honorary Life member.

Otago schist explanation 2012

Onboard RV Southern Surveyor, 2012
(Image: Maria Seton)

HONORARY MEMBERSHIP
Nick Mortimer, GNS Science, Dunedin

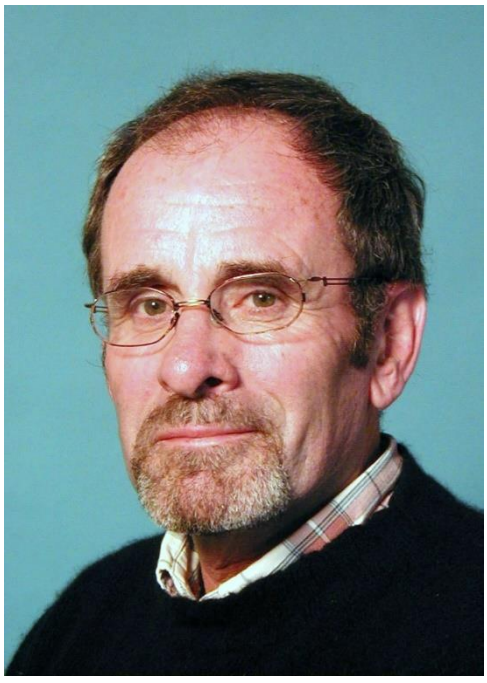
I would like to thank the Geoscience Society of New Zealand National Committee for awarding me Honorary Membership. I arrived in New Zealand on a postdoc in 1986, joined GSNZ straight away, and have been a member ever since. Now it seems I will be a member until my eventual demise! GSNZ has played - and continues to play - an important part in my geological life. I don't know where the last 34 years have gone. Honorary Membership of the society is an unexpected surprise, a rare accolade and one of which I am very proud. Thank you again.

……

CHRIS ADAMS, pioneer geochronologist – a tribute

Simon Nathan

2019 is the fiftieth anniversary of the arrival of Chris Adams in New Zealand to start work on K-Ar dating. Over the succeeding half-century he has made an unrivalled contribution to the geochronology of Zealandia, Antarctica, and the broader south Pacific region – and is still publishing major papers. This short article is intended to record his major achievements to date. It is based on personal knowledge as well as discussions with Chris and a number of colleagues.



Chris Adams in the laboratory in the 1970s and a more recent portrait (image: N. Mortimer)

Chris Adams did his undergraduate training in geology at Queen Mary College in London, where contemporaries included Margaret Bradshaw, John Bradshaw and Peter Ballance. He moved to Oxford to undertake his PhD under Steve Moorbath on the geochronology of the Channel Islands and adjacent French mainland, using Rb-Sr and K-Ar dating. At Oxford he met New Zealanders Malcolm Laird and Chris Harper who made him aware of some of the complexities of New Zealand geology and their major research potential – at that stage almost virgin territory for a geochronologist. While on a postdoctoral fellowship at the University of Toronto, he applied for a job at the DSIR's Institute of Nuclear Sciences (INS) at Gracefield where Athol Rafter had set up a small geochronology group, and he arrived in Lower Hutt in 1969. Physicist John Hulston and nuclear chemist Bill McCabe had built the first K-Ar system at INS and, with constant modification and updating, the equipment produced over 1000 age determinations, continuing in use until it was decommissioned in 1997.

There was no shortage of problems for a keen geochronologist to tackle. Encouraged by Chris Harper, one of his first projects was K-Ar dating the early Paleozoic Greenland Group slates on the West Coast of the South Island, and subsequently this has been revisited using different techniques (Rb-Sr, U-Pb) over the years. For much of his first decade Chris focussed on dating Cenozoic volcanic rocks, mainly in the North Island, for example in the Coromandel Peninsula. Over the years this has been expanded to cover dike swarms in the Kaikoura ranges, the Mount Somers Volcanics, the Dunedin volcanic field, lamprophyre dikes in west Otago, and all the Sub-Antarctic islands.

The Otago/Alpine schist belt provided an interesting challenge as little comparable work had been done on similar metamorphic terranes overseas. Chris started by working with Graham Bishop who had recently completed his PhD on progressive low-grade metamorphism near Dansey Pass, providing a superb transect across the Otago schist. With similar transects in the Haast valley and Lewis Pass in high grade Alpine Schist, and lower-grade schists exposed in Marlborough, Chatham Islands and along the Dunedin coast, these were great templates for understanding uplift and cooling histories. Chris described this work when he was GSNZ Hochstetter lecturer in 1978.

Chris went on study leave in Canberra during 1973/74 prior to setting up a mass spectrometer suitable for Rb-Sr isotope determinations that were used in a variety of projects, perhaps most successfully using Rb-Sr metamorphic ages and corresponding initial Sr-isotope patterns to characterise the sedimentary rocks of New Zealand's basement terranes. Sr-isotopes again provided a fascinating way of 'fingerprinting' nephrite jade thus allowing discrimination of jade from the several New Zealand 'fields' and those around the Pacific margin (New Caledonia, Taiwan, Siberia and Canada).

It was hoped that Rb-Sr would also be useful in unravelling the complex history of local granites, but the results were often ambiguous, and eventually overtaken by U/Pb dating of zircons.

In 1978 Chris undertook the first of seven trips to Antarctica. In an expedition to north Victoria Land with Malcolm Laird he collected and dated samples of

Robertson Bay Group, a correlative of the Greenland Group. Later trips included work in Marie Byrd Land (with Peter Andrews and John Bradshaw) and Edward VII Peninsula (with Steve Weaver and). Work with German field parties in Antarctica led to a Humboldt Fellowship award in 1982-84, working in laboratories at Muenster and Hannover. Broader, regional Gondwana studies there initiated a major collaboration with geologists in Germany, Argentina and Chile, extending over ten years.

In the early 1990s it was planned to extend the K-Ar and Rb-Sr capabilities at Gracefield by adding Ar-Ar mass spectrometry. Chris spent a period of study leave at the Open University followed by construction and testing the equipment. Unfortunately, this coincided with a management review and a decision to shut geochronology laboratories and instead, to pay for time in specialist laboratories as needed: at Macquarie University (Sydney, U-Pb ICPMS), Curtin University (Perth, Ar-Ar, U-Pb SHRIMP) and La Trobe University (Melbourne, Rb-Sr). This was a big blow after 25 years building up and maintaining mass spectrometers and associated equipment, but it did mean that more time could be devoted to new research.

This was a period when the nationwide QMAP programme was getting underway, with emphasis on the distinction between different basement terranes. Chris embarked on a programme of systematically analysing detrital zircon age proportions and patterns in sedimentary and metasedimentary rocks from all the different terranes, thus providing maximum depositional ages and indicating likely sediment provenances. Initially this was done by using the SHRIMP facility at Curtin University, but Chris developed a collaborative relationship with Professor Bill Griffin at Macquarie University using ICPMS laser ablation technology. A very productive 15-year period ensued, sampling and analysing the zircon age patterns in all the major terranes, in conjunction with Hamish Campbell, Nick Mortimer and others revisiting some old project themes in Zealandia, Antarctica, Australia and southern South America). He was awarded the McKay Hammer by the Geological Society of New Zealand in 2001 for his terrane work, although at that time it was still in its initial stages. The work that Chris had already undertaken in Antarctica and Australia proved invaluable in testing possible correlations and source areas. For example, he has been able to identify the likely source of the Torlesse terrane as a restricted area in the New England orogen in NE Australia.

The major pre-Cretaceous terrane projects were completed about 2013, and then Chris and his collaborators moved to a study of the provenance of Cretaceous cover successions, widespread around Zealandia. The results have been published in three major papers covering northern, eastern and southern New Zealand as well as an overall review. Chris now enjoys a part-time retirement as an Emeritus Scientist at the Dunedin office of GNS Science.

In looking back over the projects that Chris Adams has undertaken over the last half century, one of the characteristic features has been his involvement in all phases of the work, from sample collection to laboratory analysis and scientific interpretation. He has always been familiar with the geological problems he is

working on and fully involved with geological analysis and the future directions of research. It is important to remember that, in their day, the K-Ar and Rb-Sr were the cutting edge of geochronology and isotope geochemistry. We owe where we are today to the knowledge built up in previous decades.

The work that Chris undertook has always been characterised by attention to detail – all samples are precisely located, catalogued, stored and searchable via Petlab (http://pet.gns.cri.nz) so that they are readily available for additional analytical work in the future. Although a growing number of people have become involved with geochronology in recent years, none can match the huge contribution that Chris has made in terms of problems investigated, samples analysed, and papers published.

Selected New Zealand publications by Chris Adams

The GNS Geoscience Bibliography lists over 220 scientific papers, conference abstracts and reports for which Chris Adams is an author. The following, much shorter list, arranged in chronological order, illustrates the range of work that Chris has undertaken on rocks all over the New Zealand region. It does not include papers dealing solely with Antarctica, Australia and other countries around the south Pacific – otherwise the list would be 50% larger.

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Adams CJ 1975. New Zealand potassium-argon age list 2. *New Zealand Journal of Geology & Geophysics 18(3):* 443-467.

Sheppard, D.S.; Bird, G.W.; Adams, C.J. 1975 Age of metamorphism and uplift in the Alpine schist belt, New Zealand. *Geological Society of America Bulletin, 86(8):* 1147-1153

Adams, C.J.; Robinson, P. 1977 Potassium-argon ages of schists from Chatham Island, New Zealand plateau, southwest Pacific. *New Zealand Journal of Geology and Geophysics, 20(2):* 287-301

Adams, C.J.; Nathan, S. 1978 Cretaceous chronology of the Lower Buller Valley, South Island, New Zealand. *New Zealand Journal of Geology and Geophysics, 21(4*): 455-462

Adams, C.J.; Oliver, P.J. 1979 Potassium-argon dating of Mt Somers volcanics, South Island, New Zealand: limitations in dating Mesozoic volcanic rocks. *New Zealand Journal of Geology and Geophysics, 22(4):* 455-463

Eggers, A.J.; Adams, C.J. 1979 Potassium-argon ages of molybdenum mineralization and associated granites at Bald Hill and correlation with other molybdenum occurrences in the South Island, New Zealand. *Economic Geology, 74(3):* 628-637

Adams, C.J.; Morris, P.A.; Beggs, J.M. 1979 Age and correlation of volcanic rocks of Campbell Island and metamorphic basement of the Campbell Plateau, south-west Pacific. *New Zealand Journal of Geology and Geophysics, 22(6):* 679-691

Adams, C.J. 1981 Migration of late Cenozoic volcanism in the South Island of New Zealand and the Campbell Plateau. *Nature, 294(5837):* 153-155

Adams, C.J.; Gabites, J.E.; Bishop, D.G. 1985 Potassium-argon studies of a low grade progressively metamorphosed metagreywacke sequence, Dansey Pass, South Island, New Zealand. *Journal of the Geological Society of London, 142(2*): 339-350

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Grapes, R.; Lamb, S.H.; Adams, C.J. 1992 K-Ar ages of basanitic dikes, Awatere Valley, Marlborough, New Zealand. *New Zealand Journal of Geology and Geophysics, 35(4*): 415-419

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Adams, C.J.; Graham, I.J.; Seward, D.; Skinner, D.N.B. 1994 Geochronological and geochemical evolution of late Cenozoic volcanism in the Coromandel Peninsula, New Zealand. *New Zealand Journal of Geology and Geophysics, 37(3): 359-379*.

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Adams, C.J.; Graham, I.J.; Johnston, M.R. 1999 Age and isotopic characterisation of geological terranes in Marlborough Schist, Nelson/Marlborough, New Zealand. *New Zealand Journal of Geology and Geophysics, 42(1):* 33-55.

Pickard, A.L.; Adams. C.J.; Barley, M.E. 2000 Australian provenance for Upper Permian to Cretaceous rocks forming accretionary complexes on the New Zealand sector of the Gondwanaland margin. *Australian journal of earth sciences, 47(6):* 987-1007

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Gamble, J.A.; Adams, C.J.; Morris, P.A.; Wysoczanski, R.J.; Handler, M.; Timm, C. 2018 The geochemistry and petrogenesis of Carnley Volcano, Auckland Islands, SW Pacific. *New Zealand Journal of Geology and Geophysics, 61(4):* 480-497.

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I am very grateful for advice and comments from Hamish Campbell, Nick Mortimer and Diane Seward in preparing this article.

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Estimating volcanic composition from seismic data

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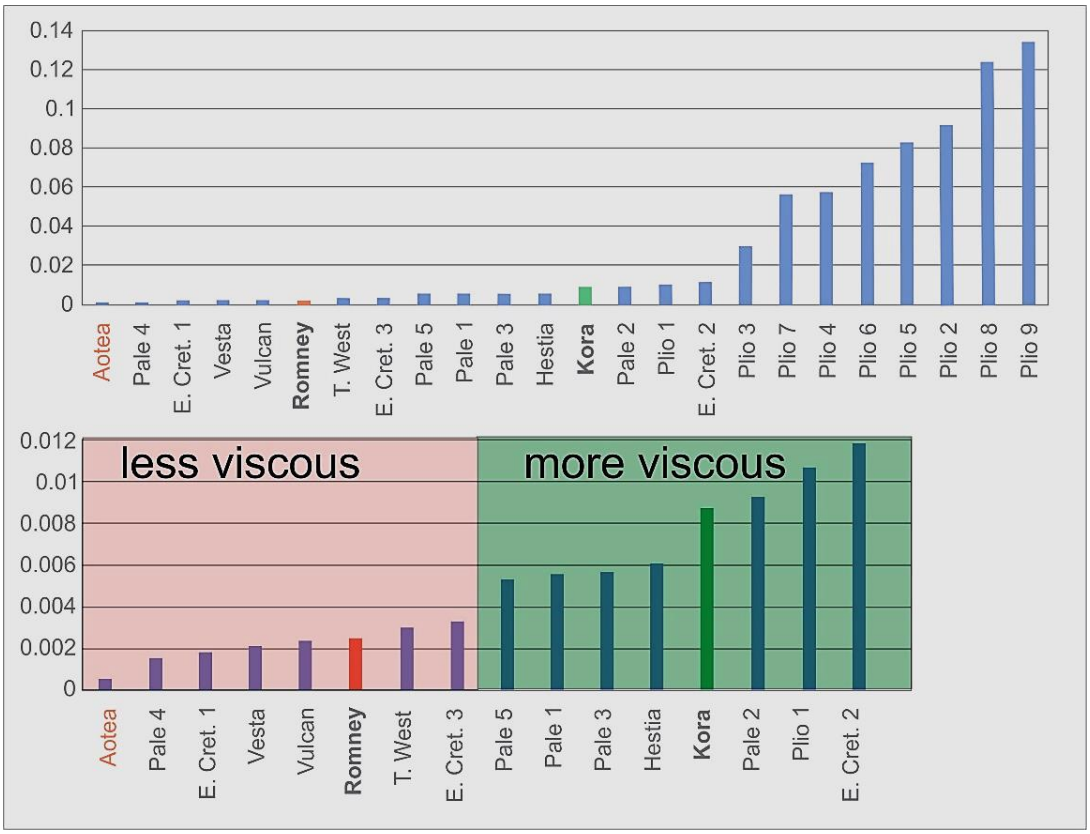
I recently wrote a paper on volcanoes in the Deepwater Taranaki Basin (Uruski, 2019), most of which are buried by great thicknesses of sedimentary rocks. I started thinking about how it might be possible in the broadest sense to try to determine the composition of the volcanoes. Seismic data gives a good handle on the shape of bodies, so could the shape be diagnostic of composition. In my first year at university, I was taught that the Hawaiian Islands are shield volcanoes that have a low height to areal extent ratio as they are composed of basalt, which flows readily due to its low viscosity. Conversely, andesitic volcanoes commonly have higher profiles as andesite is much more viscous than basalt and the resulting volcanoes are sharper and pointier.

