THE (ALMOST) UNSEEN TOTAL ECLIPSE OF 1831

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Abstract: The total eclipse of August 1831 began at sunrise in Australia, swept across the western South Pacific Ocean, and ended at sunset in the central South Pacific. As a result of the eclipse's path over mostly uninhabited ocean, the region's sparse European (British) population, and near-useless local predictions of the event at Hobart and Sydney in almanacs sold to the general public, almost no one witnessed its passage. In an attempt to document the eclipse, journals of naïve observers—those having no access to a prediction—were examined. Thus far, the sole record is in the *Pitcairn Island Register Book*. Considering the Pitcairners' extreme isolation and the rather modest partial eclipse that occurred there, the entry is a surprising one; however, it can be explained in terms of events associated with their initial removal to Tahiti in March 1831 followed by their return home in June. Further, an authoritative means to identify any issues associated with eclipse predictions compiled for private-sector almanacs came in 1833 when sweeping changes in the British *Nautical Almanac*'s section on eclipses were instituted..

Key Words: *solar eclipse, almanac, ephemeris, Australia, South Pacific*

1 INTRODUCTION

Two solar eclipses took place during 1831. The first, in February, was an annular eclipse that passed over the United States. The event was predicted and also highly publicized in the country's newspapers. Thanks to clear weather in many places, it was seen by a multitude of specialists and non-specialists alike.

The second eclipse came in August. This one, whose duration of darkness was 3 min 20 sec at maximum and whose path of totality was almost 160 km wide, began at sunrise in Australia, swept across a wide expanse of the western South Pacific Ocean, and ended at sunset in the central South Pacific. It, too, was predicted. However, in sharp contrast to the February eclipse, it passed over a very sparsely inhabited part of the globe. But other reasons diminished the chance of sightings, and they are discussed here.

2 ECLIPSE PREDICTIONS

2.1 Great Britain's *Nautical Almanac*

During 1828 the Commissioners of Longitude ordered the printing of *The Nautical Almanac and Astronomical Ephemeris for the year 1831*, this volume continuing a series begun in 1766 with the printing of an ephemeris for 1767. Among the sections in the publication was a list of solar and lunar eclipses. The solar eclipses, one predicted for 12 February and the other for 7 August, would be invisible at Greenwich.

For each solar eclipse only a few lines of information were printed: data regarding the moment of conjunction, and the apparent time at Greenwich when the eclipsed sun was centered on the local meridian.[1] No diagram for either eclipse was included. For the total eclipse germane to this study the following was given

> Aug. 7. The SUN eclipsed, invisible at Greenwich.
> ⊙ will be centrally eclipsed on the Meridian at $10^h.24\frac{1}{4}^m$, in Long. 156°.2′ West, and in Lat. 26°.35¾′ South.

2.2 An American Almanac

Late in 1830 the privately-issued *American Almanac and Repository of Useful Knowledge, for the year 1831* appeared. A several-hundred-page compendium, it included sections on the year's solar and lunar eclipses, including a discussion of data sources. The compiler was the astronomer-computer Robert T. Paine of Boston (1803-1885).

For the annular eclipse of 12 February, Paine gave lengthy descriptions of the eclipse's progress, from its start at sunrise in the North Pacific Ocean to its conclusion in the Atlantic Ocean southwest of Iceland. He provided details for twenty-five cities—from New Orleans to Canada's Halifax—along the eclipse's path, as well as two sketches showing the appearance of the sun at conjunction of the sun and moon and at greatest obscuration. The *American Almanac*'s publishers added a map showing the annular eclipse's central path across the United States.

Paine also provided information about the total eclipse of 7 August, an event invisible in the United States. He detailed its progress and extent as well as listing specific parameters for the partial eclipse at the Parramatta Observatory (Paine, 1830: 27):

> At the Astronomical Observatory in Par[r]amatta, in New Holland, in latitude 33° 48′ 49.8″ S., Longitude 151° 1′ 34″ E., the Sun will rise eclipsed.
> The greatest obscuration (10½ digits) will take place at 19h. 7½m. Mean Time at Par[r]amatta.
> The end of the Eclipse [will occur at] 20h. 16½m. Mean Time at Par[r]amatta.

2.3 Two Australian Almanacs

Early in 1831 two almanacs intended for the general public became available, one printed in Hobart (Figure 1), the other in Sydney (Figure 2). The sections listing eclipses for the year were quite similar to the one given in the British *Nautical Almanac,* but with alterations germane to the Australian locales. The prediction printed in the Hobart almanac for the August solar eclipse read as follows:

> … an eclipse of the Sun, centrally eclipsed in longitude 156 degrees 2 minutes west, and latitude 26 degrees 35 minutes South, at 14 minutes past 8 am the morning of the 8th of August at Hobart Town.

