Reviews

Misfortunes as Blessings in Disguise, the Story of My Life, by Dorrit Hoffleit (The American Association of Variable Star Observers, Cambridge, Massachusetts, 2002). 176 pp., ISBN 1 878 17448 7 hardback. $25, £15.

The title of this book might lead a reader to expect a self-help guide or a collection of moral tales. In fact, it is something much more inspiring—the autobiography of a distinguished astronomer who at the age of 96 is still active in the science which she has loved and served for three quarters of a century.

Dorrit Hoffleit is well known to two (or three!) generations of astronomers for her prolific contributions to spectral classification, variable stars, stellar photometry, and astrometry. Her official professional life was divided down the middle—the first half at Harvard College Observatory, the second shared between the Maria Mitchell Observatory in Nantucket and Yale University Observatory. There is also a third phase—her ongoing attachment since formal retirement to her old department at Yale, which she regards as the happiest. She also remains deeply committed to the Association of Variable Star Observers to which she has belonged throughout her astronomical life.

Dr Hoffleit was born in 1907 of German parents who had emigrated to the United States as young adults in quest of a better life. Her hardworking father was employed as a bookkeeper on the railroad; her talented mother, daughter of a Physics teacher, had studied music in the conservatoire. Their home, modest by worldly standards, provided an intellectual environment of books and music for Dorrit and her brother, her only sibling, who became a Classics scholar.

Dorrit regarded herself as a very ordinary pupil at school, and received little encouragement from her mother who believed it more appropriate for a lady to choose "fine embroidery, music and modern foreign languages." Nevertheless, she reached university and graduated with honours in mathematics from Radcliffe College at the age of 21 in 1928. Her ambition was to be a high-school mathematics teacher, but posts were scarce, and she accepted employment instead at Harvard College Observatory where the Director could "hire two women for the price of one man." Far from complaining at this turn of events, Dorrit regarded it as her first "blessing in disguise."

At Harvard she found life under the Director, Harlow Shapley, "delightful", and never forgot the encouragement she received from him in those early days: her Memoirs are dedicated to his memory. Tutored by Henrietta Swope, her papers on variable stars and spectroscopy soon appeared in increasing numbers in the Harvard Bulletins. She was overwhelmed when Shapley and Bart Bok suggested that she embark on a Ph.D., something that, in her modesty, had never occurred to her. She obtained her Doctorate in 1938 and was promoted to the rank of Astronomer in 1948. Her work was interrupted by the second World War when she was seconded to do research in ballistics (about which she published a number of papers). After Shapley's retirement in 1952, Harvard lost much of its magic for her, and she moved in 1957 to Nantucket to become Director of the Maria Mitchell Observatory as successor to Margaret Harwood who was due to retire. There followed a fraught few years while Miss Harwood pleaded for time to finish her research project, and even resisted retirement altogether. Here was another misfortune to be turned into a blessing. By special arrangement, Dorrit was able to divide her time between Nantucket and Yale, where she was given an appointment in that observatory's astrometry programme, with charge, among others, of that indispensable *opus*, the Yale Bright Star Catalogue, with which her name will ever be associated. She retired from Maria Mitchell Observatory in 1978, but was granted the privilege of continuing to work to her own liking in the Yale Department of Astronomy.

The most interesting chapters in the book deal with her work at the Maria Mitchell Observatory—named after America's first women astronomer—where she instituted a summer course of instruction for women students (men later took part) who were given original material on variable stars to work on. Students came from far and wide; many went on to careers in astronomy, or became active members of the American Association of Variable Star Observers. All remained her cherished friends. Among them was the late Janet Akyüz Mattei, who persuaded her to write these memoirs, and who has provided a charming Preface.

Dr Hoffleit was in due course rewarded with many academic honours, including Honorary Doctorates and an asteroid Dorrit, named on her 80th birthday. She found happiness in her private life from her students and colleagues, into whose families she was ever welcome: sixteen pages of fascinating photographs illustrate her intertwined personal and professional lives. Her account modestly refrains from parading her own contributions to science. These speak for themselves in an appended bibliography of 450 publications spanning a period of over seventy years. Readers of this *Journal* will be pleased to find among them numerous contributions to the history of astronomy—essays, book reviews, and entries in international and American biographical dictionaries.

