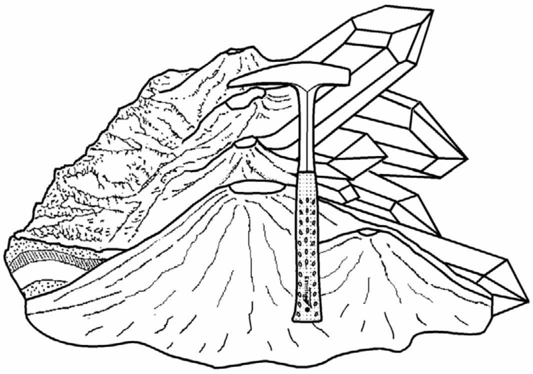


Geocene

Auckland GeoClub Magazine
Number 28, February 2022

Editor: Jill Kenny

CONTENTS

Instructions on use of hyperlinks	*last page*	17
THE TRAGIC 1965 MURIWAI LANDSLIP	Bruce W. Hayward	2 – 5
ENIGMATIC FOSSILS AT WAITOMOKIA	Hugh R. Grenfell	6 – 8
TUFF LAYERS UNDER THE SEA REVEAL PRE-VOLCANIC TOPOGRAPHY BENEATH MOTUKOREA / BROWNS ISLAND VOLCANO	Bruce W. Hayward	9 – 10
UPPER OAKLEY CREEK LAVA FLOWS	Hugh R. Grenfell	11 – 12
Geological crossword		13
CAMPBELL ISLAND PILLOW LAVA	Bruce W. Hayward	14 – 15
MEMORIES OF GEOFF JENKINS - GEOCLUB TREASURER, 1994–2008	Bruce W. Hayward, Hugh Grenfell	16
Corresponding authors' contact information		17
Geological crossword answers		17

Geocene is a periodic publication of Auckland Geology Club, a section of the Geoscience Society of New Zealand's Auckland Branch.

Contributions about the geology of New Zealand (particularly northern New Zealand) from members are welcome. Articles are lightly edited but not refereed.

Please contact Jill Kenny   jill.kenny@xtra.co.nz

THE TRAGIC 1965 MURIWAI LANDSLIP

Bruce W. Hayward

On August 27 and 28, 1965, two landslips came down from the steep escarpment at the southern end of Muriwai Beach village on Auckland's west coast. These slips destroyed two baches and killed two of four people who were holidaying in one of the baches. Mrs Isobel Crane and her 18-year-old daughter, Margaret Maria Crane, lost their lives, whereas her husband Mr E.A. Crane and 15-year-old daughter Christine were also caught by the first land slip but were rescued.

The landslips followed 2 days of unusually heavy rain, with a nearby gauge recording 95 mm occurring on August 25–26, plus 45 mm in the 12 hours preceding the slips occurred on August 27. This is somewhat less than that recorded officially for the 3-day period at Whenuapai (220 mm) and Manukau Heads (190 mm) (Wright, 1966). The first, larger, and tragic, landslide occurred at 3 pm. Witnesses describe it as starting as a fast-travelling wave of mud and came down a path 10 m to the east of the second landslide that came down 14 hours later at 5 am on August 28. Many smaller slips continued to come down for days after the main slips (Wright, 1966). The main landslips started as slides that almost instantaneously became mud flows or "debris avalanches" as the source material liquified as it began to move downslope (Wright, 1966).

At the head of both paths was the Edwin Mitchelson Track (Fig. 1), which was used as an access track (as it is today, Fig. 2) within that part of Motutara Domain containing the bush-covered escarpment. This part of the former Domain (now Muriwai Regional Park) became Recreation Reserve in 1954 as part of the reserve requirements of a nearby subdivision and partly as a gift from the subdivider Mr Norman Spencer. The track was created as the access driveway to Sir Edwin Mitchelson's home "Oaia" in about 1900 (Fig. 3).

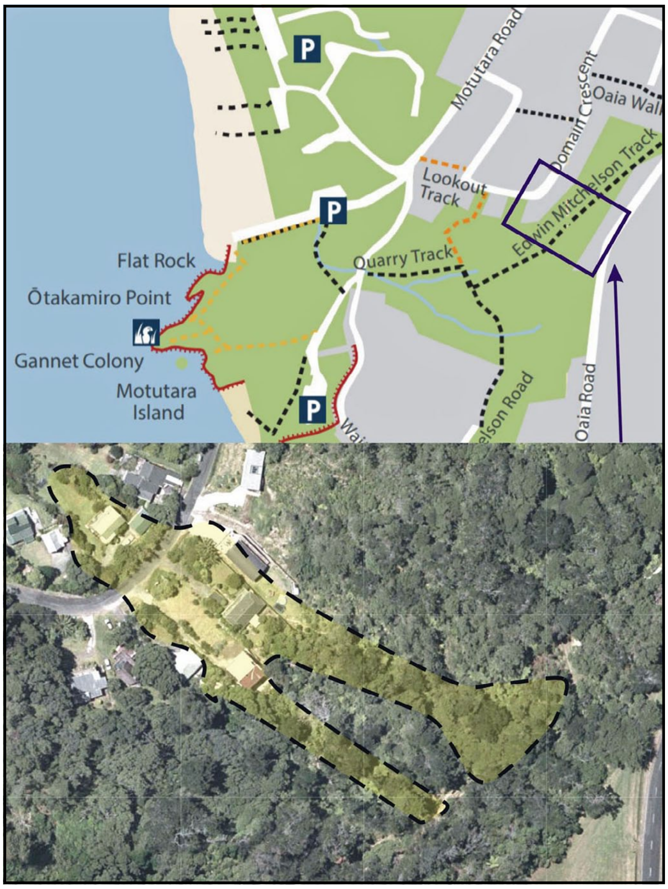


Fig. 1. Map of part of Muriwai Regional Park today, showing the area (dark purple rectangle) of the aerial photo (2006) below it. The extent of the two landslips (from Wright 1966, Fig. 5 below) is outlined by a dashed line on the air photo.

Fig. 2. That part of Edwin Mitchelson Track where the water table was blocked in 1965. Water poured over the outer edge in two places and was a major contributor to the tragic landslides.

Fig. 3. The Edwin Mitchelson Track was carved into the soft Pleistocene dune sand sequence that forms all the higher country around Muriwai as the access roadway to the Mitchelson home, about 1900.