The prediction given in the Sydney almanac was more detailed:

> Aug. 7. The Sun eclipsed, visible at Port Jackson.
> Centrally eclipsed on the Meridian at 24 minutes 15 seconds past 10 at night, Greenwich time, in latitude 26° 35′ 45″ south, and longitude 156° 2′ west.

On the meridian of Port Jackson, the Eclipse will begin at 36 minutes past 7 in the morning.
Middle of the Eclipse, 25 minutes 36 seconds past 8.
End of the Eclipse, 45 minutes 36 seconds past 9.
The Total obscuration will be in the South Pacific Ocean, 10° south by west of Taheite.
Digits eclipsed 9° 30′.

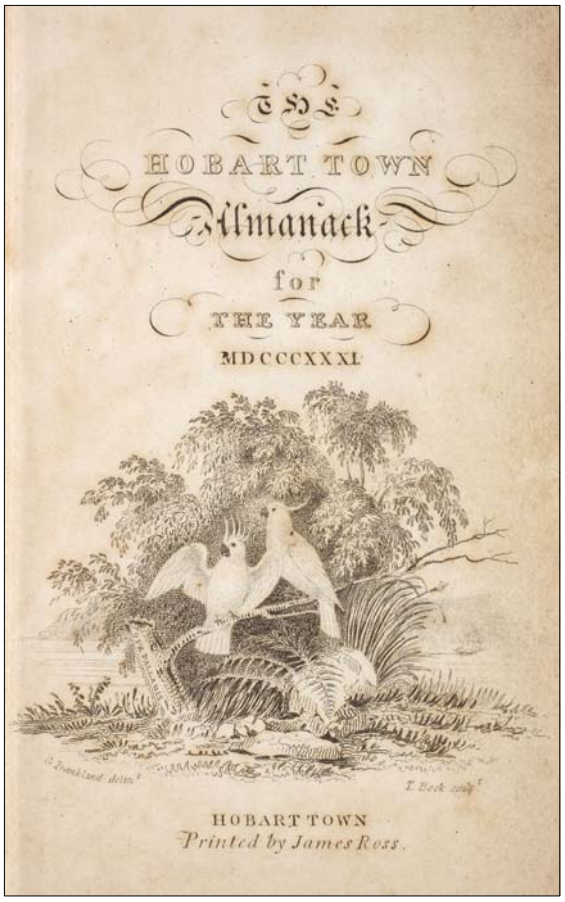

Figure 1: Second title page of *The Van Diemen's Land Anniversary and Hobart Town Almanack for the Year 1831*, one of two separate almanacs printed in Hobart during the year and the one discussed in the text (courtesy: Heritage Collections, State Library of Tasmania).

On 6 August, a Saturday, the *Sydney Gazette* summarized the almanac's prediction (Editor, 1831a):

> ECLIPSE OF THE SUN.---Our readers are reminded, that tomorrow morning there will be that rare celestial phenomenon--a visible eclipse of the sun. It will begin at 36 minutes past 7; its middle will be a little sooner than half past 8; and will end at 45 minutes and 36 seconds past 9: the total continuance being 2 hours and 40 minutes. The total obscuration will occur in the South Pacific Ocean, 10° South by west of Taheite.---

As we shall see, this summary led not only to the questioning of the almanacs' predictions, but also much finger pointing. In order to appreciate the issues, some authoritative information is needed.

3 THE AUGUST 1831 ECLIPSE

EmapWin, freeware developed by Shinobu Takesako of Japan, is an extremely convenient way to examine solar eclipse parameters; an accompanying file gives details of the program's data sources. The path of the total eclipse given on the Mercator map (Figure 3) is based on EmapWin results. The various values calculated via this program will represent the actual eclipse's progress.

3.1 British and American Predictions vs. EmapWin Results

The prediction presented in the *Nautical Almanac* is in very good agreement with the EmapWin result, the difference in location between the two being 14 km. Paine's predictions for the Parramatta Observatory location are also in good agreement with EmapWin (Table 1).

3.2 Australian Predictions vs. EmapWin Results

For Hobart the apparent time given for when the sun is centrally eclipsed on the meridian is simply a shift of the *Nautical Almanac*'s value to reflect the fact that Hobart's local time is $9^h49^m16^s$ ahead of Greenwich time. Note that the *Hobart Town Almanack* shows the event date as 8 August, which is correct; however, the time listed is apparent time, not the more-useful mean time. Further, an unsophisticated reader might conclude that the time given reflects local circumstances, which it does not. The time is for an event taking place over 5300 km away (Table 2).

Table 1: Almanac predictions (converted to civil time) compared with EmapWin results.

