The Amateur's Moon:
British selenography and the BAA Lunar Section

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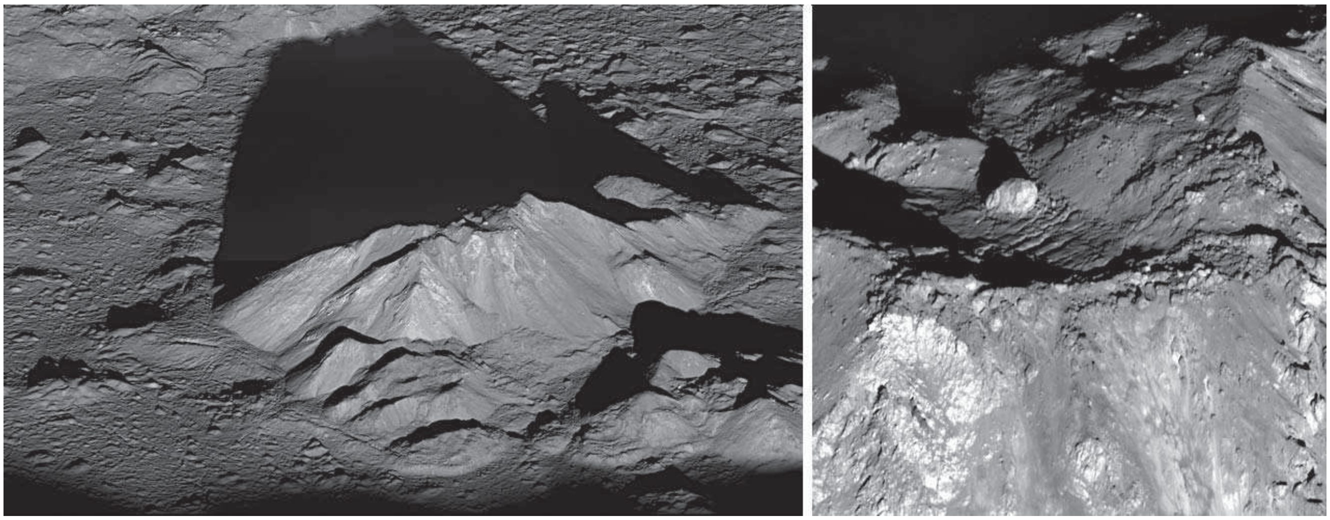

Figure 1. The central peak of Tycho. ***NASA LROC image.***

Beginning his presentation at Astrofest in 2011, the American lunar scientist Chuck Wood paid fulsome tribute to the contribution made to the history of selenography by the BAA Lunar Section, 'the longest-existing organisation that has actively promoted observation of the Moon. It encouraged study of the Moon over decades when no-one else seemed interested'.[1]

Wood is perhaps the best-known contemporary figure in the world of lunar studies, and his appearance at Astrofest reminded me of the extent to which lunar science has become professionalised in the last few decades. It is true to say that cutting-edge lunar research today is conducted largely on the basis of results from spacecraft, albeit by both professionals and amateurs. NASA's *Lunar Reconnaissance Orbiter* (LRO) is only one of several recent successful missions,[2] but its results to date show the extent to which we now rely on spacecraft data, ranging from magnificent high-resolution imagery (see, for example, the close-up of Tycho's central peak in Figure 1) to invaluable datasets that allow us to model relief and other maps of the lunar surface.

But it was not always thus. The history of selenography before the space age is the story of dedicated amateurs and their efforts to understand our nearest neighbour, at a time when that neighbour was almost completely neglected by professional scientists. Key roles were played in particular by German and British observers, possibly as a result of the superior telescopes being produced in those countries by the likes of Fraunhofer, Cook, With and Calver, etc. A list of the most prominent German selenographers would include Tobias Mayer, Johannes Schröter, Wilhelm Lohrmann, Beer & Mädler, Julius Schmidt, Johann Krieger, and Philip Fauth; but it is certainly the case that by the late nineteenth and early twentieth centuries the most significant contributions were also being made by British amateurs and by the BAA Lunar Section. It is that legacy I wish to analyse in this address.

British selenography before the BAA

This is not the place for a full history of lunar observation, and in any case that task has been carried out by Bill Sheehan & Thomas Dobbins in their fine book *Epic Moon* (2001).[3] But we should pause here to acknowledge briefly the contribution made by those early British selenographers whose work contributed to the emergence of three themes that, as this address will argue, came to distinguish later British lunar study and define its essential character. Those themes were:

– an emphasis on a primarily cartographic approach to lunar study;
– an enduring romantic belief in the possibility of lunar change (and even lunar life); and
– a general preference for volcanic, rather than impact, theories of lunar surface formation.

