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ROYAL PATRONAGE IN NINETEENTH CENTURY INDIAN ASTRONOMY: MAHARAJA SWATHI THIRUNAL, JOHN CALDECOTT AND TRIVANDRUM OBSERVATORY

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Abstract: Patronage played a prominent role in the development of Indian astronomy during the nineteenth century as some Maharajas and Rajas used their wealth and influence to establish and maintain Western-style astronomical observatories. One of these was Maharaja Swathi Thirunal from the Kingdom of Travancore in far southern India, who in 1837 set up Trivandrum Observatory and appointed a British amateur astronomer, John Caldecott. as Director.

In this paper we provide biographical data on the Maharaja and on Caldecott, review the astronomical instruments that the Maharaja funded, discuss the types of astronomical and other observations that Caldecott and his local assistants made, and examine Caldecott as yet another international example of the 'amateur-turned-professional' syndrome.

Keywords: patronage; Indian astronomy; Maharaja Swathi Thirunal; John Caldecott; Trivandrum Observatory.

1 INTRODUCTION

The Indian subcontinent has a long history of astronomy, stretching back to pre-Rig Veda times (Kochhar and Narlikar, 1995; Sen and Shukla, 2000; Vahia et al., 2016), but the development of Western astronomy was directly connected with the British East India Company (Keay, 2010; Lawson, 1993; henceforth EIC) where time-keeping and cartography were intimately associated with colonialism (Kapoor and Orchiston, 2023; Kochhar, 1991). Thus, the EIC founded observatories at Madras, Calcutta and Colaba (Bombay) in 1789, 1825 and 1826 respectively (see Ansari, 2000; Gawali et al., 2015; Kapoor and Orchiston, 2023; Kinns, 2020; Kochhar, 1985a; 1985b; Kochhar and Orchiston, 2017; Sen, 2014). Meanwhile, a complementary role in land surveying was played by the Survey of India, founded earlier, in 1767 (Markham, 1878; Phillimore, 1945–1968).

Superimposed on these developments during the nineteenth century were two transits of Venus (in 1874 and 1882) and a succession of total and annular solar eclipses. Both kinds of events not only attracted Indian-based astronomers but also international expeditions (Kapoor, 2014; Launay, 2021; Nath and Orchiston, 2021; Orchiston et al., 2017; Venkateswaran, 2021).

One of the local responses to this fertile scientific environment was the emergence of wealthy influential patrons who wished to promote professional astronomy in India by founding and lavishly furnishing observatories, complete with salaried directors. Thus far, four examples of these have been documented. In 1832 Naṣīruddīn Ḥaidar Shah (1803–1837), the Nawab of Oude (Awadh), set up such an observatory in Lucknow, the capital city of the wealthy Shia Empire of Awadh (Kochhar and Orchiston, 2017; Orchiston and Kapoor, 2023). Another noted patron of Indian astronomy was Nawab Zafar Jung Shamsul Mulk Bahadur (d. 1907), who in 1900 or early 1901 set up Nizamiah Observatory in Hyderabad (see Orchiston and Kapoor, 2023). A third example of an Indian patron of Western astronomy was Raol Shri Sir Takhtsinhji Jaswantsinhji, the Maharaja of Bhavnagar (1858–1896), who funded the establishment of the Takhtasinhji Observatory at the Government College of Science in Poona in 1888. This was one of two Indian observatories at this time to pioneer astrophysics rather than positional astronomy (Ansari, 2019; Orchiston and Kapoor, 2024).[1]

However, the example I have selected as an Indian case study for this conference proceedings is Trivandrum Observatory, in the far southern state of Travancore, which was founded in 1837. The following account builds on Kochhar and Orchiston (2017: 728–732) and Kapoor and Orchiston (2024: 930–937). In the nineteenth century Trivandrum[2] was the capital of Travancore (now Kerala). For the history of Travancore astronomy see Kurien (2009), and for Indian localities mentioned in the text see Figure 1.

