Core Lab Cookbook

I. INTRODUCTION

The IODP Core Lab Cookbook is intended to guide Marine Laboratory Specialists (Techs) sailing onboard the *R/V JOIDES Resolution* in basic core lab procedures. All Techs assigned to the core lab share the responsibility of processing core and maintaining the lab. Below is a drawing of the core lab to help illustrate the procedures described in this Cookbook.

II. SUPPLYING THE LAB

At the beginning of an expedition, the core lab should be fully stocked and stock levels maintained during the cruise. Supplies can be obtained from Upper Tween, Pallet and Hold Reefer stores. Please remember to check out all supplies on the check-out sheets located in each storage area. In the core entry area there is a list of supplies for the core lab and where they are stored. Following is a detailed list of the supplies needed for the each area:

Catwalk Supplies

- clear, blue, and yellow end caps
- acetone in red squirt bottles (with “acetone” label)
- clean, absorbent rags
- wooden meter sticks (~149cm)
- 4" stainless steel spatulas
- permanent red markers (Marks-a-lot)
- chisel and mallet for harder sediment and hard rock
- liner puncture tool or drill for gassy sediments
- hammer, hacksaw, plunger, core catcher tools
- china markers for hard rock and marking liners on wet days
- core liner cutters with good blades
- liner patch

- Nitrile gloves, various sizes (bin by catwalk entry door)
- safety glasses (bin by catwalk entry door)
- hearing protection (bin by catwalk entry door)

These supplies must be clean. Meter sticks should be trimmed slightly short to yield 150 cm core sections. Rusty tools should be cleaned or replaced - a small amount of rust can ruin core material for paleomagnetics.

The chem techs provide their own supplies for taking headspace and vacutainer samples. IW samples require no special supplies. You should work with the Curatorial Specialist to maintain the supply of equipment for any special catwalk sampling such as MBIO.

Description Table Supplies

- glass slides
- toothpicks
- mounting media (Norland Optical Adhesive for ultraviolet curing)
- coverslips
- smear slide cases, smear slide labels
- glass sample vials with snap lids
- miscellaneous glassware
- desk supplies, including pens, pencils, Liquid Paper, rulers, etc.
- gloves for those who do not remove their jewelry
- GLAD™ Plastic Wrap

D-Tube Rack Supplies

- black (working) or red (archive) D-tube end caps
- d-tubes
- black (working) or red (archive) Permanent Markers
- waxed core boxes
- polyethylene tape (d-tube tape)
- core box stapler and staples
- shrink wrap

Sample Table Supplies

The bins under the sample table should be stocked with:

- 5 and 10 cc sample tubes and scoops
- 5 and10cc foam plugs
- pop top vials
- sample bags
- foam rods
- "Kapak" bags
- ceramic-bladed knives
- P-Mag cubes
- other supplies as labeled

Splitting Room

- hook, utility and core cutter blades
- cleaning sponges
- acetone
- hard rock dividers, halved end caps (blue and clear)
- split foam rods
- PAL spacer foam, both black and red for sediment cores
- permanent red and black markers, china markers
- spatulas, various sizes
- squirt bottle with DI water

III. IODP CORE NAMING

IODP has a specific naming convention for identifying cores, data and samples. All are named with the leg number, site number, hole letter, core number, core type, section number, and which half (working or archive) plus Text ID. Samples and data will also include the sample interval.

Here is an example for scribing core liner in the Laser Engraver or by hand if needed

323-U1243B-6R-5W, ß, SHLF55443322

Here is an example for a sample:

323-U1243B-6R-5W, 25-30 cm, CYL55443322

Core Types

The following is a list of all the valid core types and their associated code with the most commonly used in bold:

A	RAB-C, resistivity at the bit to log while coring
B	Bit Sample
C	Center Bit Recovery
D	Positive Displacement Coring Motor (PDCM)
E	HRC or Hyacinth Rotary Corer recovered under in-situ
F	Half APC Core
G	Ghost cores, re-drilled intervals
H	Originally referred to as Hydraulic Piston Coring now called Advanced Piston Core (APC)
M	Miscellaneous
N	Originally called Navi-Drill Core Barrel (NCB), now replaced by MDCB (Motor Driven Core Barrel)
P	Pressure Coring System (PCS) or Pressure Core Barrel (PCB)
R	Rotary Core Barrel (RCB)
S	Side Wall Sample
V	Vibra Percussive Corer (VPC), not a viable coring system anymore
W	Wash Core Sample
X	Extended Core Barrel (XCB)
Y	FPC or Fugro Pressure Corer recovered under in-situ pressure
Z	Originally called Diamond Coring System (DCS) now replaced by ADCB (Advanced Diamond Core Barrel)

IV. CORE RECOVERY - CATWALK

After the liner is removed from the core barrel, it is placed on the catwalk holders (working side up, denoted by the double-lines on the core liner), where it is temporarily capped at either end to keep sediment from falling out during the initial handling stages. Full core barrels are usually 9.5 meters long, yield six sections, a shorter seventh section, and a core catcher. Recovery of material in length to the cored interval is considered full, or 100% recovery. However, the length of the recovered material may differ from the length of the cored interval. Recovery less than the cored interval may occur for a variety of reasons. Apparent recovery greater than the cored interval may also occur, typically a result of gaseous expansion of the sediment.

