

# These articles have been combined from a series written for the Charlotte Gem and Mineral Club Newsletter. 2009 - 2011

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author: ron gibbs  
theimage1@aol.com  
[www.theimage.com](http://www.theimage.com)  
[www.theimagebooks.com](http://www.theimagebooks.com)

## *A rough summary of the information in each article ...*

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# *Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Parts I - XX* by ron gibbs



*Stone Canyon Jasper Cabochon*



*Calcite Crystal*

Over the next several months I will be writing a series of articles on using digital cameras to capture items related to our hobby. I now have a ready supply of material since I am just finishing the preparation for teaching a class in the topic at William Holland Lapidary School.

My company bought me a Mac II color computer in 1987 and I saw what real color digital images could look like, wow, I was impressed. I was a very early user of digital cameras, the first one that I used (notice I did not say owned, again my company bought one for me to evaluate) was from Panasonic, and dated back to 1989 - 1990. They produced a digital still camera with something like 320 x 240 pixels of resolution for the price of only \$2500. It used, small, roughly 1 inch floppy disks to save the images in almost real time. Color photos, well not at this time and price point.

In 1990 I managed to get a copy of Photoshop with the PhotoMat icon and began to play with digital images, I closed down most of my personal "wet chemistry" darkroom that same year as I believed I saw the future, and it was digital photography.

In 1994 I got my hands on my second digital camera, the Apple Quicktake camera which doubled the resolution to 640x480 pixels and could save 8 full size images for only \$750. And it had Color! How could things get any better?

It has taken about 20 years for the digital camera to achieve the same general resolution as film, but digital editing (Photoshop) provided advancements in image control never fully realized by the "wet chemistry darkroom". I spent much of my time developing digital techniques to adapt to science since I was once a chemist with a strong interest in photography.



*Citrine, Rose de France (Amethyst), Ametrine*



*Gaspeite, jasper, opal in sterling silver*

I will break up the future articles into the following main topics and proceed accordingly. There will likely be more than one article devoted to each topic.

- 1.) The Camera - what are the minimal requirements of a camera to produce reasonable digital images from the afore mentioned subjects.
- 2.) The Camera Controls - what are the most important settings, and why select them for virtually all of the photography.
- 3.) Lighting - the often overlooked critical element in taking the photographs - the “Color” of light, the quality of light and its placement.
- 4.) Lighting setups for each of the subject types, and backgrounds
- 5.) Adobe Photoshop or Adobe Elements for editing the photos and getting the most from each image. Which tools are easy and fast for most users.
- 6.) What can I do with all these images now that I have created this library of photos?

So let’s begin with camera specifications for use in close-up digital images of lapidary materials.

- 1.) The Camera Specifications -

We may as well start with the number one *marketing* topic for digital cameras ... Resolution. This seems to be the topic most often discussed when describing a digital camera and, what makes it better than another. In reality it has become one of the least important topics for most cam

era users. Notice I highlighted the word “marketing”, it has become more of a marketing gimmick than a useful function for sometime.

Resolution is given in terms of total pixels, we have 2 mega pixel (MP = millions of pixels) cameras, 4 MP, 8 MP up to about 20 MP today. The resolution you need is solely dependent upon the final use of the image.

There are generally two uses for images, they can be used to display on a monitor (WEB, e-mail, pdf based newsletter, or slideshows.)

For this use, most computer monitors display 1024 x 768 pixels of resolution, that’s less than 0.8 MP! If we want to show full resolution slides on our high definition TV, it is now 1912 x 1080 pixels for full screen, or only slightly over 2 MP off total resolution.

For users who do not want to print images, and only want to electronically display them at high quality, they rarely need more than 4 to 5 MP of resolution. Try to find a digital camera with that low of resolution today.

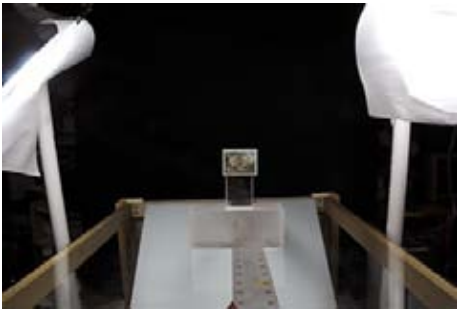
For those interested in printing pictures, you do need more resolution. It’s actually because all of the printing technologies have to use patterns of dots to create a full spectrum of colors. This technique, called dithering, requires more pixels to achieve the same visual resolution that a monitor does.

At the low end of the scale, you need about 2 MP to create a reasonable 8 inch by 10 inch print. If you



*Porcelean Jasper (aka Scifi Jasper, Exotica Jasper, etc. etc. )*





Stamp with 35mm lens



Stamp with 70mm lens



Stamp with Macro lens

want the best possible 8x10 print then about 8 MP is recommended. If you are going to print enlargements that are 11x14 or 16x20 inches in size, then higher resolution camera may be the ticket for you.

For most people, non-photo pros, 8-10 MP is over kill as far as resolution is concerned.

So what else is important for shooting close-up images? The camera needs “macro” capability. “Macro” means that the camera can “fill the frame” with the subject. Digital images cannot be blown up beyond their highest original resolution without loss in image quality.

Lets look at the examples to the



35mm lens

70mm lens

macro lens

left. Each photo is full frame and is about 3000 x 2000 pixels of total resolution. In the first image the stamp is roughly 228 x 174 pixels in total size. In the second image it is 670 x 510 pixels in size, and in the last image it is 1500 x 1150 pixels in size.

Notice the resolution/quality difference in the three blow-ups above. The first is with the 35mm lens, the second with the 70mm and the final image is with the macro. Sharpness is best obtained when you fill the frame with the image and get as many original pixels as possible in the photo - so the general rule for digital images - ***always fill the frame!***

Next month we'll look at focus, and shutter speed.

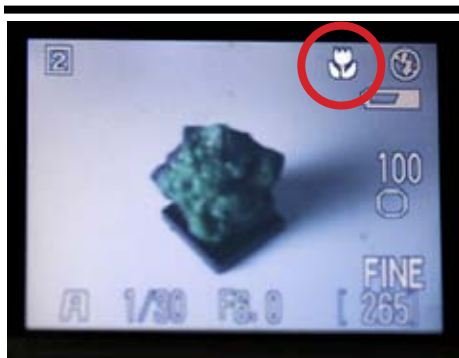
# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part II by ron gibbs



Macro Mode

Over the next couple of installments I will discuss what I believe are the most important features to obtain when you purchase a digital camera for Lapidary related close-up work on the WEB or in print.

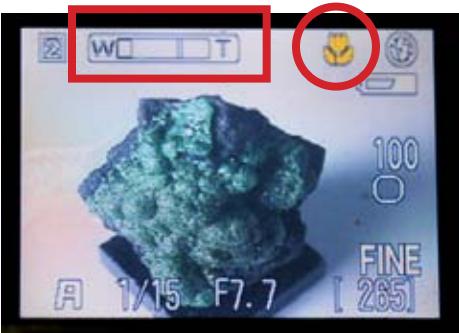
In Part I, I ended with the general rule of “fill the frame” with the image. Digital images cannot easily be enlarged above their original size without image detail loss. Thus high on the feature list for jewelry, cabochons, gemstones, slabs, etc. is MACRO FOCUS on the camera. To achieve highly detailed images you must fill the frame with the material being photographed and that means focusing close to the subject matter.



Macro Mode - but “zoom” in wrong position and therefore NO focus possible

Today most digital cameras have a “macro” mode and it is often designated as a small “flower icon” (fig. 1) somewhere on one of the many controls. Typically the focal distance runs from about 1 to 3 inches out to about 8-10 inches. It may vary depending on the “zoom” setting of the lens.

When the lens is set to it’s wide angle setting, it will typically be in the 1-3” range and when set to one of a telephoto setting it’s likely to be in the 6-10 inch range. (Important NOTE! - many times the macro setting will only focus throughout a narrow band of the zooming range.)



Macro Mode - “zoom” now in acceptable range - macro will now focus properly. The flower has changed from white to yellow in this image.

This means once the macro function is turned on, the zoom must be adjusted to a certain narrow range where close focus is possible. Some manufacturers show the flower icon in the view finder as you try to focus and when the proper focus can be achieved, the flower changes color. Look in the camera manual to see if this is true for your camera or you will NOT be able to achieve focus no matter how hard you try. (See figure 2.)

So, item one on our purchase list is a macro capability in the lens. I prefer a lens that will focus successfully at about 3” out to 8” and fill most of the frame with the photographed object. If your camera focuses at the 1 to 2” range only, it may be hard to get lighting into the subject as there is little space between it and the lens.

This brings me to the next point on focus. Most of today digital cameras can be divided into two “AUTO-FOCUS” categories, passive auto and active auto.



Typical Self-Timer Icon

Active focus systems use a secondary beam of light, infra red or in rare cases sound to achieve the focus. They measure the time it takes to send the beam out to the object and then return to the camera sensor. The time is proportional to the distance and they set the focus accordingly. These type of systems have a few problems build-in. First if there is something



transparent between the camera and the object (like a clear window) the camera will tend to focus on the window pane and not the object. In the case of IR (infra red) sensors they can be fooled by heated objects in the scene or by objects that absorb large amounts of infra red radiation.

The Passive focus systems use software in the camera and examine the image on the ccd (or equivalent sensor) in the camera and determine focus by the contrast in the image. Sharp lines are sharp because they have high contrast. Thus the software determines the best spot to focus on by the area in the image with the best (read that as highest) contrast. Unfortunately this is not always the part of an object you may want in focus. Take of example a piece of jewelry, a rounded cabochon in the center may not have enough to contrast to force the auto-focus to find it if the is sharp wire work or edges around the rear surface of the jewelry piece. Hence the cab may always appear out of focus while the wire work is sharp. Continuous tone, similar hues, and flat objects without shading may confuse this type of focusing system.,.

Another nice feature in a digital close-up camera is “MANUAL FOCUS”. It is possible to work around the lack of manual focus, but it’s really handy if you are doing large quantities of macro work.

Also the next topic goes hand-in-hand with focus, and that is tripping the shutter (taking the picture). In order to get crisp, sharp images the camera must be maintained rock steady. This means the use of a tripod, either table top or floor standing for all of our shooting. Buy a sturdy tripod, not a little thin, flimsy one.

When a camera is mounted on a tripod via the tripod mounting screw in the base of the camera, it is best to actually take the exposure by using either the self-timer on the camera (virtually all of today’s digital cameras have them. OR if available, buy a remote shutter release to fire the camera. Many of the current digital camera’s have either IR remote controls or manual remote with a wire tether. Either will work. If they are not available then use the self-timer to actually take the image.

At first glance images shot hand-holding or on the tripod using your finger will look fine in the camera view-finder or in most camera LCD display screens. When the image is finally transferred to the computer to look at it full size it will likely look far less sharp when blown up if taken hand-held or with your finger on the shutter release (even on the tripod). The three images to the right show the result of lowing up part of the cabochon shot using the three methods.

Fig 3. - Image hand held and enlarged - very large loss of detail in the photo. Fig 4. the camera on a tripod but the shutter pressed by a finger. There is still some degree of blur in the blown up image. The last in the sequence, Fig, 5, was captured using the self-timer and the detail is sharp.



*Cabochon Photograph*



*Fig. 3*



*Fig. 4*



*Fig. 5*

The list has now grown to begin the selection of a digital camera with features most likely to aid in close-up photography.

- 1.) Macro -focus to boost the size of the image and apply the largest number of pixels possible.
- 2.) Manual control of focus to select the specific part of the image to maintain in sharp focus.
- 3.) Self-timer and/or remote shutter release to use to take the picture to avoid camera shake and maintain a crisp image. (Although not part of the camera - a good tripod is also a necessity for a sharp image.)

Next month I will discuss the exposure part of taking a proper image, the need for f-stop (aperture) control, the best shooting mode, and how the camera determines the exposure, and why it can be wrong.

*(Continued info on auto-focus)  
-some work arounds -*

If the camera you have does not have MANUAL focus there are a couple of potential work-arounds you may try in order to achieve the control of focus you need. The first one can be implemented easily if you have a remote release mechanism.

Most of the current digital cameras run through the same general procedure just before they actually expose the image. They re-check the exposure if in auto-mode, and they RESET the FOCUS (in auto focus) just before they actually take the picture. This auto-RESETTING OF FOCUS is what may change the desired focus point. Most of the

current crop of digital cameras can be made to auto-focus and HOLD the focus by HALFWAY depressing the shutter release button and holding it in that halfway position.

While holding the button in the half way position you can move the object very slightly toward or away from the camera to achieve the desired focus. It's not easy, but it can be done. Once the object is moved to the correct position, the shutter is fully depressed finishing the exposure.

It is a little difficult using the LCD plate to determine the focus, but it can be done with practice on most cameras while the shutter is half-depressed. You have to look at the image in the LCD while manipulating the object and continuing to hold the shutter in the half-depressed position.

Another, *sometimes* successful trick is to introduce a "crosshair" drawing in the image at the point where you desire focus. A bright white piece of paper with a dark cross on it (crosshair) (Figs. 6-8) will sometimes make the camera see it as the highest contrast area and focus at this point. If there is room the crosshair can remain in the image and be removed in post processing with Photoshop or an equivalent.

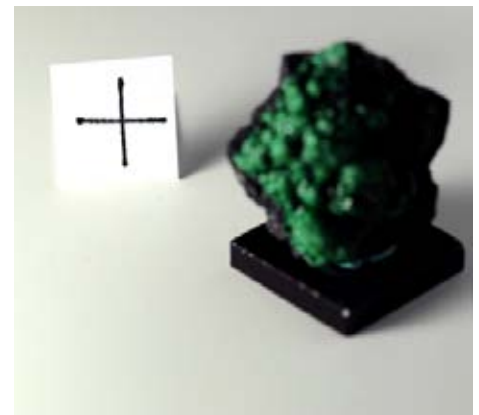
Once the camera focuses on the crosshair it can also be removed, halfway depress the shutter, and while holding the shutter at the half-depressed point, check the focus to be certain the camera focused properly on the crosshair, and then remove the small



*Fig.6 - too far front*



*Fig.7 - about right!*



*Fig.8 - too far behind*

crosshair, and finish depressing to take the image. Both techniques are much easier with a remote shutter release.

# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part III *by ron gibbs*



figure 1.



figure 2.

Picking up this month we'll look at some things related to proper exposure, and those features I think are important for a camera that is being used for close-up photography. Three items immediately come to mind, the control of the f-stop (sometimes called the aperture, iris, or diaphragm), the best exposure mode to use for most close-up work, and finally how the camera actually calculates exposure.

Proper exposure is obtained by balancing three things in photography. The "intensity of the light" striking the sensor (or film), the "duration of time" it strikes the sensor, and the "sensitivity" of the sensor. For now we'll assume the sensitivity of the sensor (ISO value or ASA speed) is going to be a constant value. When this value is constant then the ratio of light intensity and duration control the exposure.

Light intensity is controlled by a "light valve" (a mechanical iris) which in effect is a variable size hole. When a lens allows all of the light to pass that it can, the lens is said to be operating at its native aperture or highest speed. The lens in figure 1 is shown "wide open" at its native aperture. When the iris is reduced, it allows less light to pass through the lens and effectively makes it slower. Figure 2 shows an iris partially closed.

Aperture is measured as a function of the diameter of a lens versus its focal length. Thus a 50 mm diameter lens with a 50 mm focal length would have an aperture value of f/1.0. If the iris is reduced to allow only one half as much light to pass, then the f-stop of the lens would be f/1.4. So where do the weird numbers come from? Turns out that the amount of light passing through the hole is really a function of the size (or area) of the hole. The area of a circular hole can be calculated by the formula  $Area = \pi \times r^2$  (pi times the radius squared). Thus a hole that allows one half the light so pass will be related to the square root of area,  $r = \sqrt{A/\pi}$  (since pi is a constant value we can forget it while doing comparisons.)

Light Ratio	f-stop	square root hole area
1:1	f/1.0	1.0
1:2	f/1.4	1.4142
1:4	f/2.0	2.0
1:8	f/2.8	2.8284
1:16	f/4	4.0
1:32	f/5.6	5.6568
1:64	f/8	8.0
1:128	f/11	11.3137
1:256	f/16	16
1:512	f/22	22.6274

figure 3.

Thus the table of f-stops looks like figure 3 and is actually based on the area of the circle involved in the iris. It's too hard for us to remember the precise values so we round them off to the f-numbers. Controlling the f-number provides the close-up photographer with one very important tool. Not only is it one half of the exposure control, but the higher the f-number (the smaller the hole size) the greater the "depth of focus" of the image.

As an object gets closer to the lens, it has a shorter range of focus. This range of focus is often described as the "depth of field," or the total range of sharp focus in front and behind the primary object. In macro photog



raphy the depth of field can be measured in fractions of an inch in many cases. For this reason it is desirable to use a high f-number whenever close-up work is being done. The f-stop of the camera should be set to a minimal value of f/8 and f/11 through f/22 may be more desirable. Thus we have a new requirement for our digital camera. The camera should have independent f-stop control and should reach at least f/8 and higher values are better.

This usually means that the desired camera will also have what is called an “aperture” controlled exposure mode. This means that the photographer pre-selects the f-stop value and the camera will auto-calculate the proper exposure time. Because low f-stops often mean longer exposure times, it is necessary to use the tripod or other camera steadying techniques in lost cases. As described in the previous articles, tripods and remote shutter releases are priority items for the camera.

Let’s examine this “depth of field” phenomena. Look at the figures 4 - 7, the first image was captured with the f-stop set to f/5.6 and the screw at the 17” mark was the primary focus point. Notice that the number 18 is totally out of focus, but as the f-stop increases down the range of figures the area in front and behind the primary focus is sharper. Thus for close-up work the camera needs to be set to a fixed f-stop between f/8 and f/22 to get the most depth of field.

The camera should have an “aperture priority” mode so the photographer can set the desired f-stop and the camera will then select the needed shutter speed to make the correct exposure. This assumes that the ISO equivalent setting is the lowest the camera supports. Typically between 50 and 200. In the digital world, the ISO value is not the same for all cameras, but the lowest setting is always the best for each variety. When film was in use, a faster film speed (higher ISO or ASA value) always produced more grain in the image. Thus ASA 400 film could be used in low light situations, but the image often had a sandy texture. This was the cost of using faster film.

Today, the higher ISO speed means that the camera sensor is set to more sensitivity. This will result in an image with more “digital noise.” Digital noise shows up as lower contrast images, often with strange color spots randomly around the image. Sometimes the images show a color band along a very strong contrast area or edge. It is the equivalent of the old film grain. Most digital cameras are acceptable up to about ASA 400, but degradation begins at higher values. Some cameras are more forgiving and some are less so. As a general rule set the camera to the lowest ASA value in its range.

So are there any other features which can help with exposure in a digital camera? The answer is yes, a nice feature is “fine exposure control” sometimes referred to in the camera manual as Ev control.



figure 4.



figure 5 .



figure 6.



figure 7.

Cameras can be fooled fairly easily when doing close-up images. Their exposure mechanism is designed to give proper exposure for an “average photo.” So what is an average photos? In general camera exposure systems read the entire image and it will yield about 18% gray when all the pixels are averaged together. Once again this comes from the film days of photography and it assumes that the photo is an average snap-shot. That is, it contains some sky, some ground, a few points of interest and that it’s about mid-day. That’s why many of today’s cameras have multiple exposure methods that can be turned off or on, like sunset, night time, back lighting, snow, etc.

When we go most jewelry or close-up work the exposure is often fooled because we tend to use overly dark or over light backgrounds to make the jewelry stand-out. Thus if we place the jewelry on a true black background, the image has too much black and the camera will compensate to make the overall exposure about 18% gray. Thus the jewelry piece often comes out too light and the background looks gray and not black. See figure 8. The camera exposure system is fooled by the large area of black in the background. If the camera has Ev settings (exposure compensation) then the they can be adjusted to make the background appear black and gem or jewelry comes out properly exposed. Figure 9 Ev setting of Ev = -1.3.

The same, but opposite, effect happens when the background is white figure 10. The exposure meter is fooled and tries to make the overall image darker, by compensating for the white background. Again the background turns gray and this time the jewelry or gemstone is too dark. Once again by adjusting the Ev setting the image can be corrected. (Figure 11.)

