

Digital Photography

Large Format Digital Infrared Cave Photography with Betterlight Super 6K



Introduction

Caves for the ancient Maya inhabitants of Guatemala, Belize, Mexico, and Honduras were the entrance to their Underworld. This concept of sacred cave entrances came from the earlier Olmec civilization roughly 1000 BC.

The Olmec developed a special symbol to show the cave entrance and the Maya elaborated on this motif for the next several centuries. Many excellent books have been written about caves in Maya art, iconography and belief systems. Sections of my PhD on Classic Maya iconography of their cosmology included a discussion of these cave entrance symbols.

Although the entrance to the cave was what was most often pictured in Classic Maya art, it is the rivers that pour out of these cave entrances that most interest me, since these rivers are part of the Surface of the Underwaterworld. The Surface of the Underwaterworld is a mixture of cave springs, lakes and rivers, and the ocean. The Maya were aware of both oceans since Guatemala and Mexico have both the Atlantic on one side and the Pacific on the other side.

As a child growing up in the Karst area of the Ozark Mountains of Missouri, I spent many weekends exploring the caves on our family weekend farm. Several of my brothers also developed a long-term interest in cave exploring.

Over the last two years biologist Eduardo Sacayon has been doing field studies of cacao as well as other flora and fauna in the region of Alta Verapaz, Guatemala, especially near Chisec. I have accompanied him on several previous field trips, and we spent one day exploring some of the larger caves in the Mucbilha area. For Spring 2009, I intended to return to this area to do additional photography, and my brother Daniel asked to come along and bring his son, Henry. At the last minute I had to fly to Europe to lecture

in Croatia, Bosnia, and Serbia on wide-format digital imaging, but rather than cancel the entire field trip Daniel, Henry and two photographers from FLAAR Mesoamerica went ahead.

The professional photography of Eduardo Sacayon graces this PDF. The shots of the camera equipment set-up are by Jaime Leonardo, a talent especially in fine art photography (see Photo of the Week archive on www.digital-photography.org). The local people in this area are all hospitable and enjoy guiding visitors. I high recommend this as a place to go to explore a unique culture.

The book of the Popol Vuh speaks of the ancestors of the Hero Twins going down a chasm to enter the cave. Then the Hero Twins have to progress down the same path. Naturally this could be any of thousands of caves in Mesoamerica, or could even be inherited from earlier cave myths of the pre-Maya cultures. But the one collapsed cave of Mulbilha certainly brings out memories of what the Popol Vuh describes.

This particular report is not a report on archaeology since we do no excavation nor collect artifacts. There are plenty of trained archaeologists in Guatemala to accomplish that aspect. This FLAAR Report is on suggestions of what a large format digital camera is capable of doing to record the cultural heritage of Guatemala in the sense of its caves. These photographs are substantial file sizes and can be enlarged to over one meter high by over five meters long. Our long range hope is that future art exhibits (of other scholars) will wish perhaps to utilize these views of the Maya Underworld to document to the general public the natural beauty and cultural heritage of the land of Guatemala.

Nicholas Hellmuth
FLAAR Reports
St Louis, Missouri, April 2009

Candelaria Caves

The Candelaria Caves are one of the largest cave systems in Latin America. They were discovered by a French speleologist some 30 years ago, and are now being managed by local Qeqchi communities. They are located 6 hours drive north from Guatemala city, in the municipality of Chisec, Alta Verapaz. The cave system extends along the karst region where the Peten lowlands begin, most of the vegetation is comprised of Tropical Wet Forest, it is one of the most biodiverse regions in Guatemala and the amount of rainfall can reach up to 2000 mm average per year. Several communities are located near the entrance of some of the caves, and this provides an alternative source of income from eco-tourism activities like rafting and tubing among the Candelaria and San Simon Rivers.

