Paleomagnetism 1958 revisited: a Golden Anniversary

Members of the Australian Society of Exploration Geophysicists and the Geological Society of Australia met jointly at the Australian National University (ANU) on 22 October 2008. Beginning with refreshments at 5 pm hosted by the ANU Colleges of Science, the occasion was held to unveil a plaque, and to celebrate major developments in geophysics that took place 50 years ago. An inconspicuous building now amongst storage sheds at the rear of the Research School of Biological Sciences (RSBS) was in the spotlight, as the surviving part of a paleomagnetic laboratory which operated from 1955–64.

In 1955, that part of the ANU campus was an unoccupied bare paddock, and the site was chosen by John C. Jaeger and his research fellow Edward (Ted) Irving[1] of the Department of Geophysics of the Research School of Physical Sciences as ideal for a laboratory needing an undisturbed environment. Rocks of different ages, collected carefully from around Australia, were returned to the laboratory for measurement of their magnetic properties. When the results were compared with similar results from North America and Europe, the demonstration of continental movement was clear, though much debated at the time, as might be expected for such a revolutionary result.

To further complicate the debate, many rock samples were found at the laboratory to be reversely magnetised (i.e. when the rocks were formed, compasses would have pointed south). The understanding of such reversals was greatly advanced when they were shown to occur world-wide, simultaneously. The achievement of this result involved radiometric dating, also then in its infancy. With this knowledge of reversals and later international developments especially in marine geophysics, continental drift became part of the plate-tectonic model for geology which is taught in schools today.

The first part of the paleomagnetic laboratory was a wooden hut built in 1955, constructed to be non-magnetic (Figure 1). An east–west wooden wing was added in 1958 to house demagnetisation apparatus, as these (then-new) techniques were developed. The surviving concrete-block wings date from 1963. These wings are still known fondly as 'the Old Mag Hut', and they belie their origin on a map of the campus by exhibiting an unusual magnetic north-south orientation.

Fig. 1. *The paleomagnetic laboratory 1955, photo by Ted Irving. Black Mountain (without tower) is in the background.*

In 1964 paleomagnetic research moved to a new laboratory in an old quarry on the eastern slopes of Black Mountain, near the ANU campus. The move to Black Mountain heralded a new era in both national and international paleomagnetism, and that laboratory is still in operation today.

Fig. 2. *Kurt Lambeck after unveiling the plaque on 'the Old Mag Hut'.*

The meeting on 22 October 2008 first gathered at the surviving wings of the Old Mag Hut. To commemorate the fundamental discoveries which played important roles in the development of modern geology, a plaque on the building was unveiled by Kurt

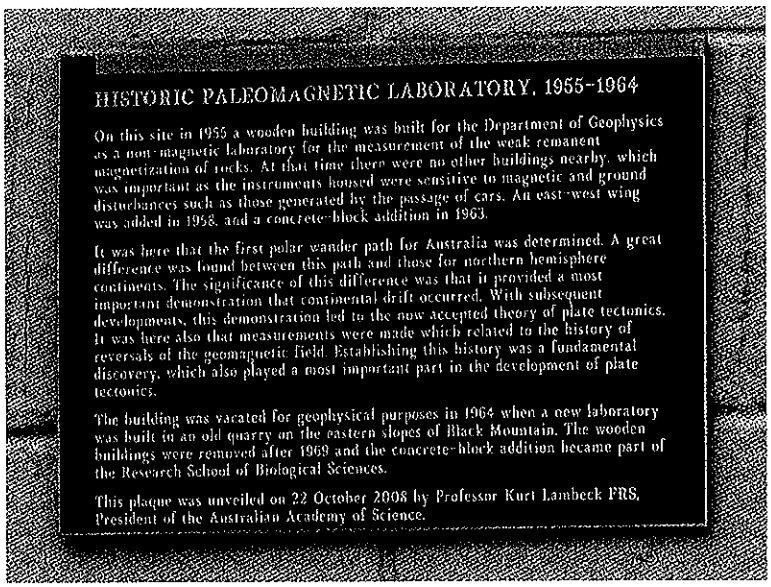

Fig. 3. *The plaque.*

[1]After his arrival in Canberra from the UK, Irving learned that his PhD thesis, describing pioneering paleomagnetic work in England, had not been passed by the University of Cambridge, such was the opposition to this new method and its implication for continental drift. Later, the same university awarded Irving the degree of DSc for his work in paleomagnetism (Editor).

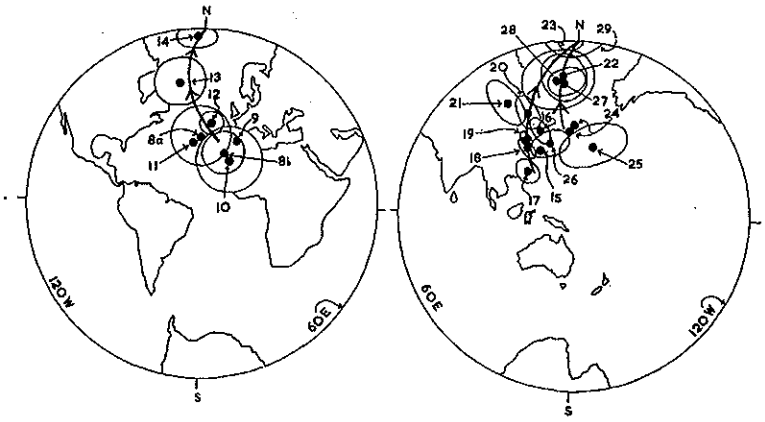

Fig. 4. *Copy of the original Fig. 5. from Irving, E. and Green, R. 1958, Polar movement relative to Australia: Geophys. J. Roy. Astron. Soc., 1, 64–72. The caption read, in part: 'Pole positions obtained from rock formations of Carboniferous and later ages in North America, Europe and Australia (equatorial projection). The large discrepancy between equivalent results from Australia and those from northern continents is illustrated here.' This discrepancy demonstrates relative continental movement and notice how even the North American and European curves were separated – due to the opening of the Atlantic Ocean, not well established at that time.*

