

Traveller's Microscope

Baker's Traveller's Microscope / Moginie Traveller's Microscopes

2nd Edition

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Figure 1. Baker's Traveller's Microscope as shown in Jabez Hogg's *The Microscope*. 6th Edition (1867), page 108

Scientifically-oriented portable microscopes with high-quality optics and durable design began to appear in response to user demands. One of these responders was William Moginie who worked (1) either full-time for C. Baker of High Holborn, (2) as a consultant to Baker, or (3) as a microscope maker in his own right, who sold some of his production to C(harles) Baker. Regardless, it is uncontested that Moginie designed a travelling microscope for naturalists and others.

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, in that book, as "Baker's Traveller's Microscope". It is recommended for the field-naturalist and described as:

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

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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 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.

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. (Hogg, 1867)



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 (or Moginie). 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 originally sold with its leather case, but without lenses, for £2 5s (Hogg, 1867).

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This model has hollow legs, in which smaller upright feet are enclosed to allow the microscope to be used in a fully vertical 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, so 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 (Purtle, 1974) 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 Disassembled Showing Small Legs



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

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Moginie also designed a larger edition of this microscope, ca 1870. 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 (Cooke, 1898) see below for a picture of some of his books.

Cooke noted that he used his Moginie microscope for over 30 years to produce more than 15,000 drawings (Turner, 1980). 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 (Turner, 1980).

In a 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 the time.

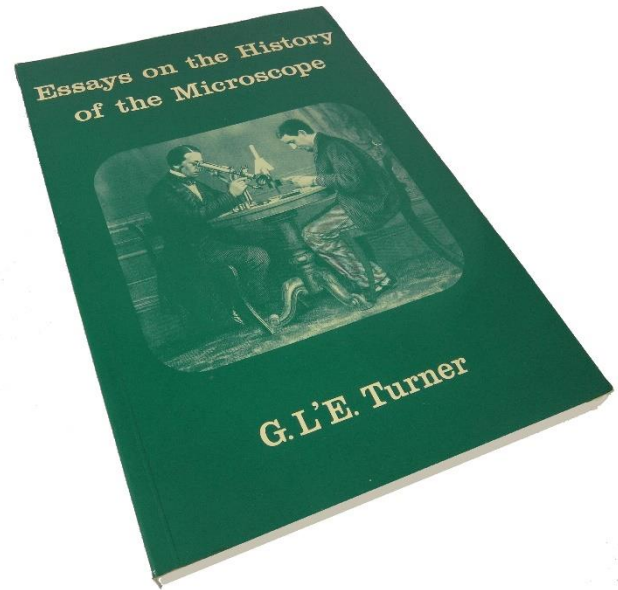


Figure 6. Turner *Essays on the History of the Microscope*. 1980



Figure 7. Powell and Leland 1/4"

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Figure 8. Larger and Smaller Moginies Side-by-Side.

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It is surprising 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 (Cooke, 1869).

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. 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, but perhaps this picture was felt more likely to sell books. 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".

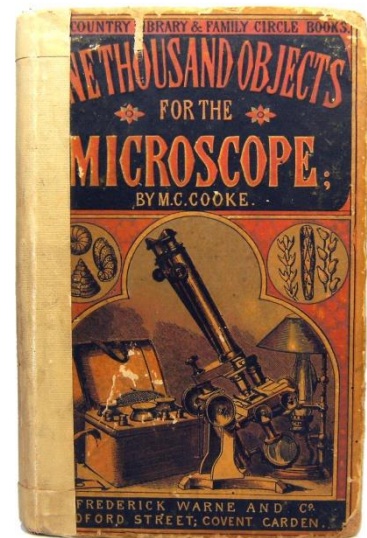


Figure 9. M.C. Cooke's 'One Thousand Objects for the Microscope'

Figure 10. Larger Moginie
Showing Cruciform Base
Detached and in Use



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The Science Museum. London Catalogue (2005) shows a similar larger Moginie (25/29) with the cruciform base, but without slide-on stage or condenser, given to the museum by Thomas H. Court (Clay and Court, 1932). 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 the microscope is 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 upset" is essential (Cooke, 1890). 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" (Bracegirdle, 2005).