Aiya (1906: 119) described Travancore as

> … a narrow strip of land more or less triangular in shape with a maximum

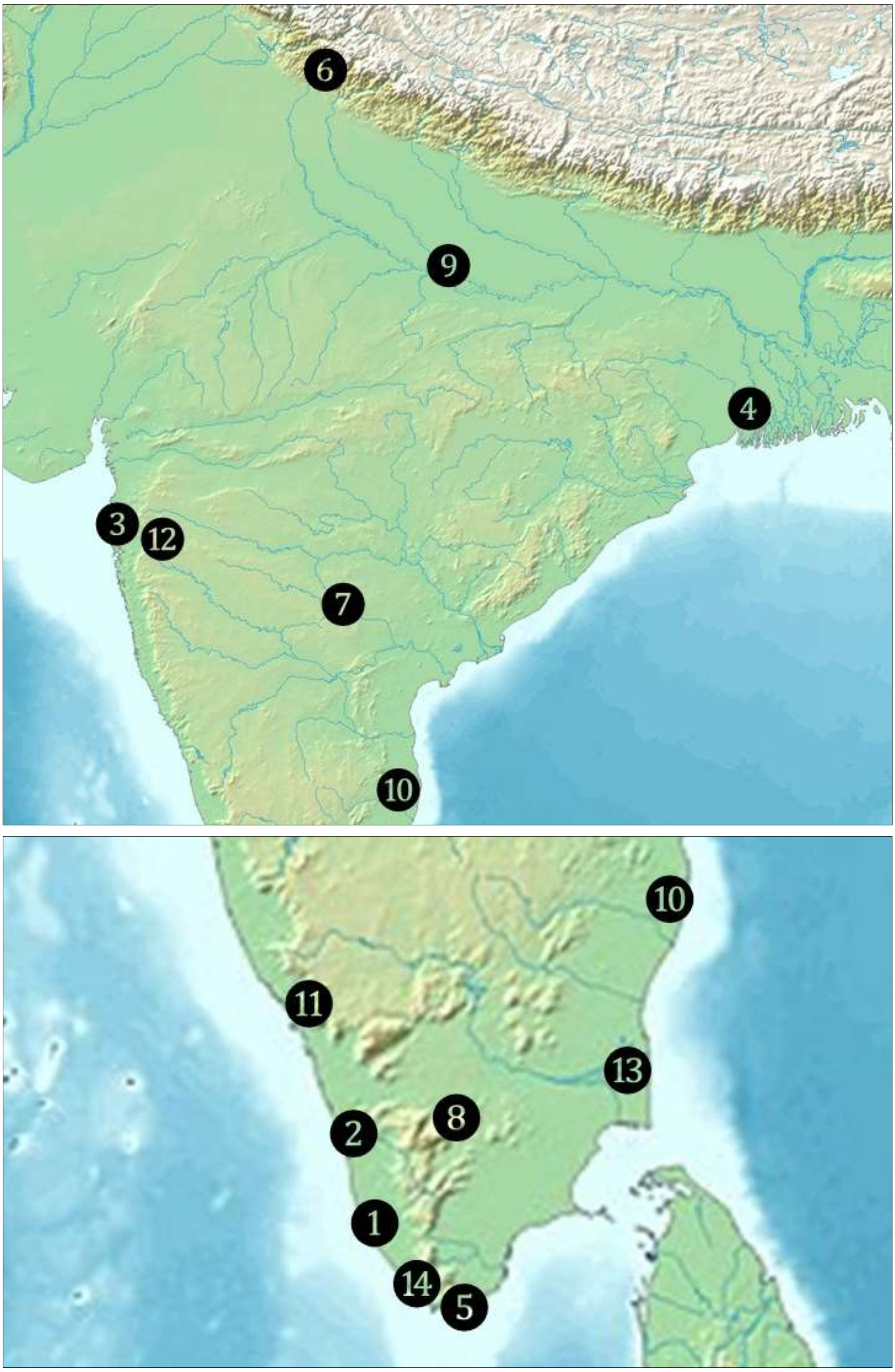

Figure 1: Indian subcontinent locations mentioned in the text. The upper map shows the central and northern part of the subcontinent, while the lower map, on a larger scale, shows southern India. Key: 1 = Alleppey, 2 = Alwaye, 3 = Bombay & Colaba, 4 = Calcutta, 5 = Cape Comorin (Nagercoil is nearby), 6 = Dehra Dun, 7 = Hyderabad, 8 = Kodaikanal, 9 = Lucknow, 10 = Madras, 11 = Mahé River mouth, 12 = Poona, 13 = Tranquebar, 14 = Trivandrum (base map: South_Asia_non_political,_with_rivers; map modifications: Wayne Orchiston).

Figure 2: Maharaja Swathi Thirunal, 1813–1846, (https://en.wikipedia.org/wiki/List_of_Maharajas_of_Travancore#/media/File:Swathi_Thirunal_of_Travancore.jpg).

Figure 3: Maharani Lakshmi Bayi, 1791–1815 (https://en.wikipedia.org/wiki/Gowri_Lakshmi_Bayi#/media/File:Sree_Padmanabhasevini_Maharani_Gowri_Lakshmi_Bayi.jpg).

> breadth of 75 miles and a length of 174 miles. It is bounded on the west by the sea and on the east by the watershed of the hills which run from Cape Comorin to the extreme north, ending in the Kannan Devan hills or High Range, which is connected with the Anamalays on the north and the Pulneys on the east.

In 1838

> The whole length of the town [of Trivandrum], from N.W. to S.E. is about 2 miles, and is calculated to contain a population of about 12,000 .... (Nair, 2004: 16–17).

The Indian aristocrat responsible for founding Trivandrum Observatory in 1837 was the King of Travancore, Maharaja Varma, better known as Swathi Thirunal (1813–1846), who ruled from 1829. He had two objectives: aiding

> … the advancement of astronomical science, and of introducing by its means correct ideas of the principles of this science amongst the rising generation under his government … (Caldecott, 1837a: 56).

He also was eager that "… his country should partake with European nations in scientific investigations." (Menon, 1878: 416). Following is biographical information about this remarkable young Maharaja and his mother.

2 MAHARAJA SWATHI THIRUNAL: A BIOGRAPHICAL SKETCH

Prince Rama Varma (Figure 2) was born on 16 April 1813, the first son of Maharani Lakshmi Bayi (Figure 3) and her husband Raja Raja Varma. As the only eligible Royal, Lakshmi Bayi had assumed the throne in 1811 at the age of 20, after the death of her uncle Maharaja Bala Rama Varma (Aiya, 1906). Following the birth of her first son, she was to serve as Regent until the Prince turned 16 and could become King.

For administrative purposes, the EIC had sub-divided India into four regions, and the State of Travancore came within the southeastern region, headquartered in Madras. The 'Resident', or senior EIC administrative officer, for Travancore was Colonel John Munroe (1775–1858; Aiya, 1906: 472–473). The EIC had a long and close working relationship with the State of Travancore (see Aiya, 1906: viii), so much so that in 1814 the Maharani announced:

> … I have placed this child [Prince Rama Varma] of mine on the bosom of the Company and the responsibility of the future support and respectable treat-

> ment of this Royal scion shall now rest with the Honourable Company. What more need I say? (Aiya, 1906: 466).

That same year a second son was born. Then later in the year the young Maharani died unexpectedly, and her role as Regent was inherited by her younger sister, Maharani Parvathi Bayi, pending Prince Rama Varma 'coming of age'.

Both Maharanis proved to be excellent sovereigns, and Colonel Munroe worked closely with them to end corruption, debt and introduce a succession of reforms that were of benefit to their nation. So, by the time the young prince turned 16 in 1829 and became Maharaja Swathi Thirunal, Travancore was a peaceful State in a healthy financial position (Aiya, 1906: 483).

The new Maharaja

> … possessed great natural intelligence and sagacity and had an excellent training under his distinguished father Raja Raja Varma Koil Tampuran, and his English tutor Subba Row who subsequently became Dewan [the equivalent of Prime Minister of Travancore]. He possessed a strong will and showed great aptitude for business. His scholastic attainments were of a high order. He was a good scholar in Sanskrit and English and had mastered the vernaculars such as Persian, Hindustani, Marathi and Telugu ... (Aiya, 1906: 482).

Maharaja Swathi Thirunal also proved to be an accomplished composer, and he had an interest in providing a Western education for talented Indians. Consequently, in 1834

> … an English School was opened at Trivandrum and placed under Mr. J. Roberts, who had been keeping a private school at Nagercoil … General Fraser who became the Resident … took great interest in the progress of the institution and at his instance a few District Schools were started as feeders of this central school. This was the foundation of English education in Travancore. (Aiya, 1906: 488).

This was part of an overall colonial pattern associated with the EIC (see Basu, 1867; Nurullah and Naik, 1943).

In addition to music and education, Maharaja Swathi Thirunal had a strong interest in science—especially astronomy—and he was keen to investigate the differences between traditional Hindu astronomy and contemporary Western astronomy. This opportunity arose in 1832 when he visited the Travancore port of Alleppey and met a British amateur astronomer named John Caldecott. We will discuss Caldecott in Section 3, and the founding of Trivandrum Observatory.

Aiya (1906: 505) has described Maharaja Swathi Thirunal as "… proud and reserved and naturally of a shy temperament …", and this may go a long way towards explaining the Maharani's ultimate demise. After enjoying cordial relations with a succession of EIC Residents, in September 1840 Lieutenant-General William Cullen (1785–1862) was appointed the Resident for Travancore. Apparently, Cullen and the Maharaja took an instant dislike to one another, and Cullen then made it his personal obsession to destroy the Maharaja's reputation within the EIC and belittle the State of Travancore and its Government. In the end,

> No State appointments could be made without the sanction of the Resident. The Dewan became altogether powerless and could not even give small increases to his own office staff without the Resident's permission.
>
> Day by day this interference increased and passed all legitimate bounds. It became the tyranny of the Resident …
>
> The position of the Maharajah became humiliating. and he naturally felt much annoyed and the misunderstanding between the two became irreconcilable. To add to this, the Resident misrepresented matters to the Madras Government who passed several strictures and recorded unfavourable remarks on the Travancore administration. The Maharajah's remonstrance was of no avail and even the Court of Directors endorsed the opinion of the Madras Government. (Aiya, 1906: 492).

