Scaling the magnitude: the fall and rise of N. R. Pogson

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A study of the life and work of the neglected British astronomer N. R. Pogson, whose magnitude scale is still the standard formulation for normal use.

Introduction

Few people in the history of astronomy have contributed more but remained as obscure as British astronomer Norman Robert Pogson. Pogson's lifetime work in observational astronomy had few rivals in the nineteenth century, yet most historians continue to ignore his scientific career. Part of the reason for this could be he fact that, unlike other European astronomers, he spent much of his life in colonial India where bureaucracy, isolation, and limited resources blighted his existence. Bureaucracy, scientific politics, and a lack of interpersonal skills perhaps doomed what could have been a brilliant career. Another reason why historians have ignored Pogson could be that he did not publish his most important contribution to astronomy, the magnitude scale, as a paper, nor did he make a concerted effort to popularise it. Despite this, his magnitude scale is one of the most important formulations in modern astronomy. His asteroid and variable star magnitude catalogues were pioneering works, and he discovered no fewer than eight asteroids, including four from Madras, India. One of these asteroids, Asia, was the first such discovery from the Asian continent.[1]

Pogson's life also presents an insight into the nineteenth-century British astronomy establishment. Of special interest is his relation with the Astronomer Royal, George Biddell Airy. His letters to Airy about the working conditions of the Madras Observatory help us understand the British bureaucracy in colonial India.[2] His relations with other astronomers of his time, including Sir John Herschel, Joseph Baxendell and John Russell Hind, provide important clues about the collaboration between them. Pogson's relation with his first assistant at Madras Observatory, Chintamany Ragoonatha Chary, is fascinating. Not only did he encourage

Figure 1. Norman Robert Pogson (1829–1891). *(Popular Astronomy, 1913[3])*

Solar eclipse of 2008 August 1

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It includes a formidable amount of information for every eclipse, produced by experts who calculate eclipse paths, plot them on maps and place them online along with weather forecasts and even analyses of the likelihood of forest fires at your chosen viewpoint.

A site devoted entirely to eclipse links is **http://eclipse.im**

To subscribe to the Solar Eclipse Mailing List, send an email to: **SEML-subscribe@yahoogroups.com**

For the technically-minded, the International Astronomical Union has a huge amount on eclipses: **http://www.williams.edu/Astronomy/IAU_eclipses/**

If it's information on eclipse photography, or fascinating facts you are after, such as how to say 'total solar eclipse' in over 80 different languages, and view eclipse stamps over the last 50 years this is your site, run by Fred Espenak: **http://www.mreclipse.com/**

For British eclipse links including links to tour companies see **http://www.clock-tower.com/eclipse.htm**

Address: The Clock Tower, Stockgrove Park, Leighton Buzzard, Beds. LU7 0BG [**2008tse@clock-tower.com**]

References

1 NASA/TP-2007-214149, F. Espenak & J. Anderson, with permission. Downloadable PDF from **http://sunearth.gsfc.nasa.gov/eclipse/SEpubs/TP214149.html**

2 2134 BC. For more details on this eclipse see Earth View Inc., **http://www.earthview.com/ages/history.htm**; CSIRO, **http://www.csiro.au/resources/ps2af.html**

3 Diagrams not otherwise credited, photographs and eclipse timings are by Sheridan Williams, **http://www.clock-tower.com/eclipse.htm**

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Figure 2. The South Villa Observatory, comprising the tapered dome of the equatorial room, and the adjoining transit room. *(Courtesy the Library of the Royal Astronomical Society)*

Chary to observe, he also helped him publish his observations in the *Monthly Notices of the Royal Astronomical Society (MNRAS)*.[3]

While all these factors make Pogson's life important to study, historically few authors have written about him. Pogson himself in the year 1882, less than ten years before his death, authored a compilation titled *Discoveries, Observations, Calculations, Etc.* containing his major scientific contributions from the year 1847 to 1882.[4] A biographical summary was published in 1892 in the form of his obituary in the *MNRAS*.[5] Other authors such as T. S. Shearmen in 1913 and D. Jones in 1968 wrote about Pogson either out of personal relation or with respect to his work on the magnitude scale.

Early days: 1829–1846

Norman Robert Pogson was born into a middle-class English family on 1829 March 23. His father, George Owen Pogson, was a Nottingham hosiery manufacturer with enough income to support an extended family.[6] Pogson had at least one sister, Mary Anne. As in most family-owned businesses, young Pogson was to take over from his father and was sent for 'commercial education.'[7] But he was fascinated by science, and his mother supported and encouraged this interest. She also made sure that he had access to the works of local instrument makers and opticians. When Norman was a teenager, business commitments forced George Pogson to move to Manchester where Norman received private lessons in trigonometry and other areas of mathematics.[8] These lessons later proved to be invaluable in obtaining his first job.