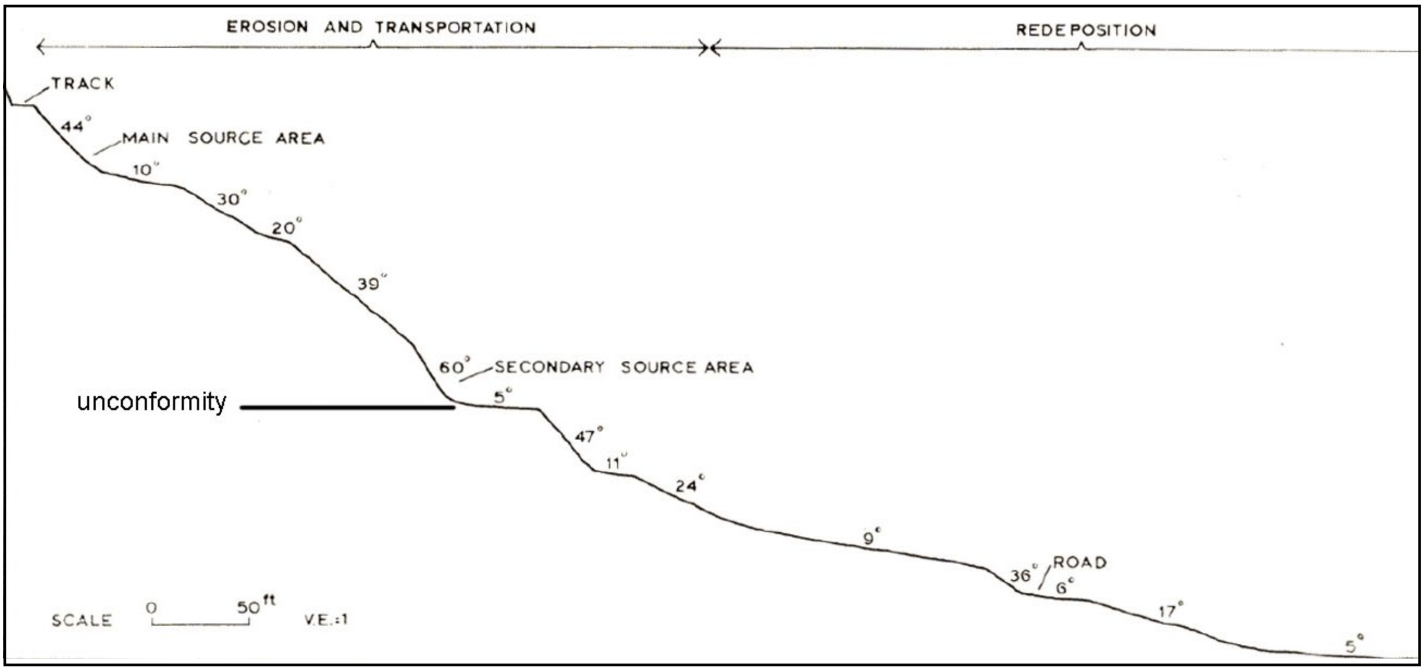


Fig. 4. Cross-section along the length of one of the landslip pathways from the Edwin Mitchelson Track down to the depositional toe on the downhill side of Domain Crescent. Measured and drawn by Lawrie Wright (Wright 1966).

Locals, Domain Board Rangers and the papers all concluded that the slips were a result of a blocked ditch alongside the track, which resulted in water pouring over the edge and saturating the loose debris on the 35° sloping escarpment beneath (Fig. 4). Investigations by British geographer and Auckland University Geography Lecturer (1965–68), Lawrie Wright, identified two main source areas for the landslip material – just below the track and half-way down the escarpment (Fig. 4). He observed that for days after the events, water seeped out of the Pleistocene sands about midway up the landslip paths. This water flowed down through the permeable Kaihu Group sands until it reached the subhorizontal erosional contact over relatively impermeable sedimentary rocks of the Waitakere Group. On reaching this aquiclude, the water flowed laterally through the sands and in normal times seeped out along the cliffs. Clearly, after sustained heavy rain the amount of groundwater rapidly increased and made the sand more susceptible to failure where it cropped out in the escarpment. This same unconformity is clearly visible at the top of the vertical cliffs all the way down the coast from Muriwai to Te Henga today and is often marked by a rich growth of vegetation where the groundwater seeps out.

Wright (1966) stated that the landslips began movement close to the level of the unconformity and the source migrated upslope as far as the track as a result of "headwall sapping", although he provided no first-hand accounts or descriptions of this happening. I think the overall conclusion would be that it was a combination of the surface water flowing down from Mitchelson Track, along with groundwater flowing through the Pleistocene sands above the unconformity, that resulted in the tragic landslips in 1965. The two landslips came down two separate paths that coalesced near the bottom of the escarpment, where they deposited their load in a lobe that flowed right across Domain Crescent (Fig. 5). Interestingly, there have been no more similar large slips along this escarpment since then.

The 1965, landslips (Figs 6–11) completely destroyed two baches and left a depositional lobe of sediment over all the gentler sloping land next to the road (up to 4–5 m deep) of what are now 53, 55 and 57 Domain Crescent. The debris avalanche flowed right across the road and deposited sediment, up to 1.5 m thick, over the upper parts of 34 and 36 Domain Crescent. The destroyed baches were on the uphill side of the road. One was demolished and its roof and remains were left on the uphill side of the corner on the front part of 53 Domain Crescent (Figs 6–7). The second bach was swept off its foundation and carried across the road where it came to rest surrounded by debris (Fig. 11).

At the time of the landslips, Rodney County engineers declared that no houses would ever again be allowed to be built in the path of these slips. Today there are now four, possibly five, modern homes built on the depositional lobe and the foot of the escarpment (Figs 1, 8).

Reference

Wright, L.W. 1966. The Muriwai debris-avalanche: some aspects of its form and genesis. *New Zealand Geographer* 22: 90–93.

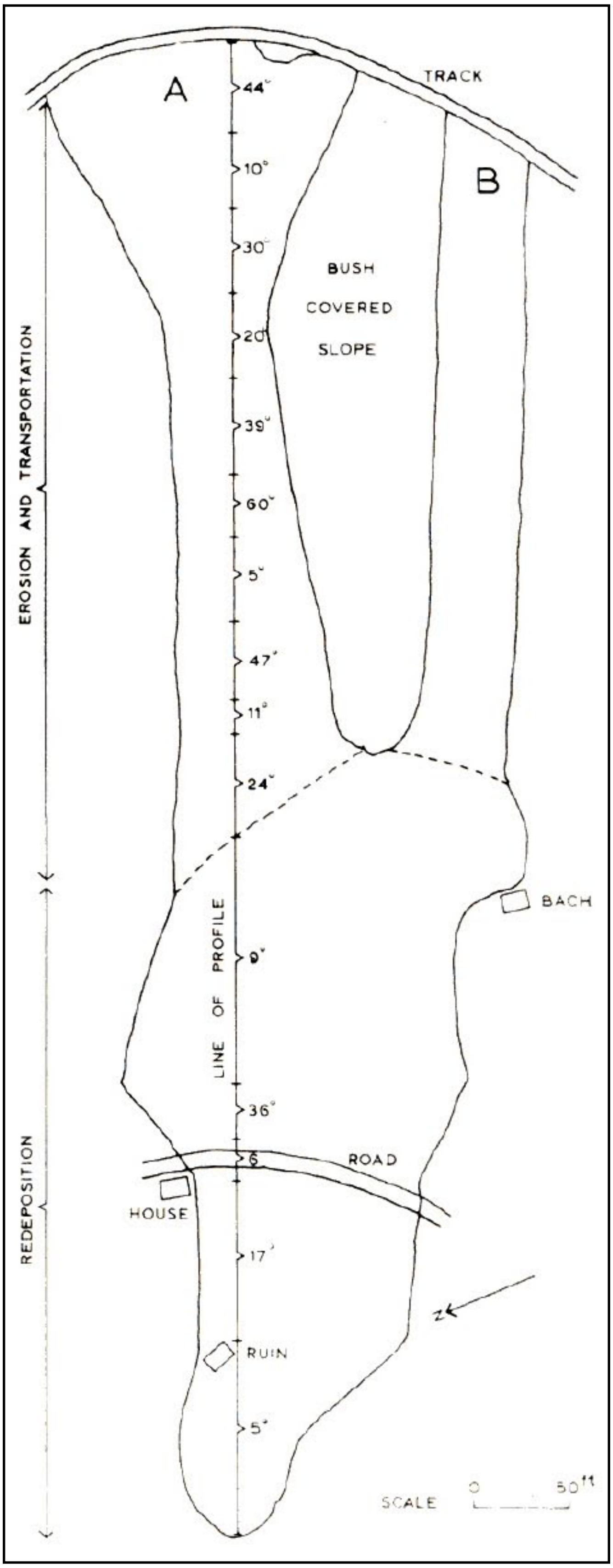


Fig. 5. Geographer Lawrie Wright's plan of the Muriwai Landslips of Aug 1965 (from Wright 1966).

Fig. 6. View from the road corner towards 51 and 53 Domain Crescent only hours after the second landslip had flowed down on August 28, 1965. The roof and collapsed walls of the bach in which two people were killed is in the foreground. Photographer unknown.

Fig. 7. View from the road showing the remains of one bach and the two landslip paths coming down the escarpment that coalesced and deposited the debris avalanche material in the foreground.
Photo: Auckland Star.

Fig. 8. Same view as Fig. 7 taken in October 2021 showing the growth of vegetation over the slip paths and the depositional lobe. There are glimpses of four of the houses now built on the landslip.