This very readable book is a personal story told with good humour and charity, of one who made the most of life as she found it, working hard and loyally, and achieving success and fulfilment in the service of Urania and of her fellow human citizens.

Mary Brück

Shining in the Ancient Sea, by Laurin R Johnson. (Portland, Oregon: Ash Creek Press, 1999), 137 + ixx pp., ISBN 0-9669828-0-0, soft cover, US$20.00, 228 × 140 mm.

Homer's two epic works *Iliad* and *Odyssey* are among the most important creation of our cultural heritage. Their influence in all levels of the human activities has never faded in the three thousand years—or more—of their existence. They belong to the most translated and read books of the world. Scientists of several different disciplines have written thousands of pages trying to describe the beauty and analyse the origin and meaning of their contents.

The present book is an attempt to expound *Odyssey* as an ancient astronomical almanac. It contends that the voyage of Odysseus took place in the

night sky among the constellations. Its author seems to know the Vedic texts —something that the writer of this text ignores. He argues on the basis of the widely-accepted theory of the common origin of the Indo-European culture. According to the book, an astronomical almanac was created in the framework of the Indo-European parent culture and took the form of a poem formed around 3500 BC; the aim was to transmit astronomic knowledge to the next generations easily via the poetic rhythm and prosody. Some of the Indo-Europeans would then move to India and create their new culture there, in the heritage of which we would find the Vedic texts. Other Indo-Europeans would move to Europe and, in particular, some of them to Greece, where the original astronomical almanac was transformed to *Odyssey*. A critical element of this metamorphosis was the influence of future generations, that slowly added new elements—these of the new Greek culture—to the original astronomical song.

The author argues that several strophes in Vedic texts correspond to verses in *Odyssey*, and that the metaphors used by the two different texts show clearly the astronomical meaning of the initial almanac. It could be. Also, the book correlates a constellation with each place Odysseus visited during his ten-year journey home, giving another poetic dimension to *Odyssey*. Odysseus was finally a planet, probably Saturn.

There are quite a few interesting remarks in this book, especially in Chapter Two, according to which the time when *Odyssey* started to be created should be "about 2750 (give or take a few hundred years)". In one of these remarks one reads, on pages 48-49, that "... the only reasonable explanation for the fact that the Pleiades were chosen as the beginning point of a continuous circle rather than any of the other 27 asterisms must be that the Pleiades marked the beginning of the year ... The Pleiades did once serve this function between 3000 BC and 2200 BC." Furthermore, the author argues that the beginning of the creation of *Odyssey* could even go back to 4000 BC. Actually, this hypothesis, elaborated on also in other works by many researchers, cannot be rejected.

There is also an exciting idea in the background of the book. We know that early cultures created huge astronomical observatories, even during the pre-historic era. We still admire the remnants of these astronomical sites for their architectural symmetry, as well as the astronomical capacity of their astronomers. We know that astronomers were often priests, and the astronomical orientation of temples and churches is an additional indication of the old traditional link between astronomy and religion. Astronomers and priests worked in these ancient observatories, which often were temples as well. Religion preserved tradition as too did poetry. The suggestion that one of the most marvelous poems in history is in fact an astronomical almanac in which ancient priests and astronomers put their observations is a highly fascinating speculation.

Yet, the book does not deliver any proof of this tempting hypothesis. The arguments are poor, and the correlation of constellations with places in *Odyssey* are not convincing. The task of the author to find persuading arguments was surely not an easy one. Nevertheless, a reader who knows the night sky, has some elementary astronomical background, and loves good poetry will find in the pages of this book plenty of charm—or example by looking at the Hyades and seeing a group of pigs there (Chapter Three, page 70), or at the *Pleiades* as the floating Homeric island *Aeolia* (Chapter Four, page 79). Nonetheless, no convincing arguments in the book support the scientific correctness of the reasoning; therefore the reader's fascination should remain at the poetic and artistic level.

Dimitris Sinachopoulos

Mary Somerville and the World of Science, by Allan Chapman (Canopus Publishing Limited: Bristol 2004), 157pp + XV, ISBN 0 9537868 4 6, hardback. £12.95. 17.5 × 12.0 mm.