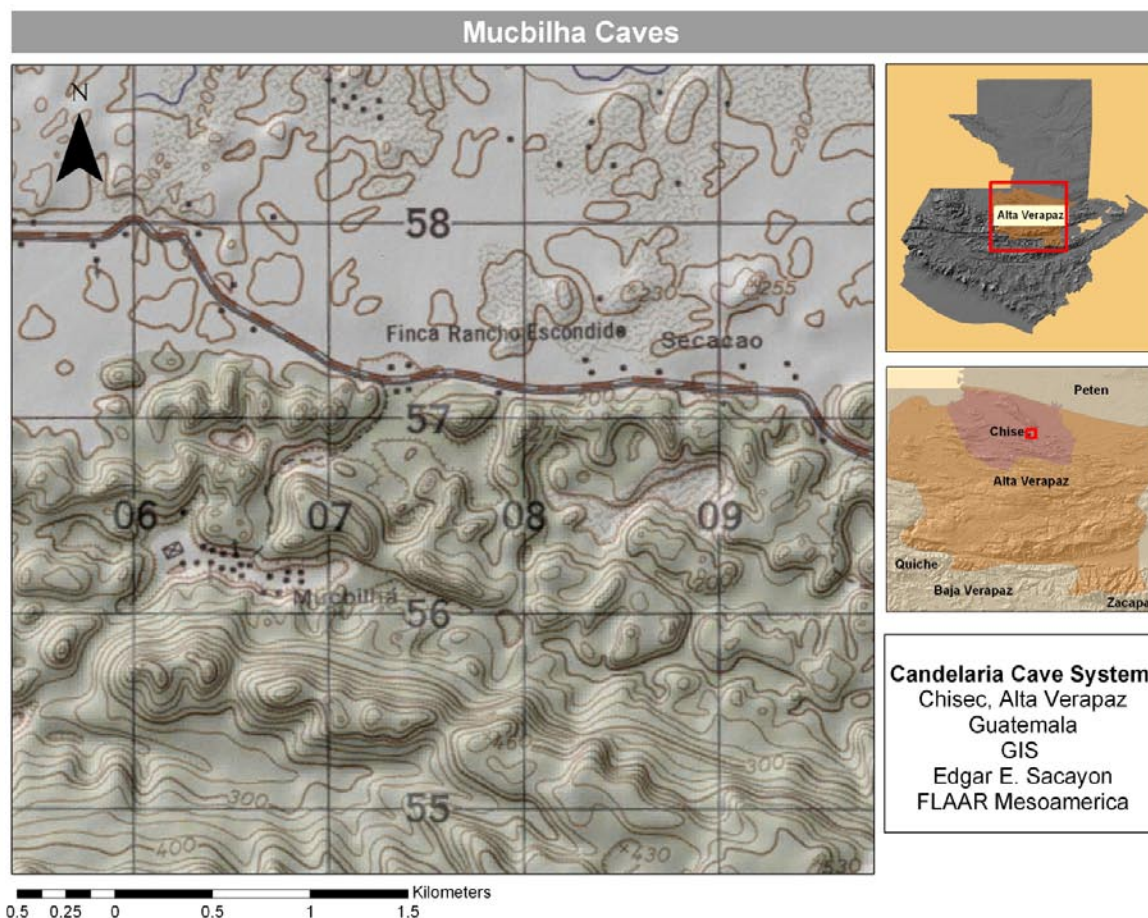
The caves have something special and unique that have drawn me to them these past years, my interest as a biologist is to document as much of the biodiversity of the region. The people living here are very friendly and I have become friends with some of them. The images in this report were taken in Mucbilha and Bombil Pek and always at the entrance of caves where there was light from the sky (MAP)

Getting ready for the trip (Equipment)

Using a large format camera doesn't compare at all with using a 35mm or medium format, it requires a lot of patience and thorough thinking. Before our field trip we spent several days getting

the equipment ready. My first concern was to pack the minimum equipment possible since I knew we were going to be walking in the middle of the jungle several kilometers daily, and to protect it from rain.

So prior to the field trip I spent several days taking photos with different wide angle lenses to see which of them would offer the largest field of view, this would reduce also the amount of accessories for every lens like lens shade and polarizing filters, I didn't want to



be carrying things that I wasn't going to use. Of course I had people helping me carry the stuff, but the lighter the weight the easiest it was to get to our locations.

I read a couple of books from the FLAAR resource library on large format digital photography so I could get some advice and insights once I was on the field, even though I have plenty of experience using the Betterlight for art repro and studio work it was my first time taking the Betterlight on location and I did not want to waste this opportunity to get perfect shots.

I present a detailed list of the equipment we used with some images so you can understand what I will be discussing further on the report.

I also spent some time understanding the Betterlight's focal length and nodal point settings so I didn't have any problems on location, this would allow me to focus only on taking photos rather than fixing problems.

