RASC: One Hundred and Forty Years of Art and Observation

catalogue of an exhibition from the RASC National Archives for the 2008 General Assembly in Toronto, June 28-30, 2008

a project of the RASC History Committee
Barry Matthews, Chair
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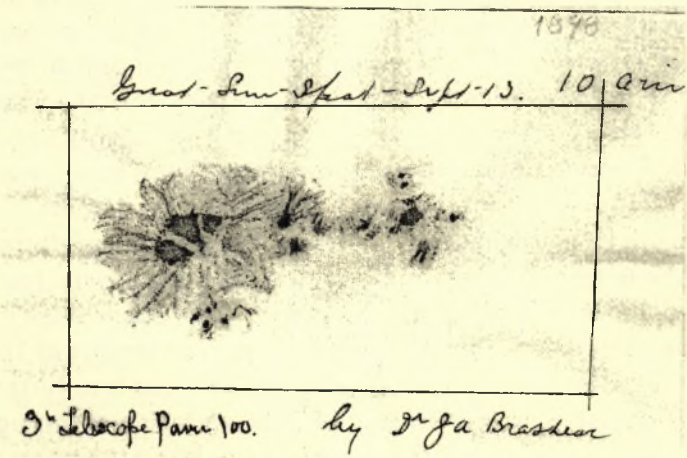

Introduction

The recording of astronomical observations in graphic form predates the invention of script, if not the advent of *homo sapiens sapiens*.[1] The basic impulse to depict astronomical objects, events, and ideas is seemingly common to many cultures, however much they may differ in their approaches to imaging the heavens. Perhaps we are "hard-wired" for this. Astronomical art has been a vital tool for making, mapping, and manipulating astronomical discoveries and theories from before the rise of Copernicanism. Galileo's epoch-making telescopic observations and analyses owed their quick achievement and telling impact to his mastery of two technologies: telescope design, and visual representation (Biagioli 2006; Bredekamp 2001). Skill in drawing enabled Galileo to enhance the textual presentation of his observations in support of his new theories. His depictions aided others in comprehending and eventually reproducing his results. The original "Galileo moment" would not have happened for Galileo's contemporaries had he not artfully rendered his observations.

The Archives of the RASC contain an intriguing paper trail of our more recent predecessors' varied astronomical activity. That trail among the stars can be discontinuous and faint, but amidst its more vivid vestiges is the surviving graphic record of observations by RASC members, particularly those from the immediate prehistory and early days of the society, roughly corresponding with our late-Victorian and early-Edwardian corporate existence. ***RASC: One Hundred and Forty Years of Art and Observation*** presents more than a dozen hand-drawn images of astronomical observations by RASC members or those associated with the Society, all but two of which are taken from the RASC Archives. Each image is accompanied by an identification, artist attribution, listing of the media, and description of how it was produced. The chronological space separating the earliest from the latest image is approximately 124 years, but we have preferred to reckon the temporal element of our title from the official founding of the RASC, for the Canadian astronomer of 1884 would have used the sketching tools and techniques of his or her counterpart of 1868.

This exhibition has two chief goals. The first is to further the RASC membership's experience of the Society's history through its Archives, and the other is to encourage more RASC members to try their hand at astronomical sketching. Aside from its continued scientific utility,[2] astronomical sketching provides a wonderful discipline for increasing one's observational prowess, and is a

technique perfectly within the capabilities of all RASC members.[3] The tools are inexpensive and readily available, and there is but one cardinal rule: *attempt to draw only what you see, and be honest about what you record.* If you want to do something more creative with your results afterwards, there is nothing stopping you from doing so. And you have the advantage of basing what you then do on your own graphic record of a real observation.

Training, techniques, and tools

As a rule, there were no formal procedures or courses specifically designed for the grounding of observers in the art of astronomical drawing from the 16th to the early 20th centuries. For most of that period, training in many aspects of observational astronomy was very much an informal affair – what we would now call "on-the-job" training – consisting of unequal measures of mentoring, autodidacticism, and most important of all, cumulative experience. What is truly surprising is the absolute dearth of instruction on astronomical drawing in the handbooks, amateur or professional, from the heyday of the hand-drawn astronomical record (*e.g.*, Webb 1859; Herschel 1878; Young 1889). This is in stark contrast to contemporary treatises on microscopical instruction, which regularly feature a detailed chapter devoted to sketching what one saw on the slide (*e.g.*, Suffolk 1870). Occasionally comments are offered in the astronomical literature on how drawings were done, but they are infrequent (notable and instructive exceptions are Rosse 1874; Weinek 1890; Morehouse 1922). A few papers expressly devoted to astronomical drawings and their reproduction were written, but enumerating them would hardly exhaust the fingers of one hand (Smyth 1843; Webb 1871; Huggins 1882). This lack of written instruction specifically aimed at astronomers seems less odd when one considers the position of artistic activities in 19th-century society. Painting in watercolours was a socially acceptable activity in polite circles; many handbooks were published, and many instructors found ready pupils among the gentry, not to mention the mercantile and mechanical classes with a bent for self-improvement. The training of many professions – surveyors, architects, engineers, and military and naval officers – involved instruction in design (Drayson 1865). And those are the very ranks from which many astronomers were drawn. Divers astronomers were also microscopists. Clearly there were ample opportunities to acquire drawing technique before one ventured near a telescope.

The media chiefly favoured for graphically recording

astronomical phenomena were watercolour, pen and ink, graphite pencil, coloured crayon (Conté), charcoal, coloured chalks, and pastels. All the techniques employed in landscape, still-life, and portrait work were employed in astronomical drawing. The supports (lined and unlined, bound and unbound notebooks, watercolour papers, boards), the brushes and pens (quill and steel), and the pigments were the same. Mathematical drawing instruments (dividers, compasses, ruling pens, scales) were also used (Stanley 1878). In one amusing case from the RASC Archives, Sir Adam Wilson recorded a transit of Mercury (May 9th, 1891) in watercolour on the back of a printed probate of 1872![4] Perhaps the most unusual support for a drawing in the RASC Archives is a record of the solar eclipse of May 28, 1900, by A. E. Weatherbe, done neatly in ink in a booklet entirely of birch bark (a museum quality facsimile has been prepared for this exhibition – to examine it, ask the RASC archivist). The material of this artifact is probably unique among 19th-century Commonwealth eclipse records, and there is an innocent quality to the choice of such a quintessentially "Canadian" support. Weatherbe was a brave man; ink generally cannot be corrected when laid down on birch bark. The bark, however, is a reasonably long-lived material.

The major part of the Victorian and Edwardian images in the RASC Archives were done at the eyepieces of quality long focal length achromatic refractors with 3"-4" objectives (Harvey 1904), the so-called "common" telescopes of the era.[5] The fortunate could afford instruments by the likes of Cooke, Wrey, and Brashear (the latter was an honorary member of the RASC, and a loyal supporter). The foremost exception is the lunar watercolours done by the "ladies of Simcoe" with J.J. Wadsworth's 12.5" reflector, an imposing instrument for its time and place.

