

How to Photograph Cultural Properties: Procedures from Raw Image Photography to Image Processing

There are two methods in digital photography, one in which a commonly used image format (JPEG/TIFF) is automatically processed within the camera, and the other in which the output is in raw image format (Fig. 1).

An image processed within the camera, either automatically or according to manual settings, does not always provide the accuracy needed for cultural properties research.

Using image processing software with suitable settings, however, it is possible to produce sufficiently accurate images of various targets that are photographed, based on the raw image output. The same procedure is followed for archaeological sites and artefacts, so this text describes only photography of sites as the example.

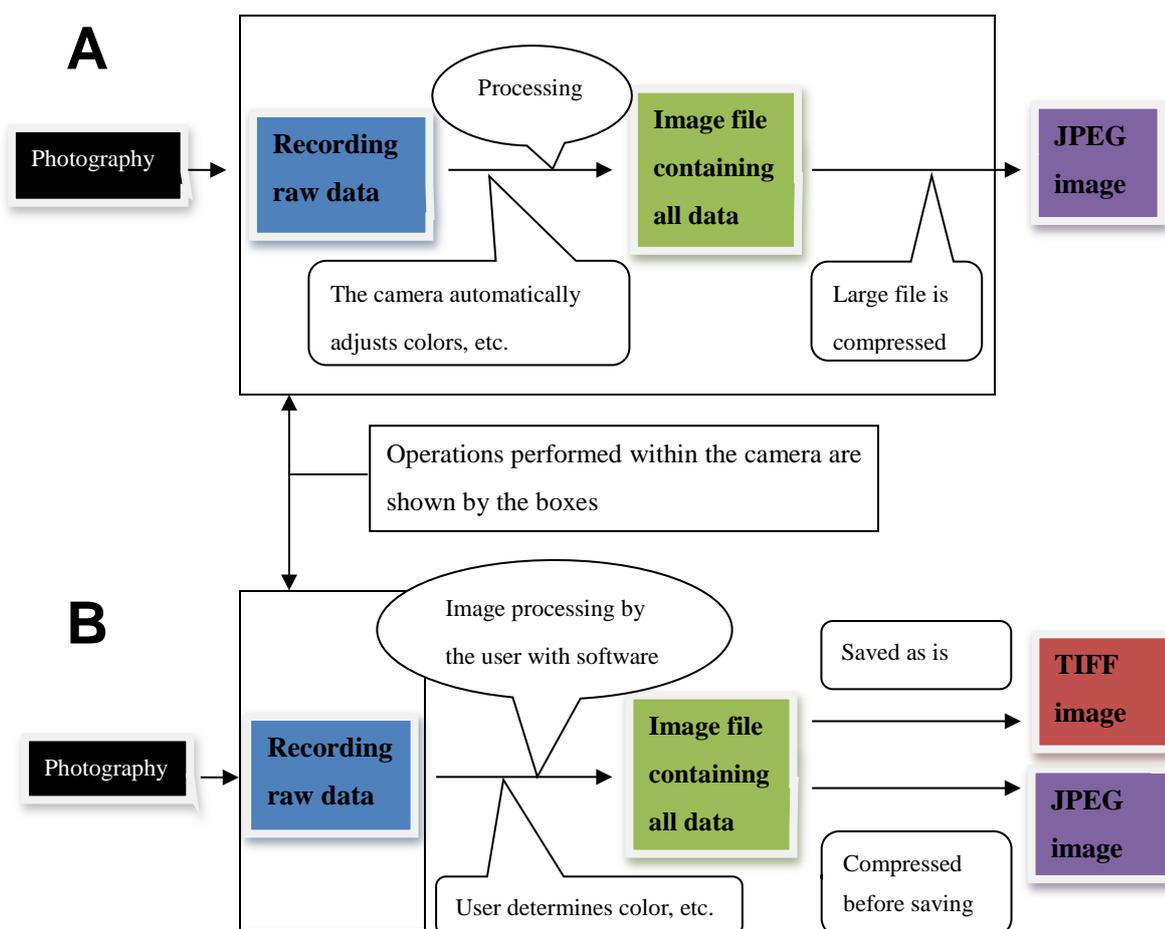


Fig. 1 (A) Typical use of a digital camera for snapshots, etc. The image is automatically processed within the camera and the resulting image may be insufficient for research. **(B)** The raw image file from the camera can be subsequently processed by the user as needed to different specifications for accuracy and file size.