To summarize this month, the features set that makes a camera a good selection for close-up photography should also include ...

- Adjustable f-stops (f/8 or higher)
- Aperture priority exposure mode
- Ev control (exposure compensation control)
- Add to them the desired features from last month ...
- about 5 or more mega-pixels of resolution
- Macro focus mode (fill the frame)
- Self-timer or remote shutter release (steady exposure)
- Manual focus (this one can be worked around)
- and a steady tripod.

Next month we’ll look at the final feature that make a camera a good candidate for close-up photography; white balance control. We’ll then discuss the typical set up for the camera. Once the camera is set up and ready to shoot, most of what needs to be done is proper lighting. The camera set up and controls stay 95% the same for all close-up images, with the exception of a little Ev adjusting depending on the background. Once the camera is defined, we’ll spend nearly all the rest of the time discussing lighting to get the best look.

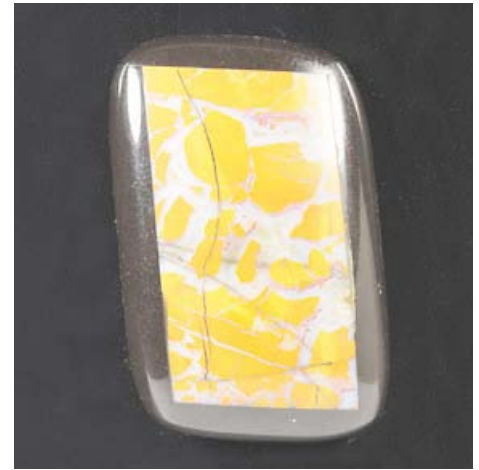


figure 8.



figure 9.



figure 10.



figure 11.

# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part IV by ron gibbs

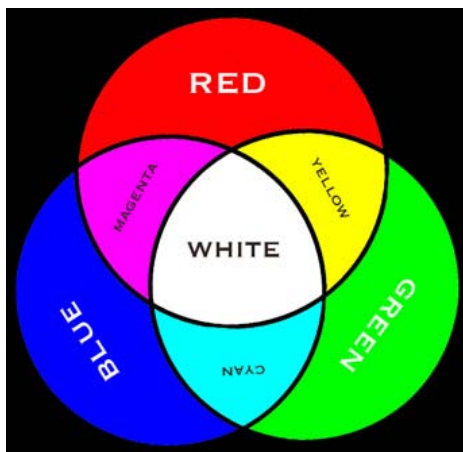


Figure 1.

Source	degrees K
Summer Day - (sun & sky)	6500
Fluorescent Daylight	6500
Xenon (flash)	6400
Overcast Sky	6000
Sunlight (noon)	5400
Fluorescent Daylight	5000
Daylight Flood	4800-5000
Sunlight (Early morning)	4300
Sunlight (1 hour after Dawn)	3500
Photo Flood	3400
Fluorescent Cool White	3400
100 watt Tungsten Halogen	3000
Fluorescent Warm White	2950
100-watt incandescent	2870
50-watt incandescent	2500
candle flame	1850-1900
match flame	1700

Figure 2.

Auto
Incandescent
Fluorescent
Direct Sun
Flash
Cloudy
Shade
Manual

Figure 3.

This will be the last installment of information that describes the useful features in a camera for close-up photography, next month we'll continue with lighting and setups. So this month we'll look at color. Color is important if you want our images to closely resemble the objects being photographed, although there are people out there marketing and selling "green" amethyst, I think amethyst by definition should look purple.

Light has two important descriptive properties with regard to photography, first it has a Color (or Hue) and second it has what I will refer to as Texture (hard or soft). The color of light is usually described by a name, thus words like red, yellow, blue, orange, purple, violet, etc. describe a specific hue or color. The computer world and digital camera world live in what we call RGB space. All colors can be defined as mixtures of red, green, and blue light. (Fig. 1.)

Equal parts of Red and Green produce Yellow, equal parts of Green and Blue produce a pale blue called Cyan, and equal parts of Red and Blue produce hot pink called Magenta. The thing that surprises people is that equal parts of all three R, G and B produce WHITE. All colors come from what we know as White. True white has equal portions of all colors, or another way to think of it is that white light contains all the colors in the rainbow. When we see a red object it is because the white light illuminating it has had the green and blue portions removed, leaving behind the red color.

We can also measure the color of light by something called its temperature. There is a temperature scale called the Kelvin scale which can be used to describe the color of light. Low color temperatures are at the red end of the scale. A description of the scale is illustrated in the table of figure 2. As you can see even "daylight" can and does have different color temperatures. It can be warm (red-yellow) to bluish depending on the time and weather conditions.

The color of objects in a scene are dependent upon two things, their inherent color (what part of the spectrum they reflect) and the color of the light source illuminating them. We'll examine several possible cases in the next set of diagrams to get an idea of how tough it might be to get correct color. Most of the digital cameras on the market today have color balance settings built-in (typical Fig. 3), but not all have a "manual" color correction, many have automatic or a series of specific color corrections that can be selected. For precise close-up work a manual color correction is desirable, but not absolutely necessary as long as the camera has at least an auto setting, or you (the photographer) develop very good habits when setting up and shooting your desktop (close-up) photos.



Why we don't always get the color we expect. In the first case (1), there is a white sphere in a white room with a white light. Any camera should be able to get this image with pretty good color rendition. The auto color mode should not have anything to fool it. In case 2 there is a light red sphere in the same white room with white light. Again the auto color mode likely would be able to handle this and give pretty good color.

Case 3 gets a bit more difficult. It is actually case 1 with the substitution of a red light source. In Auto mode the camera may or may not understand what should be white in this image. This could just as easily be a light red sphere in a light red room with white light.

Case 4 is even more of a challenge, is it a light red sphere in a dark red room with white light, or a white sphere in a dark red room with a white light, or is it a red light on a white sphere in a red room, or is it a red light on a light red sphere in a dark red room? Again there is nothing that auto color can do to make an informed decision.

In the last case there is a white sphere in a single red-walled room with a white light. The camera may be able to make a decision on this one, and get the color balance correct. But, even if it does the red wall is casting a red color on half of the sphere, and a simple color correction to fix the right side of the sphere later in software will result in the left side of the sphere being falsely colored to a cyan.

If there was a "manual color correction" in the camera, then a true white card would be placed in the room and the camera would be focused entirely on the card, and set to make the card pure white regardless of the illumination color, or the room's wall color. Hence there would be a higher probability of getting the color more correct on the first try. (Fig. 4)

In most cases, doing close-up photography under controlled conditions means not having to deal with most of these situations, and hence manual color correction is not a necessity. But, it can be an aid in situations where there is mixed color illumination, like extra light hitting the subject from an open window.

I avoid nearly all of these problems by controlling the environment where I shoot most of my desktop images. I use color neutral lights (5000 °K), and black, white or gray surrounding walls with no windows or extraneous light sources.

The named settings, shown in figure 3, work well if you remember to reset them as needed and you can match the light sources properly. For instance if the same sphere, in white room were photographed using a "tungsten incandescent bulb" and the camera light balance was set to "outside" then the image would look something like that in the first one on the next page.

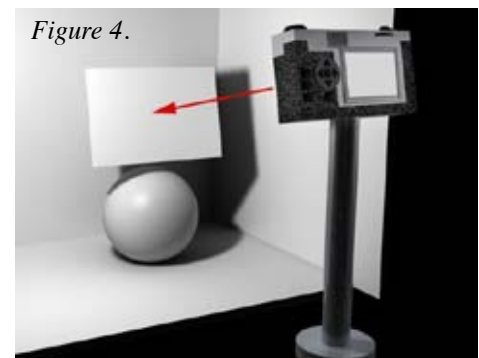
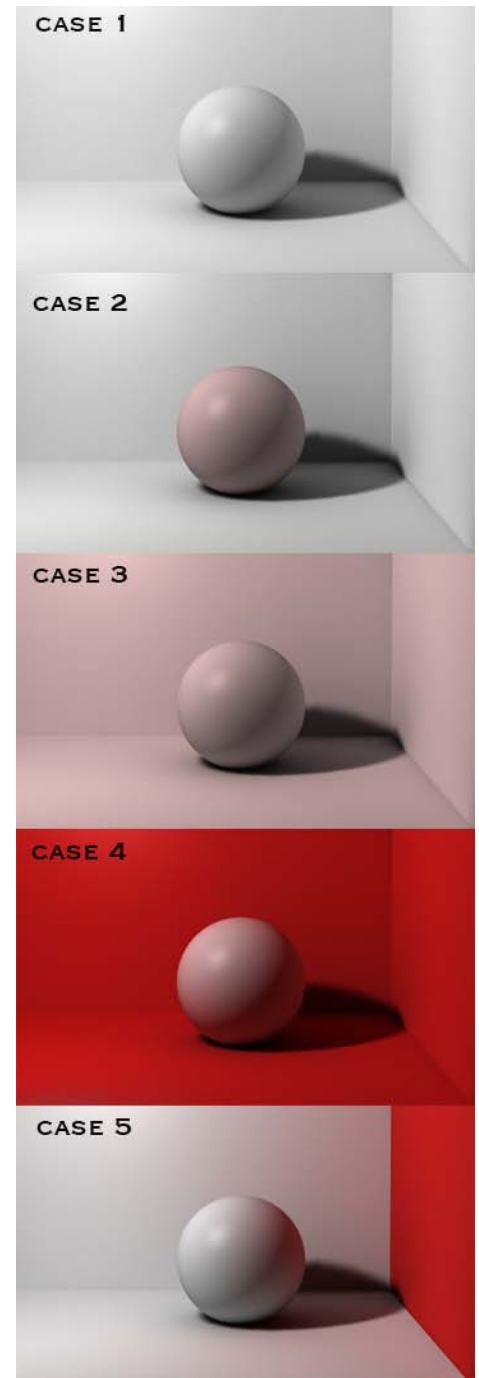
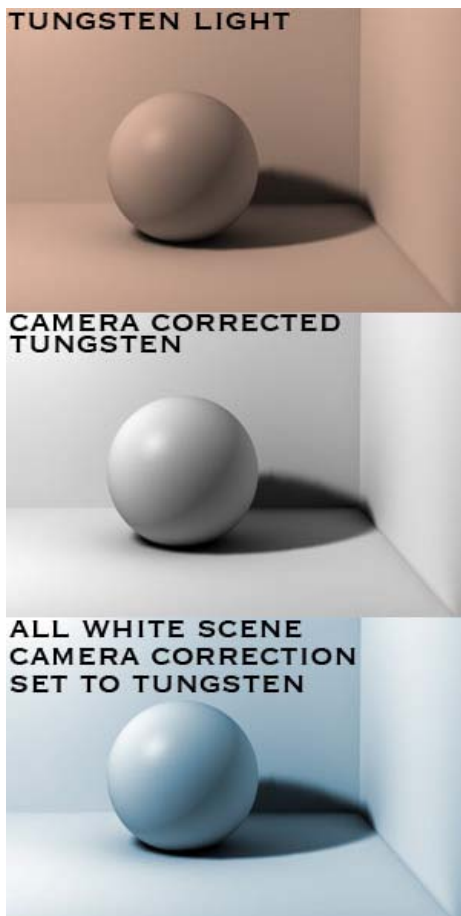


Figure 4. Manual white balance set by using a white card in lighting setup



The image would appear an orange color as the camera was expecting nearly white light and saw the tungsten light color instead. If the white balance were set properly to tungsten then the image would appear similar to the second one in this series and look roughly correct.

This is as it should be, but if you forget to reset the white balance to daylight and then shoot a daylight image (still with the camera tungsten setting selected) the white image would appear like the third image in the series. It would show a blue cast as the camera would be trying to correct the white daylight to remove an orange cast (normally present in a tungsten light).

Thus the light balance controls in the camera work fairly well as long as you always remember to set them to the correct light type each time it is used, or set it to auto and hope for now unusual situations (works most of the time), OR manually set it properly for the specific light you are about to use.

Camera feature summary ... if you are purchasing a camera for close-up work look for the following features ... (Compiled in this PDF.)

- (1) Macro Focus (fill the frame ... June)
- (2) Manual focus (July)
- (3) Auto Timer (or remote shutter release ... July)
- (4) f-stop control (Aperture priority mode ... August)
- (5) Ev (exposure compensation nice but not necessary ... August)
- (6) Color Balance (manual mode nice but not necessary ... September)

For nearly all of the close-up work described in the next several issues and all of the materials (cabs, gems, jewelry, beads, minerals, etc.) that will be covered, the Camera will be set up to function in the same way. Here are the desired camera settings and position.

- 1.) Set the camera ISO/ASA to the lowest number the camera supports (typically ASA 100 - 200)
- 2.) Put the camera on a steady tripod for ALL exposures
- 3.) Set the Exposure mode to Aperture priority. (you can select the f/stop the camera auto selects the shutter)
- 4.) Select an f-stop of at least f/8, and f/11 or f/16 is better.
- 5.) Set the white balance manually with the lights you are using
- 6.) Fill the frame with the object
- 7.) Manually focus on the most important part of the object
- 8.) Use the self timer or remote shutter release to make the exposure
- 9.) Look at the finished image, adjust the exposure with the Ev controls if needed, then repeat steps 7,8 and 9 until a satisfactory exposure is achieved.

The first 5 steps are typically only done once for any photo session. As long as the lighting does not change then these setting will remain the same. Most of the time only steps 6-9 are done for each new subject matter.

Next month we'll begin looking at the table top setup and the lighting for most work. We will discuss the second light property, it's texture.

# *Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part V* by ron gibbs

There are several types of light that can be used successfully in table top digital photography. The ideal light might be natural sunlight, but it is exceedingly hard to control in the studio situation, and rarely available in the evenings unless you live pretty far north!

Traditionally tungsten based photo-flood lights were/are used in film based photography because there is a film specifically designed to color correct this type of light. Remember from last month that light “color” is measured in degrees Kelvin, with low values associated to red-orange light, and higher values headed toward pure white light. Traditional photo floods have a value around 3400 °K. Providing a warm orange tone.

While it is possible to use these lights with today’s digital cameras (with white balance set to tungsten) there are some disadvantages. First, for a given amount of light you must use fairly high wattage bulbs. The higher wattage bulbs tend to run quite hot and this limits materials that can be used as diffusers, it heats up the studio, it wastes electricity, and they have a tendency to burn skin when accidentally brushed against.

Halogen lights operate in a similar manor although they tend to provide more light for the same wattage, they also run very hot and show all the same types of disadvantages. They can be tamed to a degree when used with fiber-optic light directors as in microscope use, but they are expensive and not used in larger situations. I believe that the best lighting today is either white balanced fluorescent lights or flash. Both can produce excellent color results with minimal color correction needed. Both operate much cooler than the filament type bulbs, and both can be diffused with any number of inexpensive materials. The only real disadvantage to electronic flash is the cost and ease of use.

To get good (consistent) results with a flash set up takes a good deal of practice, and a fairly high expenditure. The flash built-in to most digital cameras is basically useless in all but a few cases, so external units are needed to successfully light most scenes. Studio flash equipment is often as expensive as a camera and can be difficult to “pre-visualize” when used. Under correct use and professional control the results can be excellent. (See most of Jeff Scovil’s work!)

For most of us, the use of medium wattage, color correct, compact fluorescent bulbs are a good choice. They are now inexpensive, have long life times, run relatively cool, and can be obtained with good color balance. After recommending them I have had people show me poor color results, but in nearly all cases I found that the wrong fluorescent bulbs were purchased. Names like “Bright White”, “Cool White”, “Warm White”, etc. are not used consistently throughout the industry and often have a wide color latitude. Always buy bulbs that have a Kelvin



<i>Fluorescent</i>	<i>Equivalent Tungsten</i>
<b>18-20 watt</b>	<b>75 watt</b>
<b>23-28 watt</b>	<b>100 watt</b>
<b>29-30 watt</b>	<b>120 watt</b>
<b>32-36 watt</b>	<b>130 watt</b>
<b>40-42 watt</b>	<b>150 watt</b>
<b>55 watt</b>	<b>240 watt</b>
<b>85 watt</b>	<b>350 watt</b>



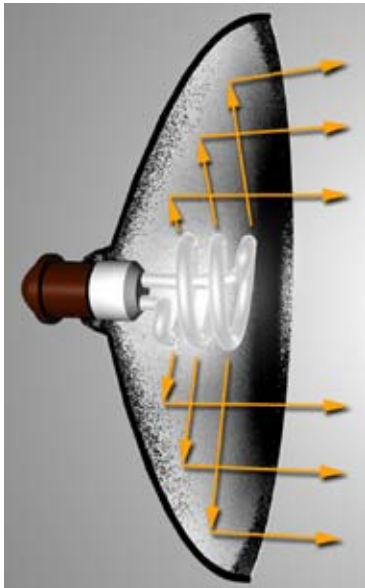
rating on the package. Always buy bulbs that are 5000°K or higher. I also strongly recommend that you always stick with a single value in any given set up. Don't mix 5000°K with 6500°K bulbs. Use all of one or the other.

A variety of sizes and shapes are now available in the compact fluorescent bulbs (see previous page), and their rough watt age equivalents are provided in the accompanying chart. The compact bulbs with wattage values over 40 tend to be larger than their tungsten equivalents in size.



Due to the shape of the compact fluorescent bulbs, the light is designed to be emitted from around the length of the cylinder models. Thus it is most useful to place these bulbs in a reflector to direct as much light as possible in the direction of the subject matter. Even the inexpensive clamp-on work lights work well, or any old photo-flood fixture with a standard screw socket works fine.

Some sort of frame work is necessary to aid in positioning the reflectors around the subject. A typical lighting set-up for most work will involve 2 or 3 lamps. Thus the reflectors can each have their own independent stands or can be used in some kind of frame work. Independent stand offer the most flexibility but often take up the most space and can get in the way of one another.



*reflector provides directed light*

Stands can be made out of anything that offers sufficient support for the reflector. I have used lighting tripods, normal photo tripods, short microphone stands, and even bricks. My favorite stand is now is simple framework built from 1" PVC pipe. It can be customized as needed to hold the reflectors and can be combined with any of the other individual stands as needed.



*2 kinds of clamp on lights*



*microhone stand*



*camera tripod*



*brick*



*lighting tripod*



Here is the basic PVC piping set-up I use with the clamp-on lights for most of my table top photography. The two bottom supports are permanently glued as they are basically never adjusted, they simply hold up the rest of the rig. I usually glue the top support at only the cross member to aid in the stability of the set up.

Other joints are just friction fit to allow them to be changed easily as the need arises. I color coded the joints in the diagram to make them stand out for ease of viewing. I use a variety of different tubes connected to the two “T’s” on the risers to hold both background materials, lights, and reflectors. These two “T’s” can be rotated to hold items in front, behind or to either side of the apparatus. In upcoming articles I will demonstrate some of these set ups.

The clamp lights can be attached to any place on the structure and the system works using the table top as the main surface or by placing a riser of some kind inside the lighting cage. A riser helps maintain the camera at a more comfortable height, and causes less back strain when many samples are being photographed.

I use a wooden structure with a sheet of plate glass on the top. The general design came from Jeff Schovil and his book, *“Photographing Minerals, Fossils, and Lapidary Materials.”* I use this riser for most table top work as it puts the camera



view-finder at a comfortable working height. The entire pipe frame assembly and wooden support is placed on a large table bringing the glass height to about 46” above the floor.

One other specialty light that I sometimes employ is the LED (Light Emitting Diode). These are fairly new and but not all that expensive. Although it is possible to get nearly pure white (~5000K) LED lights, they are rarely marked, and most have a bit of a bluish color shift. These lights are useful in certain special situations when more “color play” is desired in faceted gemstones, or a very small (directed light) is desirable to light-up the interior of some things. I will cover there use and show some examples when I describe the situations where I actually use them.

The color balanced, compact fluorescent, described above will be used in about 90% of the setups in this series of articles. I would suggest the need to at least two reflectors and third would be handy from time to time. I recommend 25 watt or higher bulbs, and I happen to use the 5000°K variety, but the 6500°K bulbs will work fine too. The wattage describes the overall light output (brightness) of the lam, and the kelvin rating describes the color of the light.

