IMMEDIATE REPORT

OF

VICTORIA UNIVERSITY OF WELLINGTON

ANTARCTIC EXPEDITION

1981-82

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WELLINGTON

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This report has been prepared for the benefit of the Council of Victoria University, the University Research Grants Committee, the Ross Dependency Research Committee, Antarctic Division DSIR, and individuals who have assisted the Expedition in the execution of its research programme. It is not intended as a final publication for scientific results, and if reference is made to this report its interim nature should be made clear.

COVER: Wannigan and tractor on site to sample sea floor sediment through annual sea ice, in McMurdo Sound.

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PREPARATIONS FOR VUWAE 26

PROGRAMME:

Six scientific projects were submitted by the University to RDRC. Three were approved (A rating) but judgement was withheld on the other three (B rating). Subsequently, one programme was withdrawn and the other two modified. The modified programmes are outlined below:

Erebus Studies and IMESS.

In this second of the three years of the International Mount Erebus Seismic Survey (1980-84) the crater area will be occupied for about 3 weeks to check out and repair scientific and telemetering equipment. In addition, visual observations of crater activity will be made to complement the instrumental records.

McMurdo Sound Sediment Studies.

This is a continuation of last year's programme to obtain undisturbed representative samples of the floor of McMurdo Sound. The samples are to be studied for their foraminiferal content, so that the ecological factors controlling their populations structure can be assessed. Also the variation in physical character of the sediments is being studied.

Sampling is to be carried out from a tractor-drawn wannigan. An auger for cutting 33cm access holes in the sea ice has been constructed, and the trigger for the sphincter corer, which gave a lot of trouble last season, has been redesigned. Underwater photography through the access hole will also be attempted.

Bathymetric, tidal and current information is also be be collected.

Beacon Studies.

A paleohydraulic study of the Triassic alluvial plain sequence at the head of the Dry Valleys is to begin. Work will be concentrated at Mount Bastion, where the sequence is thickest and best-exposed. The purpose is to determine the character of the river system (sinuosity, channel width, depth, slope, discharge, etc.) from features of the sedimentary sequence.

A regional study of the Beacon sequence in northern Victoria Land will also be carried out as part of the International North Victoria Land Expedition. The party will concentrate on two main aspects - the glacial strata and regional paleogeography.

Fission-Track dating.

The principal objective of this project is to collect samples of granitic rocks suitable for fission-track dating from the eastern end of Wright Valley and along the coast of McMurdo Sound. The samples from lower Wright Valley are to be collected at controlled elevations over as wide a vertical interval as possible.

FINANCE:

A grant of $11,000 was obtained from the University Grants Committee to run the expedition. This was to cover food, travel and freight, insurance, field clothing and some scientific supplies for the 8 VUW personnel. The $656 deficit in the final budget was covered by a grant from the University's Internal Research Committee who also provided some financial support for two students and the field leader. Dr. Gleadow and Dr. McKelvey were financed through their own universities and clothed with the combined resources of Antarctic Division and VUW.

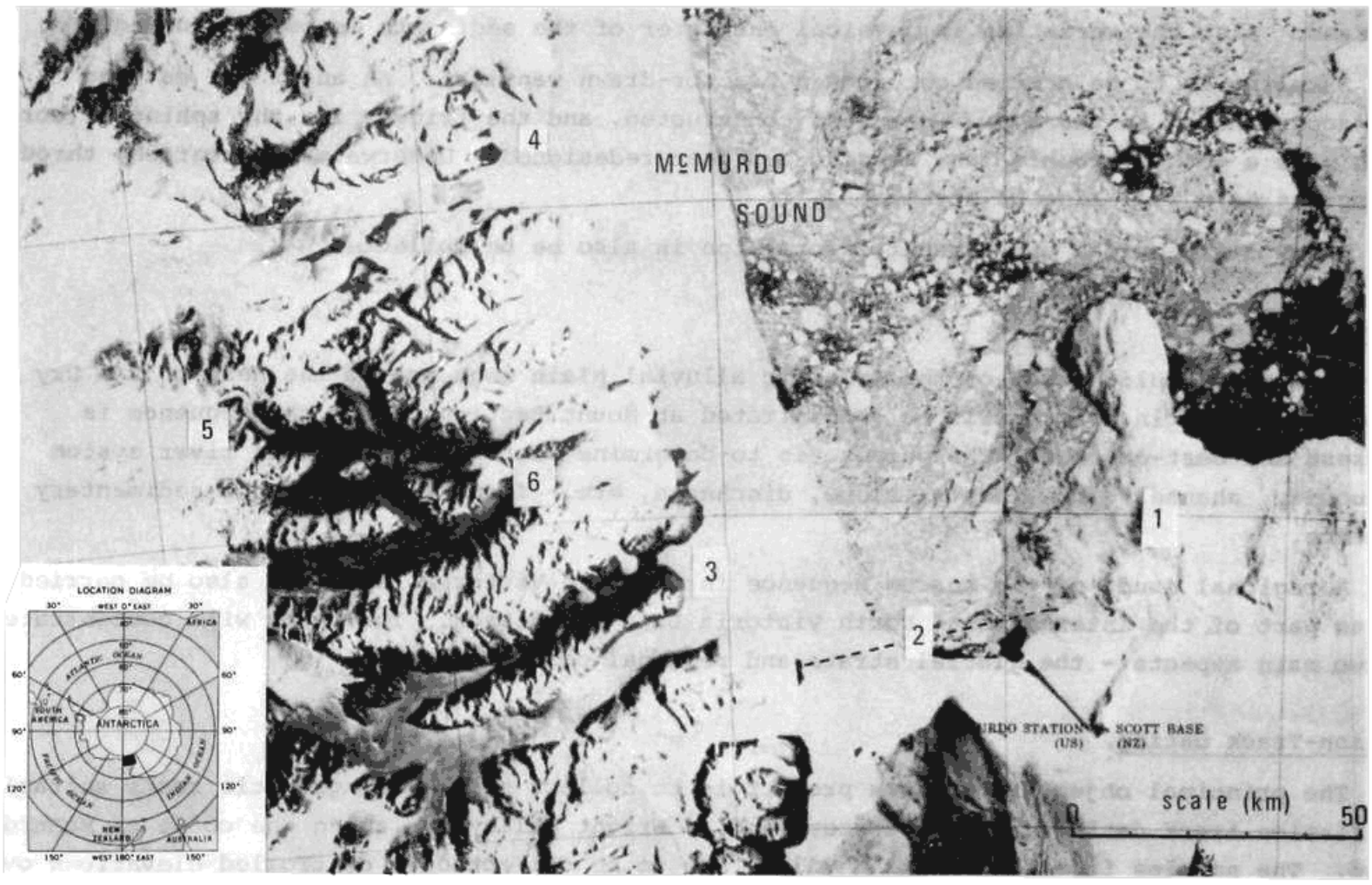
EQUIPMENT:

The VUW Engineering Workshop built and modified several items of equipment for the sediment sampling programme. The sphincter corer built the previous year was modified to improve its triggering on the sea floor and method of adding weight to increase the depth of penetration. Twelve inch diameter ice augers were built to fit the existing "Mate" motorised powerhead. These augers are used to provide a 12 inch diameter access hole through the sea ice. A wire laying system for the winch and tools for core splitting and sampling were also built.

Equipment borrowed for the programme included an underwater camera and flash system, current meter and water column sampling bottles from the New Zealand Oceanographic Institute. An orange peel grab was once again borrowed from the McMurdo Station Bio Lab.

Antarctic Division, DSIR, provided logistic support for VUWAE 26 programmes. The IH500 tractor, Wannigan and Cantago sledge, toboggan, Maudheim and Tamworth sledges were provided for the sea ice party. VUWAE 26 was charged $40.00 per man week for food, tentage and accommodation by Antarctic Division while in Antarctica.

New field clothing bought to replace old VUW stocks included: 4 dacron jackets, 4 anoraks and 4 dacron insulated bib-overalls. Mukluks were again purchased second-hand from Antarctic Division and New Zealand-made felt inner boots purchased for these.



KEY:

1. Mt. Erebus (K4)
2. McMurdo Sound transect (K5)
3. New Harbour (K5)
4. Granite Harbour (K5)
5. Mt. Bastion (K7A)
6. Lower Wright Valley (K7B)

PLATE I: Places where VUWAE personnel worked during the 1981-82 season.

STRUCTURE OF THE EXPEDITION

Erebus Studies and IMESS (NZARP Event K4).

Personnel this year were as follows:

U.S.A. (Telemetry seismographs and lava lake surveillance).

Phil Kyle
Bill McIntosh (Ohio State University)
Steve Estes (University of Alaska)
Dianne Marshal (University of Alaska)

Japan (Temporary seismographs, and data recording and processing).

Kazua Shibuya (NIPR)
Kei Terai (NIPR)
Muneo Okayama (University of Hokkaido)

New Zealand (Infrasonic and magnetic sensors, electro-magnetic surveys, lava lake probes, deformation studies, and mountaineering control).

Ray Dibble (VUWAE)
Peter Otway (NZGS)
Nick Craddock (DSIR Field Assistant)

All work at Erebus was carried out between 24 November and 13 December.

McMurdo Sound Sediment Studies (Event K5).

October 16 - December 11	Alex Pyne (Leader/Geologist)	MSc student, VUW
	Barbara Ward (Geologist)	PhD student, VUW
	Mike Cattely (DSIR Mechanic/Assistant)	
November 13	Peter Barrett (Geologist)	Reader in Geology, VUW
	Brent Alloway (Geological Assistant)	BSc student, VUW
December 1	Paul Fitzgerald (Geological Assistant)	BSc student, VUW

Beacon Studies.

Study of Triassic alluvial plain sediments at Mt. Bastion (Event K7A).

October 28 - November 21	Barry Walker (Leader/Geologist)	PhD student, VUW
	Peter Barrett	
November 13	Paul Fitzgerald to K7A (Peter Barrett to K5).	

Study of Permian and Triassic sediments in north Victoria Land (Event K18).

November 24 - January 4	Barrie McKelvey (Leader/Geologist)	Senior Lecturer in Geology, University of New England, Armidale.
	Barry Walker	

Beacon studies in the Quartermain Mountains.

December 14 - December 27	Alex Pyne
	Paul Fitzgerald
	Brent Alloway
	Lindsay Main (DSIR Assistant)

Fission-Track dating.

November 21 - November 31 — Sampling granites for Fission-track dating in the lower Wright Valley and nearby coast.

Andrew Gleadow (Leader/Geologist) — Research Fellow in Geology, University of Melbourne.

Paul Fitzgerald

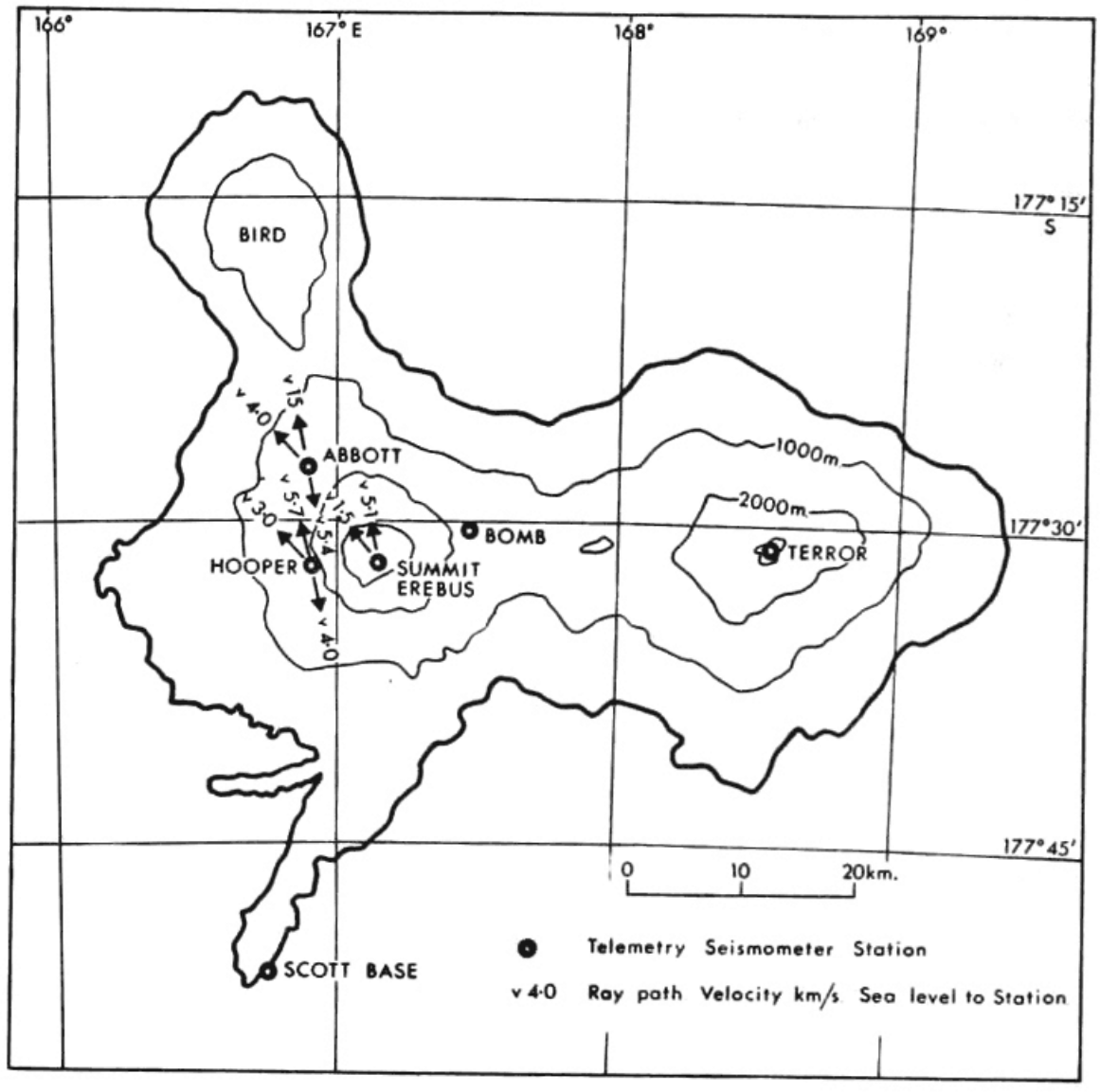


Figure 1: Stations of the IMESS seismic telemetry net on Ross Island, and P-velocities between sea level and station altitude obtained from teleseisms in the directions indicated.

SCIENTIFIC ACHIEVEMENTS

Erebus Studies and IMESS (K4) - R. Dibble.