Source	Event	Predicted Value	EmapWin
Nautical Almanac	Centrally eclipsed on the meridian	August 7, 22:24:25 Greenwich apparent time [22:30:04 GMT] at 26.60°S, 156.03°W	August 8, 12:00 local apparent time [22:30:30.6 GMT] at 26.66°S, 156.15°W
American Almanac	Sunrise Greatest obscuration End of eclipse	Rises eclipsed 7:07:30 mean time 8:16:30 mean time at Parramatta Obs'y	6:47:08 local mean time 7:07:51 local mean time 8:16:58 local mean time at 33.81°S, 151.03°E

Table 2: Predictions from Australian almanacs compared with EmapWin results. EmapWin co-ordinates are 26.66°S, 156.15°W.

Source	Event	Predicted Value	EmapWin
Hobart Town Almanac	Centrally eclipsed on the meridian	August 8 (26.60°S, 156.03°W) 8:14 Hobart apparent time	----
Australan Almanac	Start of eclipse	August 7, 7:36 Sydney apparent time	August 8, 6:54 apparent time, 6:59:39 mean time (first contact)
	Middle of eclipse	8:25:36 Sydney apparent time	8:28 apparent time, 8:33:59 mean time (event mid-point)
	End of eclipse	9:45:36 Sydney apparent time	10:03 apparent time, 10:08:19 mean time (last contact)

Table 3: EmapWin results for selected locations (times rounded to nearest minute).

Location	Latitude	Longitude	Maximum Eclipse	Local Mean Time
Hobart	42.88°S	147.32°E	0.713	7:05 sun rises eclipsed at sunrise 8:09 last penumbral contact
Parramatta Observatory	33.81°S	151.03°E	0.878	6:47 sun rises eclipsed 7:04 mid-eclipse 8:17 last penumbral contact
Sydney	33.87°S	151.22°E.	0.876	6:47 sun rises eclipsed 7:09 mid-eclipse 8:18 last penumbral contact
Maitland	32.73°S	151.55°E	0.899	6:45 sun rises eclipsed 7:09 mid-eclipse 8:18 last penumbral contact
Brisbane	27.47°S	153.03°E	Total eclipse 1m 29.3s duration	6:37 sun rises eclipsed 7:08:34 first umbral contact 7:09:18 mid-eclipse 7:10:03 last umbral contact 8:20 last penumbral contact
Norfolk Island	29.05°S	167.95°E	0.892	7:14 sun rises eclipsed 8:24 mid-eclipse 9:46 last penumbral contact
Tonga	20.00°S	175.00°E	0.961	8:29 sun rises eclipsed 9:54 mid-eclipse 11:30 last penumbral contact
Cook Islands	20.00°S	158.00°E	0.875	10:11 sun rises eclipsed 11:48 mid-eclipse 13:23 last penumbral contact
Pitcairn Island	25.07°S	130.08°E	0.642	13:25 sun rises eclipsed 14:45 mid-eclipse 15:56 last penumbral contact

The predictions in the *Australian Almanack* are an example of a badly thought-out listing. The tabulation begins correctly with a 7 August date for Greenwich, but the compiler apparently assumed that any reader would understand that the next line's "in the morning" was for 8 August, the following day—or simply forgot to advance the date to conform with Sydney time, which is $10^h4^m52^s$ ahead of Greenwich. Further, the value given for the so-called beginning of the centrally-eclipsed sun seems to be in error. The words "total obscuration" would certainly cause a reader to think that totality was limited to a small area on the globe, not along a fairly narrow path thousands of kilometers long. Finally, the values in the table given are in poor agreement with EmapWin results.

Throughout this tabulation, it is left to the reader to grasp that the values are not for local circumstances at Sydney, but for locations from 660 to more than 5,000 km away: at first contact of the umbra, and when centrally eclipsed on the meridian. Small wonder that the *Sydney Gazette's* editor summarized the predicted event … on the wrong day.

3.3 Other EmapWin Results

Table 3 lists local circumstances for places of interest. Not surprisingly, for Hobart and Sydney the times shown are different from those given in the respective almanacs. In the case of Hobart, if an unsophisticated reader assumed—incorrectly—that the almanac value of 8:14 in the morning was linked to local circumstances, by that time the actual eclipse was over. Even if a hopeful observer had turned up earlier to make sure he would see the event, the hilly terrain across the River Derwent would have blocked the first minutes of the eclipsed Sun's rising, reducing his window of opportunity.

