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Geoscience Society
of
New Zealand

GEOSCIENCE SOCIETY OF NEW ZEALAND

A member body of the Royal Society of New Zealand
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LETTERS, EVENTS, NOTICES (cont.)

FEATURE ARTICLES

The second of Richard Cotton's images of flow bands in Cambrian Gneiss/calc silicate rocks— Cascade Basin, Long Sound, Preservation Inlet. (QMap 17, Fiordland). Taken in September, 2020.

Geoscience Society of New Zealand Newsletter - Issue 37

Kat Holt
President

Tēnā koe,

Ngā mihi o Matariki, te tau hou Māori. Greetings of Matariki and Māori New Year. I hope everyone has found time to take a break and share time with friends and family in the spirit celebration of Matariki.

The National Committee have been very busy over the past few months. By the time you read this, we would have had 2 full National Committee meetings, and one interim (half day) meeting. So far, all our meetings are still online. This works quite well as it allows members to duck out here and there to attend meetings or teach and then return afterwards, rather than needing to skip the meeting altogether. Plus there is the added bonus of savings to the Society on travel costs.

For this edition of the President's column, I'd like to update you on a couple of the bigger items that we'll be working on in the coming months. A very important development for the Society is the passing of the Incorporated Societies Act 2022 into law on the sixth of April. This Act requires all Incorporated Societies to re-register by the 1st of December 2025. While this may seem like plenty of time, the volume of work needed to become compliant with the new Act means that we need to start making headway promptly. The most significant new requirements of the Act as far as GSNZ are concerned include:

- Establishing a grievances and complaints procedure.
- Establishing a register of conflicts of interests for Committee members and procedures to allow members to inspect that register.
- Continue to maintain a register of our members, and check we have all necessary member information under the new Act. Necessary member information includes some data that we do not currently hold, such as date of joining.
- Establishing grounds for removal of Officers from the National Committee
- Establishing procedures for responding promptly to member requests for information.

There are a number of other minor aspects that will need addressing too. This Act will ultimately require us to significantly revise our Constitution (Rules) such that we demonstrate we meet the requirements of the Act before re-registering as an incorporated Society. As such there will be need for consultation with the Membership on a new draft constitution, followed eventually by voting at an AGM. So please keep an eye out for any requests for feedback relating to this process over the next 12-18 months.

The other project I'd like to update you on is our review of the GSNZ Awards portfolio. As you may well have seen from emails sent out in recent weeks, we have begun our review process with a survey of the Membership's opinions on the awards. Prior to this, letters signalling the review and assuring opportunities for feedback were sent directly to the families of named awards, and to those responsible for setting up particular awards, where applicable.

We had a total of 93 respondents to this survey (approximately 15% of the membership) expressing a variety of viewpoints. The results of the survey are available on request from the Secretary. The immediate next step for the review process is to use the results of the survey, as well as other feedback received, to determine possible avenues for maximising the impact and appeal of our GSNZ Awards.

As you will see in this current edition of the newsletter, there is no change to the Awards offering for 2022. I'll take this opportunity to encourage everyone to please consider submitting a nomination this year. The Call for Awards (page 26) in this issue has information on the awards available and information about applying. I encourage anyone unfamiliar with the awards process to read the additional 'Awards FAQs' section on page 27. In the meantime, we welcome further feedback on anything to do with the awards review. Please email the Vice-President and incoming chair of the Awards Subcommittee, Sam McColl (vp@gsnz.org.nz) with comments.

Lastly, I will be kicking off my President's Tour soon, with a lecture on the different roles that palynology plays in NZ geosciences. More information and dates for this can be found on the Society webpage. ■

Mā te wā

Kat Holt

Kat with a freshly collected lake sediment core on Rekohu Chatham island. Ancient lake sediments like these provide optimum preservation for pollen and other microfossils. Photo supplied.

Janis Russell
Editor

Kia ora koutou,

As I write this editorial, Aotearoa / New Zealand is only a few days from making history with a new public holiday on 24th June. It is one that is based in te ao Māori — a worldview that acknowledges the interconnectedness and interrelationship of all living and *non-living* things. This latter element should resonate well for a Society that is fully immersed in the geosciences.

We are, slowly, but surely, maturing as a nation and embracing the unique indigenous culture we have here. This holiday does not solely focus on honouring a notable person, commemorating an historic event, memorialising a cause, or sanctifying any one religion's leader. We are bringing people together to create a new identity—one that reflects shared values as well as geographical position on the globe.

The Matariki themes, of remembrance, connection and setting hopes or planning for the future, encourage us to remember those who came before us, to come together to celebrate the present, and to set hopes or plan for the future. You may notice that these themes are subtly present in different ways, in this issue.

In the first of two feature articles on the planetary geology theme (p46), Michele Bannister takes a look into the past that has shaped her, and honours those who have gone before her, or are no longer with us. She acknowledges that removing barriers, and limitations on what's possible, creates enormous opportunities for others who follow afterwards. Notions of connection, collaboration and community are highly visible drivers in her work. And what she has gained, from these experiences of teamwork and being in accepting and welcoming communities, is a desire for others to have that too.

In the spirit of Matariki, I, too, have taken pause to engage with these themes in my capacity as editor.

Firstly, I have reflected on the past, honouring those who have gone before me, taking a look over what existed before my time. Then taking a critical look at what I have already produced since I was appointed to the role. There are aspects of Newsletters from previous years that remain but some change is inevitable as the world around us alters.

Secondly, as part of a committee who comes together regularly, I feel connected to a welcoming and supportive team (even if it is via an electronic medium). We have made a lot of progress and approved some new initiatives, such as geology-themed, limited edition prints (see p38), which will add richness to merchandise offerings provided by the Society.

Lastly, I have set hopes and have been making plans for the future, such as implementing some of the changes already foreshadowed:

- Requiring dual language place-names to be used in articles submitted for publishing in 2023
- A new name for the Newsletter incorporating a fresh new header design for issues published in 2023 (see p34 for the committee-approved change).
- I'll also revisit text size for readability to give readers a much better experience.

My hopes are that we can, once again, increase the number and scope of articles submitted in an effort to regain some ground lost during the lockdown stages of the pandemic. It certainly has been difficult for everyone. Living under the spectre of Covid has wreaked havoc on our reserves and tested our capacity for additional workload. Let's try to ease into a different normal, change our view on what is possible, share the load, and rebuild. We are a team that's 700 strong. If even 1% of our members contributed one article, there would be more than twice as many as we had submitted for this issue.

Ngā mihi o te tau hou Māori—
Best wishes for the Māori New Year.■

GRAEME STEVENS: PIONEER SCIENCE COMMUNICATOR

Simon Nathan

Graeme Stevens celebrates his 90th birthday in July 2022, and members of the Society will join with me in sending him good wishes. He and Diane are in good health, living in central Lower Hutt and still walking their dogs regularly. They celebrate their 60th wedding anniversary this year. While Graeme is remembered for his outstanding work in Mesozoic paleontology, especially his definitive monographs on New Zealand's belemnites and ammonites, I would like to pay tribute to a lesser known aspect of his career as one of the first New Zealand scientists to devote time to teaching geoscience to a non-scientific audience and writing popular books.

In the 1960s, soon after he joined the Geological Survey, Graeme was involved with Geoff Shaw in running a series of lectures on geological topics in Lower Hutt. There was an ongoing demand for such lectures from organisations such as the Workers Educational Authority (WEA) and University Extension, and this expanded to weekend lecture courses (usually combined with a field trip) at different places in the central North Island. He also took a leading role running summer schools, up to 10 days. Many non-academic people were introduced to the fundamentals of geology and geomorphology — hunting for fossils and becoming more aware of the forces that shaped their local landscape. One of the notable participants was Joan Wiffen, later well known for her fossil reptile discoveries, who paid tribute to these experiences for raising her interest in geology.

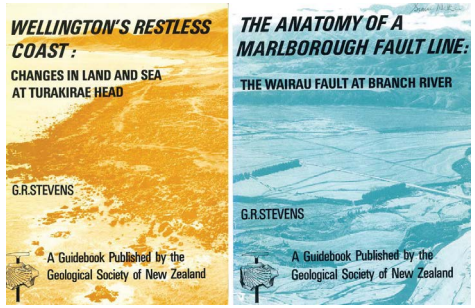
Although Dick Willett and successive directors of the Geological Survey were very supportive, and allowed the use of equipment and facilities, there were grumbles from some older staff members who felt that this was cheapening the reputation of the organisation. I can remember phrases such as "dumbing down" and "oversimplifying" being tossed around – but from the popularity of his lectures it was clear that Graeme knew how to talk to an audience in words that they could understand.

Graeme soon realised that there was a need for an illustrated book covering the topics he was lecturing on, leading to the preparation of *Rugged Landscape – the Geology of Central New Zealand*. There were almost no other books on New Zealand geology available at the time, and it was breaking new ground. As well as photographs, there were a large number of diagrams which were painstakingly hand-drafted by Diane – using ink pens and stick on patterns before the arrival of computer technology. Although the manuscript had been prepared in his own time, Graeme felt an obligation to offer it first to DSIR Publishing, and was taken aback to be told that they would only consider books that were 'serious science'. He then sent the proposal to AH & AW Reed, then the leading publisher of New Zealand books and it was accepted with the personal approval of the founder, AH Reed who clearly had a nose for a good book. Published in 1975, it was reprinted several times and won the prestigious Wattie Book-of-the-Year award for non-fiction.

Covers of "*Rugged Landscape*" (1975) and "*New Zealand Adrift*" (1980)

Graeme and Diane 2022 Photo: Simon Nathan

In the early 1970s there was a move for the Geological Society to produce guidebooks about notable geological features. Graeme produced manuscripts for the first two, covering the Cape Turakirae raised beaches and the faulted terraces at Branch River. I was on the GSNZ committee at the time, and can remember a difficult discussion when we debated whether the Society could afford the cost of publication – and whether this was an appropriate way to spend members' funds. Fortunately the president, Ian Speden, was a strong supporter and managed to find commercial sponsorship. In retrospect the first two guidebooks are modest black-and-white booklets, but they sold well and were the start of our our ongoing series of geoscience guidebooks. Also published in 1974 was a slim volume that still appears in tattered form at the bottom of a pack, often protected in a plastic — *A tramper's guide to the geology of the Tararuas*.

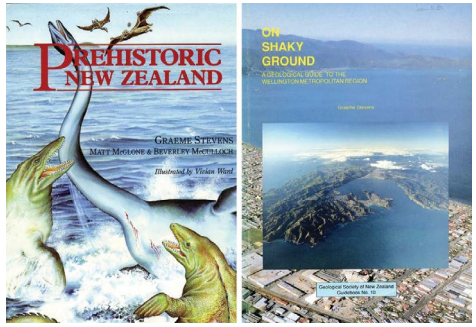


Covers of GSNZ Guidebooks 1 & 2 (1974)

Pleased with the success of *Rugged Landscape*, Reeds suggested that Graeme prepare another geological book. The 1970s was the time that plate tectonics was being recognised as explanation for diverse geological phenomena, but most of the literature was highly technical. Having been under the influence of John Bradley, an ardent proponent of continental drift, while he was at Victoria University, Graham was an early convert, and could see the need for a popular book explaining how New Zealand fitted in a plate tectonic framework. He started work on New Zealand Adrift, again with the assistance of Diane. Published in 1980, it repeated the success of his earlier book, selling well and also winning the Book-of-the-Year award. Having seen the success of Graeme's books, DSIR Publishing, by then under different management, approached Graeme. This led on to the publication of *Lands in Collision – discovering New Zealand's past geography* in 1985, and they subsequently published a new edition of *Rugged Landscape* in 1990.

In the 1970s Graeme had taken responsibility for editing the paleontological sections of Geology of New Zealand, a massive 2-volume summary volume produced by the Geological Survey under the supervision of Pat Suggate. With the assistance of co-authors he developed this into a popular book, *Prehistoric New Zealand*, telling the story of changing life in the New Zealand region over the last 500 million years.

Graeme's MSc thesis was on the geology of the Hutt Valley, and over the years he maintained a close interest in the region. In 1991 he produced another GSNZ guidebook, *On Shaky Ground*, covering the wider Wellington region. Published in colour, it showed how much publication standards had changed since his first guidebooks fifteen years earlier.



