Baker's Traveller's Microscopes

R. Jordan Kreindler (USA)
Yuval Goren (Israel)

Scientifically-oriented portable microscopes, with high-quality optics and durable design, began to appear in response to users demands. One of these responses was made by William Moginie who worked either full-time or as a consultant to C. Baker of High Holborn in London. Moginie designed a travelling microscope for naturalists.

The Baker Moginie-style travelling microscope is one of the first attempts to create a sturdy field microscope for professional use. J. Newton Tompkins described this microscope in his 1867 article in the *Journal of the Royal Microscopical Society*, "On a Travelling Microscope". This microscope is described and illustrated in Hogg's, "History of the Microscope" 6th ed. of 1867. It is identified in Fig. 63 as "Baker's Traveller's Microscope". It is recommended for the field-naturalist and described:

> The aim has been to combine steadiness with extreme portability. The compound body is permanently affixed to the fore-leg of the tripod-stand ; the two other legs are supported on capstan-bar joints, which can be tightened at pleasure, or folded up parallel with the former when not in use. The difficulty of using high powers with an instrument the body of which slides in cloth is well known; the tube becomes tarnished by continued use, and a firm adjustment, which shall be easy of access, is almost indispensable. To obtain an approximate focus, the inner tube is drawn out until the combined length of the tubes is eight inches; the body is then returned to its jacket," and placed at a proper distance from the stage to suit the object-glass employed. The fine adjustment is effected by means of a tangent-screw (fifty threads to the inch) placed conveniently behind the body, and worked by a milled-head acting on a spring contained in the upright which supports the body.

Figure 1. Baker's Traveller's Microscope as shown in Jabez Hogg's The Microscope. 6th Edition (1867)

> This part of the instrument is very satisfactory; it is steady and works efficiently. A mechanical stage is not generally applied, but can be if required. Sufficient movement is obtained by a plain stage, with two springs to hold the live-box or glass slip. [i]

Figure 2. Baker's Original Moginie-Style Field Microscope

Figure 3. Signature from Baker's Traveller's Microscope

As previously noted, the model described above, and shown here from our collections, was designed by William Moginie in 1867 and manufactured by Charles Baker. It is described in Baker's 1868 catalogue and is today frequently referred to as a Baker Moginie-style or more simply a Moginie microscope. It sold with its leather case, but without lenses, for £2 5s [ii].

This model has hollow legs, in which smaller upright feet are enclosed to allow the microscope to be used in an upright position for observing specimens in liquid. When used in this way, the two hollow legs are detached, there are 'L' slots at the top of the legs, and the three smaller legs stowed inside can be removed. Two of these legs go on each side of the stage and the third behind the column. All three are installed into screw fittings. The Billings Catalog [iii] shows a similar microscope in Fig. 99 dated c 1860, some years before the original Moginie appears to have been first described.

Figure 4. Original Baker Moginie-Style Dissembled Showing Small Legs

Figure 5. Original Baker Moginie-Style Configured to View Specimens in Liquid

Figure 6. Larger and Smaller Moginies Side-by-Side - Larger With Cruciform Base and Slide-on Stage removed.

Moginie also designed a larger edition, c 1870, of this microscope. The addition of rack and pinion focusing to this larger model appears to have been suggested by pioneer British mycologist and botanist Dr. Mordecai C. Cooke for his own larger Moginie. Dr. Cooke was a founding member of the Quekett Microscopical Society, and author of over three dozen books, including one on microscopic fungi[iv]. Cooke noted that he used his Moginie microscope for over 30 years to produce more than 15,000 drawings [v]. Dr. Cooke stored his Baker microscope under a bell jar with additional lenses, for easy access and set-up, rather than in its travel case. Thus, it's probable that while he occasionally used his larger Moginie in the field, its primary use was as a desktop instrument. We don't know the price Dr. Cooke originally paid for his Moginie. However, after at least 30 years of use, he sold it to the Royal Horticultural Society in 1913 for £ 10 [vi]

In the letter written prior to the 1913 sale, Dr Cooke says that he "used the best glasses that could be procured" for this microscope. A note provided with the instrument mentions that it was used with the "best 1/4 inch by Powell and Leland (cost five guineas)". In the 1876 issue of *Nature A Weekly Illustrated Journal of Science*, there is an advertisement for "Unequaled Student's Microscope with English 1-inch and 1/4 inch objectives, Five Guineas". In the same issue there's another advertisement for a used Powell and Leland microscope for twenty guineas. Although the Powell and Leland 1/4" was probably one of the finest lenses available at the time, and perhaps even now, as can be seen from the prices quoted above, a single lens costing five guineas would have been quite expensive at that time.