Photographic Equipment

BetterLight (super 6K) system

- BetterLight (super 6K) tri-linear scanning back
- Betterlight USB2 Box
- Betterlight rotating stage
- Digital infrared filter (outdoors/indoors)
- Betterlight Battery
- USB 2.0 Cables
- Stage synchronizing cable
- Scan Back cable



Photo by Jaime Leonardo

BetterLight manuals

Cambo Large Format Camera (4x5)

Schneider Kreuznach Super Angulon XL 5.6/58
 Polarizing B+H Filter Ø=58mm
 67mm Lens shade
 58-67mm Adapter rings
 View Finder
 Loupe

Panasonic Toughbook computer

2 Batteries
 Power supply & electric adapters
 Sun Shade
 Mouse
 Adobe Photoshop CS4

Gitzo tripods

Bogen 3263 tripod head
 Gitzo G1548 GT Tripod
 Gitzo 1127 Mk2 Tripod
 Tripod adapter plates
 Gitzo laptop tray

Accessories

Bubble levels
 Black gaffer tape
 Rubber bands
 Macbeth ColorChecker
 Tools to tighten camera bolts
 Lens cleaning cloth; lens cleaning liquid
 Allen wrench for tightening camera to arm
 Velcro



Photo by Edgar E. Sacayon

Lens cleaning bulb
 Electric Extension Cords & adapters
 Calumet Large Format Case

Venado Seco (Dry Deer) Cave

Working inside the cave presented several challenges, light conditions were very poor and focusing was very hard even with the lens f-stop set at its highest aperture; the light was so dim I could not see through the ground glass. I used a loupe to get the image in focus but since I had to use a small f-stop (wide aperture) the depth of field was very low, so it was difficult to focus a complete scene in one panorama. I couldn't use a lens shade because it created a large amount of vignetting, reducing the field of view.

In general I found taking photographs inside the caves was better with completely clouded or totally clear skies, because it provided



Photo by Jaime Leonardo

a continuous source of light; taking one good shot can take several days in the same location due to weather conditions.

For almost every color panorama inside or at the entrance of the caves I had to use ISO settings above 1000 and line time of 1/20s or below. You can check at the technical details of every image to see the settings, for every color panorama an automatic color balance was made using a Gretag Macbeth Color chart.

The rear or front standard was adjusted to allow a better field of view or to reframe the panorama. The Cambo Ultima allows tilts and shifts but since we were using a rotating stage they are not very useful unless using the camera in scene mode. After a good color panorama was obtained I removed the infrared filter and started to adjust the camera for the infrared shot. Going infrared was like having night vision. I could see every detail of the cave that the prior color shot was not able to obtain. Without the filter the camera becomes so sensitive I had to lower the ISO and raise



Photo by Jaime Leonardo

line time settings. It also made easier and more reliable to do a digital focus.

One of the advantages of using the Betterlight system is its resolution, I asked Cesar one of our assistants to stand in the middle of the Venado Seco cave so people could understand the size of the cave and the fine detail the system is able to provide.

Post-Processing Infrared

Photo by Jaime Leonardo





Technical Details: Cueva_Venado_Seco_05, Tue Mar 17, 2009, 2:24:15 PM, 8C, 6000x10122, (58.0/120.0), 100%, bent 6 stops, 1/15 s, R102.7, G77.1, B73.4. ISO: 1000



Cueva_Venado_Seco_07, Tue Mar 17, 2009, 2:45:35 PM, 8C, 6000x10122, (58.0/120.0), 100%, bent 6 stops, 1/15 s, R48.7, G23.1, B19.4, Without IR filter