Covers of "*Prehistoric New Zealand*" (1988) and "*On Shaky Ground*"(1991).

This is only a very brief summary of the major popular books about New Zealand geoscience that Graeme has produced. Today books related to geoscience are common, and sell well. They build on Graeme's pioneering work in science communication which has led to a much wider community appreciation of geoscience ■

TAKANINI FORMATION

A FIELD TECHNICIAN'S VIEW

Roger Evans: Geotechnics Ltd, Auckland

Introduction

My introduction to Auckland's post-Miocene geology began when I joined Geotechnics fifteen years ago. As I worked my way across the city and its rural fringes, I found that pretty much everything that wasn't volcanic was called either Puketoka Formation or Tauranga Group, both essentially synonymous. Since then, endless hand augers and a few deep boreholes have brought a growing appreciation and knowledge of the stratigraphy, particularly of the northern Manukau lowlands. Over the years, and more recently with an introduction to the nuances of the central Manukau Lowlands, I have come to realise that this carpet-bag nomenclature includes distinct sets of lithologies, which can be grouped into distinct age-defined lithostratigraphic units.

By 2010 there was increasing recognition among geologists that the term Puketoka, by comparison with the type locality, was being widely misapplied (Hayward and Grenfell, 2010). With news that a long overdue revision of the geology was under way, I eagerly anticipated a review and subdivision of the post-Miocene geology into distinct mappable lithostratigraphic formations. However, upon reading the formal Report establishing the Takanini Formation (Barrell et al., 2021) my anticipation rapidly turned to dismay. It seemed that one carpet bag had simply been exchanged for another, introducing another round of names to add to the overall confusion.

Identifying the problem

Basically, the new Takanini Formation can be defined in paraphrase as 'everything not volcanic, but younger than Kaawa strata of Opoitian age' (see Barrell et al. sec. 2.2.2 for precise definition). Strata of Waipipian age, conceivably part of the Kaawa depositional sequence, are separated off and included with unconformably overlying sediments as part of the "Otahuhu Member" on the premise that Opoitian sediments are largely unknown north of the Waikato. This distinction, however, may be an artifact of a lack of deeper drilling into the Kaawa, as Opoitian faunas are known to underlie Waipipian at depth in at least one deep borehole (Beu, 1974).

When defining a Formation, bypassing unconformity in favour of a chronostratigraphic boundary drawn through an imperfectly known sequence at depth seems to me to be curiously at odds with best geological practice. Further subdivision of this "Formation" into lithofacies, each given status as poorly described and documented "Members", raises further geological and geotechnical concerns.

Take for example the Ardmore Member, defined simply as "peat". Does this mean that the weak log-riddled peats of the Ardmore area are the same unit as the competent amorphous peats of the north Manukau Lowlands, or the deeper consolidated peat layers that occasionally exist at a depth of 20+ metres? These three peat facies, which have different geotechnical properties, occupy distinct and predictable stratigraphic positions within the field, but under the new proposal are lumped together as a single Member. Giving all the same name is bound to give rise to confusion.

Consider also the Otahuhu Member, defined by the presence of shell, which equates Late Pliocene (ex Kaawa) shellbeds with Quaternary marine cheniers, and also by inference, with layers of presumably reworked shell that occasionally occur within the Pleistocene alluvial sequence. Clearly, all three shelly units occupy distinct stratigraphic positions, yet the proposed definition of the Otahuhu Member disregards this, lumping them together as one unit.

The problem, as a colleague in Tonkin and Taylor astutely remarked, is the application of age-stratigraphic terminology to age-independent lithofacies units. When it comes to regional correlation, this confusion of nomenclature can only become a source of frustration.

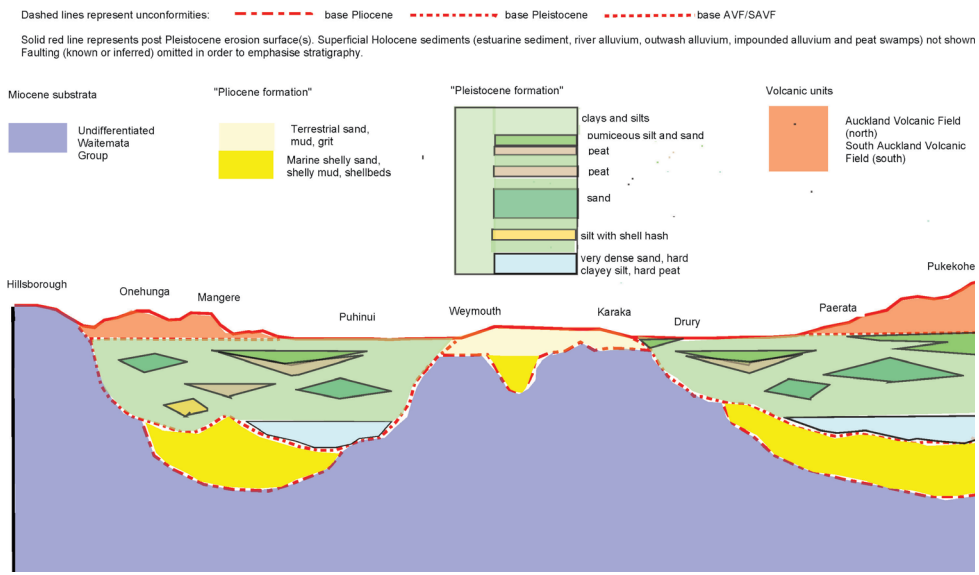
Field Observation

If we return to the original problem of carpet bag definition, we find that the real problem is carpet bag mapping. Historically, large areas of South Auckland - which in practice can be mapped as distinct units consisting of subunits - are represented in QMap Auckland (Edbrooke, 2001) by a single formation (Puketoka Formation, "Pup"). In reality, strata encountered near surface at Karaka and Weymouth are completely different to strata encountered near surface at Mangere or Papakura, yet no cartographic distinction is made.

When scoping out a job in central Auckland, the first thing I do is go to the geological maps and quickly determine, from the units shown, what I can expect at depth. The same cannot always be done in the south Auckland area. Essentially, the first tool for geotechnical assessment, as to what can be expected at surface and at depth, is a well-researched and well-produced geological map, with well-defined stratigraphy and illustrative cross sections. From my experience over fifteen years of field investigation, I believe that the post-Miocene sediments of Auckland can be mapped in terms of two or three traditionally defined lithostratigraphic formations, each comprising cycles of renewed deposition following a period of erosion, each containing distinct lithofacies that can be confidently logged in subsurface (Fig.1).

This concept is not new. Detailed stratigraphy within the Pleistocene has been mapped in subsurface at Rosebank Road by Philip Kirk (Kirk,2012). Probable unconformity between the Pliocene and Pleistocene was recognised by Jim Schofield (Schofield, 1958) and has recently been shown in subsurface investigation at Mangere (Watercare Central Interceptor Project, 2022). Waipipian strata rest unconformably on Waitemata Group (Hayward 2021; Watercare 2022) but also overlie Opoitian strata of similar facies at depth near Glenbrook (Beu 1974) with presumed conformity. Takanini Formation dismisses any recognition of distinct

Fig.1. Schematic straitigraphy, north to south section, Manukau Lowlands.



formations bounded by unconformities, presenting instead the apparent misconception of a continuous period of sedimentation laid down in interfingering facies from the middle Pliocene to the modern day (Barrell et al., Fig. 2.5, p.12). This concept is congruous with lithofacies modelling, but incompatible with field evidence and with age-stratigraphic mapping.

Resolution

Can the proposed stratigraphy be amended? The approach taken by Nelson et al. (1988) in assessing Tauranga Group at Ohinewai (Waikato district) is well worth considering. They recognised a series of "stratigraphically unconfined lithofacies" which they grouped into "assemblages", and noted general coincidence with existing mapped Formations and Subgroups (Kear and Schofield 1978); keeping the concepts of lithofacies modelling and formal stratigraphy separate.

In their paper, Nelson et al. offer the following general observation on the Tauranga Group in the South Auckland Region: "*A better understanding of the record of late Neogene sedimentary events in the South Auckland region will depend largely on subsurface studies in the separate lowland basins, and then only if sufficiently good age control is available in the sections. Presently the age of Tauranga Group sediments is rather loosely constrained.*"

Revision in the Auckland area either has to take a fully facies-based approach, with a 'Takanini Assemblage' subdivided into informal lithofacies, or it has to take a formal age-stratigraphic approach. If Takanini Formation was redefined as a subgroup of Tauranga Group, formally correlated with the three subgroups recognised in the Waikato, and (potentially) subdivided into Formations; and if the lithofacies units were redefined as such or discarded in favour of age-stratigraphic member units based on systematic geological mapping and borehole log analysis, then the proposed stratigraphy, in revised form, could become a significant step forward.

Technicalities

The status of Kaawa Formation (Opoitian to Waipipian), excluded from Tauranga Group in QMap Auckland (Edbrooke 2001), included in Tauranga Group as the lowest unit of Frankton Subgroup in the Waikato District (Kear and Schofield, 1978), and only partially included in the Takanini Formation (Barrell et al. 2001), would have to be resolved in the process of formal lithostratigraphic redefinition.

It would also be worth considering whether Pleistocene sediments in south Manukau (Drury and westward) have closer affinities with the Waikato basin via ancestral drainage systems underlying South Auckland Volcanics than with Pleistocene sediments in north Manukau; being separated from north Manukau by a persistent substrate high of Waitemata Group (Fig.1).

Dissimilarity between Puketoka Formation *sensu stricto* (Pliocene conglomerate at its type locality and at Kidds Beach: Hayward and Grenfell 2010) and Puketoka Formation as a member of Walton Subgroup (Pleistocene sediments; Nelson et al. 1988), also requires review; but is outside the scope of this discussion.

Summary

Is the Takanini Formation in its present format fit for purpose, or fundamentally flawed? Is a modified lithofacies-based 'Takanini Assemblage' a better answer to the challenge of redefining the various strata of the Manukau Lowlands; or does resolution lie in a 'Takanini Subgroup' subdivided into age-lithostratigraphic formations, formally established in peer-reviewed journals? Any resolution - whichever is chosen - should be supported by sustained collaborative arrangements between GNS, academia, geotechnical practitioners and their clients; to publicly share borehole logs, encourage theses, and to submit samples for dating, allowing continuing refinement of the geological model.

In my view, the most practical tool to assist geotechnical personnel unfamiliar with a site in getting the geology right, is a detailed informative map that indicates what units can be expected at surface, and predictably in subsurface, and places any proposed site investigation squarely into a focused and workable age-stratigraphic geological context. Such a map is most useful if it is built on a foundation of careful and traditional geological mapping integrated with borehole data, rather than upon a subjective desktop collation of lithofacies.

Only when we get the foundations right can our interpretative structure stand firm. ■

Acknowledgements: Thanks to Bruce Hayward, Hugh Grenfell and Jill Kenny for their reviews and improvements, and to Jill for proof reading, which have been much appreciated. Comment by Rhys Graafhuis of Tonkin and Taylor is also gratefully acknowledged.

References:

Barrell D.J.A., Bland K.J., Hill M.P., Lee J.M. 2021. Revised stratigraphic framework for the Pliocene to Holocene sedimentary deposits of the Auckland area. GNS Science Report 2020/05. March 2021 25pp.

Beu, A.G. 1974. A Kaawa Creek molluscan fauna from a bore south of Manukau Harbour, Auckland. NZ Journal of Geology and Geophysics 17 (2) pp. 490-494.

Edbrooke, S.W. (comp.) 2001. Geology of the Auckland area. 1:250,000 (QMap series). Institute of Geological and Nuclear Sciences 1:250,000 geological map 3.

Hayward B.W. 2021. Once in a lifetime fossil digs at Mangere sewage works. GSNZ Newsletter 33: pp.46-49

Hayward B.W., Grenfell H. 2010. The Puketoka Formation and the age of the Hauraki Graben. Pre-conference field trip, Auckland, 21 November 2010. Geological Society of NZ Miscellaneous Publication 129b 9pp.

Kear, D.; Schofield, J. C. 1978: Geology of the Ngaruawahia Subdivision. New Zealand Geological Survey bulletin 88

Kirk, P. 2012. Depositional history of the Late Neogene Tauranga Group at the Causeway, SH16, upper Waitemata Harbour, NZ. Geoscience Society of NZ 2012 Conference: Abstracts pg. 51.

