

# Standard Operating Procedure - Paleomagnetism Lab

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The Paleomagnetism Lab technician shares his/her duties between the Core Lab and the Paleomagnetism Lab. This SOP addresses the Paleomagnetism Lab duties per se including the AMST and Digital Imaging System duties. For details on the Core Lab duties, refer to the Core Lab SOP.

## I. PORT CALL—ON COMING

- Go to your lab and begin cross over with the off going technicians. Read the lab report from the previous leg and discuss any changes in equipment status, software or procedures.
- Attend introductory meeting or any other safety or training meetings.
- If you have a service call, make sure you prepare all supplies etc. necessary for it. Find the service rep. and start ASAP.
- Assist with loading/unloading freight and other tasks as directed by the Lab Officer or his assistant.

The following tasks are to be performed on the Cryogenic Magnetometer before leaving port:

- Check the vital signs of the Cryogenic Magnetometer. Use the electronics interfaces to measure the vital signs inside the magnetometer: liquid helium level, SQUID temperature, shield temperature, cryo-cooler inner shield, cryo-cooler outer shield. Read the chill water return temperature on the Haskris water recirculating system. Check water level inside Haskris. Finally read the pressure on the cold head supply.
- Read the safety pressure gauge and boil off on the outside of the Cryogenic Magnetometer
- Update log sheets. The log sheets are located in the “//Cryo Vital Signs” binder and the excel log sheet data path’s: *C:\All Pmag\Cryomag Logsheets\Cryolognew.xls* on Tech Volume).

If a service call is scheduled in port call to refill the magnetometer with Helium, the following tasks are to be done:

- Prepare all supplies etc. necessary for it: fill hoses, pressure gauges, fittings, gloves and tools (located under the magnetometer and in the Second Look Lab on the Lower Tween).
- Set up a bottle of ultra high purity Helium gas prior to fill.
- Go through the 2G-Manuals and make sure you understand the procedures and have the manuals ready for the fill.
- Be sure that the Marine Logistic Coordinator at the upcoming port call has ordered the necessary amount of liquid Helium.
- Be extra careful to keep the log sheets updated during and after a fill.
- Measure the vital signs parameters frequently for twenty-four hours post-fill.

Other tasks include:

- Measure the interior field of the magnetometer using the 3-axis fluxgate (“field profile”).
- Heat the SQUIDs for 30 seconds. After waiting for about an hour tune the I-Bias currents for all the SQUIDs in order to optimize the SQUID response and set the counts on the electronic SQUID boxes to zero.
- Replace the compressor adsorber once/year and record the date
- If necessary, adjust the SQUIDs by accessing the calibration pots mounted beneath the SRM/Degauss Coil junction. To perform the adjustment, refer to the 2G manual. This shouldn’t be necessary but if required one must be extremely careful to follow the instructions! If a SQUID box is out of tune change it with a spare and have the bad box sent for repair immediately.

## II. SITE PREPARATION

The following is a list of actions that should be accomplished prior to arriving at the first site. On cruises with short transit times before reaching the first site it is advisable to perform as many of the preparations in port as possible.

### **Paleomagnetism Lab**

- Run standards through the Cryogenic magnetometer and add the results to the log sheet, data path *C:\All Pmag\Standards\Cryomag.Standards.xls* on Tech Volume.
- Bring several boxes of Paleomagnetism sampling cubes from the hold reefer. Drill a hole in the bottom of each cube and draw an orientation arrow on it. There is a template by the sampling table that fits over top a box of cubes for drilling. Orientation arrows are best marked with an indelible/waterproof marker
- Analyze and Charge Tensor Tool batteries. Condition the batteries if time permits and mark the date and operation performed on the log sheet.
- Train the scientists in the operation of the instruments used the most (e.g., Cryogenic Magnetometer, Molspin spinner, Kappabridge magnetic susceptibility system, AF Demagnetizer and Impulse magnetizer).
- Go over the various software packages with the Paleomagnetism scientist(s) (e.g., LongCore, Pmagic, Dtech2000 and Kappabridge programs). It is especially important is to familiarize the scientist (s) with the operation of LongCore. Set up data path files for the Cryogenic Magnetometer data.

## **AMST**

- Familiarize the Sedimentologists and Physical Properties scientists with the various AMST instruments, software package, and how to measure and log cores.
- Perform several runs on the AMST using practice cores. Be sure data is being saved correctly and the instruments are working properly. Set up data path files for the AMST data.

## **Digital Imaging System**

- Change the light bulbs if they were used frequently on the previous Leg or the light source seems yellow or fading.
- Carry out a white and black calibration of the camera on the Digital Imaging System (DIS). Set the focus and aperture.
- Demonstrate the DIS for the Sedimentologists and Physical Properties scientists and explain the importance of correct aperture settings.
- Perform several test scan's and evaluate the images with the scientists.

