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Geoscience Society
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GEOSCIENCE SOCIETY OF NEW ZEALAND

A member body of the Royal Society of New Zealand
Mailing address: P.O. Box 7003 Newtown, Wellington, 6242

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Geocene:	Jill Kenny (ed)	jill.kenny@xtra.co.nz
Waikato:	Andrew La Croix	waikato@gsnz.org.nz
Bay of Plenty:	Kim Martelli	bayofplenty@gsnz.org.nz
Taranaki:	Diane Toole	wanderweg@xtra.co.nz
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Canterbury:	Alex Nichols	canterbury@gsnz.org.nz
Otago:	Nick Mortimer	otago@gsnz.org.nz
Talks:	Jack Williams	jack.williams@otago.ac.nz

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Geoscience Society of New Zealand Newsletter - GA Issue 4

Kat Holt
Immediate Past President

Kia ora koutou,

This will be my sixth and final President's Column. Time sure flies by! When I joined the National Committee for the first time back in 2009 I never had any intention of becoming President. Even just putting my name forward to be nominated for Secretary in 2010 seemed a rather big step! Between then and 2016 (when I stepped down to go on maternity leave) I took up the Publications Officer role, and also had one year as Vice President (Geology) in the days post-merger when we still retained two Vice Presidents. Coming back on board in 2020 as Vice President, I was still rather unsure about progressing into the President's role. But the train was on the tracks at that point!

Reflecting on my two terms, I have mixed feelings. I certainly have no regrets about taking on the job. It has been an amazing opportunity to get out and about and connect with all aspects of geoscience in Aotearoa. I do have some regrets about the limits to the progress made on some of the initiatives which were goals at the start of my first term though. Perhaps I was a little overambitious.

What has become abundantly clear is that it is harder than ever to keep an organisation such as ours operating when we largely rely on voluntary participation from our members to run our operations. A big issue here is the increased time pressures placed on those of our membership who are employed in the academic or research sectors. Expected levels of performance in publishing, research contracts, and student completions produce a lot of pressure. This pressure is even greater for those in precarious employment. Aiming to reach benchmarks in order to achieve promotion or to simply have a contract rolled over can leave very little time for voluntary service roles, particularly those which are outside our employment institutions. Service to the discipline has, and probably still is, considered in the academic promotions process, which provides some reward/return for time spent on the Committee. Yet, publications and research outputs are arguably given far more weighting.

The proposed redundancies and program closures in geosciences across at least two of our major universities only further restricts the ability of members to take on voluntary service roles, whether in GSNZ or otherwise. The loss of staff, both academic and technical, will increase pressure on those remaining to take up the slack in teaching and teaching preparations. The advent of workload models for academics also presents a threat. At my institution, a proposed workload model allows only 5% of our time for service work. This includes internal service (academic committees, thesis examination etc.,) as well as service like grant application and manuscript review, and any other external service such as on discipline specific committees like GSNZ. Adoption of such a workload model earlier would have precluded me taking up a role such as the Presidency, (at least with the blessing of my line manager). I can't speak for other institutions, but I expect more controlled work routines may be in the pipeline elsewhere as well.

I speak mostly about the academic situation, as this is what I know best. But I know that those working in CRIs face similar pressures in terms of making required levels of billable hours and meeting other time commitments. However, I do wish to express the appreciation for the fact that the CRIs, namely GNS and NIWA, have been so supportive in the operation of the National Committee over the years through allowing numerous staff to give their time, and in some cases their rooms, to our uses.

So what's the solution going forward? Well, we're not at a crisis point yet, but sustainability of our operations in an increasingly pressured environment needs to be considered. First and foremost, I would like to encourage anyone who has not yet served on the Committee to consider putting themselves up for nomination at some point. While it is great to have the institutional knowledge that comes from long-serving members, a semi-regular exchange of officers helps to 'spread the load' across the members in individual institutions/branches. Secondly, perhaps it's time to consider expanding the number of Committee members listed in our constitution/rules as another way of spreading the workload of the National Committee across more people. Currently, the Committee is stipulated as consisting of nine elected members (four officers, five elected members and the immediate past president ex-officio), with options for up to two co-opted members, and for branch representatives in the case where a branch or branches are not already represented. However, we do still need members to step up and fill any newly created positions!

Not unrelated is the ongoing vacancy in the newsletter editor role. This has traditionally been a voluntary role as well. But after many months of searching, we are yet to garner any interest from the membership or otherwise. This is also a signal that we should perhaps be considering changing the model for the newsletter editor and moving instead to something like an editorial team to share the load, and/or offering a small honorarium to reflect the work hours that go into delivering a key member benefit. In the meantime, if you or someone you know have any interest in getting involved with the newsletter, please get in touch with either myself or the administrator as soon as possible. Doing so will earn you a place on my Christmas card list for sure!

I'll finish my final column by expressing my extreme gratitude to my fellow National Committee colleagues who have been really wonderful to work with. I thank them for their patience with my sometimes haphazard or tardy email responses, and I especially thank them for the time and effort they put into the Society.

Ngā mihi nui,

Kat Holt

PRESIDENT'S LETTER

Guest Editors
Matt Sagar
Alex Nichols
Jenny Stein
Angela Griffin

In lieu of a replacement Newsletter Editor members of the National Committee have been temporarily filling in...but **we are still on the hunt for a new permanent Editor (or Editors) for *Geoscientist Aotearoa*!**

DO YOU...

Have a **passion** for geoscience?

An **eye** for detail?

A **flare** for creative design?

A **hankering** to write for a nationwide audience?

Do you want to play a **key role** in how we communicate with our members?

...then

WE WANT YOU!

Email the GSNZ president at president@gsnz.org.nz to enquire about becoming our next GSNZ NEWSLETTER EDITOR!

GEOSCIENTIST AOTEAROA:

SUBMISSION DEADLINES:

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

EDITORS' NOTICE:

A REMINDER FOR CONTRIBUTORS

We welcome a range of contributions to *Geoscientist Aotearoa,* including articles, trip reports, reviews, notices, advertisements, letters, memorials and more. However, please remember that contributions for the newsletter should adhere to the guidelines set out in the Geoscientist Aotearoa 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 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 also ensure you have appropriate permissions for any photos you submit to be published, especially those with people in them.

Please email any questions and contributions to editor@gsnz.org.nz.

IS AUCKLAND SINKING?

Bruce W. Hayward

Around much of New Zealand's coast our ability to predict the extent, rate and therefore impact, of future sea level rise is complicated by instantaneous and/or gradual vertical displacements as a result of plate boundary tectonic forces. On the other hand, Northland and Auckland have been regarded for a long time as tectonically stable, at least during the Holocene. This was supported by the well-known presence of widespread "Flandrian" (mid-Holocene high-stand) coastal terraces located 1– 2 m above the elevation that they would have formed at (e.g., Searle, 1959, 1964, p. 36; Schofield, 1960; Ballance, 1968, p. 42; Williams et al., 2015). The next highest coastal terraces (inferred of Last Interglacial age, marine isotope stage, MIS, 5e) are somewhat more variable in elevation (mostly 5 – 10 m above present mean sea level, MSL), which suggests variable stability to slight uplift rates (0 – 5 cm/1000 yrs) over the past 120,000 yrs (e.g., Kear and Waterhouse, 1961, 1971; Ballance, 1968, p. 40; Selby et al., 1971; Hayward and Morley, 2014; Hayward, 2017, p. 269-271; 2018).

It was somewhat surprising, therefore to read in the papers in May last year, when the NZ SeaRise on-line tool went public (www.searise.nz/maps-2), that satellite and related measurements between 2003 and 2011 showed that parts of Auckland city were currently subsiding at quite variable rates of between 0.5 and 4 mm/yr (1 sigma errors = 0.1– 3.0 mm/yr) = 0.5– 4 m/1000 yrs (Levy et al., 2020; Hamling et al., 2021) (Fig. 1). The widespread occurrence of the mid-Holocene high-stand terraces at relatively similar elevations suggest that these measurements are inaccurate, temporally variable, or of very recent onset.

Precise dates on the mid-Holocene terraces around Auckland city are hard to obtain because of the difficulty in finding preserved organic carbon from a horizon that can be relatively accurately tied to sea level at the time. From experience, I conclude that one of the best places to look for dateable evidence of a Holocene high-stand is in storm beach ridges composed of shell. In many sandy and gravelly storm

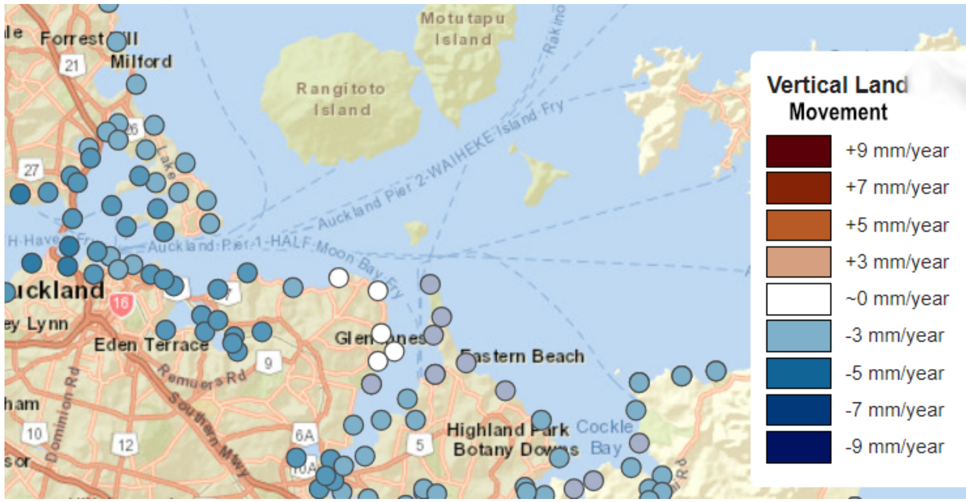

Figure 1. Screen capture of NZ SeaRise map of Vertical Land Movement for Auckland, 2003-2011. From https://searise.takiwa.co/map/6233f47872b8190018373db9/embed

ARTICLES

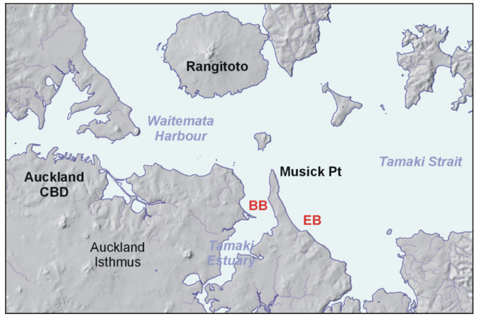

Figure 2. Location of study areas at BucklandsB beach (BB) and Eastern Beach (EB), east Auckland.

Figure 3. Oblique aerial looking north over Musick Pt, east Auckland showing the location of the two study sites at Bucklands Beach (BB) and Eastern Beach (EB).

beach ridges, any scattered shell has dissolved away. Two places with preserved shelly storm beach deposits in Auckland's eastern suburbs are at Bucklands Beach and Eastern Beach, on either side of Musick Pt (composed of Miocene Waitemata Group strata) (Figs. 2, 3).

Bucklands Beach

Bucklands Beach, located in moderate shelter 1 km inside the entrance to the Tamaki Estuary, is backed by a 1 km long, 200 – 300 m wide terrace 3 – 4.5 m above MSL (Fig. 4). This terrace is composed of sandy shell layers clearly deposited as an aggrading storm beach ridge. The crest of the modern shelly storm beach is 2.6 m above MSL at the more exposed northern end and 2.2 m above MSL along the more sheltered SW-facing side. In 2020 I took advantage of some roadside diggings alongside a road down the middle of the terrace to collect the least abraded shells in the highest shell layer at three localities (BB1– 3; Figs. 4, 5). These shells were radiocarbon dated to provide an approximate age for the crest of the storm beach ridge at each locality. The elevation of each sample location was calculated (Table 1) from the stratigraphic depth of each sample (0.3 – 0.5 m beneath surface) and the Auckland Council Lidar map at 0.2 m contour intervals (https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html). These were combined with an earlier dated sample of an in-situ dog cockle (BBi) collected intertidally (0.15 m above MSL) at a minimum of 1.3 m higher than it would have lived at today, as this species always lives below mean low water level, MLW (Hayward and Morley, 2013) (Figs. 4, 5).

