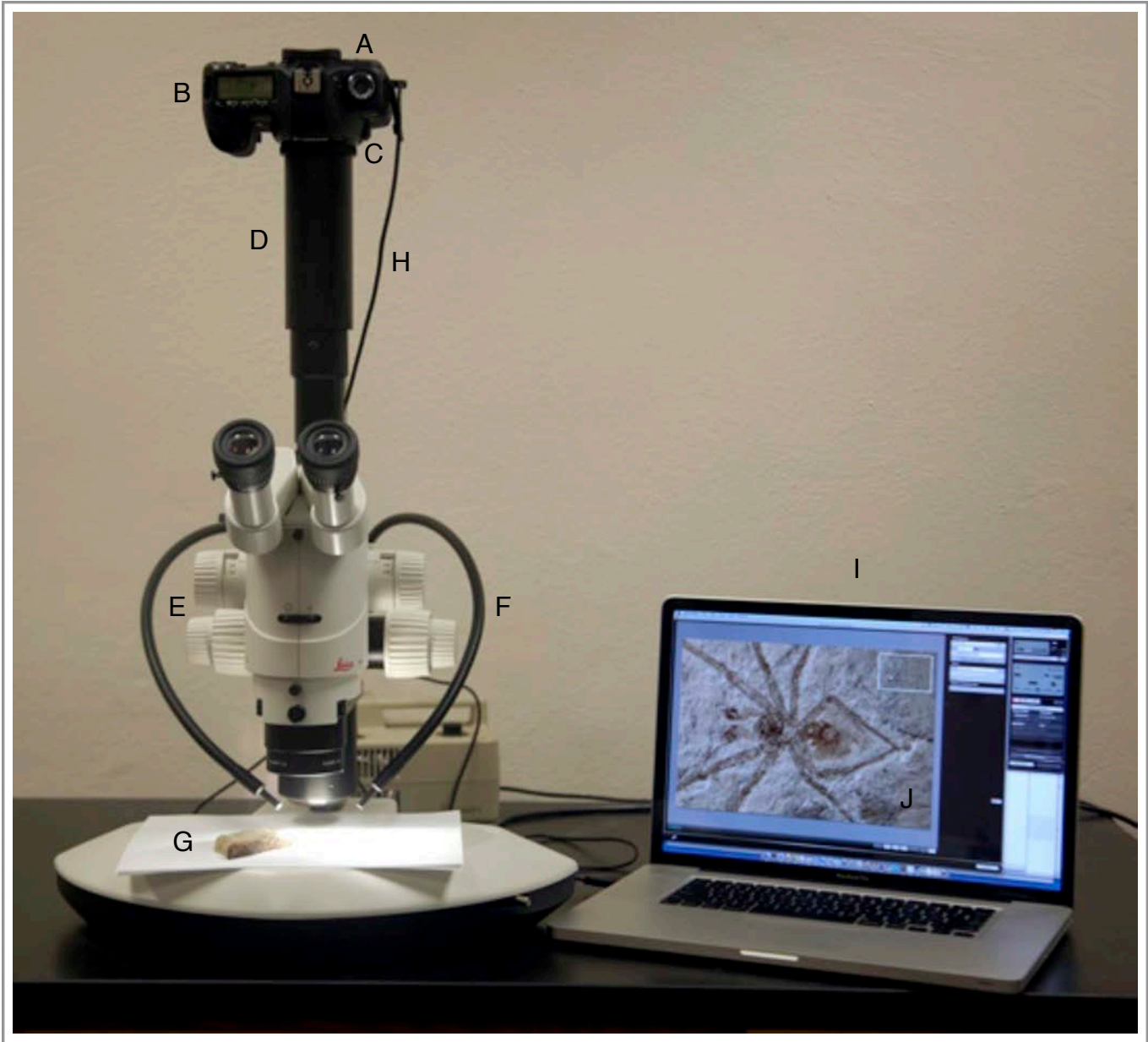# Workflow for Fossil Spiders

This document gives the setup and workflow I use for photographing fossil spiders. There are two setups: the microscope (see picture) and a macrophotography setup on the copy stand. The protocol for the microscope is given here, together with notes on the macro setup and workflow, as appropriate.

