

Microphotography & Photomicrography

There is a Distinction & There Should be No Confusion

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Unfortunately, from time to time you will see the term "microphotography" used when "photomicrography" is the appropriate term or "microphotograph" used when referring to a "photomicrograph". Even though these terms have been around for over 150 years, there still seems to be some misunderstanding about their **correct** use.

The Royal Microscopical Society (1) defines:

- 1) Microphotography - "Photography, especially of documents, arranged to produce small images which cannot be studied without *magnification*. Not to be confused with *photomicrography*."
- 2) Photomicrography - "The recording by photography of an *image* formed by a microscope; i.e. photography through a microscope. Note: Not to be confused with *microphotography*."

Furthermore, the New York Microscopical Society (2) defines:

- 1) Microphotograph - "A small, microscopic photograph, in which the image is minified; it requires enlarging or use of a lens system in order to view it. See photomicrograph."
- 2) Photomicrograph - "An image enlarged approximately 40X or higher, produced by light, cf., electron micrograph."
- 3) Photomicrography - "This term should not be reversed into microphotography. A photomicrograph is a photograph of a small object, the image is magnified more than approximately 40X by means of a compound microscope. A microphotograph is a small photograph, requiring an enlargement or a lens system in order to view it; the image is minified."

Also, most general use dictionaries will define the terms correctly but one may see in some dictionaries that after the correct definition for "photomicrograph" there is an added note that "microphotograph is sometimes used" and (sadly) not go on to express "incorrectly".

John Delly addresses this misunderstanding and explains in a footnote (3) that "Photomicrography should not be confused with *microphotography*, which involves making extremely small images of large objects. The distinction between the terms photomicrography and microphotography was made as early as 1858, but the confusion still persists. A contributing factor is faulty translation from the German language in which photomicrography is *mikrophotographie*."

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Microphotography is a fascinating subject that will only be briefly covered in this article. This author made a presentation on this subject with a good friend Robert Kuksuk, Curator of the State Microscopical Society of Illinois (SMSI), back in the eighties. The presentation was composed of 12 individual microphotographs that were recorded on a single microscope slide using a microscope in reverse. This was accomplished by projecting the presentation images downward through the microscope with high resolution film placed on the microscope stage to record the images.

Once developed, a microscope was used with a video system connected to TVs that showed the presentation to the audience. Microphotography was invented by John Benjamin Dancer from Manchester, England in 1839 using the Daguerreotype method (4). In 1858 he popularized and started to commercially produce microscope slides bearing micro-photographs on a variety of different subjects using the collodion process. A John Benjamin Dancer slide is shown in Figure 1 along with images of the microphotograph on the slide at higher magnifications. The detail that can be seen is amazing, especially since the microphotograph is well over 100 years old.

This J. B. Dancer slide bears an image of a painting by Landseer that was commissioned by the 6th Duke of Devonshire. The book referenced above by Bracegirdle and McCormick is beautifully produced, extremely informative, and is a wonderful addition to anyone's library.



Figure 1) Upper image of a J. B. Dancer microphotograph slide. The slide is a standard 1" by 3" glass slide and the microphotograph on the slide measures 1.8 mm by 1.4 mm. Lower left is a photomicrograph of the microphotograph. The lower right image shows a portion of the microphotograph with a scale inserted.

When first introduced, Dancer's microphotography slides were very popular but a microscope was needed to view the images. This problem was addressed by René Prudent Patrice Dagrón (5), a Frenchman, who combined the Stanhope lens (invented earlier in the century by Charles, 3rd Earl of Stanhope) with the microphotograph to produce magnificent novelty items (pendants, charms, rings, religious items, pocket knives, tie-pins, letter openers, etc). The novelty item was referred to as a "Stanhope", a "Stanhope Lens" or sometimes a "peep". A Stanhope pocket watch charm is shown in Figure 2. Each optical tube contains a different picture and when the Stanhope is placed near the eye one will see an enlarged image of the microphotographs when looking through one, then the other optical tube. Stanhopes can be found on e-Bay or can be purchased from Stanhope MicroWorks (www.stanhopemicroworks.com). Again, it is worth noting that the book by Jean Scott referenced above is beautifully produced, extremely informative and is a wonderful addition to anyone's library.