Thomas Harriott and lunar cartography

We shall consider in due course why cartography should have become the dominant mode of lunar study, but we should acknowledge at once that the first lunar cartographer was British. Thomas

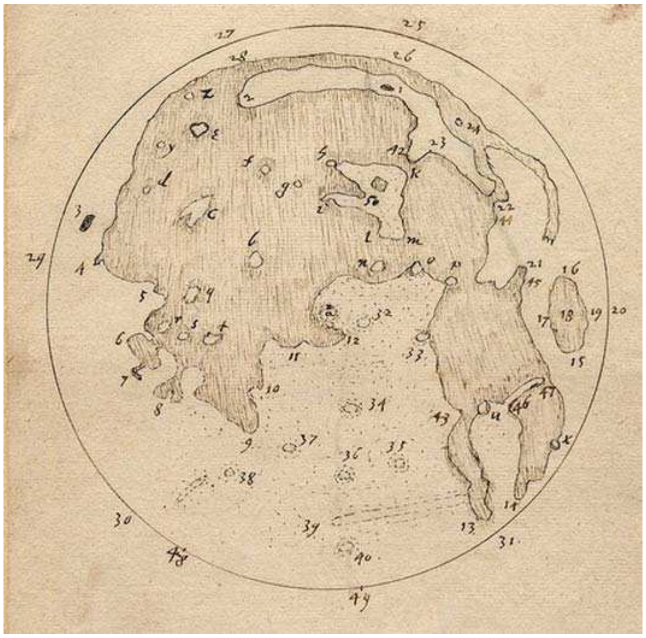

Figure 2. Thomas Harriott's lunar map, 1610.

Harriott (1560–1621) was an associate of Sir Walter Raleigh and Christopher Marlowe. He first turned his rudimentary telescope to the Moon on 1609 July 26 – some four months before Galileo's observations – but he did not see fit to publish his chart until the summer of 1610, by which time Galileo's drawings of the Moon had already appeared and, in Sheehan & Dobbins' memorable phrase, 'boldly annexed its landscapes for the human imagination'.[4] Harriott's is an accurate enough little chart (Figure 2), and its features are readily recognisable to the modern observer, but it illustrates the force of the dictum 'publish or perish', for Harriott's achievements are now largely lost to the popular imagination.

William Herschel and lunar changes

Much more familiar is the name of William Herschel (1738–1822), although not primarily as that of a lunar observer. Widely acknowledged as the 'father of stellar astronomy' and discoverer of the planet Uranus, Herschel's lunar work is less widely known. Perhaps that is just as well, for his early lunar observations included the 'discovery' of trees and forests of gigantic proportions in the vicinity of Gassendi and the Mare Humorum (Figure 3),[5] as well as other indications of lunar life, including intelligent life which Herschel considered to be 'a great probability, not to say almost absolute certainty'.[6]

Figure 3. William Herschel's depiction of forests near Gassendi, 1776.

Herschel also argued the case for active volcanism and topographic change on the lunar surface, observing in 1787 three glowing 'volcanoes' on the Moon's dark hemisphere – almost certainly the bright ray craters Aristarchus, Copernicus and Kepler, illuminated by earthshine. Indeed, if we leave aside Robert Hooke's 'bubble' theory of crater formation a century or so earlier, Herschel might well be regarded as the first 'British' selenographer to argue for a volcanic theory of crater formation – a view that, as we shall see, came to dominate and shape nearly all later British thinking about the nature of the Moon.

Nasmyth & Carpenter and lunar volcanism

Analogies between the craters of the Moon and known terrestrial volcanic features were drawn by several subsequent British scientists, including the Rev. William D. Conybeare (1787–1857),[7] the Rev. T. W. Webb (1807–'85),[8] Sir John Herschel (1792–1871),[9] John Phillips (1800–'74),[10] and Edmund Neison (1849–1940), the greatest of the pre-BAA British lunar mappers.[11] However, it was the team of James Hall Nasmyth (1808–'90) and James Carpenter (1840–'99) who, in their monograph *The Moon: Considered as a Planet, a World, and a Satellite* (1874), first paid proper attention to what they called the 'causative phenomena' giving rise to the features observed on the lunar surface.[12]

Nasmyth was a Scottish engineer, the inventor of the steam hammer and an amateur astronomer; Carpenter was a professional astronomer working at the Royal Observatory, Greenwich. Between them they recognised, as others had done before, that there were significant differences between the craters of the Moon and terrestrial calderas, especially in scale; and they set out to explain those differences and advance a coherent theory of lunar crater formation by volcanic means. This is not the occasion to explore their results in detail; suffice to say that they saw lunar craters as ring formations created as the result of a volcanic 'fountain' mechanism (see Figure 4).

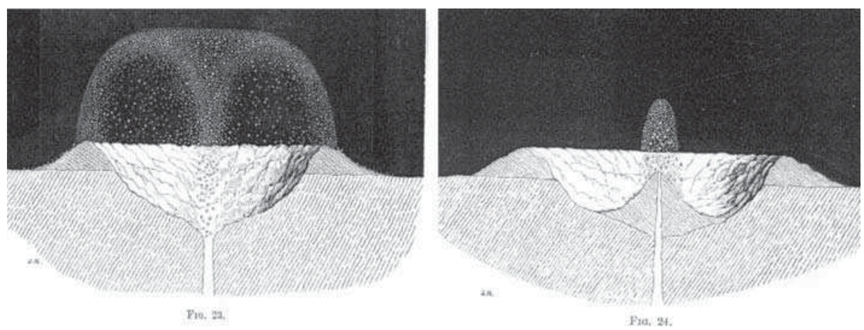

Figure 4. Nasmyth & Carpenter's 'fountain' theory of crater formation.

Their theory was deeply flawed; for a start it did not fit the observed facts, especially with regard to the heights of crater floors relative to surrounding terrain. Nor was there any evidence of equivalent volcanic mechanisms on Earth that might serve as models for what was being hypothesised on the Moon. Nevertheless, their work set the pattern for subsequent British thinking on the origins of lunar craters right through to the advent of the space age: from Nasmyth & Carpenter in the 1870s to Moore & Cattermole in the 1960s, volcanic theories would hold sway. The only significant British proponent of impact theory was Richard A. Proctor, better known for his book on Saturn.[13]

It was left to others to defend the impact hypothesis – most notably, the American geologist Grove Karl Gilbert (1843–1919) and the American businessman and planetary scientist Ralph Belknap Baldwin (1912–2010), whose groundbreaking book *The Face of the Moon* (1949) essentially got most things right.