SETUP

In the photograph, the labels refer to the items below:

A.   Eyepiece cover; remember this to keep light from entering through the eyepiece.

B. **Canon EOS 5D MkIII**. This is a full-frame sensor DSLR. The MkII is also fine, as is any similar DSLR, but make sure that the camera allows for LiveView (the mirror flips up so that the image can be seen on the computer screen).

C. M42 screw adapter. Use the correct mounting adapter to enable fitting your camera body (in this case Canon) to the M42 screw thread on the phototube. Adapters are cheap from any photo store.

D. Phototube. The Leica uses a series of tubes and includes a 10× eyepiece. The whole assembly fits onto a trinocular head. This assembly will also mount on a lateral photo tube.

E. I use **Leica** stereoscopes. Any one will do: when I travel, I carry the camera and phototube assembly (A–D), which will mount on any of the Leica M and DM series microscopes. The one shown is an M16; we also have M205C and DM2500M microscopes in the lab; the photo assembly can be transferred between them all. Make sure the iris diaphragm is wide open, any drawing tube is turned off, and (IMPORTANT), also cover the eyepieces or turn off the room lighting otherwise you will get an image of any ceiling lighting superimposed on the photo. It took me years to discover this problem. Also, if using polarization, you do not want stray, non-polarized light entering the system.

F. Lighting: I use a variety of lighting setups: twin swan-neck (shown), and ring-illumination most commonly. For polarization on the stereoscope, I have a circular band of polarizing filter (cut by hand form a sheet) taped over the ringlight, and a photographic circular polarizing filter fits neatly between the ringlight and the objective lens. Rotating the polarizing filter to extinction provides higher definition and also cuts out any glare from the alcohol. Both filters are available from photo stores.

G. The specimen shown here is dry, but normally I would immerse in alcohol to increase the definition of the fossil from the rock. Sometimes, both alcohol immersion and polarization gives the best results. For a quick snap, it is possible to just squirt ethanol over the specimen, but for longer sessions, and to reduce glare from things breaking the surface, full immersion is better.

H. USB cable from camera to computer.

I. I use an **Apple MacBook Pro** 17" laptop for capture and processing (more on that later). This model is no longer available (15" is the largest screen size, but the new screens have higher density pixels). My machine is souped up to the maximum, with 16GB RAM, SSD drives, and a 128GB SSD Wintec FileMate ExpressCard in the ExpressCard slot (no longer fitted to the newer MacBooks) as a dedicated Photoshop scratch disk.

J. Software: any image capture software will do for capture, including that supplied by Canon (shown in the picture). However, I prefer **DSLR Assistant**, which is dedicated Canon–Mac capture software. It is simple to use and does a few neat things. For example, if using it on a macrophotography setup, a stack of images can be taken automatically as the software will drive the macro lens remotely. It cannot, of course, do this on the microscope.

WORKFLOW

1. Turn on the lighting, connect the cable from the camera to the laptop, and turn on the camera. This usually starts up the software automatically; if not, open the application and choose LiveView: a picture of what you have under the microscope will appear on the screen.

2. Camera is set to P; I use 100 ASA for lowest noise (less of a problem these days), and the software works out the exposure. Photos are taken in Camera Raw. This allows for archiving at the best quality and widest color gamut. Occasionally, I do need to go back to these raw files.

3. Name your files and folders! Choose any system you want; I use the date and specimen number (also part or counterpart for fossils with both sides).

4. Zoom in or out for the crop you want and focus the microscope. I normally take a preliminary shot of the whole specimen together with a mm scale alongside, for future reference (see later).

