

exposition of his method of 'Adjusting the orientation of a polar axis' (1980). He wrote a state-of-the-art chapter on Mars for 'Splendour of the Heavens' (1923) and two books, *A Hundred Years of Astronomy* (1938) and *The Revolving Heavens* (1942). His two presidential addresses to the BAA 'Instrumental and Technical Advances of the Last Forty Years' (1955) and 'The Story of the Hertzsprung–Russell Diagram' (1956) still make exciting reading and show that his knowledge was not confined to observing matters. He took part in radio broadcasts between the wars and during the visibility of comet Arend–Roland in 1957.

Reggie Waterfield joined the Society in 1916 serving on Council during 1937–42 and again from 1958 to 1963 during which time he was a Vice-President (1959–61). He was awarded the Hannah Jackson-Gwilt Gift and Medal in 1942. He served on the Joint Permanent Eclipse Committee and was an RAS appointee to the Board of Visitors to the Royal Observatory (1959–64). He joined the BAA in 1914 and contributed much to its aims becoming President (1954–6) and being awarded the Walter Goodacre Medal and Gift in 1966. He was also first recipient of the Comet Medal of the Astronomical Society of the Pacific in 1969. He served on the IAU Commission for the Physical Study of Comets. Minor Planet 1645 was named Waterfield.

Waterfield's success in his chosen fields was in part due to his great grasp of physical principles, the high standards he set himself and others, and his boundless energy and enthusiasm. Despite the considerable discomfort and restriction his illness imposed for the last 37 years of his life, he was always eager to get just one more observation, however unpromising the circumstances. The last object he saw through his telescope was Halley's comet during the winter of 1985–6. He died at his home in Woolston on 1986 June 10: he had belonged to the Society for 70 years and to the BAA for nearly 72 years, during which time he had observed regularly with but a few breaks for illness and war service. He had a wide circle of friends and colleagues many of whom still visited him to use the telescope or to listen to his fund of astronomical reminiscences, but he greatly missed those who had departed before him. Reggie was not married but his sister Mrs Patsy Warner survives him: we offer her our condolences.

M.J.HENDRIE

PROFESSOR SIR RICHARD WOOLLEY, OBE, ScD, FRS, 1906–86

Richard van der Riet Woolley played a major role in the development of Astronomy in three continents: Australasia, Europe and Africa. He was one of the architects of the re-birth of British optical astronomy through the Anglo Australian Telescope and the UK Schmidt but he retired from Britain before those became operational.

He was born on 1906 April 24 at Weymouth. His British father became a Paymaster Rear-Admiral, his mother was a Van der Riet, daughter of the resident magistrate at Simonstown. Initially educated in England, Woolley

moved to South Africa when his parents retired there and took a degree at the University of Cape Town. He returned to England to Gonville and Caius College, Cambridge where he came under the benign influence of Professor F.J.M.Stratton. Stratton worked on solar eclipses, novae and their shells, and was an early investigator of luminosity effects on the H & K lines of Calcium. He also took a great interest in students and directed Woolley towards astronomical research. Woolley took the Mathematical Tripos, becoming a Wrangler in 1928, and stayed to do research on stellar atmospheres under Eddington. His strong personality and promise as a scientist won him a Commonwealth Fund Fellowship (now Harkness Fellowship) to the USA which he held at Mt. Wilson Observatory. There he worked on solar problems for two years. In 1931 he returned to Cambridge and was appointed to the Isaac Newton Studentship. He again came under Eddington's influence and acquired an unbounded respect for his intellect and physical intuition. Upon completing his PhD Woolley became Chief Assistant to the Astronomer Royal, Sir Frank Dyson, at the Royal Observatory, Greenwich. There he collaborated with Dyson in writing their well-known book *Eclipses of the Sun and Moon*. However, the opportunity to become Eddington's Chief Assistant arose after only two years so he returned to Cambridge holding the joint appointment as J.C.Adams Astronomer, and renewed his friendship with Professor Stratton. After two further years Professor Stratton suggested that although only 33, Woolley should apply for the Directorship of the Commonwealth Solar Observatory at Canberra which was then vacant.

Woolley had married Gwyneth Meyler in 1932. By the time they disembarked in Sydney, the second world war had been declared. Under Woolley the optical expertise at the observatory was turned to the design and development of specialist items such as gunsights. To take these developments further the workshop was greatly expanded to employ a total of 70 men and small batches of up to 50 sights were produced.

