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1986/74. Operations report - 1985/86 Mt Read gravity survey

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Abstract

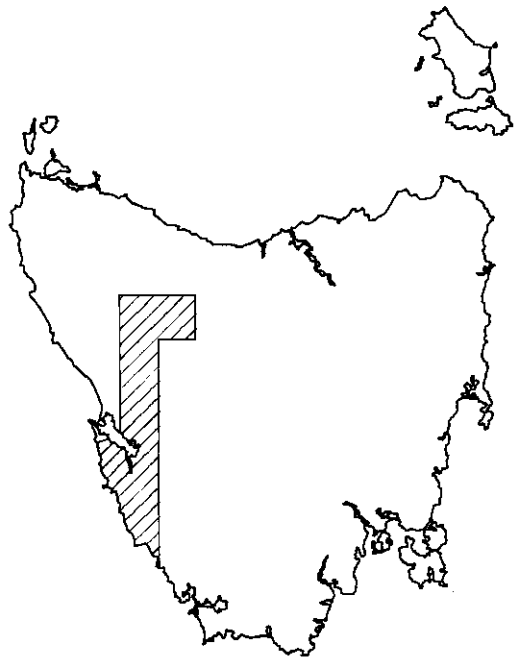
The area of Mt Read Volcanics between Elliott Bay and Black Bluff was covered with a gravity survey at a nominal reading density of one station per square kilometre over two periods totalling seven months. Approximately 90% of the 3422 stations were read during helicopter supported operations, the overall cost of which was at least 50% less than the cost of equivalent ground supported operation.

INTRODUCTION

The area surveyed is shown in Figure 1. At the inception of the programme it was proposed that the area between 375 km E and 390 km E be covered at a nominal station density of one station per square kilometre and that five kilometre wide margins to the east and west of this central strip be covered at a nominal station density of one station per four square kilometres. During the processing of the first stage of the survey it became apparent that the zone of interest extended further to the west than the coverage and a wider coverage was acquired in the southern part of the area.

Vegetation in the area varies from heavy forest through button grass to low alpine. Ground access to the area south of Kelly Basin (310 km N) is confined to the Pillinger Track and the waters of Macquarie Harbour and the Gordon River. The remaining part of this southern area was covered with helicopter access where practical. The area bounded by 375 km E, 390 km E, 380 km N and 400 km N has undergone both forestry and mineral exploration a activities and was totally surveyed using ground transport. The helicopter operations infringed on National Parks and the World Heritage Area and at these times a representative of the National Parks and Wildlife Service accompanied the field crew as an observer. The representative also took vegetation samples as part of a National Parks and Wildlife Service programme.

The first stage of the programme commenced in January 1985 and the area (the Tyndall Range) bounded by 375 km E, 390 Km E, 338 km N (Mt Owen) and 365 km N (Mt Read) was covered using helicopter access. The second stage commenced in October 1985 and concluded in June 1986. Weather conditions deteriorated towards the end of May and it is recommended that any future surveys terminate at the end of May. Appendix 1 shows the hours flown and number of stations acquired during the helicopter operations. The interpretation report (Leaman, 1986) was released in August 1986.



Area of gravity survey

FIELD TECHNIQUE

Data acquisition used aerial photographs and maps for navigation and micro-barometers for elevation determination. With the exception of the area south of 315 km N the maps and photos used were at a scale of 1:10 000 with spot-heights marked. The southern area used maps and photos at a scale of 1:15 840.

Elevations were determined by the method of Leaman (1984) using spot-heights, trig points and sea-level for control. Survey pegs were also read with the barometer but previous experience has shown that heights can be located for only a small percentage of the pegs read. Checks on accuracy, both by reading survey pegs and re-reading the same point using different known points for control, showed a maximum difference of 1.7 metres.

