Journal & Proceedings of the Royal Society of New South Wales, Vol. 142, p. 17–28, 2009
ISSN 0035-9173/09/010017–12 $4.00/1

For Further Consideration: Mr James Dunlop, Esq.

SHARON RUTLEDGE

Abstract: James Dunlop submitted a paper to the Royal Society of London in 1833–34. The archives of the Philosophical Transactions of the Royal Society record an abstract for this work but the manuscript itself was not published. The original paper has now been located within the extensive archives of the Royal Society. The main content of this document entailed his 'at sea' magnetic research from his second voyage to New South Wales (NSW). He extended the study with further 'on land' data collection particularly from Parramatta and Sydney. The following paper briefly outlines the interest in the 19th century for magnetic observations and goes on to examine aspects of Dunlop's unpublished manuscript. An overview of James Dunlop's role in Australian scientific history and his lack of recognition are also discussed.

Keywords: Astronomy, Brisbane, Dip Needle, Dunlop, Magnetic Observation, Parramatta Observatory

INTRODUCTION

It is June 1831 and the ship 'Mary' is at anchor below Woolwich equipped for a voyage to the Australian colonies. The occupant of the '*stern cabin in the poop on the harbour side*' (Dunlop 1834a, p. 1), James Dunlop, shown in Figure 1, is preparing to undertake '*the most extensive uninterrupted series* [of magnetic observations] *. . . extending over the Earths surface about 180 Degrees in Longitude and 100 Degrees in Latitude*' (Dunlop 1834a, p. 1).

Suspended from his cabin roof is a magnetic needle device, which will remain fixed in this position throughout the long journey. Dunlop's trunks are also packed and stored in a manner to ensure their contents cannot affect the magnetic apparatus.

DUNLOP'S EARLY YEARS

On October 31st 1793, the son of an Ayrshire weaver was born in the village of Dalry, Scotland. Young James working in a Beith thread factory had a mechanical gift. At the age of seventeen, '*he was constructing lathes and telescopes and casting reflectors for himself*' (Service 1890, p. 135). Sir Thomas Brisbane, the newly appointed Governor of NSW, had determined to build a private observatory in that colony. Sir Thomas, also from Ayrshire, became aware of Dunlop's skills. Deciding these abilities would be useful in the distant settlement, he engaged Dunlop's services to maintain the delicate astronomical instruments. Although Brisbane was himself an avid astronomer, he understood the Vice-Regal role in NSW would force limitations on his personal involvement in the new observatory. Sir Thomas therefore also employed a German mathematician and astronomer Christian Carl Ludwig Rümker as an assistant.

James Dunlop, with his wife Jane, accompanied Governor Brisbane and Carl Rümker to the colony of NSW arriving at Port Jackson on November 7th 1821. Upon completion of the observatory built near Government House Parramatta, the mammoth task of '*cataloging* [sic] *all stars of 8th magnitude or brighter south of declination -33*' (Cozens & White 2001, p. 113) commenced on May 2nd 1822. Following Rümker's acrimonious departure from Parramatta, in 1823, Dunlop recorded the bulk of the observations and he completed a catalogue of 7385 stars by 1826. This catalogue, which became known as "The Brisbane Catalogue", was printed in London in 1835.

