Procedures for magnetic susceptibility measurements using the Sapphire Instruments cup meter

Set up

The meter is located in the microscopy room. Place the meter on a wood surface (the wood chair) at least a meter from any solid metal in the room. Use the same positioning of the meter at all times. Keep all metal away during measurements (e.g., keys, phone, watch).

Software

These instructions are for measuring samples in 7-dram (25.9 ml) polystyrene vials in a cup meter. The software was developed in particular for handling cores in the ring meter, thus some data fields are not needed. These instructions also assume that sample depths are labeled as depth below sediment-water-interface.

Open the Mag Susc custom software developed by Megan Walsh. The executable is named UI.exe

> Enter initials of user
> Enter site code
> Select cup meter.
> Core number = this can be the year the core was taken, not I, II, III, etc.
> Water depth=0
> Core starting depth: this is normally 0, if the upper-most sample to be measured is 0-1.
> Core ending depth: the lowest depth in the samples.
> Enter volumes as 1 cm^3

Add drive: drive number. This refers the code of the Livingstone 1-m drive. Normally A, B, C, etc. Since you are not using continuous cores, this can be any value; it is not used in later steps. You *could* enter the drive numbers from which the samples originally came. It is also possible to use a single "drive" in this software for an entire core from sediment-water interface to core base.

Take measurements:

- The highlighted row in the program refers to where the sample will be measured.
- If the vial is partly full, center the sample within the coil (use paper towel in the bottom of the cup.
- Follow instructions alternating air and sample measurements.
- Use empty vial for air measurements.
- Keep notes (in a notebook) on the volumes of each sample in the meter. You will enter the volume information in the spreadsheet later.

Following measurements, open data in Excel and adjust samples by volume of sample in the coil so that results can be reported as volume-specific magnetic susceptibility: cgs emu/cm^3

Volume of vial within coil = 12.27 cm^3
Density of MnO_2 in vial = 1.85 g/cm^3
Mass of MnO_2 under sensor = 22.7 g
Expected reading of MnO2 standard = 26.2 x 10^{-6} cgx/g * 22.7 = 594.74 x 10^{-6} cgx
If S = observed measurement of MnO_2 standard, then:
Calibration factor = 594.74 x 10^{-6} / S

In Excel, multiply all sediment samples by the calibration factor, and divide by volume of sample. Ideally, the calibration factor will not change appreciably from day to day, and only one single calibration factor can be used on all samples.

Important Notes:

Take MnO_2 reference samples every 50 samples. To do this, save and quit your core, and open new file for MnO_2 measurements.

Note that the software may not handle negative susceptibility values properly. This may be a source of the program crashing. High organics and diatom content may produce negative values.

The air measurements are used to calibrate the lower bounds of the measurements and account for natural drift in measurements. This calculation is in the software. The MnO2 measurements can be used to detect drift of the upper bounds of the measurements and check if accuracy is changing over the course of measurements. These measurements may be used to develop a constant factor to multiply your measurements so the absolute cgs values are accurate. See above for more information.

Be sure to save output files as csv.
Open in Excel to complete the calculations (applying calibration factor and entering sample volumes for each sample).
Save with a different file name in Excel, as an Excel workbook.