European Mountain lake Ecosystems: Regionalisation, diaGnostics & socio-economic Evaluation

EMERGE

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SEDIMENT CORES

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EMERGE PROTOCOLS: SEDIMENT CORES

1. Full cores from new areas (Romania, Bulgaria) and Ladove (Tatras).

Cores are needed to cover the last 150 years. In AL:PE / MOLAR, cores 30-40 cm in length were found to be sufficient for this purpose. Gravity corers (e.g. Glew) were found to be satisfactory. However, any corer that takes undisturbed cores of sufficient length (and gives enough sediment mass per slice - see below) is suitable. It is important to stress the need for a good undisturbed sediment / water interface so that the surface layer(s) are known to be intact. Laboratories responsible for coring should check with Joan Grimalt (CSIC) about the suitability of their coring apparatus for taking cores for POPs. Four cores should be taken.

Extrusion

- The cores should be extruded vertically. Extrusion should be in 0.25cm slices between 0 - 5cm and then 0.5cm slices from 5cm to the base of the core. Samples are best obtained from the centre of the tube to avoid 'smearing' and this is best achieved by using two sampling rings of differing sizes.

Core 1.

- The 'Master' core. This should be the less disturbed and longer core. Samples for ^{210}Pb will be amalgamated if necessary.

- The core should be split on extruding into two halves. The first half should be stored in acetone rinsed aluminium foil for POPs analysis, **frozen** as soon as possible and transported frozen to CSIC (see storage and transport requirements below).

- The second half should be stored in sealed, labelled plastic bags and kept cool until further analysis can be undertaken. Dry weight, loss-on-ignition and wet density analyses should be done by the laboratories responsible for the coring. Sub-samples for metals analysis (3g wet) should be placed in acid-washed glass vials and sent for metals analysis.

- The remaining samples should be sub-sampled for diatom analysis (0.1g wet weight) and then dried either by freeze drying or in a drying cabinet in a 'clean air' laboratory. Sub-samples of 0.1 - 0.2g dry mass can then be taken for SCPs and the rest sent for ^{210}Pb dating.

- Diatoms to be analysed by UCL and / or local groups. SCP samples to be sent to Neil Rose (UCL); metals samples to Gloria Lacort (Barcelona - see storage and transport details); ^{210}Pb samples to Peter Appleby (ULIV)

Core 2.

- The sediment should be stored in sealed, labelled plastic bags and kept cool (4°C) until further analysis can be undertaken. Dry weight and loss-on-ignition analyses should be done by the laboratories responsible for the coring in order to cross-correlate with the dated core.

- The rest of the sediment (as much as possible) should be weighed into labelled plastic bags (also label the bag with the sediment weight) and sent for chironomid analysis (Øyvind Schnell - UiB for the Romanian and Bulgarian sites; Peter Bitusik - IZ-SAS for the Tatra site).

Core 3.

- The sediment should be stored in sealed, labelled plastic bags and kept cool until further analysis can be undertaken. Dry weight and loss-on-ignition analyses should be done by the laboratories responsible for the coring in order to cross-correlate with the dated core.

- The rest of the sediment should be weighed into labelled plastic bags (also label the bag with the sediment weight), sealed and **frozen** as soon as possible and sent for pigment analysis (Andrea Lami - CNR) after which it will be sent for cladocera analysis (Anton Brancelj - NIB).

Core 4.

- This is a back-up core. Extruded samples should be stored cool, in sealed plastic bags. DW and LOI analyses should be undertaken on this core for correlation purposes. All samples should be clearly labelled with site name/code, core code and sediment level.

SEE BELOW FOR DETAILS OF STORAGE AND TRANSPORT REQUIREMENTS.

2) Cores for sediment focussing studies (Redo, Ladove)

These cores are needed to map the spatial distribution of sediment records over the bed of the lake. Approximately 6 cores will be taken covering a representative set of locations over the bed of the lake, following the same coring procedures as those indicated above. The precise locations of each core should be determined e.g. by sightings to various fixed points on the shore. Taking cores from shallow waters is likely to be a problem. It would be helpful to map the bottom sediments in advance of coring.

Extrusion

- The cores should be extruded vertically. Extrusion should be in 1 cm slices between 0 - 5cm, 2 cm slices from 5-11 cm, and thereafter in 3 cm slices to the base of the core.