Processed infrared image using the channel mixer method in Adobe Photoshop CS3



Photo by Edgar E. Sacayon



Photo by Edgar E. Sacayon

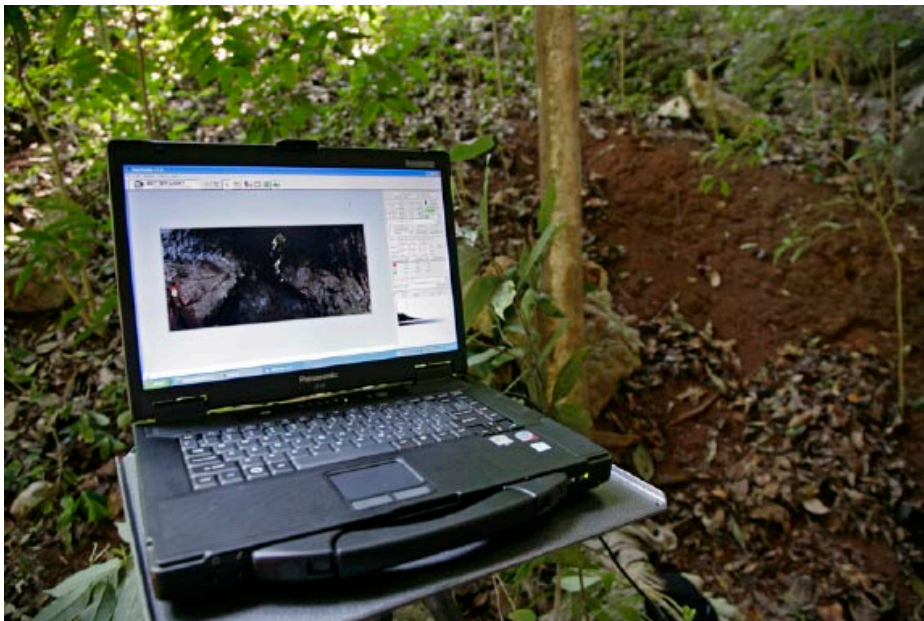


Photo by Edgar E. Sacayon

Images

I used the channel mixer post-processing method discussed in the other FLAAR Report on infrared photography. The channel mixer method requires you swap the red for the blue channel, but for these images I only swapped the red channel, and then desaturated the image completely. I did not use the lab channel method because you tend to lose the layer information and it is not possible to create adjustment layers. But keeping color information by desaturating the images allows a wider tonal range to enhance with basic adjustment layers.



Cueva_Venado_Seco_14, Wed Mar 18, 2009, 10:35:33 AM, 8C, 6000x12652, (58.0/150.0), 100%, bent 6 stops, 1/10 s, R81.3, G55.9, B53.1 ISO: 600

The red arrow point to one of our asisstants, Cesar.



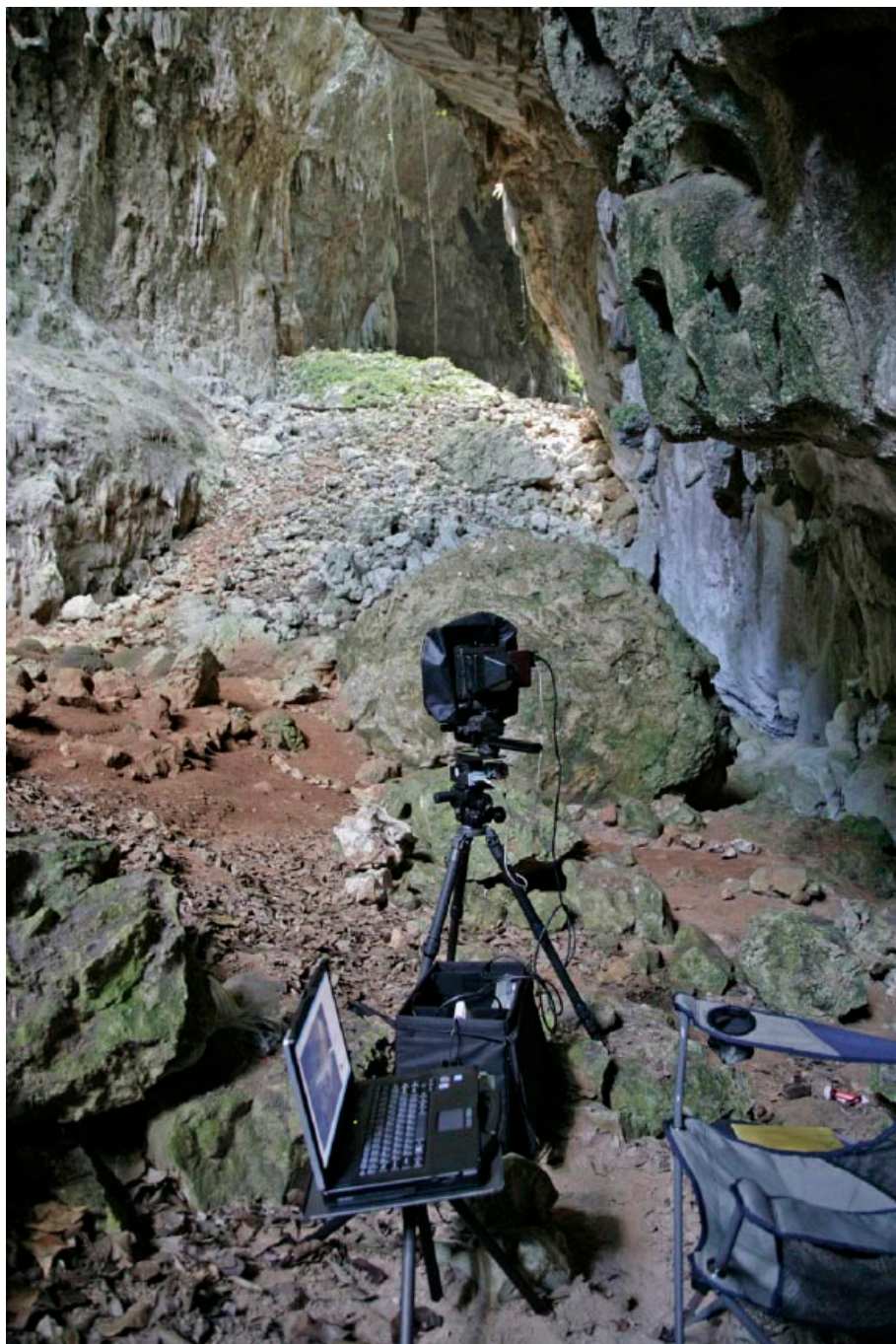
Cropped image from the previous file to show quality and resolution of trilinear scanning back showing Cesar position in the middle of the cave.