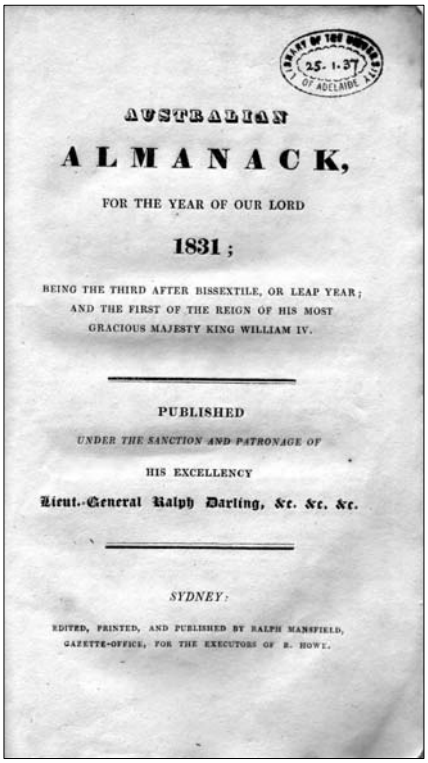

Figure 2: Title page of the *Australian Almanack, for the Year of our Lord 1831* (courtesy: Special Collections, Barr Smith Library, University of Adelaide, South Australia).

The 8 August sunrise at Sydney was a different matter; there are no heights to the east-northeast to block the view. Ironically, if an unsophisticated reader in Sydney concluded (incorrectly) that the almanac values were linked to local circumstances and used the beginning value given there, he actually would have seen a partial eclipse—but *only* if the correct date had been printed with it.

4 AFTER THE EVENT

4.1 Hobart Town

The first hint that something was amiss came in an August 9 letter sent to the editor of Hobart's *Colonial Times*. Its author had not seen the eclipse and scolded the almanac compilers (G., 1831):

> The Hobart Town Almanacks publish an account of an eclipse of the sun, which was to have taken place yesterday, and let me assure your readers was not visible, although the publications say the contrary. With whom the negligence arises, is not for me to determine, but allow me to recommend their compilers to be more careful in future.

Apparently no immediate attention was paid to the letter.

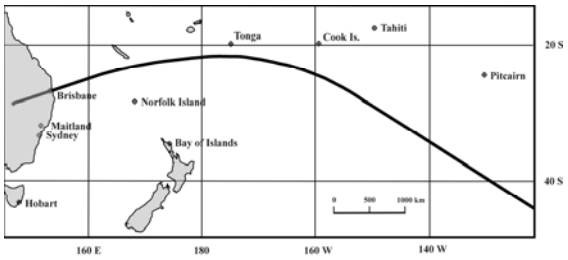

Figure 3: The path of totality for the total eclipse of 1831 (the entire path is not depicted). The data used for drawing the smooth curve are from EmapWin; the Mercator-projection base map is taken from "Oceania," CIA map 802480 (R02111) 1-97.

4.2 Sydney

On 11 August the *Sydney Gazette* printed a long and detailed letter received by its editor (Correspondent, 1831). The writer, whose equipment was a 4¼ in reflecting telescope having an achromat eyepiece of 25 power and a deep red filter placed in the focus, recounted his failure to observe the eclipse. He stated that he had used the *Australian Almanack*'s predictions to guide him, and that he had examined the sun continuously since shortly after sunrise until at least fifteen minutes after the eclipse was supposed to begin: that is, until 7:50. Further, he had continued observing the sun throughout the day, "… but there was no obscuration from the time of rising, to setting, not even the most partial." To emphasize that an overcast sky was not involved, the letter writer added, "Sunday [7 August] was a remarkably fine day."

The writer, undoubtedly a qualified observer and likely with tongue-in-cheek, noted:

> This [lack of an eclipse] is a most remarkable fact; should notice of it reach the eye of any of our Astronomers in England, especially those gentlemen who calculate the elements for the Board of Longitude, I have no doubt this statement will lead them to ascertain if there had been an error in the calculation, or whether the moon has been attracted from her orbit by means of a comet.

The *Gazette*'s editor, who was also responsible for the *Australian Almanack*'s content, answered with (Editor, 1831b)

> In reference to the calculations in the Australian Almanack, we are at liberty to say, they were corrected by one who had devoted the greater part of a long life to mathematical and astronomical studies, and who was considered to possess superior talent as well as ample experience.

In spite of this somewhat effusive appeal to the skills of a deceased calculator, the issue would not go away. On the 22nd of the same month the *Gazette*'s editor received another long and detailed letter, this time from Australia's Reverend Henry Fulton (1761–1840), well-versed in mathematics thanks to his initial training at Trinity College, Dublin. He began his exposition—also tongue-in-cheek?—with

> Observing in the newspapers extraordinary conjectures about the approach of a comet to our regions, so near as to attract the moon out of her usual orbit, and yet not perceivable by human eyes; I had the curiosity to calculate from Ferguson's and Maskelyne's tables, the correct times of full and change of the moon in this month, and also her distance from the node at these times. I found that these times agreed with the times in the *Australian Almanack*, and the distances from the nodes were such as to cause great eclipses … (Fulton, 1831).

Having calculated approximate values for the two lunar and two solar eclipses occurring in 1831, Reverend Fulton then stated that for the third one, its middle time was on "… the 8th of August, at 8 minutes past 8 in the morning—without an error of more than 20 minutes." (The EmapWin result for the eclipse's mid-point is 8:21.) His final words were damning: all the *Australian Almanack*'s eclipse predictions were seriously—hours—in error, "… nearly 24 hours in the third …", the eclipse under discussion here.