Sample treatment

- Each slice should be divided into two equal parts, one to be used for POPs and the other to be used for radionuclides, trace metals and SCPs.

- The POPs samples should be stored in acetone rinsed aluminium foil and **frozen** as soon as possible (see storage and transport requirements below) after which they should be sent to Joan Grimalt (CSIC). Selected samples chosen on the basis of the radiometric results will be bulked and analysed as a single sample for POP inventories

- The half for the 'other' analyses should be stored in sealed, labelled plastic bags and kept cool until further analysis can be undertaken. Sub-samples for metals analysis (3g wet) should be placed in acid-washed glass vials and sent to Gloria Lacort (Barcelona). Selected samples chosen on the basis of the radiometric results will be bulked and analysed as a single sample for metal inventories.

- Dry weight, loss-on-ignition and wet density analyses should be undertaken by the laboratories responsible for the coring. Once these have been done the remaining sediment can be dried either by freeze drying or in a drying cabinet in a 'clean air' laboratory (by local groups).

- The dried sediment should be sent to Peter Appleby – ERRC (ULIV) where they will be analysed for ^{210}Pb and ^{137}Cs. Selected sub-samples will be taken, amalgamated and analysed for SCPs (Neil Rose (UCL).

SEE BELOW FOR DETAILS OF STORAGE AND TRANSPORT REQUIREMENTS.

3) Cores for gradient studies

Cores will be taken from 3 lakes in the Italian Alps (the Paione lakes (Superiore, Medio, and Inferiore)), 3 lakes in central Norway (Fallbekktjern; Øvre & Nedre Neådalsvatn), and 3 lakes in the Slovak part of the Tatra Mountains (Vysne Wahlebergove pleso, Vysne Temnomsmrecineske pleso, and Nizne Terianske pleso), as part of the vertical biological gradient study.

Two cores will be taken from each lake, one (the master core) is for the analyses itself, the other is to be stored as a back-up. The cores should be extruded in 0.5cm intervals and the sediment stored at 4 ^{o}C.

The master core from each lake will be 'skeleton' ^{210}Pb dated (Peter Appleby - ULIV) and analysed for chironomids (Øyvind Schnell - UiB, for the Italian and Norwegian sites, Peter Bitusik - IZ-SAS, for the Tatra site).

4) Cores from survey lakes

Cores are required from c. 30 lakes within each lake district. A number of cores are needed from each site to provide sufficient material for all the required analyses. Cores of a length sufficient to reach pre-industrial times (15-17cm) are needed. In cases of doubt, or where local knowledge suggests a faster sediment accumulation rate, an additional deeper sample (25 - 27 cm) can also be taken.

Any corer that takes undisturbed cores of sufficient length is suitable. Again, it is important to stress the need for a good undisturbed sediment / water interface so that the surface layers are known to be intact. Laboratories responsible for coring should check with Joan Grimalt (CSIC) about the suitability of their coring apparatus for taking cores for POPs.

For practical purposes all cores will be extruded in the field. As samples will be sent for POPs and trace metal analysis sectioning should preferably be teflon utensils (using stainless steel risks trace metal contamination) previously rinsed with Milli-Q water and acetone. This rinsing should also be done between samples. **Samples are best obtained from the centre of the tube to avoid 'smearing' and this is best achieved by using two sampling rings of differing sizes.**

Given the multiple coring at each site core sample labelling must be clear. It is recommended that data sheets accompany each set of samples sent to analysts giving site name and location, core codes and sampling depth(s) details. All samples should be clearly labelled with the pre-determined site code and the sediment depth.

Top sample

The 0 - 0.5cm slice from **7 (seven)** cores should be taken. The samples should be amalgamated, homogenised and then divided for each of 9 analyses such that the required amounts of sediment are allocated for each.

Chironomids	equivalent of 2 slices	?
Pigments / Cladocera	equivalent of 1 slice	c. 3g wet weight
POPs / ECDs	equivalent of 1 slice	c. 2g (1 + 1) wet weight
Dry weight & Loss-on-ignition	equivalent of 0.5 slice	c. 0.5g wet weight
SCPs	equivalent of 0.5 slice	c. 1g wet weight
Metals	equivalent of 2 slices	c. 4 g wet weight
Diatoms	small amount !	c. 0.1g wet weight

Analytical responsibilities for each of these parameters for each region are given in the following table.