The four shell dates (Table 1) range between 3,700 and 5,150 ± 200 cal. yrs BP and come from elevations of 3.15 – 3.65 m above present MSL (Fig. 5) and each is buried by a further 0.3 – 0.5 m of sand and soil. As the present storm beach is 2.2 – 2.6 m above MSL, these dates indicate the storm beach ridge was at least 1 – 1.1 m higher than today at 3,700 and 5,100 cal. yrs BP. Conceivably the storm beach in the mid-Holocene could have been higher than it is today because of the absence of shelter from Rangitoto Island (erupted 600 – 650 yrs ago). However recent evidence suggests that before Rangitoto erupted there was already some land in that vicinity providing shelter for the Tamaki Estuary from northerly storms (Hayward et al., 2022).

Figure 4. Oblique aerial looking north over Bucklands Beach and its 400 m wide mid-Holocene high stand storm beach terrace. Sample sites are labelled.

Sample No.	Year dated	Lab. No.	Dated material	Elevation wrt MSL	Radiocarbon age (yr BP)	Calibrated age age (yr BP)
BBi	2012	Wk33780	*Tuecetona in situ*	+0.15 m	4835 ± 29	5152 ± 210
BB1	2020	Wk50689	*Austrovenus*	+3.3 m	3720 ± 43	3715 ± 210
BB2	2021	NZA73444	*Paphies, Tawera*	+3.15 m	4822 ± 28	5137 ± 204
BB3	2021	NZA73453	*Austrovenus*	+3.6 m	3709 ± 27	3699 ± 192
EB1	2021	NZA73455	*Austrovenus*	+4.3 m	4440 ± 28	4667 ± 193

Table 1. AMS radiocarbon ages for cockle shells at Bucklands Beach (BB) and Eastern Beach (EB). Dates have been calibrated (2 sigma) using the MARINE20 calibration curve and ΔR for the Auckland region of 156 ± 34 yr. Radiocarbon dating supplied by Waikato University Radiocarbon Laboratory (prefix Wk) and GNS Science Rafter Radiocarbon Laboratory (prefix NZA). Elevations are of the actual dated shell sample, buried by a further 0.3–-0.5 m sand and soil.

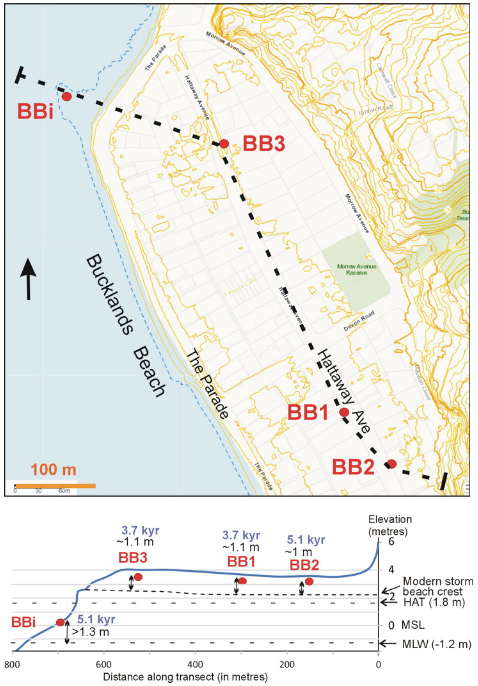

Figure 5. Bucklands Beach mid-Holocene high stand storm beach terrace showing location of dated shell samples (BB prefix). 1 m LIDAR contours shown in brown. Cross-section profile shows elevation and age of dated shell samples with respect towrt mean sea level (MSL), also shown are the elevation of present day mean low water (MLW), highest astronomical tide (HAT) and crest of storm shell beach. Inferred approximate minimum elevation of sea level at time of each dated sample is listed.

Eastern Beach

On the other side of Musick Pt is the 1.5 km long Eastern Beach with a 100 – 400 m wide terrace behind it at a similar elevation to that at Bucklands Beach. East-facing Eastern beach is sheltered from northerly storms and somewhat exposed to easterlies and would have been unaffected by the eruption of Rangitoto. At the southern end a distinct 1.5 m-high relict storm beach ridge is preserved in Maclean Park (Fig. 6). This beach ridge is composed of layers of shell and shelly sand and a sample of the least abraded cockle shells was taken for dating from 0.15 m beneath the surface (Table 1). This provided an age of 4,550 ± 200 cal. yrs BP for a storm beach crestal height ~2 m above the present at the southern end of Eastern Beach (Fig. 7).

Mid-Holocene sea-level high stand in northern NZ

These estimates of sea level >1 – 1.1 m above present between 5,100 and 3,700 cal. yrs BP at Bucklands Beach and ~2 m above present at 4,700 cal. yrs BP at Eastern Beach are consistent with previous well-dated sites in Auckland and Northland at Miranda Chenier Plain, Firth of Thames (Schofield, 1960; Dougherty and Dickson, 2012) and Houhora, Far North (Hicks and Nichol, 2007). At Miranda Chenier Plain a succession of accreted shell cheniers record a sea level ~2 m above present 4000 cal. yrs BP that progressively fell to near present by 1000 yrs BP. At Houhora a sea level ~1.2 m above present has been inferred for ~3200 cal. yrs BP from diatoms in a brackish sediment sequence. The new dated relative sea level estimates from Bucklands and Eastern beaches are also near-perfect matches for the global isostatic adjustment model predicted Holocene sea level curve for the Auckland area (Clement et al., 2016, figure 6L).

Figure 6. Looking inland to the Eastern Beach mid-Holocene high stand storm beach ridge in Maclean Park. Sample site EB1 is shown.

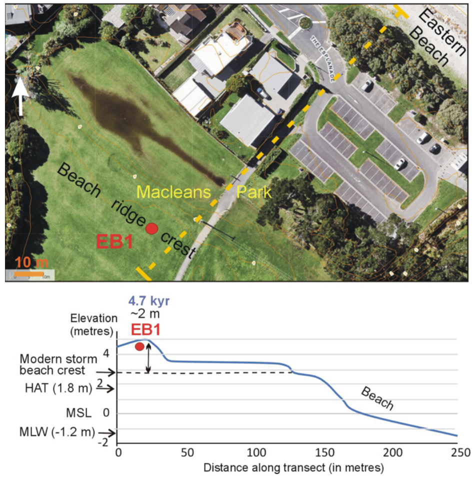

Figure 7. Southern end of Eastern Beach showing mid-Holocene high stand storm beach terrace (bottom left) and dated shell sample (EB1). 0.5 m LIDAR contours shown in faint brown. Cross-section profile shows elevation and age of dated shell sample relative to modern mean sea level (MSL). Also shown are the elevation of present day mean low water (MLW), highest astronomical tide (HAT) and crest of storm shell beach. Inferred approximate elevation of sea level at the time of the dated sample is indicated.

Implications of vertical land movement (VLM) estimates for elevation of mid - Holocene coastal terraces

The NZ SeaRise tool estimates a subsidence rate between 2003 and 2011 (Fig. 1) for Bucklands Beach of -0.8 ± 2.0 mm/yr, for Eastern Beach of -0.7 ± 1.9 mm/yr (1 sigma errors), for Houhora of -1.3 mm/yr and an uplift rate of 0.3 – 1.2 mm/yr for Miranda Chenier Plain (Hamling et al., 2021). If these were consistent for the past 4000 yrs, then the indicated sea level at these three sites for that time would be 4.7 m, 4.3 m and 6.4 m above present at the first three sites and 1.2 – 4.8 m below present at Miranda Chenier Plain, whereas the congruence of the elevation of the mid-Holocene terraces/beach ridges around northern North Island suggests stable or insignificant and consistent vertical land movement (VLM) since then.

Why the mismatch?

Some of the more obvious options for explaining the mismatch between the mid–late Holocene record of relative land stability around Auckland and the recent satellite-based VLM estimates of subsidence include:

1. There has been a recent change (last few hundred years or less) in the tectonic regime beneath Auckland.

2. Auckland city buildings and roads are compacting the underlying strata. Undoubtedly that is true for places with human reclamation, especially between the old cliff-line and the present shore in the CBD and in a few places where mud flats have been reclaimed in the suburbs (Hobson Bay, Onehunga foreshore, northern and northwestern motorways). By far the majority of Auckland isthmus and North Shore is built on Late Quaternary volcanic rock and pre-compacted early Miocene Waitemata Group sedimentary rocks. There is no obvious correlation between the estimated VLMs and differences in the underlying geology.

3. The land is subsiding because of subsurface dewatering as a result of human extraction. Water is extracted from the lava flows at Onehunga and scoria/lava pond fill of some maar craters (e.g., Auckland Domain) but these are solid or clast supported and unlikely to compact further as a result.

The dominant rock beneath Auckland is Waitemata Group strata that have had >500 m of strata eroded off them and are unlikely to compact further even if they were a significant groundwater source, which they are not. Yes, at shallow depth beneath the Manukau lowlands, Pliocene shellbeds are a major groundwater resource and some possible compaction and subsidence could potentially be expected as a result, but the VLM estimates show no significant difference between the Auckland isthmus and Manukau lowlands.

4. The weight of the city is depressing the crust. One might expect a more consistent VLM beneath the central city, which is not the case.

5. The amount of the increased sea level (~30 cm) over the past 150 yrs on the continental shelf around Auckland is now depressing the crust. Again, this would surely result in more consistent VLM estimates across the region.

6. The satellite measurements may not be accurate or the estimated VLMs are extremely short-lived and varying for unknown reasons.

I leave it to readers to decide what is the most likely explanation/s. ■

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ROCK MEMORIES IN RETIREMENT

Cam Nelson, Retired (University of Waikato)

No, not rock music stars of the past like Elvis Presley or Mick Jagger or Tina Turner, but rather those rocks that underpin the discipline of geology. My working life as a university-based geologist (Geology, University of Auckland 1966-1970, and Earth Sciences, University of Waikato 1971-2012) guaranteed day-to-day contact with a huge variety of different rock types and unconsolidated geological deposits through teaching and research activities, and especially on field excursions far and wide. However, upon retirement, this close association with rocks can suddenly lessen, for some geologists at least, especially where health-related matters intervene.

Figure 1. Five large rock groupings along border of section entrance.

This was the situation in my case and so following retirement in 2012, I set about establishing some rock displays on our home section in Hamilton in an attempt to try and preserve a few of those rock memories. A bordering Buxus hedge alongside our driveway parking area had slowly succumbed to blight. Removal of the hedge afforded an ideal location for displaying some of the larger rock specimens I have in five small groups dominated sequentially by concretions, limestones, volcanics, fossils, and a seep carbonate boulder (Figure 1).

Figure 2. Concretions group.

The concretions group includes a fused-double spherical or dumbbell shape specimen, 40 cm across, and some small conduit or tubular varieties formed about ascending methane seepage pathways in deep-water Miocene mudstones on the North Taranaki coastline (Figure 2; marker pen 14 cm long). The limestone group includes a block of vivid white, very fine-grained micritic limestone of the Amuri carbonate lithofacies from Wairarapa, a 35 cm tall quarried boulder of coarse-grained flaggy Otorohanga Limestone typical of the Te Kuiti carbonate lithofacies, and two specimens of very coarse-grained limestone breccias (Figure 3). The "volcanic" group shows a couple of 50 – 60 cm tall basalt columns out of a Mt Karioi lava flow of Pliocene age, a fine slab of banded rhyolite/red obsidian from the Bay of Plenty, and also non-volcanic examples of a very coarse-grained hornblendite and a slabbed specimen of partially iron-stained, banded copper-lead-zinc-iron ore from Mt Isa (Figure 4).