By 1845 Pogson, age 16, gave up formal education and set out to teach mathematics as a profession.[9] He also met another Nottingham native, John Hind, in Manchester, who was impressed by young Pogson's skills and suggested to his parents to send the boy to London, where his son John Russell Hind was an astronomer at George Bishop's South Villa Observatory in Regents Park.[10,11] Armed with a letter of introduction, Pogson arrived in London in early 1846 and started his life as an astronomer.

First light: 1847–1851

At Bishop's observatory, Hind trained Pogson in practical astronomy while he supported himself by teaching mathematics.[12] Hind was interested in comets and asteroids as well as variable stars.[13] Young Pogson was impressed by his work and Hind had great influence on him. With Hind's help, Pogson calculated the orbital elements of two comets. At the age of 19, Pogson published his first paper on comets in *MNRAS* and was on the road to a promising astronomical career.[14] In 1848, he calculated the orbit of asteroid Iris, which was discovered by Hind on 1847 August 18.[15] Two years later, Pogson also studied the orbits of Pons' comet and Petersen's comet. Impressed by his accurate work, Hind, who was now the director of South Villa Observatory, hired Pogson as an assistant.[16] In 1849 Pogson, aged 20, married Elizabeth Jane Ambrose.[17]

Pogson did not stay at South Villa for very long because he was offered, and accepted, the post of an assistant at the Radcliffe Observatory in Oxford. The young couple moved to Oxford by the end of 1851.[18] Here, he worked for famous astronomer Manuel John Johnson. At that time, Johnson was doing pioneering research on the stellar magnitude scale that was later adopted by Pogson himself.[19]

The magnitude scale

Radcliffe Observatory, located at Oxford University, owed its existence and name to a London physician, Dr John Radcliffe, who left £40,000 to the university for a charitable

Figure 3. The Radcliffe Observatory in 1793, from an early engraving. *(Oxford Physics website)*

purpose. Acting upon a suggestion by Thomas Hornsby, Savilian Professor of Astronomy at Oxford, an observatory was completed in 1774. Hornsby was given the title 'Radcliffe Observer' and was appointed as the observatory's first director.[20] By the time Pogson arrived in 1851, the Radcliffe Observer was Manuel Johnson. He was absorbed in measuring the distances between stars using the newly-received 7.5-inch heliometer by Repsold & Sons of Germany. The heliometer had been developed by John Dolland to measure the Sun's diameter. It consisted of a divided objective, which formed a double image and measured the distance between two stars separated by up to a degree. Johnson had a tough time measuring stars with different brightness and thus had to reduce the brightness of one to the same level as the other. In doing so, he realised that the ratio of brightness between two magnitudes was 2.43 and was independent of the magnitude or the observer. Pogson further investigated Johnson's findings to see if this ratio was useful for estimating accurate magnitudes of the asteroids and variable stars he was observing.[21]

In a paper published in the *MNRAS,* Pogson wrote: 'I had read with much interest the remarks made by the Rev. William Rutter Dawes... and intended to make use of his proposed ratio of 4, when the very different result of 2.43 obtained by Mr Johnson from his heliometric equalisation experiments... threw uncertainty upon a matter I had regarded as settled.'

Pogson's own experiments led him to the 2.4 ratio as found by Johnson earlier. So he concluded, 'I selected 2.512 for convenience of calculation as the reciprocal of .5 log R, a constant continually occurring in photometric formulae, is in this case 5.'[22] It is interesting to note that Pogson never published his calculations as a separate paper, and only mentioned them in his variable star or asteroid papers. Other astronomers did not accept Pogson's scale for more than two decades. The first to acknowledge and use the system was Harvard astronomer Edward Charles Pickering for the famous *Harvard Photometry.* Later in 1886, Charles Pritchard at Oxford used the scale for *Uranometria nova Oxoniensis*, which was followed by the works of Muller and Kempf at Potsdam in 1905.[23]

Radcliffe days: 1852–1858

At Radcliffe Observatory, Pogson's main duties were to measure the position of stars using the transit instrument. He continued to do research on variable stars and asteroids when time permitted, and discovered many new variable stars. On 1854 March 2, using the 7.2-inch telescope, he independently discovered asteroid Amphitrite. Albert Marth first observed this asteroid on the previous night at Pogson's former employer, South Villa Observatory, London.[24] In October that year, Pogson assisted Astronomer Royal George Biddell Airy in his pendulum experiments at Harton Colliery, South Shields, on the English North Sea coast.[25] Airy was attempting to determine the mean density of the Earth, and Pogson's mathematical skills proved useful. Appreciating his work, Airy wrote to Johnson commending Pogson's 'intelligence and spirit' displayed at Harton.[26] After losing the Amphitrite discovery to Marth, Pogson had to wait for two years before he was rewarded.

