

## MAWSON GEOMAGNETIC OBSERVATORY

# URNS 50

**This year marks 50 years of continuous operation of the geomagnetic observatory at Mawson in Antarctica.**

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In August 2005, the Mawson observatory became the second Geoscience Australia magnetic observatory to have provided more than a 50-year time-series of data. The observatories at Macquarie Island, which began operations in 1952, and Mawson continue to produce high-quality data, with further upgrades planned for Mawson to meet changing demands for geomagnetic data.

The 50 years of data generated from the Mawson observatory is one of the longest continuous time-series of geomagnetic data available from the Antarctic continent. Such long datasets are particularly valuable in the study of geomagnetic secular variation—the slow change of Earth’s magnetic field arising from its liquid core (figure 4).

Mawson geomagnetic data is used in the development of global and regional field models, such as the International Geomagnetic Reference Field model, the World Magnetic Model, and the Antarctic Reference Model, all of which have applications in navigation, exploration and research. The data is also used to support satellite magnetic field missions, and helps us better understand the nature and origin of Earth’s magnetic field and of ionospheric and magnetospheric processes in the polar region.

### The pioneers

Geoscience Australia’s predecessor, the Bureau of Mineral Resources, Geology and Geophysics (BMR), established the Mawson Geomagnetic Observatory as part of the Australian National Antarctic Research Expeditions.

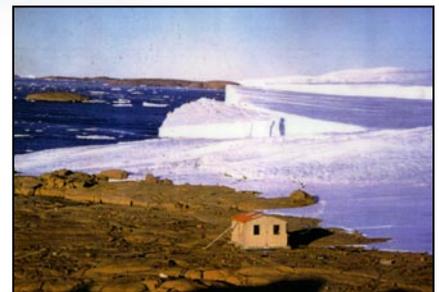
Jim Brooks, the geophysicist who spent 1953 operating a geomagnetic observatory established on Heard Island in the sub-Antarctic the previous year, joined the pioneering voyage of *Kista Dan* that led to the selection and establishment of Mawson Base. In mid-February 1954, he made absolute observations of intensity and direction in the area allocated for the eventual magnetic observatory.

Two original plywood observatory huts—known as the ‘absolute’ and ‘variometer’ huts—were removed from Heard Island in October 1954 and installed at Mawson the following February.

The Heard Island absolute observing piers were left in place for future use, and a new wooden absolute observing pier was installed at Mawson. The original magnetic absolute hut and pier (figures 1,2 and 3) are still a vital part of the Mawson observatory, where they are used for weekly absolute calibration observations. The original variometer hut, which remained in place when a new hut was installed in 1985, was accidentally destroyed in a quarry blasting accident in 1994.

Hugh Oldham, the first in a long line of Australian Government geophysicists to spend the winter at Mawson, established the observatory. He made his first observations on 4 May 1955, and the observatory started producing hourly mean values of the vector geomagnetic field in August 1955. Geomagnetic hourly mean values are still one of the data products of the observatory today, while the variometer equipment also records changes in the geomagnetic field with a time resolution of one second and a field resolution of 0.025 nT (nanoteslas).

At least four Mawson veterans still work in Geoscience Australia today. Observers typically spent one year at the observatory to run the equipment and prepare data. Many observers did multiple ‘tours of duty’ at Mawson, or a year at Mawson followed by a year at the Macquarie Island Observatory.