Cueva_Venado_Seco_12, Tue Mar 17, 2009, 4:19:39 PM, 8C, 4500x11388, (58.0/180.0), 75%, bent 6 stops, 1/15 s, R102.7, G77.1, B73.4 ISO: 1000, IR Filter removed

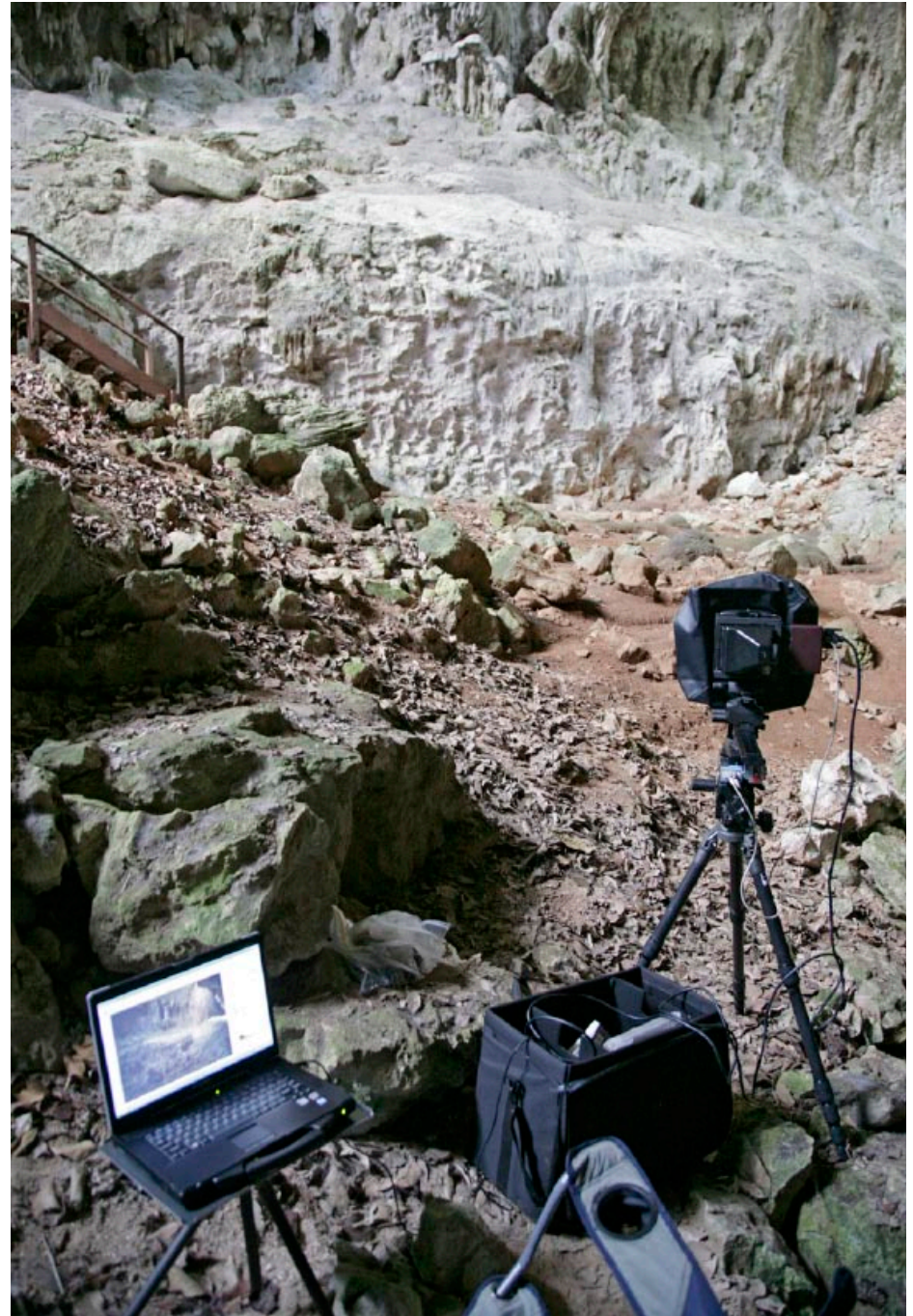


Processed infrared image using channel mixer method and adjustment layers in Adobe Photoshop CS3



Photos by Edgar E. Sacayon





Photos by Edgar E. Sacayon





Cueva_Venado_Seco_32, Thu Mar 19, 2009, 11:29:26 AM, 8C, 2250x3162, (58.0/100.0), 37%, bent 6 stops, 1/10 s, R129.7, G104.1, B100.4 ISO: 2000



Cueva_Venado_Seco_27, Wed Mar 18, 2009, 1:32:06 PM, 8C, 3750x5270, (58.0/100.0), 62%, bent
6 stops, 1/20 s, R57.7, G32.1, B28.4
ISO: 400



Processed infrared image using the channel mixer method and adjustment layers.



Photo by Jaime Leonardo

Bombil Pek Cave

Bombil Pek means literally painted stone in Qeqchi, referring to a prehistoric painting found inside the caves. The entrance to the cave is quite big but the light was also very poor even for a sunny day. I made a couple of tests shots to review general settings, but the light was so bad I decided I would only shoot infrared panoramas. The first panorama was done at the middle of the cave, it is a little difficult to imagine the shape of the cave by looking at the