The two chief differences in technique between 21st- and 19th-century astronomical drawings are the present neglect of watercolour, and the use of digital image processing.

Of course, differences in the general aspect of astronomical drawings executed between 1868 and 2008 are not just caused by technological change, or even principally caused by technological change. Alterations in human perceptions, conceptions, and expectations of astronomy are probably more important factors. We do not process what we observe with the eyes of 1868, 1908, or even 1998. To try to observe as our predecessors observed, however, would be a potentially useful, salutary, and difficult exercise. At the very least it may teach us that as they now appear, so shall we.

Drawing and Photography

Astronomers were quick to imagine the scientific possibilities of photography from the late 1830s, and many of them were innovators generally in photographic technology. These pioneer astrophotographers were frequently noted astronomical draftsmen as well (*e.g.*, William C. and George P. Bond, Charles Piazzi Smyth, Edward Emerson Barnard – this list could even start with John Herschel, if we admit a first rate astronomical draughtsman who was also a photographer, but not an astrophotographer). Inevitably, comparisons of the utility of the two techniques were made. By the 1890s Edward S. Holden would comment that what the keenest observer and gifted artist might accomplish through decades of examination and recording of a single object could be achieved by three or four hours work with an astrograph (Holden 1891). Note that photography did not triumph in results, it seemed to score rather in the area of efficiency. Astronomers were well aware that there were physical differences in the light processing systems (eye and hand vs. lens and plate) which could account for the dissimilarities in drawings and photographs of the same nebulae (Keeler 1895). For some work, such as coronal observations during total solar eclipses, drawing was definitely abandoned in favour of specialized photography in the most technologically progressive "professional" astronomy circles of the last quarter of the 19th century (Pang 2002). For other research, such as planetary observations, drawing played a dominant role till the 1960s (Hockey 1999). Some amateur selenography was of scientific value to the burgeoning space programmes of the late 1950s and early 1960s (one thinks in particular of the work of our honorary member, Sir Patrick Moore). The most impressive example of astronomical sketching surpassing photography in a scientific application is that of the superbly detailed high-resolution sunspot images drawn by Samuel Pierpont Langley during the last quarter of the 19th century – photography did not equal his results till the late 1990s (Wittmann 2000 – Langley was also an honorary member of the RASC). The advent of astrophotography and its successive improvements never did effect the extinction of astronomical sketching – and it is unlikely to do so. The two technologies can now be seen to meet different needs, and should be seen as complimentary, rather than competing.

The RASC record of achievement in astronomical drawing

It is probable that most, if not all, of the active observers in the RASC from its foundation to the death of C. A. Chant (1865-1956),[6] the

launch of Sputnik I and the International Geophysical Year (1957-1958), practiced astronomical sketching to some degree. Evidence of that activity can be found throughout *Looking Up* (Broughton 1994). Nearly all of the images in the Archives from those years are of solar-system objects – it is remarkable that it holds no sketches of deep-sky objects (DSOs) done by the Victorian and Edwardian members of the Society. All of the Messier list and more than a few of the NGC would have been visible in their telescopes. DSOs were certainly recognized as sporting telescopic quarries (Webb 1859; Proctor 1873); the brighter could even be bagged with opera glasses (Serviss 1900). RASC members read, respected and referred to those observing guides. Granted that avocational observing in this period was heavily weighted towards solar-system objects, nevertheless a representative body of sketches should include some DSOs. Perhaps RASC members spent more time on the solar system than did their British, Continental, and American counterparts, or perhaps the sample in the Archives has been skewed by accidents of acquisition or survival. It is not till the 1950s that the Archives can show DSO sketches, namely the acrylic paintings of R. Broadfoot.

The Archives' drawings are by and large of moderate to exceptional quality. The poorest drawing is Sir Adam's transit of Mercury mentioned above, the most exceptional, scientifically and artistically, is John Goldie's paraselene image. The RASC drawings are comparable to the work of members of the Royal Astronomical Society (RAS), the British Astronomical Society, and the Société astronomique de France (SAF), and to drawings published in the American journal *Popular Astronomy*. Some of the drawings by early RASC members are clearly superior to those by famous British men of science issued in the *Monthly Notices of the Royal Astronomical* Society, or *The Observatory* (Huggins 1882; Denning 1904 – William Huggins was also an honorary member of the RASC). On the other hand, no member of the RASC was an astronomical artist equal to the RAS's John Brett, R.A., or the SAF's E.-M. Antoniadi (Brett 1878; Antoniadi 1930). Few of the drawings in the RASC Archives were intended for publication; those from the important Journal Album of the Astronomical and Physical Society of Toronto (A&P) were probably executed in the first instance for distribution and discussion at Society meetings. The majority of the images in this exhibition are drawn from that source. It would be interesting to know more about the history of this album; it seems clear from the back of some of the drawings that they were cut down from larger sheets (some of the A&P ownership stamps now appear

awkwardly placed, and some are partially trimmed off). Was this astronomical scrap book compiled from loose sheets of observations cut to size, or from dismembered observing log books? When did this happen? When the album was new, *ca.* 1890-1910, or later? And why?

There are what appear to be chronological gaps in the Archives' holdings. It is difficult to say whether these reflect fallow periods in the art of astronomical depiction in Canada, or losses due to carelessness or worse with the RASC's documentary heritage during the 1950s or before.

On display are drawings by some figures of renown in the late 19th- and early 20th-century astronomical world: the Rev'd T. W. Webb, Richard Proctor's daughter, Mary, and Dr. John A. Brashear (a museum quality facsimile of Brashear's sunspot drawing has been prepared for this exhibition – to examine it, ask the RASC archivist).

Present and future practice

Astronomical drawing is alive and well in the RASC, although the it has received less notice than ccd imaging. There is no specific and regular RASC forum for discussing astronomical sketching, nor programmes for developing it, although its practice forms a necessary part of the certification for the Isabel K. Williamson Lunar programme, and the Messier and Finest NGC programmes, and it is strongly encouraged by the various RASC observing sections. Prominent current RASC members who have drawn at the eyepiece include Scott Young (Winnipeg Centre), Bill Weir (Victoria Centre), Carl Rousell (Hamilton Centre), Barry Matthews (Ottawa Centre), Gilbert St-Onge (La Société d'astronomie de Montréal et du Centre francophone de Montréal de la Société royale d'astronomie du Canada), and Dr. David H. Levy (Jarnac Observatory, Vail AZ). Two images are included in this exhibition to represent astronomical sketching in the modern RASC; the more important of these is by the late Fr. Lucian Kemble, and it is a model of the use of drawing in a log-book entry.

