Module 2: Imaging Objects

Module 2C: Imaging Three Dimensionally Preserved Specimens

Task ID	Task Name	Explanations and Comments	Resources
T1	Select and retrieve specimens/drawers from storage location.	Some institutions record images of labels and specimens simultaneously, combining relevant tasks from Module 2B and Module 2C.	● Institutional specimen imaging policy or project guidelines. ● Technician.
T2	Transport selected collection objects to appropriate staging area.	Ideally, staging areas should be located adjacent to or in close proximity of its related imaging station. For institutions that maintain two or more permanently configured imaging stations (e.g. microscope vs. camera), this step requires determining the staging area to which the specimens should be transported. This is especially true when imaging stations do not share a single staging area. For institutions with a single imaging station or staging area, the imaging station should be pre-configured for	● Cart. ● Technician.

		the selected specimens before or immediately following specimen transport. It is therefore often most efficient to image specimens of approximately uniform size and shape together, to avoid constant re-adjustment of the imaging station.	
T3	Find specimens in drawer.	In some workflow implementations, T3 precedes T2. Institutional strategies vary. In some instances, specimens are ordered by size to optimize imaging efficiency by reducing or eliminating frequent lens changes and copy stand and lighting adjustments. In other instances, specimens are selected by taxonomic group. Specimens might also be selected/organized by whether or not image stacking will be required.	Institutionally or project-specific (e.g., grant, research request, etc.) guidelines governing specimen selection criteria.

		Decisions to be made include: ● whether to image multiple or single specimens from a single lot or slab, ● determining the best quality specimen for exemplar images, ● determining the size(s) of specimens to image from a single lot (e.g., smallest, largest, average, representatives of several size classes, etc.), ● whether to include several specimens from varying lots in a single composite image, ● whether stacking will be utilized.	
T4	Set up camera/imaging station (may need to be set up each time and disassembled for security reasons etc.).	Attach appropriate lens. The imaging station can then be configured for whatever size/type of fossils you have chosen in T3, and whether you are	

		utilizing stacking, in preparation for iterating through T5-T13.	
T5	Clean specimen (if needed).	Might Include: ● cleaning dust/hairs off of specimens, ● removing old blackening if possible or needed. Typically T5, T6, and T7 occur prior to mounting (T8), but may occur after mounting, depending on the specimen.	Methods of cleaning: ● compressed air. Caution: this method is specimen dependent and should be used only for sturdy specimens. Compressed air can destroy or seriously damage fragile specimens. ● air puffer with soft brush. ● soft bristle paint brush. ● toothbrush. Electric, ultrasonic, or manual toothbrushes can be used, depending on the lithology and fragility of the specimen. ● water. Caution: water may be used for certain prep types and not suitable for many types of specimens.
T6	Blacken specimen (optional).	When employed, blackening occurs prior to mounting, depending on the	Blackening media: ● Pro Black (reversible), ● Photographic

		characteristics of the specimen. This is an optional step that might be done to increase contrast and help to bring out fine details on some specimens. Caution: Some blackening agents are not reversible or separate chemically to produce objectionable colors.	opaque (reversible), ● India Ink (Not reversible).
T7	Whiten specimen (optional).	When employed, whitening occurs after blackening (if used; whitening is often applied without blackening, especially with naturally dark-colored specimens) using ammonium chloride.	Note: Using magnesium oxide is not recommended and is not reversible. See: http://idigbio.com/sites/default/files/working-groups/DROID4/Hegna_2010.pdf
T8	Mount specimen (optional).	Mounting is sometimes employed to orient specimen.	Mounting media: ● black sand (may adhere to part of the specimen and be difficult to remove), ● sandbags, ● twist ties (can fold into small props), ● blue poster removable adhesive,

			• gum tragacanth, • black toothpicks, • bamboo skewers, • insect pins with black cork, • black velvet (for creating a uniform background), • water-soluble school glue. Caution: Some materials (see above) may leave residue on specimens. Some sands might need sifting to isolate coarse grains for use; coarse sand reduces the possibility of static electricity adhesion and the grains are more easily removed.
T9	Maintain the association between specimen and labels.	This step is a cautionary reminder to ensure that specimens do not become separated from their labels, and that labels from one specimen are not inadvertently intermingled with those of another.	
T10	Position specimen and insert fade-resistant	Strategies vary. Some institutions	Institutional policy, guidelines, or adopted

	color checker, white/black points, scale into imaging frame, as needed. Calibrate to digital grey card, as needed (this task may occur and/or be checked periodically for accuracy).	limit image composition to specimen only, others include some or all associated labels within the image. The parameters listed here apply to both strategies. T10-T16 constitute an iterative process, often including sub-iterative processes for accommodating the capture of multiple standard views (e.g., anterior, posterior, lateral, dorsal, etc.) or multiple images of a single view in preparation for a subsequent focus stacking workflow. For example, a complete tray or several trays of specimens might be imaged prior to commencing with T18. Views to be imaged vary by organism and fossil type and should be reflected in institutional policies or documentation.	references detailing standard views to be imaged. References might include: *Atlas of Invertebrate Macrofossils.* 1985. Murray, J. W. Palaeontological Association. see : http://www.worldcat.org/title/atlas-of-invertebrate-macrofossils/oclc/10696137&referer=brief_results *Treatise on Invertebrate Paleontology.* 1953-2007. see: http://paleo.ku.edu/**treatise/** References to specific color checkers include: http://store.rmimaging.com/digitalgraycard-100.aspx http://www.munsellstore.com/default.aspx/MenuItemID/499/MenuGroup/Home.htm http://www.amazon.com/CameraTrax-24ColorCard-2x3-White-Balance-Guidebook/dp/B004Q