In the Deepwater Taranaki Basin, a small number of samples is available from drilling and dredging, but most volcanoes are interpreted from seismic data and no information is available on their composition. What is known is that most of the Northland and Taranaki volcanoes, including Kora, are andesitic. DSDP

well 207 drilled Late Cretaceous rhyolites from the north Challenger Plateau. Cretaceous volcanic rocks from Romney-1 are basaltic, while the western Challenger Plateau samples from DSDP 593, Mount Spong and Megabrick (Carey et al, 1991) are all of Late Eocene alkaline basalt. A sample dredged from the Aotea Seamount (Bache et al, 2014) proved to be of Early Miocene basanite (Mortimer et al, 2018). The cause of the variable petrology is unclear, although as these rocks were extruded over a period of around 100 My, such variability is perhaps not surprising and is common even in individual volcanoes. The actual shape of the volcano will depend on a number of factors including temperature of the extruding magma, the rate at which it will cool in seawater and the rate at which it is extruded, smaller volumes perhaps solidifying more quickly. Erosion could modify the shape if the volcano were exposed. Finally, the composition of the magma controls its viscosity, so the ratio of height to surface area or volume may give a rough approximation or proxy for magma viscosity and therefore composition. This of course assumes that viscosity has the greatest influence on the shape of the volcano, which is not necessarily the case. Nevertheless, the idea was tested by comparing shapes with those of volcanoes with known composition.

The ratios of height to surface area are illustrated by the figure below. The upper part of the figure shows the full range of viscosity proxies for all volcanic mounds recognised. The basaltic Romney volcano is in red and the andesitic Kora volcano is in green. Most of the Pliocene bodies indicate viscosity proxy ratios that are much greater than those of older volcanoes. This could be due to do their small volumes combined with a much more viscous magma, perhaps rhyolite or dacite. However, small volumes of lava would crystallise rapidly in sea-water and rapid solidification may result in steeper slopes and a higher height to area ratio.



The lower part of the figure shows the height to area ratios of the older volcanoes only. Those near the values of Kora may be assumed to be andesitic, while those around the Romney value may tend to be basaltic. There is no relationship between age and height to area ration, which appears random.

The Aotea Seamount is of interest for its size and because it has the lowest height to area ratio of all. This Miocene intra-plate volcano is exposed at the sea-bed, covers an area of 6,600 km^2 and has a volume of some 4,800 km^3, almost identical to that of Kilimanjaro. A sample of basanite was dredged from one peak (Bache et al, 2014; Mortimer et al, 2018) and, while such a large body is likely to include a range of volcanic composition, the viscosity of basanite is lower than that of basalt, so an overall basanite composition would fit.

It's obvious that this initial observation, while it appears to work, is simplistic. As mentioned earlier, there are many factors that would influence the shape of a volcano, but could a model be built to take account of all known and perhaps some unknown factors? I guess that depends on how much one would want to understand the composition of buried volcanoes. When all you have is seismic data there must be some way to make use of it.

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SAVING FOULDEN MAAR – GSNZ Involvement

Daphne Lee, Bruce W Hayward and Jennifer Eccles
GSNZ Geoheritage Subcommittee

In 2019 the most significant geoheritage issue in New Zealand was the public debate about the future of the diatomite deposit preserved in Foulden Maar, near Middlemarch, Otago. Foulden Maar is considered to be of international significance by the Geoscience Society of New Zealand (GSNZ)'s Geopreservation Inventory because of its amazing terrestrial and freshwater fossils (Lee et al., 2016) and its unique annually-resolved (varve-like) record of paleoclimate during a 120,000 year-interval about 23 million years ago (near Oligocene-Miocene boundary)(Fox et al., 2016, 2017).

Foulden Maar was listed in the Society's NZ Geopreservation Inventory during the first year of its compilation in 1986 and classified as being nationally-significant for the significance of its well-preserved leaf fossils. Note that the term 'Foulden Maar' was first used in Lindqvist & Lee (2009). During the 1990s-2010s GSNZ did not advocate for legal protection for it, because of concern by Otago University researchers that doing so might result in the owners shutting down access to geologists and thereby curtailing the ever-increasing number of significant fossil finds.

In 2000 the farm property changed hands and the new owners applied for a resource consent to open up a much larger diatomite mine. GSNZ sent a submission asking for protection of a part of the exposure of leaf beds, but not opposing the application to restart quarrying which might conceivably expose new important fossils. This enlarged mine did not eventuate and in 2014 a 42 ha site containing about 80% of the diatomite deposit was sold to an overseas mining interest without any alarm bells ringing.

This resulted in a new major diatomite mining proposal which began to gain momentum in 2018 and early 2019 and received backing from local politicians who saw it as boosting the local economy. Initial talks between Otago University geoscientists and company representatives gave the impression that the company would preserve some of the deposit and provide for scientific access to the deposit as the mining went deeper. The mining company determined that to get access in and out of the deep pit and be financially viable would require purchase of the farm surrounding the mining site and applied to the Overseas Investment Office (OIO) for permission to do so. The GSNZ made a submission in September 2018 on this application stating the immense scientific value of the site, the need to retain a representative section in perpetuity but stating mining could expose new scientific information.

The full, long-term impact of the company's mining proposals on the scientific values of the site did not become apparent until after an internal report on the viability of the proposal prepared for the mining company's financial banker was leaked to the media in April 2019. This report galvanised local opposition by statements that implied that any local resistance to the proposal could easily be overcome by the company's superior resources and the support already

expressed by local and national politicians. At this stage local residents became aware of the high scientific value of Foulden Maar's freshwater lake sequence and began active lobbying for its protection as their best chance to stop the mine. The leaked report made no mention of the scientific value of the diatomite and its fossils or of any measures to protect any portion in perpetuity for research.

During a frenetic period of local lobbying and media interest in May-June 2019, Otago University palaeontologist Daphne Lee (as leader of the international research team that had conducted most of the recent research on Foulden Maar), was flooded with media and politician enquiries about the scientific and fossil heritage values of the deposit. Daphne gave many interviews and briefed the Dunedin City Mayor and CEO on the geoheritage values of the site. Soon afterwards the Council suspended its previous support for the proposal.

As a member of GSNZ's Geoheritage Subcommittee, Daphne kept GSNZ well briefed on developments and sought advice and support from our Society at the national level. After considerable discussions, a press release was prepared by GSNZ and widely distributed:

GSNZ PRESS RELEASE – 14 May 2019
Foulden Maar, Otago

NATIONAL TREASURE NOT STOCK FOOD!

The Geoscience Society of New Zealand calls on the Government and Dunedin City Council to stop the proposal to mine away New Zealand's most important terrestrial fossil site at Foulden Hills, near Middlemarch, Otago.

"New Zealand's national identity is strongly bound to its unique plants and animals. We cannot stand by and see this fountain of paleontological knowledge about where we have come from destroyed; particularly not for so little transient local and national gain", said Geoscience Society of New Zealand President Dr Jennifer Eccles.

The diatomite sediment that infilled this crater lake, 23 million years ago, contains the most extraordinary array of exquisitely preserved plant, fish, spider and insect fossils in New Zealand. These fossils are unique and record the previously unknown history and origins of a large portion of New Zealand's present-day biota. They are all extinct species. Many are the ancestors of NZ's current biota but others record groups of plants and animals that are no longer living here. To date, over 100 different species of plant fossils have been identified (mostly leaves, but also fruits, seeds and wood). The plants include extremely rare fossil orchids, mistletoes, fuchsias and a host of other taxa that link NZ's biota to Australia, New Caledonia and South America. Forty fossil flowers have been found, many still containing pollen, representing 15 plant families. Fossil flowers with associated pollen are extraordinarily rare globally.

Amazingly preserved freshwater fish fossils include the oldest freshwater eel fossil in the Southern Hemisphere and the oldest galaxiid whitebait in the world. Insects are NZ's largest group of terrestrial animals. More than 50% of NZ's discovered fossil insects have been found in this one deposit and include over 200 different kinds from 21 families. Four fossil spiders have also been

found. All these fossils come from just a small area near the top of the deposit. This unique site will hold hundreds more different kinds of fossils that will help paleontologists in future decades and centuries document and decipher the rich history of NZ's biota. The rich fossil collections already found could form the basis of an important museum and information centre in Middlemarch.

"The diatomite at Foulden is an irreplaceable treasure box from which only a small proportion of its jewels have been found so far", said Geoscience Society Geoheritage Convenor Dr Bruce Hayward.

"Foulden crater lake fossils are as important to our understanding of the origins of New Zealand's biota as the UNESCO Messel World Heritage Site in Germany is to understanding the history of Europe's biota", said paleontologist Prof Daphne Lee. Government-funded scientific drilling has revealed the full 120 m thickness of the diatomite sediment fill of the crater. It is composed of thousands of 1 mm-thick layers, each deposited by annual algal (diatom) blooms. This core provides a unique and truly world-class record of annual climatic fluctuations spanning a 120,000-year period around 23 million years ago. Detailed international studies now and in the future will provide unprecedented detail of annual climatic factors such as rainfall and greenhouse gas variability that will lead to better understanding of the ancient El Niño-Southern Oscillation (ENSO) and other climate cycles. To do this requires preservation of a complete sequence through the deposit in perpetuity so that future generations of scientists can use the inevitable new technologies to interrogate the sequence and obtain increasingly more detailed information about the fossils and the history of climate at that time. A deposit with this level of annual resolution is unknown in the Southern Hemisphere.

Recently released company documents say that the whole deposit will need to be mined to be economic and afterwards the hole will fill with water and prevent access to any scraps that may have been left behind. Dr Eccles says "we recognise that mining of this deposit would clearly provide access to much deeper levels and undoubtedly uncover many more fossil treasures, but it would be unconscionable for us to support the proposed quarrying away of virtually the entire deposit. This site is of international importance and it is beholden on us to protect it for future generations of scientists and the public."
Jennifer Eccles, GSNZ President

With more information on the mining project becoming available, GSNZ sent a revised submission to the OIO on the proposed purchase of neighbouring land explaining in more detail the international value of the diatomite deposit and the desirability of retaining a representative section through the entire sequence. By this time the wider group was also more aware about the importance of the anoxic *in situ* environment in the preservation of the delicate fossils and that the hydrology of the site would need to be assessed to see if lateral drainage into a pit could jeopardise any deposits that might be left after mining had occurred. In June the company requested a face to face meeting with Daphne Lee, Andrew Gorman and Jennifer Eccles as representatives of GSNZ, but they were unsuccessful in their efforts to get GSNZ not to oppose their large-scale mining proposal. Within days of this meeting, the company set up to establish the diatomite mine

announced it was going into receivership and soon afterwards its application to the OIO was withdrawn. The following statement was released by GSNZ giving our opinion on the scientific values and future of Foulden Maar.

5th July 2019 GSNZ Statement on Future of Foulden Maar

To Whom It May Concern:

The 42 ha property near Middlemarch, Otago, containing the majority of the Foulden Maar is currently held by the Australian company, Plaman Resources, which has recently gone into receivership. The company had floated plans that could have seen the entirety of the diatomite deposit infilling the Maar mined away. From a scientific perspective Foulden Maar is a globally significant maar lake deposit containing a ~120,000-year-long annual record of infill (mostly varved diatomite) from the early Miocene (approximately 23 million years ago). Numerous plants, flowers, insects and freshwater fish have been described from this deposit and enable geological research into New Zealand climate in the Miocene. The detail available from the deposits is exceptional and is the best record of Miocene freshwater environments in New Zealand. This is an extremely valuable scientific resource and of relevance to all New Zealanders interested in our biological and geological history. This has been recognised financially via research funding support to investigate this site. This research has yielded nearly 40 peer-reviewed scientific articles and several postgraduate student research theses. The site was one of the first to be included in the New Zealand Geopreservation Inventory as "Middlemarch diatomite-bearing leaf fossils." and now as "Foulden Maar terrestrial and freshwater fossils in diatomite" see https://services.main.net.nz/geopreservation/. Attached is a summary document covering the significance and scientific outputs related to Foulden Maar.

The climate record at this site is also globally unique and has not yet been fully utilised. It is preserved to its full extent only in the central and deepest part of the diatomite deposit. The climate record is important as:

1. Foulden Maar is the world's only known annually layered record of climate and environment from the earliest Miocene. It can be investigated down to individual years and seasons, allowing us to see changes on human timescales, such as El Niño events. Other records of the time period have at best millennial resolution (i.e. a single subsample represents an average of at least 1000 years, and there is no way to look at any changes or events that take place over shorter timescales). The Foulden Maar thus is our only way of understanding human-timescale events during this period of geological history.

2. Foulden Maar also includes an unparalleled record for atmospheric carbon dioxide. There is no other place in the world where you have the potential of linking global climatic events to changes in the carbon cycle. This is highly relevant to the modern interaction between Antarctic ice extent, global temperatures and rising carbon dioxide levels. The presence of well-preserved fossil leaves also allows us to estimate atmospheric carbon dioxide changes. Again, this is very unusual for a deposit this old, and this combined with the

annual resolution allows us to pinpoint the rate of change of atmospheric carbon dioxide at a level of detail which is almost unknown elsewhere.

3. During this period of the Miocene, large parts of the Antarctic ice sheet melted for reasons that are not well understood. The Foulden Maar represents a unique opportunity to investigate the causes of this ice-sheet loss and the effects that the warming had on New Zealand on human timescales.

In the future, new geological techniques will become available which will allow us to extract even more information about climate, environment and ecology from Foulden Maar and thus preservation of a most significant location for scientific research.

While industrial excavation at the site can expose new scientific information the pace and scale of an economic mining operation would make it difficult to realise the full scientific value of fossils exposed under any sort of NZ paleontological research 'business as usual' scenario as fossil preservation and study is slow and labour intensive. Although other infilled maar craters, such as Hindon Maar, exist in the Otago region no other site in New Zealand or elsewhere globally preserves this time sequence and suite of fossil plants, fish and insects (and potentially birds and reptiles). During the recent mining proposal we also became concerned that lowering the water table (pumping the pit) during deep extraction could have caused any intact/preserved portion of the deposit to dry out. While currently lacking data to model this, if it occurred it could cause irreparable damage to the in-situ fossils and layering hence destroying the scientific value of the entire site.