NOTE: SAMPLES FOR METALS, POPS, ECDS, PIGMENTS MUST BE FROZEN AS SOON AS POSSIBLE AFTER SAMPLING.

NOTE: AS SAMPLES ARE TO BE AMALGAMATED AND HOMOGENISED BEFORE SPLITTING FOR ANALYSIS, THIS MUST BE DONE USING ULTRA-CLEAN MATERIALS TO AVOID CONTAMINATION OF POPs AND METALS.

Bottom sample

A single slice from 15-17cm of one of the cores should be taken and homogenised. This should then be divided up as above, remembering that wet weights will contain less water and therefore more sediment

equivalent. Again, this must be done using ultra-clean materials to avoid contamination of POPs and metals.

If for any reason it is suspected that the site may have a higher accumulation, and that 15 - 17cm may fall within the indutrial period, then an additional sample (25 - 27cm) may be taken and stored. If the resulting SCP analysis should show that the 15-17cm sample is post-industrial then this lower sample can be analysed instead.

NOTE: SAMPLES SHOULD BE SENT TO ANALYSTS WITHIN ONE WEEK OF THE COMPLETION OF THE REGIONAL SAMPLING.

NOTE ON METALS ANALYSIS:
Metals analysis will be undertaken in Barcelona. The costs for the metals analyses of these top and bottom samples must be covered by the regional group.

ANALYTICAL STORAGE AND TRANSPORT REQUIREMENTS
(See individual analytical protocols for further information)

1. POPs

Plastic materials for extrusion and sub-sampling should be avoided at all times. Sub-samples for organic micropollutant analysis must be double wrapped in aluminium foil. Two aluminium sheets must be used. One in direct contact with the sample should have been previously rinsed in acetone. The second foil layer should be used to wrap the first. The outer layer should be clearly labelled. A paper label with a water resistant marker is preferred.

Sediment samples should be frozen as soon as possible and stored frozen. If this is not feasible, they should be kept as cool as possible. These conditions must be maintained during transport, using boxes of dry-ice. Samples should be sent to ICER-CSIC.

Contacts: Joan Grimalt: jgoqam@cid.csic.es
Pilar Fernandez pfrqam@cid.csic.es

Address: Department of Environmental Chemistry
IIQAB-CSIC
Jordi Girona, 18
08034 Barcelona
Spain
Tel: +34 93 400 61 00
Fax: +34 93 204 59 04

2. ECDs.

Samples should be treated, stored and transported as for POPs above. Samples should be sent to IBMB-CSIC.

Contact: Benjamin Pina.: bpcbmc@cid.csic.es

Address: Dept Ecologia, Facultat de Biologia, Universitat de Barcelona
Avda. Diagonal, 645
08028 Barcelona
Spain
Tel: +34 93 400 61 57
Fax: +34 93 204 59 04

3. Radionuclides

Sediments should be dried (either freeze-dried or air-dried in a 'clean air' laboratory) and sent in clearly labelled plastic bags (site code and sediment depth) to ULIV.

Contact: Peter Appleby appleby@liverpool.ac.uk

Address: Department of Mathematical Sciences
University of Liverpool
P.O. Box 147
Liverpool
L69 3BX
UK
Tel: +44 151 794 4020
Fax: +44 151 794 4061

4. Pigments
During field-work sediment samples should be protected against direct sunlight and excessive warming. After slicing the core, the samples should be stored in plastic bags and deep frozen (-20°C) as soon as possible. Samples should be transported frozen to CNR. A suitable method is in an 'ice cream' type box, packed with dry-ice. Be sure that the ink / label on the bags are resistant to low temperatures!

Contact: Andrea Lami a.lami@iii.to.cnr.it

Address: CNR - Istituto Italiano di Idrobiologia
Largo Vittorio Tonolli 50 / 52
Verbania-Pallanza
I-28922
Italy
Tel: +39 0323 518 300
Fax: +39 0323 556 513

5. SCPs
Samples should be stored in plastic bags and dried such that they cannot be contaminated e.g. freeze dried or in a drying cabinet in a clean laboratory. Bags must be clearly labelled with site code and sediment depth and sent to UCL.