Cores taken from a hole are numbered serially from the top of the hole downward. When full recovery is obtained, the core sections are numbered 1 through 7, the last section being shorter than 1.5 meters. For sediments, the core catcher sample is extruded into a short piece of plastic liner and is treated as a separate section below the last core section. For hard rock, material recovered in the core catcher is included at the bottom of the last section.

The Curatorial Specialist and techs measure and mark the ends of each section, labeling each with core, core type and section number and an arrow pointing 'up'. At the section breaks, the liner is cut with a circular cutting tool and cut through the contained sediment with a spatula. If the material is well lithified a hacksaw or hammer & chisel is used to section the core. After separating into sections, whole round (aka catwalk samples, see next section) samples are taken. After the whole round and head space samples are removed from the catwalk, the rest of the core may be capped and glued with acetone. Blue end caps are placed at the top of each section, clear end caps at the bottom, and yellow end caps at the end of any section from which a whole round sample was taken. Once labeled, sectioned and capped, the core is ready to be brought into the Core Lab for processing.

For obtaining good measurement on the NGR, a section needs to be minimum of 50 cm, preferably more than 50 cm. Curator/ALO should mark the second to last section accordingly to ensure the last section is at least 50 cm. For example – if the last two sections measure 200 cm, it is better to measure the last two as 120 and 80 cm, rather than 150 and 50 cm, or if the last two sections measure 175 cm, it is better to measure the second to last as 100 and the last 75 cm.

V. CATWALK SAMPLING

In addition to the usual hard rock/soft rock sample requests taken from the split core at the sample table, shipboard scientists will most likely take samples on the catwalk. Because most of these analyses are sensitive to the geochemical nature of the material it is important to keep the catwalk area **acetone-free** until the shipboard scientists and chem techs have finished taking their samples. All samples taken on the catwalk must be recorded in Sample Master.

Paleo Samples (PAL)

(PAL = paleontology) - Paleontologists receive material from the core catcher for biostratigraphic dating of the core. Generally, 5 cm is sufficient, but in unfossiliferous material a greater volume may be required. This sample typically comes from the bottom of the core catcher.

After the PAL sample is taken, the core catcher is placed in plastic liner, capped and glued with acetone, and labeled with black marker. Leave an empty space in the liner where the PAL sample was removed. A foam spacer will be added after the liner is split. The PAL sample should be recorded as sample code PAL in Sample Master.

Head Space/Gas Analyses (HS, VAC)

The Shipboard Chemist or Chemistry Technician will take at least one 5cc sample for analysis of hydrocarbon composition and concentration. These include a sediment sample for headspace gas analysis (HS) and, if present, free gas samples (VAC or Vacutainer Samples). These samples are immediately analyzed to determine if it is safe to continue drilling.

Headspace samples are taken from the top or bottom of a freshly cut section, depending on the condition and lithology of the core, usually adjacent to the IW (interstitial water whole round sample). The cylinder used for headspace sampling removes material from the working side of the core. In the case of lithified sediments, scrapings or chips are taken. These samples are entered in Sample Master as sample code HS.

When gassy voids are present, the chemist may need to take free gas samples using a puncture tool and a vacutainer. Shipboard scientists may take as many vacutainer gas samples as desired for immediate or later analysis. The location of each sample must be entered in Sample Master as sample code VAC.

Interstitial Water Samples (IW)

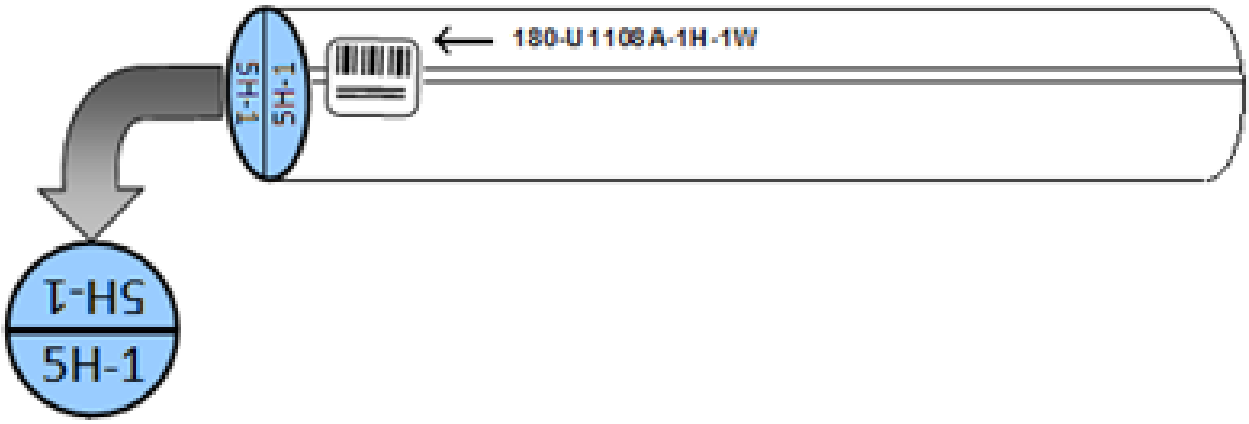
Interstitial waters for geochemical analysis samples are generated from the whole round samples removed on the catwalk. In less consolidated sediments at the top of a borehole, IW samples are generally 5cm long (176cc). The size of the sample may be increased as the sediment becomes more lithified with depth. The Co-Chief Scientists, Staff Scientist, and Curatorial Specialist work together to come up with an IW sampling plan that best meets the needs of the shipboard party. These samples are entered in Sample Master as sample code IW.

