The Micro Collector's Workshop

Micro-mineral Photography "On The Cheep"

Tom Mortimer

Part of the fun of micro-mineral collecting is the enjoyment of showing your specimens to others. Attending our Micromounters meetings a great way to do this, but your audience is limited to the 10 to 20 members that typically attend. Photographing your specimens and attaching the digital images to e-mails sent to fellow collectors greatly expands your sharing domain. Ultimately, you may choose to post your shots to the world via mindat.org, (which presently boasts over 108,000 specimen photos, a significant percentage of these are micro specimens.)

In 2005, Scott Whittemore gave an excellent presentation at our May Symposium meeting on the art of Digital Microphotography. With a top-end Meiji trinocular microscope, a state-of-the-art digital camera, and a meticulous attention to detail, Scott was able to achieve superb photos of his micro specimens. Many of Scott's photos are presently posted on mindat.org, (http://www.mindat.org/gallery-2504.html). Scott has invested many thousands of dollars in his professional level set-up.

A desire to take digital photos of my micro-specimens, coupled with a desire to not break the family budget, (and maintain domestic tranquility), has motivated me to explore the micro-photography results I could obtain with a low-cost set-up. In December 2005, I took advantage of a Walmart pre-Christmas "door-buster special" to purchase a 5.1 M-pixel digital camera, (HP Photosmart E317), for $88. At the time, this was a very low price for a 5.1 M-pixel digital camera. The camera has a F3.5, 7.7 mm lens. It is a pretty minimalist digital camera: no optical zoom, auto focus only, no expansion memory card slot. My original plan was to remove the camera body and lens and experiment with positioning the camera's CCD image sensor above the eye-piece of my microscope. I might destroy the camera in the process, but if my experiment failed I would be out only $88. After I got my camera home and played with it a bit, I became reluctant to take it apart. I thought I would see what kind of results I could get by building an adapter to hold the camera at the optimal spot above my microscope eye-piece. I knew the attachment, once in place, must allow for no movement between the camera and the scope. Further, the alignment of the optical axis of the camera lens and the microscope eye-piece would want to be near perfect. The camera attachment needed to be easy to engage and remove, and be repeatable with a minimum of "fiddling". My completed camera adapter, is shown below, (Figure 1), and, fitted to my scope, (Figure 2).

Figure 1: Adapter with mounted digital camera.

Figure 2: Adapter, digital camera, and microscope.

Adapter Construction

For my scope attachment method, I chose to press fit a plastic piece onto the eye-piece holder of my American Optical brand scope. The plastic material I selected was a piece cut from a small nylon kitchen cutting board, (purchased for $3, from my local hardware store). This material is 3/8 inch thick. Since my attachment is to be a tight friction fit, the matching hole size in my nylon piece needed to be near perfect. Fortunately, a standard 1 ¼ inch hole saw turned out to be just right. My finished nylon attachment piece is shown in figure 3 and fit to the scope in figure 4.

Figure 3: Nylon press-fit microscope attachment piece, (approx 4“ x 2 ½ “).

Figure 4: Nylon press-fit microscope attachment piece on American Optical microscope.

Next, two holes were drilled in the end of the nylon piece and tapped for 6-32 screws. These holes enable the attachment of a 4 inch by 5 inch piece of ¼ inch Plexiglass at a right angle to the nylon piece. All that now remains is to attach the camera to the Plexi piece. My HP camera, like most sold today, have a threaded hole in the base for attachment to a tripod. The hole is threaded for a standard ¼ - 20 bolt. A bolt hole through the Plexi piece for the camera mount must be positioned accurately, so the camera lens aligns with the hole in the nylon piece. The left-right distance of this bolt hole, (relative to the 1 ¼ Plexi hole), is critical. The front to back separation distance to the nylon piece is less important, and can be compensated for, as explained later. The distance from the camera lens optical axis to the camera bolt mount hole is unique to each camera model. This distance must be accurately determined in order to position the bolt hole in the Plexi piece. I used a 2 inch long ¼ - 20 bolt for my camera attachment. A pair of ¼ - 20 nuts adjust the camera vertical position relative to the Plexi piece, (and thus the camera lens vertical position relative to the nylon piece hole). A third ¼ - 20 nut locks the camera in position to the top of the bolt.

Adapter Alignment

This section describes the x, y, and z axis positioning of the camera relative to the microscope eyepiece lens. First, pick a high contrast subject to view, such as a section of printed text. Focus your microscope as usual, then place the camera with the adapter on the scope. Turn on the camera and observe the image on the camera display. Each axis positioning is described separately below. I have found the camera to microscope alignment to be an iterative process. I alternately made adjustments to each axis position until I achieved the best alignment.