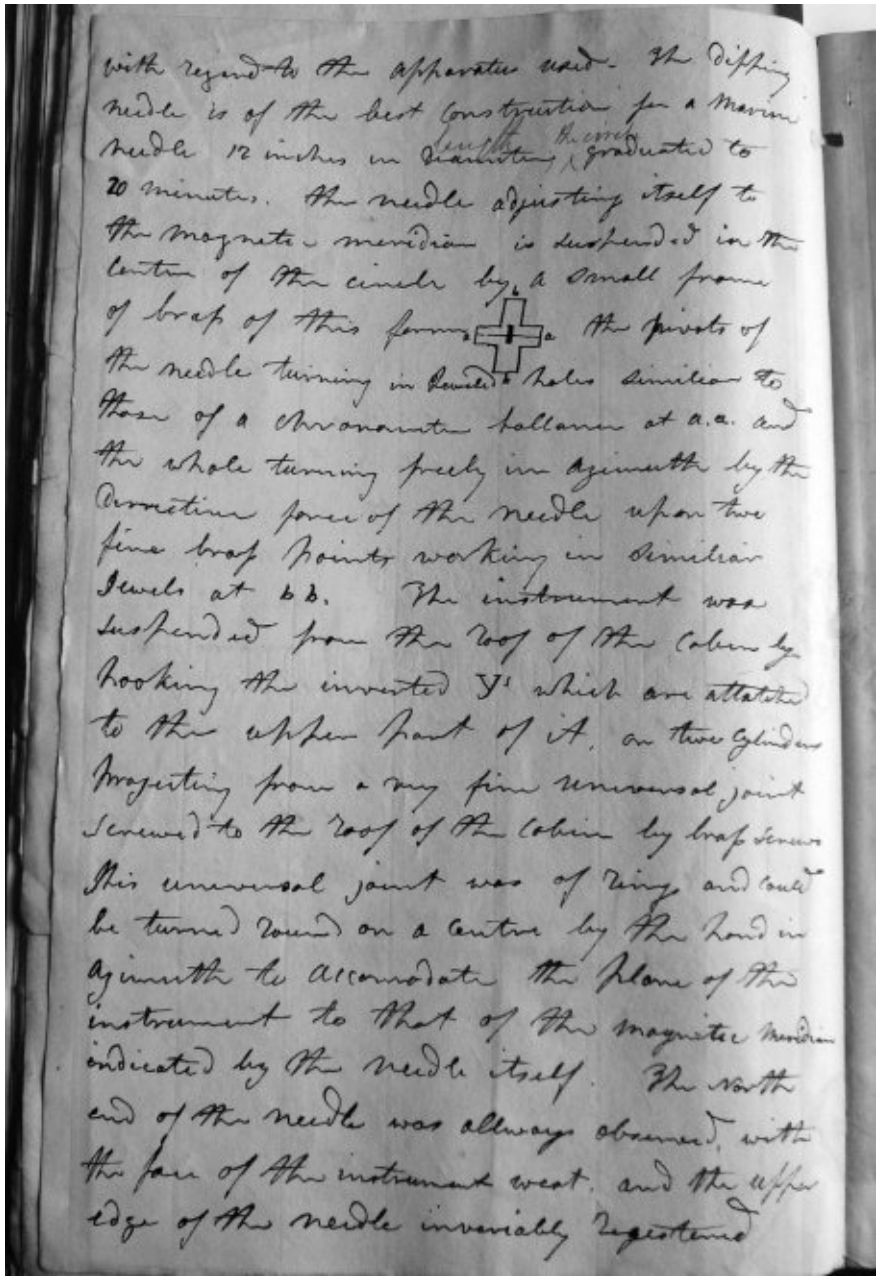
Governor Brisbane returned to Europe at the end of 1825. However, as previously stated, Dunlop stayed in NSW and continued working from his home at Parramatta, '*6″ of a degree south, and about 1.78″ of time east of the Brisbane Observatory*' (Service 1890, p. 146). He particularly observed nebulae and groups of stars. Dunlop eventually left NSW in 1827 and rejoined Sir Thomas in Scotland.

Figure 1: James Dunlop, 1826. ©Mitchell Library, State Library of NSW.

Dunlop presented a paper, on nebulae and star clusters, to the Astronomical Society of London in December 1827. The Society published his observations in 1828 and both he and Brisbane received the societies gold medals of the year, for their astronomical work at Parramatta Observatory. In his manuscript Dunlop stated '*I trust this catalogue of the nebulae* [sic] *will be found an acceptable addition to that knowledge which the Brisbane observatory has been the means of putting the world in possession of, respecting that important and hitherto but little known portion of the heavens*' (1828, p. 114).

Dunlop remained in Scotland working at Brisbane's newly completed, 1826, observatory at Makerstoun. During this period, 1827–1831, Sir Thomas and Dunlop began geomagnetic observations throughout Scotland. Brisbane, like many astronomers of his time, had a keen interest in understanding the distribution of magnetic intensity. Sir Thomas states in Dunlop (1834b, p. 1) '*the regret I feel that this important branch of science should have been so much neglected in Great Britain*'.

Cawood quotes Harcourt's 1839 address to the British Association regarding the investigation of the magnetic field's importance not just as a navigation tool but as '*. . . a completion of what Newton began – a revelation of new cosmical* [sic] *laws*' (Cawood 1979, p. 493). Tasker (1860) describes Sir Thomas' continuous pursuit in this field of science and his later construction of his Magnetic and Meteorological Observatory at Makerstoun in 1841.



with regard to the apparatus used. The dipping needle is of the best construction for a Marine needle 12 inches in diameter, the circle graduated to 20 minutes. The needle adjusting itself to the magnetic meridian is suspended in the centre of the circle by a small frame of brass of this form, the pivots of the needle turning in jewelled holes similar to those of a Chronometer balance at a.a. and the whole turning freely in Azimuth by the directive power of the needle upon two fine brass points working in similar Jewels at b b. The instrument was suspended from the roof of the Cabin by hooking the inverted Y which are attached to the upper part of it, on two Cylinders projecting from a very fine universal joint screwed to the roof of the Cabin by brass screws. This universal joint was of Ring and could be turned round on a centre by the hand in Azimuth to accomodate the plane of the instrument to that of the magnetic meridian indicated by the needle itself. The North end of the needle was always observed with the face of the instrument west, and the upper edge of the needle invariably registered

Figure 2. Page 2 from Dunlop's unpublished manuscript (Dunlop 1834a). Photographed by Ms Gail Gibson, London.