On the night of 1856 May 23, during regular observations, Pogson discovered a new asteroid. But clouds prevented follow-up observations until the May 29. Pogson was elated by the new find and asked Johnson to propose a name. The new asteroid was named Isis.[27] Pogson was later awarded the famous Lalande medal by the French Academy for this achievement. He followed up this discovery with asteroid Ariadne on 1857 April 15. Excited by his new find, Pogson wrote to the famous English astrophotographer, Warren De La Rue of Canonbury, 'I have the pleasure to inform you of my discovery of another planet last night, rather this morning.'[29]

Throughout this period, Pogson communicated frequently with other astronomers in England and on the Continent. These may have been attempts to get better positions than the one he had at Radcliffe. With a modest income of £120 per annum, Pogson had to support his wife Elizabeth and a growing family of eight children.[30] He was also unhappy working under Johnson. The reasons for this rift between them are unknown but Pogson mentioned it in numerous letters to other astronomers.

During the summer of 1857, he visited several observatories owned by rich amateur astronomers in the hope of finding a new job. One such visit was to Hartwell House, just outside Oxford, run by Dr John Lee, who later became the president of the RAS. Hartwell House was equipped with a permanently mounted 5.9-inch telescope that was donated by Admiral William Henry Smyth in 1829. The observatory also housed a tripod-mounted 3.5-inch telescope of 5 foot focal length. Pogson impressed Dr Lee and Admiral Smyth by showing them his famous discovery, asteroid Isis and some variable stars.[31]

On 1857 August 16, Pogson discovered his third asteroid, Hestia, from Hartwell House, with the hope that the new discovery would convince Dr Lee and Admiral Smyth to hire him.[32] That did not happen. The following summer, Pogson visited Hartwell again and observed at Leyton Observatory owned by J. G. Barclay, where he detected the variability of R Librae and announced the discovery from Leyton.

On 22 July, Pogson wrote to Admiral Smyth emphasising that a 'distinction is drawn between amateurs who devote their time as a labour of love and those who are paid for their work and only successfully fulfil their duty.'[33] By saying this, he tried to convince Admiral Smyth that he was the right person to run Hartwell. Impressed, Admiral Smyth recommended the appointment of Pogson as the new director of Hartwell House Observatory.

Hartwell House, 1859–1860

Hartwell House lies at the centre of over a thousand years of British history. It was the seat of William Peverel, son of William the Conqueror, and John Earl Mortaigne, the brother of Richard the Lion Heart. Louis XVIII, who was exiled from France, held court at Hartwell from 1808 until 1824. Between

Figure 4. Hartwell House today. *(Car and Driving)*

the sixteenth and the twentieth century, Hartwell House was home to the Hampden and Lee families, ancestors of American Confederate General, Robert E. Lee.[34] Obtaining a position at Hartwell was very important for Pogson's career as an astronomer. He met Dr Lee to negotiate the terms of his new position as director of Hartwell House Observatory, and on 1858 December 12, they signed a memorandum of agreement. Under this, Pogson received £220 per annum with a house and a garden. Dr Lee provided him and his family an additional sum of money until the house was ready. All research and publications related to the observatory were the property of Dr Lee. Pogson took over as the new director of the Observatory on 1859 January 1.[35]

At Hartwell, Pogson's role was more defined and focused. His arrangement with Dr Lee gave clear instructions on what astronomical objects he was to work on. The astronomy part of the agreement included use of the Smythian telescope for private use at Pogson's house; he was in charge of observatory equipment, working on clock rate, occultations, eclipses, comets and variable stars. Searching for asteroids, making sidereal charts down to 12th magnitude, measuring double stars and continued observation of Gamma Virginis were all added to the first list of duties.[36] The Smythian telescope that was loaned to Pogson was the 3.5-inch F/17.1 refractor which would remain with him till his death in 1891.