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).

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The table below shows 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 Baronet Humphry Davy (Cornish Inventor who was the first to isolate potassium and sodium) in 1809. Although not commercially-viable, incandescent light bulbs had been developed and patented, the first in 1841 (Encyclopedia Britannica On-line), 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 (Nye, 1990).



Figure 11. View through smaller Moginie

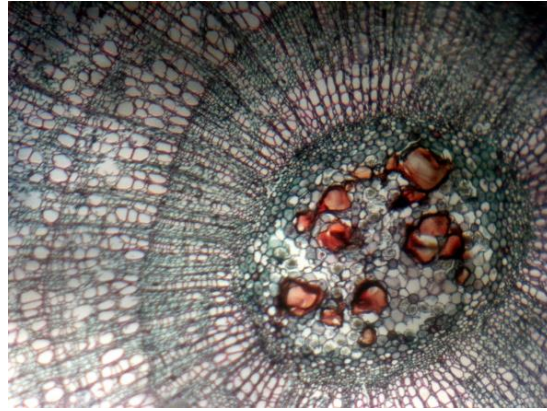


Figure 12. View through larger Moginie

Some of what appears below was taken from a joint paper by one of the author's, RJK, and Manuel del Cerro, titled, *Ten Tantalizers: Microscopes that Continue to Fascinate*. (Kreindler, 2012).

Was Moginie the Manufacturer/Maker of the Traveller's Microscope?

Some of what has been published about Moginie is unfortunately inaccurate, as new information and scholarship has recently revealed. Many of these inaccuracies are still repeated today, as most have come from the same original sources or derivative works. For example, in his excellent paper, *Dr. M. Cooke's Microscope designed by W. Moginie* (Turner, 1980), Gerard Turner commenting on Dr. Cooke's microscope states, "The constructor is named as Moginie, a name not found on instruments as a maker or retailer".

As recent sales of Moginie-signed instruments have shown and further supported by the Moginie signed "Traveller's" microscope shown here, Turner's conclusion was incorrect. Folding tripod microscopes signed by Moginie are now known, including the one shown below and in the possession of one of the authors, RJK.

The microscope shown below has a Plössl-style tripod base, likely "borrowed" and "grafted" from an earlier German microscope. Identification of Dr. Turner's statement as an error has occurred many years after Gerard's 1978 paper was first published. However, that statement is still repeated today. So to set

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the record straight, Moginie -was- a manufacturer of at a minimum, folding tripod, bar limb, and dissecting microscopes.



Figure 13. Moginie Traveller's Microscope signed by Moginie

Although relatively inexpensive, Moginie's tripod microscopes were innovative, unique and capable of sustained professional performance. As, previously noted, Dr. Mordecai Cubitt Cooke made "upwards of 15,000 drawings" (Turner, 1980) mainly of fungi using his larger Moginie "Traveller's" microscope.

Unfortunately, Moginie's bar limb microscopes, unlike his folding tripod designs, were not up to appropriate standards for professional use. Although his dissecting microscopes appear to be of professional quality.