MEASURING MAGNETIC FIELDS

'In the 19th century the three recorded "elements" of the earth's magnetic field were the intensity, the declination, and the inclination. The intensity, which was measured by counting the number of oscillations of a magnetized needle in a fixed interval, could be determined either parallel or perpendicular to the direction of the field at a given location. The declination, which was often known as "variation" in Britain, was the difference between true north and magnetic north at a particular point, and the inclination, or "dip" was the angle between the vertical direction of the field and the horizon measured in the plane of magnetic north.' (Cawood 1979, p. 495)

Robert Norman a London instrument-maker first published results of magnetic needle experiments in 1581. McConnell states '*... his carefully-balanced compass needles, when subsequently magnetised, always took up a position in which the north-seeking point hung downwards*' (1980, p. 12). Further experiments, with a magnetised needle held in a horizontal position, ascertained the swing and angle the needle would reach in its magnetic attraction. The angle is read from a graduated circle attached to the apparatus.

In 1830, before the Royal Society of Edinburgh Sir Thomas Makdougall Brisbane presented Dunlop's paper '*An Account of Observations made in Scotland on the Distribution of the Magnetic Intensity*' (Dunlop 1834b). Sir Thomas introduced Dunlop's presentation and subsequent paper, '*Mr Dunlop has so fully and clearly detailed his mode of proceeding with these observations, ... that, in point of number, extent of country, combined with precaution, accuracy, and consistency, I consider they are unrivalled in this or any other country*' (Dunlop 1834b, p. 1).

Following his years with Brisbane at Makerstoun, Dunlop's interest and ability to conduct magnetic research is evident. Upon the announcement that Dunlop is appointed Superintendent of Parramatta Observatory, the opportunity to conduct magnetic observations during his voyage to New South Wales is timely. The Admiralty Hydrographer, Captain Francis Beaufort R.N. extracts a pledge from Dunlop to carry out this arduous task.

The first observations commenced on the 4th June 1831 from the 'Mary' and the final series noted, from this ship, occurred that year on the 17th October. In total, Dunlop recorded for 332 days covering the thousands of miles from Woolwich to Hobart Town. This, across the seas, study continued whilst travelling aboard the Brigg 'Helen' from October 31st 1831 until his arrival in Sydney Town on November 6th.

Dunlop describes the preparation of his cabin for the experiments (Figure 2) and includes a sketch of the apparatus. He goes on to give details, on page 11, of both his mechanical skills and innovative thinking. '*In the year 1828 I made a number of needles in the expectation of obtaining from the whole two or three in which the magnetism had become stationary – but was disappointed. It occurred to me that I had an old C* [indecipherable word] *by Ramsden with an excellent needle about 2 1/2 inches in length. I took out the needle and by means of shellac varnish cemented a silver loop on the top.*' (Dunlop 1834a, p. 11). As previously revealed, Dunlop not only kept his promise to Captain Beaufort but he supplemented the magnetic research he recorded, during his voyage to NSW, by further land/sea observations until January 16th 1833. Dunlop reduced the data he gathered over these years in a similar manner to those readings taken during his travels through Scotland. '*With regard to ... these observations – the corrections applyed* [sic] *for the reduction to 60° of temperature ... and those for Arc of vibration depend on the cosine of the difference of the mean of the arcs. Commencing with an arc of 20 and ending with an arc of 5 degrees on land being the standard. But at sea there will be some uncertainty respecting the mean of the arc of vibration because the motion of the ship particularly in rough weather will make the arc irregular during a series. Though in moderate weather and the ship going free the observations are in general equal to any I could have made on shore.*' (Dunlop 1834a, p. 6)

In the nineteenth century, astronomer Sir Edward Sabine was the driving force in a British push to organise and establish a worldwide

chain of magnetic observatories. Observations for this international venture commenced in 1840. Apart from the official publications generated by the various institutions Sabine published compilation reports of magnetic surveys in the Philosophical Transactions of the Royal Society.

