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MAWSON GEOPHYSICAL OBSERVATORY

ANNUAL REPORT, 1986

BY

RODNEY HUTCHINSON

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SUMMARY

The work described in this report was part of the Bureau of Mineral Resources' contribution to the 1986 Australian National Antarctic Research Expedition. The observatory continuously recorded global seismic activity and the geomagnetic field at Mawson.

The period of data covered in this report is from the 1st February 1986 to 6th November 1986.

Recording instruments included a three component Photo-Electronic Magnetograph, recorded digitally on an Edas2 cassette tape recorder.

Seismic activity was monitored by a three component Benioff short period seismograph and a Press-Ewing long period vertical seismograph.

Magnetic field observations were carried out at Commonwealth Bay, Oom Bay, 100km west of Mawson, and Byrd Head, 80km west of Mawson.

Two ice falls near Mawson were recorded on the seismographs. Volume estimates were attempted on several visits to these areas.

The South Magnetic Dip Pole was located using a fluxgate magnetometer from aboard the resupply vessel M.V.Icebird.

Preliminary geomagnetic data were fowarded monthly to BMR, Australia for publication in the Geophysical Observatory Reports. Preliminary seismic data were reported weekly to BMR Canberra and relayed to National Earthquake Information Service (NEIS) of the US Geological Servey, Denver, Colorado, via the Bureau of Meteorology's Global Telecommunication System (GTS) and to all other Antarctic geophysical stations.

CHAPTER 1: INTRODUCTION

The Bureau of Mineral Resources (BMR), Division of Geophysics, Department of Resources and Energy, undertakes standard geomagnetic and seismological observatory operations at Mawson base, Antarctica. Logistic support is provided by The Australian National Antarctic Research Expeditions (ANARE), organised and operated by the Antarctic Division, Department of Science. Several other governmental agencies and universities provide personnel and equipment for the diverse scientific programs which are undertaken. Station details are listed in Table 1.

The observatory commenced operation in 1955 with the installation of a three component La Cour magnetograph from Heard Island (Oldham, 1957). The history of instrumentation at Mawson to date can be found in Appendix A.

The author arrived at Mawson on the 29th January 1986 on the M.V. Icebird. The 1985 Mawson geophysicist, Peta Kelsey returned to Australia on 14th March 1986 aboard M.V. Nella Dan allowing for an extended changeover. The replacement Geophysicist, Stewart Dennis arrived at Mawson on the 6th November 1986 aboard M.V. Icebird, and after a five day changeover the author departed on the 11th November aboard M.V. Nella Dan.

Absolute instrument comparisons were carried out by the author during the short changeover. Comparison instruments were left at Mawson upon direction from Canberra.

CHAPTER 2: MAWSON MAGNETIC OBSERVATORY

Variometers

The geomagnetic field was monitored by a three component (X;+ve true north, Y;+ve true east and Z;+ve down) Photo-electronic magnetograph (PEM) and an MNS2 PPM with a noise cancelling head located in the variometer building (Figure 1). The field at Mawson is +X,-Y and -Z with a negative declination, or variation, and a negative inclination. The data was recorded on an Edas2 seven channel digital cassette recorder in addition to a W+W six pen chart recorder in the science building (Wombat).

PEM Variometer Temperature Compensation

PEM temperature compensation circuit boards were installed and operating from 10th of March 1986.

Table 2 shows the temperature coefficients of the variometers resulting from adjustments made to the temperature compensation circuits (Seers & Black, 1985). Temperature coefficients for the X,Y and Z PEM's were calculated by a least squares analysis of drift corrected baseline value data verses variometer temperature.

Adjustment to the temperature compensation networks was initially accomplished by increasing the variometer temperature and removing the offset shown on the W+W charts by turning pot R75 (Seers & Black, 1985). For finer adjustments, baseline values at different variometer temperatures were used to determine the coefficients. An approximate figure of one turn on R75 for a change of one nT/°C was observed for these networks.

PEM Baselines and Scale Values

Table 3 shows X,Y and Z PEM adopted observed baseline values resulting from variations due to temperature compensation adjustments, QHM fibre relaxation or other effects.

Doric temperature scale values and baseline values were calculated by a least squares analysis of the observed temperature verses corresponding Edas2 counts (Table 4). Temperature scale values were calculated to yield a minimum standard deviation of generated baseline values.

Monthly observed PEM X,Y & Z scale values were used for the determination of magnetic data appearing in the monthly observatory reports. Final scale values were determined from the means of these values and reapplied to the original observation data on disc.

F scale values for 1986 were calculated by comparing the total field values observed during semi-weekly absolute observations with the concurrent variometer total field output. A similar method as used in the temperature scale value determination was applied to F data. The scatter of results was very high, although the final values agree well with S. Dennis's preliminary F scale values for February 1987.

PEM X and Y Fibre Relaxation: BLV Drift

The PEMs were installed in 1983 (Cechet, 1984). From baselines determined, the X PEM would be expected to show a baseline drift of 1 nT/month due to fibre relaxation about 18 months after installation, and 1 nT/year after a further two years. The Y PEM would take three years to stabilize to 1 nT/month and six years to stabilize to 1 nT/year (Crosthwaite, 1986).

From baselines at 10°C from February to November 1986 the X-PEM drifted -16 nT/year and the Y PEM drifted 46 nT/year. The predicted drift for 1986 should be approaching 1 nT/year for X and between 12 and 1 nT/year for Y.

Stabilisation of Variometer Temperature

The temperature of the new variometer building was susceptible to ambient wind and temperature fluctuations and would change in the order of 5°C over a 12 hour period and 1°C over a few minutes. To control this the vents were taped up leaving only a small hole for circulation. As a result the variometer temperature fluctuations were dramatically reduced from the order of 10°C to 1°C upon the onset of blizzards.

Preliminary Data

BMR's present practice is to fix BMR Standards so that all observations within Australia are homogenous and compatible. Corrections are applied to observed magnetic data to reduce them to a compatable state and to relate them to the International Association of Geomagnetism and Aeronomy (IAGA) standard.
The Canberra **preliminary standard** provides **preliminary corrections** for Australian observatories. Preliminary mean monthly data is the monthly mean of observed instrumental data corrected to field values by applying preliminary corrections. This yields the best estimate of the values at the present. The **Final Standard** will give **final corrections** yielding the best value ever likely to be obtained and can be adopted only some time after the event.

K-indices, PEM baselines (Table 5), scale values and derived ordinates from the W+W charts were used to calculate preliminary mean monthly field values. These were transmitted monthly to BMR geomagnetism section, Canberra for publication in monthly Geophysical Observatory Reports. The preliminary corrections applied in the reports have been subsequently corrected as follows;

PEM X: 0 PEM Y: -1 PEM Z: +1

Preliminary mean monthly values appearing in Table 5 of this report were calculated using magnetometer corrections;
PEM X: -4 PEM Y: +9 PEM Z: -3

The disparity was due to reappraisal of instrument comparisons and adoption of new preliminary instrument corrections.
K-indices were calculated from X and Y indices and appear in Table 5. Preliminary geomagnetic anual mean values from 1976 to 1986 appear in table 6.

Instrumentation Modifications

The battery recharging facility on the Edas2 cassette recorder system was found to be malfunctioning as the batteries were not recharging. The pot for recharging was found to be 180° out of alignment on the 18th of February 1986 and subsequently adjusted. As the author was not happy with the EDAS2 recharging facility and the poor quality of the batteries, a 12v car battery was placed on the external battery facility in case of power failure. This proved to be more reliable.

Edas2 timing was found to be out by up to 10 seconds a week upon the authors arrival. This was easily reduced by the adjustment of trim pots in the Edas2 circuitry.

Determination of Reference Mark Azimuth

Sun observations were carried out in late October 1986 to determine the azimuth of the mark SOH (Figure 1).

25th Oct 1986	-85° 44.9´
31st Oct 1986	-85° 44.8´

Sun observations were also carried out by the author for the Bureau of Meteorology on the 31st October. The azimuth from the Meteorology theodolite station to Bechevaiese Trig Station and Welsh Island Drum Beacon was determined as follows;

31st Oct 1986	297° 32.9´ to Bechevaise Trig
	26° 37.6´ to Welsh Is. drum beacon.

BMR theodolite 532345 was used all determinations.

These azimuths compared favourably with previously determined azimuths to the same marks. The method of calculation is detailed in Appendix 2.

Absolute Instruments

QHM 300 with thermometer 1650, Askania Declinometer 630332, Askania glass circle 611665 and Elsec PPM E770-199 were the primary standard magnetic absolute instruments. QHM 301 and 302 were used as backup and field instruments along with BMZ 62.

Residual torsion changes incurred in 1985 (Kelsey, in prep) were found by the author not to be due to the swapping of thermometer 2143 for 1650. Mean residual torsion (alpha), for QHM 300= 12.5´ +/- 1.3´.

Instrument differences between QHMs 300,301 and 302 since 1982 are listed in Table 7. Differences for 1986 tend to agree with Kelsey's suggestion of a decrease of 4.3nT on 19 March 1985 for the preliminary QHM 300 correction.

In 1987 the number of QHM 301 and 302 observations has been increased for a better control on the above differences.