Figure 4. Powell and Leland 1/4 "

It's interesting that the cover of Cooke's small book "One Thousand Objects for the Microscope" shows a bar limb microscope rather than the Moginie-style used so extensively by the author [vii]. However, this may be due to the publication date of the first edition (1869), or it may have been solely a marketing ploy by the publisher - as both Moginies are monocular instruments with a single lens mount, while the pictured microscope is a Wenham binocular with two lenses, probably more costly than was obtainable by most readers. In this book Dr. Cooke wisely notes that in, " ... examining the objects enumerated we may be permitted to recommend the novice always commence the examination with the lowest power of his microscope ... the greatest satisfaction will always be derived from a great practical use of low powers".

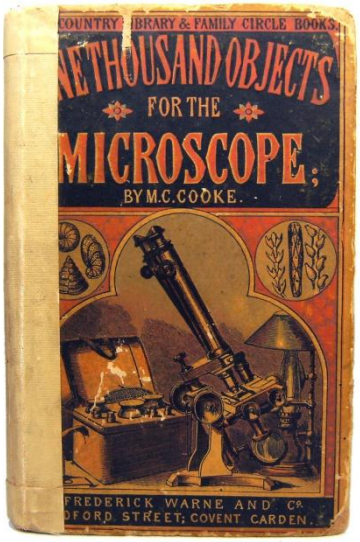

Figure 7. M.C. Cooke's 'One Thousand Objects for the Microscope' from the Authors' Collections

Figure 8. Larger Moginie Showing Cruciform Base Detached and in Use

The Science Museum. London Catalogue (2005) shows a similar larger Moginie (24/29) with the cruciform base, but without slide-on stage or condenser, given to the museum by Thomas H. Court [viii]. It describes this as a "Moginie Traveling Microscope by Baker" and pictures it in the catalog with the two removable legs detached and the microscope supported solely on its fixed column inserted into the center opening of the Cruciform base as would be appropriate for the examination of liquids in the field. Clearly this is not as stable for bench work as is possible if setup using all three legs attached to the base, as shown above. In fact Dr. Cooke notes, "a firm stand, with a good spreading base not easily overset" is essential. [ix] The description of this microscope in the Science Museum Catalogue mentions that the "hollow legs contained dipping tubes, pipettes, mounted needles and the like ... [and that] the instrument was usually packed into a leather telescope tube for carrying into the field". [x]

The slide-on stage for the larger Moginie is approximately 3inches (76.2mm) wide x 2-1/2inches (61mm) deep. It has two brass tracks on its underside to slide securely onto the fixed stage. The tracks' screws can be loosened for attachment and then tightened to more permanently secure the removable stage. As this component and the condenser are generally missing from existing models, they may have been optional accessories.

Although the two Moginies are similar in design, their size difference means that while objectives are interchangeable, i.e., they use standard threads, the eyepieces are not. The original Moginie uses eyepieces with a 30mm external diameter while the larger Moginie uses 34 mm eyepieces (body tube approx. 36mm).

The table below presents data for the two different size Baker Moginie-style field microscopes in our collections: (1) The original Moginie design, and (2) A larger Moginie design with substage condenser, slide-on rectangular stage, and cruciform base similar to that used by Dr. Cooke, but without the rack movement.

Table 1. Comparison Table for Two of Baker's Moginie-style "Traveller's Microscopes"

	Original Moginie Design	Later Moginie Design*
Measurements		
Body Tube Length (inches/mm) Shortest length of telescoping tubes	5.25 / 133.35	6.25 / 158.75
Tripod Leg Height (inches/mm)	8.25 / 209.55	9.75 / 247.65
Microscope Weight (ounces)	20.6	40.4

* Weight includes cruciform base, slide-on stage, and condenser

As can be seen the larger Moginie is a substantial microscope, and with cruciform base is appropriate for both field and bench work. Considering the weight of the two additions, cruciform base and slide-on stage, they probably would have been left behind for field work. It should not be a surprise that a related version was used so successfully by Dr. Cooke, and it's likely that Dr. Cooke's microscope would prove useful even to today's naturalists.