After finding the unpublished manuscript in the annals of the Royal Society, Sabine utilised Dunlop's observations taken during his 1831 voyage to NSW. In the Philosophical Transactions of the Royal Society of London Sabine published 'Contributions to Terrestrial Magnetism' in 1840, with acknowledgment of Dunlop's labour. Between 1840 and 1877, Sabine published fifteen volumes of this series of observations. Throughout the successive papers, he continued to make use of Dunlop's unpublished manuscript. '*Mr. DUNLOP'S observations . . . furnish us with a series of dip and intensity results obtained at sea between the meridian of the Cape of Good Hope and New South Wales, and between the parallels of -35° and -41°; a part of the globe from whence no* ***recent*** *data at least have been obtained for the lines of dip, and where materials for the lines of intensity were previously wholly wanting.*' (Sabine 1840, p. 142)

JAMES DUNLOP RETURNS TO PARRAMATTA

Dunlop's return to Parramatta in 1831 was to take up the position of Superintendent of Parramatta Observatory. He discovered a comet in 1833 and another in 1834. The scientific community again honoured Dunlop, this time for these discoveries. He received the Lalande medal from the Académie des Sciences. '*The medal created by M. de Lalande to be given every year to the person who, in France or elsewhere (members of the Institute excepted) has done the most interesting observation or the communication most useful to the progress of astronomy, has been given in 1835 to Mr Dunlop, director of the Observatory of New Holland*'. (Académie des Sciences 1835, p. 521. translation by Babron, May 2003).

In 1834, John Herschel travelled to South Africa and commenced a four-year examination of the skies of the southern hemisphere. His observations included viewing the return, in 1836, of Halley's Comet, and evaluating the brightness of stars. Whilst on this South African expedition Herschel raised doubts regarding the authenticity of observations taken at Parramatta. The number of observations with '*so small a telescope*' (Cozens & White 2001, p. 114) seemed implausible. Herschel found '*only 211 of Dunlop's objects in spite of using a substantially larger telescope . . . he* [Herschel] *remarked that Dunlop saw them from "subjective reasons"*'. (Cozens & White 2001, p. 114).

Due mainly to John Herschel's disparagement, of the work performed at Parramatta the observations fell into disrepute. Herschel's own objectivity, perhaps professional jealousy, regarding his comments is questioned by Agnes Mary Clark and cited by Cozens & White as Herschel felt . . . 'the cream of the Southern Hemisphere had already been skimmed by Dunlop' (2001, p. 114).

Dunlop continued to observe and note both meteorological and astronomical data for many years. Although his last recorded observations were in 1839, James Dunlop remained at Parramatta and the Observatory until 1847 when illness forced him to resign.

The Sydney Morning Herald retirement notice reads '*Mr Dunlop, the Astronomer Royal of the Colony, has resigned his appointment. During the many years Mr. D. has held this most distinguished appointment, he has made it a fixed rule of his life to distribute in acts of charity the salary he received from the Admiralty, with whom the appointment is vested*' (1847).

The article continues by mentioning some of Dunlop's prestigious awards and the preparation for a parting function. Unfortunately, due to the sudden death of the Governor's wife, no farewell event occurred. James Dunlop retired to his home at Brisbane Waters where he died the following year. His published death notice is in The Sydney Morning Herald, for September 1848 but the date of death is recorded as 22nd September whilst his gravestone states 23rd September.

A TANGIBLE RESULT

All the equipment from Parramatta Observatory was stored prior to the demolition of the building in 1847–48. Holland has recently (2008) unearthed more details of these particular circumstances. Examination of Brisbane's papers, when he furnished his first observatory at Brisbane Glen, Scotland, finds an account (1809, 1810) for the acquisition of some astronomical instruments. They show no record of Brisbane purchasing a dipping needle/compass at this time. Further investigation may lead to its purchase occurring whilst he was stationed in Paris between 1815 and 1818. Although online records do not detail its provenance there is a Gambey of Paris dipping needle in the collection of the Powerhouse Museum in Sydney with an observatory index code. This instrument is shown in Figures 3 & 4. Evidence suggests it is part of the original observatory equipment bought to NSW by Governor Sir Thomas Brisbane. Records include the magnetic observations taken by Brisbane and Rümker during the voyage to NSW and published in 1830 by Rümker. This paper contains a report of a magnetic reading (p. 2) upon their arrival in November 1821 using a Gambey of Paris dipping compass. When Brisbane left the colony in 1825, the instrument was amongst the equipment purchased, with the observatory, by the Colonial Government.