Figure 3. Limestone group.


Figure 4. Volcanic rocks group.

The fossil group comprises two very large stromatolite specimens, an oblong boulder of molluscan-rich Miocene sandstone, and samples from the Oligocene Te Kuiti Group of the giant scallop *Athlopecten athleta*, fused giant oysters of the tribe Flemingostreini Stenzel, and calcareous serpulid tubes (Figure 5). The two stromatolites (centre and right side Figure 5) are among my favourite rocks along this border stretch. The white cone/dome-shaped one is 30 cm tall and is from the modern intertidal zone within an embayment in Shark Bay, Western Australia, while the other, displaying characteristic internal concentric laminations, is of Precambrian age (up to a couple of billion years) from the Pilbara region inland from Shark Bay. The pair well illustrate James Hutton's 18th century "Principle of Uniformitarianism – the present is the key to the past", with the Precambrian example probably growing from cyanobacterial activity about the margins of some ancient salty lagoon, just like the modern Shark Bay example, but separated in age by more than a billion years!

A hefty boulder from southern Hawke's Bay of highly fossiliferous Miocene seep limestone, 60 cm across, dominates the final rock group (Figure 6). It contains a distinctive assemblage of chemosynthesis-based fossils including bathymodioline mussels, lucinacean bivalves, vestimentiferan worm tubes and provannid gastropods. Alongside is a slab of Late Triassic, *Monotis*-rich, indurated muddy fine sandstone from the Kiritehere coastline.

All of these boundary group specimens sit in a mix of colourful volcanic pebbles quarried and concentrated out of alluvial gravelly sands of the local Late Pleistocene Hinuera Formation, and sold as "Waikato Gold" (Figure 7). The pebbles include a wide variety of rhyolite, pumice, ignimbrite, and volcanic breccia lithologies disgorged by the ancestral (braided) Waikato River(s) into the Middle Waikato (Hamilton) Basin from the Central Volcanic Region of North Island during the Last Glacial period (the avulsion of the ancestral Waikato River at Piarere took place c. 24,000 cal years ago). The same Waikato Gold pebbles cover several other small outside storage or display areas about the property.


Figure 5. Fossils group.


Figure 6. Seep limestone boulder.

Beyond the groups of large border rocks, and spread out under a canopy of an established tall conifer hedge, is a diverse variety of more than 100 hand-specimen-sized rock types from widely different sources (Figure 8). They include examples of granite, gneiss, serpentinite, andesite, obsidian, greywacke, argillite, conglomerate, glauconitic and quartzose sandstone, and limestone. Also present are quartz, calcite and gypsum crystals, xenoliths, tubular and cone-in-cone concretions, molluscan and red algal fossils, trace fossils, ventifacts and pisolites. My treasured favourite is a sample of the Acasta Gneiss (a tonalite gneiss) from the Northwest Territories of Canada sent to me by a Canadian research colleague (Figure 9). Radiometric dating of its zircon crystals gives an age of about 4.03 billion years, making it one of the oldest known exposed crustal rocks on Earth.

Removal of a row of ageing tall conifers along the back boundary of the section allowed the establishment of a long strip of low-upkeep grass clumps with interspersed green and grey schist slabs, kind of mimicking in a very low-key way a Central Otago landscape (Figure 10), a popular vacation destination for our family. Some scattered quartz pebbles, a few old miner's iron pots, a porcelain rabbit, and a family "head stone" all help support this locality perception.

The substrate of a pétanque court (French boules or bowls) along part of one side of the section consists of mixed terrigenous-carbonate sediment composed of crushed bivalve shells, mainly *Austrovenus stutchburyi*, and small greywacke pebbles (Figures 11 and 12). The original source of this material is unknown, but it does resemble some of that in the

Figure 7. "Waikato Gold" matrix pebbles for rock groups.


Figure 8. A wide variety of hand specimen-sized rocks and minerals.

Figure 9. 4.03 billion year old Acasta Gneiss.

Figure 10. Schist slabs in a "Central Otago landscape" boundary strip.

Figure 11. Mixed shell-greywacke pebble pétanque court.

Figure 12. Close up of mixed shell-greywacke pebble pétanque court.

beach ridges forming the Holocene coastal strand plain along the Kaiaua-Miranda stretch of shoreline bordering the southeastern corner of the Firth of Thames.

Inside the house, as is the situation for many geos and rock hounds, a small number of special samples are on display. I have three particular favourites (Figure 13):

1. A polished slab of a Devonian ammonite from Morocco with its chambers filled by spectacular combinations of isopachous rinds of calcite crystals, granular calcite crystals, and internal micritic sediment.

2. A 2012 retirement commemorative plaque from the Department of Earth Sciences at Waikato that incorporates core slices of six well-known New Zealand limestone formations (a major research interest of mine). Top left: Otorohanga Limestone, Te Kuiti. Top right: Amuri Limestone, Wairarapa. Mid left: Papakura Limestone, Raglan. Mid right: Tikorangi Limestone, Taranaki. Bottom left: Te Aute Limestone, Hawke's Bay. Bottom right: Bexhaven Limestone, Gisborne.

3. In 2017 I received the Honorary Membership Award trophy of the Geoscience Society of New Zealand that is mounted by a polished slab of dark green dunite with an iron oxide weathering rim (probably goethite). The dunite comes from the Dun Mountain Ophiolite Belt and was collected by Nick Mortimer as a boulder from Eves Stream (Marlborough) draining the Red Hills, and subsequently sliced into small slabs and polished for use on future trophies.

In summary, whether working or relaxing about home, all these personal rock materials keep me in daily touch with so many pre-retirement geological memories and occasions, and especially recollections of my research colleagues and former graduate students. My family also treasures the rock collections. Moreover, the rocks appeal to many home visitors, including tradespeople, who can be keen to chat and learn more about them. Occasionally this leads to wider conversation about other topical subjects in the Earth sciences, like landforms, evolution and the fossil record, dating rocks, volcanism, catastrophic sedimentation, earthquakes, coastal and land erosion, and climate and sea-level changes. So, in a very small way, geological education continues in my retirement! ■

I thank David Lowe, Margaret Nelson and Nick Mortimer for helpful comments when preparing this article.

Figure 13. Devonian ammonite, NZ limestone cores and dunite trophy.

MIGARS - SENSING THE OPPORTUNITIES IN CONFERENCE HOSTING

Tourism New Zealand

New Zealand will host the Machine Intelligence for GeoAnalytics and Remote Sensing (MIGARS) Conference in 2024 – with the event planned as a stepping stone to develop the country's remote sensing capability.

When Tourism New Zealand put out the call for conference champions, Gabor Kereszturi, Associate Professor at Massey University, sensed an opportunity. He linked up with Alejandro Frery, Professor at Victoria University of Wellington, on the congress committee for the first-ever MIGARS in India this year. With support from Tourism New Zealand, the duo tabled a proposal and won the bid to bring the second edition of MIGARS to Wellington in 2024.

MIGARS will bring together around 200 students, graduates, researchers, practitioners, and industry leaders aligned with remote sensing (Earth Observation) at Wellington's Shed 6, from 8–10 April 2024.

Kereszturi says: "Remote sensing is growing exponentially. There are hundreds of new satellites launched each year creating new data. New Zealand launches many sensors, but the analytic side is behind compared to the launching capability. This conference aims to bring a broad spectrum of people working in this area together for a dedicated focus and workshops on using these new data sets.

"Remote sensing has applications across multiple disciplines but in geoscience alone it can be applied in volcano mapping, post-disaster recovery, geothermal resource management, monitoring landslides, detection of erosion and land use change over time."

Assoc. Prof. Gabor Kereszturi of Massey University (left) and Prof. Alejandro Frery of Victoria University of Wellington (right).

Frery adds: "It touches New Zealand's primary industries: agriculture and aquaculture, and forestry; for example, biomass measurement is essential when discussing carbon markets, and it can be used to detect invasive species. There are so many applications.

"Here in New Zealand, we have a great scientific community, but we haven't always made the right connections; this is why MIGARS is so important. This conference is an amazing place to gather all these people and create momentum."

Kereszturi says the event will discuss new techniques, providing an excellent opportunity for firms and government departments to 'fish' for ideas.

It will also be a fertile hunting ground for Early Career Researchers, who will have a dedicated programme within the conference content. "This will be a great networking opportunity," he says.

"The combination of academia and industry attending also signals job opportunities for graduates – firms will be actively looking for students with these skill sets."

MIGARS will be one of the first remote sensing conferences to come to New Zealand, but the duo hopes it will not be the last. With MIGARS growing awareness, reputation, and recognition in the sector, they are now working on a bid for the much larger International Geoscience and Remote Sensing Symposium (IGARSS) when it returns to the Asia -Pacific region in 2028.

The flagship conference of the IEEE Geoscience and Remote Sensing Society, IGARSS, is aimed at providing a platform for sharing knowledge and experience on advancements in geoscience and remote sensing technologies, particularly in Earth observation, disaster monitoring and risk assessment.

That event would bring some 2000-plus people to Auckland.

Frery and Kereszturi are now leaning on support from Tourism New Zealand's Business Events team to deliver the bid. This includes connection with a Professional Conference Organiser (PCO) to establish the feasibility and budget for the conference, production of a professional conference bid document, funding travel to the next IGARSS in Athens to present the bid, and marketing support if the bid is successful.

Kereszturi says: "They have helped us a lot. It's an exciting opportunity for New Zealand."

Tourism New Zealand has been working with the Geoscience Society of New Zealand (GSNZ) to encourage more bids for international conferences in the earth sciences sector.

The partnership to date has been fruitful, with wins including the 11th International Association of Geomorphologists (IAG) Conference in Christchurch in February 2026 (1,000 pax); and the 22nd International Sedimentological Congress (ISC) in Wellington in January 2026 (1,000 pax), with the capital also hosting the Australian Organic Geochemistry Conference in 2024.

Tourism New Zealand General Manager NZ and Business Events Bjoern Spreitzer says: "New Zealand's expertise in geoscience research, together with the 'natural laboratory' of our landscapes and our strong event infrastructure and support, makes us an excellent destination for business events in this field.

"We hope to inspire GSNZ members to bid for conferences and reap the many benefits they bring to New Zealand beyond bringing high quality visitors to our shores. These include the exchange of knowledge and ideas, building international networks, showcasing local research, increasing investment and collaboration opportunities, attracting talent, and enhancing our global reputation." ■

For more information on MIGARS 2024 visit conferences.co.nz/migars2024.

A MISSING PAINTING

Simon Nathan

Charles Cotton was appointed the first lecturer in geology at Victoria University College in 1909. He lectured in both geology and physical geography, and was appointed a professor in 1921. Cotton had a distinguished career, developing the study of landforms (geomorphology) in New Zealand and writing many scientific papers and a series of widely used textbooks. Soon after he retired in 1953 he was knighted, the first scientist to be recognised in this way by the New Zealand government.

The centenary of the teaching of geoscience at Victoria was celebrated in 2009 by an anniversary dinner attended by many Te Herenga Waka Victoria University of Wellington (VUW) geoscience graduates.

A group of VUW graduates collected money to commission a painting by artist Bob Kerr that was unveiled at the dinner, and installed in the Cotton building at the entrance stairwell to the Geology Department. It was unveiled by Paul Cotton (son of Charles Cotton) and Lynn Clark (widow of Bob Clark).

Commemorative card from the 2009 gala dinner held in celebrating the centenary of the teaching of geoscience at Victoria University of Wellington.

The painting shows four distinguished VUW geoscience professors in a view overlooking Wellington Harbour—from left, Bob Clark (Cotton's successor who expanded the Geology Department and built up its research reputation), Charles Cotton, Frank Evison (first professor of geophysics), and Harold Wellman (one of New Zealand's leading 20th century geoscientists). The painting shows the dramatic line of the Wellington Fault as well as the characteristic faceted spurs, first recognised and described by Charles Cotton.