panorama. The “stone unicorn-dragon” as I called it, on the left side is actually in front of the big stones at the right side of the panos. The difference between infrared and normal color image here is notorious, the infrared image has more detail in the shadow areas than the color image.



Photo by Jaime Leonardo



Bombil_Pek_01, Fri Mar 20, 2009, 2:05:51 PM, 8C, 6000x10122, (58.0/120.0), 100%, bent 6 stops, 1/10 s, R114.7, G89.1, B85.4 ISO: 1400

The light was so poor it was impossible to get any details in the darkest areas.



Bombil_Pek_03, Fri Mar 20, 2009, 11:37:03 AM, 8C, 6000x10122, (58.0/120.0), 100%, low contrast 8, 1/15 s, R87.7, G62.1, B58.4 ISO: 800, IR filter removed.

Notice the details in the shadow areas of the previous color image.



Processed infrared image using the channel mixer method and adjustment layers in Adobe Photoshop CS3



Bombil_Pek_05, Fri Mar 20, 2009, 12:05:53 PM, 8C, 6000x20244, (58.0/240.0), 100%, bent 6 stops, 1/15 s, R102.7, G77.1, B73.4 ISO: 1000



Processed infrared image using the channel mixer method and adjustment layers in Adobe Photoshop CS3



Bombil_Pek_08, Fri Mar 20, 2009, 1:01:47 PM, 8C, 6000x15184, (58.0/180.0), 100%, bent 6 stops, 1/20 s, R60.7, G35.1, B31.4 ISO: 400