One explanation for why the volcanic theory should have been favoured by British observers over impact theory is that the latter inevitably implies an essentially dead Moon, a celestial museum displaying the scars of a violent, but long-gone, past. Volcanism, on the other hand, holds out to the telescopic observer the alluring possibility of continuing change and activity – a much more exciting prospect.

Exploring and mapping unknown landscapes

Thus at the time of the formation of the BAA in 1890, selenography in Britain was essentially cartographic, driven by the conviction that the Moon's violent volcanic past was not entirely dead and that changes continued to manifest themselves, albeit on a relatively small scale when compared to the past. The attention of observers was focused on areas suspected of change, such as Linné (following Schmidt's announcement in 1866 October of structural change in that crater). Further structural changes were reported in the 'twin' craters Messier and Messier A, while the floor of Plato was suspected of being susceptible to mists and outgassings that obscured from time to time the small craterlets visible upon it. Hermann Klein's 'discovery' in 1878 of what he took to be a new crater near the Hyginus rille also continued to engage the interest of telescopic observers.[14]

The quest for fine detail

But if such small 'changes' were to be identified with certainty, good and highly detailed reference maps would be needed. Thus, as Sheehan & Dobbins point out, 'the stage was set for the future direction of selenographical studies: observations must focus more and more closely on minute detail. Indeed, the obsessive pursuit of detail became – with a vengeance – the preoccupation of many of the selenographers who worked the field'.[15] The *descriptive* account of the minutiae of the lunar landscape thus displaced all attempts to *interpret* the whole, and this tendency shaped the activities of the BAA Lunar Section for much of the twentieth century.

However, the obsession with detailed lunar mapping may be explained in yet another way, for it represents a further example of the essentially *geographic* approach to the telescopic study of other worlds that was so characteristic of late nineteenth- and early twentieth-century solar system astronomy. Here I shall draw to an extent upon the arguments of Maria Lane's fine recent study *Geographies of Mars* (2011), since much of what she writes about the Red Planet may be applied equally to how the Moon was studied at that time.[16]

Exploring alien 'geographies'

Let us start by considering again the title of Nasmyth & Carpenter's book *The Moon: Considered as a Planet, a World, and a Satellite*. Note in particular the use of the word *World* in addition

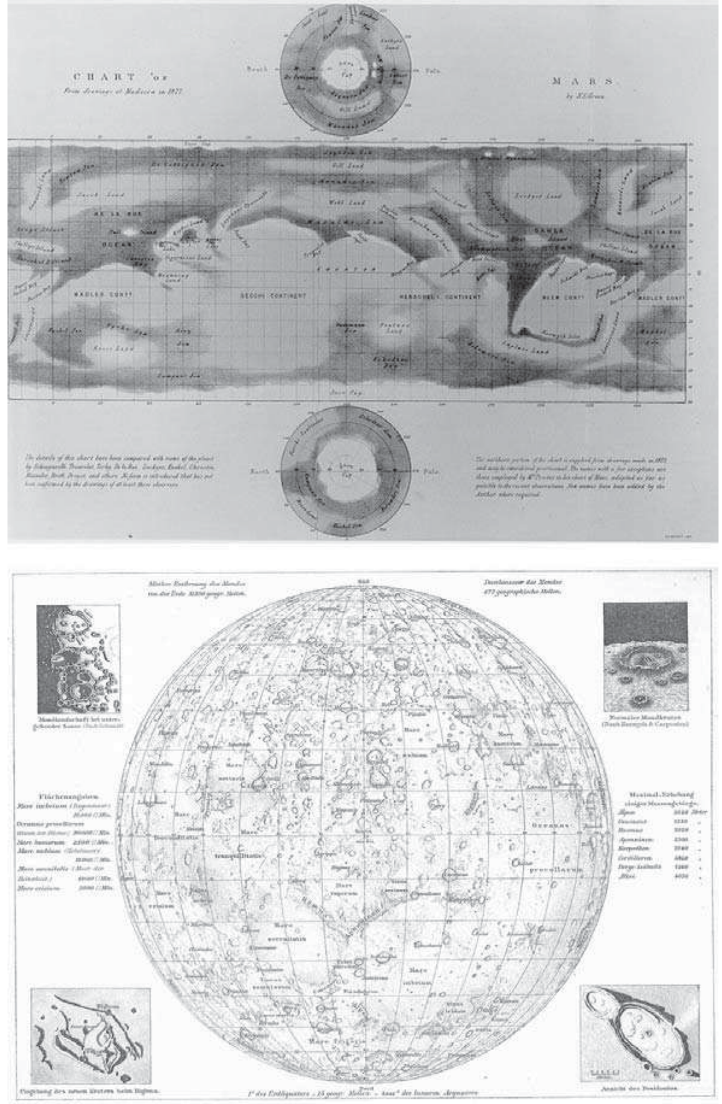

Figure 5. Examples of maps of Mars and the Moon, using different cartographic approaches.

to, and therefore distinct from, the word *Planet*. It is clear that the use of *World* was intended by the authors to convey additional semantic weight. Indeed, from the time of Fontenelle's *Conversations on the Plurality of Worlds* (1686) the notion that the Moon and planets were not merely astronomical bodies, or simply pieces in the elaborate chess-game of celestial mechanics, but were truly *other worlds* like Earth, came to structure thinking about their topographies.[17]

The result was a 'geographical' approach to alien landscapes (of Mars in particular, but also of the Moon) that was rooted in the assumption that these were worlds that could be explored in the same way that our own world was being explored. Just as nineteenth-century terrestrial explorers, stimulated by the great age of imperialism and colonialism, set out to discover and chart unknown territories, and open up new worlds, so did the great lunar and planetary explorers bring the same sensibilities and assumptions to what they encountered in the eyepieces of their telescopes.