In the sphere of amateur astronomy it seems that the hand-drawn astronomical image is enjoying something of a renaissance, although ironically that may be due to a very untraditional technology: web-based communication (see the sources in note 3 above). The major change in astronomical drawing that can be foreseen is the increasing melding of 19th-century art methods with modern image processing. This has led in many instances to astronomical drawings which seek more and more to take on the appearance of astronomical photographs, such as the final image in this exhibition. How far that is

desirable is certainly open to debate. Those who have thought deeply about the history of astronomical observation, who themselves are modern observers, and have attempted to understand the work of their predecessors by doing it they way they did, will continue to use both ccd cameras and graphite pencil and paper, drawing rigorously and creatively on all the observing styles, techniques, and technologies available to them. We could do worse than follow in the footsteps of Dr. William Sheehan and Stephen J. O'Meara. *Catalogue and introduction prepared by R. A. Rosenfeld for the History Committee*

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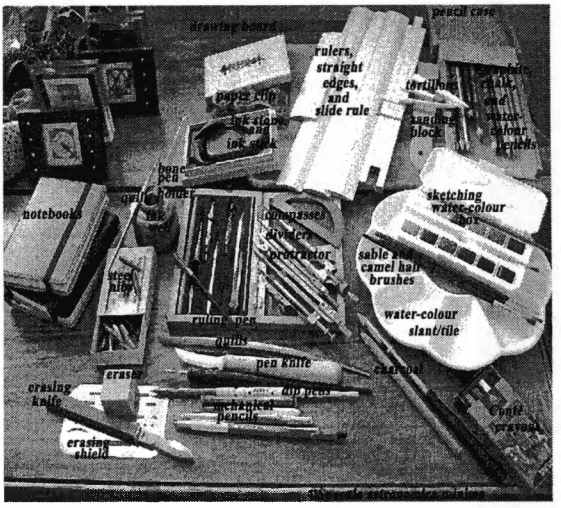
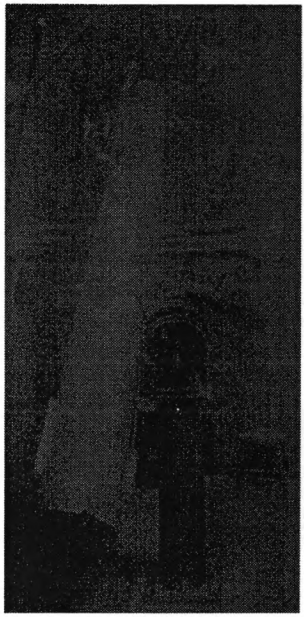
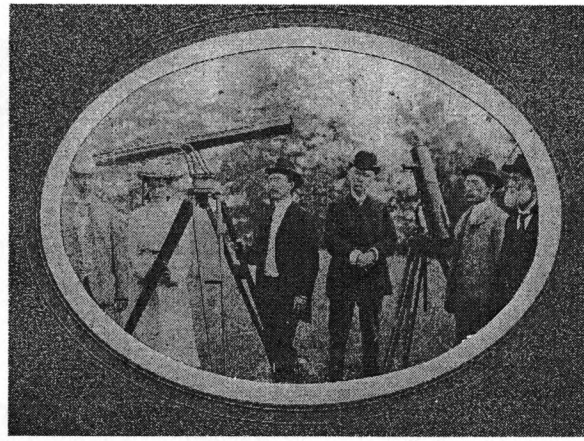
Catalogue

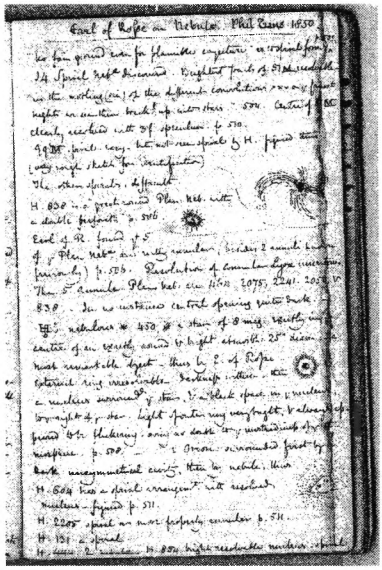


1. Tools for astronomical drawing, *ca.* 1850-1950. A representative collection of the sort of tools used to produce the drawings in this exhibition. These include notebooks, steel nibs, nib holders of bone and plastic (together these form dip pens), goose and crow quills (cut from the actual feathers), penknife, ruling pen (multiple width ancestor of the single-width drafting pen), mechanical pencils of silver, bone and copper-alloy, and plastic, an erasing knife, erasing shield, and gum eraser, a fitted box of German-silver and copper-alloy drafting/mathematical instruments, compasses, dividers, protractor, rulers and straight-edges, a Mannheim type slide rule, a Japanese traveling Suzuribako with ink-stone and ink stick (some astronomers preferred to mix their own ink prior to a night's work), a paper clip and portable writing board, *tortillons* and sanding block (the *tortillons* were used to blend pencil and other dry pigments on the page; the sanding block was used to sharpen or clean pencils of all types, and *tortillons*), a pencil case with numerous graphite, chalk, and watercolour pencils, a traveling watercolour box, sable, and camel hair watercolour brushes, a slant/tile for mixing colours, charcoal and a porte-crayon, and Conté crayons. All of these artifacts work as well now when they were made. Due to the relative conservatism in the functional elements of traditional writing tools modern equivalents of virtually all of these instruments can be obtained today. That conservatism works both ways; the tools used by Charles Messier in the 18th century for his comet and nebula drawings are identical to those show here. The tool and technique which must strike an astronomical artist of today as most alien are the erasing knife, and employing its sharp edge to make corrections in sketches. If used with care the erasing knife is as effective as any modern plastic eraser; in some cases it is much more efficient. The fine blade on an erasing knife allows one to work on an area much smaller than one can with a trimmed vinyl eraser. The user of the knife must remember to re-compress the paper fibres with a burnisher (a smooth small stone will do) to even out the surface and prevent ink seepage. Instead of an erasing knife, some artists in the early 20th century used flexible blades from safety razors. The technique is much safer than it sounds. *Lit.: Pike 1856; Stanley 1878.*



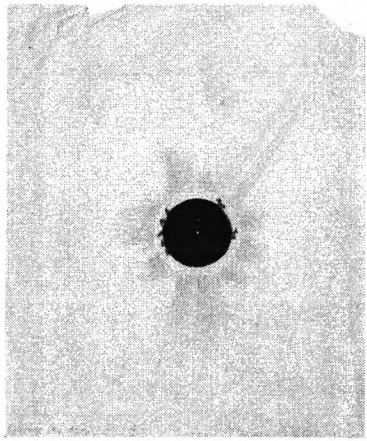


2. RASC Telescopes, *ca.* 1904-1909. The first photograph shows Dr. J.J. Wadsworth's 12.5" (31.75cm) reflector in the observatory in his yard in Simcoe, Ontario (the instrument is sometimes listed as 12" [30.5cm] in the sources). He personally constructed all the optical and mechanical components of the system. It was an impressive amateur telescope making (ATM) accomplishment for a Canadian at the time, and would still have impressed if done during the phase of the ATM movement under Russell W. Porter and Albert G. Ingalls a half century later. The German equatorial mount (GEM) mount was clock driven, and accurate enough to permit astrophotography (Broughton 1994, 138), although the instrument's chief imaging fame is as the research instrument for the selenographers of Simcoe: Cora Beemer, Eva M. Brook (see cat. no. 8 below), and Helen Stennett. The second photograph was presumably shot during a star party (given the photographic technology of the time, it may rather be a shot posed to look like a star party). Of the two instruments shown, one is almost certainly the RASC's 4" (10.16cm) Thomas Cooke achromatic refractor (a higher end version of the period's "common telescope"), and the other is, somewhat unexpectedly, a short focal length reflector, probably with a 3"-4.5" (7.62cm-11.43cm) mirror. The Cooke is on a sturdy altazimuth mount atop a field tripod, and the small reflector may be similarly mounted, although it is difficult to be certain. Out of the five historically significant "common" amateur telescopes belonging to the RASC in 1904, the Cooke is the only one still in the possession of the National Society. The BAA have been more successful in preserving their heritage of instruments than has the RASC. *Lit.: Harvey 1904.*