5. For most fossil spiders, I take a large mosaic of high-magnification shots which I stitch together. So, starting at one corner (e.g., top left), take a shot. NOTE: you will need some shots of bare rock, e.g., between outstretched legs and around the edges, in order to end up with a nice, rectangular final picture for publication.

6. For each shot, if not all is in focus, take several shots of the same area at different focus planes. Focus manually on the microscope or, if using a macro lens, this can be achieved automatically with the software. Later, these can be stacked.

7. Move the specimen gently to the next shot area, remembering that about a 40% overlap is necessary for stitching successfully. If necessary, take a stack again.

8. After all shots are taken, turn off LiveView, turn off the camera, and close the software.

9. Find your folder, in which will be all the shots taken. I now convert these from RAW to TIF. Photoshop can do this, but I use **Capture One Pro**, which is reckoned to be the best. It is a professional photography suite, similar to Aperture or Lightroom, written for the Phase One medium format digital cameras, but also available for Canon and Nikon DSLR. It is expensive, but if your educational institution has a contract with a software supplier, you can get it for about $100. I batch convert all to 8-bit RGB TIF files (with this setup, they are each about 60MB in size). Store the RAW files somewhere safe!

10. Now begins the process of stitching everything together in **Photoshop**. First, find the stacks. Photoshop has a number of ways to stack and merge. Under *File > Automate*, you will find *Photomerge*. This only works for a few files, e.g., a short panorama, or 5 or 6 well-overlapped pictures of a specimen that would not fit under the microscope completely. I rarely use this.

11. For stacking, it is usually safe to use *File > Scripts > Load Files into Stack...* Use the option *Add Open Files* to load your stack (if more files open, you can remove the unwanted ones), or else browse for the files you need. Make sure you click on the *Attempt to Automatically Align Source Images* option; this will align the images ready for merging.

12. The fully manual method of stacking is to copy and paste all of the images you want to stack into one file (each one on its own layer). If one layer is a Background, it must be converted to a numbered layer by double-clicking on it in the Layers palette and renaming it (e.g., Layer 0). Then, select all layers in the Layers palette, and choose *Edit > Auto-Align Layers...* there are various options here; I just leave it at Auto and do not check the other boxes. This command will attempt to align the layers, just as in the automated method in 11.

13. Once the layers are aligned, they can be merged. Again, all layers you want to merge must be selected in the Layers palette (they will be already after the last step). Choose *Edit > Auto-Blend Layers...* The options here are: Panorama or Stack Images (choose stack for this step) and make sure you check *Seamless Tones and Colors*.

14. The result will be a series of layers in the Layers palette showing which parts of each layer have been used or deleted. It is worth looking through these to identify if any images are redundant. If all looks OK (the main window shows the result), then choose *Layers > Merge Layers* to merge them. You will probably see that the edges are a bit blurry; IMPORTANT: crop the image to exclude these artefacts.

15. Having done all the z-stacks in this way (NOTE: this can also be done in Helicon Focus or other stacking software), we now need to stitch the images together into a mosaic. *File > Automate > Photomerge* is unlikely to work on more than a few images (see above), in which case, do it manually. Copy and paste the first image onto the second and auto-align (see 12, above). Then select all layers (remember: none can be a Background) and choose *Edit > Auto-Blend Layers...* as in 13. This time, select Panorama, and make sure you check *Seamless Tones and Colors*. The result will be a small panorama of the two images.