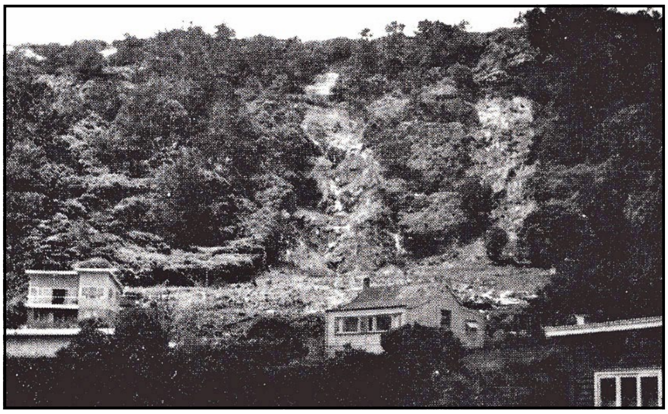


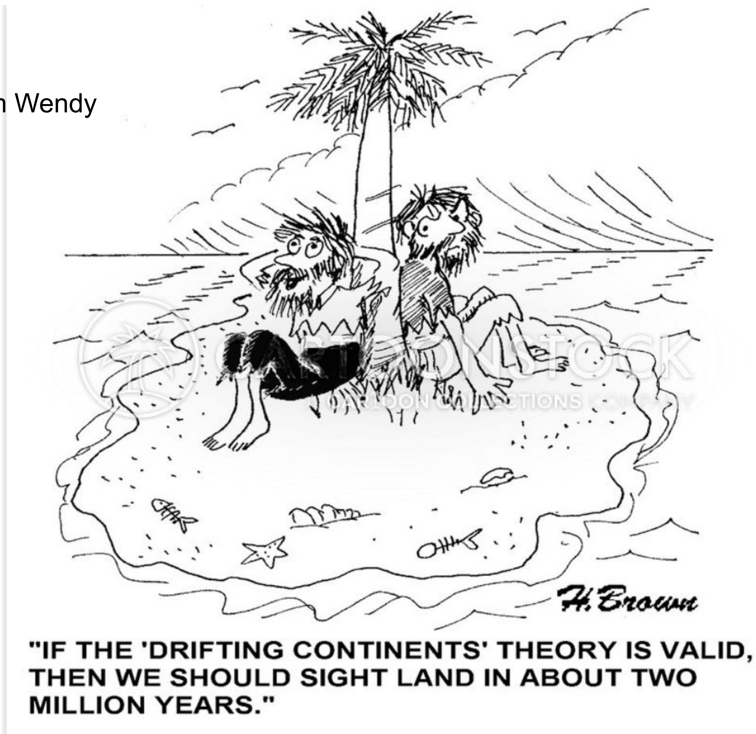
Fig. 9. Photo taken from further away showing the two distinct paths of the separate landslips. Photo from Wright 1966.

Fig. 10. Photo taken in 1966 from Edwin Mitchelson Track, after much of the debris had been cleared away, looking down over the depositional lobe of the Muriwai Landslips. Photo by Lawrie Wright (1966).

Fig. 11. Photo taken in Oct 2021 from the same place as Fig. 10 showing how vegetation has grown up over the western slip pathway, which can hardly be recognised when viewed from Domain Cres.

Return to contents page

from Wendy



The threatening hurricane or tsunami in the background will probably get them before then (Ed).

ENIGMATIC FOSSILS AT WAITOMOKIA

Hugh R. Grenfell

Auckland volcanoes are well known for sampling the country rock beneath them in their explosion crater and tuff ring formation phase. Waitemata Group material, ranging from the highly pulverised to very large bombs, is prevalent. Occasionally, other interesting things are sampled from beneath Auckland, such as the basement Dun Mountain – Maitai Terrane material at Glover Park and Taylors Hill (Spörli *et al*., 2015), Pleistocene *Anadara trapezia* and other macrofossils from Motukorea Volcano tuffs (Bryner & Grant-Mackie, 1993) and blocks of Te Kuiti Group limestone at Mangataketake Volcano (Hayward, 2019). Pliocene Kaawa Formation fossils are known from the Barriball Road Volcano tuff ring in the ancestral South Auckland Volcanic Field (Pittari *et al*., 2012).

Just south of Mangere Lagoon (see localities below), a major Watercare project and shaft in 2021 resulted in a very large volume of highly fossiliferous Pliocene (Waipipian) Kaawa Formation / Otahuhu Shellbed material from about 35 m depth being set aside for study at Greenwood Road (see localities) (Hayward, 2021). Over 200 species and counting have been found to date.

On a whim, I decided to revisit an outcrop of Waitomokia Volcano tuff nearby to look for "naturally" recycled Kaawa fossils (Fig. 1, Locality 1). Maybe the volcano had already shown the presence of Kaawa Formation at depth? We know from Marwick's seminal publication that the "Auxiliary Pumping Station" borehole (Marwick,

Fig. 1. 1939 aerial photograph of Waitomokia Volcano (tuff ring and scoria cones still intact). 1 - fossil locality discussed and exposed tuff. 2 - location of current road cut through tuff within the Villa Maria Estate.

1948, p.5, inset 1, G.S. 3536) had Kaawa material. It was located just southeast of Mangere Mountain and 1.5 km away from the current Watercare shaft (see localities). The nearby Waitomokia tuff coastal outcrop was visited by GeoClub in 2005 and subsequently written up by Bruce Hayward (Hayward, 2015). Exposed here is presumably a juvenile phase of the tuff ring formation, since large bombs of basalt and Cornwallis Formation (up to suitcase sized) are common. The other place where Waitomokia tuff is readily seen is in a road cut within the Villa Maria Estate (Locality 2).

I found the two fossils illustrated (Figure 2) at Locality 1, near mean high water (see localities) and removed them. They are both gastropods and one is clearly an *Alcithoe* species, the other a poorly preserved, low spired species (Auckland War Memorial Museum MA126852). What is preserved of the *Alcithoe* is 75mm long and 38mm wide.

There are two possible scenarios as to how these fossils have ended up in “Waitomokia tuff”.

Scenario 1: That the identifiable fossil is probably the Recent species *Alcithoe arabica* (Gmelin, 1791) was preserved in some kind of Holocene “beach rock” derived from eroding Waitomokia tuff. Such beach rock is seen elsewhere, such as the southern end of Brown’s Island/ Motukorea. The specimen fits the size range for *A. arabica*, a species which has considerable morphologic variability (Beu & Maxwell, 1990, p.366).

Fig. 2. Fossil *Alcithoe* and another gastropod at Locality 1.

Scenario 2: Recycling of Kaawa Formation (country rock) during the eruption of Waitomokia Volcano 20,000 yr BP. The Pliocene *Alcithoe arabicula* Marwick 1926 is a contender and was first described from the Kaawa type locality at Kaawa Creek (Marwick, 1926). See also Fleming (1966) and Beu & Maxwell (1990).The specimen illustrated here fits the size range of *A. arabicula*. Several specimens of *A. arabicula* have been recovered from the current Greenwood Road spoil heap.

At the outcrop I could not find an unconformity between tuff and what might possibly constitute beach rock with fossils (Fig. 2). Higher up in the section at the back of the beach there is clearly an unconformity exposed between weathered tuff, dark sediment with gravel and comminuted shell, then eroded salt marsh sediment and lastly modern fill (Fig. 3). In two other places I found broken shell in tuff, which could be interpreted by either of the two scenarios.

Conclusions

Take your pick. Young Holocene beach rock with Recent species including *Alcithoe arabica* or recycling of 3.5 My BP fossils (Kaawa Formation), including *Alcithoe arabicula* (or similar) by a 20 Ky BP volcano (Waitomokia). I don’t have a particular preference.

Localities

Mangere Watercare shaft site: -36.960439° 174.777581°.
Greenwood Road spoil heap: -36.968182° 174.781781°.
Auxiliary Pumping Station, Mangere: -36.953345° 174.791904°.
Locality 1: -36.977470° 174.763196°
Locality 2: -36.977609° 174.765530°

Fig.3. High tide (EHWS) / storm erosion and unconformity at Locality 1.

References

Beu, A.G. & Maxwell, P.A. 1990. New Zealand Cenozoic Mollusca. *New Zealand Geological Survey Paleontological Bulletin* 58, 518p.

Bryner, V.F., Grant-Mackie, J.A. 1993. The bivalve *Anadara trapezia* and other macrofossils in tuffs of Motukorea Volcano. *Tane* 34: 123–131.

Fleming, C.A. 1966. Marwick's illustrations of New Zealand shells, with a checklist of New Zealand Cenozoic mollusca. *New Zealand Department of Scientific and Industrial Research Bulletin* 173, 456p.