Additional data on seismic velocities within and below Erebus were recorded on the IMESS seismic telemetry net (Fig. 1). During epicentre determinations from recordings made early in 1981, Kienle et al. (1981) confirmed the near surface velocity of 1.5km/s determined by the writer in 1975. From recordings of 3 distant earthquakes in November/December 1981 (Table 1), the writer has calculated velocities along the ray paths between sea level and the telemetry station elevations on the assumption that the velocity structure below the Scott Base seismograph is identical to that below sea level under Erebus. Of 8 determinations shown on Fig. 1, 6 lie between 3 and 5.7km/s, and have a mean of 4.5 $\pm$ 1.0km/s. The other two values of 1.5 and 15km/s were discarded as anomalous.

Velocities below sea level were determined with the aid of a large seismic shot fired at $04^h34^m54.48^s$ UT on 23 November 1981 by L.D. McGinnis's party. The shot point was at 165.720°E, 77.835°S, and it was recorded at Scott Base, Hoopers Shoulder (166.90°E, 77.538°S, 1900m), Abbott Peak (166.90°E, 77.460°S, 1793m), Bomb (c. 167.43°E, 77.512°S, 1800m), and Terror (c. 168.54°E, 77.518°S, 3230m). Summit (167.15°E, 77.532°S, 3794m) was not operating at the time. The time versus slant-distance graph (Fig. 2) shows an apparent velocity across the net of 7.2km/s with a time intercept of 1.60s. This is more likely to be a downdip than an updip velocity due to isostatic subsidence of the volcanic pile, and indicates oceanic rather than continental type crust under Ross Island.

Table 1. Data for 3 distant earthquakes recorded on the IMESS telemetry net in December 1981. dt(P) is the observed P-time difference t(station) - t(Scott Base); Va is apparent P-velocity across the net from J-B Tables; Ve is the computed velocity within Mount Erebus.

Epicentre 1981, Dec 13, $01^h39^m15.8^s$, 6.431 S, 154.917 E, h = 62km, M = 5.9.

Station	Alt m	Dist km	Az° E of N	dt(P) s	Va km/s	Ve km/s	Remarks
Summit	3794	7932.77	347.2	-1.05	18.364	5.12	Distorted waveform.
Abbott	1793	7923.66	247.4	-2.16	"	17.4	Exc.
Hooper	1900	7931.99	347.4	-1.51	"	6.14	Exc.
Scott B.	38	7965.12	347.6	0	"	-	V. Clear.

Epicentre 1981, Dec 14, $12^h05^m45.5^s$, 56.319 S, 26.350 W, h = N, M = 5.9.

Abbott	1793	5107.32	169.82	3.29	14.06	5.42	V. Clear.
Hooper	1900	5098.87	169.82	2.80	"	4.23	Exc.
Scott B.	38	5065.38	169.86	0	"	-	V. Clear.

Epicentre 1981, Dec 18, $18^h31^m40.5^s$, 1.491 N, 126.375 E, h = 82km, M = 5.2.

Summit	3794	9118.28	318.77	1.62	21.16	1.42	Very weak arrival.
Abbott	1793	9108.32	319.01	-1.00	"	3.91	Clear.
Hooper	1900	9114.50	319.04	-0.55	"	3.05	Clear.
Bomb	1800	9121.12	318.48	-0.18	"	2.64	Clear.
Scott B.	38	9138.76	3119.19	0	"	-	Clear.

Fifty five eruptive events observed by eye and ear between 27 November and 12 December 1981 are listed in Table 2. Most of these were also recorded on the tape seismograph and infrasonic recorder operated in the summit hut at the levels listed. The larger eruptions again had the characteristic infrasonic signature reported in 1978/79 and 1980/81, and this allowed a further eleven eruptions to be identified instrumentally. The relation between recorded seismic and infrasonic levels are shown in Fig. 3. For a given seismic level, the infrasonic levels (which are related to eruption intensity) varied over a range of 30dB, indicating variation in the partition of energy between seismic and eruptive phenomena.

To check the party's impression that eruptions tended to occur in the early morning, a diagram was constructed of the frequency of occurrence of recorded earthquakes with the time of day (Fig. 4). This was done separately for large earthquakes (which are usually accompanied by eruptions), medium and small earthquakes, and compared with the average diurnal gravity tide (predominantly a diurnal tide of solar origin). There was indeed a peak in large earthquakes between 2 and 6 hours NZST which is just after the maximum tidal gravity (i.e. low earth tide). No obvious correlation with tide exists for medium earthquakes, but small earthquakes were most frequent between 12 and 14 hours NZST which corresponds with minimum tidal gravity (high earth tide). The correlations are of doubtful significance, however, because with the exception of an early morning peak in large earthquakes in December 1974, no correlations were obvious during the other four observation periods.

Further progress was made in the study of earthquake size versus frequency of occurrence. Figure 5 shows that the b-value for small to medium earthquakes in November/December 1981 was 1.6, and not significantly different from that in the 1980/81 season. For the large earthquakes the b-value for combined 80/81 and 81/82 data is only 0.6, indicating that frequency decreases less rapidly with increasing size for eruptive events than for the smaller volcanic earthquakes. Probably there is a mixture of two populations rather than a transition from one slope to the other, and the previous interpretation of a preferred size and upper limit to explosive eruptions of Erebus can no longer be sustained. The concept of different slopes for b-type and eruption earthquakes is important for risk assessment at other volcanoes.

References:

Kyle, P.R., Dibble, R.R., Giggenbach, W.F., Keys, J.H., 1982: Volcanic activity associated with the anorthoclase phonolite lava lake, Mt. Erebus, Antarctica, In Craddock (Ed.), Antarctic Geoscience, University of Wisconsin Press, IUGS Series B - 4.

Kienle, J., Kyle, P.R., Estes, S., Takanami, T., Dibble, R.R., Submitted 1981: Seismicity of Mt. Erebus 1980/81, Antarctic Journal of the United States National Science Foundation.

Takanami, T., Terai, K., Osada, N., Kienle, J., Estes, S., Kyle, P.R., Dibble, R.R., 1981: Earthquake Observations at Mt. Erebus, Antarctica. Part 1 (in Japanese), Seismological Society of Japan, Proceedings of the Annual General Meeting, October 1981.

Takanami, T., 1981: Earthquake Observations at the summit of Mt. Erebus, Antarctica (in Japanese), Kyokucki (Polar News, Japan Polar Research Association), 33: 52-7.

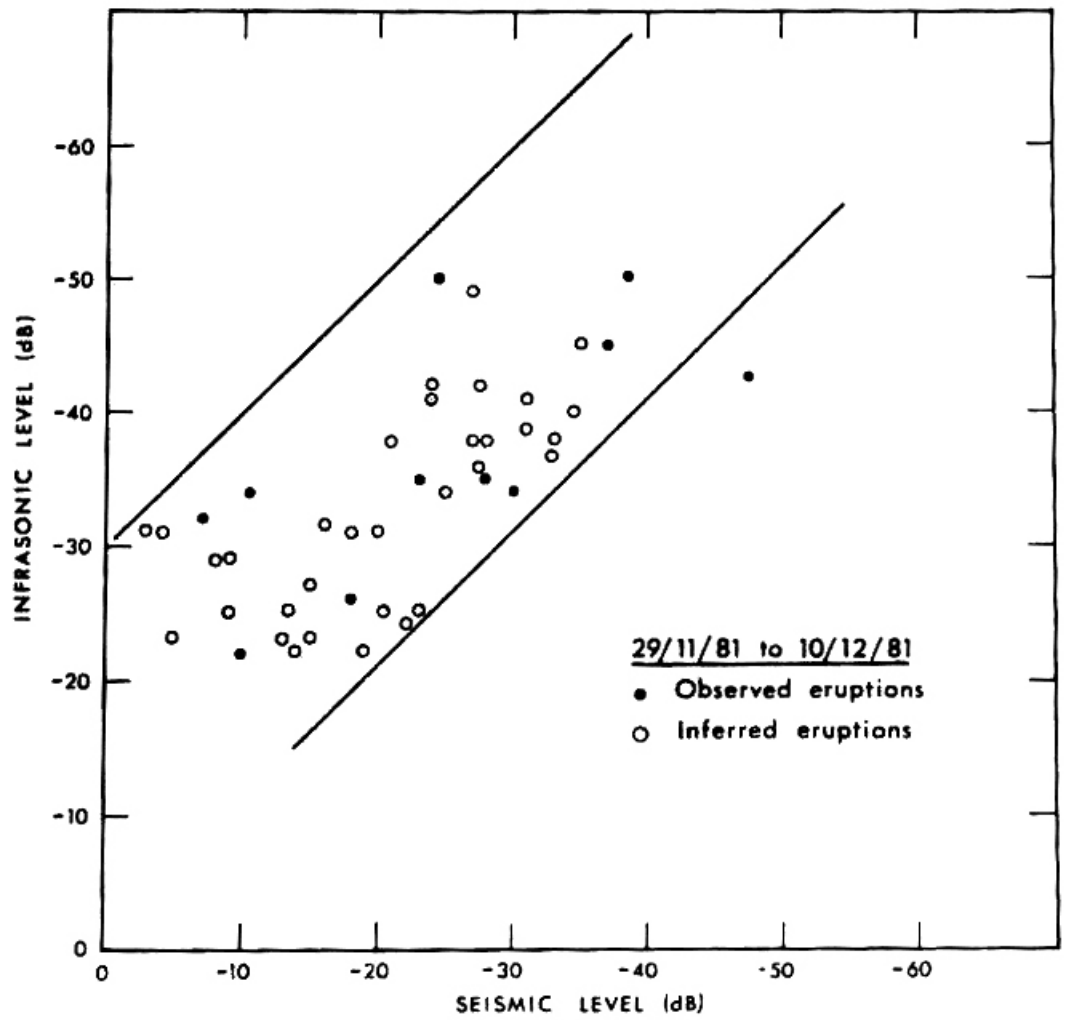


Figure 2: Relation between recorded levels of seismic signals and infrasonic signals of eruptions at the summit of Erebus. For a given seismic level, the range of infrasonic level is 25 dB.

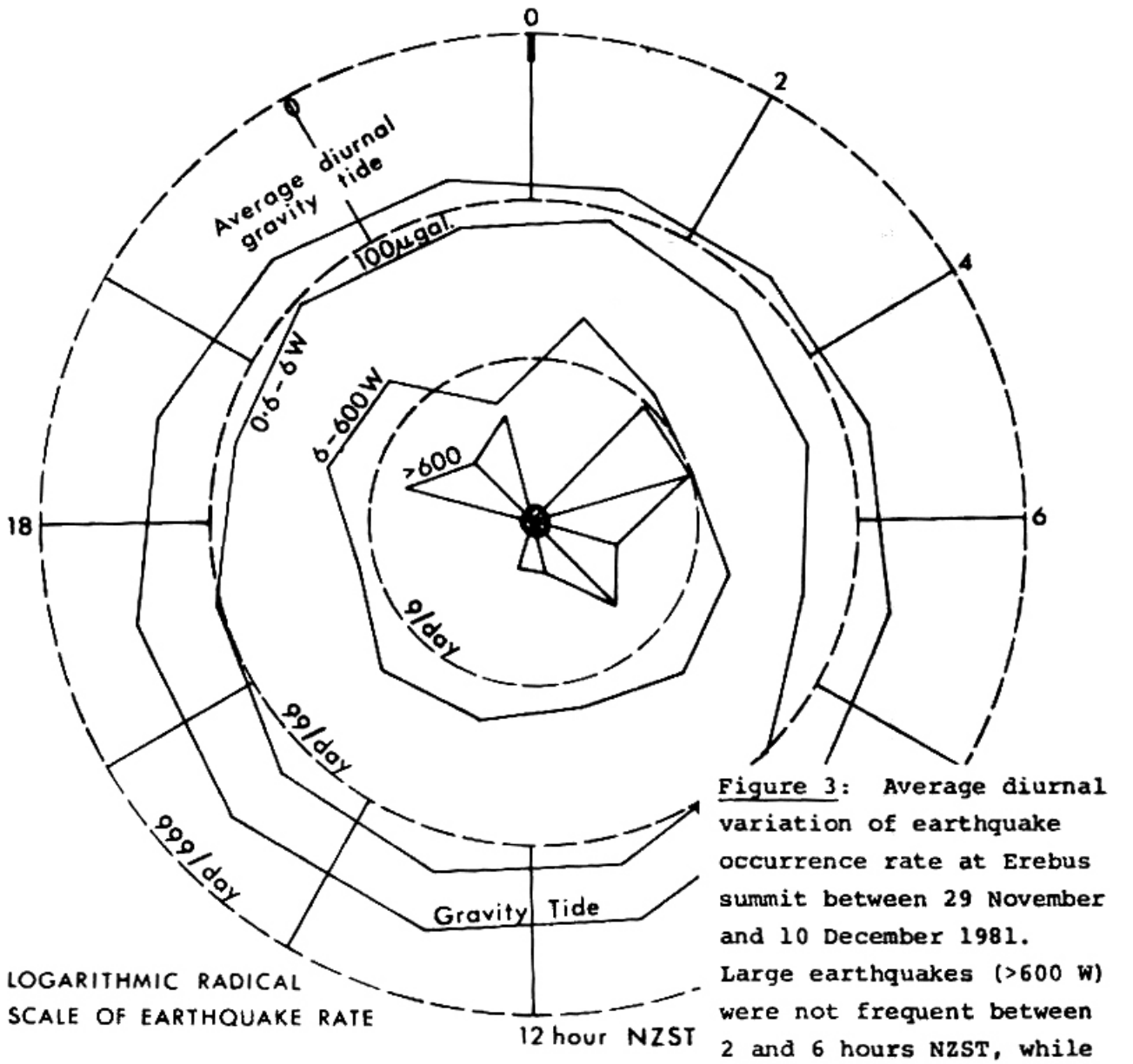


Figure 3: Average diurnal variation of earthquake occurrence rate at Erebus summit between 29 November and 10 December 1981. Large earthquakes (>600 W) were not frequent between 2 and 6 hours NZST, while small earthquakes (0.6-6 W) were most frequent between 10 and 18 hours NZST and correlated with the mean diurnal gravity tide.

Figure 4: Earthquake occurrence rate versus size at the summit of Erebus. The levels and slopes of the graph are similar in the 80/81 and 81/82 seasons, and show different b-values for small earthquakes and for the larger earthquakes which are usually accompanied by eruptions.