As a result, the whole scientific approach to the study of the Moon, and to an even greater extent of Mars, was centred on *cartography* – the mapping of hitherto unknown landscapes and the exploration of new and exotic worlds. This was clearly the case with Percival Lowell's endeavours at Flagstaff – the one-time orientalist now turning his appetite for new worlds and remote civilisations away from the terrestrial Far East and out to the much more distant reaches of the Solar System, and to an even more 'alien' race fighting for survival in the parched landscape of Mars.

'Geographical' exploration and the Moon

However, those observers who sought to bring the same geographical approach to exploration of the Moon were, of course, dealing with much less promising material. Whereas Mars presented a landscape replete with seasons, weather, polar ice caps and an atmosphere, the Moon appeared to offer only a craggy, apparently barren landscape on an essentially airless world.

But the romantic sense of adventure and exploration persisted, as did the corresponding expectation of new discoveries around every corner, and it fed the cartographic endeavour in the Moon's case too. So did the tendency to draw analogies between the Moon and terrestrial landscapes, and this was encouraged by, for example, the familiar terrestrial nomenclature that had been attached to lunar mountains. Names such as Apennines, Alps, Pyrenees, Caucasus, Carpathians, etc., all helped to reinforce the notion that the Moon was 'another world'.

But if by the late nineteenth century 'cartography had become the primary mode of representing scientific data and knowledge' about the observable other worlds of the Solar System, as Lane argues with respect to Mars,[18] then we need to take into account one essential difference between lunar cartography and how Mars and the Earth were mapped. The adoption by Richard Proctor, Nathaniel Green and others of the Mercator projection for representing Martian topography had served to reinforce absolutely the sense of analogy with terrestrial mapping – Martian maps now began to look like terrestrial ones. But the Moon's captured rotation rendered the Mercator projection inappropriate for the depiction of the lunar surface, and lunar maps continued to represent the Moon's visible hemisphere as it appeared to the telescopic observer – i.e. as a flat disk, complete with foreshortening at the limbs (see Figure 5).

On the one hand, this might have given pause and instilled a sense of the Moon's difference from both Earth and Mars, but on the other it also gave rise to the powerful and romantic notion of a '*luna incognita*' and encouraged speculation about the nature of the far side, including notions that the unseen hemisphere might be quite different from the inhospitable landscape presented by the

Figure 6. The 'Moon Hoax' of 1835.

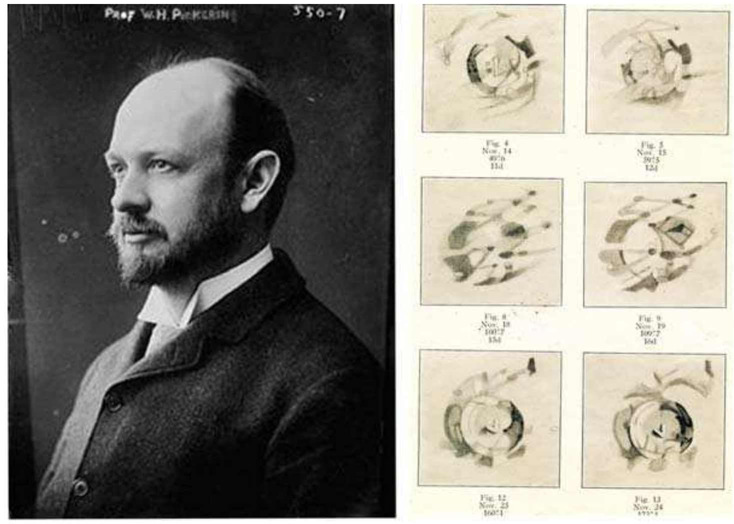

Figure 7. W. H. Pickering and his observations of Eratosthenes.

Earth-turned side. More compellingly for the telescopic observer, it provided the opportunity to explore those difficult limb regions revealed by libration, where mysteries possibly still abounded.

The perception of the Moon as another, as yet unexplored territory had already long given rise to speculation that that territory, like such territories on Earth, might be inhabited. The infamous 'Moon Hoax' of 1835 August is perhaps the best known example, when Richard Adams Locke used the pages of the *New York Times* to give a fictional account of the 'great astronomical discoveries' recently made by Sir John Herschel from the Cape of Good Hope, discoveries that included the observation of fantastic creatures disporting themselves on the banks of a lunar shore (Figure 6).[19]

Locke's account was a deliberate joke, but speculation about lunar life also fed the observational endeavour in a more serious way in the nineteenth century and gave rise to 'discoveries' of evidence for lunar habitation. These included observations of the remains of a lunar 'city' by the eccentric Bavarian Franz von Paula Gruithuisen in the early 1820s, as well as the claims by Professor William H. Pickering nearly a century later that changes in dark patches observed in and around the crater Eratosthenes might be attributable to the diurnal migration of swarms of lunar insects (Figure 7).[20]

But by the end of the nineteenth century, when the BAA Lunar Section came into being, it was already clear to most observers that lunar life – if it existed at all – had to be of a very lowly order, in the form of lichens and mosses. The amateur's pursuit of alien life on the Moon thus became confined to the search for evidence of lunar vegetation, belief in which persisted in some quarters until the middle of the twentieth century.