The editor put the best face on the situation by noting that Reverend Fulton had shown that a portion of the work in the *Australian Almanack* was satisfactory (the phases of the Moon). However, the editor wrote, "… the eclipses, which he [the almanac's compiler] entrusted to one whom he considered more competent than himself, are wrong by several hours." Then he deliberately(?) confused the issue by adding:

> … with respect to the solar eclipse, the middle of which Mr. F. fixes at 8 minutes past 8 of the morning of the 8th of August, we are as much in the dark as ever, for the sun was carefully watched in Sydney on the 8th as well as on the 7th, but there was no indication of shadow visible on his disk. (Editor, 1831c).

Toward the end of September the editor tried once again to soften the blow aimed at the *Australian Almanack*'s reliability. After seeing a column in *Colonial Times* discussing the failure to observe the eclipse there, he prefaced his publication of it with:

> Is it not a little strange, that it now appears that the Hobart Town Almanacks were as much out in their reckoning concerning the late solar eclipse, as least as far from being confirmed by the fact, as was that of Sydney. (Editor, 1831d).

He quoted in full the 9 August letter to the *Colonial Times* given above as well as the Hobart newspaper editor's 7 September response to the complaint:

> On receipt of this letter, we very naturally concluded that the Hobart Town savants were wrong, and we were unwilling to expose their error, but on skimming over the *Sydney Gazette*, we find our neighbors have also been deceived as well as ourselves.

(The *Colonial Times* editor followed this reader's statement by reprinting the critical remarks given in the *Sydney Gazette*'s 11 August issue.)

What to make of all this? Most likely a general reader could figure out that something had gone awry. But he might not conclude correctly on whose doorstep the error should be placed. For the printed exchange tends to indicate that both editors were not yet willing to accept the fact that an 'error' actually existed in the almanacs—that the compilers had provided information essentially of no use at all to their readers. Further, if they had admitted it, then their own ignorance with regard to what they were placing in the newspaper columns would have been exposed.

5 WHO SAW THE ECLIPSE?

5.1 The 'Naïve Observer'

In the early years of the nineteenth century, European communities in Oceania were few and far between. An idea of Australia's small population can be gleaned from official statistics. In 1830 the population of Tasmania (Van Diemen's Land) was 24,279 persons; that of New South Wales in 1833 was 60,794, of whom 16,232 lived in Sydney; and in 1836 an estimated 5,000 persons were living in Parramatta. In the year of the eclipse, the Moreton Bay Penal Settlement—today's Brisbane—numbered 1,066 convicts and 175 soldiers. Elsewhere in Oceania a tiny handful of Christian missionaries was busy proselytizing on a few of the South Seas islands, with many of them keeping a daily journal of events.[2]

This vast region's population was almost entirely composed of non-specialists having no access to the prediction of an approaching event. A total eclipse's sudden darkness would have taken any one of them by surprise; in general, a partial eclipse would have escaped notice. 'Naïve observer' is an apt characterization.

At some stage during an eclipse's progression toward totality and darkness, even a naïve observer would become aware of the decrease in the sky's brightness. A number of eclipse descriptions intended for the general public include the following:

> A total solar eclipse is not noticeable until the sun is more than ninety percent covered by the moon. At ninety-nine percent coverage, daytime lighting resembles local twilight.

While the second statement can be traced backed to numerous experimental verifications including photometric studies undertaken in the 1960s under the aegis of the Air Force Cambridge Research Laboratories in Massachusetts (Sharp, et al., 1970; and Silverman and Mullen, 1975), no comparable reference for the first one has been found. Nevertheless, this psychophysical statement allowed us to drop from consideration journals of missionaries on Tahiti and at the Bay of Islands, New Zealand, where the magnitude of the maximum eclipse was 0.717 and 0.740, respectively, and almost certainly would not have been noticed.

5.2 Candidate Locations

For the places listed in Table 3, only a very few written records were found. In this section the specific source, if any, is identified along with a summary of the entry for the day of the eclipse.

5.2.1 Australian sites

5.2.1.1. Hobart and Sydney. Already discussed in detail are the almanac predictions and the subsequent exchanges in Hobart's *Colonial Times* and in the *Sydney Gazette*.

5.2.1.2. Parramatta Observatory, maximum eclipse 0.878. No astronomer was at the Observatory from the beginning of 1829 until late 1831; James Dunlop's observing books begin in January 1832.

5.2.1.3. Maitland, maximum eclipse 0.899. On 8 August 1831 surveyor Felton Mathew was working for the New South Wales Survey Department in or near Maitland. His journal entry for that day does not mention the partial eclipse (Mathew, 1831).

