

International Ocean Discovery Program
Shipboard Curatorial Cookbook

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IODP
INTERNATIONAL OCEAN
DISCOVERY PROGRAM



TEXAS A&M
UNIVERSITY

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Introduction

Important information before getting started

Sample Requests

Before heading to the ship make electronic copies of all sample requests for your expedition, and additional documentation provided by the requesters (e.g. Excel lists, relevant publications, etc). The easiest way to do this is by saving each request as a *.pdf file. Additionally consult with the EPM of the expedition to see if they have additional documentation.

Computer Accounts

It is mandatory that each oncoming curator have their own login for 3 separate user accounts: the Oracle database (LIMS), onboard server (Novell), and shipboard document wiki (shipboard Confluence).

note: the shipboard Novell and Confluence accounts are different than your shore Novell and Confluence account.

The Novell login should allow access to the Curator folder (on VOL1) on the ship, as well as the shipboard Confluence page. Contact a Marine Computer Specialist (MCS) and/or a Developer for access to these folders, websites and applications. You can find contact information for all IODP staff here: <https://iodp.tamu.edu/staffdir/directory.html>

You should also have a copy of standard shipboard sampling templates on a hard drive. This folder can be found on Google Drive: (<https://drive.google.com/drive/folders/13UtVJLNuUzLMVVJw3soCBcuN9tak7XJU>), and also on the Curation server on shore.

Purpose

The Curatorial Cookbook is a guide for the IODP Marine Curatorial Specialist sailing on the research vessel, the *JOIDES Resolution*. This guide is also for Shipboard Assistant Laboratory Officers (ALO) who act as the curator while the curator is off-shift. This guide is a starting point. Procedures should be modified as the need arises. The material included in the Curatorial Cookbook is drawn from a variety of sources including older versions of the Curatorial Cookbook, telexes and memos from the hardcopy Curatorial Reference File, the Core Laboratory Cookbook, the Shipboard Scientist's Handbook, the Sample Distribution Policy and old CURLOG entries stored on former Curatorial Specialist's computer hard drives.

Procedures for revision

Curatorial Specialists, as well as the Gulf Coast Superintendent and Gulf Coast Curator are responsible for updating the cookbook as the need arises. Changes can be made on the Curatorial Cookbook Google Doc on the IODP-GCR group drive. A hard copy should be exported and sent to current staff members if a significant change or round of edits are made.

The IODP Curator should be notified of any significant changes before or immediately after they are first implemented. If you find yourself in a new situation, or one that has not been covered in the cookbook, do not hesitate to solve it in a way you deem appropriate. However, remember to **document it and send it to the GCR Curator, Michelle Penkrot (penkrot@iodp.tamu.edu) and GCR Superintendent, Chad Broyles (broyles@iodp.tamu.edu) (as of April 2020)**. In this way, this cookbook can be updated and the next time the situation arises, you and the other Curatorial Specialist know what to do.

Pre-cruise

Note for new curatorial specialists

Once your name appears on the official staffing list for a given cruise, expect to be contacted by the Travel Department to arrange the required visas and vaccinations. There will also be information for staff travel for a given expedition here: <https://iodp.tamu.edu/travel/staff.html>. Be sure to have a valid passport at all times. You will also be allowed to send one personal box (“p-box”, 12x12x12 in) to the ship. You can ask any Assistant Laboratory Officer (ALO) on information regarding this. Passing yearly physical exams is also required. A record of this exam is kept on file in Human Resources. A Human Resources representative will contact you when it is time for your physical. As these roles change frequently, your best points of contact to point you to the right staff member will be GCR Curator and Superintendent, and the ALOs.

All email address and contact information for IODP can be found here: <https://iodp.tamu.edu/staffdir/directory.html>

To familiarize yourself with the upcoming cruise do the following:

- Attend Pre-cruise meeting(s) in College Station.
- Obtain a copy of the Scientific Prospectus. The Prospectus is assembled by the Expedition Co-chief scientists and staff scientist (also known as Expedition Project manager or EPM) of the expedition. This document will be available on the IODP website approximately three months prior to the cruise. It lists the scientific objectives, proposed sites, drilling

operations, sampling strategy, and staffing for each expedition. To obtain the prospectus follow the link <http://iodp.tamu.edu/scienceops/expeditions.html> and click on your assigned expedition.

- If you are a **new Curatorial Specialist**, please go to <https://wiki.iodp.tamu.edu/> and familiarize yourself with shipboard labs. Most important to read:
 - The Core Laboratory Cookbook (and general docs). This document describes Core Laboratory Procedures to new Marine Laboratory Specialists:
<https://wiki.iodp.tamu.edu/display/LMUG/General>
 - Core Lab and Curatorial Representative SOPs:
<https://wiki.iodp.tamu.edu/pages/viewpage.action?pageId=53674256>
 - The Shipboard Scientists Handbook (SSH, Technical Note #3), which summarizes the laboratories and facilities aboard ship as well as the responsibilities of scientists and marine laboratory specialists at sea. Copies of the SSH can be found in the following locations:
Shore website: http://www-odp.tamu.edu/publications/pubs_tn.htm
Ship website: http://web/publications/pubs_tech.html
- Become well acquainted with the latest version of Sample Distribution, Data Distribution, and Publications Policy (<http://iodp.org/policies-and-guidelines>). Once on the ship, review curatorial reports from previous expeditions, and of course, read this Curatorial Cookbook.
- Approximately one month pre-cruise, meet with the shore-based Curator and the Staff Scientist to review sample requests. Assist in identifying potential conflicts (i.e. overlaps with the Sample Distribution Policy or between requestors). The Staff Scientist will contact the co-chiefs about problematic sample requests, and suggest possible ways to resolve conflicts before the cruise. In addition, the Staff Scientist will send you a copy of a spreadsheet shore-based that outlines each of the requests and identifies potential overlaps.
- If necessary, ask the Staff Scientist to flag requests that require special equipment or handling. The Laboratory Officer (LO) should be notified of any special procedures.

Be aware of how much transit time you have before arriving at the first site and schedule your activities wisely. Be realistic about how much work can be accomplished during the port call or transit to the first site. Be sure to give yourself some contingency days on land for your last minute shore assignments, and personal business.

Port call

Generally port call is a very hectic and confusing time as everyone becomes oriented and adjusted to the ship. As a marine specialist, in addition to your curatorial duties, you will also need to assist unloading and loading freight when not occupied with pressing curatorial duties. The Laboratory Officers, Assistant Laboratory Officers and the Marine Logistics Coordinator direct port call activities. Talk to them to see what your particular duties will be.

There are many beginning-of-the-cruise curatorial tasks that may be tackled either while in port or during the transit to the first site. You may wish to schedule your activities according to the time available, but a good rule of thumb is "the earlier, the better." If your "To do" list is too long and the port call too short, you can request the Laboratory Officer to excuse you from routine shipment handling to finish preparations for the first site.

Curatorial office

The Curatorial Office is located in the 'Open Office' on the port side of the Forecastle deck (F-deck) (Figure 1). Climbing up the gangway puts you on this deck. Upon entering the laboratory stack via a door directly in front of you, the open office is the first door to the right. The Curatorial portion of this office is located in the port side corner (Figure 2).

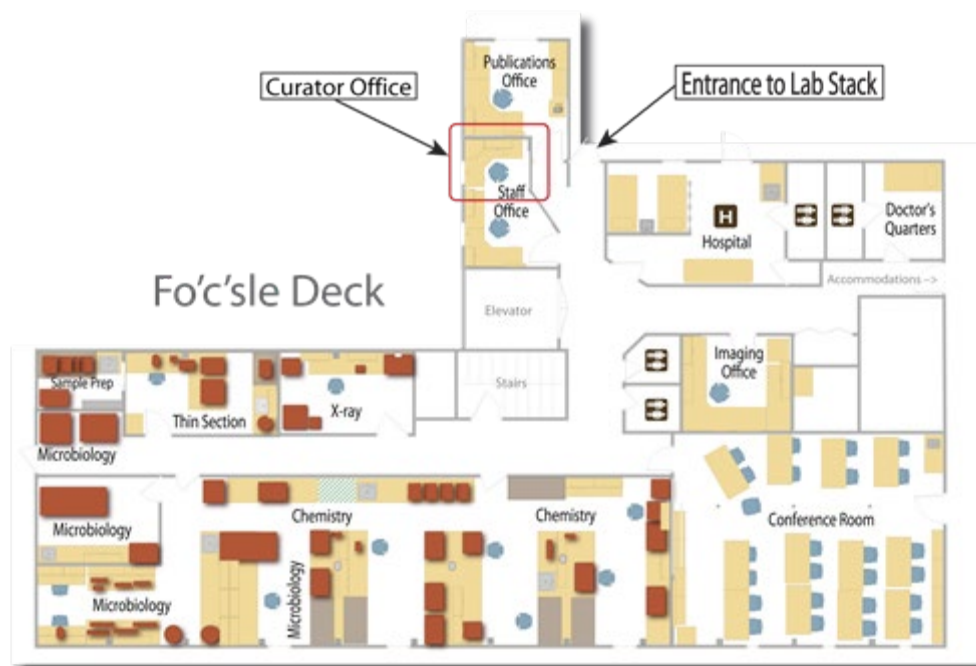


Figure 1. Map of the F-deck port side. The location of the Curator's Office is shown in the red rectangle.



Figure 2. The shipboard Curator office.

Crossover

You must crossover with your off-going counterpart, the Curatorial Specialist, during the port call. This includes providing the oncoming Curatorial Specialist with both electronic and hard copies of all necessary documents to ensure a smooth transition for the rest of the port call. Together you should review the Curatorial Report from the previous cruise, and address any residual problems/projects you may encounter on your cruise. Remember to review any significant changes to the facilities: the Core Laboratory/Sampling Area, hardware and software of computers, and the Curatorial Cookbook. **Most importantly, review handling of the off-going frozen/refrigerated sample, ambient sample, and core shipments with the off-going Curator.**

Crossover day is busy, and there are a lot of people in a small space. Please be respectful of everyone's space, especially the off-going crew who just spent two months at sea! When possible, let the off-going curatorial specialist have the office space until they leave the ship.

Core shipment

In your role as Shipboard Curator, you should take part in the off-loading of cores. Make sure that the core boxes are handled carefully. In consultation with the Assistant Laboratory Officer, you may choose to either direct unloading of the core refrigerators or to help with loading the containers on the dock. Be sure that the containers are loaded safely and properly, with no more than 21 core boxes total on each pallet (i.e. two stacks of ten with one in the middle to stabilize the pallet). The pallets are banded with steel banding, and wrapped in plastic stretch wrap. **Make sure the banding is tight, otherwise the pallet will be unstable while moving from the hold, on and off the elevator, being craned off the ship, and being placed in refrigerated container vans on the dock. It is everyone's responsibility to ensure this is done properly, and to speak up if the pallet needs to be re-banded.** Keep in mind that it is not necessary for the core boxes to be kept sequential during transit to the core repository. **However, the working and archive half boxes should not be mixed on an individual pallet.** Each pallet should contain the working halves only or the archive halves only (See Image 3). There will likely be a pallet with residues returning back to the respective repository as well. The off going Curatorial Specialist should provide a digital and hard copy **Pallet Inventory** to the oncoming Curatorial Specialist. The Pallet Inventory documents every core box contained on each pallet. This is essential information for the repository to have when receiving a core shipment. The Curatorial Specialist or assigned Marine Technician should fill out the inventory out by hand as the pallets are packed in the core refrigerator. Transfer this information to a digital file, scan the original, and email to the GCR Curator and Superintendent.



Figure 3. Core box pallet

Frozen and refrigerated sample shipments

This can seem overwhelming at first, but don't fear! The Laboratory and Assistant Laboratory Officers know the correct procedures for this, and you will work as a team. These are the steps for packing frozen shipments, divided into tasks for the off-going and on-coming Curatorial Specialists.

Off-Going Curatorial Specialist tasks

1. Provide the Assistant Laboratory Officers (ALO) and Laboratory Officers (LO) with a list of names, addresses, and sample codes for all frozen shipments. Use an estimate of 13 kg (28 lb.) dry ice per cooler. World Courier system replenishes dry ice in route.
2. The Curatorial Specialist and ALO should review the locations of all frozen and refrigerated shipments in a time during the final transit that is mutually agreeable to both sides. If possible, prepare all frozen and refrigerated World Courier boxes and/or coolers in advance with the proper shipping labels.
 - Frozen shipment requires the following labels:
 1. Black and White Hazardous Material Label for dry ice (Figure 4)
 2. Penguin Keep Frozen label (Figure 4)
 3. Up arrow labels (Figure 5)
 - Refrigerated shipment requires the following labels:

1. Keep Refrigerated labels (Figure 5)
2. Up Arrow labels

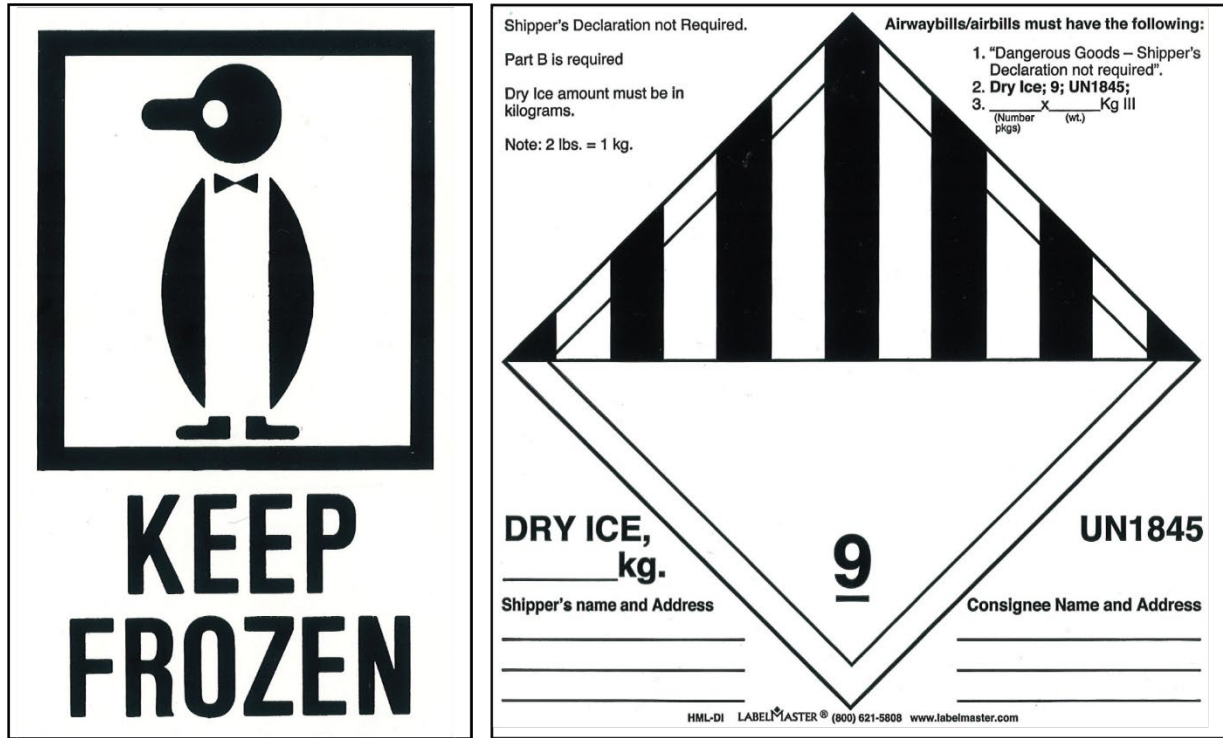


Figure 4. Here are examples of two labels that should be placed on every frozen sample box for shipping. The estimate for the dry ice weight is 13kg. Write this estimate on the label above.



Figure 5. Up arrow label and keep refrigerated labels

Tape each label with filament tape along the outside perimeter. The adhesive on these labels is not durable enough for the shipment. The final product is shown in Figure 6.



Figure 6. Example of a cooler with refrigerated sample ready for shipping.

3. Frozen samples are stored at either -20°C or -80°C .

-20°C samples are typically packed in a cardboard ‘p-box’, taped, and stored in the freezer. Before being placed in the World Courier Box the sample p-box should be wrapped in two plastic garbage bags before adding dry ice.

-80°C whole round samples typically are stored directly on the freezers’ shelves. They are directly transferred into a double layered clear garbage bag inside a World Courier Box before adding dry ice. -80°C samples can also be stored on freezer shelves in garbage bags. These bags then will be transferred into a double layered clear garbage bag inside of a World Courier Box.

Wrapping the samples in clear garbage bags prevents contact between sample bags and dry ice that will be added later. The ice can rupture the bags causing contamination of the samples. Deflate, tie the bag with a knot, and wrap a gas bottle tag writing the **request code** written on in it. The oncoming Curatorial Specialist can confirm the correct samples from these tags. Avoid using tape (e.g. polyethylene, duct) because it does not work well at -80°C . Also note plastic becomes brittle in -80°C conditions.

Oncoming curatorial specialist tasks for frozen shipments

As the oncoming Curator, you will be responsible for the previous cruise's frozen shipment. Usually the Laboratory Officer, ALO and/or the IODP Logistics person will inform you the arrival time of the dry ice.

When the dry ice arrives, take the pre-weighed and double bagged samples from the freezer and put them in the insulated World Courier shipping container. This is a cardboard box with a styrofoam insert shown in the Figure 7.



Figure 7. Example of a World Courier box with a styrofoam insert filled with bagged samples in a plastic bag to protect from dry ice.

1. Leave the container 1/3 empty to ensure space for dry ice. World Courier will refill each package with ice while the shipment is in transit.
2. Dry ice could arrive as blocks or pellets. Handle blocks with goggles and gloves. Break dry ice carefully into large chunks using a heavy hammer and place them on the top of the bubble wrap. Handle pellets with a large scoop for the same purpose.
3. Label the container with an IODP shipping label and shipping documents. Place tape over the label and papers. Ensure that the World Courier box is taped and secure for shipping.

4. Immediately after packing is complete, ensure that the shipment is delivered to the dock safely. The Marine Logistics Coordinator will be on the dock to ensure that the boxes are loaded onto the truck for delivery. It is necessary to confirm that all shipping documents are accurate.

Dry ice properties and handling

Dry ice needs special care in handling. Keep the following security protocol in mind:

1. Do not handle with bare hands; it can cause burns. Use heavy gloves, tongs or cloth.
2. Do not taste or put in mouth.
3. Do not place in tightly sealed container. Dry ice makes CO₂ gas as it sublimates. It may cause sealed container to explode.
4. Do not inhale. Work with dry ice in adequate ventilation; heavy CO₂ vapor may cause suffocation.
5. Short-term storage: wrap in brown paper in a heavy plastic bag, then in a towel.
6. Longer-term storage: place wrapped dry ice in cooler. Do not place in freezer or refrigerator!
7. Disposal: Unwrap and leave at room temperature in a well-ventilated area. It will sublime from a solid state to a gas.

Dry ice chemical formula: CO₂ – inorganic chemical family

- Name: Carbon Dioxide, synonym: carbonic anhydride
- Temperature: -78.5°C (-109.3°F)
- DOT Shipping Class: ORM-A UN-1845 Pkg. GROUP 111 Class 9
- Non-flammable Gas: UN2187

Physical Data

Property	Value
Molecular Weight	44.0004
Density Liquid	63.69 lb/ft ³ @ 0°F
Density Gas	0.1234 lb/ft ³ @ 32°F
Triple Point	-69 °F, 75.1 PSIA
Critical Temperature	87.8 °F
Critical Pressure	1066.3 PSIA
Critical Density	28.9855 lb/ft ³
Latent Heat of Vaporization	122 BTU/lb @ 0°F
Viscosity Gas	0.015 Centipoises @ 32°F
Viscosity Liquid	0.14 Centipoises @ 0°F
Solubility in H ₂ O	1.79 ft ³ CO ₂ gas/ft ³ H ₂ O (32°F)

Table 1. Physical characteristics of dry ice-refrigerated shipments

Off-Going Curatorial Specialist Tasks

Some samples require refrigeration immediately after collection and during shipment (e.g. studies of microbiology, chemistry, pore water physical properties whole rounds). The following are the off-going Curatorial tasks for packing refrigerated shipments:

1. Provide the Assistant Laboratory Officer and Laboratory Officer with a list of names, addresses, and request codes for all refrigerated shipments.
2. At a mutually agreeable time during the final transit, the Curatorial Specialist & ALO should team up to review locations of the refrigerated shipments. On that day, obtain a World Courier box shipping container from the Hold Stores.
 - a) Non-whole rounds - The smaller samples are typically boxed in standard IODP personal boxes (13"x18"x7"). The box is then put into a plastic bag inside of a World Courier insulated box or Igloo Cooler.
 - b) Pore-water in glass ampoules – Protect ampoules with foam and pack them in a standard IODP personal box. Next, put the box in a plastic bag inside of a WC box. While packing, keep the samples upright in the box.
 - c) Physical properties whole rounds – Onboard, the waxed whole rounds should be stored upright in a seawater-filled Igloo container inside the core refrigerator. For shipping, the whole round requires special packaging. Take the whole rounds out of the seawater and place them in zip top bags with moist sponges. Stand them upright in an Igloo cooler (preferably a 5-day cooler). Surround them with plenty of packing material.

3. Label the cooler with the sample code. Place cooler in the core refrigerator until it is ready for shipment.

On-Coming Curatorial Specialist Tasks for Refrigerated shipments

As the oncoming Curator, you will be responsible for the previous cruise's refrigerated shipment. Usually the Laboratory Officer or the person in charge of IODP Logistics will contact you to inform you when World Courier arrives.

1. When ready to offload, place bagged samples in the labeled cooler and add a generous amount of blue ice on top. World Courier will replace the blue ice during transit.
2. Place and tape an IODP shipping label and shipping papers on the outside of the container. Wrap the cooler and the lid with filament tape to keep it from opening.
3. Immediately after packing is complete, hand the shipment over to the Laboratory Officer and/or the Marine Logistics Coordinator who will send it to the agent.

Under way/pre-site

Underway geophysical watch

The Curatorial Specialist may be required to stand up to a three-hour watch in the geophysical laboratory each day while the ship is in transit and streaming gear. The Laboratory Officer will schedule the watches and should provide training. If you are unsure about how things are done do not hesitate to ask the Underway Geophysics technician for help. If your scheduled watch conflicts with the shipboard scientist's meeting, or some other important event, arrange to swap schedules with another technician.

Pre-site preparation

As soon as you get settled on the ship, ask the Staff Scientist to email you any last minute sample requests or sample requirements/handling which have been submitted by oncoming scientists, and/or provide the Staff Scientist and Co-chiefs with last minute requests which they do not have. Remind those scientists who have not submitted the requests that they must do so before arriving at the first site. Find out the schedule for all science meetings concerning sample requests or sampling. You should attend as many meetings as you can.

Sample Allocation Committee (SAC) meeting

Request a meeting with Sample Allocation Committee (SAC: the Staff Scientist, two Co-Chiefs, shipboard Curator) before any scientist-involved sampling meetings take place. The objective of this meeting is to get a general idea of the sampling strategy that the Co-Chiefs have in mind. It is also an opportunity to discuss any issues with sample requests.

Curation Presentation to Scientists

Schedule a curation presentation with the Staff Scientist well before the first site if possible (if there is a long transit, this meeting does not have to take place during port call). Present a PowerPoint discussing curatorial procedures on the ship, core flow, the concept of permanent archives, a basic sampling strategy for the expedition, and some basics of a shore-based sample party if applicable. You can find past curation presentations in the Curator folder on IODP Official and IODP Share in VOL1 on the server, or in your curation templates folder. If you cannot find a previous version, email someone from the GCR and they will be happy to provide you with a recent presentation and any advice. The Staff Scientists are also a good resource, and you can discuss concerns or questions with them if they have time.

Additional sampling meetings

The SAC usually holds at least one meeting with all the scientists' groups (sedimentology, pore water, isotopes, biostratigraphy, structure etc.) to talk about their research overlaps, or any other sampling concerns. On most cruises the scientists are asked to break into groups to discuss in detail their requests. If one group has an inordinate number of conflicts, then usually the Staff Scientist/Co-chiefs ask them to meet again looking for a final resolution. You can attend these meetings or talk to scientists individually asking them about important details (e.g. samples per core, volume, geological time, frequency of shipboard samples). It is also an opportunity to talk about the frequency of shipboard samples. Some examples of shipboard samples include those taken for paleomagnetic measurements, physical properties measurements, paleontology, and X-ray diffraction.

Sample classes for scientists (and new technicians)

In order to train a new crew of sampling assistants, you need to hold sampling orientation sessions at the beginning of the cruise for the science party. Work with the Staff Scientist to schedule these sessions. Observe and avoid schedule conflicts. Each session should include 4 to 8 people, and last about a half-hour or so. Scheduling a sample class for new technicians is a little more nuanced based on port call activities. If there is time, encourage them to join the scientist sample class, but try to make time to train them in basic sampling skills before core on deck.

Compiling shipboard sampling plans

There are multiple “areas” of sample-taking, and it is ideal to have these strategies finalized before the first site. These broad “areas” include catwalk, sample table and chemistry. There are examples of templates used by past/current curatorial specialists to make sure that the proper samples are being taken, stored and shipped correctly. Examples of these templates are in should be on your hard drive before you get on the ship, provided to you by the GCR staff. These templates can also be found on Google Drive:

(<https://drive.google.com/drive/folders/13UtVJLNuUzLMVVJw3soCBcuN9tak7XJU>), and in past expedition folders within the Curator folder on IODP Official.

Back to the drawing board

Sampling strategies usually require multiple meetings before each site. Keep editing sampling templates, and make sure to ask any questions necessary to ensure proper taking, handling and storing of each shipboard sample.

Arrange meetings with the Staff Scientist and co-chiefs to discuss sample requests, conflicts, and the operational plan for the upcoming sites and as needed.

Be sure to address the status of requests submitted by shore-based participants. As soon as possible, notify the scientist of their approval status and ask any pertinent samples to make sure their samples and research plans are handled properly.

Sample shifts (sediment expeditions)

The Staff Scientist is in charge of assigning scientists sample shifts if all of the personal samples will be collected on the ship (no shore based sample party). Scientists may also be placed on sampling shifts even if there won't be personal samples taken, based on the pace of the scientists, core recovery etc. Scientists usually work in pairs for two hours a day. This is especially important if you are expecting heavy load of shipboard sampling. Review the schedule for possible conflicts. For example, avoid having two micropaleontologists on the same shift or a sedimentologist working at the sample table during the major midnight and noon changeovers. It is also a good idea to consider pairing native and non-native English speakers. It is everyone's responsibility to make sure that people adhere to these schedules so cores can move through the lab in a timely manner.