When core recovery is less than about two sections, whole round sampling is often suspended. However, there is no official policy limiting the amount of whole-round sampling when recovery is low. The unofficial policy is that the co-chiefs, staff scientist, and the Curatorial Specialist define appropriate limits on whole round sampling to safeguard the scientific interests of the cruise. Always get the Curatorial Specialist's (or his/her representative's) OK to cut IW samples.

VI. IN THE LAB

The Curatorial Specialist or ALOs then enter the pertinent data into Sample Master to generate the bar coded labels for each section.

The marine technicians engrave the working (double line) and archive (single line) side of the liners with the Laser Engraver. Standard IODP identifier, "EXP-SITE-HOLE-CORE-CORETYPE-SECTION and TEXT ID" (e.g. 323-U1340A-1H-1W, ß, SHLF55443322). This ensures that each section is permanently and uniquely distinguished. The Laser Engraver is generally used to engrave the cores, however if the Laser Engraver does fail the sections must be labeled with the dremel tool. View the Laser Safety training presentation that can be obtained from the ALO's before using the Laser Engraver and read the user guide for Laser Katjie program. If engraving by hand (using Dremel™ tool) the engraving should be as legible as possible. The blue end caps of each section should be marked with the core, core type and section number like so:



Place sections 1-4 inside the engraver, working end (double lines) facing up. Make sure that the area to be engraved falls within the two black arrows marked on the forward end of the engraver. If the core section is too short, use the Small Format.

After placing the sections in the engraver, make sure the engraver door is completely closed. The Laser system contains safety switches that will not allow you to use the engraver with the door opened.

Warning! The laser engraver utilizes a Class IV laser. Follow all of the safety procedures for this tool!

Warning! If any of the safety features of the laser engraver seem to be malfunctioning, call an ET immediately! The Class IV laser is very dangerous if its safety measures are not all in place.

Open the Laser Katjie software if it is not already open. The monitor is a touch screen for easy use. In order to be engraved, the cores have to be entered into Sample Master by the driller and ALO's/Curator. Select the Expedition>Site-Hole>Core of the sections to be engraved. The first four sections should automatically pop up. If you do not want to use one of the positions, for example, one section is too short, etc, simply select "not used" for that position.

Once your sections are selected, hit "Engraver" on the touch screen. The engraver will begin engraving your sections. After ~10 seconds, it will finish the working halves and prompt you to rotate the sections to the archive half. Open the door and rotate all sections 180 degrees to archive half up. Close the door and hit next on the software to enable the engraver. After ~10 sec, the engraver will complete the archive half engraving process and a light will prompt you that it is safe to open the engraver door and remove the cores.

Once properly marked and recorded, the sections are moved to the next available spot in the rack to equilibrate to room temperature before they are measured on the tracks and measured for thermal conductivity.

Physical Properties Whole Rounds

Sometimes physical properties whole round samples are chosen after the core has been run through the tracks. The Curatorial Specialist or ALOs will cut the whole round on the catwalk and then seal the samples in wax as soon as possible. Once the sample has been sealed in wax, it should be stored upright in a salt water bath in the reefer.

Splitting Core

After whole round measurements have been made, the sections are ready to be split. Verify with the ALOs or Curatorial Specialist that sections are ready to be split. A program called LIVE (LIMS data Viewer) can be used to confirm data on WR tracks is ok. Sections are split longitudinally from the bottom of the section to the top on the core splitter with either the wire (for soft sediments) or the supersaw (for lithified material) along an axis halfway between the double line and the opposing single line scribed on the liner. Lithified cores split with the supersaw should have the melted plastic that accumulates on the edges of the section due to sawing cut away with a hooked razor blade for safe handling (the plastic is sharp) and for better quality photographs and digital images. The sections should be gently rinsed and lightly scrubbed with a sponge to remove the cutting slurry before leaving the splitting room. The bottom to top direction that must be used when splitting a core is to prevent downward contamination. Biostratigraphic ages are based on the youngest fossils present in a sample. If the core is split from top to bottom, we would cause younger fossils to move downward into older age material.

Archive Half

The archive half is placed on the description table in the Core Lab. The core describers describe the core in detail, making smear slides to examine under the microscope. The core describers also run the sections through the Imaging (SHIL) and Section Half Multi Sensor Logger (SHMSL). The Paleomagnetists will measure the archive halves, one at a time, through the Cryogenic Magnetometer (Cryomag). After the cores have been described and run through the Cryomag the archive half is placed in the D-Tubes. (See section on Storing Core below).

Close-up Photos: Check the close-up photo request sheet to see if a close-up has been requested for that core. If so, place the sections in the d-tube but do not tape it closed. Place a yellow dot on the endcap.

Working Half

The working half sections are taken to the sample table where physical properties measurements are made and discrete samples are taken by the Phys Props scientists. Once Phys Props is done, a rotating team of scientists takes samples for the shipboard party. Once the core is sampled, the scientists will put the cores in pre-labeled (prepared by techs) D-tubes in the working half rack. It's a good idea to stay ahead of the scientists by preparing a few cores worth of D-tubes in advance. The Curatorial Specialist will keep an eye on sampling activities during his/her shift, but during off-hours, it's very helpful (and greatly appreciated) if you check on things at the sample table. Assist where needed.

Note on Core Flow

All techs assigned to the Core Lab watch over core flow by staying in touch with fellow techs and scientists in the lab. Ask if another core needs splitting or if supplies are low. Let them know you are available to assist with all core flow activities, including feeding the tracks. During slow times or if you need to work in another lab, check back frequently to see if you need to lend a hand to split, box core, etc..