The gravity base stations used initially were those of Richardson and Dix (1986) but additional base stations were required at Crotty, Mt McCutcheon, Moores Valley, and Pencil Pine Lodge and these are described in Appendix 2. The gravity meters used were Worden meters W592 and W913 and a Sodin meter number 183. All but 55 of the helicopter supported stations were acquired using the Sodin meter. Data were drift corrected by assuming linear drift between base station readings.

(a) Helicopter Operations

A field crew of three was used in the helicopter. One person navigated whilst the other two read the barometer and gravity meter. As the gravity meter was being read the other person described the close topography for the near-zone terrain corrections and then read the barometer and made the field book entries. Both operations were of almost identical duration and in open country where landings were easy a reading rate of 12-14 stations per hour could be maintained.

At least three gravity base station readings were made per day. A barometer reading was made at a spot height at least once every 40 minutes and the aircraft altimeter was then adjusted to take any major pressure changes into account. Gravity readings were made on pronounced topographic features to provide additional height control. Station heights were calculated each night to allow any stations with major height discrepancies to be re-read the next day. The short time interval between known heights kept such re-reads to a minimum.

(b) Ground Operations

Two crews of two, each crew equipped with a four-wheel drive vehicle, were used in the area. Most of the stations required foot access and the times to reach a station position were quite long. Only two gravity base station readings were made each day. This is the case in most parts of Tasmania where the road network is not sufficiently dense to allow ready vehicular access.

Access to spot heights was limited to those within vehicle reach or easy walking distance and most elevations were determined by reading the barometer at a number of points whilst going to and returning from a gravity station position. Approximately 10 % of stations read required re-occupation because of major elevation differences along the entry and return routes. Where checks were possible the elevation error, after

re-reading as necessary, was less than 1.7 metres.

HELICOPTER LOGISTICS

During the first stage of the survey, in the Tyndall Range, a Bell 206 Jet Ranger based from Queenstown was used. This machine suffered from two major disadvantages; awkward entry and exit whilst in the hover, and poor rate of climb, but was available at a relatively low cost. As the survey progressed transit times to the area of operation increased to a maximum of 60 minutes per day.

For the second stage of the survey an Aerospatiale AS350 Squirrel was used. This machine was equipped with a sliding door, allowing easy entry and exit and had a good rate of climb. The extra power was particularly advantageous when the National Parks and Wildlife Service observer was also carried. The fuel capacity of the Squirrel was sufficient for approximately four hours of operation in the Queenstown area but for the southern area, where transit time to the area of operation approached 40 minutes in each direction, fuel was transported by road to Mt McCutcheon and by air to the Moores Valley airstrip.

COST COMPARISON

A cost comparison between helicopter and ground supported operations shows clearly that in remote areas or areas with difficult access, the helicopter supported operation is cheaper.

Assume that a field assistant is paid $16 000 per annum spread over 260 working days and that the daily travelling expenses rate is $60. Then the total daily cost per field assistant is $121.54. Assume also that the total cost of a four-wheel drive vehicle is $40 per day. Note that in the following calculations days scheduled for flying but with bad weather impose both a machine and labour cost.

(a) Tyndall Area (helicopter operation)

This an area of largely alpine vegetation within 15 minutes flying time of Queenstown.

Survey duration	17 days
Total helicopter charges	$30 120
Number of successful stations	464
Number of personnel	3
Cost per station	$78.27

(b) Second stage of helicopter operation

This covered most of the rest of the area with a mixture of vegetation types within 40 minutes flying time of the base of operations.

Survey duration	119 days
Total helicopter charges	$227 520
Number of successful stations	2597
Number of personnel	3
Cost per station	$104.32

(c) Ground-supported operations in Mt Read Project area

Survey duration	299 meter days
Number of vehicle days	299
Number of successful stations	361
Number of personnel (with each meter)	2
Cost per station	$234.46

(d) Ground-supported operations in Sorell area

This area near Hobart offers excellent ground and water access at the station density in use. The major land uses are grazing and urban development and the extensive sheltered coastline allows the use of boat access.