Computerization

A number of software programs were written by the author for the determination of monthly baselines and temperature coefficients on a privately owned IBM compatible computer, allowing continuous updating of preliminary magnetic data and monitoring the effects of temperature compensation adjustments.

An HP 150 was purchased by the Geomagnetism section during the year and proved valuable for processing the years data upon return to Australia after adoption of yearly parameter. Delays and typing errors usually incurred from data entry at BMR on return were avoided as the year's data were returned on floppy disc and read straight into the HP 150.

PEM Record Loss

A summary of digital and analogue magnetic data loss appears below. Full details of record loss appear in table 8 and figure 4.

Cause	W+W hr:mn	Cause	EDAS2 hr:mn
Power failure	01:00	Tape ran out	22:08
Y pen ran out	17:00	EDAS malfunction	2640:
Chart loss	35:25		
PEM modification	03:50		
PEM Temp compensation	01:57		
Tape change	08:16		

Due to the large amount of Edas2 digital data loss (Fig. 4), mean hourly values for the period 00 UT 17-5-1986 to 00 UT 4-9-1986 are derived from the analogue W+W chart records. For the remaining period from the first of February to the sixth of November 1986, the mean hourly values are derived from Edas2 digital data.

CHAPTER 3: FIELD MAGNETIC OBSERVATORIES

Comparison of Field Instruments

QHM 302 was used for the measurement of H and D at two field sites near Taylor Glacier shown in Figure 2. QHM 301 and 302 were compared through XYZ baselines with QHM 300 (Table 6) and the resulting corrections applied to the regional values (Table 9) reducing the data to instrumental standards QHM 300, Dec 332 and PPM 199.

BMZ 62 was used to determine the Z component and was compared through baselines to the Z component calibrated from QHM 300 and PPM E770-199.

Commonwealth Bay (Cape Denison)

The scientific base at Cape Denison was erected as nearly as circumstances would allow directly north of the Magnetic Pole Area. About six weeks after landing, the chief magnetic observer, E.N.Webb, began regular absolute measurements in the Absolute Hut. These continued from 20th February 1912 till November 1912, when he left on the sledge journey to the magnetic polar area. Subsequent work was done by Hannam, and later by Bage. The results of this work, combined with expeditions in the Ross Sea area, and Mawson's results during Edgeworth David's 1908/1909 journey to the magnetic polar region, confirmed and qualified the northwesterly motion of the dip pole.

The author visited Webb's absolute hut on Sunday 5th January 1986. Observations of F and D were made between 0200 and 0600 universal time (ut) (Appendix B). Other field values appearing in appendix B were provided by Steve Tremont of the 1986 Project Blizzard Team.

Unfortunately, the field was unsettled and the time of observation was not optimum (Webb, 1925); the H observations were unsatisfactory as the QHM magnet flipped.

Mean D = 116° 35.9´ East
Mean F = 65914 nT

Declination was observed to change from 108° 31.7´E to 127° 12.9´E over 10 hours. F changed by 7025 nT over a similar period.

Byrd Head and Oom Bay

Figure 2 shows the location of the Byrd Head and Oom Bay magnetic sites visited by the author on the 10th and 12th of October 1986 respectively. Oom Bay was visited in 1983 (Cechet 1984). A cairn marked the exact location. Cechet was unable to take a sunshot of his mark and quoted the angle of declination from the mark. The azimuth to what probably was his mark has now been determined by the author as 97° 24.7´.

Byrd Head was visited by P.McGregor in the early 50's (Pers-comm). No brass peg or cairn could be found in the area and the precise location is not quoted so the author selected the tip of Byrd Head as the site. Preliminary values of these observations can be found in Table 9.

Location of the South Magnetic Dip Pole (SMP)

At midday on the 6th January 1986, the position of the SMP was determined by the author to be 65°14.4´S, 139°45.0´E (Barton,1987). Observations of the magnitude and direction of the horizontal field were made from the stern of the Australian Antarctic charter vessel Icebird, which was approximately 11 km from the pole when the above position was determined.

The mean position of the dip pole was estimated at approximately 65°20´S, 139°15´E; about half a degree south of the IGRF 1985 dip pole for epoch 1986.

The technique used for this experiment was to determine H by sailing the vessel in a tight circle while integrating the signals from two fluxgate magnetometers over 20° sectors. Components of the horizontal field for each sector were averaged over a complete 360° turn, cancelling the residual field of the vessel and yielding a magnitude and direction for the horizontal component of the earths magnetic field. For the purpose of preliminary reduction of observations on board ship, a value of 4.70 nT/km for the rate of change of H with distance was used. Final data reduction in Canberra was based on the 1986.0 pattern of the field given by IGRF 1985.

CHAPTER 4 SEISMOLOGICAL OBSERVATORY

Operation

Seismic activity was monitored by three short period Benioff seismometers and one Press-Ewing long period seismometer located in the Cosray vault. The pre-amplified signal from these seismometers was amplified and recorded in Wombat on three hot pen helicorder drums. Seismic data were forwarded to the Earthquake Seismology section (Australian Seismological Center), BMR, Canberra as well as into the WMO/GTS system for global transmission.

The LPZ TAM5 pre-amplifier was still separated from the instrument rack with its own mains-fed, transformed power supply. The problems associated with relocating the amplifier into the rack have been outlined previously (Crosthwaite, 1986). No changes to this situation were attempted. Similar cross-talk was observed on the SP horizontals in response to a calibration pulse on the SPZ.

The wiring from the rack to the seismometers and to the make-shift junction board on the main cable to Wombat are old and cumbersome and are in need of replacement. It is suggested that a new rack be constructed in Canberra, fitted out with pre-amplifiers, tested and sent to Mawson and that the existing rack be returned to Australia.

The LPZ boom frequently had to be centered after coming to rest on the stoppers. Low pressure systems have been suggested to cause this phenomena (Cechet,1984), along with temperature fluctuations but these factors were not observed to be the cause of drift. The regularity of drift suggests a cause other than atmospheric.

Modifications

A rectilinier pen helicorder was installed into the seismic rack for recording SPZ on 31st of January 1986.

A two pen set up on the SP horizontals was installed on the 5th of February 1986.
On the 11th of February 1986 the author completed re-wiring the seismic instrument rack in Wombat. Initially the cables from Cosray and the variometer building came up through the floor to a make shift junction board 2.5 m up the wall behind the rack. From this board a jungle of leads ran down to the rack so one would have to wade through all the input leads to access the rack. Two Telecom-type junction boards were installed onto the rack. The main cables were relocated next to the rack and led up the side to the junction box for distribution to the AR320's. The DC distribution board was attached to the front of the rack and cables to the La Cour system removed. The inverter for AC backup was positioned into the rack resulting in an easily accessible configuration.

The above modifications do not alter the existing wiring specifications for the Mawson seismic system (Kelsey, 1987).

Calibration

Calibration pulses were applied to SPZ charts only. The polarity of the seismometers was corrected to the standard up, north and east ground movement all being up the page on 14th of February 1986 therefore the polarity of the traces may be spurious between the 9th and 14th of February. Polarity determinations were conducted with a person at the helicorder listening on a phone as the weights were lifted. This shows that the initial movement is over-written by subsequent pen deflections which may lead to erroneous polarity setups in the past. These polarities were recorded on all charts along with amplifier settings, date and time.

Complete calibration of SPZ was carried out on 24th of February 1986. Results of this calibration are listed in Table 10. The frequency output from the BWD Minilab function generator was found to be stable if left on for long periods but the analogue selector was unreliable. For this reason frequencies used for SPZ calibration were measured by an HP frequency counter on loan from Aeronomy. A Fluke digital multimeter was used to monitor input signals. Peak to peak voltages were obtained by measuring peak positive and negative voltage by swapping the leads and adding. A CRO was used to check the wave form. There is a need for a new function generator and/or a frequency counter. A portable storage CRO is also highly desirable.

The LPZ seismometer was not calibrated as the long period data was not required for telexing and the LPZ system was very unstable as outlined above.

Refer to Appendix D for calculation of calibration factors.

Data

P-phase arrival times were reported weekly to BMR Canberra and relayed to National Earthquake Information Service (NEIS) of the US Geological Servey, Denver, Colorado, via the Bureau of Meteorology's Global Telecommunication System (GTS) and to all other Antarctic geophysical stations.

Icefalls Near Mawson

Two icefalls were detected on the seismographs and later investigated;

1: An icefall along a 2.5 km front 25 km east of Mawson occurred at 1100 11s utc 8/8/1986. The part above sea level was estimated at 10,000,000 cubic meters.

2: A second iceberg calving occurred one kilometer east of Mawson at 2326 utc 20/10/1986 and was estimated at 150,000 cubic meters.

Full details of these events including seismic charts, location maps, method of volume estimation, and photographic records can be found in the Mawson 1986 archives at BMR.

CHAPTER 5: CONTROL EQUIPMENT

Power Supplies

Station mains (240V ac) and two lead-acid battery systems supply power to the seismic system. The AR320 amplifiers are powered by station mains with -12V, 0, +12V dc back-up power. The helicorders run off an Invertech inverter (240V ac) with switching to station mains if the inverter fails.

