MEASURING AND MODELLING THE DYNAMIC RESPONSE
OF REMOTE MOUNTAIN LAKE ECOSYSTEMS TO
ENVIRONMENTAL CHANGE

A programme of **MO**untain **LA**ke **R**esearch

MOLAR

CHRYSOPHYCEAN ANALYSIS

SILICEOUS CYSTS, SCALES, PLANKTON SAMPLES

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Chrysophycean analysis
Siliceous cysts, scales

1. Sediment cores

1.1. Coring and subsampling

Procedures followed are according to diatom analysis.

1.2. Preparation

1.2.1 Chemical treatment

Procedures followed are according to diatom analysis (Battarbee, 1986).

1.2.2 LM

Procedures followed are according to diatom analysis (Battarbee, 1986), spiking with microspheres (Battarbee & Kneen, 1982).

1.2.3 SEM

Chemically cleaned suspensions as used for diatoms (without microspheres!) are diluted to an appropriate density, evaporated on cover slips, mounted on SEM stubs and sputtered.

Battarbee, R. W. & M. J. Kneen 1982. The use of electronically counted microspheres in absolute diatom analysis. Limnol. Oceanogr. 27, 184-188.
Battarbee, R. W. 1986. Diatom analysis. In: Berglund, B. E. (ed.), Handbook of Holocene Paleoecology and Paleohydrology. John Wiley & Sons Ltd., Chichester: 527-570.

1.3 Identification

1.3.1 Cysts

Facher, E. & R. Schmidt 1996. A siliceous chrysophycean cyst-based pH transfer function for Central European lakes. Journal of Paleolimnology 16: 275-321.
Duff, K. E.; Zeeb B. A. & J. P. Smol 1995. Atlas of Chrysophycean cysts. Developments in Hydrobiology 99. Kluwer Academic Publishers, Dordrecht, 189 pp.

Unknown cyst types are described according to:

Cronberg, G & C. D. Sandgren 1986. A proposal for the development of standardised nomenclature and terminology for chrysophycean statospores. In: Kristiansen, J. & R. A. Andersen (ed.), Chrysophytes: aspects and problems. Cambridge University Press, Cambridge: 317-328.

1.3.2 Scales and bristles

Asmund, B. & J. Kristiansen 1986. The Genus *Mallomonas*. Opera Botanica 85: 1-128.
Takahashi, E. 1978. Electron Microscopical Studies of the Synuraceae (Chrysophyceae) in Japan, Taxonomy and Ecology. Tokai, University Press, Tokyo: 1-143.

1.4 Counting and quantification

a) Microsphere/diatom/cyst relations are evaluated in LM.
b) Since not all cyst types can be identified in LM, counts should be checked in SEM.
c) Recommended number of cysts to be counted in SEM/LM: 200.
   Magnification: LM: 1000x -1250x (oil immersion, high resolution phase contrast objectives)
   SEM: 4800x

The absolute number of each cyst type is calculated by the following equations:

a) $$total\,number\,of\;cysts\,(LM) = \frac{microspheres\;introduced * cysts\,counted\,(LM)}{microspheres\,counted\,(LM)}$$

b) $$number\,of\;cyst\,type = \frac{\%\;of\;cyst\,type\,(SEM\;or\;LM) * total\,number\,of\;cysts\,(LM)}{100}$$

1.5 pH reconstruction

As for diatoms, the pH is calculated by using WA regression and calibration (WACALIB). Cyst optima and tolerances are listed in Facher & Schmidt (1996).

2 Sediment trap samples

2.1 Trap type

A simple Bloesch-type (plastic tubes of 60 cm in length and 6 cm in diameter; 6 tubes per trap) is used.

Bloesch, J. & N. M. Burns 1980. A critical review of sedimentation trap technique. Schweiz. Z. Hydrol. 42: 15-55.

2.2 Sampling

Half of the water can be removed carefully. The rest is filled into plastic bottles and fixed with formol.

2.2.1 Sampling intervals

A pilot study on lake Gossenkölle indicated, that because of low accumulation rates in high alpine lakes, sampling intervals during summer less than monthly were insufficient. Sampling starts 2-4 weeks before ice break and ends 2-4 weeks after the beginning of ice cover. Since cyst production under ice is extremely low, traps are not sampled during winter.

2.3 Preparation

Sediment trap samples are centrifuged and washed carefully (Formol fixation). For further preparation see 1.2.

2.4 Identification, counting and quantification

See 1.3 and 1.4.

Application: Facher E. & R. Schmidt 1996. Application of chrysophycean sediment trap data and a cyst-based pH transfer function of annually laminated sediments (Lake Plesné, Czech Republic). Beih. Nova Hedwigia 114: 219-231.

3. Taxonomic harmonisation

As cyst types occur which are not described until now, individual iconographs are recommended. Finally these cyst types must be taxonomically harmonised.