VII. HARD ROCK CORES

Core Handling

When a hard rock (igneous or metamorphic) core arrives on deck, the liner is placed on the catwalk core holders. If hard rock pieces are scattered along the length of the liner, the upper end is raised slightly to shunt the pieces to the lower end to provide a more accurate recovery measurement. Place contents of the core catcher into the bottom of the liner in order. Sometimes it's not possible to make room for the CC in the last section, especially if the rocks are jammed in the liner and won't push up. In this case just give the CC the next sequential section. The sections are then measured starting at the bottom of the recovered material and working upwards (i.e. toward the top of the core). Be sure to label the sections in the correct order. Measure until you get to the last section (i.e. Section 1). You may find when you get to Section 1, it could be either very full of rock or it may only contain small amount. Now it is time to estimate if you will need additional empty liners to give you extra space to "curate" the core. To "curate" a hard rock core is to add dividers between non-continuous rock pieces. This almost always expands the core. Once all the sections (including CC) are numbered on the catwalk, measure the recovered rock inside the liner to get your total recovery. The Curator or ALO will estimate the number of sections to enter into Sample Master with the total recovery adding up to the length of core (rocks) received. For example, if the total length of core is 205 cm and it is estimated to take up 2 sections with dividers enter the sections into Sample Master as Section 1 = 100cm and Section 2 = 105cm, so total length is 205cm.

Note: We also drill without a liner on occasion. When this is the case the core is shaken from the core barrel into split liners. Make sure to mark the bottom of the core pieces, when applicable, and keep them in order.

Unlike sediment cores, hard rock cores do not always break at 1.5 meters. They are sectioned at fractures or other natural breaks as close to 1.5 m intervals as possible. Sometimes pieces longer than 1.5 meters are recovered; then it is necessary to break the core at some appropriate point with a hammer and chisel. However, try to use natural fractures rather than breaking a core for sections.

Hard rock sections are carried into the core entry area where the recovery (recovery = liner length in Sample Master) is recorded on paper form. The recovery is then entered into Sample Master as sections and the record saved (but do not print labels at this point – wait for final curated length). The true "curated length" will not be correct until the core is fully spaced-out (i.e. curated). Engrave the sections but no labeling. Note: when working with hard rock, it is always helpful to have a plentiful supply of pre-cleaned and pre-split core liners on hand. Carry the core to the splitting room.

The Curatorial Specialist or senior tech will start to curate the cores shaking the rock piece out of the liner into split liners (not the engraved liners but split liners we use as holders, labeled 1, 2, 3, 4, 5, etc). Starting from the top of the section, **mark the bottom** with a red/blue wax china marker of every piece which is long enough not to have rolled in the liner (the pieces that roll are called rollers and cannot be oriented). It is not important which color china marker is used.

All rock pieces need to be thoroughly washed and dried before putting into the engraved clean split liner.

With the help of the igneous petrologist or structural geologist (or both), broken or beveled rock pieces that have recognizable features (e.g. foliation directions, connecting veins) are aligned from piece to piece and fitted together (Figure 2). The inspecting scientist(s) will mark a splitting line on the rock pieces with Working or Archive half clearly marked (Figure 3). Subpieces that fit together should have hatch marks drawn to help maintain connections between subpieces when cutting on the rock saw (Figure 4). Hard rock pieces that do not fit together are separated from each other in the core liner by plastic dividers. The dividers are then acetoned (or sonic welded) in the engraved split liner. Once the pieces in each section are spaced out and the dividers attached, the Curatorial Specialist or ALO will measure the curated length and enter it in Sample Master. The length of each bin (space between dividers) is also recorded and entered into Sample Master along with the piece number. It's important to recalculate offsets, and re-build depths after entering curated lengths, as the depth calculation method used for hard rocks uses the curated lengths, not catwalk recovery length.

At this point it is possible to make several fatal errors when entering and changing curated lengths and section numbers. It may be necessary to delete a section that originally had catwalk recovery assigned. If so, be sure to add the recovery length to the length of one of the other sections, so the overall core recovery length does not change. Just deleting the section and associated recovery length will result in errors with depth calculations. There is only 1 proper way to delete a section. It must be deleted LIME and the text-ID associated with the section Once again, re-calculate offsets, upload, and rebuild depths when these edits are complete.

Hard rock core pieces are split on the rock saws in the splitting room along the splitting line marked by the petrologists. Sometimes the Supersaw is used to cut long, solid pieces that do not fit on the table top saws. Similarly, a series of long pieces may be more conveniently cut on the Supersaw. Before making any cuts, check again to be sure that the bottoms of all orientable pieces are marked with wax pencil. Ideally, pieces are split symmetrically with regard to any contacts, veins or other special features, so as to preserve part of the feature in each section half. Pieces which fit together or which have contiguous features are split along a single line drawn on all the pieces when they are fitted together. Shattered rock which can be pieced together by hand may be held together with Parafilm™, masking tape or shrink tubing and cut as one unit.

Once split, the hard rock core pieces are returned to their respective liners and set flat side down (Figure 5). They can be air dried with aid of a fan, dried with a heat gun (the heating element in the 'off' position), or with compressed air. Applying direct heat to the core can affect alteration products and demagnetize the rocks so be careful.

Figure 2- Piecing together hard rock.

Figure 3- Hard rock ready for splitting line.