Core Laboratory Orientation for scientists and new technicians

Core Receiving Platform

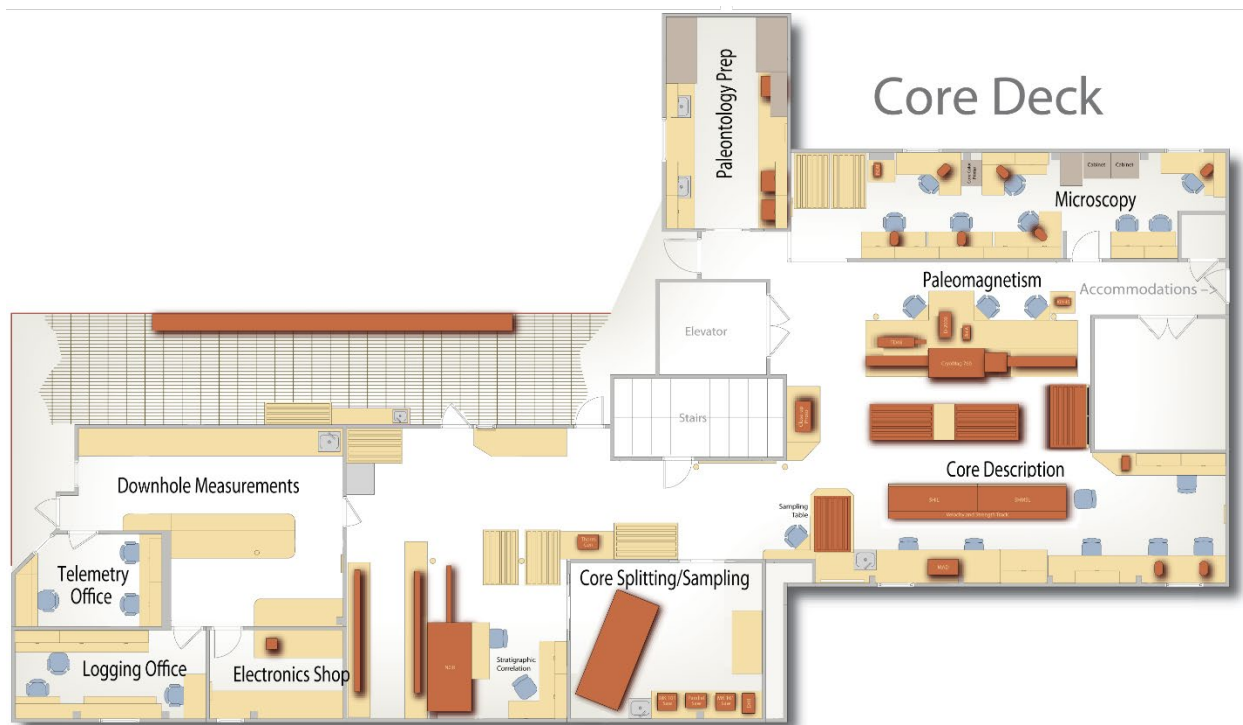


Figure 8. Core Deck Layout showing the distribution of catwalk and core laboratories.

In addition to a sampling session, the curatorial specialist will also want to give a core flow tour, specifically with curation details in mind (Figure 8), and discussing core handling and flow (Figure 9). Starting on the catwalk, discuss core-handling procedures of particular interest to the scientists: whole round sampling (interest of chemists and physical property specialists); core catcher sampling (paleontologists), and the hydrocarbon monitoring procedures (chemists). You should also stress security measures around the rig floor when core is being handled. While in the core entry area, discuss how the core data is entered into the Sample Master/LIMS entry station database.



Figure 9. Crew holding the core in the Core Receiving Platform (“Catwalk”)

Core Entry/Splitting Room

In this section, first introduce the core entry whiteboard (Figure 10). Make sure the scientists are aware of the numbering and labeling scheme of the cores/sections. If you are on a hard rock expedition, discuss the orientation and labeling of the core pieces. You may want to have a separate meeting with just the structural geologists for this purpose. Scientists should be reported briefly about the whole-round measurements performed in the Core Laboratory. They may also visit the splitting room to see how various types of cored material are split (Figure 11). Discussion at the description table should cover the proper treatment of archive halves and handling and storage of the smear slides. Also cover sampling at the end of the tour.

Site: U0070 PDR:

Hole	Core	GMT TOD	mbsf Top	mbsf BOT	Adv.	CoreD	% Recovery	Comments
A	24R	17:00	193.8	197.5	3.7	117	32%	
	25R	19:20	197.5	207.1	9.6	764	80%	
	26R	22:10	207.1	216.7	9.6	88	92%	
	27R	00:40	216.7	226.3	9.6	785	82%	
	28R	03:35	226.3	235.9	9.6	842	88%	
	29R	05:25	235.9	245.5	9.6	610	64%	
	30R	08:05	245.5	251.1	5.6	53	95%	
	31R	12:30	251.1	255.1	4.0	481	120%	
	32R	14:25	255.1	264.7	9.6	862	90%	
	32R	14:25	255.1	274.3	9.6	898	94%	
	33R	16:30	264.7	274.3	9.6	740	77%	
	34R	18:35	274.3	283.7	9.6	427	44%	
	35R	21:40	283.9	293.5	9.6	427	44%	
	36R	00:25	293.5	308.1	9.6			

Figure 10. Example of Core Entry Whiteboard

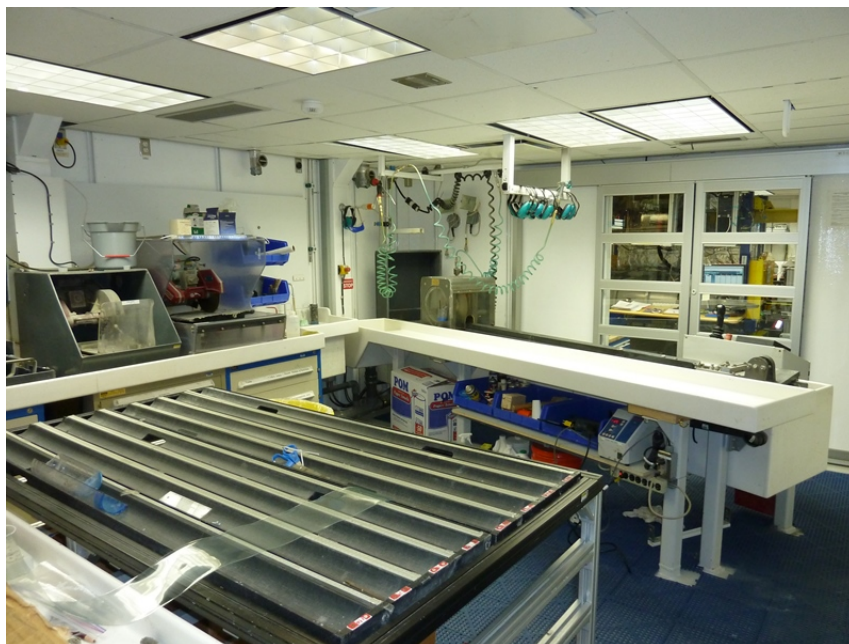


Figure 11. Splitting room

Sample Master/sampling orientation

At the sampling table, scientists should be introduced to the IODP curatorial sampling application: Sample Master. Allow them to enter, save data and print labels on the TEST expedition (Figure 12). Discuss sampling tools, techniques, volumes, the whiteboard, and review the Sample Distribution Policy.

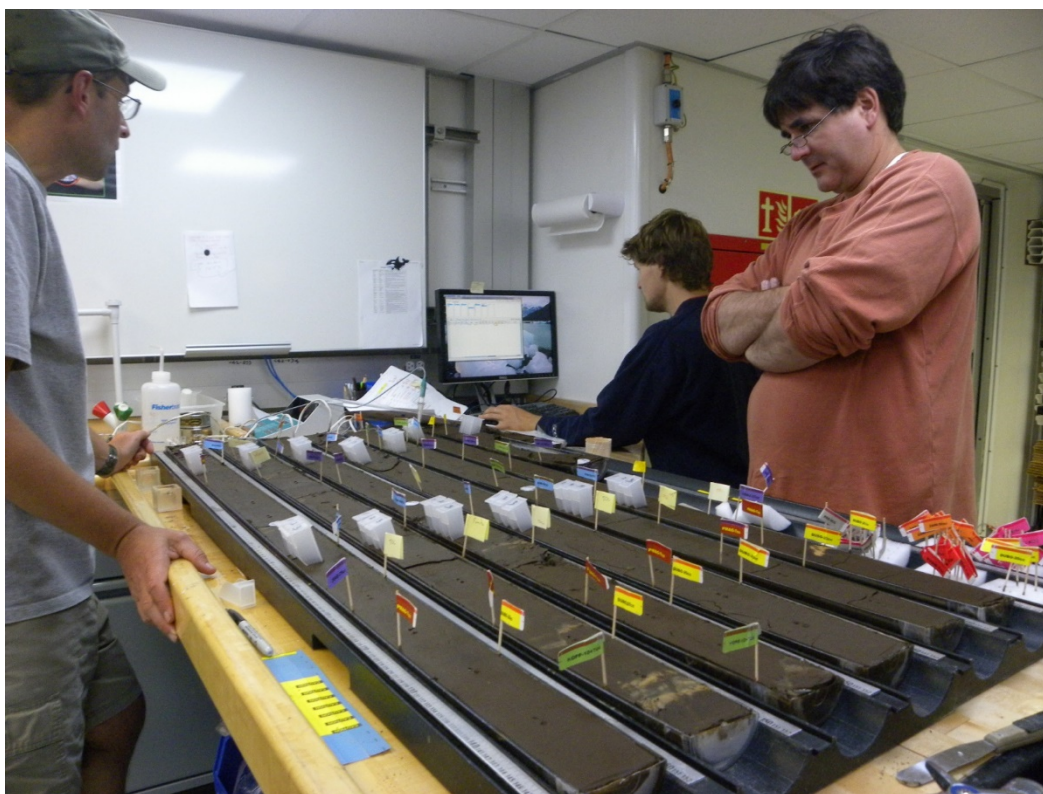


Figure 12. Sample table. Sampled cores flagged with codes.

Remind the scientists that no gold, platinum or other precious metal jewelry can be worn at either the sampling tables or anywhere else in the lab. This policy has the objective of reducing the potential of Rare Earth Element contamination (e.g. Iridium content at the K/T boundary). Also remind the scientists to wear gloves, as not to harm the core. Other topics to cover might include: thin sections, re-sampling, labeling d-tubes, and your hours of availability. Be sure to mention that if a request requires flagged intervals, rather than assigned intervals, the investigator needs to designate a 'buddy' on the opposite shift to look after his or her interests. Ask the photographer/imaging specialist to meet with each sample session group to collect special requests for core imaging. Every expedition has different scientific objectives, which dictate a slightly different flow/sampling strategy, so remember to stay flexible and come up with the best strategy possible, with the help of the Staff Scientists, ALOs and LO.

Set-up and supplying the core laboratory and sampling area

Before arriving at the first site, you need to be sure the sampling area is ready for the flurry of activity about to begin. In addition to restocking sampling supplies and gathering your sample tools, there are a few other tasks to take care of:

1. Label sample bins for shipboard samples. If taking personal samples on board, either label sample table bins, or create boxes to store samples before bringing down to the hold periodically.
2. Sample Code Flags (“Dots”) are used on the core material to identify samples. There are labels that have already been printed from previous expeditions in the label drawer (at the core entry station), and blank labels in multiple colors. Additional blank labels can be found down in UTS.
 - a) If personal samples are being taken, or more shipboard sample types than different color dots, make individualized patterns with request codes or tests.
 - i. Find previously made designs in past expedition folders, which are Adobe Illustrator files (“DOT labels”). Basic templates can also be found on the Wiki page, and in your shipboard curator template folder.
 - ii. Once the design is finalized, print to the core lab printer, selecting “4x6” for paper size.
 - iii. Walk to the core lab printer, and open the hatch on the right hand side of the printer, and adjust the tray to the label sheet. It will automatically take the paper.
 - iv. If the designs are a little off, that is okay (or if they are very off center, go back to the Illustrator file and adjust accordingly).
3. Place the coded flags in the wooden flag tray located in the Curatorial Supply Cabinet in the Core Laboratory. Set the flags in the block on the sampling table or place them at the base of the TV. For the routine samples it is helpful to put colored dots containing sample codes on the core material (See Figure 12 and 13).



Figure 13. Sample dots used for hard rock core material.

Core Laboratory supply locations

Here is general list of core laboratory supplies and their location on the ship (Table 2). Please remember to check out all supplies on the inventory checkout sheets located in each storage area.

DESCRIPTION TABLE SUPPLIES	LOCATION*
10% HCl	CHEM LAB
Desk supplies: pens, rulers, etc...	UTS
Glad Wrap cut into thirds (for AMST)	UTS
Glass sample vials with snap lids (16mL & 8mL)	UTS
Gloves (for those w/ jewelry)	UTS
Miscellaneous glassware	UTS
Mounting media (Norland Optical Adhesive)	HRS
Nalgene bottles	UTS
Smear slides, coverslips & labels	UTS
Toothpicks	UTS
GENERAL CORE LAB SUPPLIES	LOCATION
Kimwipes	UTS

Kleenex	UTS
Paper towels	UTS
PHOTO AREA SUPPLIES	LOCATION
Bucket	UTS
Core box staples	HS
Core boxes	UTS
d-tubes	HRS
Filament tape	HRS
Polyethylene tape	HS
d-tube end caps (red)	HS
Permanent markers (red)	UTS
Shrink wrap	HRS
Utility knives	UTS
CORE RACK SUPPLIES AT SAMPLE TABLE	LOCATION
Bucket	UTS
d-tube end caps (black)	HRS
Permanent markers (black)	UTS
Core box staples	HS
Core boxes	UTS
d-tubes	HRS
Filament tape	HRS
Foam sponges	HRS
Polyethylene tape	HRS
Utility knives	UTS
SAMPLING TABLE SUPPLIES	LOCATION
10cc scoops	UTPS
5 and 10 cc sample tubes	UTPS
5-10cc ethafoam sample plugs	UTPS
Ethafoam rods	UTPS
Kapak bags	UTS
Pop-top vials	UTPS
Sample bags	UTS
*LOCATION KEY	
HRS - HOLD REFRIGERATOR STORES	UTPS – UPPER TWEEN PALLET STORES
UTS - UPPER TWEEN STORE ROOM	BDC – BRIDGE DECK CONTAINER

Table 2. List of core supplies and their location on the ship

Reference Tables

Reference tables are also useful at the sampling station. In particular, help the samplers to locate a list of conversions (length to volume), sampling tools, sampling guidelines, and a summary of the Sample Distribution Policy. If personal samples are being taken on board, the sampling-watch schedule and a list of sample codes/request names should also be posted for quick reference. There should also be a list of everyone's summarized sample request that has been approved, along with a checklist of what samples need to be taken and at what frequency. Templates for this can be found in the shipboard curator template folder, or in past expedition folders on the server.

Sample Table Supplies

You are responsible for keeping the sample table area sufficiently supplied during the expedition (Figure 14). Supplies can be obtained from Upper Tween, and Hold stores, and Hold Refrigerator ("reefer"). Please remember to check out all supplies on the checkout sheets located in each storage area. The checkout sheets are located on the same deck where the corresponding supplies are stored. At the end of every expedition, return all materials back to their original bins, and clean out the sample table bins for the oncoming curator. Every expedition has different sampling needs, so the bins will be arranged to accommodate these needs at the start of every expedition.



Figure 14. The storage area for sample supplies is located in blue plastic bins underneath the sample table.

The bins under the sample table should be stocked with:

- 5 and 10cc tubes and scoops
- 5 and 10cc foam plugs
- pop top vials
- sample bags
- foam rods (more located behind the core entry table)
- other supplies as labeled

The core rack area and drawers under core section entry station should be stocked with:

- "Kapak" bags (for frozen/organic samples)
- black d-tube end caps (in bins)
- black permanent markers
- core boxes
- d-tubes
- Ethafoam rod
- filament tape
- polyethylene tape
- sample bags
- shrink wrap
- utility knives
- "Ziploc" bags
- office supplies
- black ball point pens
- permanent felt tip markers
- "Avery" colored dot labels (for easy identification of igneous/metamorphic rock, critical boundary cores, critical material, dropped cores, and hard rock sampling parties; see Section on Core Storage System/ Labeling D-Tubes).
- hard rock labeling supplies (including red/blue grease pencils, epoxy, mixing sticks, Brady thermal adhesive labels and ribbons, and glass scribes)

The curatorial supply drawers, located in the core splitting room, beneath the rock saws, should be stocked with:

- sampling tools (spatulas, hammers, and chisels)
- extra utility knives
- Epoxy supplies: Epoxy, applicator tips, Epoxy guns, wood sticks
- Extra hook blades and wire for core splitter

Stock both the core entry and sampling computer stations with bar code labels and ribbon.

Description Table Supplies

The technicians working in the core laboratory (including the Curatorial Specialist) are jointly responsible for maintaining the description table supplies (Figure 15).



Figure 15. Description Table

The core description area should be supplied with:

- glass slides
- toothpicks
- mounting media (typically Norland Optical Adhesive - for ultraviolet curing- but sometimes Canada Balsam, Permunt and Piccolyte)
- coverslips
- smear slide cases, smear slide labels
- glass sample vials with snap lids
- miscellaneous glassware
- Visual Description Forms (the scientists will usually know which ones they need; if not, ask the Staff Scientist)
- Desk supplies: pens, pencils, Liquid Paper, rulers, etc.
- “Glad Wrap” cut into thirds for the AMST. Note: based on geochemical testing it was determined that “Glad Wrap” brand is the only IODP acceptable brand of plastic wrap that can come in contact with the surface of the cores.

Catwalk Supplies

The marine technicians, among them the Curatorial Specialist, are jointly responsible for maintaining the stock of catwalk supplies. These include:

- 4" stainless steel spatulas
- acetone in red squirt bottles (with “acetone” label)
- china markers for hard rock and marking liners on wet days
- chisel and mallet for harder sediment and hard rock
- clean, absorbent rags
- clear, blue, and yellow endcaps
- cutters (for core liners) with good blades
- hammer, hacksaw, plunger at core catcher bench
- hearing protection (bin by catwalk entry door)
- liner puncture tool
- air drill to drill liner when recover gassy sediments
- wooden meter sticks (cut to 149cm)
- nitrile gloves, various sizes (bin by catwalk entry door)
- permanent red and black markers
- safety glasses (bin by catwalk entry door)

As a curatorial specialist, you should be especially aware that these supplies must be clean. Meter sticks should be trimmed slightly short (149cm) to yield 150 cm core sections. Rusty tools should be cleaned or replaced - a small amount of rust can ruin core material for paleomagnetism and geochemistry studies.

The chemistry specialists provide their own supplies for taking headspace and vacutainer samples. Work with the chemistry laboratory specialists before reaching the first site to make sure this is organized and sorted out. Interstitial water (IW) samples require no special supplies besides yellow end-caps. You should work with the shipboard scientists to maintain required supply for any special catwalk sampling.

Sampling plans

Pre-Cruise Sampling Plan

The Pre-Cruise Sampling Plan (PCSP) is typically a spreadsheet (Excel) that is assembled by the Staff Scientist with input from the curatorial staff if needed. Before leaving for sea, you should receive an electronic version of this document. This PCSP will be your primary resource to post a well-assembled subsequent Site Sampling Plans in the laboratory. In the early stages of the cruise, the PCSP is a dynamic document that can quickly change based on the resolutions of the scientist’s sampling meetings. Make notes of these changes for incorporating them into your posted sample plans.

If you do not receive an electronic copy of this plan with your sample request package, ask the Staff Scientist for a copy. This document should include:

- Request number and request part
- Request name

Site Sampling Plans

On soft sediment expeditions, in addition to the cruise sample plan, you might also want to prepare a Site Sampling Plan (Table 4). This document maps requested sample intervals or lithologies at a given site.

Name	Description	Sample type	Sample Tool	Length	Vol (cc)	Frequency	Special handling/Storage	R
Bourlange	Clay	QRND	SCOOP	3	20-30	3cm long – Clustered with IW, MAD, XRD samples.	Wrapped in plastic film, vacuum sealed. Refrigerated	
Childress	turbidite deposit (0-100 m)	WDGE	clean metal spatula and wrapped in foil before packaging; stored cold	2	10	in a single turbidite deposit, three samples: (1)from the fine, (2)medium, and (3)coarsest intervals of the deposit (~0-100m)	3 samples; stored cold -20C	
Childress	Mass transport deposit (110-210 m)	WDGE		2	10	every ~25m (four samples distributed throughout deposit) (~110-210m)	4 samples; stored cold -20C	
Childress	fine-grained interval (210-510 m)	WDGE		2	10	fine-grained interval samples; ~evenly distributed (~210-510m)	3 samples; stored cold -20C	
Clennell	Sediment (intact sediments avoiding heterogeneities)	CUBE	CUBE_L	2	8	5 m to TD at 1 per core	pmag cube, parafilm, small sponge in bag, refrigerated	
Crouch	sediment- fine grained, organic-rich	CYL	TUBE (2)	3	20	one per core in Neogene		
Crundwell	Calcareous ooze or mudstone (0-30 Ma)	CYL	TUBE (3)	5	30	mid-section; 1 per section plus mudline		
Epstein	turbidites	WDGE	SCOOP	2	10	~0-700 mbsf at 50 m interval	loose material okay	
Epstein	Miocene pelagic sequence	WDGE	SCOOP	2	10	25 m interval		
Fagereng	Main lithologies	TSB/SLAB/QRND	SPATULA/SAW	3	10	range of rock types w/ representative fabrics/discrete structures	oriented and intact	
Georgiopoulou	sandy intervals >5cm thick starting below the sand and finishing above it	CYL	TUBE	1	5	5 representative sands from Ruatoria MTD		
Georgiopoulou	thinly bedded sands and clays or thinly bedded silts and clays	U-CHANNEL		40-50	450	1 u-channel from low resistivity interval		
Greve/Li/Petronotis	Undisturbed lithologies	CUBE/CYL	CUBE/SAW/MINCORE	2	7	2-3 per section (as needed) Oriented samples	intact, oriented, cube unless stated otherwise	
Harris	Sediment	SPCM	SPATULA	3	20	dependent on ThermCon		
Hashimoto	Turbidites (clay if no coarser material)	QRND	SPATULA	5	40	Every 100 m		
Ketzer	sediment carbonates when present (concretions)	QRND/WDGE	SCOOP/SPATULA			carbonate concretions whenever present		
Kutterolf	Tephra layers and pods	WDGE/CYL	SCOOP/TUBE	2	10	all		
Kutterolf	Tephra layers >5 cm	WDGE/CYL	SCOOP/TUBE	3	20	all >5 cm		
Kutterolf	Fine sediment	WDGE/CYL	SCOOP/TUBE	3	20	2 per core		

Table 4. Example of Site Sampling Plan

The Site Sampling Plan is the basis for the plan posted at the sample table.

A number of variables, such as type of drilling, type of request, and purpose of request, should be considered when plotting the sample intervals on your sampling plan. The type of drilling determines the degree of disturbance in the core, constraining the amount of core usable by certain investigations. In hydraulic piston coring (APC) for example, the top 30-40 cm of the core is often disturbed, precluding this interval of core for paleomagnetic or physical properties sampling. Rotary or extended core barrel (XCB) drilling commonly yields disturbances from drilling artifacts, known as biscuits, which often are surrounded by churned up sediment, or slurry. In these types of cores, the ideal sample interval is a location of least disturbance, usually found in the more consolidated material.

There are important considerations about routine samples. When choosing sample intervals, remember that routine IW whole rounds samples normally eliminate some fraction of the core (usually the bottom 5-15cm of sections). For the remaining routine samples, first check with the shipboard scientists if any of the investigations requires samples at or near the same interval. Secondly, some investigators may be seeking high resolution samples, and may require sampling intervals spread evenly throughout the core. A typical example would be fulfilling three nannofossil requests, each requiring 2 cc per section. Plotting these samples at or near the same

interval would duplicate the results of the three investigators. Separating the samples at approximately equal distance across the section, say at 40 cm, 90 cm and 150 cm might give the desired resolution. Similar interval selection may be appropriate for routine samples as for inorganic carbon or other paleontology investigations.

The plan should be shared among the scientific party and Staff Scientist for comments or corrections. Before arriving on site, the final plan should be simplified and posted on the whiteboard next to the sample table.

The posted sampling plan (Table 5) is the streamlined sampling guide for the scientific party during their individual two-hour sampling shifts.

1520D Sample Requests										
SHIPBOARD										
Name	Description	Frequency	Type	Tool Name	Volume (cc)	Test	Comment			
CARB	Shipboard Analysis	2+ per core	CYL	TUBE_5	5	CARB	Cluster next to all WR			
MAD	Shipboard Analysis	2 per section	CYL	SYRINGE	10	MAD	1 next to all WRs. Enter Mud or Sand in SampleMaster 'Comment' section.			
PMAG	Shipboard Analysis	As needed	CUBE	CUBE_L	7	PMAG				
TSB	Shipboard Analysis	As needed	TSB	SAW_ROCK	10	TSB				
XRD	Shipboard Analysis	2+ per core	XRD	TUBE_5	5	XRD	Cluster next to all WR			
PERSONAL										
Name	Description	Sample type	Sample Tool	Length	Vol (cc)	Frequency	Special handling/Storage	Request Code	Request Number	Name
Bourlange	Clay	QRND	SCOOP	3	20-30	3cm long - Clustered with IW, MAD, XRD samples.	Wrapped in plastic film, vacuum sealed. Refrigerated.	BOUR	53493IODP	BOUR
Childress	turbidite deposit (0-100 m)	WDGE	clean metal spatula and wrapped in foil before packaging; stored cold	2	10	in a single turbidite deposit, three samples: (1)from the fine, (2)medium, and (3)coarsest intervals of the deposit (~0-100m)	3 samples; stored cold -20C	CHIL	60330IODP	CHIL
Childress	Mass transport deposit (110-210 m)	WDGE		2	10	every ~25m (four samples distributed throughout deposit) (~110-210m)	4 samples; stored cold -20C	CHIL	60330IODP	CHIL
Childress	fine-grained interval (210-510 m)	WDGE		2	10	fine-grained interval samples; evenly distributed (~210-510m)	3 samples; stored cold -20C	CHIL	60330IODP	CHIL
Clennell	Sediment (intact sediments avoiding heterogeneities)	CUBE	CUBE_L	2	8	5 m to TD at 1 per core	pmag cube, parafilm, small sponge in bag, refrigerated	CLEN	53191IODP	CLEN
Crouch	sediment- fine grained, organic-rich	CYL	TUBE (2)	3	20	one per core in Neogene		CROU	53356IODP	CROU
Crundwell	Calcareous ooze or mudstone (0-30 Ma)	CYL	TUBE (3)	5	30	mid-section; 1 per section plus mudline		CRUN	52930IODP	CRUN
Epstein	turbidites	WDGE	SCOOP	2	10	~0-700 mbsf at 50 m interval	loose material okay	EPST	53243IODP	EPST
Epstein	Miocene pelagic sequence	WDGE	SCOOP	2	10	25 m interval		EPST	53243IODP	EPST
Fagereng	Main lithologies	TSB/SLAB/QRND	SPATULA/SAW	3	10	range of rock types w/ representative fabrics/discrete structures	oriented and intact	FAGE	52905IODP	FAGE
Georgiopoulou	sandy intervals >5cm thick starting below the sand and finishing above it	CYL	TUBE	1	5	5 representative sands from Ruatoria MTD		GEOR	52898IODP	GEOR
Georgiopoulou	thinly bedded sands and clays or thinly bedded silts and clays	U-CHANNEL		40-50	450	1 u-channel from low resistivity interval		GEOR	52898IODP	GEOR
Greve/J/Petronotis	Undisturbed lithologies	CUBE/CYL	CUBE/SAW/MINICORE	2	7	2-3 per section (as needed) Oriented samples	intact, oriented, cube unless stated otherwise	GREV	53246IODP	GREV
Harris	Sediment	SPCM	SPATULA	3	20	dependent on ThemCon		HARR	53795IODP	HARR
Hashimoto	Turbidites (clay if no coarser material)	QRND	SPATULA	5	40	Every 100 m		HASH	53029IODP	HASH
Ketzer	sediment carbonates when present (concretions)	QRND/WDGE	SCOOP/SPATULA			carbonate concretions whenever present		KETZ	53455IODP	KETZ
Kutterolf	Tephra layers and pods	WDGE/CYL	SCOOP/TUBE	2	10	all		KUTT	52883IODP	KUTT
Kutterolf	Tephra layers >5 cm	WDGE/CYL	SCOOP/TUBE	3	20	all >5 cm		KUTT	52883IODP	KUTT
Kutterolf	Fine sediment	WDGE/CYL	SCOOP/TUBE	3	20	2 per core		KUTT	52883IODP	KUTT

Table 5. Example of Whiteboard spreadsheet *.xls file

A few points to keep in mind when making the sampling plan are:

Emphasize that all written changes on the whiteboard should only be made by the Curatorial Specialist, Staff Scientist or ALO when the curatorial specialist is off-shift only if absolutely essential.

