

S. C. B. 'Ben' Gascoigne 1915–2010

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ABSTRACT

Professor Sidney Charles Bartholomew Gascoigne AO, FAA (1915–2010) was an Aotearoa New Zealand-born astronomer whose distinguished career was carried out mostly in Australia. Known to all as Ben Gascoigne, his warm personality and many contributions to Australian optical astronomy made him a respected and much-loved elder statesman of the science. His work on the development and commissioning of the Anglo-Australian Telescope (opened in 1974) is held in particularly high regard. In retirement, Ben took on a new career, supporting his wife Rosalie as she found fame as one of Australia's most prominent artists.

Keywords: Anglo-Australian Telescope, Australian astronomy history, Great Melbourne Telescope, LMC, Magellanic Clouds, Mount Stromlo Observatory, photoelectric astronomical photometry, Rosalie Gascoigne, S C B 'Ben' Gascoigne, SMC.

Towards the end of his life, Ben Gascoigne wrote a very long autobiographical memoir in the style of the *Historical Records of the Australian Academy of Science*.¹ This unpublished 'Personal Record' documented his long and illustrious career as a professor of astronomy in the Australian National University (ANU), together with the extraordinary wartime work that led him there. It is complemented by another noteworthy account: Professor Bob Crompton's extensive interview with Ben, recorded for the Australian Academy of Science's 'Hundred Years of Australian Science' project.²

For a biographer, these are invaluable resources, providing a framework within which to explore the richness of Ben Gascoigne's scientific and personal life, and giving deep insights into his thinking on the big-picture topics that dominated his career. They are supported by Ben's wide-ranging canon of publications, which are listed in the Supplementary material. They must, however, present a Ben-centric view of the times in which he lived and his contribution within those times. Thus it has been the mission of the present author to provide as objective a view as possible, balancing the inevitable subjectivity of the autobiographical accounts with other referenced sources including, in particular, the definitive history of Mount Stromlo Observatory—the institution where Ben spent most of his working life.³ It has also been most helpful to be able to draw on the recollections of friends and colleagues, as well as the author's own personal conversations with Ben, while Ben and Rosalie's children, Martin, Thomas (Toss) and Hester, were more than generous with their contributions. Full acknowledgements can be found at the end of the memoir.

Early life

'Sometimes it helps to know that Gassy, and Sid and Ben were all the same person.'
(M. B. Gascoigne, *Dad—Dancing with the Stars*, 2010)

Sid Gascoigne, as he was known as a child, was born on 11 November 1915, in the art-deco town of Napier, New Zealand, the eldest in a family of four children.⁴ His parents,

¹S.C.B. Gascoigne unpubl. memoir.

²Australian Academy of Science (2000).

³Frame and Faulkner (2003).

⁴Unreferenced material on Ben's early life is drawn principally from S.C.B. Gascoigne unpubl. memoir and Australian Academy of Science (2000).

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Sidney Charles and Rena Agnes Gascoigne (née Bartholomew) were both born in New Zealand into well-respected families who had emigrated from Britain between 1840 and 1878. Sid's father was a schoolteacher at Napier Boys' High School when he married Rena, later improving the family fortunes by entering the wholesale automotive parts business, and moving the family to Auckland in 1921.

It was here that Sid's academic abilities flourished, spurred on by a passion for books and learning that had been kindled by access to his maternal grandfather's enviable library. Even at Remuera Primary School, he 'did not care to be anywhere but at the head of the class', and his academic abilities were apparently mirrored by his skills in rugby. His rampant enthusiasm for that sporting code remained with him for the rest of his life.

Sid's academic prowess followed him to Auckland Boys' Grammar School, reputedly the best-performing school in the country, which he joined in 1929. He worked hard, earning prizes in history and mathematics as well as a university entrance scholarship a year earlier than normal.

Thus it was that in 1933, he entered Auckland University College, which was then part of the University of New Zealand—having first made one of the many life-changing decisions that punctuated his early career. Revealing much about the young Gascoigne's pragmatism, it was the decision to pursue science rather than history in his studies, despite both being equally close to his heart and his abilities. The logic behind it was predicated on a severe stammer, which Sid thought would hinder him more in a career in the arts than in science. The decision shaped his life, although history was never far from his interests, and he wrote skillfully on historical topics in his retirement.

From Sid to Gassy...

Even before his entry into Auckland University College, Sid was known to his peers (and teachers) by the rather unflattering name of 'Gassy' and remained thus throughout

his undergraduate years and beyond. He was always Sid at home, however. He involved himself in university activities and evidently kept good company. A photograph from this period shows four energetic-looking students on a university hiking trip (Fig. 1). At one end of the group is Gassy, while at the other is a lanky young man by the name of Edmund Hillary—who, with Tenzing Norgay, achieved the first successful ascent of Mount Everest on 29 May 1953.

Gassy excelled in pure mathematics and physics, and in 1935, his final year, won the university's senior scholarships in those subjects as well as the Shirtcliffe Graduate Bursary—the University of New Zealand's award for the best bachelor's degree in the year. In order to elevate the degree to honours status, however, the regulations in those days demanded further examinations be passed in individual subjects at master's level. This Gassy did—twice—gaining First Class Honours in mathematics in 1936, and in physics in 1937. Although he was deeply immersed in mathematics, it was physics that won him the Michael Hiatt Baker Fellowship to the University of Bristol in 1938—a mixed blessing for Gassy, since he had always been keen on undertaking his PhD at the University of Cambridge.

Bristol it was to be, however, and on 25 August 1938, Gassy embarked on the long voyage from Auckland to the great West of England port aboard the RMS *Rangitata*. The clouds of war were already gathering in the United Kingdom, but he focused single-mindedly on the future direction of his career. It was with some disappointment that on his arrival he found Bristol had little to offer in mathematics research, with theoretical physics being the closest option. Studies in the promising new field of semiconductor physics were offered to him, but he set his sights instead on problems in optics that he thought might lead towards a new aspiration that had been forming in his mind—to become an astronomer. It was another of those life-changing decisions that again turned out to be providential.

During this period, Gassy worked with some of the great names in British optics—Linfoot, Burch and Bates—although he found not all of them as inspiring as he'd hoped,



Fig. 1. An Auckland University College hiking trip in the mid-1930s. From left: Edmund Hillary, Neil Robinson, E. D. 'Eddy' Burton, and 'Gassy' (Gascoigne Family).

particularly in some of the early tasks he was allocated. But he soon found a niche with a theoretical study of a problem that had eluded some of the most brilliant minds in physics, including Lord Rayleigh and the eminent Dutch optician, Frits Zernike. This was to fully understand the behaviour of light waves in a commonly used test of the accuracy of an optical surface during its polishing, the whimsically named ‘knife-edge test’. Indeed, it does use a knife-edge—to cut rays of light near their focus, revealing any deficiencies in the surface of the lens or mirror under test.