This impasse would have tragic consequences:

> These unpleasant relations with the Resident and the extremely humiliating treatment accorded him by the British Government sorely affected His Highness. He therefore became indifferent to the administration of the State … devoted most of his time to religious observances ... [and] became a recluse … (Aiya, 1906: 497–498).

Daily the Maharaja's health deteriorated, and at noon on 25th December 1846 he was

> … very weak, and after taking a light supper at about 10 o'clock in the night he retired to bed but never to wake again. Towards the small hours of the

morning of that gloomy day, the Maharajah was found dead in his favourite chamber. (Aiya, 1906: 500).

The irony is that when Travancore acquired a new monarch (Swathi Thirunal's brother), and General William Cullen had his 'favourite' installed as the Dewar, the princely State could not have found a better, more co-operative and supportive Resident (Aiya, 1906: 498)!

3 JOHN CALDECOTT: A BIOGRAPHICAL SKETCH

John Caldecott (1801–1849; Figure 4) was born in London. Little is known about his time in Britain or his education, but we do know that he sailed for India on the *Mulgrave Castle* in January 1821, arriving in Bombay on 25 May. There, according to Walding (n.d.), he worked for Daniel West at Apollo Cotton—the Wests were friends of the Caldecotts in London.[3]

Figure 4: An undated painting of John Caldecott (after Walding, n.d.).

In 1815, another owner of Apollo Cotton, William West "… began investigations in telescopes and microscopes as an evening amusement ..." (ibid.), which appealed to John Caldecott and would have far-reaching consequences (as we shall see shortly).

We have little reliable information about the type of work that Caldecott was engaged in, until his appointment in August 1831 by the Government of Travancore as their Commercial Agent and Master Attendant at the State's leading port, Alleppey (now Alappuzha). Caldecott's duties mainly involved overseeing the international exporting of the State's main commercial products: cardamoms, teak, coconut, betel-nut, ginger, coffee, pepper and fish. This was a key Government position, with the Commercial Agent acting as an intermediary between the State of Travancore and other nations. Caldecott therefore held a position of power and authority (Menon, 1878), which must have reflected a degree of commercial and political acumen.

Aiya (1906: 27–28) describes the location and setting of Alleppey:

> ALLEPPEY (lat. 29° 48′ N., and long. 76° 18′ 46″ E.) is the principal seaport town of Travancore and the seat of the Commercial Agent. It is the chief [export] depot of the Travancore Government … Many European and American Firms have their representatives here and extensive industries are carried on. It is a safe roadstead all the year round being protected by a soft mud bank on which a vessel might ride at less risk than at any other part of the coast. A shoal bank of from 6 to 9 feet extends about l½ miles off shore. During the south-west monsoon, although the surf breaks on the shore to the north and the sea is white with foam outside, there is at Alleppey a large extent of smooth water, on the outer part of which a vessel might conveniently anchor in 4½ fathoms and keep up a communication with the shore. In the fine season, a vessel not drawing more than 18 feet water may anchor in 4 fathoms or a trifle less, the bottom being soft mud. The anchorage in the roads during the south-west monsoon is with the lighthouse from N. E. to E. N., in 5 or 6 fathoms water. In the fair season from October to May, vessels may anchor in 3 or 4 fathoms with the lighthouse bearing E. by N., the soundings being very regular. During the south-west monsoon trade cannot sometimes be carried on with Cochin, but the port of Alleppey is always available.

Meanwhile, the thriving port of Alleppey (the name means 'the land between the river and the sea') is described by Nair (2004: 21–22; my italics):

> The town itself lies scattered between the beach and an extensive tract of paddy cultivation, bordering the backwater, which here stretches eastward to considerable distance, forming an extensive lake. A canal, leading from the backwater to the Circar timber-yard on the coast, passes through the center of the town and is crossed by six wooden bridges, about a third of a

> mile from each other, having streels leading from them at right angles to the canal, by means of which every facility is afforded to the merchant in conveying his goods from one side of the town to the other. The southersn [sic.] portion is divided into compounds, containing the dwelling houses of Arab and Parsee merchants as well as of the better classes of the inhabitants. Contiguous to the coast at the end of the canal are the Pepper and Salt Banksalls, and Sea-custom house *and a private dwelling house for the accommodation of the Commercial Agent ...* The town of Alleppey was of little or no importance 50 years ago [i.e. in 1789]; but from the encouragement, held out to merchants and settlers of all classes, it has by degrees become most populous and a place of vast trade … The whole of this department is under the superintendence of a British Officer in the capacity of Commecial [sic.] Agent.

As we have seen, while Caldecott was still living in Bombay William West whetted his appetite for astronomy, and this flourished in the financially supportive environment of Alleppey. Walding (n.d.) claims that Caldecott

> … had a small bungalow at Alwaye (about 13 km NE of Cochin)[4] that he used in the very hot months from April to June. Here he built an observatory…

This housed a selection of astronomical instruments that he had imported from England at great personal expense, as he continued to learn more about astronomy and practice making astronomical observations. From all accounts he was an accomplished self-taught amateur astronomer, but this was soon to change. Caldecott had taken on the onerous role of Commercial Agent in Alleppey at the comparatively young age of 30, but four years later we find him employed as the Director of the newly-founded Trivandrum Observatory (more on this in Section 4 below).

Sadly, Caldecott's career as an astronomer was not always 'plain sailing' and eventually Lieutenant-General William Cullen, the British Resident for Travancore, tarred him with the very same brush reserved for Maharaja Swathi Thirunal (Walding, n.d.). Caldecott, too, emulated the Maharaja's fate, dying just three years later. He had yet to reach his 49th birthday.

4 TRIVANDRUM OBSERVATORY

From their first meeting, in 1832, Maharaja Swathi Thirunal liked to discuss astronomy with John Caldecott, who

> … being well versed in that science, used to make astronomical observations with several portable instruments of his own. Mr. Caldecott's descriptions of his observations of the various movements of the heavenly bodies, closely corresponding with the calculations and observations of the Hindu Astronomers, *the Maha Rajah was most anxious for a thorough investigation of this science*. (Menon, 1878: 415; my italics).

In 1834,[5] the Maharaja was on tour of the northern districts of Travancore and he visited Alleppey and took the opportunity to inspect Caldecott's astronomical instruments. For his part, Caldecott took the opportunity to suggest that the Maharaja establish

> … a small Observatory, at Alleppey; but the Maha Rajah wished to have a good building erected at Trevandrum.[6] (Menon, 1878: 415–416).

The Maharaja asked Caldecott to send a formal proposal to the British Resident, Colonel James Stuart Fraser (1783–1869; Fraser, 1885), who had a personal interest in astronomy, and knew Caldecott (Walding, n.d.). Fraser promptly forwarded the proposal to the Maharaja, who immediately approved it. The Maharaja appointed Caldecott as his Astronomer, and "… gave him power to furnish it with the best instruments to be obtained in Europe." (Menon, 1878: 416). In return, Caldecott agreed to place his own astronomical instruments at the disposal of the Government pending the arrival of the new instruments. Caldecott's modest suite of instruments is listed in Table 1. Note that Dollond (King, 1979) and Troughton & Simms (McConnell, 1992) were leading British manufacturers of astronomical and surveying instruments.