The first non-novelty application of microphotography was used during the Franco-Prussian War (1870-1871). During the Siege of Paris, stories have been told about how pigeons were used to carry messages but what one may not know is that the messages were in the form of microphotographs. Dagron was able to escape Paris by balloon and organize the sending to Paris microphotographs of military dispatches that were contained in goose quills attached to the tail of carrier pigeons. SMSI actually has one of these dispatches in their archives. A similar application was used in World War II when approximately 15 lines of text were embedded in a full stop or period (.) contained in letters from Germany (6). These periods looked innocuous but when removed and examined under a microscope at approximately 200X the message became obvious. The use of microphotography in the world of espionage continued throughout the twentieth century.



Figure 2) A bone Stanhope watch fob setting on a US quarter (diameter = 24 mm). Each optical tube contains a different microphotograph.

There has always been an unofficial competition based on how small a microphotograph can be made. In 1925, E. Goldberg recorded a legible page with 50 lines of text which was no larger than 0.1 mm (100 μm or 0.004 of an inch). This would be equal to imaging 50 complete bibles in one square inch (7). An example of a micro-Bible is shown in Figure 3. This micro-Bible contains 1245 pages in approximately one square inch and can be easily read using a magnifying system. If interested, a micro-Bible can be purchased from GreatScopes, Inc., (www.greatscopes.com). Some individuals may not know that a number of micro-Bibles were taken on the Apollo 14 mission to the moon and following their return were presented to dignitaries as gifts. One will probably recognize this Bible as Microfilm or Microfiche. Today microphotography is applied to data storage, optical reticles, and

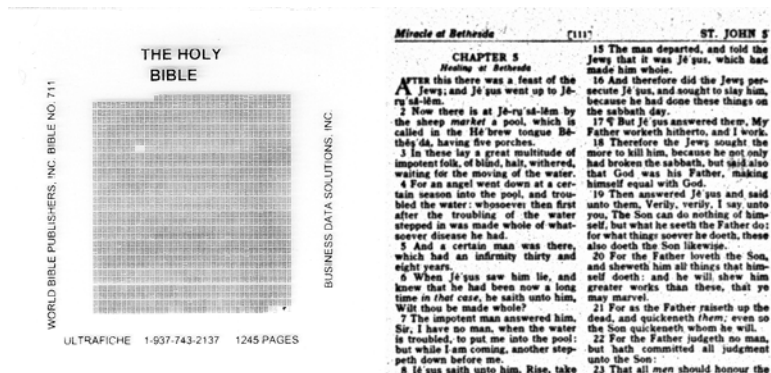


Figure 3) Left image is of a micro-Bible that measures 1 inch wide and 1-1/8 inches high. On the right is a photomicrograph of a page that measures 0.55 mm wide.

microelectronics (8). Also, the passion to see how much data can be stored in a minute area still continues today. In 2007, it was reported (9) that Israel produced a Hebrew Bible (Old Testament) containing ~300,000 words by photon etching a silicon surface within a 0.5 mm square area.

Now, a micrograph is a graphic reproduction of an enlarged image of an object formed by any microscope and is what we normally produce or see in publications. A photograph taken of an enlarged image through a light microscope is correctly referred to as a photomicrograph or sometimes light micrograph. The term macrophotograph may be used but not strictly adhered to if the magnification of the image is less than 40X. An image obtained by an electron microscope (e.g. scanning electron microscope and transmission electron microscope) is referred to as an electron micrograph or sometimes just micrograph. Determining and depicting the correct magnification of your micrograph (light or electron) is another topic for discussion that will be discussed in a future article.

By the way, a free internet encyclopedia (not named) defines "microphotograph" and "photomicrograph" as having the same meaning. Not surprisingly, by searching the Internet for "pictures of microphotographs" one will find thousands of photomicrographs and electron micrographs that are incorrectly identified as "microphotographs". Now the wrong usage and confusion is being spread world wide. What can I say?

REFERENCES

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