Figure 4 - Hard rock core with hatch marks

Figure 5 - Hard rock split and ready for labels.

All hard rock pieces are labeled with the IODP standard identifier Expedition, Site, Hole, Core, Core type, Section, Piece (and Sub-piece number), an “Up” arrow if the piece is oriented, and a "W" or an "A", indicating whether the piece is from the working or archive half. The labels are written using the hand-held Brady labeling machine. Labels are affixed parallel to the cut face 2/3rd between the bottom and the cut edge, closer to the cut face, of the left side of the core with epoxy resin so that they read parallel to the lines of writing and with the orientation arrow pointing towards the top of the core (see Figure 6). The label is then covered with more epoxy so it is completely sealed. Take care not to use too much epoxy because it can drip down the front of the cut rock face and make it difficult to describe core and take good photos. Once the epoxy has set, the pieces are rotated in the liner so that the split side faces up. All oriented pieces should have arrows pointing “UP” core. As a general guideline, any unattached piece that is smaller than 6cm should not be oriented.

Each piece should be numbered consecutively from the top of the section down. Every section should begin with piece number 1 even if a piece is continuous between sections.

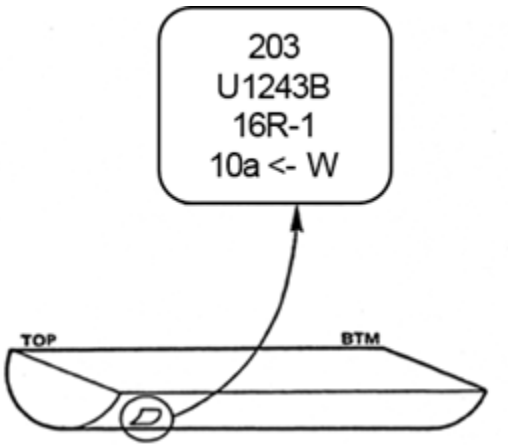


Figure 6. Hard rock label under the epoxy.

Sub-pieces (i.e., the pieces which fit together between liner dividers collectively to form a piece), should be consecutively alphabetized from the top of the piece to the bottom of the piece. When the CUT FACE of the WORKING HALF is facing up, the sub-piece to the right, relative to the stratigraphic top of the section, is sub-piece A (see Figures 7 and 8).

When it is not possible or desirable to put labels on the actual pieces, the label should be stuck to the far side of the core liner. Examples of this are:

- Pieces which are too small to label.
- Rollers and rubble that, for convenience sake, are curated as one "piece", between two liner dividers.
- Pieces which, if removed for labeling, would disturb the core (e.g., sediment basement contact which have been shrink-wrapped together, volcaniclastics interbedded with basalts).

Whenever possible, sections should be divided between pieces. Remember that curated section lengths may be shorter than the average 150cm length; however, the cut-liner should remain 150cm with “EMPTY” written in the blank space at the bottom. Use a red marker for the archive, and black marker for the working section. If the section is continuous and there is a space at the bottom of the liner mark “CONTINUOUS or CONT” in the space. Use a red marker for the archive, and black marker for the working section.

Please ensure that hard rock cores are curated so the assigned piece and sub-piece numbers are the same in both the archive and working halves. Should there be one piece in the archive half that has broken into two pieces in the working half, then each unit in the working half would be assigned a single piece number (No sub-piece numbers would be assigned, see Figure 8).

Hard rocks are sampled in one fell swoop at a “sample party”, so don’t box the working halves like you normally would. After enough cores accumulate, the techs and the Curatorial Specialist lay them out in the lab. You will assist the Curatorial Specialist in drilling, sawing & labeling, and bagging the samples. Both working and archive sections must be shrink-wrapped prior to the final trip down to the reefer. This ensures the pieces do not roll around or become damaged in transit.