Because this painting is a unique part of our geoscience heritage I wanted to write something about it for Geoscientist Aotearoa. In early 2019 I visited the Cotton Building to view the painting again, and to my surprise found that it had been removed. The Geology Department and Institute of Geophysics are now part of the larger School of Geography, Environment and Earth Sciences (SGEES), and I could only get evasive and contradictory answers about what had happened to the painting. The official answer was that it had suffered water damage and was being temporarily stored until it could be repaired, but others told me that a few people campaigned against the SGEES being represented by a painting of four elderly white men, and had requested its removal.

In response to my repeated requests for information on the fate of the painting, I was advised earlier this year that it had now been moved to the official VUW art collection, stored in the basement of the Te PŌtaka Toi Adam Art Gallery, and I was able to recently view it there with the artist, Bob Kerr.

A painting by artist Bob Kerr, depicting a view over Wellington Harbour and featuring distinguished Victoria University of Wellington geoscience professors: Bob Clark, Charles Cotton, Frank Evision and Harold Wellman. The painting was commissioned by a group of graduates to commemorate the centenary of the teaching of geoscience at the university and was unveiled by Paul Cotton and Lynn Clark at the gala dinner in 2009.

While it is a relief to know that the painting is now properly curated, it is disappointing that it is stored out of sight as a historical artifact. Paintings are made to be displayed. I can understand that some may not welcome it as a symbol of the SGEES, there is plenty of room to hang it elsewhere in the large Cotton building to remind students of their scientific heritage. What do you think? ■

Acknowledgements

I am grateful to Warren Dickinson for finding the photographs of the 2009 unveiling of the painting; to Belinda Behle (School Manager of the SGEES) for information on the current location of the painting; and to Sophie Thorne (Curator of Collections at the Adam Art Gallery, VUW) for arranging a viewing of the painting.

GEOCRYPTIC CROSSWORD ANSWERS (FROM PAGE 42):

Across
1. magma, 7. fulgurites, 9. gold, 10. denser, 12. mym, 13. worm, 15. opaque, 17. mat, 18. pleochroic, 21. lr, 22. landslide, 24. event, 25. retrograde, 28. correlated, 29. gley

Down
1. magnetotelluric, 2. mode, 3. allomorph, 4. subduction, 5. winnow, 6. Te, 7. fiamme, 8. stomatolite, 11. scarp, 14. ohm, 16. users, 19. LIDAR, 20. calving, 23. draft, 26. tar, 27. gal

NZ GEOPRESERVATION INVENTORY

40 YEARS SINCE INCEPTION

Bruce W. Hayward and Jill A. Kenny

This year marks the 40th birthday of the start of the GSNZ's New Zealand Geopreservation Project, thus it is an appropriate time to remind people of its existence, summarise its present content, and acknowledge its history of compilation and review. One of the stated objectives of the GSNZ since the earliest days of the Society is "To seek the preservation of sites of geoscientific importance".

In the first 25 years of the Geological Society of New Zealand's existence (1955–1980), there had been a number of one-off endeavours to protect specific geological features. This was mainly through the creation of Scientific Reserves, where the land was purchased by the state. Some of these campaigns, led by GSNZ stalwarts like Graeme Stevens, Norcott Hornibrook, Gerald Lensen, Bryce Wood and Doug Lewis, lasted decades before full reserve protection was gazetted. These included Red Rocks pillow lavas and red argillites (Fig. 1; gazetted 1972; Hayward, 1986), Chancet Rocks fossil "sponges", Cretaceous/Paleogene boundary (1979; Lewis and Strong, 1984), Otapiri Stream Triassic type section (1980), Cape Turakirae uplifted beach ridges (1981; Stevens, 1976), Clifden Miocene type section (1981; Hayward, 1988), Hutchesons Quarry fossils, Target Gully Shell Pit fossils, Waiohine faulted terraces (1987; Hayward and Little, 2022), Wiri Lava Cave (1998, Hayward and Crossley, 2014), plus the stopping of quarrying of Muriwai pillow lavas (1975).

Figure 1. Red Rocks on the south coast of Wellington was one of the earliest protection advocacy successes of the GSNZ, who managed to have it gazetted a Scientific Reserve in 1972 to stop its complete removal by quarrying.

Some of these campaigns were reactive to quarrying threats (Red Rocks, Turakirae, Muriwai) but others were proactive, possibly as a result of calls from the GSNZ National Committee for information on sites that members felt needed to be protected. These calls began in Newsletter 2 and continued at regular intervals as evidenced by the following extracts from GSNZ Newsletters:

"We would like to be able to compile a list of proposed 'Geological Monuments', or features of national importance." - Newsletter No. 2, 1956.

"If members know of geological features sufficiently important to warrant preservation, would they send details to the Secretary." - Newsletter No. 16, 1964.

This appeal was repeated again in Newsletter 18 (1965) and 20 (1966), but there is no record of any replies having been received.

"Conservation of geological sites needs to be anticipated well in advance ... We should be taking stock of localities now." - Newsletter No. 27, 1969.

"As a Society we should ... give our support to future efforts to preserve critical fossil and mineral localities." - Newsletter No. 34, 1973.

"The Geological Reserves and Notice-boards Subcommittee would like to hear of any geological site that members feel should be preserved." - Newsletter No. 49, 1980.

These pleas resulted in none of the hoped for widespread input from members. Prior to 1979 a Geological Noticeboards Subcommittee existed to encourage or undertake the provision of noticeboards in public places explaining the significance of important sites, but these well-meaning endeavours were plagued by vandalism (e.g., White Creek fault scarp). In 1979 the brief for this subcommittee was widened and it was renamed the Geological Reserves and Noticeboards Subcommittee.

New Zealand Geopreservation Inventory history

The history of the inventory can be divided into the following phases (Fig. 2):

1. Concept and design, 1983-1985

By the early 1980s the Geological Reserves and Noticeboards Subcommittee realised that to achieve the GSNZ's objective of preservation of important geological sites required a more proactive approach of informing planning authorities of the existence and values of geoheritage sites before proposals for their development were well advanced. Steve Weaver and Bruce Hayward (1983) proposed that the subcommittee take on the task of compiling an "Inventory and assessment of New Zealand geological and geomorphological features of national and regional importance". They wrote that "the object is to compile an inventory of all nationally and regionally important geological and geomorphological features, irrespective of their location, degree of protection or threatened status. The relative importance of such features for long term preservation would be judged with an aim to preserve the best examples from a broad spectrum of geological phenomena."

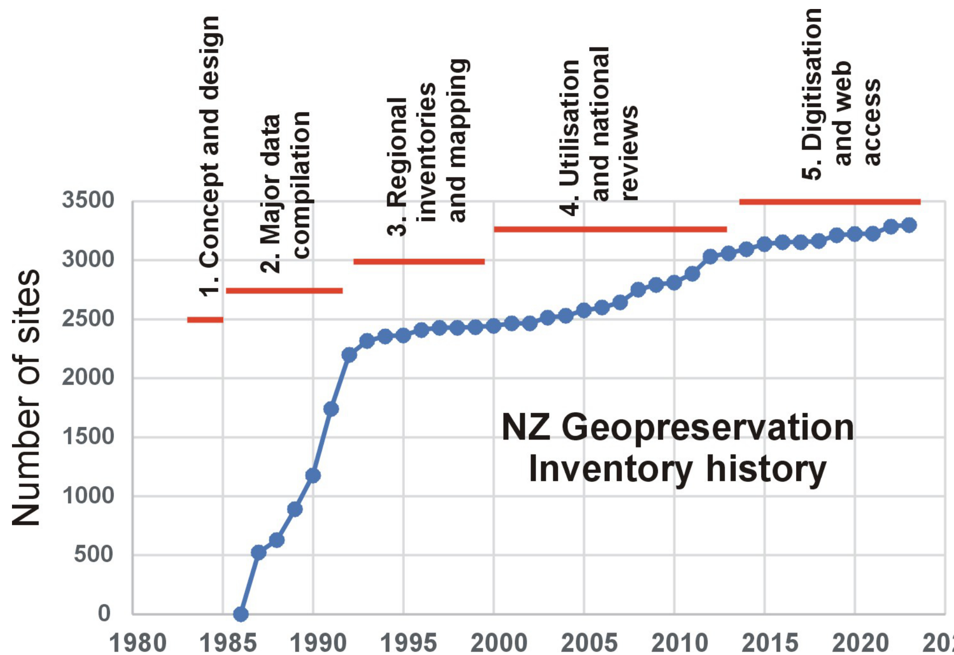


Figure 2. Phases in the first 40 years of history of the New Zealand Geopreservation Inventory and growth in the number of geopreservation sites.

Under modus operandi it was stated: "we are aware that the proposal is a massive undertaking and would like to adopt a method which would yield optimum results for minimum amount of work by any individual." Using a recently completed inventory and report on preservation of Aotearoa New Zealand's geothermal features of interest by the GSNZ's Geothermal Subcommittee (Fig. 3; Houghton et al., 1980) as a successful example, it was proposed to compile the inventory in approximately 15 subject-based categories. The Subcommittee would seek an enthusiastic specialist geoscientist to co-ordinate a working group to compile each category. These working groups would seek nominations of sites from around the country that would be assessed for their importance. Information would be compiled for each site to fill the required compulsory and additional fields. Reports would be prepared for each category and widely circulated to promote site protection.

Figure 3. Preparation of a report assessing the significance and preservation of New Zealand geothermal features (Houghton et al., 1980) provided the impetus for establishment of the New Zealand Geopreservation Inventory in 1983. One of the features saved as a result of that report was Pōhutu Geyser, Whakarewarewa.

A pilot study on Fossil sites was begun by Bruce Hayward:

"to expose a number of the problems and permit better definition and planning of the whole project."

The introductory item in the GSNZ Newsletter in 1983 concluded by saying:

"We trust that in each sub-discipline of geology and in each geological institution there are a handful of people willing to make some real contribution towards the preservation of New Zealand's geological heritage."

In the next few years, several categories were started and preliminary lists of sites compiled, but progress slowed when it came to gathering and entering data into the Department of Scientific and Industrial Research (DSIR) Virtual Address Extension (VAX) computer database, as this was time-consuming. Despite their support, individual volunteer scientists did not have that much spare time to devote to this aspect. The Subcommittee realised that if progress was to be made then we needed to find a way of undertaking this time-consuming aspect by obtaining funding to employ geology graduates during their university vacations.

At the same time, it was realised that protecting our geoheritage was also a matter of concern for a number of other groups and so a Joint New Zealand Earth Science Societies' Working Group on Geopreservation was formed in 1985, comprising representatives of the Geological Society of New Zealand, Australia and New Zealand Geomorphology Group, New Zealand Geographical Society, New Zealand Soil Sciences Society, New Zealand Speleological Association and New Zealand Association of Landscape Architects. This resulted in greater impetus in the compilation of the giant landforms inventory and also in compiling unforeseen inventories on representative North and South Island soil sites.

2. Major data compilation phase, 1986–1992

The first successful Lottery Board grant was obtained in 1986 and used to employ graduate students working on four categories. Successful annual grants from both the Lottery Board and Department of Conservation followed in the next few years, allowing students to be employed to travel around the country, interviewing scientists in all the main centres to obtain nominations and information that they could enter in the respective inventories. No field surveys were undertaken specifically for the inventory compilation. Instead, the combined knowledge and advice of the majority of Aotearoa New Zealand's earth scientists was utilised, representing hundreds of person-years of field work. This information was provided voluntarily by all informants despite the advent of the user-pays environment that was being imposed on Aotearoa New Zealand science by politicians at that time. It clearly illustrated the level of concern and commitment to Earth science conservation by most in the Earth science community.