The views below are adjusted somewhat in Photoshop to come close to their visual views through the microscopes. Both have good contrast and are somewhat sharper visually than shown. Both photographs were taken using electric illumination. It's easy to forget that this was not available when these microscopes were first purchased. They would have been used with non-electric illumination such as natural light, candles, or paraffin lamps.

The first electrically illuminated light was made by Englishman Humprey Davy in 1809. Although not commercially-viable, incandescent light bulbs had been developed and patented, the first in 1841 [xi], before the work of Thomas Edison. However, Edison developed the first practical, commercially-viable, light bulb in October 1879. Thus, at the time of purchase of the original Moginie c 1867, electric illumination was not available. Even during the 1880s, electric illumination was a costly luxury. The price for a single light bulb c 1880s was about 1/2 day's wage[xii].

Figure 9. View Through Smaller Moginie

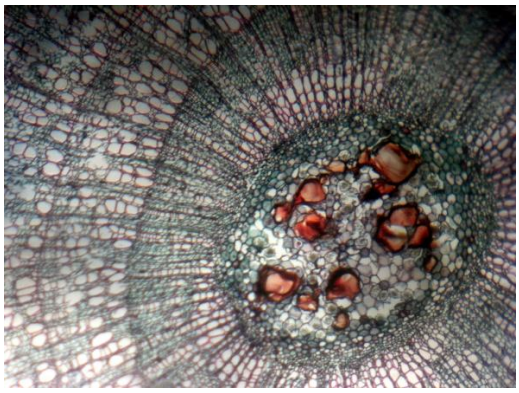

Figure 10. View Through Larger Moginie

What you sow, so shall you reap

In the mid-1880s, before Baker's Moginie-style microscope was designed, a seminal event occurred symbolizing the popularization of the microscope, making it available to a broader audience, i.e., the Society of Arts Prize awarded in 1853 to Messrs. Field and Son of Birmingham, England for an affordable microscope design.

This microscope design garnered almost instant popularity. A contemporary article noted that owing to its popularity other makers are now producing "Society of Arts" models, and in some cases, such as those produced by Mr. Baker, are describing their models as if they themselves were the prize winners.

> We know that Mr. Baker may reply that his microscopes are of the same pattern as the one which obtained the Society of Arts prize, but we hardly think that this justifies him and his friends in speaking of any instrument he makes as the "Society of Arts Microscope," much less in claiming for him the award of a medal which was given to another microscope-maker. We do not say this to depreciate Mr. Baker's Microscopes -- for aught we know they may be better than Mr. Fields's -- but we think that the public ought, in fairness, to know who is really the inventor and original maker of the "Society of Arts Microscopes. [xiii]

It was common at this time for contemporary microscope makers in England, and elsewhere, to freely copy each other's work. As happened with the "Society of Arts" model over a decade earlier, Baker's newly-designed field microscope gained significant popularity. So, as Baker himself had done for the Society model, his design for the "Traveller's Microscope", as described above, was freely copied by others including John Browning, and Watson & Son (as can be seen in the collection of the RMS) [xiv].

Be Careful Out There (Some guidelines for buying).

Baker's Traveller's microscopes are lacquered brass, including their stages. The minor exception being the attachments for the stage and mirror to the supporting cylinder. The portions of these attachments closest to the cylinder were at times finished in black. However, this black finish does not extend to the stage or mirror.

If you see any instruments where large portions of the microscope are finished in black, e.g., the body tube, the supporting cylinders to the microscope, the sliding sleeves over the supporting cylinders, the stage, or the cruciform base - use extra caution. These may be indications of a damaged microscope where the reseller, or a previous collector, rather than restoring the microscope to its original lacquered brass finish made the, probably unfortunate, choice to replace damaged parts with components not made of brass, or to mask existing damage with black spray paint.