The inverter, radio and SPZ calibrator are powered by a -12V, 0, +12V battery system. The primary power to the GED clock is station mains with the 0, 24V battery system supplying dc back-up power. The Time Mark Relay Driver, which supplies time-marks from the clock to the AR320 amplifiers and the W+W chart recorder, is powered from the clock (0, +12V). This was initially designed with a 0, 12V external power supply but was modified to be powered from the clock.

For time comparisons between the clock and radio pips, the respective time signals are displayed on the CRO via the Time Mark Relay Driver. This connects the 0V (circuit board earth) of the Time Mark Relay Driver to mains earth via the CRO; hence the 0V of the 0, +24V battery system to mains earth. It is easy to inadvertently earth the AR320 amplifiers (or any other component of the system).

The seismometers in the Cosray vault use station mains and a 12V dc back-up power system. The W+W chart recorder uses station mains. The Edas2 uses station mains as its primary power source and a 12V lead/acid battery as mains failure back-up. The new variometer system (PEMs and MNS2) utilizes station mains power and a 24V dc back-up power system (see Kelsey, 1987; Section 2.4.3) located in the new magnetic variometer building.

Timing

A Labtronics radio was used to provide time pips from Radio Lyndhurst, Victoria (VNG), for timing control. Radio reception was usually from VNG as other stations (Crosthwaite, 1986) are rarely received at Mawson. The Ionospheric Prediction Service (IPS) supplies BMR with a "V" antenna located on IPS aerials.

Two GED digital crystal oven clocks were kept running through the year to an accuracy of 50ms. The spare clock showed a large drift and needs rate adjustment before use. The GED clock was used for providing time marks to the seismic system and to the W+W magnetic chart via a time mark relay driver (see Figure 13; Kelsey, in prep).
Time comparisons between the clock and radio pips from VNG for timing control were made by displaying both signals on a dual channel CRO (Crosthwaite,1986).

The Edas2 cassette recorder was started manually from observation of the clock via the teletype.

Cables

No cable damage was incurred during the year. The only danger area was where the seismic cable connects to the site services tray near the water supply building (Figure 1). People frequently work in this area so the cable was tied to a pipe and scaffolding before it joined the cable tray. No evidence of wind abrasion was observed upon the author's departure.

Several cables were removed from the area between Wombat and the rock crusher by the author and Peta Kelsey over the summer, as the Department of Housing and Construction (DHC) were moving a building in this area which provided the oportunity.

CHAPTER 6: Buildings and Building Maintenance

Absolute Hut

The absolute hut at Mawson was initially constructed at Heard Island in 1951 and transported to Mawson in 1954, (McGregor, 1979). The hut is old and in need of replacement. Upon inspection of the hut in February 1986, Brian Turnbull from the Antarctic Division offered to submit an urgent request for a new absolute hut to the Antarctic Division (pers comm).

On the 5th of August 1986 the hut was found to be at ambient temperature. This was the result of a corroded power switch falling apart. The switch was replaced along with some power cable to the light over the absolute pier. The light socket was also replaced.

About one third of the joints in the walls and floor were sealed with Silicone Sealant 88 Expandite-Rawplug on the 15th of May 1986. Styrofoam is used to insulate the windows of the hut and the above sealant was found to be useful for securing the old, shrinking foam in position. This was necessary as a styrofoam panel falling from the roof window on the 9th of May 1986 led to the glass breaking and slipping down, causing the hut to cool to ambient temperature. If the panel had fallen from the other roof window it may have dropped onto the declinometer which is kept unclamped on the pier when not being used for absolutes.

A non-magnetic heater was installed in the absolute hut on the 17th of April 1986 at 1057 UT, replacing a simple bar radiator. An initial trial showed the temperature of the hut to rise to 30°C, creating heat shimmer when viewing the mark and creating an uncomfortable working temperature. Utilization of a thermostat from the old variometer building kept the temperature to within a few degrees from 10°C through the winter.

Variometer

The vents in the new variometer were further taped up for better temperature control.

Wombat

Part of the front landing (south west corner) of Wombat was removed accidentally by a 950 (huge fork lift) as the driver was inadvertently distracted by a passing female expeditioner.

CHAPTER 7: Other Duties

Assistance was provided by the author in the re-supply of Casey and Davis on route to Mawson.

The author assisted in the setting up of a wind powered VHF radio repeater station in the David Ranges south-east of Mawson, approximately 2km north-west of the Fang Peak field hut.

A series of computing lectures was given by the science personnel to expeditioners over 4 weeks.

The author also took part in the construction and painting of the new Rum Doodle field hut and the welding, concreting and placing of 44 gal drum beacons on the plateau south of Mawson.

The usual station duties were performed. This included one night per month night watch, a couple of weeks of full time kitchen duties and Saturday afternoon council duties (garbage disposal etc.). Volunteer cooking was also done to enable the full time cook to go on field trips.

1986 Mawson expeditioners were actively involved in the general cleaning of the base. Approximately half a tonne of nails, a few containers of scrap metal and odd junk from around the base were collected and the old rubbish tip where waste was regularly burned was removed. All waste was subsequently burned in a specially designed incinerator and the residue returned to Australia.

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The author wishes to express his thanks to the Mawson 1986 wintering and summering parties for their assistance and co-operation. In particular special thanks are due to Mathew Shirlock and Peter Yates for their involvement in the south magnetic pole experiment and the technical advise offered as the author was testing the new PEM controller boards. Again, Mathew Shirlock along with Jim Hasick deserve special thanks for carrying out the daily routine during the author's absence.

The captain and crew of MV Icebird are thanked for their help in preparation for and execution of the south pole experiment.

Mark Conde, Peter Yates, Michael Knight and Dave Gillies provided support to the author with his requests for and execution of scientifically based field trips.

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APPENDICES

Appendix A: History of Mawson Instrumentation up to 1987

A brief summary of the development of Mawson Geophysical Observatory in terms of instrumentation up to and including 1986 is presented below.

Geomagnetic

May 1955	:	Absolute instruments used for regular observations of H, D & Z (Oldham, 1957).
Jul 1955	:	Continuous recording commenced by three-component normal La Cour magnetograph (Oldham, 1957).
1957	:	Bar-fluxmeter magnetograph installed (Pinn, 1961).
Jan 1961	:	Three-component insensitive La Cour magnetograph installed and recording commenced (Merrick, 1961).
Dec 1967	:	Bar-fluxmeter magnetograph withdrawn (Dent, 1971).
Sep 1968	:	Insensitive La Cour magnetograph converted to medium sensitivity and renamed normal magnetograph. The normal La-Cour magnetograph was renamed sensitive magnetograph (Smith, 1971).
Feb 1975	:	15 mm/hr normal recorder replaced by 20 mm/hrrecorder (Hill, 1978).
Dec 1975	:	15 mm/hr sensitive recorder replaced by 20 mm/hr recorder.
Mar 1981	:	MNS2 proton precession magnetometer installedfor absolute measurements.
Aug 1982	:	La Cour sensitive magnetograph removed (Silberstein, 1984).
Jul 1983	:	Photo-electronic magnetometer (PEM) X and Y components installed (Cechet, 1984).
Jul 1983	:	MNS2/1 proton precession magnetometer ceased operation (Cechet,1984).
May 1984	:	Digital recording of PEM X and Y component data began (Crosthwaite, 1986).
Dec 1985	:	La Cour normal magnetograph ceased operation. X,Y and Z PEMs commenced operation (Kelsey, in prep)
Mar 1986	:	X, Y and Z PEM temperature compensated. to less than 1 nT/°C.

Seismological

Jul 1956	:	Three-component Leet-Blumberg seismograph (pen-and-ink recorder) installed.
1960	:	Three-component seismograph installed consisting of Benioff seismometers (free period 1.0 s) and three-channel BMR single drum recorder. Z galvanometer 0.2s free period, horizontal galvanometers free period 70s (Merrick, 1961).
Feb 1963	:	BMR recorder replaced by Benioff 60 mm/min three channel recorder. 14s free period horizontal galvanometers installed (Black, 1965).
Sep 1970	:	14s free period horizontal galvanomters replacedby short period (0.2s) galvanometers (Robertson, 1972).
Dec 1973	:	Z seismometer transferred to vault beneath Cosray building (Almond, 1975).
Apr 1977	:	Transfer of Geophysics office, including power and timing to Wombat (Science Building).
1978	:	Recording of SP-N Benioff seismometer discontinued (Petkovic, 1973).
Jul 1981	:	Helicorder hot-pen recorder installed for SP-Z and LP-Z; and SP-N Benioff restored.
Aug 1983	:	Four Teledyne-Geotech seismic amplifiers (AR320) installed for connection to twin hot pen recorders (Cechet, 1984).
May 1984	:	Horizontal seismometers and the Benioff photographic recorder disconnected (Crosthwaite, 1986).
Feb 1985	:	Horizontal seismometers installed in Cosray vault, output to visual hot pen recorders in Wombat (Crosthwaite, 1986; Kelsey, in prep)
Feb 1986	:	SPZ Rectilinear Pen Helicorder. Two Pen Helicorder for SP horizontals. Rewiring of the instrument rack in Wombat.