Mary Somerville (1780–1872) was one of the most celebrated and most influential *interpreters* (as distinct from *popularizers*) of science of her era. In this study of that extraordinarily gifted woman, Allan Chapman recounts how his interest in her began when he was researching *The Victorian Amateur Astronomer, Independent Astronomical Research in Britain 1820-1920* (1), his invaluable compendium of the personalities who inhabited that period in various capacities. Until late in the nineteenth century, Britain, unlike France and Germany where scientific work was state-sponsored and hierarchically-organized, had very few salaried posts in astronomy (apart from the Royal Observatory at Greenwich). Research was largely in the hands of self-supported individuals whom Chapman calls "Grand Amateurs", the word being used in the literal sense of lovers of knowledge. They operated in a world in which "private independence brought a higher kudos than did a paid job", and—what was particularly relevant in the case of talented women—did not depend on formal academic qualifications. He places Mary Somerville firmly among the Grand Amateurs.

In his new book, Chapman examines Mary Somerville's career in more depth, demonstrating her place as an interpreter of science who may be bracketed with luminaries such as John Herschel or William Whewell. He sets the scene with an account of the organization of science in late Georgian Britain, and in that frame he outlines Mary Somerville's early life, from her childhood in Scotland to celebrity in London. She was largely self-educated, until she reached the advanced stages of her mathematical studies. Then, advised by academics of the Edinburgh school, she progressed, astonishingly, to the works of the great contemporary French mathematicians, culminating in the first published volumes of Laplace's *Méchanique Celeste*. In fact, her mastery of mathematics while still a young woman was ahead of that taught at Cambridge.

Mary and her Army physician second husband, William Somerville, began their married life in Edinburgh where they belonged to that great city's circle of scholars and thinkers. Chapman here makes the point, not generally appreciated, that Mary Somerville, with her progressive views on issues such as education and the abolition of slavery, was very much a product of the Scottish Enlightenment. He also draws attention to the role of William Somerville, a man of considerable standing in his profession, whose encouragement of his wife's talents (unlike the disparaging attitude of her first husband) was of the greatest importance to the furtherance of her career.

Life in Edinburgh for the Somervilles was followed by twenty years' residence in London, the

decisive and most fruitful period of Mary's career. She established herself quite naturally among key figures in astronomy and physics such as John Herschel, Thomas Young, Francis Wollaston and many others—a list that, as Chapman says, "reads like a *Whos Who* of late Georgian science." Mary took every opportunity to learn from these experts: John Herschel was until his death her closest adviser. Geology, too, had its Grand Amateurs in William Murchiston and Charles Lyell, who also became her friends and guides. Mary Somerville's scientific circle was not confined to the metropolis: on her first European tour she was received as an honoured guest in Paris and in Geneva, even before she achieved fame as an author.

The proof of Mary Somerville's talent lies, of course, in her writings. Her first book, *The Mechanism of the Heavens*, tackled the most abstruse scientific subject of the day—celestial mechanics—and made her a celebrity. Her second, immensely influential work, *On the Connexion of the Physical Sciences*, drew together all branches of physics and astronomy, presenting, as the author puts it, "an intellectual vision of science that was truly encyclopaedic in scope". So successful was this book that it was almost a full-time job to keep it updated in successive editions throughout her lifetime. Her *Physical Geography* had a similar impact. The commercial success of these books, combined with a Civil List pension, made Mary Somerville a truly independent Grand Amateur. It also made her an icon to her own and later generations of women.

In the last stimulating chapter, the author reviews Mary Somerville's scientific career and discusses whether—as some have suggested—she might have achieved more if she had better opportunities. Certainly, had she been a man she would have been a member of learned societies with direct access in her own right to scientific progress. As regards potential scientific achievement, the historian's answer is that it is not realistic to transplant the conditions of one age into another. Mary Somerville was born in the late eighteenth century, and lived in the world of the Grand Amateurs; and it was in this world that she "found her voice and established her reputation". She used her voice and her reputation to advance the cause of women, and lived to see at least some results thereby.