5.2.1.4. Brisbane, total eclipse. No mention of the eclipse was found in the official correspondence from the Moreton Bay Penal Settlement. The archived Register for the Brisbane General Hospital, 1825-1844, which includes the state of the weather, are missing the daily records for 1831.

5.2.1.5. Norfolk Island, maximum eclipse 0.892. The surviving records for 1831 of the second penal settlement at Norfolk Island, Lieutenant-Colonel James Morisset commandant, have no eclipse-related information.

5.2.2 Tonga (maximum eclipse 0.961)

The daily journal of John Thomas, a member of the Wesleyan Methodist Missionary Society (London) assigned to Tonga, does not mention the partial eclipse. However, his entry for the following day (9 August) includes "Yesterday we had bad weather, but was able to get on with the translations." Extracts of the journals of James Watkin and Peter Turner for the same period do not mention the event.

Considering how close these missionaries were to the path of totality and the resulting great obscuration of the Sun, the comment regarding bad weather provides a possible explanation for them not noticing a decrease in the sky's brightness: throughout the morning the sky was overcast (heavy rains?).

5.2.3 Cook Islands (maximum eclipse 0.875)

The manuscript journal of Charles Pitman, one of three members of the London Missionary Society on Rarotonga during 1831, was examined. No mention of the partial eclipse was found.

5.2.4 Pitcairn Island (maximum eclipse 0.642)

This magnitude is far below the level at which a naïve observer would become aware of the event. However, a completely unexpected entry appears in the records

being kept on the island, carrying a 7 August 1831 date: "Sun Eclypsed." A detailed explanation follows.

The *Pitcairn Island Register Book*, a record of births, deaths, and marriages, was initiated by John Buffett, who came to the island in 1823 (Figure 4). The original, whose entries are quite sparse between 1790 and 1823 and which ends in 1854, has been microfilmed (S.P.C.K., 1977). Its contents were transcribed and published, along with an introduction by Sir Charles Lucas who added appendices dealing with the fascinating history of the *HMS Bounty* mutineers and their descendents (Lucas, 1929). The entry, "Sun Eclypsed," with its 7 August date, is in the "Remarkable Family Events" section of the *Register Book*.

The date of 7 August stems from the fact that in 1831 the Calendar or Date Line passed east of Tahiti and the Tuamotu Archipelago and west of Pitcairn Island; that is, the Pitcairners were keeping Western or American dating (Bartky, 2007). That the event was actually recorded is a consequence of the turbulence that was altering the lives of these isolated descendents of the mutineers.

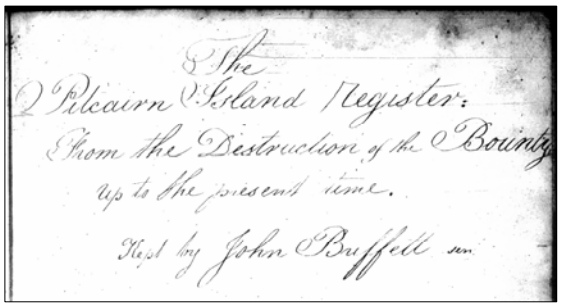
The
Pitcairn Island Register:
From the Destruction of the Bounty
up to the present time.
Kept by John Buffett sen.

Figure 4: Half-title of the *Pitcairn Island Register Book*, 1790-1854 (courtesy: Society for the Promotion of Christian Knowledge, London).

In the late 1820s, fearing that the expanding population on Pitcairn Island would exceed available resources, the British Government decided to remove them to Tahiti. On 6 March 1831 all eighty-six inhabitants embarked on a transport ship, arriving at Papeete, Tahiti's major settlement, on the 21st. In this new environment many became ill; over the next two months a dozen Pitcairners would die. Further, this most devout group of Christians was profoundly shocked at what was to them the licentious behavior of the Tahitians. They pleaded with the London Missionary Society's authorities on the island to be allowed to return to their homeland, and arrangements to have them go back to Pitcairn were initiated.

Not anxious to linger on Tahiti for some unknown period of time hoping for a solution to their plight, on 24 April twelve Pitcairners under the leadership of John Buffett sailed back to their home island in a small schooner. According to an entry in the *Register Book*, adverse winds stranded them on Lord Hood's Island in the Tuamotu Archipelago, and the schooner that was to have taken them home returned to Tahiti.[3] The Pitcairners waited there for further transport, during which time they suffered the death of one of their number. Finally on 21 June they embarked on the "French Brig Bordeaux packet" (*Courier de Bordeaux*?) and were taken to Pitcairn Island. The group arrived on the 27th, noting their return in the *Register Book*. It had taken them two months to come home (Lucas, 1929: 36, and Moerenhout, 1837: 442-444).