Appendix B: Magnetic Observation Data From Commonwealth Bay

OBSERVED TOTAL FIELD OBSERVATIONS 5/1/86

UT	PPM READINGS (nT)				un-corrected PPM E770-193			
0250	66971.	67474.	67242.	66600.	67203.			
0251	66760.	65526.	65672.	66257.	66431.	66967.	66579.	66397.
0253	66883.	65948.	67102.	66594.				
0356	69428.	69386.	69426.	69413.	69387.	69395.	69336.	69306.
0357	69252.	69251.	69444.	69190.	69613.	69235.	69283.	
0456	65791.	67111.	65762.	65778.	65777.	65771.	65780.	65771.
0458	65769.	65775.	65776.	65778.	65775.			

PROJECT BLIZZARD OBSERVATIONS

Compass Theodolite TO-93794 (WILD)

Preliminary correction; +40´ applied to D data.

ELSEC: E770/206

Preliminary Correction; -2nT applied to F data.

Reference Mark Azimuths
West Mark= 245° 54.9´+E
East Mark= 62° 34.2´+E

Observations by Steve Tremont

time UT	day No.	yr	reading° +E	mark° +E	mag nth° +E	D° East (prelm)	F(nT) (prelm)
1340	351	85	132.433	245.915	113.482	114.149	65843
1342	351	85	132.500	245.915	113.415	114.082	65845
1344	351	85	132.533	245.915	113.382	114.049	65845
1346	351	85	132.583	245.915	113.332	113.999	65848
1348	351	85	132.683	245.915	113.232	113.899	65845
1350	351	85	132.783	245.915	113.132	113.799	65847
1352	351	85	132.800	245.915	113.115	113.782	65849
1354	351	85	132.933	245.915	112.982	113.649	65848
1356	351	85	133.033	245.915	112.882	113.549	65852
1358	351	85	133.067	245.915	112.848	113.515	65852
1400	351	85	133.083	245.915	112.832	113.499	65853
1200	001	86	132.767	245.915	113.148	113.815	65949
1300	001	86	133.350	245.915	112.565	113.232	65969
1400	001	86	133.433	245.915	112.482	113.149	66003
1500	001	86	137.333	245.915	108.582	109.249	66059
1600	001	86	133.167	245.915	112.748	113.415	66038
1700	001	86	133.433	245.915	112.482	113.149	72798
1800	001	86	133.817	245.915	112.098	112.765	65974
1900	001	86	133.550	245.915	112.365	113.032	65971
2000	001	86	133.367	245.915	112.548	113.215	65984
2100	001	86	133.233	245.915	112.682	113.349	65882
2200	001	86	133.100	245.915	112.815	113.482	65830
2300	001	86	134.400	245.915	111.515	112.182	65781
0000	002	86	128.767	245.915	117.148	117.815	65773
0100	002	86	118.700	245.915	127.215	127.882	65860
0200	002	86	119.767	245.915	126.148	126.815	65854
0300	002	86	124.600	245.915	121.315	121.982	65832
0400	002	86	127.383	245.915	118.532	119.199	65811
0500	002	86	128.083	245.915	117.832	118.499	65898
0600	002	86	130.017	245.915	115.898	116.565	65924
0700	002	86	130.600	245.915	115.315	115.982	65924

Appendix B (cont)

time UT	day No.	yr	reading° +E	mark° +E	mag nth° +E	D° East (prelm)	F(nT) (observed)
0800	002	86	131.250	245.915	114.665	115.332	65979
0900	002	86	132.017	245.915	113.898	114.565	65962
1000	002	86	132.017	245.915	113.898	114.565	65945
1100	002	86	131.317	245.915	114.598	115.265	65924
1200	002	86	134.233	245.915	111.682	112.349	65945
1300	002	86	134.950	245.915	110.965	111.632	66074
1400	002	86	130.717	245.915	115.198	115.865	65937
1500	002	86	130.300	245.915	115.615	116.282	65999
1600	002	86	130.217	245.915	115.698	116.365	65975
1700	002	86	130.150	245.915	115.765	116.432	65966
1800	002	86	130.233	245.915	115.682	116.349	65982
1900	002	86	130.083	245.915	115.832	116.499	65970
2000	002	86	130.167	245.915	115.748	116.415	65920
2100	002	86	128.750	245.915	117.165	117.832	65933
2200	002	86	128.933	245.915	116.982	117.649	65955
2300	002	86	128.950	245.915	116.965	117.632	65914
0000	003	86	135.567	245.915	110.348	111.015	65847
0100	003	86	127.667	245.915	118.248	118.915	65836
0200	003	86	127.400	245.915	118.515	119.182	65850
0300	003	86	128.600	245.915	117.315	117.982	65845
0400	003	86	132.333	245.915	113.582	114.249	65880
0500	003	86	129.150	245.915	116.765	117.432	65897
0600	003	86	128.450	245.915	117.465	118.132	65934
0700	003	86	128.900	245.915	117.015	117.682	65924
0800	003	86	129.933	245.915	115.982	116.649	65877
0900	003	86	130.400	245.915	115.515	116.182	65920
1000	003	86	134.450	245.915	111.465	112.132	66041
1100	003	86	134.650	245.915	111.265	111.932	65978
1200	003	86	136.067	245.915	109.848	110.515	65959
1300	003	86	135.283	245.915	110.632	111.299	65939
0250	005	86					67096
0251	005	86					66322
0253	005	86					66630
0300	005	86	129.188	245.915	116.727	117.394	
0301	005	86	129.197	245.915	116.718	117.385	
0303	005	86	305.487	422.570	117.083	117.750	
0356	005	86					69375
0357	005	86					69322
0400	005	86	129.188	245.915	116.727	117.394	
0400	005	86	129.183	245.915	116.732	117.399	
0401	005	86	305.487	422.570	117.083	117.750	
0404	005	86	312.940	422.570	109.630	110.297	
0404	005	86	312.797	422.570	109.773	110.440	
0405	005	86	312.805	422.570	109.765	110.432	
0406	005	86	130.655	245.915	115.260	115.927	
0407	005	86	130.943	245.915	114.972	115.639	
0408	005	86	131.022	245.915	114.893	115.560	
0409	005	86	131.056	245.915	114.859	115.526	
0410	005	86	308.802	422.570	113.768	114.435	
0411	005	86	308.793	422.570	113.777	114.444	
0456	005	86					65921
0458	005	86					65773
0502	005	86	130.285	245.915	115.630	116.297	
0502	005	86	130.325	245.915	115.590	116.257	
0503	005	86	130.322	245.915	115.593	116.260	
0503	005	86	130.327	245.915	115.588	116.255	

Appendix C: **Method of Calculation of Sun Observations**

Hc= $\sin^{-1}$[sin(d)*sin(L) + cos(d)*cos(L)*cos(LHA)]

where;

Hc = theoretical altitude of Sun
d = Sun's declination
L = latitude of observer (-ve for southern hemisphere)
GHA = Greenwich hour angle from Nautical Alminac
LHA = Local hour angle
LHA = GHA + East Longitude

Z= $\cos^{-1}${[sin(d) - sin(L)*sin(Hc)] / [cos(L)*cos(Hc)]}

Zn= Z if sin(LHA) is less than 0
= 360-Z if sin(LHA) is greater than or equal to 0

where;

Z = azimuth to Sun
Zn = corrected azimuth to the Sun

Sun's declination and GHA can be obtained from the Nautical Alminac.

Knowing the true azimuth to the Sun and the circle reading at the time of the observation, a circle correction can then be calculated and applied to reading's of the reference mark.

NOTE, Z can be calculated using the FORTRAN function ATAN2;

z = ATAN2 [sin(LHA) , cos(LAT).tan(DEC) - sin(LAT).cos(LHA)]
which allows for the quadrant of Z being lost in the above Zn equation.

Appendix D: Calculation of Seismometer Calibration Constants

$$mag = \frac{A}{K \times Is \times T^2} = \text{magnification}$$

where;

A = P-P pen deflection of test wave (mm)

Is = P-P sinusoidal current through coil from input test wave (mA)

T = Period of test wave (s)

G = Motor Constant (Newton/amp or N/A)

$$G = \frac{9.81(Xp \,.\, m)}{(Ip \,.\, Xw)}$$

Ip = Current pulse amplitude (mA)

Xp = Pen deflection amplitude (mm)

m = test weight (g)

Xw = Pen deflection amplitude (mm)

M = Seismo mass (kg)

$$K = \frac{G}{4pi^2 M}$$

$$\text{Ground movement (nm)} = \frac{\text{P-P amplitude X } 10^6}{2 \text{ X mag}}$$

Ground movement (nanometers) is reported in seismic telexes.