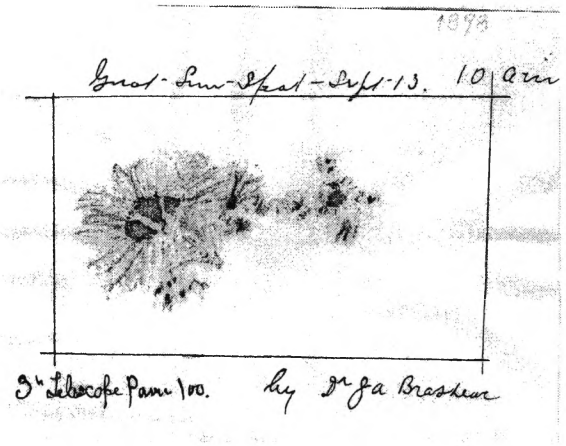
3. Page from a notebook of the Rev'd T. W. Webb. "Astronomical Index". Pen and India ink on paper. Bound in full leather covers. Individual folios 4.5"x7.125", with some irregular pages. Contains some sketches of nebulae. *ca.* 1855-pre-1885. Webb (1807-1885), although not affiliated with the RASC, enjoyed immense respect among its members, primarily for his legendary general observing guide (Webb 1859). Webb was a skilled observer and an early champion of silver on glass reflectors. The RASC acquired this Webb notebook in 1910 through a gift of the prominent Hamilton Centre member G. Parry Jenkins, FRAS. Jenkins acquired the book in Hereford in 1889, where he lived for a time and was a friend of the great telescope maker G. H. With, who was also a close personal friend of Webb's. Both Webb and Jenkins used telescopes by With. Like many of Webb's surviving notebooks, the RASC volume bears the marks of a carefully executed production, giving the impression of a finished product, rather than of rough working notes. This is clearly not an observational notebook, but a record of his varied reading in the astronomical literature, intended as an important research tool for his research and writing. More research on the text is required, but it seems likely that Webb used this notebook in the composing of his epochal *Celestial Objects for Common Telescopes*. The book bears signs of use, among which is a further level of organization imposed on the contents; Webb has assigned different-coloured markings to some of the sources. On the page exhibited here the nebula sketches are meant to be quick visual reminders of some of the drawings published by Lord Rosse (Rosse 1850). In descending order down the page these are M99, M97, NGC2392, and NGC1980. Webb himself describes the first of his drawings here as a "very rough sketch for identification". From the standpoint of likeness to Rosse's images, they are rough; the first two are certainly closer to Rosse's drawings than are the last. Webb's sketches are perhaps best viewed as diagrammatic, almost like "icons" through which he can access the Rosse images filed in his memory. They are not unattractive, and add a certain interest to the page. They also signal that those images and Rosse's arguments regarding them were particularly important to Webb,

for none of the other entries are illustrated in the same way. A preliminary examination revealed no underdrawings, *pentimenti*, or pencil marks which had escaped inking, so it is likely these sketches were *truly* drawn as freehand sketches, without any preliminary layout. *Lit.: Chant 1910b; Robinson and Robinson 2006.*

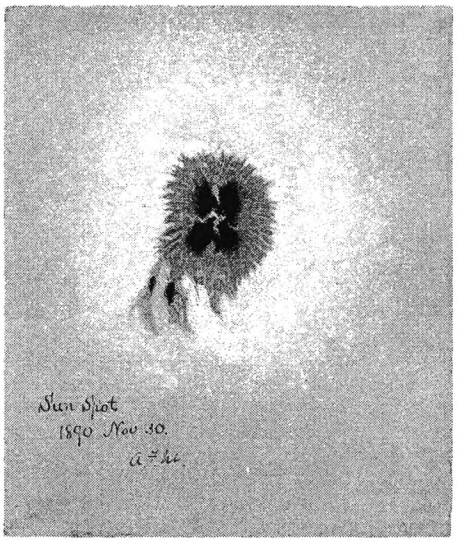


4. Coronal streamers and solar prominences at totality during the solar eclipse of 9th August, 1896, by Mary Proctor. "Corona as seen Aug 9th". Compasses, graphite pencil, and watercolours on paper. 4.563"x5.563". Mary Proctor (1862-1957) was a daughter of the noted English astronomical author and lecturer Richard Proctor (1837-1888). Mary followed in her father's footsteps, becoming a noted popularizer of astronomy. For many of the "quality" New England papers from the late Edwardian period to the end of the Great Depression she fulfilled the role Helen Hogg played at the Toronto Star decades later. In addition to her astronomical journalism, Mary led eclipse expeditions for amateurs. This drawing was done in the period just before her rise to prominence as an astronomical personality. It is typical of amateur sketches of eclipse phenomena in the period *ca.* 1860-*ca.* 1929. It is not known how the RASC acquired this image. It may have been from a member who was on this, or a subsequent eclipse expedition with Mary, or it may have been given to the Society in the early 1970s by Richard and Mary's relative, Douglas Richard Proctor (Darby) Coats, a three- time President of the Winnipeg Centre (Broughton 1994, 198). Mary prepared the image by first inscribing the circle for the occulted solar disc—and, curiously, for the inner corona—with a pair of compasses and a pencil. She may next have coloured the occulted disc in black, possibly even prior to the eclipse. The coronal streamers were then drawn, and finally the solar prominences were painted in watercolour directly without underdrawing in pencil. The work sequence can be established through the overlapping of the various media: the placement of the coronal streamers and the solar prominences require the circles to be drawn first; there are traces of damage from small water droplets near the beginning of some of the streamers; the black watercolour overlays the pencil, and the red watercolour overlays the black. Approximately indicating the area of the inner and middle coronas with a pair of compasses, and leaving the area blank seems a strange strategy. It may indicate that she was not interested in those coronal sections, or that the sketch was left unfinished. Mary Proctor did not have a lot of time to work; the duration of totality was 2' 43". She may have done some of the work from memory