The printed edition of the *Register Book* includes a section, "Arrivals." Transcribed from the original document, also kept by John Buffett, it is an incomplete but chronological listing of the vessels stopping by Pitcairn Island. An entry dated 3 July 1831 lists "[Whaleship] *Origon* of Fairhaven [Mass.], 307 tons, Jabez Delane [*Delano*, master]."

The next chronological entry of interest appears in the "Remarkable Family Events" section of the *Register Book*. It is dated 2 September, and notes the return from Tahiti of the rest of the Pitcairn Islanders on the American brig *Charles Doggett* via a sea voyage lasting only seventeen days.

In summary, these entries demonstrate that eleven Pitcairners—the first wave of returnees—were on Pitcairn Island the day of the eclipse, which was a partial one at the island's location. Thus far, the *Register Book* is the sole document linking the solar event to an observer.

5.2.5 Other Locations

Surviving logs of eight whaling ships, selected from the lists of vessels known to be in the South Pacific Fishing Grounds during 1831, were examined to determine if any August eclipse entries, partial or otherwise, were recorded. Unfortunately, no entries were found.

6 CONCLUDING REMARKS

First of all, it is understatement to term the Pitcairn Islanders 'naïve'. Prior to their disastrous move to Tahiti, the vast majority of them had never been off the island. Just as with such observers elsewhere, the Pitcairners should have sensed nothing different in the sky's brightness during the solar event; the evidence in the *Pitcairn Island Register Book* indicates otherwise. A plausible explanation for this apparent contradiction is at least one of the eleven Pitcairners on the island was informed of the event prior to its occurrence. Who informed them? Since the logs of the French packet ship and the American whaler have never been located, one can only speculate: the navigator of one of the two vessels was the source of the Islanders' information.

Second, as is shown in Table 1, the *Nautical Almanac*'s total-eclipse prediction, the partial-eclipse prediction from the *American Almanac*, and Reverend Fulton's calculations demonstrate convincingly that various aspects of the solar event could be calculated quite accurately. On the other hand, the several almanac compilers in Australia lacked comparable skills, and this fundamental problem was exacerbated by the editors' lack of understanding of what was being placed before them. Fortunately for all, soon after the 1831 eclipse a major transformation of the *Nautical Almanac* was initiated, one part of which gave editors a means for judging their compilers' products.

In a report to the Lords Commissioners of the Admiralty dated 19 November 1830, a distinguished committee of the Astronomical Society of London (today's Royal Astronomical Society) recommended sweeping changes in the annual issuance. Among

them was Recommendation 23, focused on the section devoted to solar and lunar eclipses:

> The Committee recommend [sic.] that in the account of the solar eclipses, there should be given the elements employed in the computation, the line of the moon's umbra across the earth, together with a diagram of the same; and generally more particulars relative to the phenomena, as in the Berlin Ephemeris.

The Admiralty ordered the committee's recommendations to be carried into effect (Astronomical Society, 1830: xix).

The changes took effect in the *Nautical Almanac and Astronomical Ephemeris for 1834*, printed in 1833. An eclipse diagram of the kind recommended by the committee astronomers was included (Figure 5). Together with accompanying data, it allowed anyone with no more than modest cartographic skills a means for judging the quality of a compiler's products. For example, a user or a local editor could glance at a diagram in the style of Figure 5 and see that the eclipse predicted for, say, Cape Town would be a partial one, and that the path of totality would begin at sunrise in the Atlantic Ocean, cross Africa, and end at sunset in the Indian Ocean. With additional mathematical skills and knowledge of astronomical conventions, the time of the eclipse in a particular locale could be estimated.

The impact of this transformed, authoritative source on locally-produced almanacs is not a subject of this study. However, being printed well before the event—the Admiralty also adopted the recommendation that the *Nautical Almanac* be made available four years in advance—doubtless it had an impact on the quality of these later, derived publications.

7 ACKNOWLEDGEMENTS

Numerous individuals on several continents and islands contributed to the completion of this near-decade-long effort. Former career diplomat for New Zealand, Rhys Richards, now a maritime historian specializing in Pacific Ocean history prior to 1850, located and transcribed the Hobart Town almanac discussed here, forwarded an overlooked item in the *Sydney Gazette*, and re-checked the daily journals of several South Seas missionaries; he also selected and examined the whaling ship logs. Professor (ret.) Niel Gunson, Australian National University, found in his research notes the 'solution' to the lack of an eclipse sighting by the missionaries on Tonga. Nigel Erskine, Curator for Exploration, Australian National Maritime Museum, reviewed the records for the penal settlement on Norfolk Island; Nick Lomb, Curator of Astronomy, Sydney Observatory/Powerhouse Museum, provided the details on the Parramatta Observatory; and Tony Marshall, Senior Librarian (Heritage Collections), State Library of Tasmania, guided me through the thicket of almanacs printed in Hobart during the 1830s.