The Geoscience Society of New Zealand has consistently submitted a recommendation that at this unique site a significant and representative portion of these deposits should be retained in perpetuity, so that the scientific value of this resource remains for future public science and educational use. Public purchase of the land when it comes up for sale in the receivership process would be a good way to preserve this even if only a small section of land from the edge to centre of the Maar was ultimately retained for science and education. The geoscience value of the site could be preserved in harmony with pastoral/agricultural use of the land surface.
Yours sincerely

Dr Jennifer Eccles
GSNZ President

At the time of writing there have been indications from Dunedin City Council that they are investigating the possibility of scheduling Foulden Maar as an Outstanding Natural Feature in their District Scheme. Additionally the newly-elected Dunedin District Council have indicated a desire to purchase this property for a reserve to protect its high heritage value. We await further developments.

Fig. 1. A fossil flower preserved in the Foulden Maar diatomite.

Fig. 2. A fossil insect from Foulden Maar.

Fig. 3. An example of the exquisite preservation of fossil leaves in the Foulden Maar diatomite.

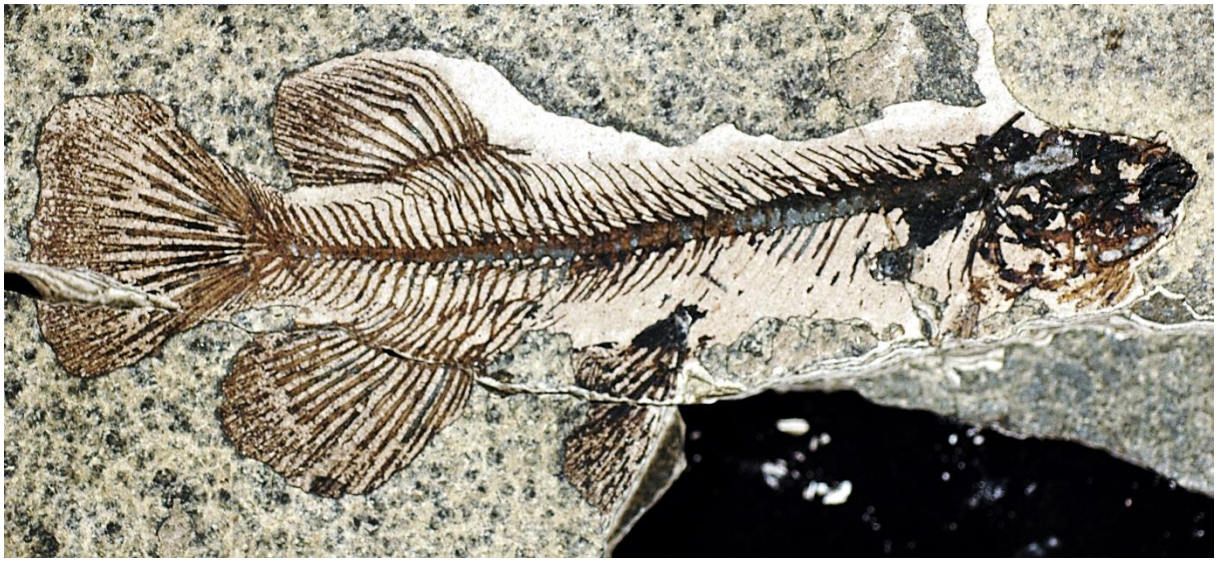

Fig. 4. Fossil *Galaxias* whitebait from Foulden Maar.

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Murchison boulder of orbicular “granite” (diorite)

Bruce W. Hayward and Matthew W. Sagar

Fig. 1. Boulder of orbicular granite outside the information centre in Murchison.

Many readers will have seen the beautiful boulder of orbicular “granite” (ring stone) outside the information centre in the main street of Murchison (Fig. 1), but we imagine lots of you have driven through Murchison on many occasions without noticing it. We recommend next time you are passing that you stop and take a look at what is probably the largest known boulder of orbicular granite in New Zealand. It is also one of the best examples that can be seen.

Undoubtedly the best examples of multi-shelled orbicular granite from New Zealand (and in the world) came from Karamea (Fig. 2) and have been reported on by Marshall (1946), Grapes (1996), Kobe (1999), Watters *et al.* (1998, 1999), Keam (2001) and Grenfell and Fleming (2016). One of these boulders was sliced up into a number of slabs that Marshall distributed to at least three museums overseas and at least a similar number in New Zealand. Three of these exceptional slabs are on display in Te Papa, GNS and Auckland Museum (Fig. 2).

Fig. 2. Polished slab of New Zealand's best-developed multi-shelled orbicular granite, from Karamea, sent to Auckland Museum by Pat Marshall. (Photo 50 cm across).

All examples of orbicular granite in New Zealand have come from the northwest portion of the South Island (Kobe, 1988) and most have been as float boulders in rivers (e.g., Figs. 3–4). Kobe (1988) reported on a number of *in-situ* occurrences in the Separation Point Pluton, but all these are of inferior quality orbicules. Accessible coastal examples occur at Breaker Bay, Coquilles Bay and Apple Tree Bay, all north of Kaiteriteri.

Fig. 3. Another boulder of orbicular monzodiorite from Mt Cann Pluton, *in-situ* in Mt Cann Creek. Photo by Matt Sagar.

Fig. 4. Broken slab of orbicular Separation Point granite from a float boulder, Wangapeka. From the collection of the late Huko Kobe. Photo 20 cm across.

The Murchison Boulder (Figs 1, 5, 6) was found by local rockhound Steve Craddock. It has been traced back to the Mt Cann Pluton which outcrops in the headwaters of the Glenroy River, south of Murchison and immediately west of the Alpine Fault (Sagar *et al.*, 2016). It has been described as a biotite–epidote quartz monzodiorite–granodiorite and has recently been dated at 114 ± 1 Ma (Sagar *et al.*, 2016). This orbicular granite was described in detail by Reid *et al.* (1972) and Sagar (2011) photographed a beautiful float boulder in Mt Cann Creek (Fig. 3). The orbicules consist of a coarse-grained aggregate of white oligoclase (plagioclase feldspar) with or without concentric rings of black biotite. Cores are generally absent. Reid *et al.* (1972) reported a “boulder, about 1.2 m across” “found in the lower reaches of Granity Creek, a small tributary of the Glenroy River”. This may be the same boulder now on display in the centre of Murchison (Fig. 1).

Fig. 5. Part of the Murchison orbicular “granite” boulder in the centre of Murchison.

Fig. 6. Close-up photo of part of the Murchison orbicular “granite” boulder in centre of Murchison.

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Young Researcher Travel Grant Report (YRTG)

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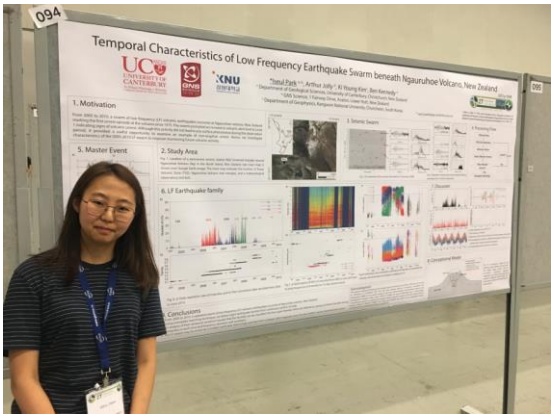
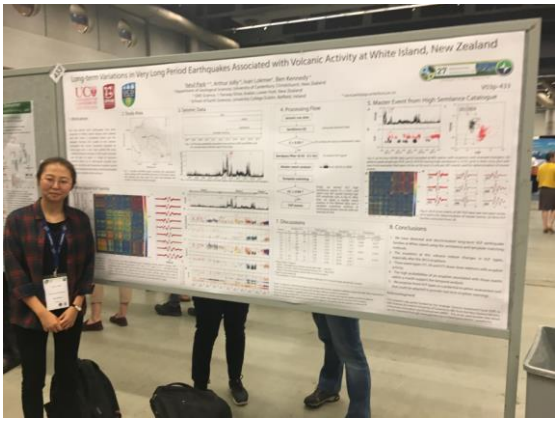
Thanks to the Geoscience Society of New Zealand (GSNZ) Young Researcher Travel Grant. I received the great opportunity to attend my first international conference as a PhD student. I attended the 27th International Union of Geodesy and Geophysics (IUGG) General Assembly in Montreal, Canada. The 2019 IUGG conference was held from July 8 to 18 with more than 4000 participants from more than 100 countries and provided various themed lectures and symposia including geology, volcanology, seismology, etc. The year 2019 marked the 100th anniversary of IUGG, so I had a chance to meet many renowned geoscientists as well as attend their presentations.

At this conference, I presented two posters associated with my PhD research investigating long-term trends of volcano earthquakes at Ngauruhoe and White Island. The volcanoes produce repeating volcanic earthquakes, and their long-term assessment allows us to recognize important types of earthquakes leading to eruptions and relationships with volcanic activity. This research will be contributed to the development of monitoring and forecasting eruptions as well as volcanic activity.

Many international scientists visited my poster sessions and gave me useful comments to improve my research. I also gained different perspectives by other talks and posters and learned a way of how to effectively communicate my opinion to audiences. The conference motivated and encouraged me to study even harder and to have confidence. I really appreciate GSNZ support to give me this privilege. Thank you.





Iseul with her two posters at conference.

Young Researcher Travel Grant Report
F-Image Workshop
September 15-21, 2019
Cargese, Corsica

Bryant Chow bryant.chow@vuw.ac.nz

Last year, assisted by the GSNZ Young Researcher Travel Grant, I was able to attend a workshop entitled “Passive Imaging and Monitoring in Wave Physics,” in Cargese, Corsica. This workshop brought together a broad collection of scientists who conversed over the study of wave physics. Whether the subject was extraterrestrial planets, the interior of our own, or that of the human body, we collectively bonded over the measurement of wiggles. Lecture topics varied from seismic waves on the moon, to machine learning in the Earth Sciences, to medical imaging. It was refreshing to participate in discussions that ventured far outside my own field, but were still tangible within the scope of my research. My PhD, undertaken at the Victoria University of Wellington, involves imaging the Earth's crust using seismic waves and earthquake simulations. During the evening poster sessions, I was able to share my research and receive feedback from a diverse and international audience of researchers. The workshop was an ideal platform for making connections with future collaborators, while also sharing the work of New Zealand geosciences. I am grateful to the Geoscience Society of New Zealand for their contribution to my attendance through the 2019 Young Researcher Travel Grant, and I know that attending this workshop has shown to an international audience that New Zealand values the Earth sciences and is playing a leading role in pushing the boundaries of cutting edge science.

A collection of brilliant minds and leading-edge science packaged into an island holiday, is how I would describe the ‘Passive Imaging’ workshop held in Cargese, Corsica. A part of the French Republic, Corsica is an island in the Mediterranean Sea situated west of Italy and south of France. Cargese, a small village on the island’s west coast, is roughly 50 kilometers north of the capital of Ajaccio. With its population of less than 1500, Cargese houses a harbor, some restaurants, and the Institut d'Études Scientifiques de Cargèse, a small huddle of buildings perched on short cliffs, home to a constant rotation of scientists that flock to its beaches seeking collaboration, innovation, and mediterranean sunshine.

I arrived in Ajaccio 30 hours after departing Wellington, warmly greeted by the humid breeze. Most of the workshops 100 attendees had arrived that day, and waited to shuffle onto the buses that would ferry us across mountain roads to Cargese. After meeting my bus-mate, the conference coordinator from the University of Grenoble, France, and my roommate for the week, a PhD student from Stanford University, California, I recognized the international diversity of the workshop; I would eventually meet attendees arriving from various parts of the world, including Europe, Japan, the U.S., Australia, and even two others from New Zealand. The workshop was to last five days, with lectures and practicals running from morning till evening. Lunches were served at the institute in French style with fine food, some bottles of wine, and an assortment of

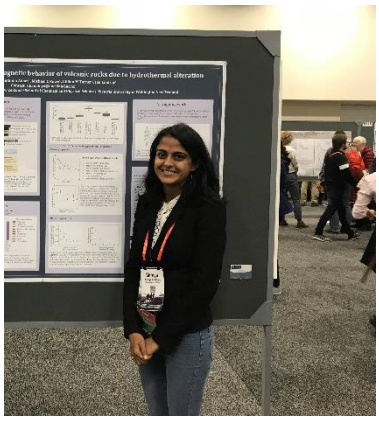
cheeses. “Lunch” extended into early afternoon, enough time to chat with lecturers, talk science with other attendees, or take a dip in the ocean at our own secluded beach, just a short walk from the institute; dinners were had at the various restaurants around Cargese, always filled with lively discussions of the days talks, among other things.

The title of the workshop, “Passive Imaging and Monitoring in Wave Physics,” brought together a broad collection of scientists who were able to converse over the study of wave physics. Whether the subject be extraterrestrial planets, the interior of our own, or that of the human body, we could all collectively bond over the measurements of wiggles. Lecture topics varied from seismic waves on the moon, to machine learning in the Earth Sciences, to medical imaging. It was refreshing to participate in discussions that ventured far outside my own field, but were still tangible within the scope of my research. My PhD, undertaken at the Victoria University of Wellington, involves imaging the subsurface using seismic waves and earthquake simulations. My poster was hung alongside others in the gardens outside the lecture room for the duration of the conference. During the evening poster sessions I was proud to explain my research, and the research of my colleagues in New Zealand, and to receive feedback from such a diverse and international audience of researchers.

The conference was attended by scientists from diverse international backgrounds, and was an ideal platform for making connections with future collaborators, while also sharing the work of New Zealand geosciences. I am grateful to the Geoscience Society of New Zealand for their contribution to my attendance through the 2019 Young Researcher Travel Grant, and I know that attending this workshop has shown to an international audience that New Zealand values the Earth sciences, and is playing a leading role in pushing the boundaries of cutting edge science.

Young Researcher Travel Grant Report

Shreya Kanakaya skan887@aucklanduni.ac.nz



In December 2019, I had an opportunity to attend the Fall meeting of the American Geophysical Union (AGU) in San Francisco, U.S.A. This opportunity was made possible partially by the Young Researcher Travel Grant from the Geoscience Society of New Zealand (GSNZ). Today, I'd like to share my AGU experience with fellow GSNZ student members and thank the donors for their continued support.

My first day was very overwhelming, with over 25000 attendees and various interesting sessions, early-career events, workshops all happening concurrently around multiple venues. I then narrowed down my list and attended the talks and posters of the session on *Volcano Seismology and Acoustics: Recent Advances in Understanding Volcanic Processes*. I presented a poster at this session to share our results so far on how hydrothermal alteration affects the elastic behaviour of volcanic rocks and in turn their seismic signatures. This was an incredible experience as I got to share my research and get feedback from a broad Earth and Space Science audience. I also attended some talks from the *Lab- Scale Seismology: Ultrasonic Characterization in Rock Mechanics* session which helped me learn how other researchers in rock physics that perform lab-scale studies are handling upscaling problems. In addition to these technical talks, I found the more general AGU Centennial discussion events on new perspectives and approaches towards research on volcanic hazards and fluids in the Earth very insightful. The cutting-edge research I learned about through these talks will certainly help shape my future research pathways.