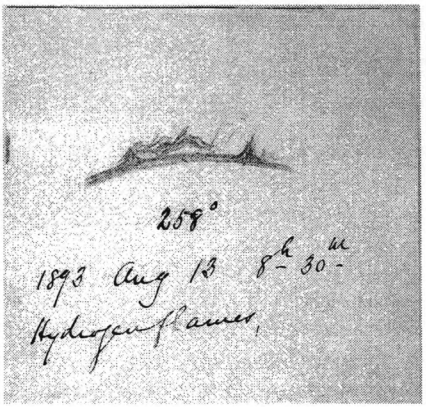
and textual and graphic notes immediately after the eclipse, as was (and is) the practice of many experienced observers (Pang 2002, 90, 105; Warner 1983, 111). *Lit.: Kidwell 1984.*



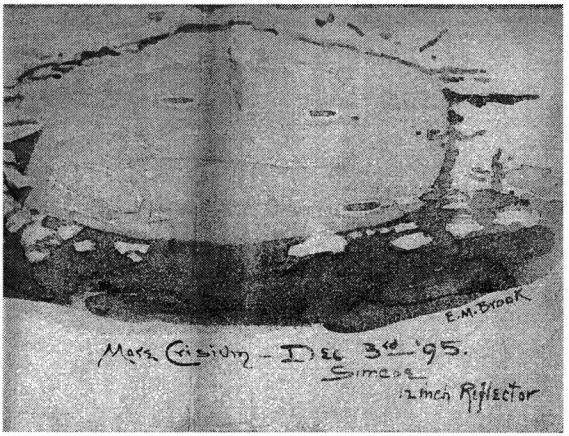
5. Great sunspot of 1898, by John A. Brashear. "Great-Sun-Spot—Sept-13. 10 am/ 3" [7.62cm] Telescope Power 100 by Dr J A Brashear". Graphite pencil, and pen and India ink on paper. 4.125"x5". Brashear (1840-1920), a confirmed autodidact trained as a mill-wright, became one of the outstanding telescope makers of the later 19th and early 20th century. He was also one of the most attractive characters in the firmament of North American astronomy at the time. Throughout his life, even after he became a key supplier of advanced optical systems to those on the cutting edge of the nascent discipline of astrophysics, he still took great pleasure in recreational observing. His relations with Canadian astronomers, professional and amateur, were very good. His firm provided the optics for the 15" (38.1cm) refractor of the Dominion Observatory (1905) in Ottawa (the objective is now in the collections of the Canadian Museum of Science and Technology), and figured the 72" (1.83m) mirror of the Plaskett telescope (1918) for the Dominion Astrophysical Observatory in Victoria (the mirror is on display as part of the Centre of the Universe educational facility there). Brashear was an honorary member of the RASC who actually took an active part in the Society, occasionally meeting with members and writing for the *Journal*. He and his family would vacation on their island in Muskoka, "Urania's Isle". Brashear writes: "I had, of course, a little telescope to use at Muskoka. It was mounted on a tripod on the porch of the cottage, and people used to come in their boats on fine nights to get a peep at whatever they could see" (Brashear 1924, 155). It was probably with that telescope that Brashear did the drawing exhibited here (September 1898 was either just after or just before he and his wife purchased "Urania's Isle"). Brashear's training as a mill-wright meant he had to acquire a facility in reading (and presumably executing) technical drawings. His skill with the pencil is obvious. The rapid development of the Great Sunspot of 1898 was particularly noted. The Society acquired this and another drawing by Brashear from the artist himself, who sent them to the RASC as an observing report (Harvey 1899). The image exhibited here is of a museum quality facsimile prepared for this exhibition (to examine it, ask the RASC archivist). It was drawn from a photocopy in the RASC Archives; the original is now in the National Archives of Canada. *Lit.: Brashear 1924: Enright 2007, 63-68.*



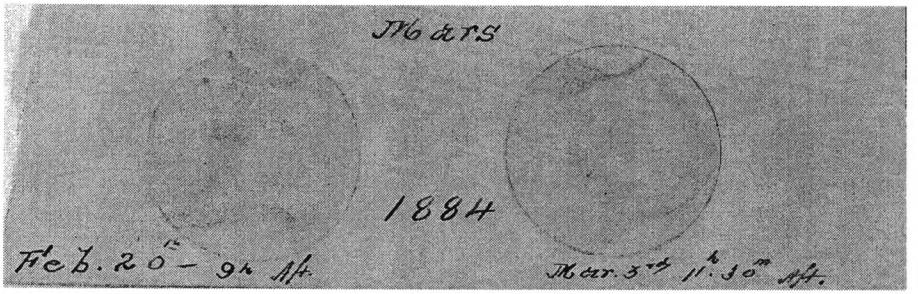
6. Sunspot drawing of 1890, by Allan F. Miller. "Sun Spot/ 1890 Nov 30./ A.F.M." watercolours on watercolour paper. 5.69"x7". A. F. Miller (1851-1947) was one of the most accomplished amateur members of the early RASC. His observing abilities and astrophysical knowledge led to his being appointed to the IAU. Miller was RASC President just after the Great War. His own private observatory was equipped with an excellent 4" (10.16cm) achromatic refractor by Wrey on a GEM, equipped with a filar micrometer (an expensive accessory, but much more common a century ago than today), and a Browning star spectroscope. Miller's observatory was located on Carlton Street, in what is now downtown Toronto (the Wray telescope is now on display at the Centre of the Universe educational facility in Victoria, keeping company with the 72" Plaskett's original mirror). This would have been an excellent instrument for solar work. The Archives have several of his sunspot watercolours. He was a skillful astronomical watercolourist (see cat. nos. 7, 9-10 below). No underdrawing is visible; Miller may have had sufficient confidence to dispense with that stage. The lighter tones of brown in the penumbra seem to have been laid down first, followed by the dark of the umbra, and finally the white highlights. This sequence, revealed by low-power microscopic examination of the paint layers, would be hard to lay down without the guidance of a cartoon. Particularly effective is the use of white to depict the solar granulation. It is too precise and controlled to have been done with a spatter technique. Lit.: Broughton 1994, 137.



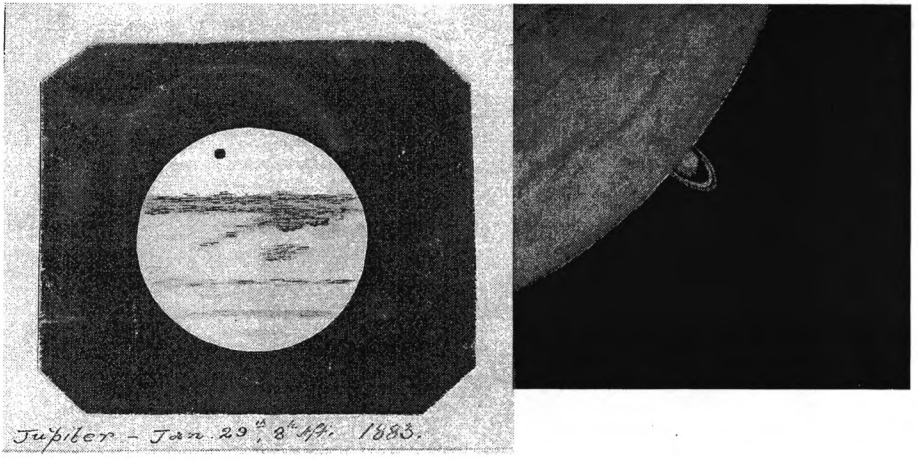
7. Hydrogen flares, 1893, by Allan F. Miller. "258°/ 1893 Aug 13 8h 30m/ Hydrogen flares,". Pen and India ink, and crayon on paper. 4"x5". Presumably done with the same equipment as cat. nos. 6 above, and 9-10 below. It is just remotely possible this observation was made in white light; could it have been made spectroscopically?



