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Reconstruction of limnological and environmental variations in the lake Lauzet (Southern Alps), during the last 3 centuries: contribution of diatoms

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Context:

Alpine lakes are particularly sensitive to climatic and environmental variations (Cartier et al., 2015): the study of lake sedimentary records allows to reconstruct the evolution of the lake and its catchment area.

Diatoms are micro-algae that are sensitive to variations in the physico-chemical parameters of the water. Combined with a very short residence time, this capacity enables diatoms to be very good bioindicators.

A sediment core was taken from the Lake Lauzet (890 m altitude), in the Alpes de Haute-Provence (PACA, France). This lake of glacial origin is located downstream of sentinel lakes: those are preserved from anthropic pressures, and has a sedimentary fill of over 15 m in depth. However, at the Lake Lauzet, numerous developments of the lake and his catchment area have taken place since 1702.

The DURANSED project, started in 2019, has enabled the coring of the lake (mastercore Lau19). Other cores and samples were taken by OSU Pythéas students.

Objectives:

- Reconstruct the limnological and environmental variations of the lake.

- Show the impact of Humans on the lake and is catchment area during the last three centuries.

- Show that diatoms are good bioindicators of the Actual variations of the physico-chemical parameters of the lake, and of the impact of Humans; but also of past environmental variations.

Methods:

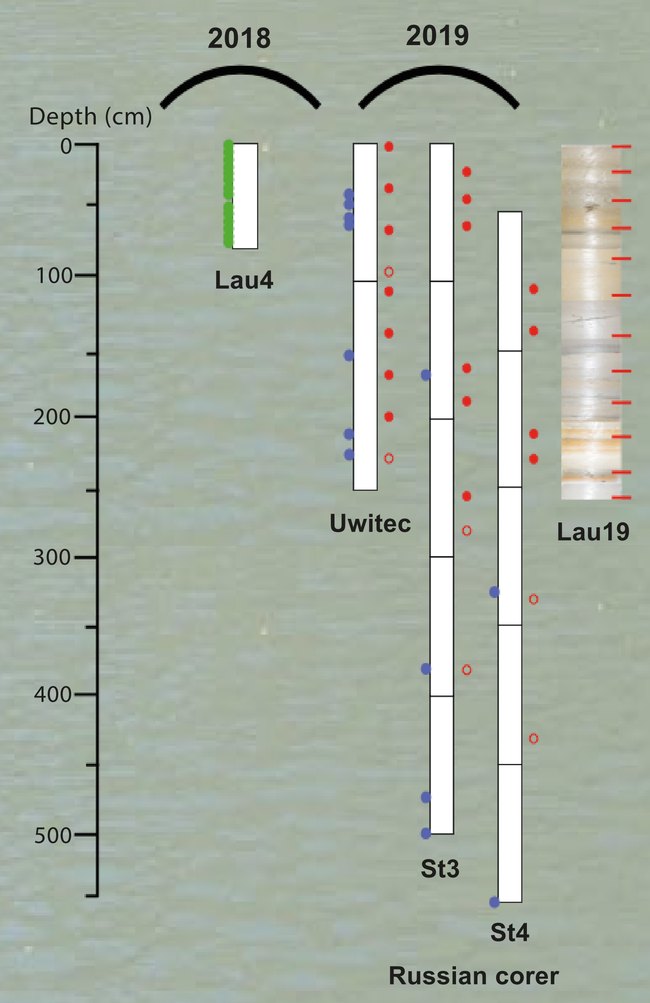
Dating:

- 14C: bulk, leaf, wood (contributions F. Guiter, L. Vidal)
- 210Pb on Lau4 (J.-C. Mazur)
- → Age-depth model made on CLAM (Blaauw, 2010)

Uwitec: XRF - Mineralogical analysis (M. Garcia)