Appendix E: **QHM Calculations**

All QHM observations (preliminary and final) for PEM variometer baselines were calculated using the following H formula. Residual torsion corrections were included (McGregor, 1967; Crosthwaite, 1986 (Appendix D)). Delta D corrections were calculated from X & Y PEM counts.

$$\log H = C + \log n - \log\sin(\mathrm{phi}) + c_1.t - c_2.H.\cos(\mathrm{phi}) - \log\cos(V)$$

where H = horizontal field strength

C = QHM constant

n = number of whole turns of the QHM from the zero position eg, for 2pi; n=1 and for 3pi; n=1.5

phi = mean deflection angle $((\mathrm{mean}^+ - \mathrm{mean}^-)/2)$

c_1 = QHM temperature coefficient

t = mean value of temperature in the two deflected positions

c_2 = induction coefficient

V = a + 0.5(J)

J = mean^+ reading + mean^- reading - $2(\mathrm{mean}^0$ reading)

a = deviation due to residual torsion

$$= \frac{\cos(\mathrm{phi})}{2(1-\cos(\mathrm{phi}))} . J$$

The QHM coefficients are given below :

	C	$c_1 (\times 10^{-5})$	$c_2 (\times 10^{-10})$
QHM 300	4.19467	17.1	30
QHM 301	4.21644	17.4	40
QHM 302	4.18696	18.4	40
QHM 172	4.20077	17.0	20
HTM 704	4.081045	11.3	

TABLES

TABLE 1: Station Data for Mawson 1986

Magnetic Absolute Hut	- Pier A (instrument level)
Geographic co-ordinates	67°36´14.2"S 62°52´45.4"E
Geomagnetic co-ordinates	73.34°S 105.89°E
Elevation (m)	12
Foundation	Precambrian Granite
Magnetic Variometer Building	- New, Mark N1
Geographic co-ordinates	67°36´11.4"S 62°52´38.5"E
Elevation (m)	9
Foundation	Precambrian Granite
Magnetic Variometer Building	- Old
Geographic co-ordinates	67°36´13.0"S 62°52´38.5"E
Foundation	Precambrian Granite
Cosray Building	- Seismometer platform
Geographic co-ordinates	67°36´16.6"S 62°52´16.6"E
Elevation (m)	17
Foundation	Precambrian Granite

The co-ordinates of pier A, Mark N1 and the Cosray building seismometer platform were measured by Crosthwaite in 1984 using ISTS-51 as a reference location. This reference is a satellite trig station positioned by the road near the old Seismic Vault and the Bureau of Meteorology buildings. Its location is 67°36´04.95"S 62°52´23.66"E, its height above mean sea level is 9.79m and its spheroidal height is 39.37m.

The co-ordinates of all buildings were measured by Australian Survey Office surveyors, and the WGS 72 co-ordinates provided by ASO agree within 0.2" of latitude and longitude with the instrument pier co-ordinates measured by Crosthwaite.

Elevations quoted are Height Above Mean Sea Level. The elevations of Pier A, Mark N1 and the top of the Cosray shaft were measured relative to ISTS 51. The quoted elevation of the seismometer platform assumes the shaft to be 13m deep.

TABLE 2: Temperature Compensation of PEM's

utc	date	Xturns	Yturns	Zturns #	QX	QY	QZ
						(nT/°C)	
					2.45	-6.35	-12.94
1058	30/1/86			ins------			
					2.45	-6.35	-7.17
1300	24/2/86						
					2.45	-6.35	-7.9 *
1302	7/3/86	ins--------------------					
					0.3	-2.0	-7.9
0500	10/3/86		ins--------------				
					0.3	-2.0	-7.9
0830	3/4/8			+2-------			
					0.3	-2.0	-4.9
2038	4/4/86			+2.5-----			
					0.3	-2.0	-3.3
1155	11/4/86	+0.25	-1.0	+1.5-----			
					1.3	-2.1	-1.9
0500	15/4/86	-0.33	-2.0	+2.5-----			
					1.4	-3.5	0.4
1051	9/5/86	+2.33	+3.0-------------				
					-1.0	-1.1	0.4
1454	20/5/86	-0.75	+1.0-------------				
					0.1	0.6	0.4
0000	1/11/86						

X,Y and Z turns are positive (clockwise) on R75 (Seers & Black 1985) as viewed from the electronics panel towards the sensor.

* QZ difference due to new observer.

ins Temperature compensation circuit boards installed into PEM's.

QX, QY and QZ are in nanotesla's per degree celcius.

TABLE 3: Observed Baseline Values for PEM X,Y,Z,Temp and F

utc	date	X BLV @ 10°C (nT)	+/-	Remarks
0000	1/3/86			New observer
		8180	5	
0000	9/3/86			Temp comp installed
		8144	2	
0000	14/6/86			Fibre relaxation
		8141	1	
0918	5/9/86			Blizzard static
		8137	2	
0000	1/11/86			

utc	date	Y BLV @ 10°C (nT)	+/-	Remarks
0000	1/3/86			New observer
		-16504	10	
0000	11/3/86			Temp comp installed
		-16600	3	
0000	28/4/86			Unknown
		-16595	2	
0930	30/6/86			Fibre relaxation
		-16591	1	
0000	4/7/86			Fibre relaxation
		-16588	1	
0000	24/7/86			Fibre relaxation
		-16584	1	
0000	30/9/86			Fibre relaxation
		-16580	1	
0000	1/11/86			New observer

utc	date	Z BLV @ 10°C (nT)	+/-	Remarks
0000	1/3/86			Temp comp installed
		-46365	15	
0000	11/3/86			Temp comp adjustment
		-46300	5	
0000	6/4/86			Temp comp adjustment
		-46323	2	
0918	5/9/86			Blizzard static
		-46326	3	
0000	1/11/86			New Observer

utc	date	F(10) BLV (nT)	+/-	Remarks
0000	1/3/86			F(1) BLV was undeterminable from the Edas2 data.
		50	6	
0612	10/5/86			
		10	5	
0000	1/11/86			

utc	date	TEMPERATURE BLV °C	+/-	Remarks
0000	1/3/85			Start of records
		-0.4	0.1	
0000	15/4/86			PEM temp board
		-0.3	0.1	
0000	22/9/86			Blizzard static
		-0.4	0.1	
0000	31/10/86			New observer

TABLE 4: Scale Values, Currents and Coil Constants

EDAS2	Scale Value	+/-	Coil Constant	Scale Value Currents
X	0.2010 nT/count	0.00083	8.03 nT/mA	1/3/86 157.4 mA
Y	0.2010 nT/count	0.00067	8.03 nT/mA	29/3/86 157.2 mA
Z	0.1994 nT/count	0.00072	8.03 nT/mA	19/5/86 157.3 mA
T	0.0203 °C/count	0.0813		26/8/86 158.0 mA
F1	0.04 nT/count	42.2		2/10/86 158.2 mA
F10	0.409 nT/count	4.7 (regression)		(peak to peak on 80mA setting)
F1	0.0406 nT/count	0.0001		
F10	0.410 nT/count	0.001 (S. Dennis FEB 1987 pers. comm)		

W+W Scale Values

	June	July	August	September
X	8.79nT/mm	8.75nT/mm	8.72nT/mm	8.75nT/mm
Y	8.78nT/mm	8.75nT/mm	8.73nT/mm	8.75nT/mm
Z	8.77nT/mm	8.75nT/mm	8.73nT/mm	8.77nT/mm
T	0.41nT/mm	0.41nT/mm	0.41nT/mm	0.41nT/mm

TABLE 5: Preliminary Mean Monthly and K-Index Values 1986

	D(° ′E)	I(° ′)	H(nT)	X(nT)	Y(nT)	Z(nT)	F(nT)	K
Jan	-63 44.1	-68 16.0	18444	8162	-16540	-46271	49812	3.5
Feb	-63 47.3	-68 16.6	18456	8152	-16558	-46322	49863	4.1
Mar	-63 47.7	-68 14.8	18475	8158	-16576	-46300	49850	3.2
Apr	-63 46.8	-68 16.4	18448	8151	-16550	-46297	49837	2.5
May	-63 47.7	-68 15.1	18463	8153	-16565	-46282	49829	2.7
Jun	-63 48.2	-68 14.7	18464	8151	-16568	-46269	49817	2.9
Jul	-63 48.9	-68 14.5	18465	8148	-16570	-46264	49813	2.8
Aug	-63 48.3	-68 15.0	18456	8147	-16561	-46263	49809	3.5
Sep	-63 52.1	-68 14.7	18466	8133	-16578	-46271	49819	3.6
Oct	-63 51.2	-68 14.2	18468	8138	-16578	-46260	49810	3.0
Nov	-63 50.3	-68 14.8	18457	8138	-16566	-46256	49802	3.1
Dec	-63 52.2	-68 14.7	18457	8129	-16571	-46251	49798	2.7
MEAN	-63 48.7	-68 15.1	18460	8147	-16565	-46276	49822	3.1

Values for January and February differ from values appearing in Kelsey's report.