8. Mare crisium (Sea of Tears), by Eva M. Brook. "Mare Crisium – Dec 3rd'95./ Simcoe/ 12inch [sic.] Reflector/ E. M. Brook". Graphite pencil and watercolour on thick-weight J. Whatman watercolour paper (watermark partially visible). 10"x13". Eva Brook was one of the Simcoe selenographers mentioned in cat. no. 2 above. This painting is the largest example of their work in the RASC Archives. An underdrawing was first done with the pencil, and the rest was done in a grisaille wash. The natural colour of the paper was used for the white highlights. Lit.: Broughton 1994,45, 138.

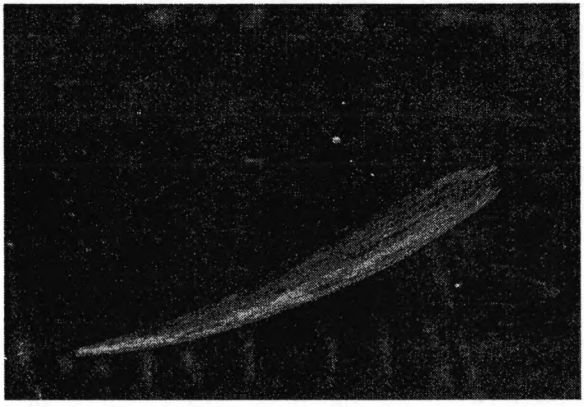


9. Mars 1884, by Allan F. Miller. "Mars/ 1884/ Feb. 20th – 9h Aft. Mar. 3rd 11h.30m Aft./ 4 in. Wray Achromatic – Power 200.". Compasses, graphite pencil, pen and ink, and watercolours on thick-weight watercolour paper. 1.44"x4.5". On Miller, see cat. nos. 6-7 above, and 10 below. The planetary discs was first drawn with the compasses (first in pencil, then with a light ink), then the very dilute watercolours were laid down. The natural colour of the paper was used for he polar caps. The muted tonal range, and the cryptic "9h Aft." and 11h.30m Aft." are suggestive of daytime observations, yet Mars did not rise by those times on the dates indicated.

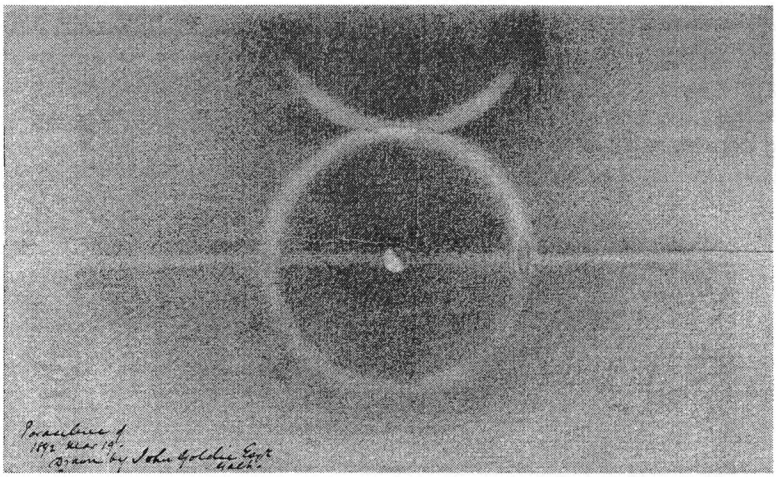


10. Jupiter with dark spot, and Occultation of Saturn by the Moon, 1883, by Allan F. Miller. "Jupiter – Jan. 29th, 8h Aft. 1883", and "Occultation of Saturn by the Moon./ 1883 April 9d 8h 33m 35s. Aft./ Toronto Mean Time." Compasses, graphite pencil, watercolours, and watercolour papers, scissors, and glue. 2.69"x3.19" (Jupiter), 2.25"x2.5" (Moon and Saturn). On Miller see cat. Nos. 6-7, 9 above. The image of Jupiter shows either one of the dark spots also reported by contemporary British observers, or a satellite in transit across the disc. The planetary discs were first drawn with compasses and graphite (the oblateness of the discs can be achieved by modifying the compass drawn circle). For the Jovian image the yellows were laid down first, followed by the whites, and ending with the darker colours. In the lunar occultation, the lighter colours of the Moon were laid down before the darker, and for Saturn, the first layer of colour was the yellow, followed by the greys and blacks. Note the fineness with which Cassini's

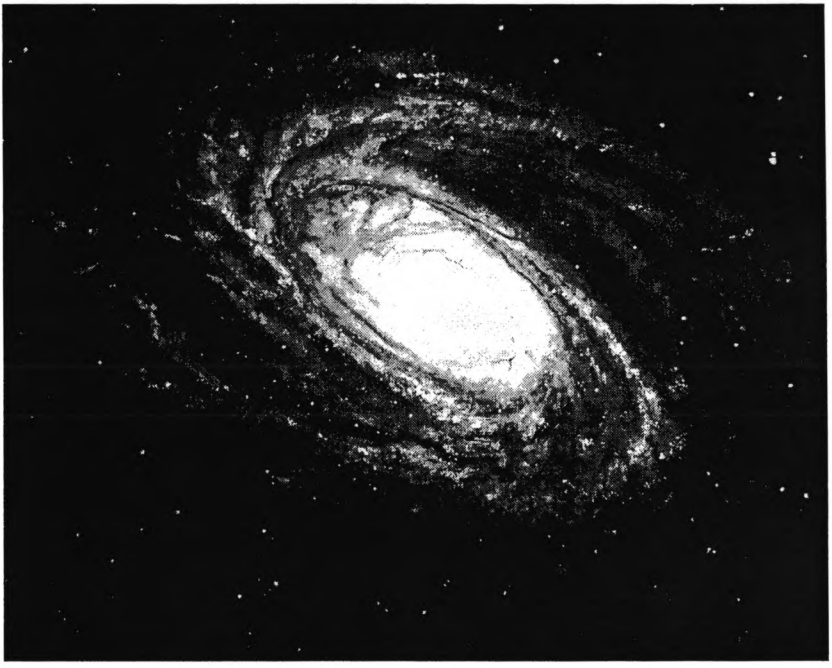
division has been drawn. The background for both, interplanetary space, is rendered in black watercolour. Both paintings are actually appliqués. The planetary discs were carefully cut out, and glued onto the black-painted background representing interplanetary space. The diminutive image of Saturn was cut out separately from the Moon. The cutting, presumably with sharp fine-bladed scissors, and the aligning and gluing were done with considerable adroitness. A trace of the glue line can be detected. *Lit.: Broughton 1994,140; Hockey 1999.*



