EUROPEAN **M**OUNTAIN LAKE **E**COSYSTEMS: **R**EGIONALISATION, DIA**G**NOSTICS & SOCIO-ECONOMIC **E**VALUATION

EMERGE
Protocol #28

SEDIMENT TRAPS FOR EVALUATION OF PARTICLE DYNAMICS IN MOUNTAIN LAKES

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Sampling protocol for EMERGE site operators work package 4

1. Objective

The main objective is to characterize the particle dynamics in ice covered high mountain lakes during the course of the year. Especially high resolution studies of particle fluxes during ice break-up and freezing periods in perennially ice covered high alpine lakes are missing yet. The only way to collect information about processes that take place during these two very important time periods is to deploy computerized automatic sequencing sediment traps.

2. Sampling methods

The amount and composition of material collected in the traps will be compared with data resulting from total material of the sediment record. We expect to measure a gross flux composed of atmospheric and catchment input, lake internal productivity and resuspended material from the lake bottom.
Depending on the lake different types of sediment traps will be deployed that will collect 2 to 48 individual samples per year. The focus is on high resolution (days to week)s sampling of the two critical periods i.e. freezing and thawing of the lake.
All possible disturbancies which could interact with the sedimentation of particles must be avoided, especially coring must be done very carefully.

3. Trap design

Two types of sediment traps will be deployed in 3 EMERGE reference lakes (Gossenköllesee, Lake Redó, Paione); (1) open traps and (2) sequencing traps.
(1) The design of the open traps (EAWAG-130) is described in Ohlendorf & Sturm (submitted), which have already been used in Hagelseewli during the MOLAR project. These traps collect particles with an active area of 130 cm^2. The total annual fluxes determined with open traps are used to cross-check the total fluxes of the sequencing traps, exposed during the same time and the sediment accumulation rates of the sediments.
(2) The sequencing traps collect particles with an active area of either 500 cm^2 (TECHNICAP-PPS3/3 with 12 cups) or 5000 cm^2 (TECHNICAP-PPS5/2 with 24 cups). Each of the sample cups can be programmed individually, i.e. it is possible to collect samples during unevenly spaced time intervals ranging from hours to years. Sample cups are made of PVC and have a volume of 250 ml each cup. Sample collection will start only some time after the mooring has been set to avoid collection of resuspended material that originates from sediment resuspension during the installation of the mooring.
An “I”-mooring string is used to deploy the traps in the different lakes (see Fig. 1). The mooring consists of an anchor weight (> 40 kg), a pre-stretched plastic rope (Ø = 6-8 mm) and several floats at the upper end of the string providing the needed buoyancy. Trap units, including one sequencing trap (TECHNICAP PPS3/3 or PPS5/2) and one open trap (EAWAG-130) are attached to the mooring string at 1.5 m above the water/sediment interface. Additionally, depending on the depth of the lake, one to three open trap units are attached to the string higher up in the water column. One of these should be just below the epilimnion. In order to avoid damage by ice and loss of buoyancy by large changes of lake level the floats have to be installed at sufficient water depth; the uppermost floats, which guarantee an upright position of the mooring, should be installed at a water depth of at least 2 m. If necessary, for exchange and/or retrieval of the traps an acoustic release system can be installed. It has to be ensured that no disturbances occur during deployment periods of the traps, such as net-fishing and water sampling activities near the mooring.