16. Continue to add each image to the new panorama, merging, and saving after each step. See the picture below.
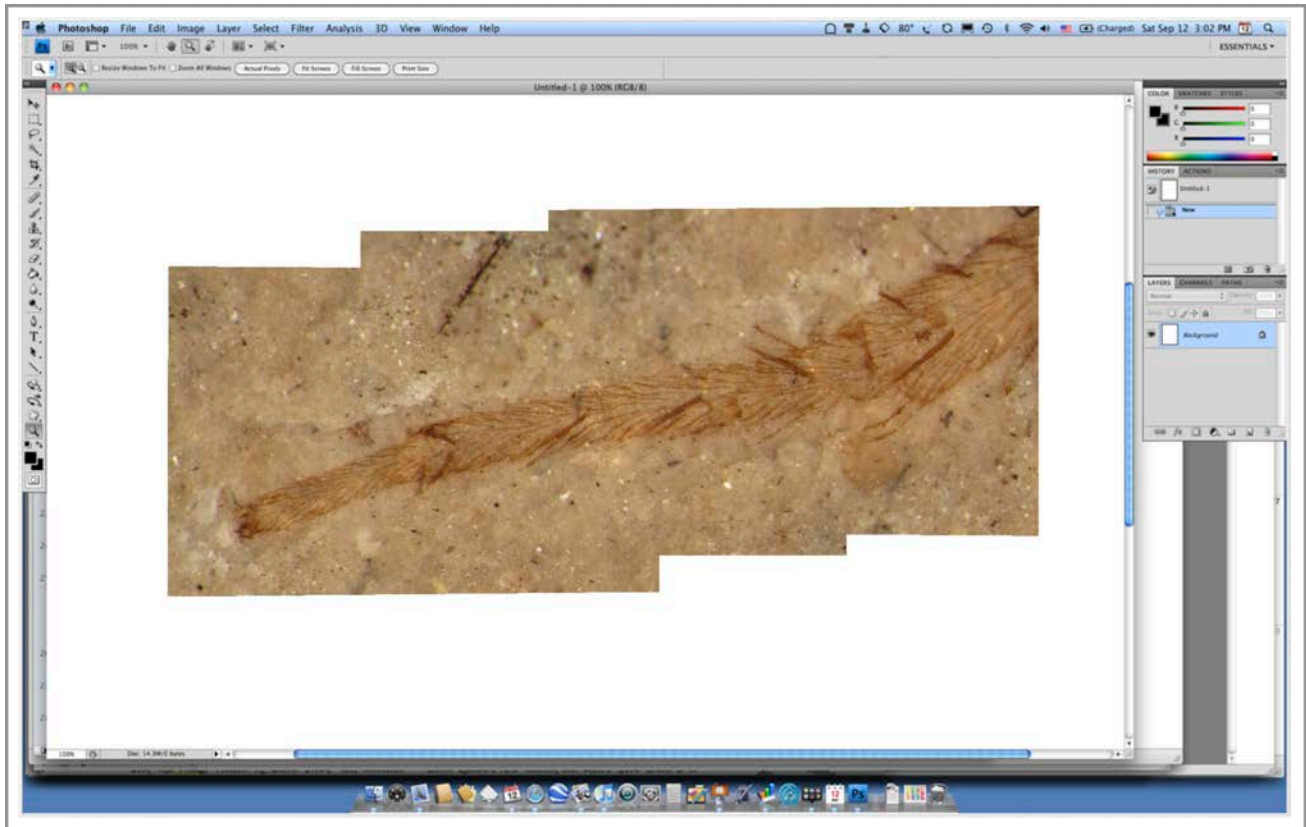
17. Gradually, the whole specimen can be assembled into one large mosaic. Each image starts at about 60MB, so the final image can reach 1 or 2GB in size. You will need plenty of RAM and scratch disk space to manipulate this file.

18. The final image may show distortion around the edges. To remove this, I drop in the picture I took of the whole specimen with the scale ruler. Make this layer half-transparent (Opacity 50% on the Layers palette), so both layers can be seen. Resize and rotate the new layer with the whole specimen until it is at the size of the underlying panorama. If any distortion needs correcting, the panorama layer can be distorted back to its correct proportions by selecting the layer (*Select All*) and then carefully using *Edit > Transform > Warp* to get it into shape. In practice, I find that there is really little or no distortion and this step is unnecessary, but it is worth checking.

19. Before removing the additional layer, create a new layer and draw a black line along 1mm (or whatever) of the ruler to provide a scale for the main panorama. Now, the imported layer can be deleted, and what remains is a panorama with a scale on a separate layer.