Nelson C.S, Mildenhall D.C, Todd A.J, Pocknall D.T 1988. Subsurface stratigraphy, paleoenvironments, palynology, and depositional history of the late Neogene Tauranga Group at Ohinewai, Lower Waikato Lowland, South Auckland, New Zealand. NZ Journal of Geology and Geophysics 1988 (31): 21-40

Schofield, J.C. 1958. Pliocene shellbeds south of the Manukau Harbour. NZ Journal of Geology and Geophysics 1(2) pp. 247-255.

https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=2697

EARLY MIOCENE GHOST SHRIMP BURROW NETWORK

Bruce W. Hayward

According to Hynzy and Klompmaker (2015) there are 42 published records of fossil ghost shrimp (Callianassidae) remains preserved inside their burrows world-wide. There are six records from the Southern Hemisphere and just the one from New Zealand. The record from the Early Miocene (Altonian) in the Nihotupu Formation at Muriwai on the west coast of Auckland (Hayward, 1976a) is the only known Miocene record from the Southern Hemisphere at the present time. It is also one of the deepest known records of a fossil ghost shrimp burrow network. The benthic foraminiferal fauna from the associated sediment (Q11/f7002D) is classified in thanatotope D of Hayward and Buzas (1979) estimated to have been deposited at lower bathyal to abyssal (1000-3000 m) water depths.

The burrow network of multiply-branching, mostly unlined burrows (burrow diameters of ~5 cm) is exposed as a 5 m-wide by 0.3 m thick complex within calcareous volcaniclastic medium sandstone (Fig. 1).

Fig.1. 3m-wide photo of the main part of the ghost shrimp burrow network (Thalassinoides) south of Muriwai. The open burrows are now filled with recrystallised light-coloured sand.

The sandstone is dm-m-bedded and the burrow network (assigned to the ichnogenus Thalassinoides) occurs 1.5 m below the base of a pahoehoe flow lobe on the southern side of the Collins Bay pillow lava flow (Fig. 2). This significant trace fossil network is readily found as it occurs at about high tide level on the shore platform immediately south of the deep sand-filled gut between Collins and Pillow Lava Bays. Those wishing to view the feature

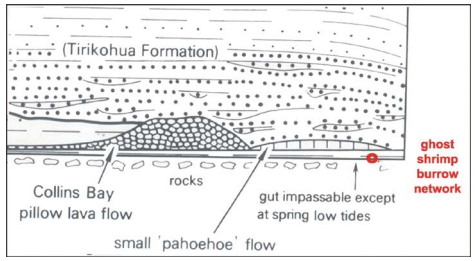


Fig. 2. Sketch of the geology in the cliff between Collins and Pillow Lava Bays, south of Muriwai, with the burrow network location marked. Modified from Hayward (1979).

should visit on a spring low tide and relatively calm seas so they can easily walk and clamber their way 1 km south from the Maori Bay carpark (Fig. 3).

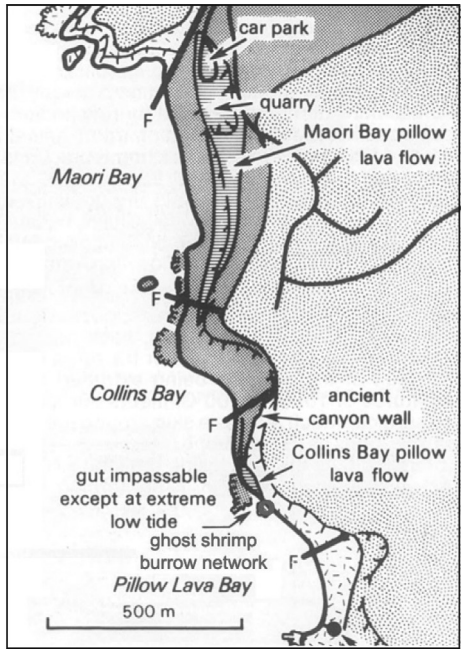


Fig. 3. Map of the coast south of Muriwai showing the location of the ghost shrimp burrow network. Modified from Hayward (1979).

Finding remains of the animal responsible inside the fossil burrow it has made, is rare, as most such animals are soft-bodied and rarely fossilise. Ghost shrimps (Fig. 4.) have rather soft, weakly calcified exoskeletons except for their chelae which are more heavily calcified and usually the only remains that may be preserved. As they grow these shrimps moult their exoskeletons on a number of occasions and thus one individual may leave more than a single pair of chelae that could be fossilised. It has been observed (Schafer, 1972) that ghost shrimps usually remove the moulted exoskeleton from the burrows but often the heavy chelae break off and are left behind.

In the 1970s I found and collected four chelae from in the cemented and recrystallised burrow fill (Hayward, 1976, fig. 4). The burrow fill is so hard and recrystallised it is extremely difficult to dig out any fossil remains. Over time wave erosion slowly exposes additional specimens and, on several occasions since the 1970s, I have found additional chelae of the same species of ghost shrimp ("Callianassa" awakina Gleasner, 1960). Most chelae only possess the lower fixed finger (Fig. 3) but one specimen (Fig. 4) shows both the fixed and moveable fingers of the chelae. These additional specimens have been lodged in the fossil collections of Auckland Museum.

The coast south of Muriwai is best known for the most easily accessible gannet colony to a major New Zealand city and for its internationally-significant pillow lava flows. For those who explore

Fig. 4. A modern ghost shrimp (100 mm long) and two sides of one of the fossil callianasid chela from out of the burrow network at Muriwai (scale units 1 mm each).

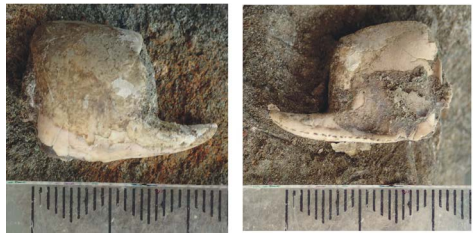


Fig. 5. Fossil chela with both fixed and moveable fingers still intact in the sediment fill of the burrow network at Muriwai. Chela 20 mm long.

further south there are dikes feeding pillow rolls along their crest and bathyal submarine canyons with trace fossil assemblages bored into the canyon walls (Hayward 1979). This bathyal ghost shrimp burrow network with fossilised remains of its makers is yet another reason why this section of coast is a must see place for geologists visiting Auckland. It has planning protection as an Outstanding Natural Feature of international significance in the Auckland Unitary Plan.■

References

Hayward, B.W. 1976. Lower Miocene bathyal and submarine canyon ichnocoenoses from Northland, New Zealand. Lethaia 9: 149-162.

Hayward, B.W. 1979. Ancient undersea volcanoes: A guide to the geological formations at Muriwai, west Auckland. 32 p.

Hayward, B.W., Buzas, M.A. 1979. Taxonomy and paleoecology of early Miocene benthic foraminifera of northern New Zealand and the north Tasman Sea. Smithsonian Contributions to Paleobiology 36, 154 p.

Hynzy, M., Klompmaker, A.A. 2015. Systematics, phylogeny and taphonomy of ghost shrimps (Decapoda): a perspective from the fossil record. Arthropod Systematics and Phylogeny 73: 401-437.

Schafer, W. 1972.Ecology and paleoecology of marine environments. University of Chicago Press, 568 p.

GEOCRYPTIC CROSSWORD 04

by **Cryptonite**

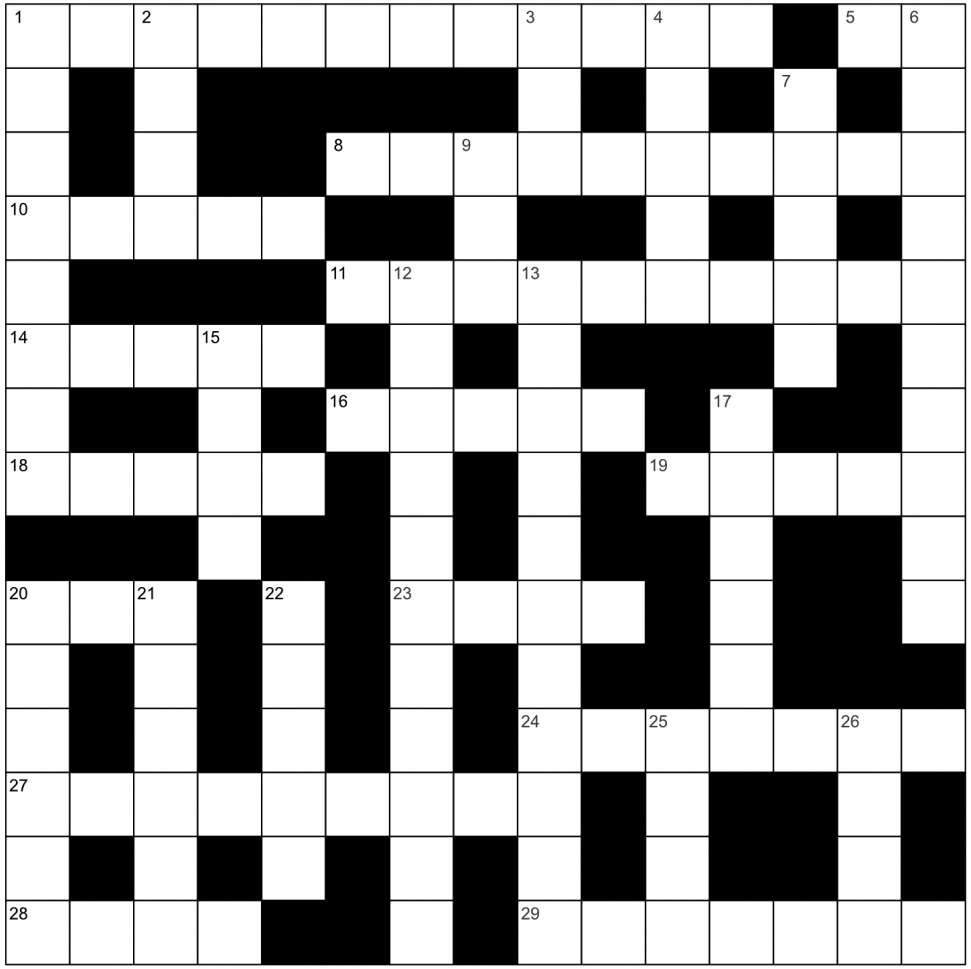
ACROSS

1. & 16A. Product of gradual build up (awry… awry) at boundary (12, 5)
5. Double singular? It's hot and frothy! (2)
8. Sandal dials 0, we hear, for fossil reptiles from Lake Manuherikia (10)
10. Toy grunt overturned a flat submarine mountain (5)
11. Love them after upset sleep is found in a cave (10)
14. This flightless plane finds the middle of a fold (5)
16. (see 1 Across)
18. & 27A. Mean Kelvin shocked by conveyance describes fluid motion (5, 9)
19. Parlay loses right to become a dry lake (5)
20. ACDC is upset after losing leader for calcite equilibrium point (3)
23. The theatre group is a naturally fake fossil (4)
24. Malformed ear gave a way to summarise data (7)
27. (see 18 Across)
28. A nappe has what a fossil rhizome once was (4)
29. The European Union stays bewildered about global change in sea level (7)

DOWN

1. A filled hole produced by treatment of example malady (8)
2. Finest sediment is loved by the potter (4)
3. In short, nickel and carbon can be analysed at this NZ facility (3)
4. An isotope that plays music and decays? (5)
6. Get together with silver inside a natural collection of fossils (10)
7. A leader is the most common of the quartzes (5)
9. An alternative resource, we hear (3)
12. IPCC scenarios to take place before word choices (11)
13. Fossil locality made exceptional by great lattes (11)
15. Science publisher adds arsenic to 5. (4)
17. This bedding is full of sand and mud! (6)
20. Century assessor makes a big impression (6)
21. Nay, Dom fixed the generator in Earth's core (6)
22. Cu and Zn are an alloy of impudence (5)
25. Listening implements retuned for long time intervals (4)
26. Goes bananas for people who love rocks (4)

Answers on p.34



PULLAR-VUCETICH PRIZE 2020

A RESEARCH JOURNEY

Tephrostratigraphic constraints on sedimentation and tectonism in the Whanganui Basin

Callum Rees: 2020 recipient

Supervisors: julie & alan palmer

I was incredibly fortunate to receive the Pullar-Vucetich Prize in 2020 for a series of papers on the tephrostratigraphy of the Whanganui Basin in the lower North Island (Rees et al. 2019 a, b; Rees et al. 2020). These papers were all co-authored by my fantastic academic supervisors Julie and Alan Palmer who have been actively working on and promoting tephrostratigraphic research in this area for several decades. The research would not have been complete without help from Alan Beu (GNS), Steve Abbott (Geoscience Australia), Ian Schipper (Victoria University), David Lowe (Waikato University), Brad Pillans (Australian National University), Anja Mobeis (Massey University) and Boxin Li (Massey University). Furthermore, the work would never have been possible in the first place without the amazing landowners of the Manawatū-Whanganui hill country and the seminal work of Feldmeyer et al. (1943), Te Punga (1952) and Fleming (1953).