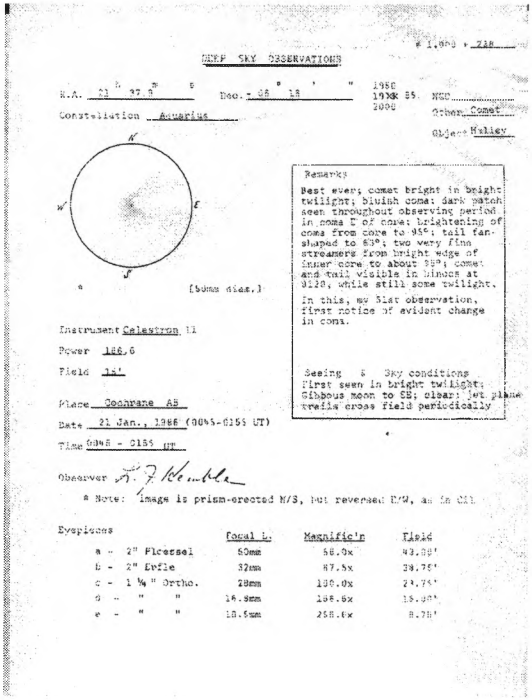
11. Unidentified comet in starfield, anon., late 19th-early 20th century. Watercolours on black paper. 6.5"x7.69". There are no annotations on the image or the page on which it is mounted to aid in the identification of either the comet, or the artist, and no details of the instrument used (if any), or the circumstances of the observation. The image is quite competently done, and is comparable to similar Victorian and Edwardian images of comets. The proportion of head to tail, and its general shape are reminiscent of Donati's comet (C/1858 L1, 1858 VI), yet the curve of its tail is reversed, which seems an odd graphic strategy for portraying a naked-eye comet. The curve is approximately right for the Great Comet of 1882 (C/1882 R1, 1882 II), yet their tails, particularly towards their termini, are unalike. In the RASC comet drawing only two relatively bright stars are shown, and not enough others to suggest an identifiable asterism. The combination of grey tones with a blueish cast, together with the white highlights is reasonably effective. No trace of underdrawing is discernible. *Lit.: Olson 1985; Olson and Pasachoff 1998.*



12. Paraselene, 1892, by John Goldie. "Paraselene of/ 1892 Mar 19./ Drawn by John Goldie Esqr/ Galt.". Graphite pencil, crayons, compasses, straightedge, pen and India ink on paper. 7.25"x10.75". This is both the most accomplished drawing in this exhibition (and in the RASC Archives), and the most scientifically significant. Goldie was a member of a prominent Galt family whose patriarch, also named John, made several notable contributions to botanical science. In this image, John Goldie the astronomer has captured a relatively rare atmospheric phenomenon, a paraselene, which is the lunar equivalent to the ice halos, parhelia (sundogs), and associated phenomena caused by the refraction and reflection of sunlight by very small atmospheric ice crystals. When solar or lunar ice halos and associated phenomena occur, the sun or moon is usually low in the horizon. In Goldie's drawing one can see a circumzenithal arc, a 22° halo, a paraselenic circle, and paraselena (moon dogs). The detection of colour by the eye during these phenomena, as in the paraselena here, is most rare. Goldie first constructed the main geometrical features with a pair of compasses and a straightedge. He then did the elaborate shading with the graphite pencil, using his considerable skill in cross-hatching to create local variations in the darkness of the sky. He finished the drawing by adding the colours with the crayons. This image has never been published, to our knowledge.



13. Spiral galaxy in Ursa major (M81), by Raymond Broadfoot. "M81 by R. Broadfoot presented to R.CASC [sic.] June 1956". Acrylic on canvas. *Ca.* 10"x15". Raymond Broadfoot was instrumental in reviving the practice of regular observing groups in the mid-1950s in the Toronto Centre, and he served as National Treasurer for a time in the mid-1960s. His painting of M81 (NGC 3031, a type Sb spiral) is one of three he donated to the National Society, and they have hung in the National Office ever since, at 252 College st., 124 Merton, and at 136 Dupont. Broadfoot's series of paintings are not based on his own observations through modest amateur telescopes, but are his interpretations of classic photographic images captured by the big reflectors of the first half of the twentieth century. They resemble the sort of images taken by Ritchie with the 60" (1.5m) reflector on Mount Wilson. One suspects Broadfoot's painting is based on one or more of the images taken either with the Hooker 100" (2.54m) at Mount Wilson, or with the Hale 200" (5.08m) at Mount Palomar. He has clearly tried to reproduce the effect of an astronomical photograph of that time. The effort is quite successful; there is a certain technical virtuosity in achieving the apparent high realism of photography by non-photographic means. Broadfoot has saved his image from being merely that, by giving it a certain extra dynamism. Exactly how is difficult to pinpoint, but it may have something to do with his choice of brush strokes, and the rhythm in the layering of colour – or not. He probably prepared a cartoon, either freehand with a pencil directly on the canvas, or he may even have used the Renaissance expedient of transferring the outlines of the design to the canvas with pounce applied to a cartoon (in this case a photograph) with tiny holes around the contours of the image. He would then proceed to add the layers of paint (but not very thickly to avoid an *impasto* effect). It is worth asking again: should a drawing or painting aspire to be as close as possible to a photograph? What is one doing when one does that? *Lit.: Broughton 1994, 66, 270.*



DEEP SKY OBSERVATIONS

1,000 + 238

R.A. 22 h 37.8 m s Dec: + 08 ° 18 ' " 1950 1983.5 2000 NGC ..... Other Comet

Constellation Aquarius Object Halley

N W E S

(Coma diam.)

Remarks

Best ever; comet bright in bright twilight; bluish coma; dark patch seen throughout observing period; in coma I of coma; brightening of coma from core to 45"; tail fan-shaped to 60°; two very fine streamers from bright edge of inner core to about 30'; comet and tail visible in binocs at 0120, while still some twilight.

In this, my 51st observation, first notice of evident change in coma.