Contact: Neil Rose nrose@geog.ucl.ac.uk

Address: Environmental Change Research Centre
University College London
26 Bedford Way
London
WC1H 0AP
Tel: +44 (0) 207 679 5543
Fax: +44 (0) 207 679 7565

6. Metals
Samples should be stored wet in acid cleaned glass vials provided by the analytical laboratory, frozen and sent to the laboratory without further treatment. Vials must be clearly labelled with site code and sediment depth.

Contact: Gloria Lacort gloria@giga.sct.ub.es

Address: Serveis Cientifico-Tecnics. University of Barcelona
Lluis Sole i Sabaris, 1
E-08028 Barcelona
Tel: +34 93 402 16 99
Fax: +34 93 411 13 98

7. Diatoms
Samples should be stored, wet, in plastic bags. Bags must be clearly labelled with site code and sediment depth and sent to the analyst responsible for the sites or lake district (see table).

8. Chironomids

Sediment samples should be stored fresh in plastic bags at 4°C. If possible, bags should also be labelled with the sediment weight. Where the analyses are not being done by the 'home' laboratory these should be sent to UiB.

Contact:	Gunnar Raddum	gunnar.raddum@zoo.uib.no
	Øyvind Schnell	oyvind.schnell@zoo.uib.no

Address: Institute of Zoology
University of Bergen
Allegaten 41
Bergen
N-5007
Norway
Tel: +47 55 582 236
Fax: +47 55 589 674

9. Cladocera

Samples are to be sent on from CNR to the responsible laboratory (see table) following pigment analysis.

LAKE DISTRICT CORING AND ANALYTICAL RESPONSIBILITIES

Lake District	Coring	Extrusion/ DW & LOI	Chironomids	Pigments	Cladocera	POPs	Diatoms	ECDs	SCPs	Metals
Norway	UiB	UiB	UiB	CNR	CU-Prague *Evzen Stuchlik*	CSIC	UCL *Gina Clarke*	CSIC	UCL	UB-DE
Greenland	Copenhagen	Copenhagen	Copenhagen	CNR	Copenhagen	CSIC	Copenhagen	CSIC	UCL	UB-DE
Pyrenees	UB-DE	UB-DE	UB-DE	CNR	UB-DE	CSIC	UB-DE	CSIC	UCL	UB-DE
Central Southern Alps	CNR/SPAA	CNR/SPAA	CNR/UiB *Øyvind Schnell*	CNR	CNR	CSIC	CNR/SPAA	CSIC	UCL	UB-DE
Central Swiss Alps	UNIBE-BOT / EAWAG	UNIBE-BOT / EAWAG	UiB *Øyvind Schnell*	CNR	NIB *Anton Brancelj*	CSIC	UNIBE-BOT	CSIC	UCL	UB-DE
Julian Alps	NIB	NIB	UiB *Øyvind Schnell*	CNR	NIB	CSIC	NIB	CSIC	UCL	UB-DE
Tatra	CU-Prague	CU-Prague	IZ-SAS	CNR	CU-Prague	CSIC	IZ-SAS / IFB-PAS	CSIC	UCL	UB-DE
Finland	Helsinki	Helsinki	Helsinki	CNR	Helsinki	CSIC	Helsinki	CSIC	UCL	UB-DE
Tyrol	UIBK-IZL	UIBK-IZL	UiB *Øyvind Schnell*	CNR	NIB *Anton Brancelj*	CSIC	UIBK-IZL	CSIC	UCL	UB-DE
Retezat	UNIBUK-ECO	UNIBUK-ECO	UiB *Øyvind Schnell*	CNR	NIB *Anton Brancelj*	CSIC	UNIBUK-ECO / UCL	CSIC	UCL	UB-DE
Rila	BAS-IZ	BAS-IZ	UiB *Øyvind Schnell*	CNR	NIB *Anton Brancelj*	CSIC	BAS-IZ / UCL	CSIC	UCL	UB-DE
Scotland	UCL	UCL	UiB *Øyvind Schnell*	CNR	CU-Prague *Evzen Stuchlik*	CSIC	UCL	CSIC	UCL	UB-DE