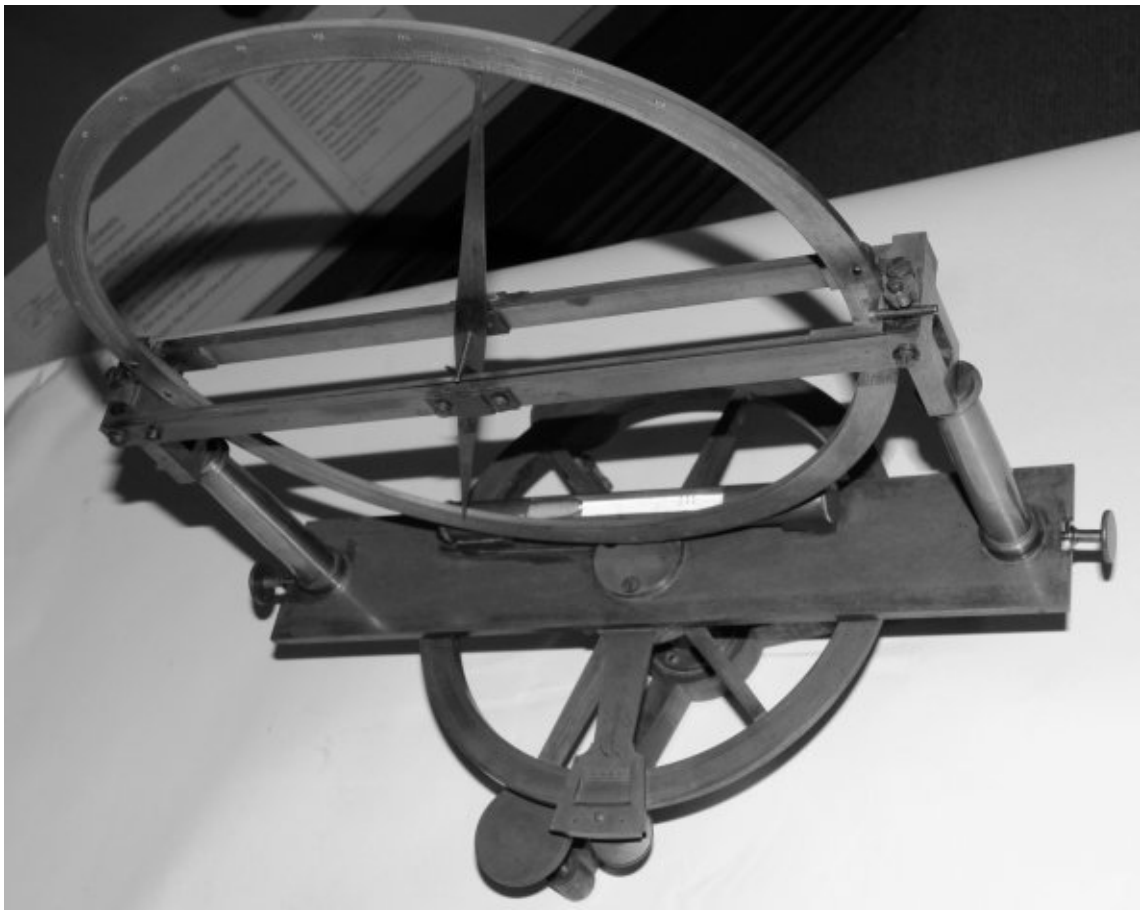
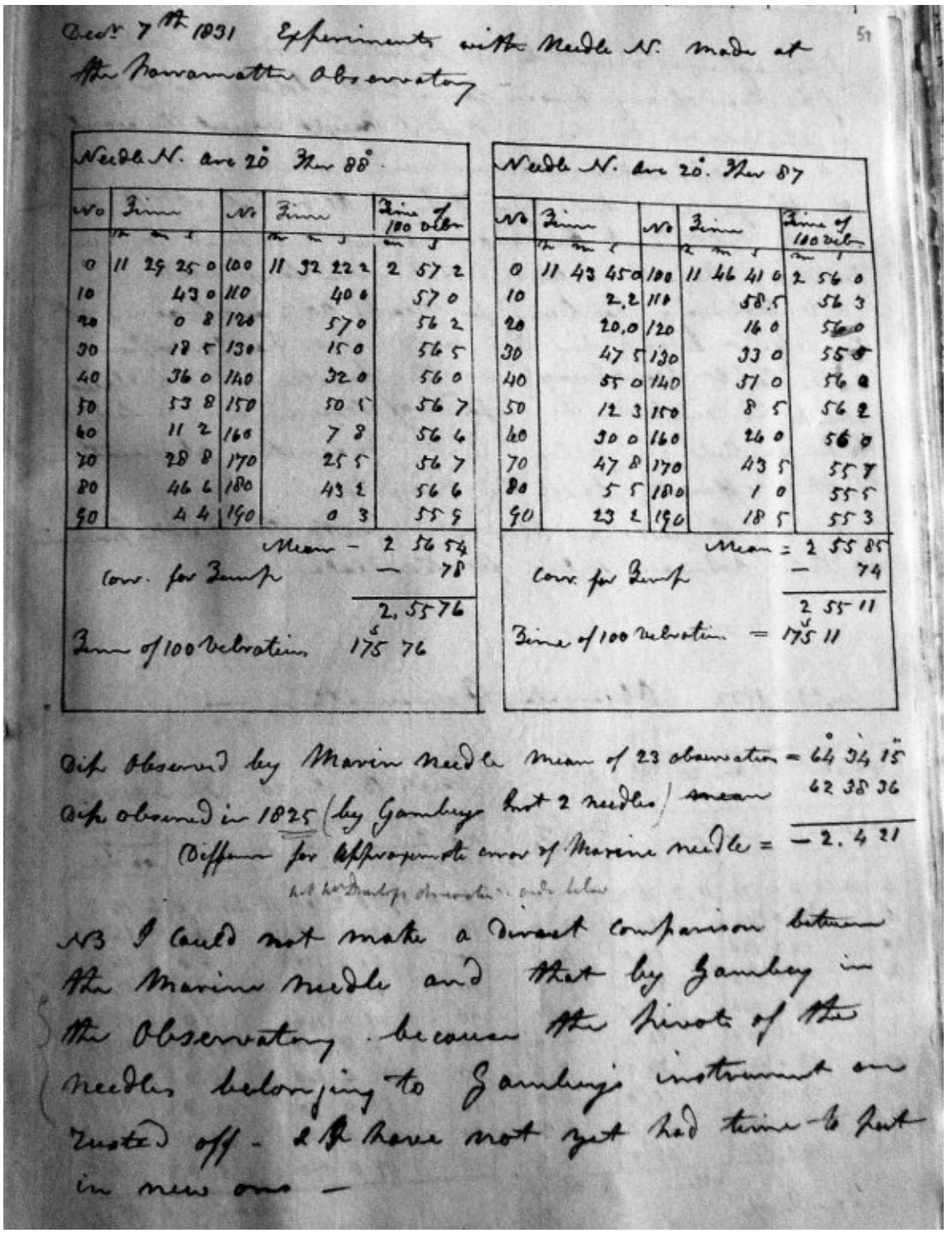


