

Sediment core initial processing: workflow and decisions to produce a continuous stratigraphy

Purpose:

To correlate overlapping core drives, develop a continuous sequence for sampling, and cut core segments (@ 1-cm resolution) into sample bags.

Background:

Lake sediment cores, even if wrapped in saran wrap and stored at 4°C, lose water and shrink over time. Cutting cores into ≤1-cm sections and storage in Whirlpak bags allows easy access to samples.

Tools needed:

- Spatulas and knives
- Squirt bottle with RO water for cleaning spatulas, clean rags.
- Bags: Fisherbrand™ Sterile Bags with Round-Wire Closure item 14-955-175
- Tackle boxes (Plano Utility box, Grainger item number **30F071**)
- Labels for plastic bags (use label maker)
- Plastic wrap
- D-tubes
- Plastic depth markers (cut up old weigh boat plastic trays into pieces ca. 1 x 2 cm in size).
- Sharpie markers

Types of cores and labelling:

- 1) The site name is usually a three or four-letter code. Check the master list of site codes in order to not duplicate codes.
- 2) Surface cores are usually labeled 'SS'. Surface cores usually extend 40- to 60-cm below the sediment-water interface, and are sectioned in the field at 1-cm intervals, labeled 0-1, 1-2, 2-3, etc.
- 3) Livingstone core drives. Each core of consecutive 1-m drives is labeled by roman numerals. Each drive is labeled by a letter. Thus, the first drive on the first core from a site called Mirror Lake is labeled MIR IA.

- 1) Surface core (usually labeled SS): Measure magnetic susceptibility
 - a) Place sample in 7-dram polystyrene vials. These vials have 26-ml capacity. Use Sapphire Instruments cup meter.
- 2) Split Livingstone cores. Work with two people. Wrap tightly with plastic wrap on clean PVC holders. 'Work' half stored in D-tubes with black caps. 'Archive' half could be stored in D-tubes with red caps.

- 3) Determine tie point between SS core and the top Livingstone drive. The goal is to have a "depth below sediment-water interface" assigned to the top Livingstone drive that is more accurate than the depths measured during coring (which may vary by as much as ± 5 cm).
 - a) Use measured depths of each core to estimate the overlap area between the SS core and the top Livingstone core.
 - b) If there is an obvious visual tie point (examples: tephra, sand layer, color change) within ± 5 cm of the estimated alignment of the two cores, then use this point to tie sampling from the SS core to the Livingstone core.
 - c) If there is no obvious visual tie-point between the SS core and the top Livingstone drive, then use the magnetic susceptibility stratigraphy to find a correlation between the surface core.
 - i) Subsample the top Livingstone core over the depths of possible overlap with the SS core. Place samples into 7-dram polystyrene vials.
 - ii) Measure magnetic susceptibility with the Sapphire meter.
 - iii) Plot the two Mag. Susc. profiles separately and examine visual correlation (be sure the x-axes are the same). A correlation should exist within ± 5 cm of the measured depths.
 - d) If no correlation is evident, then use measured depths and select a tie point and use the higher-quality core for the majority of the overlap depths.
- 4) Determine tie points on overlapping Livingstone core drives to develop a continuous sequence, avoiding zones of potential contamination at tops of Livingstone drives.
 - a) Place tie points at distinct color changes and marker beds. Describe the tie points on the core sheet.
 - i) If tie points not visible,
 - b) Favor one of the cores (core I or II).
 - c) Place plastic markers at tie points and at every 10 cm in both work and archive core halves. Place markers on the 10-cm depths (for example, at 30, 40, 50 cm below sediment-water interface).
 - d) Depths will be referred to these markers.
- 5) Describe sediment using terminology from Schnurrenberger et al. (for color, texture, gradations between units, presence of laminations). Describe on core log sheet.
- 6) If a fine stratigraphy exists, obtain images using line-scan camera at Oregon State University. If detailed sediment density data is important (e.g., for reconstructing erosion history) then use CT-scans at OSU vet school. Otherwise, simply photograph with hand-held camera.
- 7) Wrap both work and archive cores tightly with saran wrap. If not needed, 'Archive' halves can be sealed in black plastic tubing (two core-halves, face-to-face) and stored in core boxes. This saves valuable cooler space.
- 8) Cut the work-half of the core (of the portion to be used) into 1-cm sections and store in Whirlpak bags. Clean exterior of core if smearing on outside of core suspected. Note on

core sheets that cores were cut into samples. Label bags using site code and the depth interval (i.e., the depths as noted on the core-drive sheet).

- a) If abrupt changes in sediment occur, modify the depth of sampling so as to not span the abrupt change in sediment type. Label to nearest 0.1 cm. (normally this is rarely needed, e.g., for tephra).
- b) Organize samples into tackle boxes.

Schnurrenberger, D., Russell, J., and Kelts, K., 2003, Classification of lacustrine sediments based on sedimentary components: *Journal of Paleolimnology*, v. 29, p. 141–154, doi:[10.1023/A:1023270324800](https://doi.org/10.1023/A:1023270324800).

Adaptive, iterative, process to develop a radiocarbon-dated pollen profile.

- 1) Dates to obtain immediately: Core base (if possible)
- 2) Process and count 12 pollen samples roughly evenly down-core. Plot a diagram.
- 3) Note locations of change in the pollen percentages. Select 12 more depths with increased resolution at depths of major changes. Process and count pollen, plot new diagram.
- 4) Obtain a few radiocarbon dates at depths of rapid changes in pollen percentages.
- 5) Build age-depth model. Plot diagram on age scale.
- 6) Select depths for 12 pollen samples with the aim for even temporal resolution. Process and count samples. Plot diagram. Return to step 4.