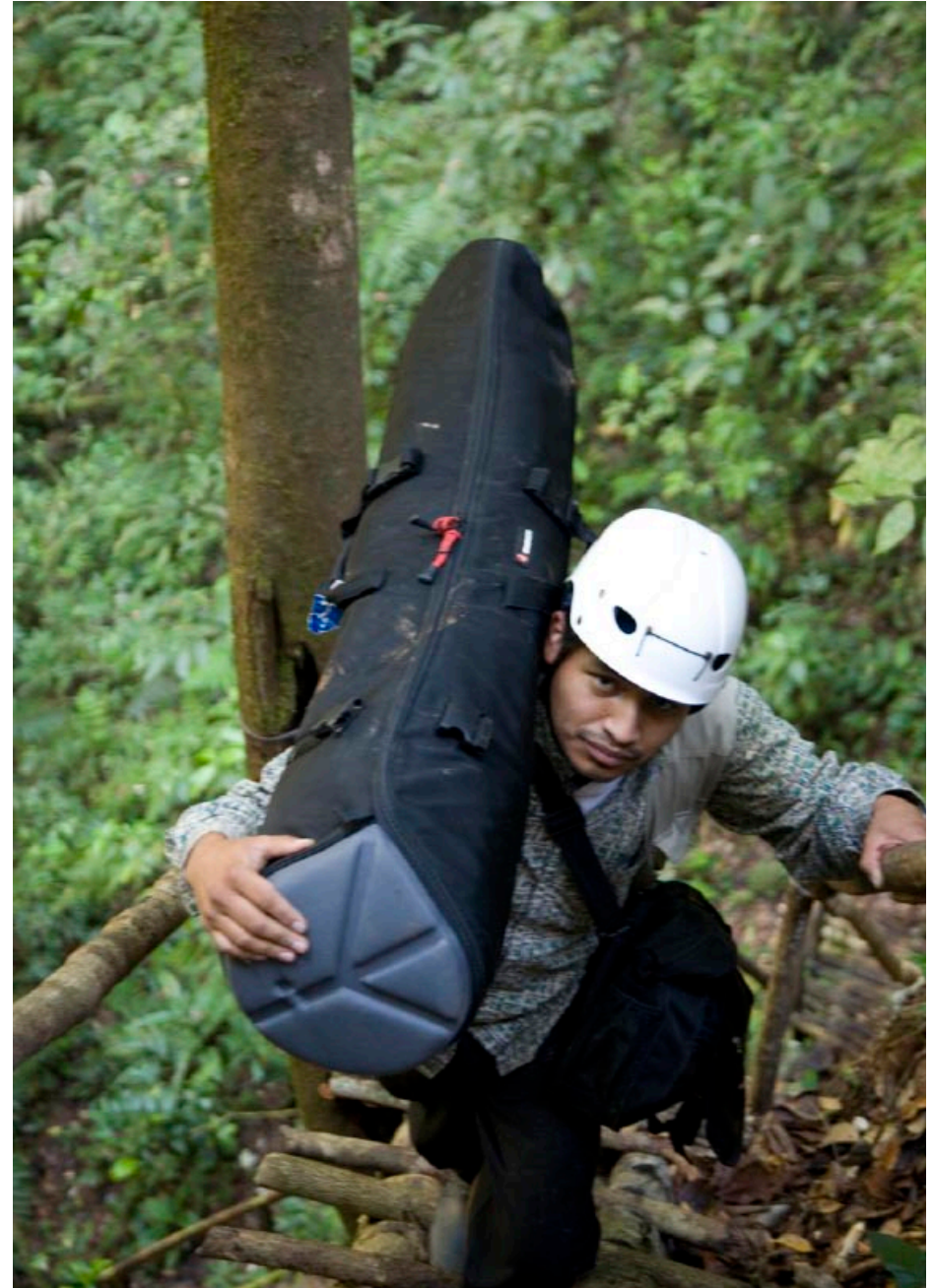
Bombil_Pek_10, Fri Mar 20, 2009, 1:31:30 PM, 8C, 6000x15184, (58.0/180.0), 100%, bent 6 stops, 1/20 s, R81.7, G56.1, B52.4 ISO: 600
Banding is caused by changes in light during the scan time.



Manual HDR image made from three different exposures in Adobe Photoshop using adjustment layers.



Carrying the equipment through the jungle we had the help from Cesar and local people. Photos by Edgar E. Sacayon