Figure 3. Gambey of Paris dipping needle/compass from Sydney Observatory.
Photograph by author, courtesy Dr Nick Lomb, Curator of Astronomy, Powerhouse Museum.

Dunlop's unpublished manuscript again discusses the Gambey of Paris dipping needle. He notes observations, using this instrument, for 1825 but he is unable to duplicate the experiment in 1832 because of the rusty condition of the '*pivots of the needles*' (Dunlop 1834a, p. 126, see Figure 5). Due to its historical significance, further research to confirm the provenance of this instrument is warranted.

As previously mentioned, Brisbane and Rümker also conducted magnetic observations during voyages to and from NSW, but although their results were published, they were not as wide-ranging as Dunlop's 1831 series. (Figure 6 aptly illustrates the extent of Dunlop's magnetic observations.) The worth of James Dunlop's comprehensive magnetic observational work was not overtly credited during his lifetime and this oversight should finally be recognised.

Figure 4. Detail of the Gambey of Paris dipping needle/compass from Sydney Observatory. Photograph by Dr Nick Lomb, Curator of Astronomy, Powerhouse Museum.



Dec^r 7^th 1831 Experiments with Needle N. made at the Parramatta Observatory

Needle N. dec 20° Ther 88°

No	Time	No	Time	Time of 100 Vibn
	h m s		h m s	m s
0	11 29 25 0	100	11 32 22 2	2 57 2
10	43 0	110	40 0	57 0
20	0 8	120	57 0	56 2
30	17 5	130	15 0	56 5
40	36 0	140	32 0	56 0
50	53 8	150	50 1	56 7
60	11 2	160	7 8	56 6
70	28 8	170	25 5	56 7
80	46 6	180	43 2	56 6
90	4 4	190	0 3	55 9

Mean = 2 56 54
Corr. for Temp — 78
2, 55 76
Time of 100 Vibrations 175 76

Needle N. dec 20°. Ther 87

No	Time	No	Time	Time of 100 Vibn
	h m s		h m s	m s
0	11 43 45 0	100	11 46 41 0	2 56 0
10	2,2	110	58.5	56 3
20	20,0	120	16 0	56 0
30	47 5	130	33 0	55 8
40	55 0	140	51 0	56 0
50	12 3	150	8 5	56 2
60	30 0	160	26 0	56 0
70	47 8	170	43 5	55 7
80	5 5	180	1 0	55 5
90	23 2	190	18 5	55 3

Mean = 2 55 85
Corr. for Temp — 74
2 55 11
Time of 100 Vibration = 175 11

Dip observed by Marine needle Mean of 23 observation = 64° 34' 15"
Dip observed in 1825 (by Gambey but 2 needles) mean 62 38 36
Difference for Approximate error of Marine needle = — 2. 4 21

NB I could not make a direct comparison between the Marine needle and that by Gambey in the Observatory. because the pivots of the needles belonging to Gambey's instrument are worsted off - & I have not yet had time to put in new ones —