In essence, my research tries to unravel how the Manawatū-Whanganui hill country formed through time. The story involves uplift and denudation of the Whanganui Basin and exposure through one of the most complete Quaternary records of climate change visible onland anywhere in the world. The basins fortuitous location on the periphery of the Central Volcanic Region means it has acted as a sink for volcanic products and preserved a rich archive of environmental change. The succession is highly fossiliferous and provides a wealth of paleoenvironmental information.

My research journey involved moving into an old air force flat in the small township of Bulls with my wife, who showed great patience as I immersed myself with mapping the geology of the central Rangitikei as part of a 2016-2019 PhD project. Conspicuous tephra and volcaniclastic layers (Fig. 1) have been used to map the basin fill since the early 1940's. Issues with rapid lateral facies variation and reworking of material into overlying beds has sometimes hampered correlation. Our ability to now geochemically fingerprint glass in tephra and volcaniclastics using an electron microprobe has revolutionised mapping. My co-authors and I helped to refine correlations and trace marker horizons laterally across the landscape, mapping units and helping to tell part of the Whanganui Basin story.

Potaka Pumice in Pohangina Valley—Broadlands Station

References:

Feldmeyer A.E., Jones B.C., Firth C.W., Knight J. (1943). The geology of the Palmerston- Wanganui Basin, "West side", North Island, New Zealand. Unpublished Report of the Superior Oil Company of New Zealand, Petroleum Report Series 171, Ministry of Economic Development, Wellington, New Zealand. 46 p

Fleming C.A. (1953). The geology of Wanganui subdivision. New Zealand Geological Survey Bulletin 52. Wellington, New Zealand. 362 p

Rees, C., Palmer, A., & Palmer, J. (2019a). Quaternary sedimentology and tephrostratigraphy of the lower Pohangina Valley, New Zealand. New Zealand Journal of Geology and Geophysics, 62(2), 171-194.

Rees, C., Palmer, J., & Palmer, A. (2019b). Whanganui Basin, an archive of prehistoric earthquakes? Waitapu Shell Conglomerate (c. 0.9 Ma), North Island, New Zealand. New Zealand Journal of Geology and Geophysics, 62(2), 195-216.

Rees, C., Palmer, J., & Palmer, A. (2020). Tephrostratigraphic constraints on sedimentation and tectonism in the Whanganui Basin, New Zealand. New Zealand Journal of Geology and Geophysics, 63(2), 262-280.

Te Punga M.T. (1952). The geology of Rangitikei Valley. New Zealand Geological Survey Memoir 8, Wellington, New Zealand. 46 p.

CALL FOR AWARD NOMINATIONS

AND APPLICATIONS FOR THE 2022 GSNZ ANNUAL AWARDS

The awards on offer this year are listed below. Please email your nominations/applications to the Awards Subcommittee Convenor, Sam McColl, at vp@gsnz.org.nz. The deadline for submission is **1st of September 2022** for all awards except the YRTG which has an earlier deadline of **31st July.** For more details on individual awards and to download nomination templates please visit http://gsnz.org.nz/awards

PREMIER GEOSCIENCE-WIDE AWARDS:

Hochstetter Lecturer

For a geoscientist with excellent public speaking skills to present new research to all branches of GSNZ. We welcome nominations of ALL members of the geoscience community for this award, from ECRs, through to senior geoscientists.

McKay Hammer

For the author(s) of the most meritorious geoscience paper(s) from the last 3 years (2019-2021).

GSNZ Honorary Member

Nominations are called for to recognise outstanding lifetime contributions to geoscience in New Zealand.

Hayward Geocommunication Award

Awarded to a NZ-based geoscientist or geoscientists for the most meritorious contribution to geocommunication in the previous 3 calendar years (2019-2021).

YOUNG RESEARCHER/STUDENT AWARDS:

Hornibrook Award

For a postgraduate student undertaking a research project involving methods of stratigraphic correlation and of relevance to NZ and/or the southwest Pacific.

Jim Ansell Geophysics Scholarship

Post-graduate scholarship for NZ's top up-and-coming geophysicist.

John Beavan Geodetic Fieldwork Grant

Support for students involved with geodetic research to undertake or participate in associated fieldwork. Applications can be submitted at any time.

Wellman Research Award

A contribution of approximately $3000 towards research in New Zealand. Contribution can cover field, travel, analytical expenses, etc (more details on website).

Werner F. Giggenbach Prize for Geochemistry

For the most outstanding geochemistry publication in 2021 by a NZ-based young researcher.

SPECIAL AWARDS:

New Zealand Geophysics Prize

For the most meritorious publication in NZ geophysics in the current and last 2 years (2019-2021).

Harold Wellman Prize

Awarded for a recent discovery of important fossil material within New Zealand.

Kingma Award

Awarded to the most outstanding Earth science technician in New Zealand.

Pullar-Vucetich Award

For the most meritorious contribution to tephrochronological research in the New Zealand region published in the previous 3 calendar years (2019-2021).

Alan Mason Historical Studies Fund

Up to $500 awarded to assist research on the history of Earth science in New Zealand.

YOUNG RESEARCHER TRAVEL GRANT

To provide funding assistance for New Zealand early career Earth science researchers and PhD students to attend and present a talk or poster at their first international overseas conference.

Application deadline of 31st July.

AWARDS FAQ:

Learn more about who is eligible and how to apply for the GSNZ Awards.

Who can apply? Are the awards just for students or high-flying senior scientists?

Our awards are open to all members of the Society. Yes, we do have awards that are just for students, and a couple are directed at those with a long history in the Geosciences. But the remainder are available to anyone who fits the criteria for a given award. We would welcome more nominations for/from Early Career Researchers for awards such as the Hochstetter Lecturer, New Zealand Geophysics Prize, Hayward Geocommunication Award, and McKay Hammer, the majority of which may have anecdotally been regarded as the territory of more established researchers.

Can I apply for these awards myself, or do I have to be nominated by someone else?

This depends on the award. For some awards (e.g. most of the student awards and the Alan Mason Historical studies fund), it is generally expected that the recipient will also be the applicant. For the majority of the other awards, it has traditionally been that recipients are nominated by others.

However, this does not mean that you cannot arrange for yourself to be nominated if you would like to be considered for one of the awards. The Awards Subcommittee would welcome self-nominations for all other awards, with the exception of the GSNZ Honorary member and S.H. Wilson Prize. Depending on the award, you may still need to find nominators to support your application, but you can be responsible for completing and submitting the applications yourself.

Is it a lot of work to apply?

Generally no. Some awards require more input than others. Most of the work in any given award is writing the justification to explain why the applicant/nominee is a worthwhile recipient. To get an idea of how much work is involved for a particular award, go to http://gsnz.org.nz/awards and download the award template for that award.

Who judges the Awards?

The majority of the awards are judged by the Awards Subcommittee, which is chaired by the current Vice President of the Society. The Subcommittee usually consists of the Chair plus at least 4 or 5 other geoscientists selected by the Chair, some of which may be members of the National Committee.

The makeup of the subcommittee changes each year. The Chair aims to ensure that the Subcommittee contains members from a range of institutions (Universities and CRIs) and disciplines. Some awards (Wellman Research Award, Wellman Prize, Werner F Giggenbach Medal, S.H Wilson Prize) have rules which state the decision lies with other parties. However in practice, the Awards Subcommittee will generally make a recommendation to these other parties, who can then ratify it.

If I submit an application or nomination this year and it isn't successful, can I resubmit it again the following year?

Yes! We do recommend checking with the Chair of the Awards Subcommittee first. But as long as the award is offered again in the subsequent year and the application still complies with the respective rules for the award (e.g. publications relating to a particular timeframe, etc.) then we do encourage resubmissions.

What are the chances of success?

Lately, pretty good! In recent years, the majority of our awards have, on average, received fewer than five nominations in a given year. We'd like to see this change though, so please get writing and nominate yourself or your colleagues & students for these awards which recognise excellence in our community! ■

GEOID UPDATE

GEOEDUCATION, OUTREACH, AND INTERNATIONAL DEVELOPMENT

Jenny Stein: GeOID convenor

Kia ora koutou,

It's been a case of where has the time gone for us here at GeOID. It seems only yesterday we were assembling a new committee and setting up our monthly seminar series "GEOTalks". Now here we are, already four speakers into the series! We are very grateful to the speakers who have enthusiastically shared their GeoEducation and Outreach experiences with us so far and look foward to many more to come. The GSNZ's recent purchase of a Zoom Pro licence means we (and other GSNZ SIGs and branches) now have the abililty to record our virtual events. This means we can make the recorded talks available to any members who may not be able to make it on the day, or who may wish to refer back to them in future. In this way we hope to gradually assemble a library of information about different outreach initiatives and resources, one that will not only acknowledge the great work being done around the country in the geoscience outreach space, but also be a repository of useful ideas and information that may help support and inform future initiatives.

Another exciting development is the return of the Tauranga STEM Fest. Last year we had a team of members all set and ready to present an interactive range of geoscience-related exhibits and demonstrations at STEM Fest 2021, but they were called off when the event—like so many others—was cancelled due to COVID-19. However, STEM Fest is back and scheduled for 2 October, 2022 (https://www.taurangastemfestival.co.nz/). We are currently reassembling a team of eager outreachers to travel to Tauranga and represent the GSNZ as they spend a day helping inspire young minds and their whanau with the wonders of geoscience.

For the social-media minded, don't forget to join our Facebook Group "What kind of rock is this?!" and help us answer enquiries from the public about interesting geological finds and features spotted around Aotearoa New Zealand. Don't be afraid to share posts of your own to stimulate conversation either! Our 200+ group members are always interested to learn more about all the interesting rocks and landforms to be found around the country.

As always there's plenty more we could be doing, so don't hesitate to reach out with your own ideas and get involved.

Tūwhitia te hopo, mairangatia te angitū! (Feel the fear and do it anyway)

Mā te wā,
Jenny

PETROLEUM UPDATE

NEW ZEALAND'S PETROLEUM INDUSTRY UPDATE —2022

Mac Beggs

In Newsletter 32 (2020) I contributed a review of the state of the petroleum industry in New Zealand, which was updated a year ago (Newsletter 34). The first article concluded, "Petroleum exploration in New Zealand is at a low ebb. This may be the local manifestation of the permanent sunset many envisage for petroleum industry; or, a prelude to a 3rd cycle of success, if the exploration ban were to be overturned and conditions for investment to improve. We shall have to wait to see." The update observed, "the petroleum industry is not yet dead, from either its natural aging or from the political blows it has taken. But neither is it proving well enough to do all of the work expected of it." This point was demonstrated on 9 August last year when, in the face of record power demand on one of the coldest nights of the year, more than 34,000 households were left without power, in some cases for more than 2 hours. Historically, thermal generation fuelled from Taranaki natural gas would have covered this type of situation. It seems timely to again take a reading of vital signs on the petroleum industry. Unfortunately, it has become increasingly difficult to gather information on the industry. Media coverage of the industry has diminished, and companies engaged in oil and gas exploration and production are ever more reluctant to attract public attention in fear of stimulating disruptive protest action from groups who blame the industry for the perceived excesses of consumers. There are less and less geoscientists engaged in the industry in its current form, and only a few choose to maintain membership of this Society. The following is based on my best efforts to gather and summarise activities but may have missed some significant aspects.