Gassy derived an elegant mathematical solution to the problem that formed the basis both of his PhD thesis and his first significant publication in a mainstream scientific journal.⁵ And it was a sign of things to come that his mathematical insight could be applied to an entirely practical purpose—the fabrication of precision mirrors and lenses for optical instruments.

...and back to Auckland

The end of Gassy’s scholarship in mid-1940 came on the eve of the greatest threat to the security of Britain since the Second World War had started in September 1939—the airborne Battle of Britain. The two years he had spent in the Bristol Optics Laboratory had taught him a good deal about both the theory and practice of optical instruments, and he felt ready to embark on a career where he could put his training to good use. If it would lead, as he’d hoped, to astronomy, then so much the better. But the exigencies of war made more immediate demands on his skills.

Gassy was not keen to leave Bristol, having established himself within the Optics Laboratory as well as making many friends during his sojourn. But he had good cause to return to New Zealand. Apart from his scholarship running out, he was anxious to meet up with a young Auckland woman by the name of Rosalie Norah King Walker, with whom he had unknowingly shared primary school days in Remuera but had got to know at university—and about whom he had ‘long since made up his mind’.

Gassy sailed from Southampton on 6 July 1940 on the last available boat. His low expectations of the voyage turned out to be unduly pessimistic when he met, and was befriended by, an abstract painter by the name of Carl Plate, together with other artists, musicians, actors and writers who were all returning to Australia from embattled Europe. To Gassy, this was a revelation—an insight into an entirely different world from his science-based one, with an intensive course in modern art thrown in. It was the beginning of a long and productive friendship with Plate and his family, and tempered Gassy’s sadness at reaching the end both of his student days and his life in Britain.

⁵Gascoigne (1944).

⁶Bolton (1990).

⁷Frame and Faulkner (2003, chapter 4).

Wartime scientist

‘In wartime, you learn *fast*.’

(S. C. B. Gascoigne, *Personal Record*, 2005)

With the skills he had accumulated, Gascoigne had unwittingly become a desirable asset in the burgeoning field of optical munitions—the supply of specialist equipment by optical manufacturers, which reached high levels during both World Wars. In the pre-radar era, all manner of optical instruments were needed to enhance both the certainty with which enemy assets could be identified and the precision with which weapons could be deployed against them. The list included telescopic sights, rangefinders, field periscopes and artillery directors as well as ordinary service binoculars—items that in 1940 were in short supply from the British firms that would normally have provided them to Commonwealth countries.

In both New Zealand and Australia, facilities were established to provide optical munitions under the guidance of expert panels or committees.⁶ In Auckland, a manufacturing workshop was set up, funded by the New Zealand Department of Scientific and Industrial Research, and Gascoigne soon found himself in charge of a small group that made telescopic sights for trench mortars. By the end of the war, they had manufactured 240 of them, although long before that, he had made another life-changing decision—and had moved on.

It was to Australia that Gascoigne had looked, having learned that optical munitions there were on a much bigger scale than in New Zealand. In fact, no fewer than twenty five establishments (including commercial firms and university physics departments) were making and assembling the optical components for what eventually became forty three different types of instrument. In particular, the Commonwealth Solar Observatory on Ngannawall Country at Mount Stromlo, Canberra, was engaged in optical munitions under the direction of a well-known astronomer, Richard van der Riet Woolley, and it was to Woolley that Gascoigne directed his application. He was immediately successful and, in 1941, joined the Commonwealth Solar Observatory as a research fellow.

Becoming Ben

For the next three years, Gascoigne lived and breathed optical munitions at Mount Stromlo.⁷ He began by setting up a measurement and quality control unit, but soon took charge of the manufacture of a particular type of anti-aircraft gunsight, whose complex design he had had to adapt to suit locally-available optical glasses rather than those in the original specification. Fifty of these were turned out, all passing rigorous test procedures.

Rather more rewarding were significant events in his private life, beginning with his graduation *in absentia* with a PhD from the University of Bristol in 1942. Then, on 9 January 1943, he and Rosalie were married at St John's Church, Reid, ACT, the couple making their home at Mount Stromlo. And it was Rosalie who finally dispelled the confusion surrounding Sid/Gassy's first name, deciding on her wedding day that he should be known as Ben.

Rosalie faced real difficulties in adapting to the small and isolated mountain-top community, which had little to offer her. Her move to Mount Stromlo was followed within a year by the birth of the couple's first child, Martin. But Rosalie slowly warmed to her environment, eventually reaching an intensity of attachment that would become apparent to everyone three decades later.

In his *Personal Record*, Ben commented on the efficiency with which the Commonwealth Solar Observatory had turned its hand to the manufacture of optical munitions, and the spirit of cooperation that existed there. It included European refugees who were 'absorbed into that very Australian community [in] a real foretaste of multiculturalism'.

He also remarked on the deep understanding of optical technology that he gained during that period, in everything from the initial layout and optical design of instruments through to their optical and mechanical manufacture, assembly and final testing. His experience tallies with a post-war survey whose results showed that most of the young scientists involved in optical munitions 'found their work ... as interesting and as formative as any other post-graduate training'.⁸ Within a decade of the war's end, however, most of those fine instruments were either obsolete or redundant and became widely available to the public in government-surplus stores.⁹

Becoming an astronomer

Ben's first foray into astronomy took place while the Second World War ground into its final year. With the closure of Melbourne Observatory in 1944, Australia had lost its official time service, which had to be maintained by a combination of astronomical observations and delicate pendulum clocks. It fell upon Ben's shoulders to set up a new time service at Mount Stromlo. The task involved modifying an old telescope to perform the necessary observations, then ensuring that those observations were effectively carried out, and setting up a process to turn the accurate clock times into radio time signals (Fig. 2). Except for that final step, this was fundamental astronomy of a kind that had been carried out for more than two centuries, but it was still astronomy. Ben achieved a high level of success, winning praise from the redoubtable Woolley.