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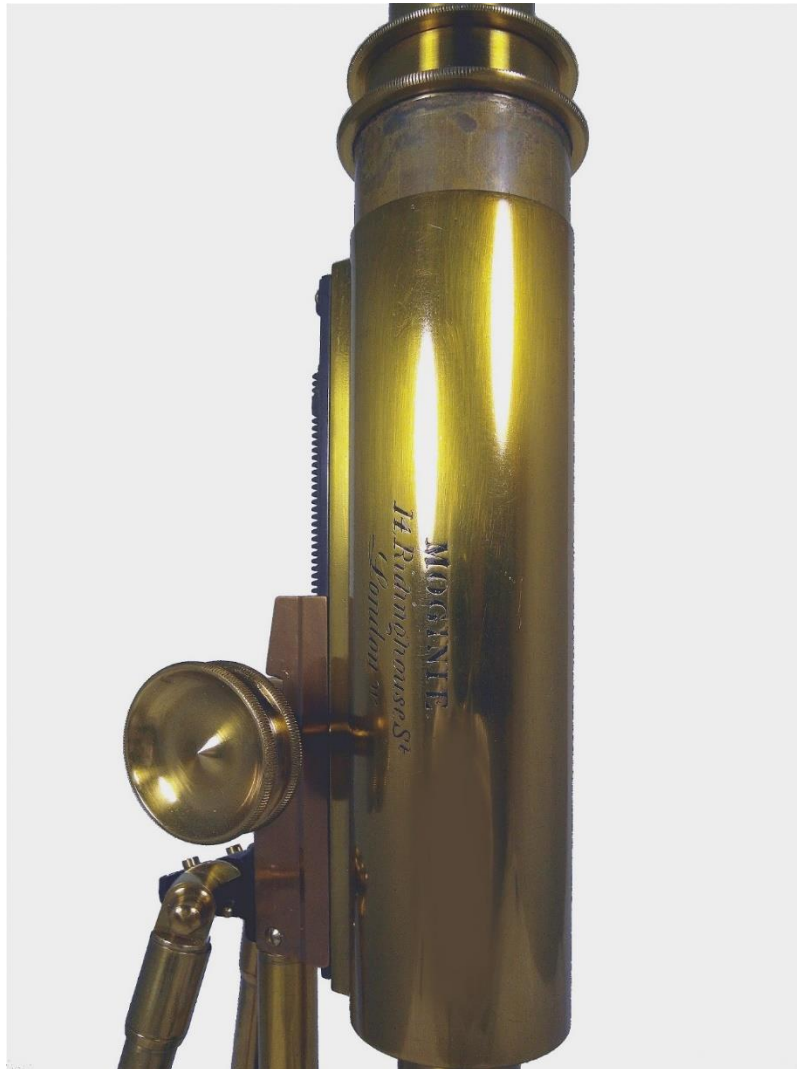


Figure 14. Moginie's signature on a Traveler's Microscope

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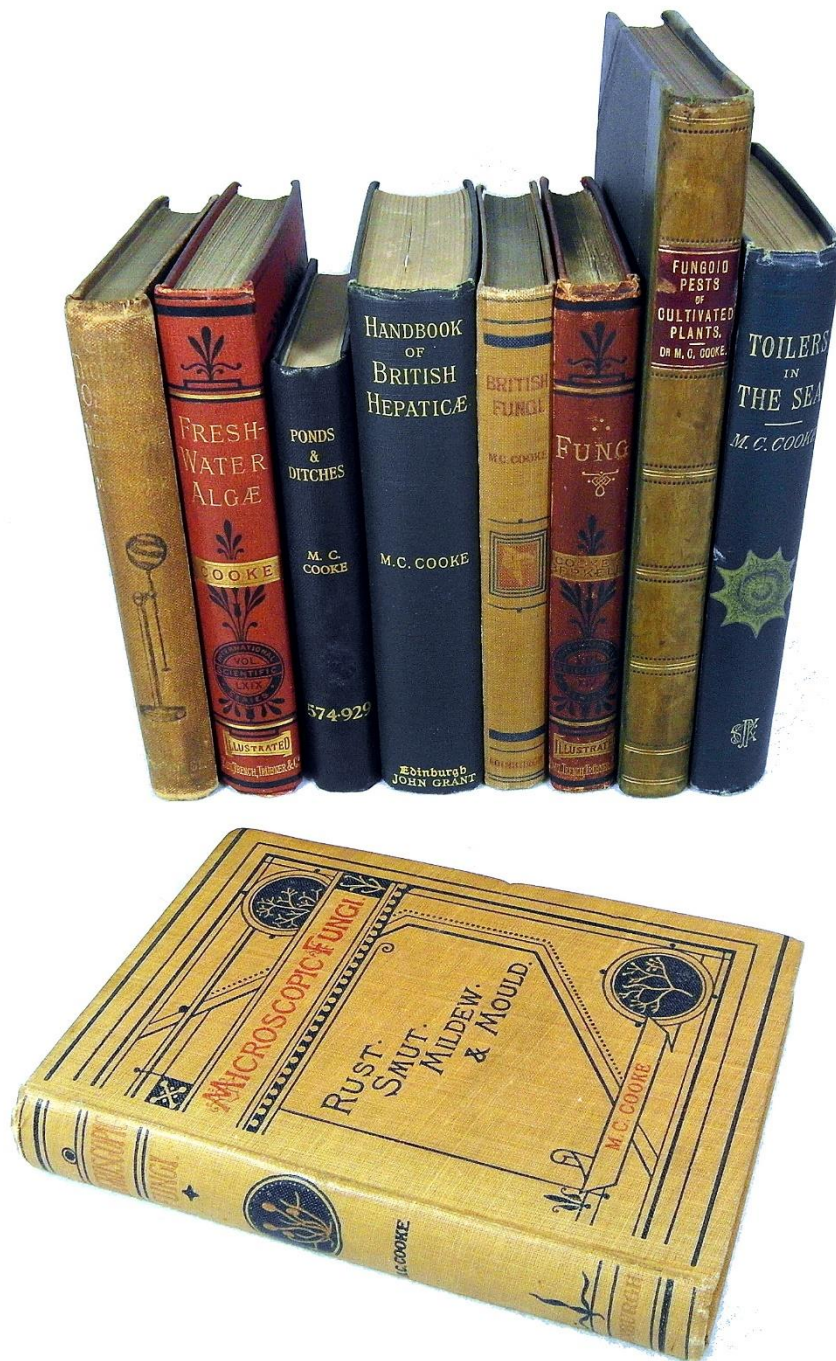