This enjoyable book places Mary Somerville properly in a historical context, and conveys an entrancing picture of a woman and a scientist who combined formidable talent with a remarkably charming personality. It will make an ideal companion volume to Mary's own *Personal Recollections*, now fortunately available in Dorothy McMillan's recent excellent edition, *Queen of Science* (2). The book, which includes a discussion of the contrasting career of Mary Somerville's older contemporary, Caroline Herschel, may also be recommended as a level-headed contribution to the literature on the history of women in science.

References

(1) Allan Chapman. *The Victorian Amateur Astronomer*. Chichester: Praxis Publishing Ltd., 1998. (Reviewed in *Journal of Astronomical History and Heritage* **3**, 86-88, 2000.)

(2) Mary Somerville. *Queen of Science, Personal Recollections of Mary Somerville.* Edited and Introduced by Dorothy McMillan. Edinburgh: Canongate Classics 2001. (Reviewed in *Journal of Astronomical History and Heritage* **5**, 192-3, 2002.)

Mary Brück

Mapping Mars: Science Imagination and the Birth of a World, Oliver Morton, 2003 (Fourth Estate: London), 351 + xv pp, ISBN 1 84115 669 8, soft cover, price £ 8.99, 197 × 128 mm.

Observing the Craters of Mars, Part 1, Rodger W. Gordon, 2003 (Typographica Publishing: Middlesex, New Jersey), 51 pp, no ISBN, soft cover, price $15.00 (US), 217 x 136 mm.

> Already Mars was a small disc showing numerous surface markings even to the naked eye, and there was much peering through telescopes and argument over maps and photographs. Gibson had borrowed a large Mercator projection of the planet and had begun to learn the names of its chief features—names that had been given, most of them, more than a century ago by astronomers who had certainly never dreamed that men would one day use them as part of their normal lives. How poetical those old map-makers had been when they ransacked mythology! Even to look at those words on the map was to set the blood pounding in the veins—Deucalion, Elysium, Eumenides, Arcadia, Atlantis, Utopia, Eos. ...
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> The Sands of Mars, 1951
> A C Clarke

The author of *Mapping Mars* now lives in Greenwich and his book opens with musings on the view from Greenwich Park and on the significance of the Royal Observatory for both astronomy and geography. From this beginning it is obvious that the book is about more than the mapping of Mars in a strict cartographic sense. Rather it uses mapping as a metaphor for increased knowledge, charting the increased understanding which has transformed Mars from a point of light in the sky that moves against the fixed stars, to a real world, with its terrain charted and mapped, and the processes which have moulded it understood. The book is also about the artistic responses to that increased knowledge: the authors who have written about Mars and the artists who have drawn it.

Along the way there is a good deal of information about Martian exploration. There is some coverage of the pre-space age mapping by terrestrial observers, not least the system of nomenclature, largely due to Schiaparelli, which seems at once so evocative and so appropriate. However, most of the book is about the robotic exploration of Mars by spacecraft in the forty-odd years since Mariner 4 was launched to the Red Planet in 1964. The treatment is informal and anecdotal and introduces many of the scientists, engineers, and cartographers who have worked on the Mars missions, many of whom the author has interviewed. In addition to describing the topographic mapping of Mars the book also covers the disentangling of the geologic processes which have shaped the topography, the differences and similarities with the Earth, and the great debates over water and life.

Oliver Morton is a journalist and it shows: his book is well written, in prose that is at times elegiac and poetic. He effortlessly imparts a great deal of information about Martian topography, the process which have shaped it and the means by which this information has been gleaned. The book is aimed at the layman and requires no technical knowledge to follow. It is not a text book in any conventional sense, but nonetheless anyone reading it is likely to learn a great deal. The book is well produced. There is a small collection of colour plates and a grey-scale map as a frontispiece. More illustrations would certainly have been welcome, but would probably have pushed up the price. It is highly recommended.

Morton describes how in 1965 Mariner 4, the first successful US mission to Mars, sent back a few grainy pictures at, by modern standards, a ridiculously low bit-rate. Nonetheless these photographs caused a revolution in studies of Mars. They revealed a world pot-marked with craters and changed the conventional understanding of the planet from a world that was basically Earth-like (though less hospitable) to one which was more like the Moon (later the view would partly swing back again, of course). However, the existence of craters on Mars should not have come as a surprise. They had been observed before, glimpsed under fleeting moments of exceptional seeing by terrestrial observers. Unfortunately, it is impossible to record or reproduce such observations and they were never reported, partly for fear of ridicule. *Observing the Craters of Mars* describes these early terrestrial sightings of Martian craters by E E Barnard, John Mellish, G H Hamilton and others. The terrestrial observation of craters is a little-known byway in the history of Martian mapping, and this book is a good introduction to it. A previously unpublished article on the subject by Charles Capen is included as an appendix.