Selenography and the BAA

Elger and Goodacre

Thomas Gwyn Empy Elger (1838–'97), was an engineer from Bedford who served as the first Director of the BAA Lunar Section from 1892 until his death. He had previously served in the same capacity for the Liverpool Astronomical Society, and was a gifted and experienced lunar observer. His notebooks, now held by the

BAA at Burlington House, reveal him to have been a cartographer and draughtsman of the highest order, and his reputation as a selenographer is undiminished to this day. He observed with an 8½-inch [21cm] reflector and produced in 1895 a book containing an 18-inch map that is still useful to the observer.[21]

Although essentially a lunar cartographer in the traditional mould, Elger did go beyond the mere representation of surface detail in order to speculate about the nature and origins of lunar features; and considering the age in which he worked, some of his ideas were reasonable. For example, he argued that mare wrinkle-ridges were not the results of alluvial action on the beds of former seas, as many still contended, but were instead the products of volcanic action and lava flows, which is not too far from the truth.[22] He also recognised that the bright ray systems associated with certain craters were ejecta deposits, although he failed to recognise impact as the mechanism giving rise to those deposits.[23]

In the end though, Elger was a man of his time, and his selenography was driven by the same imperative of pursuing ever more detailed maps that would settle once and for all the vexed question of changes and activity on the Moon. As he wrote in his book: 'In short, the more direct telescopic observations accumulate, and the more the study of minute detail is extended, the stronger becomes the conviction that in spite of the absence of an appreciable atmosphere, there may be something resembling low-lying exhalations from some parts of the surface which from time to time are sufficiently dense to obscure, or even obliterate, the region beneath them'.[24]

Figure 8. Robert Barker in 1938.

Elger's successor, Walter Goodacre (1856–1938), was the longest-serving Director of the Lunar Section. Between 1896 and 1938 he produced a fine series of Section *Memoirs*, as well as his own privately published book *The Moon*, containing an excellent 77-inch map.[25] He was a popular and much-admired Director, but it has to be said that his approach offered little that was new and he continued to emphasise the discovery of ever-finer detail in a way that clearly set cartography at the heart of observational activity.

Reviewing Fauth's new charts in 1933 for the BAA *Journal*, Goodacre wrote: 'Fauth's maps of portions of the lunar surface in general show a greater amount of detail than mine, and incidentally I may add than those of Schmidt and other selenographers of note … One of the chief sources of pleasure to the lunar observer is to discover and record at some time or other details not on any of the maps; it also follows that if in the future a map is produced which shows all the detail visible in our telescopes, then the task of selenography will be completed'.[26]

Moreover, Goodacre appears to have ploughed his own furrow to the extent that by the 1930s organised observational work within the Lunar Section had effectively passed into the hands of an informal group gathered around Robert Barker, a prominent Section member (Figure 8). Barker's 'Circle' included the gifted astronomical artist L. F. Ball, Ben Burrell, who served as Assistant Director of the Mars Section under E. H. Collinson, and William H. Fox, later Director of the Jupiter Section. Its other members were E. F. Emley, C. F. O. Smith, R. F. Diggles, H. Simmons and H. E. Wooldridge.[27]

A new direction and a false dawn

In some respects, the most interesting part of Goodacre's Directorship (at least from the point of view of this address) was its end. In 1937 October, now elderly, Goodacre decided to stand down, and the archives contain a letter from him to Ball, from which it is clear that Ball was his preferred successor: 'Knowing your keen interest in selenography I believe you have every qualification to fill this post. I am therefore venturing to ask you to allow me to suggest your name in this connection to the Council meeting on 27th inst. If you are elected you may count on all the assistance which lies within my power to aid you'.[28] Goodacre subsequently proposed Ball's name to Council but was prevented by illness from attending the Council meeting. At that meeting Council appointed T. L. MacDonald (Figure 9), who had been proposed by the influential Rev T. E. R. Phillips.

Barker was outraged by the appointment of someone he regarded as a 'non-observer', and he put it down to Phillips' meddling and desire to advance his 'dear old pals'.[29] He sought the views of his Circle. Interestingly, although there was the expected general support for Ball's nomination, three members (Emley, Fox and Smith) defended MacDonald's appointment, and the grounds on which they did so are significant. They argued that the Section's traditional emphasis on the pursuit of ever-finer detail was no longer appropriate, and that a more rigorous, scientific, quantitative and analytical programme should be adopted. As Emley wrote:

'For several years I have been uneasy as to the ultimate value of the Circle's ordinary charting activities. To my mind the ultimate object of lunar observation is to ascertain the present condition and the past history of the lunar surface… Much of the time I have spent examining Smythii etc. might I wonder have been more profitably spent in another direction. What I think the Section should do is to plan investigations with the direct object of furthering the ends suggested above… I should like to see our Circle obtain quantitative results…, results capable of analytical discussion.'