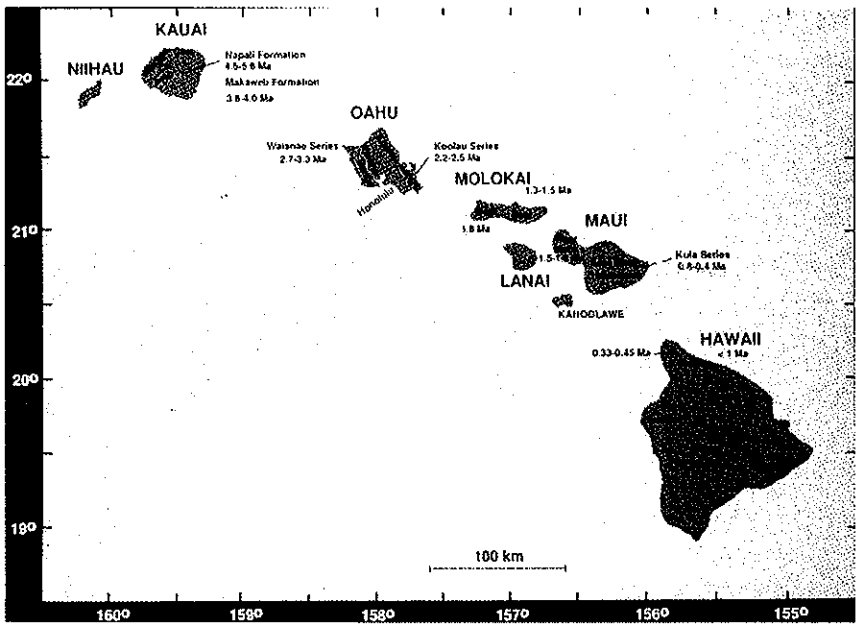

Fig. 5. *Results from McDougall, I. 1964, Potassium-argon ages from lavas of the Hawaiian Islands, Bull. Geol. Soc. Am., 75, 107–128. The progressive increase in age towards the northwest indicates migration of volcanism to the southeast at about 10 cm/year.*

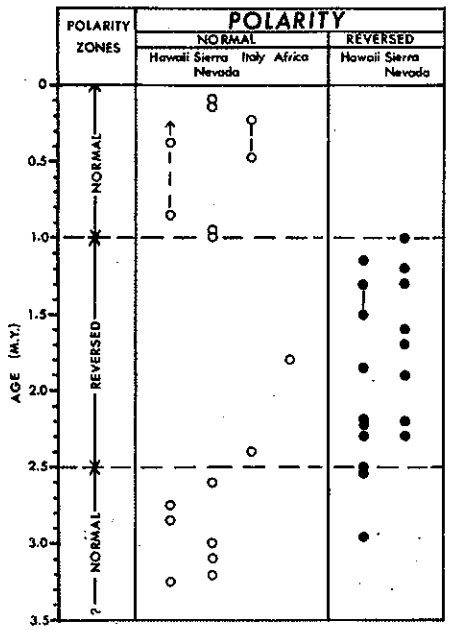

Fig. 6. *Combining Hawaiian ages with magnetic polarity determinations, McDougall and Tarling showed a zonation of normal and reversed polarity, providing strong evidence that the Earth's magnetic field changed polarity, a contentious issue at the time. The figure is from McDougall, I. and Tarling, D.H. 1964, Dating geomagnetic polarity zones, Nature, 202, 171–172.*

Lambeck FRS, President of the Australian Academy of Science (Figures 2 and 3).

The celebrations continued with talks revisiting the historic results of 50 years ago. Chaired by Brad Pillans, the talks were held in the D.A. Brown building (named after David Brown, Foundation Professor of Geology and himself a protagonist of continental drift). Ted Lilley spoke on 'The Old Mag Hut 1955–64, and Australian Continental Drift', in which he showed photos of the early ANU campus; reviewed the paper by Irving and Green (1958) in which the Australian polar wander path is shown to be very different from those of Europe and North America (Figure 4); and concluded with photos taken on a recent visit to the home of the Ted and Sheila Irving on Vancouver Island, Canada.

Then a message from Ted Irving was read by his colleague Carmel Lowe, visiting Canberra from the Pacific Geoscience Centre, British Columbia. Ian McDougall spoke on 'Establishing Geomagnetic Reversals', recounting especially how he and Don Tarling (a student of Ted Irving) had collaborated on dating recent geomagnetic reversals found in lava flows on the Hawaiian Islands. These results provided the steps taken in developing a global geomagnetic reversal history and also provided evidence for crustal movement relative to a mantle 'hot spot' (Figures 5 and 6).

The talks concluded with Ron Green addressing the audience informally, with accounts of his experiences in geophysics at the Bureau of Mineral Resources and at ANU 50 years ago.

The celebrations ended with dinner at the nearby Teatro Vivaldi Restaurant. During the evening the 48 diners were welcomed, and greetings were received from well-wishers around the world. A toast to 'The early paleomagnetists' was proposed by Charles Barton. Later, Ronald Green responded 'On behalf of all early paleomaggers', recalling the popular term of the time.

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