The author is an amateur astronomer and Mars observer of many years standing. The book is published by Typographica Publishing (see URL http://jersey-mall.com/tpo/) who also publish *The Practical Observer* magazine. It is very much a 'small press' publishing enterprise, but no worse for that. There is a 'printer's widow' and also a couple of other infelicities, but generally the typography and proof-reading are good. The book is well-illustrated in both black and white and colour, with numerous reproductions of sketches made by the various observers. It was published to coincide with the 2003 opposition of Mars. A companion volume is planned for the 2005 opposition, which, if it is similar to the present one, is something to look forward to.

Clive Davenhall

A Popular History of Astronomy During the Nineteenth Century, by Agnes M. Clerke (Facsimile Edition, Sattre Press, 2962 Middle Sattre Road, Decorah, IA 52101, USA; 2003), xviii + 489 pp., ISBN: 0-9718305-5-X, soft cover, US$35.00, 148 × 222 mm.

To my mind, the most invaluable contemporary reference book overviewing nineteenth century astronomy is Agnes Clerke's *A Popular History of Astronomy* ..., even if inclusion of the term 'Popular' in the title erroneously conjures up an image of a short simplistic volume. Nothing could be further from the truth. As Mary Brück (2002) has shown, *A Popular History* is a *tour de force*, and Agnes Clerke a skilled writer: her "... breadth of knowledge, her capacity for assembling and collating data, were enormous." (page 44). While the original quickly went through several new editions, each studiously up-dated with the latest findings—often in that newest of astronomies, *astrophysics*—with the passage of the years second-hand copies found their way onto the international book market with increasing rarity, and an automatic corollary of this was an escalation in the sales price.

Bill Sattre from Sattre Press, has therefore done us all a great service by producing a facsimile reprint of the fourth edition (originally published in 1902), and at a very affordable price. Not only is the original content all there, but we are favoured with a new Foreword, penned by Mary Brück. Agnes Mary Clerke (1842–1907), she tells us, was born into an educated Irish family but did not attend school as she and her equally talented sister were tutored by their parents. Agnes

> ... was already an experienced writer before she embarked on her *History*, being a regular but anonymous contributor to the prestigious *Edinburgh Review* and the author of several biographies in *Encyclopaedia Britannica*. Yet she remained elusive until the *Popular History of Astronomy during the Nineteenth Century* was put before the public. This, her first book, was an instant success and brought her into fruitful contact with the leading astronomers of the day, at home and abroad. (page iii).

For those with a penchant for nineteenth century astronomy, this facsimile edition has it all: background material on the foundations of sidereal astronomy; new data on sunspots, the chromosphere, prominences and the corona; planetary discoveries; transits of Venus and the astronomical unit; remarkable comets; advances in what we would now term Galactic and extra-galactic astronomy; and a useful introduction to those indispensable tools of the 'new astronomy', photography and spectroscopy. In her very readable presentation, Clerke deftly interweaves elements of positional astronomy and astrophysics, in the process producing a book that will long remain a favourite with many scholars.

At long last, we can now use Sattre's facsimile edition for everyday reference purposes, and endeavour to preserve and protect those cherished originals that decorate our bookcases.

Wayne Orchiston

Reference

Brück, M., 2002. *Agnes Mary Clerke and the Rise of Astrophysics*. Cambridge, Cambridge University Press.

The Maunder Minimum and the Variable Sun-Earth Connection, by Willie Wei-Hock Soon and Steve H Yaskell (World Scientific Publishing Co. Pte. Ltd.: Singapore 2003), 278 pp + 13, ISBN 981-238-274-7 $64/£44, ISBN 981-238-275-5 (PBK) $32/£22.

How constant is our Sun? The question, of practical as well as of scientific interest to its Earthly dependants, motivates this exposition of our present knowledge of the relations between Sun, Earth, and the space between. In answering it, the authors unfold the development of the subject from its beginnings about a

century and a half ago, thus combining history with physics in a fascinating manner.