In the next edition of this continuing essay I will discuss the “quality” of the light, and how to modify it by using a variety of diffusers, and secondary reflectors.

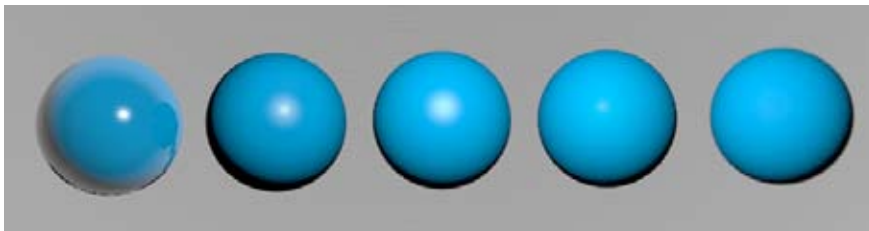


## *Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part VI by ron gibbs*

As discussed last month lights have a color (measured in degrees Kelvin), and an energy rating (brightness) that is a function of the wattage. Using a reflector produces “directed light” and increases the output from a bulb by reflecting the axial light mostly in one direction.

Another property of light can be described as “quality” and plays a major role in gemstone and jewelry photography. The quality of light can be described from hard to soft. Hard light is created when the light source is generated from something near a “point source.” A naked bulb, open metallic reflector, or a flash produces this type of light.

When light strikes an object it is reflected from that object. Soft objects, like cloth or fine textured surfaces, have a reflectivity that spreads light over the surface and reflects over a wide area. Hard objects, like metals, plastics, and stone, tend to reflect light at single concentrated points, and reflect in specific directions. A visual clue as to the hardness or softness of any surface is the size and brightness of the “specular reflection.” A specular reflection is a mirror like reflection that reflects predominantly at a narrow angle. A diffuse reflection is one that breaks the reflected light into a wide range of angles as it is reflected. All materials have a component of each type, but the eye differentiates the specular much easier.



In general, hard light will illuminate an object and enhance textures and surface characteristics. Hard objects show small, tight, specular highlights (left sphere in the series), and soft objects show gentle light fall off over the entire surface (right two spheres in series.)

As a general rule of thumb we use hard light to illuminate soft surfaces, and we use soft light to illuminate hard surfaces. Since most of the jewelry world is full of hard surfaces we need to temper the light and make it softer so highlight don't turn featureless white. How do we create softer light?

We use diffusers to create softer light. Diffusers are placed between the light source and the object being illuminated, they are made up of translucent materials that will scatter the light. Another way to diffuse light is to use reflected light from a soft surface. Diffuse light will tone down specular highlights and make the specular component larger and less bright. The trade off is the loss of some detail information. Diffuse light will not produce strong shadow boundaries and thus not differentiate textures as well as non-diffuse light.

At the top of the next page are three images side by side with different lighting. The first one has no diffusers on the light, the second one has mild diffusion, and the last one has strong diffusion. First examine the large cabochon on the left of each image. In the first image, the actual light shape and reflector is clearly visible in the strong highlight. The center of each highlight is entirely devoid of any texture or information. Look next at the leaf in this image and the shadow it casts on the back of the jewelry piece. The shadow follows the precise shape of leaf's edge. In the middle photo the cabochon highlight is a bit softer and the leaf's edge has a little less detail. In the final image, the diffusion has eliminated the bulb shape, and the cabochon highlights are no longer pure white. The shadow edge is barely distinguishable.





To the right are the three light reflectors and their associated diffusers. The first is the reflector only without any diffusion, the second uses a thin piece of flexible foamed plastic over the reflector, and the third uses a translucent piece of rigid corrugated plastic as the diffuser. (**Important Note:** these types of diffusers should **NEVER** be used with tungsten or halogen bulbs as they get too hot. All of the bulbs used in this example were fluorescent bulbs.)

There are several other methods of obtaining diffuse light. One of those currently in vogue with most table-top photographers is the light tent. These are small (usually white nylon) structures that can be folded flat or “pop-up” to form a white translucent box around an object. They come in various sizes and are light weight and easily transported. Exterior lighting is placed around the tent, and the nylon diffuses it around the object(s) being photographed. (Remember you still need color corrected lighting on the outside, they do not color correct, they simply diffuse the color of light provided.)

They work well for medium and larger items, but their lighting is not easily fine tuned to provide for special case items or lighting conditions. Below are a couple of examples of light tents with their external lights.



no diffusion



ethafoam diffuser

Below are images of the 12” tent set up inside the 24” tent, and a photo of the 12” tent folded for storage or transport.



12” & 24” light tents



folded light tent



corrugated plastic diffuser

There are other things that can also be used to provide diffuse, even, illumination for small objects. A make-shift light tent can be created using a stackable white - storage bin turned on it's open end. The thicker plastic makes it more difficult to get strong lighting through to the interior, but it can also be lighted from the bottom using a light box or a directed light shining upward through corrugated or acrylic plastic. See top image to the right.



*white storage bin*

One of my favorite methods of shooting small jewelry is to use a plastic salad bowl. These can be either translucent or somewhat opaque white in color. They are usually made from polyethylene or polypropylene. A whole is cut in the bottom of the bowl to fit the camera lens, and then bowl can then be lighted from the sides or from beneath using a light box.



*translucent and white plastic bowls*

Many different results are possible with this setup, and they will be discussed in more detail when we get to specific lighting setups for specific items. To the right are photos of two bowls and one more that shows a camera positioned on the bottom of a bowl with light coming from a light box positioned beneath.

Finally one of the simplest methods of creating diffuse light is to use a reflector made of white paper, cloth, or white board. Shinning a light onto a large surface will reflect that light and diffuse it at the same time. I sometimes use a single light source (with diffusion) from one side and then se a white reflector on the opposite side to provide lower density soft "fill-in" light to open up otherwise dark shadow areas.



*camera pointd through hole in bowl*

The left image below is without a white reflector on the right, and the second image was captured with a white reflector on the right. The bounced light fills in the shadow areas and provide nice detail without creating any washed out specular highlights. Another visual clue is the shadow on the right is created by the stronger light to the left of the mineral, and the reflected light is insufficient to fill-in and remove the shadow entirely.

Last month we learned that we need white light to reproduce color in the proper range, and that this can be obtained from the use of 5000°K - 6500°K color temperature bulbs. For most of the work we do with lapidary materials and jewelry we need to use diffuse (soft) lighting to help control the strong specular highlights we will otherwise obtain. I find most work can be done with two lights and reflectors, but that on a few occasions a third light with reflector is useful.



*Diffuse from left - no reflector*



*Diffuse from left - reflector on right*

To summarize the basic lighting set up needed for close-up digital photography is 2 (or 3) positionable lights with the same color balance. I typically prefer the slightly warmer look of 5000°K bulbs, but all 6500°K or 5500°K are fine too. It is best not to mix them. I recommend fluorescent bulbs with between 30 and 40 watts of power.

Obtain some materials for diffusing the lights, I use the soft foam plastic called ethafoam often found as a wrapping or insulation material.

I also like corrugated plastic and prefer the translucent white rather than opaque white variety, but I use both. This material can be obtained from art stores (*Dick Blick* on-line) or yard signage shops.

You will also need a small supply of clamps (I sometimes use the larger spring paper clips or small hobby clamps to attach the diffuser material to the light.)

Finally either build a PVC pipe rack to aid in light positioning, or

get some weighted objects, both as described in the previous newsletter.

Assuming you have your camera and a tripod, were just about ready to begin setting up our table top studio and to start the image capture process. Next month, I will discuss a few small (handy to have) items that will aid in holding the cabochons, jewelry and other miscellaneous object we will shoot and provide some nice background materials.



## *Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part VII by ron gibbs*



Photo 1



Photo 2



Photo 3

In our miniature photography studio there are dozens of small accessories that can make our job easier in lighting, and holding the various objects to be photographed.

First get a supply of small clamps (top photo), the more the better. These things come in handy for holding all kinds of small reflectors to highlight specific parts of the items being photographed. Don't limit yourself to just the concept of mechanical clamps either. One of the most versatile materials in my tool box is the material known as "liquid thumb-tack". It can be used to hold the product being photographed or can also be used to actually hold reflectors near a sample.

Besides liquid thumb-tack I also recommend oil based modeling clay. The water based products will try out and become stiff, whereas the oil based clays stay flexible almost indefinitely. The liquid thumb-tack is shown in the second photo, with the modeling clay the slightly lighter colored material. The modeling clay is purchased by the pound and is very inexpensive, the thumb-tack is also inexpensive but you typically only get a couple of small sticks in a package.

The third photo shows a variety of clamps (and clay) being use to hold reflectors made of plastic, paper, 3x5 cards, and even small mirrors. A useful stand alone mirror-reflector can be created by using two small rectangular mirrors with a piece of gray tape on the back acting as a hinge. They can be placed on the table at roughly a right angle and will stand without further support.

Notice that clay can be used as a base to hold the reflector directly or it can be used to hold an alligator type clip which then holds the reflector. The clip can be positioned at virtually any angle in the clay.

A collection of "white" (I stress white) paper, thin modeling plastic, 3x5 cards, silver aluminum foil, and perhaps some brass foil to add warmth are all useful reflector materials. Most can be obtained at office supply or hobby stores.

I also have several small pieces of acrylic plastic (plexiglas) drilled to accept small wooden dowels. (See the second photo. These provide a wide variety of small supports for jewelry, cabochons, slabs or mineral specimens.

Photos 4 and 5 show the back and front view of the plastic and small wooden dowel holders. I also use 12" x 12" acrylic plastic as a background for much of my work, and drill the holes directly into the background base. The dowels were obtained in a package of 200+ from Michael's Art Supply and are about 1/16" in diameter. They can easily be trimmed to the needed length, and the modeling clay or liquid thumbtack" is used to adhere them to the subject material. A little window cleaner and paper towels will remove any residue from the plastic.

Another useful platform for jewelry is a clear CD case. Photo 6 shows a clear front (often called jewel case) CD case sitting on a strip of rubber shelf paper. The rubberized paper provides enough friction to hold the CD case at a selected angle. Thus it can be pointed directly at the camera lens.

Background material is placed in the joint behind the plastic, and the stone or jewelry is attached to the front with the clay. Earrings can be attached to a small pair of holes in the clear plastic front. The background material can hang straight or it can be curved and is placed far enough behind the plane of the jewelry or stone so it is out of focus. With proper lighting the clear plastic just disappears.

I'm sure I have forgotten a few things I use on a regular basis but will cover them in future articles on lighting set ups. Next month I will begin discussing some lighting techniques that I use on cabochons. (As we'll discover many of the techniques can be used for more than one thing, so some of the cab lighting also worked on jewelry and mineral samples.) There will be a break in February as the author (that's me!) will be in Quartzsite and Tucson so no newsletter will be published!



Photo 4



Photo 5



Photo 6

# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part VIII by ron gibbs

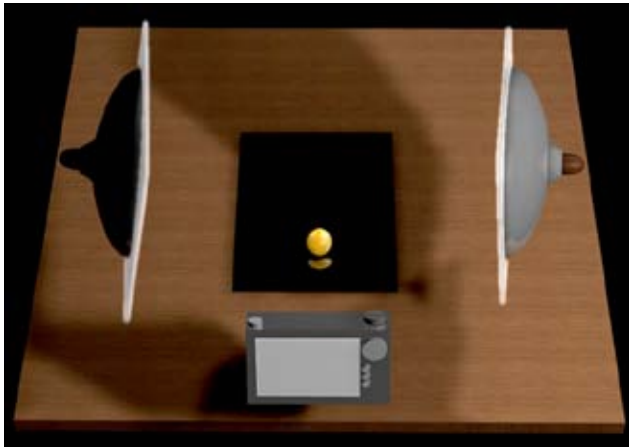


Fig. 1.

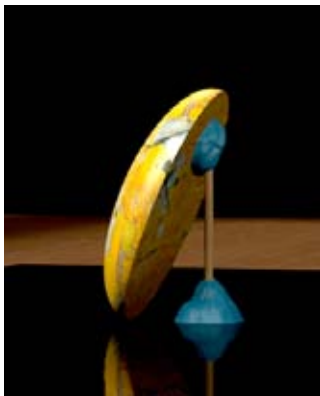


Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.

The camera should be set up on a solid tripod, the ASA needs to be set to the lowest value possible, aperture priority mode is selected, and the f-stop is set to between 8 and 11. The camera self-timer or a remote shutter release will be used to take the image. The focus should be set to macro and manual mode if available, and the object (cabochon) needs to fill as much of the frame as is feasible for good composition. This is the typical camera set up for virtually all of the future set-ups. The tripod is not shown in the following diagrams.

Cabochons are domed stones with highly polished surfaces so they need to be lighted with soft lights, and from the sides or edges to help avoid hot spots and specular highlights. A good set up is two diffused lights directed at the cabochon from opposite sides (Figure 1.), but a single light with a good white reflector is also a reasonable setup.

Last month I showed one of my favorite cabochon holders, basically a stick with a couple of dabs of clay to hold it upright. (Figure 2.) I like to use black acrylic sheet as the surface and background for the image. The black sheet becomes a mirrored surface making a nice reflection of the cabochon (Figure 3.). Clear acrylic can also be used with a color beneath it, and it too will produce a reflection, but much less pronounced.

Since all close-up photography has very limited depth of field is not a good idea to place cabochons flat on a surface unless the camera is stationed directly above. This makes for an uncomfortable working set up. Thus the cabochon should be placed as close to parallel to the camera lens as possible. Cabs which are laid flat and shot from an angle will be out of focus at one end or the other. (Figure 4.) When they are set up parallel to the front of the camera lens, they can usually be brought into focus with an F-stop between 8 and 11. (Figure 5.)

If the cabochon has a dark edge or a dark pattern running out to the edge, then it can become lost in the black acrylic. By using a white reflector behind the sheet of acrylic it is possible to control the background color anywhere between pure black and very light gray. The white background is reflected into the black acrylic and by adjusting the angle of reflection it is possible to create the level of gray desired. It can also be accomplished by placing a light directly above and slightly behind the cab.



Figure 6. shows the two light set up with a white reflector behind. In this case the reflector is not large enough to completely cover the black acrylic, but is large enough to use with the cabochon. In the next figure (Figure 7.) is an example from the point of view of the camera. If the image is cropped then only the grayish area will show behind the cab.

Another way to hold a cabochon is to use a jewel CD case, and a piece of rubberized shelf paper. (Figure 8.) Adjust the angle of the CD case to place the clear face directly in front of the camera. The cabochon is attached to the case with a little liquid-thumbtack or modeling clay. The rubberized shelf paper provides sufficient friction to hold the case at the desired angle. Cut a piece of colored paper or cloth to place behind the clear plastic front, and curve it slightly to take it out of camera focus.

A typical image is shown in the next figure (Figure 9.) By avoiding any lighting directly from the front, there are virtually no light reflections. It works well with the same light setup shown in figure 1. Graded color backgrounds are expensive when purchased from camera stores. By using a graded background that is held behind the focal plane in the CD jewel case it can easily be made with an inkjet or even laser printer. When curved it stays out of focus and the quality does not have to be top notch.

Clear acrylic can also be used below a cabochon (similar to the black acrylic) but it will allow the background material to show through. If the background is offset below the flat acrylic about an inch or more, then only the general color and virtually none of the texture will be apparent in the photograph. I often bend a single piece of acrylic or polycarbonate to create a small "table" to hold the stone, while placing a variety of textures and colors below. (Figure 10.) Notice in this example the bend was done in polycarbonate which will

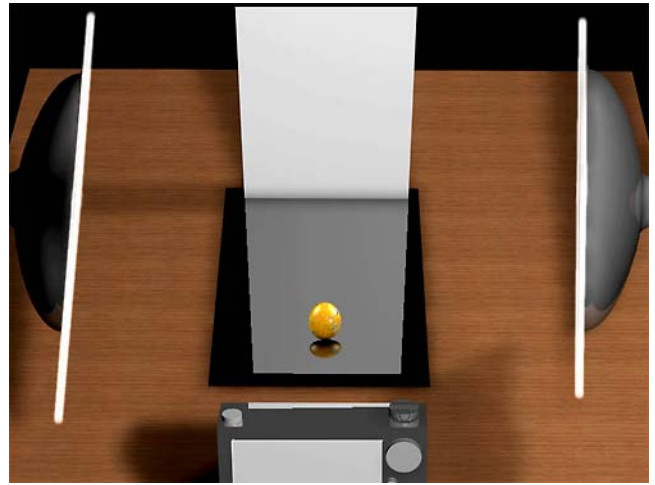


Fig. 6.



Fig. 7.

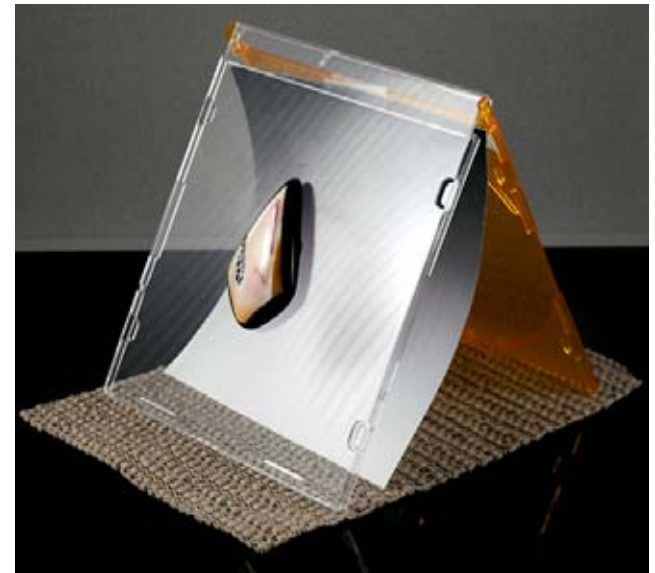


Fig. 8.



Fig. 9.

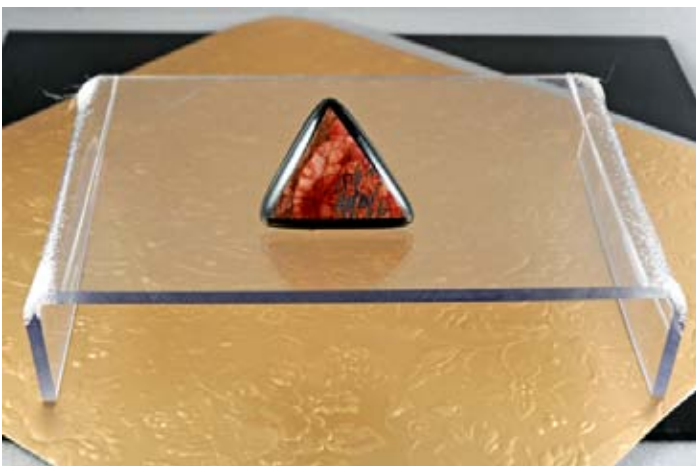
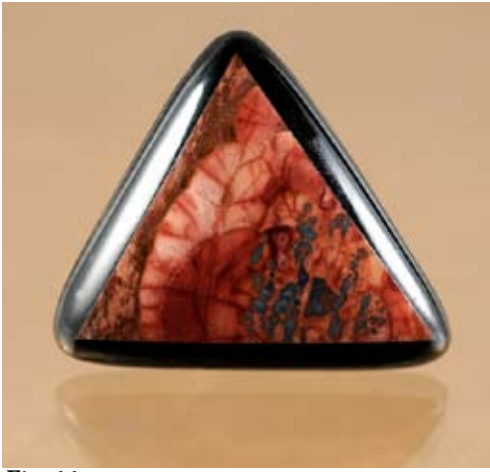


Fig. 10.



*Fig. 11.*

*Fig. 12.*



bubble when heated to bending temperature. Polycarbonate tends to absorb water over time which makes it less desirable for thermal bending, acrylic works better. Figure 11. shows a typical result with a patterned backing (invisible do to the lack of depth of field even at f/11). Notice there is a reflection in the clear plastic which adds some depth to the image.

The last photo (Figure 12.) is simply a comparison of a two light set-up (on the left) with the same stone then photographed using one light and a white reflector opposite. (The reflector image is the one on the right.) Notice the right hand image is missing one bright edge, but retains enough light to see clearly. This pair also used the reflected white card behind the cabs to make the background lighter so the black jade edges would not be lost.