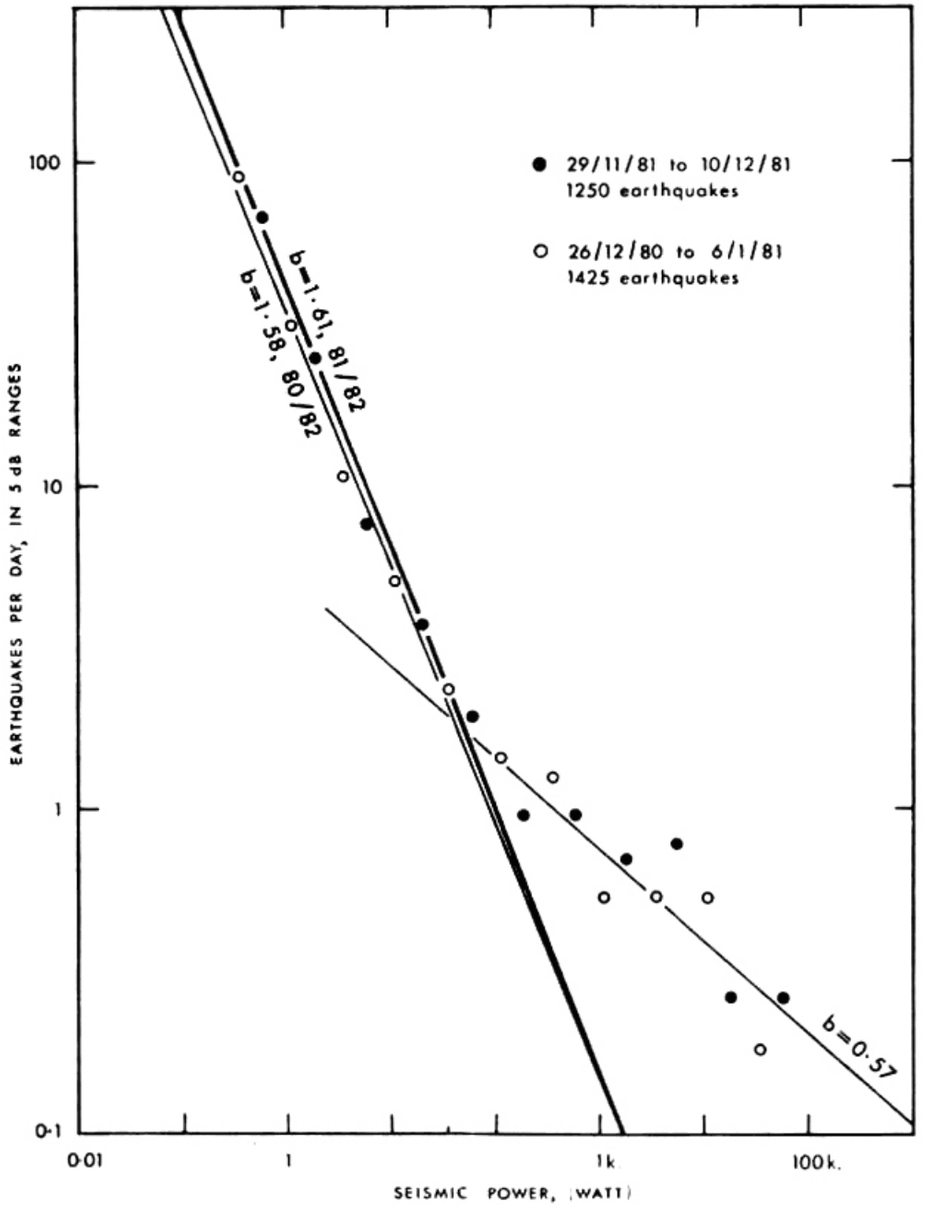


Figure 5: Travel time graph of seismic waves from a large explosion fired by L.D. McGinnis in McMurdo Sound which was well-recorded on the IMESS net.

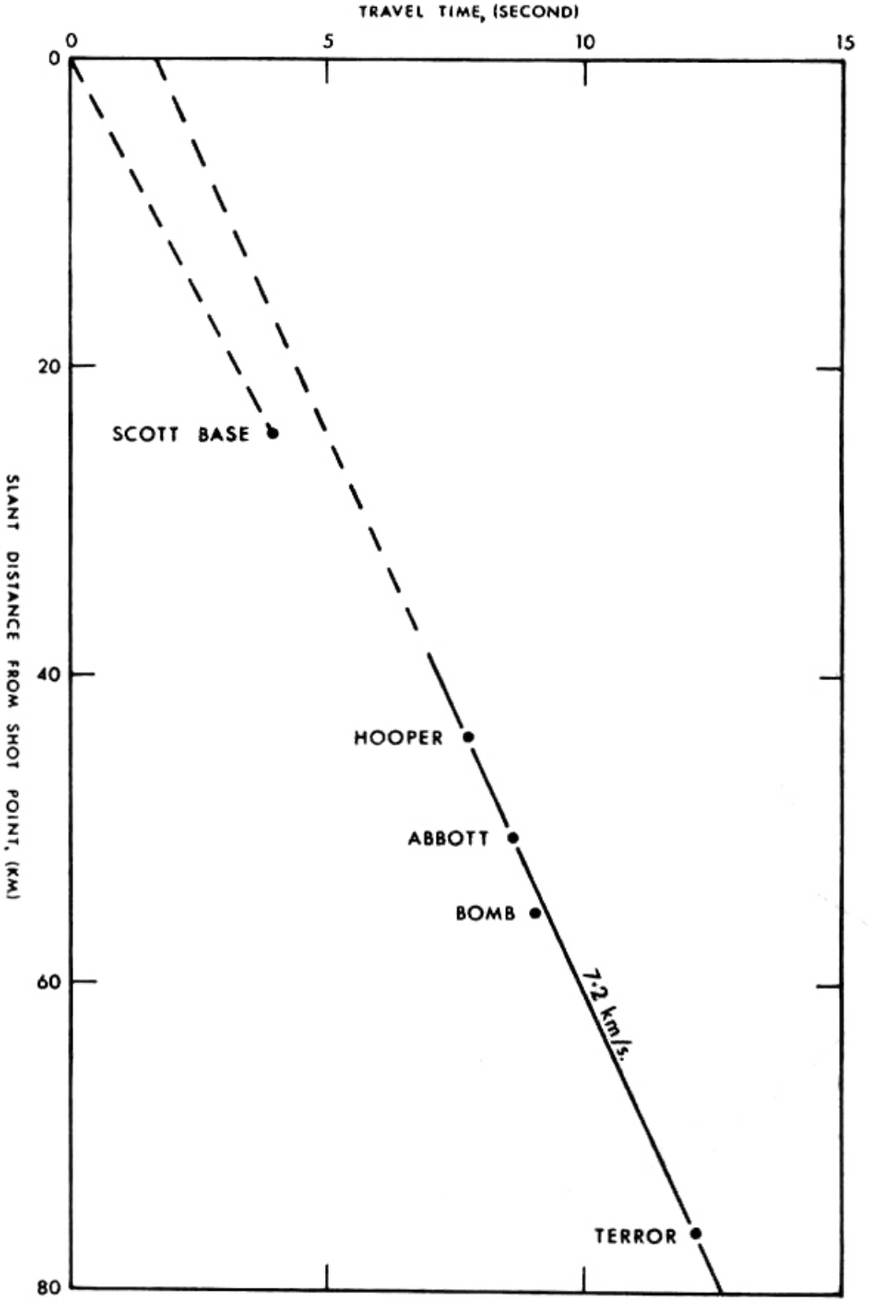


Table 2. Eruptions of Erebus between 27 November and 12 December 1981.

Date	Time NZST	Seis. power kW	Sonic level dB	Description and Observers location	Duration second	Observer(s)
Nov.						
27	1820	N.A.	N.A.	(Explosion heard at Fang		Thompson,
"	2205	"	"	(2 pulses 5s apart. Sulphur smell 5 min later.		Otway, Rogers, Craddock.
29	1440	0.4	"	Expl. like big wind gust heard 100m from rim.		Otway & Tinnely.
"	2200	0.13	"	Rumble, in tent at c. 23h	3	Rogers.
30	0801	2.5	"	Medium long roar, in tent	5	Thompson.
"	0842	12	"	Short strong roar, in Hut	3	Dibble (6).
"	2155	.001	"	Short roar, at rim		Tinnely.
Dec.						
1	0743	12	"	Rumble, in tent		Rogers.
"	1931	.002	"	Medium quiet roar, on speaker	2	Dibble.
2	0345	31	-29	Strong explosion, in tent	3	Dibble.
"	0517	79	-31	" " " "	3	Dibble.
"	1747	.04	-54	Short weak roar, in crater at rim		Craddock, Dibble.
"	2317	0.8	-42	" " " , on speaker		Dibble (6).
3	0241	0.4	-49	Single expl., on speaker		Otway.
"	0535	100	-31	Strong expl.	3	Tinnely.
"	1124	N.R.	N.R.	Faint roar	5	Dibble.
"	1320	.003	-55	Two brief roars, 4s apart, 1st weak, 2nd med., on speaker	1	Dibble.
"	1801	3.2	-31	Loud expl., in Hut, on seis.	8	Estes (2).
4	0247	2.5	-22	Expl. woke Obs. in tent		" "
"	0321	10.0	-23	Loud roar woke Obs. in tents	3	Tinnely (3).
"	0456	8.0	-22	Heard in tents		Marshal (2).
"	0902	63	-23	Loud roar on speaker, woke Obs.		Dibble (4).
"	2114	25	-25	Dull roar, also on seis.	4	Marshal.
5	0735	6.3	-23	Short bang	2	Kyle.
"	1935	25	-29	Loud roar, shook Hut		Marshal.
"	2114	0.16	-39	Roar on speaker		Estes.
"	2215	1.3	-24	Loud roar on speaker		"
6	0037	.003	-36	Short roar on speaker, with v. small E.Q. on seis.	2	Dibble (4).
"	0423	8.9	-25	Medium expl., in tent	3	Kyle.
"	0438	1.8	-25	Med. weak expl., in tent	1	"
"	0439	1.0	-25	Weak expl., in tent (0446?)	1	"
"	1111	6.3	-27	Loud roar. 3 bombs seen above Shackleton Cairn		Marshal, McIntosh.
7	0508	0.16	-41	Weak expl., in tent	1	Kyle.
"	1515	0.4	-38	Roar, in Hut 6s after loop cal.		Marshal.
"	1900	0.8	-41	Low rumble at Hut (no bombs)	5	Marshal.
8	0310	.063	-45	Low growing rumble at Hut first seen on seis.		Marshal, Estes.
"	0338	0.36	-36	Long loud roar at Hut with small E.Q. No bombs seen	10	Marshal.
"	0620	0.63	-34	Long loud roar	6	Kyle (2).
"	0951	0.16	-40	Long crackly roar at Hut, with small complex E.Q. on seis.	6	Dibble.
"	1754	N.A.	-32	Long loud roar	17+	Marshal.
9	0420	0.10	-38	Roar, near rim (iceblocks rolled past geophone just before)	10	Otway, McIntosh.
"	0528	1.6	-38	Long loud roar woke Obs. in tent		Kyle.
"	1031	0.10	-37	Roar with strong onset & 2nd pulse, on speaker & seis.	10	Dibble (2).

Dec.						
9	1318	0.36	-42	Little roar, on speaker	1	Estes (3).
10	0021	0.36	-38	Long roar on speaker, but faint outside hut		Estes et al.
"	0202	N.R.	N.R.	Faint roar on speaker		Estes (2).
"	0323	2.0	-31	Long loud expl.	10	Kyle.
"	0337	5.0	-31	Medium expl.	2	Kyle.
"	1312	.07	-40	Long low roar, outside hut		Marshal.
"	2246	N.A.	N.A.	Double roar, in & outside hut		Estes (3).
11	1026	"	"	Short roar	3	Dibble (3).
"	2134	"	"	" "	3	McIntosh.
12	1524?	"	"	Medium roar at rim just after loop calibration		Dibble.
"	1902	"	"	Sharp roar, seemed to shake hut. Dark cloud arose	2	Dibble.
"	2002	"	"	Short quiet roar	2	Otway (2).

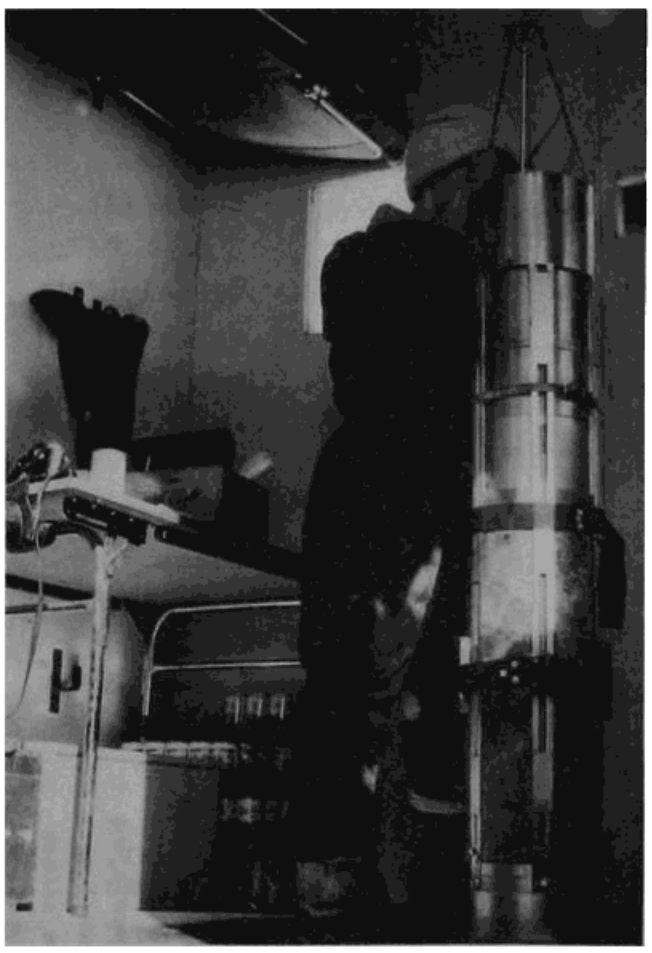


PLATE II: Sphincter corer ready to drop (left), and resulting core (below). (See next page).

McMurdo Sound Sediment Sampling (K5) - A. Pyne/B. Ward.