Onshore Taranaki

Apparently, New Zealand's small fleet of drilling rigs is busy in Taranaki (and on geothermal developments in the central North Island), but mainly, if not entirely, within existing fields. The map below shows the petroleum mining and exploration holdings in Taranaki as of May 2022, colour-coded as to the companies in control. The 2021 share of oil and gas production (totalling 3.83 million barrels and 62 billion cubic feet respectively) for each of the companies is shown by the pie graph.

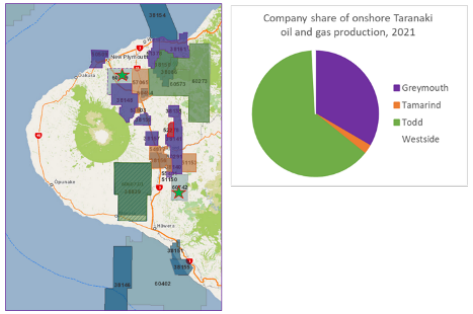


Figure 1. Onshore Taranaki petroleum mining and exploration permits with controlling companies colour-coded as for the pie chart showing shares of 2021 oil and gas production. Greymouth includes its common-owned New Zealand Energy Corporation. WestSide permits in southeast. Green stars mark exploration permits awarded in 2021, pending litigation from groups opposing oil and gas exploration

There are more missing jigsaw pieces than previously within the main producing fairway between about Eltham and the northern coast of the peninsula, and most exploration permits still in force were granted before 2017 – some as long ago as 2008. The annual Block Offer process has largely broken down, with one permit from a 2018 round granted in 2020, while two permits (marked with stars in the map above) granted in 2021 from the "2019 Block Offer" are held up by a law suit brought against the government by an activist group. The case is scheduled to be heard in June. Todd maintained an active four-well drilling campaign in the Kapuni field last year before the Big Ben rig was moved to the north coast where it is currently drilling a new development well with operator OMV out into the offshore Pohokura field. It is scheduled to move again to Todd's Mangahewa field over the next couple of months. Greymouth generally maintain steady activity in their fields in the northern peninsula to sustain production. Eight wells have been drilled in the Turangi field since 2019. Greymouth subsidiary NZEC acquired a 3D seismic survey over the largely depleted Tariki gas field last year, and its interpretation may reveal further opportunities whether for development of additional "bypassed" gas, or possibly for storage, which is increasingly important to manage fluctuations in gas demand. The only existing geostorage facility in the former Ahuroa gas field is owned by FirstGas (who operate the national high pressure gas pipeline system) and is shown in red on the map.

Offshore

Comparing the permit map from 2020 with the current one graphically demonstrates the severe spatial contraction in petroleum industry activity. There are now only five offshore petroleum exploration permits in force in New Zealand, all in the Taranaki Basin. Todd Energy has relinquished two permits while taking over the Kaheru permit off the SE coast, adjacent to the Kupe and WestSide fields at the coast. Even more than onshore, significant investments are being made in the fields, especially OMV-operated Maui where six infill and two step-out wells have been drilled from the northeastern, Maui A Platform, and work is underway with a programme of similar magnitude at the southwestern, Maui B Platform using the Super Gorilla class Valaris JU-249 jackup rig over the platform to sidetrack existing wells and target additional bypassed gas. The last offshore exploration campaign in New Zealand was wound up abruptly due to the 2020 Covid 19 lockdown, without drilling the Maui-8 prospect between the production platforms, so that well may be added to the current programme. There is also appraisal drilling provisionally scheduled for the same rig, on OMV's indicated discovery at Toutouwai-1 in 2020. The Valaris rig may also drill a well or two in the Kupe Mining Permit, operated by Australian company Beach Energy, when its work for OMV has been completed. Government is also active in offshore Taranaki, overseeing the decommissioning of the Tui oil field following the insolvency of its last Operator, Tamarind Offshore. When equipment on the

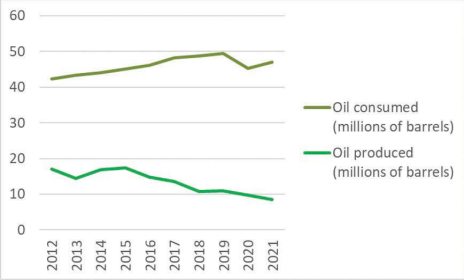
seabed has been removed, a semi-submersible workover rig will be brought to New Zealand to plug and abandoned the oil production wells. The unfortunate outcome of government having to cover the Tui decommissioning no doubt contributes to continuing delays in granting government approval to transactions in respect of other offshore projects, notably the sale of OMV's 69% share of the Maari oil field interest to Jadestone.

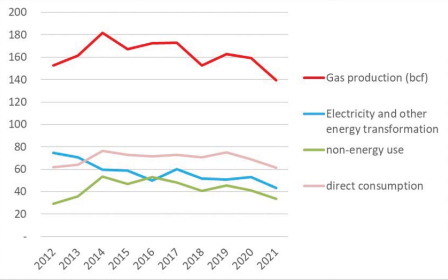
Consumption of petroleum in New Zealand

While exploration for oil and gas, and development of discoveries, historically important for the application of geoscience knowledge and technology, are being brought to an end in the supposed interest of limiting climate change, New Zealand's consumption of these commodities trucks on, apart from what appear to be relatively short-term pandemic impacts. Oil consumption is met with increased imports, but at this point there is no infrastructure for natural gas importation, so some industries relying on gas are facing the costs of alternatives. The Huntly power station we rely on for periods of high electricity demand exceeding the capacity of developed renewable energy and Taranaki gas is now fuelled by imported coal. International oil and gas exploration

A sharp fall in oil prices since 2014 resulted in much reduced investment in exploration for a few years, and hence limited discoveries of new fields. However over the past year or two, several important new theatres for oil and gas have been opened. The Atlantic margins have seen underexplored countries (their offshore territories to be precise) join the echelon of producing countries – Guyana and Suriname on the west, and Namibia on the east. Numerous discoveries have been reported from the Mexican sector of the Gulf of Mexico. As near as Australia, the onshore Perth Basin, and the Bedout Basin on the NW shelf, have yielded significant new play discoveries, while Beach Energy has expanded its gas production in the Otway Basin offshore Victoria.

Perhaps New Zealand was also due for a renewal of discovery just as exploration was curtailed by Government in 2018.■





LETTER TO THE EDITOR

RE: GEOSCIENCE SOCIETY OF NZ NEWSLETTER 36

Kia ora Janis,

I wish to correct an inconsistency in the subject newsletter.

In the Gear Stick award article, you note that the trophy was awarded to Mike Hall relating to his shooting a horse in the Clarence Valley.

The incident took place in the St James Station section of the Clarence River's valley, northeast of Hanmer where the river flows south, and I was the 4th geologist in the party.

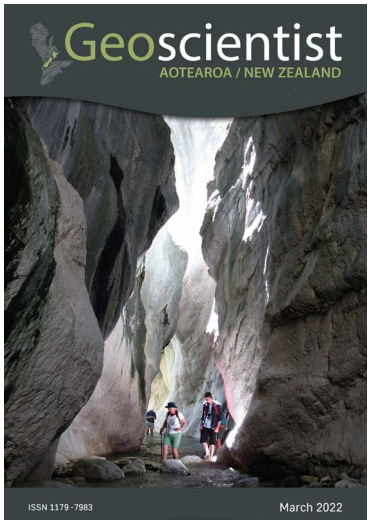
It was back in 1960, and we were tasked with setting up the geology of the Clarence Valley upstream west-southwest from Coverham, where Mike had done his MSc thesis work, and the parallel Awatere Valley, for Geological Map of New Zealand 1:250 000 Sheet 16. A party of 4, including Mike, Roger Cooper, Gerald Lensen, and a tramping club supporter of Gerald's, had worked up the Clarence Valley from Kekerengu. Roger describes the whole trip in his paper in GSNZ News Letter 138. The area was pretty remote, and it was estimated that the trip would take over at least 6 weeks. An air drop of back up supplies was arranged for when they reached the Clarence Reserve Station outpost at Quail Flat in the valley. They set out with personal gear and food for half the trip on 3 pack horses. The lead horse was a big bloke, Prince, who knew all about pack horse strings. When you were leading him, you held his halter, but he parked his head over your shoulder, matched paces, and breathed and snorted in your right ear.

At that time, I was working with Ko Kingma on 4 mile sheets 11 and 12 at the NZGS building in Lower Hutt, but had been scheduled to link up with the Clarence Valley group in the beginning of January. I took the ferry, the Tamahine, and rail car to Kaikoura where Mike picked me up and took me to the Clarence Reserve homestead, then, on 2 horses, into the Clarence Valley. The air drop arrived next morning, I remember chasing tins of food racing across the flats after containers broke. The group split into 2. Gerald went on up the Awatere valley, and Mike, Roger and I continued up the Clarence. A couple of days later, I had taken Mike's rifle up a gully behind our camp, and was stalking a pig, when a plane came up the valley. It all but landed, dropped a bundle and at full throttle, headed back into the sky. Mike grabbed the bundle, and shouted "Don't worry about that, we've got fresh bread!" Apparently they had forgotten about it on the first trip and made a special effort. We continued up the valley, to stand on the pass up from Hanmer, thinking how well a cool beer would go.

We then turned into the south trending St James Station part of the river valley. A couple of days later, I was nursing a twisted ankle behind the others, when the horse I was leading pulled me over, broke loose, and took off, scaring the others, and galloping in an arc, slowed to a walk, and headed south, looked distinctly like it was going back home to Kekerengu. Mike had the rifle, and the horse was packing all of the expedition's data, hence the shot.

Shortly after, we reached the overlap with the other groups mapping. Mike headed on up the valley, and Rodger and I took the horses 125 km, 78 miles in those days, back to Kekerengu.

Ngā mihi,
Tom Haskell



A fresh new header was designed to accompany the name change and as shown in the mock-up above. All feedback on the new header is welcome.

FOUND!

NEW NAME FOR THE GSNZ 'NEWSLETTER'

In Issue 35 of the GSNZ Newsletter, we welcomed suggestions for a new name for the new-look GSNZ Newsletter.

We wanted to build on the changes already made and make the Newsletter recognisable as a uniquely Kiwi publication. Ideally, the new name would concisely articulate what the publication is about and reflect who we are.

There were a number of submissions from members and the majority were in favour of a change. The suggested names were whittled down and incorporated into 15 variations on the design. A shortlist was presented to the National Committee who voted for the one pictured at left.

While it would have been preferable to include elements of te reo, in the name, we would need to have undertaken appropriate consultation which may have taken some time. This is still under consideration for a later date.

GEOCRYPTIC CROSSWORD ANSWERS (FROM PAGE 22):

Across
1. & 16A. accretionary wedge, 5. aa, 8. crocodiles, 10. guyot, 11. speleothem, 14. axial, 16. (see 1A), 18. & 27A. Ekman transport, 19. playa, 20. CCD, 23. cast, 24. average, 27. (see 18A), 28. root, 29. eustasy

Down
1. amygdale, 2. clay, 3. NIC, 4. radio, 6. assemblage, 7. alpha, 9. Ore, 12. predictions, 13. lagerstatte, 15. AAAS, 17. flaser, 20. crater, 21. dynamo, 22. brass, 25. eras, 26. geos

EDITOR'S NOTICE:

A REMINDER FOR CONTRIBUTORS

Please remember that contributions for the Newsletter should adhere to the guidelines set out in the Newsletter section inside the back cover of each issue.

In particular, all images (figures, tables, photos etc) must be supplied separately and not just embedded in a Word document. Pre-formatted (grouped or annotated) images are unnecessary and undesirable as this may hinder page formatting. Similarly please check legibility of text when used as a label on a figure that may need to be be reduced in size to fit an A5 format.

It is the responsibility of the submitter to ensure that these requirements are followed. This is especially so when forwarding articles on behalf of others.

PLEASE NOTE THAT NEWSLETTER GUIDELINES ARE CURRENTLY UNDER REVISION. AN UPDATED VERSION WILL BE AVAILABLE FROM THE NOVEMBER ISSUE.

Geoscience Society of New Zealand

GSNZ NEWSLETTER

SUBMISSION DEADLINES:

- **1ST FEBRUARY (FOR MARCH ISSUE)**
- **1ST JUNE (FOR JULY ISSUE)**
- **1ST OCTOBER (FOR NOVEMBER ISSUE)**

GSNZ IS ZOOMING!