This should provide a good starting point for most cabochon photography, I would suggest not using highly patterned backgrounds or wild colors for most cab images, keep them simple and let the cabochons natural pattern dominate.

The author will be gone to Quartzsite and Tucson in January and February so the series will not pick up again until March. In March we'll look at photographing slabs and/or any flat objects.

# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part IX



Figure 1.

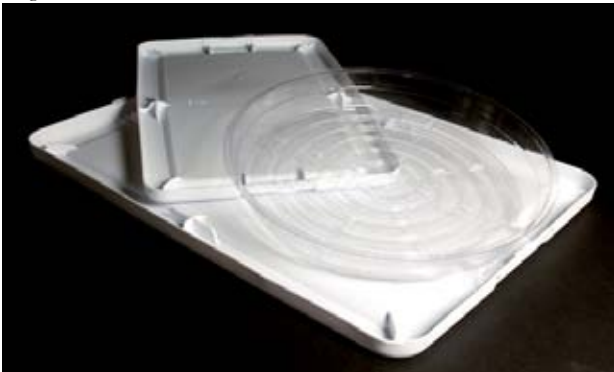
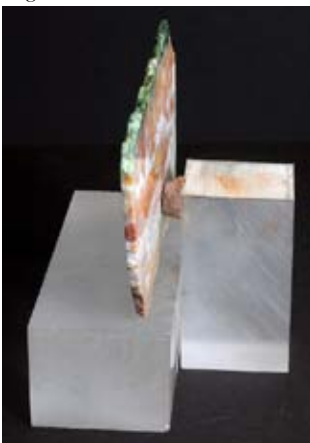
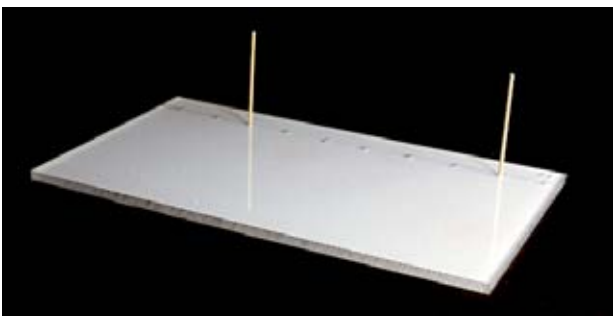


Figure 2.



A. Figure 3.

B.



C.

The camera should be set up on a solid tripod, the ASA needs to set to the lowest value possible, aperture priority mode is selected, and the f-stop is set to between 8 and 11. The camera self-timer or a remote shutter release will be used to take the image. The focus should be set to macro and manual mode if available, and the object (slab or flat object) needs to fill as much of the frame as is feasible for good composition. This is the typical camera set up for virtually all of the future set-ups. The tripod is not shown in the following diagrams.

Slabs are not always polished, so it is necessary to prepare a photographic area where the slab can be wetted and maintained wet throughout the photo taking process. I like to use a “catch basin” under the slide to keep the photo surface dry. Use any relatively flat container with a small lip to contain the water. In art stores I have found the paint boxes used to keep paint moist work great. (See Fig 1.) I have also used the tops from a variety of plastic containers or plant saucers. (Fig 2.)

I keep two spray bottles ready for use. One bottle contains Windex (or equivalent) and the other has distilled water. Many purchased slides (or self cut slabs) still have oil on their surface and this prevents water from coating it completely. I use the Windex to remove the oil (if needed) and then use the distilled water to wet the surface. (Fig 1.)

I like to support a slab (Figure 3.) using a rigid back or two or more small pegs in a piece of Plexiglas. I often use modeling clay (normally oil based so it does not dry out) for additional support and to keep the slab from tipping. For opaque slabs I use a couple of pieces of thick plastic with a small dab of clay (A). For transparent slabs I tend to use the small dowels as far apart as I can get them (B or C). Remember translucent to transparent slabs will show any backing material, the dowels can be removed by cropping the image later.. If I am using only a portion of the slab, then anything can be used to support it.

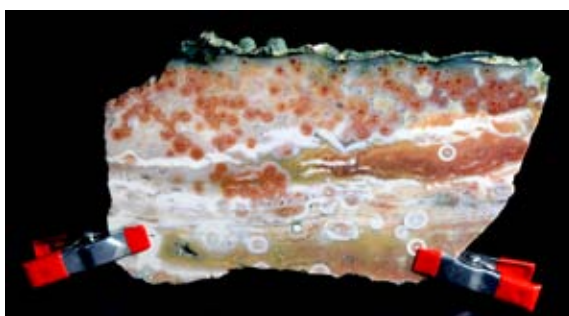


Figure 4.



Because the slabs are either wet or polished when photographed (this produces much better color saturation), they are highly reflective. The good news is that flat objects can easily be lit by angle light from the side, and they will not produce specular (blown-out) highlights. I tend to use two 5000K fluorescent lamps to get proper focus, and often employ a flash unit away from the camera. The angled flash produces no specular highlights on the flat surface, and it's high speed provides additional stability for the shot, and the color balance is right on target. (Figure 5.)

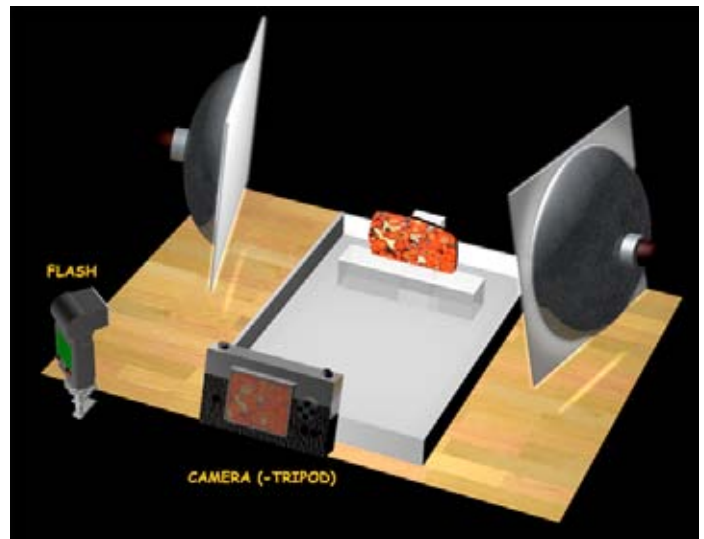


Figure 5.

Figure 6 shows the entire slab shot with a zoom lens set to 75mm, and the second image (Figure 7) shows a portion of the slab shot with a 135mm macro lens (after recalculating the 35mm equivalent it is roughly a 200mm equivalent.) The camera exposure was set to auto TTL letting the camera decide the final flash duration and intensity. Both images were shot at f/11. In the first image (Figure 6.) a piece of black cloth was hanging about 18 inches behind the slab.

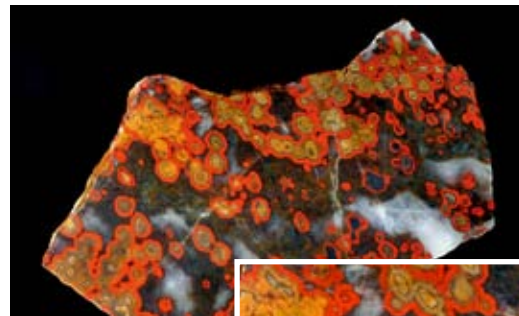


Figure 6.

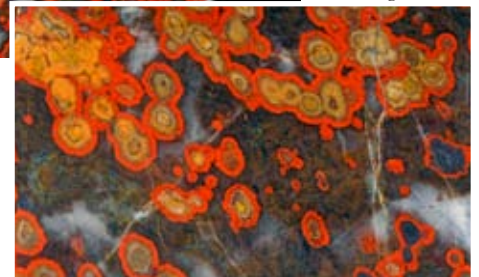


Figure 7.

When shooting translucent slabs it is sometimes useful to light them from behind instead of from the front, or a combination of both front and back lighting. If the shooting surface is opaque then the rear light can be placed above and behind the slab. (Figure 8.) My own table is made of glass so one light can be placed below and behind the slab. In this case the slab holder should be transparent too. (Figure 9.)

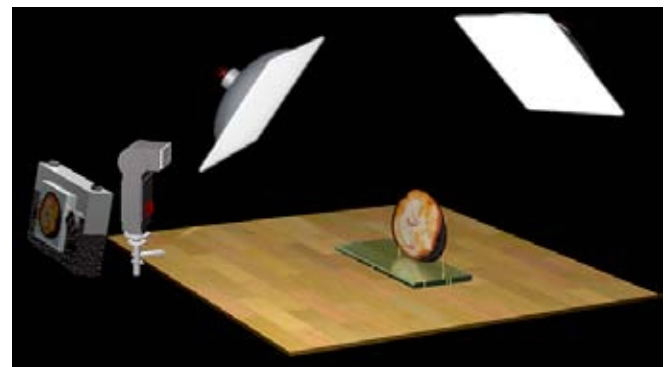


Figure 8.

In the first pair of examples the lighting from the front compared with that from the back shows only a marginal difference on the resultant photos. (Figure 10.) In other cases the difference is often very strong. Many agates tend to shift toward warm yellow-orange colors when lighted from the rear, but may show a broader variety of color with reflected light from the front. (Figure 11.)

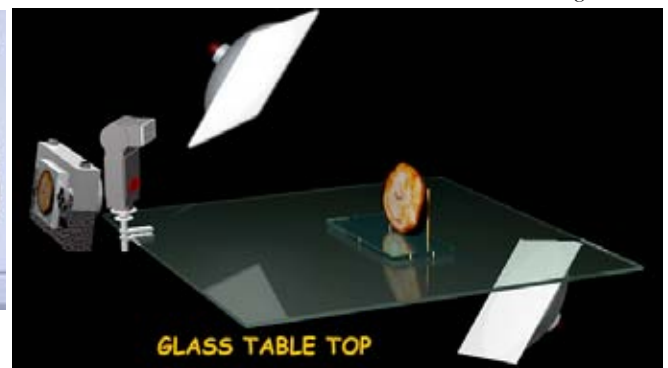


Figure 9.



Figure 10.

The same general set up can be used to photograph flat Intarsia too. Unlike domed stones, side lighting of the flats will not force a specular highlight on the surface. (Figure 12.) The general method of holding up the stones is the same as any of the domed cabochons covered in an earlier article. The lighting can be done using a single flash from an angle.



Figure 11.

Below are a few of the resultant images exposed using this combination of lighting and camera settings.

Next month we will explore the photography of mineral specimens.



Figure 12.

*Ocean Jasper*

*Teeter Ranch Plume Agate*



*Prudentman Plume Agate*



*Hog Crk Jasper/Agate*



*Bone Jasper*



# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part X

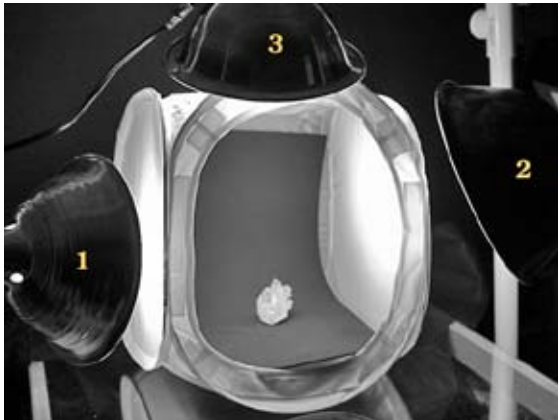


Fig. 1 Light Tent & Lights

The photography of minerals can be quite challenging as they come in wide variety of colors, shapes, and most important reflectivities. Crystal clusters can be difficult to light as they have reflective surfaces pointing in all directions. (About the only material more difficult is faceted stones, think of them as crystals with way to many faces!)

The general rule of thumb for most highly reflective surfaces is to use strongly diffuse light. Any strong direct lighting will be reflected back as specular (pure white reflections). Probably one of the easiest ways of handling highly reflective mineral specimens is to use a light tent. The light tent will likely not give the very best possible image, but it will give a reasonable image with the least amount of work.



Fig. 2 Fluorite

In the first two photos (fig 2 and 3) only lights 1 and 2 (Fig. 1) were used to provide the even illumination. Notice the very soft shadows below the minerals, and there are few strong specular highlights. The mineral is illuminated evenly in most shadow spaces. In the third image (fig 4.) all three lights were used to help differentiate the top crystal faces of the quartz. All of the lights were directed through the nylon of the tent. (There was no direct illumination on any of the shots.) The background was changed from white to black to help provide added contrast with the quartz.



Fig. 3 Galena

Figure 5. shows the galena with the addition of the on-camera flash. Because the mineral is like a mirror, any surfaces that point directly at the camera will become textureless highlights. (See red circles.) Also note the sharper shadow below the mineral. Curved background material is used to avoid the horizon line in



Fig. 4 Quartz



Fig. 5



the final image. The camera should be mounted on a sturdy tripod in aperture priority mode. The f-stop should be between  $f/5.6$  and  $f/11$  to get maximum depth of field. Finally the camera shutter is fired using a remote or the self timer to avoid camera shake.

Individual lights, with their own diffusers, make it possible to adjust the light placements over a wider range of positions. This also provides more space to use additional reflectors to highlight specific crystal faces. This process takes more time but offers the opportunity to create superior photographs.

Figure 6 shows one light with a diffuser (1) pointed at the main sample, a second light (2) without diffusion pointed only at the background to provide some depth, and a reflector (3) to open the shadow areas in the mineral. The result for both the galena and the fluorite are show in figures 7 and 8.

In both cases there is more distinction in the crystal faces, and slightly sharper shadows at the bases. The overall contrast is increased providing more depth in the image. The backgrounds differ in figures 7 and 8 because the light on the background was pointed more downward (still behind the mineral) in figure 7 making it somewhat lighter. This was to prevent the darker galena from “melting” into the background.

In both of these cases the curved background provided a seamless field to view the mineral. It is possible to get a similar result by using a flat background and setting the camera position at a higher angle up on the tripod. By doing this, only the base material (used to support the mineral) will be seen in the background.

In the final set of images I used a set up similar to the cabochon set up. I used a white card behind a black acrylic base to lighten the background. The acrylic also provided a reflective surface to show the mineral reflection. Instead of a shadow the reflection “anchors” the mineral to the ground and provides a visual plane of reference.

In figure 9. the set up is shown. It is very similar to that in figure 6., but has the additional white card (2) for background reflection, and the black acrylic plate (4) used to hold the mineral sample and provide the reflection. The same single light and reflector are used as in the previous example (1 and 3).



Fig. 6 Free lighting setup



Fig. 7 Free lighting Galena



Fig. 8 Free lighting Fluorite

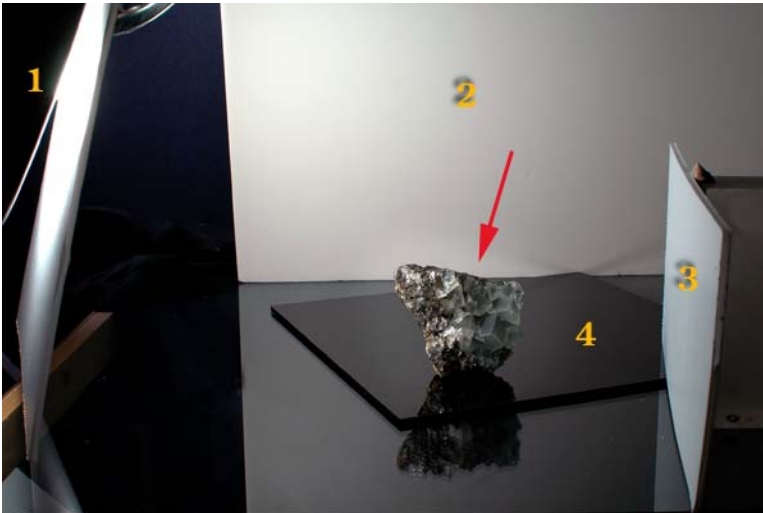


Fig. 9 Reflective setup

The results are displayed in figures 10 and 11. In both cases the acrylic provides a texture free rear surface that reflects the white card, and the white card is beyond the depth of field of the set up, hence the rear surface looks polished. The background level of gray is controlled by the angle of the white card as it was in the cabochon set up. It is a little lighter in the galena image to better contrast with the darker edges of the mineral.

While the reflection appears very sharp, the acrylic also reflects light back up on the bottom surface of both mineral images making them very slightly lighter and opening up what would otherwise be dark shadows. If another light is placed above and in front of the mineral specimen, it can be directed down into the acrylic and used to open up even more of the lower shadows without adding specular highlights to the sample.

Colored paper can also be for the reflective rear card (2), and will provide subtle colors in the background. Halo effects can be achieved by putting a spot light higher up on the rear card and letting it bleed a bit from the center. If positioned correctly, it produces a nice orbicular gradient around the sample. (Figure 11)



Fig. 10 Galena reflective setup



Fig. 10 Fluorite reflective setup



Fig. 11 Fluorite Color Reflector

# *Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XI* by ron gibbs



figure 1.

Last month I showed some general setups for shooting minerals. I will continue this month with another background that works with other materials too. In previous articles I have shown how to use black plastic with a reflected card (from behind) to control the gray level of a background. (See figure 1.) This method relies on the camera pointing in a more or less downward direction to make the black plastic base become the entire background of the image.

This careful selection of camera angle helps to avoid a “split-background” that would otherwise appear in the image. (Figure 2.) In the second image you can clearly see the line between the background and the bottom surface where the mineral resides. This line is present in virtually all cases unless both the background and the bottom surface are pure black. To avoid this surface break a continuous background must be employed. There is then no separation in the background and the bottom surface. The general set-up is shown in figure 3.



figure 2

A continuous piece of material is hung from out of the camera perspective and forms a curved surface through the bottom surface. It's a pretty simple set-up and can actually be used to achieve several different effects. In this example (figure 3 & 4.) the background is a piece of vinyl upholstery material. This set up used two lights, one from each side with the one on the right higher up and slightly further away. This allowed a very light shadow to the right of the sample, but demonstrates the clean continuous background.



figure 3.



figure 4.



Once this background is in place, it is easy to place secondary materials on it's surface and use it to aid in shaping them into continuous backgrounds. (figure 5.) In this case a piece of craft-foam (tan colored) was placed on the original backing and used to shot the same general image. (figure 6.) Once again a clean continuous background with only a light shadow to the right of the sample.

If the side lighting is moved forward, and not allowed to illuminate the curved background near its top, then the background will take on a continuous shadow effect making it look as if it was made up of a graduated color.

Figure 7, shows one possible look with slightly more light coming from the left than from the right, but both the left and right lights being partially blocked from the upper background. This was done on the same tan colored piece of foam. Next is the same general lighting done on the original piece of vinyl. (figure 8.) Notice the degree of difference between the backgrounds in figures 4 and 8, caused only by a slight difference in positioning the same two lights.

In the last set of diagrams I am using another piece of craft-foam as a continuous background (blue this time). The first image (figure 9.) shows the same beginning set up with the lights stationed on opposite sides (very similar to figure 3.) But the second (right light) is close enough to obliterate the shadow cast to the right in figure 4. The resultant image is shown in figure 10. It is difficult to tell whether the sample

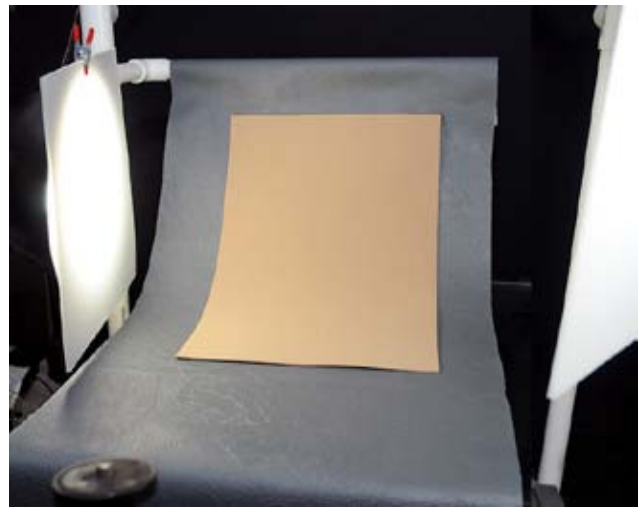


figure 5.