Each recent graduate was assigned one category and worked under the supervision of the experienced specialist scientist in that category. In this way the following category inventories were completed in the years cited:

- Fossil sites, 1987, 1989 (314 sites), convenor Bruce Hayward, graduate assistant Barbara Ward. GSNZ unpublished report 89/1 (for site protection).
- Caves and karst, 1987, 1989 (103 sites), convenor Trevor Worthy. GSNZ Misc. Publ. 47.
- Active earth deformation sites, 1988 (226 sites), convenor Sarah Beanland, graduate assistant Mark Stirling. GSNZ Misc. Publ. 38.
- Geothermal fields and features, 1989 (146 entries), convenors Bruce Houghton, Ted Lloyd, and Ron Keam, graduate assistant David Johnston. GSNZ Misc. Publ. 44.
- Landforms, 1989, 1990 (567 sites), convenors Mike Crozier and Jack McConchie, graduate assistants Rebecca Priestley, Rosalind Squire, Elizabeth Vaughan and Sarah Crozier. Victoria Uni Research School of Earth Sciences Occas. Paper 4.
- Sedimentary sites, 1992 (254 sites), convenors Brad Field and Jill Kenny. GSNZ Misc. Publ. 62.
- Geologically-related historical sites, 1991 (212 sites), convenor Bruce Hayward, graduate assistants Tasha Black and Stephen Nowell. GSNZ Misc. Publ. 52.
- Pre-Quaternary igneous sites, 1990 (227 sites), convenor Steve Weaver, graduate assistant David Johnston. GSNZ Misc. Publ. 49.
- Quaternary volcanoes and volcanic features—Northland, Auckland, South Auckland and Taranaki (244 sites), convenors Ian Smith, Les Kermode and Bob Stewart, graduate assistants Leah Moore, Janet Ashcroft and Stephen Nowell. GSNZ Misc. Publ. 61.
- Quaternary volcanoes and volcanic features—Taupo Volcanic Zone, 1991 (350 sites), convenors Bruce Houghton and Jim Cole, graduate assistants Barbara Hobden and David Johnston. GSNZ Misc. Publ. 55.
- Mineral sites, 1991 (135 sites), convenor Bill Watters, graduate assistants Rebecca Priestley, Richard Wyzoczanski and Stephen Nowell. GSNZ. Misc. Publ. 53.
- Structural geology sites, 1991 (110 sites), convenor Bernhard Spörli, graduate assistant Stephen Nowell. GSNZ. Misc. Publ. 54.
- Metamorphic rock sites, 1992 (84 sites), convenor Bill Watters, graduate assistants Rebecca Priestley and Stephen Nowell. GSNZ Misc. Publ. 60.
- Soil sites, South Island, 1991 (443 sites), convenors Peter Mcintosh and Les Basher, graduate assistants Joseph Arand and Michael Heads. New Zealand Soil Soc. Occas. Publ. 1.
- Soil sites, North Island, 1993 (308 sites), convenor Les Basher and Peter Mcintosh, graduate assistants Joseph Arand, Rob Wardle and Kate Wardle. New Zealand Soil Soc. Occas. Publ. 2.

By 1992, the advocacy task of the Joint Earth Sciences Working Group had been successfully completed and GSNZ took over sole management and copyright of the Inventory to be made freely available throughout New Zealand for the benefit of Earth science conservation.

3. Production of regional inventories and mapping the sites, 1993–1999

Once all the category inventories had been compiled and their report published, it was clear that to be most useful for district and regional planners and regional DoC offices, we needed to combine all the data and produce 12 new regional inventories. We recognised at this point that the Soil Inventories were compiled using a different set of values for assessment and as a result they were set aside as stand-alone products. Jill Kenny was contracted on another grant to undertake this task and format the new regional inventories, which were published in 1993 as further GSNZ Miscellaneous Publications that were sent for free to all the relevant planning and conservation advocacy organisations in each region.

In order to expedite completion of the assembly of each category, it had been decided that for location, only a single grid reference was needed, which was fine for small sites but did not show the extent of larger sites. Following completion of the regional inventories, therefore, funding was obtained for Jill Kenny to map the extent of larger sites using the literature and some input from the original site nominators. A new set of regional inventories containing a set of hard-copy maps of all larger sites was prepared and published from 1996 to 1999.

4. Utilisation and national reviews, 2000–2013

Once the regional inventories had become available, they were more widely used by regional and district council planners and consultants trying to implement the Resource Management Act (RMA) clause 6B, which stated that the protection of outstanding natural features was a matter of national importance. Many requests for information and reports were being answered. We were aware that since the landform inventory had been compiled altogether without subdivision into subcategories, there had been no national assessment to determine that all the best representatives of the various landform types had been undertaken and that this was an issue that needed addressing. In 2005 the New Zealand Geopreservation Inventory appeared on its own web page, listing all sites by region and metric map sheet (NZMS 260) and advertising the availability of published inventories.

In 2007, Jill Kenny once again became available, and grants were obtained from Lottery Environment and Heritage to contract her first to undertake a national review of New Zealand caves and karst, and then several years later New Zealand coastal landforms. All sites were reassessed for importance and gaps identified and filled in terms of site types and geographic distributions, and the new information added to the inventory. To further promote protection of these two categories of sites, two booklets were prepared and published by GSNZ in the guidebook series (Kenny and Hayward, 2010, 2013).

Inevitably the requests began asking for digital copies of the data and digitised maps, and so further funding was obtained from Lottery Environment and Heritage for this phase.

5. Digitising the maps and data for web site access, 2013–2023

In 2013, Jill Kenny was contracted to transfer the hard copy maps of larger sites to a GIS layer (on QGIS), along with plotting and checking the locations of all the smaller spot sites. We then teamed up with the non-profit, charitable MAIN Trust (Mapping, Analysis and Information Network Trust, New Zealand) and in 2015 the Inventory was made available for all to use and interrogate on the MAIN Trust web site. We were encouraged to add photographs for sites and 1000 of these were prepared, but for unknown reasons they failed to upload.

In 2022 the MAIN Trust migrated the Inventory to new software that now also has the photographs accessible (see below). Since preparation of the regional inventories, additional sites have been progressively added to the Inventory as they have been brought to our attention, and occasionally sites have been removed as they have deteriorated or been destroyed.

The Inventory Today

There are currently 3299 sites in the New Zealand Geopreservation Inventory with 216 assessed as being of international importance, 1080 as being of national importance and 2003 of regional importance. The accompanying figures (Figs. 4–6) show the distribution and number of sites in the Inventory in 2023.

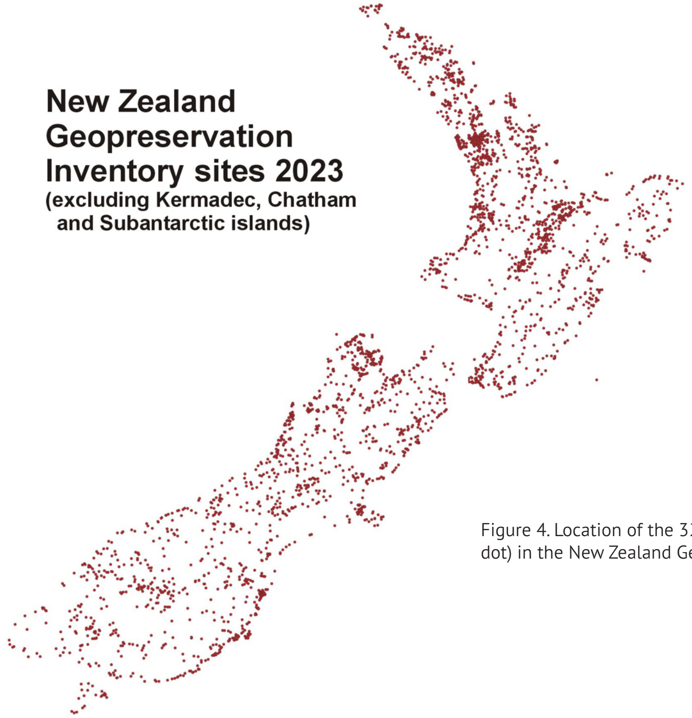
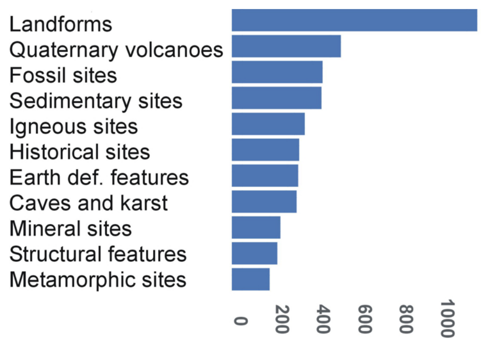


Figure 4. Location of the 3299 sites (each represented by a dot) in the New Zealand Geopreservation Inventory, 2023.



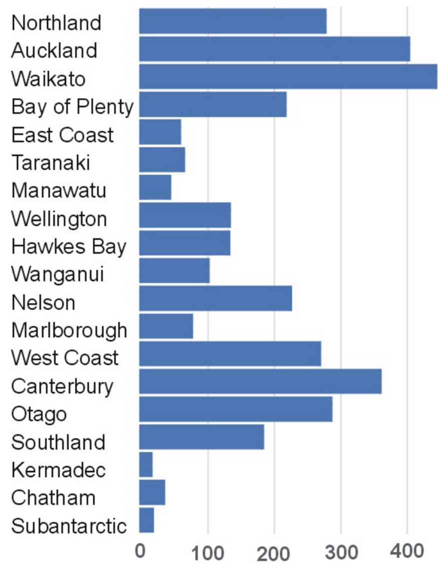


Figure 5. (above) Number of sites in the New Zealand Geopreservation Inventory by region, 2023.

Figure 6. (right) Number of sites by category in the New Zealand Geopreservation Inventory, 2023.

The Future

Despite the enormous effort so far expended in compiling this Inventory, it can never be regarded as complete or the last word. Some important sites have undoubtedly been overlooked, and the assessed importance of some sites will change as more information is gathered or their state of preservation and exposure alters. We are always receptive to nominations of additional sites or to information that may correct current entries. Please send these to the convenor of the Geopreservation Inventory (b.hayward@geomarine.org.nz).

We are aware that further categories of landform (e.g. glacial and fluvial) need national reviews to fill gaps in coverage and make sure that the best representative examples are included. More photographs of sites could also be uploaded and more recent information on included sites needs to be added into the reference fields. Unfortunately, opportunities for further grant funding of a national project like this appear to have dried up. We are now awaiting the practical implications of the new legislation that is set to replace the RMA to see what role the Inventory will play as we move forward to further protect geoheritage, especially in private ownership. ■

Acknowledgments

The New Zealand Geopreservation Inventory has been compiled with the generous provision of information from hundreds of Aotearoa New Zealand Earth scientists, too numerous to list individually. The financial assistance of the New Zealand Lottery Board and Department of Conservation is gratefully acknowledged. Compilation was made possible through the logistical support of the former New Zealand Geological Survey (now Institute of Geological and Nuclear Sciences), the Earth science departments of the Universities of Auckland, Canterbury and Wellington, Manaaki Whenua Landcare Research (formerly New Zealand Soil Bureau), Auckland War Memorial Museum and Geomarine Research. Voluntary contributions have been provided by Earth scientists who supervised the compilation of the different subject categories as listed earlier.

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Simple practical guide to use and interrogation of the New Zealand Geopreservation Inventory in 2023:

1. Access at: https://naturemaps.nz/maps/#/viewer/openlayers/484 (bookmark this for return visits)

2. Front page is a New Zealand map. Zoom in and out and move with mouse to find location of site/s of interest.

   a. For information about a site, click on layers icon (top left) then click on (highlight) Geological areas. Click in a pink area of interest for all the information about it in the inventory.

   b. For photographs of sites, return to map. Click on Site locations layer, then on blue site marker. Photos appear if some have been loaded for that site.

3. To interrogate or search the whole inventory within fields, click on Geological areas layer. Then open attribute table (select icon from options bar above). Excel-like table appears with fields in columns and sites in rows. To search within a field, type search word in box at top of column. Combined searches are possible, . e.g., Caves of national importance (B) in the Nelson region.

4. An explanation of the inventory and fields is available at http://www.geomarine.org.nz/NZGI/ or use link provided on the header page.