The book's title refers to the 'Maunder Minimum', a period of more than seventy years in the seventeenth century when spots on the Sun were unusually rare. That period, named after the British astronomer E W Maunder, was also a time when contemporary accounts of various kinds point to colder than average temperatures in many countries over the globe. The Maunder Minimum was not the only cold spell in the millions of years of our Earth's existence. Neither was it unique in terms of sunspot absence: modern data on the atmospheric production of carbon 14 by cosmic rays show that prolonged periods of solar inactivity have occurred ten times in the last 7000 years, and another may be anticipated in the future.

The serious study of solar-terrestrial relations dates from the discoveries in the mid-nineteenth century of unmistakable connections between the state of the spotted Sun and certain geophysical manifestations. The famous eleven-year cycle of sunspot numbers was discovered in 1843; then came to light the identical periodic cycle in the variation of the elements in Earth's magnetic field, which in turn was found to be linked with the visibility of polar auroral displays. Individual great magnetic storms and spectacular aurorae appeared to be associated with large sunspots, though the correspondence was far from straightforward, and no plausible physical explanation was in sight.

In discussing these phenomena, and efforts to interpret them, the authors give particular prominence to the long-term systematic work at the Royal Observatory Greenwich. The most complete records of the Sun anywhere in the world were the daily photographs obtained there from 1872 onwards under the charge of (Edward) Walter Maunder, who was to devote over forty years of his life to the task. In 1904-05, drawing on observations accumulated by him over three sunspot cycles, he published a thorough analysis of the subject, its best-known finding being the famous butterfly diagram displaying the latitude drift of spots in the course of a solar cycle. He also investigated earlier records, including the long 'calm' in the seventeenth century that now bears his name. Maunder's discovery of regions on the Sun's face devoid of visible spots, which nevertheless were sources of terrestrial magnetic activity (foreshadowing M-regions), and his suggestion of particles being ejected from certain restricted areas (the later 'coronal mass ejections' and 'coronal holes'), were notable insights. He supported, and—as the present authors show—actually anticipated the corpuscular theory (that magnetic storms were caused by charged particles emanating from the Sun), proposed by Svante Arrhenius in Sweden, which came to be generally accepted by the end of the century. The Maunders (because one must include Walter's mathematician wife, Annie, who was his collaborator from the time she joined the Greenwich staff as his assistant 'lady computer' in 1891, and having resigned her post on marriage four years later, continued as his close helper and adviser), were confident of their own conclusions. The authors suggest that Maunder, who lacked a university education, was sidelined at this time by the academic establishment. A case in point was the debate on the rôle of giant sunspots in triggering large magnetic storms and aurorae. The elderly Lord Kelvin (formerly William Thomson), a dominant figure in the British scientific elite, always maintained that the apparent connection was an impossibility, on the assumption that the Sun's magnetic energy would be radiated like light. The authors admire Maunder for holding firm to a contrary opinion.

The next major stage in solar-terrestrial research was the theoretical work on the physics of the corona by eminent mathematicians such as Sydney Chapman, who also provided the first satisfactory theory of solar corpuscular radiation. The crowning achievement of that age was Eugene Parker's brilliant solution of the supersonic solar wind in 1958—a year that, coincidentally, had just witnessed the launch of the first Earth satellites. The final chapters of the book summarize the present highly-complex picture of the Sun and its environment, including Earth and its magnetosphere, brought about by advances in physics and technology and by research in space. Such studies contribute to the much larger problem of climate change and global warming, and are therefore of the utmost scientific importance. These intricate discussions, intended for solar physicists and climatologists, are quite accessible to less specialist readers of this book. The text is mathematics-free, with much of the technical information supplied through illustrations taken from the literature.

The book is a rich tapestry of scientific information and wide-ranging historical narrative, into which is woven the personal story of Walter Maunder and his wife Annie. The Maunders were among the most experienced eclipse observers of their day, and were active promoters of amateur astronomy in Britain. As regards the solar-terrestrial connection, the authors see Maunder as "clearly a man ahead of his time" and his wife as a collaborator who brought the benefit of a university training to an unusual and devoted partnership. They are here given an honoured place in the annals of the Sun.