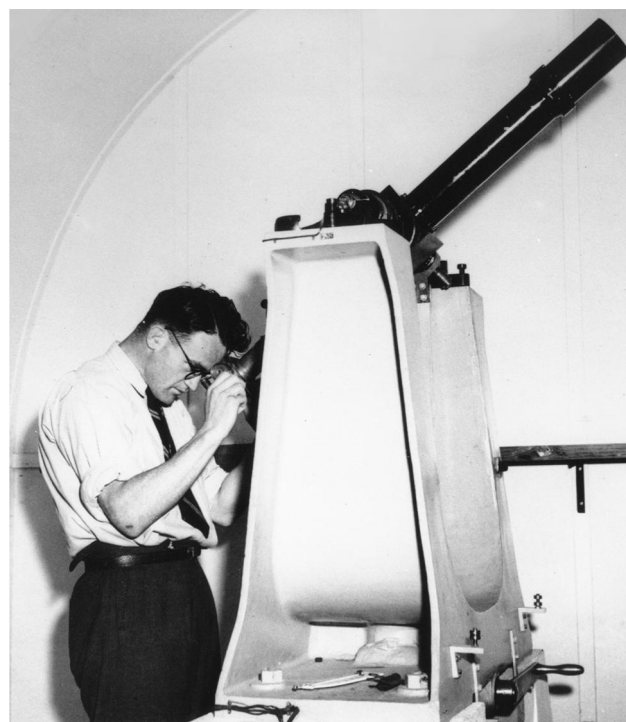


Fig. 2. Ben with the Australian Time Service transit telescope at Mount Stromlo in about 1946 (Gascoigne Family).

Woolley was a good ally to have. He is best known as the eleventh Astronomer Royal in the UK, a post he held from 1956 to 1971 with great distinction, and for which he received a knighthood in 1963. At Mount Stromlo, he was a strong advocate for progress and, once the war was over, began to take it in a new direction. The Commonwealth Solar Observatory had been founded in 1924 for studies of the Sun and related phenomena of geophysics. Woolley had arrived in 1939, and immediately had to devote the observatory to the production of optical munitions. But the remit he had been given on his appointment was to transform it into a front-line astrophysical institution, concentrating on stellar rather than solar astronomy. In the event, the change of direction was facilitated by the observatory's wartime role, which had required a much-enlarged technical staff and more up-to-date facilities compared with pre-war days. In 1946, when it became the Commonwealth Observatory, it lacked only one thing: astronomers who knew about the stars.

Head in the clouds

'I recall Dad disappearing up the hill and into the night, set for another night's observing.'

(M. B. Gascoigne, *Dad—Dancing with the Stars*, 2010)

⁸Bolton (1990).

⁹Watson (1996).

Ben was perfectly placed to build an influential career in stellar astronomy, and that is exactly what he did. Guided initially by Woolley, he quickly recognised the two nearby dwarf galaxies known as the LMC and SMC as keystones to the science he wanted to do.¹⁰ These galaxies are too far south to be easily studied from major northern observatories, but have the potential to reveal much about the workings of the universe at large. They are satellites of our own Milky Way galaxy, containing millions or billions of stars, rather than the hundreds of billions in the Milky Way itself. To an astronomer, the supreme value of observing stars in either the LMC or the SMC is that they are all seen at more-or-less the same distance from the solar system. It means that differences in brightness between individual stars are intrinsic to the stars themselves, rather than due to differences in their distances.

This is particularly important for the study that Ben eventually settled on, which was to use a particular class of variable stars to measure the distances of the LMC and SMC from the solar system. Variable stars are ones whose brightness changes, often in a periodic way. The class of stars Ben focused on are called Cepheid variables, after the first of the type was discovered—a star named Delta Cephei. They vary in brightness because of regular changes in both their diameter and temperature, with variation periods from a few days to a month or so. The key property, discovered by American astronomer Henrietta Swan Leavitt in 1908, is that their intrinsic brightness (either at maximum or minimum light) is directly related to the period of variability. In fact, Leavitt made this discovery by observing such stars in the two Clouds (the LMC and SMC). And once their intrinsic brightness is calibrated, they can be used as standard candles for accurate distance determination.

Crucial colours

Ben's study, however, took a subtly different direction from Leavitt's simple photographic brightness measurements. In 1951, Gerry Kron, a colleague from the Lick Observatory in California, arrived at Mount Stromlo for a lengthy visit. He brought a newly developed photoelectric photometer, which could measure star brightness much more accurately and with greater sensitivity than the photographic methods used previously. Moreover, by using various filters, the photometer enabled quantitative measurements of the colours of stars to be made.

With Woolley's blessing, Gascoigne and Kron became the exclusive users of the Commonwealth Observatory's largest telescope for a period of nine months—the 30-inch (76-cm) aperture Reynolds Reflector at Mount Stromlo. The end-

product of this work and subsequent observations was nothing less than a major revision of the distance scale of the universe. That possibility had been suggested a few years earlier in research by a well-known German-born astronomer at Mount Wilson Observatory, California, Walter Baade.¹¹ His discovery of two distinct populations of stars in nearby galaxies implied the need for a revision of the intrinsic brightness of stars used as standard candles in those galaxies, and potentially a doubling of the distance scale established earlier by Edwin Hubble.

Inspired by Baade's work, Ben saw in the Clouds 'a wonderful opportunity, created for me personally, for trying out some of his ideas'.¹² The innovation that he and Gerry Kron made was to measure not just the brightness, but also the colours of the Cepheid variables in the LMC. To their surprise, they found that they are systematically bluer than those found in our own Milky Way galaxy.¹³

Ben's interpretation of this hinged on the fact that the Milky Way Cepheids lie within the disc of the galaxy, which is known to be permeated by a smoke-like haze of interstellar dust. The effect of dust on starlight is well-understood: blue light is scattered away, rendering the star yellowish in a process known as 'reddening'. The more dust the starlight passes through, the redder it becomes, and importantly, the fainter it appears.

But the line of sight to the LMC is much less dust-affected, with a low level of reddening that is uniform over the field of the LMC. By assuming that the Cepheid variables have the same intrinsic colour no matter where they are located, Ben was able to estimate the effect of the galactic dust on their brightness and recognise that these standard candles were actually four times as bright as had previously been assumed. That meant the Clouds were twice as far away as had been thought—some 160,000 light years for the LMC, and 200,000 light years for the SMC. And because the distance to the Clouds is one of the steps in determining the distance to galaxies beyond, it meant that in turn, the distance scale of the universe was twice as large.¹⁴ This confirmation of Baade's hypothesis was a breakthrough of global significance in astronomy, and for Ben, an epiphany—the happy realisation that he had truly become a professional astronomer.

Cloud clusters

With his place in the annals of astronomy all but secured, Ben went on to study another aspect of the Clouds that needed investigation—this time not single stars, but clusters of stars. Like the Milky Way galaxy, the LMC and SMC contain many clusters, which are classified either as open

¹⁰In deference to a growing view among astronomers that the Large and Small Magellanic Clouds are inappropriately named, they will be referred to in the text as the LMC and SMC, or collectively as the Clouds.

¹¹Baade (1944).

¹²S.C.B. Gascoigne unpubl. memoir.

¹³Gascoigne and Kron (1952, 1965). Gascoigne (1969).