The distance from the camera lens to the eyepiece lens, (I’ll call this the z axis), may be adjusted by how far the adapter is pressed onto the scope eyepiece holder tube. An incorrect distance may result in “vignetting”, i.e. the microscope image appears in a circle on the camera display. Once the optimal position is found, a “stop” may be fit onto the scope eyepiece tube, so the same z axis position is achieved

each time the adapter is attached. I used my 1 ¼ hole saw and several thicknesses of hobbiest basswood for this, (figure 5).

Figure 5: Basswood adapter "stop" on microscope

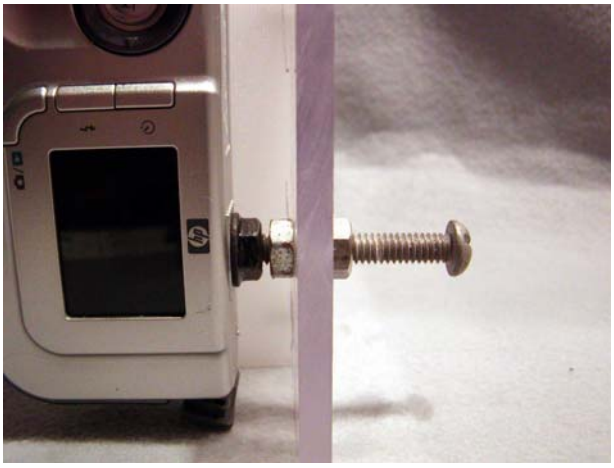

Figure 6: Camera mounting bolt with "y" position adjustment nuts.

The up-down position of the camera lens, (I'll define as the "y" axis), is simply adjusted using the two ¼ - 20 nuts on the mounting bolt, Figure 6.
The left-right ("x" axis) may require adjustment if the bolt hole in the Plexi piece is not positioned exactly, (based on your measurement of the camera lens optical axis to the camera bolt mount hole described above). To enable this adjustment, a bit of extra work is needed. The holes for the 6:32 screws in the Plexi piece must be elongated to permit the nylon piece to slide in the "x' direction. These elongated holes are shown in figure 7.

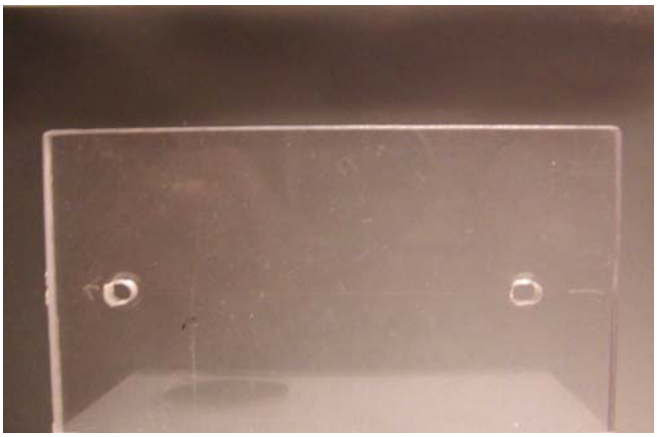

Figure 7: Elongated holes in Plexi piece for "x" axis adjustment.

Taking Pictures

Focus your specimen as normal, then attach your adapter-camera set-up. If your camera has an autoflash, turn it off. Use your camera's delay trigger shutter to eliminate any camera vibration when snapping the picture. You may also wish to adjust the scope focus up and down slightly, taking multiple shots, then choose the best focused one when viewing the results on your PC.

A couple of photos I have taken with my set-up are shown in figures 8 and 9. (I have Photoshop to add red text to my pictures.)

I will bring my adapter and camera to the October, 2007 MMNE meeting.

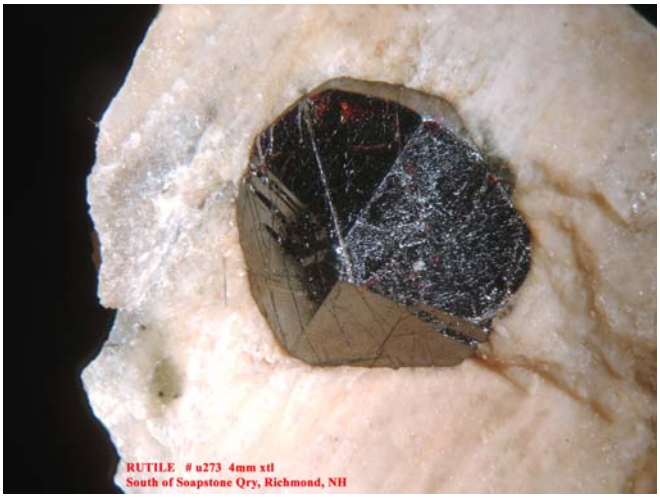

Figure 8 Rutile, 4 mm XL, Soapstone Quarry, Richmond. NH

Figure 9 Gahnite, 3.5 mm XL, Davis Pyrite Mine, Rowe, MA

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Gene Bearss Photograph

Milarite, Oliver Trench, WMNF, Moat Mtn., Hales Location, NH
Gene Bearss Specimen and Photograph