If the desired change is small (e.g. increase sample volume from 5cc in calcareous material to 10cc in siliceous material) the investigator can verbalize the request to the specialist. In case of significant changes (e.g. unexpected occurrence of porcellanite leads investigator to request all such occurrences) the investigator must submit a written statement to the Co-Chief Scientists for approval.

Make sure that the scientists have representatives who look after their sampling requests on all shifts. If you make any changes to the sample table plan be sure they are very noticeable because people have a tendency to memorize the plan and may not look too closely from day to day.

Special handling requests should also be noted on the sample table plan (e.g. Kapak bags for organic geochemistry, double bagging and refrigeration of samples).

When creating a plan, divide it into sections:

- a) Routine Samples: Samples that the watch crew can take easily (e.g. assigned intervals at a constant volume).
- b) Flagged Samples: This type of sample can be based on lithology (calcareous vs. siliceous, organic rich, ash layers, contacts, etc.); structure (e.g. microfaults); or age dependent (e.g. Maastrichtian – Campanian). In the case of age dependent samples, because age is determined by paleontologists through the analysis of the “PAL” core catcher sample; it is helpful to flag the beginning and end of samples that are age dependent.
- c) Using a checklist such as the one below can help scientists and staff ensure that all samples are taken at correct intervals, or shifted if needed.

U1518 (HSM-15A) Sampling Plan															
SAMPLE(S) IN EVERY CORE															
SAMPLES AS NEEDED															
SAMPLES IF PRESENT															
IMMEDIATELY AFTER SPLITTING (DON'T TOUCH CORE):															
Savage	Sediments (every 30 m)	SAVA	53284IODP		top depth:	351.2	360.8	370.4	380	389.6	399.2	408.8	418.4	428	437.6
Clennel	sediment (every 30 m)	CLEN	53173IODP		Core:	18	19	20	21	22	23	24	25	26	27
THEN:															
MAD	Shipboard Analysis			MAD											
STRUCTURE DESCRIBES CORE															
Sample 1st: Cluster Samples															
XRD	Shipboard Analysis			XRD											
Underwood	Mud	UNDE	52545IODP												
CARB	Shipboard Analysis			CARB											
Sample Next:															
Greve	Background lithology	GREV	53246IODP												
PMAG	Shipboard Analysis			PMAG											
Kutterolf	Tephra layers and pods	KUTT	52883IODP	KUTT2											
Kutterolf	Tephra layers >5 cm	KUTT	52883IODP	KUTT2											
Kutterolf	Volcaniclastic, tuffaceous sandstones	KUTT	52883IODP	KUTT3											
Kutterolf	Fine sediment	KUTT	52883IODP	KUTT											
REST OF SAMPLING:															
SHIPBOARD															
Tests	Description	Code	Request Number	Name											
TSB	Shipboard Analysis			TSB											
PERSONAL															
Investigator	Description	Request Code	Request #	Name											
Bourlange	clay	BOUR	53493IODP												
Cook	sand or coarse silt sediment from intervals between 300-320 mbsf, 350-430 mbsf, 490-540 mbsf (next to HEES)	COOK	53139IODP												
Crundwell	Calcareous ooze or mudstone (0-30 Ma)	CRUN	52930IODP												
Fagereng	Faults, foliated rocks	FAGE	52905IODP												
Fulton	Background lithology	FULT	53606IODP												
Harris	Sediment chips	HARR	53795IODP												
Hashimoto	turbidites	HASH	53029IODP												
Heeschen	sandy sediment (next to COOK)	HEES	53329IODP												
Ito	Representative lithology and fault material	ITO1	52794IODP												
Ketzer	sediment carbonates when present (concretions)	KETZ	53455IODP												
Malie	"coal" sample	MALI	52946IODP												
Marsaglia	sand/sandstone and gravel/conglomerate (including volcaniclastic deposits)	MARS	52995IODP												
Meneghini	discrete samples	MEN1	52805IODP	MEN1											
Meneghini	Host rock with veins	MEN2	53081IODP	MEN2											
Morgan	prefer cohesive sediment	MORG	53422IODP												
Morgan	Cohesive sediment, discrete structures	MORG	53422IODP												
Noda	Sand/sandstone and gravel/conglomerate (including volcaniclastic deposits)	NODA	52663IODP												
Noda	Mud/mudstone, mass transport deposit	NODA	52663IODP												
de Oliveira	sand	OLIV	52107IODP												
Paganoni	hydrate bearing sediments	PAGA	52297IODP												
Shreedharan	Representative lithology	SHRE	52024IODP												
Torres	carbonates	TORR	52783IODP												
Torres	Slime	TORR	52783IODP												

Table 6. Example of sample table checklist.

Chemistry Laboratory Sampling Plan

Before reaching the first site, meet with the Chemistry Marine Laboratory Specialists to discuss the sampling plan for the expedition. Provide the chemistry technicians with copies of each request associated with the chemistry laboratory and with a list of sample codes to be used in Sample Master during the expedition:

IW	Interstitial water sample
IWS	interstitial water - shipboard
IWICP	interstitial water - shipboard icp
IWALK	interstitial water – shipboard alkalinity residue
SC	iw sediment squeeze cake
IW(CODE)	interstitial water personal samples
SC(CODE)	sediment squeeze cake personal samples

Verify that chemistry technicians know how to use the Sample Master application, and help them if they have questions or problems. Scientists request personal samples from the routine IW samples as well as other materials recovered by special tools. These personal samples should be assigned a hybrid code that consists of: the first two letters 'IW', followed by either the scientists sample code (ex. KAST) with a number to distinguish between multiple samples (IWKAST1, IWKAST2); or by the analysis the sample will be used for (IWS for sulfur or sulfide, IWDOC for DOC, IWFE for iron, etc.).

Also, verify that chemistry technicians are aware of curatorial policies and procedures regarding IW whole rounds, Head Space (HS) gas samples, and carbonate (CARB) sampling. Chemistry techs and scientists who have sailed before will be able to suggest the most sensible procedures to the Curatorial Specialist and the scientific party. It is also important to work with the chemistry technician and shipboard chemists how to split IW pore waters for shipboard analysis and personal sampling. Keep in mind that you are responsible for ensuring that current sample policy is followed.

On-site

Core recovery - catwalk

With the call of the first "CORE ON DECK!" you assume your primary duties as Curatorial Specialist. During the cruise it is your responsibility to ensure that every core is handled according to IODP policy and procedure. Although the marine technicians generally receive, measure, section and cap the cores, your participation in catwalk activities will facilitate the proper handling and labeling of the cores. Pay special attention to unusual core conditions such as voids, poor recovery, or expansion in cores.

IODP Core Naming

IODP has a specific convention to name cores, data and samples. The name follows this identity array: expedition number, site number, hole, letter, core number, core type, section number, which half (working or archive). Here is an example for a core: **203-U1243B-6R-5 W**

346 U1425B 2H 1 A

346 U1425B 2H 1 W

A



SHLF5039951

W



SHLF5039941

Figure 16. Examples of archive and working half section labels

Core Types

The following is a list of all the valid core types and their code. In bold are the most commonly used types:

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
G	Ghost cores, re-drilled intervals
F	½ APC Core
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)

Table 7. List of Core type nomenclatures

Designating Permanent and Non-permanent archives

Each core section gets split into two halves: the working half and archive half. There are two types of archive halves: permanent and temporary. Permanent archives cannot be sampled until 5 years post-expedition, and then only with CAB (Curatorial Advisory Board) approval.

Temporary archives can be sampled like working halves once the permanent archive has been set (i.e. archive halves from multiple-hole sites). On the ship, no archive halves are sampled (except for whole-rounds and non-destructive sampling), as the splice and permanent archives still need to be refined and defined, respectively. There needs to be a complete set of permanent archive halves from the top to the bottom of a site.

Additional points:

- Extra copies of sediment archives (e.g., of important features) can be designated as permanent by the SAC.
- All (single or multiple cored) igneous, metamorphic, and metalliferous rocks are permanent.
- Whole round samples are an exception to the restriction on sampling permanent archives.

No Splice

When there is only a single hole at a site, the entire archive half is permanent archive. When a site has multiple holes, and there is an overlap of core material, the permanent archive can be a combination of archive halves across holes (Figure 17).

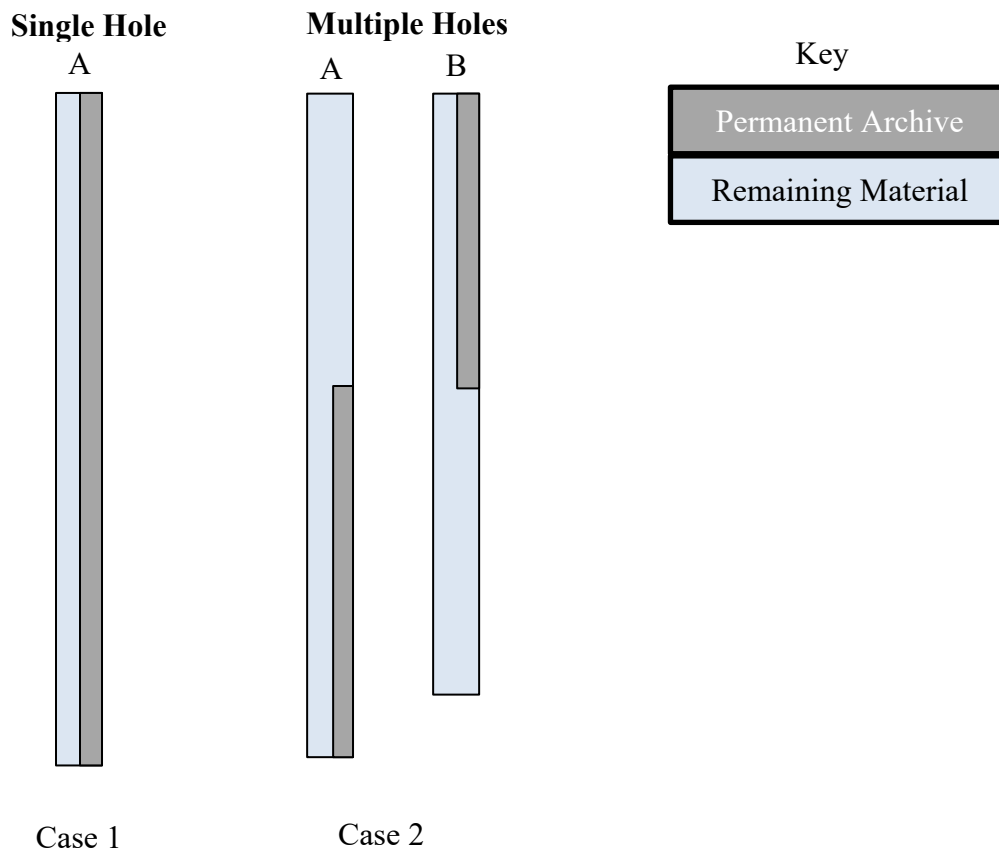


Figure 17. The entire half of the core is designated as permanent when a single core is recovered (Case 1). A combination of holes is used as a permanent archive when there is more than one hole per site (Case 2).

Splice

Some expeditions (especially paleoceanographic ones) core multiple holes over the same depth at a site in order to retrieve multiple copies for high-resolution sampling. In this case, a splice will be created from top to bottom of the site, determined by the stratigraphic correlators. A splice is created to ensure that there are no gaps from top to bottom of a site, if possible. There needs to be one set of permanent archives from top to bottom of the site (Figure 18). This will be assigned by the GCR curator after an expedition based on the splice/remaining material. An

“alternate splice” can also be designated if there are at least two complete “copies” of the splice. The remaining material outside of the splice is deemed “off-splice”.

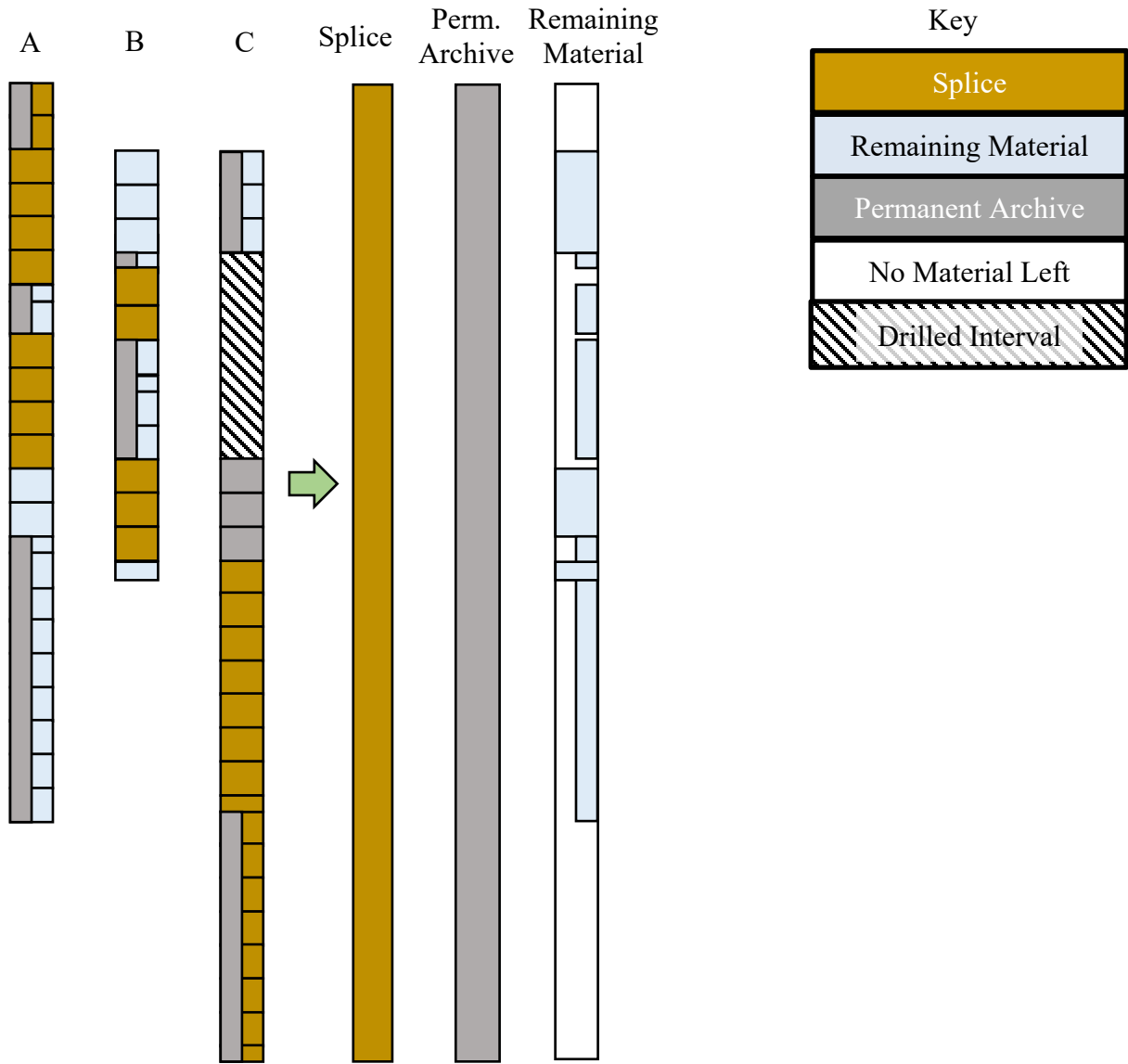


Figure 18. An example of multiple holes/cores at a given site. There is at least one set of either working or archive halves in the splice, one set of permanent archive halves, and remaining material off-splice.

Considerations with Permanent Archives and splices

The permanent archive is designated by section, which will cause overlap when converting from CCSF to CSF-A depth scales. This can possibly cause more sections to be designated as permanent archives than anticipated (i.e. the archive halves of the splice/an alternate splice might not be available at all depths). If the working half is depleted in a region that was only recovered by one hole, there will be no additional material for sampling in these cases.

Core handling

After the liner is removed from the core barrel (Figure 19) and received by the technicians (Figure 20), the liner is placed on the catwalk holders (Figure 21) with the double line or working half side up. The liner is temporarily capped at both ends to prevent sediment from falling out during the initial handling stages.



Figure 19. Removing liner from core barrel

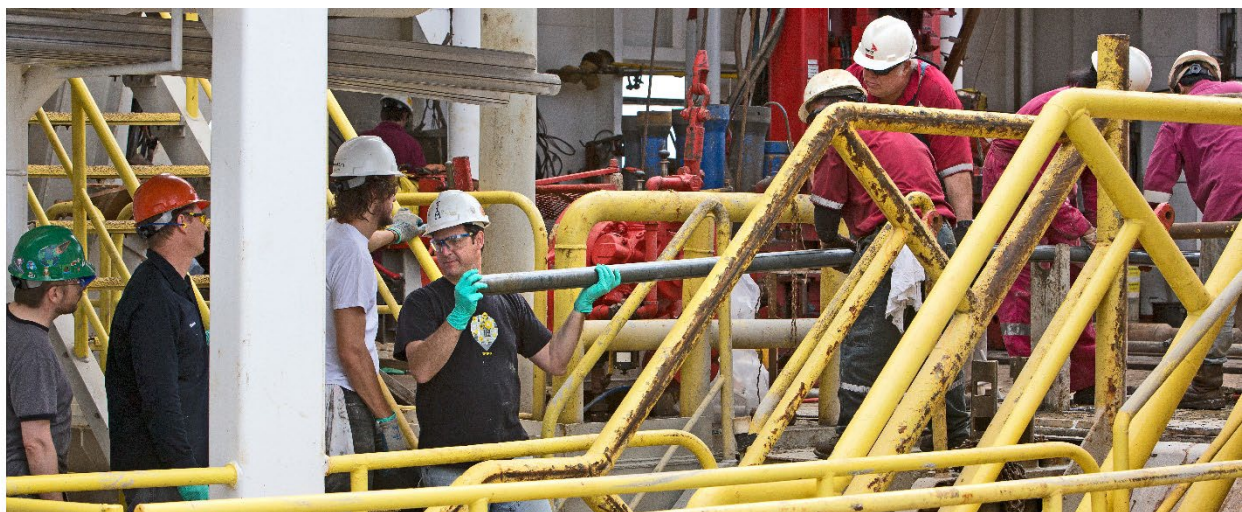


Figure 20. Receiving core in the catwalk after it was removed from barrel

Full core barrels are usually 9.5 meters long. The consecutive cores taken from a single hole are numbered sequentially from top to bottom. In the same way, each core is divided in sections. This is done in the catwalk by the curator. The curator marks each core diving it in six sections

of (ideally) 150 cm, a seventh section that is usually shorter, and a core catcher. These marks made in red (Figure 21) are coincident to the places where the liner should be sectioned later.



Figure 21. Marking liner at each 1.5 meters of core.

Recovery of material in the full capacity of the core barrel (9.5 meters) is considered 100% recovery. The length of the recovered material however, may differ from the length of the core barrel interval. Recovery less than the cored interval may occur as well as an apparent greater recovery. The last occurs because of gaseous expansion of the sediment.

In this way, when full recovery is obtained, the core sections are numbered from 1 to 7. The last two sections (6 and 7) are usually shorter than 1.5 meters. When sampling hard rock, material recovered in the core catcher is included as the bottom of the core and therefore, the bottom of the last section. On the other hand, when coring sediments, the core catcher sample is extruded and placed in a short piece of plastic liner, and is treated as a separate section below the last core section.

When sediment recovery is less than 100%, whether or not the recovered material is contiguous, the recovered sediment is placed at the top of the cored interval and then 1.5 meter sections are numbered sequentially, starting with section 1. Sections are cut starting at the top of the recovered sediment and the last section may be shorter than the normal 1.5 meter length (Figure 22). To measure sections properly on the new Natural Gamma Ray (NGR) machine, the last two sections of the core must be greater than 50 centimeters.

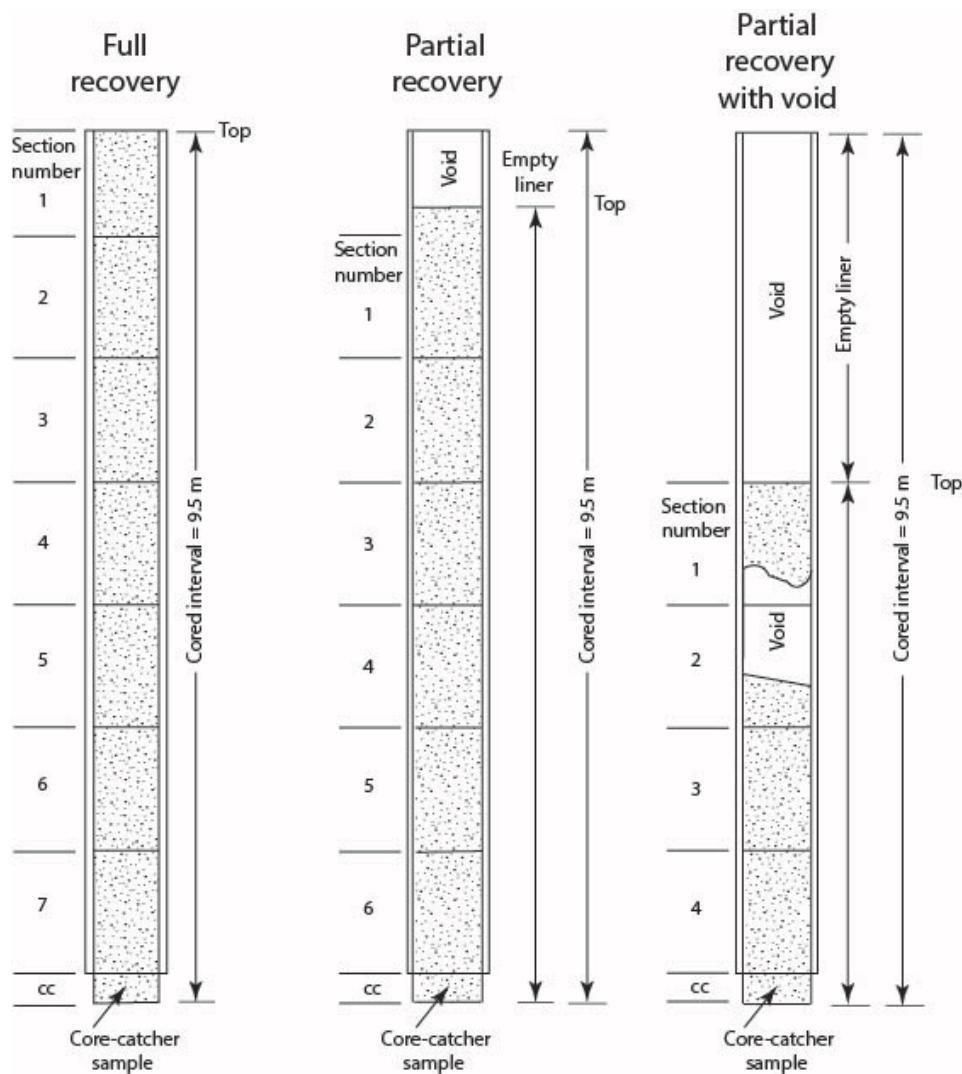


Figure 22. Core recovery

Next, the Curator and the technician measure and label the ends of each section with number of the core, the core type, number of sections and an arrow pointing 'up' (towards the top of the section). Whole-rounds (i.e. IWs) should be marked during this time as well (if possible). Also, whole round samples are marked on the liner with an asterisk (*) above where the sample is taken.

The liner is cut at the section breaks with a circular cutting tool (Figure 23) and the material belonging to each section is well separated with a spatula. If the material is well lithified a hacksaw (or hammer) and chisel is used to section the core. The next step is to take samples in the whole round sections (or “catwalk samples”, see next section). Once the whole round, headspace and any other samples that could be affected by acetone 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/gray end caps at the bottom. In case that a whole round sample was

taken in a particular section, a yellow end cap it is placed at the bottom instead of the clear cap. The asterisk helps technicians recognize where to put yellow end caps. Once labeled, sectioned and capped, the core is taken to the Core Lab for processing.



Figure 23. Circular cutting tool.

Voids

Cores may contain void spaces, typically because of gas expansion. If voids are forming because of gas expansion, first allow the Chemistry Laboratory Specialist to take a vacutainer sample, and then puncture the liner along the cut-line between sections with air-powered drill to vent the gas. Close the voids. This can be done in two ways: a) while the core is still in whole round, cut the void liner sections out. Empty sections does not need to be preserved (preferred) or b) While the core is still in whole round, punch a hole in the liner at the void and push the pieces of sediment together with a plunger stick, avoiding compaction of the core. Closing a void should only be done when it can be accomplished without harming the core. If the core is being damaged, simply cut the void liner section out or gently push the pieces back together after the core has been split. Closing of voids in lithified sediments and in igneous and metamorphic rocks is done routinely and does not have to be noted in Sample Master.

If you know that a void is caused by a gas hydrate (crystalline water-based solid that physically resemble ice) or a washed out sand layer, it should not be closed.

Expansion

If there is evidence that core sediment is expanding on the catwalk, puncture the length of the liner ideally on the split line using the air powered drill (Figure 24). Allow the core to degas. Be sure that the drill holes are not made in a straight line because the liner may crack or shatter explosively along these lines, deteriorating the integrity of the liner. As always, be sure everyone is wearing safety glasses when handling expanding cores (Figure 25).



Figure 24. Drilling holes in liner



Figure 25. Face mask with mud

While dealing with expansive cores, delay measuring and cutting of the cores sections as long as possible to allow degasification. Additionally, you can slit or puncture or simply delay the placement of end caps of the sections the core is ready to be split. Electrical tape can always be used to secure caps and extenders temporarily, to allow for further expansion before splitting. Resting time eliminates the need of handling excess of material that expands beyond the cut section lengths. The delay time varies depending of gas content and the core recovery rate.

If these steps are not possible because of catwalk sampling, or if the core continues expanding, then sections may also be cut shorter than the standard 150 cm length (140 cm should be sufficient). Attach pre-made ~15cm liner patch extenders with acetoned end caps to the bottom or top of the liner to accommodate the excess of sediment, creating a 150 cm or less section

length. **Note:** the end cap may be fastened securely to the **INSIDE** of the liner patch with the aid of a small slit in the side of the end cap. Handling expansive cores in this way avoids ending up with over-sized sections. In case of that more expansion needs to occur, keep the patch loosely on the core without acetone until the sections are ready to be split, using electrical tape. Once ready to split, the electrical tape can be removed, the patch can be permanently acetoned and sonic welded in place. If the length of a section changes due to expansion, the curated length should be updated in Sample Master and depths recalculated.

If, after the core is curated on the catwalk, the Core Technician brings you a piece of cored sediment found in the pipe, find out its specific location, create a new section and make the appropriate changes in Sample Master and on the whiteboard. Be sure to notify the rig floor of the new recovery number.

If the sediment does not expand on the catwalk but does so after the core is brought into the Core Laboratory or after splitting, do the following:

1. Acetone or weld a liner patch to the split core at either end of the sections. The end cap may be fastened securely to the **INSIDE** of the liner patch with the aid of a small slit in the side of the end cap. The cap can be acetoned and sonic welded on. Be sure to change the curated length of that section in the section entry application.
2. Since d-tubes can only contain a section of up to 155 cm, further expansion of the core implies the creation of additional sections or of sub-sections. Subsections should be created dividing section into two pieces of roughly 75 to 80 cm. Label the sub-sections as A and B. Number them as one section. The curated length in the Sample Master will be the sum of the two sub-sections lengths. Store sub-sections in individual d-tubes. Make sure that the number of sections created match in the archive and working halves. Put stickers on the d-tube caps to denote this as well, and put comments in Sample Master.

If sediment oozes out of the top of a core before it is cut into sections on the catwalk, section 1 should begin at the top of this overflow material.