Other activities include:

- Stand Underway watches in the geophysical lab as assigned by the Lab Officer.
- Perform core lab duties on spare time.

## **III. ON SITE ACTIVITIES**

The following is a list of actions that are accomplished once on site by technicians alone or cooperatively with the scientists assigned to the laboratory for a Leg.

### **A. SAMPLING**

The basic magnetic measurements are conducted on whole/split sections and discreet samples:

- Continuous sampling is done on archive halves of the cores. Archive-half cores need to be equilibrated before being run in the Cryogenic Magnetometer. They are "fed" in the magnetometer by either the technician or scientists.
- Discreet sampling is usually done by the paleomagnetists on the working-half of the core. Hard rock samples are to be sampled with a non-magnetic drill on a drill press in the sample preparation area. Soft sediments are sampled using non-magnetic plastic sampling boxes.
- From time to time U-channels are collected into split core sections by scientists for post cruise analyses

## B. ROUTINE LAB MEASUREMENTS

The following is a list of the typical analysis done shipboard by the paleomagnetism technician and scientists. It is a good idea to discuss with the scientists at the beginning of the leg who will be responsible for which analysis. Data entry in Janus is mainly the technician's responsibility.

- Continuous Magnetic Remanence will be measured on archive halves of cores using the Cryogenic Magnetometer. The magnetometer can also be used to measure and demagnetize discrete samples. The work is usually shared between the technician and the paleomagnetists. See the 2G Magnetometer manual and LongCore software manual for specifics on running the instrument.
- Magnetic susceptibility and anisotropy of magnetic susceptibility (AMS) of discrete sediment and hard rock samples are acquired using either the Bartington Susceptibility Meter or the Kappabridge Magnetic Susceptibility system. The collection of data is non routine and usually done by the scientists. The data are not stored in the database. Refer to the Handbook for the Shipboard Paleomagnetist (Tech Notes 18) for calibration instructions of the Kappabridge,.
- Isothermal Remanence (IRM) and anisotropy of IRM can be measured on an ASC Impulse Magnetizer. The collection of data is non routine and usually done by the scientists. The data are not stored in the database. For operating instructions, refer to the Handbook for the Shipboard Paleomagnetist (Tech Notes 18).
- Demagnetization of hard rock or soft samples can be done on the DTECH Demagnetizer or the Schonstedt Thermal Demagnetizer depending on the scientists' interest. For operating instructions of the two demagnetizers, refer to the Handbook for the Shipboard Paleomagnetist (Tech Notes 18).
- Orientation of cores recovered by advance hydraulic piston is measured using the Tensor Tool. This instrument is run by the Paleomagnetism technician.

The following tasks are performed on a routine basis by the paleomagnetism technician:

### Paleomagnetism Lab

- Upload Cryogenic Magnetometer data to JANUS using the Generic Upload application and edit any mistakes using the "Cryoedit" application on the workstation. Periodically scroll through uploaded data and make sure there are no errors that were not reported on log sheets.
- Clean and demagnetize core tray of Cryogenic Magnetometer at each change of shift or whenever deemed necessary. Wipe down the tray with isopropyl alcohol and Kimwipes when cleaning. It's especially important to keep the track and boat clean when the sediment is changing from high intensity core samples to low intensity.
- Tune SQUIDS of Cryogenic Magnetometer at the change of each shift or whenever necessary.
- Check the boil off and the "SAFETY pressure gauge" on the magnetometer every day at shift change or whenever deemed necessary. Periodically (normally once a week) check and record vital signs of the Cryogenic magnetometer and enter the data into the vital signs sheet located in the "//Cryo Vital Signs" binder and the excel logsheet, data path: *C:\All Pmag\Cryomag Logsheets\Cryolognew.xls* on Tech Volume.

- Calibrate the Molspin spinner every hour of operation when in use. This is normally done by the scientist (s).
- Ensure that all instruments are free of dirt, lubricated and fully operational in the lab.
- Whenever whole rounds are to be measured, make sure to knock off the ice inside the magnetometer and raise the tension on the track lines. Make sure that the scientist (s) are aware of this so the cores won't get stuck.
- Remain in contact with the Core Tech and Operations Manager while orienting APC cores. Make sure that the Tensor Tools are exchanged every 8 hours.
- Recharge Tensor batteries with the Alexander charger after every run.
- Correct declination data at the end of each hole, ensuring that the orientation values are correct. Re-examine Tensor data if declination data seems peculiar, correct if possible/necessary.
- Download Data from Tensor Tools and save to a disk/network. Select the orientation points and save them to Janus using the T-Tool application on the PC. Make a spreadsheet for the scientist (s) and add comments to the data, such as good, medium or bad run, averaging factor and number of points and tool number.