A VIRTUAL PLATFORM TO HOST ONLINE EVENTS

Like many organisations in recent years, GSNZ has shifted towards hosting several events online. However, until now we have not had a dedicated virtual platform to do this and have relied on those organising and hosting our online events to do so through their own personal or workplace accounts.

Earlier this year the point was raised with the National Executive Committee that not everybody wanting to host GSNZ events has access to a reliable, fit-for-purpose virtual platform and a request was made that the GSNZ investigate the purchase of a platform licence that would allow all members to access features that include recording capabilities and meetings involving a higher number of attendants.

A subsequent proposal presented to the National Committee at their March 2022 meeting outlined the following benefits of the GSNZ having its own, paid platform licence:

- enable the society to develop a standardised approach to hosting online events that, in addition to reinforcing the GSNZ 'brand', would make it easier for members to host online events, therefore making it more likely that events would be held
- enhance our event administration capabilities. In particular, it would give us the ability to assign co-hosts who can help with administration of meetings, which will in turn:
  - give us better control over events
  - present events more professionally
  - provide more options for the types of events we can hold (break-out room discussions, live audience polls, etc.)
- allow GSNZ virtual events to be recorded. This will add value for members who might otherwise miss out on events due to competing commitments. It will also provide GSNZ with the opportunity to develop a library of presentations that will be both a valuable resource and legacy archive of research and events dedicated to Aotearoa New Zealand Geoscience.

A range of potential platform licences and various options for how these would be implemented were presented and based on this information the National Committee voted to unanimously approve the purchase of a Zoom Pro licence on a one-year trial basis. This licence was purchased in May 2022 and members of the National Committee have been using it to test and develop GSNZ-specific protocols for access and use of the service.

Once these are finalised the service will be implemented so that GSNZ-related online event hosting is accessible to all GSNZ members. We hope that it will be of particular use to SIG convenors and branch representatives wishing to host online talks, seminars, workshops and virtual fieldtrips.

In the meantime, any members wishing to host a GSNZ online event using the GSNZ Zoom licence may contact the Secretary, Jenny Stein, by email (secretary@gsnz.org.nz).

CALLING THE LEADERS IN GEOSCIENCE!

BID FOR AN INTERNATIONAL CONFERENCE

CONFERENCE FUNDING AND SUPPORT AVAILABLE

Tourism New Zealand's business events team offers support for international conferences of more than 200 international delegates through its conference assistance programme.

This includes supporting costs for a financial feasibility study of the conference, production of a professional conference bid document, funding bid travel requirements, and marketing and promotional support if the bid is successful.

For more information on bidding for an international conference visit:
businessevents.newzealand.com

GSNZ LIMITED EDITION ART

EXCLUSIVE LIMITED EDITION PRINTS BY KAMEN ENGEL

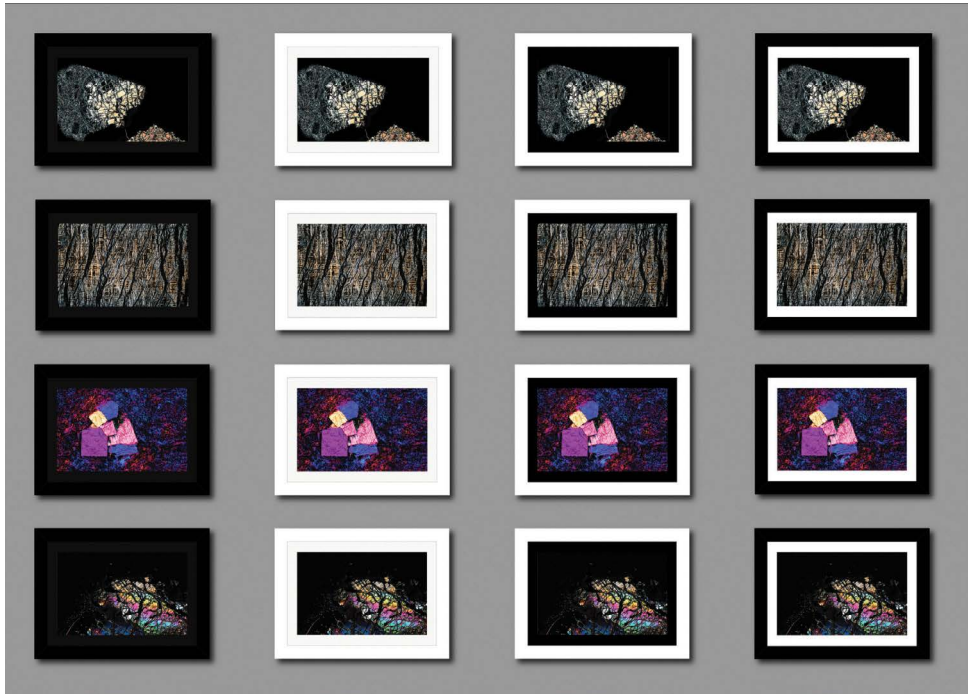
ONE OF THESE BEAUTIFUL PRINTS COULD SOON GRACE YOUR HOME OR OFFICE!

Kamen Engel, who won the GSNZ Photo Competition 2021 for the Student Indoor category, has offered GSNZ a select number of images as a limited edition set which will become available in our webstore soon.

Generated from thousands of single thin-section images, these photographs have been painstakingly captured, processed and stitched to create stunning works of art that showcase the beauty of rock when viewed under a microscope.

Each A3 framed print is numbered and signed, by the photographer, and comes labelled with a description of the image. These prints will be available with white or black mat/frame combinations giving 4 options for each print as depicted below.

At this stage, we are planning to have several displayed at the GSNZ Conference 2022.



INTERNATIONAL PODCAST SERIES

GEOLOGY BITES

Do you struggle to keep up with reading interesting research, outside of your own field of expertise?

Instead, consider using your commute or exercise time to listen to this podcast series from Oliver Strimpel, former astrophysicist and museum director.

Each episode is a bite-sized chunk of conversation with world class researchers who are making key contributions to our understanding of the Earth and the Solar System.

Typically, the episodes are approximately 30 minutes in length. Accompanying illustrations are also hosted on the website should you wish to listen online via your browser. All are also intended to be accessible to those with curious minds but, perhaps, a little less little scientific knowledge. At present, with more than 60 indexed episodes on a vast array of topics, there is sure to be something for everyone.

You can find the series at www.geologybites.com

GEOPHOTOGRAPHY

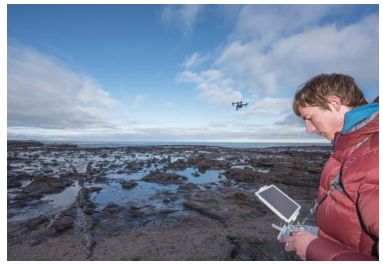
NOVEMBER 2022 ISSUE: LAST CALL FOR ARTICLES

Do you have a story to tell?

It's not too late!

Each issue of the GSNZ Newsletter will feature a set of articles on a theme.

Interesting articles on this topic have already been promised for November 2022 but there is still time for you to to prepare another!



Articles on any aspect of geophotography including technical, experiential, artistic, historical, biographical and others, will be welcome.

GSNZ CONFERENCE 2022

A WHOLE NEW WORLD — FROM GLOBAL TO LOCAL

29th NOVEMBER- 1st DECEMBER **MASSEY UNIVERSITY, PALMERSTON NORTH**

Welcome to the GSNZ Annual Conference 2022 – Palmerston North

Call for Abstracts & Registrations open on the 1st July:
https://confer.eventsair.com/gsnz2022

Tēnā tātou katoa,

Welcome to the Geoscience Society of New Zealand annual conference to be held in Palmerston North from 29 November to 1 December 2022. The conference will be held on Massey University's Turitea Campus and will include oral and poster sessions, an evening public lecture, pre-conference workshops and several post-conference field trips.

The annual conference is the ideal opportunity to meet face-to-face, network and interact face to face with fellow researchers. This year, the conference commences on the Monday evening with an Icebreaker function and will include an informal barbeque and formal conference dinner on Tuesday and Wednesday, respectively. The large seating capacity of the conference dinner venue guarantees room for everyone, and we sincerely hope that as many students as possible will attend that function. There will also be numerous lunchtime breakout sessions, meetings, and workshops.

We look forward to welcoming you to Palmerston North in November 2022 for what we hope will be another very successful annual conference.

Anke Zernack and Julie Palmer
Conference Co-Convenors
Kat Holt
President, Geoscience Society of New Zealand

CONFERENCE 2022: IMPORTANT DATES

1 Jul 2022:	Abstract submission opens
1 Jul 2022:	Registration opens
2 Sep 2022:	Abstract submission deadline
14 Oct 2022	Authors Notified
21 Oct 2022	Early Bird Registration closes

Registration for Geoscience 2022 will be discounted for GSNZ members

To qualify for the reduced fee you will need to be a current financial, honorary or complimentary member. New members are welcome to take advantage of this benefit but your membership subscription will need to be paid prior to your registration being made.

Showcase your photographic creativity and passion for geoscience by entering the Geoscience Society of New Zealand (GSNZ) annual photography competition. Enter a photo into one (or all!) of this years' categories and be in to win some cool prizes, as well as bragging rights!

2022 Entrance Categories and Prizes

	Adults (GSNZ Members only)	Tertiary Students (open)	School Students (open)
OUT & ABOUT	$50 cash prize	$50 cash prize	Hand lens
PATTERNS	$50 cash prize	$50 cash prize	Hand lens
Comic Relief	Open category with a mystery prize		

How to Enter:

Email your photo(s), along with the following details to events@gsnz.org.nz

- Your full name (and age for School Students)
- Photo details (category, title, date and location)
- Photo caption (max. 50 words)

Entries are limited to one photo per person per applicable category (i.e. max. 3 per person). For full terms and conditions visit our website www.gsnz.org.nz/gsnz-events/ViewEvent/177

Entries close July 31st 2022

Geoscience Society of New Zealand | Organised by the GSNZ National Committee and participating branches | Visit us at gsnz.org.nz.

Follow us on LinkedIn, Twitter (@GeoscienceNZ), Instagram (@geosciencenz) and Facebook (@GeoSocNZ).

GSNZ GEOBAKE 2022

WINNER ANNOUNCED

Thank you to everyone who took part in the Geobake across the country and sent in their entries to be judged. While we had few entries this year, the standard was high, and the decision was a close call.

Congratulations to the winner of the Geobake 2022: Kirsty Vincent, with her wonderful Sampling Lava creation! Kirsty's entry depicts Volcanologists sampling fresh lava to gain information on its chemical properties.

Thanks to all those who took the time to shake out their aprons, roll up their sleeves and enter the competition. We loved looking at your bakes, and picking a winner was not an easy decision! Given the few number of entries this year, the Events Committee has decided to award spot prizes to the other entries.

Below right is a collage of the entries from this year.

Geobake 2022 winner:
Sampling Lava by Kirsty Vincent

TOP: Glacial Flour from Jaime Delano —This sourdough shows a glacial valley and includes a glacier perched in mountains of folded bedrock. Down-valley are moraines and a braided river system. Flavours are sesame seed (white), cocoa and caraway seed (brown), butterfly pea flower (blue), and basil (green).

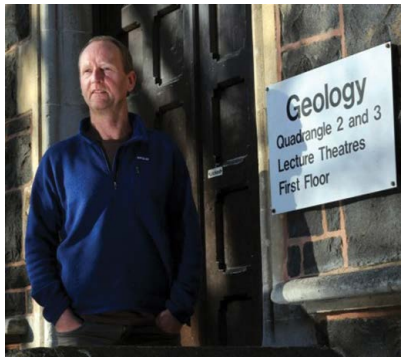
BOTTOM LEFT: Grand Prismatic Spring"Yellowstone" from Chelsea Jack— The Grand Prismatic Spring- An American geological wonder and one of the Earth's largest super volcanoEs. The volcano consists of multicoloured layers of bright bands of yellow, orange and green and is centred with a crystal clear deep blue spring. The Grand Prismatic Spring lays on a bed of rhyolitic rock containing several forms of bacteria which thrive in geothermal conditions. The bacteria are known to create extremely bright pigmented colours surrounding the volcano. Having visited Yellowstone in 2018, I was extremely fascinated by this location as it is really like no place on Earth.