Sphincter cores 20cm in diameter were recovered from 18 sites in depths ranging between 850 and 109m in McMurdo Sound and Granite Harbour (Fig. 6,7). Most cores were only a few centimetres long on account of the hard sandy bottom, and three were just mounds of disturbed sediment, but the remainder appeared quite undisturbed, with worms, sea spiders and sea-anemonies still alive on the sediment surface. Other common biogenic material in the sediment included sponge spicules and bryozoans. Four cores, three in Granite Harbour (14A, 15, 16) and one off Ferrar Glacier (18) were much longer (41 to 56cm), presumably because of the mud bottom.

Samples from the cores were treated with alcohol soon after recovery so that the living and dead foraminifera could be distinguished later in the laboratory (Ward, 1982). Splits were treated with rose bengal stain, and tests containing stained protoplasm extracted for further study. Non-stained tests were also separated for comparative purposes. Three areas of varying foraminiferal distribution have been identified in the McMurdo Sound area as follows: (1) below 560m there exists an assemblage of agglutinated foraminifera with Reophax spp. as the dominant taxa; (2) between 560 and about 210m there is a mixed assemblage, again with Reophax spp. as the dominant agglutinated taxa, and Trifarina earlandi, Globocassidulina cf. subglobosa and Cassidulinoides porrectus as the dominant calcareous taxa; this includes the Granite Harbour area; and (3) the New Harbour area supports an agglutinated population similar to that found below 560m in the open Sound.

Comparison of living (stained) and dead assemblages from the top 20m of five 22cm-diameter cores indicates that post-mortem alteration of assemblages, specifically, disappearance of calcareous tests, increases progressively with greater water depth until the CCD is reached, somewhere between 560 and 850 metres. The difference in proportions of calcareous and agglutinated foraminifera in live and dead assemblages increases the difficulty in the ecological interpretation of ancient (dead) assemblages.

Grain size analyses were carried out in all cores, and from these and samples from previous seasons several significant conclusions were drawn concerning marine sedimentation in the area (Barrett et al., 1982): The most important processes operating in the Sound today are ice-rafting of wind-blown sand by sea ice and sedimentation of fine terrigenous and biogenic material from suspension. Glacier and shelf ice locally make small contributions. Wind-blown sand is a major component, as much as 70 percent in places, of sea floor sediment on the western shelf and slope. However, the deep basins around Ross Island are floored with mud mostly containing less than 5 percent sand. Superglacial debris appears limited to the southern and western parts of the Sound. Coarse basal glacial debris was not found even close to the floating terminus of Mackay Glacier, where it appears to have already melted out.

References:

Barrett, P.J., Pyne, A.R., Ward, B.L. 1982. Modern sedimentation in McMurdo Sound, Antarctica (abs.), Fourth International Symposium on Antarctic Earth Science, Adelaide, August 16-22.

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McMurdo Sound Bathymetry and Oceanography (K5) - P. Barrett.

Over the last four seasons about 200 soundings have been made from surveyed positions on the sea ice in the course of gravity survey (Sissons, 1980) and sediment sampling (Barrett, 1979; Pyne, 1981; and this season). Most measurements were made with a weighted terylene line, and compare well with measurements from a meter wheel on 5mm steel cable taken during coring, the terylene gave measurements from 0 to 3m greater than the steel cable along the western side of the Sound and in Granite Harbour in depths as gerat as 550m, though in the central part of the Sound, where there may have been significant current activity measurements ranged from 0 to 16m greater.

Bathymetry beyond the coastal fringe was obtained from continuous depth recorder records off cruises by VUW and DSIR personnel since 1972 and plotted by B. Ward. The ship's track was obtained from satellite navigation data, radar fixes and dead reckoning, and depths were read off at km intervals. Most depths at track crossings were within 10m, the greatest different being 24m. Comparison of depths from ships' tracks and line soundings are hard to make because of errors in the ship's position of several hundred metres, and local relief of the sea floor, but appear to be of the order of a few metres. 500 data points were plotted from the shipboard data, and contoured along with the nearshore data (Fig. 7). Soundings were also made in Granite Harbour, allowing for the first time a coherent view of its bathymetry (Fig. 6).

Measurements of current velocity and tide were made over a 2 day period in 167m of water 0.6km off the edge of the Strand Moraines ($77^{o}45'S$; $164^{o}30'E$). Velocities ranged from less than 0.02 (sensitivity of the meter) to 0.12m/s, but appeared unrelated to the phase of the tide, which had a range of 0.6m in that period. No current was recorded near the sea floor but became detectable about 5m above. Flow was invariably to the north, judging from the deflection of the wire.

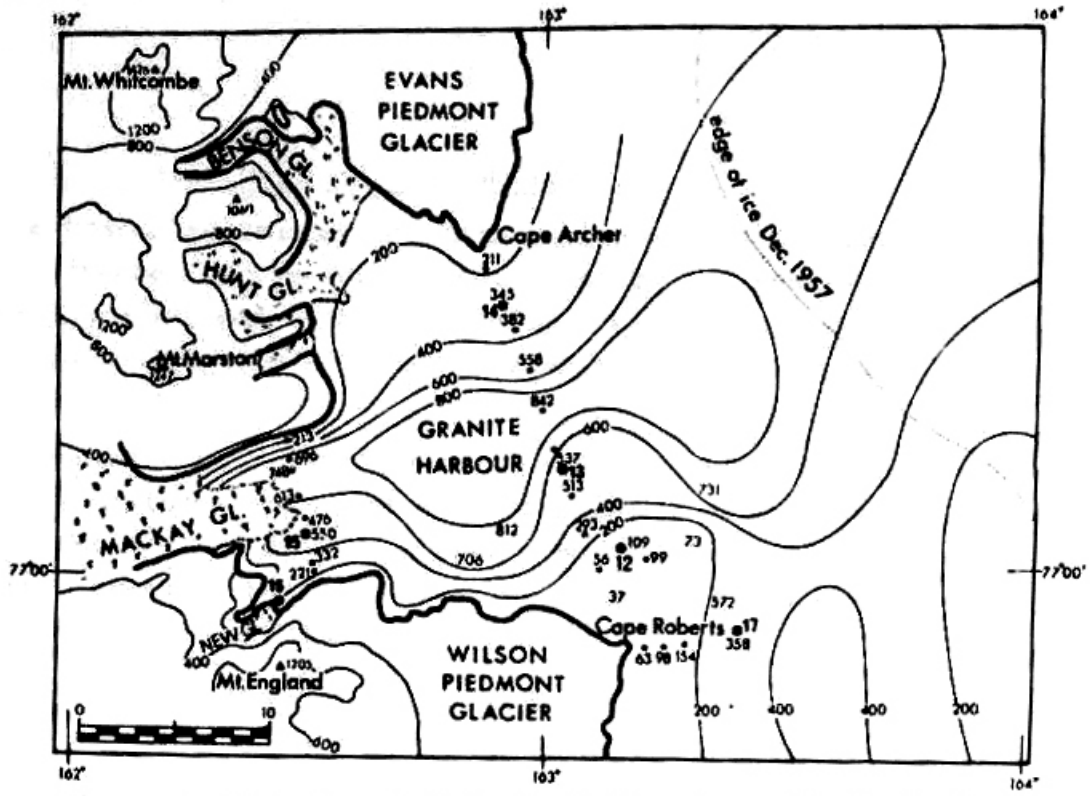
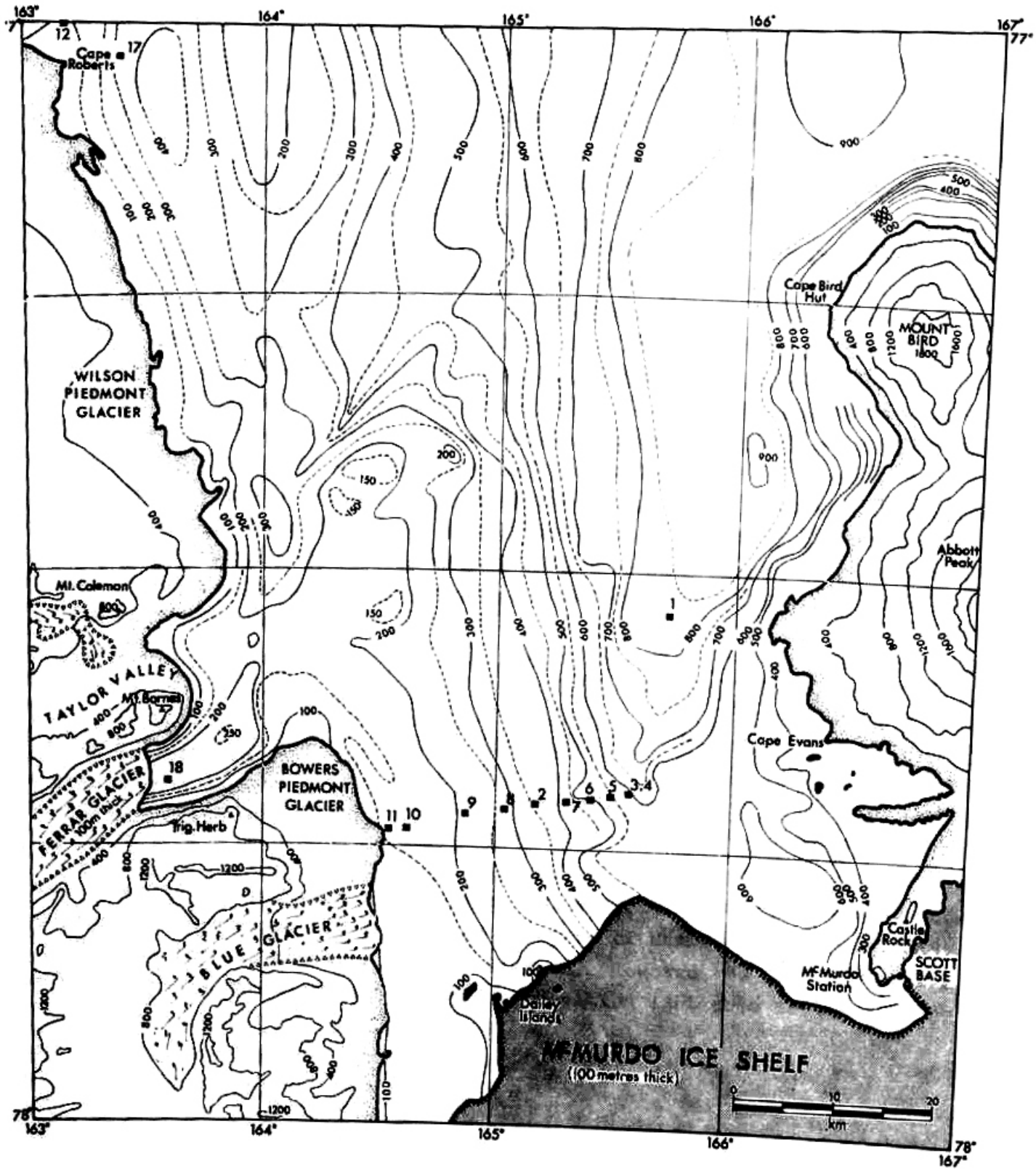


Figure 6 (above) & 7 (below): Bathymetry of McMurdo Sound and New Harbour respectively. Locations of cores 1 to 18 are also shown.



Triassic strata at Mt. Bastion (K7A) - B. Walker.

The Triassic Beacon Supergroup of south Victoria Land is divided into 5 stratigraphic units, the Fleming Member of the Feather Conglomerate and Members A-D of the Lashly Formation, and all are exposed at Mount Bastion. Preliminary investigations show that at least 4 distinct paleohydraulic regimes operated during the deposition of the Triassic strata.

The Fleming member consists of medium to large trough-x-bedded, medium to coarse grained quartzose sandstones with intervals of planar-x-beds. Paleocurrent variability is low as was also found for the other members. The Fleming member is considered to have been deposited in a braided stream environment where dune migration along the floors of wide but shallow river channels and transverse bar formation were the dominant processes.

Member A of the Lashly Formation has a greater diversity of sedimentary structures and variation in grain size. A change in grain composition from quartzose to volcaniclastic is evident from the weathering behaviour of the sandstones. The 80 metres of member A can be broadly divided into two facies, a trough-x-bedded medium grained sandstone facies and a parallel and ripple laminated very fine sandstone to siltstone facies with mudstones containing white rootlets. River channel cross-sections can be clearly seen at some exposures and show channel widths in the order of 100 metres with depth of 3 to 5 metres. Both facies are considered to be "in channel" facies with the mudstones representing still water deposition and alter plant colonisation in abandoned channels. The trough-x-bedded sandstone facies may represent deposition of sand within channels during floor events. A 0.5 metre thick sandstone with very low angle cross-stratification interbedded with horizontal laminae is at present unique to the section at Mount Bastion and requires further investigation as does a cross-stratified sedimentary structure whose geometry has not been reported in the scientific literature.

Member B is 96 metres thick and consists almost entirely of medium grained well-sorted sandstone. The bedforms are of a larger scale than found elsewhere with individual trough and planar-x-beds several metres thick. Large scours are common and often associated with thick (up to 14 metres) massive sandstones containing large silicified logs. Channel cross-sections exposed within a bluff at the northern end of Mount Bastion indicate channel depths of over 10 metres. Member B is interpreted as representing the deposits of wide and at times deep rivers that transported large amounts of sand, large mudstone blocks (up to 1 metre across) and plant debris during the peak flow of big floods. Channel avulsion was common accounting for the occasionally recorded 90° paleocurrent different from the general flow direction. In at least one place channel avulsion has cut through 20 metres of ripple laminated carbonaceous and non-carbonaceous fine sandstone. As yet unexplained is a 180° paleocurrent reversal that occurs within an interval of 5 metres and can be traced for the length of the outcrop (400m).

A complete change in paleohydraulic regime occurs in Member C which consists of thinly bedded carbonaceous and non-carbonaceous ripple laminated very fine sandstone and siltstone The 78 metres of Member C includes 2 thick sandstone units which suggest inundation of coarser flood debris onto what may have been a shallow lake environment. Conditions were at times stable long enough to allow for the accumulation of peat which eventually formed thin coal seams. Plant material is abundant suggesting that the Triassic landscape was well covered in vegetation.

Member D is 205 metres thick and consists largely of trough and planar-x-bedded medium to coarse grained sandstones. It is similar to parts of Member B and the Fleming member and similar conditions for its deposition are envisaged. Towards the top of Member D several sandstone units show a return to a quartzose composition last seen in the Fleming Member.

Lower Feather Conglomerate at Mount Bastion (K7A) - P. Fitzgerald.