Photography with a grey card

Various grey cards are available on the market. Some are made of plastic and some expensive ones can even produce camera profiles (Photo 1). In the case of excavation research, less costly paper cards are easily replaced when they get dirty.

Practically, a grey card is used in three shots per scene. After setting the camera focus and exposure, place the card before the camera and take one shot as seen Photo 2. In this shot, it does not matter that the image is out of focus. Then, take two shots with the same focus and exposure as back-ups against data errors (Photo 3).

Be careful to hold the grey card at the proper angle. If the subject is the earth, the card must be tilted as close to the same angle as the earth as possible (Photo 4). Tilting it toward the lens as shown in Photo 5 will result in color reproduction for a different angle of reflection than the object being photographed, so it will be difficult to get the correct color balance (Photo 6).

Comparing an image as taken by the camera without subsequent correction (Photo 7) and one corrected for color temperature and balance using a grey card (Photo 8), the uncorrected image is seen to reproduce a bluish tinge caused by reflection of the blue sky.



Photo 1



Photo 2

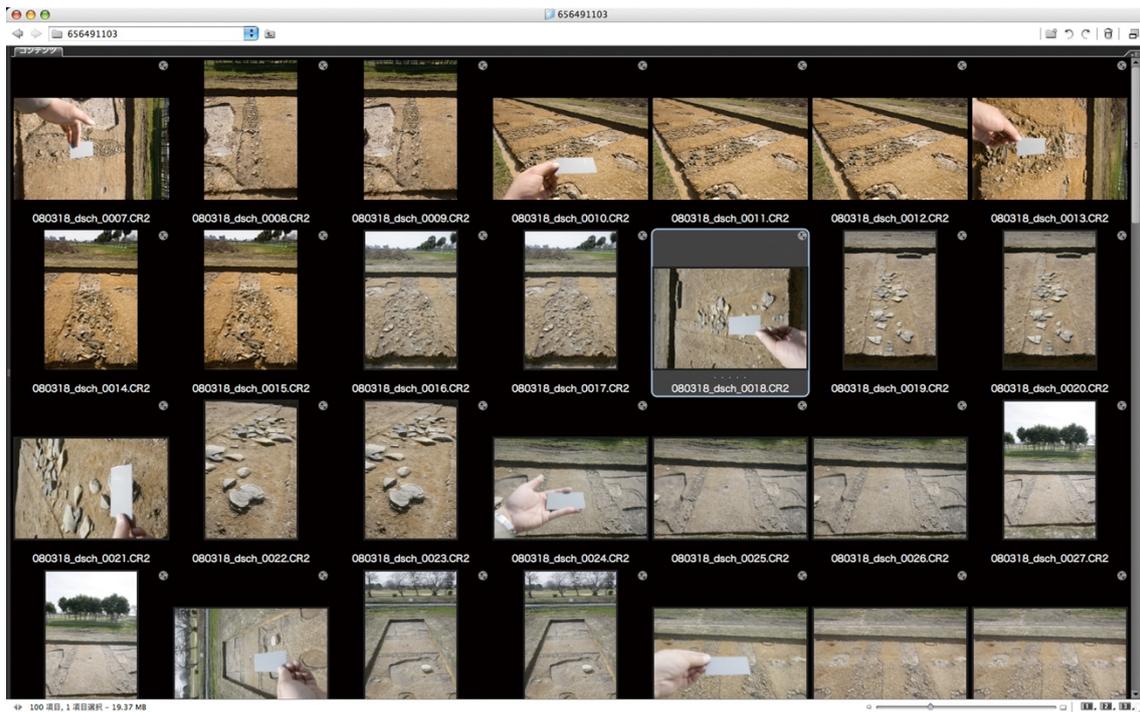


Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8

Workflow after shooting

Care should be taken when returning from the site to avoid damage to the memory card in which image data are recorded. As memory cards are easily damaged by static electricity, they should not be handed to another person, etc., especially in winter. For greater data security, a backup can be made on site with a portable hard disk. Introducing such devices for important photo work should be seriously considered.

Memory cards are normally used to transfer data to a computer. After storing the data in a computer, always format the card in the camera in which it is used. It is important to establish and follow this procedure to avoid accidental erasure of data.