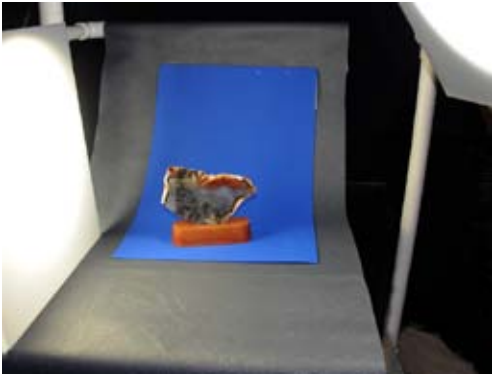
figure 6.



figure 8.



figure 7.



*figure 9.*



*figure 10.*



*figure 11.*

is sitting on a surface or floating in front of a blue background. But, there is no line bisecting the background.

In the final example, a third light was hand-held slightly in front of the slab and pointed to a position just above the slab on the rear surface. This produced a gradient light above and slightly behind the slab. This light can be placed lower to make a glow appear around the slab or higher and wider to make a reverse color gradient appear (lighter to darker) from top to bottom.

This method of using the continuous background provides a wide range of possible results depending upon your selection of lighting placement and number, and solves the problem of a distracting line through the background of the final image.

# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XII *by ron gibbs*



This month we'll begin to look at jewelry photography, second in line to faceted gemstones for the toughest thing to photograph. Silver can be one of the most reflective surfaces around, it can be on par with mirrors in its ability to reflect things. Let's first look at the whole idea of reflection so let's look at a mirror, something which is actually not that hard to photograph. Mirrors come close to 100% reflection and thus will show anything in their line. The trick with photographing a mirror is to simply stay out of its line of reflection. Mirror can be photographed by placing them at an angle to the camera.



1. Full Front Reflector 2. Partial Reflector

Notice in the first photo, three mirrors, two are angled away from the camera and photographer, while one is facing the camera. Obviously any angle that keeps the photographer (and camera) out of the line of site of the mirror can be used to successfully get an image. Some consideration should be given to what "is" in the mirror's line of reflection. I used a white card, hand held, above the left mirror and hence it reflects back only the nondescript card. The mirror on the right was positioned to reflect the smaller mirror and a white card behind it. When shooting a piece of flat polished jewelry, place it at an angle to avoid the camera reflection, but also pay attention to whatever else it is reflecting.



3. At Camera 4. White Reflector Left

In the series of four photos to the left, the first photo had the jewelry positioned so that it totally reflected the diffuser on the right light. In the second image, the jewelry was positioned to reflect only a part of the diffuser. Notice in the first, the surface appears evenly lighted and shows almost no imperfections. When the reflector is only partially reflected (picture two), many of the scratches, polish marks, and hammer marks appear in the photo. When the image is facing square-on to the camera (3.), you can see the reflection of my hand on the camera. In this photo there are also scratches and polish marks apparent, but the uneven surface is harder to differentiate. The last photo was taken with one light on the left side, and a white card positioned near the jewelry (on the right) to get a total reflection (similar to the first) and lighting comes out even and makes the piece once again appear nearly flawless. (Same lighting set up as Article X, Fig. 9.)



Side light Dome light

When a reflector or reflected diffuser totally fills the front surface, the light fills in all of the blemishes and the surface can be made to look nearly perfect. When light strikes the surface at an angle, it can produce small shadows and even very tiny scratches or imperfections can easily be differentiated.



Obviously it is possible to light jewelry to minimize or remove scratches or poor finish workmanship. This is not recommended if the piece is being photographed “for sale!” You will likely end up with an unhappy customer. At the same time, some imperfections that are not easily seen with the naked-eye, will show up when you do close-up photography, as the camera is enlarging the jewelry to much larger than life-size. A balance must be reached, and that point is left to the reader.

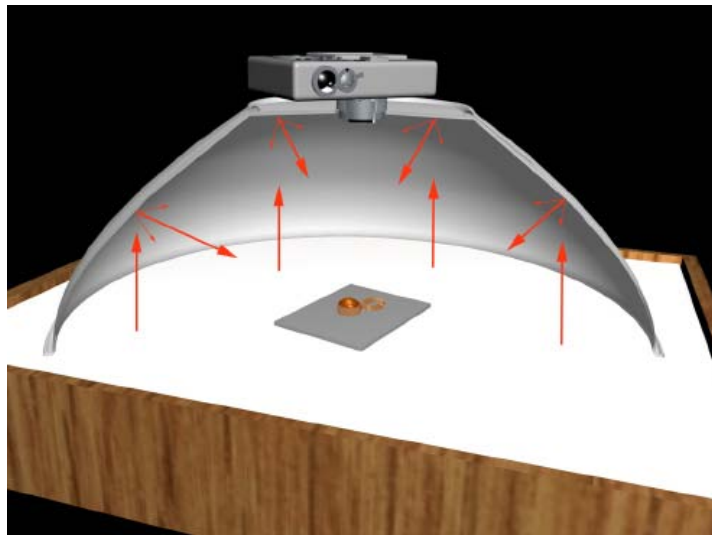
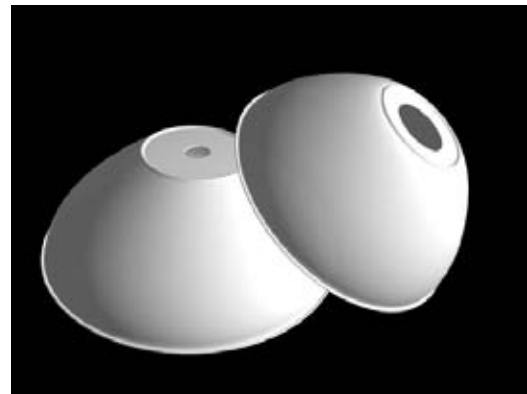
The last two photos on the previous page show the same pendant, one with even (blemish reducing) lighting, and the other with strong side-lighting, showing off every scratch. The piece is small enough that the blemishes go unnoticed when viewed at normal distance, but look pretty bad when photographed close-up. My wife wore it quite happily for many years, until I showed her a blown up version of the close-up image on the left. The photo on the right (same exact pendant) was taken using a “bowl-diffuser” which will be discussed next.

If you look at the internet and search for automated jewelry photography you can find several gadgets that are designed to make jewelry photography fast and easy. (<http://www.mkdigitaldirect.com/> , <http://www.photostudiobox.com/> , <http://www.tabletopstudio.com/> , and <http://www.clouddome.com/> )

Functionally they all function about the same although they may have different shapes, and some have built-in lighting while others do not. Several are rectangular boxes with color corrected interior lighting and white sides. The camera is often mounted on the top or front of the box and the image is captured through a small hole in the wall. You can think of this variety as a metal light-tent with built-in lighting. Most use fluorescent (color corrected lights) and some have now added banks of LED lights (again color corrected) to provide more “sparkle” in gemstones and especially dazzle with diamonds. Another variety uses a plastic dome and the lighting is supplied by the photographer from the exterior.

My own WEB site has had a tutorial on using a salad bowl to take jewelry photos for several years. I will summarize here. There are more photos of the set up on the site ([www.theimage.com](http://www.theimage.com)) Basically you need to acquire a large white or translucent salad bowl and cut a hole in the bottom. This can be used to photograph small pieces of jewelry quickly and very consistently. The lighting can be directed from the outside, or you can use a light box and light the whole thing from the bottom. At the top of this page are two typical salad bowls, each has a hole cut in the bottom. In the first case the hole is roughly the same diameter as the camera lens, and in this case the camera is placed on top of the bowl when in use. See the second image.

Lighting can be done from a light box below the bowl or it can be done with external lights outside the bowl in the manner used for a light tent. When the lighting is done from below (light box), a small opaque card is placed under the jewelry items to provide a solid background for the image. The lights are evenly bounced all around from below and provide almost perfectly balanced illumination. (The lights in the light box should be color balanced as would be any lights used externally.)





The second bowl with the larger hole can be positioned over a slanted background which is solid and not transparent or translucent. The jewelry is affixed to the background (modeling clay, two sided tape, thin string, etc. etc.), and the bowl is placed over and centered on the piece to be photographed. In the case the normal external lights are used, typically one on each side of the bowl.

The camera is placed on its usual tripod and the image is photographed through the hole. In the diagram to the left, the background is a piece of gray acrylic plastic, the gold pendant was fixed to it using a small dab of modeling clay, the camera photo was taken with the camera on the tripod and pointed through the larger hole. This is the same general way the following image was captured, only black acrylic was used as the backing material.



Some care needs to be taken with this method to avoid lighting the camera itself with the external light sources. If the camera is well lit, then it will show up in reflective backgrounds or as a part of the jewelry itself. Look closely at the left image and you can see the reflection of the cut-out in two spots on the gold. (outlined with a red circle.) Care in placement and positioning the camera slightly off axis can be used to eliminate some of this.

Three more examples below with different backgrounds. All using the bowl and two external lights. The first one once again shows the hole reflected near the top.

Three more examples below with different backgrounds. All using the bowl and two external lights. The first one once again shows the hole reflected near the top.

*White Styrene Plastic*



*White Acrylic*



*Black Acrylic*



I tend to reserve this method for use when I have to shoot a large number of similar items for placement on a WEB page. The method is fast, the images require minimal post processing, and it produces an acceptable image without much work.

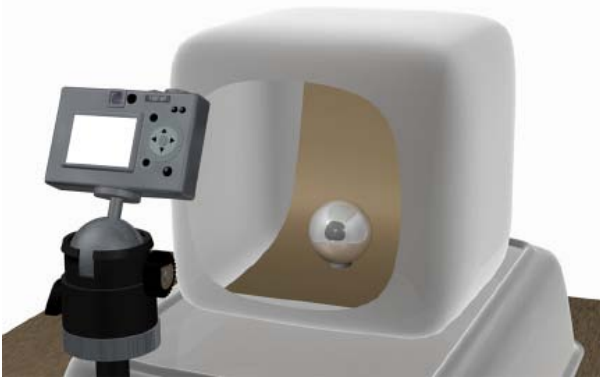
As with any close-up photography this set up aids in placing the items almost perpendicular to the camera lens to get maximum depth of field. It does not provide for much “art-sy” work or fancy compositions. It may not provide the best lighting for faceted gems, but it is adequate for most commercial products.

Next month we’ll continue with jewelry and begin to cover a more challenging topic. Think about it ... how would you photograph a mirrored sphere? How do you position a mirrored sphere to place yourself out of the reflection?

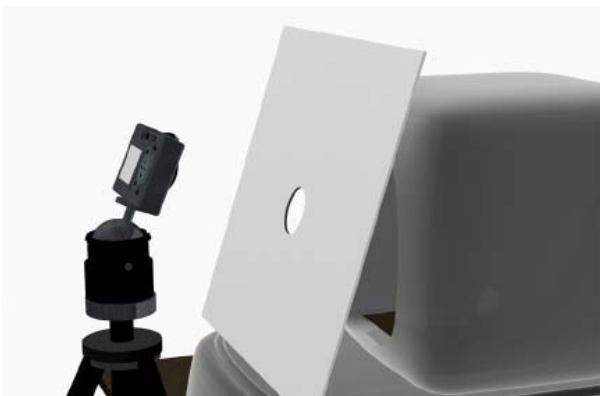
By the way if anyone comes up with a sure fire way to do it, let me know and I’ll include it in next months write-up!



# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XIII by ron gibbs

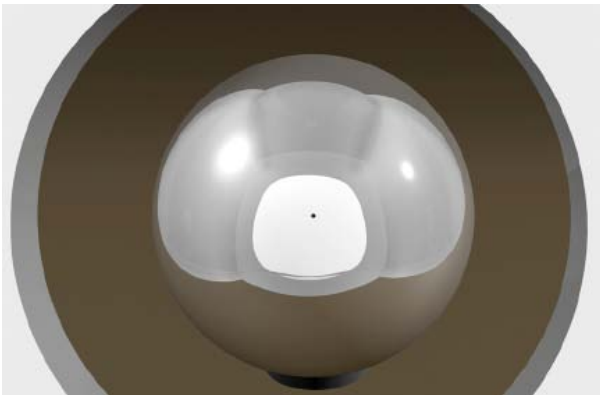


So how do you take a photograph of a perfect silver sphere? Well it's just about impossible to get a "clean" photo, without any awkward reflections. Since a polished sphere will reflect everything in its vicinity, the entire vicinity must contain nothing to reflect. (Now that is a bit awkward.)



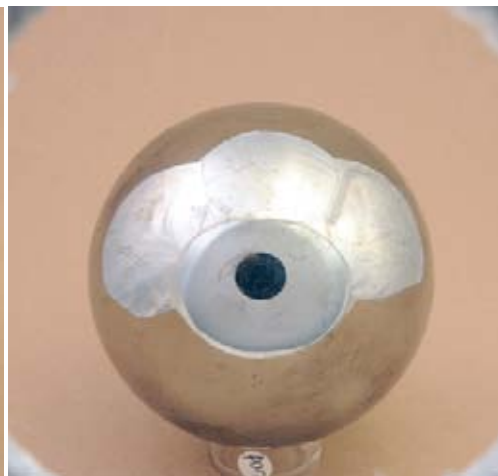
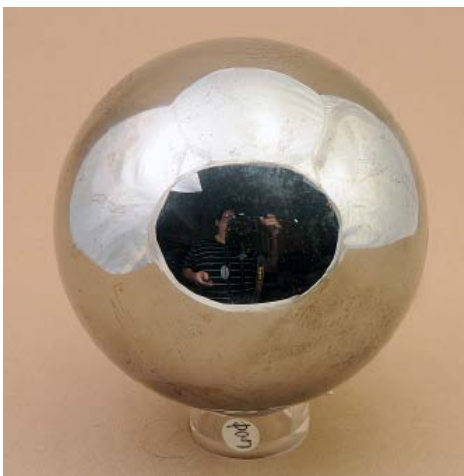
About the best one can do is to encapsulate there in a light tent and use small opening in the front to position the camera and take the image. Ideally a circular light tent without seams would be best, basically a large white sphere with a single hole. The diagrams to the left show a possible set up with a light tent. I placed a continuous background in the tent and positioned a couple of lights outside and to the sides of the tent.

I then used a piece of white foamcore board with a hole in it to shot the final image. The computer generated version in the third image down. The two images at the bottom of the page are actual photos taken of a steel (a bit rusty) ball bearings taken in the real world equivalent.



With the tent wide open it is easy to see the camera and the photographer reflected back in the sphere. When I covered the front with a white card with a hole and shot through the hole the reduced size hid most of those reflections, The image does look a bit like an eye.

With a little photoshop work the "eye's iris" can be entirely removed. Now this is a mental exercise and not really an example of how to create a good photograph. I just wanted you to think a bit about the considerations that must be taken based



on the properties of the object being photographed.

Now let's look at a small set-up to "float objects" for photography. This will provide a means to hold an object in the air, unseen by the camera and works well for cabochons or small pieces of jewelry. The idea of doing this provides a means to separate the background from the object and throw it completely out of focus while maintaining sharp focus on the object.

It provides separation from the backgrounds without using any transparent glass or plastic in between. This illuminates the possibility of unwanted reflections. We'll use perspective to hide the stone or jewelry holder.

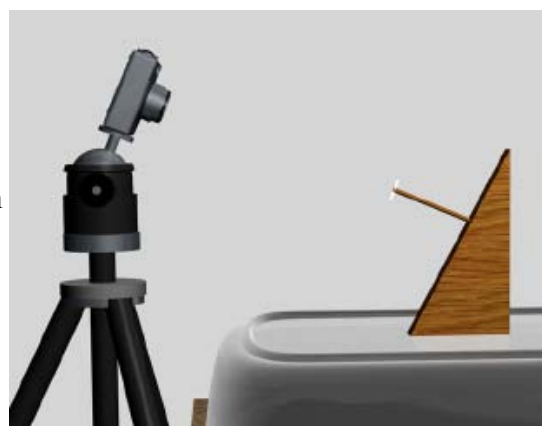
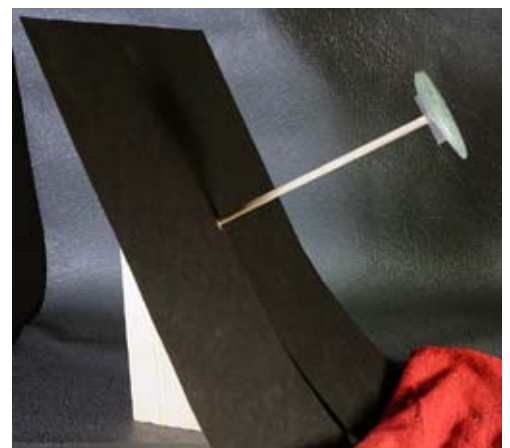
I use a 4x6 piece of wood cut into a 30-60 degree right triangle. This provides two possible viewing angles for the camera. I drill a hole the same size as a short wooden dowel in to the hypotenuse and the longer of the two sides of the triangle. At the end of dowel I use a small piece of plastic also drilled for the dowel. This piece of plastic becomes the support for the item being photographed. I use a small dab of clay or liquid thumb-tack to hold the item and completely cover the plastic holder.

See the third photo for a cabochon on the end of the holder. Not completely trusting the removable adhesive I often place a soft surface below the object to catch it in case of an unintended release. The selected background material is cut with a single slit to the point where the dowel will protrude. I enlarge the area at the dowel slightly to make it fit better, and attach as in the photo. (Sliding it down from the top.)

The camera will be placed in a direct line with the jewelry of cab and focused on the object. Since the camera can be adjust to nearly a perfect perpendicular with the object, there is a minimal depth of field needed, and the entire object can easily be brought into focus. By using which ever side of the wooded triangle desired you can help adjust the angle of the camera and the tripod set-up. The two images at the bottom of the page demonstrate the proper set-up for the camera and the wooden block.

The camera is adjusted so that it looks directly down the length of the wooden dowel. The background paper or clothe is not shown in these illustrations.

Typical results are show in the next set of photos. The first image is the one taken





from the precise set up illustrated on the previous page. The cabochon is floating above the black paper background. If you look closely you can just make out the two shadows cast by the lights used to illuminate the cab.

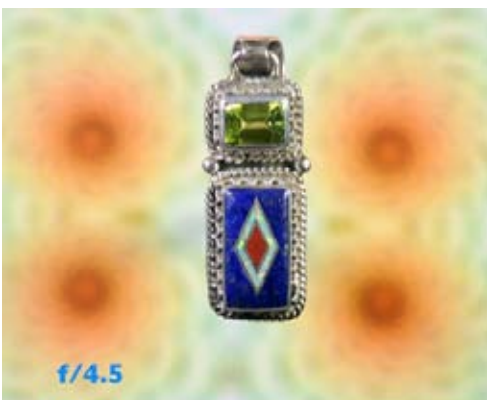
In the next image I used a small pendant and floated it above a slightly graduated blue background. I did use photoshop to cover over the slit in the paper that was apparent below the pendant. Again you can see the slight shadows that were created by the two lights used to illuminate the pendant.

This technique will allow the use of strongly patterned backgrounds if desired. Normally a strongly patterned background will make the image much too busy and make it hard to focus on the main subject. In the next photo I used a very strongly patterned background image and set the camera aperture to  $f/4.5$  which is sufficient to keep the pendant in focus, but is not high enough to keep the background in good focus. IT makes the background appear more like a soft pattern.



In the last image, the same set up was used but the f-stop was set of  $f/16$ . Here the pendant is obviously in focus, but the background is also coming into sharper focus and beginning to compete with the foreground topic, the pendant. In the first one of the two images, the pendant does appear to be floating above the background.

Without using something to separate the subject from the background, even a relatively low f-stop will still make the background fairly sharp.