The lower part of the Feather Conglomerate at Mt. Bastion was deposited in late Permian times on a moderately steep west-to-northwest dipping paleoslope (Fitzgerald, 1982). Deposition was characterised by sheetflow during flood events and low sinuosity braided rivers during normal flow. The dominant facies present, trough cross-bedded sandstone, is a result of dune migration in the upper lower flow regime. The planar cross-beds are a result of linguoid bar formation, whereas other minor facies are a consequence of low water modification processes and overbank sedimentation. Sediments are from a dominantly granitic provenance and consist of submature quartzarenites and subarkoses. Roundness of quartz pebbles (0.55) and mineralogical immaturity indicate deposition within a few hundred kilometres of source.

The paleosols have been recognised from several features including vein networks, which result from desiccation produced by clay contraction. Mottling and gleying in the underlying sandstone along with gammate structure in the paleosols themselves indicate periodic, possibly seasonal, waterlogging of the soil profile. Concretions associated with the paleosol have formed both syngenetically and epigenetically. These along with absence of any carbonaceous material suggest an oxidising environment and a low level of contemporaneous vegetation. Climate was temperate to moderately cool and humid.

Trace fossils included Skolithos and hypichnial ridges. Skolithos occurs throughout the section, in some instances destroying almost all sedimentary structures. It was not found in fine grained sediments or in paleosols. The presence of Skolithos as well as clean, moderately well sorted sands indicate a high energy environment and abrupt sediment aggradation or degradation. Its presence here in alluvial plain sediments indicates that it can occur in non-marine as well as marine sediments.

A metamorphic overprint assemblage has resulted from the intrusion of the Ferrar Dolerite in Jurassic times. Both 7 Å and 14 Å chlorite are present in the sandstones but only 7 Å in the paleosols. 14 Å oxy-chlorite is a result of alteration of detrital biotite and 7 Å a result of recyrstallisation of clays due to thermal metamorphism. The presence of pyrophyllite also indicates metamorphism and its co-existence with kaolinite and quartz suggests a temperature of 310-315°C.

Reference:

Fitzgerald, P.G., 1982: Environment of deposition of the Feather Conglomerate at Mount Bastion, south Victoria Land, Antarctica. Unpubl. BSc Hons Thesis, Victoria Univ. of Wellington Library, 89pp.

Permian strata in north Victoria Land (K18) - B. Walker.

Alluvial sediments:

The sediments of the Beacon Supergroup in north Victoria Land occur as scattered outcrops exposed along cliff faces and valley walls, that have been cut by glaciers. The Permian sediments (recognised from the presence of the Glossopteris flora) rest on the flat-lying sub-Beacon surface that cuts a basement of metasedimentary and plutonic rocks.

The Takrouna Formation proposed by Dow and Neall (1974) for the sediments of north Victoria Land is from this season's field work divided into two facies (Walker, 1982).

Facies Association 1 which outcrops in the Alamein Range, Morozumi Range and Helliwell Hills is characterised by variation in type, scale and grain size of sedimentary structures. Medium scale trough-x-bedding and ripple lamination are the most common bedforms. Mudstone lenses, planar-x-bedding, scour fill and coal measures (including coal seams, green siltstones and fining upwards sandstones) are also found. Coarse to fine grained ratios vary within sections and between outcrops and it is evident that a variable paleohydraulic regime operated during the deposition of this facies. The trough and planar-x-bedding and ripple laminated units are considered to be deposits reflecting the varied flow conditions associated with the different water level stages of flood episodes. The different scales of the same sedimentary structures reflects the varying intensity of those floods. The fine grained units including the coal measures are most probably in channel facies that were deposited when a channel became separated by the processes of channel avulsion and migration from the main flow of water. Channel cross-sections, low paleocurrent variability and sequence of sedimentary structures suggest that the rivers that deposited facies 1 had high width to depth ratios and were of low sinuosity and due to an apparent variable climatic regime could expect a variable discharge.

Facies Association 2 is exposed in the Moawhanga Neve, Gair Mesa, Neall Massif, Jupiter Amphitheatre (Morozumi Range) and is in marked contrast with Facies Association 1. It is dominated by multi-storey "sheet-like" sandstone bodies comprised almost entirely of medium to large scale trough and planar-x-bedding with individual sandstone bodies separated either by erosion surfaces or mudstone drapes. Facies Association 2 is considered to have been deposited by braided rivers with high width to depth ratio channels. Individual sandstone bodies probably represent discrete flood events which transported large quantities of sand by the processes of dune and transverse bar migration. Flood events were relatively frequent and allowed no time for overbank deposits to develop.

Paleocurrents for Facies Association 1 show that it was deposited on a paleoslope dipping towards the northeast and that Facies Association 2 was deposited on a paleoslope dipping west (Fig. 8).

It is possible that Facies Association 1 represents the deposits of rivers that flowed over a flat low gradient flood plain from the area of the retreating Permian ice cap that was centred in north Victoria Land at this time (Barrett et al., 1972). This depositional episode ended when uplift of mountains to the east reversed and increased the gradient of the paleoslope resulting in a new paleohydraulic regime that determined the depositional character of Facies Association 2.

Glacial beds:

An early Permian (?) tillite sequence is exposed on the western side of the Lanterman Range, north of the Orr Glacier (McKelvey, 1982). The tillite is faulted against the metamorphic rocks of the Wilson Group and is tightly folded. The following description is from McKelvey and Walker (1982).

The glacial beds are of acid plutonic and metasedimentary provenance and are exposed on two spurs about 2 kilometres apart. On the northern spur the oldest exposed strata consist of at least 70 metres of poorly sorted lensoidal or channel-fill outwash conglomerates, pebbly sandstones and diamictites associated with laminated or cross-bedded coarse sandstones. The coarser rock types are most common at the top and bottom of this interval. A dark mudstone and shale unit containing interbeds of thin sandstone, lensoidal conglomerate and a fine diamictite overlies. This unit thickens eastwards to at least 150 metres and changes rapidly in facies to a monotonous mudstone sequence containing in its uppermost 80 metres thin laterally persistent graded and laminated turbidites sometimes with erosional bases and containing infraformational sandstone clasts. No dropstones are present. More than 100 metres of coarse outwash strata similar to those at the base of the section overlie.

On the southern spur a similar coarse sandstone sequence with lensoidal conglomerates and pebbly sandstones at the base overlies more than 150 metres of fissile or massive mudstones alternating with very coarse tillite sheets and lenses. Most of the mudstone and shale horizons contain sparsely scattered dropstones.

The contact between the folded glacigene sequence in the Lanterman Range and the widespread Permian fluvial Takrouna Formation of northern Victoria Land has not been observed. Coarse metasediment breccias up to 50 metres thick and associated sometimes with minor petromict conglomerate lenses frequently mantle the pre-Permian basement complex beneath the Takrouna Formation. No definite glacial features have been observed in these breccias.

References:

Barrett, P.J., Grindley, G.W., Webb, P.N. 1972. The Beacon Supergroup of East Antarctica. In: Adie, R.J. (Ed.), Antarctic Geology and Geophysics, Universitetsforslaget, Oslo: 319-332.

McKelvey, B.C., Walker, B.C. 1982. Late Paleozoic glacigene strata in northern Victoria Land (abs.), Fourth International Symposium on Antarctic Earth Science, Adelaide, August 16-22.

Walker, B.C. 1982. The Beacon Supergroup of northern Victoria Land, Antarctica (abs.), Fourth International Symposium on Antarctic Earth Science, Adelaide, August 16-22.

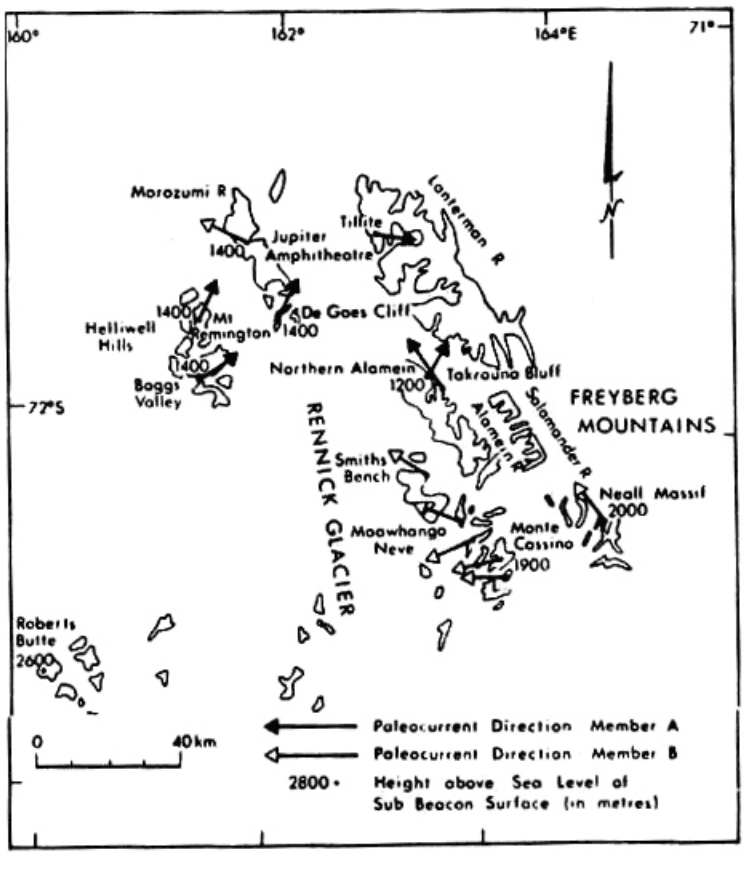


Figure 8 Localities visited in north Victoria Land by K18. Arrows are paleocurrent directions from the Beacon strata.

Fission-Track dating (K7B) - A. Gleadow.

Twenty-one granite samples (several Kg each) were collected for fission-track dating at various elevations in the lower Wright Valley and along the McMurdo Sound coast between Gneiss Point and Spike Cape.

Field observations suggest that step faulting on a number of different faults may be important in controlling the eastern front of the Transantarctic Mountains in this area (Fig. 9). Fission-track ages of apatites from these samples were reported at the Fourth International Symposium on Antarctic Earth Sciences, and confirm the step-like nature of the faulting. They also indicate a steady uplift rate of 15m/m.y. throughout the Mesozoic (Gleadow, 1982).

Reference:

Gleadow, A.J.W., 1982: Fission-track geochronology of granitoids and uplift history of the Transantarctic Mountains, Victoria Land, Antarctica (abs.), Fourth International Symposium on Antarctic Earth Science, Adelaide, August 16-20.

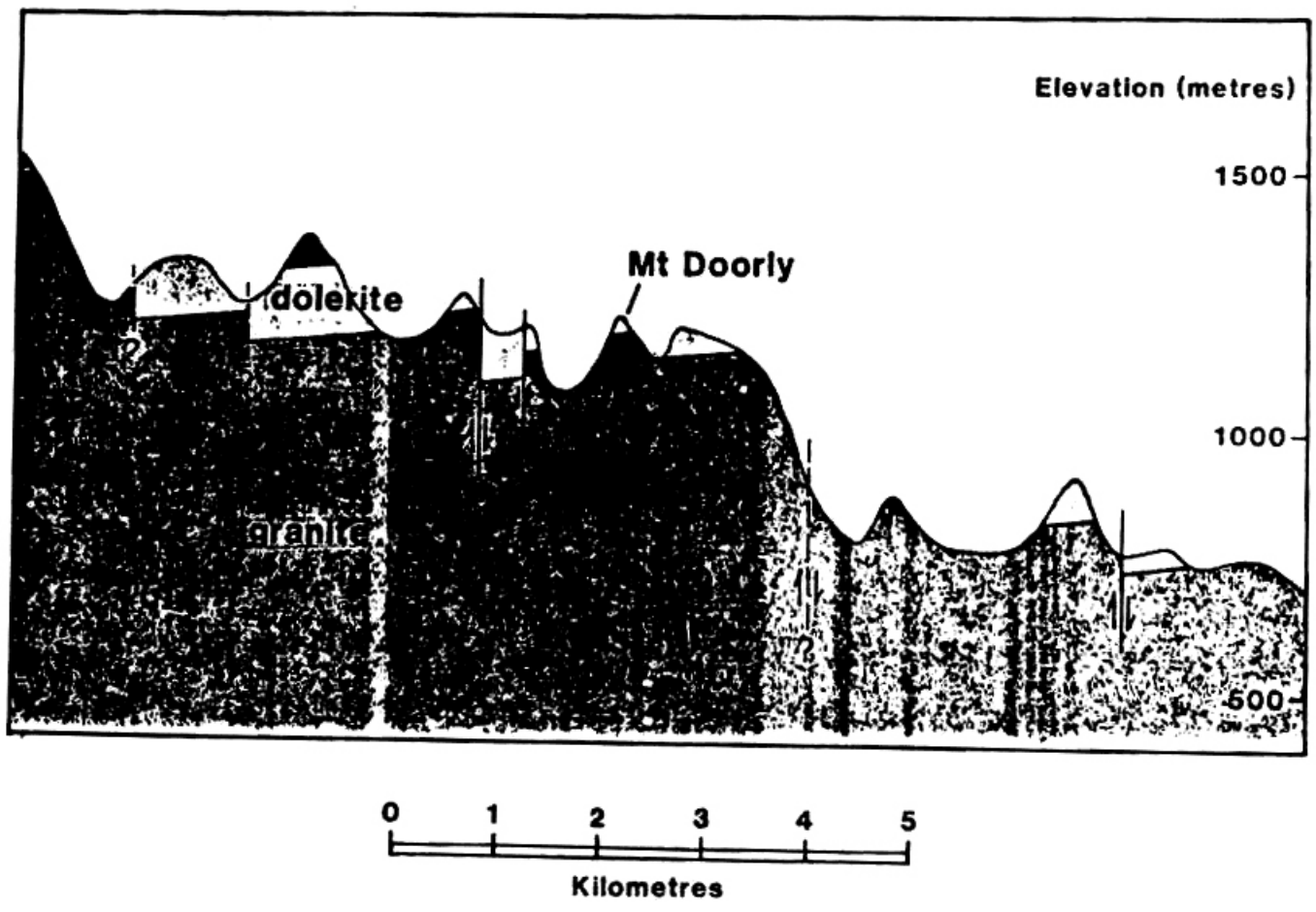


Figure 9: Latitudinal section through Mt. Doorly, showing the step-like nature of the faulting in the basement near the Victoria Land coast.

FIELD NOTES

Erebus Studies and IMESS (K4).