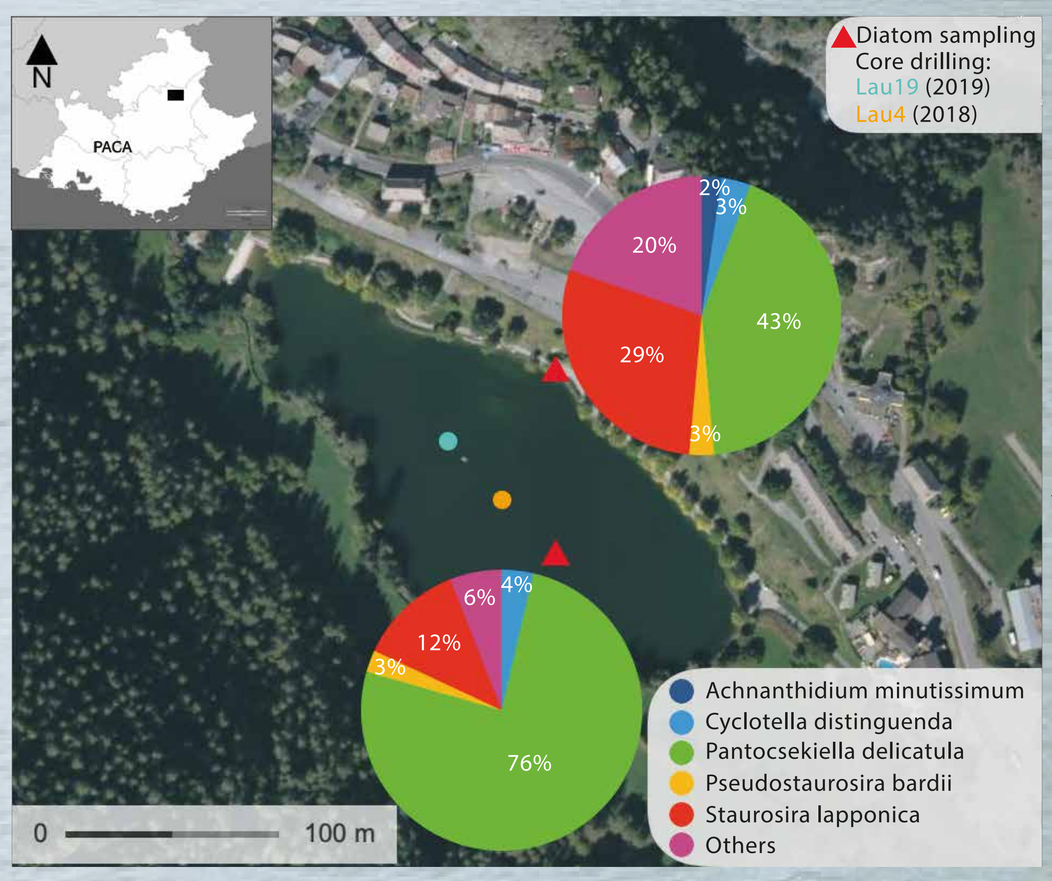
Diatom assemblages:

- Smear slides:
  - No diatoms
  - Presence of diatoms
  - → Feasibility study
- Mycroscopy:
  - Diatoms determined and counted in 12 samples



▲ Mastercore Lau19 = Uwitec + St3 + St4.

Results and interpretations:



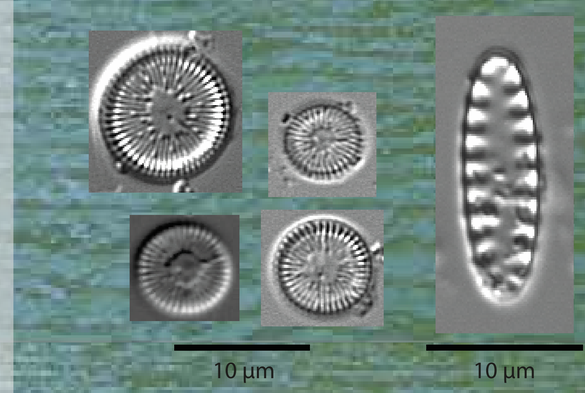
Results of the Actual samples study:

- 47 species dertermined and counted
- 2 dominant species : *Pantocsekiella delicatula* (Hustedt) Kiss & Ács and *Staurosira lapponica* Lange-Bertalot
- Rare cysts of chrysophytes
- pH between 8 and 9

Notes and interpretations:

- Actual dominant species identical to those in fossil Zone 1b : the species living in and around the lake are well deposited in the sediment
- Dominant species are neutrophilic and alkaliphilic, which corresponds to the pH of the lake (8 to 9)
- Diatoms and mineral indicators show numerous anthropic pressures