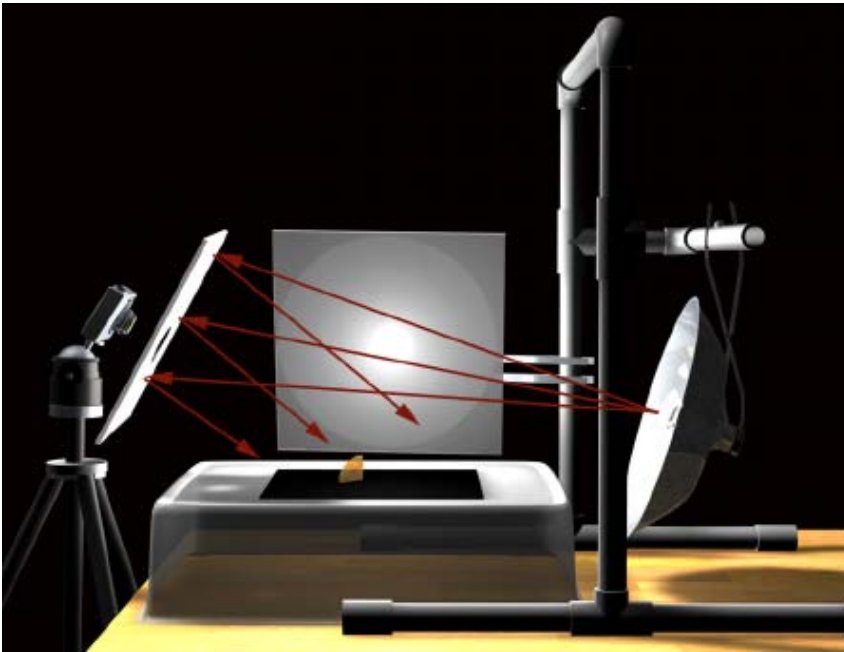
For very small items, thin metal tube or stiff wire can be used to “levitate” the items. The thinner the support, the less shadow it will cast on the background. Multiple thin wires can be use to support larger pieces and any wire showing in the final image can be removed with photoshop.

Next month I’ll demonstrate the results from adapting some of the cabochon lighting techniques to jewelry items, and well look at roughing up the background and making it less reflective for jewelry objects.

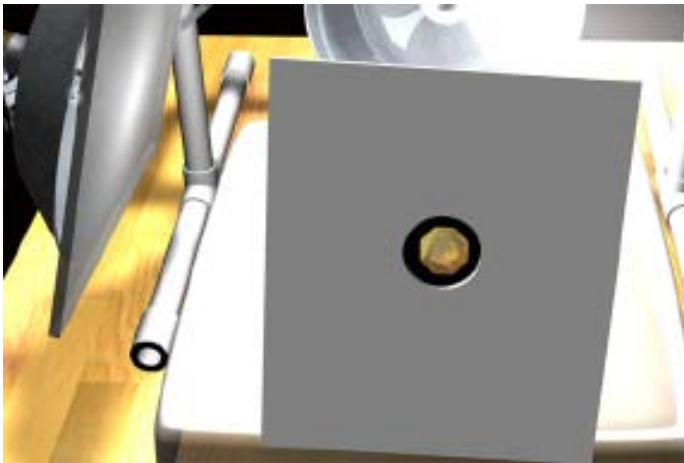




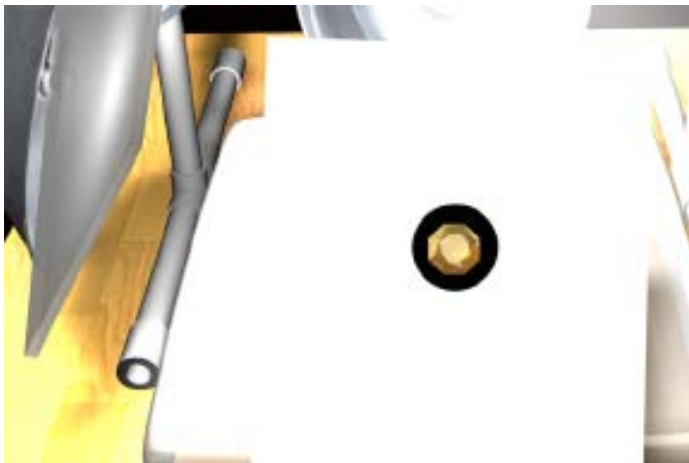
# *Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XIV* by ron gibbs



*lighting set up*



*camera's point of view 1*



*camera's point of view 2*

Successfully shooting a faceted gemstone is one of the most challenging photos to make. By their very nature faceted stones need to have the light enter almost directly into the table of the stone, and that is exactly where the camera needs to be to get the best image. So how do you get two objects in the same spot at the same time without resorting to the basic time-space warping phenomena often used in sci-fi movies?

One of the best set-ups is illustrated in the first image to the left, one light with strong diffuser is set up at about a right angle to the stone, this provides the overall illumination of the "scene" and provides enough light to make camera focus easy.

The second light is placed BEHIND the stone and pointed toward the camera. A position must be selected where the resultant light does not cause lens flare in the camera. This light is then reflected using a large white card with a hole in it. The camera is positioned to shoot the image through the hole. The card can be manipulated to direct the desired reflected light directly into the gemstone.

The amount of reflection and the angle of the card provide a wide variety of different possible images. The next two illustrations (taken from where the camera's point of view) show how the position of the card controls the number of facets receiving direct light. In the lower of the two illustrations, there is nearly a complete reflection in the crown of the stone.

At the top of the next page are two images of the same stone using different amounts of card reflection. The left most stone has

nearly full-on 100% reflection, and the second has only a slight reflection directly mainly to the right.

Two more examples can be seen in the next pair of images, one using the reflector and one using two lights from the side.

The stone being photographed can also be turned slightly away from the camera, and a single reflector (without a hole) can be used to illuminate as much of the table facet as desired.

The card not only directs the light into the stone, but a portion or all of it can be made to reflect directly on the table of the stone. This produces a highlight that can be accurately controlled to whatever level the photographer desires. (See line of images at bottom of page.)

Finally one additional way to get more “fire” from gemstones with higher refractive index is to use LED lamps which act as very bright point sources. I use a microscope LED ring light. Like the hole in the reflector the open ring can be used to center the stone and the photograph is taken through the center hole.

The LEDs work exceptionally well with CD, diamonds, and zircons.



*two orthoclase faceted stones*



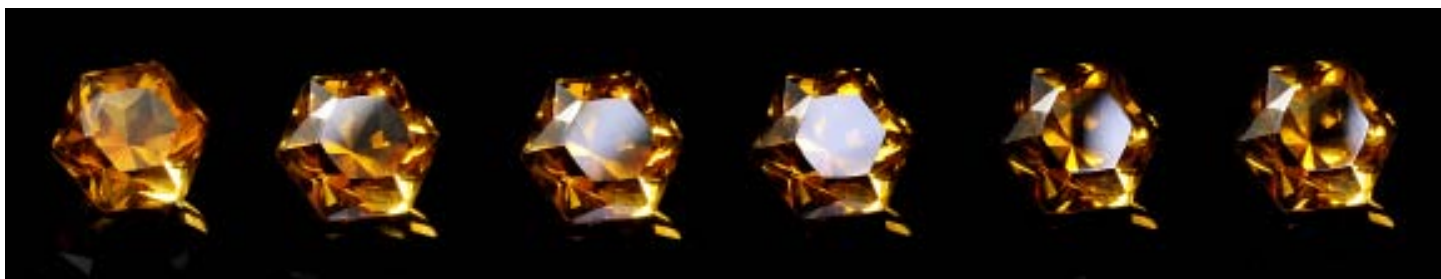
*two sides lights/ no reflector*

*one side light / with reflector*

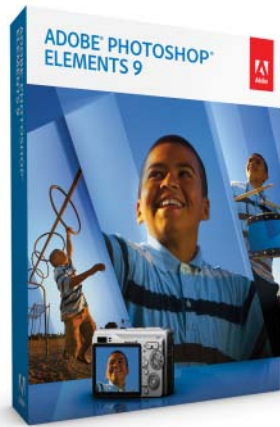
*reflwtcor card*

*LED light*

*microscope LED ring light*



# *Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XV* by ron gibbs



We'll now begin to examine the computer software needed to edit our images, and prepare them for either WEB or print use.

I will discuss two specific packages, but the tools I will describe are available in a variety of software and they work in a similar manner in most applications. The best known imaging software on the planet is Adobe Photoshop, but it's a professional level application with a professional level price! The extended edition of Photoshop retails for about \$1000. Unless you aspire to eventually publishing a book of photos on an offset printing press, you do not need the capabilities of this software.

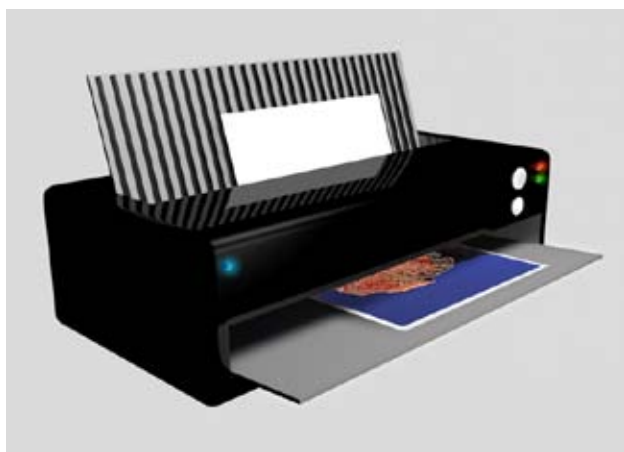


Adobe also makes a product called Photoshop Elements, and it has all the tools needed to fix up photos for the WEB, for home printing, or for single color book publication like those offered by such companies as Blurb, Lulu, Apple iPhoto, etc. The good news is that it's less than \$100.

So over the next few articles I will discuss a few of the more or less generic tools needed to "fix-up" the images we have taken with our digital cameras.

***Monitor - fixed resolution- image size depends only on the total pixels used to display.***

We'll discuss the resolutions needed for print vs. WEB, the use of the histogram tool (aka Levels) to adjust exposure, color correction tools, sharpening functions, and the rubber stamp/clone tool which can be used for spot and dust removal *and* a "few other things."



I often tell people to "begin at the end" when preparing photos for use. That is, you need to know where you will eventually use the photographs before you prepare them. If you wish to print a photo, then you must control the infamous "DPI" (Dots Per Inch) in the file, whereas if you want to use the photo only on the WEB or on an LCD screen (computer or TV) then you only need to worry about the total number of pixels. The total resolution is important for the WEB, but NOT the DPI.

***Printer- variable print resolution- image size depends the DPI value set in the image.***

Computer monitors (and TV sets) have fixed pixel reso-



lution. The overall resolution of the monitor can be somewhat adjusted, but the DPI value is fundamentally fixed by the hardware itself. As rule of thumb we use 72-75 dpi as the fixed value. That is slightly over simplified, as it can actually change a bit beyond those values but not by much. Hence it is best just to worry about the total resolution of the image (height x width pixels) and not the DPI value. On an monitor, a resolution of 1024 x 768 (max for many of today's monitors) will fill the screen regardless of whether or not it is 75 dpi, 150 dpi or 300 dpi because the screen has a fixed dpi.

Let's use an analogy, if you have a ruler that is 1 foot long, it can be divided up into 12 inches. The ruler does not change length when you say it is 12 inches long. It could also be described as 24 half-inch divisions and it would not be anything different than 12 inches or 1 foot.

When we set a DPI value on an image (if we do not change anything else) then the total resolution remains the same. DPI is just an accounting system that can be used when the photo is output to a machine that *has* the ability to create images at different DPI values. (Monitors cannot change their DPI so to change the image size on a monitor you must adjust the height and width of the image and not the measurement value (DPI).

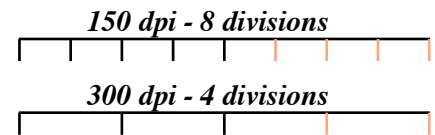
If we want to create an image for print, we have a different situation. Printers can print at different DPI values, they are not fixed resolution. Hence we can take the total resolution of the image (height and width) and divide it up into different DPI values to make different sized prints.

Printers need to print at higher DPI values than monitors because they produce colors in a different way. Each dot on a printer can have only a single ink color, and hence to produce other colors it requires combinations of ink dots. Thus it takes several dots to produce a single color. A rule of thumb the lowest resolution for acceptable printing is about 150 dpi. You will get slightly more sharp images at higher values, and for the most part there is no need to print at values higher than about 360 dpi.

Assume for minute that we have a 6 mega pixel (MP) original image. That would give a typical height x width value of about 3000 x 2000. On a monitor screen that would produce an image that is (3000/75 dpi = 40) 40 inches wide on a monitor. Way too much for any current screens. The typical 1024 x 768 monitor can only display a 13.65 inch image. (1024/75 dpi = 13.65) So you would use the width or height pixels to determine the largest size you wanted for WEB use.

For the same 6 MP image you could set a DPI value of 150 for printing, (3000/150 dpi = 20) and it would produce a 20" wide print. If you selected 300 DPI then it would produce a 10 inch wide print (3000/300 dpi = 10) and it would be slightly sharper. At 75 dpi the print would be much less sharp. (See examples to the right. 75 dpi vs 300 dpi)

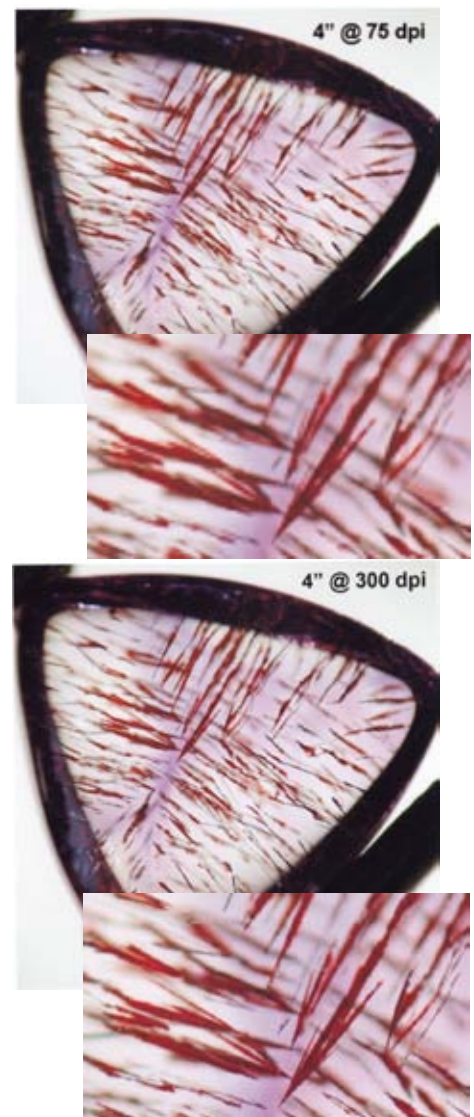
*Original 1200 pixels wide*



**A 1200 pixel wide image can be divided up by 150 dpi to produce an 8" wide print. OR it could be divided up by 300 dpi to produce a 4" wide print.**

**In either case 1200@150 dpi or 1200 @300 dpi, the image would spill over (slightly) a 1024 x 768 monitor and entirely fill the screen! The dpi value do not effect the monitor only the total resolution.**

*From printer .. notice quality difference between the two prints*



# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XVI *by ron gibbs*

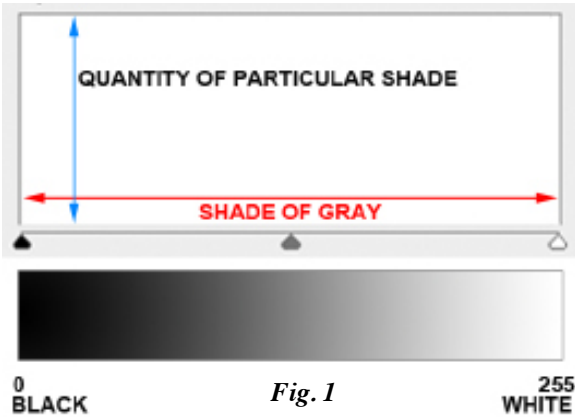


Fig. 1

Probably the most useful tool for the fine-tuning of photographs is the histogram tool (also called the Levels Tool in some software.) “Reading a histogram” is useful in assessing the exposure of an image as well as making modifications to it.

So what is a histogram? It’s actually just an elongated bar chart. (Fig 1.) The long horizontal axis represents the various shades of gray (or color tones), and the height of each bar illustrates the quantity of that particular shade. The horizontal axis starts with pure black on the far left and ends 256 levels later with pure white at the right.

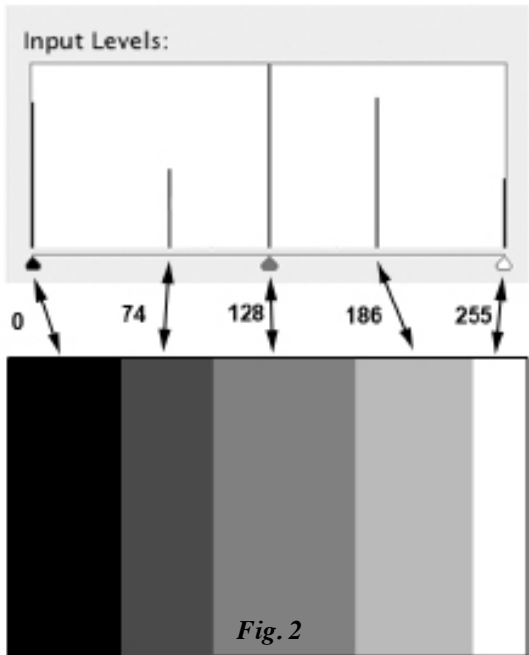


Fig. 2

The next figure (Fig. 2) shows the resultant histogram from the 5 levels of gray in the image below the graph. Each of the bars represents the gray level (numerical values), and the height of each bar is representative of the amount of that shade. Thus the value at 128 is at the tallest because the amount of 128 gray is the largest. Next is the lighter gray (186 value) which is roughly 80% of the size of the 128 gray. The smallest amount of tone is the white (at the 0 value) area. Even without seeing the image (only reading the histogram) you could determine that there were 5 shades, with both black and white and three levels of gray.

The shape and position of the graph relative to the two ends is a good indicator of proper exposure. While there are a wide variety of acceptable histograms there are a few which indicate that the image should be recaptured or shot again with the camera.

The worst possible result is a full height line at either or both of the black and white ends of the scale. In both cases this means that there is loss of detail with no ability to recover it. Figure 3 illustrates an over exposed photograph with washed-out whites, and this is evident in the 100% peak at the 255 end of the histogram (outlined in red).

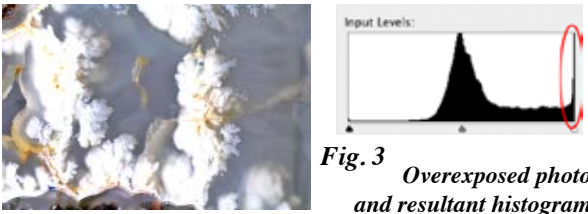


Fig. 3 Overexposed photo and resultant histogram

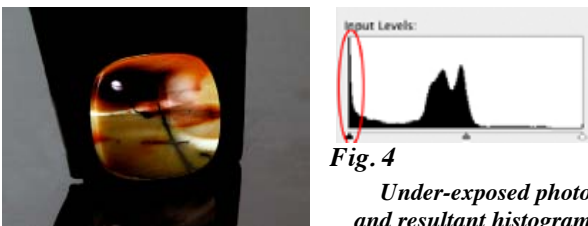


Fig. 4 Under-exposed photo and resultant histogram

Figure 4. demonstrates an under-exposed image and the resultant histogram. Again the area of interest is circled in red, and shows a 100% peak at the 0 (zero) end of the histogram. This means that at least some portion of the image has lost detail in the darkest areas. Although there is a large pure black area in the image, the darkest pattern in the stone is also under-exposed with loss of information.