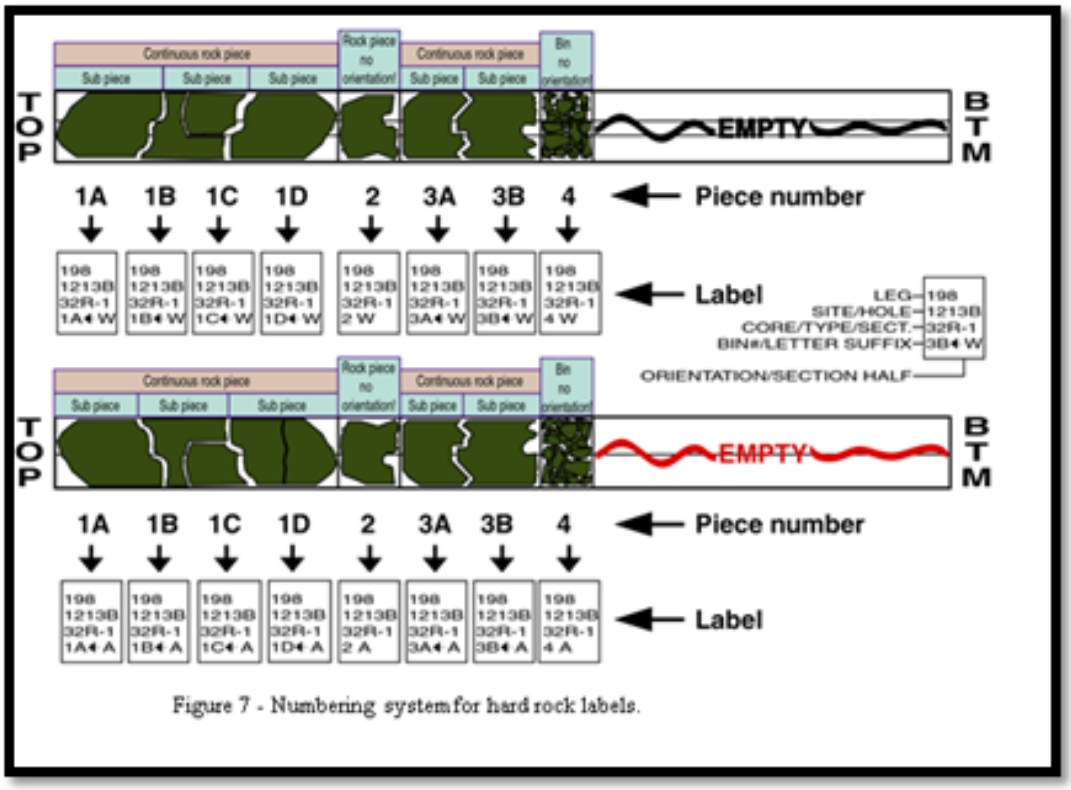
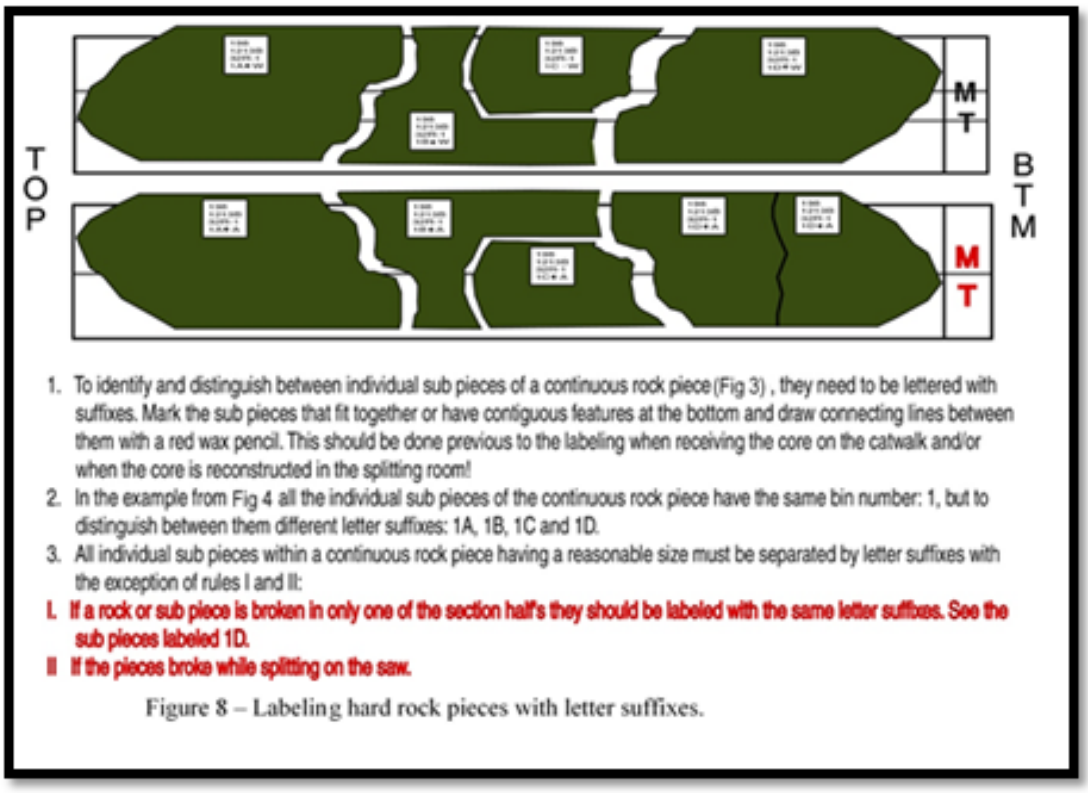


Figure 7 - Numbering system for hard rock labels.



1. To identify and distinguish between individual sub pieces of a continuous rock piece (Fig 3) , they need to be lettered with suffixes. Mark the sub pieces that fit together or have contiguous features at the bottom and draw connecting lines between them with a red wax pencil. This should be done previous to the labeling when receiving the core on the catwalk and/or when the core is reconstructed in the splitting room!
2. In the example from Fig 4 all the individual sub pieces of the continuous rock piece have the same bin number: 1, but to distinguish between them different letter suffixes: 1A, 1B, 1C and 1D.
3. All individual sub pieces within a continuous rock piece having a reasonable size must be separated by letter suffixes with the exception of rules I and II:

I. If a rock or sub piece is broken in only one of the section half's they should be labeled with the same letter suffixes. See the sub pieces labeled 1D.

II If the pieces broke while splitting on the saw.

Figure 8 – Labeling hard rock pieces with letter suffixes.

VIII. STORING CORE

The System

Split cores are stored permanently in white plastic d-tubes. Archive and working halves are distinguished by color coding. Working halves have black end caps and are labeled with black permanent markers; archive halves have red end caps and are labeled with red permanent markers. Archive and working halves d-tube end caps are stored separately, in boxes.

The core racks accommodate roughly 100 sections at a time, allowing the most recent 150 meters of core to remain in the Core lab. Keeping cores in the lab as long as possible allows each crew of scientists the chance to view and/or sample material that came up while they were off shift. When there is no more space for temporary core storage in the lab, sections are boxed and moved to the core reefer.