Pogson was quite happy with this arrangement. He had the time to observe what he wanted to and was answerable only to Dr Lee. Initially at least, Pogson and he enjoyed a close relationship, evidence of which can be found in the numerous letters and notes between them. In a letter dated 1860 February 5, Pogson thanked Dr Lee for his 'considerate and liberal advance... as it obviates the dreaded consequences resulting from heavy domestic expenses and twelve years of ill-requited devotion to science.' Pogson was also content with Dr Lee's agreement to publish the *Hartwell Atlas of Variable Stars*. He signed off as 'your humble protégé and friend.'[37]

The Pogsons lived at 2, South Parade in Oxford, about 20 miles from Hartwell House. He started working on the variable star atlas, and ran into problems with Argelander's nomenclature. Friedrich Wilhelm August Argelander was a Prussian astronomer who was responsible for the Bonner Durchmusterung (BD) catalog that was published between 1852 and 1859. Argelander believed that there would be few variable stars, and brought in a system of naming them with the last nine remaining capital letters of the alphabet (R to Z) followed by the Latin genitive version of the constellation name,[38] for example, R Ursa Majoris. Pogson, who was cataloguing variable stars, was convinced that the available designations would soon be exhausted by new discoveries. He wrote to Sir John Herschel seeking his approval of a new nomenclature. Herschel, along with Airy and Hind, were willing to contemplate a new system, but after Pogson's departure for Madras the matter was dropped.[40]

Manuel Johnson's death early in 1860 created a vacancy which Pogson hoped would be the next step in his rising career, the Radcliffe Observership. In a letter to Airy, Pogson wrote that he, 'cannot look upon [it] as anything short of a right, after my arduous official and voluntary labours for the seven years during which I toiled on small pay and still less encouragement.'[41] This shows that Pogson was still unhappy about his years at Radcliffe under Johnson. Herschel warmly endorsed Pogson's application; Airy seems to have been somewhat cool. Pogson also informed Dr Lee about the application. But despite his best efforts, his application was declined. Rev. Robert Main, who was the chief assistant at the Royal Greenwich Observatory, instead got the job.[42] Embittered by this reverse, Pogson learned that something of a glass ceiling existed in British astronomy, for without a university qualification – a Cambridge wrangler was Airy's ideal – the directorship of a public observatory was unlikely to be his.

Departure for Madras: 1860

On 1860 July 7, Lt. James Francis Tennant resigned as government astronomer in Madras, India, due to 'low pay.'[43] When Pogson became aware of this vacancy he was elated and told Dr Lee that the salary was more than £1,000 a year.[44] He also wrote to Airy expressing his keen interest and sought his recommendation. 'We have just heard that the Madras Observatory is vacant... and my kind valued friends and neighbours Admiral and Mrs. Smyth seem to think so eligible an opportunity of promotion ought not to escape me without a struggle.'[45]

Airy forwarded his recommendation but not without some cryptically unfavourable statements. 'Mr Pogson was educated, I believe, at a German University. He was, for some years, assistant at the observatory of Oxford, but quit that post upon some disagreement with the principal Mr Johnson.'[46] Of course Pogson had never attended a German university; Airy really meant to underscore the fact that he had not attended a British university. Airy's remarks also confirmed earlier suspicions that all was not well between Pogson and Johnson at Radcliffe. Nonetheless, Herschel again gave a solid recommendation and even confirmed the pension benefits attached to the job.[47]

In early October, Pogson was appointed to the Madras post. Dr Lee initially opposed Pogson's abrupt resignation, but later said he would not stand in his way. In a letter to Dr Lee, Pogson described himself as the 'Astronomer Royal of India.'[48] This can be seen as an indication that, for Pogson,

the title of his post was very important. Pogson promised that he would complete the Hartwell atlas at Madras and would survey the southern heavens. With his responsibilities completed at Hartwell, Pogson planned for his long voyage to India. He wrote to Airy about the cost of the trip for him and his family. He suggested that instead of taking a ship, an overland, via Suez, would be shorter and would cost £307. But the British government would pay only £150. He was also examined for life 'assurance' and was declared '…healthy and likely subject to endure the climate in India.'[49] Pogson also wrote to Airy, while he was at London, days before he took the ship. 'I owe my appointment entirely to your powerful influence and kind friendship.'[50] Pogson, with wife Elizabeth and three children (younger ones stayed back with aunts in Manchester), sailed from England on January 4 onboard the Peninsular & Oriental Steam Navigation Company steamer, Pera. Pogson made observations on the passage using a 2.5-inch Capt. Jameson's sea glass. He noted, '…heavy rolling in the Bay of Biscay. One passenger dead.'[51] The Pogsons themselves arrived safely at Madras on a clear February morning after more than a month at sea.