It is interesting that the Maharaja chose to site the new observatory on what were then the outskirts of Trivandrum, not on one of the numerous neighbouring peaks of the Western Ghats. Astronomers had yet to learn that mountain sites, or elevated observing positions in low-altitude observatories, offered appreciable advantages in seeing (Donnelly, 1974).

Nor was the site of Trivandrum Observatory optimal climate-wise as it lay within the tropics and experienced typical monsoonal weather (see Table 2). But rainfall was seasonal, which impacted directly on when astronomical observations were possible. Thus,

> The annual variation of rainfall in Travancore follows a regular curve that has two maxima and two minima. The

Table 1: John Caldecott's own astronomical instruments (after Walding, n.d.).

Type	Manufacturer	Details
Refracting telescope	Troughton & Simms	Equatorial mounting.
Refracting telescope		ca. 3-inch (76-mm) aperture, 46-inches (1.8-m) long; unspecified mounting.
Transit telescope	Dollond	30-inches (76.2-cm) long.
Altitude and azimuth instrument		With 18-inch (45.7-cm) and 15-inch (38.1-cm) circles; portable.
Reflecting circle	Troughton & Simms	Portable [marine surveying instrument].
Chronometer		
Chronometer		
Chronometer		

Table 2: Trivandrum's monsoonal weather (after Aiya, 1906: 58).

Months of the Year	Mean Temp. (°)	Mean Humidity (%)	Mean Cloud Amount	Total Rainfall (inches)	Mean No. Days with Thunderstorms	Seasons and Monsoons
Dec to Feb	77.0	74.9	3.9	3.372	7	Dry season
Mar to May	80.3	70.6	5.6	16.133	36	Warm season
Jun to Sep	77.0	86.0	7.4	27.352	8	Wet; SW monsoon
Oct to Nov	77.0	85.1	6.6	16.350	17	Retreating SW monsoon

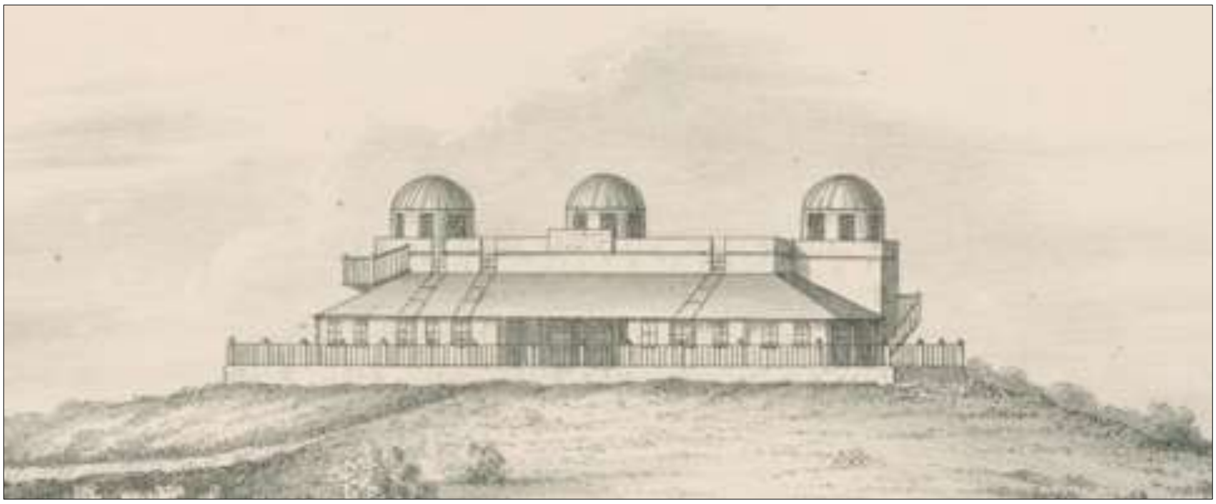

Figure 5: A panoramic view of Trivandrum Observatory from the northwest (after Caldecott, 1837a: facing 57).

> absolute maximum and minimum occur in June and January respectively, while the secondary maximum and minimum fall respectively in October and September. The least amount of rainfall is received in the month January. Precipitation then goes on moderately increasing till the commencement of the S. W. monsoon, which takes place generally about the last week of May. June is preeminently the month of maximum rainfall throughout Travancore. Then a slight diminution takes place in the amount of the rainfall received in the several stations during the months of July and August, and the secondary minimum is arrived at in the month of September. There is a sudden increase in the amount of rainfall in the month of October. This rain is locally known as *Thulavarsham*. The fall then decreases slowly in the month of November and rapidly through December and January, which last is the driest month of the year. More than 87% of the annual rainfall is received during the prevalence of the S. W. monsoon, viz., from May to November. (Aiya, 1906: 66).

From the Maharaja's perspective, we presume that local accessibility—not optimal seeing or prevailing weather conditions—was the primary consideration in siting Trivandrum Observatory.[7]

4.1 The Establishment of the Observatory

Construction of Trivandrum Observatory began in October 1836, and it was completed in mid-1837 (see Figure 5)—it measured 78ft × 38ft, i.e. 23.8m × 11.6m. Views of the elevation, plan and longitudinal section are shown in Figure 6.