SJ HASTIE AWARD REPORT

THE ABUNDANCE AND SIZE DISTRIBUTION OF TUAKI/COCKLES WITHIN MODERN AND HISTORICAL NEAR-SHORE HABITATS OF UPPER WHAKARAUPŌ/LYTTELTON HARBOUR, AND RELATIONSHIPS TO SEDIMENT CHARACTERISTICS.

Jessie Henwood (MSc Student)

Supervisors: Catherine Reid (School of Earth and Environment, University of Canterbury), Islay Marsden (School of Biological Sciences, University of Canterbury

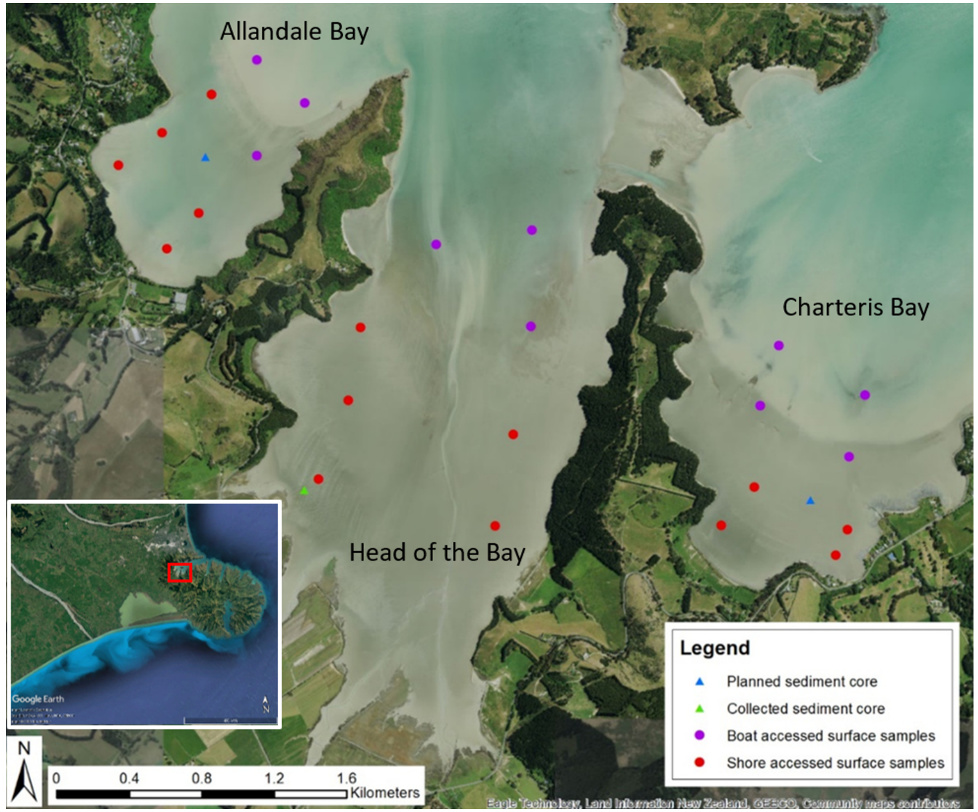
Estuarine environments throughout Aotearoa New Zealand have been influenced by anthropogenic activities, threatening the habitats of a range of species. The mudflats at the head of Whakaraupō/ Lyttelton Harbour are no exception to this. Changes in natural vegetation due to European arrival rapidly increased the sedimentation rates in this harbour, which has the potential to influence benthic communities. Tuaki/cockles make up the only major shellfish beds in this harbour and are an important part of mahinga kai resources. However, populations are noticeably lower in abundance when compared to other Canterbury estuaries. The modern distributions of tuaki populations in upper Whakaraupō have been established but the changes in these through time have not been identified.

This study aims to determine how tuaki populations in Charteris Bay, Head of the Bay and Allandale Bay in upper Whakaraupō (Fig. 1) have changed over the last 3,000–4,000 years. Sediment characteristics are analysed alongside tuaki abundance and size to determine how sediment changes might have influenced the populations. The time scale over which this project is focused will highlight if tuaki population changes have been induced by anthropogenic influence. Determining how tuaki populations in Whakaraupō have changed over time is important to inform what remediation measures would be ideal to encourage population restoration.

To achieve these aims, both surface and historical samples of tuaki and sediment have been collected. One sediment core has been retrieved and analysed so far (Fig. 2), with two more to be collected and analysed in the coming months (Fig. 1). Surface sediment samples and tuaki surveys have been completed at the same locations along six transects across the upper harbour mudflats (Fig. 1). Sampling was done both by walking to the location from shore and utilising a boat for access. All sediment samples from the surface and sediment cores will be analysed for total organic carbon, total nitrogen, total carbon, total phosphorous, composition (using portable X-ray fluorescence) and grain size distribution. Completing these tests for the surface samples is currently underway. Four repeats of surface tuaki surveys at each location were completed, measuring the sizes of tuaki found in a 25 cm x 25 cm quadrat. In the sediment cores any tuaki found were extracted and measured. So far the data collected has been plotted but not yet analysed. This will be undertaken over the next few months to determine if tuaki populations have changed as a result of anthropogenic influence. ■

Figure 1. (right, top) Location of the study area, including sampling points. Inset shows Banks Peninsula with the outline of the study area in red.

Figure 2. (right, bottom) Images of sediment core collection. Photo credit: Sophie Fay.



SJ HASTIE AWARD

SUPERVISOR'S SUPPORT LETTER: JESSIE HENWOOD

Faculty of Science

School of Earth and Environment
earthandenvironment@canterbury.ac.nz

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

21 September 2023

Tēnā koe

Jessie Henwood was the Canterbury recipient of a Hastie Prize for 2023 and started her MSc thesis in March 2023. She has collected one sediment core and all of her modern samples. Now that we head back into better weather Jessie will be collecting her remaining two cores via a new pontoon system designed for work on otherwise inaccessible intertidal mudflats. Her research is going well and with luck samples plenty of cockles in her remaining two cores.

Nāku iti noa, nā,

Associate Professor Catherine Reid
Kaimātai Mātātoka | Palaeontologist
Te Kura Aronukurangi | School of Earth and Environment
Te Kaupeka Pūtaiao| Faculty of Science
Te Whare Wānanga o Waitaha | University of Canterbury
Private Bag 4800
Ōtautahi | Christchurch 8140
Aotearoa | New Zealand

Ph +64 3 3694438
Internal 94438
catherine.reid@canterbury.ac.nz
Beatrice Tinsley Building room 216

YOUNG RESEARCHER TRAVEL GRANT REPORT

RECONSTRUCTING PAST ENVIRONMENTAL CHANGE OVER THE HOLOCENE THROUGH MARINE AND TERRESTRIAL PROXIES AT LYTTELTON HARBOUR, BANKS PENINSULA, NEW ZEALAND

Johanna M. Hanson (PhD Student, University of Canterbury)

Co-authors: Catherine Reid (University of Canterbury), James Shulmeister (University of Canterbury), Matiu Prebble (University of Canterbury), Atun Zawadzki (Australian Nuclear Science and Technology Organisation), Quan Hua (Australian Nuclear Science and Technology Organisation), Christopher Moy (University of Otago).

My name is Johanna Hanson and earlier this year I was kindly awarded the GSNZ Young Researcher Travel Grant. This award provides an excellent opportunity for students and early career researchers to gain new skills and/or experience presenting at international conferences.

I am a PhD student at the University of Canterbury, Christchurch with a background in geology (Bachelor of Science Hons 1st class) and archaeological sciences (Bachelor of Science) at The University of Queensland, Australia. My current research focuses on the environmental reconstruction of Te Whakaraupō Lyttelton Harbour, Te Pātaka-o-Rākaihautū Banks Peninsula, Aotearoa New Zealand, utilising a multiproxy study combining micro-fossil analyses, geochemistry, geochronology and sedimentology on a transect of sediment cores. In this research I aim to reconstruct past vegetation and fire regimes, understand sediment provenance and rates of accumulation, identify past coastal hazards (e.g., storm events) and construct a regional sea level curve. This will provide knowledge for future management response and provide information on past hazards that have affected the Harbour and may do so in the future.

With funding provided by the GSNZ, I attended the International Union for Quaternary Research (INQUA) conference held in Rome between 13–20 July 2023. The INQUA conferences are the largest for Quaternary Research and run once every four years. This was my first international conference and it provided a fantastic opportunity to both share my research and also learn about current research being conducted globally. Attending INQUA allowed me to meet and network with key researchers in my field on an international scale. However, there was a considerable number of New Zealand and Australian delegates, many of whom I met at the GSNZ conference last year or knew previously, which proved useful to discuss more local research being conducted in the Southern Hemisphere.

This was my first in-person conference where I presented an oral presentation, which was a great learning experience both for my confidence and skills in public speaking. My presentation about past storm events that have affected Te Whakaraupō over the last ~5,000 years was very well received.

Overall, attending INQUA has been an excellent experience and a highlight of my PhD journey so far and has provided me with skills and connections that will help me for my future academic career.

Thank you very much for your support in providing me with funding to attend INQUA! ■

FIELD TRIP: TAUPŌ/TARANAKI

VICTORIA UNIVERSITY OF WELLINGTON GEOLOGY SOCIETY

Emma Taylor (President)

Between the 21st and 25th of August, the Victoria University of Wellington Geology Society took 20 members on an educational field trip to the Taupō and Taranaki regions with the support of the GSNZ. The trip aimed to educate geology students on Te Ika-a-Māui North Island volcanics, lithostratigraphic supergroups, and the geothermal and petroleum energy industries.

Day one included a drive up to Tongariro National Park from Wellington. On the way, we stopped at Mokai Gorge to view the marine sedimentary facies carved by subsequent fluvial erosion (Fig. 1). Next, we visited the Tangiwai Rail Monument and learned the devastating power of volcanic lahars. The end of the day involved half of the group walking to Taranaki Falls at Tongariro National Park, while the others drove up the mountain to experience the snow (Fig. 2) and stopped at the information centre.

Day two began with a look at past river levels at the Taupō Bungy followed by a viewing of the Aratiatia Rapids hydroelectric power station dam release. We then went to the Wairakei power station lookout point and Huka Falls. This was the first time many students had seen the Huka Falls; it was an impressive 15 m wide gorge of hard volcanic rock.

Figure 1. Mokai Gorge

Figure 2. Studetns in the snow at Mount Ruapehu.

Our final activities were examining an outcrop of the Taupō region eruption history (Fig. 3) and hunting for the Whakaipo Bay Lake Terraces (Fig. 4). We were fortunate to have Liam Bramwell, Dene Carroll, and Cliff Atkins from Victoria University of Wellington to outline the geological significance of these sites.

On day three we started with the Pleistocene Mangakino Ignimbrite (Fig. 5), this was an awesome opportunity to see such a widespread deposit! We then drove to Waitomo where we did a scenic walk at the Ruakuri Caves (Fig. 6). There were some awesome limestone formations and caves along the track. We then went for a walk along Urenui Beach (Fig. 7) where we could see the Urenui Formation outcropping along the coast.

Day four was spent with geologists from the Taranaki region. In the morning we headed to the Todd Energy warehouse where we got to examine a massive sedimentary core from the Mckee oil field (Fig. 8). Experts at Todd Energy explained different features of the core before suiting us up in personal protective equipment (PPE) for a visit to the Mangahewa Production Station (Fig. 9). Several Todd Energy staff walked us through the production

site where we got to see the wells in action. Todd Energy kindly supplied lunch with an informal presentation from a geophysicist and a petrologist. The experience with Todd Energy was insightful and highly useful for our geology students exploring graduate options. In the late afternoon, we scrambled up Paritutu Rock in New Plymouth (Fig. 10), which is the remnants of a 1.75 Myr volcanic neck. For dinner, we had pizza in the company of Cliff Atkins' and Dene Carroll's old friends Nick Jackson and Steve Bunton who talked us through their geology career paths.