Place a “caution” sticker on the end cap of expansive cores using the words “expanding”.

Desiccation

Some recovered shales begin to disintegrate as soon as they dry. To slow the process, ask the scientists to keep them covered with Glad Wrap while they are working in description of the samples. When they are ready to put in d-tubes, it’s always helpful if they are shrink-wrapped. Also, these cores should not be exposed to strong, direct light, since this will hasten the drying process.

Split Liners

Cores are often recovered with split, shattered or crushed liners (Figure 26). Depending upon the severity of the damage, the liner may need to be taped, liner patched, or material transferred to another liner. In anticipation of this situation, Marine Specialists can prepare a supply of split and capped liners to replace damaged liners.

Patching or transferring material is done after sectioning, and should preserve the original orientation of the whole round core. Extract cores from damaged liner carefully because they are very sharp.

If liner patch is used to repair a damaged liner, it should be cut to just short of the liner's end, to allow an end cap to fit on. Patch may be secured in place with acetone or with the sonic welder. Remember that cores fitted with liner patch sometimes cannot be run through the whole round tracks. Shattered liner cores are generally not desirable for whole core measurements, so inform the Physical Properties scientist about your intentions to liner patch the core. They may not want to run the core if there is liner patch.



Figure 26. Example of a shattered liner

After the damaged liner is repaired, it may be labeled and engraved in the usual manner. Remember to put “Caution” stickers on damaged cores with a brief description of the damage and procedures. Also, include these notes in the Sample Master.

To stay consistent with the terminology for broken core liner, we suggest the following phrases be entered into Sample Master to describe the damage:

- Cracked liner=one line down the core. I've often used "split liner", but as we use that term for the physical split liners, maybe this would be better.
- Shattered liner=broken liner repaired by a piece of liner patch.
- Shattered liner, full liner=broken liner repaired by a whole piece of liner patch.
- Imploded liner=when the core liner is compressed or folded into itself
- Extruded on rig floor=when core has to be extruded out of the core barrel into a split liner.
- Extruded to new liner=when core has to be removed from an irreparably shattered liner into a split liner.

Critical Intervals

Critical intervals are special guidelines to handle and sample cores. Important stratigraphic boundaries, structural phenomena, key macrofossils, rare volcanic glass are examples of this category. Specific examples are:

- Cretaceous/Tertiary boundary (K/T boundary)
- Paleocene/Maastrichtian
- Eocene Impact (NP21)
- volcanic glass
- Cenomanian/Turonian Boundary Event (CTBE)
- Mediterranean Messinian/Tortonian boundary
- Oligocene/Miocene
- Eocene/Oligocene boundary
- Late Paleocene Thermal Maximum (LPTM also called the PETM)
- sediment/basement interface
- salt cores
- sulfides
- sapropels
- evaporites (anhydrites, halite, gypsum)
- soil horizons

A science party can ask that sections be treated with special storage and handling care for events not listed above (i.e. oceanic anoxic events), within reason. If an interval is deemed 'critical', it is prudent to exclude all personal sampling 3 meters above and below its boundaries. There should

also be a discussion with the SAC for the best measures to preserve the core (using oxygen scrubbers, flushing with nitrogen, shrink wrapping etc). Stickers should be placed on these sections to ensure proper handling and sampling. Selected shipboard sampling, as approved by the Co-Chiefs, should take place to define the nature and limits of the interval. Sampling of the critical interval can either take place later in the cruise or may be deferred to shore. On shore, investigators will have sufficient time to assess their sampling needs, and to work out cooperative studies to maximize the science gained from this unusual material. For additional information about critical intervals, see the IODP Sample Distribution Policy.

Cores containing Hydrogen Sulfide

Hydrogen sulfide (H₂S) gas may be found in cores in which microbial sulfate reduction is occurring or in cores from hydrothermal vent areas in which seawater sulfate has reacted with high-temperature intrusions. H₂S is a highly reactive, toxic gas, which is normally at negligible concentrations by rapid reaction with iron or other metals present in the sediment.

In some cases, however, cores are taken from iron-deficient carbonate sediments or areas with presence of gas hydrates or sulfate-rich brines. In these cores, H₂S concentrations may be sufficient to cause a toxic gas breathing hazard, especially when cores are being handled in confined or poorly ventilated areas. If you smell H₂S gas, alert the Laboratory Officer or Assistant Laboratory Officer. He/she will ask you to monitor the cores with a handheld H₂S gas detector (Figure 27). The drill crew on the rig floor should also be measuring the gas with handheld detectors. The detectors will have alarm levels preset by the Lab Officer and the detector should be worn by the user at waist level.



Figure 27. Handheld H₂S gas detector



Figure 28. H2S fixed H2S monitor

The JOIDES Resolution is equipped with permanently mounted H₂S sensors on the rig floor, the core-receiving platform, and in the interior core-handling areas (Figure 28). H₂S levels that are above safety standards should activate audible and visual alarms. H₂S odor is only apparent at low levels, however sensors or analytical instruments can detect all levels. If H₂S presence is suspected, the hydrocarbon monitoring techniques should include analysis by thermal conductivity detector gas chromatography (NGA) to provide concentrations values in cores.

Operating Procedure in Core Laboratory for H₂S Alert

Official procedures for responding to an H₂S alert are fully described in ODP Technical Note 33 (<http://www-odp.tamu.edu/publications/tnotes/tn33/INDEX.HTM>).

After receiving a core on the catwalk, the first section cut should be monitored with the handheld H₂S detector (Figure 27). If the H₂S level is over 10ppm, all core-handling personnel (microbiologists and geochemists included) should use self-contained breathing apparatus (SCBA, Figure 29 and Figure 30). Non-essential personnel should stay clear of the catwalk. If time permits, the core should de-gas on the core holder on the catwalk for a period (~20-30 min) before capping and scribing. When the core is ready to section, turn on the large hanging catwalk fan to disperse the gas as cuts are made. The outside core rack should be set up on the aft end of the catwalk so the cores are downwind of the living quarters as they de-gas. All scribing should be done outside. Core should remain outside until splitting takes place.



Figure 29. Self-contained breathing apparatus



Figure 30. Drill crew with SCBA

When a core is ready to be split, the Marine Lab Specialist should wear a SCBA in the splitting room (Figure 31), cut the section and immediately place it under a split piece of rubber ducting (1.5m long) that feeds into the H₂S suction system. Letting the core sit under the ducting for about 10 minutes should yield acceptable H₂S readings. The core can then be safely given to the scientists in the laboratory.



Figure 31. H₂S core splitting

The fact that cores with H₂S are stored in an unventilated and confined space in the refrigerator can make for a potentially dangerous situation. Be sure that the H₂S monitors are working properly whenever operating under an H₂S alert. If you have any concerns, bring them the attention of the Laboratory Officer as soon as possible.

Slowing Oxidation in Sulfide-Rich Cores

1. Allow time (up to a few hours) for the core to degas on the catwalk. Also allow time for the sections to degas after splitting, until you can no longer detect H₂S with the portable monitor.
2. Place the wrapped section in a silver tri-laminate Kapak foil tubes. These bags have a polyethylene inner layer and a polyester outer layer. Normal shrink wrap is too permeable on its own, but there may be acceptable alternatives, including materials used for storing MBIO cores.
3. Place desiccant in the Kapak tube if desired. Note: the need for prepackaged desiccant should be identified and ordered pre-cruise by the Staff Scientist or shore-based Curator.
4. Purge Kapak foil tube with nitrogen gas to expel all oxygen.
5. Evacuate the tube and heat seal with a high-temperature hand held heat sealer.

6. Place in cold storage immediately. Place a purple dot on the d-tube to indicate H₂S-bearing cores.
7. The bag should be an extra 5-10 cm longer than the section so that it may be sealed at the outer edge, and re-opened and re-sealed several times without bag replacement.

Handling Radium-Bearing Rocks

The Staff Scientist, Curator, and Laboratory Officer should be aware pre-cruise that there is a possibility of recovering radioactive samples, especially when drilling in hydrothermal vent areas. Proper handling procedures should be discussed and necessary precautions should be in place before actually recovering this type of material. If you have any concerns about preparedness after reading the Scientific Prospectus, contact the Staff Scientist, Curator, and/or Officer with your concerns. The following is the procedure for handling possible radioactive materials (USGS - Francis, 1991):

Identify the samples that contain the radioactive material with a survey instrument.

All samples identified as being radioactive should be sealed in plastic bags and marked with "*Caution! Radioactive Materials*". During this operation, personnel should wear plastic or rubber gloves.

These samples should be kept separate from other samples to avoid contaminating non-radioactive samples.

In the entrance to the laboratory it should be posted: "*Caution! Radioactive Materials--No Eating, Smoking, or Drinking Allowed--Wash Hands Before Leaving*".

Allow the built up radon to escape opening the samples in a well-ventilated area before any work is to be done with the samples. Samples should only be manipulated remotely, i.e. gloves and tongs.

Any operation that requires cutting or grinding of these samples should be reviewed on a case-by-case basis. All cutting operations should be conducted in water to ensure that no dust is generated from the material. Wash the sampling area carefully after handling the cores. On the shore, any wastewater generated from these activities must be disposed in accordance with Nuclear Regulatory Commission (NRC) requirements for radioactive waste.

Catwalk sampling of whole rounds

In addition to the usual hard rock/soft rock sample requests, biologists and chemists take real-time 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 have finished taking their samples. All samples taken on the catwalk should be entered into Sample Master.

Paleontology Samples (PAL)

A small amount of core-catcher material is removed immediately on the catwalk and taken to the paleontology laboratory for age determination. Generally a 5 cm whole round is sufficient, but in case of the presence of non-fossiliferous material a greater volume may be required. This sample typically comes from the bottom of the core catcher but scientists may request the most suitable material from the top or middle of the core catcher. The PAL sample produces multiple types of residues, including untouched material if they didn't need to use the whole sample, sieved material, slides, etc. See the "residues" section for more details on how to handle residues.

After the PAL sample is taken, the core catcher is placed in plastic liner, capped and glued with acetone, and labeled with red marker. The location of the PAL sample is marked on the outside of the liner with permanent marker if not from the bottom. Back in the laboratory, this sample should be recorded as a sample code PAL in Sample Master. After splitting the CC, an ethafoam spacer marked with the text "PAL" is inserted into the void (Figure 32).



Figure 32. Example of Paleontology spacer in a split core

Head Space/Gas Analyses (HS, VAC)

The Shipboard Chemist or Chemistry Technician will take at least one 5 cc sample for analysis of composition and concentration of hydrocarbons. A headspace (HS) sample is required every 9.5 meters for safety. The only time a HS sample will not be taken is if a) half-length piston cores are being used, so the HS only needs to be taken every other core, b) if the interval has been drilled and analyzed in a previous hole, or c) if the science party has concluded that drilling has reached basement (i.e. true igneous rock; however, scientists are welcome to request headspace samples in basement). Other hydrocarbon samples could include, if present, free gas samples (“VAC” or Vacutainer Samples). These samples are immediately analyzed to determine if it is safe to continue drilling. More information on organic chemistry can be found here: http://www-odp.tamu.edu/publications/tnotes/tn30/TNOTE_30.PDF

HS samples are taken from the top or bottom of a freshly cut section, usually adjacent to the interstitial water whole round sample (Figure 33) and depending on the condition and lithology of the core. The pencil-size cylinder used for headspace sampling removes material from the working half of the core. In the case of lithified sediments, scrapings or chips are sampled. The code used for these samples is HS in the Sample Master system. The curatorial specialist (or ALO if curator is off-shift) enter these samples after the core comes off of the catwalk.



Figure 33. Example of Headspace gas sampling (HS)

When gassy voids are present, the chemist may need to take free gas samples using a puncture tool and a vacutainer (Figure 34). Shipboard scientists may take as many vacutainer gas samples as desired for immediate or later analysis. Documentation is not required; however, the location of each sample can be entered in the Sample Master system with the code VAC.



Figure 34. Free sampling with vacutainer (VAC)

Interstitial Water Samples (IW)

Interstitial water for geochemical analysis (IW) are taken from the whole round samples removed on the catwalk (Figure 35). In softer sediments at the top of a borehole, IW samples are generally 5 cm long (176cc). The size and frequency of the sample may change as the sediment becomes more lithified with depth. The SAC and the Chemistry Techs work together to devise an IW sampling plan that best meets the needs of the shipboard science party. The IW sample will be recorded at the core entry computer via Sample Master



Figure 35. Example of cutting an IW sample

Whole round sampling is often suspended when core recovery is less than two sections. Although there is not an official limiting amount of whole-round sampling, the co-chiefs and staff scientist along with the Curator define appropriate limits on whole round sampling to safeguard the scientific interests of the cruise. Marine Laboratory Specialists should always get the Curator's authorization (or his/her representative) before cutting IW samples.

After the whole round and chemistry samples are removed from the catwalk, the remaining core is capped and glued with acetone. Blue endcaps 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 laboratory for processing.

Meanwhile, the chemistry technician collects the interstitial water squeezing the IW whole rounds (Figure 36 and 37). Water derived from the whole round is used for shipboard analyses and sample requests. While there is no official limit on the amount of water that can be given to an investigator, most studies can obtain results using 10 ml or less. Water not apportioned for shipboard analyses or sample requests is archived in sealed glass ampoules or plastic tubing. Water remaining after the shipboard alkalinity analysis is also archived. The squeeze cake, retrieved from the press when the squeezing is over, is also preserved, often distributed among the chemists as part of their sample request. The Chemistry Technicians sort and label the IW subsamples, and enter the appropriate data into LIMS.



Figure 36. Process of scraping from side, putting the pressure vessel and attaching the syringes for posterior squeezing of samples to take the interstitial water from them.

Additional Catwalk Samples

There are many different types of samples that can be taken on the catwalk or before the core is split.

Gas Hydrates

Gas hydrate are ice-like solids in which water molecules trap gas molecules in structure that resemble a cage known as a clathrate (Figure 37 and 38).



Figure 37 and 38. Clathrate Examples

The location of a clathrate sample in a whole core can often be detected with the use of an infrared camera (Figure 39).



Figure 39. Infrared Camera for detecting clathrates

Use the following sample codes for gas hydrates:

HYD Hydrate WRND sample taken on catwalk
HYD ____ Sub-sample to investigator

Sampling Gas Hydrates

- 1) Gas hydrate sampling procedure:
 - a. Use the infrared imaging camera and scanned the whole core for cold spots as soon as the core was laid down in the racks and before any other processing started (no pictures need to be taken unless requested).
 - b. If a gas hydrate sample is identified, label and cut immediately.
 - i. Label the GH WRND with a black marker and also include Site/Hole/Core#
 - ii. On the bag and its string/tie label Site/Hole/Core# and the corresponding letter (ex.A) of the GH.
 - iii. Wrap the GH sample with foil and put it in the bag then place it inside the dewar
 - b. Place sample in the liquid nitrogen dewar (LN2) immediately.



Figure 40. Press to squeeze interstitial water

Physical Properties Whole Rounds

Physical Properties whole rounds need to retain moisture. They are either taken on the catwalk when the cores come up, or taken after the cores are run through the tracks. Best practices to store whole rounds are:

- 1) Print two labels. Affix one sample label to the whole round itself. Tape the label with d-tube tape.
- 2) Cut a piece of Mylar/silver “wine” bag that is large enough to fit the whole round and a wet blue sponge (or half of a sponge), and that has room left to seal.
- 3) To seal the bag, use the handheld crimper, as the normal sample bag sealers will not properly seal these bags.
 - a. It will take about 20 minutes for the crimper to heat up, so plug in ahead of time.
- 4) Seal the bag twice, with seals on opposite corners, and overlapping in a cross-hatch fashion (see figure below).
- 5) Place the other sample label on the outside of the bag, and cover it with a piece of d-tube tape.
- 6) Bring down to the reefer immediately.

Core handling in the laboratory

Inside the Core Laboratory, the marine technicians bring the core sections from the catwalk to the laser engraver. The technician labels the blue end cap with the core and section numbers (Figure 41 and 42). The sections are then laser engraved on the working (double line) and archive (single line) sides of the liner with the standard IODP identifier following the sequence: "EXPEDITION-SITE-HOLE-CORE-CORETYPE-SECTION" (e.g. 180-1108A-1H-1, W) (Figure 41). This ensures that each section is permanently and uniquely distinguished.

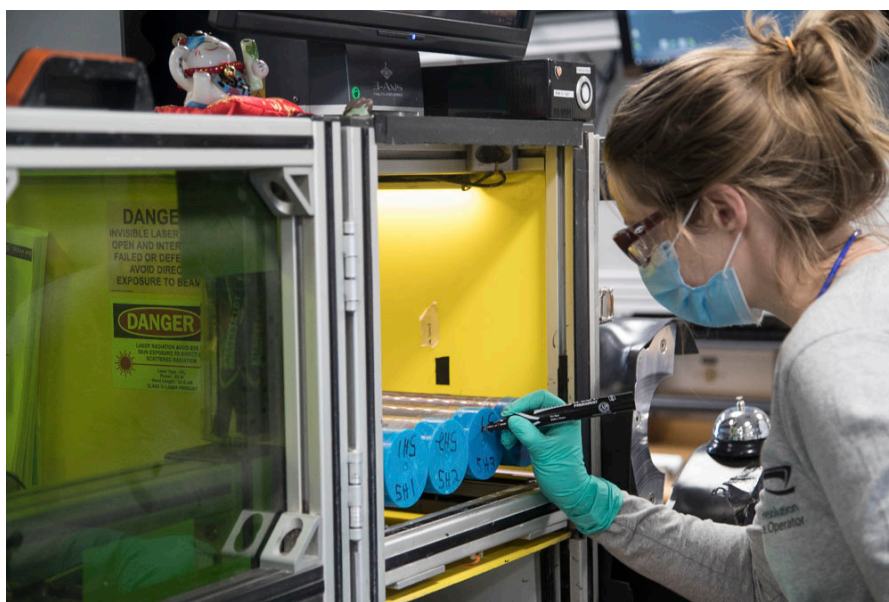


Figure 41. Labeling the endcaps while the sections are in the laser engraver

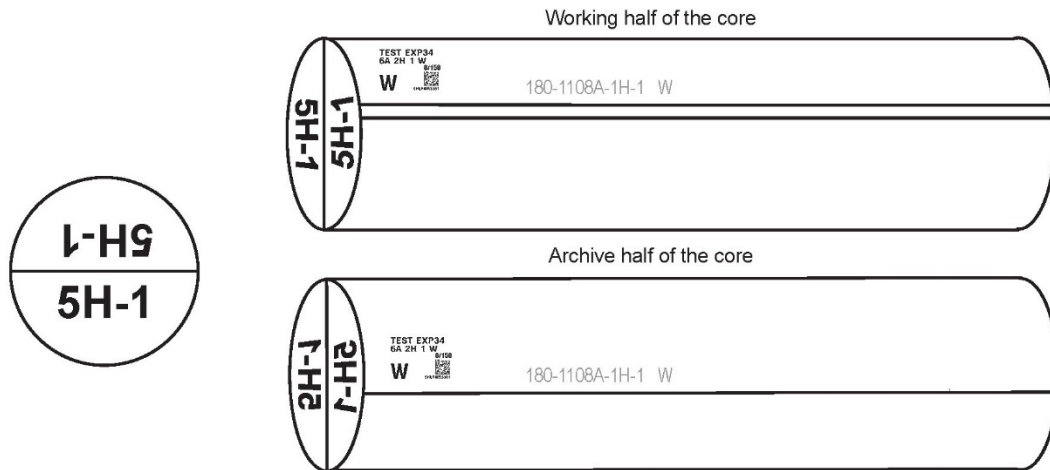


Figure 42. Sketch of an engraved core. The half core with double lines is assigned as the working half. The single line corresponds to the archive half

After the labels are placed, the Curator enters the data into the Sample Master system. Sample Master generates 3 copies of the 2D bar code label for each section. Two labels will be used for the d-tube and end cap. The third is placed directly on the liner. Working half labels are placed on the side with double lines, while archive half labels are placed on the single line 180 degrees from the double line.

Once properly labeled and recorded, the sections are left in the rack to reach room temperature before they are measured on the Whole Round Multi-Sensor Logger (WRMSL) (Figure 43) and measured for thermal conductivity (Figure 44).



Figure 43. WRMSL Multisensor track

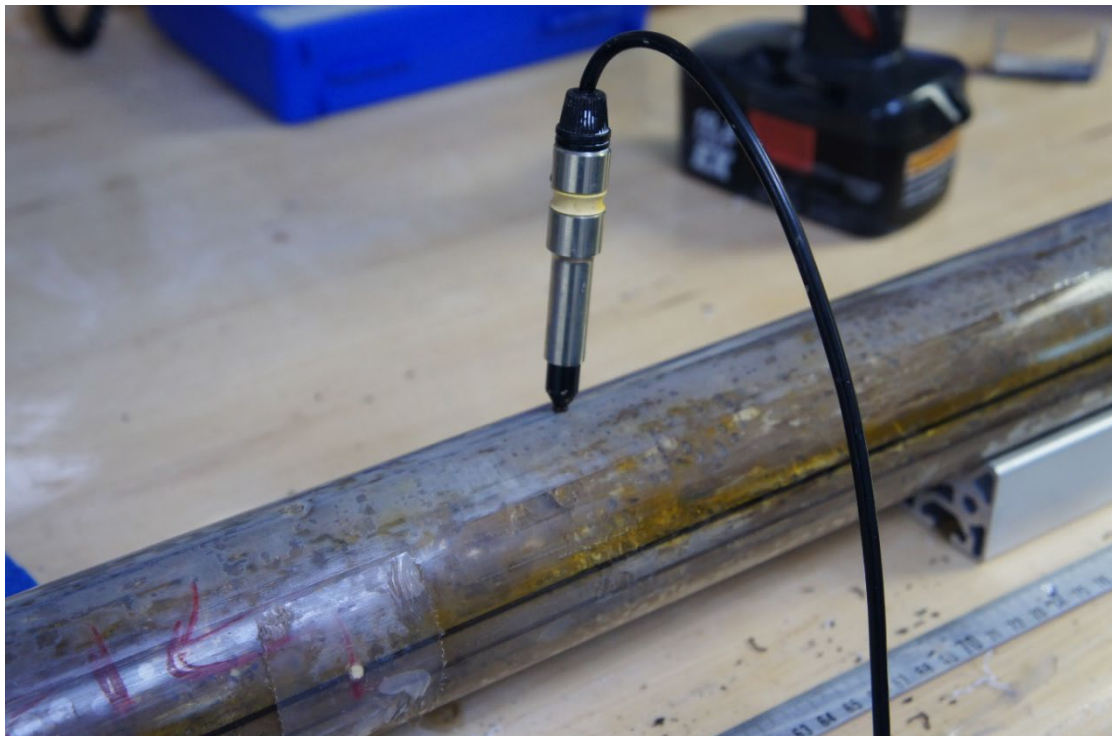


Figure 44. Thermal Conductivity Measurement

Rhizon Sampling

Rhizon sampling for pore waters have become more common since 2009. Rhizon samplers extract small volumes of pore water from sediment cores without removing entire whole round pieces of core material (i.e. traditional whole round IW sampling). Rhizon sampling is performed on whole sections before they are split, and can be done. Rhizon sampling can affect whole-round measurements, so be sure to confirm the order of operations in the lab with the SAC before core comes up if you will be doing Rhizon sampling. Sometimes holes are pre-drilled in the end caps so the Rhizon sampler can be inserted in the bottom of the section. Another method used is drilling holes down along the split line at desired intervals and offsets (Figure 45).



Figure 45. Example of scientist collecting IW through rhizon sampling.

Splitting the core

After whole round measurements have been made and all data uploaded, the sections are transferred to the splitting room. **Note: It is very important that you check that all whole round data is uploaded into LIMS before splitting the core.** (If for some reason this was not done, the halves can held together with electrical tape, and Glad Wrap placed between both sections. Cut the Glad Wrap so it does not get stuck in the whole-round tracks.)

Sections are split longitudinally from the bottom of the section to the top using the core splitter with either the wire (for soft sediments) or the supersaw (for lithified material). Delineation follows an axis halfway between the double line and the single line scribed on the liner. Splitting

of soft and lithified sediment cores is done from bottom to top of the stratigraphic sequence 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, pieces with younger fossils could be moved downward contaminating older age material.

For APC/soft cores, use the wire set-up. Two hook blades are fixed on either side of the core, and the wire is bolted down in between. Use the joystick to puncture the core liner and drag the wire through the core. In case of extra soft or sticky cores, drag the wire twice or use the cheese cutter that is usually stored in above the splitting table over the sink. A squirt bottle containing DI water is also used when splitting sticky core material. One technician squirts DI water between the two section halves while the other gently pries the sediment apart with spatulas. The wire can often break and will have to be replaced by unscrewing the bolts and replacing the wire.

For XCB/RCB/harder material, the supersaw will be used. These cores will have melted plastic on the edges of the section. Cut the sharp plastic off with a box cutter containing a hook blade for safe handling and to ensure good quality photographs and digital images. Super-sawed sections are gently rinsed and, if lithified enough, wiped with a blue sponge to remove the cutting slurry before leaving the splitting room.

See the “Core Splitter User Guide” on Confluence to change mechanisms or to troubleshoot if necessary.

Archive Half

The archive half of the core is placed on the description table in the Core Laboratory. The sedimentologists describe the core in detail, using Munsel color charts, making smear slides and examining them under a microscope. The sedimentologists also run the sections through the Section Half Image Logger (SHIL, Figure 46 and Figure 47) and Section Half Multi-Sensor Logger (SHMSL). The Paleomagnetists will pick up archive halves, one at a time, to run through the Cryogenic Magnetometer.

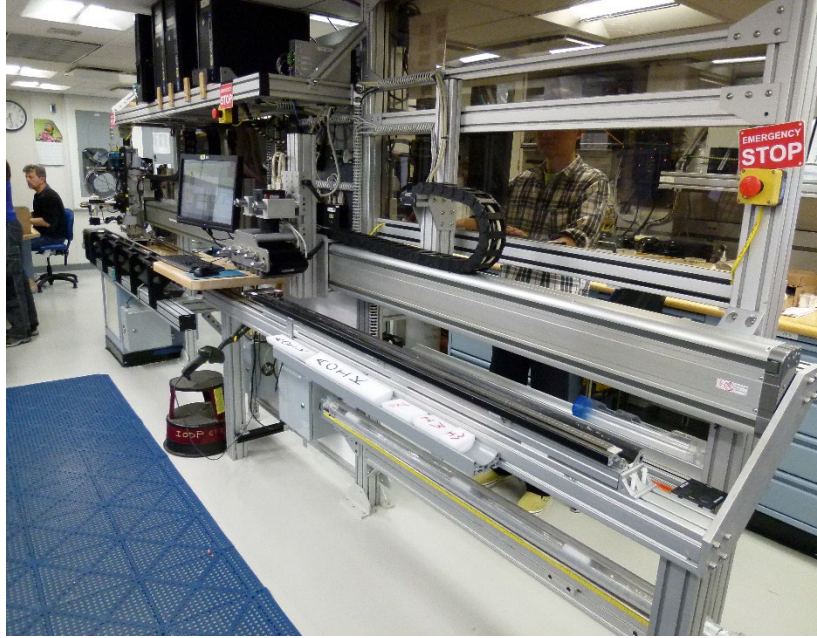


Figure 46. Section Half Imaging Logger (SHIL)

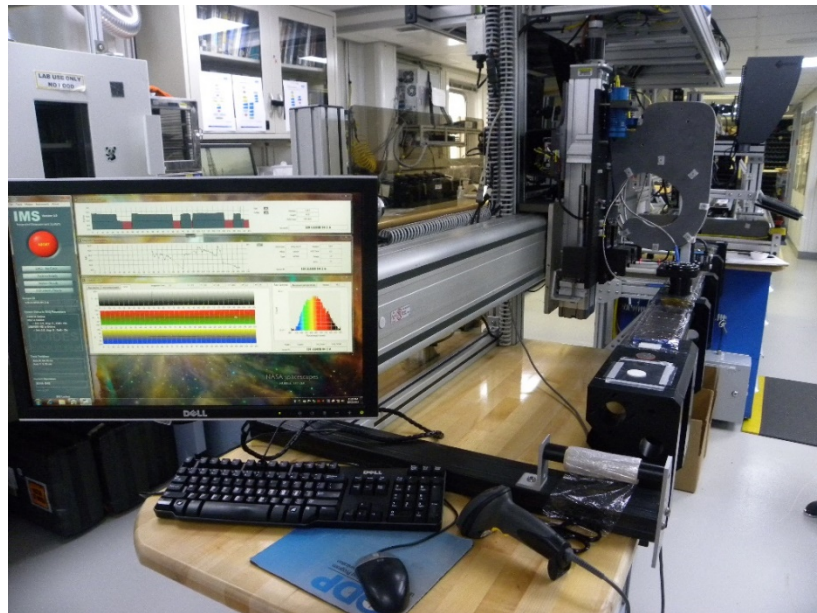


Figure 47. Section Half Multi Sensor Logger (SHMSL)

After finalizing the measurements made in the Cryogenic Magnetometer, the archive halves are placed in d-tubes and put in the archive core rack. The technicians will check if a request of a close-up photo exists. Sections with close-up requests are marked with a yellow dot on the end cap. The section stays in the laboratory until all the close-ups are completed by the photographer. When you are sure the scientists finished all descriptions (including structural with

often lag behind lithology descriptions) and analyses, you can authorize boxing the cores (see section on Core Storage System).