Hayward B.W. (2015). Cornwallis Formation blocks in Waitomokia Tuff Ring Deposit, Mangere. *Geocene* 12: 2–4.

Hayward B.W. 2019. Volcanoes of Auckland: A field guide. Auckland University Press. 344p.

Hayward, B.W. 2021. Once-in-a-lifetime fossil digs at Mangere Sewage Works. *Geoscience Society of New Zealand Newsletter* 33: 46–49.

Marwick, J. 1926: Tertiary and Recent Volutidae of New Zealand. *Transactions and Proceedings of the Royal Society of New Zealand* 56: 259-303.

Marwick, J. 1948. Lower Pliocene Mollusca from Otahuhu, Auckland. *New Zealand Geological Survey Paleontological Bulletin* 16. 38p.

Pittari, A., Briggs, R., Ilanko, T., Gibson, A., Rosenberg, M., Németh, K. 2012. Variation in deposit characteristics and eruption processes across the lifetime of a monogenetic field, the South Auckland volcanic field. Fourth International Maar Conference: a multidisciplinary congress on monogenetic volcanism. *Geoscience Society of New Zealand Miscellaneous Publication* 131A: 70–71.

Spörli, K.M., Black, P.M., Lindsay, J.M. 2015. Excavation of buried Dun Mountain–Maitai terrane ophiolite by volcanoes of the Auckland Volcanic field, New Zealand. *New Zealand Journal of Geology and Geophysics* 58 (3): 229–243.

Return to contents page

What could the rock be?

TUFF LAYERS UNDER THE SEA REVEAL PRE-VOLCANIC TOPOGRAPHY BENEATH MOTUKOREA / BROWNS ISLAND VOLCANO

Bruce W. Hayward

Motukorea / Browns Island Volcano erupted c.24,500 years ago (Hopkins *et al*., 2017) about 1.5 km north of Musick Pt (Fig. 1). At that time, sea level was at least 100 m lower than present and the volcano erupted on forested land close to the course of the Tamaki River. After the end of the Last Ice Age, sea level rose, reaching its present level or slightly higher by 7300 years ago. Since then, marine erosion has attacked the northern and eastern sides of Motukorea / Browns Island, mostly removing some of the softer volcanic ash of the tuff ring on these sides. Presumably erosion was more severe prior to the eruption of Rangitoto Island, 600 years ago, which has since provided more shelter from larger northeast swells coming in from the Hauraki Gulf.

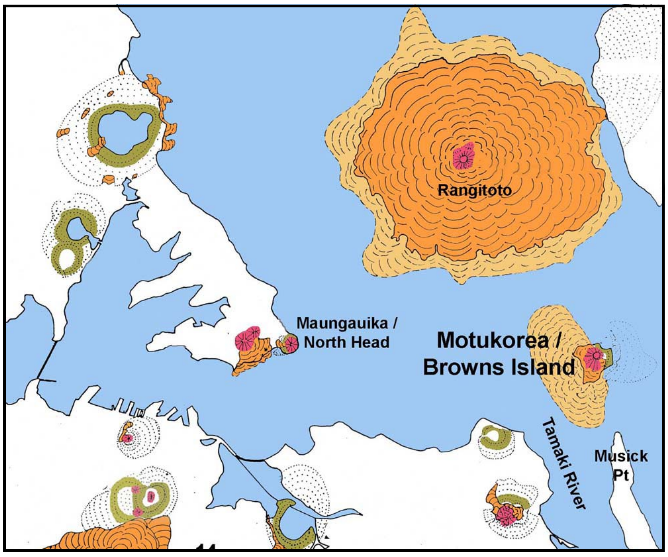


Fig. 1. Location of Motukorea / Browns Island volcano in the northeast portion of the Auckland Volcanic Field.

Fig. 2. Oblique aerial image of the northeast portion of Motukorea showing the swirling layers of eroded tuff beneath the sea, seen on a calm day.
Photo: Bruce Hayward, 2009.

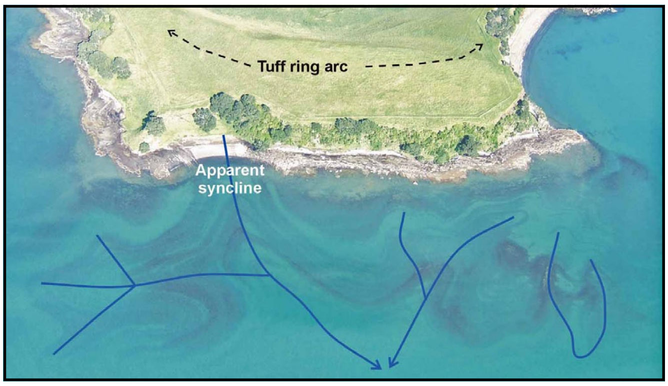


Fig. 3. Interpretation of the branching valleys seen beneath the sea in Fig. 2. North to the right.

When flying over Motukorea in a helicopter on a fine day in 2009, I became aware that layers of eroded-off tuff could be clearly seen beneath calm waters off the northeast corner of the island (Hayward, 2019, p. 64). Instead of showing the expected circular pattern around the large explosion crater, the layers showed a completely different pattern (Fig. 2), seemingly unrelated to the shape of the arcuate remnant of the eroded overlying tuff ring. On reflection, the pattern is that produced by a thin covering of tuff layers mantling and reproducing the pre-volcanic topography of small branching valleys separated by low ridges and spurs (Fig. 3).

The basal layers of the tuff ring, exposed on the northwest corner of the island, include tuff breccias with numerous blocks composed of basement greywacke, Waitemata sandstone and Parnell Grit (early Miocene). Finer beds of tuff somewhat higher in the sequence contain broken fossil bivalve shells and soft Pleistocene sediment (Bryner & Grant-Mackie, 1993). When combined, these observations indicate that Motukorea erupted through a rock sequence of fairly shallow basement greywacke overlain by a thin veneer (probably less than 100 m thick) of Waitemata Group sedimentary rocks, overlain by a thin layer of Pleistocene marine sediments that contain the extinct Sydney mud cockle *Anadara*. Bryner & Grant-Mackie (1993) produced cross-sections through Motukorea (Fig. 4) showing this stratigraphy based on a number of drill cores put down in preparation for the aborted sewerage treatment works in the 1950s. They inferred that a major ridge of Waitemata rocks extended north from the end of Musick Pt to under the island with the course of the Tamaki River out to the west. This ridge reaches a maximum elevation of 1 m above MSL where it outcrops in the eastern corner of Crater Bay, north side

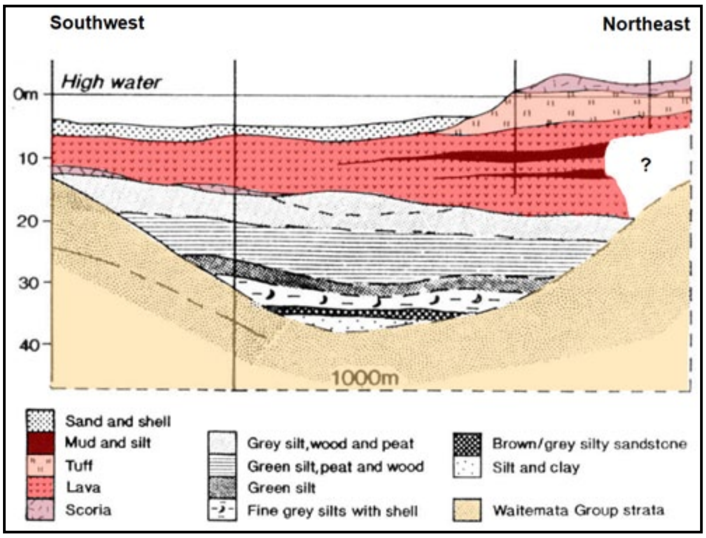


Fig. 4. Northeast-southwest cross-section extending 1 km off the southwest corner of Motukorea to illustrate the subseafloor stratigraphy identified by boreholes for the aborted sewerage plant (vertical lines). Modified from Bryner & Grant-Mackie (1993).