Raw image files in a computer are checked and processed by image processing software. There are numerous processing software programs: software provided by the camera manufactures, commercial software, and open-source free software. They basically perform the same functions: (1) **lens correction**, which corrects lens distortion and chromatic aberration (color blur/bleeding along edges of the photo) caused by lens characteristics, (2) **profile correction**, which adjusts color reproduction characteristics of each camera, (3) **white (grey) balance correction**, which adjusts color balance based on an image of a grey card, and (4) **gradation compensation**, which adjusts brightness and contrast. Nearly all programs also enable additional processing such as trimming (clipping out the needed portion of an image), and size adjustment (setting the required size and resolution for processing).

Settings for image processing

Among the above-mentioned corrections, lens correction, white balance correction, and gradation compensation are essential.

The term used to indicate lens correction differs according to the processing software. By using a “lens profile correction” tool, lens distortion is corrected based on a profile of data on the characteristics of the lens used. As shown in Photos 9 and 10, it corrects the distortion and decrease in brightness around the edges of the image (vignetting). While image manipulation is not permissible for photographs of cultural properties, a correction such as this can be understood as a component of lens performance, based on an analysis of the characteristics of the particular lens being used.

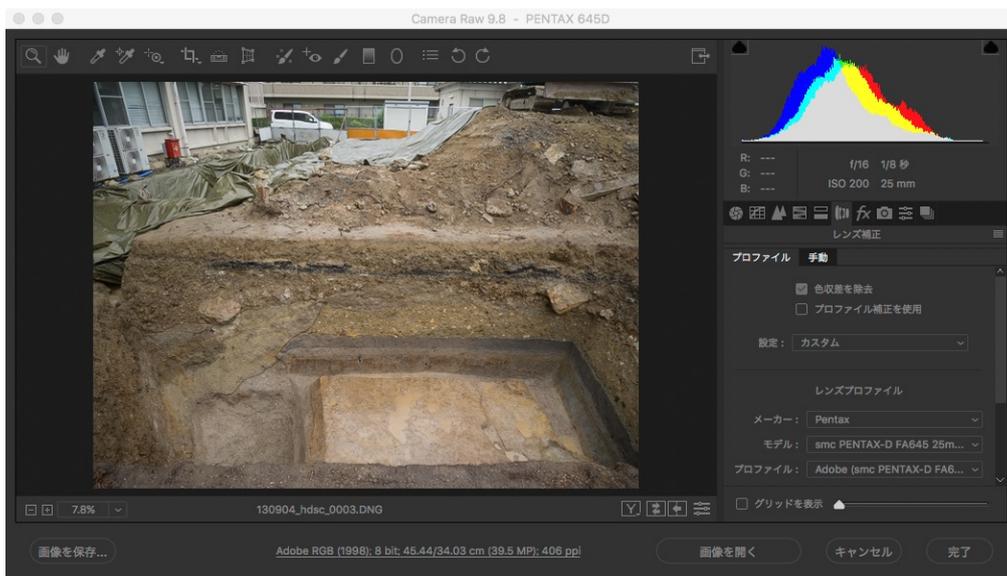


Photo 9. Before lens profile correction

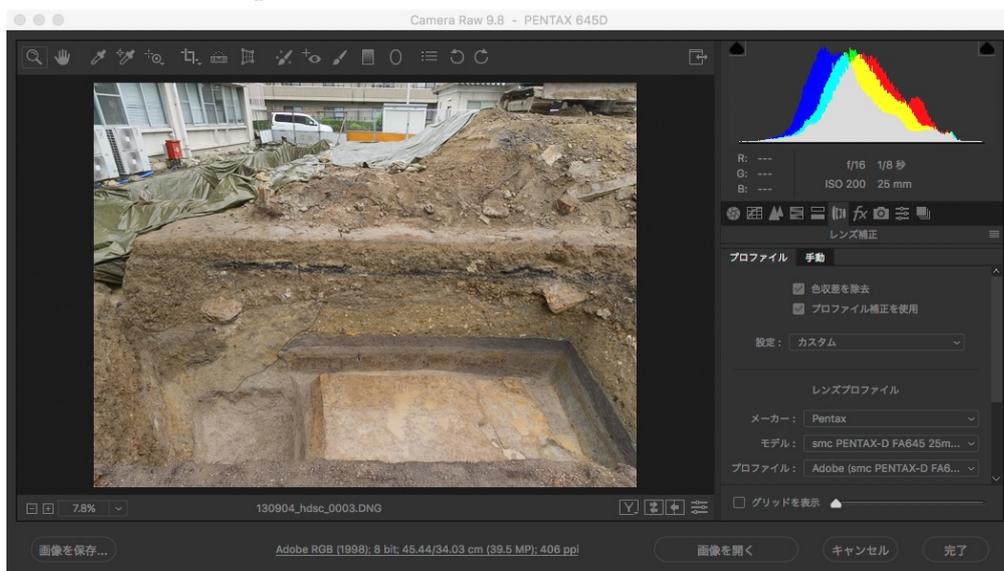


Photo 10. After lens profile correction

Next, perform a white balance correction. This uses the grey card within the image to set the white balance in the computer according to the light conditions at the time of shooting.

A digital image reproduces colors using the three primary light colors of red, green, and blue, and when the white balance is properly set, the brightness value of each component in the grey card image should be the same. When photographed in auto white balance mode, in many cases, each color does not have the same value, as shown in Photo 11. This is due to a limitation of the auto white algorithm, meaning that it is difficult to obtain correct color reproduction using the automatic setting.