NARRATIVE:

The field work began with a helicopter inspection of the telemetry transmitters by Stan Whitfield and Jon Prosser on 26 October 1981. At Hoopers Shoulder and Abbotts Peak, the equipment was working and intact, except for the guy wires on the antenna mast. The turnbuckles had unscrewed in the wind - sometimes completely. The Gel/cell batteries measured 14V, even when the solar panels were shielded from the sun. At the summit, the antenna cable was broken, and the ventilation pipe to the buried battery box was tilted ominously. The transmitter was not working. The protective polythene film had been stripped off the infrasonic microphone and the aperture was blocked with snow.

In the period 10-30 November, the USARP party serviced the Abbott and Hooper stations, retrieved and overhauled the summit transmitter, installed new permanent telemetry seismographs at "Bomb" and "Terror" (Fig. 1), and installed a temporary telemetry seismograph near Bird Hut for the purpose of recording the large seismic explosions fired in McMurdo Sound on 23 and 27 November by Lyle McGinnis. I assisted in recording the 23 November explosions before ascending to the fang with the Event 4 party on 24 November.

Between 28 November and 13 December, I operated a tape seismograph at the hut (from 1217 NZST, 29 Nov.); rebuilt the old infrasonic microphone, reinstalled it at the Winch Site, and connected it to the monitor speaker in the hut (from 2300 NZST, 30 Nov.); reinstalled the telemetry transmitter to give seismic recordings at Scott Base (from noon, 2 Dec.); installed the new infrasonic microphone (consisting of 2 Philips 8 inch Hi Z speakers mounted on opposite sides of a $0.05m^3$ chipboard box and connected in parallel so as to reduce seismic response) on the main crater floor (3 Dec.); located and repaired 4 breaks in the loop and renewed 350m of damaged wire, and (with Pat Tinnelly) surveyed the position of the loop around the crater rim (5 Dec.); rebuilt the infrasonic preamp/VC (1020 Hz), and installed it, together with the new Geotech model 45.50/46.22 preamp/VCO (1360 Hz) for the loop, in the transmitter box at the summit (noon, 6 Dec.); and made trial electromagnetic transmissions from a 100W audio signal generator and portable loop from the edge of the summit plateau to the main loop (8 Dec.).

Problems encountered in carryout out the work were moisture damage to the old infrasonic microphone and the preamp/VCOs; the persistent drifting of the infrasonic VCO (1020 Hz) out of its frequency range due to an unexpected failure of the main battery; the tendency for the induction loop to become unburied and the insulation to crack off exposed wire; and the majority decision by the N.Z. party to leave the mountain earlier than planned as a combined group with the U.S. party. In fact the helicopter problem delayed this and we descended on 13 December.

The Japanese party were based at McMurdo for their entire period from 23 November to early January. They began by deploying their "DAR" slow speed tape seismographs on the flanks of Erebus. While these were recording ($\geq$ 20 days), the party played back the telemetry tapes as they finished recording at Scott Base, and made continuous slow speed index recordings and high speed recordings of selected events on a visicorder. Photocopies were made for distribution to all collaborating scientists. All DAR seismographs

were then retrieved for return to Japan. The Citizen quartz clock with the Sony UFR data recorder at Scott Base, which had hardly tolerated the ionosondes, , was replaced with a new TCG-1000B clock made by the Eikura Transmitting Co. Also a 4 channel pen recorder was installed temporarily at Scott Base to allow real time monitoring of 4 telemetry channels in addition to the permanently installed San-ei Sokki monitoring recorder.

TRANSPORT:

All transport to and from Antarctica was by Hercules, and all transport within Antarctica was by helicopter. The latter was a major source of uncertainty in planning the expedition, because the helicopters were to be shared between Northern Victoria Land and the McMurdo area. It was believed that close support at the summit of Erebus, which had never been freely available, would be denied this year because it risked too large a proportion of the available aircraft. Consequently, the Japanese changed their plan from a wire telemetry seismic network on the summit plateau to a more flexible separate station network on the flanks of the volcano.

In the event, helicopters were withdrawn completely between 5 and 10 December due to serious faults which were at first thought to be unrepairable. The squadron deserves the highest possible recommendation for their fast solution to the problem, but the initial instructions to all NZARP parties to standby for immediate return to base, and the subsequent lack of definite information, resulted in stop-gap measures which could have been avoided.

WEATHER:

The weather was good except for a severe storm when the Event 4 party was at the Fang. No time was lost at the summit due to weather conditions, but an attempt to carry out the spear viscometer program in the final days at the summit was abandoned due to murk inside the crater.

COMMUNICATIONS:

Two VHF hand radios, a Compak, and a USARP radio provided excellent communications with Scott Base and Macsideband. The ability to communicate directly on VHF with the Science Lab at Scott Base at almost any time, and from almost any place (even the main crater floor) was especially valuable, and the expedition owes a lot to the Post Office and to Ross Mason. Less satisfactory was the dearth of information from Scott Base about the withdrawal of the helicopters.

EQUIPMENT:

Two of the three preamp/VCOs at the summit transmitter site were damaged beyond repair by corrosion. Because air temperatures were expected to fall below the operating limit of the electronics, both the transmitter and the VCOs were buried in warm ground. The VCOs were in a deeper reaching box however, the inside of which experienced copious condensation which penetrated the plastic freezer bags in which the 2 VCOs were sealed. The third VCO (1020 Hz) in both a bag and metal box was less affected, while the transmitter which remained below freezing point was undamaged. As only one new preamp/VCO was available, the recording of the level of audible sound in the crater was abandoned for 1982. The wooden cabinet of the old infrasonic microphone was badly split by moisture from the warm ground around it, although it had been sealed in polythene rubbish bags. The plastic was apparently stripped off by the weather.

The main carbonaire battery (supplied by the Americans) may also have been affected by its burial in warm ground. Condensation in the ventilation pipe blocked it with ice, and some of the 30 cells which were only 1/3 discharged (as confirmed by the volume of zinc electrode remaining) inexplicably gave no voltage, and were discarded. When reconnected on 6 December, the remaining good cells gave 12V, but by 12 December they had fallen to 8V, forcing the complete replacement of the battery after we were supposed to have left the mountain.

The induction loop had become unburied over at least 350m of its length due to strong winds (which had also unwound the turnbuckles on the antenna guy wires). Where so exposed, the PVC insulation had cracked badly, and the wire had to be replaced and reburied. Until it is all reburied more deeply, this maintenance work will continue to be necessary in the future. If neglected, wind noise in the records and early breaks in the cable will soon render it useless.

RECOMMENDATIONS:

A determined attempt should be made next season to shift the ENE section of the induction loop (which tends to become unburied) to higher less steep ground, and bury it more deeply. Electro magnetic surveys of the summit plateau using the buried loop and a portable transmitting loop, which were proved feasible this season, should be given priority next season. The preamplifier/VCO in use for the infrasonic telemetry (1020 Hz) which proved intolerant of battery voltage fluctuations should be replaced with one similar to that in use with the loop.

Regarding the recording of the telemetry signals at Scott Base, it is noted that although the science technicians in 1981 were shown how to check the subcarrier frequencies, this was not done, and they are unable to say when the failures of the 1020, 1360 and 1700 Hz signals from the summit occurred during the year. Scott Base has since been provided with a simple tunable audio filter to make checking the subcarrier frequencies a routine matter.

McMurdo Sound Studies (K5).

NARRATIVE:

Pyne and Cattley arrived at Scott Base on October 16, four days behind schedule, due to a hold on flying because of communication problems caused by sunspot activity. The first three days were spent servicing the IH-500 tractor, work that had not been anticipated. The refitting of the Wannigan for scientific use had been started by the winter over personnel but was unsuitable and was removed. The base carpenter, Pyne and Cattley spent a full week refitting and securing the Wannigan to the sledge. By the time this work was complete we were a full week behind in our planned schedule.

The remaining preparatory work which included issuing and testing the normal field equipment and testing our scientific equipment was therefore rushed. We had allocated three to four days for testing the scientific equipment alone, but this became impossible and consequently we decided to leave for the field with some equipment untested. In retrospect we were lucky that only one major item of equipment (the underwater camera) did not work because of this.

On November 4 Pyne, Ward and Cattley (K5) departed Scott Base at 0950 hrs. for Cape Royds. At 1800 hrs. we reached Cape Evans and remained there for the night. Numerous thin snow drifts between the Erebus Ice Tongue and Cape Evans slowed us down considerably. The following day we completed the traverse to Cape Royds. During this leg of the trip, we became stuck in deep soft snow out from the Barne Glacier.

On November 6 we prepared the sampling equipment for a coring attempt in 850m deep water 10km northwest of Cape Royds. This involved adding 400m of extra wire onto the winch and transferring all the equipment onto the toboggan-pulled Tamworth sledge. This was necessary because we anticipated that the ice would be thinner out towards the centre of McMurdo Sound. We were not prepared to risk the heavier tractor and sledge with Wannigan without first checking the ice thickness. As it transpired the ice thickness at the sample site was 1.2m and sufficient to carry the tractor. The next two days were spent in actual collection of the sample, cleaning and repairing the equipment and preparing to begin the "across sound" traverse.

On November 9 we departed Cape Royds for a rendezvous at Cape Evans with the dog team carrying our mogas resupply and the penguin census group, Colin Monteath and Lindsay Main, who joined us for three days at Cape Evans.

Between November 10-16 we traversed a line westwards between Cape Evans and the Strand Moraines to continue the sea-floor sampling programme. On November 12 Brent Alloway joined us and Monteath and Main left on the same helicopter for the Wright Valley. Peter Barrett joined K5 on the 13th. K-2 (Lands and Survey surveyors) joined us on the 16th for one night before continuing to Butter Point. We obtained cores 2 through 10, 5A and 8A along this line, arriving at the Strand Moraines on the 16th.

By this time we needed a resupply, and repairs to the IH-500 and toboggan. On the 17th, Cattley, Pyne and Ward drove back to Scott Base to institute repairs and manufacture replacement weights for the sphincter corer. We spent 4½ days at Scott Base, leaving there at 4.30 p.m. on the 22nd, and arriving at the Strand Moraine camp at 10.30 p.m. During this time, Barrett and Alloway recorded tidal measurements and attempted several core and grab samples. Sample #11 was taken by orange-peel grab during this time.

November 23 and 24 were spent travelling the 85km to Cape Roberts. On the 24th Barrett and Pyne took the toboggan back to Butter Point to assist K-2 (surveyors) in the sea ice movement survey, but were able to rejoin us that evening at Cape Roberts. The following day we began the Granite Harbour sampling programme. Three cores (12 through 14A) were taken along a line extending from Cape Roberts to Cape Archer. On the 29th and 30th cores 15 and 16 were taken within Granite Harbour. On Tuesday, 1 December, Barrett was lifted out by helicopter for his return to Christchurch, and Paul Fitzgerald joined us. The 2nd was spent travelling out of Granite Harbour to Cape Roberts. On the next day, the Tamworth sledge and toboggan were loaded with the sampling equipment, as the IH-500 and Wannigan could not cross the 2½m lead 1km seaward of Cape Roberts, and Pyne, Cattley, Fitzgerald and Alloway travelled 5km offshore for core 17. We then moved to Dunlop Island after picking up fuel at Cape Roberts.

On the 4th we moved from Dunlop Island to Marble Point, where two full fuel drums were stockpiled on the land. That evening while still at Marble Pt. we received a radio broadcast from the O.I.C. Scott Base for all Kiwi field parties in the McMurdo area. The message required that all field programmes be prepared to move all personnel and essential equipment back to Scott Base as soon as possible. No clear statement explaining why this was necessary was given but "the inability to support science field parties from McMurdo Station" was quoted. A final decision about the withdrawal of field parties and Vanda personnel would be made on the Sunday evening (December 6) by the O.I.C.

We decided to continue to Butter Point that evening to meet the K2 surveyors. Because of the broadcast we were all committed to returning to Scott Base with K2. Originally we had intended to send only the togoggan back to base to bring back a part needed for the tractor so that the work at Cape Chocolate could be cone. The next day before leaving for Scott Base we successfully sampled in front of the Ferrar Glacier snout (core 18).

If we had been told that the problem of support concerned only helicopters (from which we were independent) our original intention to move to Cape Chocolate would have been possible. The Sunday decision which required us to return to base but to finish work that was enroute came too late.

December 8 to 14 were spent cleaning and returning gear, packing cargons and samples for transport to New Zealand, as well as preparing equipment for Pyne, Fitzgerald, Alloway and Lindsay Main to take to Mt. Feather.

We had hoped to complete the sampling programme at Cape Chocolate by togoggan. Unfortunately the only other toboggan available at Scott Base was an old OMC which was considered unreliable for a journey of this length. The total equipment load was over 2500 lbs. and was considered too great for our single toboggan to pull, so this part of the programme remained uncompleted.

TRANSPORT:

The International Harvester 500 crawler tractor and Snotric 047 motor toboggan were made available to Event 5 for work on the sea ice. The IH-500 tractor was used to pull the "Cantago" sledge with Wannigan and a Maudheim cargo sledge. The toboggan pulled a single Tamworth sledge.

Helicopter transport was used for an initial sea ice reconnaissance and fuel flight to Granite Harbour and later for minor resupply and personnel movements.

A detailed summary of performance and problems for each major transport unit is presented below:

IH-500 Tractor.

The tractor had been brought into the garage at Scott Base by the relieving mechanic and previous wintering mechanic for checking and overhaul. Two sheared main sub-frame studs and bolts had been discovered and one removed by October 16 when Pyne and Cattley arrived at Base. Three days were spent by Cattley and Pyne removing the remaining broken bolts, making new parts (which are not stocked for the tractor at Scott Base), reassembling and fixing the cracked fuel tank. The electrical system was checked and a new regulator fitted by the base assistant mechanic before leaving for the field on November 4.

The tractor started cold very well on most occasions, especially considering the cold temperatures in early November. Normal preheating and a small quantity of ether were usually all the starting preparation required. The "noyse" heater and parachute carried in case of starting problems were never required. There was a starting problem on only one occasion and this was found to be fuel leaking into the starter motor, gumming the brushes and contacts. No further starting problems occurred after cleaning the motor and sealing the holes in case of further fuel spills.

On November 10 a crack was discovered in a previously repaired section of the main frame. The crack slowly increased in length as we travelled across the sound to the Strand Moraines necessitating repairs before moving to Granite Harbour. It was decided that the repairs would be most easily carried out at Scott Base although the possibility of effecting repair in the field with helo support was considered. Repair of the frame required removing the old repair gusset and arc welding a new heavier plate steel gusset over the cracked section. The tractor returned to Scott Base on November 18 after completing the Cape Evans-Strand Moraines sampling. The fuel tank sprang a further leak on returning to base.