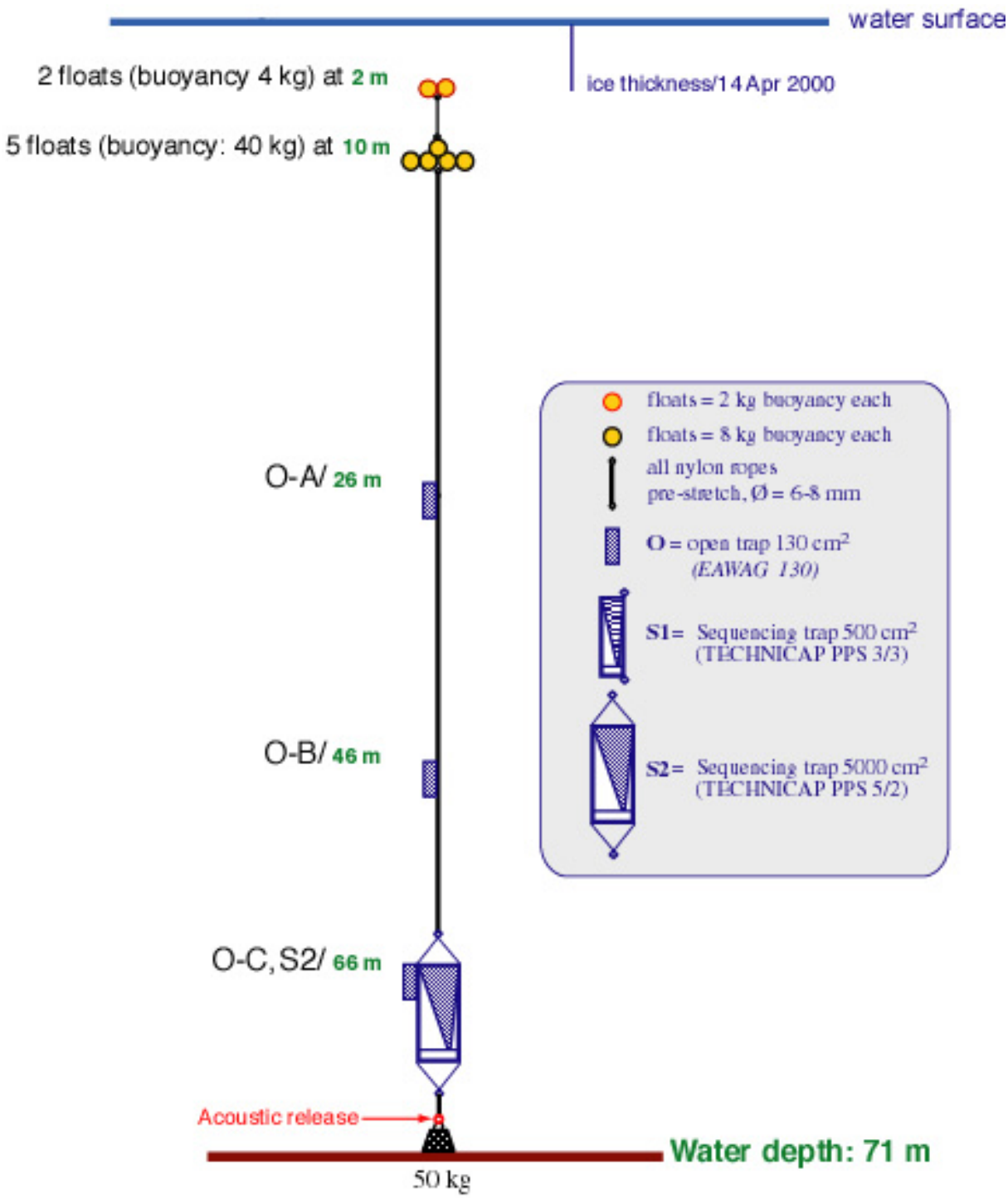

Fig. 1: Example of sediment trap mooring under ice (installed without acoustic release in Lake Redó in April 2000).

4. Sampling technique

After retrieval of the sediment trap units:
- remove individual sampling cups (2, 12 or 24) from trap units,
- note in a sampling protocol macroscopic observations (e.g. colour, swimmers)
- close sampling cups with PVC lid,
- transfer into cooling box,
- transport to cool-room (4-8°C)at EAWAG.

Before starting further activities, sampling cups have to be left standing in cool-room (4-8°C) for 48 hours, to ensure settling of all suspended particles. After 48 h:
- measure pH and conductivity,
- decant supernatant water into plastic bottle,
- note decanted volume,
- acidify decanted sample to a pH of 2 with HNO_3,
- store fluid for further analyses (DOC, N_{tot}, Si, NH_3, P_{tot}, Ca, and major ions) in cool-room.

From the remaining homogenised suspension:
- take one drop (note volume) with a pipette,
- transfer to a NUCLEPORE® filter for SEM-EDS.

From the remaining homogenised suspension:
- take three drops (note volume) with a pipette,
- transfer into three small cuvettes for laser granulometry.

Freeze dry rest of the suspension:
- transfer into open jar,
- close with perforated plastic foil,
- let sample deep freeze in a freezer,
- transfer to freeze-drier,
- determine dry weight,
- split into aliquots for further analyses (e.g. TOC, TIC, TN, Si_{bio} ,major ions, metals, SCP, diatoms)

5. Results

All data, of sediment trap are stored on EXCEL work-sheets containing:
- total flux (mg cm^{-2} yr^{-1}),
- TOC, TIC, TN (mg kg^{-1}),
- major ions (g kg^{-1}),
- metals (mg kg^{-1}),
- SCP's (n cm^{-2} yr^{-1}),
- diatoms (list of species, DDI),
- EDS (semi-quantitative chemical analysis of major elements),
- SEM pictures (stored as JPEG or TIFF-files).