### **AMST**

- Perform a zero / white calibration on the AMST spectrophotometer (RSC) at the change of each shift or whenever deemed necessary.
- Upload AMST spectral data to Janus using the Generic Uploader application on the PC in the Paleomagnetism Lab. Edit any known mistakes prior to uploading. Periodically scroll through data and edit any mistakes using the "RSCedit" application on the PC and make sure everything is uploaded correctly.
- Compile the Magnetic Susceptibility data in a spreadsheet after each hole. Add depth and make the data available for the scientists.
- Make sure that rolls of Glad polyethylene wrap are cut in three and available for the scientists at all times.
- Clean the track after each site or whenever deemed necessary.

### **DIS**

- Once a day or whenever deemed necessary, carry out a white and black calibration of the camera on the DIS and set the focus and aperture.
- Clean the track after each site or whenever deemed necessary.
- Keep a dialog running with the whoever is editing the images. Make sure that cores are being rescanned if errors occur.
- Look at the images and check if the scientists fully understand the importance of correct aperture settings

### **C. GENERAL ACTIVITIES**

- Perform core lab duties as assigned.

- Maintain good notes or a logbook for each instrument to document problems encountered and monitor changes in parameters.
- Check and maintain your inventory on a regular basis and submit orders to the Assistant lab officer. This includes both SIMAN and non-SIMAN items.
- Update shipboard manual and cookbooks on a regular basis.

#### IV. LAB MAINTENANCE

In the Paleomagnetism Lab, a lot of the maintenance takes place on a daily or weekly basis during the Leg as partially listed in the section above. However, for some instruments, maintenance is only required on a monthly or quarterly or yearly basis. The end of Leg maintenance is a must.

##### A. During Leg

- Monitor vital signs of Cryogenic Magnetometer on a regular basis to ensure that temperature remains constant within the instrument and to check helium boil-off.
- Clean and lubricate the Tensor tools on a regular basis.
- Annually, change the cryo-cooler adsorber (every 10,000 hours of use).
- Annually, have the ET's do maintenance on the Haskriis water recirculating system.

##### B. At the End of Leg

- Clean the Tensor tools and check if the o-rings are in good shape otherwise replace them.
- Clean the boats for the Cryogenic Magnetometer.
- Clean the entire length of track and replace any of the Harken ball bearings if deemed necessary.
- Polish and clean the Cryogenic Magnetometer outer surface. Be careful though, it's a delicate instrument!
- Heat the SQUIDS and striplines. Set the I-BIAS on the magnetometer. Make sure the noise level is normal.
- Run the Standards through the Cryogenic Magnetometer once everything is complete. Add the data to the logsheet *C:\All Pmag\Standards\Standards.xls* on Tech Volume.
- Clean the ceramic boats for the Thermal Demagnetizer.

## **V. END OF LEG ACTIVITIES**

- Ensure that the downloaded text files of the Tensor Tool are named and stored in the proper folder on the small Compaq laptop, PC5639 and Data 1.
- Put any left over Paleomagnetism cubes in the Paleomagnetism cubes drawer.
- Make sure all data are updated, edited, corrected and sent to Janus before the MCSs cut off database access. All non essential data should be erased from the hard disk of all the Lab MACs and PCs.
- Write the end-of-leg lab report, give a copy to the Lab Officer and Yeo-person.
- Make a copy of the log sheets (both Cryogenic magnetometer and the AMST) and hand them in a binder to the Lab Officer for shipment back to headquarters.
- Pack up equipment being returned for repair and give the Assistant Lab Officer the following information: ODP inventory number, value, weight, serial number, model number, vendor's name and country of manufacture.
- Give the Lab Officer a list for port purchases if any.
- Perform the end of leg maintenance as listed above.
- Clean the lab as listed below and other area as assigned. Bring all the trash including the glass container to burn basket or incinerator.

At the end of the Leg, it is the responsibility of the paleomagnetism technician to clean the Lab as follows:

- Clean the various Paleomagnetism Lab instruments gently. Make sure all hoses and cables are well plugged and secured
- Clean the AMST track and make sure it's fully operational.
- Clean the DIS track and make sure it's fully operational
- Clean under and above the Cryogenic Magnetometer.
- Vacuum all the shelves and wash thoroughly countertops and cabinets.
- Clean the desk and the stereo system.
- Clean all monitors, keyboards AND mouse pads.
- Clean the lights and vents.
- Vacuum the chair seats and wash their feet.
- Vacuum and scrub the floor.

## **VI. PORT CALL—OFF GOING**

- Find the oncoming marine specialist for your lab and cross over. Make sure the technician that is replacing you is aware of any changes made to the lab, procedures, current equipment status, and if port purchases are necessary.
- Attend port call meeting.
- Unload off going air-freight and frozen shipment, or any freight as required. Load on coming freight if time permits.