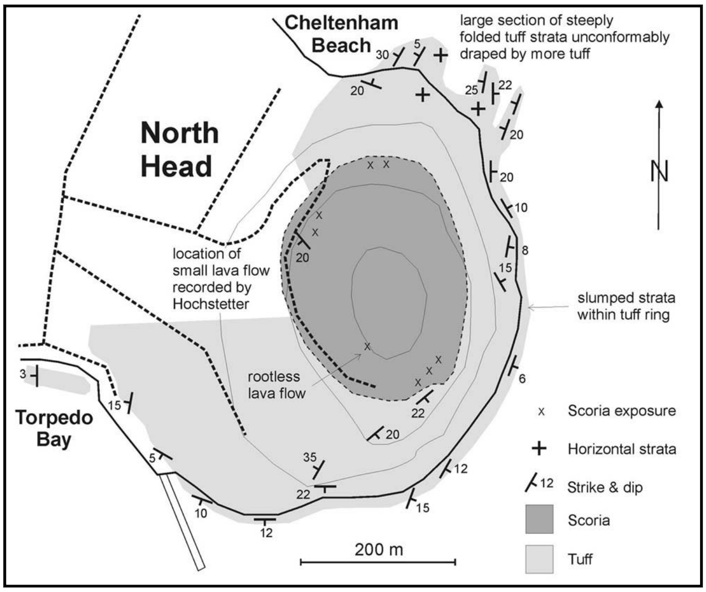


Fig. 5. Map of North Head volcano (from Hayward *et al.*, 2008) showing the anomalous north-striking tuff on the northern coast. Is this, too, a result of mantling of underlying pre-volcanic topography?

of Motukorea. Bryner & Grant-Mackie (1993) do not mention the valleys seen under the sea from the air, presumably because they did not fly over the island on a calm day.

The branching valleys outlined beneath low tide are probably eroded into Waitemata Group rocks as the soft Pleistocene sediments are unlikely to have been strong enough to develop such landforms. The mantling of the underlying topography seen out to sea, explains an unusual apparent syncline in the tuff that is exposed on the northeast coast of the island (Fig. 3), with the axis of the syncline oriented at right angles to the axis of the tuff ring at this locality. The apparent syncline is formed by the mantling of the tuff layers of a small pre-volcanic valley that can be traced out to sea.

Maungauika / North Head volcano, 7 km west of Motukorea (Fig. 1), also has tuff layers in the intertidal on its northern side that strike at right angles to the tuff ring arc (Fig. 5). The reason for this has never been understood (Hayward *et al.*, 2008), but could these too, be related to mantling of pre-volcanic topography at shallow depth beneath the exposed tuff layers?

References

Bryner, V.F., Grant-Mackie, J.A. 1993. The bivalve *Anadara trapezia* and other macrofossils in tuffs of Motukorea Volcano, Auckland. *Tane* 34: 123–131.

Hayward, B.W. 2019. Volcanoes of Auckland: A field guide. Auckland University Press: 335 p.

Hayward, B.W., Daymond-King, P., Daymond-King, R. 2008. North Head Volcano. *Geocene* 3: 3–4.

Hopkins, J.L., Wilson, C.J.N., Millet, M-A., Leonard, G.S., Timm, C., McGee, L.E., Smith, I.E.M., Smith, E.G.C. 2017. Multi-criteria correlation of tephra deposits to source centres applied in the Auckland Volcanic Field, New Zealand. *Bulletin of Volcanology* 79: 55.

Return to contents page

UPPER OAKLEY CREEK LAVA FLOWS

Hugh R. Grenfell

Both Mount Roskill and Mount Albert volcanoes (Fig. 1, 1 & 6) produced lava flows, the latter clearly in much greater volume. It is thought that 120,000 yBP (Hayward, 2019) lava flowing south and southwest from Mount Albert Volcano were channelled down an ancestral Oakley Creek valley and are visible in many places, including the eastern entrance to the Southwestern Motorway tunnel (Fig. 1, 9), in Alan Wood Reserve, the railway cutting next to Pak'nSave on Great North Road, western side of the Unitec grounds and finishing at the Waterview interchange area of the Northwestern Motorway. There was no Waitemata Harbour at this time but rather a large, forested valley. Below the Richardson Road bridge (Figs 1, 3 & 2, 3) the meandering path of Oakley Creek is nicely dictated by the contact between the "hard" lava flows and the "soft" Waitemata Group sediments to the southwest and west. It is less clear what is happening in and beyond the area of Underwood Park (Fig. 1, 4 & 5) in the upper part of Oakley Creek. I speculate as to where the lava in this area is sourced from, contrary to current mapping.

As always in Auckland, you have to be careful as to what is *in situ* and what is not. Just like the large logs and stumps used during the naturalisation and landscaping of the creek in this area, some of the basalt blocks are not *in situ*. But plenty of *in situ* lava can be easily seen from the end of Wainwright Avenue down to the Richardson Road bridge, where the lava has been cut through to create a straight drainage channel (Fig. 2, 4). Most of the area between Mount Roskill and Mount Albert was extensively built over by the late 1950s and outcrop is hard to find. Originally the lava flows dammed Oakley Creek and created swamps and wetlands all the way back to the area around Mount Roskill Grammar School.

Since Hochstetter's time, it has been thought that lava flowing north-westward from Mount Roskill Volcano (105,000 yBP, Hayward, 2019) reached the flanks of the slightly older Mount Albert Volcano in the area of present-day Underwood Park (e.g. Hochstetter & Petermann 1865). But Hochstetter does not show Mount Roskill lava in contact with Mount Albert lava. It should also be noted that the Stokes and Drury (British naval surveyors) base map used by Hochstetter doesn't accurately depict the path of Oakley Creek, other wetland drainage and the Waitemata Harbour generally in this area. Much later publications (e.g. Searle, 1964; Kermode, 1992; Hayward 2019; and others) indicate that lava from these two volcanoes "touch" near the Richardson Road bridge (Figs 1 & 2). Upper Oakley Creek was considered to flow along this boundary and upstream along the edge of "Mount Roskill flows". Lava downstream of the Richardson Road bridge clearly belongs to Mount Albert