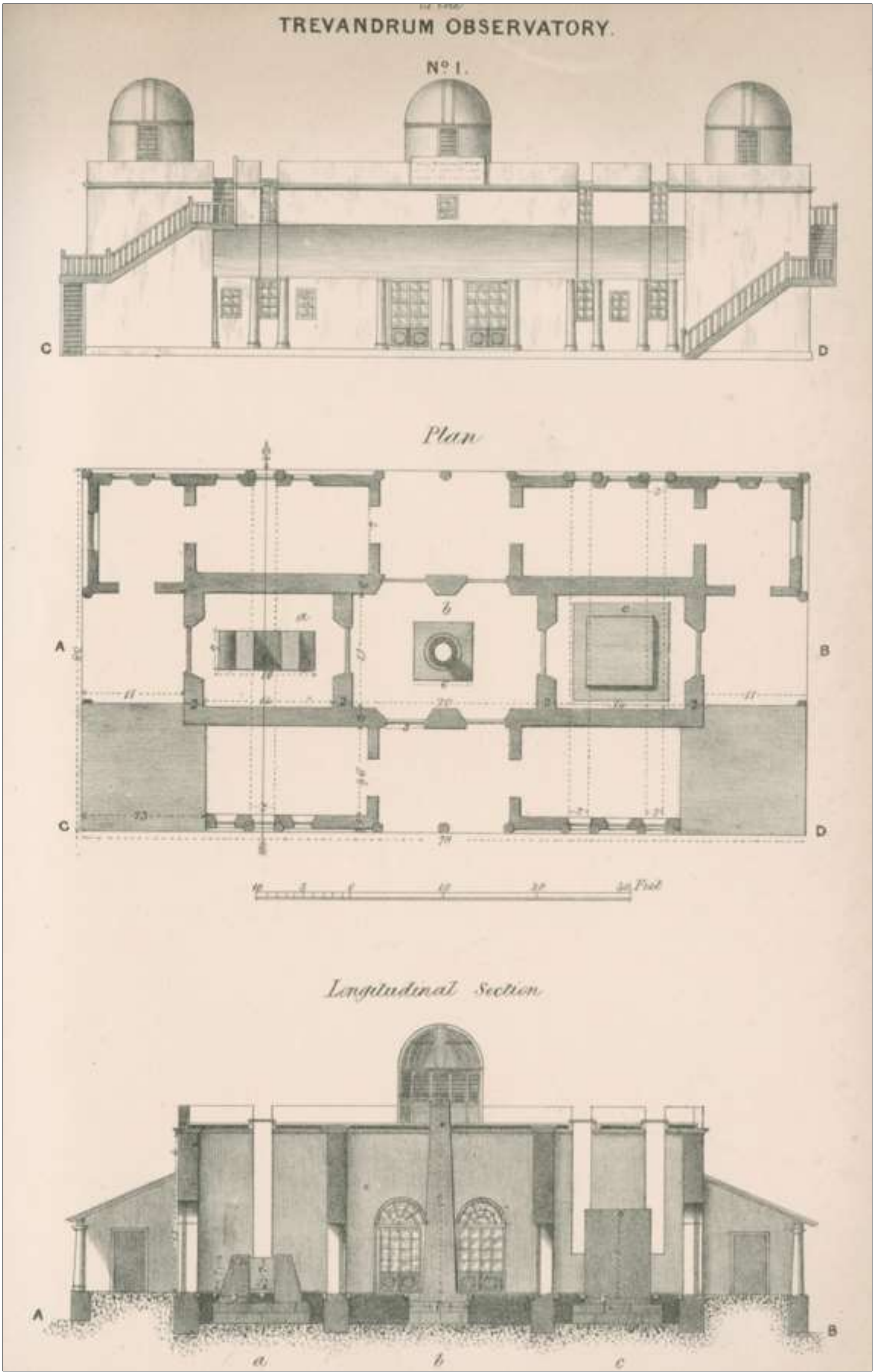

Figure 6: The elevation, plan and longitudinal section of Trivandrum Observatory, 1837 (en.wikipedia.org).[8]

Table 3: New astronomical instruments purchased in Britain for Trivandrum Observatory (after Caldecott, 1837a: 58–59).

Type	Manufacturer	Details
Refracting telescope	Dollond	5-inch (127-mm) aperture, 7-ft (2.13-m); English Equatorial mounting.
Refracting telescope		4.2-inch (108-mm) aperture, 5-ft (1.63-m) long; equatorial mounting.
Transit telescope	Dollond	3.75-inch (95-mm) aperture.
Mural circle	Troughton & Simms	5-ft (1.63-m), with 4-inch (102-mm) aperture telescope.
Mural circle	T. Jones[9]	
Azimuth	Troughton & Simms	
Azimuth	Troughton & Simms	
Sidereal Clock	E.J. Dent[9]	
Meantime Clock	E. Wrench[9]	

The architect of Trivandrum Observatory was William Henry Horsley (1812–1893; Richardson, 2020), and this is his sole observatory commission—which may explain the unique design of the building.

Lieutenant Horsley (1838) was an engineer, not an architect, and was the 'Visiting Engineer and Superintendent of Irrigation' who headed Travancore's Department of Engineering. His Department built the impressive old stone bridge in Trivandrum that still crosses the Karamana River, and a branch of his Department, the Irrigation Maramut Department "… repaired and constructed palaces, temples, etc.)." (Nair, 2004: 2).

Figure 7: A recent photograph of the historic equatorially-mounted 5-inch refractor at Trivandrum Observatory (photograph courtesy: Pramod Galgali).

We know that Horsley was born in England and attended the East India Company Military Seminary, also known as Addiscombe College, in the London borough of Croydon. This was set up by the EIC in 1809 to provided engineering training for cadets destined for India (Bourne, 1979). After completing his initial training at Addiscombe College in 1831 Horsley went to The Royal Engineer Establishment at Chatham in Kent for specialized practical training. This is where he was taught basic architecture.

After Chatham Horsley then sailed to India, and "After a few years of service in other places in India, he got appointment as Engineer of Travancore." (Nair, 2004: 4).

4.2 Astronomical Instruments and Scientific Observations

While the Observatory was under construction, the new astronomical instruments were ordered from England. These are listed in Table 4, and a recent photograph of the 5-inch Dollond refractor is shown in Figure 7. Note that this telescope and the second refractor came "… with micrometers and all appurtenances for observations on the double stars, &c. …" (Caldecott 1837a: 59). When it came to the allocation of funds for these instruments and the Observatory building itself Caldecott (1837a: 56) was very clear about where his own priorities lay:

> I very soon came to the conclusion that no outlay, beyond what was absolutely necessary to effectiveness, should be made on the building, but that no expense should be spared in procuring instruments of such a size and quality as would ensure to an Observatory, when they were judiciously and actively made use of, a rank second to none in the world.

It would surely have been interesting to get Horsley's reaction to this statement!

While the Observatory was under construction Caldecott and Madras Observatory's Thomas Glanville Taylor (1804–1848; Kapoor, 2011) undertook a magnetic survey of southern India, through which the magnetic equator passed, using second-hand instruments from previous surveys. Taylor had been collecting magnetic data at Madras since 26 April 1837. He departed Madras on 23 July 1837 to meet Caldecott at Tranquebar on 2 August 1837, beginning a magnetic survey that would continue into 1838 (Walding, n.d.). They published their first results in 1839 in the *Madras Journal of Literature and Science* (Taylor and Caldecott, 1839). This formed part of an international campaign (see Cawood, 1977).

Caldecott went to Britain in December 1838 in order to oversee the acquisition of the new astronomical instruments, but after he arrived in London the scope of Trivandrum Observatory's research portfolio changed dramatically when he

> … became aware of plans for a world-wide network of magnetic observatories, and obtained the Raja's consent to buy a set of magnetic instruments from Grubb of Dublin to match those being provided for the other British and East India Company observatories. (Walding, n.d.).

It also is clear that once he was back in 'Mother England' Caldecott's view of Trivandrum Observatory continued to evolve. Responding to the recommendation of the British Association for the Advancement of Science that "… a set of hourly meteorological observations within the tropics … [was] highly desirable …" (Report …, 1841: 28), Caldecott saw meteorology as a natural part of Trivandrum Observatory's operations, and he obtained permission from the Maharaja to also purchase meteorological instruments. However, even before he left for Britain Caldecott (1837b) had made some preliminary meteorological observations using instruments already available.

Caldecott returned to Trivandrum in April 1841 just a few days after the arrival of the magnetic instruments. A new magnetic and meteorological observatory was then constructed followed by a modest new building for the 5-inch Dollond refractor. Taylor helped Caldecott install the two mural circles (Walding, n.d.).

Subsequently, Caldecott used these instruments to observe a solar eclipse in 1843 (Caldecott, 1846a) and comets in 1843–1845 (Caldecott, 1843; 1845; 1846b).