Canberra in those days, although the seat of Government, was nevertheless quite a small town. Through his direct connection both as Government Astronomer and with the war effort, Woolley became well acquainted with ministers. When the war ended he already had a large workshop and was well placed to get his observatory equipped with modern instruments. The Australian National University had been founded in Canberra three years before the war and was now growing. Woolley saw advantages to the observatory in a greater contact with students and the greater freedom of academic rather than government directed research. He therefore proposed that the responsibility for the observatory should be transferred to the University. This was opposed by the minister who was loath to lose the observatory from his sphere of influence but Woolley successfully appealed to the Prime Minister (Menzies) and with the backing of Oliphant at the Research School of Physical Sciences, the Mt. Stromlo Observatory, as it was now called, became part of the ANU.

Meanwhile, astronomical research was flowering. In a famous paper Woolley and Allen showed that the upper chromosphere was hot and suggested heating by downward conduction from the corona. These interests in the atmospheres of the Sun and stars, which had been instigated by

Eddington, formed the basis of his book *The Outer Layers of a Star* written in collaboration with his younger colleague at Mt. Stromlo, D.W.N. Stibbs.

He stimulated a broad interest in stellar astronomy by bringing in American astronomers who were keen to have access to the rich Southern sky. As a result of his drive for new instruments, funds were made available for a new 1.9-m telescope but before this was working he was appointed to succeed Sir Harold Spencer Jones as Astronomer Royal in 1956. Leaving his budding observatory, his devoted staff and his horse was a wrench. Indeed, Stromlo was then set to become the leading observatory in the Southern Hemisphere.

The move of the Royal Greenwich Observatory to the clearer skies of Sussex was well advanced but the workshop was small, the instruments were old and the staff had continued with the more traditional disciplines of accurate stellar positions, the determination of time and the accurate determinations of the motions of the Earth and Moon. Woolley used their experience to create a modern observatory studying the astrophysics of the stars and the Galaxy. However he did not want these new developments to be dissipated in an attempt to advance on too wide a front. Realizing that his experiment to monitor Cosmic Ray Neutrons was unwanted, T. Gold left to make his career in the United States. However, this was two-way movement, for Eggen came to Herstmonceux from the Lick Observatory and his energy coupled with his immense knowledge of stellar photometry, enlivened discussions of the properties and the motions of the nearby stars. These became one of Woolley's recurrent interests. Because most stars are too dim to be studied individually at large distances, much of our knowledge is inferred by extrapolation from our local neighbourhood. Woolley's studies in this area are well typified by his paper 'On the velocity distribution of 743 stars within 20 pc of the Sun' based on Gliese's catalogue and by his later extension of that catalogue to stars within 25 pc published with his staff in *Royal Observatory Annals*. Olin Wilson of the Mt. Stromlo and Palomar observatories collaborated with him on the use of the Calcium K line both to determine luminosities and as an age indicator.

One of Woolley's first concerns when he became Astronomer Royal was the Isaac Newton Telescope. Although the project to build this telescope was an integral part of the move to Herstmonceux, nevertheless Government austerity had delayed its funding and the astronomers were divided as to whether a revolutionary, large, convertible, Schmidt design should be preferred to a more conventional giant reflector. Woolley opted for the well-tried reflector and construction proceeded on that basis. The concept of making an outstation abroad was not seriously considered, as the extra expense would probably have cancelled the project. However, in later years when travel became cheaper and more widespread, the decision to place the Isaac Newton Telescope under the cloudy skies of Herstmonceux was much criticised. The La Palma observatory was originally planned with three *new* telescopes but a poor and expensive decision to move the INT instead of one of them was said to be more acceptable politically. The extensively rebuilt INT is now doing sterling work on its new site in the Canary Islands.

As the INT was nearing its completion at Herstmonceux, Ryle sent early news of the discovery of the first pulsar by Hewish and Bell. The telescope

was not yet in a fit state for serious observation but Woolley asked Harding to point it to the relevant patch of sky and look for a source pulsing at the 1.33 second period. None was seen. Much more stringent limits were set with better equipment on the 30 in at Herstmonceux a few weeks later.

Woolley's time at Herstmonceux was marked by his encouragement of students with the invention of the student summer course, his founding of the Annual Herstmonceux Conference which ended with a grand dinner followed by port with dessert and his encouragement of astronomy at the new University of Sussex. He greatly valued his position as Visiting Professor of Astronomy. He and his senior colleagues lectured and supervised research students for the University and junior staff members of the RGO were encouraged to obtain master's and doctor's degrees at Sussex. He enjoyed sport and liked to win whether it be croquet, tennis, golf or cricket. On one occasion when out with the cricket team he found he had forgotten his wallet. This caused some consternation as he strongly believed in the civil service rule that a senior should never borrow money from a junior – nevertheless his bill had to be paid!