1861–1865, at Madras

Having landed at Madras, the Pogsons took up residence close to the observatory, which was located at Nungumbakkam, a suburban area south of the city. Madras Observatory was established in 1792 by the governor, Sir Charles Oakeley of the British East India Company. The primary instrument at the observatory was a 6-inch equatorial refractor. By the time Pogson reached Madras, the equipment was damaged and the observatory was in disrepair. He wrote to Airy on 1861 February 12: 'It is grievous to see fine weather passing, so many government hands comparatively holiday-making, and so costly an instrument actually less efficient than the decayed old wreck it ought long since to have superceded [*sic*]. Equatorial shelter in dangerous condition. I, your grateful humble protégé...'[52]

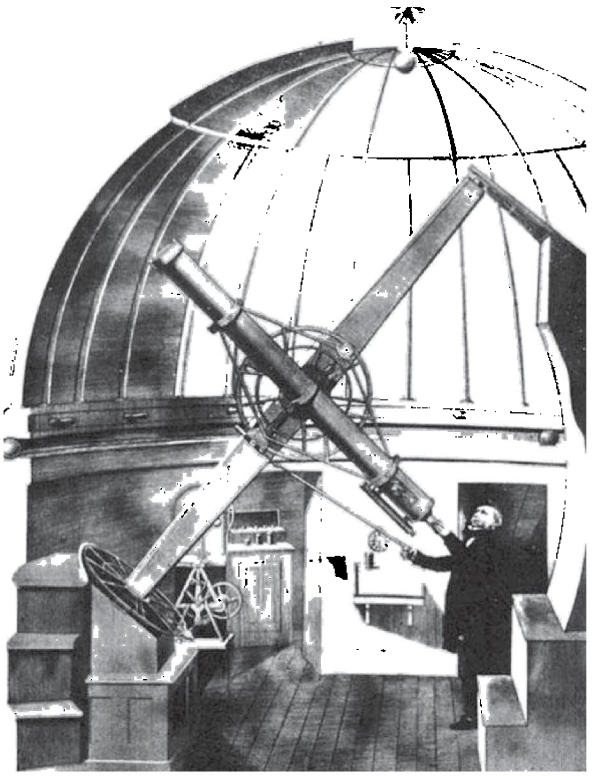

Figure 5. The Smyth equatorial refractor in 1844. (from *The History of the Telescope*, by H. C. King, Charles Griffin & Co., 1955)

Despite this, Pogson made his first observations days after he reached Madras. 'First observations in India taken in the compound, in happy, fearless ignorance of snakes, centipedes, scorpions, and all the filthy, dangerous vermin abounding in my new home.'[53] Pogson was also shocked to see the arrears of observations that were waiting to be reduced. In a letter he noted, '...fifteen years of hourly magnetical observations, about twelve years of meteorological ditto, and a by no means small catalogue of stars, observed simply raw material wholly unreduced and awaiting attention.'[54]

On 1861 April 17, Pogson discovered the first asteroid found from the continent, promptly named Asia. Three days later, Chintamany Ragoonatha Chary, who was one of Pogson's four native Indian assistants, made the second observation of the asteroid and reduced them.[55] In the following months Pogson effected necessary repairs on the equatorial telescope and installed the Troughton and Simms transit circle which had gone unused since its delivery to Madras in 1858.[56]

He was ready to commence his ambitious southern sky survey. But almost immediately Pogson ran into trouble with the Royal Astronomical Society over the survey. He wrote to Airy about this in a letter on 1862 May 13: 'The remarks there fill me with surprise and regret, to think that of my many acquaintances, whom I have been accustomed to think were friends, and who knew well what my avowed objects and policy were in coming out to India... I could imagine willfully ignored.'[57]

The RAS planned to do the southern sky survey from Sydney rather than India and Pogson was furious about it. While no reason can be found as to why the RAS was unhappy with Pogson, it is interesting to note that Dr Lee, Pogson's former employer, was president of the Society during this period, and J. R. Hind was on the committee that made the decision of the survey. Was Pogson referring to Dr Lee or Hind when he wrote to Airy of 'my many acquaintances' and 'friends'? The information available is insufficient to reach a conclusion on this matter. Despite opposition from the RAS, Pogson started his southern sky survey in January of 1863. He again wrote to Airy complaining about its attitude but decided to proceed on 'the chief work of my life.' He also asked for an English assistant, as the natives were 'not good.' He complained: '…to take this my chosen work out of my hands, and to have it executed elsewhere, perhaps at Sydney, in utter defiance not only of me, but as I conceive, equally of yourself, under whose high authority the announcement above referred to was officially made.'[58]