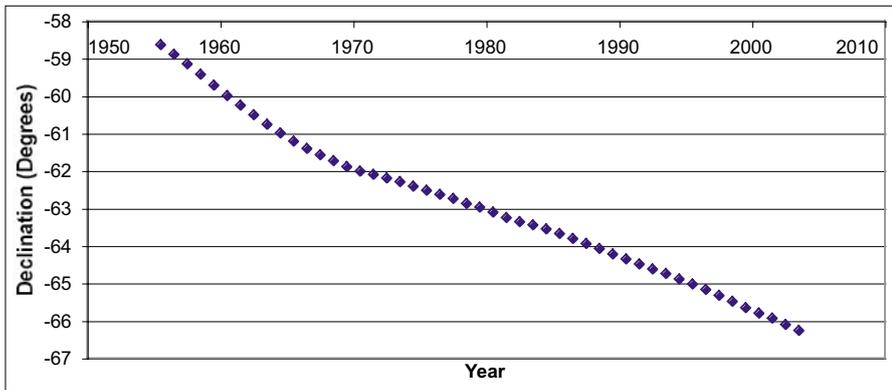
▲ **Figure 1.** The Mawson absolute hut soon after installation (photo by Hugh Oldham, 1955).



▲ **Figure 2.** The absolute hut (foreground) and the variometer hut installed in 1985 (photo by Peter Crosthwaite, 2003).



▲ **Figure 3.** Inside the absolute hut—an Askania declinometer is mounted on the primary absolute pier.



▲ **Figure 4.** Annual mean declination for Mawson Geomagnetic Observatory, 1955–2004. Magnetic north at Mawson is to the west of true north, hence the negative values of declination shown in the plot.

## The technologies

The first variometer equipment to monitor changes in the magnetic field at Mawson was a La Cour photographic system. The La Cour variometer consisted of several suspended magnets that were free to rotate in response to the changing magnetic field. Mirrors attached to the magnets reflected carefully directed light beams onto a rotating drum carrying photographic paper. Much of the work of the early Mawson geophysicists involved attending to the variometer equipment, developing the photographic paper and hand-scaling the magnetic traces.

The La Cour system operated from 1955 to 1985, when it was replaced with a photo-electronic system. Data was recorded on chart paper and also digitised for recording on cassette tape. A further upgrade in 1989 integrated a personal computer into the system. In 1993, the photo-electronic variometer was replaced with a modern electronic three-axis ring-core fluxgate magnetometer, which continues to run as the primary instrument today.

Full-time geomagnetic observers operated the Mawson Observatory until 1997, when data telemetry and electronic communications technologies were installed to provide daily downloads of data to Geoscience Australia's Canberra headquarters.

In 1998, the observing duties were converted to a part-time position shared with the Bureau of Meteorology. Onsite observing duties are currently performed by the Australian Antarctic Division's communications technical officers. In 2005, the duties of the geomagnetic observer are being carried out by Mathew Leayr, who undertook intensive training in observatory procedures at Geoscience Australia before he left for Mawson in January this year.

The excellent communications infrastructure that has been available at Australian Antarctic stations for some time allows all the data processing, analysis and dissemination to be done from Geoscience Australia's headquarters in Canberra.

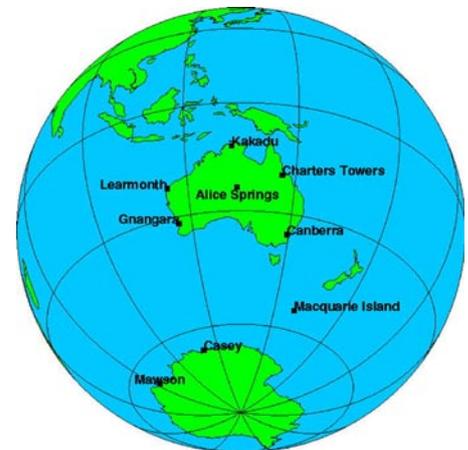
Future plans for the Mawson observatory include installation of a new primary magnetic variometer system and an upgrade from daily data downloads to real-time data (both planned for early 2006). This upgrade should allow Mawson to be accepted in the near future as a member of the INTERMAGNET global network of high-quality geomagnetic observatories.

The most recent data from Mawson, and from Geoscience Australia's eight other magnetic observatories (figure 5) is available on-line from the geomagnetism pages of the Geoscience Australia website ([www.ga.gov.au](http://www.ga.gov.au)) or on request.

## References

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▲ **Figure 5.** Geoscience Australia's network of geomagnetic observatories.