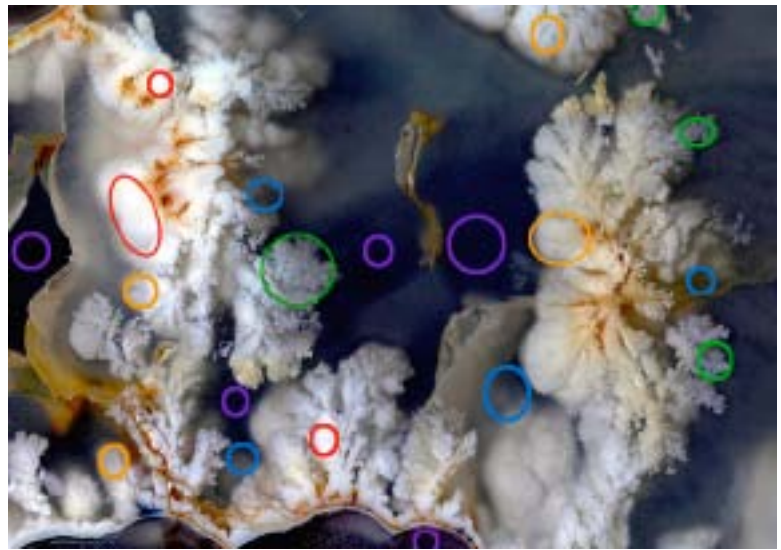
Figure 5 shows a reasonably good exposure for the image, and its associated histogram. The histogram goes show a tiny amount of pure white at the zero point, but not pegged to the 100% bar. There is no pure black, so no loss on that end. It would be slightly better if the shades at the dark end were not at 100% but it's close enough. The color squares in the histogram are associated with their same color circles and ellipses in the photograph. This represents the various tones and some of their locations in the image.

Although there are always exceptions to the rule, a good histogram taken directly from the camera image will cover at least 50% of the width of the graph (the more the better). The histogram will end before reaching either end ( 0 and 255) so that there is no lost information. Depending on the subject matter, the graph may be predominantly to the left or right of center, that's not really important. It may also be centered.

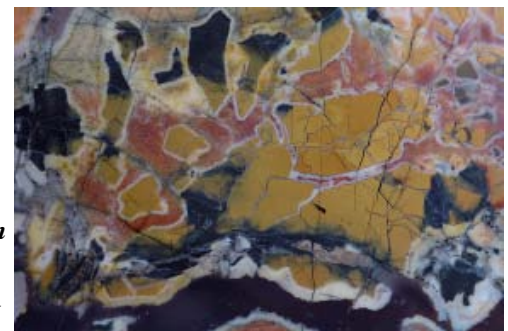
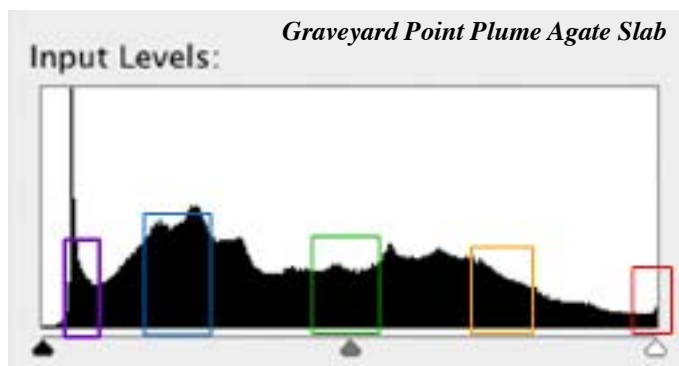
Keep in mind the ideal for most images is getting the histogram to cover the entire width of the graph, but not saturate (100% bar) either end of the graph. When the photo shows a wide histogram it means that has a full range of tones.

So let's now look at the Level's command in Photoshop Elements (this calls up the histogram tool). The same general tool with similar controls exists in many other photo editing packages. Figure 6 shows the Histogram tool that results from the Levels... menu selection. Pay close attention to the histogram graph and the three small triangles that are below the bottom axis of the graph. These are actually control handles and can be manipulated with the mouse to change the histogram and thus the tonality of the image.

The box outlined in blue shows the histogram graph and the three triangular tools. They are sliders and can be moved independently. The white slider allows adjustment of the lighter tones without changing the black end, and the black slider can be used to change the darker tones without changing the white tone. These sliders can each be moved in only one direction, toward the center.

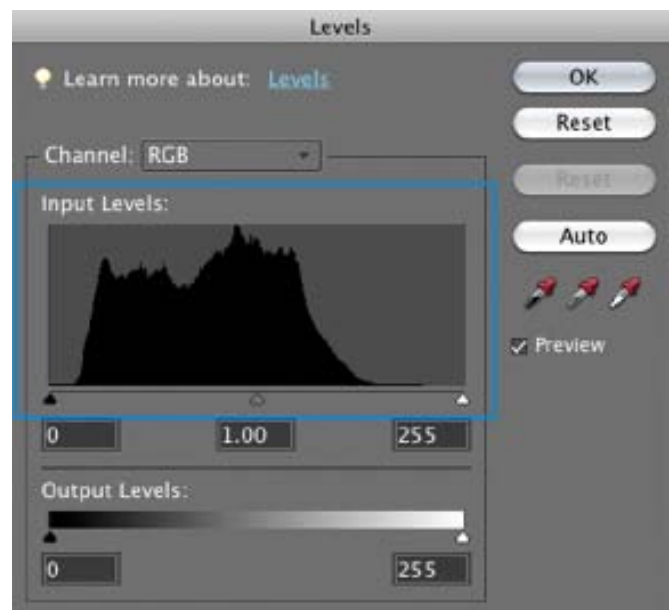


*Graveyard Point Plume Agate Slab* Fig. 5

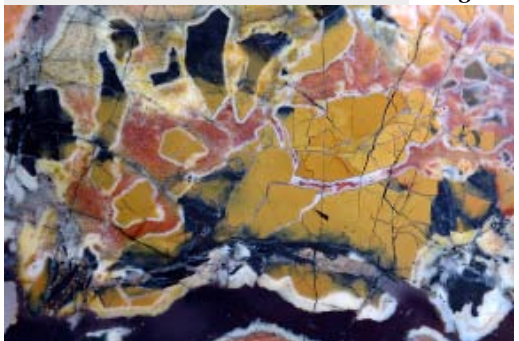
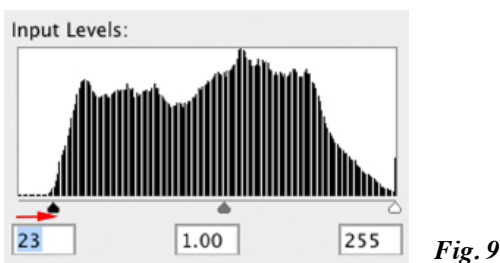
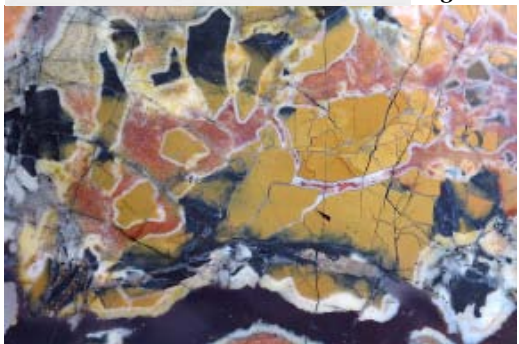
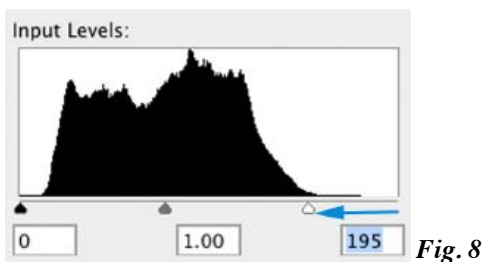
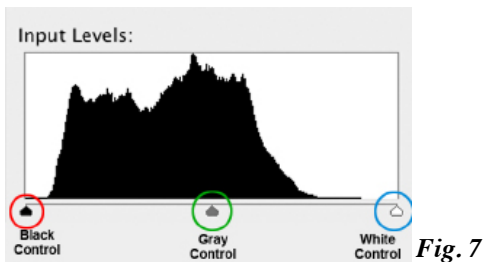


*Stone Canyon Jasper Slab*

Fig. 6







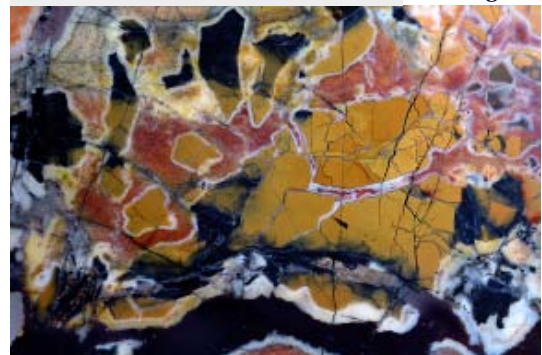
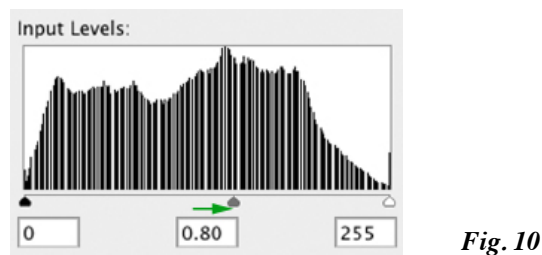
The middle slider (Fig 7. green) adjusts the central gray tones and can be adjusted in either direction, and it has no effect one pure black or pure white. Let's examine what happens in each case when a single slider is moved. We'll use the starting position illustrated in figure 7.

Figure 7 is the histogram of a mainly mid-toned image with no strong dark or light shades. Notice that the histogram does not stretch from the light to dark end of the graph. The first change I would make in this image is to move the white slider to the base of the histogram. (From 255 --> 195, Blue arrow Fig 8.) After this adjustment the resultant image (Fig 8.) is now much lighter than the original (Fig 7.) The adjustment has promoted much of the image tonality toward the lighter side of the histogram.

In the next set of images I have adjusted the dark slider from 0 in to 23. (Red arrow Fig 9.) This has stretched all of the values between 0 and 23 and converted them to 0 (black) and pulled the whole histogram slightly back toward the middle. The two adjustments have produced an image with higher contrast.

The good news is that adjustments can be monitored while making them, the image actually changes in real time as the triangles are moved, helping you to decide the proper amount of adjustment. (Make certain Live Preview is checked.)

Finally in Figure 10, I am adjusting the center triangle which can be used to make middle tones lighter or darker. In this case I decided to make the middle tones a little bit darker so I move the triangle from 1.0 to 0.80 on the axis. This adds a bit more "punch" to the image.



Notice the difference between the starting image and the final image after adjustments. It has better overall exposure, increased contrast and more intense tones. The beginning histogram has now been stretch over the entire range, and the mid-tone made slightly darker.

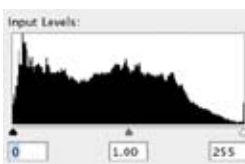
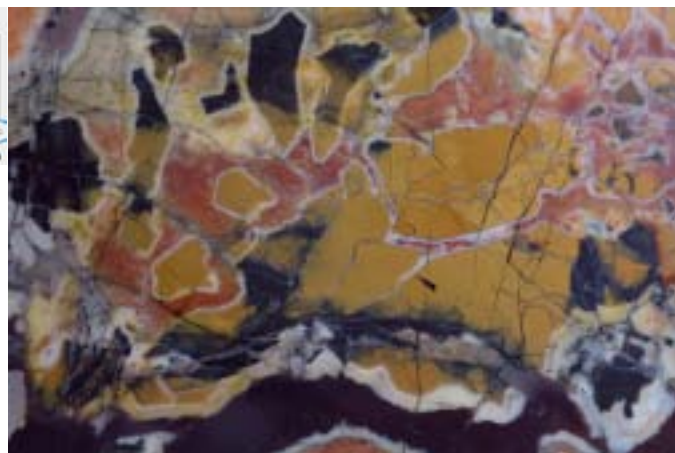
This is the typical type of adjustment that can be done with the histogram tool. Also notice there is little fully saturated white or fully saturated black showing loss of detail. This was achieved by carefully selecting the positions to move the triangular controls.

It is sometimes easier to see the magnitude of change possible using more familiar subject matter. The last pair of images (bottom of page) illustrate similar adjustments to those explained above, and the changes possible in the image and their resultant histogram.

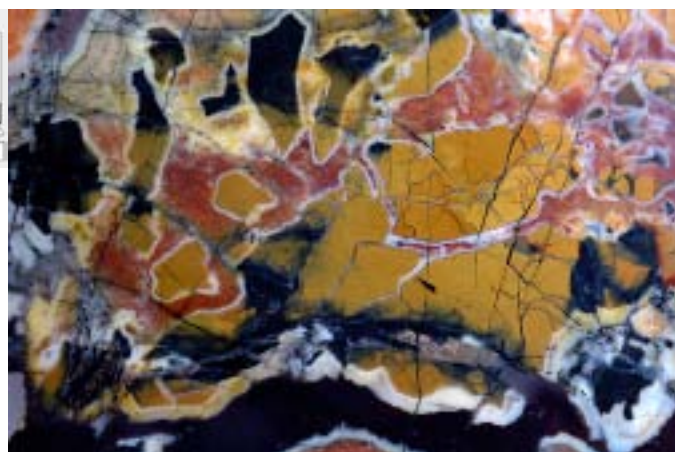
In this particular photo the original image showed a histogram with virtually all tones lower (darker) than 50% gray. The image was flat



*No adjustments*



*After Histogram adjustments*



with no contrast. After moving the white triangle to about the mid-way point (middle gray) and the black triangle in just a tiny bit, The histogram now had a full set of shades from light to dark, and far more impact as a photo.

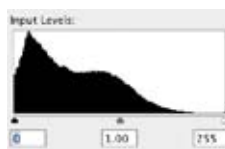
We'll look more at the histogram tool next month, and how to achieve a degree of color correction.



*No adjustments*



*After Histogram adjustments*





# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XVII

by ron gibbs

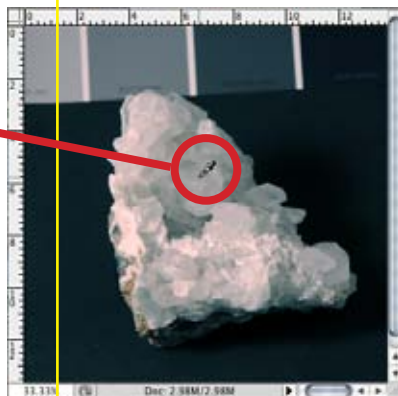
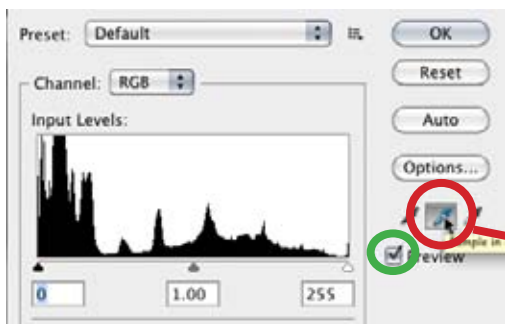


The same tool that we used to adjust the tonality of an image can also be used to color correct in some cases. This method works when the photo has a consistent color cast over the entire image. For instance in the case of the white calcite (correctly colored in the first photo) it is possible to fix an image with a bad color cast using the eyedropper tool in the histogram (level command).

The second image on the page shows the calcite with a reddish shift in hue over the entire image. This could have been caused by taking the photo with improper color balance set on the camera. This is fairly easy to correct by using the eyedropper tool. Bring up the histogram (bottom left) and select the middle (gray) eyedropper (red circle). Place the eyedropper on any portion of the image where there should be neutral gray, and click once.

The software determines how much of a color shift there is at the point where the eyedropper is placed and adds the appropriate corrective color to make that point turn neutral gray. It adds the correction to the entire image, thus correcting it everywhere. In this case the resultant image is shown at the bottom of the page, and is much better than the red original.

You can continue to select different points in the image with the eyedropper and click over and over until you get a desirable result. The result is updated in the image as long as the “preview” box is selected (green circle). This technique works well when the entire image has a color cast and when there is a true gray or neutral color in the image. (Neutral can also be black or white.)



This technique is not very successful when the image has a non-even color problem. For instance if the photo had color on one side of the subject matter from something like a colored

reflection then it does not work particularly well. This example is shown in the next photo at the top of the next page. Here the calcite was photographed with a red wall on the right side and it reflected the red color only onto the right side of the sample.

In this case if the gray eyedropper

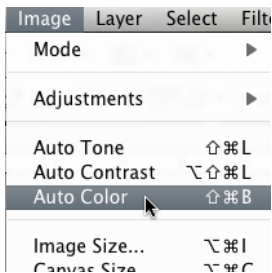
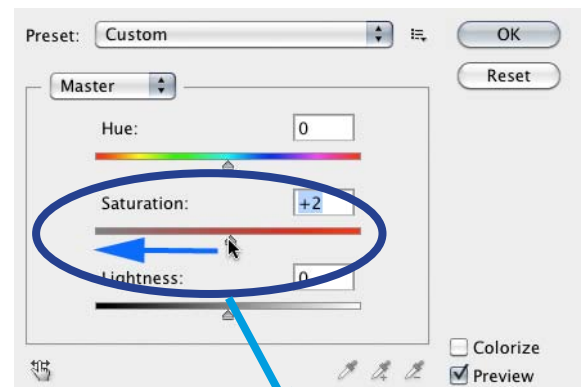


were used at the yellow circle, the resultant image would be corrected to make the red neutral, but all areas in the photo that were not originally too red would become too cyan. See second photo on this page. The red area under the eyedropper is now white, but the rest of the image has been color shifted too.

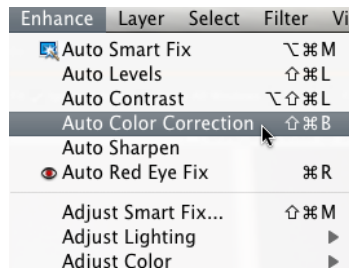
In this particular case there is a “sneaky” way to color correct the image, but it is only available because the image is entirely neutral tones. White calcite, black background and gray scale card at the top. In this case the Hue/Saturation tool in Photoshop or Photoshop Elements can be used to desaturate the image (desaturate means to remove all color. See the figure with the blue circle, it show how to use the Hue/Saturation tool to desaturate the image directly above. The saturation slider is moved all the way to the left removing all vestiges of color. The resultant image is shown below the Hue/Saturation tool. Again this only works when the entire image is made up of roughly neutral tones.

In both Photoshop and Photoshop Elements there is also an “Auto Color” command. I have found this to work best AFTER the image has been adjusted for correct tonal range. I first adjust the histogram as described in the previous article and then try the Auto/Color command. If the color shifts are minimal to begin with, then this command will often work, but if there are strong color shifts in the image, then I find this command usually just makes them worse. In my experience Auto Color works about 10-15% of the time, so I don’t use it very often. It’s worth a quick try, then move on to more controlled techniques. (See commands at bottom of page.)

We’ll continue with color correction in the next installment of this series. We’ll look at making selections of only a portion of the image and then color correcting them without effecting the entire image. This technique can also be used to control other changes in an image in a similar way, like changing only the tonality of part of an image.



*Current version of Photoshop*



*Current version of Photoshop Elements*

# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XVIII *by ron gibbs*

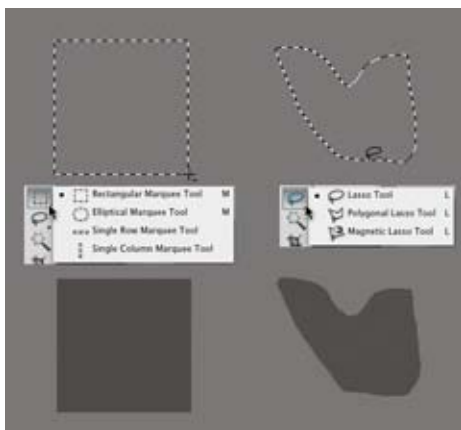


When applying a correction to an image it is not always necessary to apply the same correction to the entire image. So how do you select just a portion of an image to work on? This article will show how to use the SELECTION TOOL(s) to mark a partial area for the desired correction.

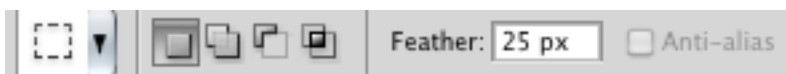
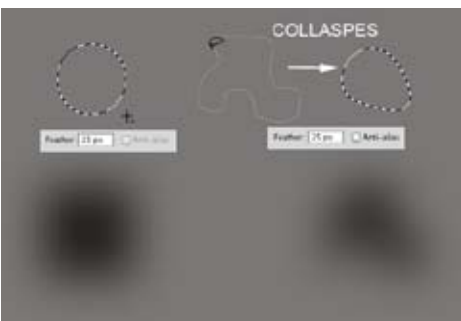
Let's examine the white calcite in the first image. It has a strong reddish reflection on it coming from the right side. If you were to correct the image using the EYE-DROPPER tool illustrated in the previous article, then the resultant image would be turned largely a cyan color. (See second image) The area sampled by the eye-dropper would be color corrected back to white, but the remainder of the mineral also receives the same change and converts the remainder of the image to the cyan color.