Mary Brück

Stargazer. The Life and Times of the Telescope, by Fred Watson (Allen & Unwin, Sydney, 2004), x+ 342 pp., ISBN: 1-86508-658-4, cloth, A$35, 140 × 204 mm.

With a well-thumbed copy of Henry C. King's *The History of the Telescope* occupying pride of place in that part of my library dealing with telescopes and their history, I was curious to see how Fred Watson's new work, *Stargazer. The Life and Times of the Telescope*, measures up. Fred was one of my colleagues at the Anglo-Australian Observatory (AAO), and in Australia is a legend for his ability to very effectively communicate the excitement of astronomy at a public level. Some would see him as the Patrick Moore of Australian astronomy! But he is more than that: he is a highly-respected researcher, and is Astronomer-in-Charge at the AAO Coonabarabran site, home of the 3.9-metre Anglo-Australian Telescope. After leafing through the 350 pages making up *Stargazer*, I was not disappointed. Once more Fred has done an admirable job, in the process bringing the history of the telescope to life.

Most astronomical histories start at the beginning and work their way chronologically towards the present day, but in *Stargazer* Fred begins his survey with a chapter on "Power Telescopes", which recounts a major conference on telescopes and instrumentation

for the new millennium that was held in Munich in March 2002. The discussion largely focussed on existing and planned telescopes in the >6.5-metre class, and these surely provide a sobering technological comparison when measured against the pioneering refractors and reflectors of the seventeenth century.

Early refractors and their scientific predecessors occupy the next five chapters, and along the way we visit the writings (and experiments?) of Thomas Digges and William Bourne, examine competing claims for the invention of the first telescope, and survey Galileo's marvellous observational record. The invention of the reflecting telescope is also steeped in controversy, and Fred expounds on this in Chapters 7 and 8 before discussing the work of Gregory and Newton. After examining all the evidence, Fred is moved to suggest that "If Newton is to be called the 'father of the reflecting telescope', then surely Cavalieri must be its godfather." Cavalieri's interesting role is discussed on pages 134-135.

Subsequent chapters, in the main, chart familiar territory and familiar names—Ramsden, the Dollond dynasty, Hadley, Short, William Herschel, Sir James South and the 'Great Equatorial', Grubb Lassell, Nasmyth and Lord Rosse—before adopting a more parochial tone with an account of the "Heartbreaker", the Great Melbourne Telescope. That chapter ends with what for me must be the saddest image in the whole book, a photograph showing all that remains of the Great Melbourne Telescope after the devastating fire that swept across Mount Stromlo Observatory on 18 January 2003.

The second half of the nineteenth century, with its advances in optical design, mountings, accessories (such as the spectroscope) and the emergence of what Fred refers to as the 'Big Refractor', is discussed in Chapter 14, which leads to a chapter on the twentieth-century quest for increasing aperture and the emergence of the reflecting telescope and various catadioptric designs as the research instruments *par excellence*. Given his intimate association with the 1.2 metre Schmidt at Siding Spring mountain, it is no surprise that Fred devotes a number of pages to Schmidt telescopes and that "... eccentric ... ill-adjusted genius names Bernhard Voldemar Schmidt, who solved the problem of wide-angle photography with fast focal-ratio telescopes." (page 258). Chapter 14 ends by introducing the 4 metre class telescopes, thereby providing a natural link to the very first chapter of this fascinating book.

But *Stargazer* does not end there. In focussing all-to-briefly on radio astronomy and space-based telescopes and satellites in "Walking With Galaxies. Towards the Half-Millennium", Fred takes us beyond the realm of the visible, and above the light and other pollutants of the Earth's atmosphere, before indulging in some amusing crystal ball-gazing in the final chapter, which is conveniently set in the year 2108 (and as such celebrates the telescope's first half millenium)! It is a nice way to end a book, but for those wanting more, there are 33 pages of notes, sources and references, followed by a useful glossary and a master list of the world's largest ground-based optical and infrared telescopes that were operating or near operational in 2004.