¹⁴Gascoigne and Eggen (1957). Gascoigne (1958).

or globular. The former are sparsely populated clumps of a few hundred stars at most, while the latter are dense, spheroidal aggregations that might contain hundreds of thousands of stars. In our Milky Way galaxy, the open clusters are sites of recent star formation and therefore young (sometimes only a few tens of millions of years), whereas the globular clusters are typically as old as the galaxy itself—12 billion years or so. What Ben wanted to establish is whether the Cloud globular clusters were similarly aged.

Determining the age of a cluster is a major piece of work, requiring colour and brightness measurements of many stars in the cluster—thousands if you can manage it. And it would need a bigger telescope than the 30-inch Reynolds, and a more sensitive photometer than Kron's. By 1957, Ben had both at his disposal—a new 74-inch (1.9-m) telescope at Mount Stromlo, and a two-channel photometer recently developed by Harold Johnson in the USA, and by then commercially available. Ben's technique for measuring faint stars in the clusters involved using the photometer to calibrate photographic plates that had been taken through blue and yellow filters to permit the stars' colours to be determined.

Having done that for as many stars as is practicable in a given cluster, an astronomer can plot what is known as a colour-magnitude diagram (in which magnitude denotes the astronomer's scale of brightness). This reveals details symptomatic of the age of the cluster, based on our understanding of the way individual stars' colours change as they evolve. It is a reliable technique, and Ben aimed to carry this out for ten clusters; seven in the LMC and three in the SMC.¹⁵ What he found surprised him—the ages of clusters in the LMC typically mimic those in our Milky Way galaxy at some 12 billion years, while those in the SMC are generally younger, from 4 to 8 billion years.

Modern measurements have vastly increased the number of clusters with age estimates and demonstrate that the age distribution is more nuanced. While the LMC does, in fact, have recent cluster formation, it also has an 'age gap' with no cluster formation between 4 and 9 billion years ago. On the other hand, the SMC has been continuously forming clusters for the past 10.5 billion years. Possible mechanisms for these differing cluster-forming histories include gravitational interactions between the two Clouds, and with the Milky Way Galaxy itself.¹⁶

New facilities

'No computer drives and warm control rooms then.'
(M. B. Gascoigne, *Dad—Dancing with the Stars*, 2010)

For Ben, the mid-1950s marked more than just his coming of age as an astronomer. He and Rosalie had a lively young family, with Martin having been joined by Thomas (Toss) in 1945 and Hester in 1949. Ben had a new boss, with Dutch-born American astronomer Bart Bok taking over from Richard Woolley as Director of Mount Stromlo Observatory in March 1957.

The transfer had not been straightforward, as Woolley had left to become Astronomer Royal in December 1955. With no obvious successor, the role of Acting Commonwealth Astronomer had fallen to Arthur Hogg, a talented and genial scientist who had worked at Mount Stromlo since 1929.¹⁷ Ben recalled that the fifteen-month interregnum was difficult because Hogg was strongly opposed to the transfer of the observatory from the Federal Government to the ANU, a move that had been set in train by Woolley.¹⁸ In the event, the transfer went ahead in January 1957, and was welcomed by Ben and others for the consequent reduction in bureaucracy.

Bok's appointment was beneficial to Ben. The new director was a noted expert on the structure and evolution of the Milky Way galaxy and he was very supportive of Ben's research. That continued to flourish with his work on the Cloud clusters and other astrophysical projects throughout the next decade, eventually leading to his election to Fellowship of the Australian Academy of Science in 1966. One further asset that Ben valued enormously was a succession of graduate students whose research he guided with characteristic generosity, and in whom he often found lasting friends. 'I enjoyed my students, I learnt a great deal from them, and I discovered there was nothing like a bunch of clever competitive graduate students for bringing out the best in their elders and betters'.¹⁹

This was also a time of investment in new telescopes at Mount Stromlo. Woolley had started the ball rolling in 1948 with an order to Sir Howard Grubb, Parsons & Co. Ltd in Newcastle-on-Tyne for the 74-inch (1.9-m) telescope that was later used by Ben for his work on the Cloud clusters. This telescope was the third in a remarkable series of six similar instruments built by the Newcastle firm between 1935 and 1963.²⁰ In the event, the Stromlo telescope was not erected on the site until 1955, and needed further work on the mirror before it was deemed to be commissioned. But it then became the Observatory's principal workhorse as a state-of-the-art facility with up-to-date instrumentation.

The other major acquisition could hardly be described as 'new', since it was a telescope that had seen first light in 1869. This was the Great Melbourne Telescope, the first

¹⁵Gascoigne (1962, 1963a, 1966) Gascoigne (1966).

¹⁶See, for example, Glatt and others (2010).

¹⁷Frame and Faulkner (2003, chapter 2).

¹⁸Gascoigne (1968a).

¹⁹S.C.B. Gascoigne unpubl. memoir.

²⁰Grubb Parsons (1956, 1973).

project of Howard Grubb's career built to a design by his father, the Dublin engineer and telescope-builder, Thomas Grubb.²¹ Located at the then-new Melbourne Observatory, the 48-inch (1.2-m) telescope was mechanically sound but never lived up to expectations. It was hampered by outmoded technology—a mirror made of speculum metal rather than silvered glass, and no provision for the rapidly evolving technique of photography. Its site in central Melbourne was also less than ideal.²²

In 1944, after a long, slow decline, the Melbourne Observatory closed, and the 48-inch telescope was bought by Mount Stromlo Observatory for scrap. But in 1952, when a young German technician by the name of Hermann Wehner arrived at Stromlo, he began a process of refurbishment that restored it to working order and cemented Wehner's key engineering role in the Observatory for the next twenty eight years.²³ The restoration culminated in 1959 with the installation of a new 50-inch (1.3-m) Pyrex glass mirror from Grubb Parsons. In this guise, the renamed '50-inch' did much useful work in the field of photoelectric photometry in the hands of Ben and other Mount Stromlo astronomers.

In search of darkness

For all it was now well-equipped with optical astronomy facilities, Mount Stromlo was being increasingly affected by light pollution from encroaching Canberra suburbs. It was recognised by the university that this was an unsustainable situation for the most exacting astronomical research, where the faint objects being observed are sometimes only a few percent brighter than the natural sky background illumination. Plans were made to seek an outstation on a dark site where new telescopes could be located.

Bok had established a small outstation in 1960 on Mount Bingar, a 200-m-high hill near Griffith in the Riverina 290 km north-west of Canberra, where he had located a 26-inch (0.66-m) telescope for his own research.²⁴ But a national campaign of site testing, led by the capable Arthur Hogg, aimed to find the site with the best observing conditions in Australia.²⁵ This not only included clear skies and freedom from light pollution, but crucially, minimal atmospheric turbulence to enable astronomers' telescopes to produce the sharpest images.