Seeing 5 Sky conditions First seen in bright twilight; Gibbous moon to SE; clear; jet plane trails cross field periodically

Instrument Celestron 11

Power 166.6

Field 15'

Place Cochrane AB

Date 21 Jan., 1986 (0045-0155 UT)

Time 0045 - 0155 UT

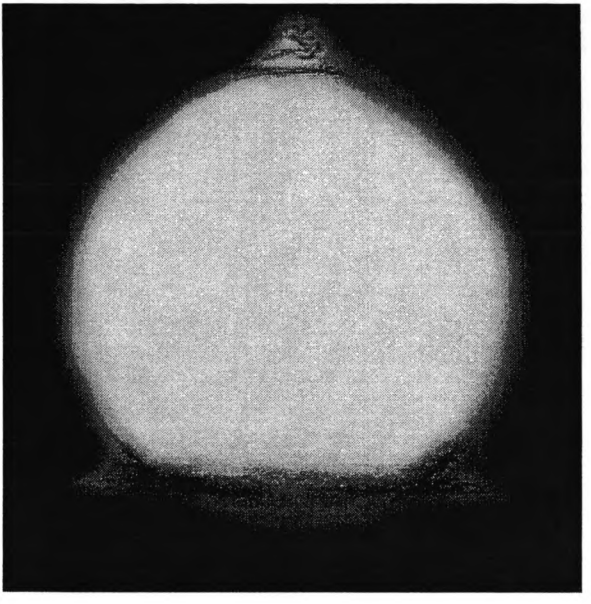
Observer F. J. Kemble

a Note: Image is prism-erected N/S, but reversed E/W, as in Cit

Eyepieces	Focal L.	Magnific'n	Field
a - 2" Plossel	50mm	58.0x	43.08'
b - 2" Erfle	32mm	87.5x	28.75'
c - 1 ¼ " Ortho.	28mm	100.0x	23.76'
d - " "	16.9mm	196.6x	15.08'
e - " "	10.5mm	258.6x	8.75'

14. Halley's Comet, 1986, by Fr. Lucian Kemble, ofm. "Deep Sky Observations/ #1000+238/... Constellation Aquarius Comet/ Halley/... Cochrane AB/ 21 Jan., 1986 (0045-0155 UT)". Graphite pencil on photocopied observing form. Ca. 8.5"x11". Fr. Lucian Kemble (1922-1999) was a Franciscan friar, and a noted deep-sky observer. He was the discoverer of the asterism "Kemble's Cascade" in the constellation Camelopardalis (1980), and was awarded the RASC's Ken Chilton Prize for his thousands of astronomical drawings and the observational perspicacity they demonstrated (1989), and the Webb Society's Award of Excellence (1997). And he was dedicated to helping others see what he saw. He commonly used binoculars, and for a long time a 5" (12.7cm) Schmidt-Cassegrain telescope (SCT). Later he installed an 11" (27.94cm) SCT in his Roger Bacon Observatory (named after a 13th-century English Francsican natural philosopher). The drawing chosen for this exhibition is one of over fifty observations of Halley's comet he had made to that date. He was able to capture its evanescent and mutable features expertly. What marks his image off from those of RASC observers' of the previous apparition is its setting on the page; in those seventy-six years the comet sketch is now embedded in a standardized observing form.[7] The format forces a certain rigour in the noting and presentation of information. The form imposes a routine for filling in the fields: down the page, and left-to-right. Of course, one is free not to follow that order strictly (an order to which countless non-astronomical forms have conditioned us), but it is different with the fields. There is a twinge of guilt if one leaves some of them blank. The imposition of greater rigour is not a bad thing, and the consistent entries eases the comparison of observations, and their subsequent conversion to other formats for analysis. Our present practice does

not give us license, however, to assume that just because a Victorian observer didn't use a well-ordered printed observing form, that he or she was incapable of noting the things we record. Fr. Kemble's record of his observation of Halley's comet exhibited here is exemplary for how the modern form can integrate written and visual data. *Lit.: Bergbusch 1999.*



15. Green flash at sunset, 2007, by R. A. Rosenfeld. "Green Flash/ setting Sun/ 16.3.'08". Compasses, graphite pencil, and crayons on light-weight watercolour paper, with minimal image processing. 4"x4.94". This drawing records one of the more common varieties of the green flash, the mock mirage. Green flash phenomena are effects of atmospheric refraction which may be seen fleetingly at sunrise and sunset, if conditions are favourable. This was observed during sunset on March 16, from an elevated position in Toronto with a clear view to the Western horizon (a rare circumstance!). For those interested in pursuing the green flash, Fr. O'Connell's classic monograph (1958) can now be consulted online at http://adsabs.harvard.edu/abs/1958RA.....4.....O (note: the images have not been optimally reproduced), and an excellent up-to-date presentation of the phenomena is on Andrew T. Young's website http://mintaka.sdsu.edu/GF/index.html, complete with animated gifs and photographs, critical discussions of modern theories, and bibliographical and observing resources. The equipment used was a 3.15" (8cm) f.6 semi-apo refractor (shades of the "common telescope" of a century before), an objective filter of Baader Astro-Solar Safety film, a 25-mm Plössl eyepiece, and an no. 12 Wratten filter.[8] The solar disc was drawn with a pair of compasses and then distorted to the observed amount with a graphite pencil, the colouring of the solar surface followed, then the green flash, and finally the dark distortion of the solar disc at the bottom. The image processing software was used principally to create the dark background as seen through a full-aperture solar filter. The choice of support was not an entirely happy

one; the rough surface texture of the paper is still discernible beneath the colouring of the solar disc. The moment depicted is that perceived just as the momentary green flash vanishes; it give the impression of disappearing upwards. It must be admitted that this image is the most egregious example in this exhibition of a drawing given a photographic appearance. It is something which has gotten much easier with modern image-processing software, and reflects a trend which can be seen in many of the current astronomical sketches on the web. The artist of this image has grave reservations about the practice, particularly if it drives out earlier ways of depicting astronomical phenomena. For excellent examples of fine work firmly rooted in the lively and functional tradition of astronomical drawing, see http://mthamilton.ucolick.org/public/TwoWeeksOnMars/.

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Notes

1. To our knowledge no serious commentator has attributed extant astronomical imagery to extinct fossil hominid species (*i.e.*, *Homo sapiens neanderthalensis/H. neanderthalensis*), yet serious claims for the creation of astronomical art at sites like Lascaux *ca.* 20,000-15,000 *B.P.* have been advanced on behalf of our upper-paleolithic ancestors (Rappenglück 1999). Such claims are best met with interested scepticism.

2. *E.g.*, the 150-Foot Solar Tower Current Sunspot Drawing (http://astro.ucla.edu/~obs/cur_drw.html), or the reports of the various observing sections of the British Astronomical Association, for which see the JBAA.

3. For a modern instructional guide see Handy *et al.* 2007 (*n.b.*, there are other effective technical approaches than those described in this book). For a collection of modern examples of astronomical sketching, see the Astronomy Sketch of the Day site (http://www.asod.info/), and for an active web community there is a dedicated Cloudy Nights forum (http://www.cloudynights.com/ubbthreads/postlist.php/Cat/0/Board/Sketching). Jeremy Perez maintains an excellent collection of web resources on all aspects of astronomical sketching (http://www.perezmedia.net/beltofvenus/archives/000567.html).

4. For technical reasons it has not been included in this exhibition.

5. Hence the title of Webb's celebrated handbook: Webb 1859.

6. Published examples of Chant's drawings can be found in *JRASC*; Chant 1910a (Halley's comet on its 1910 apparition).

7. Some professionals at some of the larger institutions were apparently using forms by the mid 19th century (Airy 1896).

8. Mention of filters highlights another interesting change in the craft of observing. Various filters for solar work were employed in the 19th century. This was not the case with filters for planetary work. They are ubiquitous now, yet they were apparently not regularly used by the Victorians and Edwardians; none of the various editions of Webb's handbook recommend them. Nineteenth-century instrument makers certainly possessed the technologies for producing usable planetary filters, had the astronomers desired them.