20. Now, the image can be cropped to remove the ragged edges. If there are still some patches without an image (e.g., at the edge where some background is missing), then use of the Clone Stamp, Spot Healing Brushes, etc. can be used to fill in. Adjustments to color, tone, contrast, saturation, etc. can now be applied, also some sharpening if necessary.

21. The final result is shown in the picture overleaf.
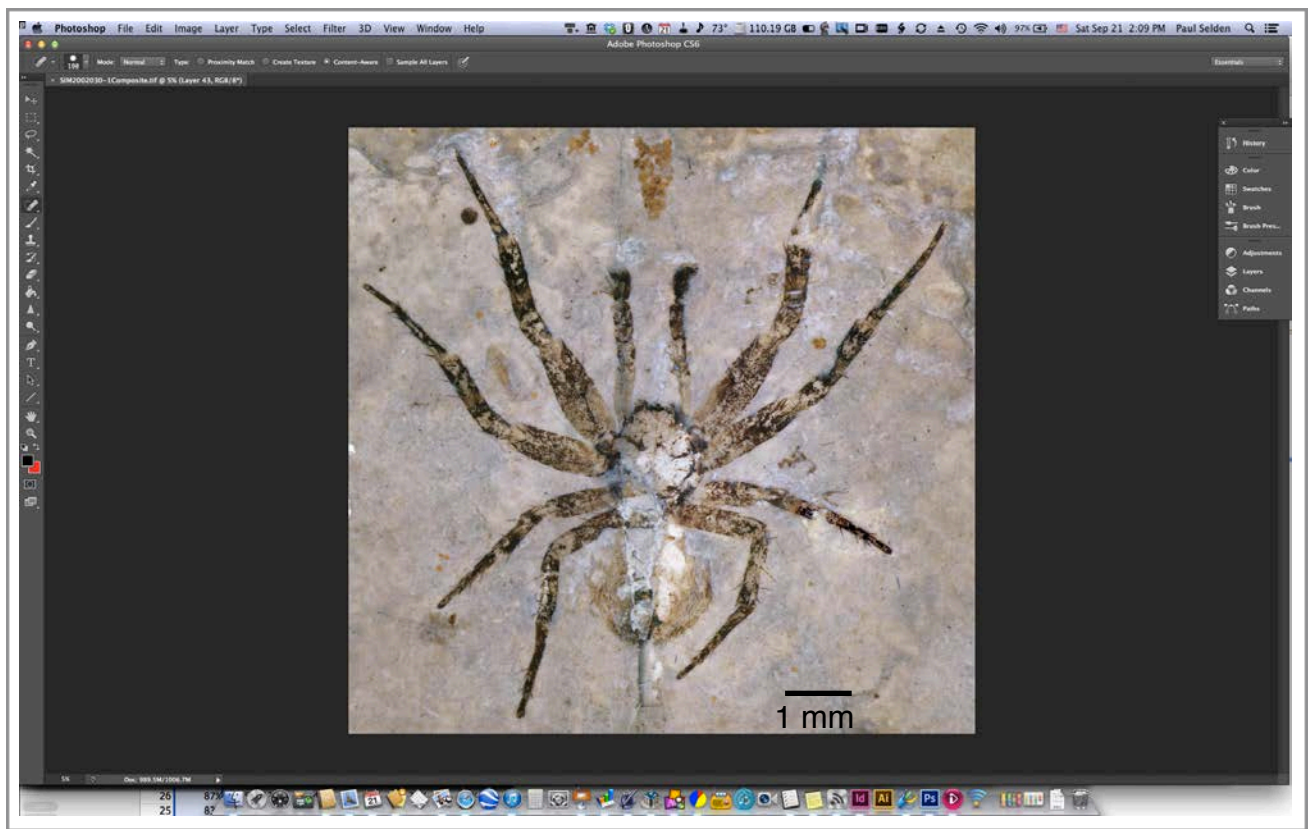
Paul Selden
Saturday, September 21, 2013