To fix this kind of problem we need to employ a selection tool, that will limit the area of the change. Although easy to do, it requires a small trick to be completely convincing. Selection tools in both Photoshop and Photoshop Elements tend to have precise outlines, and will produce an easy to identify border if the desired modification is even moderately large.

In the third image I have used selection tools to select a square area of the gray rectangle using the RECTANGULAR SELECTION TOOL and an odd-shaped area of the rectangle using the LASSO TOOL. I then made an adjustment to the LEVELS command and made that area of the rectangle substantially darker. Just below the small menu items you can see the result of the change. You tell exactly where the change has been made as it produces a strong outline defining it. This type of shape demarcation is often easy to spot even in a photograph.



To fix the problem and help hide any editing done by you, it is useful to make a change to one of the SELECTION TOOL parameters. When any of the selection tools are chosen, they may be adjusted with the FEATHER tool to make the edges every soft and gradual. The feather sets a boundary around the selection and makes a gradation in transition between the selected area and the surrounding area.

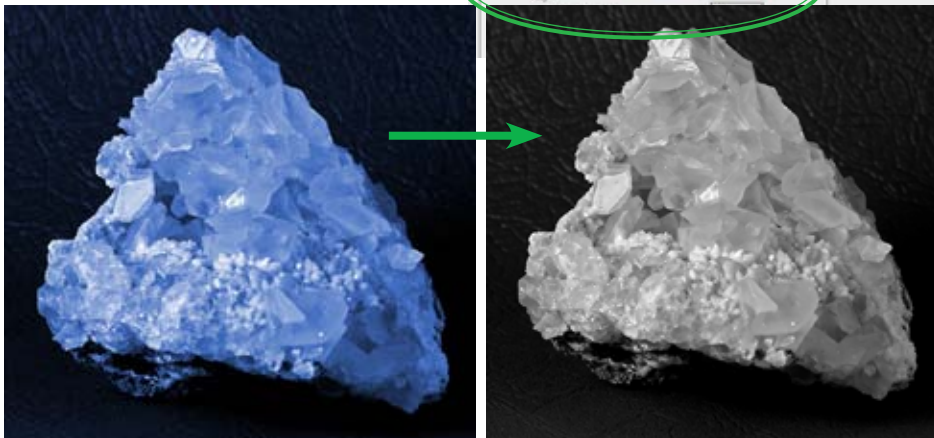
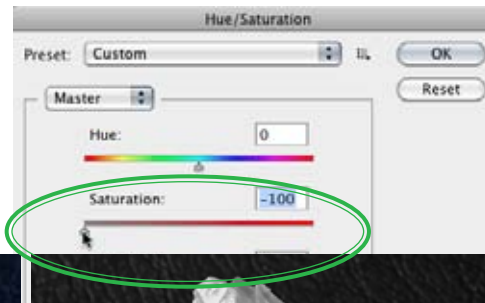


See the bottom image to better understand the type of selection that the FEATHER TOOL provides. The upper row shows a feather value set to 25 pixels. The original rectangle or lasso selection look normal until the mouse button is released, and it then appears to draw-in to a rounded shape. The bottom images show the same selection after the levels command was used to darken the selected area. The effect is complete near

the center and slowly fades away toward the edge of the selection. This makes a soft edge around the periphery and hides the border which is diagnostic of the change. In the right top image the feather was set to 25 and the lasso was used to select the right side of the crystal. It was then color corrected using the eye-dropper in the levels command.

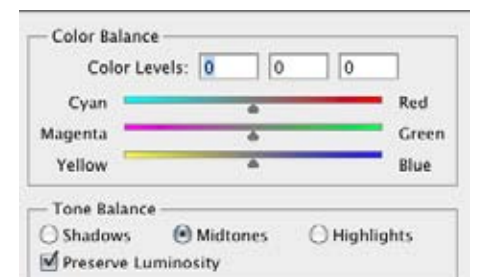
Notice that the selection area is shifted back to white after the correction and there is no tale-tale line around the selection showing the boundaries of the change. The amount of the FEATHER is set based on the total resolution of the image. This original image was about 800 pixels across and I set the feather to 25 pixels. As a rough rule of thumb about 25 pixels of feather for every 1000 of resolution is a reasonable starting point. The final results will dictate the proper feather selection.

A few more tricks for fixing a color cast is special situations. First if the mineral is white, black or gray you can simply use the SATURATION tool in the soft-



ware and dial the saturation back to zero. In this case it removes the entire color cast as a hue with zero saturation is neutral. This technique can also be used with a selection area to set one crystal in a mixed mineral back to a neutral value. (Look for the SATURATION TOOL in both Photoshop and Photoshop Elements - it's likely in other photo editing software too.

Another tools useful for selective color changing or general color correction is the COLOR BALANCE tool, it is set up to help guide you in the proper selection of color. Each pair of associated primary and secondary colors are placed at opposite ends of a slider. To remove one color, simply move the slider for that pair in the opposite direction. Thus to remove RED move the slider toward CYAN. This tool is most useful for correcting selection areas and can be fine tuned using the SHADOWS, MID-TONES, and HIGHLIGHT buttons in the lower dialog. This tool takes practice and is not automatic.



*Color Balance Tool*



# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XIX by ron gibbs

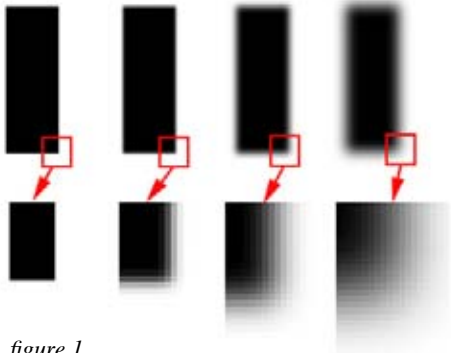


figure 1.

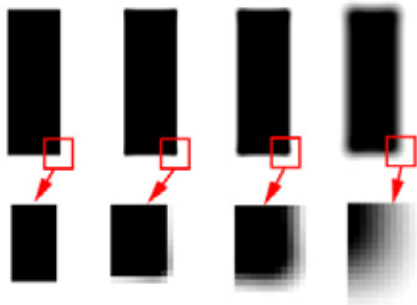
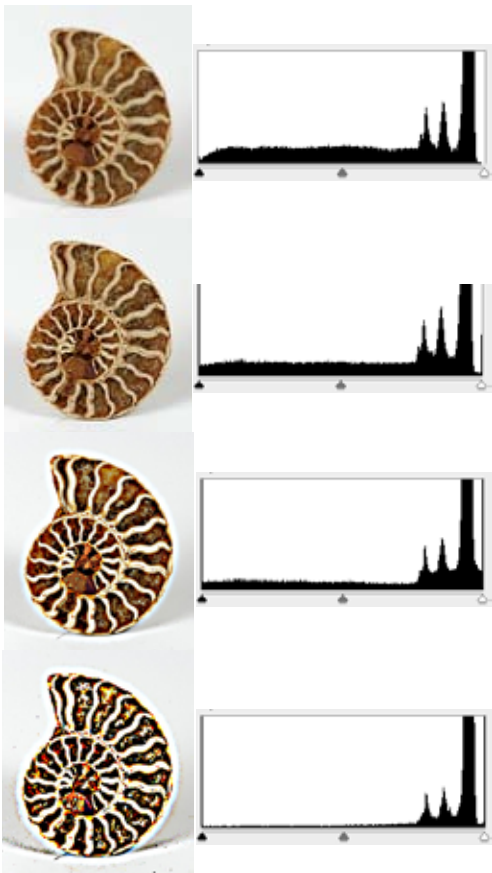


figure 2.



In the first couple of articles in this series we discussed the importance of sharpness in the image. Without a sharp image, the photo of jewelry, minerals, or cut stones can never be pleasing. There are many filters in Photoshop and Photoshop Elements related to “sharpening an image,” but if truth be told, none can create sharpness from a blurry image. The sharpening filters can only increase the slight loss in sharpness created by ALL digital cameras. You can make a slightly less-sharp image look sharper, but you cannot make a blurry image look sharp. If your image is blurry straight out of the camera, then re-photograph it and don’t waste your time trying to fix it with a sharpness filter.

So what is sharpness? The eye sees sharpness in two ways, in the distance of fall off between two adjacent colors, or the distance between a change in contrast. The first figure shows a series of black boxes on a white background. They become progressively more blurry as they move from left to right. One corner of each has been magnified to show the transition area. The sharpest one has an immediate change from black to white no matter what the magnification, and the others show an increasing width of change progressing through shades of gray. Our eye perceives this slow change as indistinct and hence blur (lack of sharpness.)

The next figure (2) shows the same boxes after application of a very strong sharpness filter to each. The width of blur decreases slightly and the contrast between each step increases even more. The result is a “sharper blur”, not a “sharp image”. Notice also that the corners of the boxes show even more rounding as the filter is applied. When sharpen filters are applied to an image, those areas that are most blurred will often show “artifacts” of the sharpening, and become quite apparent.

Let’s now look at what sharpening actually does to an image. In the next series of photos the shell is progressively sharpened from the top to bottom image. The histogram showing the overall tonality of each image is also displayed. As the sharpening increases, the histogram loses the middle levels of tone and the histogram moves from the center (full range) of tones toward the edges and eventually a toneless two shaded image. More of a line drawing and far less photographic. If the sharpening continues, eventually there are only the



highest levels and lowest levels and nothing in between. (last image)

The filter of choice for most photography has traditionally been the “unsharp mask” filter in the Photoshop applications. It provide a good degree of control without the automatic over-sharpening that happens with most of the simple sharpen filters (sharpen, sharpen more, and sharpen edges). The newer smart sharpen filter also looks promising but I am not as familiar with it and will not discuss it here. Here is a mineral image that could use a little digital sharpening. The left portion of the image is fairly sharp, and there is a natural fall-off blur on the right (red circled area) that cannot be corrected. We will use the “unsharp mask” to sharpen the image just a bit. The unsharp mask dialog is shown in figure 3.



figure 3.

There are three control sliders in the dialog. Set all sliders back to zero value. The first slider to be adjusted is the RADIUS slider. The values for the radius slider can only be guessed at based on the overall resolution of the document. If you are working with fewer total pixels (say 150 - 800 pixels in width of image) then set it to a value between about 0.3 and 0.5, if more pixels (1000 - 2000) then a value between about 0.8 - 1.2 might be close, if it is a higher resolution image, then values up to about 3.0 - 3.5 are about the top of range. Most people tend to adjust this slider too high and end up over sharpening.

Next adjust the AMOUNT slider while looking at the image in dialog view or after selecting “preview” in the dialog box. This setting will make the sharpness begin to appear in the image. If you can see the sharpness easily while toggling it ON and OFF with the preview button, then you have likely added too much. It should be barely visible when applied. The final slider (THRESHOLD) tones down the sharpness away from edges. (Edges are usually where we want to add a bit of sharpness.) Figure 4 represents an image that has been sharpened to about it’s maximum. Figure 5 has been sharpened *well beyond a desirable result*.



figure 4.

Let’s examine a few of the artifacts showing up in figure 5. The tale-tale signs of over sharpening. In this example they are abundantly clear to make them easy to see. (Enlargements below.)

- (1.) Edge ghosting - halo type effect
- (2.) Small highlights multi-colored edges and widening
- (3.) Edge bleaching in high contrast areas
- (4.) Stair stepping on diagonal lines.

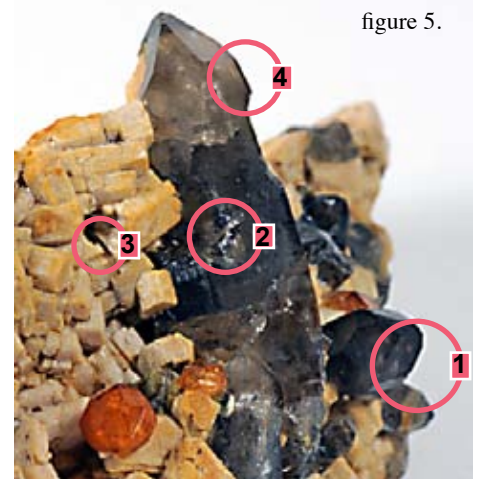


figure 5.

When applied properly sharpening can make a good image pop! When over applied it stands out and makes the image look less photographic and more like a drawing. It also creates many annoying artifacts.

The easiest place to begin to see over sharpening is in small specular highlights like these shown in figure 5, number 2. Small light colored “dots” on a dark background will over-enhance really fast. They provide one of the most sensitive areas to actually see how much sharpening is being added to an image.

Even things like dust on a darker background will unfortunately “pop” if over sharpened. (See images to the right.) Notice the more pronounced dust in the second image.

Next month I will conclude the photo series showing one last editing tool to help cleanup the dust and hide small imperfections in your images.





# Using a Digital Camera to Photograph slabs, cabs, gemstones, minerals and jewelry - Part XX *by ron gibbs*



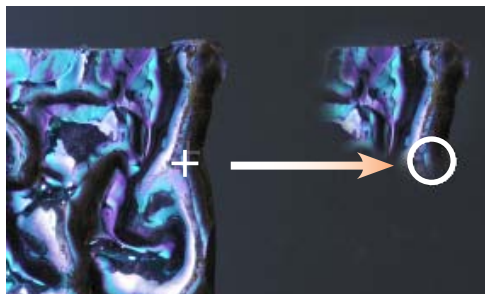
So we've taken a collection of photographs using our table top techniques and we begin to examine them in our editing program. What? We forgot to clean the background before we took the pictures. There is dust and other debris around our object. We need to remove it now in the post production editing.

Photoshop and Photoshop Elements provide a variety of ways to remove these little specks. Perhaps two of the easiest tools to use are the Clone Tool and the Spot Healing Tool (their icons shown at the left.) As the Clone Tool is by far the oldest one in the software, I still tend to use it over the somewhat easier, but more limited Spot Healing Tool.



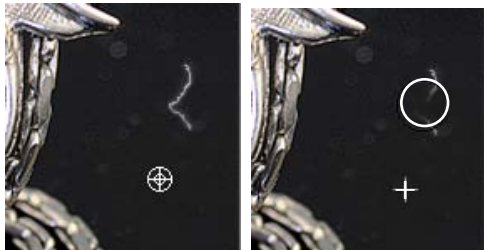
Clone Tool

Spot Healing Tool



Clone Tool at work

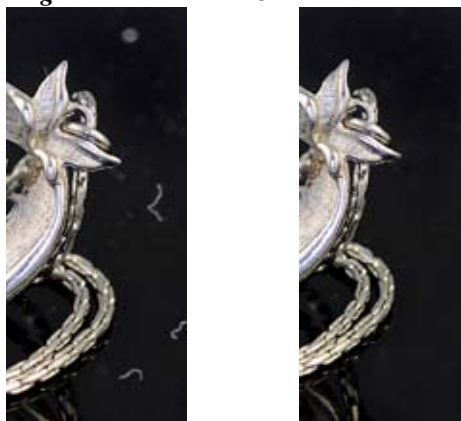
The Clone Tool picks-up information from one spot and paints it over a second spot on the screen. See the illustration to the left where I am duplicating a piece of dichroic glass from one place to another. Thus it can be used to cover the annoying white dust by painting some "background" from nearby and covering the dust. After selecting the Clone Tool, the Option or Alt key is pressed and a target appears on the screen. Click the mouse once to select a target area *from which* information will be copied. Then move the circle pointer over the area to be covered and click and drag over it. The area originally under the target will be copied to the current position of the mouse pointer.



Target

Clone

In the bottom image notice that all of the dust has been covered from nearby clean-background and now the image appears to be dust free. (See bottom left image pair.) There are some other useful adjustments that can be made to the Clone Tool. The size or "area" to be copied can be adjusted and the percentage of covering can be adjusted using the Opacity control. (see control panel at bottom of page)



Before

After

The Opacity can be used to reduce an effect or part of an image without totally replacing it. For example a reflection may be too strong in an image and I want to reduce its effect but not remove it entirely. On the image of the bracelet (top of next page) the object was placed on a mirror and the resultant photo was somewhat distracting because the reflection portion was just as strong as the original item. I used the Clone Tool with an opacity value set to about 25% to cover part of the reflection removing some of its significance in the second picture. (I used the Clone Tool set at 100% on the right side of the second image)



soft or hard edge brush

size of brush

opacity of brush

to show how the reflection could be totally removed.) In both cases I simply selected a clean portion of the background and copied it over the reflection. Another use of this tool is to remove unwanted clutter or props from a photo. The bead in the third image was strung on a wire and then photographed, I use the Clone Tool to remove the wire on one side to illustrate the technique. (The wire could easily be removed from both sides if desired.

The Spot Healing Tool accomplishes many of the same functions but works a bit differently. Once the circle is drawn around the blemish using the spot brush, it samples the background from around that circle and tries to remove the blemish by covering it with the near-by sampled area. This works really well when the blemish is on a continuous area without a break in the background pattern. See the example at the bottom of the page on the left. The dust on the solid black background is nicely replaced in one click.

It fails, however, when the background is less uniform. See the next example where the dust crosses the bracelet. The Healing Tool tries to copy it's best guess of the background over the area, and manages to get the two different tones pretty well, but it fails to understand that the pattern in the reflected bracelet is opposite that of the real bracelet and thus produces a similar, but wrong pattern. See second set of images at the bottom right of the page. The result joins the two patterns and produces a small bulge in the bracelet. Here I would use the Clone Tool with a small brush size and carefully clone out the dust.

The Spot Healing Tool tends to fail when the item needing removal crosses or is near to multiple different background items with contrasting color or more complex pattern. It is a powerful tool, but does fail in some cases.

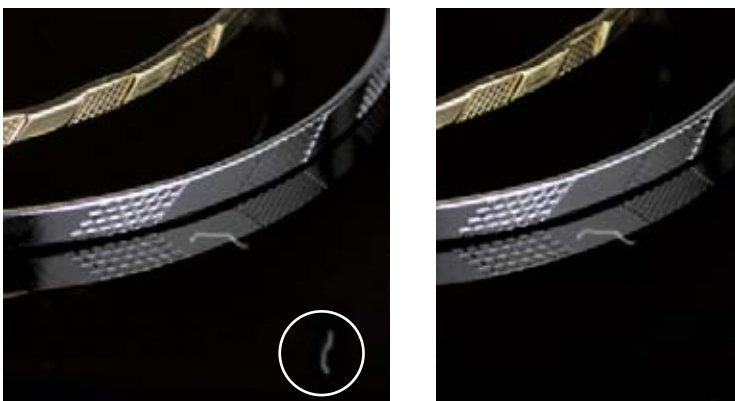
This completes a series of 20 articles on close-up photography for lapidary and jewelry. If you would like to have the complete set in one document you can download it from my WEB site at:  
<http://www.theimage.com/apubimages/20photopaper.pdf>



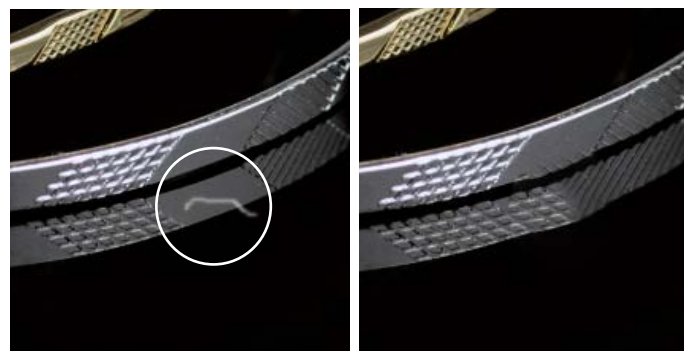
*Shadow reduced on left and removed on the right*



*Used to remove part of hanging wire*



*healing tool circles spot - one click - gone!*



*healing tool circles spot - one click - opps, wrong pattern created where the dust used to be*