Once the site-testing was completed, Ben was deeply involved in the final selection process. It came down to two sites—Mount Bingar and an 1165-m high ridge in the Warrumbungle range in north-western New South Wales known in the language of the Traditional Gamilaraay

Owners as Woorut, but more commonly as Siding Spring. Bok favoured Bingar, and Hogg Siding Spring, but while observing conditions were similar at both, Ben was able to show that Siding Spring had the better image quality. Moreover, the nearby country town of Coonabarabran some 30 km away offered comfortable accommodation for astronomers and technical staff together with their families. So Siding Spring won the day, with Bok eventually coming around to be one of the site's most ardent supporters.

The first telescope to be installed at the new outstation was a 40-inch (1.0-m) built by the US company of Boller and Chivens. Ben wrote the optical specifications for the telescope while on a six-month secondment to the Royal Greenwich Observatory in the UK in 1963,²⁶ and his engineer colleague Hermann Wehner looked after the technical aspects. The telescope was commissioned in 1964 and became an outstandingly successful instrument. It was followed by two smaller ANU telescopes and, perhaps more importantly, by infrastructure such as observer accommodation, power, water and a paved road to Coonabarabran, promoting the site from a mere outstation to a fully-fledged observatory.

Anglo-Australian astronomer

'It was an exhilarating job, I felt almost as if I had been preparing for it all my life.'
(S. C. B. Gascoigne, *Personal Record*, 2005)

Even before he left Australia to become Astronomer Royal, Richard Woolley had floated the idea of a joint British-Australian optical telescope in the same class as the Palomar 200-inch (5.1-m), the world's largest since its commissioning in 1949. By 1960, the idea was being taken more seriously. A *Nature* paper by Ben shaped the proposal, presenting strong astronomical arguments, and eventually forming the nucleus of the formal scientific case for the new telescope.²⁷ A meeting the following year between prominent British and Australian astronomers (including Ben) visited possible sites in Australia and refined the proposal to a 150-inch (3.8-m) telescope. This was essentially a compromise between a 200-inch (whose high cost would probably have struggled to gain government support) and the 120-inch (3-m) that Woolley and Bok had come to favour, despite its more limited capabilities. There was also confidence that a 150-inch entering service in the 1970s would perform at least as well as the ageing 200-inch Palomar telescope by virtue of technological advances.

²¹Watson (2004, chapter 13). Gillespie (2011).

²²Gascoigne (1996).

²³Winternitz (2014).

²⁴Frame and Faulkner (2003, chapter 7). R. Shobbrook pers. comm.

²⁵Gascoigne (1968a). Gascoigne in *Australian Academy of Science* (2000).

²⁶Gascoigne (1965, 1968b).

²⁷Gascoigne (1963b).



Fig. 3. Inspecting the Cer-Vit mirror blank for the Anglo-Australian Telescope (AAT) at the Owens-Illinois factory in May 1969. From left: David Brown (Grubb Parsons), Roderick Redman (Cambridge), Ben Gascoigne and John Pope (Royal Greenwich Observatory) (Owens-Illinois).

Ben was a co-author on the final submission that went up to the two governments (through the Australian Academy of Science and the Royal Society) on 30 July 1965. After a long silence, during which the astronomical community's hope 'slowly ebbed away', there came out of the blue in June 1967 word that the proposal for the Anglo-Australian Telescope (AAT) had been accepted with several conditions, including that its location was to be at Siding Spring Observatory. Its expected cost was \$11 million. The final construction cost in 1974 turned out to be \$15.9 million, which Ben noted was less than the original estimate conflated with the inflation rate of either country.²⁸

Technical Committee

The difficulties in finalising a binational agreement to build and operate the new telescope were just the start of a series of tensions that permeated its early history. As Paul Wild and Sir Robert Wilson wrote in the foreword to the telescope's official history, 'The AAT had to face many problems and difficulties, not only those which always beset any major new project, but additional ones posed by a binational venture involving two governments located on opposite sides of the world. The early days saw considerable controversy and difference of opinion, sometimes between the two partners, sometimes between institutions, and sometimes between the philosophies of individuals. It is to the credit of all involved that these problems were fully resolved to leave us today with a major front rank observatory managed with great harmony and good will on behalf of the two astronomy communities'.²⁹

²⁸Gascoigne and others (1990, chapters 2, 4).

²⁹Gascoigne and others (1990). See also Hoyle (1982).

A sizeable proportion of that credit is due to Ben and his emollient personality, but more specifically to his astronomical input to a four-person technical committee that was set up in the immediate aftermath of the project's government approval. His counterpart on the UK side was a distinguished Cambridge University astronomer, Roderick Redman, while the engineering input was provided by John Pope of the Royal Greenwich Observatory and the redoubtable Hermann Wehner—by then a close friend of the Gascoignes as well as a valued colleague.

The technical committee steered the fortunes of the project until the formation of a formal Project Office early in 1968. Ben and Redman remained as astronomical advisors, while Wehner eventually became Project Manager. Early decisions concerned the AAT's optical design—mapped out largely by Ben—and its sixteen-tonne primary mirror, which was cast from the ultra-low-expansion glass-ceramic, Cer-Vit, by Owens-Illinois Inc, in April 1969, and delivered later that year to Newcastle-upon-Tyne in England (Fig. 3). There, the firm of Grubb Parsons began the long process of polishing the blank to turn it into a finished 154-inch (3.9-m) mirror. In March 1973, it was declared ready for final testing, and its superb optical quality was revealed. Having satisfied all requirements, the mirror was transported to Australia, arriving at Siding Spring Observatory on 5 December 1973.

Gascoigne's Leap

By then, the dome and building had been finished for almost twelve months, allowing work to proceed on installing the

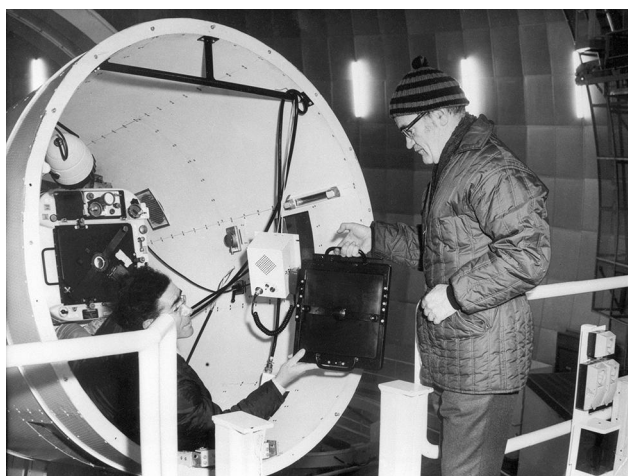


Fig. 4. Ben Gascoigne hands a loaded photographic plateholder to Roderick Willstrop in the AAT prime-focus cage during the telescope's commissioning in 1974 (AAO).