In the following months, Pogson discovered a number of new variable stars and also observed the total lunar eclipse of 1863 June 1. On 1864 May 3, Pogson discovered another asteroid from Madras, which he named Sappho as suggested by Herschel.[59] But conditions deteriorated from this point on, regardless of new discoveries. Pogson learned that his request for an English assistant was rejected. In a letter to Airy he noted: 'I have received the heaviest blow to all my future hopes and plans conceivable. Assistant astronomer post refused. Predecessor did not have assistants, but left arrears. Natives superstitious and devious. Government schools are preparing better qualifications, but natives opt for Revenue Board or Public Works, not the observatory. Considering own boy as assistant on Rs 200 per month, not as nepotism or for extra income, but in the interest of getting things done.'[60]

The beginning of the end: 1866–1880

Using the same charts he used to find Isis and Sappho, Pogson discovered another asteroid on the morning of 1866 May 17. Selected like Sappho from a list furnished to Pogson by Herschel, the new asteroid was named Sylvia, the mother of Romulus.[61] But celebration of the new discovery was short-lived. Pogson found out about a British government plan to merge the Bombay and Madras observatories. Furious about this, he wrote to A. J. Arbuthnot, the chief secretary to the government at Fort St. George, threatening to resign. The Indian Government reconsidered its move and decided to keep the observatory in Madras. However, in the summer of 1867 it created a new Madras Meteorological Department and appointed Pogson as meteorological superintendent.[62]

A year later, Pogson and Chary observed the total solar eclipse on August 18 during the height of the monsoon season. During this time, Pogson's wife Elizabeth contracted cholera, a water-borne disease, and fell ill. Later that year, Pogson discovered another asteroid, Camilla. In early 1869, Pogson was asked to help Col. J. T. Walker in the Great Trigonometrical Survey. Col. Walker was the superintendent of the Survey. Airy, by now unhappy with Pogson's attitude, wrote the Code of Instructions for Madras Observatory that he had to follow. The instructions included accountability for the work done and the expectation of official scientific guidance. Pogson was given some freedom to observe what he wanted, but only after the routine observations and reduction work were performed.[63] It is unclear how Pogson viewed the new operating rules, but they could be seen as an attempt by Airy to bring Pogson under the more direct control of the Astronomer Royal. Tragic personal news followed. On 1869 November 5, after 11 children and 16 months of cholera, Elizabeth Jane Pogson died. The death of his 'beloved wife' was a great blow to Pogson.[64]

Col. Walker recommended to the government that Pogson's eldest son, Norman Everard Pogson, be appointed as assistant astronomer with a salary of rupees 150. The proposal was accepted and Pogson Jr. joined his father, but bureaucracy caught up with Pogson very soon. Due to delays in government publications, Pogson lost credit for being the first to observe the spectrum of the solar corona, during the total solar eclipse of 1868. Airy dodged all letters from Pogson requesting instruments, instructions and nominations for the RAS.[65]

Finally, in 1872 June, the government sanctioned money for a room, a darkroom and a printing room. Nevertheless, Pogson's position as meteorological superintendent soon came under fire. He was accused of negligence for not providing warning of a tropical storm from the Bay of Bengal.[66] A year later, another tragedy struck. His eldest son and the assistant astronomer, Norman Everard Pogson, died. The tragedy was overwhelming, but no records of the cause of death are known. Pogson's daughter, Elizabeth Isis Pogson, was appointed the new assistant astronomer.[67]

Chintamany Ragoonatha Chary

Amidst all this, Chintamany Ragoonatha Chary stood out as a pillar of support for Pogson. Chary was born into a Brahmin (educated priestly caste) family in Madras and joined the observatory as an assistant under Captain Jacob.[68] His personal qualities can be glimpsed in a letter Pogson wrote to the geographer, C. R. Markham: 'C. Ragoonatha Chary is a good clever self taught assistant; particularly ready at calculating eclipses and occultations. The rest are mere dolts – machines without the certainty of machinery.'[69]

It was clear from the beginning that Pogson liked working with Chary. He was given charge of many important projects, including the regular transit circle observations and an expedition to observe the solar eclipse of 1868. While he was paid just rupees 100 per month, his passion for the skies kept him going. Apart from the discovery of variable star R Reticuli, the first modern astronomical discovery by an Indian, he is also credited with the discovery of V Cephei's variability. He published three papers in the *MNRAS* and was the first Indian elected as a fellow of the RAS.[70]

During his lifetime, Chary spent a lot of time educating the Indian public about the importance of astronomy and tried to 'convince them of the absurdity of their notions regarding astronomical events.'[71] He also wrote a booklet on the transit of Venus that was published in 1874. The booklet was a big success and was subsequently translated into numerous vernacular languages. Close to 5,000 copies were sold throughout India.[72]