For me, attending AGU, however, was more than just a technical research meeting. It was also about networking at the early career and section business meetings and attending career development workshops. To name a couple, I attended the *Establishing and Sustaining an Undergraduate Research Program* and *Navigating the NSF System* workshops. These workshops taught me ways to address the challenges and issues in conducting successful research with undergraduates, setting up a research laboratory and tips to writing successful NSF proposals. Being a student, the learnings from these workshops will assist me as I navigate through the academic career pathway. Lastly, I also attended some talks of general scientific interest not directly related to my research to broaden my knowledge. This included machine learning sessions and an engaging discussion led by former New York City mayor Michael Bloomberg and former California governor Jerry Brown on the future of climate action.

Attending the 2019 AGU Fall Meeting has been a remarkable opportunity to learn about the cutting-edge research being pursued in Earth and Space Sciences internationally and to share my research with fellow scientists. I'd like to thank the donors and GSNZ for providing me this opportunity to develop as a researcher.

Jim Ansell Geophysics Scholarship Report 2018

Shreya Kanakaya

Hydrothermal alteration processes change the physical and chemical properties of rocks in volcanic environments. These changes can mechanically weaken the volcanic edifice predisposing it to catastrophic collapses and even affect eruption dynamics by building up pressure within the subsurface, causing an increase in outgassing, or a decrease in outgassing if the alteration clogs permeable pathways.

But, how do these processes manifest themselves in geophysical data used to monitor and study the internal structure of volcanoes? The answer to this question is not straight forward as competing alteration processes like dissolution (which create new pores) and precipitation (which fill the pores with secondary minerals) often produce contrasting changes in the geophysical signatures of the rocks.

To address this challenge, here we aim to establish a link between measurable petrophysical properties of variably altered volcanic rocks (porosity, permeability, mineralogy) and their corresponding elastic, magnetic and electrical geophysical signatures. Forty-three samples comprising variably altered lava, tuff, and breccia from White Island (Whakaari) volcano and thirty-four samples of variably altered lava from Mt. Taranaki are being used as representative samples. Our initial measurements on White Island samples show that alteration mineral phases comprise of alunite, natroalunite, cristobalite, tridymite, and pyrite, which are representative of advanced argillic acid-sulfate alteration type. As expected, porosity mainly controls the rock's stiffness and thereby its representation in P-wave velocities. However, a decline in P-wave velocities of lava samples with increasing alteration is observed. This may be indicative of an increase in pore spaces due to dissolution that can weaken the volcanic rocks. Furthermore, our magnetic susceptibility data shows, that as the alteration products replace primary minerals, magnetite is destroyed. Thus, a highly altered lava sample (with magnetite destroyed) and tuff samples could be misidentified while interpreting magnetic susceptibility data.

Ongoing measurements of rock properties under pressure will provide further information on how hydrothermal alteration controls the physical and chemical properties of volcanic rocks and their corresponding geophysical signatures at depth. Overall, our laboratory data will semiquantitatively help geophysical data interpretation in hydrothermally active volcanoes. Planned measurements of geomechanical strength of the variably altered samples will further guide volcano slope-stability models at White Island and Mt. Taranaki.

Young Researcher Travel Grant Report

Nature and Potential Origins of the Low-Rate Tectonics of The Hauraki Rift and North-Western New Zealand: A Geophysical Investigation.

Recently completed PhD, the University of Auckland
Robert C. Pickle

Supervisors: Jennifer D. Eccles (UoA), Sigrun Hreinsdottir (GNS), Julie Rowland (UoA)

Robert, a California native, joined the University of Auckland from Brown University and after submitting joined the Australian National University where he has been dodging bushfires and getting heavily involved in field seismology.

Little is known about the nature or origin of tectonic activity throughout north-western New Zealand, beyond that it is a stable environment (velocities ~1 mm/yr relative to Australia) and home to the Hauraki Rift, N-S trending, 250+ km long and 25 km wide on-shore/off-shore continental rift 40 km east of Auckland City and oblique to the Hikurangi subduction margin. A three-year 40+ station campaign GNSS geodetic survey was done incorporating previously unused historic data to constrain the crustal motion throughout the north-western North Island and the Hauraki Rift. A screw dislocation rift model incorporating this data derived estimates for the far-field widening rate and mechanical thickness of the Hauraki Rift to be 1.15 +/- 0.3 mm/yr and 17.5 +/- 7.7 km respectively. Relative to a fixed Australian Plate reference frame, the results generally showed S-SE velocities east of the Hauraki Rift and W-SW velocities west of the rift with increasing magnitudes to the south towards the plate boundary.

North of Auckland (~37°S) sites maintained consistent W-SW velocity magnitudes throughout, over 700 km from the plate boundary. This indicates that northernmost New Zealand may not be stable relative to the Australian Plate. Analysis of ground and satellite-based gravity anomalies in conjunction with the observation of geodetic velocity discrepancies were used to infer the location and motion of several faults not currently considered active, including N-S trending faults parallel to the west coast of New Zealand near Auckland. The observation of similar cGNSS geodetic velocities on both Norfolk Island and New Caledonia similar to those observed throughout Northland NZ may be evidence that the eastern portion of the Australian tectonic plate (east of Lord Howe Island) is mechanically separated. An Oligocene-Miocene tectonic model detailing the westward collision of the Loyalty-Three Kings arc and subsequent opening of the Norfolk Basin is presented. This model proposes that the relative motion between the Australian and "East Australian" sub-plate may be accommodated by a continuous ~2000 km lineament of weakened crust, low Bouguer Anomalies, and concentrated volcanism. This feature may extend from New Caledonia along the western Norfolk Ridge through the Reinga Basin and along the western coast of the North Island of New Zealand.

Young Researcher Travel Grant Report

Defining Volcanic Regimes at Mt. Taranaki, New Zealand

Geoffrey A. Lerner (UoA)
Supervisors: Shane Cronin (UoA), Gillian Turner (VUW)

Active stratovolcanoes commonly undergo periods with heightened rates of eruption. These often show a particular, narrow range in eruption characteristics and scales and thus may be categorized as “regimes” of volcanic activity. Over the past ~1000 years, the Maero Eruptive Period (MEP) at Mt Taranaki produced a series of episodes involving lava dome growth and collapse from its summit crater. This millennial record provides an excellent test for the concept of volcanic regimes in hazard estimation. Deposits from this period were studied in detail to provide a precise record and a new age model. The MEP consists of 11 temporally distinct eruption episodes, with a restricted range of style and magnitude compared to earlier eruptions at Mt Taranaki. MEP eruptions included single dome growth/collapse events, repeated dome growth/collapse sequences, directed-blast eruptions, and two sub-Plinian eruptions. Paleomagnetic methods were used to analyse the youngest summit dome and deposits from its collapse, producing a new age of 1780-1800 AD for Taranaki’s latest eruption. Detailed mapping and age determinations showed that the repose periods during the MEP were between <10 yrs to ~150 years, with the 200 year gap from the latest eruption being the longest yet. These methods were also used to show that the primary hazard during the MEP resulted from block-and-ash flows deposited on the northwest flanks of the volcano.

These domes were still hot during collapse. Analysis of deposits of an older larger eruption in the same area revealed it to be part of one of the largest-known eruptions from Taranaki at 11,500 years BP, and far larger than the events of the MEP. This research showed for the first time that large scale eruptions at Taranaki may produce pyroclastic flow hazards out to 24 km from the volcano, around 9 km further than they have ever been recognized before. The methods profiled here and the concept of volcanic regimes provided a more robust evaluation of the timing and hazards associated with long periods of dome growth at Taranaki, with results applicable to similar stratovolcanoes around the world.

What’s next: In late 2019, Geoff will be starting a position as a Research Fellow at the Earth Observatory of Singapore.

NZ SAGE Award recipient 2019

Laura Hughes hugs.l.1997@gmail.com

I am Laura, a Masters of Science student at Victoria University of Wellington and I received the SAGE award for 2019. Summer of Applied Geophysical Experience (SAGE) is a four-week program which is run in New Mexico, USA. 2019 was the first of a five-year plan to conduct geophysical surveys in Valles Caldera, and involved several different surveys being run across the caldera.
The first two weeks of the course involved fieldwork collecting a range of different data sets, that spanned across the different corners of the caldera. Near-surface surveys included near-surface seismic lines, ground penetrating radar, resistivity and magnetics surveys. These were completed to investigate the fens, which is where water is brought to the near surface, creating a mash land. Deeper penetrating surveys were also undertaken including, active- and passive-source seismic, distributed temperature sensing (DTS), magnetotellurics (MT), transient electromagnetics (TEM), and gravity. These were completed to understand the deeper structure of the caldera and to find locations of interest to run targeted surveys over the next four years. The remaining two weeks involved a series of lectures, learning about the theory behind the surveys that we had just completed and how to analyse the data. Analyse and comparison of the datasets was completed in teams in order to unearth the underlying structure of Valles Caldera.
SAGE was not just about all work and no play! Fieldtrips were run to investigate the wider New Mexico region, and see how Valles Caldera was connected to the wider geological setting. It was the most amazing four weeks with an incredible group of people from all round the world. The friendships made at SAGE are lifelong, as you bond over the highs and lows of data collection and analysis. SAGE also allows you to find out what you are passionate about and where you want to head, with further study or as a career.
Thank you to GNS Science, Earthquake Commission - EQC and Geoscience Society of New Zealand for their support towards this award which enabled me to attend this unforgettable experience!

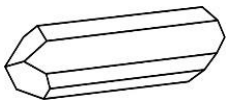


Snippet from The New Zealand Gazette and Wellington Spectator Vol.1. (8), May 30, 1840

severe shaking of their houses. Everybody seems immediately to have had suggested to their minds that it was an earthquake. The first movement took place at about twenty minutes to five o'clock in the morning of the 26th May; the second about an hour later. The following night their was another slight shock, and since then there have been two more shocks, which have, however, been so slight, as to have been felt by a few. The first shock was by far the severest and longest in duration;—it was not, however, the cause of any mischief, though it alarmed some of the inhabitants. It appears to have been nearly equally felt all round Port Nicholson.

GEOSCIENCE QUIZ 30

by Aenigmatite



Arghhhh! There's a lot of talk of global disasters these days. As we await the next one, test your knowledge of past disasters. Match these ten events to their approximate ages.

Event	Age (million years)
Formation of Solar System (it all went downhill from here)	0.008
First mass extinction event: Ordovician-Silurian boundary	0.075
Hikurangi Plateau-Chatham Rise collision	5.6
Holocene Climatic Optimum	56
Marinoan Event: snowball Earth glaciation	93
Messinian Crisis: dessication of the Mediterranean Sea	105
Nectarian: Late Heavy Bombardment of planets by asteroids	444
Oceanic Anoxic Event 2	640
Paleocene-Eocene Thermal Maximum	3900
Toba Supereruption	4566

Answers: *In age order from youngest to oldest: Climatic Optimum < Toba < Messinian < PETM < OAE2 < Hikurangi-Chatham collision < First mass extinction < Marinoan < Nectarian < Solar System*

TEST YOURSELF

From the independent British charity education authority have a look at what students had to answer in 2018. WJEC CBAC Ltd. is a company limited by guarantee, registered in England and Wales (no. 3150875) and is a registered charity (no. 1073332). A subsidiary company, WJEC CBAC Services Limited, provides specialist printing and publication services. Eduqas is a registered trademark of WJEC CBAC Ltd.

https://www.wjec.co.uk/qualifications/qualification-resources.html?subject=Geology&level=GCSE&pastpaper=true

CONFERENCES and BOOK REVIEWS

The triennial International Conference on Paleoceanography was recently held at the University of New South Wales in Sydney. This is the first time that this conference has been held in the Southern Hemisphere since the conference was first held in Zurich in 1983. ICP13 was opened with a "Welcome to country" by local aboriginal elder Dr Peter McKenzie and an introduction by the UNSW marine biologist and dean of science Professor Emma Johnston.
The ICP conference has a unique format with only 24 invited keynote talks from a mix of early career to experienced researchers, and 4 plenary talks from high profile researchers in paleoceanography or adjacent disciplines (e.g. ice core research). All other delegates present their work in the lively poster sessions. The conference themes for ICP13 were: Proxy development, new models and statistical tools; Geobiology and new frontiers paleoclimate changes with biology and evolution; Carbon climate feedbacks across time scales; Ocean circulation and system dynamics; Role of Southern Hemisphere processes; Ice sheet/ocean interactions; drivers and impacts. Under proxy development we heard talks about clumped isotopes (Nele Meckler), GDGTs (Susanne Fietz), oxygen isotopes in gypsum (Yama Dixit), and using proxies to look at climate variability (Thomas Laepple). In the geobiology space we had talks about deep sea coral mounds (Jurgen Titschack), ostracod evolution (Moriaki Yasuhara) and aDNA from deep sea cores (Linda Armbrecht). In Carbon-climate feedbacks theme talks covered modelling possible variations in the biological Redfield Ratio (Katsumi Matsumoto), Cenozoic hyperthermal events (Lucas Lourens) and Cenozoic polar amplification (Matt Huber) and how changes in calcification can alter the carbon cycle (Gert Jan Reichart). Ocean circulation and dynamics was explored by looking at changes in the El Nino in the Indian Ocean (Kaustubh Thirumalai), changes in the north Pacific during the melting of the Laurentide ice sheet (Summer Praetorius), changes in hydrology and vegetation in the Sahara

and Sahel regions (Francesco Pausata), as well as using Neodymium isotopes to understand circulation changes in the Atlantic across the Mid-Pleistocene Transition (Kazuyo Tachikawa).