Working Half

The working half sections are taken one by one to the sample table. A core-flow and sampling strategy will have to be established before sampling begins. Physical Properties (Gantry) measurements are also made on the working half, in addition to samples coming out (Figures 48 and 49). These are generally not too destructive, but the bayonets can leave large holes in soft sediment. It is important that PP scientists are made aware of this, and to be as delicate as possible. Because of this, and the specific objectives of every expedition, these measurements might be deferred or lowered in frequency due to their impact on the core or samples. Typically, these measurements are made first. Then PP samples and PMAG cubes are sampled first, as these are more sensitive to drying out or disturbance from taking other samples. Again, this core flow is different for every expedition and should be decided on before the first core is split. Once the core is sampled, the scientists will put the cores in d-tubes and place them in the working half rack. These sections need to be wrapped in Glad Wrap before placing them in the d-tube. This will mostly be done by the scientists, but the technicians can help when available. The Curator supervises sampling activities during his/her shift, but during off-hours, it's very helpful to have one or two experienced technicians (preferably the Assistant Laboratory Officer) to check actions at the sample table.



Figure 48. Sonic velocity and Shear strength instrumentation (Gantry)



Figure 49. Syringes used to sample for moisture and density. Next to them are the properties beakers

Sampling guidelines

Before describing in detail sampling procedures and techniques here are a few useful reference tables.

Sample Volume

According to the Sample Distribution Policy, the following are typical sample volumes by sample types:

Sample Type	Volume/Length
Thin-section billets (TSB)	Standard: 10 cm ³
Thin-section billets (TSB)	Oversized: 50 cm ³ (for large-grained plutonic rocks)
Alkenone (Uk37)	5 cm ³
X-ray diffraction (XRD)	5 cm ³
ICP	1-5 cm ³
Carbonate (CARB)	2 cm ³

Paleomagnetism (PMAG) – cubes	7 cm ³
Paleomagnetism (PMAG) – minicores	12 cm ³
Paleomagnetism (PMAG)- U-channels	600 cm ³
Moisture and density (MADC)	10 cm ³
Grain size	10–20 cm ³ (depending upon coarseness)
Planktonic foraminifers (FORAMP)	10-20 cm ³
Benthic foraminifers (FORAMB)	10-20 cm ³
Nannofossils (NANNO)	2 cm ³
Diatoms (DIAT)	5-10 cm ³
Radiolarians (RAD)	10 cm ³
Palynology (PALY)	10-30 cm ³
Organic samples	20 cm ³
Interstitial pore waters whole rounds (IW)	5–20 cm long (based on water content)
Inorganic geochemistry	10 cm ³
Organic geochemistry	10 cm ³
Sedimentology (SED)	10-20 cm ³
Slabs (for laminae studies)	25-50 cm ³ (depending on s lab length)
Slabs (large grained plutonic rocks)	50-100 cm ³ (often shared by scientists for multiple analyses)
Stable isotopes (C, O)	10-20 cm ³

Table 8. Samples types and their respective volumes

Sampling Tools

The tools and procedures that help the Curatorial Specialist sample efficiently are:

Tool	Volume/Size	Comment	Material
sample tubes, small*	2-5cc tube	A single punch fills the tube halfway (~3 cc) and a second punch fills it (~5cc). The interval between samples is given by how the first and second punch are arranged when inserted: Horizontal side by side = 1cm, Vertical side by side = 2 cm.	soupy or consolidated sediment
sample tubes, large*	10 cc tube	A single punch fills the tube halfway (~10 cc), a second punch fills it (~20 cc). The intervals are given by the size of the sample: 10 cc sample = 2 cm, 20 cc sample = 5cm	soupy or consolidated sediment
plastic scoops**	5 cc and 10cc **	Small scoops are useful when trying to preserve 2/3 of the core for later high-resolution sampling. Note that there is some contamination on the edges of these samples.	soupy or consolidated sediment
stainless steel scoops***	20 cc, 40 cc, 100cc	The larger metal scoops are sturdy and can be used for organic geochemistry sampling when the use of plastic is not desirable. They can also be gently pushed or hammered into semi-lithified sediment instead of using a hammer and chisel	soupy or consolidated sediment; can be used in semi-lithified sediment also.
plastic sample cubes, standard	2" x 2" x 2" (same in all dimensions, AKA "French" cube) -	<p>The bottom of the pmag cubes are pre-drilled and pre-marked with directional arrows. The standard IODP cube volume is somewhere between 6-7cc but is recorded in LIMS as 7cc. The cube is placed open side down, with arrow pointing to the top of the core. It is then pressed on with both thumbs, applying equal pressure across its surface. The sample is then removed from the core with spatula(s), trying not to disturb the material in the cube. Gently scrape or break the material off from the bottom of the cube with a clean spatula. Clean the cube and cap. Always place a handwritten or printed label on the cube itself and not the cover. Cover the cube. Putting the label over the hole in the lid is a good idea to slow evaporation from the sample.</p> <p>Pre-drilled and pre-marked sample cubes are also used to take fabric study samples (physical properties type samples) in soft sediment. Handle fabric study samples in the same way you handle paleomag cubes. Place cube in a sealed pop vial. Place the pop vial and a moistened sponge in a 4 x 6 sample bag with a computer-generated label. Refrigerate the sample.</p>	Paleomagnetism samples and fabric studies
plastic sample	1cm x 1cm x 1cm	Generally used for sampling across magnetic transitions and for high-resolution sampling. The Paleomag MLS should prepare the plastic	paleomagnetic high resolution sampling

cubes, small		cuvettes. The cuvettes must be cut down to 1 cm cube, the burrs cleaned off, and a tiny hole drilled in the bottom. A slip of parafilm is used to seal the sample inside the cube.	
minicorer	10-12cc	In harder materials, paleomagnetists and PP scientists sometimes prefer to take minicores, cylindrical samples taken with the drill press. All drilled paleomag samples should be marked with a directional arrow before drilling. Slice off the bottom of the paleomag minicore using the rock saw. Return the slice to the core. It is not uncommon for scientists to request minicores for geochemical or petrological studies. Place all drilled samples in pop vials. Vials should be taped and have a computer generated label on the outside.	paleomagnetic (and sometimes geochemical/ petrological) samples
vertical minicores	30-50 cm ³	These are generally requested for sonic velocity measurements. It is important that the samples are cut in materials that do not contain fractures or veins. Samples should be oriented with respect to the top of the core. At times, vertical minicores can be requested from whole rounds. In this case, each sample must be pre-approved by the SAC in the same way that a PPwhole round needs the SAC approval.	paleomagnetic
parallel bladed saw	12cc	Make sure that the sample is marked with a directional arrow. In lithified sediment and basalt, sonic velocity samples are often cut on the parallel saw.	sonic velocity and paleomagnetic samples
hammer and chisel	variable	Metal hammer and chisels can be used in almost all samples. Check for each case. Always use a plastic chisel at the K/T boundary and other geochemically significant (as defined by the SAC) locations.	lithified sediment, igneous and metamorphic rock
rock saw	variable		lithified sediment, igneous and metamorphic rock

*Note for plastic tube (5 and 10cc) sampling: A ridge on the inside wall of either size sample tubes may be used to orient the sample up-core, if desired. If either tube is pushed in twice always scrape off the bottom of the sample after pushing it in the first time. This removes any contamination, which is always found next to the liner. To get away from this problem simply do not push to the liner the first time.

**Note for plastic scoop sampling: The leading edge of the scoop is set down at the interval to be sampled, oriented parallel to the length of the core. The outside, flat surface of the scoop should be facing away from the sampler. To take the sample, press straight down on the rounded handle of the scoop until it hits the bottom of the liner; then scoop it toward you until the leading edge clears the top of the liner.

*** Note for metal scoop sampling: For organic geochemistry sampling with metal scoops: without touching the sample (skin oils contaminate the sediment) transfer it to a labeled Kapak bag, and seal it in another bag to keep the el inside and protected. Then stick the bagged sample in the freezer in the core .

Table 9. Table types

LIMS Sample Types, Tests, Request Codes, and Request Numbers

When a split core is placed on the sample table it is almost ready for sampling. Before sampling can occur, all approved sample requests must have assigned a LIMS sample **Type, Test, and/or Sample Request Number/Code**. Sample **Type** is an identifying string of character in the LIMS database associated with a particular measurement. The database then automatically generates and attaches a number to the end of the Sample **Type**. The result is a **Text ID**. The **Text ID** is the unique identifier for each sample in the database.

There are two primary types of sampling: Shipboard and Personal. Shipboard samples refer to samples taken for shipboard tests (i.e. MAD for moisture and density, CARB for carbonate analysis). Personal samples refer to samples that are assigned to individual scientists. These can be assigned to them with their personal request code and number, or they could include reallocated residues (i.e. a scientist can request all MAD samples to do post-cruise analyses). If there is a post-cruise sample party scheduled, usually only ephemeral personal samples are taken, or those needed to do a pilot study. ALL samples, resolution, volume etc. must be approved by the SAC.

Shipboard Samples

Shipboard sampling should be designated by a shipboard **Test** (i.e. MAD, CARB, PMAG etc). All shipboard samples should also be accompanied by test numbers (generated by LIMS), referring to the test that were performed on them in the lab.

Personal Samples

Personal samples should have assigned **Type, Sample Request Code, and Sample Request Number**. The **Sample Request Number** is assigned by the SADR system when a scientist submits his/her sample request. Sample Request Code is linked to the LIMS Request number. It is assigned by the Shipboard Curator via the Request Code Management application. Sample code naming is often derived from the **first four letters of the primary investigators last name**. Each sample request should have at least one sample code associated with it. When an investigator has more than one sample request for the cruise or a variety of sample types for one request, individual codes should be assigned (can add a number to the end of the code, or can change the name field as well to differentiate). Often a sample request is submitted jointly by more than one investigator; despite this, choose only one sample code to be associated with that request. Finally, assign a **sample code** for samples taken for all approved shore-based requests.

Tests are permanent fixtures in the LIMS Sample tables. If a new test needs to be created, request it to the shipboard application developer. Document the laboratory code addition in your Curatorial Report. Here is a list of standard Test (laboratory) codes for shipboard analyses or routine archiving.

LIMS Type List (as defined in the LIMS database)

Type	Description
BEAD	Bead-Bead pressed from a powder
CAKE	Squeeze Cake-Solid fraction remaining after forced expulsion of interstitial fluids from a source sample; typically has the shape of a cylindrical disc
Type	Description
CFRC	Chemical Fraction-Parts of a parent sample separated chemically
CLTR	Culture-Biological material cultured in geological material
CORE	Core-Long cylindrical cores, or fist to sand-sized fractured pieces of such cores
CUBE	Cube-equidimensional prism of material
CUTS	Cuttings-Loose, coarse, unconsolidated material suspended in drilling fluid
CYL	Cylinder-Cylinders of material
GAS	Gas-Any gas
HOLE	Hole-Spot on the ground below which material is drilled out. Origin sample for most of LIMS
HRND	Half Round-Half-cylindrical products of along-axis split of a whole round. Cross-sectional radius is nominally equal to that of the parent whole round
LIQ	Liquid-Any liquid
MFRC	Mechanical Fraction-Parts of a parent sample separated mechanically
OTHR	Any
PC	Piece-Material occurring between unambiguous [as curated] breaks in recovery. (Curator note: basement/hard rock only)
PWDR	Powder fine-grained (<62 micron), dry, granular material
QRND	Quarter Round-Quarter-cylindrical products of along-axis split of a half round. Cross-sectional radius is nominally equal to that of the parent half round
SECT	Section-Arbitrarily cut segments of a "core"; if the core is < length of a typical section it becomes a section without further sampling
SHLF	Section Half-Half-cylindrical products of along-axis split of a section or its component fragments through a selected diameter. Cross-sectional radius is nominally equal to that of the parent whole round.

SLAB	Rectangular prism of material where one dimension is significantly shorter than the others
SP	Sub-Piece-Unambiguously mated portion of a larger piece noted for curatorial management of the material
SPCM	Specimen-Material of any shape or form selected for specific characteristics of interest
SS	Smear Slide-A toothpick sample suspended in liquid and fixed on slide
Type	Description
STS	Sedimentary Thin Section
TPCK	Toothpick-Minute amount of material taken for observation
TS	Thin Section. A sub-millimeter thick slice of material mounted on a glass slide
TSB	Thin Section Billet
UCHN	U Channel-Long rectangular prism of material
WDGE	Wedge-Sample form factor named for the tool used to extract it. Typically 5-20ml in volume
WRND	Whole Round-Cylindrical segments of core or core section material. Typically includes the core liner.

Table 10. LIMS Type List

LIMS Test List

Type	Description
BIO	Biostratigraphy, taken on catwalk from cuts between sections
CARB	Carbonate analysis
CELL	Abundance of microbial cells per cubic centimeter of sample based on SYBR Green 1 staining
CHNS	CHNS Analysis
CLU	Cluster
CNTMASSVOL	Container: record mass + volume
DIAT	Diatoms: sample for paleo microfossil processing and analysis
DINO	Dinoflagellates: sample for paleo microfossil processing and analysis
DML	Clay swelling tests for down-hole logging
FORAM	Foraminifera: sample for paleo microfossil processing and analysis

FORAMB	Benthic foraminifera: sample for paleo microfossil processing and analysis
FORAMP	Planktonic foraminifera: sample for paleo microfossil processing and analysis
H2	Head-space method for determining dissolved hydrogen (H2) concentration in sediment plugs
HS	Analysis of headspace gases, taken on catwalk
ICP	Inductively coupled plasma
IW	Whole round for interstitial water, taken on catwalk
LOI	Prepare sample for loss on ignition (LOI) analysis
MADA	MAD analysis version A (no PYC)
MADC	MAD analysis version C and D (PYC and MAD_MASS)
MADD	Method D analysis (cube): CALIPER, MAD_MASS and PYC analyses
MBIO	Whole round microbiology, taken on catwalk
MSPH	To be filled in per curator
NANNO	Nannofossil biostratigraphy
NOTESTS	test list used for standard creation ONLY
OSTRA	Ostracods: sample for paleo microfossil processing and analysis.
PAL	From core catcher for biostratigraphic dating,taken on catwalk
PALY	Palynology: sample for paleo microfossil processing and analysis.
PFT	Analysis of PFT gas in headspace, taken on catwalk
PMAG	Oriented sample taken for paleomagnetic analysis
PP	Whole round taken for physical properties analysis, cut from whole rounds after MSTing
RADS	Radiolarians: sample for paleo microfossil processing and analysis.
RMS	Routine microbiology sample
SCRAPE	Cut face scrapings from sections (used when material is especially critical, e.g. K/T boundary)
SED	Sedimentology Routing Code
SRA	routing code for the SRM
STRX	Oriented samples taken for structural analysis
TCH4	Refined (more quantatative) method for total dissolved and adsorbed methane in sediment plugs

TOC	Total organic carbon
TS	Thin section slides, entered by Curator after TSB is made into thin section slide
TSB	Thin section billet
VACType	Analysis of gas voids, taken on catwalk Description
VPVAC	P-wave velocity Analysis of gas voids, taken on catwalk
XRDVP	X-ray diffraction analysis P-wave velocity
XRFXRD	X-ray fluorescence analysis (XRF machine no longer on-board JOIDES Resolution) X-ray diffraction analysis
XRF	X-ray fluorescence analysis (XRF machine no longer on-board JOIDES Resolution)

Table 11. LIMS Test List

Sampling Guidelines for Sediment

Once the sampling plan is posted, the sample codes created, the core is split, it is time to take samples. Use the following as a general guide for **sampling sedimentary cores**. Improvise as needed to get the best quality samples. Note: During the initial training period (i.e. the first few days of coring), the Curatorial Specialist (or his/her representative) should be present as much as possible to guide the sampling process.

1. **Paleomagnetism (PMAG) sampling** - First, the paleomagnetist is called to take samples. Shipboard paleomagnetists normally deal with two categories of discrete samples: shipboard samples and personal samples. Most of the paleomagnetism (pmag) samples taken are for shipboard analysis. After preliminary measurements are done on the discrete samples and archive half core, the paleomagnetist may request higher resolution sampling at interesting paleomagnetic transitions. Orienting and removing the samples properly requires care and time. Shipboard paleomagnetists (rather than the paleomagnetic Marine Specialist) are responsible for taking all paleomagnetic samples, or for training other shipboard scientists in the proper techniques. In softer sediment, 2" x 2" x 2" paleomagnetism cubes are used for sampling (Figure 50). When the material gets more indurated, taking cubes with the parallel saw will be required. When the paleomagnetic sampling is complete, the remaining samples can be taken.



Figure 50. Example of paleomagnetic cubes. Samples taken in soft sediment.

2. **Physical properties sampling (Moisture and Density, MAD).** After splitting, the core is placed on the sampling table. The physical properties scientist typically measures shear strength (shear vane) and sonic velocity on each section (Figure 51). After that, 10cc samples are removed from the core for moisture and density (Figure 52). The amount of MAD samples per core vary between expedition, usually from about one to three per core. Advise that taking one per section will be too much to keep up with unless it is a low recovery expedition.

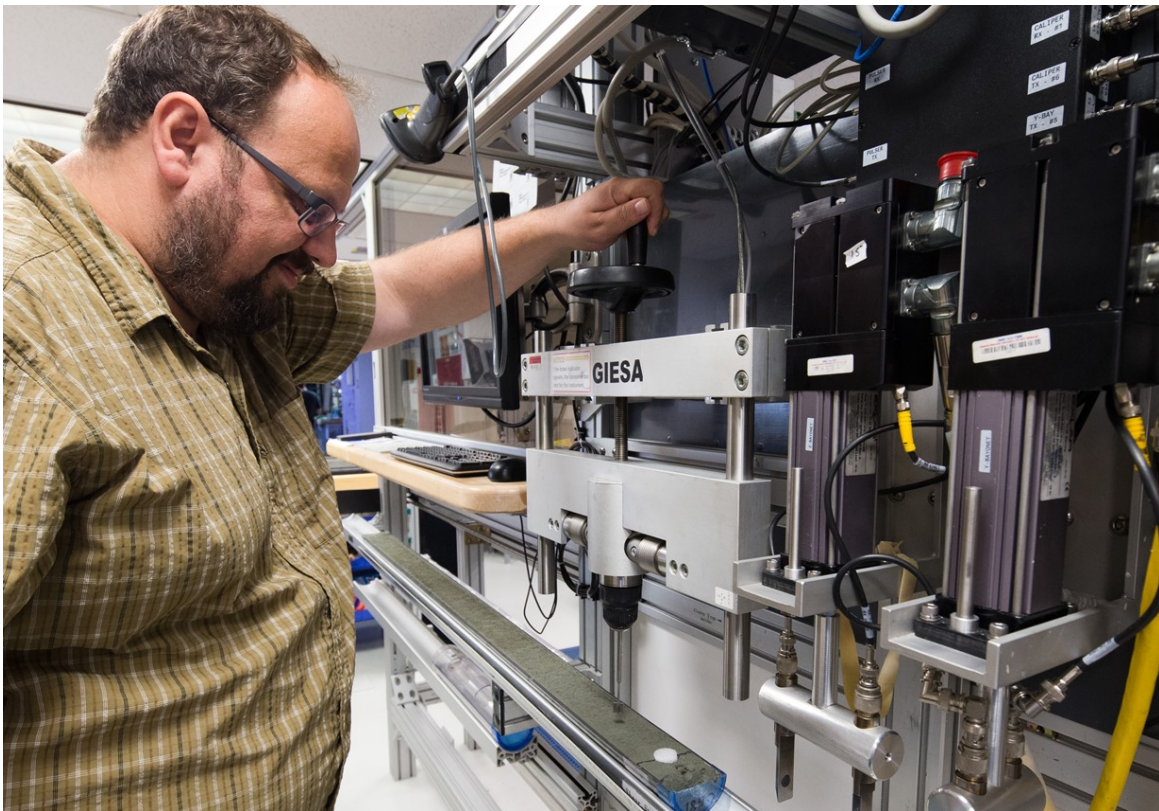


Figure 51. Sonic velocity and shear strength measurement (Gantry)

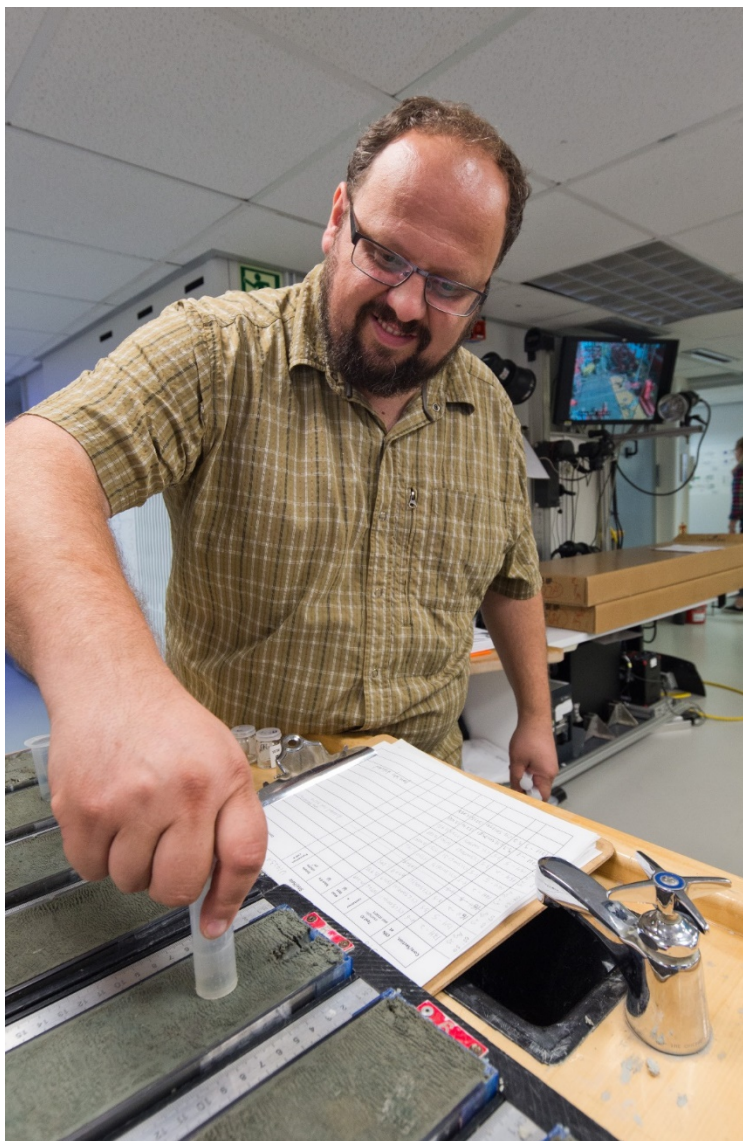


Figure 52. Sampling for Moisture and Density (MAD)

3. **Sediment sampling for shipboard analysis and personal studies using flags -** Scientists working their 2 hour sampling shift should make an announcement over the P.A. stating: “Core X is on the sample table. Please flag your samples”. Guided by the sampling plan, the requesting scientist or their representative, takes a sample flag and places it in the working half core material. (Figure 53). Flagging for shipboard analyses (e.g. XRD, CARB, TSB, etc.) needs to be done too. Often the responsibility for flagging these samples falls by the wayside. It is the Curatorial Specialist’s job to ensure that these samples get flagged. If you notice that all requested shipboard analysis samples are not being taken, ask the Staff Scientist to assign the task to someone. Often a good choice is one of the sedimentologists on watch. It can be useful to use a tracking sheet to ensure all samples are taken, especially if they are depth or lithology dependent, or infrequent. You can find this in the shipboard curator templates folder.



Figure 53. Flagging the core samples

4. **Data entry into LIMS.** One scientist on shift (or an available technician) stands in front of the core and calls out the sampling information (usually going down the length of the core one section at a time). The other scientist enters the data into Sample Master. It is good practice to enter sample data one section at a time.
5. **Print labels and tracking** – Check if the bar-coded labels are printed properly. If there are mistakes, ask the scientists to notify you or the ALO on duty to correct mistakes and reprint the label. If it is an entry to be deleted, ask them to write ‘delete’ on the label and post it on a clipboard near the core entry or sample station. The incorrect sample entries are then deleted by the curator or on shift ALO.
5. **Labeling the bags** - Peel and stick all labels to sample bags, keeping things in order by section.
6. **Remove samples from core. First crosscheck** – This is a two-person job. To reassure that the sample interval corresponds exactly to the one being recorded in LIMS, check each sample removed against the corresponding labeled bag. **This check is the single most important step in sampling**, because at this point the exact identity of the sample is known with complete certainty. Confirm that the sample location matches the sample ID marked in the bag. Finally seal and place the sample bag in the properly marked sample bin.

Note: It is important to double-bag any samples to be frozen because the labels do not always stick to the plastic bags when stored in freezing conditions. It may also be necessary for muddy material, if the bag does not seal completely.

7. **Second crosscheck** - After all of the samples have been taken, a second check should be performed. Are there any flags still standing? This indicates that a sample may have been mistakenly omitted from the database. Or are there labeled bags leftover? This indicates that a sample was not taken. An investigator may retract of taking some material already entered into LIMS, and simply forget to tell the samplers in watch that he/she withdrew his/her flag).

8. **Plugging the holes** - After all sampling is completed the holes and voids left behind are filled with ethafoam sample plugs, available in 5cc (1/2" diameter) and 10cc (1" diameter) (Figure 60). Quarters or slices of IODP standard 2.5" diameter ethafoam rod can be cut to fill odd shaped holes. If a whole-round was taken before splitting, fill the gap (if not already done) with a piece of foam, labeled with the shipboard test or request code. If a half-round is taken from the working half, follow the same protocol. If an interval in the working half is depleted by multiple requests, leave the ethafoam blank.

Sampling Guidelines for hard rock

Core Section 360° image analysis

The 360° images are taken from the outer surface of the core using the SHIL (Figure 54) that generally is used for section-half surfaces. This system was developed at IODP-Texas A&M University. The main element of this system is an aluminum frame that can simultaneously hold the cylindrical pieces of a single core section and rotate them in 90° increments (Figure 55). Four images of the core surface are later processed to simulate a continuous image of the unrolled 360° surface.