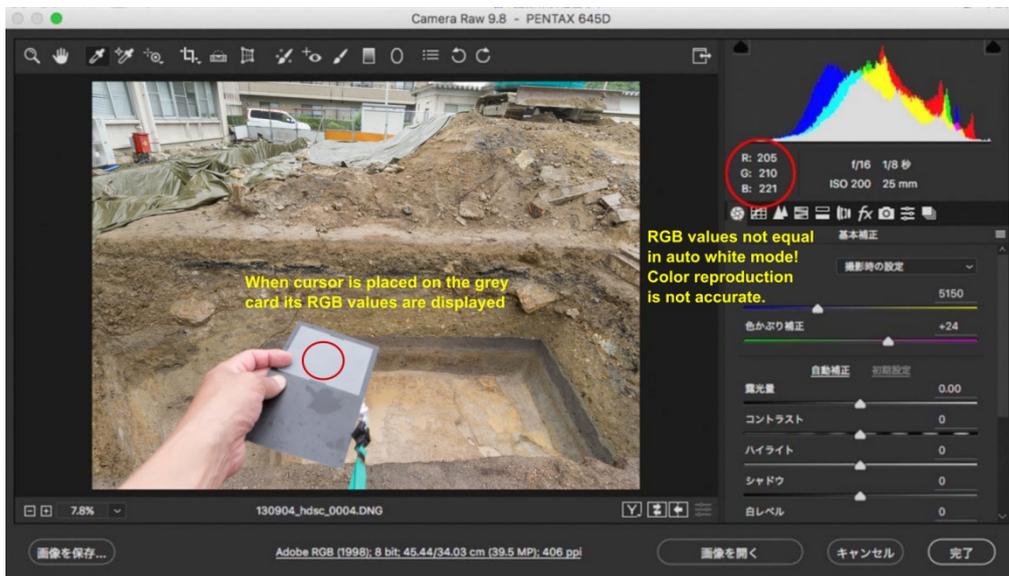


Photo 11. Reproduction in accordance with the auto white balance mode

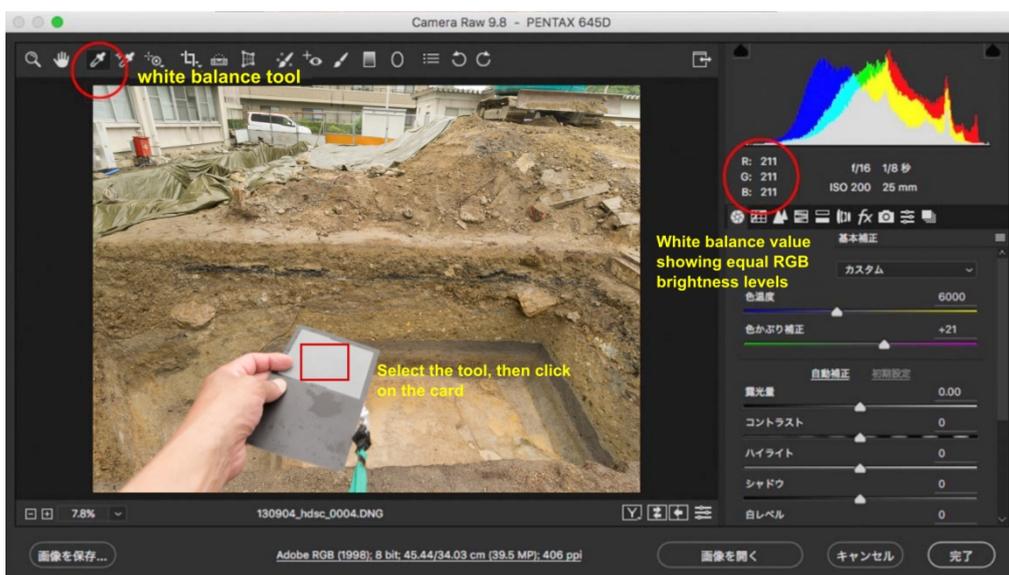


Photo 12. Adjusting RGB values to the same level with the white balance tool

Clicking on the grey card image with the white balance tool (the term differs depending on the software) adjusts the RGB brightness values to the same level, thus enabling the white balance to be properly set for the image as a whole by using the grey card.

Gradation compensation has the greatest effect on the quality of a photograph. The definition of “good photographic tone” is the same for film and digital photographs: a photo having both bright (highlight) and dark (shadow) regions, and a rich gradation in between, can be said to have good tone. In film photography, long periods of training and experience were needed to master photographic tone. In digital photography, however, good tone can be achieved by understanding the histogram. It is necessary to adjust the tone appropriately, as explained in the text “Understanding a Histogram.”

Performing image processing

Using image processing software with the adjustments described above, the image is then “saved” or “output” by the program, and thereby processed in a format such as JPG or TIFF as shown in Fig. 1B at the start of this text. It is important to process the image files according to the purpose for which they will be used, and to manage them properly as described below.

○Data for archives

Data for archives are for long-term preservation and utilization, and need to be suitable for various possible applications in the future. At present, the bitmap format is thought to be most suitable for permanent use. The TIFF (Tagged Image File Format) format embeds color management information such as a color profile, a color space, and Exif information (metadata) with the bitmap image. JPG or JPEG (Joint Photographic Experts Group) files are a highly compressed type of bitmap image. The specifications of both formats are openly released, and both should remain parsable (readable) even if the format becomes obsolete in future. It is important that image files for archival purposes be preserved according to an openly released and thus parsable format.

○Data for print publication