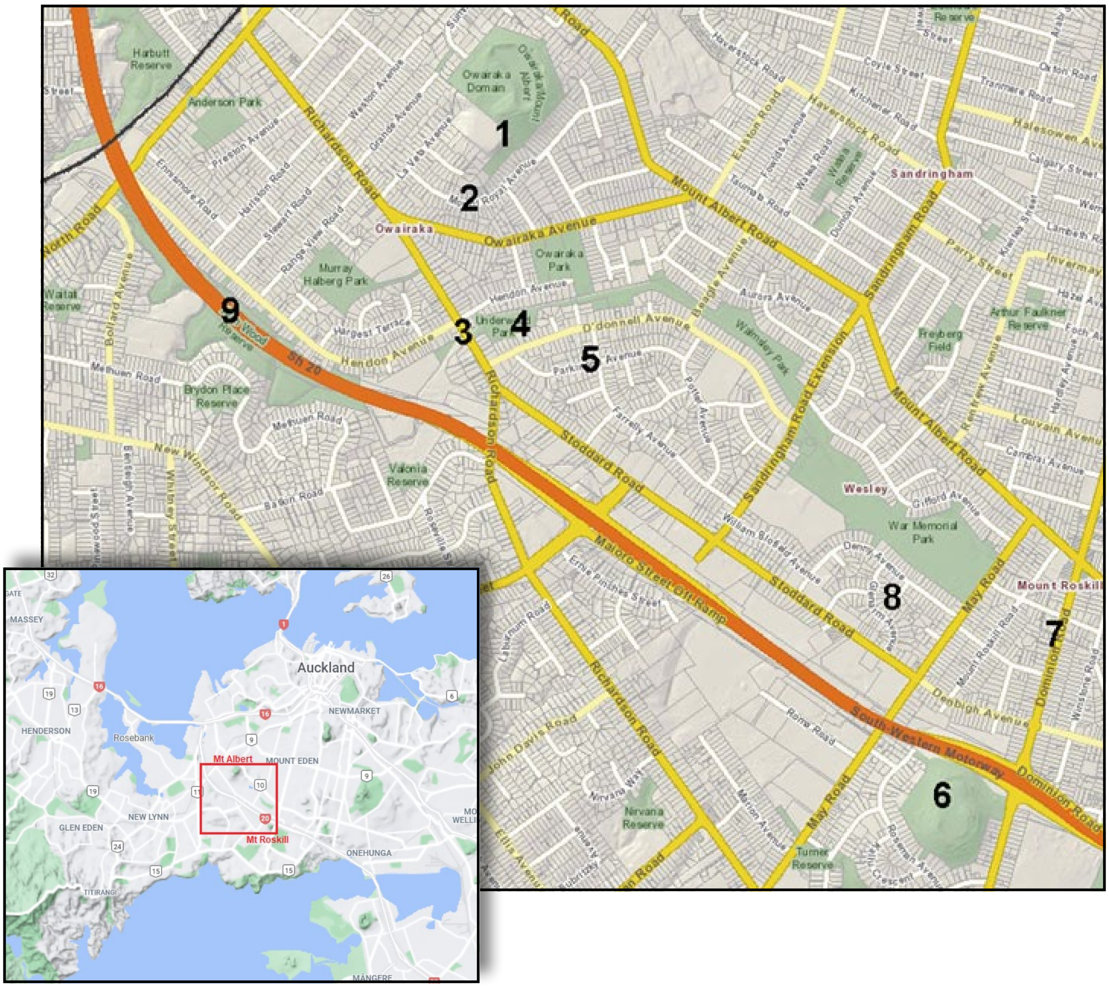


Fig. 1.
1) Mount Albert Volcano
2) Mount Royal Avenue Lava Cave
3) Richardson Road bridge over Oakley Creek
4) Underwood Park
5) Mount Albert lava
6) Mount Roskill
7) 1053 Dominion Road,
8) Mount Roskill lava
9) Southwestern Motorway Tunnel outcrop

Inset - Map's location on Auckland isthmus.

Fig. 2. 1940 air photo of the Mount Albert/Mount Roskill area.
1) current track of Southwestern Motorway
2) intersection of Richardson and Stoddard roads
3) Richardson Road bridge today over Oakley Creek
4) drainage cut through lavas
5) Mount Albert lava flow fingers and lobes
6) Beagle Avenue bridge today
7) Mount Albert Road

Volcano. But does Mount Roskill lava really reach this far west and outcrop in Underwood Park?

Mount Roskill lava can be seen in a Southwestern Motorway cutting adjacent to the Dominion Road overbridge (northern side) at Mount Roskill itself, but beware of the terrible fake geology built there also. A lava cave was briefly visible nearby (pers. obs.) during construction of the motorway (-36.911586, 174.739087). Another place to see Mount Roskill lava *in situ* is from a culvert over Oakley Creek at 1053 Dominion Road (Fig. 1, 7). Mount Roskill lava is visible in the 1940s air photos, but very hard to find on the ground today. There might be some *in situ* outcrop at the end of Kinlock Avenue (Fig. 1, 8), for example.

The 1940 air photo series gives you a good idea of the landscape before it was covered by housing in the 1950s (Fig. 2). Southeast of Underwood Park the geomorphology appears to be composed of lobate fingers going east and southeast (Figs 1, 5 & 2, 5). These are most likely to be fingers of lava and are going away from, not towards, Mount Albert. Not what you would expect if the lava was indeed coming from Mount Roskill to the southeast.

Other reasons why the lava here is more likely derived from Mount Albert and not Mount Roskill are:

- From source, Mount Roskill Volcano lava flows immediately encountered very low flow angles. This would have slowed down the lava and made it cool closer to source. The cooled lava creates a barrier to later flows that either have to pond before over topping or flowing around, again on low slope angles.
- The slope angle of Mount Albert adjacent to this area (Fig. 1, 4 & 5) is much greater, the source much more proximal (c.¼ of the distance compared to Mount Roskill) and this combination would have allowed lava to quickly and easily flow at greater velocity into the area in question before cooling or flowing further.
- Mount Albert was a much bigger producer of lava. For example, in this sector alone, the thick flows outcropping at the entrance to the Waterview Tunnel (Fig.1, 9) are substantial.
- Mount Royal Avenue lava cave (Fig.1, 2) is 400 m away as the crow flies. Recent footage of Icelandic eruptions are a good example of how much lava can come from just a single point source like this high on the flank of Mount Albert.

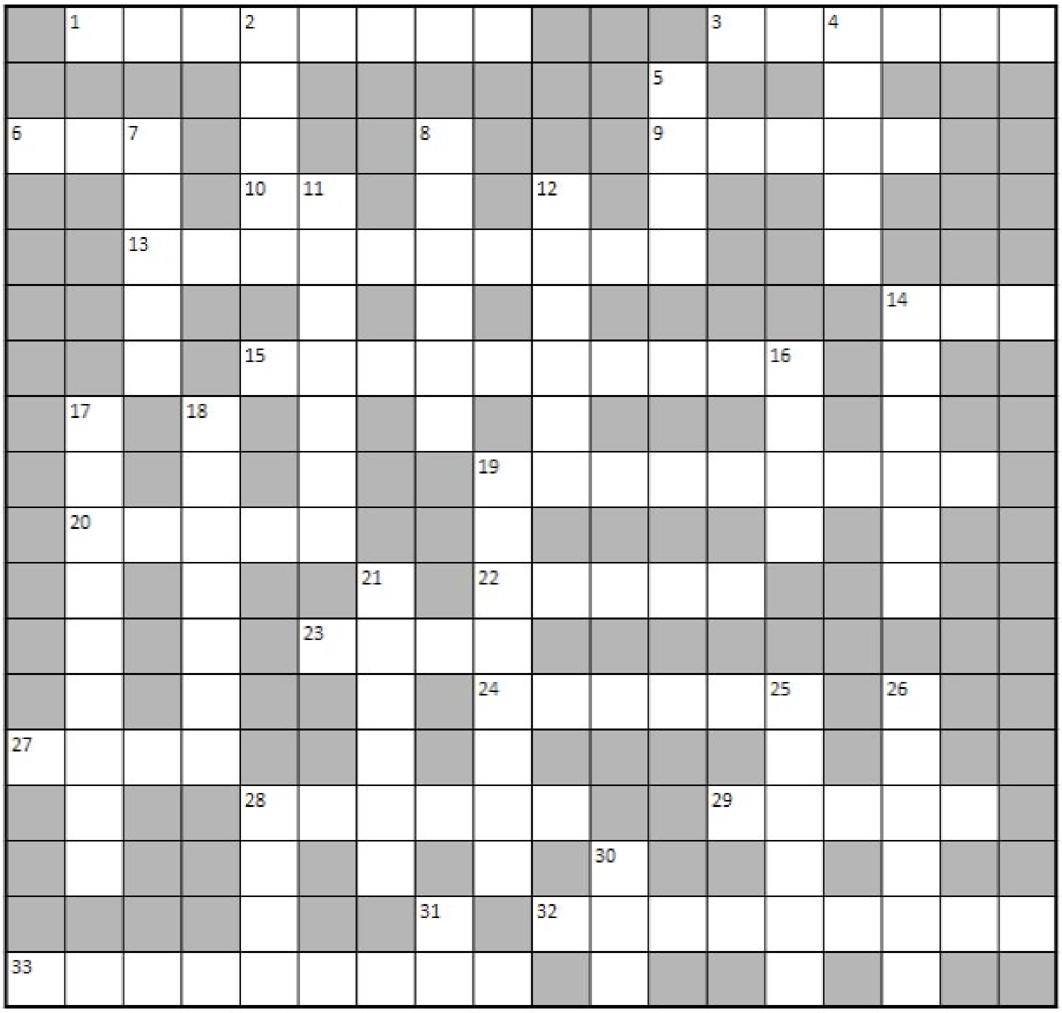
Therefore, based on the above arguments and the geomorphology, I consider all the lava in the Underwood Park area, downstream of it and to the southeast (Figs 1, 5 & 2, 5) to have come from Mount Albert. Mount Roskill lava does not reach this far west. If geochemistry of the lavas is investigated sometime, maybe this can be confirmed.

References

Hayward, B.W. 2019. Volcanoes of Auckland: A field guide. Auckland University Press: 335 p.
Hochstetter, F and Petermann, A. 1865. Geological and topographical atlas of New Zealand : six maps of the provinces of Auckland and Nelson.
Kermode, L. 1992. Geology of the Auckland urban area: sheet R11. Scale 1:50 000. Lower Hutt: Institute of Geological & Nuclear Sciences.
Searle, E.J. 1964. City of volcanoes: a geology of Auckland. Longman Paul, Wellington.