The regulator was found to be faulty during the period at Granite Harbour. It was promptly disconnected and later repaired. The idler bearing for the fan belt became faulty on the return from Granite Harbour to Butter Point (December 4). The bearing was disassembled and regreased but remained faulty which necessitated a deliberately slow return to Scott Base.

Early in the season the tractor was using about 1 litre of transmission oil every eight running hours. A leak which contributed to higher oil usage was found at the oil guage connector and promptly fixed. The oil usage appeared to drop slightly later and averaged about 1 litre every 10 running hours. The track bearings were greased about every 3 running hours.

Minor repairs carried out in the field included replacing the clutch return spring and several battery retaining bolts broken by vibration during travel.

The IH-500 performed very well considering that it was usually towing between 13,000 and 14,000 lbs. and working at its limit. On several occasions the second sledge had to be disconnected when relatively minor obstacles were encountered because no reserve power was available. The lack of a blade on the tractor also meant that difficulty was experienced negotiating some rough ice or snow drifted areas. The difficulty of these situations would have been reduced considerably if a blade were available.

We believe that we were very lucky to cover over 800 miles with this machine considering it was underpowered and did not have a front blade. The great age of the machine and incomplete stock of parts at Scott Base reduce its suitability for this type of programme in the field. It is, however, very reliable and probably will be useful for several years yet around Scott Base.

Snotric 047.

This toboggan was new at the beginning of the 1981-82 season. The machine generally was easy to start and performed well with only two major problems.

Early in the season when temperatures were less than 10°C freezing often occurred in the original airfilter-carburettor system on the Briggs and Stratton engine. This usually happened after the machine had been idling or running slow for some time. It is thought that the carburettor remained sufficiently cold to freez out moisture from the air. The carburettor was dismantled several times and the ice scraped or melted out before the machine would start.

Secondly, the flexible exhaust coupling broke where it enters the muffler soon after leaving Scott Base. This did not affect the performance unduly but required that the toboggan be run with the fibreglass cowling removed until repairs were made at Scott Base.

"Cantago" sledge.

The "Cantago" sledge is a scaled down all steel version of the American tandam "Octago" sledge and was built in Christchurch for Antarctic Division DSIR. It was first used this season by Event 5 to carry a twelve foot long Wannigan, winch and fuel on the sea ice. The sledge performed reasonably well in most conditions and provides a form of transport not previously available from Scott Base. There were, however, some problems with the sledge which will require some modification.

The sledge did not perform well on the softer snow drifts, often breaking through to run on the sea ice beneath. Where the snow was more than 0.3m thick the sledge would bulldoze snow in front until the tractor would lose traction and stop.

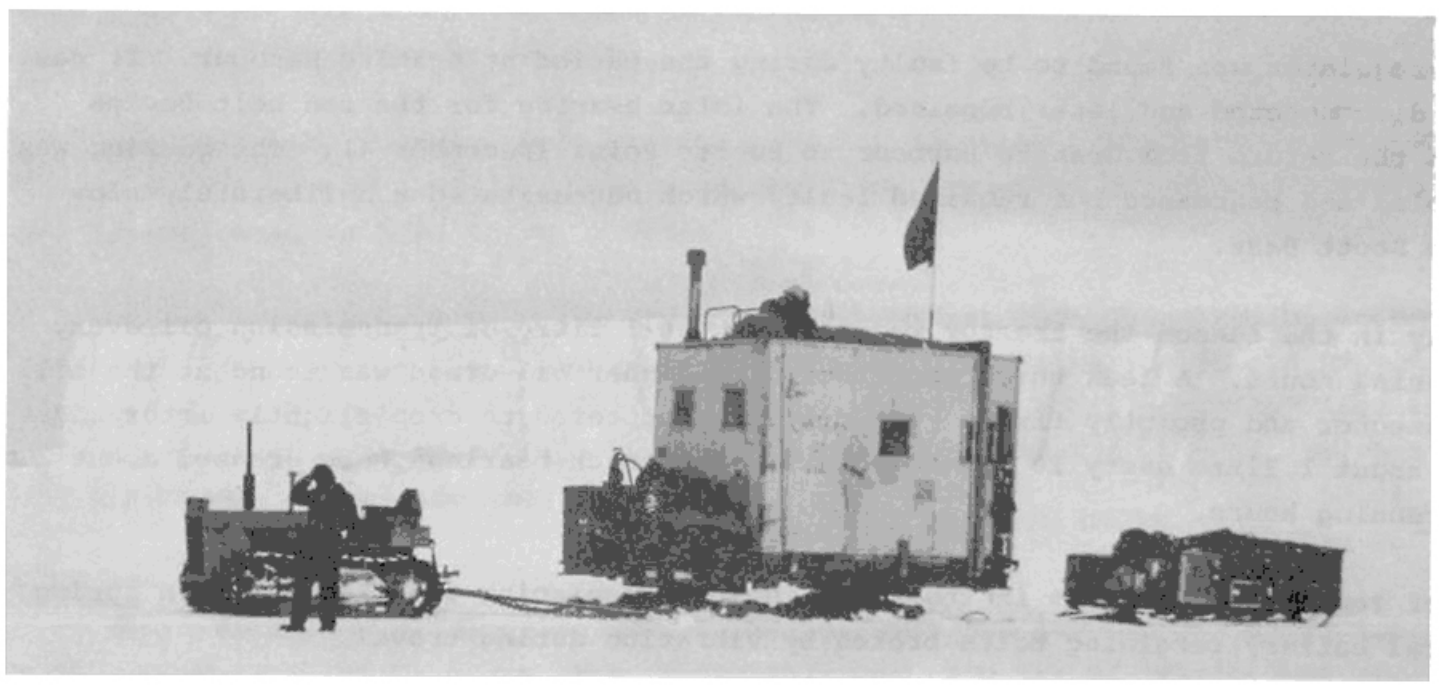


PLATE III: Tractor and Wannigan at Cape Roberts.

The return from Granite Harbour to Butter Point involved crossing some rough ice around Cape Bernacchi. The rough ice caused some minor damage to the sledge in particular bending the small front ski protectors and slightly bending the draw bar.

The sledge was heavier at the stern with the Wannigan at the back of the deck. This, however, was necessary to maximise the remaining forward deck space for the winch and fuel.

We believe that the sledge's performance could be improved if fitted with wider skis with a higher rocker in the front. This might be achieved by bolting wider ski shells underneath the present skis. By moving the back ski beam aft about 0.5m the loading capabilities of the sledge may also be improved.

WEATHER:

Poor weather conditions were experienced early in the season (strong winds and snow with intermittent white-out for 3 days), but did not hinder progress of the sea-floor sediment sampling programme. Later in the season, we experienced exceptionally good weather at Granite Harbour and New Harbour. A summary of weather observations is presented in Appendix III.

COMMUNICATIONS:

A Compak radio was used for daily radio skeds with Scott Base. The equipment worked well but on many occasions there were operator problems at Scott Base. In particular messages from field parties often did not appear to reach the appropriate people at Base and was possibly the reason why some helo movements and resupplies did not go according to plan.

The availability of two VHF sets for the sea ice work would have reduced some problems and time delays. During this work the toboggan was often used for forward route reconnaissance and bathymetry traverses. With VHF sets it would have been possible to keep both toboggan and Wannigan informed of progress (or breakdown).

FIELD EQUIPMENT:

Clothing:

Several new items of clothing, the same models as the Antarctic Division issue, were first used by VUWAE members this season, and were all very successful. Minor problems were found with the bib-overalls which had some wear patches which were too small and too lightly sewn in stress areas. We also tried New Zealand manufactured wool felt booties in the normal Japanese mukluks. These booties are more expensive than the conventional mukluk inner boot but give superior warmth and ankle support.

Equipment:

See Transport section for report on the Antarctic Division "Cantago" sledge, IH-500 tractor and Snotric 047 toboggan.

Scientific Equipment:

This season the "sphincter corer" performed "with distinction", the triggering problem encountered last season having been eliminated with a new design. The poor penetration by the corer in some parts of the sound is definitely attributable to a hard gravelly sea floor. Even in this sediment short undisturbed cores were often retrieved.

We are still learning how to operate the corer with successive attempts and minor accidents such as losing weights should be prevented in future.

The limitations of the winch which performed well last season were discovered this season. The extra lead weights on the corer and deeper water created a 600m depth limit to our operation even though there was sufficient cable for 1000m. Unfortunately, testing the winch in deep water around New Zealand requires a large ship and great expense.

The underwater camera was the one major item of equipment which did not work successfully. The camera and flash components were borrowed from NZOI and mounted in our housing as in a previous season. Our unfamiliarity with the components and lack of time are probably the main reasons for the problems.

RECOMMENDATIONS:

Field Preparation:

The Narrative describes the considerable amount of work (some unexpected) necessary at Scott Base to prepare for a Tractor Train on the sea ice. The limiting factor to work on the sea ice is time, which is determined by when the ice is considered unsafe for heavy machinery, normally early-middle December. It is therefore imperative that the start to preparations at Scott Base be as early as possible to ensure sufficient field time to achieve a reasonable amount of work.

Transport:

The International Harvester 500 tractor performed faithfully this season. However, a larger tractor is really required for operation on the sea ice a considerable distance from Scott Base. A blade and winch are also necessary for some travelling conditions (see Transport section for details).

The "Cantago" sledge requires wider skis to improve its performance (see Transport section for detailed recommendations).

Communications:

Many problems which concerned field parties this season could have been avoided if one person only had been responsible for both helo logistics and radio scheds. The person who does the radio skeds is the most informed about field party movements and logically should be responsible for all Scott Base initiated field support (e.g. helo planning and resupply).

Portable radios (e.g. VHF) are needed for efficient work on the sea ice where parties must work some distance apart. This is particularly important for seismic work where people firing the charges require verbal communication with the recording station.

Equipment/Clothing:

A modification to the bib-overall design should be made to improve their wearability (see Equipment).

Beacon Studies in the Quartermain Range (K5).

NARRATIVE:

The main objective of this trip was to study exposures of the Weller Coal Measure (Permian) and Feather Conglomerate (Permian-Triassic) at Mt. Feather (77°58'S, 160°18'30"E) and Tabular Mt. (77°51'26"S, 160°7'E). At Mt. Feather camp was set up in a sheltered basin at 2200m, approximately 6km NE of the summit, but immediately after we arrived heavy snow set in, confining us to tents for 2 days. The third day was spent working upsection on the Feather Conglomerate, some 3 hours away but this was hampered by deep snow and high winds.

We moved to Tabular Mt. (lying some 12½ kilometres to the NNW of Mt. Feather) on 19 December and set up camp at 2400m, on the ridge directly north of the summit. This provided access to limited sections of both the Weller Coal Measures and the Feather Conglomerate.

TRANSPORT:

All transport was by helicopter, with all moves in the field being on schedule. The move from Tabular Mt. to Vanda was successful despite high winds and deteriorating weather conditions. Aerial reconnaissance was helpful at each location for an overall view of the geology.

WEATHER:

Soon after our arrival at Mt. Feather we were greeted by heavy snow and poor visibility. This cleared up enough to enable us to move to Tabular Mt., where we were met with heavy snow and poor visibility once again. Weather cleared after a few days here but was closing in again just prior to departure.

COMMUNICATIONS:

A DSIR Compak SSB radio was used. This proved satisfactory except that most transmissions to Scott Base had to be relayed via Vanda.

FIELD EQUIPMENT:

All equipment performed well and new VUWAE clothing this year was appreciated, especially at high altitude where in the past this has been an inconvenience.

The only loss of equipment was the leaving behind of the toilet at Mt. Feather due to a hurried departure.

Beacon Studies at Mt. Bastion (K7A).

Three weeks were spent working in detail on the very well-exposed Triassic strata at Mount Bastion. Apart from two snow falls which covered the outcrops and required up to three days to abate the weather was good and the lack of strong winds made working in temperatures lower than -20°C bearable. It is recommended that work at Mount Bastion is carried out before mid-November to avoid heavy snowfalls that accompany warmer temperatures.

Work was carried out between 0300 hours and 1500 hours so as to catch the sun on the outcrops and to avoid the low thick cloud that invariably rolled in from the south at around 1200 hours. It is advised that Helo movements to and from Mount Bastion be performed as early as possible in the morning so as to avoid this problem.

Communications with Scott Base were good and only on a few occasions was it necessary to relay through Vanda.

Fission-Track dating (K7B).

NARRATIVE/AREA COVERED/WEATHER:

Dr. Gleadow and Paul Fitzgerald were put in by helicopter at the eastern end of Lake Brownsworth in lower Wrights Valley, where they spent two days carrying out the bedrock sampling programme and sketching the local geology. On the return flight to Scott Base rock samples were collected from several points on the coast between Gneiss Point and Spike Cape.

The weather was fine throughout the field period.

TRANSPORT:

Helicopter transport was used to put the field party in to the camp site in Wright Valley and to carry out an aerial reconnaissance of the sampling area. This proved to be extremely valuable in selecting the best outcrop areas for the sampling traverses and in locating the survey benchmark where camp was set up. The three sampling traverses up the sides of the lower Wright Valley were then completed in two days on foot.

Return to Scott Base was delayed by several days and close support work to collect samples along the coast had to be curtailed because of the helicopter problems which developed at the beginning of December. However, this did not seriously restrict the geological sampling programme and all major objectives were achieved.

EQUIPMENT and COMMUNICATIONS:

Several days were spent at Scott Base preparing equipment - no difficulties were encountered and the equipment performed well under field conditions. Communications were quite satisfactory although a fault developed in the radio which necessitated switching the set off and on again between transmitting and receiving.