The 1843 solar eclipse was a special event in Indian astronomy. From the mid-nineteenth century, astronomers began arranging international solar eclipse expeditions in a bid to better understand prominences, the chromosphere and the corona (e.g. see Pang, 1993; 2002). The first such expedition was undertaken in 1851.

India soon became a key participant in this whole process, with total solar eclipses in 1868, 1871 and 1898 collectively attracting astronomers from Britain, France, Germany, Japan and the USA. Meanwhile, 'local' teams from Indian observatories and the Great Trigonometrical Survey also mounted their own expeditions (see Kochhar and Orchiston, 2017: 737–741).

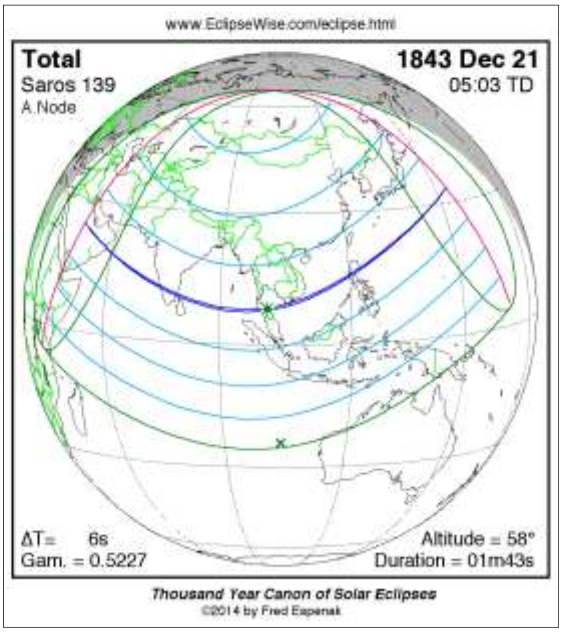

Figure 8: Map showing the path of totality of the 21 December 1843 total solar eclipse across southern India (courtesy: Eclipse predictions by Fred Espenak, 2022; www.Eclipsewise.com).

The long-duration total solar eclipse of 18 August 1868 (>7 minutes maximum totality), proved to be a 'watershed event' in the history of solar physics, when photography, polariscopy and spectroscopy combined to lead to a major breakthrough in our understanding of prominences and the corona, not to mention the discovery of the element helium (Nath, 2013). However, a quarter of a century earlier Caldecott (1846a: 171–178) had mounted India's first known solar eclipse expedition, for the event of 21 December 1843.

This was a short-duration eclipse of well under two minutes, but fortunately the path of totality crossed southern India, not too far from Trivandrum Observatory (Figure 8). After computing the path of totality, Caldecott decided to observe from Parratt, on the Malabar Coast, three miles north of the mouth of the Mahè River (see Figure 1), and the night before the eclipse he pitched his tent there. In the research paper that he published after the event, Caldecott (1846a: 171) describes the instruments that he and his two Indian assistants brought on the expedition:

> … an excellent achromatic telescope of 30 inches focal length, having an object glass of 2¼ inches, made by Troughton and Simms, with an eye-piece giving a magnifying power of about 50, protected by a smoked glass, gradually increasing in intensity from one end to the other, and sliding easily in a groove, with which to observe the eclipse; a sextant and artificial horizon, with a good pocket watch for time … and an actinometer, for observing the rate of decrease of solar radiation.[10]

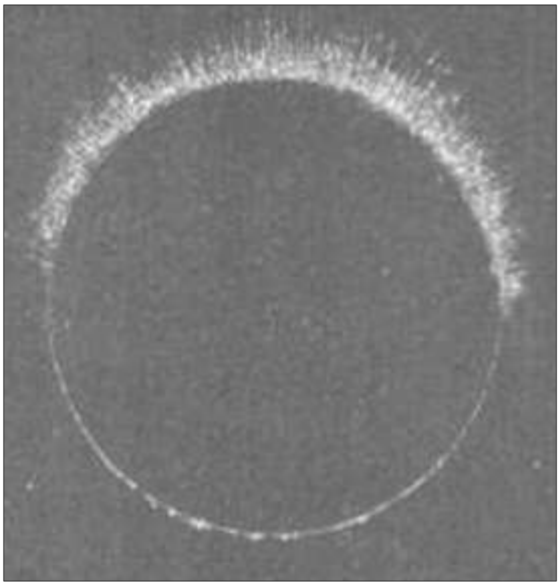

Figure 14: A drawing by Caldecott of the total solar eclipse of 21 December 1843 (after Caldecott, 1846a: 173).

The sky was clear and so Caldecott and his assistants were able to successfully observe the eclipse and record timings, altitudes, ambient temperatures and other details. During the eclipse Caldecott

> … noticed the southern limb of the Sun breaking into beautiful beads, forming now and then, but never fully disappearing [see Figure 9] ... To his knowledge, this was the first time the so-called Bailey's Beads had been seen anywhere other than on the western and eastern limbs since Francis Bailey first reported them during the eclipse of 15 May 1836. (Orchiston and Kapoor, 2023: 935).

Actually, Caldecott (1846a) reasoned (wrongly) that the beads were the effect of the continuously changing refraction of the atmosphere on the two limbs, causing the bubbling motion. He briefly saw the corona but no prominences. Totality was short-lived, so this may have prevented a detailed search.

Apart from the aforementioned solar eclipse and cometary observations, over the years, Caldecott was able to accumulate a large number of astronomical, geomagnetic and meteorological observations and measurements (Walding, n.d.), but the meagre list of research papers authored by 'Caldecott' in the Reference Section of this paper gives little indication of these. For example, his three papers on comets relate solely to the Great Comets of 1843 and 1844/1845, which were naked eye objects, and did not demand the use of an equatorially mounted 5-inch Dollond refractor (e.g. see Kapoor, 2021). Kronk (2003) and Vsekhsvyatskii (1964) both show that there were many other comets within the light-grasp of the Dollond telescope during Caldecott's time as Director of Trivandrum Observatory. Caldecott's contemporaries who observed or researched other comets included Juggarow (1836) and Taylor (1836).

But there were other astronomical objects or events that could or should have drawn Caldecott's attention, including lunar eclipses (e.g. see Princep, 1829), lunar occultations of stars and planets, Jovian satellite phenomena, micrometric positional observations of planets and minor planets, measurements of double stars (Jacob, 1846; 1847a; 1847b; 1847c; 1848; 1849) and magnitude estimates of variable star—although such observations seemed to attract Indian-based astronomers a little later (e.g. see Powell, 1861).

Speaking of variable stars, Caldecott missed an outstanding opportunity to track the changing luminosity of the remarkable Luminous Blue Variable Eta Argus (now known as Eta Carinae) which was rising rapidly in magnitude during the 1830s and reached its peak around 1840 before starting a prolonged decline (see the light curve in Frew, 2004). Any observations that Caldecott reported would have been invaluable in elucidating the change in the light curve at this critical time.

Transits of Mercury were another possible observing target, but the widely observed transit of 1832 occurred just before Trivandrum Observatory was established, while neither the 1835 nor the 1845 transit was favourably timed for India (see Kapoor, 2025). Then, by the time the November 1848 transit occurred, and was visible from India, Caldecott was on his deathbed.