Figure 5. Page 126 from Dunlop's unpublished manuscript (Dunlop 1834a). Photographed by Ms Gail Gibson, London. ©Royal Society, London

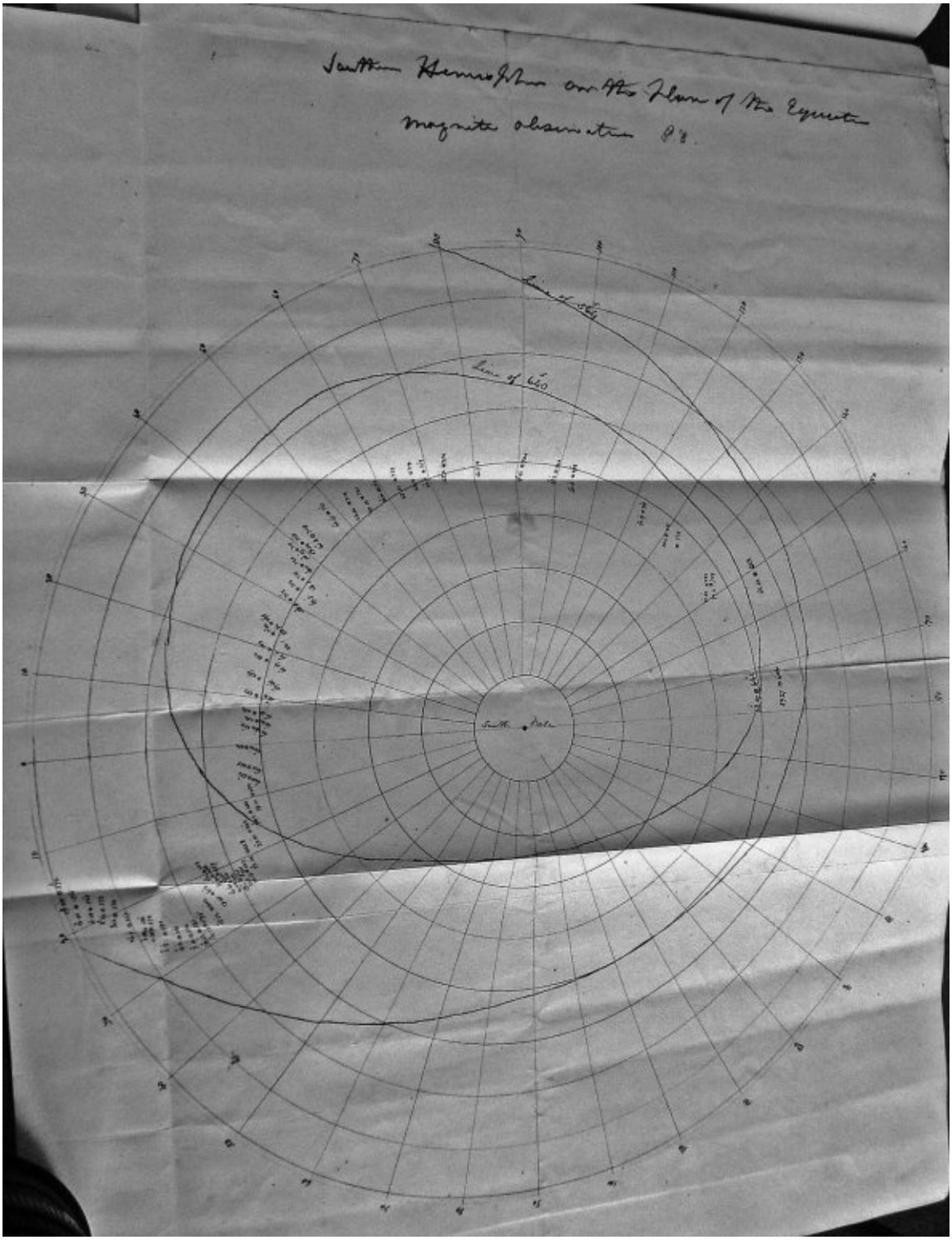


Figure 6. Page 148 from Dunlop's unpublished manuscript (Dunlop 1834a).
Photographed by Ms Gail Gibson, London. ©Royal Society, London

IN CONCLUSION

An almost forgotten figure in Australian colonial history James Dunlop travelled across the world and participated in the establishment of Parramatta Observatory and the cataloguing of the southern sky. The initial accolades he received from the European scientific community, for his contributions to astronomy, turned to condemnation. On his second voyage to NSW, Dunlop conducted difficult research and then reduced the accumulated results into a manuscript. This document was never printed (Figure 7 records the Royal Society's decision) and his carefully prepared data only became accessible under the authorship of another.