BOTTOM RIGHT: Paleoseismic trenching in the Hauraki Plains from Joshua Hughes—The base of the cake is volcanogenic alluvium (Hinuera Formation). While radiocarbon dating of a chocolatey peat lens indicates some post-Hinuera sedimentation, the top of the sponge cake is bulk tephra, deposited incrementally via developmental upbuilding pedogensis. Coconut and rice bubbles are used for the two visible tephras, Taupo and Kaharoa.

HOCHSTETTER LECTURER 2022

DAVID PRIOR: THE SHEAR ZONES THAT HOLD BACK THE ICE SHEETS

Dave will deliver a talk entitled 'The shear zones that hold back the ice sheets', which will showcase the lateral thinking of using geophysical and geological methods to study the physics of ice, which is also highly relevant to our society as it informs ice sheet modelling and predictions for a warmer world.



This work will appeal to both professional scientists and the general public, and will include some entertaining examples of field work in Antarctica, the vital participation of students, and the need for scientific teamwork.

You can watch Dave's acceptance speech here: https://youtu.be/J2GcpkJ6Tcw%20

Full details of David's tour will be made available later in the year. Check www.gsnz.org.nz for updates.

North Island dates as follows:

Manawatu Branch	7th September 2022
Wellington Branch	8th September 2022
Auckland Branch	20th September 2022
Waikato Branch	21st September 2022
Bay of Plenty Branch	22nd September 2022
Taranaki Branch	3rd October 2022

FIREBALLS AOTEAROA

RECOVERING METEORITES IN NEW ZEALAND

Fireballs Aotearoa is a newly-minted, collaborative project that ultimately aims to recover fresh meteorites in Aotearoa / New Zealand. At this moment, a dedicated team at University of Canterbury Aerospace is assembling sophisticated, yet affordable, meteor-capturing cameras. Fireballs Aotearoa is part of the Global Meteor Network https://globalmeteornetwork.org/

Installing these cameras, across the motu, will increase the chances of meteorite recovery by plotting a meteor's trajectory captured by the cameras. The Fireballs team are hoping to increase the density of cameras, widely distributed with each pointing in a different direction, which will increase data triangulation and, therefore, accuracy and power of the network.

Do you like to get hands on in Citizen Science Projects?

You can join the Fireballs project and purchase a camera to mount on your own house! By doing so, you and your camera could help shed light into the formation, and evolution, of the solar system. Each flash across the sky is a notification that they're bringing us another message from the deep past. We just need to be able to find them and read what they have to say.

Everyone's cameras will be connected to the network and data is transferred, automatically, for analysis by a team at the University of Ontario. This will help scientists begin to map the trajectory of the incoming meteors, over our islands, and give them the best opportunity to access uncontaminated samples. Any falls detected, here, will be screened by James Scott and his team who will co-ordinate and plan how to collect one of the samples. They'll be able to ascertain whether fresh collection in Aotearoa / New Zealand is even feasible.

This project can be completely hands off, or on, depending on your inclination. The camera will send data regardless. But, if you're super keen, then you can follow the data collected from your camera, and view the the latest modelling, via a small dashboard. What's more, if your data is used in any scientific papers, then you get recognition for it!

At the very least, we can deepen the connection between our own little place on Earth, not only to the rest of the planet but to the rest of the solar system and beyond.

So, this Matariki, just go outside and look up.

MICHELE BANNISTER

'COLOSSOS' OF THE COSMOS

Janis J Russell: Science Communicator, Christchurch

As I watched Michele Bannister striding towards me, along the light and airy hallway of the Beatrice Tinsley building at the University of Canterbury, I could see that this was a woman with places to go. And she goes further than most—to the very outer reaches of our solar system.

The new building, sandwiched between the Julius von Haast and Ernest Rutherford buildings, in the heart of the university campus, is a testament to local ingenuity and creativity from the in-house UC engineering team. It is a striking four-storey, orange and charcoal, wooden edifice that stands out among the crowd.

The young woman that I was about to interview, is no less remarkable. In the two years since that building was officially opened, Michele has become a co-recipient of several prestigious, international awards for her contributions to space research. And just last year, she was awarded the UC Emerging Researcher medal. Such is her contribution, in the first few years following her PhD, that she was also honoured in 2017 by having an asteroid named after her—10463Bannister.

Here at home, the Royal Society Te Apārangi awarded her a Rutherford Discovery Fellowship, in 2020, to assist with her research[1]. Michele has carved a niche for herself, specialising in the discovery and exploration of small worlds in the outer solar system. Observations of these distant small worlds is a key component in boosting our understanding of the formation, and evolution, of our solar system from its early days to the present.

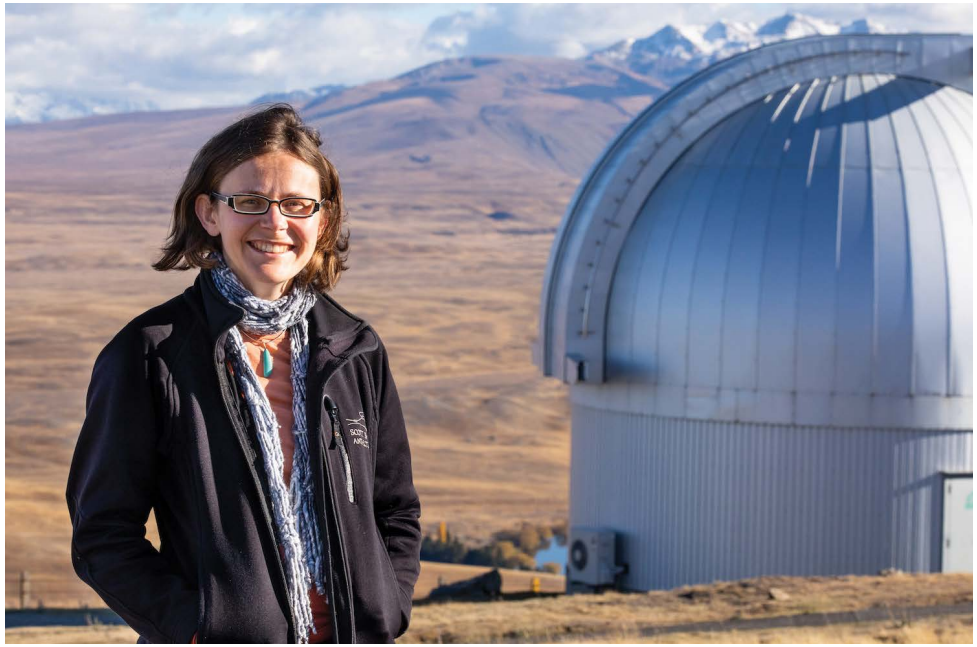


Photo: Elaine P Snowden

Michele Bannister at Mt. John Observatory, Takapō

Two back-to-back post-doc stints, saw Michele involved in two investigations of Trans-Neptunian objects (TNOs) (minor planets that orbit the sun at a greater distance than Neptune). As a team member of the OSSOS discovery project and Col-OSSOS (Colours of the Outer Solar System Origins Survey) she uses telescopes, and techniques that harness the power of optical and near-infrared photometry. Colour data obtained can be used to determine the surface properties of TNOs and, ultimately, the project's aim is to "reveal the intrinsic colour structure of the outer solar system" [2].

Working in the building that bears the name of our 'Queen of the Cosmos', is a constant reminder of the legacy left by Beatrice Hill Tinsley, our most famous woman astronomer, and a source of inspiration as someone to live up to. Yet, Beatrice is not the only woman who has had an impact on Michele.

She gratefully pays homage to countless women who have gone before her, normalising the presence of women in space research, and removing participation barriers for generations to come. Michele notes that it is a privilege to come through as a young academic, now, with a clearer pathway forward. These women have paved the way, inspiring her to follow her passion, to use her immense intellectual curiosity to ask the big questions, and to forge a career path that will facilitate her desire to answer some of them.

Michele mentions individual, local influences such as Pam Kilmartin, a stalwart in the field of asteroid astronomy, but is also excited at the prospect of providing greater opportunities, for more women, within the recently established Women in Space Aotearoa, initiative.

Michele points out that this will assist the "centralisation of resources and organisation" that will support women in this particular discipline.

She emphasises that "Aerospace is a brand new field", here, and with that comes extra benefits. "We can ask the companies that are employing our colleagues to sign up to the fair pay register, to say, you're doing a new thing in a new way, you're going to explore a new domain—let's get this *right*. Let's do this the way we'd want to see this happening in New Zealand".

Outside of Aotearoa, the work of other pioneering women also bolstered Michele's burgeoning fascination with involvement with space missions. She acknowledges, in particular, American astronomer —Heidi Hammel— who led the team using the Hubble Space Telescope to view the impact of Comet Shoemaker-Levy 9 with Jupiter in 1994, when Michele was still a young girl.

It turns out that this 1994 impact event had a profound impact on Michele and has played a pivotal role in her career trajectory. In her childhood, she had spent a lot of time at airfields and had read books on space exploration. She vividly remembers one book that captured her imagination and infiltrated her thinking from that point forward.

"Jupiter, the star that failed" by Joel N. Shuker was a popular science book, published in 1979, (and is still available on Amazon). But, as Michele points out, it was "one of those that really talked about the way mission teams for spacecraft *worked together* and how they try to solve problems".

A short time later, she witnessed history in action when she had the opportunity to see this impact first hand, in Australia, at the Sydney Observatory. Michele recalls, "My parents took me up so we could see it. We travelled to go and see it through the telescopes there—just seeing the surface of Jupiter that had been changed by this bolide impact on to the surface. You can see Hubble Space images that come to you on a picture, or a screen, but being able to actually see it with your own eyes is amazing!".

While she has had mentors here in Aotearoa/ New Zealand, Michele is quick to point out that she is fortunate to have a whole swathe of the planetary science community, across the globe, lend their

> *My parents took me up so we could see it. We travelled to go and see it through the telescopes there—just seeing the surface of Jupiter that had been changed by this bolide impact on to the surface. You can see Hubble Space images that come to you on a picture or a screen but being able to actually see it with your own eyes is amazing!*

support at various times. She acknowledges and emphasises all of the the communities in Aotearoa/New Zealand, Australia, USA, Canada and Europe that have contributed to her development. From Aotearoa/New Zealand as an undergraduate, then heading across the Tasman to ANU for her PhD, she has been embraced wherever she has landed.

Nevertheless, she also singled out fellow Kiwi Trevor Ireland, who also moved to ANU for his PhD after graduating from Otago University, as "super supportive" during her time there. Trevor ended up as a professor in the Geology department at ANU and was part of the team on the Hayabusa II mission to collect samples from asteroid, 162173 Ryugu, in 2014—the year Michele's PhD was awarded.

His work uses ion probe analysis to to characterize the provenance of early solar system dust grains and to provenance and origin of rocks from Gondwana. So when the rare, pristine space dust samples arrived back in Australia, in 2020, he got to work. It's another example of the collaborative space mission teamwork, that Michele loves so much.

Articulating a sense of community is something that's liberally peppered throughout Michele's answers to my questions. She has worked in quite a few, starting here at home, when she was straddling astronomy *and* geology courses and scuttling back and forth between the two. When she started that journey, it became clear that is wasn't the usual path most students take, here.

Even after graduating, most students involved with space research have traditionally headed overseas to the large research centres elsewhere. She laments the fact that some of our notable planetary scientists, such as Dave Stevenson, for example, have spent their whole careers working away from home. "You have people like that, who are known internationally, but they're not known as much for what they have done to help grow the planetary community here, just because of the way our academic system works".

Michele's own experiences and observations have led her to question whether we can do things differently here in Aotearoa. She is certain that we can. Her desire to see a more co-ordinated, and seamless, approach to structuring degrees for planetary geologists has led to her spearhead a brand new course at UC. There had been many students across the country who were interested planetary science but, until now, exposure to it, in a multidisciplinary way and at a single institution, was fairly limited.

Planetary science is definitely multidisciplinary. As Michele, notes, "You can have a chemistry background and end up looking at the atmospheric chemistry of Saturn's moon, Titan. Or...having a geosciences background and looking at dune formation on Titan. These perspectives that you have to bring to things as a planetary scientist... everyone is going to bring their own training—and that's fabulous! You need the insight from so many different fields of science to make progress on undertsanding the geology, and the evolution, and the really interesting scientific questions on how other worlds work" .