During my sojourn in the United Kingdom, the Council for World Mission gave me permission to examine the archives of the London Missionary Society, as did the Methodist Church with regard to the archives of the Wesleyan Methodist Missionary; both collections are held at the School of Oriental and African Studies, University of London.

On this continent Wendy Schnur, Collection Research Center, Mystic Seaport, Connecticut, corrected one of my ship identifications; Librarian Gregory Shelton located a large number of sources in the Naval Observatory Library's superb astronomy collections; and USNO Public Affairs Officer Geoff Chester, who has seen more than a half-dozen total eclipses, shared his experiences of the changes in the sky's brightness as totality approached, as did David DeVorkin, National Air and Space Museum, Smithsonian Institution. At the Library of Congress, Science Reading Room librarians Constance Carter and Margaret Clifton tracked down a large number of early nineteenth-century works dealing with Australia. Retired Naval Observatory astronomer Alan Fiala, who spent most of his career at the Nautical Almanac Office, including serving as its chief, commented in detail on an earlier draft, thereby strengthening my subsequent one. I am also indebted to Professor of Astronomy Jay Pasachoff, Williams College, Mass., whose comments and suggestions regarding my earlier draft were invaluable.

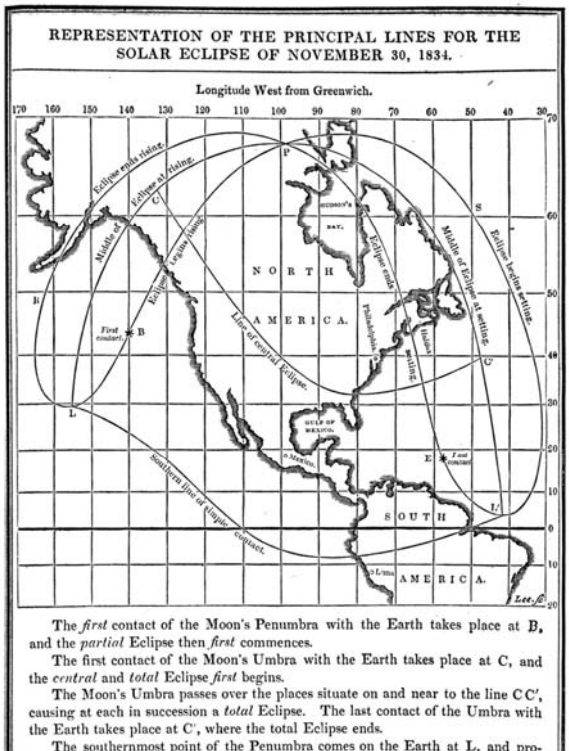

Figure 5: Representation of the principal lines for the solar eclipse of 30 November 1834. Diagram from *The Nautical Almanac and Astronomical Ephemeris for the Year 1834*, 471.

Two additional individuals helped make this undertaking a success. Shinobu Takesako's eclipse program made it possible for me to analyze the various almanacs at a useful level of detail. And without the encouragement and support of Elizabeth Bartky, this study never would have seen the light of day.

8 NOTES

1. The dates and time are in terms of the then-current Astronomical Day, which began at noon. After the

year 1828 responsibility for the almanac series was transferred to the Board of Admiralty. Starting with the volume for 1834, Greenwich mean time replaced apparent time in the various predicative tables.

2. Native populations are not included in these data. The Australian statistics are given in Lang (1837) and Steele (1975). For the South Seas missions, see Gunson (1978) and Lovett (1899).
3. Lucas (1929: 17) errs when he identifies this location as Hood Island, which lies far to the northeast of Tahiti in the Marquesas. Lord Hood's Island, now called Marueta Atoll, about 1,537 km to the southeast of Tahiti, is somewhat to the east of a direct line from Papeete to Pitcairn Island, which lies 681 km beyond the atoll. Today Marueta is one of several locales where black pearls are cultivated. See also Moerenhout (1837: 312).

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The late Ian Bartky died from lung cancer on 18 December 2007, after this paper was accepted for publication. Ian was born in Chicago and received a Ph.D. in physical chemistry from the University of California at Berkeley in 1962. He worked at the Bureau of Standards and after retiring in 1992 turned his attention increasingly towards the history of time-keeping. With support from the National Science Foundation, the Dudley Observatory and a Caird Research Fellowship at the National Maritime Museum (London) he was able to work on a succession of research papers and books. *Selling the True: Nineteenth-Century Timekeeping in America*, the first comprehensive history of time-keeping in the USA, was published in 2000, and his most recent book, *One Time Fits All: The Campaigns for Global Uniformity*, appeared shortly before his death (and is reviewed in this issue of *JAH*[2]). Ian was a member of the American Association for the Advancement of Science, the Society for the History of Technology and the Historical Astronomy Division of the American Astronomical Society. He is survived by his wife of 47 years, Elizabeth Hodgins Bartky and his two children, David J. Bartky and Anne B. Goldberg.