The role of the Southern Hemisphere was reconnoitred through presentations on the influence of the Southern Ocean going in to the glaciation (Karen Kohfeld), Antarctic sea ice changes through the late Quaternary (Xavier Crosta), a thorough multi-model review of the impact of millennial-scale changes in oceanic circulation on atmospheric CO2 (Julia Gottschalk), and on the use of annually banded corals from the Great Barrier Reef and around the world to understand variability in climate over the last glacial cycle (Thomas Felis). Results from recent coring on the Great Barrier Reef were also used to look at past sea level changes (Jody Webster) and other talks looked at sea level-ice sheet-solid earth interactions (Natalya Gomez), a new Pliocene sea level curve (Tim Naish) and some modelling work looking at differences between glacials (Ed Gasson) in the ice-sheet-ocean interactions theme.
The plenary talks covered a range of different topics with Ed Brook talking about evidence for rapid changes in CO2 in ice cores during millennial scale events. Andy Ridgwell showed some new results of linking climate models with ecological models to look at how changes in ecosystems influence the global carbon cycle. Axel Timmermann showed some new modelling results investigating how past climate change influenced human migration out of Africa and interactions between Neanderthals and Homo sapiens as they spread north into Europe. Kim Cobb (via remote talk) discussed El Nino from coral records from the central Pacific and how and why it varied in the past. She also spent some of her talk about current and future climate change and everyone aiming to reduce their carbon footprint, especially by #flyingless. Her talk is available on youtube. There were a wide range of poster presentations including 2 on automated recognition and picking of forams, which could be a big time saver for many of us in the future. Thus the talks and posters covered a wide range of paleoceanographic archives from nanos, tropical and deep sea corals, to ice cores, lots of different geochemical proxies, and age scales covering the Cenozoic through to the last 2K and into the future, including climate and ecological modelling on every different scale…

There were other talks on recent International Ocean Discovery Program expeditions to the west coast of Australia (Stephen Gallagher) and the latest results from GEOTRACES (Bob Anderson). There was a special tribute on the achievements of Professor Wally Broecker, who died earlier this year, and his 7 decades of scientific research in ocean geochemistry and paleoceanography (Jerry McManus). Wally made some major contributions to the field including coining the ideas and phrases of “Global Warming”, “Great Ocean Conveyor Belt”, “Abrupt climate change”, and “Ocean Acidification”. He was in many ways one of the founders of the field of paleoceanography.
On the last day of the conference there was a book launch at lunch time of Elizabeth Truswell’s new book “In Memory of Ice” published by ANU press, on her participation in the Deep Sea Drilling Program Leg 28 expedition to Antarctica in 1973. Liz is a palynologist interested in past vegetation changes in

Antarctica during the Cenozoic and was one of the first women to sail as a scientist on the DSDP (book review to come).
While the science schedule was busy, with additional side workshops and meetings prior and during the conference, the social schedule was equally eventful. At the ice breaker there was aboriginal singing, dancing and didgeridoo, with some audience participation. The conference dinner, which involved a cruise on Sydney Harbour at Sunset was one of the highlights of the social program. The other highlight of every ICP is the Paleomusicology concert where paleoceanographers entertain us with their musical talents and sing and play a range of different music ranging from singalong songs to improvised piano pieces. The concert also included a science parody "Cover of the Science Mag" about getting your work published in Science by Martin Kölling (cover of Dr. Hook's "Cover of the Rolling Stone" originally written by Shel Siverstein, 1972). (You can check it out on Youtube https://youtu.be/-Ux3-a9RE1Q). There was also a field trip to Wombeyan Caves and walks along the Sydney coast, tours of the opera house and pubs in the Rocks, not to mention a surf lesson at Bondi Beach. It was a very busy week for most of us!
ICP13 was a great success with >400 participants from all over the world attending and sharing their latest research in paleoceanography. It was a fantastic opportunity to catch up with local and international collaborators and develop new future collaborations. By holding the conference in Australia it was a great way to bring the focus of paleoceanography to the Southern Hemisphere. It was motivating to see so many of the Australian and New Zealand researchers and students at the conference showcasing the great work that is being undertaken in this part of the world. Congratulations to the 2 New Zealand PhD students Greer Gilmer (University of Otago) and Nick Hitt (Victoria University, Wellington) who got poster awards.
More photos and comments on the ICP13 facebook page and twitter at #ICP13

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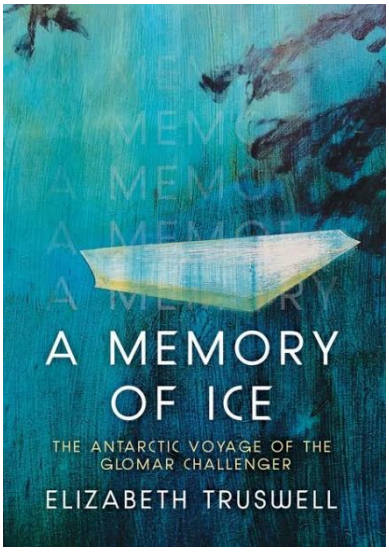
BOOK REVIEW



"A Memory of Ice"

Elizabeth Truswell, ANU press 2019
DOI: http://doi.org/10.22459/MI.2019

Helen Bostok

"During the voyage, in the best tradition of Antarctic explorers, I kept a diary. These many years later it is tattered and barely legible. It records the daily activity associated with drilling, the anticipation of steaming to new sites - to unsignposted spots in a blank grey ocean - the nervous waiting for cores to come up, the frenzy of activity when they do, the late night discussions around the science, and always the weather and the wildlife."

This book is the story of Antarctic palynologist Elizabeth Truswell's experience participating on the Deep Sea Drilling Project (DSDP) leg 28 to Antarctica. The book weaves a narrative of the leg 28 expedition taken from Liz's diaries and memory, with the history of voyages of scientific exploration from the James Cook and HMS Challenger expedition to the early expeditions to Antarctica by the French, US and British looking for the southern landmass, as well as fame and national pride. Liz was one of several Australians and new Zealanders that were part of the expedition including Peter Barrett (sedimentologist), Peter Webb (foraminifera), Derek Burns (nannofossil). The book was launched at the International Conference on paleoceanography (ICP) at UNSW in Sydney in early September 2019, introduced by Leanne Armand from ANZIC International Ocean Discovery Program (IODP) office, a short movie from the expedition made by Peter Barrett (who was also present at the book launch) and some highlights from the recent Ross Sea expedition by co-chief Rob McKay and excerpts from the book read by Liz.

As well as trying to explain how and why we do deep sea coring for a general audience, the book centres around Liz's life long quest in trying to understand the history of Antarctica's vegetation. This story started with the early work of New Zealand's Lucy Cranwell, a pioneer of palynology, who found Nothofagus (beech) pollen from boulders on Seymour island and the Ross Sea. This pollen evidence suggested there had been extensive forests on Antarctica. Leg 28 contributed significantly to this story, specifically DSDP site 270. The book brings together the story of Antarcticas vegetation and glacial history from leg 28 and a number of subsequent DSDP, ODP and IODP expeditions to
Prydz Bay, Wilkes land, Ross Sea and theWeddell Sea over the last 50 years of deeps sea drilling.
Prior to leg 28 the ice sheets of Antarctica were assumed to be the same age as those in the northern hemisphere, approx 3 Ma, but this expedition pushed the onset of glaciation in Antarctica back to about 25 Ma. More recent work has shown this onset of glaciation was even earlier and is thought to be the Eocene/Oligocene boundary (34 Ma), although plants remained present and relatively diverse up to the mid Miocene, suggesting that glaciation was gradual and the extent of glaciation varied spatially. Few plants survived the Pliocene through to today.

Liz is a trailblazer being one of the first women scientists to go on these early ocean drilling expeditions. She was a great role model for me doing my PhD in a department with few senior females. While she is clearly more comfortable writing about the history, there are a few comments that provide some personal insight into her experiences on that voyage, with comments about colleague's strong personalities. I look forward to sitting down with her over a glass of wine and finding out more about what really went on during the expedition.

BOOK REVIEW
"Volcanoes of Auckland: A Field Guide"
Bruce W. Hayward, 2019. Auckland University Press, Auckland, New Zealand

by Elaine Smid e.smid@auckland.ac.nz

He's done it again. Bruce Hayward's new book, *Volcanoes of Auckland: A Field Guide,* has immediately become a hot commodity, especially in some circles, as shown by the excitement at the most recent DEtermining VOlcanic Risk in Auckland (DEVORA) Research Forum in November 2019, where the author sold and signed copies of his new book, and took photos with his fans. The interest is logical; Bruce's books describing the natural world are known to be meticulously researched, easily understood by those of all ages and levels of expertise, and beautifully illustrated. This new book is no exception.

Dr Bruce W Hayward, left, author of 'Volcanoes of Auckland: A Field Guide,' poses with Nathan Collins, right, a proud owner of a copy of the new book, at the DEVORA Research Forum in November 2019. Photo by Siân Camp.

As the title implies, the new book is meant as a field guide to the Auckland Volcanic Field (AVF), New Zealand, as evidenced by its smaller size ("designed for the backpack") and availability in flexibond and ebook formats. The book starts with an introduction to the AVF, which is needed for many. Most of the city's visitors and residents are intrigued by Auckland's volcanoes, but do not necessarily understand their origins, likely because the volcanoes in the AVF are not your standard-issue fire-mountains. Rather than having a central cone built up over successive eruptions, each of the 53 recognised and named volcanoes in Auckland erupted over a relatively short period of time before dying, leaving small hills and craters to dot the city's landscape. While these hills and craters are extinct, the volcanic field itself is considered dormant, and could produce the city's 54th volcano at any time, a cause of concern for many. Over the first 44 pages of the book, Bruce summarises knowledge about this phenomenon over four sections: How the volcanoes work; How old is each volcano?; Auckland's next eruption?; and Human interaction with Auckland volcanoes.

This first section in particular benefits from the large amount of scientific research that has taken place over the eight years since the publication of Bruce (and colleagues') earlier book, *Volcanoes of Auckland: The Essential Guide* (Hayward, Murdoch, & Maitland, 2011). One of the most important updates includes the ages of each volcano, and the discovery that they sometimes erupt in pairs. Until the most recent decade, few of the 53 volcanoes were reliably

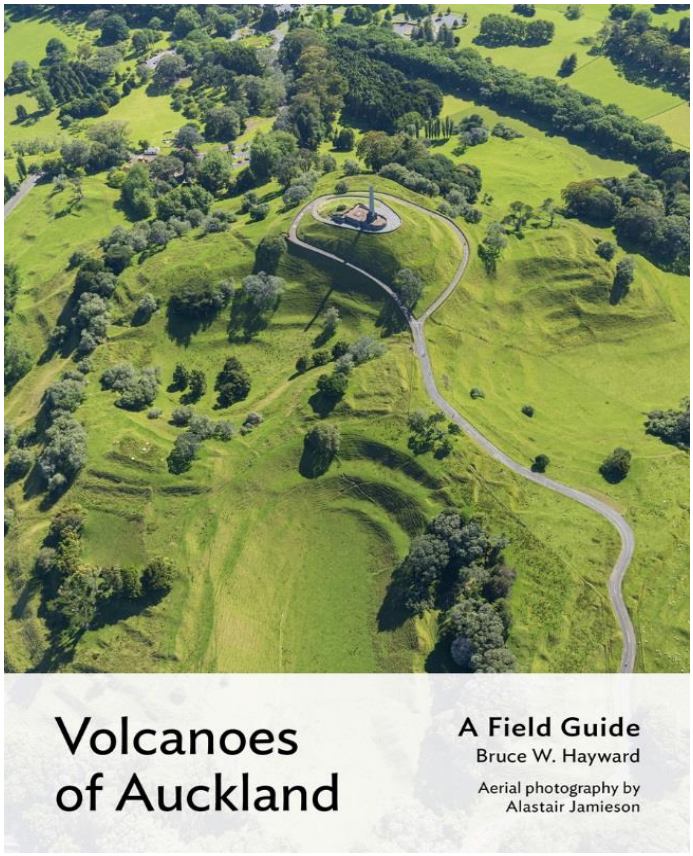
dated; now, with the advent of new techniques, which are explained in the text, many of the eruptions can be placed in age order. Another welcome addition is the two-page spread describing the newly formed (2014) Tūpuna Maunga Authority, which reflects the increasing recognition of the significant cultural and spiritual ties of the Māori people to Auckland's maunga, a topic that is given special attention throughout the book.

The next, and largest, portion of the book (pgs. 46 – 309) is dedicated to describing what is known about each volcanic centre. This includes three 'new' craters, whose discovery (or re-discovery) was led by the author himself. Each volcanic centre is given a number (1- 53) and sorted into 4 groups according to geographical location. Over 2-12 pages, each centre's unique geological, biological, and human story is summarised, with useful instructions and detailed maps to points of interest, with arrows indicating access points. This last detail is particularly nice for those exploring the volcanoes, though the easily-spotted 'X's marking significant geological outcrops at each centre (found in the earlier book) are missed. These sections benefit from the most recent research as well--in particular, the sections on Rangitoto and Ōrākei Basin are updated with results from scientific studies on the deposits, obtained from recent drill cores.

As Bruce explains in the book, the city grew up, around, and in many cases, *because* of its volcanic features. It is fitting, then, that the main portion of the text ends with a delightful section any city-dwelling geologist and/or historian will love: a walk around Auckland's historic buildings built with its native basalt. The book concludes with a glossary and index that ensure that the reader will always be able to find and understand what they are looking for, and looking at, as well as acknowledgements and selected bibliography that testify to the vast body of scientific knowledge and sources the author tapped into to write this book.

The book complements its rich scientific and historic information with visual aids, and this is where it really shines. With over 400 images, ~80% of them new, the book is generously, appropriately, and gorgeously illustrated, thanks to the skills of aerial photographer Alastair Jamieson, the inclusion of numerous original educational scientific diagrams and feature maps, and Bruce's careful selections from extensive photographic and historical archives. The images provide informative and pleasing content to enjoy with or without the text. The historical photographs and drawings in particular must have taken many hours of painstaking searches through many archives to find and curate. They bring a particularly poignant depth to the book, as many of Auckland's volcanic features have been altered by human activity. The images illustrating the volcanoes' original or past forms inspire the reader to imagine what Auckland would be like if they were still intact, and evoke a sadness over what has been lost as well as an appreciation of and a desire to preserve what is left of Auckland's unique volcanic heritage.

The trade-off for the comprehensiveness of the book is its heft and thickness (344 p.) compared to some other field guides. While this reviewer has carried the earlier, larger book during many AVF fieldwork stints, and will happily carry this new book in the future, the average interested layperson may not want to do the same. On the other hand, the book's value as a scientific, field, and historical reference would be greatly diminished if it were shortened to the



Volcanoes of Auckland: A Field Guide, by Bruce W Hayward, with aerial photography by Alastair Jamieson, ISBN: 9781869409012, was published by Auckland University Press on 7 November 2019. It is available in flexibind paperback and ebook form for $49.99 NZD at https://aucklanduniversitypress.co.nz/volcanoes-of-auckland-a-field-guide/

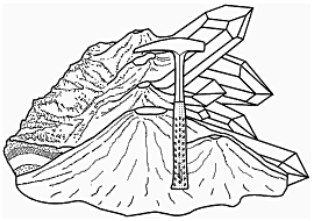
average pocket field guide length; additionally, the availability of the book in digital (ebook) format goes a long way to alleviate this potential negative.

Many reading *Geocene* have had the privilege of being led around Auckland's volcanic features by Bruce; this book puts that experience right in your hands (and backpack!). In *Volcanoes of Auckland: A Field Guide*, Bruce translates much of the available science and historical knowledge about the AVF into language accessible by laypeople, scientists, and everyone in-between, an extremely difficult line to straddle indeed. The scientific and human story of each of Auckland's volcanoes is told via text and stunning photography, historical photographs and drawings, and provides thorough details and maps to help others explore Auckland's unique volcanic features for themselves, with Bruce as field guide *in abstentia*. No detail is left unexplained; even the copyright page contains a thorough description of the cover images.