Packing D-Tubes

Before placing split cores into D-tubes, each sediment section needs to be wrapped using GLAD™ Plastic Wrap (accept no substitutes!). The plastic wrap helps keep the core section moist until it can be sampled and permanently stored at the shore-based repository. For hard rock sections with dividers, use shrink wrap to secure the pieces in the section.

It is easiest to do the wrapping on an empty slot on the sampling or close up table. Unroll the plastic wrap until it is ~15 cm longer than the length of the section. Place and center the section on the plastic wrap. Fold either end of the plastic wrap over the ends of the section, then fold the wrap length-wise over the core.

How many sections can go in a d-tube? Most of the time only one section is put in a single d-tube, regardless of its length. This rule should be followed even when it is possible to fit multiple short sections in one d-tube. The one exception is when a core catcher will fit in a d-tube with the last section of a core. Put the core catcher into the d-tube first so that it is behind the numbered section in the tube. Be sure that the actual storage is consistent between the working and archive halves are stored the same way. Accurate mirror image storage is particularly important when the cores are unboxed and racked at the repository.

Seal every d-tube with polyethylene tape extending from the top to the bottom surface of the d-tube, covering both bar-coded labels. When core sections are frequently reopened, it will save tape and time to wait until it is time to box the cores before taping them. When it comes time to finally box core, pre-tape all sections. The boxing will go much quicker.

Labeling D-tubes

Put one bar-coded Corelog label on the top of the d-tube at the open end and a second label on the endcap. After photography (or sampling), slide each section, bottom end first, into a tube and cap with an endcap. Seal the d-tube with polyethylene tape (the stretchy 3M brand kind; accept no subst itute!). KEEP THE SECTIONS IN ORDER in both the archive and working core racks.

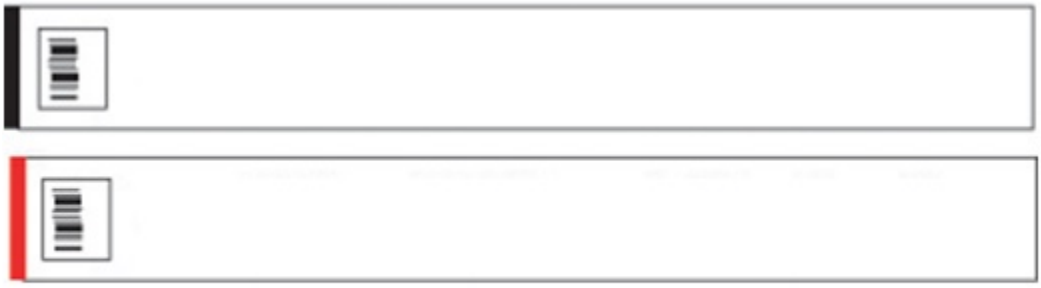


Figure 9– Top view of D-tube with handwritten label.

Colored Dots and Caution Stickers: Colored dots and caution stickers are used on D-tubes to alert people to some unusual condition of the section inside. When possible use ½" diameter dots, not larger. The colored dots signify specific conditions as follows:

- Blue – cores with igneous or metamorphic rock. This allows repository workers to quickly identify “hard rock” cores which do not need to be wrapped.
- Red glow - critical intervals (e.g. Cretaceous/Tertiary Boundary, Cenomanian/Turonian boundary, tektite layers, Paleocene/Eocene Boundary, any interval of interest designated as “critical” by the Sample Allocation Committee (SAC), etc.)
- Yellow – close-up photo needs to be taken by Imaging Specialist. Do not box section.

**Other dots which are used on the beach but not on the ship:

- Purple - cores designated permanent archives by the shore based Curator; permanent archives are at least one half of one set of cores that span the entire drilled sequence.
- Green – Deep Sea Drilling Project HPC cores (HPC, hydraulic piston corer, is the old term for APC and why APC cores are labeled with the “H” code)

- Yellow (shore) – “re-curated” sections (re-curation is when old dried-out cores are pieced back together again).
- White - no sponge due to expanding clays in old cores; cores in repositories have been known to expand up to 50cm.
- Green glow – in the mid-1990s, a so called “geriatric study” was started on the ship and at the repositories to study the process of core aging.

Put yellow pre-printed “caution” stickers on the D-tube of any section that has had something unusual happen to it. In addition to the caution label, write a brief, but complete message on the top of the D-tube explaining what happened. The message must be easy to understand by repository workers and visitors in the years to come. For example, if a section was dropped, but not conspicuously damaged, write simply "section dropped." If parts of a dropped section fell onto the floor, but were replaced in order, write "section dropped; top 28 cm fell out and were replaced in order." You get the idea. The same comment should be added to Sample Master comment fields.

Boxing Core

Core Lab

Working halves are temporarily held in the core rack next to the sampling table. When the rack is nearly full, it is time to box core. Ask the Curatorial Specialist before actually boxing, just in case some cores are still being worked on by the scientific party. Be sure that the cores are in order in the racks and that all the end caps are taped. Get a four-wheeled cart to stack the core boxes on as you are packing them and to transport core boxes to the core reefer. D-tubes are placed in wax core boxes which hold 10 sections. Instructions for assembling, packing, marking, and closing core boxes follow (below). Copies of these instructions are also posted at both ends of the core lab. When you have 4-7 full core boxes stacked on the cart, take them to the core reefer for storage until the end of the leg. More than 7 boxes on the cart make it unwieldy and potentially dangerous, especially if the seas get rough.