telescope's mounting and control systems, which were built by the Mitsubishi Electric Corporation. At the beginning of 1974, Ben was appointed Commissioning Astronomer, assisted by Roderick Willstrop of Cambridge University, and first light for the telescope took place on 27 April 1974, when Ben obtained Test Photograph No.1 (Fig. 4)

It was soon after this that an incident took place that quickly became legendary in the annals of the AAT. It is commemorated today by a plaque, fixed to the inner walkway of the dome at a point where it soars some six metres above the observing floor below. It is engraved 'Gascoigne's Leap'—and is every bit as ominous as it sounds. While Willstrop was carrying out photographic exposures with the telescope one night, Ben had gone outside the dome onto the high outer walkway to make a routine check for cloud. Returning in pitch darkness, he chose the wrong doorway of four identical ones that give entry to the dome's inner walkway, from which he stepped not onto solid ground outside the control-room, but into thin air, falling the full six metres to the observing floor. He was very lucky. He fell between the protruding hydraulic rams of the mirror handling trolley, missing them by inches, and suffered only a broken elbow.³⁰

Other concerns during those early days reflected some of the institutional tensions noted in the telescope's official history.³¹ They also related to underlying stresses in Ben's career before and after his time as Commissioning Astronomer. Both centred around the then-current Director of Mount Stromlo and Siding Spring Observatories (MSSSO), an eminent American astronomer named Olin Eggen, who had succeeded Bart Bok in 1966. Ever since the AAT project had received government approval, he had been strongly of the view that the new telescope should be operated by the

ANU under his direction. That placed him at odds with the telescope's binational board, that had been created in February 1971. It also placed him at odds with Ben, who had spoken out against this idea in the late 1960s, believing that MSSSO was simply not equipped to operate a telescope of this complexity. The eventual outcome was that the telescope was operated under the aegis of an independent board and the director it appointed—an eminently successful arrangement, although not at all to Eggen's liking.

As the AAT's commissioning proceeded throughout 1974 it became clear that because it was operated completely under computer control (being the first large telescope to do so), it was going to be a very fine instrument indeed. Its formal inauguration by HM King Charles III, then Prince of Wales, took place on 16 October of that year, and in June 1975 the AAT finally entered service as a scheduled, common-user instrument (Fig. 5). It soon took its place among the world's great astronomy facilities, excelling in the ground-breaking research it accomplished with a succession of novel auxiliary instruments and a symbiotic relationship with the 1.2-m United Kingdom Schmidt Telescope, opened at Siding Spring in 1973 to provide deep photographic surveys of the southern sky. The AAT's reputation was further enhanced by the global impact of remarkable true-colour images of celestial objects created by the observatory's innovative photographic specialist, David Malin, using a camera for the telescope whose basic design was due—of course—to Ben Gascoigne.

Crossroads

'But now... I was faced with one of the most difficult decisions of my life.'

(S. C. B. Gascoigne, *Personal Record*, 2005)

With his commissioning work complete in 1975, Ben's formal association with the AAT came to an end. It needn't have been so because he was offered a permanent senior position on the staff of what had now become the Anglo-Australian Observatory (AAO), but that would have necessitated a move to the telescope's headquarters in Sydney, which was unacceptable to Ben. What tied him to Canberra was Rosalie's burgeoning prominence as an artist of singular talent. And so, on the day before Rosalie's first Sydney solo exhibition in 1976, he formally declined the offer.³²

Rosalie's emergence as an artist is an extraordinary story in its own right. Thrust by her marriage to Ben into a vastly different environment from the verdant North Island of New Zealand where she had grown up, she had to work hard to come to terms with the dry landscape, the stifling summer

³⁰Gillingham (2011).

³¹Gascoigne and others (1990, foreword).

³²M.B. Gascoigne pers. comm.

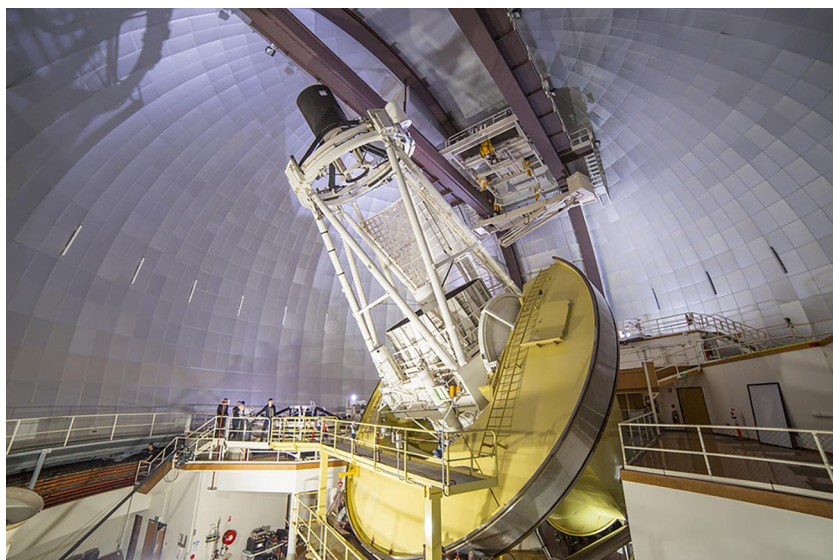


Fig. 5. The AAT as it is today, with its prime-focus cage at the top and Gascoigne's Leap just out of shot on the walkway at left (Ángel López-Sánchez).

heat and her isolation in the tiny Mount Stromlo community.³³ Raising a young family in such alien conditions was not something Rosalie's degree in English Literature nor her teaching diploma had trained her for, but she found solace in skills honed during her New Zealand childhood—collecting and arranging weathered outdoor objects ranging from stones and grass to pieces of rusted iron. Her childhood talent for flower arranging also blossomed, and it was her interest in the Japanese floral art of *sogetsu ikebana* that led to her only formal training in art between 1962 and 1969.³⁴

By about 1970, according to Ben's *Personal Record*, 'she had found her true vocation, and was firmly set on the path she followed for the rest of her life'. Working primarily with discarded objects that appealed to her, she constructed sculptures and installations that captured the spirit of the Monaro region bordering her home in Canberra. Rosalie's first solo exhibition took place at Macquarie Galleries, Canberra, in 1974 when she was fifty seven years old, and was followed by some thirty more in Australian galleries, along with several overseas exhibitions. In 1982, she became the first female artist to represent Australia at the Venice Biennale, and in 1994, she was appointed a Member of the Order of Australia in recognition of her service to the arts, particularly as a sculptor. The latter honour apparently elicited a characteristically modest 'Who, me?' on receipt of the news.³⁵

Today, there are major Rosalie Gascoigne collections in most Australian capital cities, as well as in Wellington, New Zealand, and the Metropolitan Museum of Art, New York. And one very large and unusual piece graces a cathedral-like dome on a remote mountain-top in New South Wales. Not

surprisingly, perhaps, the Anglo-Australian Telescope's striking avocado and chocolate colour scheme was Rosalie's choice.