Return to contents page

GEOLOGICAL CROSSWORD



ACROSS

1 Middle period of the Mesozoic Era (8)
3 Roman god of fire (6)
6 Colour of weathered olivine-rich rock near Nelson (3)
9 Anticlines and synclines (5)
10 Not pahoehoe (2)
13 Device that measures the pressure of groundwater (10)
14 Fundamental artwork of a geologist (3)
15 Lamp shell (10)
19 Bullet-like fossil (9)
20 Embankment, stop bank (5)
22 Largest Kermadec volcanic island (5)
23 Shape of a pyrite crystal (4)
24 One of the first to sketch the geology of Auckland (6)
27 Name of Globigerina accumulation on the seafloor (4)
28 Substances with high electrical conductivity, malleability and luster (6)
29 Cast on underside of sandstone showing direction of a turbidite (5)
32 $CaCO_3$ mineral (9)
33 Potential suppliers of meteorites (9)

DOWN

2 Fossils of these aquatic lifeforms give an indication of earliest photosynthesis (5)
4 High resolution remote sensing system (5)
5 Triple junction triangle forming one of the lowest onland places on Earth (4)
7 Thrust sheet (5)
8 Volcanic froth (6)
11 Blue carbonate (7)
12 Compass bearing of an imagined horizontal line across a bedding plane (6)
14 Cloak (6)
16 Geologist who described an old hat island in the Bay of Islands in 1840 (4)
17 Grain size between sandstone and claystone (9)
18 Fault iindicating a compressional regime (7)
19 Another name for drillhole (8)
21 Mineral that has a Moh's hardness scale of 7 (6)
25 Colour of jarosite (6)
26 Glassy (6)
28 Explosion crater (4)
30 Line of volcanoes on an overriding plate (3)
31 Symbol for Palladium (2)

(Answers on last page)

Return to contents page

CAMPBELL ISLAND PILLOW LAVA

Bruce W. Hayward

I visited Campbell island with a combined research group from GNS and elsewhere in March 2004. While others studied aspects of the geology, I was there to collect marine sediment samples for foraminifera and to document the intertidal biota. One day at low tide I walked along the foreshore on the south side of Perseverance Harbour (Fig. 1) looking at intertidal organisms and washup. At about the time I was about to turn around and return, I noticed an exposure of pillow lava in the high tide zone at the back of the narrow cobbly beach. I took a photograph as I knew it would provide evidence of eruption under water and I understood that most of the lava flow sequence above was supposed to have erupted on land.

I was recently reading through an impressive, comprehensive article on the geology of New Zealand's Subantarctic Islands (Scott & Turnbull, 2019) and noted that they mentioned pillow lava on the dominantly terrestrial Auckland Islands, but there was no mention of any having been recorded from Campbell Island. This note merely records the occurrence so others in the future know where to look for it if they are interested.

Campbell Island forms the apex of a large dome on the southern edge of the submarine Campbell Plateau. Cambrian metasedimentary rocks overlain by Late Cretaceous-Oligocene sedimentary rocks outcrop near

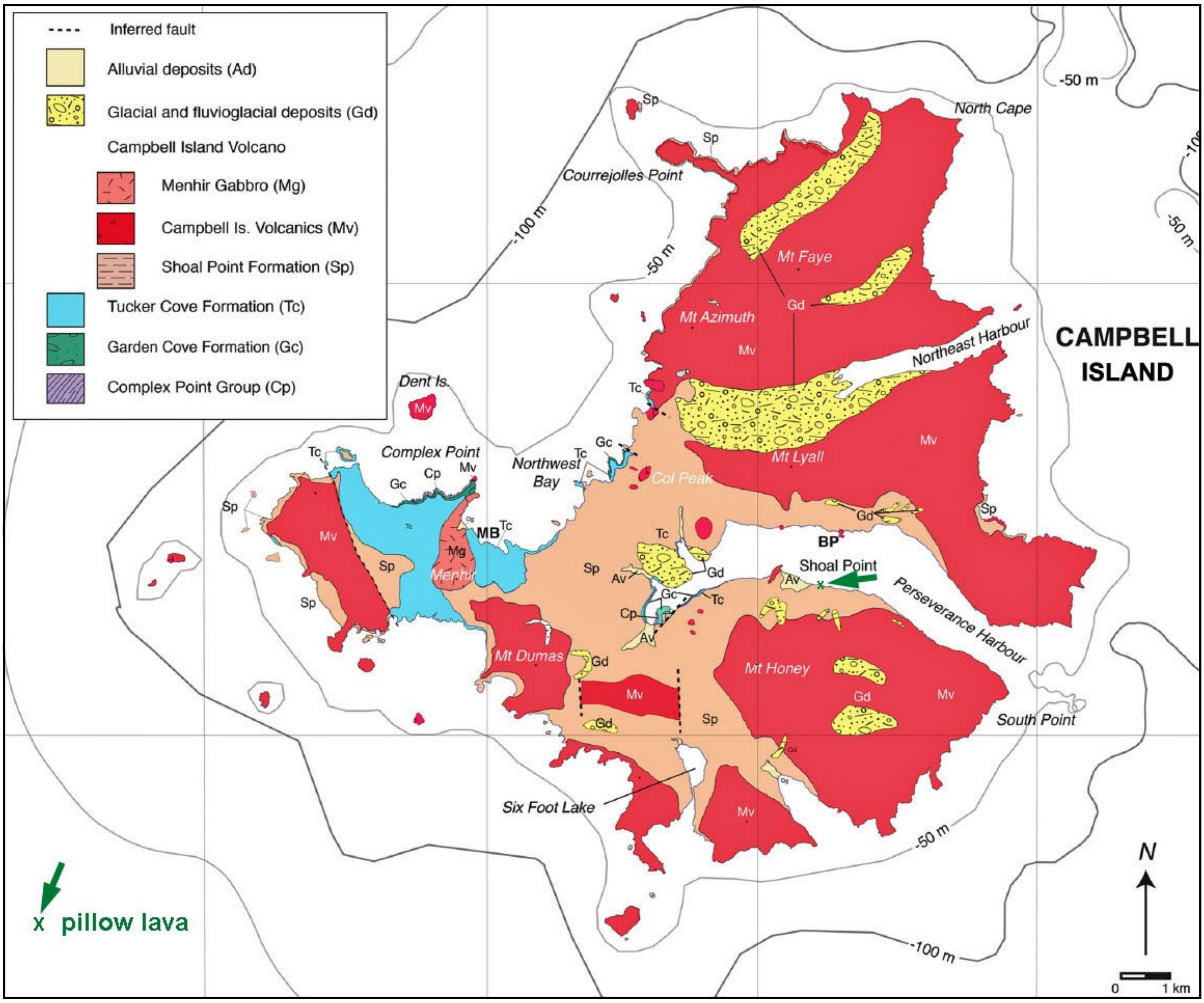


Fig. 1. Map of Campbell Island geology showing location of pillow lava exposure with respect to the recognised formations. Map from Scott and Turnbull (2019) based on map by Oliver *et al*. (1950).

sea level around the head of Perseverance Harbour and also on the western peninsula (Scott and Turnbull, 2019). These are overlain by rocks of the late Miocene Campbell Island Volcano that probably erupted between 8 and 6 myrs ago (Adams *et al*., 1979; Hoernle *et al*., 2006). The volcano rocks are divided into two formations. The older Shoal Pt Formation of volcanic tuffs and breccias is overlain by the terrestrial lava flows of the Campbell Island Volcanics (Fig. 1). Marine fossils occur in the lower part of the Shoal Pt Formation (Oliver *et al*., 1950), which is inferred to have been deposited in a shallow marine environment passing up into terrestrial conditions. Morris (1984) states there are no pillow lava or hyaloclastites within the Campbell Island Volcanics, but he did not study the Shoal Pt Formation in detail.