For printing, first set the resolution and image size to the printer’s standard of precision (the resolution to be printed or displayed on a monitor), then select a color mode (RGB, CMYK) which the printer can handle, and provide the image with the proper sharpness. For each of these, close communication with the printing company is needed in producing an image. As the method of setting the resolution etc. will be found in the software manual and has been touched on above, the details will be skipped here.

○Data for the Internet

Nowadays, posting data on the Web is the most popular means of making information publicly accessible. Images on websites basically depend on the display resolution, which is about 96 dpi (dots per inch). Recently, as displays have grown in size, the maximum number of dots (pixels) is also tending to increase. The most common displays are about 2,000 pixels in their long dimension, and higher density items of 4,000 pixels are already on the market. When producing images for Internet display, consideration should be given to the manner in which contents will be posted on a website.

○Data for printout

Large-scale printers have recently become more widespread, making it possible to print out data in a variety of ways by oneself. When printing, the distance from which the item is to be appreciated should be taken into consideration, as higher resolution will be needed for small-scale printing, whereas low resolution images are often sufficient for large printouts. Items up to A4 size that will be held in the viewer's hand require at least 400 dpi. For large-scale prints of A3 or more, as the viewing distance increases with size, 300 dpi may suffice and for poster-sized items this may fall to 150–200 dpi.

Conclusion

Concrete steps from shooting to image processing have been described in this paper. Photography for archaeological sites was taken as the example, but the procedure is the same for artefacts. The image processing software illustrated here is Adobe's CameraRAW, which currently supports the widest range of raw image formats and is continually being developed.

It is often said that the raw image format is not suitable for archives because it may not be parsable (readable) should the software become obsolete. But it is also conceivable that processing which was not possible at the time of filming will become possible with further software development. If there is sufficient leeway in terms of storage space, it is worth considering keeping image data in raw format as well.