It is just over 160 years (September 23rd 1848) since James Dunlop died in his home at Brisbane Waters and his work and life have almost disappeared from our historical records. This International Year of Astronomy is an appropriate time to recognise James Dunlop as part of Australia's scientific heritage and to reclaim some of his reputation.

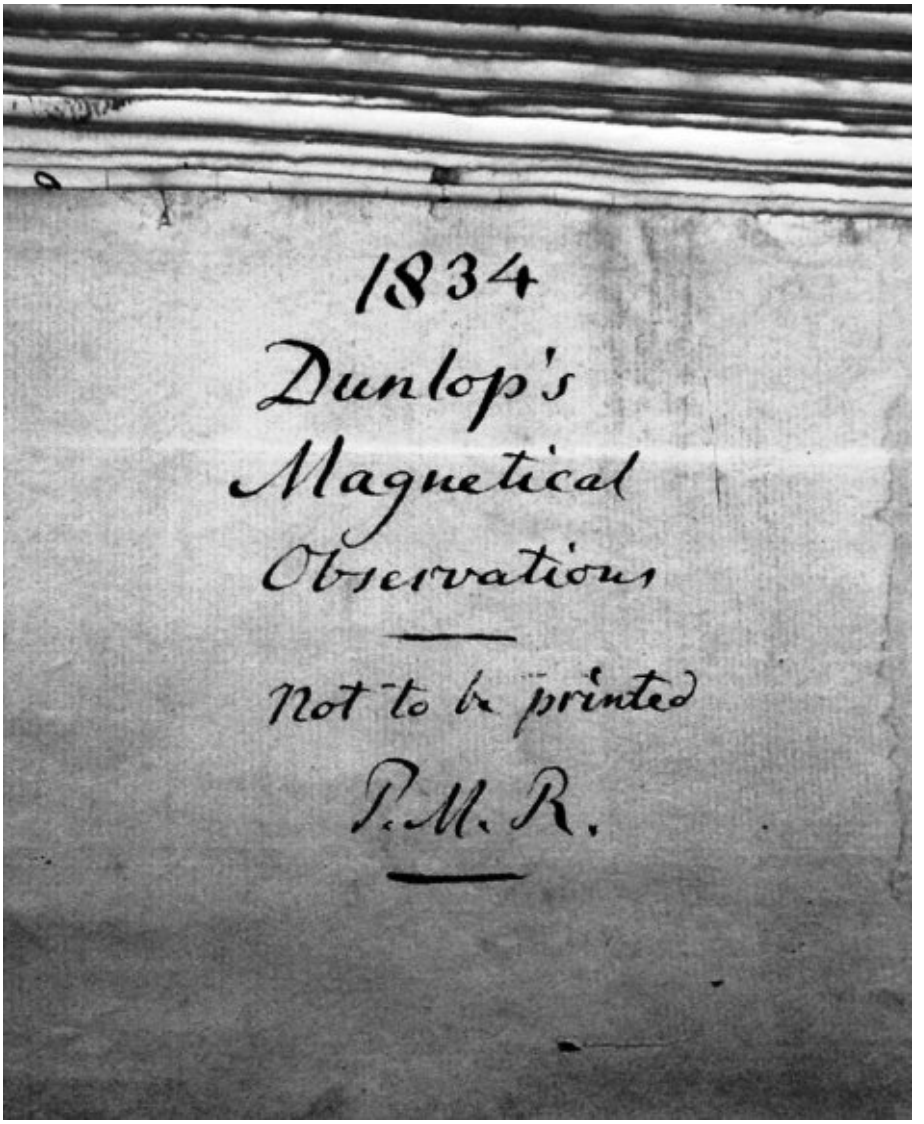


Figure 7. Page 147 from Dunlop's unpublished manuscript (Dunlop 1834a). Photographed by Ms Gail Gibson, London. ©Royal Society, London

ACKNOWLEDGEMENTS

The author would like to thank the following people and institutions for their invaluable assistance: Ms Gail Gibson (London) for the arduous task of photographing the entire unpublished Dunlop manuscript, Mr Julian Holland (Sydney), Ms Lyn Crawford archivist of the Mitchell Library (Glasgow), Mme Marie-Claude Babron (France), Ms Nichola Court archivist of The Royal Society (London), Dr Nick Lomb curator of Sydney Observatory, Ms Verena Mauldon, curator, cultural heritage of the Parramatta Park Trust, Ms Vicki Hammond archivist The Royal Society of Edinburgh. Finally, I would like to thank Mr Mike Lake from the editorial staff of the Royal Society of New South Wales for allowing me time to follow a research lead before submitting this article.

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Ms Sharon Rutledge
25 Burra Street, Pendle Hill, NSW 2145
s.rutledge@unsw.edu.au

(Manuscript received 06.04.2009, accepted 10.05.2009)