Emley then went on to argue MacDonald's suitability to direct such forms of work: 'I have been interested to find MacD. sympathises with these views, and his scientific training would make him eminently suitable for conducting such work… I believe that the reasons that Phillips has brought forward MacD. are similar to those given above, namely why in my opinion he is rather specially qualified for the job.'[30]

Figure 9. T. L. MacDonald in 1961–'62. *Courtesy Mr A. Wiseman and Carlisle City Council.*

MacDonald's reputation fully matched Emley's praise. He was not a traditional cartographer, but much closer to a lunar scientist of our age. Indeed, he had provided statistical data in support of Goodacre, and

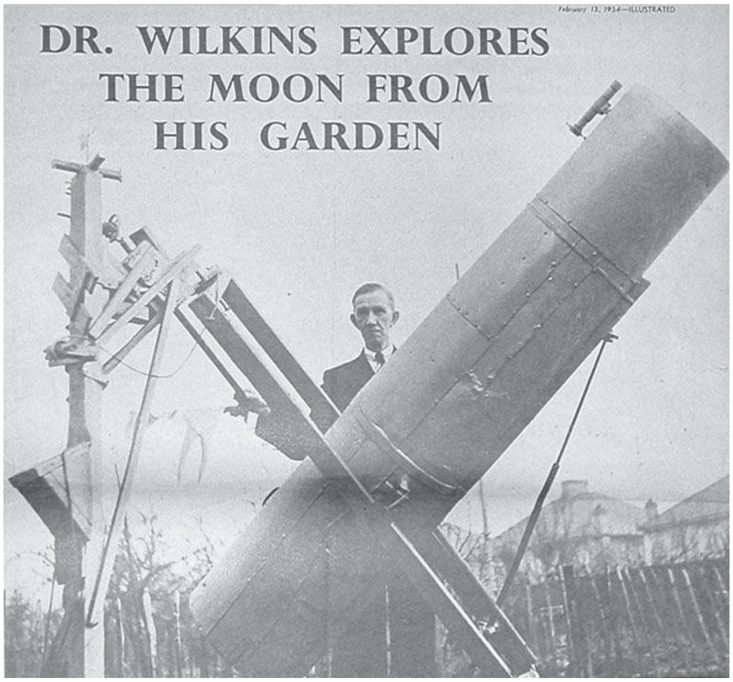

Figure 10. Hugh Percival Wilkins. (*Illustrated* magazine, 1954 Feb 13)

his quantitative work on lunar craters is still valued today. However, he never won the support of his Section, and Barker in particular remained implacably hostile. It did not help that he was a poor and neglectful correspondent, as well as being careless with material submitted to him. He was also unlucky: his appointment to the Directorship coincided with the advent of war and the practical cessation of lunar observation.

Attempts to provide a new basis for the work of the Lunar Section were thus thwarted, and efforts were not renewed until the later 1950s and the dawn of the space age. MacDonald resigned the directorship in 1945, but he remained active and continued to contribute to Lunar Section meetings and publications as late as the 1960s.

The Wilkins era

Archival correspondence leaves no doubt that, following MacDonald's resignation, Barker played a central role in securing the appointment of his successor – Hugh Percival Wilkins (1896–1960) (Figure 10).[31] There was more than just personality at stake in the appointment of MacDonald's successor; the central issue was the very nature of amateur lunar observation. In many very important respects, the choice of Wilkins was the correct one: as Patrick Moore has commented,[32] the Lunar Section essentially did not exist by 1945, and Wilkins proved to be a committed, widely respected and energetic Director who was able to turn around the Section's fortunes.

Between his appointment and his resignation from the BAA in 1956 Wilkins effectively rebuilt the Lunar Section and put together a strong team of outstanding observers. By 1952 membership had increased from less than a dozen in 1945 to over 130, and these included some exceptional selenographers such as Keith Abineri, F. H. Thornton, Patrick Moore, D. W. G. Arthur and Ewen Whitaker, all of whom went on to make distinguished contributions to the study of the Moon, some in a professional capacity.

On the other hand, the appointment of Wilkins was a clear step backwards, as well as a decisive retreat from the MacDonald era and any efforts to move the work of the Lunar Section in a new direction. Wilkins was to his core a product of the so-called 'new selenography', initiated by W. H. Pickering at the turn of the nineteenth century and followed by both Elger and Goodacre. It may have been called 'new', and the term may have been coined by an American astronomer, but in fact it continued to emphasise the three strands of selenography that we have identified as being at the heart of British efforts: the mapping of fine detail, the fixation with lunar change, and the belief in a volcanic origin for the majority of lunar features.

Wilkins was perhaps the last of the classical Moon-mappers, producing successive charts of 100 inches, 200 inches and, finally, 300 inches diameter. All these charts were driven by the pursuit of ever-smaller surface detail, and it is with them that we see the unfortunate, but inevitable, results of that approach: the charts – especially the 300-inch – are overcrowded and in places indecipherable (Figure 11). They also include much detail that is spurious, for Wilkins was not the most cautious of men in deciding what to include. As Barker had written more than a decade earlier: 'The difference between