Figure 15. Dr. Cooke was a prolific writer and used his Traveller's Microscope extensively to support his publications

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In view of Moginie's role as a manufacturer of microscopes, it is not unreasonable to wonder if Moginie not only designed the "Traveller's" microscopes that were sold by Baker, but was perhaps their manufacturer. That is, rather than being either simply an employee or consultant, as had been previously thought, Moginie may have been a supplier to the considerably larger firm of C(harles) Baker.

In the 19th century it was not uncommon for makers and retailers to engrave their name on components or microscopes made by others. Moginie's signature is shown on a folding tripod microscope shown below.

Inside the bell jar with Dr. Cooke's microscope, stored at the Royal Horticultural Society (originally The Horticultural Society of London), was a note stating " Students Portable Microscope especially constructed to order by Moginie with large body and rack movement".

Turner had seen a similarly designed, but smaller, tripod microscope described in Jabez Hogg's 6th edition of *The Microscope* (Hogg, 1867) and in the 4th edition of Beale's *How to Work with the Microscope* (Beale, 1870). The microscope's "invention", described in Hogg, is credited to Mr. Moginie, of Mr. Baker's establishment. This citation and the note, with Dr. Cooke's microscope, referencing Moginie as the source were the circumstantial evidence that led Mr. Turner to conclude that Dr. Cooke's microscope was made by C. Baker of High Holborn, although designed by Moginie.

However, as Sherlock Holmes said in the *Boscombe Valley Mystery*, "Circumstantial evidence is a very tricky thing ... It may seem to point very straight to one thing, but if you shift your point of view a little, you may find it pointing in an equally uncompromising manner to something entirely different". (Doyle, 1892)

In 1978, Gerard Turner had no way to know that later information would confirm that Moginie was a manufacturer. In his conclusion, Gerard did not account for the differences between Baker's version and Dr. Cooke's Moginie, including the larger size, coarse, and fine focusing on Dr. Cooke's instrument. However, that Traveller's Microscope is unsigned.

Cooke's Moginie microscope is now owned by the Royal Botanic Gardens (RBG), Kew. It was gifted to them, along with some of Dr. Cooke's drawings and fungi specimens, by the RHS. Unfortunately, during the transfer of this Traveller's Microscope to the RBG, Kew the base of Dr. Cooke's Moginie was misplaced or lost. Thus, the Traveller's Microscope at the RBG is now without its cruciform base.