A joy to flip through and skim as well as for a deep dive, *Volcanoes of Auckland: A Field Guide,* is well worth the retail cost of $49.99 NZD and is highly recommended for anyone with even a passing interest in Auckland's volcanoes. It is an appropriate gift for school aged children, tourists, teachers, Auckland residents, as well as the scientists and stakeholders who study or manage the risk from the AVF for a living. As with Bruce's previous AVF book, this reviewer will keep the new book readily available for quick reference, fieldwork planning, and for those times when the whim to go on an adventure strikes.

GEOCENE MAGAZINE UPDATE

Jill Kenny Geocene Editor jill.kenny@xtra.co



Geocene is a periodic publication of GeoClub - a section of the Auckland branch of the Geoscience Society of New Zealand. It is an outlet for members and others to describe field trips and record new findings and observations. It is crammed with valuable information that is not available elsewhere.

Geocene is not peer-reviewed but has been lightly edited from 2006 to mid 2014 by Hugh Grenfell and Helen Holzer and since then by Jill Kenny. Geocene issues are in .pdf format and include coloured photos and maps. They are available online by visiting the GSNZ website then using the link 'Branches' then 'Auckland' then 'Geocene Magazine'.

An index of all Geocene articles is also available in this site.

Since the Geocene Magazine article in GSNZ Newsletter 23, November 2017, Geocene numbers 16 – 21 have been added to the GSNZ website under the Auckland Branch link (http://www.gsnz.org.nz/information/auckland-i-46.html#mag).

The following topics are included:

Geocene 16:

- First macrofossil found in the Caples Terrane of the North Island – a Permian sea lily
- Elevation of lava flow quench zone confirms tectonic stability of Norfolk Island
- Book Review – 'When the Earth Roars: Lessons from the History of Earthquakes in Japan' by Gregory Smits
- Manganese mines in the Hunua District
- Cemetery Crater revealed
- Fossil pharyngeal tooth plate from an Early Miocene fish (? Labridae), Waiheke Island

Geocene 17:

- Bryozoans on kauri gum and amber
- The naming, origin and significance of Wellington's "K-surface"
- *Notorynchus primigenius* (Agassiz, 1843), an extinct seven-gilled shark, from the Early Miocene of Pakurangi Point, Kaipara Harbour, Northland
- Preliminary geological survey of Dog Island, Foveaux Strait
- Past sea levels reflected in coastal landforms on Great Barrier Island
- Smoke and mirrors – Wellington Australian ANZAC Memorial

Geocene 18:

- Current-aligned Middle Jurassic belemnite guards from New Caledonia
- Orientation of turret shells on a beach, Great Barrier Island
- Anawhata pillow lava and glassy breccia
- The use of geology (mineralogy and geochemistry) in identifying the site of migratory dispersal for one group or groups of southern Maori navigators
- Beachrock, Dravuni Island, Fiji
- Devonport's Mt Cambria revealed and removed
- *Aetomylaeus*, an eagle ray genus new to the Oligocene of New Zealand

Geocene 19:

- An amateur's rediscovery and study of tākou (red ochre) pits at Tākou, Bay of Islands, Northland
- How was the Cleary Road hill built on the crest of Panmure Basin tuff ring?
- Pseudo-reticulite (basalt foam) in the Auckland Volcanic Field
- A walk on a beach, Mangawhai Heads, Part 2
- An explanation for the origin of triangular tuff ring remnants at Puketutu Volcano

Geocene 20:

- *Crateropora* n. sp. – a conspicuous encrusting bryozoan from the Early Miocene Waitiiti Formation of Taita Stream, South Hokianga, New Zealand
- Whangateau Harbour (Omaha) during the Last Interglacial (125,000 years ago)
- The Aniseed Valley copper smelters and some ophiolite geology
- An enigmatic seal fossil from Kai Iwi Beach
- Origin of the black sandstone at One Tree Point, Whangarei Harbour

Geocene 21:

This issue was timed to coincide with Bruce Hayward's publication of his latest book – "Volcanoes of New Zealand: A Field Guide" with aerial photography by Alistair Jamieson (published by Auckland University Press).

- Basis for modified ages of Auckland volcanoes in "Volcanoes of Auckland: A Field Guide, 2019"
- The scoria cones of Puketona/Puketutu Volcano, Bay of Islands
- Orewa deep drillhole

Contributions for Geocene 22, describing field trips and recording new findings and observations, would be welcomed from Newsletter readers. Please send these to Jill Kenny (jill.kenny@xtra.co.nz).

Bill (C E) Ingham
(1926-2019)

Fred Davey F.Davey@gns.cri.nz

Bill (C E) Ingham, known through his working life as “Bill”, was born in July 1926. He joined the Public Service as a surveying cadet straight from school, with NZ Hydro-electric Department, and subsequently he transferred to the DSIR geophysical survey group at NZ Geological Survey as an assistant geophysicist working on Waikato Power scheme. He was awarded a BSc from Victoria University of Wellington in 1951. The same year, when Geophysics Division was set up in DSIR, Bill transferred with the geophysical survey group to the new Division and was based normally in Wellington. He worked on seismic, magnetic and gravity surveys in North and South Islands, and spent a year based at Ngaruwahia working on coal resources in the Huntly region.

As an experienced field geophysicist with Geophysics Division, DSIR, Bill was an obvious candidate for the NZ IGY (International Geophysical Year) Antarctic Expedition under Dr Trevor Hatherton. From late 1956 to early 1958 Bill was the New Zealand IGY science leader at Hallett Station, a joint US/NZ IGY base. His main responsibility was for the seismology, magnetics and aurora observatory programs, with John Humphries undertaking ionospheric measurements and Mike Langevad as electronics support. Observatory programs were new to Bill as were the instruments which were provided by the US. However, after some unusual problems, all instruments were set up and operating in good time for the IGY observing period that started on 1 July 1957. The 24 hour a day aurora observation project was demanding. Each of the three NZers took an 8 hr shift a day in addition to their other IGY work. Additional activities Bill carried out for other investigators included insects sampling, bird banding (skua gulls), penguin foraging observations, and geology sampling including finding fossil penguins. The rocks and fossils found were eventually passed onto the NZ Geological Survey team at end of 1957. Bill also took his golf clubs down with him, but only played a few holes as the “green” (the only one) was two miles away. The results of all the NZ IGY Antarctic measurements were documented in a DSIR Bulletin by Trevor Hatherton*.

On returning from Antarctica in 1958, Bill was transferred to The Chateau for a year to set up the Chateau volcanology observatory and its instrumentation. He then returned to Wellington and started on a series of site investigations using seismic refraction methods, working closely with MoW and NZGS for many years, and gaining a reputation for the detailed interpretation of complex seismic refraction data. Bill was always keen to find the best interpretation of the data he had collected. He would continually seek to improve his interpretation, investigating alternatives where there was ambiguity, and searching for new data that might get rid of some ambiguity. These investigations of subsurface

geology were carried out for the Waikato River Hydro Dams, Tongariro Power Project, Upper and Lower Waitaki Power Schemes and Clyde Dam project. Bill was very highly regarded by engineering geologists (eg Brian Patterson, Les Oborn, Bruce Riddolls) and Ministry of Works Power Planning and Project Engineers involved in the Tongariro development and other civil engineering projects. Smaller projects included the Wellington tunnel (including making measurements to deduce Young's Moduli for rocks in the pilot tunnel beneath the Terrace), and the prospective Buller power scheme. Bill also contributed to micro-seismicity and iron sands studies. Trevor Hatherton noted over 100 engineering projects carried out by Geophysics Division up to 1976, of which Bill would have done most.

His formal publications were few (14) but included a *Nature* paper ** co-authored with Frank Evison on the crustal thickness of Antarctica – the first such measurement. However, he had numerous short reports and letters of results of his seismic investigations for the MoW and other clients. Bill retired at age of 60 (compulsory) on 5 September 1986 after 42 years and 3 months and 14 days service.

* Hatherton, T. *New Zealand IGY Antarctic Expeditions, Scott Base and Hallett Station*, Wellington: New Zealand Government Printer, 1961 (NZ DSIR Bull. 140). 132 pp.

** Evison, F.F.; Ingham, C.E.; Orr, R.H 1959 Thickness of the earth's crust in Antarctica. *Nature, 183(4657):* 306-308.

M Broadbent provided some material for this note.

(Ed. Notes below are taken from Antarctic: A news bulletin. NZ Antarctic Society. Vol.1 (3), September 1956. p57).

> ***Mr. C. E. Ingham, (29**), leader of the New Zealand component, will be responsible for work on aurora, in geomagnetism and in seismology. Born at Petone and educated at the local Technical College, Mr. Ingham joined the State Hydro Department in 1943 and the D.S.LR. two years later. He graduated B.Sc. at VictorIa UniversIty College in 1951. He is attached to the Geophysics Divi· sion of the D.S.I.R.*

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Jean Gyles
(1925 -2019)

Hamish Campbell
Convenor, Palaeontology Special Interest Group

Jean Gyles, outside the Victoria and Albert Museum, London; Photo: Natalie Gyles (30 June 2010)

Welsh girl, graduate of Bath (England), New Zealand immigrant, wife of a Kiwi, Wellington teacher, Kiwi mother, rock-hound, ammonite hunter, jeweller, quilter, embroiderer, traveller, grand-mother.

It is appropriate that GSNZ acknowledge the passing of Jean Gyles in Wellington on the 1st of April 2019. She is the person who discovered the Giant Ammonite on a steeply-cliffed road-cutting near Taharoa, south of Kawhia Harbour, North Island. The Giant Ammonite must rate as one of the most famous fossils ever found in New Zealand and as far as I am aware it is still regarded as the world's largest Jurassic ammonite (NB there are larger ammonites of younger Cretaceous age). It is part of the National Palaeontology Collections administered by GNS Science but is currently on loan to Te Papa. It is on public display at Te Papa within the 'Te Taiao Nature' exhibition which opened in May 2019, but for much of the first 20 years of Te Papa's existence (1998-2018), it stood on its own in splendid minimalist isolation near the entrance of the original 'Awesome Forces' and 'Mountains to Sea' natural history galleries. It will have been seen and admired by more than 25 million visitors.

In my capacity as 'GNS Science geologist at Te Papa' (1998-2019), I had the good fortune to get to know Jean as well as some of her family, especially her son Roger and his wife Robyn. The following thoughts result from discussions with Roger on 2 December 2019 about his famous mother and needless to say I had GSNZ in mind with the obvious questions: who was Jean Gyles, where did she come from, and what made her tick?

Jean was born Mary Jean Davies on 25 January 1925 in Tredegar, Monmouthshire, Wales. Her parents were Elizabeth Margery Williams (1897 – 1976) and Thomas Clifford Davies (1897 – 1945), and her father was an

accountant with a coal-mining company. The family moved to Newport, also in Monmouthshire, while Jean was just a baby, and she was raised there as the third of four daughters. As a young woman, she attended the University of Bath and graduated in Home Science. It was while here in Bath that she met her future husband, New Zealander James (Jim) Reginald Gyles (1923-1988), who was based nearby as a trainee pilot at an RAF airbase for bomber squadrons. WW2 ended, Jim was returned to NZ and he 'retrained' as an accountant. Jean followed Jim a year later arriving in Wellington on 30 November 1946. For several years Jean taught Home Science at Wellington Technical College (which in 1963 split into Wellington High School and the Wellington Polytechnic). And then her three children 'arrived': Roger in 1948, Martin in 1954 and Hilary in 1960. The family initially rented in Oriental Bay but soon moved to their own house in Khandallah. With the children growing up, Jean forged a close friendship with fellow mother Christine Angwin and together they became keen members of Forest & Bird. One thing led to another, and not least an interest in the substrate: rocks, minerals and fossils. They joined the local Wellington Rock and Mineral Club based in Tonks Avenue and from this sprang a thirst for field excursions. 'Night' classes and 'extension courses' offered just such possibilities, thanks to geology and palaeontology popular 'public' communicators such as Ian Speden and Graeme Stevens of the New Zealand Geological Survey (which was morphed into GNS Science in 1992).

Come the early 1970's, Jean was back in the work force as a "contract pricing clerk" at Jenkins and Mack which later became Zip (Plumbing) and this job, unlike teaching, enabled 'free weekends': time to go places. It was on one such trip that she found the Giant Ammonite in 1976, just a matter of days after attending a talk by Graeme Stevens on ammonites. So, it was Graeme whom Jean naturally turned to with news of her discovery and it was he who subsequently organised the laborious extraction, preparation, scientific research, description and interpretation of the fossil, naming it *Lytoceras taharoaense* in 1979. For an account of its discovery see Stevens (1978: *GSNZ Newsletter 45*: 3-5).
This fossil has had a stellar 'career' as one of New Zealand's most visited natural 'icons'. As such, it has served as a major Wellington-based attraction within the tourism industry, which is quite possibly the most important driver within the New Zealand economy. It could be said that Jean's 'discovery', thanks to meaningful chance and careful observation, has done more than most in supporting this burgeoning multi-billion-dollar business for New Zealand Incorporated. And the earth science world, most notably in the form of Graeme Stevens, has added huge value to the relevance and significance of the Giant Ammonite.

In Roger's words, his mother became more and more absorbed in the world of rocks and minerals and seemed to 'never be at home'. She travelled a lot, all over the world, following her passion in North America, Australia, Asia. And she became a dedicated amateur jeweller working with silver mainly, and semi-precious stone. At home in her garage she established a small arsenal of tools and machines for making 'stuff', and if this were not enough, she was also a very keen quilter and embroider, perhaps a legacy from her Home Science days. When she developed an interest in something, she gave it her all, and pursued

it with intelligence, energy and drive. She had an eye for detail and beauty and may be thought of as a skilled artist and/or artisan, hence her exquisite embroidery and her long association with the Embroiderers Guild.

Jean is/was mother, mother-in-law, grandmother and great grandmother to: Roger and Robyn Gyles (Natalie; Maria, Paul and Jacob; Daniel, Emma and Poppy; Timothy, Purvi and Kiara), Martin and Vicky Gyles (Melanie; Jeremy and Shelley; Felicity), and Hilary Gyles-Bedford and the late John Bedford (Roydon and Jenny; Wesley; Hayden; Ethan). She was the much-loved matriarch of a large family, but to her immediate children Roger says that at times she could be particular and driven, occupied and at times superior, symptoms of her being staunchly Welsh probably, and hence perhaps the source of her independent streak. Wales after all was an ancient and venerable kingdom, with a much more illustrious and established heritage than New Zealand can ever boast. Jean was on solid ground of course, and she knew it. And this confidence enabled her. I remember her as the wonderfully cheerful, interesting, positive and bright kindred spirit that she was.