		It may also be necessary to place labels/tags into the imaging frame for identification and numbering purposes.	XU8VI/ref=sr_1_3?ie=UTF8&qid=1342555441&sr=8-3&keywords=macbeth+color+checker http://www.bhphotovideo.com/c/product/286652-REG/QP_Card_GQP201.html http://www.bhphotovideo.com/c/product/26662-REG/Kodak_1527654_Color_Separation_Guide_and.html http://www.imagescienceassociates.com/mm5/merchant.mvc?Screen=PROD&Store_Code=ISA001&Product_Code=CGNT&Category_Code=TARGETS
T11	Adjust hardware and software.	This step usually applies to a batch of images of similar collection objects and may be periodically repeated. Select camera-level EXIF metadata pre-set profile for the batch of specimens to be imaged. Adjust viewfinder, camera/lens	Potential software includes: ● Canon Digital Photo Professional, ● Breeze Systems DSLR Remote Pro for Canon, ● Breeze Systems DSLR NKRemote for Nikon, ● Nikon Camera Control Pro 2, ● Helicon

		position to previously determined calibration, or live view to fill frame when using camera. Adjustments might include: ● exposure, ● camera height, ● shooting mode, ● focus method, ● focus, ● aperture setting, ● zoom intensity. Using cameras and camera control software that support live view from a computer can negate having to handle the camera itself. Tethered cameras with camera control software can streamline transfer of image to computer or other storage media.	Remote, ● Zerene Stacker.
T12	Initial quality control and test image(s). Retake images as necessary. If stacking using a micro-focusing rail or Helicon Focus Pro, set upper and lower limits and number of shots	At this stage, the imaging technician performs a visual check of: ● focus, ● positioning, ● exposure, ● correct file name,	

	required.	● image destination (computer folder).	
T13	Record image(s).	Naming image files can be accomplished through varying methods. Options range from hand keying filenames as images are made, scanning barcode values into renaming applications, using voice recognition to capture names, etc. Filenames can be cryptic and lack discernible meaning, however, many institutions prefer to use meaningful values within the name. For example, some institutions include the catalog number, an indication of magnification, view angle (dorsal, ventral, lateral, etc.), and sequence numbers for multiple images of a single collection object, all of which are persistent values that maintain a static relationship	Institutional policy governing the naming of image files, including guidelines for naming series of files depicting varying views of a single collection object. A variety of imaging workflow software is available for managing pre-sets, file naming, metadata capture, etc. Adobe Lightroom is a popular solution for these workflows, as are proprietary Canon and Nikon software and the open source GIMP. Voice recognition software might include: ● Dragon Naturally Speaking, ● Windows Speech Recognition.

		to content of the image over time. Voice Recognition Software procedures include: ● write to a spreadsheet for correlating image file names to catalog numbers, ● speak ”save as” command to insert the catalog number as the image file name. Some institutions use presets in Lightroom to adjust levels, contrast, etc. as images are taken. T13 often consists of several steps, especially when recording stereo pairs or multiple images of a single collection object for subsequent focus stacking. When multiple images are required, all should be recorded at this step.	
T14	Stack images (optional).	If taking a series of images for stacking,	Popular stacking software includes:

		the processing of the stack may be done at this point for each specimen as the images are acquired. Alternatively, images might be batch stacked at a later date (see Module 2E for image processing)	● Helicon Focus (usually recommended for 100 slices or fewer), ● Automontage, ● Zerene Stacker (usually recommended where number of slices may exceed 100; also recommended for 1-100 slices), Note: The stacking process might discard IPTC and some EXIF metadata that are recorded with or added to the image prior to stacking. Hence, such data is better added to the archival results of the stacking process.
T15	Potentially capture additional image metadata, to include EXIF, IPTC data.	Some image metadata (e.g., Audubon Core, camera adjustment such as sharpening, stacking, stacking software, human post-processing, etc.) is better captured post-imaging.	iDigBio's Imaging Recommendations: https://www.idigbio.org/content/idigbio-image-file-format-requirements-and-recommendations. Audubon Core Vocabularies: http://vocabularies.gbif.org/node/126782.
T16	Clean specimens if whitened.	To remove ammonium chloride use hot breath and	If possible, ammonium chloride should not be left on

		potentially a soft paint brush, if specimen is very robust use water and a soft toothbrush.	specimen as it can potentially damage surface of specimen. Handling chemicals related to whitening and cleaning are potentially hazardous. Standard health and safety references should be consulted.
T17	Re-shelve specimens.	Strict and well-defined rules governing re-shelving should be provided to technicians. *Technicians charged with re-shelving should be carefully selected.* Insert tag/label indicating that specimen or drawer has been imaged.	Cart.
T18	Archive images (temporary or permanent).	See Module 1E for additional imaging processing steps.	