Survey duration	14 days
Number of vehicle days	14
Number of successful stations	56
Number of personnel	2
Cost per station	$70.77

From the above it is seen that in remote areas with poorly developed road networks, a helicopter-supported operation is very much cheaper than a ground-supported operation. In heavily forested areas, however, ground-supported operations remain the only practical method.

In areas of easy access (e.g. Sorell area) helicopter support is marginally more expensive than ground support provided that there is a well-developed road network. This, however, is rarely the case and helicopter support becomes relatively cheaper as the amount of walking increases.

It has been suggested that in non-forested areas ground support should be used to access stations lying on the roads and helicopter support should be used elsewhere. This is opposed for the following reasons:

(i) A known height should be read with the barometer at least once every 40 minutes.

Unless the known heights and gravity station positions lie close to the road it is impossible to remain within this time constraint.

(ii) The condition of the roads may prevent vehicle access except in dry periods.

This has proved to be a problem in the past, even in the dry south-east of the State, with vehicles repeatedly bogged for an hour or more at the same place.

(iii) It is easier and quicker to acquire data using helicopter support when the data is in simple rectangular blocks.

FIELD PERSONNEL

(a) Mines Department

S. Ashton
A. Catchpole
J. Corker
M. Dix
N. Duhig
C. Harris
R. Hooke
J. Read
R. Richardson
P. Ruzicka
R. Sedgman
M. Thornton
M. Triffett
R. Walsh
P. Wells
J. Wright

(b) Helicopter Resources Pty Ltd

C. Hardiman
N. Osborne
R. Piacenza
D. Pullinger
P. Waters
R. Williams

CONCLUSION

The combination of ground and helicopter support chosen for the 1985/86 Mt Read gravity survey proved cost effective. In non-forested areas that do not have well-developed road systems, the helicopter remains the most cost effective access method.

REFERENCES

LEAMAN, D. E. 1984. Notes on microbarometer elevation determinations. *Bull. Aust. Soc. Explor. Geophys.* 15:53-59.

LEAMAN, D. E. 1986. Mount Read Volcanics Project: Gravity interpretation, west and north-west Tasmania. *Unpubl. Rep. Dep. Mines Tasm.*

RICHARDSON, R. G.; DIX, M. J. 1986. West Coast gravity tie stations (Revision 1). *Unpubl. Rep. Dep. Mines Tasm.* 1986/79.

[14 November 1986]

APPENDIX 1

HELICOPTER SURVEY STATISTICS

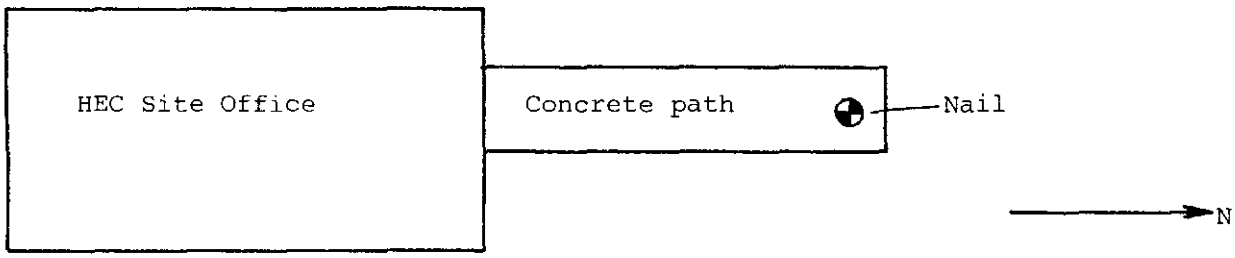
Period	*Hours Flown*	*Stations Acquired*
22/1/85 - 8/2/85	67.9	464
28/10/85-23/11/85	91.8	506
9/12/85 -21/12/85	35.3	208
20/1/86 - 31/1/86	53.7	284
17/2/86 - 28/2/86	36.7	256
17/3/86 - 23/3/86	30.4	154
7/4/86 - 20/4/86	47.4	297
21/4/86 - 3/5/86	42.0	242
4/5/86 - 17/5/86	42.6	295
18/5/86 - 31/5/86	45.3	301
1/6/86 - 5/6/86	10.0	54