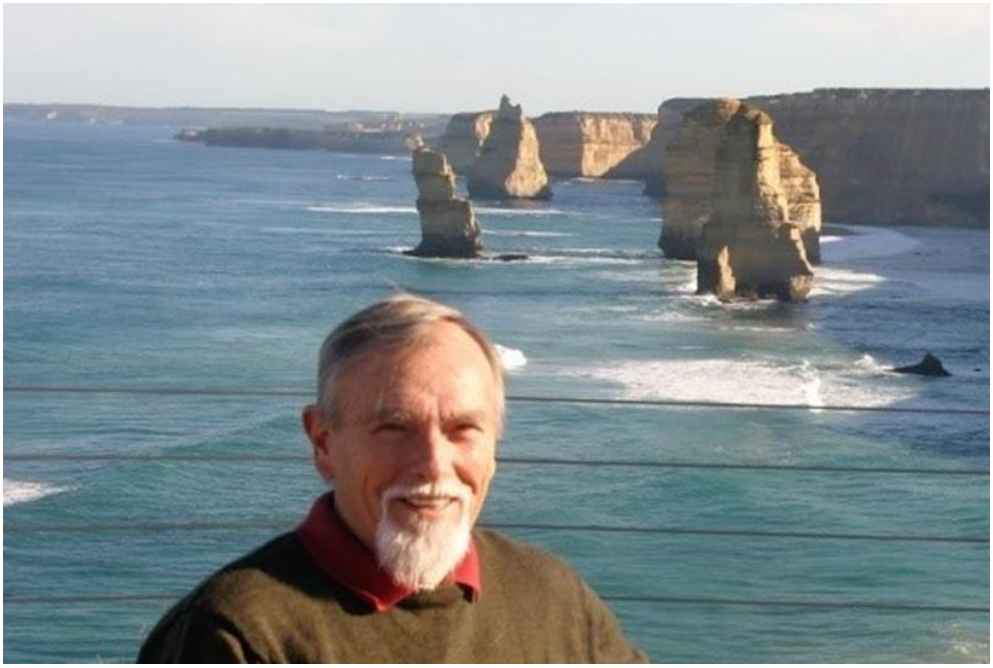
To us within GSNZ, Jean was something else: she was simply the woman who found the Giant Ammonite but as such will always command our respect and gratitude. In the context of the history and philosophy of science, her name has been immortalised. She is now part of that pantheon of famous fossil collectors and like the fossil she found, she is very much part of the permanent record.
From a geological perspective, Jean was a child of north-west Eurasia, born on Carboniferous coal measures, raised on shallow marine Triassic sediments and then matured in much deeper water Triassic sediments of Gondwanan origin in Zealandia. She was cosmopolitan and pelagic perhaps, which are (surprise surprise) ammonite-like characteristics, and like the Giant Ammonite, she chose New Zealand as her home.

We, GSNZ and the wider earth science community, owe a lot to Jean Gyles.

Lytoceras taharoaense

Robert King Park
(1943 – 2019)

Donald MacFarlan (MacFarlan Geological Services Ltd. New Plymouth).
donald.macfarlan@xtra.co.nz



Robert Park (Robin to his family, Bob to his friends and colleagues) was born in Motherwell, Scotland in 1943 and died in Hawera on 17 September 2019.

He was educated at the University of Glasgow (B.Sc. (Hons)) and University of Reading (PhD on Recent carbonate – evaporate sediments of Abu Dhabi), then taught briefly at the Universities of Leeds and Liverpool. He then joined Phillips Petroleum, at first in Denver, then at their headquarters in Bartlesville, Oklahoma, where he was Senior Carbonate Sedimentologist supporting Phillips' worldwide operations and for their geological training program.

In 1985 he joined Schlumberger as Division Geologist for Indonesia, India and Far East / Australia, and he and his family were based in Jakarta. He went on to Maxus International Energy and Kodeko Energy Corporation, working mainly in Indonesia, with wide responsibilities for exploration and development.
In 2012 he moved permanently to New Zealand, but continued international consulting and running training courses until recently.

He joined the New Zealand Geological Society and for the last four years was an enthusiastic President of the Taranaki Branch, and regular attender at national Conferences. He is survived by Marion, a New Zealander he met while in Glasgow, their two daughters and one grandson, who he met before he died.

From pharmacist to internationally-recognised belemnite researcher
Arthur Brian Challinor BSc, DSc (Waikato)
(7 December 1930 – 18 January 2020)

by Cam Nelson[a], David Lowe[a], Jack Grant-Mackie[b] and Neville Hudson[b]
[a]University of Waikato, [b]University of Auckland

Brian Challinor in the field (left) and upon the award of his DSc degree in 1994 (right). Photo sources: Challinor family.

Following night school study at Seddon Memorial Technical College in Auckland, Brian Challinor qualified in 1953 as a trained pharmacist. For much of his working life he owned and operated a pharmacy business (Challinor Pharmacy) in Main Street, Huntly, where he loyally served the local community for ~30 years until his retirement in 1990 at age 60. However, alongside his pharmacy occupation, Brian was a man of many interests and talents. These included having an active sporting association with harrier running, becoming a qualified gliding pilot and an avid photographer, having a long-term interest in both geology and astronomy (including building two telescopes in his 20s), and becoming a dedicated Waikato west coast twitcher (bird watcher and counter). He was an avid reader of books and articles that supported all these hobby interests, and was an active member of the Waikato branches of the NZ Geological (now Geoscience) Society, the Hamilton Astronomical Society, and the NZ Ornithological Society.

Among all these interests, it was the physical landscape and rocks and fossils that especially attracted Brian's attention. He became personally fascinated in pursuing a research topic on some fossil group. A chance discussion with Jack Grant-Mackie, a macropalaeontologist at the University of Auckland, suggested Brian consider studying the Jurassic belemnite fauna in the Kawhia region, partly because this was nearby but especially because Graeme Stevens (NZ Geological Survey), who had been the only belemnite expert in New Zealand, had by then turned his attention to the Jurassic ammonites. After some deliberation, Brian did settle for the belemnites and took them seriously and in much detail, as his later research shows.

Over the years, Brian spent many weekends exploring and collecting fossils from the well-exposed Triassic-Jurassic Murihiku rocks along the southwest Auckland and Waikato coastline between Port Waikato and Kawhia Harbour. He was particularly captivated by the abundance and variety of the "bullet-nosed" belemnites in the Jurassic strata. Over time, he ended up assembling at his post-retirement Hamilton home a sizeable and well-curated collection of Jurassic belemnite specimens (now housed in the Paleontology Collection, School of Environment, University of Auckland). Any finds were carefully described and photographed by Brian who used his bathroom as a makeshift darkroom for generating prints. The specimens were to form the basis for him to go on and eventually become a globally recognised expert in belemnites for the Southwest Pacific, Indonesian and Antarctic regions.

Brian met Dr John McCraw, head of DSIR Soil Bureau in Hamilton in the late 1960s, and their common Earth science interests fostered a friendship. John convinced Brian that the findings of his belemnite studies deserved writing up for publication, which led to Brian's first peer-reviewed paper in 1968 (Challinor 1968). In 1969 John became Foundation Professor of the newly established (opened in 1970) Department of Earth Sciences at the University of Waikato. At the university, John continued to encourage Brian's belemnite studies and their publication. For example, John gave Brian access to certain university facilities, such as typing, photographic and drafting services. The University of Waikato draughtsman of the day, Frank Bailey, became a very close friend of Brian's, often accompanying him on his bird watching and recording field trips away from Hamilton. Later, Brian was appreciative of drafting assistance undertaken initially by Max Oulton and then largely by Betty-Anne Kamp (both University of Waikato). For his final publication (Challinor and Hudson 2017), Louise Cotterall (University of Auckland) photographed specimens and Anne Challinor prepared the photographic plates.

In 1978, Brian, as a mature student, decided to enrol for a BSc degree at Waikato. However, at the time he did not have the required educational standard for automatic university entry and so John McCraw organised his provisional entry during which time Brian was required to demonstrate that he had adequate knowledge to cope with the lecture and laboratory courses. Unsurprisingly, he passed all courses with flying colours and graduated after three years of study with a high-calibre double major BSc in Earth sciences and biology. The biologists were so impressed with Brian's achievements that, at age 50, he

became part of a University of Waikato biological research team to visit Antarctica over the 1980/81 summer field season studying the ecology and physiology of endolithic and sublithic algae and lichens in the Lake Fryell area of the Dry Valleys. Nevertheless, once back in New Zealand, Brian's devotion to his paleontological studies of belemnites continued afresh.

In appreciation of John McCraw's ongoing encouragement of his belemnite work, Brian named for him a fossil, *Belemnopsis maccrawi* Challinor, in his 1979 publications (Challinor 1979a, b). Incidentally, he likewise named fossils for his daughters Deborah (*Belemnopsis deborahae* Challinor 1977b) and Anne (*Belemnopsis annae* Challinor 1979a), and for his late wife Patricia (*Hibolithes patriciae* Challinor and Hudson 2017). Brian also provided a selection of fossils from Kawhia Harbour as course teaching specimens in Earth Sciences. In later years, it was arranged with the University of Waikato for Brian to hold in name the title of Honorary Research Associate, despite him mainly working on his belemnite studies away from the university at his Hamilton home.

Dr Alan Green (University of Waikato Biological Sciences staff member and team leader, left) and Brian Challinor setting up a greenhouse on Lake Fryxell, Dry Valleys, Antarctica, in the 1980/81 summer field season. (Photo source: Antarctic NZ Pictorial Collection).

Brian rapidly developed an approach in his belemnite research that was characterised by detailed observation and description. Belemnites are rather featureless objects, solid calcareous rods, bullet-shaped at one end. Brian introduced a mathematical-statistical approach that enabled him to maximise the information available. He quickly became a respected researcher and was invited to study members of other overseas faunas, including from Indonesia, which he visited, along with India, New Caledonia and Antarctica (e.g. Challinor and Skwarko 1982; Challinor 1989, 1990, 1991a; Challinor and Grant-Mackie

1989; Challinor and Hikuroa 2007). Brian commonly used Jack Grant-Mackie as a paleontological sounding board and critic for his ideas, so that Jack had a close relationship with him and his research results, although he never accompanied him in the field for research purposes. Those knowing Brian's research had great respect for his scientific objectivity and reasoned approach to problems of belemnite identification and taxonomy.

John McCraw retired in early 1988 but, like Jack Grant-Mackie, continued to maintain a close supportive interest in Brian's belemnite research. By 1993 John suggested to Brian that he assemble and submit a body of his New Zealand belemnite publications for examination for the degree of Doctor of Science, which was duly awarded by the University of Waikato in 1994. Brian was the first student to have studied Earth Sciences at Waikato to receive this prestigious degree. Another career highlight stemming from his belemnite studies was the award of a New Zealand Science and Technology Bronze Medal in 2001 from the Royal Society of New Zealand. In that same year, Brian co-led a one-day field trip to Kawhia on behalf of the Geological Society of New Zealand's annual conference held in Hamilton (Challinor and Grant-Mackie 2001).

Brian's publication record is a truly remarkable one (see list below) given that his working life was not as a professional geologist or palaeontologist. Over a period of about 50 years (1968-2017) he published 26 peer-reviewed articles (plus one field guide and a DSc submission), an average output of about two publications a year. Impressively, Brian was the sole author on 19 (73%) of the peer-reviewed papers. Fourteen of his peer-reviewed papers are published in New Zealand journals, 13 in the *New Zealand Journal of Geology and Geophysics* and one in the *Journal of the Royal Society of New Zealand*. The remainder are published in Australian and other overseas paleontological journals and memoirs, and as two chapters in a book on the Jurassic of the circum-Pacific published as part of a world and regional geology series by Cambridge University Press.

Brian was the much-loved husband of the late Pat (née Patricia Venn), father of Deborah (herself a Distinguished Alumna recipient of the University of Waikato in 2017) and Anne, brother of Maurice and Kerry. He was father-in-law of Aaron, grandfather of Rebecca, Rachael, Atawhai, Kahu and Huriana, and great-grandfather of Oscar and Summer.

We acknowledge the assistance of Debby Dada (University of Waikato librarian) for helping locate some of the bibliographic information in this account, and of Anne Challinor for providing some family-related material and photographs. We thank Charles Riddle (Wintec Hamilton) for access to the information contained in an obituary he prepared for Brian that appeared in a recent issue of the Waikato Times newspaper, available at: https://www.stuff.co.nz/waikato-times/news/119292354/obituary-arthur-brian-challinor-december-7-1930--january-18-2020.

Chronological listing of Brian Challinor's publications

Challinor AB. 1968. Notes on the belemnite content of the Heterian and Ohauan stages at Kawhia Harbour, New Zealand. Earth Science Journal 2(2):109–125.

Challinor AB. 1974. Biostratigraphy of the Ohauan and lower Puaroan stages (Middle Kimmeridgian to Lower Tithonian), Port Waikato region, New Zealand, with a description of a new *Belemnopsis*. New Zealand Journal of Geology and Geophysics 17(2):235-269.

Challinor AB 1975a. New upper Jurassic belemnite from Southwest Auckland, New Zealand. New Zealand Journal of Geology and Geophysics 18(3):361-371.

Challinor AB. 1975b. Variation in *Hibolithes arkelli arkelli*-1. New Zealand Journal of Geology and Geophysics 18(6):803-835.

Challinor AB 1977a. Proposal to redefine the Puaroan stage of the New Zealand Jurassic system. New Zealand Journal of Geology and Geophysics 20(1):17-46.

Challinor AB 1977b. New lower or middle Jurassic belemnite from south-west Auckland, New Zealand. New Zealand Journal of Geology and Geophysics 20(2):249-262.

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Taranaki Geological Society Involvement with the Taranaki Science Fair

Dianne Tool

In August 2019, the Taranaki Geological Society awarded two prizes at the Taranaki Science Fair. The two prize winners, Luther Donselaar and Jackson Reid, had entered their projects in the Scientific Investigation Class. Luther Donselaar, in Year 8 at Highlands Intermediate, labelled his work “Better Alternatives to a Breakwater”, and Jackson Reid, in Year 9 at New Plymouth Boys' High School, labelled his “Coastal Defences”.

Both students (along with family support), set up their complicated handmade equipment to demonstrate the workings of their projects to the members of the Taranaki Geological Society at their 40th Anniversary Celebration in December.

They each had a water tank in which they could place the various testing equipment for their experiments. They demonstrated three different tests in their water tanks. When switched on, the water was pushed along the tank against the different resistant testing materials to observe the most efficient method of protecting a harbour or coastal area. Onlookers were amazed at the ingenuity of the workings.

Jackson had 3 shapes against which the water was forced, and he concluded that the concave wall provided greatest resistance to wave action.

Luther forced his water through different obstacles that he placed inside his tank. He hoped that in the future his experimentation could be put to practical use on a large scale.

As an extra, Luther presented a short PowerPoint introduction on his project.

The Taranaki Geological Society is pleased to be involved in these local projects which encourage our scientists of the future.

Congratulations to the following GSNZ members who were recently elected

Fellows of the Royal Society, Te Aparangi.