Brian Bracegirdle has Moginie manufacturing in the 1860s at 14 Ridginghouse Street, London and in the 1870s at 26 Litchfield Grove, Finchley, London (Bracegirdle, 1996). The proceedings of the "Microscopical Society of London" (MSL), later the Royal Microscopical Society (RMS), record Moginie's election to the society in 1866. His residence at the time of his election to the MSL is shown as 35, Queen Square. This

would place his residence and manufacturing location at Ridginghouse Street less than 2 miles from Baker's address

Baker was at his High Holborn Street location before London's geographic postcodes were implemented, so it's not surprising to see Baker continuing the tradition of signing his instruments "London" without a geographic suffix.

The Baker "Traveller's" microscope was introduced and sold by C. Baker in 1867.

Bracegirdle's dates combined with Moginie's signature on the portable field tripod microscope, as shown here, adds support to identifying Moginie as the maker of the Traveller's portable, and thus possibly Baker's supplier for these microscopes.

As his obituary noted, on Moginie's death, Microscopy had "lost a prominent and valued member".

... whatsoever a man soweth, that shall he also reap (KJV 1611: *Epistle to the Galatians*, 6:7)

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 (Microscopical Society London, 1889).

It was common at this time for contemporary microscope makers in England, and elsewhere, to freely copy each other's work. As had happened with the "Society of Arts" model over a decade earlier, and before Baker introduced the Traveller's Microscope, Baker's newly-designed field microscope gained

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significant popularity. So, as Baker had done with the Society of Arts model, his design for the "Traveller's Microscope", as described above, was freely copied by others including John Browning, as seen below (the Browning version is perhaps $\frac{1}{2}$ the size of the original Traveller's Microscope), and Watson & Son, now in the collection of the Royal Microscopical Society (Microscopical Society London, 1889).



Figure 16. Browning microscope, about 8-1/2" tall, as shown, 12.4 oz.

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Figure 17. John Browning/68 Strand/London/889 signature

Be Careful Out There (Some guidelines for buying).

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

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

At the time of this article, Traveller's microscopes, and their early copies by Browning and Watson and Son, were selling for about £375 - £1,210 GBP, or about \$600 - \$1,520 USD.

Unless this is a microscope you "must have", anything above £700 or about \$880 is likely too much. Of course, if this is a "must have" item, price is not a factor.

The prices at the higher end should include instruments with storage cases, and considered with the additional information noted below.

Microscopes with lacquered finishes and cases in excellent condition are worth more than ones that are pitted or have a large portion of their original lacquer removed. While Traveller's Microscopes are not common, 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 micro technique 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 ..." (Kakklalaya, 2011).

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, (Laurie, 1898) 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 (Ross, 1902).

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" (Bracegirdle, 2005).

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 (Gibson 1898).

The "Diagnostic" microscope (Bracegirdle, 2005) 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 (Spitta, 1907). 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, also from our collections, is the likely successor to that designed by Dr. Ross having a considerably easier to use, in the authors' opinions, side focus but no top fine focus. This model is somewhat smaller

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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 many of the Moginies, it is signed "Baker London" on the cylinder holding the body tube.



Figure 18. Bakers Folding Field Microscopes – The successor to Baker's Moginie-Style Microscopes?

Baker field microscopes provide excellent examples of the evolution of professional tripod field microscopes from their beginnings with Moginie's design in 1867, through their evolution to detect malaria, to later 20th century models.

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Although not in the top tier of British manufacturers (which include among others: Richard Beck, Hugh Powell, Peter Lealand, 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, and fortunately for collectors, Baker's microscopes, particularly later models, are not exceptionally rare or expensive and are often available from dealers and in the competitive marketplace.

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One of the authors, RJK, had corresponded with Mr. Turner for several decades. He was always helpful and generous with his time, and careful in stating his opinions. The information in this paper was not available at the time of Turner's original 1978 publication.

Published in the online magazine Micscape, February 2017,

www.microscopy-uk.org.uk.

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One of the authors, RJK, is preparing an inventory on the number and locations of existing Moginies. If you have one or more Moginie Traveller's Microscopes, please be kind enough to contact him at the email provided above. If you prefer your name not be presented in any future published lists, please annotate your submission accordingly.