She reminds us that it is all process based, and, as terrestrial geoscientists, familar and therefore transferable. Interesting differences in gravity or physical conditions, such as temperature, just add a bit of spice to the mix. Take cryovolcanism, for example—there are icy volcanoes all across the outer solar system but it's regarded as just another branch of volcanism. However, "One of the *real* differences between planetary and terrestrial geology is the inferences that you have to be able to draw...and it is so much at the level in our generation, still, at this big broad brush, big picture approach. And that's great, in a way, because you have *really big* questions like: Where is plate tectonics possible? What does lithification mean before you start having it in a planetary environment? What does a volcano mean when it's working across different kinds of materials?"

This new course is a hybrid one, and inclusive—students who are at campuses of other universities can join in. It also spans a wide range of topics, not just scientific ones, particularly relevant to space exploration. The students get a "good sampling" of both the scientific and ethical questions around planetary science and exploration.

Some of these, such as the discussions on space exploration ethics, are more akin to those encountered in anthropology or environmental studies classes. Reading around issues such as invasive species introduction, inadvertent destruction, contamination, resource exploitation, and intrinsic values is humbling, respectful and powerful. These are valuable perspectives to bring to any decision-making table.

International collaborations, large or small, are an exciting and rewarding part of Michele's work, and she's adamant that they're are keen to work with us.

> *You need the insight from so many different fields of science to make progress on undertsanding the geology, and the evolution, and the really interesting scientific questions on how other worlds work.*

Michele stresses that the scene in Aotearoa is now starting to shift — reflecting an increasing "awareness for the planetary and geological community that you don't have to leave home to do these things, to be part of space missions, to be involved in analysing these kinds of things". It gives people opportunities to choose. Whether they head overseas for awhile, or not, there will be an established home-grown community to return to.

"There's a real sense of hope and eagerness at the moment— of people going, hey, we can build things. We can be involved in this space community in a way that there just wasn't a few years ago...and that we can develop a space community in Aotearoa that is te ao Māori led—that is from a perspective that's going to be different to how other parts of the world have created their space communities".

Nor has Michele forgotten her early experiences of seeing the impact of the comet with Jupiter, in person. This "seeing with your own eyes" is something she wishes for others. One such opportunity for this, is the newly-established Fireballs Aotearoa project (see p45) that Michele is also involved with—yet another collaborative venture, this time, involving a group scientists from Kiwi universities, as part of a global meteor network.

Its chief aim is to increase our chance of recovering meteorites here. The new project offers the opportunity to make the collection of fresh samples, to supplement observational work, a tantalising possibility. A network of cameras, to be rolled out across the country, is already underway. Once installed, the process will be automatic—data transference, analysis and modelling are all handled seamlessly. With meteor trajectories plotted, predictions about the meteorite's strewn field can be calculated. Information about any likely falls can then be relayed to James Scott (Otago University) and his team for potential recovery.

Michele adds that, without these uncontaminated, information-rich, small body samples arriving on our doorstep, we'd have to mount missions to retrieve them. While this has been done before, with the Hayabusa II mission to Ryugu, or the Osiris REx one to Bennu, it is more costly in terms of time and finances.

It is also a citizen science project for astrophiles across Aotearoa, something that particularly excites Michele as a science communicator. Meteors consist of the left over building blocks of planets and come through our atmosphere as fireballs. Obtaining samples will help put together a better story about what these planetary leftovers are trying to tell us. Encouraging citizens to take part is great, for sparking more interest in Aotearoa's aerospace development, and in increasing the density of the camera network to improve accuracy of strewn field predictions.

It's also about connection. "It's this personal interaction with the experiences you're having in your own environment, in your own sense of place... connecting with the wider perception that we're on a planet and it's travelling through space and interacting with all these little particles and small bodies around it, that we live in a changing solar system and you can experience that...as part of a wider effort to try and understand the story and history of our planet our little place in the universe, and our family of planetary bodies. I think that's really exciting. I think it's going to give people a hands on connection to that in a way that simply hasn't been possible in New Zealand before".

However, our connection to these small bodies isn't merely an academic one. Some of those small worlds can become potentially hazardous objects (PHO*s). These have orbits close enough to approach Earth and large enough to cause significant damage on impact. The majority of these are asteroids.

"Given that you have an unconsolidated rubble pile of an asteroid, how do you move that if one of them is ever found that would be a planetary defence hazard?"That is one question that has driven Michele's involvement, as a team investigation member with the DART (Double Asteroid Redirection Test) project—specifically designed for testing this possibility.

It's NASA's first mission to demonstrate asteroid deflection by a kinetic impactor with the hopes of shifting its orbit. A low cost spaceship was launched in November 2021 and its target is the binary asteroid system of Didymos & Dimorphos. The strike on Dimorphos (the smaller of the two) is due on 26th September 2022, with the goal of measuring the change in orbit of the smaller Dimorphos around Didymos.

So where next for Michele? It's not difficult to guess that Michele will be a team member in yet another international space mission although this one provides an extra challenge. The European Space Agency's Comet Interceptor mission will use a 3 part, solar-powered spacecraft, to perform a fly-by rendezvous with an, as yet, undiscovered comet coming in from the edge of the solar system. The launch date it set for 2029. Technology for observing the sky is advancing fast enough that there should be enough time to direct the spacecraft towards it. Michele says, "It is a fun mission because we're going to a target that hasn't even been discovered yet!".

Furthermore, she's hoping that luck is on their side and it can go past an interstellar object, as well. Michele has already done some work[3] on the first interstellar object discovered in 2017, 1I/'Oumuamua, so it would be a real coup to get close-up images rather than what is usually possible with remote sensing from Earth.

By 2029, Michele will still have lots of places to go. And she'll likely be piloting some home-grown planetary scientists along for the ride. ■

References:

1. Rutherford Discovery Fellowship Recipient 2020: Michele Bannister. https://www.royalsociety.org.nz/what-we-do/funds-and-opportunities/rutherford-discovery-fellowships/rutherford-discovery-fellowship-recipients/michele-bannister/ (accessed 19th June 2022)

2. https://www.colossos.net/ (home page) accessed (accessed 19th June 2022)

3. Bannister, Michele T.; Schwamb, Megan E.; Fraser, Wesley C.; Marsset, Michael; Fitzsimmons, Alan; Benecchi, Susan D.; Lacerda, Pedro; Pike, Rosemary E.; Kavelaars, J. J.; Smith, Adam B.; Stewart, Sunny O.; Wang, Shiang-Yu; Lehner, Matthew J., Col-OSSOS: Colors of the Interstellar Planetesimal 1I/'Oumuamua, The Astrophysical Journal Letters, Volume 851, Issue 2, article id. L38, 7 pp. (2017)

DANIEL BURGIN

WORKING ON THE INTERIOR OF MARS FROM THE COMFORT OF HOME

Janis J Russell: Science Communicator, Christchurch

Daniel Burgin is an affable young man about to embark on an opportunity of a lifetime. He takes up an internship, to the Lunar-Planetary Institute, and heads to the US for the American summer this year. While he's there, he will be partnered with a research scientist there and conduct research alongside them.

He doesn't yet know what project he'll be working on but he described a few previous ones that covered volcanism on Venus, to glaciers on Pluto, to the interior of Io. He describes the chance, to work at the Institute that is located adjacent to the NASA Johnson Space Center, (of "Houston, we have lift off" fame) as "a dream come true". He laughs, "I couldn't believe it when they called me. I thought they were having me on!".

The 21 year old Wellingtonian is a beneficiary of the very course that Michele Bannister instigated (read more about this in the previous article on p46). He came to the University of Canterbury in 2018, to study astrophysics. Fascinated by all things space-related, ever since he watched live footage of the European Space Agency's Rosetta Mission to comet 67P/Churymuyov, he figured it would be a good choice. After that, the Curiosity Mars landing, and the build up to the Perseverance landing cemented his drive and enthusiasm to be part of a future space mission. However, it was an interest paper in geology that really captured his imagination. Realising that much of planetary science is geology, set him on the path to combining the two, just as Michele had done, except it is now much easier, having been designed precisely for that reason.

Daniel waxes lyrical about the course offered there. "What Michele Bannister has done there has been incredible". Not many people were talking about planetary science until she came back to New Zealand so that was really cool".

Since then, he has been working on Martian meteorites for his masters thesis, at Otago University, under the supervision of James Scott.

This upcoming internship will give him valuable experience, as well as breathing space, to decide where he'd like to do his PhD and which area of planetary science he wants to focus on. "It's such a wide field you can really choose anything so I'm just kind of thinking about what I'm super passionate about". He's leaning towards planetary volcanism and regards the USA as "the prime candidate" in terms of facilities and NASA scientists, on hand.

He had a taste of researching planetary volcanism during his thesis as most of the meteorites came from volcanoes on Mars—blasted off the surface

Daniel holds a piece of Martian meteorite

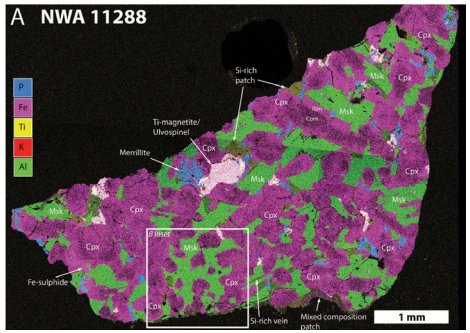
during asteroid impact, and ejected into space at the escape velocity of Mars (~5ms-1).

Daniel's research looked at the Martian meteorites to study the planet's mantle, using Strontium isotopic analysis to tell us where melting occurred within the mantle and what was melted. It is the same process as used on igneous rocks on Earth, but his incredulity bubbles forth as he ponders the significance. "It's crazy that I'm holding a rock that's travelled billions of kilometers through space, and has not only lived a life on Mars but has also lived a life on Earth. I can't quite get my head around it even though I've been studying it for over a year".

Finding freshly fallen meteorites (via the Fireballs project (p45) is an exciting prospect for Daniel. It will avoid the effects of damage from the length of time that a meteorite has been sitting on Earth's surface—weathering by rain, sandblasting etc which is a major problem when studying them. Strontium poses a particular issue as it is severely affected by the damage sustained during a lengthy stay on Earth.

Daniel explains that he, and James, "developed a method for analysing strontium isotopic composition while avoiding the stuff that had been affected on Earth, which was really exciting".

In fact, Daniel has discovered that the Martian mantle "is weird" when compared with Earth's. Results of the analysis showed "three distinct [magma] sources that have been kept separate since the time of the planet's formation so there wasn't a lot of mixing going on". And the corolllary is that if there's no mixing then there's no convection and no evidence of plate tectonics. Instead, as the mantle cooled and solidified, incompatible elements were heavily depleted in the part that solidified first and highly enriched in the part that formed last—both to a much greater extent than anything you'd find on Earth. This leads to the idea that what is beneath the surface of Mars is a nicely preserved magma ocean. He's keen to get more samples from Mars, that could lend more support for this theory, and figure out if these models are correct



Martian meteorite under the SEM.

"because they are just based on meteorites". There are no subduction zones on Mars, no moving plates, so instead of creating a chain like the Hawaiian volcanoes, there is just one plume that continually rises to create the "massive region called Tharsus... where it takes up a quarter of the planet. It's the largest volcanic region anywhere in the solar system".

Meteorites have also provided further evidence that water has played a major role in Mars's history. Daniel notes that, "You can basically zoom in anywhere, on Google Earth map of Mars, and you'll find a river channel or a lake or a delta..." Then he backs it up by mentioning Tissint, a meteorite held at the British Museum, which shows evidence, in its olivines, of interaction with water.

Daniel is pleased with the outcome of his thesis. However, he maintains that the method isn't perfect so the Fireballs Aotearoa project will provide an opportunity for barely-affected samples to give greater insight into the interior of Mars using this new method. "So when you you study it you'll know what you're going to be studying is from space and not from Earth."

He's keen to see young New Zealanders embrace this project "...because it's exciting. Who doesn't love the idea of finding meteorites and seeing shooting stars.....".

With a growing awareness of opportunities to engage with planetary geology, he just might get his wish. ■

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