Return to Mount Stromlo

It is a great credit to Ben that he recognised the need for stability in Rosalie's emergence as an artistic *tour de force*. A move to Sydney would have been catastrophic, divorcing her from the environment she had come to love as the source of her inspiration. But the temptation for Ben to accept the AAO position was very great, and he did not look forward to returning to Mount Stromlo.

In his *Personal Record*, Ben cites his difficult relationship with Olin Eggen as the main reason for this. 'When, in 1966, [Eggen] succeeded Bok, I had known him for fifteen years, we had published joint papers, important ones, we could talk for hours, and I looked on him as a friend. But I was soon disabused of that. From the day he arrived he made it clear I had no further part in running the observatory. I was given no information, saw no documents, attended no meetings, and was asked for no advice, not even in optical matters.... My own impression was that Eggen, for some reason best known to himself, was determined to get rid of me. Certainly, he was the most unpleasant individual I was ever obliged to have dealings with. What saved the day was my secondment to the AAT, which, while it lasted, was not only a wonderful job, but also an escape and a lifeline'³⁶ (Fig. 6).

Informal comments by Ben's former colleagues during the preparation of this memoir suggest that he kept the notion of persecution very much to himself, where it may have

³³R N K Gascoigne, interview 2 July 1996, quoted in Frame and Faulkner (2003, chapter 4).

³⁴Francis (2013).

³⁵Uhlmann (1994).

³⁶S.C.B. Gascoigne unpubl. memoir.



Fig. 6. Ben's secondment to the AAT necessitated several overseas trips, notably to the UK, where this whimsical portrait with a convenient Ferrari was taken in the early 1970s (Peter Gillingham).

assumed exaggerated proportions. They note that Eggen had perfectly normal relationships with other astronomers, including themselves. One former colleague speculates that hostility towards Ben was actually driven by Alex Rodgers, an influential scientist who had come to Mount Stromlo as a research student in 1954 (and eventually became Director in 1986).

In the event, Eggen's perceived antipathy did not have much longer to run, since he resigned his Directorship on 30 September 1977 to take up a position at the Cerro Tololo Interamerican Observatory in Chile. He was replaced by Don Mathewson in an acting role that became substantive in April 1979, the first director to have been recruited from the Mount Stromlo staff. Mathewson was more warmly disposed towards Ben and also to Wehner, who, like Ben, had returned to Mount Stromlo after his secondment to the AAT. He involved them both in the design of the 2.3-m Advanced Technology Telescope at Siding Spring, which was eventually inaugurated in May 1984.

What is certain about Ben's homecoming to Mount Stromlo was the difficulty he faced in returning to front-line research. 'In the years I had been away a great deal had passed me by, not only in the literature and the new instrumentation and the intimidating new computer programmes, but the whole landscape of the subject seemed different ... But I did have access to the AAT, and if anybody knew how to get the best out of it, it should have been me'.³⁷

Ben returned to his pursuit of the star clusters in the LMC and SMC. Perhaps reluctantly, as he confessed to Bob Crompton: 'Actually I found I had got a bit sick of clusters, but by then I couldn't do anything else. It was too late to

start'.³⁸ And a novel photon-counting detector on the AAT, developed mainly for spectroscopic observations, also offered higher photometric precision for faint targets. Just a few years later, in the early 1980s, the emerging technology of charge-coupled device (CCD) image sensors would revolutionise the photometric measurements on which Ben had built his career, with improvements in both precision and speed. But Ben resolutely harnessed the photon-counting system now at his disposal in a quest to tie down the ages of clusters that had been problematic in his earlier research.

Working with younger ANU colleagues including Ken Freeman, Mike Bessell and John Norris, Ben succeeded in filling in gaps in our understanding of the chemical evolution of the two Clouds, progressing towards the model described earlier in this memoir.³⁹ While disappointed with his final observing run on the AAT, when data from four clear nights were irretrievably corrupted by an overheated computer, he nevertheless felt that the insights he had gained on the eve of his retirement from Mount Stromlo in 1980 were significant and respected in the astronomical community. 'I felt I'd gone out on a high note'... and 'surprisingly, I had no qualms when it came to hanging up my hat'.⁴⁰ No doubt it was a satisfying finale to an academic career that was about to be overwhelmed by something completely different.

Astronomer gives up the Earth

'The transition from distinguished astronomer to "the artist's husband" was not entirely easy.'
(H. L. Gascoigne, *Memorial Service*, 2010)

³⁷S.C.B. Gascoigne unpubl. memoir.

³⁸Gascoigne, in *Australian Academy of Science* (2000).

³⁹Gascoigne (1980). Gascoigne and others (1981).

⁴⁰S.C.B. Gascoigne unpubl. memoir, Gascoigne, in *Australian Academy of Science* (2000).

Rosalie's support had been a vital aspect of Ben's astronomical career and when, on his retirement, she famously declared, 'You've had your turn, it's my turn now', the roles were reversed. As Ben himself admitted, he made no contribution on the creative, imaginative side, but 'became the artist's handyman, tax accountant and cook'.⁴¹ In fact, Ben had been preparing for this for some time. Early in her artistic flourishing, Rosalie had been using metal found in local paddocks to create assemblages that, once put together, needed to be fixed so that they would be 'structurally sound, and would survive reasonable handling—she set great store by this'.⁴² So, in 1972, Ben embarked on a trade certification course on welding, which he completed with flying colours.

While Ben's role as Rosalie's studio assistant was sometimes an uneasy one due to the absence of his wife's sense of urgency, he regarded his bigger contribution to her work as being the photographic and archival documentation of her output. With a scientist's instinct for recording the details, Ben was meticulous in cataloguing every work that left Rosalie's studio (Fig. 7). That database, initially on a card-index, formed the kernel of a definitive *catalogue raisonné* of Rosalie's work amounting to 690 assemblages and two colour photo-screen prints, researched by Martin and assisted by others.⁴³

What leisure time remained out of Rosalie's drive to produce significant works was shared by the couple (Fig. 8). Literature, cryptic crosswords and scrabble were recurring themes, with exhibition openings and parties a natural part of the lives of an artist and their family. Music was less so, although Ben himself was passionate and shared his love of it with Hester in particular. There was family delight when, two years after Rosalie received the Order of Australia, Ben was made an Officer of the Order in the 1996 Queen's Birthday Honours List.