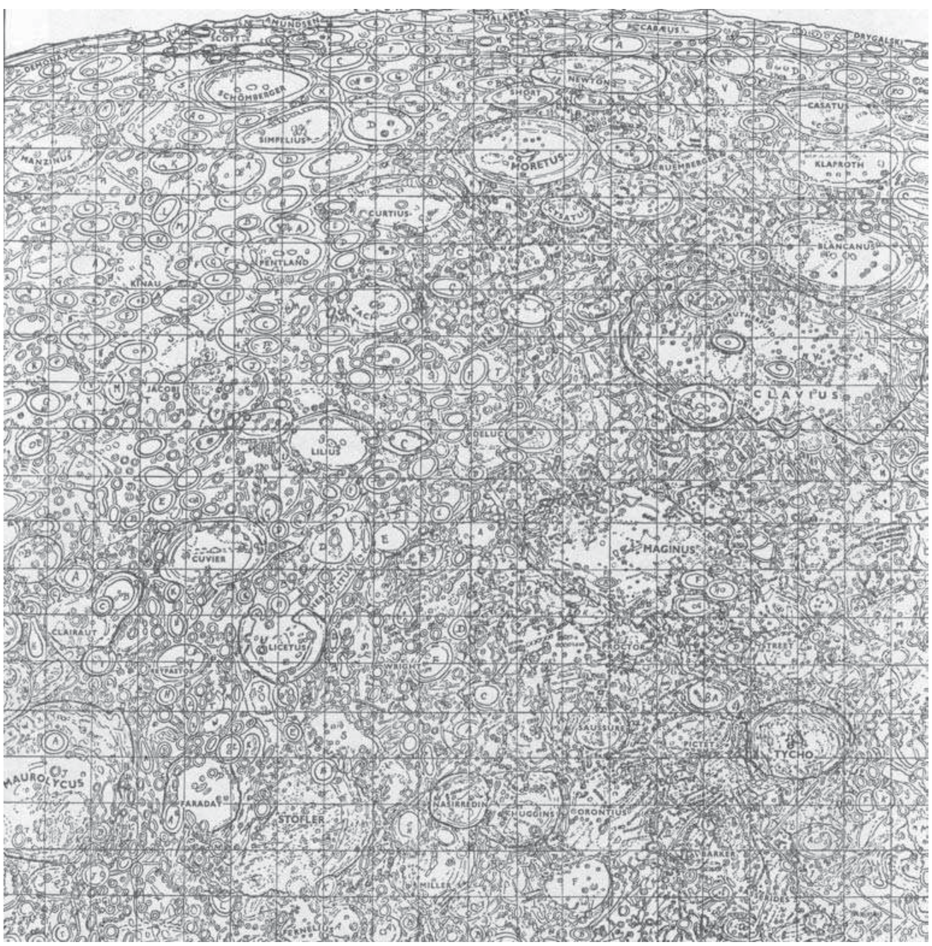

Figure 11. A section from Wilkins' 300-inch map.

Goodacre and Wilkins is – Goodacre is very careful, and prefers to *leave out* rather than to record … while Wilkins crams in any old stuff.'[33] It was that same lack of caution that later led Wilkins to make extravagant claims about changes and unusual phenomena on the Moon – most notoriously, his confirmation of J. J. O'Neill's 'discovery' of a huge bridge on the edge of the Mare Crisium in 1953. These claims did real damage to Wilkins' reputation and eventually contributed to his resignation from the BAA in 1956.[34]

All change? The post-Wilkins era

By the time of Wilkins' resignation the writing was already on the wall for the future of lunar science. The dawn of the space age was only one year in the future and professional interest in the Moon was growing, an interest that was to produce seismic shifts in approach. The establishment of Gerard Kuiper's Lunar and Planetary Institute in Arizona in 1960 brought about – quite literally – a more professional approach to lunar mapping, and indeed to lunar science in general, as the USA embarked upon its run-up to the Apollo programme.

In particular, William Hartmann's use of rectified photography to produce orthographic maps led to the recognition of multi-ringed impact basins and provided a real boost to impact theories of crater origin. Hartmann's work also showed that the devil was indeed in the detail, as the new approaches demonstrated how the holistic view of large-scale structures (or *Gestalt* perception, as Hartmann termed it) was much more likely to disclose the true nature of the Moon's surface than was the obsessive pursuit of ever-smaller features.[35]

Figure 12. Ewen Whitaker with Gerard Kuiper in the 1960s.

The futility of that pursuit was finally revealed for all to see in 1965 March when *Ranger 9* impacted in the crater Alphonsus, its final seconds providing compelling evidence that the closer you got to the lunar surface the more small craters you saw, and that to chart them all would be an endless task. Moreover, the new approaches by professionals and spacecraft were producing rich seams of new data that cast increasing doubt on the other two pillars that had sustained traditional British selenography – the belief in lunar change and the conviction that volcanism was the dominant mechanism in crater formation.

These developments were initially reflected in the work of the Lunar Section. Wilkins' successor, Ewen Whitaker, was a professional astronomer at Greenwich who in 1958 was invited to join Kuiper's team at the Lunar and Planetary Institute (Figure 12). He went on to become a primary contributor to the mapping programme that preceded Apollo and one of the key players in lunar science during the latter half of the twentieth century.[36] On becoming Director, Whitaker was quick to assert in the Section bulletin *The Moon* that he did not consider the drawing of ever-finer detail to be worthwhile: 'I do not consider that such pursuits are profitable, inasmuch as they contribute practically nothing to our knowledge of the conditions of the lunar surface or of the mode of formation of the topographical features.'[37]

Figure 13. Gilbert Fielder on the BBC's *The Sky at Night*, 1960.

Instead he advocated the use of professional photographs as the basis for lunar work of a quantitative nature by members of the Lunar Section.

Whitaker's move to the USA in 1958 brought about the end of his brief Directorship, but the broad thrust of his approach was continued by his successor. Gilbert Fielder (Figure 13) was a professional geologist, and the observing programme he devised was a new departure in that it emphasised study of the *distribution* of different types of feature over the entire lunar surface:

'I know that amateur lunar observers can produce extremely useful information, provided they are prepared to generalise more.