Woolley believed in the innate ability of his countrymen and planned equipment which would allow them to lead the world in astronomical discovery. Very early he suggested a joint collaboration with the Australians to build a large telescope to explore the Southern sky. Design studies for an Anglo-Australian telescope began under him in 1962–63 and the project was backed in Australia by Bowen and by Bok who was then Director of Stromlo. However, the concept was opposed by the biologists of the Australian Academy who considered it too great an expense. At one time it looked as if the whole project would fall apart and the possibility of Britain joining with Carnegie's Mt. Wilson observatory to build a telescope in Chile was seriously considered. However, with the threat of the loss of their possible partner, the Australian government came up with their share of the money. Eggen was by then Director of Stromlo and Gorton was the Australian Minister for Education and Science while both Bowen and Sir Harry Massey helped to convince the Australian government of the importance of the telescope. When somewhat unexpectedly there was an underspending at the SRC, Woolley strongly backed the possibility of a Southern Schmidt; at first it was thought that this would also be a joint project but the Australian budget would not stand such strain, so it became a UK instrument and Reddish worked very hard to ensure that it was both the best in the world and built on time.

The projected running costs of these new telescopes in Australia would leave insufficient money for the continuation of the Royal Observatory at the Cape of Good Hope. Furthermore, the Radcliffe Observatory at Pretoria was in financial difficulties only partly alleviated by grants from the SRC. The Republic Observatory at Johannesburg, like both the others, was now surrounded by street lights and it looked as though the coming of the AAT might spell an astronomical disaster in South Africa. However, many astronomers knew that the skies of Southern Africa were actually clearer than those in Australia and were loath to end a proud tradition of South African astronomy going back to the eighteenth century. So it was that a scheme was hatched to combine the assets of the three observatories, found

a new observing site in Sutherland far from city lights and to appeal to the South Africans to run it as their national observatory. Woolley ensured the success of this scheme by agreeing to become the new observatory's first Director on his retirement as Astronomer Royal in 1971. At the end of the 1960s Harding got construction going on the Sutherland site but at that stage negotiations to bring the 1.9-m telescope from the Radcliffe observatory were not yet agreed.

Sir Richard's retirement as Astronomer Royal was marked by a conference on the astronomical distance scale attended by a number of the world's leading astronomers. The occasion included a cricket match in which RGO Herstmonceux defeated the 'rest of the world'. Not all astronomical nations play cricket and occasionally the bat was flung down after the ball had been well struck.

From 1972 to 1976 Sir Richard was based at Cape Town as the first Director of the new South African Astronomical Observatory. The CSIR's new observing station at Sutherland was opened in 1972 by the Prime Minister Mr Vorster and the British side was represented by Mrs Thatcher, then Minister for Education and Science. For some years a third of the observing time was reserved for visiting astronomers from Britain.

The Radcliffe Trustees sold the 1.9-m telescope and its dome to the South African CSIR and later sold the very valuable site in Pretoria which had originally been given by the city for the observatory. The telescope re-erected at Sutherland during Woolley's directorship is still the largest instrument although funds for a larger, more modern telescope are now being sought.

Woolley's astronomical interests in later life were centred on the motions of stars in the Galaxy and in the globular clusters. However, he much encouraged other areas such as Pagel's determinations of the abundances of the chemical elements and work on quasars by Cannon, Penston and this author. While his heavy administrative duties meant that he relied on others to read the astronomical literature, he always had a research project of his own which he was actively pursuing. Two he worked on in his later years are active areas today; the exploitation of the infrared to improve the Baade-Wesselink method for variable stars, and the determination of the mean motion and the velocity ellipsoid of the halo RR Lyrae stars.

Woolley was elected a Fellow of the Society in 1929, served as President 1963-65 and was awarded the Gold Medal in 1971 for his work on globular clusters and RR Lyrae stars as well as that directed to developing observatories. He was elected to the Royal Society in 1953. He held office as Vice-President of the IAU 1952-58 and was Master of the Worshipful Company of Clockmakers in 1969. He especially valued the Honorary Fellowship to which his Cambridge College elected him in 1956. He was created Knight Bachelor in 1963.

Sir Richard was a fine figure of a man who combined a natural leadership with personal charm. His wide interests extended from country dancing, bell-ringing and playing Bach to studies of Napoleon and Wellington. After retirement he took up painting. When his wife Gwyneth died suddenly in 1979 he was devastated but Mrs Marples brought him back to good health and became his second wife. Many enjoyed their hospitality in South Africa but Sir Richard was again widowed. In the last years of his life he was

delighted to find intellectual companionship in his third wife Sheila who survives him.

D.LYNDEN-BELL

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