TABLE 6: Preliminary Geomagnetic Annual Mean Values,1976-1986

Year	D(° ′E)	I(° ′)	H(nT)	X(nT)	Y(nT)	Z(nT)	F(nT)
1976	-62 37.3	-68 40.0	18418	8470	-16354	-47157	50626
1977	-62 43.9	-68 36.9	18525	8442	-16376	-47051	50530
1978	-62 51.9	-68 35.5	18421	8402	-16392	-46986	50468
1979	-62 57.9	-68 32.9	18425	8375	-16411	-46890	50380
1980	-63 05.8	-68 29.8	18432	8340	-16436	-46784	50284
1981	-63 14.6	-68 27.1	18443	8303	-16467	-46705	50215
1982	-63 21.2	-68 25.5	18433	8267	-16475	-46616	50128
1983	-63 26.6	-68 22.3	18439	8245	-16493	-46503	50025
1984	-63 33.1	-68 19.2	18446	8216	-16515	-46398	49930
1985	-63 40.3	-68 17.1	18457	8186	-16542	-46345	49885
1986	-63 48.7	-68 15.1	18460	8147	-16565	-46276	49822
Mean annual changes							
1976-1986	-7.1	2.5	4.2	-32.3	-21.1	88.1	-80.4
1976-1981	-7.5	2.6	5.0	-33.4	-22.6	90.4	-82.2
1981-1986	-6.8	2.4	3.4	-31.2	-19.6	85.8	-78.6

TABLE 7: Instrument Differences

Year	QHM300-QHM301 (nT)	(+/-)	QHM300-QHM302 (nT)	(+/-)	Comments
1986	6.7		1.0		From PEM data
1985	4.4	range 5.7	-0.3	range 6.3	From PEM data
1984	1.7	1.6	-4.7	1.8	From PEM data
1984	1.7	0.6	-5.4	0.5	From La Cour data
1983	1.6		-5.4		
1982	2.5		-2.7		
	(QHM 300; PPM E770-199) - BMZ 62 (nT)				
1986	-26.8				

TABLE 8 : Record Loss

Magnetic tape	date	day	hr	mn	sc	rcrd	loss	hr	mn	sc	w+w
86/012	11/2	042	17	03	27	----					
	14/2	045	13	55			open loop				
	14/2	045	14	24			close loop	00	29	--	
	18/2	049	03	54	25	9292					
							tape change	00	38	00	
86/013	18/2	049	04	32	25	0010					
	24/2	055	03	58	34	8616					
							tape change	00	15	56	
86/014	24/2	055	06	14	30	0014					
	01/3	060	10	20	28	1020					
							tape change	02	28	02	
86/015	01/3	060	12	48	30	0020					
	03/3	062	15	35	19	3041					
							tape change	00	30	13	02/3 1502-11
											02/3 1543-56
86/016	03/3	062	16	05	32	0008					power failure
	07/3	066	04	40	30	5075					
							PEMX & Y brd	08	21	57	
86/017	07/3	066	13	02	27	0003					
	10/3	069	03	37	26	3755					
							PEM tmp cmp	11	35	02	
86/018	10/3	069	15	12	28	0002					07/3 0524-0845 XYZ
	17/3	076	06	13	24	9543					Board installation
							tape change	00	07	08	10/3 0348-0545 X
86/019	17/3	076	06	20	32	0001					10/3 0348-0452 YZ
	24/3	083	05	17	28	a018					11/3 0512-42 XYZ
							tape change	00	05	03	14/3 0540-44 XYZ
86/020	24/3	083	05	22	31	0002					14/3 0924-34 XYZ
	31/3	090	23	40	--						
							tape ran out	04	25	--	
86/021	01/4	091	04	05	32	0003					30/3 1550-01/4 0315
	07/4	097	09	42	29	8980					lost chartpaper
							tape change	00	04	03	
86/022	07/4	097	09	46	32	0002					
	14/4	104	03	53	29	9729					
							tape change	00	07	03	
86/023	14/4	104	04	20	32	0003					
	21/4	111	05	29	29	a152					
							tape change	00	13	03	
86/024	21/4	111	05	42	32	0002					
	28/4	118	04	42	28	a022					
							tape change	00	04	04	
86/025	28/4	118	04	46	32	0002					
	05/5	125	07	06	29	a222					
							tape change	00	14	03	
86/026	05/5	125	07	20	32	0002					
	12/5	132	07	58	29	a120					
							tape change	00	06	03	
86/027	12/5	132	08	04	32	0002					16/5 1800-17/5 1100
	19/5	139	05	17	29	9915					Y pen ran out
							tape change	00	04	03	

Table 8 continued.

tape	date	day	hr	mn	sc	rcrd	loss	hr	mn	sc	W+W
tape	date	day	hr	mn							
							tape change	00	12	03	
86/029	26/5	146	06	01	32	0002					
	02/6	153	02	57	29	9898					
							tape change	00	06	03	
86/030	02/6	153	03	03	32	0003					
	09/6	160	12	06	29	a626					
							tape change	00	12	03	
86/031	09/6	160	12	18	32	0002					
	16/6	167	14	15	29	a199					
							tape change	00	27	02	
86/032	16/6	167	14	32	31	0005					
	23/6	174	07	39	29	9672					
							tape change	00	14	03	
86/033	23/6	174	07	53	32	0003					
	30/6	181	04	40	29	9890					
							tape change	00	11	02	
86/034	30/6	181	04	51	31	0004					
	05/7	186	03	04	29	7097					*
							tape change	00	11	02	*
86/035	05/7	186	03	15	31	0003					*
	13/7	194	02	52	29	b500					*
							tape change	00	12	03	*
86/036	13/7	194	03	04	32	0003					*
	20/7	201	11	08	29	a156					*
							tape change	00	10	03	*
86/037	20/7	201	11	18	32	0003					*
	29/7	210	15	35	--	----					*
							tape ran out	15	37	..	*
86/038	30/7	211	07	12	31	0002					*
	06/8	218	12	20	28	a390					*
							tape change	00	09	03	*
86/039	06/8	218	12	29	31	0005					*
	13/8	225	13	10	28	a126					*
							tape change	00	09	04	*
86/040	13/8	225	13	19	32	0002					15/8 1555-1600 XYZ
	20/8	232	07	01	29	9704					power failure
							tape change	00	10	02	*
86/041	20/8	232	07	11	31	0003					*
	24/8	236	15	00	00	----					*
							Edas malfunction				*
86/042	26/8	239	poor data					246	51	--	*
			poor data								*
											*
86/043	04/9	246	21	51	30	0003					
	10/9	253	11	18	33	9450					
							tape change	00	57	34	
86/044	10/9	253	12	16	27	0011					
	17/9	260	10	39	27	9994					
							tape change	00	25	00	
86/045	17/9	260	11	04	27	0011					
	22/9	265	14	51	29	7438					
							tape change	00	13	59	

* EDAS2 malfunction caused digital data loss for these times.
Mean hourly values were therefore scales from W+W analogue charts.

Table 8 continued

tape	date	day	hr	mn	sc	rcrd	loss	hr	mn	sc	w+w
86/046	22/9	265	15	05	28	0003					
	30/9	273	03	22	32	a820					
							tape change	00	22	55	
86/047	30/9	273	03	45	27	0003					
	08/10	281	01	12	--	----					
							tape ran out	02	05	--	
86/048	08/10	281	03	17	29	0003					
	15/10	288	10	26	33	a512					
							tape change	00	22	55	
86/049	15/10	288	10	49	28	0008					
	22/10	295	11	36	32	a135					
							tape change	00	08	55	
86/050	22/10	295	11	45	27	0005					
	29/10	302	10	18	31	9998					
							tape change	00	10	56	
86/051	29/10	302	10	29	27	0003					
	05/11	309	11	07	31	a121					

Seismic

31/1 Installation of new helicorder & rectilinier pen.

05/2 Replacement of AR320 SPN transistor.

09/2 Re-wiring instrument rack in Wombat.

11/2 Re-wiring instrument rack in Wombat.

15/2 - 17/2 LPZ Limit stop screw resting on limit stop plate.

25/2 - 28/2 LPZ replaced TAM5, deduced problem to be mechanical.

24/3 LPZ Faulty connection to AR320.

24/4 LPZ Limit stop screw resting on limit stop plate.

25/8 - 29/8 LPZ Limit stop screw resting on limit stop plate.

TABLE 9: Byrd Head and Oom Bay Regional Observations

Oom Bay:

TIME	DATE	D(East)	H(nT)	Z(nT)
1055	14/11/83	-65°22.5′		
1104			18992	
1111		-65°20.7′		
1146				-46974
1154				-45956
1209		-65°29.3′		
1214			19064	
1220		-65°30.5′		
0952	12/10/86	-62°41.9′	18957	
1030	12/10/86			-45802

NOTE: D values were recalculated from Cechet 1984 as the azimuth of the mark was determined by the author to be 97°24.7′.

BYRD HEAD

TIME	DATE	D(East)	H(nT)	Z(nT)
0843	10/10/86	-62°54.7′	21333	
0913	10/10/86			-46869

In 1986 D and H measurements were made with QHM302 and Z with BMZ62
Corrections applied were;

X + 0.5
Y + 1.5 Corrections determined from comparisons to QHM300,
Z -26.8 PPM E770-199 and Dec 332 through baselines.