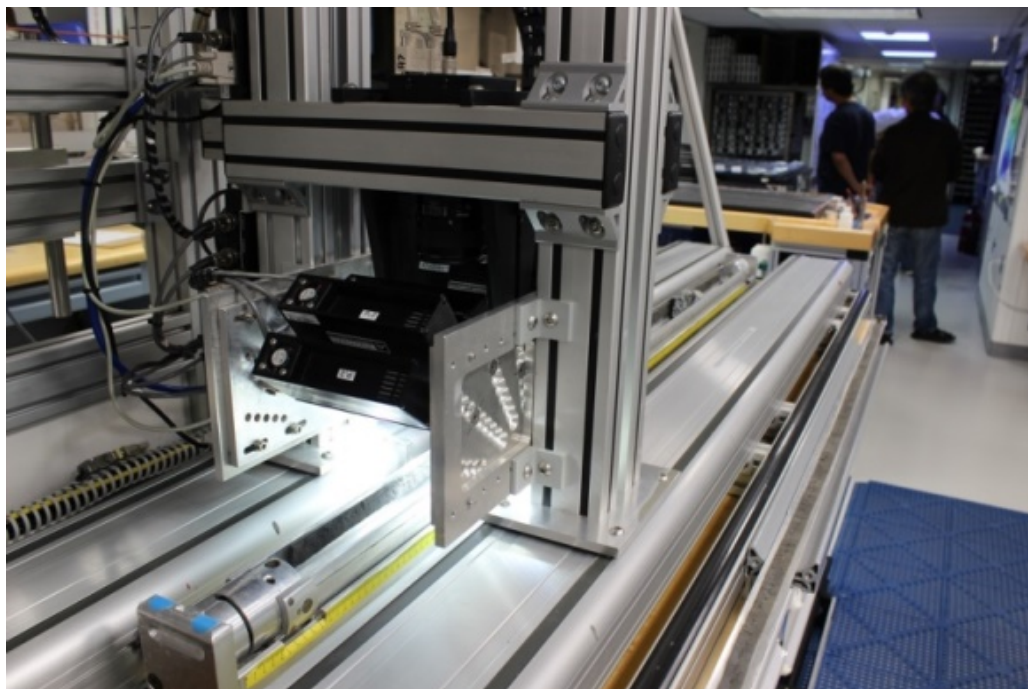


Figure 54. 360 Core Image



Figure 55. Aluminum frame used for holding whole-round core pieces for imaging, Expedition 345. View of one end of the frame, with one of the four bracing strips removed, as would be the case while imaging the outer core surface.

The process for generating the simulated unrolled image includes the following steps:

1. The vertically oriented pieces for a single section are placed at their curated-relative depths within the aluminum frame, with two of the aluminum strips in place to hold the core and two removed for access.
2. After the frame is moved to the SHIL, three of the aluminum strips secure the core surface and one is removed to allow imaging.
3. After imaging one surface, the aluminum strip is replaced, the section is turned 90°, and the next strip is removed to allow imaging.

This process is repeated to generate four images. The individual images are automatically uploaded to the LIMS database. The imaging specialist then downloads the images, aligns them visually, labels them by section, and makes them available to the science party.

Hard Rock Core Handling

When a hard rock (igneous or metamorphic) core arrives on deck, the liner is placed on the catwalk core holders by the Laboratory Specialists. 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. The sections are then measured starting at the bottom of the recovered material and working backwards (i.e. toward the top of the core). Label sections

in the correct order. The last section (i.e. Section 1) may be a very full section or it may only contain a small amount of material. Estimate if you will need additional empty liners to give you extra space ‘to curate’ the core. To ‘curate’ a hard rock core means to add dividers between non-contiguous rock pieces. ‘Curation’ usually expands the length of a core. Once all the sections are numbered, measure the recovered rock inside the liner to get the total recovery.

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. Avoid, however, breaking of whole rock pieces. Sometimes it is feasible to leave a long continuous piece sticking out of the original liner, and measure the full piece of rock. Soon enough it will be removed from its original liner and placed into another. Do not forget to put end caps (without acetone) on the sections to transfer to the splitting room.

Hard rock sections are entered into SampleMaster, labels are printed, core liners are engraved and then the sections are carried into the core splitting room. The true ‘Curated Length’ will not be correct until the core is fully spaced-out (i.e. curated). Note that when working with hard rock, it is always helpful to have a plentiful supply of pre-cleaned and pre-split core liners on hand. The rock material is shaken out into the new scribed/labeled split liner. Starting from the bottom, **mark** with a china red wax pencil **the bottom** of every oriented piece of the sections that is too long to have rolled into the liner. Once orientation marks have been made, wash each piece individually and dry them with a clean rag. It very important that only one piece is taken out of the liner at a time in order to avoid confusion about where a piece actually goes.

You can now begin hard rock curating pieces in the new, labeled split liner. Hard rock pieces which do not fit together are separated from each other in the core liner by plastic dividers. It is very important to keep pieces that “lock in” together or share similar structural features (Figure 56). Sub-pieces that fit together should have hatch marks draw to help maintain connections between them (Figure 57).



Figure 56. Piecing together hard rock



Figure 57. Hard rock core with hatch marks

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 are placed together (Figure 56). Ask the inspecting scientist(s) to mark a splitting line on the rock pieces. The petrologist or structural geologist may designate a working half on the pieces by drawing a ‘W’ on the piece.

Next, use acetone to adhere the dividers to the new split liners to match the spacing in the original liner, allowing just enough space for the pieces to be rotated. **Do not acetone dividers until split lines have been drawn.** Once the pieces in each section are spaced out and the dividers attached, measure and record the bottom offset of each bin and the orientation of each piece. Tape the two split liners together using electrical tape and place on the core racks for physical properties and whole-round imaging. Update the ‘Curated Length’ of the core in SampleMaster and rebuild the depth of the core. Create pieces in SampleMaster using the ‘Bin Bottom Offset’ and specify oriented pieces.

Once the core is ready to be split, the sections will be moved back into the splitting room to be cut along the splitting line marked by the structural Geologist or petrologist. Good care should always be taken to ensure the pieces are returned to the section half intact. If the piece splits unevenly, always make sure that the bigger half of the piece goes into the working half section and core orientation is always maintained (re-mark the bottom of pieces with red wax often). Smaller hard rock pieces can be split on the MK saw in the splitting room. Take extra care in cutting small pieces to ensure there are no marks left on them by the saw. Before making any cuts, make sure the bottoms of all oriented pieces are marked with red wax pencil. Ideally,

pieces are split symmetrically considering any contacts, veins or other special features to preserve part of the feature in each core half. This may not always be possible however, because cores should also be aligned based on structural trends. Pieces which fit together or which have contiguous features are split along a single line drawn throughout all the pieces. Shattered rock that can be pieced together by hand may be held together by shrink wrap or parafilm and cut as one unit.

The super-saw is used to cut long, solid pieces that do not fit on the MK saw (Figure 58). Similarly, a series of long pieces may be more conveniently cut on the Super-saw.

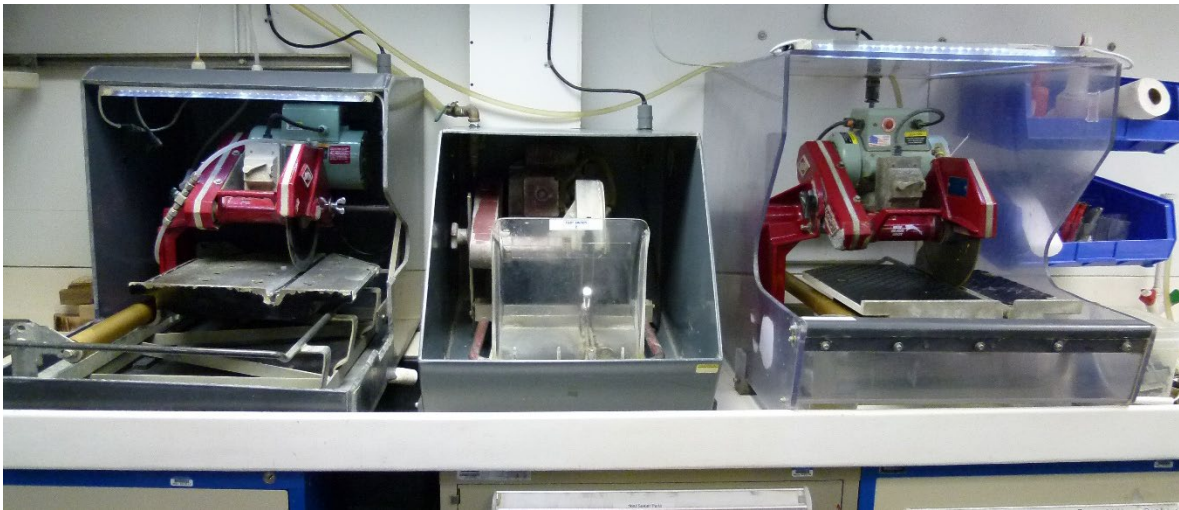


Figure 58. MK Rock saws

Once split, the hard rock core pieces are returned to their respective liners and set flat side down. All pieces should be dried with clean rags before returning to their liner if needed. They can then be air dried, with the help of two small fans. Never dry pieces with the heat gun. Applying direct heat to the core can alter products and demagnetize the rocks.

All hard rock pieces are labeled with the IODP standard identifier (Figure 59). The labels are printed using the hand held Brady labeling machine (Figure 60). Labels are affixed with epoxy resin on the left side of the piece halfway between the bottom and the cut edge. The result should be a label that reads parallel to the lines of writing and the orientation arrow pointing towards the top of the core (Figure 61). The label is then covered with more epoxy so it is completely sealed. The use of too much epoxy may cause drips and contaminate the surface of the core. Once the epoxy is dried, the pieces are rotated in the liner so that the split side faces up. All oriented pieces should have arrows pointing "UP" core. If there is any question whether a piece is oriented or not, do not put an arrow. As a general guideline, any unattached piece that is smaller than 6cm is probably not oriented.

Numbering system for hard rock pieces

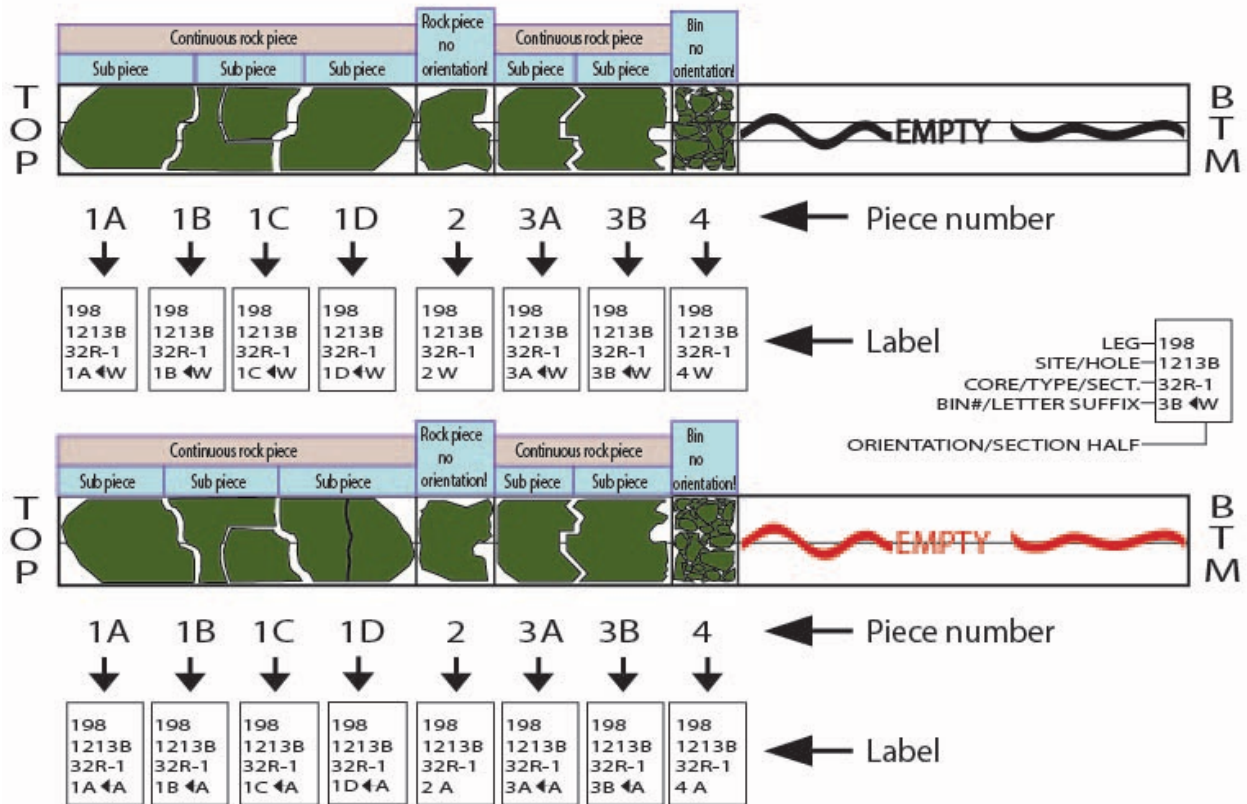


Figure 59. System for numbering and labeling hard rock pieces



Figure 60. Brady Printer for hard rock labeling



Figure 61. Gluing hard rock labels

Each piece should be numbered consecutively from the top to the bottom of the section. Every section should begin with piece number 1, even if continuity is observed between sections. Sub-pieces (i.e., the pieces which fit together between liner dividers to collectively form a completed piece), should be named in alphabetical order from the top to the bottom of the piece. In other words, 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 the sub-piece A.

When it is not possible or desirable to glue labels to the actual pieces, the label should be affixed to the right side of the piece's bin. Some of the cases are:

- Pieces which are too small to label (Figure 62)
- Rollers and rubble that, for convenience, 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, volcanoclastics interbedded with basalts).
- Pieces very porous and wet in which an epoxied label will not stick.

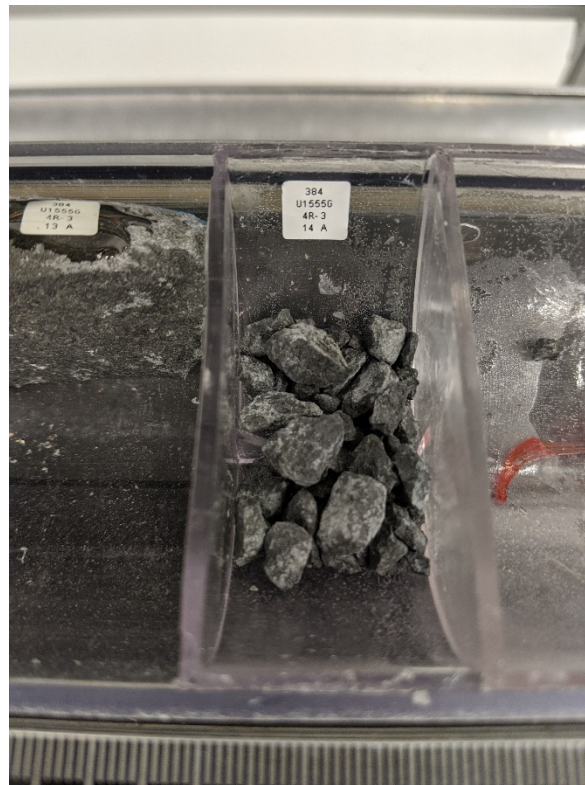


Figure 62. Examples of small hard rock samples that are labeled on the right side of the core liner because of their size

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 the label 'EMPTY' written in the space left at the bottom of the sections. In the case that there is only a small bit of empty liner left after binning, 'MT' can be written to identify the empty space.

Hard rock cores should be curated so that assigned piece and sub-piece numbers are the same in both the archive and working halves. If individual pieces break into sub pieces on both the working and archive half sides, then a letter is assigned to differentiate each sub-piece. If there is one piece in the archive half that has respectively broken into two pieces in the working half, then, each unit in the working half would be assigned a **single piece number** (e.g. 1a, 1b, 1c...). Note that in this case, sub-piece letters are not assigned) (Figure 63).

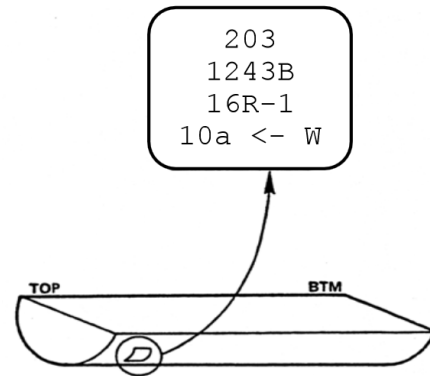


Figure 63. Example of hard rock labeling

Hard Rock Core Sampling

While the archive half is being described, the Physical Property Specialist can then select intervals to be sampled for sonic velocity and density (GRAPE) measurements as these are non-destructive tests. The sonic velocity sample, also used for wet-bulk density and water content measurements, is taken before the cores begin to dry out. This sample is stored in seawater for an hour to stabilize the temperature. Pieces of whole core chosen for physical properties sampling are marked by the sides with orientation arrows that point to the top of the section. Temporary Styrofoam placeholders of the same length are put in place of any removed pieces. Both the removed pieces and the placeholders are given temporary labels indicating their position in the section.

Once the archive halves of a core are described, samples can be selected and taken from the working halves. Shipboard analyses including paleomagnetism (mini-cores and cubes), physical properties (chips and cubes), geochemistry (XRD and ICP quarter core) and petrography (thin section billets, see next section for specific instructions). Whenever possible and especially when material is limited, multiple tests can be assigned to a single sample. Some commonly shared samples include:

PMAG_MAD: When material is limited and time allows both labs can use the same sample for analysis.

TSB_ICP: These are typically coupled to better describe the rock

TSB_XRD_XRF
XRD_XRF

The shipboard 'TESTS' assigned to a shared sample will be the first test that is ran on the sample. However, PMAG_MAD shared cubes must be entered as a MAD test with a 'Container Id' of zero. The sample 'Name' should match the order in which the sample is processed, e.g., a thin section is made from a TSB and the remaining residue is then used for ICP. If the additional shipboard analyses will destroy the original sample residue in any way, make sure the SAC and the person requesting the sample are made aware.

Sampling from routine assigned intervals using colored dots. Guided by the SAC approved shipboard sample plan, routine assigned intervals need to be sampled. Different core description groups (e.g. Igneous Petrologists, Structural Geologists, Geochemists, Sedimentologists) place colored dots on the core material (or liner adjacent to the interval) they wish to sample. Mark the samples with a wax pencil on the core (preferably in three dimensions) is also a great help to the technicians in charge of cutting the samples. All thin section requests should be accompanied by a corresponding thin section form that is filled out by the requesting scientist (Figure 64). This is applicable for high and low-resolution sampling for assigned intervals.

Cutting samples. Once the samples are flagged or dotted/marked, the sampling team of scientists and technicians cut samples (with a rock saw) at the designated intervals. Once cutting is finished, samples should be put back into their original position.

Although the responsibility of cutting shipboard samples is flexible, the Curator should always monitor the process. Sometimes, depending on the preferences, core recovery rate and experience of the Co-Chiefs and Staff Scientists, the Curatorial Marine Specialist may be asked to cut all shipboard samples while on shift, or perhaps, once a day. On other cruises, shift scientists may be assigned the task of cutting hard rock shipboard samples as the cores are split and described. Note that personal sampling should not be done at this point.

Thin Section Management

Scientists wishing to have a thin section made must first fill-out a Thin Section Request Form (Figure 64). Keep in mind that 12 standard thin sections can be made in a day, or 6 large format thin sections. The Curatorial Specialist will then cut the billet and place it in the sample bin labeled TSB (Thin Section Billet) along with a completed and signed request form. The curator usually uploads all TSB data into LIMS. The Thin Section Laboratory Specialist usually pick up fresh cut TSBs daily for processing in the Thin Section Laboratory (Figure 65). Special instructions for orientation, impregnation, or other procedures are written on the thin section request form. Unless otherwise requested, thin sections are polished and cover slips are not applied. A major objective of this procedure is to have a complete collection of sections ready for microprobe analysis on shore. Thin sections are returned to the Curatorial Specialist at the end of the cruise, but are available post-cruise by shipboard scientists from IODP/TAMU if requested.

THIN SECTION REQUEST FORM

TYPE OF INVESTIGATION: SEDIMENTOLOGY/PETROLOGY/PALEONTOLOGY (circle one)

EXP _____ SUBEXP _____ DESCRIPTION OF ROCK _____

SITE _____ HOLE _____

CORE _____ TYPE _____

SECTION _____ SPECIAL INSTRUCTIONS _____

INTERVAL: TOP _____

BTM _____

PIECE NO. _____

SAMPLE CODE _____ REQUESTOR _____

FOR TS TECH USE ONLY

PREPARATION:

POLISHED _____ IMPREGNATED _____ WITH DYE _____

THIN SECTION POST-LEG DISTRIBUTION

All thin sections manufactured at sea or in the repositories are the property of IODP, and are member of the permanent IODP thin section collection. All thin sections are to be returned to the IODP Curator at the end of the expedition. Shipboard investigators who wish to borrow the thin sections may request them by writing the IODP Curator.

Figure 65. Thin Section Request Form

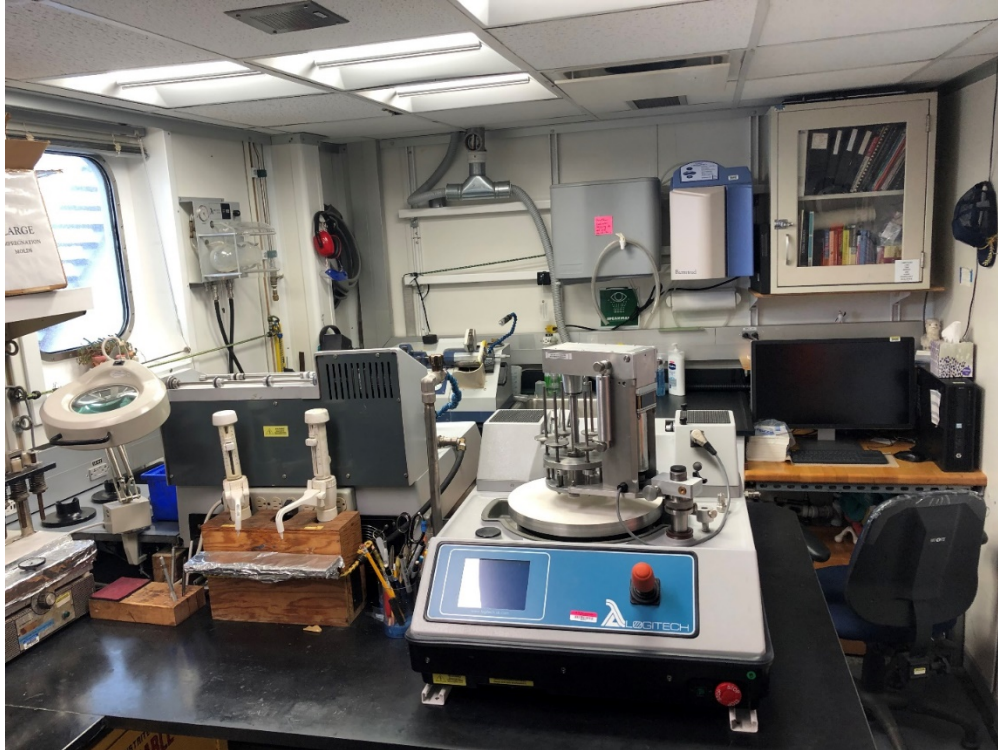


Figure 66. Thin Section Laboratory

Sampling Thin Section Billets

Do not take a TSB (thin section billet) until the requester has filled out the thin section request form. A workflow of thin section billet marking to adhering to the thin section can be seen below (Figure 67).

- 1) Mark the outline of the thin section with a wax pencil, or scratch it in with a metal tool depending on lithology (Figure 67a). Standard thin section billets should be no larger than 1.5cm x 3.5cm in order to fit on a standard slide without being trimmed. Keep a plastic demonstration block attached to the rock saw for the scientists to use as a reference when cutting billets (Figure 68).
- 2) Mark orientation:
 - a. Make an up arrow pointing towards the top of the working half (blue end cap) (Figure 67a). If another orientation is requested, make sure this is indicated on the thin section form and thoroughly documented for the thin section technician.
 - b. Also color the edge pointing towards the bottom of the section with a scratch or wax pencil (denoted by the blue marking in Figure 67b). Very soft material may just need to be wrapped in parafilm with no marks or scratches on the billet, with an orientation arrow written on the outside of the parafilm.

3) Cut thin section billets thick enough with the purpose of extracting two thin sections from the same billet. If material is soft and might not stay intact, cut the thin section slightly thicker. Make the saw cuts as cleanly as possible with the two faces parallel to each other. These thin sections will be either a second shipboard copy in case the first slide is spoiled; a personal sample by a shipboard scientist at the end of the cruise; or an archive copy at the repository.

Additional tips:

- Avoid making any markings or scratches on the face (the face is the surface that is adhered to the slide) (Figure 67c). While marks can sometimes be sanded off, at other times they can cause problems so it is best to avoid them. On very hard rock it is acceptable to have wax crayon on the face, but wax crayon will at times get stuck in tiny vesicles.
- If in doubt and time allows, consult with the thin section technician and/or have the technician cut the billet themselves.

4) The interval in the database (i.e. the label) and the interval on the handwritten request form should match exactly.

5) Piece and sub-piece should be recorded in LIMS for all hard rock thin section billets. This is entered in the comments section. It can also be entered in the name field in order to print on the label.

6) All billets for shipboard description should have the type and test TSB, never the requester's personal sample code.

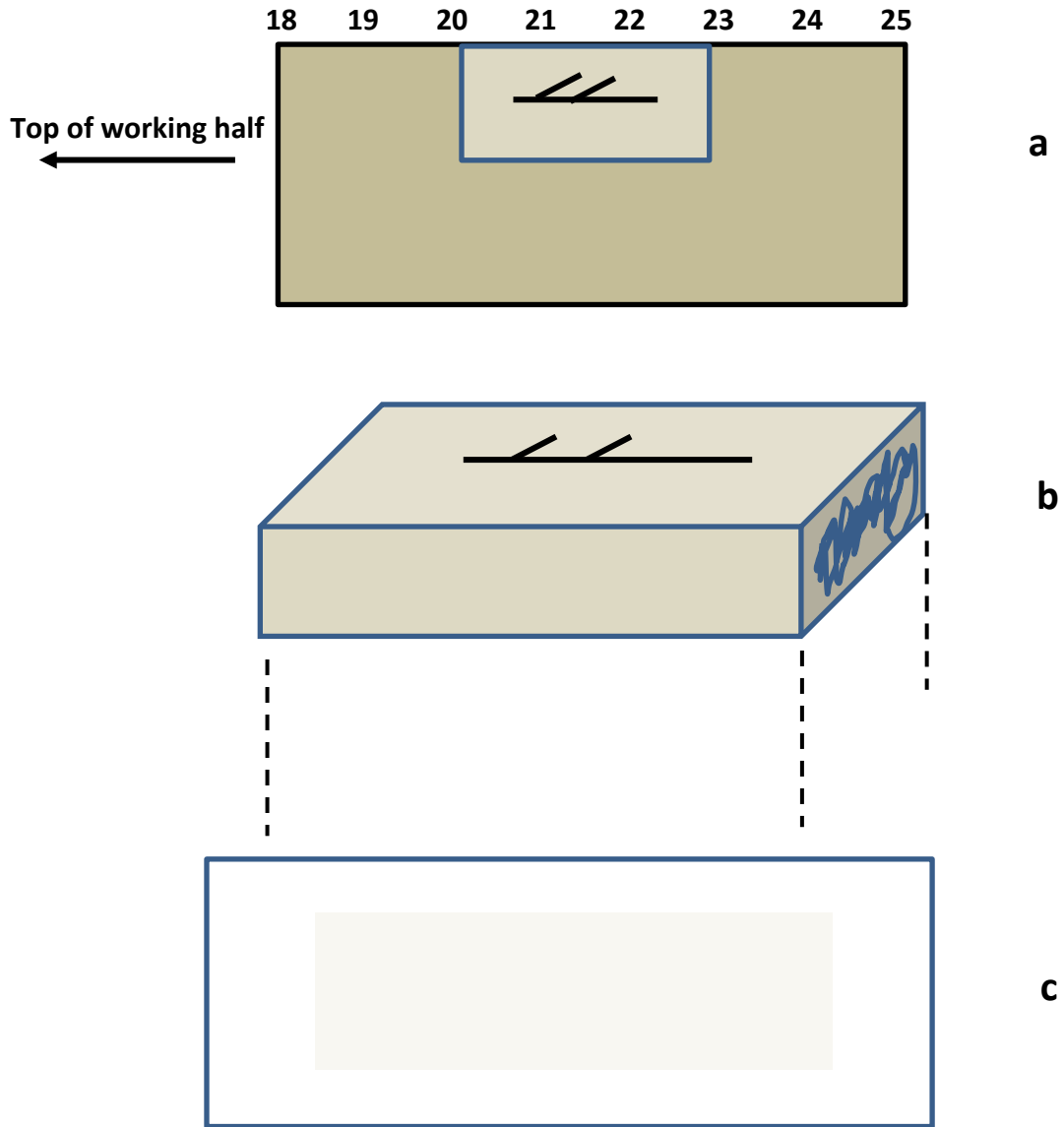


Figure 67. Workflow for thin section billets. a) Mark outline and orientation before extracting from section. b) After removing TSB, mark TSB to denote bottom of the section. c) TSB face opposite the orientation arrow will be adhered to the slide.