At the time of this article, Traveller's microscopes are selling for about £235 - £470 GBP ($375 - $750 USD). The prices at the higher end are for instruments with microscopes and storage cases in good condition, while prices at the lower end are for Traveller's without storage cases. Microscopes with large black spray painted areas should sell for considerably less, but microscopes with excellent lacquered finishes and cases should sell for somewhat more. Traveller's instruments are not common. However they are not really rare, and are usually seen a fair number of times a year on eBay or at auction.

Epilogue.

Baker's field microscopes are excellent examples of the importance of a quality microscope and appropriate microtechnique in field work. This was demonstrated by the work of Surgeon Major Sir Ronald Ross, who won a Nobel prize in medicine for his work on Malaria.

Dr. Ross worked with Malaria patients while serving as Staff Surgeon for a military hospital in Bangalore, India in the early 1890s. It was in Bangalore that Dr. Ross' interests in mosquitoes began. He soon learned of the work of the French physician Dr. Charles Louis Alphonse Laveran. Dr. Laveran, who in 1880 worked at a military hospital in Africa had discovered, using blood smears prepared from patients who had died of malaria, the protozoa that caused Malaria. Although Dr. Ross took numerous blood samples, he could not find Laveran's parasites under his microscope and wrongly concluded that Dr. Laveran was wrong.

" This inability to confirm Laveran's work, a problem shared by many investigators, was apparently due to the crude microscopic techniques of the day ... "[xv]

After his 3 year appointment in Bangalore came to an end, Dr. Ross was assigned as surgeon to the 19th Madras Infantry and shortly after took his leave in England. It was in England that he had the opportunity to meet with Dr. Patrick Manson, who was to become Ross's lifelong friend, and who showed Ross Dr. Laveran's 'crescents' on a stained specimen with an appropriate microscope. After Ross returned to India, and with Dr. , later Sir Patrick, Manson's help, he was able to prove Dr. Mason's conjecture (but not without controversy)[xvi] that mosquitoes carried malaria. He won the Parke's Memorial Gold Medal in 1895 for his paper on Malaria and less than a decade later the Nobel Prize for Medicine in 1902 [xvii].

Realizing the importance of a quality diagnostic instrument, Sir Ronald designed a successor to the original Baker Moginie-Style microscope for the "Indian Army Medical Department for diagnosing malaria."[xviii]

Details of Sir Ronald Ross' work on malaria and his confirmation of its transmission by mosquitoes is described in a short paper by Mary E. Gibson [xix].

The "Diagnostic" [xx] microscope designed by Dr. Ross and sold by Baker from 1893 to the turn of the century, had a fine focus in the same location as the Moginie-style microscope, i.e., at the top of the rear support. A later Baker folding microscope, also called the "Diagnostic", is illustrated in the 1907 edition of Spitta's book on Microscopy [xxi]. It has a similar tripod base to both the earlier "Diagnostic" and the model pictured below, and has both a coarse and fine focus.

Below, from our collection, is a successor to that designed by Dr. Ross having a considerably easier to use, in the authors' opinion, side focus but no top fine focus. This model is somewhat smaller and lighter than its predecessors, fitting when folded into a leather covered, 7-1/4 inch (184.15 mm) x 4 inch (101.60mm) x 3 inch (76.20 mm), case. It combines elements of Dr M.C. Cooke's Design for a modified Moginie, Dr. Ross's design for a Malaria microscope, and likely Baker's "Histological Microscope" of 1885. Like the Moginies, it is signed "Baker London" on the cylinder holding the body tube.

Figure 11. Bakers Folding Field Microscope - A Successor to Baker's Moginie-Style Microscope

Baker field microscopes provide excellent examples of the evolution of professional field microscopes from their beginnings with Moginie's design in 1867 through their evolution to detect malaria, to later 20th century models. Although not in the top tier of British manufacturers (Hugh Powell, Andrew Ross, and James Smith) Baker made a fairly large variety of both popular and professional quality instruments at a reasonable price. Because of the number of models made, Baker microscopes, particularly later models, are not rare or expensive and are often available from dealers and in the open marketplace.

The authors would appreciate any suggestions for corrections, improvement, or expansion. They can be can be contacted at,

Yuval Goren: ygoren@post.tau.ac.il
R. Jordan Kreindler: leona111@bellsouth.net

One of the authors, RJK, is preparing an inventory on the number and locations of existing Moginies. If you have one or more, please be kind enough to contact him at the email provided.

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