TABLE 10: SEISMOGRAPH PARAMETERS, 1986

Component	SP-Z	SP-N	SP-E	LP-Z
Seismometer	Benioff	Benioff	Benioff	Press-Ewing
Serial No.	SN 55	SN 58	SN 61	Model SV-282 SN 11
Free Period(s)	1.0	1.0#	1.0#	12.8#
Mass (kg)	107.5	107.5	107.5	6.9
Coil Res	1004 ohms	1000# ohms	1000# ohms	500# ohms
Damping Res	387# ohms	820# ohms	820# ohms	5120# ohms
Power Supply	PP2	PP2	PP2	ad hoc
Preamplifier	TAM5	TAM5	TAM5	TAM5
Bandpass filter	.1-10 Hz	.1-10 Hz	.1-10 Hz	.01-20 Hz
Recorder Amp	Geotech AR320	Geotech AR320	Geotech AR320	Geotech AR320
Recorder	Geotech RV-301	Geotech RV-301	Geotech RV-301	Geotech RV-301
Chart rate	60 mm/min	30 mm/min	30 mm/min	30 mm/min
Calibrator				
Polarity	Up-Up	North-Up	East-Up	Up-Up
Motor constant	1.45 N/A	nm	nm	nm
Coil res	247 ohm#	49 ohm#	258 ohm#	3.3 ohm#

\# values are taken from previous reports.
<u>nm</u> not measured

TABLE 11: SPZ Seismometer Calibration, February 1986

Results of weight lift tests may be spurious as the masses may have changed due to age and condition. The method of weight lift tests requires a piece of cotton to be attached to the mass which adds to the weight. New pre weighed weights with cotton attached were recommended by the author for 1987. An inconsistency in repeated weight lift tests and derived motor constant has been reported (Crosthwaite, 1986). The magnification values below are uncorrected for weight discrepancy.

Calibration pulses and calibration can be found on the charts.

Period	Magnification
(s)	(X 1000)
5.3	0.09
4.3	0.21
2.9	0.68
1.9	2.94
1.5	7.55
1.3	12.17
1.2	17.11
1.1	21.37
0.98	29.55
0.99	28.49
0.85	32.21
0.79	41.00
0.68	41.32
0.62	39.73
0.50	32.65
0.30	15.42
0.25	10.93
0.20	5.70

Magnification Conversion Table

amp	attn changed	effect
AR320:	30dB to 24dB	X 1.98
AR320:	24dB to 18dB	X 2.01
TAM5 :	66dB to 78dB	X 4.02

Magnifications are given at TAM5 set to	96dB/-18dB (gain/attn)
amp AR320	-24dB
Passband	0.1 to 10Hz
Seismometer Free Period	0.98s
Damping Resistor	378ohms
Sine wave test current P-P	6.410 - 6.404mA
Weight Lift Test	21.92mm/mg
Weight Lift Mass	0.5g
Current Pulse Test	3.24mm/mA
Motor Constant,G	1.45 N/A
Magnification,K Constant	0.341877×10^{-3} SI

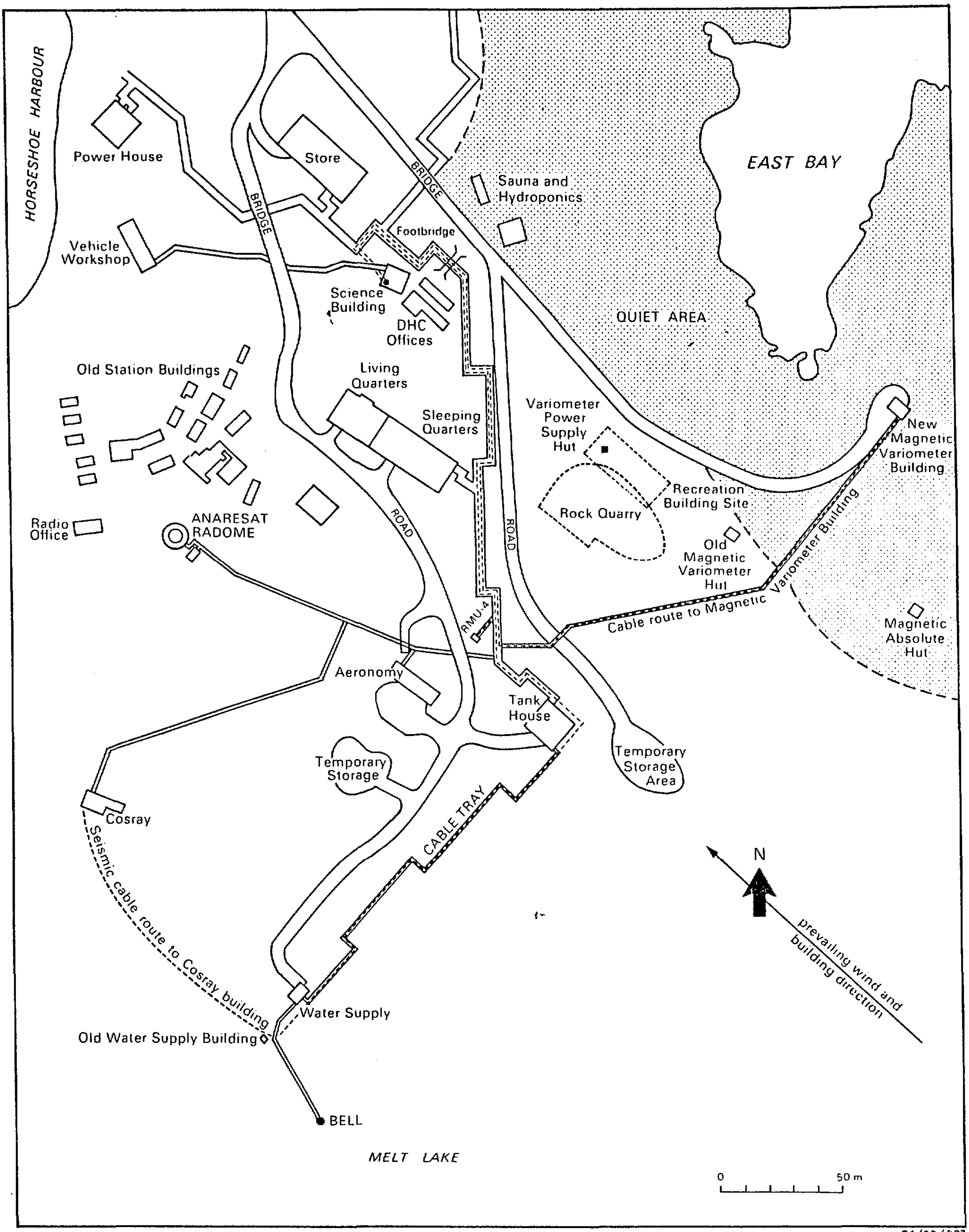
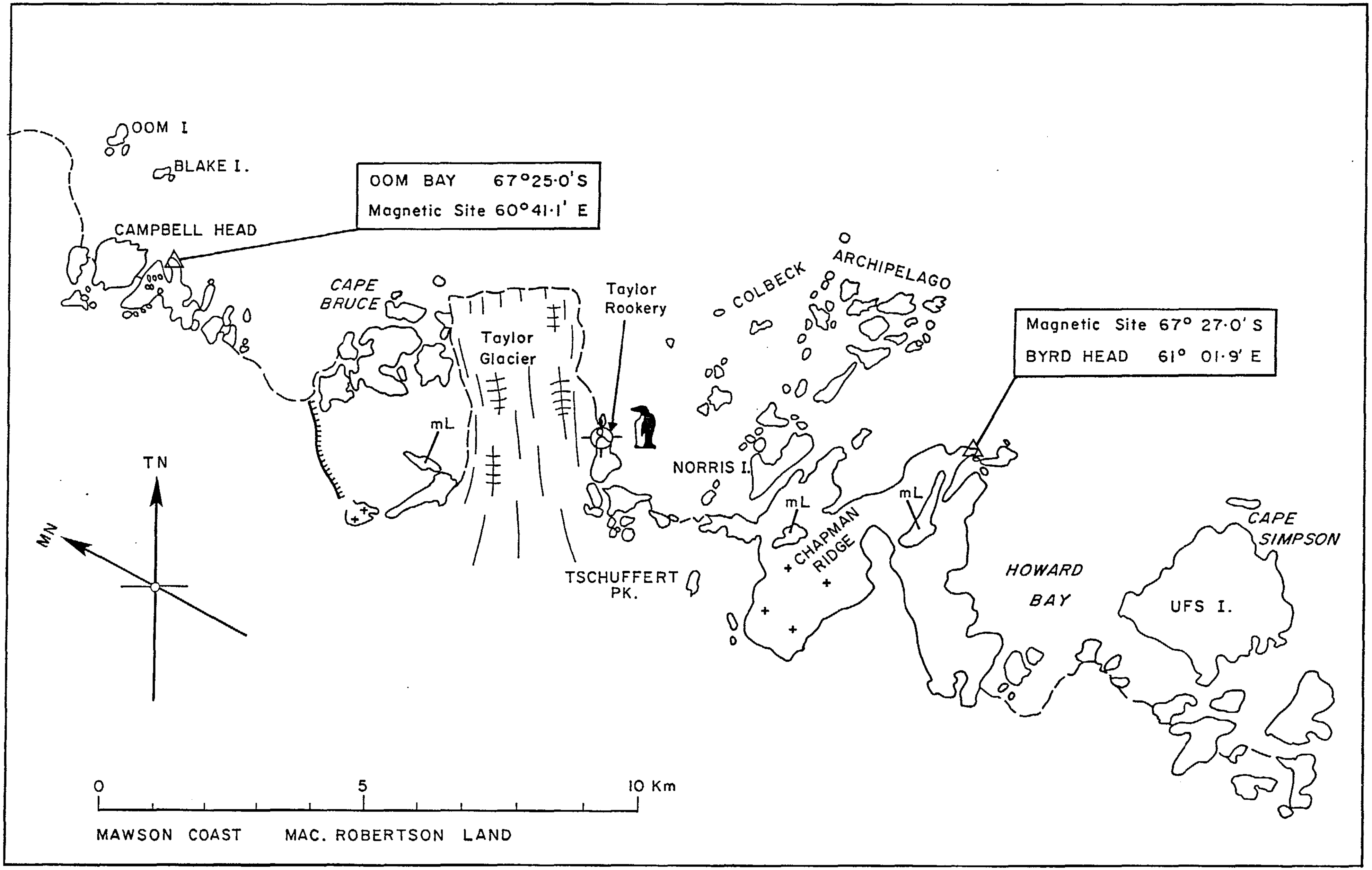