Clockwise from top left:
Figure 3. Taupō Volcanic eruption outcrop;
Figure 4. Whakaipo Bay outrcrop;
Figure 5. Mangakino Ignimbrite;
Figure 6. Ruakuri Caves;
Figure 7. Urenui Beach.

Figure 8. (top left) Todd Energy core samples.
Figure 9. (top right) Mangahewa Production Station.
Figure 10. (above)The view from the top of Paritutu Rock .
Figure 11. (right) Patea Dam.

On day five it was time to head home but not before a stop at Patea Dam from which we could see the Matemateaonga Formation (sandy mudstones and siltstones with massive boulder concretions) (Fig. 11). We visited the dam and then ended the day with some rock hammering and fossil hunting. Finally, we drove home to Wellington with our newfound knowledge of the Taranaki Basin, and Taupō Volcanic Zone geology. ■

WANT TO WRITE FOR GEOSCIENTIST AOTEAROA?

We welcome a range of contributions, including:

Articles

Letters / Opinion Pieces

Trip / Event Reports

Book Reviews

Notices

Tributes / Obituaries

Quizzes / Activities

Follow the guidelines for text and imagery on pg. 51 - 52 and email your contributions to editor@gsnz.org.nz.

BRAIN TEASERS

GEOCRYPTIC CROSSWORD 08

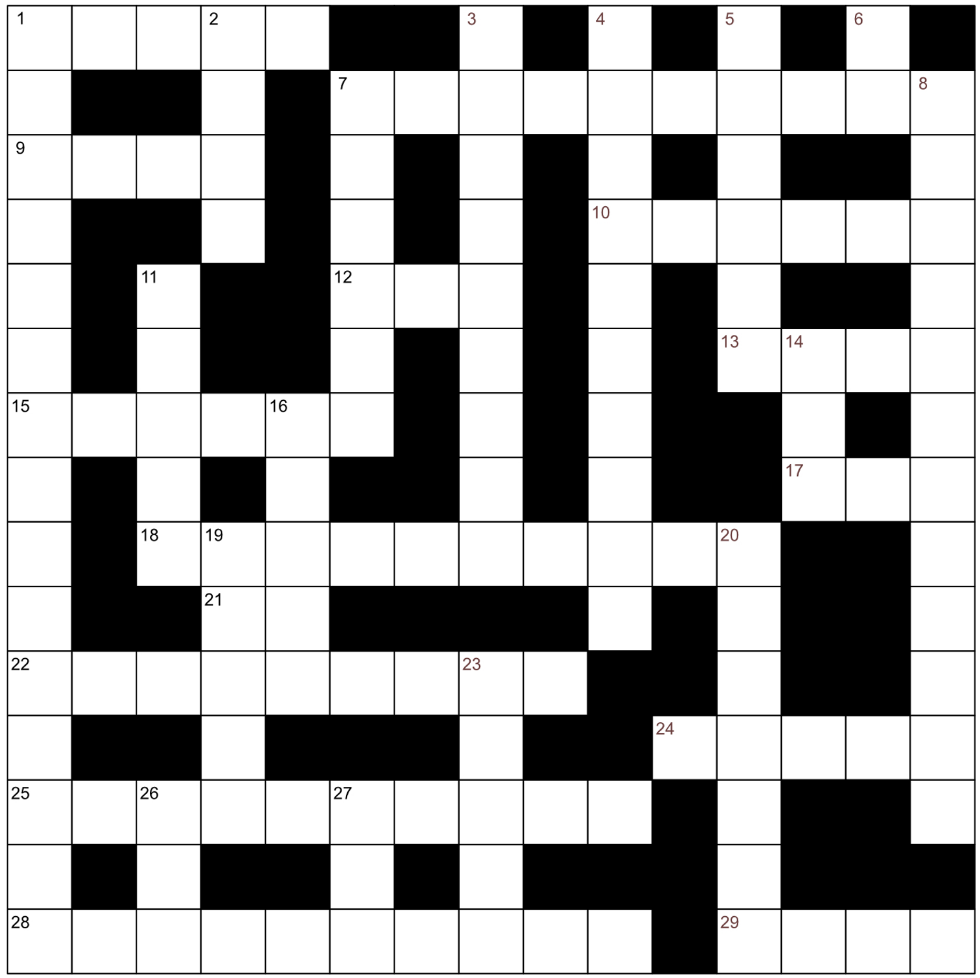
by **Cryptonite**

ACROSS

1. Melt the 3rd Greek...it's molten (5)
7. Useful grit struck by lightening (10)
9. Highest standard of fever in Mongol dominions? (4)
10. It's...the reason oceanic lithosphere is relatively depressed (6)
12. In short, 10km turns to 1 in my mind (3)
13. Insinuate oneself, like an annelid (4)
15. Such a mineral definitely isn't 18 (6)
17. Soft furnishing of algae (such as 8) (3)
18. Looks different in different lights (10)
21. Dirt contains corrosion-resistant metal symbol (2)
22. Metaphorical victory...literal failure (9)
24. Not odd Tritium describes notable point in time (5)
25. Old fashioned score for backward metamorphism (10)
28. Sedimentary horizons relocated about right are lined up (10)
29. Right becomes left in grey soil (4)

DOWN

1. Tell Marvel villain to tell acid it's a passive field survey (15)
2. The most frequent method of operation (4)
3. Crystalline variation of lo' Ph molar (9)
4. How a plate goes down revised bus conduit (10)
5. Was victorious looking back on present success to remove fine material (6)
6. Element, in short, named for 'earth' (2)
7. I am me after loud feature of some welded tuffs (6)
8. An early form of life tilts tearoom carelessly (12)
11. Scrap about fault feature (5)
14. MOHO loses love and goes back to unit of resistance (3)
16. The people receiving science advice...are drug addicts? (5)
19. Put a cap on Augmented Reality scanning technique (5)
20. Ice giving birth to cows? (7)
23. We hear passing air can prepare a paper (5)
26. Rodent reverts to hydrocarbon ooze (3)
27. She describes the strength of gravity (3)



Answers on p.25

OBITUARY:
ALAN GLENN BEU

09/12/1942 - 18/03/2023

Hamish Campbell (Emeritus Scientist, GNS Science)
& James Crampton (Professor, VUW)

It is with great sadness that the GSNZ reports the passing of yet another statesman of New Zealand geology. Alan Beu died in March this year from complications relating to a serious heart attack sustained on 18 January 2022. His wife Ira and their daughter Katie described the extra 14 months of Alan's life as a 'wonderful precious time' during which they were able to care for him full-time, at their home in Alicetown, and during which they enjoyed each others' company immensely. They were such a close family.

A memorial celebration of Alan was subsequently held in The Lounge at GNS Science, Avalon, on 26 April 2023. Close colleagues and family members were present, including Alan's younger sister Carole Beu (of literature fame) and her two adult children, Jared and Anneke, Alan's nephew and niece. Joe Prebble presided over the event and a wonderful series of anecdotes, memories and thoughts about Alan were provided by Ira Beu, Carole Beu, Hamish Campbell, James Crampton, Tim Naish, John Simes, Kyle Bland, Robyn Cooper and Chris Hollis. Alan would have been pleased and suitably humbled by the fuss made of him. And the venue was perfect because GNS Science was very much his professional 'home' away from home.

Alan's parents were Glenn and Muriel Beu. His father was born in Eastbourne, had a career with General Motors, and was a one-time President of the Wellington Computer Society. His mother (nee Burn) was raised in Lower Hutt, the daughter of a wool-classer with market-gardening interests who lived in Burnton Street (a construct named after the Burn and Brenton families, both market gardeners). Alan was also born in Lower Hutt, and educated at Eastern Hutt Primary, Hutt Intermediate, Hutt Valley High and Victoria University (VUW). A local lad through and through!

Alan Beu, a specialist in molluscan palaeontology, taxonomy and stratigraphy, whose expertise ranged widely across New Zealand's ancient and modern biota.
Photo: GNS Science.

The Beu name is of German origin and relates to Alan's great grandfather (Johann Beu, aka 'German John') who emigrated with his Swedish wife-to-be in the early 1880's from Stralsund on the Baltic Sea. They settled in Newtown, Wellington, at 515 Adelaide Road, named their home 'Strahlsund Villa' and went on to produce a whole new generation of Beus....and so on it goes.

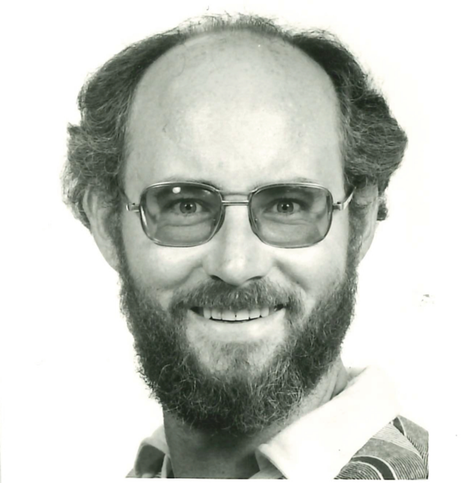
From a very early age, Alan displayed a prodigious interest in the natural world, and especially in marine shells. These interests were to dominate his life. To us in the GSNZ, he is best known as a palaeontologist. He was a geologist who specialised in molluscan palaeontology, taxonomy and stratigraphy. However, Alan's expertise was not confined to Phylum Mollusca. He had very broad interests, very much that of a classical natural scientist, interested in the identity and evolution of the entire New Zealand biota. For instance, he was as conversant in the taxonomy of several major groups of plant including orchids and ferns. And to the wider public, he was best known as a malacologist, with an abiding interest and consummate expertise in modern living shells. He was a life-long member of the Shell Club. He was fascinating to be with on any beach because he knew every species of mollusc intimately: their name, who named them, when they were first 'discovered', their evolutionary ancestry, their immediate relatives, their shape, why they are that shape, how their morphology changes through life, their anatomy, colour, diet, temperature range, sex life, eggs, spat, life cycle, peculiar habits, predators, enemies, sensory devices, defence mechanisms. Alan knew it all.

Alan attended VUW in the early 1960s, completing a BSc in Geology and Zoology in 1964, a Geology BSc (1st Class Honours) in 1965, and a PhD in Palaeontology in 1968 on gastropods of the Superfamily Tonnoidea, supervised by Paul Vella and Harold Wellman. On completion of his PhD, he commenced employment in March 1968 as a palaeontologist specialising in the study of Neogene (Miocene to Recent) molluscs with the New Zealand Geological Survey (NZGS, a division of the Department of Scientific and Industrial Research, DSIR). His job was primarily to make sense of fossil collections made by mapping geologists who were mapping the country at '4 miles to the inch' (approximately 1:250,000), and to interpret what the fossils 'meant' in terms of age, and also in terms of the environment in which they lived, such as the ecology, water depth, water temperature and hence past climate. In order to make sense of New Zealand's fossil shells, he assiduously collected modern shells, not only from New Zealand but globally and especially from Australia and the wider Pacific. After all, the present is the key to the past. This 'database' is substantial and resides with GNS Science to this day.

Alan was made a Fellow of the Royal Society in 1997, such was his fame in the context of New Zealand natural science, not to mention the world stage. Alan acquired a significant international reputation as the go-to man for Neogene molluscan studies in New Zealand, Antarctica and the Pacific. He collaborated with numerous scientists from Australia, Europe (Italy, France, Switzerland, Germany, Austria, UK, Norway), Asia (Japan, Indonesia, Philippines), Argentina and the USA. He had several specific interests of global scope: the tonnoidean gastropods and scallops (Pectenidae). These were the principal drivers of his ambitions, and they got him all over the world. Trust Alan to focus his energies on some of the most attractive and most remarkable shells on Earth! He received numerous accolades and grants over the years and was awarded a DSc in Palaeontology from VUW in 1999.