Finally, given that Taylor and Caldecott collaborated in the field of geomagnetism, perhaps Caldecott could also have used Trivandrum Observatory mural circle observations to assemble a star catalogue that built on or contributed to Taylor's (1844) acclaimed Madras Observatory catalogue.

Be this as it may, Caldecott could not get his observations published, and whether the antagonistic Resident, General William Cullen, played any role in this has yet to be determined. What we do know is that Caldecott forwarded copies of all of his scientific observations to the Court of Directors of the EIC in Britain. Then in 1846 he visited Britain again, but he could not persuade any of the scientific societies to publish his observations and measurements. After returning to India in 1847 he had some success, and arranged for them to be published at the Maharaja's own printing works in Trivandrum (Walding, n.d.). Apparently, Caldecott was busy preparing everything for publication when he fell ill and died.

5 DISCUSSION: CALDECOTT AND THE 'ATP SYNDROME'

A prominent feature of nineteenth century astronomy, especially during the positional astronomy era (prior to the emergence of astrophysics) was the success that certain amateur astronomers had in transferring to professional ranks, notwithstanding their lack of relevant academic training. This has been referred to as the 'Amateur-Turned-Professional Syndrome', or simply the 'ATP Syndrome', the astronomers being ATPs.

When we review examples of prominent ATPs mentioned, for example, by Chapman (1998), Clerke (1893), Dunlop and Gerbaldi (1988) and Williams (1988) we note that by the time they transferred to professional ranks most of them already possessed telescopes capable of serious research; that their research programs mirrored those of some of their professional colleagues; and that they published at least some of the results of their research in the leading astronomical journals of the day, *Astronomische Nachrichten* and *Monthly Notices of the Royal Astronomical Society.* In addition, many of these ATPs were involved in the formation or early development of astronomical societies in Britain, the Continent, and the USA, and some received honours, awards and other forms of recognition for their distinguished contributions to astronomy from these same societies. Furthermore, in cities devoid of professional astronomers, before they became professionals these ATPs often ran their private observatories as *de facto* city observatories, offering the full range of services and facilities normally available from government- or university-funded public observatories: public viewing nights; astronomical and meteorological information (particularly through the local media); a local time service; and public lectures, or even courses, on astronomy. In other words, before they became ATPs, in most respects these leading amateur astronomers were behaving as though they were already professional astronomers, even though they were not yet employed as such, and they were viewed by many of their colleagues and interested members of the general public as *de facto* professional astronomers. For all intents and purposes, they were professional astronomers in all but name only!

However, this proved to be too complex a categorisation for some—but not all—nineteenth and early twentieth century Australian ATPs (Orchiston, 2015), Instead,

> … timing, the available competition for newly-created positions and an element of good luck, rather than a distinguished international record in astronomy, were sometimes enough to allow one to move along the ATP continuum. (Orchiston, 2015: 334).

Thus, Robert Ellery (1827–1908; Gascoigne, 1992) was able to secure the founding directorship of one of Australia's earliest professional observatories

> … by astutely using the media to lobby the Victorian Government to establish a time-service for the rapidly-growing population of Melbourne and Williamstown, even though he could display no prior published track record in observational astronomy or in the public promotion of astronomy. But as an intelligent man with a knowledge of astronomy, friends at the Royal Observatory in Greenwich and some observational experience acquired in England, he was the right man in the right place at the right time … (Orchiston, 2015: 334).

Meanwhile, Anderson and Orchiston (2021) found that an even more relaxed range of criteria applied to the earliest appointments of astronomers to the staff of the Sir Thomas Brisbane Planetarium in Brisbane, Queensland, during the twentieth century. Another anomalous Brisbane astronomer, but during the first two decades of this same century, was John Beebe (1866–1936), who was able to achieve the status of a potential ATP in a State where there was only a token commitment to professional astronomy (see Anderson and Orchiston, 2021). Likewise, SE Queensland's variable star expert, Dr. Arthur Page (1922–2011), occupied

Table 4: Successive directors of professional-level Western-style Indian astronomical observatories.

Observatory Name	Founding Year	Director or Officer-in-Charge		Further Reading
		Name & First Year	Background	
Madras	1789	Michael Topping (1789) John Goldingham (1796) John Warren (1810) Thomas Glanville Taylor (1830) William Stephen Jacob (1848) James Francis Tennant (1859) Norman Arthur Pogson (1861) Charles Michie Smith (1891)	EIC EIC EIC Prof astronomer Engineer Military Prof astronomer Academic	Kochhar and Orchiston, 2017: 709–715; 718–725.
Calcutta	1825	V.N. Rees (1825)	EIC Military	Kapoor and Orchiston, 2023; Sen, 2014.
Colaba (Bombay)	1826	John Curnin (1826)[11] Arthur Bedford Olebar (1835?) George Buist (1842)	EIC Academic Science teacher	Kapoor and Orchiston, 2023; Sen, 2014.
Lucknow	1832	James Dowling Hebert (1832) Richard Wilcox (1835)	Military Military	Ansari, 1985; Orchiston and Kapoor, 2023.
Trivandrum	1837	John Caldecott	Am astronomer	This paper
Dehra Dun	1878	[Great Trigonometrical Survey]	Military	Kochhar and Orchiston, 2017.
Hennessy (Dehra Dun)	1884	[Great Trigonometrical Survey]	Military	Kochhar and Orchiston, 2017.
Takhtasinhji (Poona)	1888	Kavāsjī Dādābhāī Naegamvālā (1888)	Academic	Ansari, 2019; Orchiston and Kapoor, 2024.
Kodaikanal	1899	Charles Michie Smith (1891) John Evershed (1911)	Academic Prof astronomer	Kochhar and Orchiston, 2017: 752–756
Nizamiah (Hyderabad)	1907	Arthur Brunel Chatwood (1908) Robert John Pocock (1914)	Am astronomer Prof astronomer	Orchiston and Kapoor, 2023.

Table 5: Criteria involved in the transfer of Indian-based Western amateur astronomers to professional ranks.

Criterion	Caldecott (1837)	Chatwood (1907)
(1) Observatory and/or instrumentation	✓	(✓)
(2) Serious observing or research programs		
(3) Publications in leading journals		
(4) Society involvement		
(5) Public viewing nights		
(6) Meteorological centre		
(7) Public lectures/courses		
(8) Information source	✓?	
(9) Local time service	✓?	
(10) Political lobbying	✓	

an anomalous position as yet another possible ATP (Anderson and Orchiston, 2023). Sometimes it was impossible to stipulate precisely where the boundary between 'amateur' and 'professional' should be. Like the Earth's shadow during a lunar eclipse, this was a nebulous area!

So, if the Australian situation was complex, or confusing at best, what about Indian ATPs? As Table 4 indicates, most of those who served as directors of professional-level Western-style Indian observatories were military men from the EIC and after 1857 the Civil Service, whose training included observational astronomy, or men who had served as professional astronomers in Britain. The only notable exceptions were Caldecott and Chatwood, from Trivandrum and Nizamiah Observatories, respectively. What is abundantly clear in Table 5 is that neither astronomer had credentials that elsewhere would have justified their ranking as potential ATPs (even allowing for Caldecott's possible involvement in criteria 8 and 9). How Chatwood ever gained the Nizamiah directorship remains a mystery, while in Caldecott's case he was in the right place at the right time, and had the ear of the Maharaja. In his case Royal patronage played a key role.