My field map (Fig. 2) indicates that the pillow lava exposure occurs at about high tide level on an almost imperceptible point 800 m east of Shoal Pt, on the southern shore of Perseverance Harbour (52°33'21"S 169°11'06"E). This is well within the Shoal Pt Formation of Oliver *et al*. (1950) (Fig. 1). My photo (Fig. 3) shows eroded cross-sections through three pillow lava lobes, each 1–1.5 m in diameter. They exhibit well-developed radiating joints and glassy rinds. The uppermost lobe has a distorted shape that clearly shows it flowed along between the convex tops of the other two lobes and that the exposure has not been overturned. At the time, I was more concerned about looking at the modern marine biota and evading some menacing sea lions, and so I have no observations on the nature of the Shoal Pt Formation rocks around the pillow lava, but assume they were the upper volcanic breccias that overlie the finer fossiliferous tuffs.

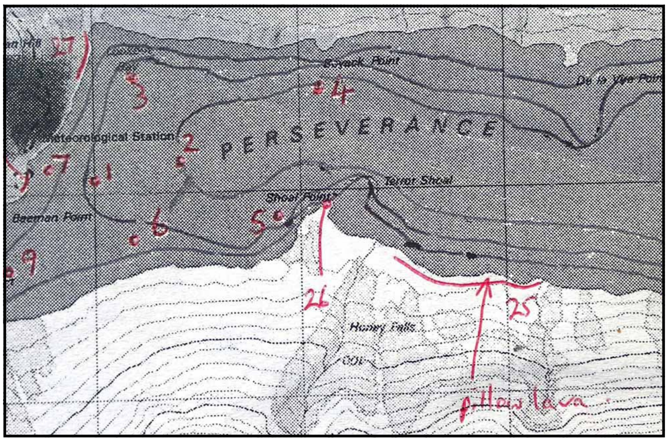


Fig. 2. Copy of my field map showing where I saw pillow lava (arrowed bottom right) on the coast 800 m east of Shoal Pt.

Fig. 3. Photo of 1–1.5 m diameter pillow lava east of Shoal Pt, perseverance Harbour, Campbell Island.

Acknowledgements

I thank James Scott for confirming that to his knowledge this is the first report of pillow lava from Campbell Island.

References

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

Hoernle, K., White, J.D.L., van den Bogaard, P., Hauff, F., Coombs, D.S., Werner, R., Timm, C., Garbe-Schönberg, D., Reay, A., Cooper, A.F.. 2006. Cenozoic intraplate volcanism on New Zealand: Upwelling induced by lithospheric removal. *Earth and Planetary Science Letters* 248: 350–367.

Morris, P.A. 1984. Petrology of the Campbell Island Volcanics, Southwest Pacific Ocean. *Journal of Volcanology and Geothermal Research* 21: 119–148.

Oliver, R.L., Finlay, H.J., Fleming, C.A., 1950. The geology of Campbell Island. New Zealand. Cape Expedition Series Bulletin 3. Department of Scientific and Industrial Research, Wellington, 62 p.

Scott, J.M. and Turnbull, I.M. 2019. Geology of New Zealand's Subantarctic Islands. *New Zealand Journal of Geology and Geophysics* 62: 291–317.

Return to contents page

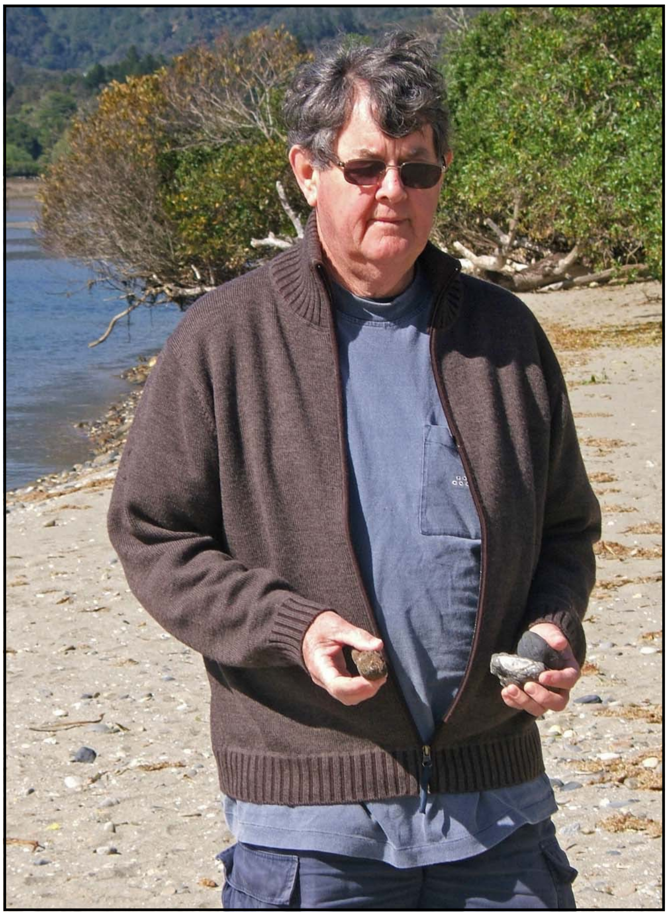
MEMORIES OF GEOFF JENKINS - GEOCLUB TREASURER, 1994–2008

Bruce W. Hayward & Hugh Grenfell

Geoffrey (Geoff) Alan Jenkins (1940–2008) was Auckland Geology Club's second and to-date longest-serving treasurer. He joined GeoClub in 1994 in the formative years of the club and at the end of that year volunteered to take over management of the club's finances after the retirement of first treasurer Kel Anglesey. Geoff held this position right up to his death in September 2008, after a relatively short illness. Geoff was always a happy, friendly and unassuming gentleman who clearly enjoyed the outdoors and went about his treasurer duties with little fuss or bother. This was pre-computer days and Geoff maintained the books on paper and carried everything to do with the club's finances around with him in a small briefcase.

In the real world, Geoff lived in Onehunga but practised as a dentist in Totara Avenue, New Lynn. He had a long-held passion for rocks and minerals that led him to joining GeoClub. He also joined the Geological Society of New Zealand and attended several GSNZ conferences. He came on many GeoClub day trips and a few of our longer trips as well, including the club's first visit to Northwest Nelson in November, 2007. HG remembers many times meeting Geoff (and others) at St Oswald's Church on Campbell Road to carpool for GeoClub trips.

His time with us was cut short by his illness and death at the relatively young age of 68. Many older GeoClubbers have fond memories of times shared with Geoff.



Geoff Jenkins with a small collection of rocks at Onekaka, Northwest Nelson, 2007.

Geoff Jenkins (third from left in white shirt) having lunch with other GeoClubbers above Huriwai Beach, Port Waikato in 1997.

Geoff Jenkins contemplating how we were going to remove this dumped car body from Ihumatao Fossil Forest site, during of GeoClub's annual clean-up days, in 1999.

Return to contents page

HYPERLINK INSTRUCTIONS

Hyperlinks have been added to the contents page numbers column (coloured blue) to simplify finding each article. To activate a hyperlink, click on the coloured page number and you will be sent to the article beginning on that page.

At the end of each article there is another coloured hyperlink, which will take you back to the contents page.

If you wish to return to the previous page you were reading, and you have Windows operating system and standard Adobe Reader, just right click and chose 'previous view' on the drop-down menu, or you can use a shortcut Alt + left arrow. For Macintosh or Ubuntu operating systems, contact the Editor for instructions.

CORRESPONDING AUTHORS' CONTACT INFORMATION

Hugh Grenfell Geoclub Member, **h.grenfell_at_orcon.net.nz**

Bruce W. Hayward Geoclub Member, **b.hayward@geomarine.org.nz**

GEOLOGICAL CROSSWORD ANSWERS

ACROSS - 1 Jurassic, 3 Vulcan, 6 Dun, 9 Folds, 10 Aa, 13 Piezometer, 14 Map, 15 Lamp shell, 19 Belemnite, 20 Levee, 22 Raoul, 23 Cube, 24 Heaphy, 27 Ooze, 28 Metals, 29 Flute, 32 Aragonite, 33 Asteroids

DOWN - 2 Algae, 4 LiDAR, 5 Afar, 7 Nappe, 8 Pumice, 11 Blue carbonate, 12 Strike, 14 Mantle, 16 Dana, 17 Siltstone, 18 Reverse, 19 Borehole, 21 Quartz, 25 Yellow, 26 Vitric, 28 Maar, 30 Arc, 31 Pd

Return to crossword page

or

Return to contents page