Alan had a charmed career in many ways. He revelled in his 'work'. He was quite literally paid to do what he loved most, and he 'rewarded' his employer accordingly with a sustained stream of high quality science productivity (reports, publications). He was a keen outdoors man, and a great field companion with an abundance of energy, good humour and positive vibes. He was very expressive and endlessly delighted with what he found. He shared his amazing knowledge with ease and joy, a great communicator, and was just such good fun to be with. He was very much a team player and a manager's 'dream run' in that he always contributed his expertise on time and to budget. He had a terrific work ethic and embraced new technology and new methodology intelligently and enthusiastically, such as Scanning Electron Microscopy, molecular biology, integrated stratigraphy and electronic databases. To keep abreast of new ideas, he read the scientific literature voraciously. The library was a large part of his daily diet. He had a ready 'let's give it a go'

OBITUARY



Alan Beu was a keen outdoors man, and a great field companion with an abundance of energy, good humour and positive vibes. Photo: supplied.

mentality, probably acquired in some measure from his most influential mentors, Jack Marwick, Harold Wellman, Paul Vella, Dick Dell and Charles Fleming, not to mention some of his closest buddies and peers such as Winston Ponder, Roger Cooper, Graeme Stevens, Ian Speden, Norcott Hornibrook, Tony Edwards, Phillip Maxwell and Bruce Marshall. Alan was also a wonderful mentor, especially to younger palaeontologists. He would go out of his way to assist students and fellow researchers alike.

Alan retired in December 2016 after 48 years of continuous employment with NZGS (1968–1990), DSIR Geology & Geophysics (1990–1992) and GNS Science (1992–2016). He was a palaeontologist for his whole career and retired as a Principal Scientist. He enjoyed Emeritus Scientist status at GNS Science for a further 5 years (2017–2023), enabling him to retain his office and access to the library, fossil collections, databases, IT support and colleagues at GNS Science, Avalon. All up, a remarkable 55 years as a research scientist with GNS Science and its predecessors. He authored and co-authored at least 320 scientific publications and there are more to come.

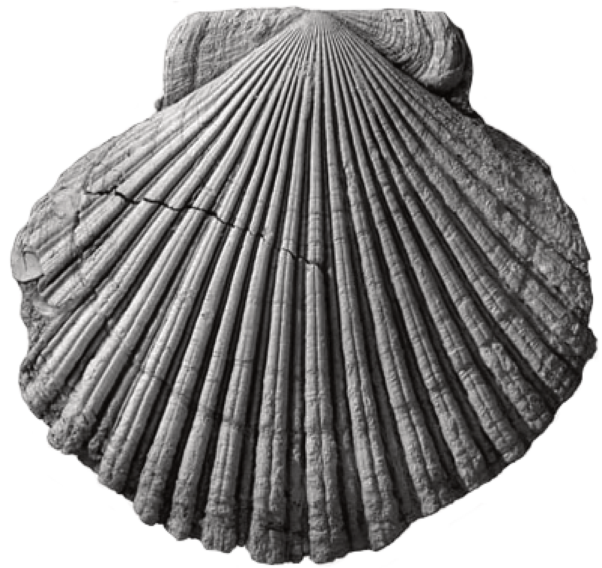
Alan will be sorely missed for his expertise but he leaves behind a tremendous scientific legacy. And as luck would have it, he was such a prolific writer and author that much of his knowledge has been captured. He also leaves behind very well-organised, fully catalogued collections housed in the National Palaeontology Collections at GNS Science, and thorough records, much of it in easy-to-read handwriting. He was a born cataloguer and archivist, and a major contributor to the Fossil Record File, a national inventory of New Zealand fossil localities. Alan is listed as collector of 1247 localities, and identifier of 2113 faunal lists. These are huge and lasting legacies that will benefit NZ Earth scientists for decades (?centuries) to come! These are the raw data for so much derivative science. He was particular, concerned with detail. This spilled over into his practical life as an artisan in his home environment (building, painting, carpentry, joinery, gardening), and as an artist of exquisite pencil drawings. More to the point, he was a very fine wordsmith, if somewhat prone to exactitude, especially when it comes to spelling, grammar and rules relating to taxonomy. He was a perfectionist but needless to say he was like the rest of us: he wasn't perfect. He was sensitive and could be stroppy and dogmatic, and might be wrong or disagree with you, but for all that, he didn't hold a grudge. He would recover quickly; his normal sunny disposition always shone through.

In terms of New Zealand geology, Alan is most widely known for his monograph on 'New Zealand Cenozoic Mollusca', which he co-authored with fellow palaeontologist Phillip Maxwell (specializing in Paleogene molluscs, Palaeocene to Oligocene) and artist Ron Brazier. This was published in 1990 on the occasion of the 125th anniversary of NZGS. This volume, and "Beu", have almost mythical, god-like status amongst second year 'geology' students. They spend hours of laboratory time poring over B&M, extracting information on identity, age and environment.

Needless to say, Alan stars in almost all the 1:250,000 Geological Maps of New Zealand, wherever there are fossil-bearing sedimentary rock formations of Neogene age. At the time of his death, Alan was working on a revision of the 'index' of Cenozoic molluscs, incorporating new data largely derived from molecular biological analysis of modern molluscs, and hence revealing new insight into their taxonomic identity and affinities.

In terms of significant ground-breaking research, Alan's expertise contributed greatly to the latest integrated stratigraphic analysis of the late Neogene (Pliocene-Pleistocene) sedimentary rocks preserved in the Whanganui Basin. This research has unravelled the extraordinary history of Pleistocene sea-level change in the Southern Hemisphere, showing it to be much more in keeping with the Northern Hemisphere than previously thought. The key to it was the recognition of the 'comings and goings' (in terms of stratigraphy) of 'cool-water molluscs'. Alan led the charge on this one and was proven to be right on the mark by his colleagues Tim Naish, Brad Pillans, Bob Carter, Brent Alloway and many others. Alan's legacy will prevail forever.

On being questioned as to what species of mollusc he would wish to be, should he be reincarnated, Alan was quick to reply: Phialopecten triphooki. Rest in peace Alan Beu. The GSNZ salutes you. He has made a huge contribution to New Zealand science and must rate as one of the world's most significant molluscan taxonomists of the past six decades. In so doing, he has taken us all closer to a better understanding of the fossil record, and its significance with respect to the meaning of life. ■



Phialopecten triphooki, an early Nukumaruan age scallop, and Alan's #1 choice for reincarnation as a mollusc. Reproduced from *A. G. Beu, S. Nolden & T. A. Darragh, 2012, Revision of New Zealand Cenozoic fossil Mollusca described by Zittel (1865) based on Hochstetter's collections from the Novara Expedition, Memoirs of the Association of Australasian Palaeontologists, 43: 1-69; figure 13G.*

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The Society is committed to supporting the geosciences. We are especially keen to encourage young people to pursue a career in the earth sciences and enable them to take advantage of learning opportunities.
Many of our awards and prizes have been made possible by the generosity of family members or friends to commemorate a loved one. We are extremely grateful for their thoughtfulness to assist future generations.

A GIFT IN YOUR WILL

Bequests are a wonderful way to extend your giving and continue to be part of the Society far into the future. Once you have made provision for your loved ones, a gift in your will can be the perfect way to support students, geoeducation and research for generations to come.
All gifts, whether modest or significant, are highly valued. We strongly recommend you discuss your wishes with your loved ones and consult a legal adviser when making provision for a gift to the Society.

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I give and bequeath to the Geoscience Society of New Zealand (Incorporated)
the residue of my estate

OR ________________% of my residuary estate

OR the sum of __________________________

as an untied gift

OR for the principal purpose of: ____________________________

for which a receipt from the Secretary, Treasurer or Administrator of the Geoscience Society of New Zealand (Incorporated) shall be a full and sufficient discharge to my trustees.
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EDITOR: (TBA)
c/o Geoscience Society of New Zealand
PO Box 7003, Newtown, Wellington 6242
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All GSNZ members will be sent an electronic version.

This is your newsletter and the editor seeks correspondence, news items, interim or preliminary reports of current research, reviews of books and of recent geological publications and other topical articles. Reviews of New Zealand geology, geochemistry and geophysics published overseas are particularly welcome. This publication is not a peer reviewed academic journal. Format equirements are outlined on the next page.

Preference will be given to articles submitted by GSNZ members however any appropriate contributions may be accommodated depending on space. Submissions will be subject to the following guidelines for acceptance:

- Contributions for potential publication for our membership are screened carefully and with a view toward the Society's core values.
- With a view to providing balance and best informing members, any individuals or specific science programmes mentioned by name, should be accorded the professional courtesy that is offered when publishing in academic literature, which is an opportunity to view the article beforehand and be given right of reply.
- No articles will be accepted 'in confidence' and may be subject to review by the editorial committee.
- Submissions received after the deadlines have passed may be held over for the following issue.

Unless indicated otherwise, views expressed are those of the authors and are not the official views of the editor or the Geoscience Society of New Zealand. Although encouraging informed debate, the Society moreover gives no guarantee concerning the accuracy, completeness or suitability of any information provided and takes no responsibility for any loss or damage that use of information in this publication may cause to anyone. Use of any information contained in any issues of this publication is the responsibility of the user.
Note that names are normally of the format "John Smith" or "Jane Smith". We prefer not to use titles such as Mr, Dr or Professor, nor to worry about whether we should use Miss, Mrs, or Ms.

SPECIFICATIONS

FORMAT

Geoscientist Aotearoa is formatted for A5. Email copy in any text format is acceptable. Attributed images and graphics are encouraged.

The current two column format accommodates approximately 500-550 words per page, without images. We suggest a limit of four pages (including images) in the current format for most contributions with minimal but key referencing. Depending on space, longer articles suitable as feature articles with illustrations are often published. If your article will run to more than four pages please contact the editor prior to submitting.

IMAGE RESOLUTION

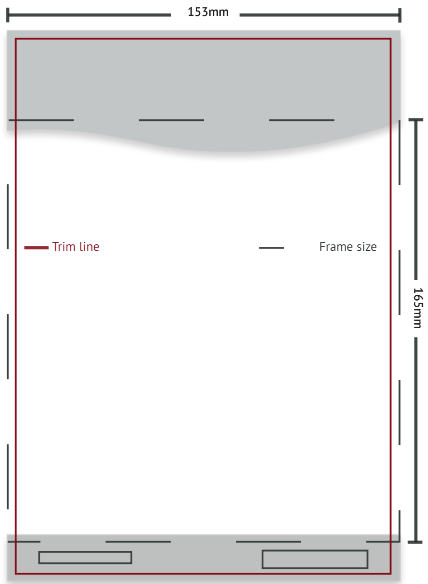
We seek to provide a high quality publication for our readership. Accompanying photos for articles must be sent as email attachments at the highest resolution possible. Please do not embed images in a Word document as they are often rendered unsuitable for the printing process. Annotation of images (numbering and descriptions on photos) is discouraged.

Any images supplied to be considered for front cover use must adhere to the following minimum resolution specifications: For A5 front cover (portrait suits best but landscape may be accommodated at the editor's discretion) 2551 x 1819 px. For A4 (full cover landscape wraparound) 3579 x 2551 px. The editor will reserve judgement on whether an image is suitable for A4 wraparound, bearing in mind that some elements may be hidden under the header, in particular (see below).

COVER IMAGES

Sizing of photos considered for cover of Geoscientist Aotearoa is not straightforward due to the variety of aspect ratios of photos provided, particularly when cropped. In many cases, the original submitted photo cannot proportionally fit within the allotted frame. In part, this is due to the title and footer block (shown in grey) design and some elements of the image would be hidden beneath them.

While the publication is A5, and image size in terms of resolution is already specified, proportions needed to fit the visible frame on the cover are different. Adjusting an image to fit may involve proportional resizing tweaks or "zooming in" to a specific portion of the image and is at the editor's discretion. A photo competition cover image presented "zoomed in" will be printed in its entirety inside the publication, albeit much smaller. It is recommended to have an image sized, proportionally, to fit a frame approximately 153mm wide and 165mm high for best results.



Geoscience Society of New Zealand

Front cover : Mount Ngāuruhoe from Waihohonu track.

Photo: Murray Baker