But what is remarkable is the way in which Caldecott was able to extract full mileage out of his self-proclaimed rather exotic designation as the 'Astronomer Royal' to an 'Eastern King' while visiting Britain. Not only did he attend the meeting of the Royal Astronomical Society on

10 January 1840 chaired by Sir John Herschel, when he was elected a Fellow, but he received an even more prestigious honour when elected a Fellow of the Royal Society on 20 February 1840. This despite a mere handful of publications in professsional journals and hardly any international visibility as a scientist. Others with vastly superior track records spent their whole lives trying in vain to covet an FRS. Clearly, Caldecott was an accomplished astro-politician.

We see further evidence of this later in 1840 when Caldecott spoke at the Glasgow meeting of the British Association for the Advancement of Science on the meteorological observations that he had made at Trivandrum. He pointed out that he "… was about to return to his post in India amply furnished with meteorological, magnetical, and astronomical instruments …" (note the order), and he invited instructions on the programmes "… in meteorology, or any other branch of the physical sciences …" that he could pursue (*Literary Gazette*, 1840).

6 CONCLUDING REMARKS

After Caldecott died a local enthusiast, Dr. Josiah Sperschneider (1825–1882), temporarily took charge of Trivandrum Observatory until the Scottish scientist John Allan Broun (1817–1879; McConnell, 2004) came out to India to take over as Director. He "… left Europe on 11th November, and arrived at Trivandrum on the 11th January 1852 …" (Menon 1878: 462). He soon discovered that some of the scientific instruments had not been installed properly, and he decided to abandon astronomy (see Broun, 1857). The subsequent nineteenth century history of Trivandrum Observatory focused primarily on geomagnetism (Jayakrishan, 2023; 2025; Ratcliff, 2016) and as such lies outside the scope of this paper.

Rather, what I have done here, is use Trivandrum Observatory as an example of how an enlightened Indian Maharaja was able to use patronage to found and liberally equip a Western-style observatory in the far southern State of Travancore (present-day Kerala). For a short period in the 1830s and 1840s John Caldecott, the British-born Director of the Observatory, was able to contribute to international astronomical research in spite of likely political intrigue from the East India Company Resident and a frustrating inability to publish most of his astronomical, meteorological and geomagnetic observations and measurements. When Caldecott finally found a solution to this dilemma, fate cruelly intervened and he died before he could achieve his goal.

In this paper, I have also used Caldecott as an example of the so-called Amateur-Turned-Professional (ATP) to explore how a British-born amateur astronomer, without any local, let alone international, track record in astronomical research, education or outreach was able to become the 'Royal Astronomer' of an Indian Maharaja—and then successfully market himself as such to both the Royal Society and the Royal Astronomical Society in London. Caldecott was more than an astronomer: he was also an astute businessman and a master politician. He was not the only British expatriate in India to become an ATP during the nineteenth or twentieth centuries, but he certainly was the most successful.

7 NOTES

1. The other was the observatory at St. Xavier's College in Calcutta (Chinnici, 1995/1996), which was inspired by the 1874 transit of Venus (see Kapoor, 2014). Meanwhile, colonial interests in solar physics saw the founding of the Dehra Dun and Hennessy Observatories at Dehra Dun in 1878 and 1884, respectively (Kapoor and Orchiston, 2023; Kochhar and Orchiston, 2017). Solar physics was also actively pursued at Kodaikanal Observatory from 1899 (Kameswara Rao et al., 2014; Kapoor and Orchiston, 2023; Kochhar, 2009; Kochhar and Orchiston, 2017).
2. Conventional nineteenth century names, spellings and Imperial units are used in this paper to preserve the historical integrity of the account. Trivandrum is now known as Thiruvananthapuram.
3. Web searches, however, show that the Apollo Cotton Mill was only established in 1876, and that the earliest cotton mill in Bombay was founded in 1854. It would appear, therefore, that Daniel and William West's business did not involve manufacturing cotton, although this region of India had a thriving cotton industry that dated back hundreds of years. I welcome further information about the West's involvement in this industry from readers of this paper.
4. Alwaye is now known as Aluva.
5. Aiya (1906: 488) gives the date of this meeting as 1836, just one year before the Observatory was built and operational. While not impossible, I think the 1834 lead-in date given by Menon (1878) is more realistic.
6. At that time the town was known as both Trevandrum and Trivandrum. For the purposes of this paper I decided to use Trivandrum throughout.
7. The site was the highest hill in Trivandrum, 195 feet above mean sea level, and around 2 miles from the coast. The longitude and latitude were respectively 76° 59′ 45″ E and

08° 30′ 32″ N (Caldecott, 1837a; 1837b).

8. Horsley's original Trivandrum Observatory no longer exists. It was demolished around 1931 and replaced by a new building modelled on the old, and now under the care of the University of Kerala. The new building has a marble tablet listing the four people who were primarily responsible for construction of the original Observatory: Maharaja Swathi Thirunal, the ruler of Travancore; Colonel James Stuart Fraser, the British Resident; John Caldecott, Astronomer; and W.H. Horsley, from the Madras Engineers, Architect. (Nair, 2004: 4).
9. Thomas Jones (1775–1852) was a respected London scientific instrument-maker; Edward John Dent (1790–1853) was a famous London manufacturer of clocks, watches and chronometers (Mercer, 1977); by contrast, E. Wrench was not a well-known clock-maker.
10. We can tentatively identify this as the first telescope listed in Table 1, one of the two small refractors owned by Caldecott when he was appointed as Director of Trivandrum Observatory.
11. Although Curnin was appointed the EIC's Astronomer at Colaba in 1822, the Observatory itself was only constructed in 1826.

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In 1998 Wayne Orchiston and John Perdrix co-founded the *Journal of Astronomical History and Heritage,* and Wayne was the Managing Editor until 31 July 2022 when he passed ownership of the journal to the University of Science and Technology of China. In 2013 the IAU named minor planet 48471 'Orchiston', and in 2019 former PhD student Stella Cottam, and Wayne, were awarded the Donald E.Osterbrock Prize by the American Astronomical Society for their 2015 Springer book, *Eclipses, Transits and Comets of the Nineteenth Century* … The Society also awarded Wayne the LeRoy E. Doggett Prize in 2024 for lifetime achievements in history of Astronomy. The previous year he had been elected an Honorary Member of the Royal Astronomical Society of New Zealand, and two of his former doctoral students edited the following Festschrift in his honour: Gullberg, S., and Robertson, P. (eds.), 2023. *Essays in Astronomical History and Heritage: A Tribute to Wayne Orchiston on His 80th Birthday* (Springer, 2023).

Wayne and Darunee Lingling Orchiston live in a quiet village near Chiang Mai in northern Thailand. When not involved in astronomy Wayne enjoys following Australian and New Zealand athletics and Formula 1 and Indycar racing.