On 1874 April 13, Chary delivered a lecture at the Pacheappah's Hall in Madras to a large meeting of 'native gentlemen.' He urged them to support his plans for a native observatory where Indians could be trained in astronomy, useful for both science and religion. During this time, Chary was worried about his health and his retirement. 'My health, too, is becoming weaker daily, and I cannot shut my eyes to the fact that my retirement from active work is not very distant.'[73] This shows that he was dedicated to his work. In

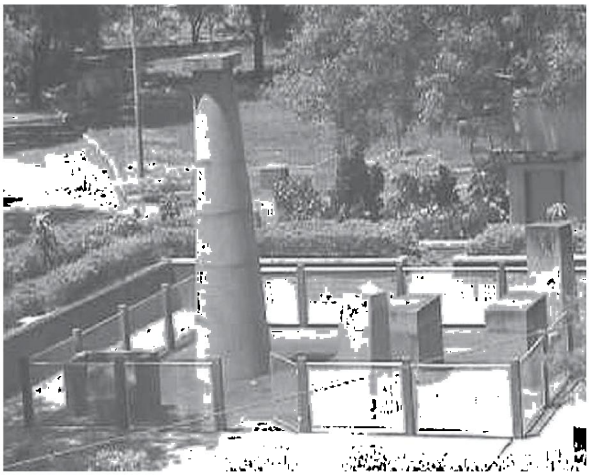

Figure 6. Remnants of Madras Observatory as seen today. *(Regional Meteorological Centre, Chennai, India)*

1878 June, Chary retired from his post as an assistant at Madras Observatory after four decades, and died two years later, on 1880 February 5.[74] His passing was also a climacteric of sorts for Pogson; from then on he was in the terminal phase of his career.

Last contact: 1880–1891

If Chary's retirement was not enough, there was more to come for Pogson. He once again unsuccessfully tried for the Radcliffe Observership. This time he had more competition and Airy was not so kind to him. Airy supported the application of Edward Stone, a talented young astronomer, because he was the most promising of the younger generation.[75] The competition for Airy's favour must have been keen, since David Gill and William Christie were among the other candidates. Pogson received some consolation as he was nominated and awarded the Companion of the Order of the Indian Empire at the distribution of New Year's honours in 1879.[76] The Order was founded in 1877 by Queen Victoria to honour Indian princes and chiefs, as well as British officers who served in India. The Order was usually given to civil servants late in their careers or at the time of their retirement.[77]

After 1880 Pogson's observational work flagged, but he continued to toil on the Madras star catalogue. He resisted numerous attempts by others in getting him to do longitude measurements that were important for the Royal Navy. Airy was also very tired of Pogson's inaction; however he left the issue to Christie, his successor as Astronomer Royal. Pogson had his own share of issues with the Madras government as he had suggested a new observatory site in the hills because Madras was not the best place for astronomy. The search for a site ended in Kodaikanal, a hill station in southern India, but the scientific establishment was convinced that Pogson was not the man for the new observatory. In discussions with the Royal Society on the future of astronomy in India, spectroscopy pioneer William Huggins wrote: 'I need not say the present Madras astronomer would not be the man for a new observatory. Success depends on the right man, a new broom.'[78]

Elizabeth Isis Pogson was appointed as the meteorological reporter after Pogson's poor cyclone predictions. She also continued to help her father at the observatory. In 1882, Pogson, fed up with publication delays due to the Indian Government's 'red tape', brought out his own publication, *Discoveries, Observations, Calculations, Etc.* This booklet enumerated all his observations made from London, Oxford, Hartwell and Madras from 1847 to 1882. It also listed Pogson's papers and letters in astronomical journals up to that time.[79] A year later, on 1883 October 25, fifty-four-year-old Pogson married Edith Stopford, daughter of Lt. Col. Charles W. Sibley.[80] It is likely that Edith Stopford was a widow. The couple had three children, one of whom, daughter Vera, died as an infant. Pogson commemorated his daughter's life with his last asteroid discovery on 1885 February 6; he called the minor planet Vera.[81] By that date, however, the British astronomical community viewed Pogson as an unproductive nonentity who should be removed from his post. As he was employed by the Madras Presidency and was still on friendly terms with local administrators (Governor Mountstuart Grant Duff had in fact quixotically nominated Pogson for a Royal Society fellowship!) there was little the Astronomer Royal or anyone else could do.[82]