Philip Barnes


James Crampton


Kelvin Berryman


Rewi newnham

During the 2019 conference dinner, the following **GSNZ award winners** were announced:

GSNZ Honorary Member	Nick Mortimer (GNS Science)
McKay Hammer	R. ewan Fordyce (Univ. of Otago)
Hochsteter lecturer	Phaedra Upton (GNS Science)
New Zealand Geophysics	Emily Warren-Smith et al
Werner Giggenbach prize for Geochemistry	Nellie Olsen (VUW)
Kingma Award	Neville Palmer (GNS Science)
Alan Mason Historic Studies Award	Martin Brook (Univ. of Auckland)
Jim Ansell Geophysics scholarship	Tayla Hill (Univ. of Otago)
Wellman Research Award	Andrew La Croix (Univ. of Waikato)
The Hornibrook Award	Oliver McLeod
Harold Wellman Prize	Peter Shaw

Student Awards

S J Hastie Awards
Anthony Shurrock (Auckland); Anya Podrumac (Waikato); Alastair Stronach (VUW); Harry Davies (Otago)

Geoscience 2019 Student Presentation Awards
Oliver McLeod. NZJGG Best student speaker. (Univ. Waikato)
May Sas. Best speaker runner up (Univ. of Auckland)
Sam Davidson. Speaker award (Univ. of Canterbury)
Lucas Corna. Poster presentation (Massey Univ.)
Jessica Fensom. (Univ. of Canterbury) Poster presentation runner up
Anthony Shurrock. Poster presentation. (Univ. of Auckland)

Taranaki Geological Society celebrates it's 40th Anniversary

A meeting was held in late 1978 to gauge interest in a geological society and Taranaki Geological Society was formed the following year. Two of the founding members, Mark Robins and Diane Toole (opposite) are on the current committee and several members have served on the committee for stretches of over 20 years.

A variety of venues were used in the early years for workshops and talks. For over 30 years monthly meetings with lectures from geologists and travellers' tales of geologically interesting parts of the world have been held at Girls' High. This long-standing relationship came to an end at the end of 2019 with a move to the TSB Community Trust at 21 Dawson St.

In the mid-1980s Taranaki Geological Society became a branch of the Geological Society of New Zealand, since renamed the Geoscience Society of NZ. The annual Hochstetter lecture and the biennial President's tour funded by GSNZ have been held in church and school halls, Puke Ariki and the Council Chamber so that members of the public could be invited. Geologists at universities, Geological and Nuclear Sciences, and those working in the private sector have been very willing to travel to New Plymouth where they have been hosted by members. They have shared their knowledge of New Zealand's early explorers, mappers and miners and the latest findings in such fields as climate change and the establishing of Zealandia as a mostly under water continent.

Regular field trips all over Taranaki have included volcanic and sedimentary sites and investigation of human land use such as pa sites, oil exploration and quarries. Longer trips every couple of years have seen members travel to other parts of New Zealand such Mt Tarawera, Kapiti Island, the Cobb Valley, Wellington's Red Rocks and Whakaari/White Island.

With financial help from TSB and oil companies a Taranaki Field Trip guide was published in the 1990s and an updated Volcanic History in the early 2000s, both are still sold adding to the society's healthy bank balance.

Former members and potential new members were invited to participate in the 40th anniversary celebration of reminiscence and memorabilia plus a quiz that was held at the TSB Community Trust Rooms in New Plymouth in December.

Taranaki Geological Society Involvement with the Taranaki Science Fair

New Plymouth students, Luther Donselaar and Jackson Reid, nearest

In August 2019, the Taranaki Geological Society awarded two prizes at the Taranaki Science Fair. The two prize winners, Luther Donselaar and Jackson Reid, had entered their projects in the Scientific Investigation Class. Luther Donselaar, in Year 8 at Highlands Intermediate, labelled his work "Better Alternatives to a Breakwater", and Jackson Reid, in Year 9 at New Plymouth Boys' High School, labelled his "Coastal Defences".

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Luther forced his water through different obstacles that he placed inside his tank and concluded that the brushes were the most effective of the three at breaking up the force of the water. He hoped that in the future his experimentation could be put to practical use on a large scale.

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The Taranaki Geological Society is pleased to be involved in these local projects which encourage our scientists of the future.

Your Committee 2020

Back row: Jenni Hopkins, Richard Wysoscanski, James Scott, Sam McColl, Alan Orpin. Front row: Andrew Rees, Eleanor Mestal, Glenn Vallender, Mathew Sagar, Angela Griffin, Jennifer Eccles. Absent: Phaedra Upton.

In an attempt to connect more strongly with members, it was thought to be a good idea to add a little more spice and interest about your elected and co-opted national committee members. So far, we have put together a short biography of various committee members. I am sure you will identify with many of the sentiments expressed. Facinating landscapes, outdoors environment, inspirational people, like minded colleagues and a desire to understand and tell others about what makes the world tick are commonalities.

Sam McColl (Publications Sales Officer)
Birth place
Lower Hutt, New Zealand
What secondary school did you go to?
Hutt Valley High School
How did you get involved in geoscience?
Geography class at high school and a passion for the outdoors – didn't want just an office job!
Who or what inspired you to have a career in geoscience?
The lure of sweet, sweet money…a whopping $5000 scholarship to do an honours project on landslide hazards at Victoria University of Wellington. Well it seemed a lot when I was a post grad back in 2006. From that first taste of research one thing lead to the next, and I am still working in geoscience research and teaching.
What has been a highlight of your work?

Meeting and working with many wonderful, passionate people, and exploring some of the most incredible landscapes in the world. In fact, I am writing this from a hut in the Southern Alps, admiring the mountain views and the whistling wind that is forcing this fieldwork rest day.

Why is GSNZ important?

It provides a sense of community. The annual conferences are always fun and on par in terms of quality of the science with many of the larger international meetings. I also think the awards are a special part of the society, providing some often-overlooked (by our institutions) recognition of our work. The annual lectures (e.g. Hochstetter lecture) and the publications help to share NZ geoscience with the rest of the nation.

Andrew La Croix (Waikato Representative)

Birth place

Vancouver, British Columbia, Canada

What secondary school did you go to?

Burnaby Mountain Secondary

How did you get involved in geoscience?

It started with many days spent camping, climbing, and in the wilderness with Scouts Canada. From there I received a full scholarship to study geoscience from Imperial Oil. This transitioned into experience working in mining, oil and gas, and academia.

Who or what inspired you to have a career in geoscience?

My parents, Carol and David, who always encouraged me to be outdoors and to follow a career exploring (whatever it was that I was curious about!).

What has been a highlight of your work?

Travelling. Field work in Canada, USA, Patagonia (Argentina), Australia, and New Zealand. Conferences in Canada, USA, Turkey and Australia. Studying in BC and Alberta. Teaching and research positions in Canada, Australia, and New Zealand.

Why is GSNZ important?

It is important for building professional and social networks between individuals who share a common passion. The Society provides learning opportunities and the chance to be exposed to facets of the geosciences that could be missed by staying within our own ‘bubble’.

Jennifer Eccles (Immediate Past President)

Birth place

Auckland, New Zealand

What secondary school did you go to?

Kelston Girls High School

How did you get involved in geoscience?

I’d been drawn to the physical sciences in high school but only seen a little of geoscience formally at that point and was also a suburbanite with little real-world connection to the landscape at that point. I started university as a Chemistry major taking chemistry, maths and physics and geology ‘for fun’. The chemistry fell away with geology and geophysics degrees and a passion for the outdoors and earth systems accumulated along the way.

Who or what inspired you to have a career in geoscience?
As a wide eyed first year University student the thing that struck me most about Geoscience was the number of big, very tangible, questions that we didn't yet have answers for compared to the other physical sciences where a lot more was presented as known and the cutting edge of the field seemed very abstract. It seemed to me this was a good place to really make an impact on the state of our knowledge.
What has been a highlight of your work?
My work has given me the opportunity to have some unique experiences around fieldwork that will stick with me forever including the opportunity to work in Antarctica and in Vanuatu on the active volcano of Yasur. The teaching and supervision aspect of my work is also intensely rewarding as I share my enthusiasm for the disciple with emerging scientists and see them develop.
Why is GSNZ important?
The GSNZ is a forum for community; for geoscience as an interest and not just a means of paying the bills between set hours of the day. The strength is in our diversity of experiences, interests and real-world roles. As a community we can make things happen, sharing our knowledge and resources and providing a legitimacy to certain endeavours such as geopreservation that would be more difficult coming from a single scientist alone. However, community is not a passive experience and to get the most out of it you need to buy in and engage; sharing as well as receiving.

Glenn Vallender (Newsletter editor)
Birth place
Cowes, Isle of Wight, England
What secondary school did you go to?
Christchurch West High School (Est. 1857) (now Hagley College)
How did you get involved in geoscience?
An early fascination with landforms at high school in the 1960s (thanks to Charles Cotton's textbook) and a curiosity about the natural world led to hearing about a subject called geology. A career as a secondary school teacher teaching biology and science eventually morphed into extramural study on geological science education and conceptual change.
Who or what inspired you to have a career in geoscience?
Inspiration came from my parents who saw education as a priority for a better life away from war torn England. Sincere encouragement from Mr Venz my school geography teacher and Mr Gallagher my history teacher (teachers did not have first names in those days!). A 1997 teaching fellowship at UC where Doug Lewis and Kerry Swanson provided that essential push of support, encouragement and belief to pursue a life long interest in geology.
What has been a highlight of your work?
Teaching and learning with many amazing young people, involvement in national and international geoscience (and science) pedagogy and assessment issues, and teaching and learning across all ages from primary to U3A.
Why is GSNZ important?
Because it connects socially and professionally all geoscientists and provides a forum for presenting the values and learnings of geoscience to the NZ public.

Phaedra Upton (elected member)

Birth place

Dunedin, New Zealand

What secondary school did you go to?

Logan Park, Dunedin (2 years)
Ellesmere College, Leeston (3 years)

How did you get involved in geoscience?

I remember wanting to be a geologist when I was about 12 after going in the field in Southern California with a family friend. I then forgot about that, did a Chemistry Honours degree, realised during my final year that I didn't want to continue in Chemistry. My sister was doing Geology at Otago and she was always so excited about it. I had a PhD scholarship but was able to defer it for a year, went down to Dunedin to do a graduate diploma in Geology and started my PhD on the Alpine Fault the next year.

Who or what inspired you to have a career in geoscience?

I've always enjoyed being outside, particularly in the mountains. At school Maths was my favourite subject. Geology, especially once I started working with Peter Koons on my PhD, enabled me to bring together an interest in mountainous landscapes with mathematics through numerical modelling of first tectonics and geodynamics and now tectonic geomorphology. As well as Peter, Dave Craw and Richard Norris have had a huge influence on my career in geoscience.

What has been a highlight of your work?

Being a geoscientist in New Zealand, which is an amazing place to be a tectonic geomorphologist. Bridging the gap between numerical modelling and field observations. I really enjoy working with New Zealand and overseas researchers, especially having my graduate students from the University of Maine and Colorado here in the field where they can see the processes they are modelling occurring in the landscape.

Why is GSNZ important?

Connections between geoscientists; opportunities for students, early career researchers and others such as teachers to see and be seen by the research community.

Angela Griffin (Elected member)

Birth place

Hamilton, New Zealand

What secondary school did you go to?

Mangakahia Area School, near Whangarei

How did you get involved in geoscience?

I studied 6th and 7th Form Geography by correspondence, and really enjoyed learning about different landforms and countries. I continued this interest at the University of Waikato, where I studied physical geography at the School of Earth Sciences, and human geography (along with some resource management planning) at the School of Social Sciences. After finishing my Masters in 2001, a few temp jobs and six years in a call centre, I finally managed to land a job at GNS Science, Lower Hutt, in 2007 and have been there ever since.

Who or what inspired you to have a career in geoscience?

Inspiration came from those correspondence courses, and also watching archaeology and ancient history shows (e.g. Time Team and anything on

Egyptian history) on TV. Scraping away dirt to reveal pottery or jewellery artefacts thousands of years old seemed exciting, even if it was on the other side of the world. I've yet to scratch my "Indiana Jones" itch, but that's a longterm goal.

What has been a highlight of your work?

Learning about and being involved in a variety of work has been a highlight, as has being able to travel, present and share research, and see a variety of geological features not seen elsewhere, whether it be in NZ or overseas.

Why is GSNZ important?

GSNZ provides a forum for all geoscientists, whether professional or amateur, to connect and share information on the geological world. As a society, I think it's important that we continue to do this, especially in this changing world, and share our geoscience knowledge with the NZ public, educators, and other like-minded people.

James Scott (President)

Birth place

Dunedin

How did you get involved in geoscience?

I enrolled in geography and ecology at Otago University and took one geology paper on the side. I remember the ecology lecturers being too honest – admitting that some of their experiments failed! – and geography just wasn't as interesting as the geology papers running at the same time, so I changed majors. The rest is history…

Favourite rock

The Nakhla meteorite. I was lucky enough to hold a hand-sized sample of this Martian meteorite. It blew my mind (and still does) to realise that I was actually holding a bit of another planet!! (These rocks get ejected from Mars when a meteorite impact hits the planet. Having a much weaker gravitational field means that debris can readily escapes Mars and move inwards in the Solar System.) My heart had never beaten so fast – at least in geology!

Favourite mineral

That's a hard question! It changes a lot. Currently it's scheelite, because it is possible to measure in-situ trace elements as well as $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ isotopes in single grains. Since it take no Rb, and the Sm/Nd ratio is low, it more or less gives initial isotope ratios of the fluid it formed from, which is pretty cool.

Favourite fossil

I don't do fossils.

What has been a highlight of your research/work?

Things that I've discovered by accident. For example, discovering that the mantle lithosphere under the Southern Alps was distinct from that under the Dunedin area in the Miocene. I didn't do anything special – just looked at mantle xenoliths in basalts from both areas under the microscope - but it was fun to discover something so geologically significant using basic techniques. I bet there is much more to discover; and that's what drives me.

Why is GSNZ important to you?

Being an active part of GSNZ is one way to support the New Zealand geoscience community.

It is time to hand the reins over!

WANTED

One enthusiastic Newsletter editor/compiler.
Glenn has decided that it is time to move on at the end of this year to other geoscience things.

For details please contact
Glenn Vallender on ge.vallender@xtra.co.nz or a current committee member

GSNZ CONFERENCE 2020
The premier event of the year

The 2020 GSNZ conference will be held in Christchurch, at the University of Canterbury

Sunday 22 to Wednesday 25 November, 2020.

Check the GSNZ website for coming details

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.

Donations

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.

Bequests

Suggested wording for a bequest
(We recommend you consult a solicitor to match the existing wording in your will)

*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

Note: The Geoscience Society of New Zealand

- is registered as Incorporated Society no. 219911
- is approved as Registered Charity no. CC41125
- has most of its award funds protected in a trust: the Geoscience Society of New Zealand Awards Trust (Incorporated), Registered Charity no. CC35670

Newsletter

You can choose online during your membership renewal process, whether or not you wish to receive the Newsletter in electronic form or posted as hard copy. Electronic form has the advantage of full colour and hyperlinking.

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, geochemistry and 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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Note that names are normally of the format “John Smith” or “Jane Smith”. We prefer not to use titles such as Mr, Dr or Professor, nor to worry about whether we should use Miss, Mrs, or Ms.

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