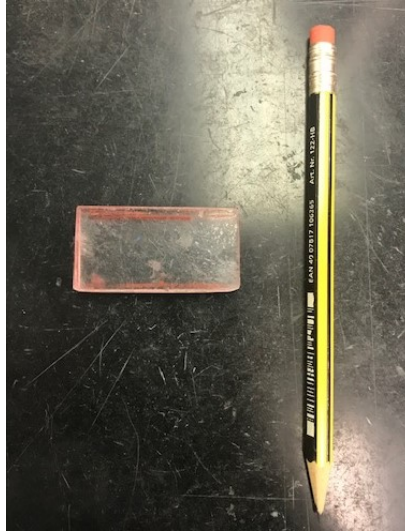


Figure 68. Standard thin section billet cutting guide.

Well cut billets will result in faster and higher quality work by the thin section technician; less material is lost in lapping to a bonding surface and will allow even distribution of pressure during bonding. Exceptionally, oversized slides may be made from large faced samples in special circumstances (e.g. when crystal size is very large).

Some expeditions request soft sediment thin sections. These are difficult to remove from the core, and should be done by the curator or thin section technician only. If the material really isn't consolidated, it is worth suggesting to the SAC that a quarter-round might have to be extracted, to give ample material and disturb the sample minimally. If it is particularly worrisome that the material will not stay intact upon extraction, you can:

- 1) Gently outline and then cut the sample away from the rest of the section with a spatula.
- 2) Take a sizeable piece of Glad Wrap and carefully push it into the edges around the quarter-round.
- 3) Carefully extract the encapsulated quarter-round into a small piece of liner, with foam filling up the empty space in the liner around the quarter-round.
- 4) The thin section technician can remove this sample and the Glad Wrap down in the thin section lab before impregnating the sample.

The average capacity of the thin section laboratory is 12 slides per 12 hour shift or six oversized slides. Typically, only one technician will be available to make thin sections and it is possible that he/she will be responsible for other laboratory functions (e.g. Core Laboratory and down-hole) as well. Please be especially aware of backlogs and time constraints towards the end of the expedition. The time between receiving the requests and finishing the slides generally

range from 1 to 3 days. It can be longer if the billet requires special treatment (e.g. impregnation).

When the thin section is complete, the technician will put it in a slide case that remains in the petrology laboratory accessible to the scientists until the end of the expedition. The Curatorial Specialist should locate and inventory all thin sections at the end of the expedition.

End of Cruise Thin Section Requests

All thin sections are the property of IODP. Shipboard scientists may request to borrow thin sections for a period of one year as a part of a new- or pre-existing sample request. All slides, however, must first be given to the IODP Shipboard Curator for inventorying. The Shipboard Curator will have the thin sections sent to the proper repository and the repository will disperse the thin sections to the requesting scientists. The shipboard curator should provide the repository with the relevant information for all thin sections requests.

It is useful to send an email to the scientists towards the end of expedition asking them to submit a list of thin sections they would like to request. Include these requests in your final updated 'Thin Section Distribution' list in the Action Items in the Curatorial Notebook. This facilitates sending thin sections to scientists as soon as they are cataloged at the repository. If more than one scientist request the same thin section, meet with the individuals to negotiate who receives the thin section first. The thin section first is sent to the assigned repository for inventory and distribution. The first requestor will have the thin section for a period of 4 months. They then return the thin section to the GCR. The GCR will forward the thin section to the next requestor.

Entering Thin Section Slides into the Sample Database via Sample Master

The thin section (TS) is entered into Sample Master by the Thin Section Technician as a child of the thin section billet (TSB (Figure 69)). When the Thin Section (Laboratory Code TS) data is entered into the sample database, a permanent archive is created for use on shore. Before starting, cross check your TSB data against the information written in the Thin Section Technician's logbook and on the thin section slides. All TSB records should match the TS technician's slides and vice versa.

The Thin Section Technician should first give them to the curator once they have been made.

Exp-Site-Core/Type-Section-Section Half (A/W) Interval-Name

335-U1256-236R-1-W 0/4-TSB_Piece1

Choose Type: TS, Tool Name: SAW_ROCK, TEST: TS, Name: TS_#

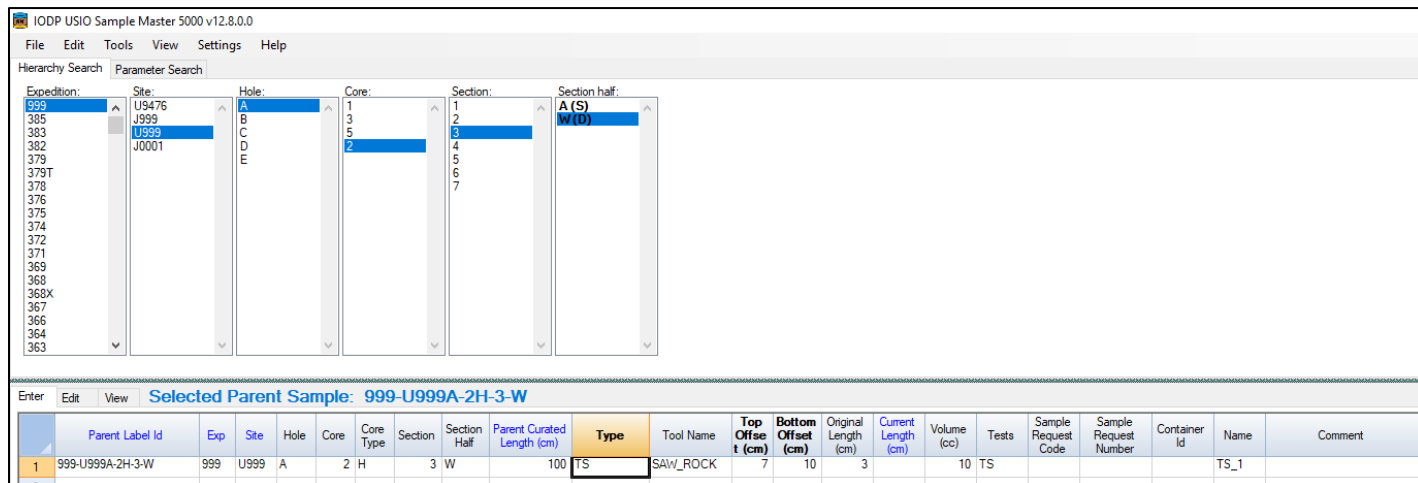


Figure 69. Example of the parent child scheme for entering thin sections in the Sample Master

After the cores have been described and sampled for shipboard analysis, the working halves are stored in d-tubes and racked in the Core Laboratory to await a sampling party for personal studies.

Hard rocks are sampled in one fell swoop during a ‘sample party’, therefore do not box the working halves like you normally would. After enough cores accumulate, they are laid out in the core lab. Marine Specialists will assist the Curator by cutting, labeling and sealing samples. Both working and archive half sections must be shrink-wrapped prior to being boxed. This ensures the pieces do not fall down or are damaged in transit.

Data entry into LIMS. After all of the samples have been cut, sample information is entered into Sample Master. One technician cuts the samples, and the other enters the data into Sample Master. It is good practice to enter sample data one section at a time. Once the samples are taken, replace the voids with foam to prevent the core from shifting (Figure 70).



Figure 70. Example of filling holes with ethafoam after sampling

Shipboard and personal splits can then be entered as children of the bulk sample. Any remaining liquid splits should be labeled and refrigerated.

Shipboard Sampling Parties

During the sample party, scientists mark their desired sample interval with their personal sample dots (Figure 71 and Figure 72). The SAC will come up with the best workflow to allow for scientists to flag, and to decide how and when to approve the samples.

Materials available for personal samples include both working halves and residues of shipboard samples that have already been analyzed. If the number of sampling requests is focalized in one specific area as a result of low recovery or the presence of a critical interval (e.g. volcanic glass), the scientists should make a mark in the specific section where they propose to sample on a “Post-It”. This label should be placed next to the piece they wish to sample (Figure 73). This way, as other scientists add their choices, conflicts are quickly seen and can be resolved more easily.

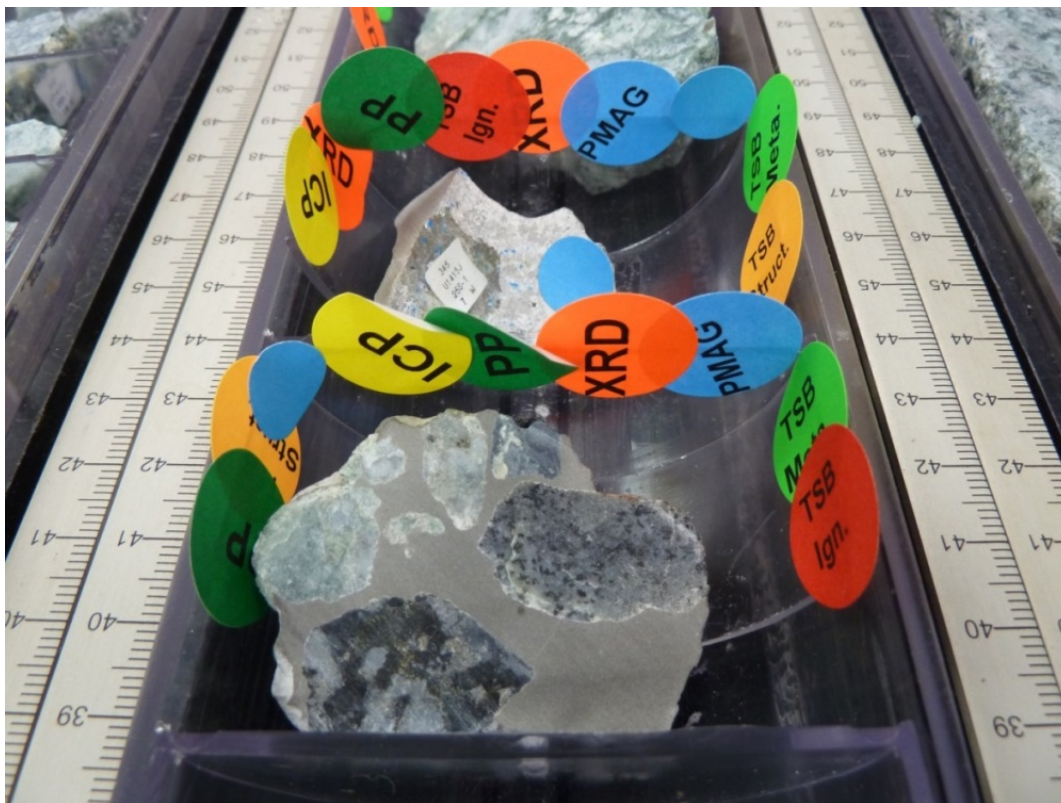


Figure 73. Example of a heavily requested set of hard rock cores

After all the samples have been chosen, the members of the SAC go over the proposed samples sorting out any conflicts as they go through the cores. The Scientists are then required to fill out sample sheets detailing the sampling that has been approved. The Curatorial Specialist, with the help of marine technicians, cuts the samples using the two rock saws, the parallel saw, and one drill press. Asking the shipboard paleomagnetist(s) to assist with cutting cubes and minicores is acceptable, especially if the number of samples is great and time is short.

Pieces containing glass or other rare materials should be cut on the rock saw. Any glass fragments or other materials that break off should be stored in the working half with the sample using a labeled bag or pop-top vial. Be sure to mark an “UP” arrow on oriented samples with a red china marker or a scribe.

Sample information is entered into Sample Master (including piece and sub-piece), bagged and carefully sealed. The unused portion of the core is returned to the liner in its proper place and orientation.

Pieces and sub-pieces in the working halves that are broken or cut into smaller pieces during sampling require special curatorial attention. Of primary importance for shipping and long-term repository preservation is to insert properly fitting ethafoam spacers in sampling voids. If there is sufficient time, pieces larger than 15 cm³ in volume (about the size of a minicore plug) can be re-

labeled. If time is limited, only re-label oriented pieces to ensure they are turned upside up after sampling.

Both working and archive sections must be encapsulated with shrink wrap before they are stored in the core storage refrigerator. This ensures the pieces do not roll around or become damaged in transit.

Smear Slides

Smear slides are used for core description and biostratigraphic age dating. Smear slides made for description are typically archived at the repository. Smear slide data is recorded in LIMS by core describers. They appear in the sample database as Type: SS, Test: SED. Smear slides are considered residues and as such, they can be distributed to scientists who request them at the end of a cruise. Any remaining slides should be sent with an inventory to the repository. Smear slides should be stored sideways in plastic slide boxes for shipment to scientist or a repository. The plastic boxes should then be secured with filament tape and bubble wrap.

Residues

Residues are any residual material derived from the processing and/or analysis of a sample. If a sample is returned unprocessed and not analyzed, it is considered a "pristine residue".

All IODP residues must be identified with the standard Expedition/Site/Hole/Core/Core Type/Section/Interval identifier. If a residue's parent sample was taken using the Sample Master Database program, the sample type used to identify the parent sample is usually used to identify its child residue(s). Samples are taken from IODP cores in order to support studies identified in investigator-submitted sample requests and/or for standard IODP shipboard analyses. Samples taken on the ship for routine IODP shipboard analysis and the sample types that have traditionally been assigned to them are listed in the Observer/Sample Type section of the cookbook.

Distribution of Residues

Followed by SAC approval, residues that are generated on the ship from standard IODP shipboard analyses may be redistributed to investigators on the ship. They also can be transferred from one investigator to another. If the residues are to be processed/analyzed as part of the same study described in an investigator's approved shipboard sample request, residues are then included as part of that request. If the residues are to be used for a new and different study, the investigator must submit a new sample request. Volumetric and quantitative sampling restrictions apply to these residues in the same manner as all IODP samples. Residues need to be catalogued in the Curatorial Report. If there is sufficient time, residues should be reassigned to the requestor with their sample code and number, however these decisions are often made at the last minute where this might not be possible. If this can't happen before leaving the ship, make sure to do this back on shore when the data is uploaded to LIMS.

Procedure for Residues Handling Aboard Ship

Compile inventory lists of all end-product residues generated from standard IODP shipboard analyses that are to be shipped back to an IODP Repository and include these in the RESIDUE section of the Curatorial Report. Residues that are consumed during shipboard analyses or that are used for additional shipboard analyses should also be noted in the Comments field of SAMPLE and included in these lists. The additional test can also be added to the name field i.e. XRD_CARB.

There are multiple ways to catalogue residues depending on how many residues are produced on a given expedition, how many are requested etc. It is useful to send an email out early in the expedition with the different types of residues expected for the given expedition, and to send residue requests soon. This should be followed by another email at the end of each site to solicit additional requests. Splitting residues along the way is much preferred to doing it at the end of an expedition or back on shore, but those are both options if time is limited. See the shipboard curator template for summary of common residues and how they are treated. Use this template to organize residue requests.

Usually the most heavily requested residue is for the untreated PAL residue. This is usually requested by paleontologists, but can also be requested by others. It is important to try to organize this as early as possible, and to split these samples along the way, as it is often time consuming to print labels and split the sample for multiple requestors. It is suggested to keep an additional Excel sheet to keep track of how to split up the PAL sample. See the shipboard curator templates folder for the residue excel spreadsheet.

The core storage system

Split cores are stored permanently in white plastic d-tubes. Archive and working halves are distinguished by the color of their end caps. Working halves have black end caps while archive halves have red end caps. Working and archive halves are stored in separate boxes.

After the cores have been described and sampled, each section should be stored in a tube, making sure that the bottom of the section is inserted first. Close the d-tube with an end cap of correct color. Even if it is possible to fit multiple short sections into one d-tube, **each section gets its own d-tube**. The last section of a core and its core catcher are routinely stored in the same d-tube if the total length of both sections is less than 155 cm.

When storing the core catcher and last section together, the core catcher is inserted into the d-tube first. **Always check that the physical storage is consistent with the Core Box Inventory Sheets and that the working and archive halves match.** If you discover inconsistencies between archive and working halves after the cores have been boxed and are unable to fix them, be sure to make a note on the Core Box Inventory Sheets for the repository Superintendent where the cores will be sent.

Labeling D-Tubes

Put one bar-coded core label (Figure 74) at the open end of the d-tube and a second bar-coded label on the end cap.

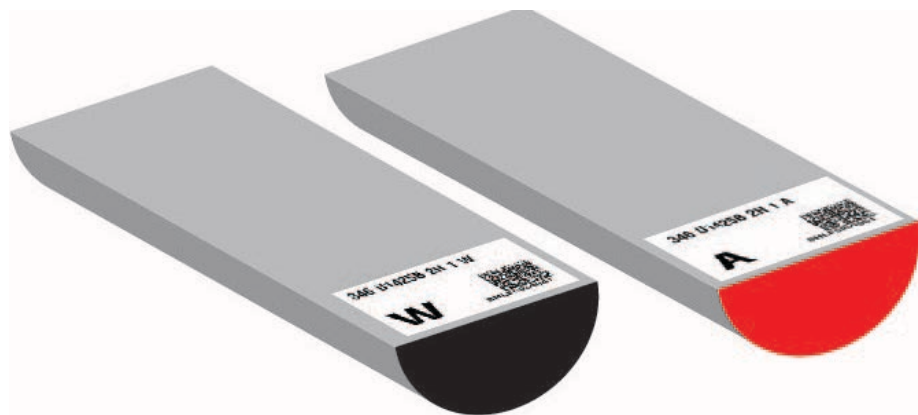


Figure 74. D-tube labeling

Colored dots can be used on d-tube caps to indicate a certain type of lithology, disturbance, notable feature, critical interval, etc. Blue dots are used to denote igneous/metamorphic/basement rocks. If dots are used, they should be indicated in the Curatorial Report at the end of an expedition. In addition to dot stickers, yellow pre-printed IODP “caution” stickers on the end caps mark sections in which something unusual happened. In extreme cases, comments can be included on the sample label itself. The message must be easily understood by the repository staff or visiting scientists at repository. For example, if a section was dropped and aligning the pieces in the original position was not possible, write: "section dropped; 0-28cm out of order and not oriented". Also include these comments in SampleMaster.

General Guide to Core Boxing

Try to keep cores in the laboratory as long as possible before boxing to allow each crew of scientists the chance to view and/or sample material that came up while off shift. When the core storage in the laboratory is full, sections are boxed and moved to the core refrigerator. It is one of the Curatorial Specialist responsibilities to monitor core flow out of the laboratory. Talk to the Staff Scientist and science party to know when they will finish the work with specific cores. Let the other technicians know what cores should and should not be boxed. Develop a workable system to minimize conflict and maximize useful work.

Core Box Inventory forms are used to track the movement of boxed sections. Keep one clipboard of blank forms for working halves and another for archive halves in the Core lab. Update these forms whenever cores are boxed. **It is imperative that these lists match.** These steps are important because it makes it easy to find sections during the expedition and facilitates the job of unloading the cores at the repository. The handwritten information should also be

transferred to an Excel spreadsheet and stored on the curator's laptop and on the ship server at the end of the expedition. Form-versions of these spreadsheets are kept on the hard drive on the curator's laptop. It is also suggested to scan the handwritten Core Box Inventory in case of discrepancies.

At the end of the expedition, provide copies of the Core Box Inventory to the on-coming Curatorial Specialist and to the respective Repository Curator and Superintendent.

Finally, one copy of the core box inventory form should be attached and taped to one of the core box before shipped.

Since d-tubes in the laboratory are routinely reopened, end caps should be taped on only once the cores are ready to be boxed. Seal the d-tubes with archival quality polyethylene tape (3M brand is preferable), taping from the top to the bottom of the d-tube to cover both section labels. D-tubes are placed in wax core boxes that hold 10 sections (Figure 75). Get a four-wheeled cart to stack the core boxes on as you are packing them and transport the full core boxes to the core refrigerator. When you have 4-8 full core boxes stacked on the cart, take them to the core refrigerator for storage until the end of the cruise.



Figure 75. Boxed core

Core Boxing Instructions

Instructions for properly assembling, packing, marking, and closing core boxes follow. Copies of these instructions should remain posted at both ends of the core laboratory.

Assemble the rear of the core box and insert cores so that the lowest core/section number is in the upper left, and the highest core/section number is in the lower right (Figure 76). It is easier to fill the box by starting in the lower right with the highest core/section number and working backwards to the upper left.

End here with the LOWEST
CORE/SECTION



Start here with the HIGHEST
CORE/SECTION NUMBER

Figure 76. How to box a core

1. Record the pertinent data on the Core Box Inventory form.
2. Mark boxes containing working halves with a black permanent marker; mark boxes containing archive halves with a red permanent marker. Mark bottom (BOT) at the rear of the box, both on the flap and top surface, and TOP on the front flap and top surface. 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 77).

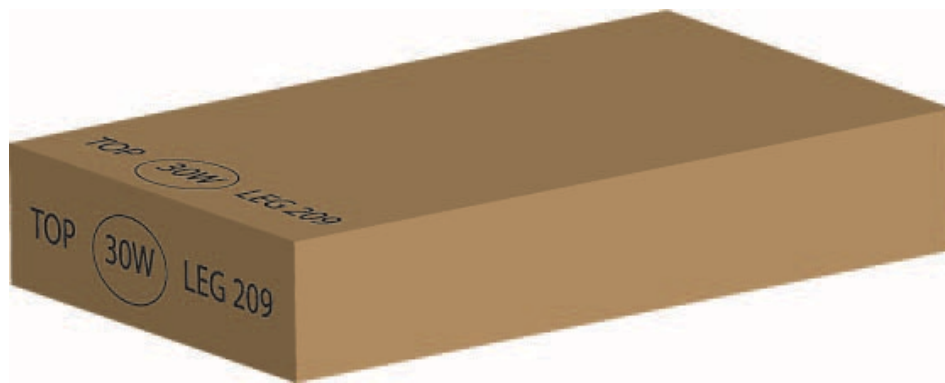


Figure 77. Example of a core-box end labeling

Core Storage in the Refrigerator

Be sure to push core boxes as far back into the racks as possible to save space on extremely busy expeditions. When the core refrigerator is nearly full, talk with the LO about clearing out space in the Hold Refrigerator or the Upper Tween landing area to adequately fit all the cores.

Re-sampling and re-describing cores

Re-sampling cores that already are stored can occur, but try to minimize it by keeping the cores accessible in the core racks as long as possible. Scientists wishing to re-describe or re-sample boxed cores must get approval from the Staff Scientist and then contact the Curatorial Specialist who determines when, where and how the activity is to be undertaken. The more core boxes are opened and re-stapled, the more they begin to lose their integrity. This weakens the boxes and obscures their labels. Investigators wishing to access boxed cores may be asked to do the legwork themselves, after consulting with the Curatorial Specialist. The investigators retrieve the desired material and then pack, staple, and shelve the boxes just as they found them or this can be done by the Curatorial Specialist and a few techs, whatever method works best. Depending on the number of samples, sections, boxes, etc., the actual re-sampling and re-describing may be done in the refrigerator itself. Label IDs can be recorded by hand on the sample bags and the data can be entered into Sample Master at the sampling station upstairs. Sometimes, especially during drilling breaks or transits, it is easier to take the cores back to the laboratory.

For safety reasons, the old staples should be removed prior to re-stapling. Old staples have caused scrapes and cuts. Keep a pair of needle nosed pliers in the refrigerator for this purpose. Toward the end of the cruise, it is generally not possible to access boxed cores. The final date for re-sampling and re-describing will be included in the "End-of-the-Cruise" schedule devised and distributed by the Laboratory Officer. The Curatorial Specialist should inform the Co-Chiefs and scientists that after this final date, re-sampling and re-describing will need to be performed at the repository.

Between sites

Between site tasks for the Curatorial Specialist include:

- Clean up and restocking the laboratory, especially around the sampling tables.
- Update Excel Core Box Inventory.
- Make corrections to the sample database using Sample Master and LIME.
- Box and bag all the previous site's samples and take them to the refrigerator. On busy cruises, it is a good idea to keep those samples in the Hold Refrigerator to maximize space for the next core boxes loading.
- Prepare the sampling plan for the next site.
- The imaging specialist will bring core photos to the attention of the curatorial specialist if the photos do not match the lengths in Sample Master.
- For hard rock expeditions you may have personal sample parties between sites depending on the transit length. If the transit time is short personal sampling should occur during logging.

End of expedition activities

Curatorial Documentation

It is very important to retain important documentation containing inventories, reports, problems or any other useful information, as reference material for that specific expedition, and to aid future expeditions. This information should be stored on IODP Official, IODP Share, and/or the Confluence pages, depending on the type of documentation/information. A suite of documents outlined below should also be sent to the GCR Superintendent, GCR Curator, and members of the BCR or KCC curatorial staff if the cores are not being stored at the GCR.

End of Expedition Documents

The End of Expedition documentation could vary according to the cruise. However, certain documentation is always required. Add any other information you think may be useful.

1. Curatorial Report - (see next section for further details)

2. Core Box Inventory Forms – Both the Excel and handwritten versions should be included.
3. Thin Sections –Thin section (Type and Test TS) inventory. LORE search: Type=TS, export to excel, make sure it is in the proper order, and nicely formatted.
4. Smear Slide Inventory – prepare in Excel. (Web Tabular search: Type=SS, export to Excel)

It could be useful to also send certain memos/emails to shore if there is any information of interest relating to curation and requests from the expedition if necessary.

Curatorial report

At the end of the expedition, the curatorial report is read by the Laboratory Officer in order to prepare the end-of-expedition Technical Report. Also, the document alerts the Curator and repository staff about any post-cruise sample request action that needs to be taken. At the same time, the on-coming Curatorial Specialist can learn about new procedures and equipment changes reading the curatorial report.

At the end of the Expedition, the Curatorial Report is sent electronically via email to the oncoming Curatorial Specialist (use their ship and shore emails if they have them), the GCR Curator and Superintendent, and the respective repository Curator and Superintendent if not the GCR. If the core shipment is being split between different repositories, it's a good idea to include the Curator and Superintendent there as well. An electronic copy is also sent to the Laboratory Officer, or place in their folder on the ship server in the format requested by them. Put an electronic copy in the Curator folder on the ship server (VOL1\IODP Official_Curator). Provide a physical copy for the oncoming Curatorial Specialist as well.

Include the topics below in your Curatorial Report. Within each area, be sure to discuss any exceptional differences from standard procedures. Of course, adjust the contents as appropriate. Previous reports can be found on the server, it is worth looking at those to structure yours.