Archive halves are often held out for close-up photos. Check the Close-Up Request form and put a yellow dot on the endcap of any section needing a close-up. The IODP Imaging Specialist will take all close-ups. Afterwards the core can be boxed. It is good practice to wait until the Imaging Specialist gives the “OK” to box. The Imaging Specialist will also check the LSIMG data to confirm the images are good.

Core Reefer

Segregate core boxes in the core reefer as much as possible. Be sure to push core boxes as far back into the racks as they will go. When the cores are being stacked on the racks, or on pallets under the racks, stack the boxes 7 high. On the floor, the core boxes can be stacked 10 high, plus one on top for a total of 21 boxes.

Moving Core Around

Take care to hold split sections level (parallel to the floor) when moving them in and out of D-tubes, when moving the D-tubes in and out of boxes, and when moving core boxes.

Core Box Inventory Forms

Core Box Inventory forms keep track of the boxed sections. One clipboard of blank forms is posted on the working half rack and another near the archive halves. Update these forms whenever cores are boxed. It is important to carefully label the boxes and fill out the Core Box Inventory forms so that you can find sections in case they need to be resampled or re-described later in the expedition. Always make sure the working and archive inventories match when boxing either section. The repository folks rely on these forms for unboxing the core. They greatly appreciate your accuracy and neatness.

Instructions for Boxing Archive and Working Core

1. Ten D-tubes fit into one box. Record the box number and the sections that will be placed in the box on the Core Box Inventory for
2. Mark boxes containing working halves with a black permanent marker; mark boxes containing archive halves with a red marker. Mark bottom (BTM) at the rear of the box, both on the flap and top surface, and TOP on the front flap and top surface (Figure 10). At both ends of the box, on the top and flap, write the expedition number and the box number (as listed on the Core Box Inventory) followed by a W or A for working or archive. Circle the core box number and letter.

Figure 10 – Labeling on outside of core box.

Here is how the open front end of a filled box should look

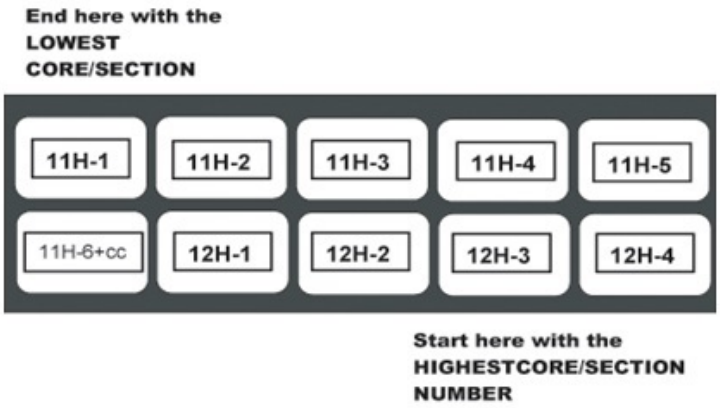


Figure 11 - Inside view of core box (view is from "top" end).

IX. LAB MAINTENANCE

In the Core Lab, the following maintenance takes place during and at the end of the expedition:

- Core Splitter/Supersaw: Keep the splitter and splitting table clean. Rinse the splitter thoroughly after splitting a core, especially inside the Supersaw if it is being used.
- Drill presses: Sharpen bit with cutting brick. Check spindle for proper rotation and alignment. Clean thoroughly and lubricate with Marvel Mystery Oil™ or WD-40™ when not in use for long periods and at end of leg.
- Rock saws: Sharpen blade with cutting brick. Check blade for proper rotation and alignment. Clean thoroughly and lubricate with WD-40™ when not in use for long periods and at end of Expedition.

X. CLEANING AND END OF EXPEDITION ACTIVITIES

During the expedition the core lab should be cleaned between sites if time permits or any time there is a lot of buildup of dust and mud. Clean the floors, wipe down the core trays, counters and tracks. Depending on the expedition, the splitting room and core entry area may need to be thoroughly cleaned during the expedition. At the end of the expedition the lab must be thoroughly cleaned.

Catwalk Clean-up

After the last core is recovered, the catwalk can be taken down. Remove acetone bottles, core cutters, spatulas, pens, hacksaws and end cap baskets and put everything away. Put all clean endcaps back into the boxes and stow. Take the blade assembly out of the core cutters and clean them. Stow acetone bottles in the flammables cabinet on the catwalk. Wash down the catwalk, core rack and core catcher bench. Scrub the core rack with a brush.

General Core Lab Clean-up

Use the list below as a guide for general End of Expedition clean-up:

- Remove all unnecessary paperwork and tape from walls, bulletin, boards, shelves and drawers.
- Clean thoroughly the splitting room and splitting table, wash the mats on the catwalk with the pressure washer.
- Clean all equipment & tools, including outside of microscopes.
- Clean the tracks and photo table.
- Clean description and sample table core trays.
- Vacuum all the shelves and drawers.

- Wash counters tops and cabinets thoroughly.
- Clean the desk and the stereo system.
- Clean all monitors, keyboards AND mouse pads.
- Clean the lights and vents.
- Vacuum the chair seats and wash their feet.
- Wash walls, doors, portholes, and base boards.
- Clean deck drains, sediment traps, and sinks
- Vacuum, scrub and then mop the floor.

Archive Versions

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