Finally, after nearly twenty five years of bureaucratic and self-imposed delay, Pogson published the first volume of *Results of Observations of the Fixed Stars* in 1887. He also continued to reduce and publish observations from the years 1865–1870. But it was too little and too late to restore his reputation. In the summer of 1891, while preparing for the upcoming Mercury transit, Pogson fell seriously ill. Despite this, he made observations with his favorite Smythian telescope, an old gift from John Lee. He sought medical advice and was informed that he was suffering from liver cancer and had only a few weeks to live. Pogson had made all his observations in cipher so he hurriedly requested the government to appoint someone that he could train. Michie Smith, a close friend of Pogson, was appointed to the observatory.[83] (He later became the first director of the new observatory at

Figure 7. Inscription on Pogson's grave at St George's Cathedral, Chennai. The decorative brass tablet that was placed in 1894 is missing. The grave is not far from the old Madras Observatory, which has since been converted to a local meteorological station. *(Photograph by Vishnu Reddy)*

Kodaikanal). On 1891 June 23, Norman Robert Pogson died. A choral memorial service held at St. George's Cathedral was attended by a large gathering. He was laid to rest less than a mile from Madras Observatory.

Conclusion

N. R. Pogson lived in a period when great advances were made in observational astronomy. During this time many modern instruments and techniques, such as photography and spectroscopy, were introduced. Pogson's life provides an insight into the life of a government astronomer during this colonial period. While Pogson tried to make grand discoveries that would have promoted the might of British imperialism, he himself was consumed by bureaucracy. Despite this, he will always be remembered for the magnitude scale, and his work on variable stars and asteroids.

Pogson, as a person, was very devoted to astronomy but he was also a person of strong opinion and character. He seems to have been interested only in doing things that he liked rather than doing his duty. Is this a sign that he was hungry for name and fame? His usage of 'Astronomer Royal of India' to define his new post supports this notion. Though he tried to maintain good relations with fellow astronomers, he had a tendency to make enemies everywhere he worked. This proved costly for his career in the end.

Pogson was aware that the southern-sky survey would bring him fame in the astronomical community. He would also be the first to discover hundreds of new variable stars and asteroids in the process. This could be the reason why he refused to give it up until the end. He attempted, in an obsequious manner, to develop relationships with leading astronomers of his day. John Herschel remained an enthusiastic friend. Airy was impressed by Pogson initially but after Pogson's spat with Johnson at Radcliffe, things were never quite the same. While Airy continued to support him, Pogson's stubbornness over the southern-sky survey, lack of productivity in routine publication, and repeated undiplomatic calls for money and equipment led Airy to discount him. His sister Mary Anne was married to variable star expert Joseph Baxendell. Pogson communicated frequently with Baxendell while he was in India and cited him in his variable star papers.

Perhaps the most complete picture of Pogson's professional career is summarised by Revd H. G. Hagen, director of Georgetown College Observatory, Washington DC, in an MNRAS note years after Pogson's death: 'The inspection of the manuscripts and even the reading of this summary statement, cannot fail to produce the highest admiration for Mr Pogson's activity and perseverance and this admiration is greatly increased if we recall his extended meridian work and other official duties. To keep up an arduous work like this for thirty years, without seeing it in print, and even without a definite prospect of ever finishing it, supposes an enthusiasm that is indeed very rare… Why was such enthusiasm and labor not crowned with more success?'[84]

In simple terms Pogson took up projects beyond his resources and vainly worked to complete them in the face of personal shortcomings as well as professional obstacles.

As a family man, Pogson cared for his children and wives. He always addressed his first wife Elizabeth as 'my beloved wife.' His daughter Elizabeth Isis had a special place in Pogson's heart. She was an intelligent woman who assisted her father in his astronomical work. But throughout his life Pogson was financially unstable. With a large family to support, he often had to take loans from relatives and friends. Despite being sceptical of native assistants, Pogson respected and supported Chary's work. Initially, he insisted on having a European assistant but was later content with Chary. He not only acknowledged this in his letters to Airy, but also helped him get elected to the RAS. Pogson also helped lay the foundations of modern astronomy in India. The British realised the importance of a mountain-top site for an astronomical observatory; soon new observatories were built in the southern Palani hills and in the Himalayas.

Despite the information presented in this paper, numerous questions remain unresolved about Pogson's life. Why did Pogson not get along with Johnson? Was it because he appropriated Johnson's work on the magnitude scale? Was he dismissed from Radcliffe for this? Was Pogson asking too much for himself? Why did Pogson continue to ask for an English assistant astronomer when he repeatedly said he was happy and impressed by Chary? Answering these questions might provide more information to better understand Pogson's personality and life.

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