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APPENDIX I - FLIGHT REQUIREMENTS FOR VUWAE 26

	Date	Event	Purpose	Origin	Destination	Aircraft
	Oct.16	K5	Aircargo 1	Chch	SB	C141
	27	K5	Aircargo 1	Chch	SB	C141
	28	K7	Aircargo 1	Chch	SB	C141
		K5	Sea-ice Reconnaissance	SB	SB	Helo
	30	K7	Aircargo 1	Chch	SB	C141
	Nov. 2	K7	Put in 2	SB	Mt.B	Helo
	6	K5, K7	Aircargo 2	Chch	SB	C141
	12	K5	Put in 1	SB	K5 sea-ice	Helo
	13	K7A	Put in 1	SB	Mt.B	Helo
		K5	Transfer 1	Mt.B	K5 sea-ice	Helo
	21	K7A	Take out 2	Mt.B	SB	Helo
	20	K4	Aircargo 1	Chch	SB	C130
	23	K18	Aircargo 1	Chch	SB	C130
	24	K18	Aircargo 2	SB	NVL	C130
		K4	Put in 1	SB	Mt.E(F)	Helo
	25	K7B	Put in 2	SB	LWV	Helo
	28	K4	Transfer 1	Mt.E(F)	Mt.E(S)	Helo
*		K18	Put in 2	NVL	AR	Helo
	31	K7B	Close support, take out 1.	LWV	SB	Helo
			Transfer 1	LWV	GH	Helo
		K5	Take out 1	GH	SB	Helo
			Aircargo 2	SB	Chch	C141
*	Dec. 5	K18	Transfer 2	AR	LR	Helo
*	12	K18	Transfer 2	LR	MR	Helo
	13	K4	Take out 1	Mt.E(S)	SB	Helo
	15	K5	Put in 4	SB	Mt.F	Helo
*		K18	Transfer 2	MR	HH	Helo
	17	K5	Aircargo 1	SB	Chch	C130
	19	K5	Transfer 4	Mt.F	T.Mt.	Helo
		K4	Aircargo 1	SB	Chch	C130
	20	K18	Take out 2	HH	NVL	Helo
*	21	K18	Close support	NVL		Helo
	23	K5	Transfer 4	T.Mt.	V.Stn.	Helo
*		K18	Close support	NVL		Helo
*	24	K18	Close support	NVL		Helo
	26	K5	Take out 3	V.Stn.	SB	Helo
*	27	K18	Close support	NVL		Helo
		K5	Aircargo 3	SB	Chch	C130
*	28	K18	Close support	NVL		Helo
	30	K18	Close support	NVL		Helo
*	Jan. 1	K18	Close support	NVL		Helo
	2	K18	Close support	NVL		Helo
	3	K18	Aircargo 1	NVL	SB	C130
	4	K18	Aircargo 1	SB	Chch	C130
		K18	Aircargo 1	NVL	SB	C130
	6	K18	Aircargo 1	SB	Chch	C130

* Movement in North Victoria Land scheduled from NVL base.

(contd...)

Abbreviations:

Chch Christchurch

South Victoria Land

SB	Scott Base	GH	Granite Harbour
Mt.B	Mt. Bastion		
Mt.E(F)	Mt. Erebus (Fang)	Mt.F	Mt. Feather
LWV	Lower Wright Valley		
		T.Mt.	Tabular Mt.
Mt.E(S)	Mt. Erebus (Summit)		
		V.Stn.	Vanda Station

North Victoria Land

NVL	North Victoria Land base camp
AR	Alamein Range
LR	Lanterman Range
MR	Morozumi Range
HH	Helliwell Hills

APPENDIX II - ITINERARIES

Erebus Studies and IMESS (K4).

? November	USARP/IMESS party (McIntosh, Estes, Marshall) fly from Christchurch to McMurdo.
20 November	Dibble and Otway fly from Christchurch to Scott Base.
23 November	Japanese IMESS party (Shibuya, Terai, Okayama) fly from Christchurch to McMurdo.
24 November	NZARP Event 4 party (Craddock, field assistant, Dibble IMESS/VUWAE, Otway NZGS/IMESS, Tinnelly L. & S., Rogers Waikato Univ., Thompson Waikato Univ.) from Scott Base to Fang by helo.
28 November	NZARP Event 4 party to Erebus Hut by helo.
30 November	Kyle flies from Christchurch to McMurdo.
1 December	USARP/IMESS party (Kyle, McIntosh, Estes, Marshall) from McMurdo to Fang by helo.
	Rogers and Thompson from Erebus Hut to Scott Base by helo.
3 December	USARP party from Fang to Erebus Hut by helo.
13 December	NZARP and USARP parties from Erebus Hut to McMurdo by helo.
16 December	Kyle from McMurdo to northern Victoria Land by air (with John A. Gamble).
	Otway from Scott Base to Christchurch by air.
19 December	Dibble, Estes, Marshall and Rogers to Christchurch by air.
? January 1982	Japanese IMESS party from McMurdo to Christchurch by air.

McMurdo Sediment Studies (K5).

October 16	Pyne, Cattely to Scott Base from Christchurch.
October 17 - November 3	Preparations for the field at Scott Base. Included: Fitting out Wannigan and "Cantago" sledge, repair and servicing of IH500 tractor and snow toboggan, preparation of field equipment and partial testing of scientific equipment. Survival courses, Pyne, Cattely.
October 27	Ward to Scott Base from Christchurch.
October 28	Pyne, Ward, Cattely - Helo reconnaissance of sea ice route; Scott Base - Cape Royds - Butter Point and Marble Point - (picked up 88 gal. DFA to dump at Cape Roberts) - Cape Roberts and Granite Harbour - Cape Chocolate and return to Scott Base.
October 30	Ward on survival course.
November 4	Pyne, Ward, Cattely - depart for field. Scott Base to Cape Evans.
	Alloway to Scott Base from Christchurch.
November 5	Cape Evans to Cape Royds.
November 6	Preparing scientific equipment for coring attempt off Cape Royds.
November 7	Travelled by Toboggan to sampling site 10km northwest of Royds. Returned to Royds late afternoon.

November 8	Cleaning equipment and preparing to begin across sound sampling transect.
November 9	Started transect Cape Evans to Strand Moraines.
	Monteath, Main join K5.
November 12	Alloway joins K5; Monteath, Main leave for Wright Valley.
November 13	Barrett joins K5.
November 16	K2 Surveyors join K5 for evening.
November 17	Pyne, Alloway assist K2 for sea-ice movement survey off Butter Point, returning to K5 at the Strand Moraines in late evening. Ward, Barrett, Cattely proceed with Wannigan to Strand Moraines for last sample site.
November 18	Pyne, Ward, Cattely return to Scott Base with IH500 (in need of sub-frame repairs), toboggan and K2 snowtrac.
November 18 - 23	Barrett, Alloway monitoring tide and currents at the Strand Moraines, local bathymetry measurements and investigation of the Strand Moraine erratics.
November 19 - 22	Work at Scott Base; repair of IH500 and toboggan, casting lead weights for corer, checking resupply and field equipment for Granite Harbour sampling phase.
November 23	Pyne, Ward, Cattely return to Strand Moraines with IH500 and toboggan.
November 24	K5 travelled from Strand Moraines to Butter Point.
November 25	K5 moved to Cape Roberts. Pyne, Barrett assisted K2 surveying sea-ice, then followed Wannigan and tractor to Cape Roberts.
November 27 - December 22	Sampling and bathymetry work; Cape Roberts - Cape Archer, Makay Glacier tongue, New glacier.
December 1	Barrett return to Scott Base. Fitzgerald joins K5.
December 3	Completion of work off Cape Roberts. Travelled to Dunlop Island, arriving late evening.
December 4	Travelled to Butter Point and joined K2. Stored spare fuel at Marble Point enroute.
December 5	Sampling at the Ferrar Glacier snout.
December 6 - 7	K5, K2 to Scott Base.
December 8 - 11	Toboggan traverse to Cape Chocolate for sampling aborted. Cleaned equipment and processed samples for return to NZ.
December 17	Ward return to Christchurch.

Beacon Studies in the Quartermain Range (K5).

December 14	Helo delay.
15	Alloway, Fitzgerald, Main, Pyne by helo to Mt. Feather. Heavy snow starts to fall soon after arrival.
16	Heavy snow, limited visibility. Tent day.

(contd...)

17	Snow in morning. Work in afternoon.
18	Work upsection on Feather Conglomerate.
19	Helo to Tabular Mt.
20)	
)	
21)	Work on Feather Conglomerate and Weller Coal Measures.
)	
22)	
23	Helo to Vanda.
24	Fitzgerald and Main ascend Mt. Aeolus. Main rejoins K10.
25	Christmas Day.
26	Alloway, Fitzgerald, Pyne to Scott Base.
27	Alloway, Fitzgerald, Pyne return to Christchurch.

Days at Vanda	2
Travel	3
Tent days (weather and helo delays)	3
Work days	4
Total	12

Beacon Studies at Mt. Bastion (K7A).

October 28	Walker to Scott Base.
29	Survival course.
30	Barrett to Scott Base.
October 31 - November 1	Preparation of field gear.
2	Walker and Barrett to Mount Bastion.
6	Fitzgerald to Scott Base.
8	Tent day.
13	Fitzgerald to Mount Bastion; Barrett to Event 5.
14	Monteath and Prosser to Mount Bastion.
16	Monteath and Prosser walk to Vanda Station.
17	Tent day.
21	Walker and Fitzgerald to Scott Base.

Days at Scott Base	4
Travel	2
Tent days	2
Work days	16
Total	24

(contd...)

Fission-Track dating (K7B).

November 21 — Fitzgerald joins Gleadow at Scott Base.

22 — Preparation of gear.

23) 24) — Helo delay.

25 — Fitzgerald and Gleadow to Lower Wright Valley.

26) 27) — Sampling on both sides of valley with three traverse lines completed.

28) 29) 30) — Helo delay.

December 1 — Close support along coast from Gneiss Pt. to Spike Cape. Fitzgerald joins K5 at Granite Harbour. Barrett (K5) and Gleadow return via Scott Base to Christchurch.

Days at Scott Base	4	(2 helo delay)
Travel	2	
Helo delay in field	2	
Work days	2	
Total	11	

Beacon Studies in North Victoria Land (K18).

November 22 — Preparation of field gear.

23 — McKelvey to Scott Base.

24 — Walker and McKelvey C130 to NVL Base Camp.

24) 25) 26) 27) — Helo delays.

28 — Walker and McKelvey to Takrouna Bluff, Alamein Range.

30 — Tent day.

December 2 — Tent day.

3 — Tent day.

4 — Helo delay.

5 — Move to Lanterman Range. Joined by Grindley and Oliver DSIR.

9 — Grindley and Oliver to NVL Base.

11 — Helo delay.

(contd...)

	12	Move to DeGoes Cliff, Morozumi Range.
	14	Joined by Dr. J.W. Collinson, USARP parties SO55 and SO56.
	15	K18, SO55 and SO56 move to Boggs Valley, Helliwell Hills.
	16	SO55 and SO56 to NVL Base.
	19	Helo delay.
	20	Walker and McKelvey to NVL Base.
	21	K18, SO55 and SO56 to Smith's Bench.
	22	White out.
	23	K18 to Northern Alamein Range.
	24	K18 to Mount Remington, Helliwell Hills and Jupiter Amphitheatre, Morozumi Range.
	25	Christmas Day.
	26	White out.
	27	K18 to Moauhango Nevee.
	28	K18 to Monte Casino.
	29	White out.
	30	K18, SO55 and SO56 to Neal Massif.
	31	White out.
January	1	K18 and SO55 to Roberts Butte.
	2	K18 to Gair Mesa.
	3	Walker to Scott Base.
	4	Walker to Christchurch. McKelvey to Scott Base.
	6	McKelvey to Christchurch.

Days at Scott Base	1
Travel days	2
Helo delays	6
Tent days/White out	8
Work days	25
Total	42

APPENDIX III - WEATHER OBSERVATIONS

McMurdo Sound Sea Floor Sampling (K5).

Date	Time NZST	Location Lat. Long.	Temp. (°C)	Pressure (mb)	Wind Speed and Direction	Visibility	Sky	Remarks
Nov.								
5	0800	Cape Evans	-17	-	12 knts. @ S	20km	OVC	Low cloud at 1000m, clearer on continent.
6	0800	Cape Royds	-17	-	15 knts. @ S	15km	SKC	Light blowing snow on ice and around flanks of Erebus; heavy blowing snow.
8	0800	" "	-14	-	10 knts. NE	1000m	OVC	Light falling snow.
9	0800	" "	-14	-	13 knts. @ SW	50km	BKN	7/60 ft.?
10	0800	15km west of Cape Evans	-14	-	2-5 knts. @ S	50km to E and NE	OVC	8/8 at 2000 ft.
11	0800	Cape Evans - Strand Moraines	-16	-	0	50km	broken	
12	1000	transect	-6	-	0	50km	SCT	3500m.
13	1100	"	-5	-	2-3 knts. @ SW	50km	SKC	
14	0915	"	-14	-	13 knts. @ _	50km	SKC	
15	1030	"	-15	-	7 knts. @ SE	50km	SCT	SC at 1000 ft. or m.
16	1015	"	-11	-	3.5 knts. @ NE	25km	OVC	Cu Sc at 2000m. ? ft.
17	1030	Strand Moraines	-23	-	17 knts. @ SE	50km	OVC	Cu Sc at 2000m or ft.
18	-	" "	-	-	-	50km		
19	-	" "	-	-	-	50km		
20	-	" "	-	-	-	50km		
21	1330	" "	-12	-	8 knts. @ NNE	50km	SCT	Cs above 2000m or ft.
22	1300	" "	-19	-	12 knts. @ E	50km	SKC	
23	1305	" "	-7	-	3.5 knts. @ S	50km	SKC	
24	1110	Granite Harbour	-6	-	-	50km	SKC	
25	0930	"	-11	-	-	6km	OVC	Fog, cloud st at 90% NS at 10%.
26	0940	"	-19	-	18 knts. @ SW	4km	OVC	St at 50% Cu at 50% Cloud break late in afternoon.
27	1106	"	-2	-	-	50km	SKC	Wind early at 11 knts., dying out, Nthly.
28	1026	McKay Glacier	-2	-	-	50km	SKC	Wind gusts up to 25km dying & changing dir. swiftly.
29	1113	New Glacier	-2	-	-	50km	SKC	Occasional gusts wind to 15 knts.
30	1326	" "	-1	-	-	50km	SKC	

(contd....)

Dec.								
1	1205	New Glacier	-3	-	5 knts. @ NW	50km	SCT	
2	1232	Granite Harbour	-2	-	-	50km	SKC	
3	1305	Dunlop Is.	-14	-	14 knts. @ _	50km	BKN	Wind gusts dying out.
4	1600	Butter Point	-3	-	_____ @ S	40km	BKN	

Beacon Studies in the Quartermain Range (K5).

N.B. Limited meteorological equipment available.

Date:	Time (NZST):	Location:	Altitude:	Wind speed and direction:	Visibility:	Sky:
Dec.						
15	1800	Mt. Feather	2200m	Slight-variable	200m	Snowing
16	0800	"	"	" "	100m	"
17	"	"	"	2-3 knots, W	200m	"
18	"	"	"	10-15 knots, W	10km	Overcast
19	"	"	"	Calm	Horizon	Clear
20	"	Tabular Mt.	2400m	4-5 knots, E	"	Scattered cloud
21	"	"	"	Slight-variable	20m	Fog, light snow
22	"	"	"	10-15 knots, E	20km	Scattered cloud
23	"	"	"	10-15 knots, E.	10km	Weather closing in