'Exactly what does this mean? It means that, although little of use to the theorist can be gleaned from disconnected drawings of favourite formations, a great deal can be inferred if … information takes the form of concentrated groups of facts collected from the whole face of the Moon.'[38]

Fielder produced special photographic charts of the Moon's visible hemisphere, on which the Section's observers were invited to mark the dispositions of features such as domes, rilles, rays, crater-chains, faults, and ghost craters.

Although clearly a moderniser in his appsroach to observational work, Fielder still advocated a volcanic origin for the craters of the Moon.[39] However, his observational programme, like that of Whitaker, met with resistance from traditionalists within the Section, and many continued to plough the old furrow and map specific features in detail. Several distinguished members took the view that the new innovations threatened to curtail amateur observing, and would render the Lunar Section 'less virile' than in Wilkins' day.

Others recognised the need for change, but doubted the Section's capacity to respond: '…how steadfastly we were standing still between Elger's death and the advent of Whitaker. We moved a bit then, but I fear we have now reverted to a stationary attitude once more. Myself I cannot see how Fielder's ideas can possibly stir up the Section to any action at all.'[40]

And that indeed proved to be the case.

Lunar observation in the age of Orbiter *and* Apollo

The acceleration of NASA's lunar programme in the 1960s and 1970s, and especially the results returned from the *Orbiter* and *Apollo* missions, drove the final nails into the coffin as far as charting fine detail was concerned. But the amateur lunar observer, now effectively disenfranchised from his traditional cartographic activities, instead turned his attention more to the observation of what became known as *transient lunar phenomena*, or TLPs. Ob-

Figure 14. Harold Hill in 1990.

servational aids such as 'moonblink' filters and 'crater extinction devices' were pressed into service in order to aid the detection of momentary glows, colours and obscurations on the lunar surface. Ironically, this had the effect of reinforcing faith in the other two pillars that had sustained British selenography from the start: the idea that perceptible changes still occurred on the lunar surface and the belief in volcanic mechanisms.

So, even the space age failed to change decisively the direction of British selenography. Although a few experienced observers did make the transition to the sort of work that was more appropriate in the post-*Apollo* era,[41] much of the observational activity of the BAA Lunar Section continued to take the form of lunar sketching with no real scientific focus, or the reporting of increasing numbers of suspected TLPs. Even the more focused cartographical work of those such as Harold Hill (Figure 14), who continued to chart the south polar areas that had been inadequately covered by *Orbiter* imagery, came to seem increasingly like a Canute-like attempt to hold back the tide, for it was to be only a matter of time before those unknown areas (*luna incognita* again!) were also revealed in detail by later spacecraft.

Nevertheless, enthusiastic Lunar Section directors, such as Patrick Moore, Ron Maddison, and their successors, kept up Section membership and activity and tried to steer a course through uncertain waters.

Conclusion

So, in a time of increasingly sophisticated examination of the Moon by spacecraft, does the amateur still have a rôle to play, or is the day of the amateur's Moon now over? Is the BAA Lunar Section's long record of vigilant observation of our satellite now completed? Far from it!

The new techniques of high-resolution imagery, using high-speed video cameras in conjunction with modest telescopes, now complement visual work and have reinforced the value of traditional telescopic observation, opening up opportunities undreamt of before. Meanwhile spacecraft imagery and datasets freely available via the internet provide new and practically unlimited possibilities for the amateur to contribute meaningfully to lunar science – perhaps even more meaningfully than in the past.

There are simply not enough professionals to analyse the data now available. So there is much for the BAA Lunar Section still to do, and a long tradition to continue, but to describe that might be the subject of a further Address – our present one is done.

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References and notes

1 See also Wood's *Lunar Picture of the Day (LPOD)* website for 2011 July 6: **http://lpod.wikispaces.com/July+6%2C+2011**

2 Others include the *Clementine* (USA), *Selene/Kaguya* (Japan), *Chang'e-1* (China), *Chandrayaan-1* (India) and GRAIL (USA) missions.

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4 *ibid.*, p. 4

5 The observation is dated 1776 May 28.

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8 T. W. Webb, 'Notice of Traces of Eruptive Action in the Moon', *MNRAS* 19 (1859), pp. 234–5

9 J. F. W. Herschel, *Outlines of Astronomy*, 10th edn., John Murray, 1869, p. 283.

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15 Sheehan & Dobbins (2001), p.191

16 K. Maria D. Lane, *Geographies of Mars: Seeing and Knowing the Red Planet*, University of Chicago Press, 2011

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18 Lane (2011), p. 25

19 For an account of the Moon Hoax of 1835 see, for example: Evans, D. S., 'The Great Moon Hoax', *Sky & Tel.*, **62**: 1981 September, pp. 196–198; 1981 October, pp. 308–311.

20 For an accessible account in English of Gruithuisen's lunar city see: A. MacRobert, 'The Fabled City on the Moon', *Sky & Tel.*, **84**: 1992 October, pp. 424–425. Pickering's analyses of Eratosthenes appeared as a series of six articles in *Popular Astronomy*: vol. **XXVII**, no. 9 (1919 Nov.); **XXIX**, no. 7 (1921 Aug–Sep.); **XXX**, no. 5 (1922 May); **XXXII**, no. 2 (1924 Feb.); **XXXII**, no. 5 (1924 May); **XXXII**, no. 7 (1924 Aug–Sep.).

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