- Summary – this might include a very brief statement on the locality and general cruise objectives.
- Sample Totals – The Laboratory Officer will be looking for this number.
- Shipments – Core – The Laboratory Officer will also be looking for this number.
- Shipments – Sample, Express, Hand Carried, Frozen, Refrigerated
- Emailed Files – a list of emailed files that were sent to the Curator and receiving repository Superintendent at the end of the cruise.
- Action Items
- Thin Sections

- Smear Slides
- Residue Distribution
- Special Projects, which might include the following:
 - a) Unusual sample requests
 - b) Curatorial Policies/Procedures: include information about cores, including any oddities important in core racking
 - c) Computing Hardware and Software
 - d) Curatorial Cookbook: copies and explanations of all changes made during the expedition.
 - e) Mention any special projects you attempted/completed during the cruise
- Problems Encountered - Note any problems with equipment, supplies or anything else.

Clean up

After all the cores have been boxed and stored, start with cleaning up the curatorial work areas. You should first make sure that all sample material has been removed from the Core and Foc'sle Deck. Gather the smear slides and thin sections for inventorying. Once you ensure that no slides are missing, label the boxes and pack them securely for shipping.

Also, sample bins need to be emptied and cleaned. Check behind bins on the floor for any stray samples.

Packing Samples

If personal samples are taken on board, check that each bag is sealed securely and labeled properly before transferring the samples to their individual p-boxes in the refrigerator. Bag sealers are not reliable. Therefore, you need to check each bag carefully before storing them in boxes. Samples occasionally get tossed into the wrong bins in the flurry of sampling activity. Inspection of sample boxes also allows you to check that sufficient volume is being taken. For all personal samples, the scientists should be encouraged to check their boxes to ensure that only their samples are contained in their sample box.

Frozen samples are stored in many locations on the ship. Likely they will be located in the -86 °C freezer on F-deck near the chemistry laboratory, in the -20°C freezer in the chemistry lab, or in

the -20°C freezer on the port side of the Hold Deck. However, there are also three -86 °C freezers on Upper Tween if needed.

You need to work closely with the ALO to arrange a time to wrap foreign air freight, get shipping labels, correct addresses for shore-based scientists and get dry ice in port-call. All frozen sample shipments are coordinated through the IODP Logistics person. As of March 2020 this person is Tim Bronk.

Core Laboratory Cleanup

After all sample material has been safely packed up for shipment it is time to clean up the Core Laboratory. Clear off the bulletin board and remove your personal items from the lab. The LO will assign you specific end of expedition clean up duties. Pay particular attention to the sampling area. Even if you are not assigned to Core Laboratory cleanup duty, do a preliminary cleanup of tools and equipment. This will avoid curatorial interfere at the time of the final cleanup.

Make sure the Curatorial Specialist's office on the F-Deck is clean and neat. Please wipe down the work spaces in the office and make sure to empty out the fridge for the next person. You may also cleanup the Curatorial mail account.

Onboard preparation for post-cruise sampling party

Post-Cruise sampling party refers to personal sampling that happens on shore, usually after a high recovery paleoceanographic expedition. This is held at one of the three IODP core repositories around the world. The Bremen Core Repository (BCR) is located in Bremen, Germany; (the Gulf Coast Repository (GCR) is located in College Station, Texas; the Kochi Core Center (KCC) is located in Kochi, Japan. As of March 2020, the GCR holds sample parties for cores stored at both the GCR and KCC. The permanent storage location of the cores depends on where they were drilled. Figure 78 shows the global divisions of the oceans, and the respective repository that houses the core material.

Core Distribution

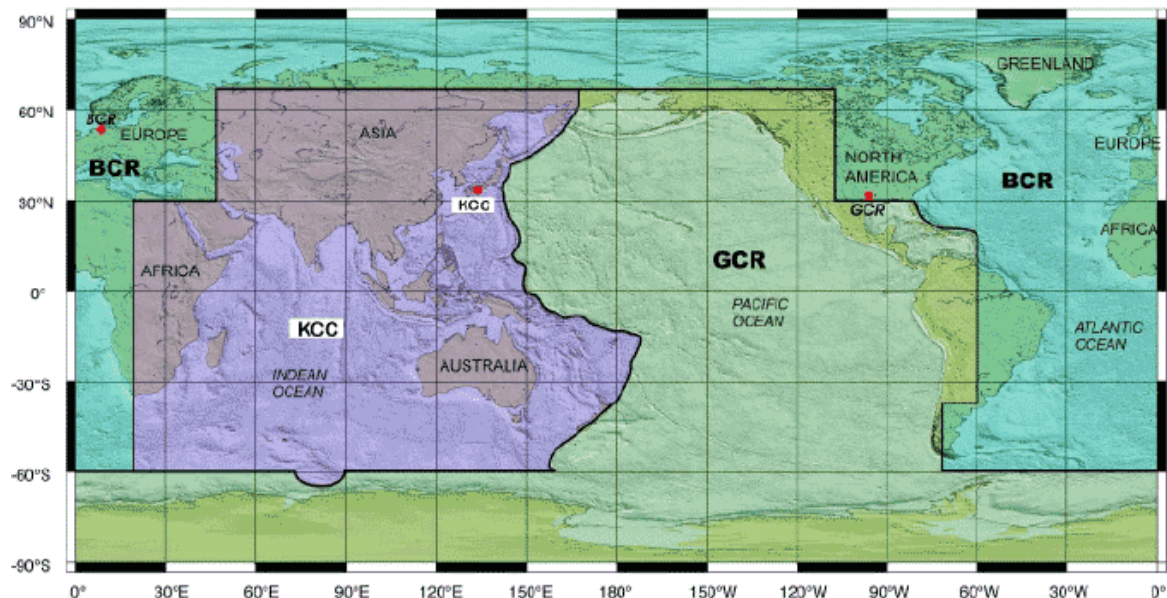


Figure 78. Distribution of scientific ocean drilling cores throughout the world. The geographic area a core is drilled determines what repository the core material will be stored: KCC (Kochi Core Center), GCR (Gulf Coast Repository) or BCR (Bremen Core Repository).

There are many things that you may do to prepare for this. First, try to get as many post-cruise sample requests as you can before the end of the expedition. If possible, ask the scientists to fill out pre-formatted Excel spreadsheets (*.xlsx files) with the details of the samples from each core section they will be requesting. It is important to instruct them how to properly fill out the spreadsheets. Work with the staff scientist to schedule a deadline for submitting post-cruise sample requests for the party. The staff scientist should convey this information to the science party.

Second, get copies of the composite section (splice) from the stratigraphic correlator for each site. Make sure there is sufficient overlap from one hole/core to another to avoid gaps. This allows the Repository staff to know beforehand which sections from which holes need to be pulled, and in what order they will be sampled.

Planning for the post-cruise sample party is usually seen as a luxury if there is a long transit, or little recovery. Do your best to talk to the scientists about sample types, how to best submit and format their sample lists, the Sample Party Planning Tool software (SPLAT) etc. while also being cognizant that they have end-of-expedition reports to finalize. See the Sample Party SOP Appendix for more information regarding shore-based sample parties.

Appendices

Water Samples

Water Samples collected during logging tool runs

There have been times where scientists have requested water samples to be collected during logging runs. For detailed descriptions of special tools, refer to Technical Report #31, Overview of Ocean Drilling Program Engineering Tools and Hardware. A web version is available at <http://www-odp.tamu.edu/publications/tnotes/tn31/tn31.htm>.

Kuster Tool

In order to curate water samples collected by the Kuster Flow Through Sampler (KFTS) you must enter the samples into the database as children of the Hole in which the tool was run. With the help of the Expedition Project Manager or Operations Superintendent, enter the bulk water sample (in centimeters) off of the Hole at the correct depth. If there are multiple KFTS runs at one site, assign a different name in the “Name” Field to each run. An example of the KFTS being run twice at a single hole is below (Figure 79).

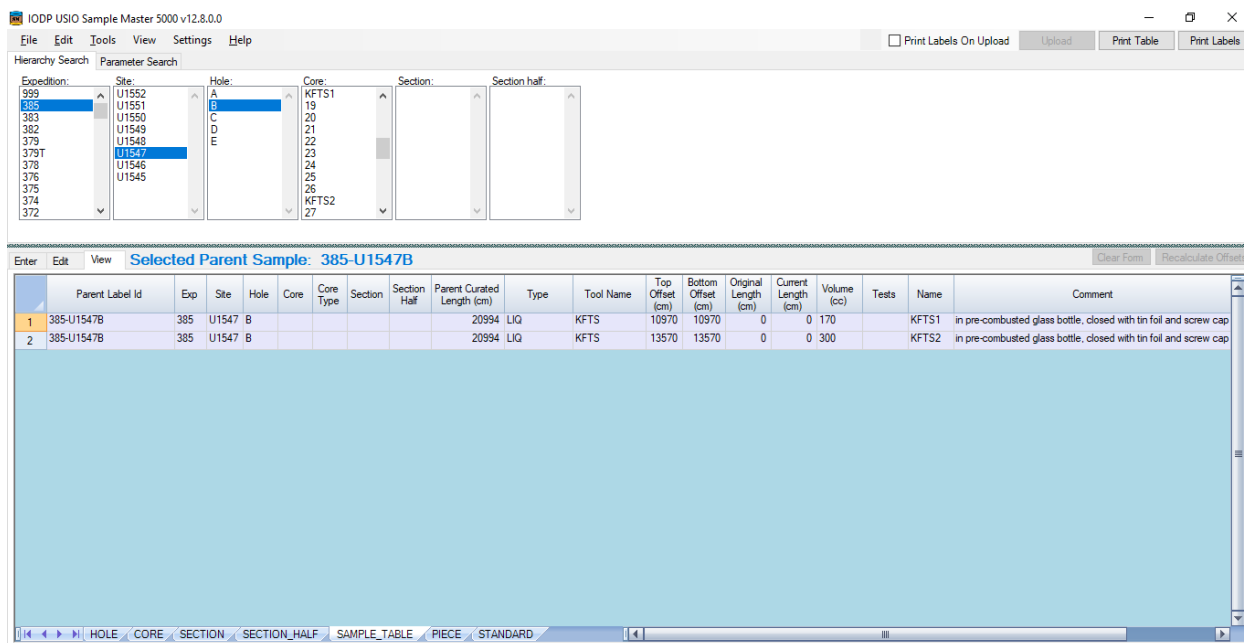


Figure 79. How to enter Kuster Tool samples

Curatorial Specialist SOP

Summary

The Curation Group is responsible for all core materials collected by IODP. This includes handling, preserving, sampling, storage, and database documentation. The Curatorial Specialist represents the Curation Group on IODP Expeditions. On the ship, the Curator enforces IODP sample policies, and ensures that cores and samples are preserved, sampled, stored, and documented correctly. One of the primary duties of the Curator is to serve a member of the Sampling Allocation Committee (SAC). The SAC is comprised of the two Co-chief scientists, the EPM (IODP Staff Scientist), and the Curatorial Specialist. This committee discusses sample and data requests, and approves shipboard and personal research samples taken from cores in accordance with the objectives of each expedition. The Curator's position on the SAC is to be an objective third party: a representative of IODP with no vested scientific interest in the core. Therefore, the Curator's primary duty on the SAC is to answer questions curatorial procedures and policies that must be followed, give advice for handling, preservation, documentation and sampling of core, and create and distribute sampling plans to the technical staff and science party to ensure the proper samples are collected. As a member of the SAC the Curator is involved in all sampling decisions. The Curator takes part in sample meetings with the SAC and science party. The Curator tries to maximize the use of the core in order to meet the scientific objectives of the cruise. It is also part of the Curator's job to help preserve material whenever possible. When the Curator is off-shift the ALO serves in their place solely to facilitate sampling agreed upon by the SAC, and to handle and label core on the catwalk during the Curator's off-hours.

Pre-Cruise

As a member of the SAC for the expedition, the Curator gives the pre-cruise presentation to the Co-chiefs and science party.

The curator needs to become familiar with overall scientific objectives of the cruise.

Duties Include:

- Reviewing all sample requests. Working with the EPM to determine sampling needs (special tools etc.). Obtain a summary research spreadsheet from EPM.
- 1 month (and on-going) meet with EPM to review sample requests and address issues arising, and become acquainted with individual scientists' research objectives
- Determine what ephemeral/approved personal samples will need to be taken on board, if not doing all personal sampling on board.

Port Call

Crossover with on-coming curator: The office, although generally a busy hub for oncoming and off-going crew alike due to location, is the off-going curator's and off-going E&O officer's office until they leave the ship. When the off-going curator has left, the oncoming curator/E&O officer can assume the office space.

Duties Include:

- Providing a digital and printed copy of the curatorial report to the oncoming curator.
- Crossover extensively about the frozen and refrigerated shipment. Show the oncoming curator all physical locations of all frozen/refrigerated shipments. Ensure that you have the correct number of frozen/refrigerated containers, and check all shipping labels. It is important for the curator to check the paperwork prepared by the ALO to ensure that it is correct.
- Coordinate off-going core shipment, and frozen/refrigerated sample shipments with ALO's and IODP logistics
- Attend scientists' presentations that discuss their research and sample requests (research objectives)
- Coordinate with the EPM to schedule the curation presentation, which includes overview of curation on the ship and back at the GCR, and any specifics about the expedition sampling/timelines for the science party.
- Meet with SAC and smaller lab groups (sedimentology/petrology, chemistry, paleontology, physical properties, paleomagnetism, microbiology etc.) to discuss shipboard sampling strategies.
- Locate necessary curation supplies and stock the sampling table. Most supplies can be found in the core splitting room and upper tween.
- Provide blank core box inventory sheets to the core lab for logging of working and archive halves.
- If you have a short transit to the first site, begin shipboard sample planning with the SAC and science party.

Under Way/Pre-Site

- Create pre-site sampling plan by depth intervals and holes (catwalk, sample table and chemistry) and distribute to SAC for approval.
 - Make sure to discuss the catwalk, sample table and chemistry plans with technicians after SAC approval.
 - Develop detailed plans for catwalk sampling and handling such as IW, rhizon and microbio sampling as required and communicate to the technical staff
 - Print out copies of the catwalk plan for the core entry table. Print out a large plotter paper sample table plan, or write the sample table plan on the white board over the sample table. Edit by hand or re-print as needed with changes.
 - Work with chemistry lab scientists and technicians to plan the distribution of pore water and squeeze cake "splits", and any additional samples (i.e. microbiology samples). Work with chemistry techs to formulate database entry/SampleMaster template and so forth.
- Work with paleontologists to decide how the paleontology catwalk whole round sample ("PAL") sample should be split and how samples should be entered into the database. If possible, discuss and future "residue" requests for PAL residue, paleo slides etc.
- Generate sample codes in Request Code Manager, so that request codes and numbers can be populated in Sample Master.

- Hold SampleMaster training classes for scientists and any new techs. Demonstrate how to sample, and explain procedures and policies. Make sure to discuss thin section requests, and where to find the request form.
- Work with the ALO to develop a core/personal or special samples storage strategy

On Site

Work with SAC to decide if any updates and changes are needed to the Site sampling plan and communicate them to the technical staff.

- When core is received
 - 1st core (assuming it is a proper “mudline” core and not a misfire or overshoot): measure sections and give driller the total length. Check with drillers for protocol if original measurement is off with the addition of end caps/expanding core etc.
 - Mark core sections, and catwalk samples on core entry sheets (recording intervals for entry into database). Ensure that correct curatorial procedures are observed.
 - Watch for gas expansion and drill holes, call for vacutainer samples if necessary.
 - In the case of gas expansion, have “sleeves” available to store excess material coming from top and bottom of sections, and liner patch to cover holes in liner if split. Re-measure each section after expansion before entering into database
 - In the case of the recovery of unusual materials decide how best to enter into the database and communicate to technicians, especially to the ALOs.
 - Enter all catwalk data into database.
 - Print and distribute section half labels to technical staff, and any additional catwalk sample labels if necessary (i.e. PAL labels).
- Coordinate with ALOs to monitor core track data to ensure all data has been collected and the core is ready to be split. Communicate to the technicians and core describers that a core is ready to be split.
- Move the working half to sampling table. Call scientists to mark samples, enter data, and take samples. Supervise the sampling table to ensure curatorial practices and policies are observed and the database is correct. Make sure to read up on hard rock curation in the Curatorial Cookbook if necessary.
- Monitor core flow and discuss with ALOs if problems arise.
- Ensure all sections are glad wrapped and prepped for boxing. Shrink wrap hard rock and critical intervals if necessary or requested.
- Check core box inventories to ensure working and archive inventories match before boxing, and correct errors as needed.

Between Sites (without transit)

- Before the end of the site, work with SAC to define the next site’s sample plan and be ready to distribute to the technical staff when required.
- Monitor core flow and sampling to ensure that there is no “run-over” into the next site.

Between Sites (with transit)

- Develop next site's sample plan, get it approved by SAC and communicate to technical staff.
- Collect, sort, and store residues and personal samples.
- Correct last site's sample data in the database.

Sample Parties

The Curator is responsible for coordinating sample parties with the LO ALOs, and SAC. This ideally occurs during transits or logging.

- For hard rock expeditions, all shipboard and personal sampling is done onboard.

EOX

- Prepare frozen/refrigerated shipments.
- Collect all residues and personal samples for shipping.
- Give post-cruise sample party presentation and sampling templates to scientists QA/QC sample data.
- Prepare (and send to GCR):
 - Smear slide and thin-section inventory (send to relevant repository).
 - Finalize core box inventory and generate an electronic copy.
 - Write Curatorial Report and distribute to LO.

JRSO Curation Sample Party SOP

By end of expedition

- Curator works with EPM and Co-chiefs to set a date for the Sample Party
 - **Sample party should be 4-6 months post-cruise** (moratorium cannot extend more than 18 months post-cruise).
 - Estimated sample party length (Based on number of expected samples, core recovery, and lithology):
 - As a guide, assume ~2,000-3,000 samples per day, depending on number of scientists who can attend.
- Sailing Curatorial Specialist gives presentation to shipboard scientists on how to submit sample requests via SPLAT.
- Curator works with EPM and Co-chiefs to set deadlines for SPLAT sample list submission
 - This will depend on the total number of sample being taken
 - **10,000-25,000 samples: Lists submitted 6-8 weeks before sample party**
 - **25,000-40,000 samples: Lists submitted 8-10 weeks before sample party**
 - It is possible to have staggered deadlines for different sites.
 - Last site should be submitted no later than 4 weeks before sample party
- Shipboard curator begins preparing customs forms and letters. China, Brazil, Australia, New Zealand.
 - Shipping references located in Google Drive
- Shipboard curator includes most up-to-date version of scientists' addresses in their End of Expedition email, and retains updated version to post and revise at the sample party.
 - Any scientists that are not going to be at the sample party but are receiving samples should be solicited before the sample party to send their updated addresses.

After expedition, before sample party

- **Permanent Archive is defined by Curator.**
 - Set at least 1 month prior to submission of sample lists and distribute to science party if there is a splice.
 - Revise as needed if splice is updated.
 - If splice requires XRF data the permanent archive is set when the splice is finalized using this data.
- **Submitting sample lists via SPLAT.**
 - Sailing Curatorial Specialist provides detailed instructions to expedition science party (2 versions: splice & non-splice). *Note: At this time curation advises using the SPLAT application to create sample lists rather than using Excel.
 - Sailing Curatorial Specialist will provide instructions and a give a presentation before disembarking from the expedition.

- Curatorial Specialist provides EPM with SPLAT documentation to be sent to the scientists to help with submitting sample lists. This documentation will be the same for all expeditions and kept in a location on the server for open access.
 - If scientists have issues with SPLAT they may contact the curatorial staff directly (Note: This is communicated to scientists via the EPM)
 - In the past we set a single deadline for all sites for sample list submission. We can also stagger the deadline for sites. The curation workload is a bit more manageable if you do not receive all of the lists at once.
 - GCR Staff meets with EPM as needed to prepare and help scientists upload their first site sample lists into SPLAT.
- **Sample List Receiving and Processing**
 - The Curator, Superintendent, and Curatorial Specialists are responsible for sample list preparation. For continuity, all Curation staff members should be copied on emails regarding sample lists and the sample lists backed up on the Curation server.
 - Once all sample lists for a given site have been submitted and explicitly approved by the EPM, the Curator moves individual sample lists into the master worklist. This will separate all of the scientists' sample lists by hole and combines them into one spreadsheet. This spreadsheet is then exported by the Curator or assigned staff member and saved as "UXXXX_Raw Combined"
 - Open the XX macro Excel file found on the server (CURATION_BriansMacros\XX). The Curatorial staff work with the Curator to assign Request Codes to the exported combined Excel file. Request Codes are manually entered into a tab in the exported combined file. Section information is entered into the Sections tab (exported from LIMS). Click the "Load and Prepare" button on the Controls tab, and choose the UXXXX_Raw Combined .csv exported from SPLAT. Save this file as "UXXXX_Vetted"
 - Overlaps: Click the "Highlight Conflicts" button on the Controls tab to check for sampling overlaps between scientists. This control determines if the volume requested exceeds what is available over a given interval. This is calculated centimeter-by-centimeter. The interval is flagged yellow if the volume is exceeded (note: for HRNDs, the interval will always be flagged in yellow. A work-around is to decrease the volume by 1-2 cc). This working file is saved as "UXXXX_Corrected"
 - GCR Staff work with EPM to manually correct overlaps and re-run overlap controls on the corrected file (UXXXX_Corrected).
 - ***Hold weekly meetings (at a minimum) between EPM and available Curation staff to work on correcting sample lists starting once the first sample lists have been submitted. This is a***

time-consuming process and should be started as early as possible.

- Curator will be responsible for taking and documenting notes on needed changes to resolve sample list conflicts.
 - Tasks for resolving conflicts in lists will be delegated as needed to Superintendent and Curatorial Specialists.
 - Superintendent and Curatorial Specialists: run the control called “Export for LIMS” in the Controls tab of the macro. This file is saved as “UXXXX_LIMS Export”
 - Once all overlaps are corrected Superintendent and Curatorial Specialists copy and paste formatted lists into Sample Master in increments of 500 samples or less. Samples are uploaded and labels printed. Labels are separated by Core.
 - Break off labels by section. Fold labels into a line of six labels, and repeat. Paper clip all sections in a single core together, or multiple cores if only a few samples per core are taken, as not to lose sample labels.
 - Superintendent and Curatorial Specialists print sampling log sheets and pull lists: Run macro “Sample_Sheet_Beautification_v1.0” that generates sample log sheets that print on 11x17 paper. Blue lines demark section breaks, red lines core breaks. This macro also generates core section pull lists in increments of 48 (maximum number that can fit on a GCR core section cart). Make sure student workers receive pull lists and understand which cores need to be pulled first. Save this file as “UXXXX_logsheets”
 - Make sure to right click-delete the whole page before loading file, as to not keep remnant blue/red lines from a previous upload.
 - Make sure to set the paper to 11x17, as the macro defaults to A3!
- **Logistics planning**

Discuss and plan logistics with the EPM and IODP Administration including transportation and meals.

 - Superintendent - Arrange transportation from hotel to GCR for scientists (typically via Ground Shuttle).
 - Provide IODP Administration with number of Curation staff and student workers helping with sample party for meal planning.
 - Curator - Discuss whether to have one or two shifts with the EPM (Note: this is done closer to the Sample Party).
 - Set sample party working hours with EPM.
 - Set sampling priorities with EPM (i.e. which sites, holes to sample first). This is important as it determines which sections are pulled for the Sample Party.
 - Work with EPM to assign scientists sample tables and sample shifts (if needed).
 - Identify which scientists will be responsible for taking p-mag samples (if needed).

- Identify if which scientists will be responsible for taking hard rock samples (if needed).
 - If there will be hard-rock sampling, C126 should be reserved to lay core out and label them.
- **Special Sampling**
 - Discuss any special sampling needs with the EPM early in the process in case any special tools or materials need to be made/ordered. Also make sure the EPM communicates this to the science party to include in their sample list comments and to discuss this with the GCR staff.
 - Most common example: biomarker sampling, combusted foil, metal tools etc.
 - Paleomagnetism (PMAG) sampling
 - Curation recommends that u-channels and p-mag cubes be taken ahead of the sample party by shipboard paleomagnetists.
 - GCR Staff will be available to help with PMAG sampling prior to sample party.
 - Scientists can be designated as a floater to take PMAG cube samples during sample party if needed.
- **Sample Party GCR Preparation**
 - Place supply orders. Note there is long lead times on some supplies and need to order far in advance
 - Curator - Set Curation staff schedules.
 - Superintendent - Set Student Worker schedules
 - Ensure sample stations have proper supplies (week before)
 - Clean Repository (day before)
 - Make boxes labeled with Sample Request Codes
 - Make sample and edit bins
 - Special handling for Organic Geochemistry (combusted foil, Ethanol)
 - Make individual hard-rock labels (if needed)

For BCR Sample Parties

- GCR staff will work with EPM to resolve sample list conflicts in the same manner as if sample party will be held at the GCR.
- Final sample list will be provided to the BCR at least one week before the start of the sample party.
- Curator and curatorial specialist/Superintendent will travel to BCR to serve on SAC and assist with implementation of sample party.

During Sample Party

- Introductory presentation by the Curator
 - Example presentation on CURATION (\\ARTIC) shared drive
- GCR staff will be available throughout their shift to answer questions, help sample if needed, and sort/edit samples.
- Sample Collection, editing and distribution.

- Student workers collect sample and edit bins from sample stations. The samples are distributed into individual scientists' sample box (labeled with their Sample Request Code).
- All bags are individually checked for a proper heat seal. If the bag is not sealed, reseal the bag before distribution.
- Confirm that samples are in the correct box by matching the Sample Request Code on the sample bag with that on the box.
- Sample edits are given to a Curation staff member. Edits should be performed in real time whenever possible.
- Post a list of scientist's addresses in A104. The expedition scientists should check their address for accuracy and make corrections before end of the sample party. Any scientists that are not at the sample party but are receiving samples should provide an updated address.
- Prepare customs forms and letters. China, Brazil, Australia, New Zealand are most complicated.
 - Reference shipping information is located in Curation Google Drive and is periodically updated.
- Curator prepares and distributes hand carry letters as needed.
- Double check address changes made during sample party before scientists leave.

Hard Rock sampling (when not done shipboard)

- Hard rock cores should be laid out for viewing prior to sampling (in C126 if available).
- Samples are identified by stickers with requestor identification.
- SAC (Co-chiefs, Curator, EPM) review all samples, and make edits as needed prior to sampling.
- 2-4 people (scientists, EPM and/or GCR Staff) are designated to take hard rock samples.
 - People selected for this should be comfortable using rock saws.
 - The number of people will depend on number of hard rock samples.
 - Prior to hard rock sampling, safety review of rock cutting area will be given by GCR Staff
- The space in front of the rock cutting room will be used as a hard rock sampling station, and is where the sample and edit bins will be located for hard rock.

Post sample party

- Check each sample box to see if it contains only the requestor's samples by matching the Sample Request Code on the sample bag with the one on the box. Samples are easily and placed in the wrong box.
- Double check each sample bag is properly sealed.
- When boxes are checked, place a checkmark on the top of the box. When it has been checked and marked twice, it is ready to be shipped.
- Double check address changes made during sample party
- Sample Party Shipping SOP: Google Drive spreadsheet

- See Google Drive→”Documents”→”Shipping Instructions” for shipping via FedEx
- Finalize customs forms and letters. China, Brazil, Australia, New Zealand are most complicated
 - Shipping information located in Google Drive.
- Track and log each sample party shipment in a Google sheet on the Google Drive to ensure all shipments are sent timely and clear customs.

Acknowledgements

The Shipboard Curatorial Cookbook is the result of the combined knowledge and writings of DSDP, ODP and IODP shipboard and shore-based curatorial staff. Many thanks to all who came before me.

Chad Broyles, February, 2014

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