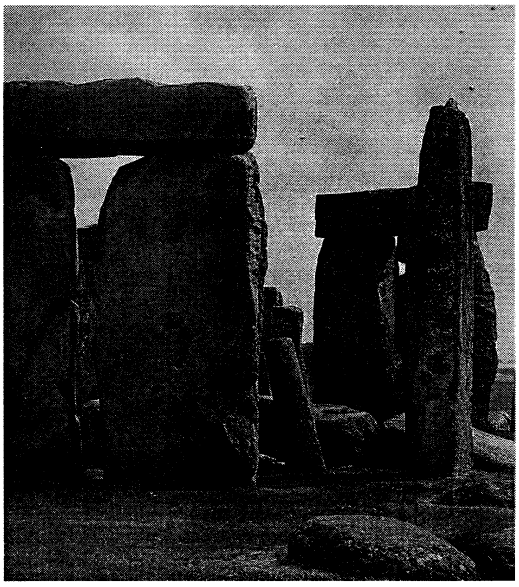
If you have an interest in telescopes and want to enjoy the interplay of technology and human drama, then this book is a 'must' for your library. I can do no better than quote from Patrick Moore's Foreword, where he says that Fred Watson "... has a marvellous story to tell, and he has done so in his unique way. This is a book which will be enjoyed by beginners and specialists alike ..."

Wayne Orchiston

Stonehenge Earth and Sky, by Gerald S. Hawkins and Hubert A. Allen, Jr (Wessex Books, Salisbury, 2004), 48 pp., ISBN 1 903035–24-4, paperback, £5.99, 158 × 250 mm.

If you have not been to Stonehenge and most probably never will, then this is your chance to see and learn about this New Stone Age monument. Crammed into this little book is most of what you need to know about Stonehenge together with some fifty illustrations. It is divided into sections, most of which are four pages with those on the midsummer and midwinter a little longer. Amongst these are: What is Stonehenge? What was the Purpose? How old is Stonehenge? Builders and Designers; The Station Stones; Carvings and Numbers; and What the Ancient Greeks Said.

Stonehenge Earth and Sky begins with a description of the more than four thousand-year old monument and definitions of some of the terms used – trilithons, sarsens, Heel (Hele) Stone, and Aubrey Holes (discovered by John Aubrey in 1666). The latter consisting of fifty-six holes arranged in a circle some two hundred and ninety feet in diameter and sixteen feet apart. Their purpose seems to be unknown. With no written records at the period of Stonehenge's construction, archaeological diggings have only revealed negative results – no pottery, no gold ornaments, only a few human skeletons, and some ashes from cremations. It is therefore the stones and their arrangements which strongly suggest a religious significance.



The tall, thin Stone 56, the largest ever to be shaped in ancient Britain (over 50 tons). The tenon knob on the top matched a mortise hole in a lintel.

Radio-carbon dating puts the earliest human presence around 7000 BC, far older than Stonehenge

which was constructed from 3200 for the ditch at the south entrance to 1720 BC for the Y and Z holes dug around the monument. Remains from human sacrifice have been found near the north-east entrance dating from 2270 BC.

The arrangement of the stones at Stonehenge gives a view of the rising Sun, on the summer solstice, at its most north-easterly position just to the left of the Hele Stone or between it and its missing companion. Naked-eye observations by the Stonehenge people created alignments that were accurate to one degree, an impressive feat in Neolithic times. Not only the Sun, but also the Moon's positions were taken into consideration at Stonehenge. These alignments were put forward by Hawkins (1963) and occurred in the 'High' year of the Moon which had intervals of 19, 18, and 19 years adding up to 56, the Stonehenge cycle.

The book ends with this short paragraph:

> Stonehenge in 3000 BC was a bold and grand endeavour to join earth and sky, to lock the patterns of the sun and moon in post, stones and archways. Even when the work was ended around 1700 BC its fame continued to be recognised far afield, across the ages of time, into the present day.

It is unfortunate that the senior author Gerald S Hawkins passed away before the publication of the book. However, if you are looking an inexpensive succinct description of Stonehenge then this little book is the answer. For if we apply the words of Barnard (1927) "one picture is worth ten thousand words" then *Stonehenge Earth and Sky* is worth half a million words.

John Perdrix

References

Barnard, Frederick R., 1927. *Printers' Ink* 10 March.
Hawkins, G.S., 1963. Stonehenge Decoded. Nature **200**:306.