Loss and recovery

Sadly, only a few weeks after a cancer diagnosis, Rosalie died on 25 October 1999 at the age of 82. A grieving family picked up the pieces, while the art world lamented the loss of 'a phenomenon'.⁴⁴ Eventually, Ben returned to his historical studies and took pleasure in representing his late wife at numerous exhibition openings that reflected the continuing popularity of her work. With five solo exhibitions and something like twenty five group exhibitions since her death, Rosalie's name remains prominent in the annals of Australian art.⁴⁵

It was the presentation of Rosalie's ten-panel final work *Earth* to the National Gallery of Australia, Canberra, in March 2008 that evoked the 'Astronomer gives up the



Fig. 7. Ben with camera and tripod documenting one of Rosalie's assemblages in her studio. 'Saw marks on the dining table' were what led to the studio being built in 1983⁴⁷ (Gascoigne family).

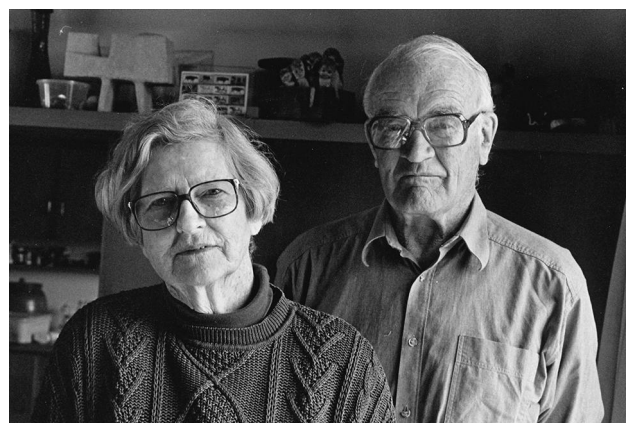


Fig. 8. Rosalie and Ben in 1997 (William Yang).

Earth' headline.⁴⁶ Ben relished the media attention, the speeches, a VIP lunch, and the presence of his family, now including grandchildren and their partners among their

⁴¹H.L. Gascoigne pers. comm.

⁴²S.C.B. Gascoigne unpubl. memoir.

⁴³Gascoigne and Gascoigne (2019).

⁴⁴Hossack (1999).

⁴⁵Roslyn Oxley9 Gallery (2023).

⁴⁶Narushima (2008).

⁴⁷Reeves and Roberts (2013).



Fig. 9. 'Astronomer gives up the Earth' at the National Gallery of Australia in 2008 (NGA).

number (Fig. 9). And in the following December, he made his last speech at such an event, with the opening of a retrospective exhibition at the National Gallery of Victoria, Melbourne.

While enormously proud of his wife's work, Ben was still at heart an astronomer and closet historian. He combined these attributes with skill and authenticity, producing in his later years a succession of insightful analyses of astronomers with whom he had associated, and the instruments and institutions they had used. Biographical essays and obituaries on several colleagues, including Woolley and Bok, took their place among more substantial works such as his investigation into the failure of the Great Melbourne Telescope and his only book, the monumental history of the Anglo-Australian Telescope, written with Katrina Proust and Mac Robins.⁴⁸

Ben would also have been painfully aware that history has a way of repeating itself. He was a young scientist at Mount Stromlo when, on 5 February 1952, a bushfire swept through pine plantations towards the mountain-top, destroying the workshop before staff and residents had time to extinguish the fire using the most desperate and rudimentary measures.⁴⁹ Just over half a century later, on 18 January 2003, a colossal firestorm in Canberra's southwestern suburbs claimed the lives of four people and left more than five hundred families homeless. Once again, the tinder-dry pine-forests around Mount Stromlo burned furiously. This time, though, they took with them all the Observatory's heritage buildings and instruments, including the 50-inch (Great Melbourne) and five other historically-significant telescopes.⁵⁰

Ben was particularly distressed at the destruction of the library, with its unique archival record, but both he and Wehner were also saddened by the loss of the 50-inch, given its historical significance and their close connection with it. Following renovation in the early 1990s, it had completed several successful programmes of research and was about to be fitted with a new electronic camera that would be used in an ambitious survey of the entire southern sky. The fire brought all that to an end, but a subsequent proposal by the Astronomical Society of Victoria (ASV) to recover the telescope's remains and rebuild it for public use in its original home in Melbourne's Royal Botanic Gardens found favour. In October 2008, the Great Melbourne Telescope Project was initiated, with Museum Victoria joining the ASV and Botanic Gardens as partners, and on 27 November 2008, the charred remnants of the telescope were brought back to Melbourne, with restoration still proceeding at the time of writing.⁵¹

Epilogue

Ben Gascoigne died peacefully in Canberra on 25 March 2010 at the age of 94. Mourned by all who knew him, his passing came on the eve of the biggest administrative change in the history of his beloved Anglo-Australian Telescope, when British involvement came to an end. On 1 July 2010, the former Anglo-Australian Observatory became the Australian Astronomical Observatory, a division of the then Department of Innovation, Industry, Science and Research of the Commonwealth Government.⁵² Not many

⁴⁸Gascoigne (1996). Gascoigne and others (1990).

⁴⁹Frame and Faulkner (2003, chapter 6).

⁵⁰Frame and Faulkner (2003, Epilogue). Watson (2004, chapter 13). Gillespie (2011, chapter 7).

⁵¹Gillespie (2011, chapter 7).

⁵²Watson and Colless (2010).

years down the track, the telescope was again in the news as the chief survivor of another destructive bushfire, the Wambelong fire of 13 January 2013, which destroyed 55,200 ha of national park and privately owned bushland in the Warrumbungle region.⁵³ Occurring ten years almost to the day after the Mount Stromlo fire, its effects were mitigated by Siding Spring Observatory being better prepared because of lessons learned from Stromlo.

The 2020s have brought a new era to Australian astronomy with progress that Ben would have relished. In an era when optical telescopes in the 8–10-m class are the work-horse instruments on sites with better observing conditions than anywhere in Australia, a ten-year strategic partnership between the Commonwealth Government and the European Southern Observatory (ESO) has given Australian access to the four 8.2-m components of the Very Large Telescope in northern Chile until 2027.⁵⁴

The other side of this coin is that as of 1 July 2018, the operation of the AAT was transitioned to a consortium of Australian universities, with the ANU responsible for the operation of the telescope. The fiftieth anniversary of its opening was celebrated in October 2024 with a symposium highlighting its many achievements and looking forward to new discoveries while acknowledging the limitations of present-day funding.⁵⁵ But Australian astronomers are also excited by the possibility of eventual full membership of ESO, which would give them access to ESO's Extremely Large Telescope, now under construction in the northern Andes. With its 39.3-m segmented mirror dwarfing the AAT's by a factor of 100 in light-grasp, it will be by far the largest optical telescope in the world when it is completed in the late 2020s.

That would surely have blown Ben's mind.

Supplementary material

Supplementary material is available [online](#).

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⁵³Green and Bauer (2013).

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