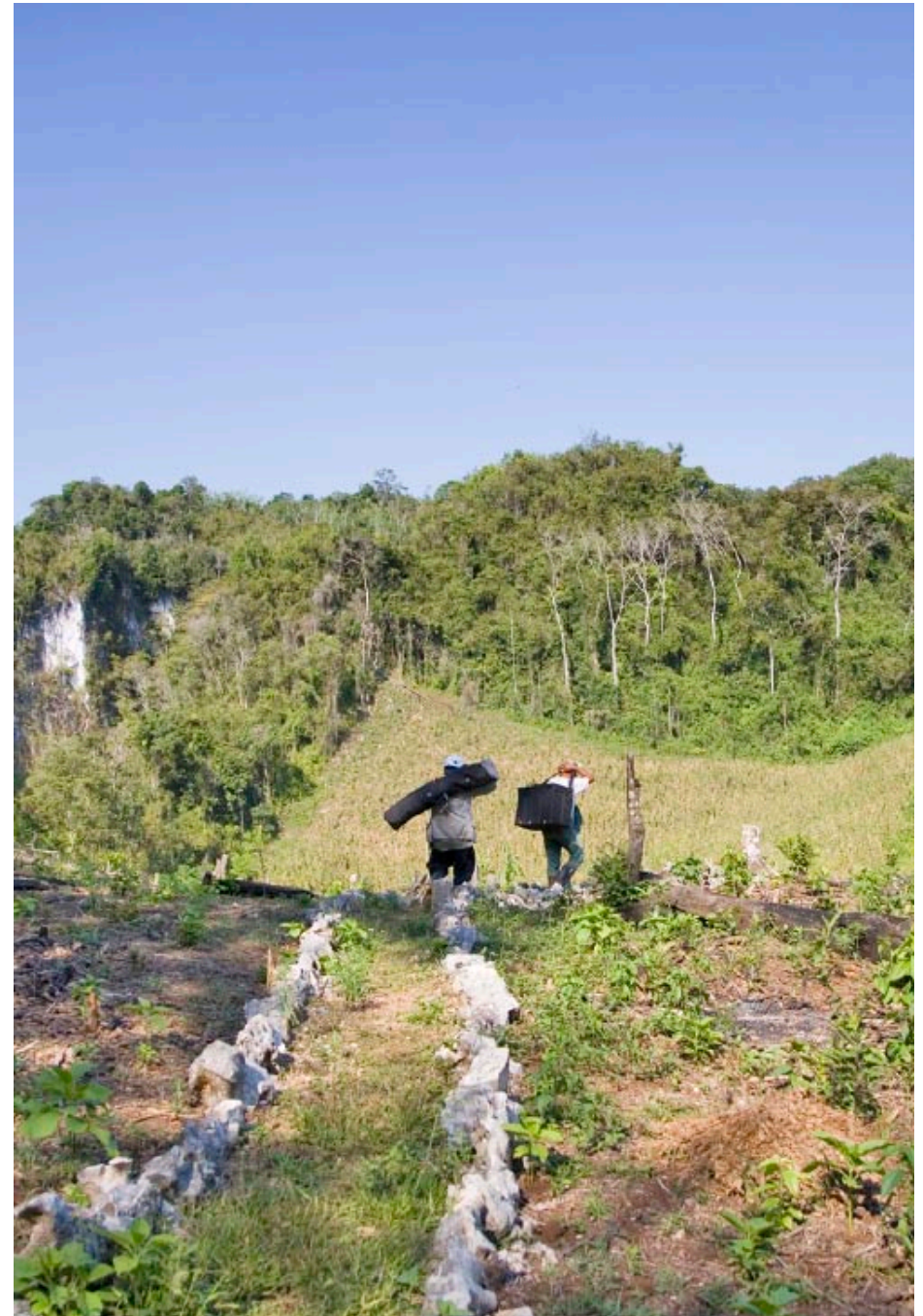
Infrared HDR

The “stone unicorn-dragon” image was made using three different exposures. I duplicated the lab channel of each exposure and combined it in a new file using Photoshop adjustment layers. I didn't use Photoshop or Photomatix plug-in because it doesn't allow to make local adjustments, so instead I did what you can say a manual HDR.

The Betterlight battery lasted exactly 4 hours, we spent most of the mornings taking panoramas and during the afternoons we would work with 35mm Canon EOS 5D. I had two new batteries for a Toughbook computer, to run the Betterlight Viewfinder software. We had no problem whatsoever with the computer, it performed really well and each battery lasted 5 hours approximately. I had a Gitzo laptop tray with a small Gitzo tripod that were very useful, either in a standing or sitting down position.

In each location we had the help of local people to carry the large format equipment on a Calumet carrying case, but this is not the most appropriate. I tried to fit the camera in to a Tenba backpack but it wasn't big enough. We hope in the future we can obtain better carrying equipment that would facilitate going in to the field.

Carrying cases for the tripods were also very useful, especially for the big heavy duty Bogen tripods and tripod heads. This tripod is sturdy enough to hold the cambo large format camera and rotating stage and are quite easy to adjust.



Photos by Edgar E. Sacayon

Acknowledgments

We would like to thank Mike Collette for providing technical support for our ongoing research of the BetterLight system that he kindly provided for review and evaluation.

If you would like to get more information on the BetterLight system please feel free to contact them at: info@betterlight.com

Also we would like to thank Rocky Nook publishers for their collection of books on digital photography, this have been very insightful and have allowed us to developed new photographic techniques. There is a separate FLAAR evaluation of this book, which you can find on our web page, www.digital-photography.org

We would also like to thank Daniel and Henry Hellmuth for their positive energy through the whole trip even though they got stomach sick the last two days.

We appreciate the help provided by Ricardo Choc, from the Mucbilha community for letting us use his electricity to recharge camera and laptop batteries.