HORSESHOE HARBOUR
Power House
Store
BRIDGE
BRIDGE
Sauna and Hydroponics
EAST BAY
Vehicle Workshop
Footbridge
Science Building
DHC Offices
QUIET AREA
Old Station Buildings
Living Quarters
Sleeping Quarters
Variometer Power Supply Hut
New Magnetic Variometer Building
Recreation Building Site
Rock Quarry
Radio Office
ANARESAT RADOME
ROAD
ROAD
Old Magnetic Variometer Hut
Cable route to Magnetic Variometer Building
RMU-4
Magnetic Absolute Hut
Aeronomy
Tank House
Temporary Storage
Temporary Storage Area
Cosray
CABLE TRAY
N
Seismic cable route to Cosray building
prevailing wind and building direction
Water Supply
Old Water Supply Building
BELL
MELT LAKE
0
50 m
24/09/283

Fig. 1 Mawson



24/09/269

Fig.2 Location of Magnetic Sites West of Mawson

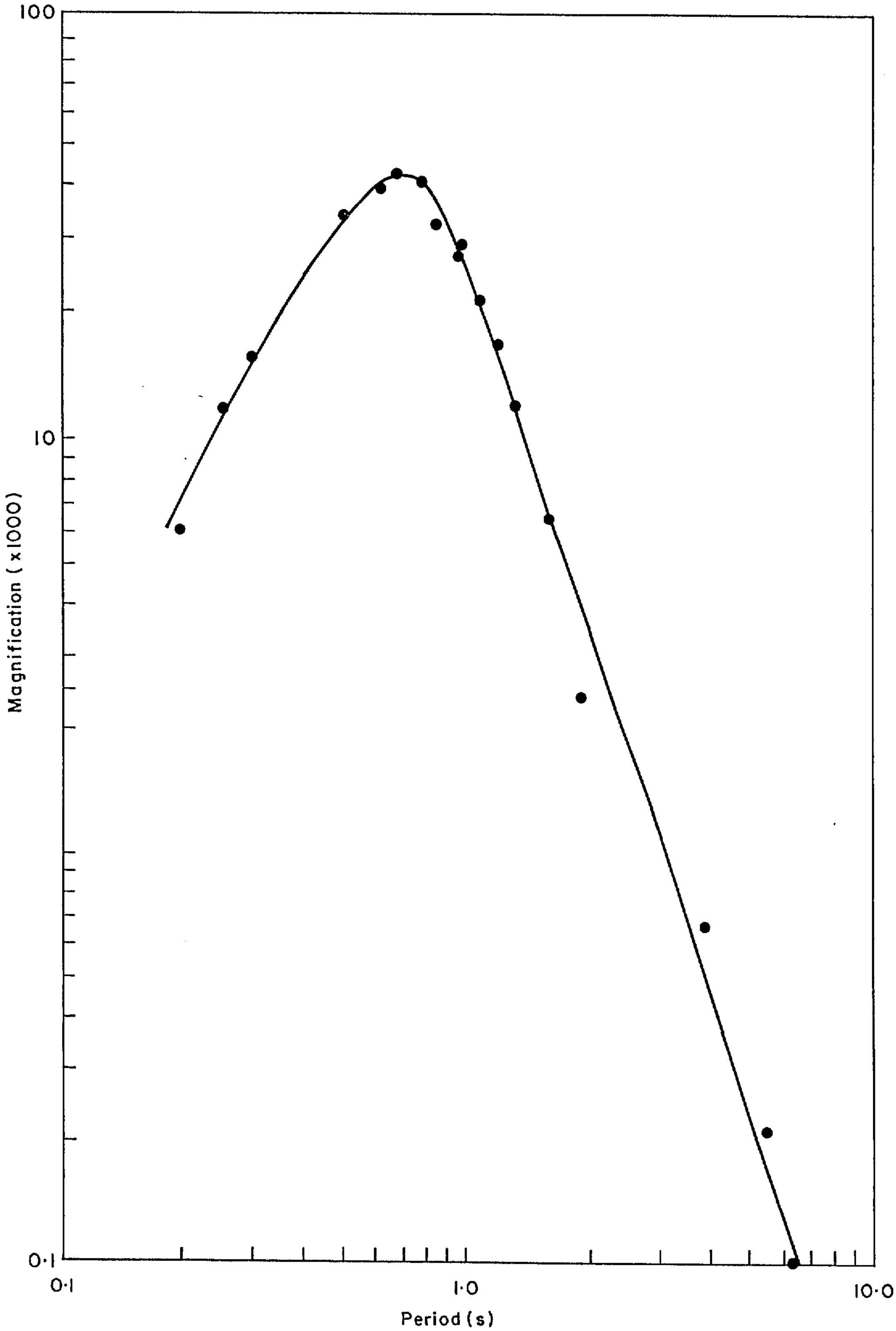


Fig. 3 Mawson SPZ Calibration curve, February 1986

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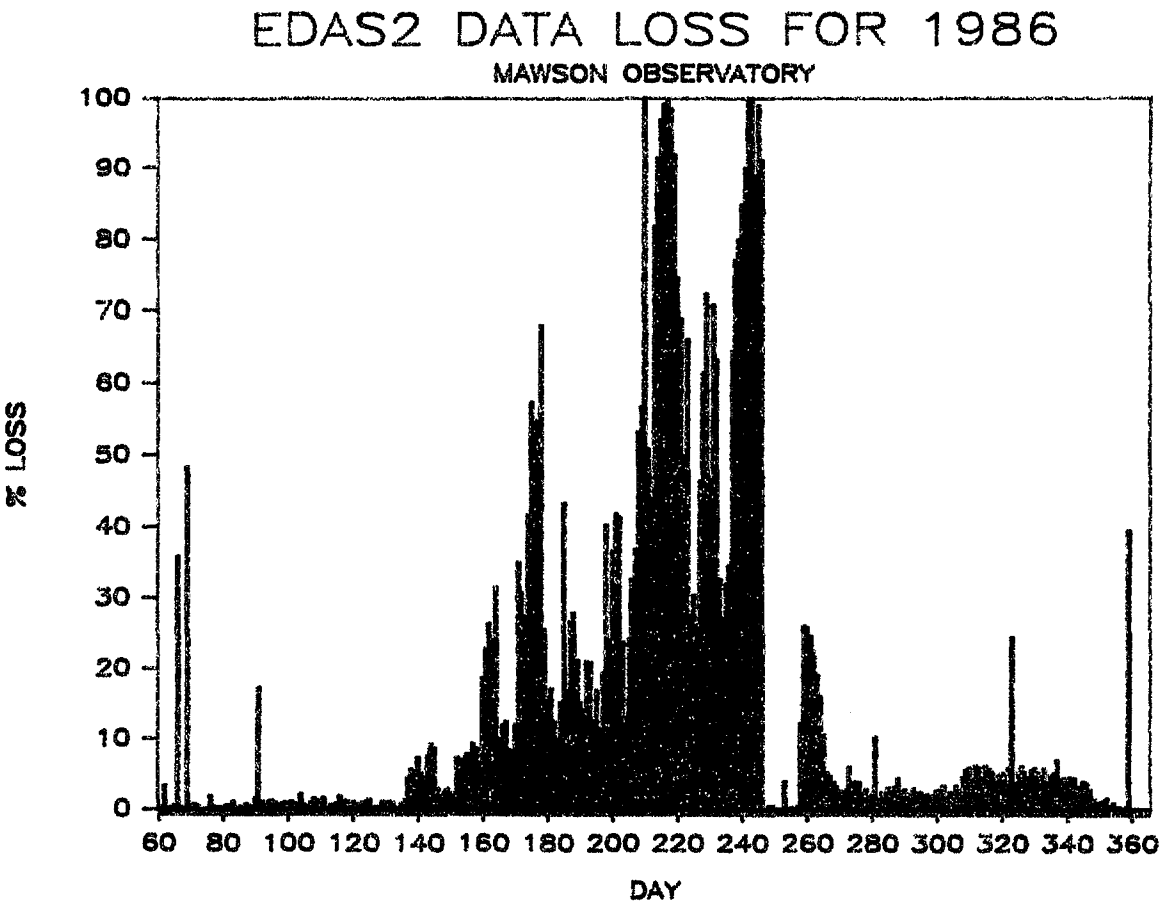
EDAS2 DATA LOSS FOR 1986
MAWSON OBSERVATORY
% LOSS
DAY
0
10
20
30
40
50
60
70
80
90
100
60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360

Fig. 4