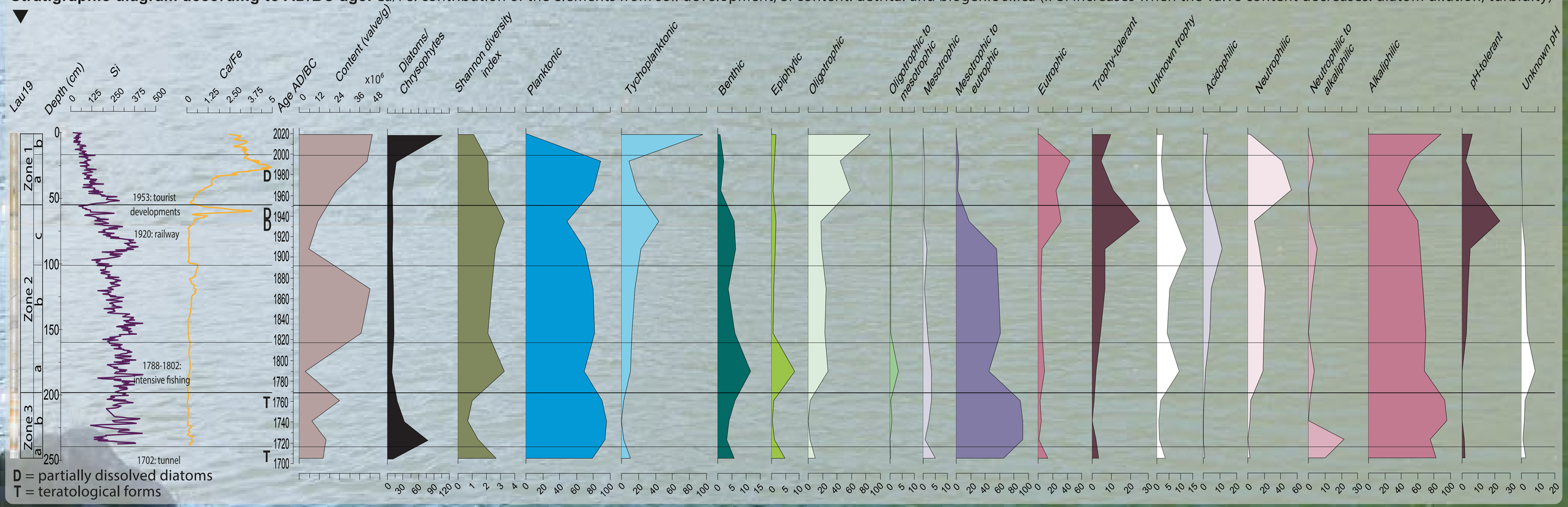
◀ **Location of the Actual samples and cores at the lake Lauzet.** Illustration of the 2 dominant species *Pantocsekiella delicatula* (Hustedt) Kiss & Ács (on the left side) and *Staurosira lapponica* Lange-Bertalot (on the right side). ▼



Results of the core study:

- 12 fossil samples: determination and counts (9113 valves of 61 species counted)
- Presence of chrysophytes cysts
- → Zonation according to the dominant species
- Mostly alkaline and mesotrophic to eutrophic lake (except at the top: oligotrophic)
- The dominant species are planktonic

Stratigraphic diagram according to AD/BC age. Ca/Fe: contribution of the elements from soil development, Si content: detrital and biogenic silica (if Si increases when the valve content decreases: diatom dilution, turbidity)



D = partially dissolved diatoms
T = teratological forms

Conclusion:

- The self-ecology of the species translates well the characteristics of the environment on the present, and can be used on the fossil to reconstruct the past environment

- Anthropic pressure detected by both diatoms and mineralogical indicators (XRF)

- Since the 2000s, improvement of the ecological state of the lake: possible awareness on the preservation of the environment?

Perspectives:

- More dating at the base of the core
- Pollen analysis (watershed plant colonization, aquatic plants)
- Temporal resolution: more accurate analyses
- Application of transfer functions to quantify past pH and trophy
- Coring of a longer slice of sediment, and therefore time

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