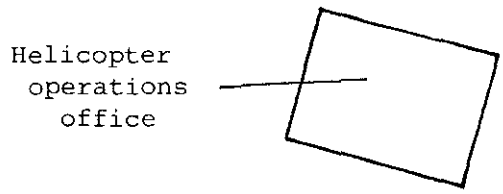
APPENDIX 2

Additional base stations

CROTTY

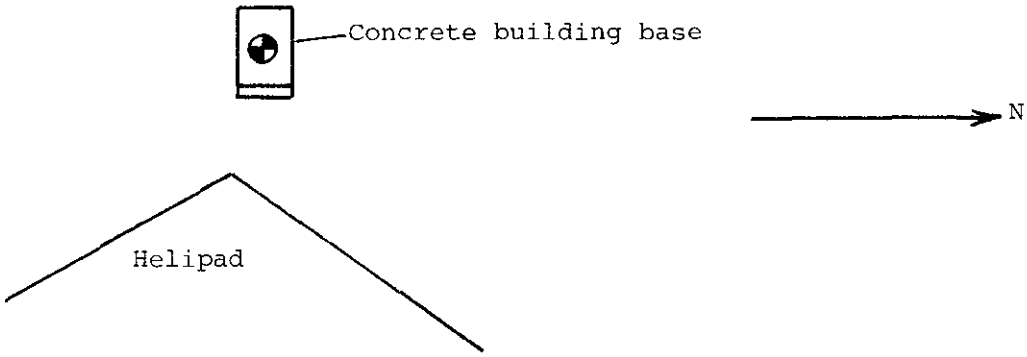
980312.34 μm/sec²





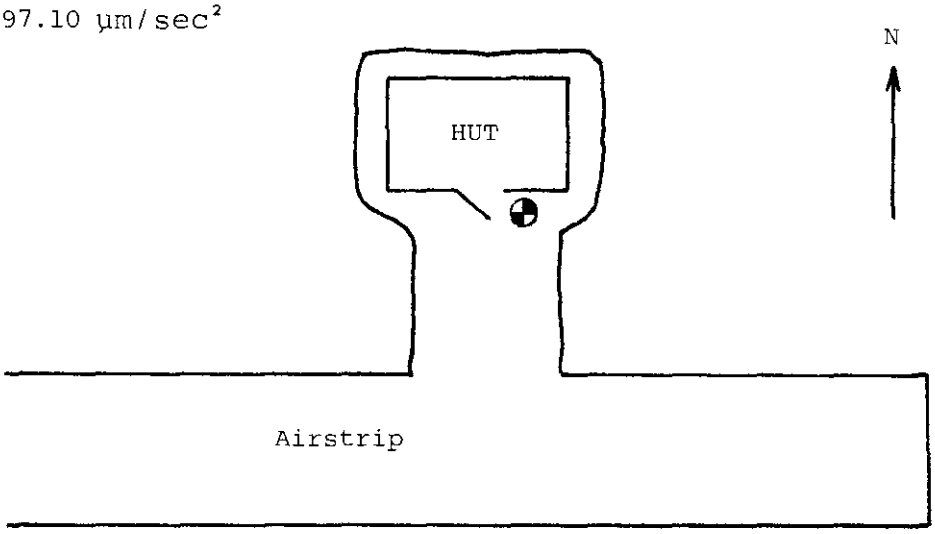
MT McCUTCHEON

980306.60 μm/sec²



MOORES VALLEY

980397.10 μm/sec²



PENCIL PINE LODGE (CRADLE)

980141.12 μm/sec²