# Il Progetto di Interesse NextData

Un sistema nazionale per la raccolta, conservazione, accessibilità e diffusione dei dati ambientali e climatici in aree montane e marine.

## P5 - The use of sedimentary proxies in high altitude lakes for inferring the environmental changes during the late Holocene


**LAMI Andrea**

***C.N.R. Istituto per lo Studio degli Ecosistemi (ISE)***

***Verbania Pallanza, Italia***

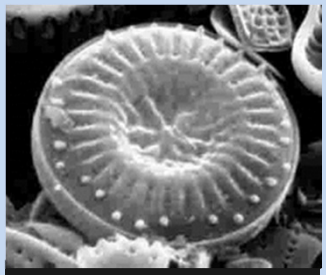
***http://www.ise.cnr.it***


Roma, 3-4 giugno 2014

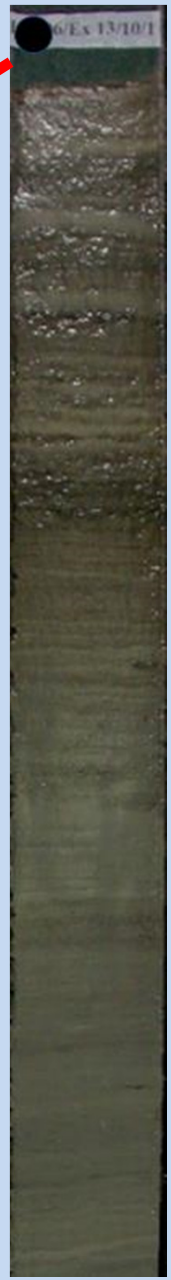
**Main goal**

- to reconstruct quantitatively the temporal and spatial changes in trophic state (e.g. primary productivity, phosphorus concentration in lake waters) and in biological communities at a high resolution (decadal) over the last 1000 years so as to obtain baseline data on the natural variability of primary production in several areas of minimal human impact in the Alps. We focus on biological proxy-records because they are closely related to human and climate impacts;
- to contribute to creation of a system of Long Term Data Repositories for lacustrine sequences, environmental data as foreseen in NEXTDATA WP 2.3;
- to evaluate the reconstructed changes from sediment core with the model scenario reconstructed in NEXTDATA WP 2.5;
- to inform policy makers about the impacts of changes in these areas in general ecological and environmental terms.

pH
Fosforo
Salinità

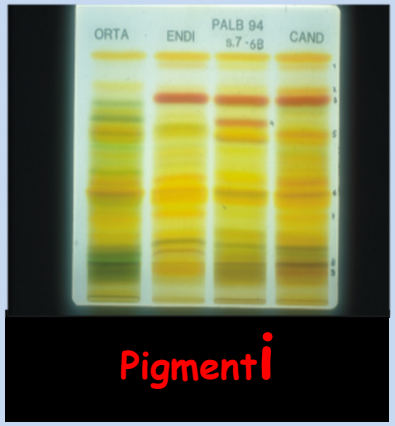


Diatomee



Sostanza organica
N, P, $CaCO_3$

Condizioni trofiche



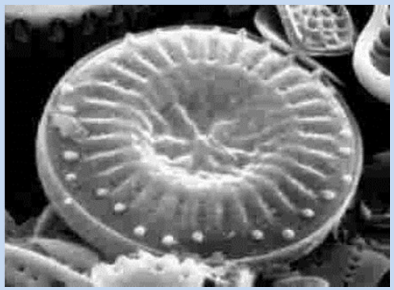
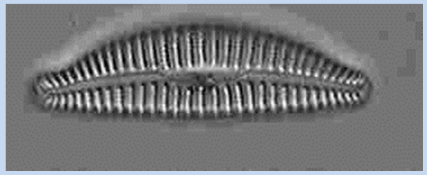
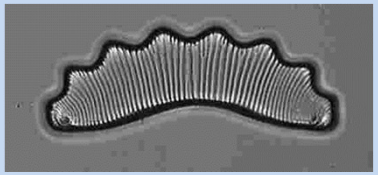
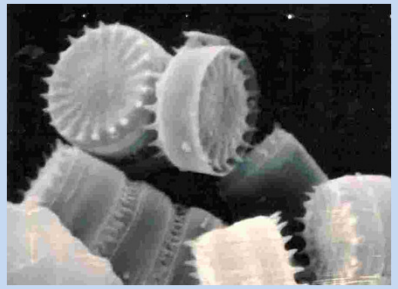

Pigmenti

Chironomidi

Temperatura dell'acqua
Fluttuazioni di livello
Condizioni trofiche

Biodiversità
Condizioni trofiche

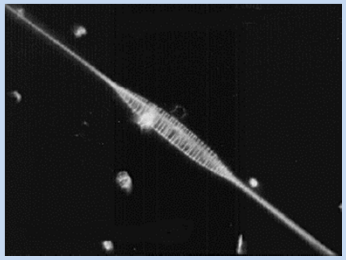
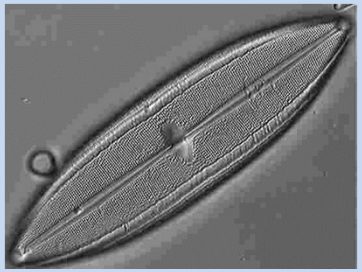
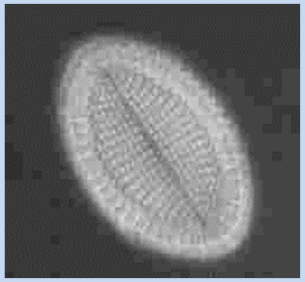
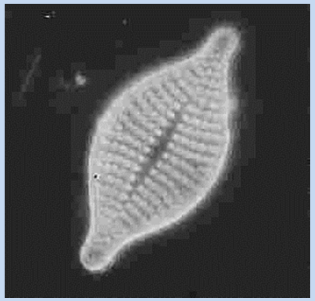
Produzione primaria
Intensità radiazione UV
Condizioni di ossigenazione

# Diatomee

**Molto abbondanti**
**Frustoli ben conservati**
**Elevata specificità a condizioni ambientali**
**Risposta quantificabile a cambiamenti ambientali**

Proxy-record per: idrochimica lacustre, trofia, salinità, durata della copertura glaciale

# Metodi

Campionamento

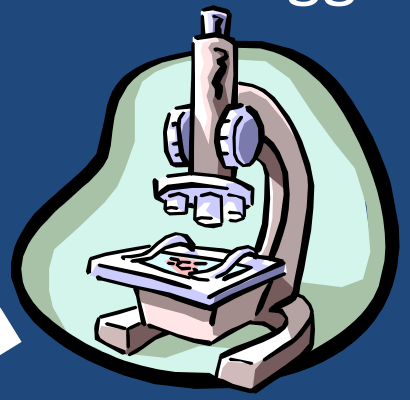
Datazione

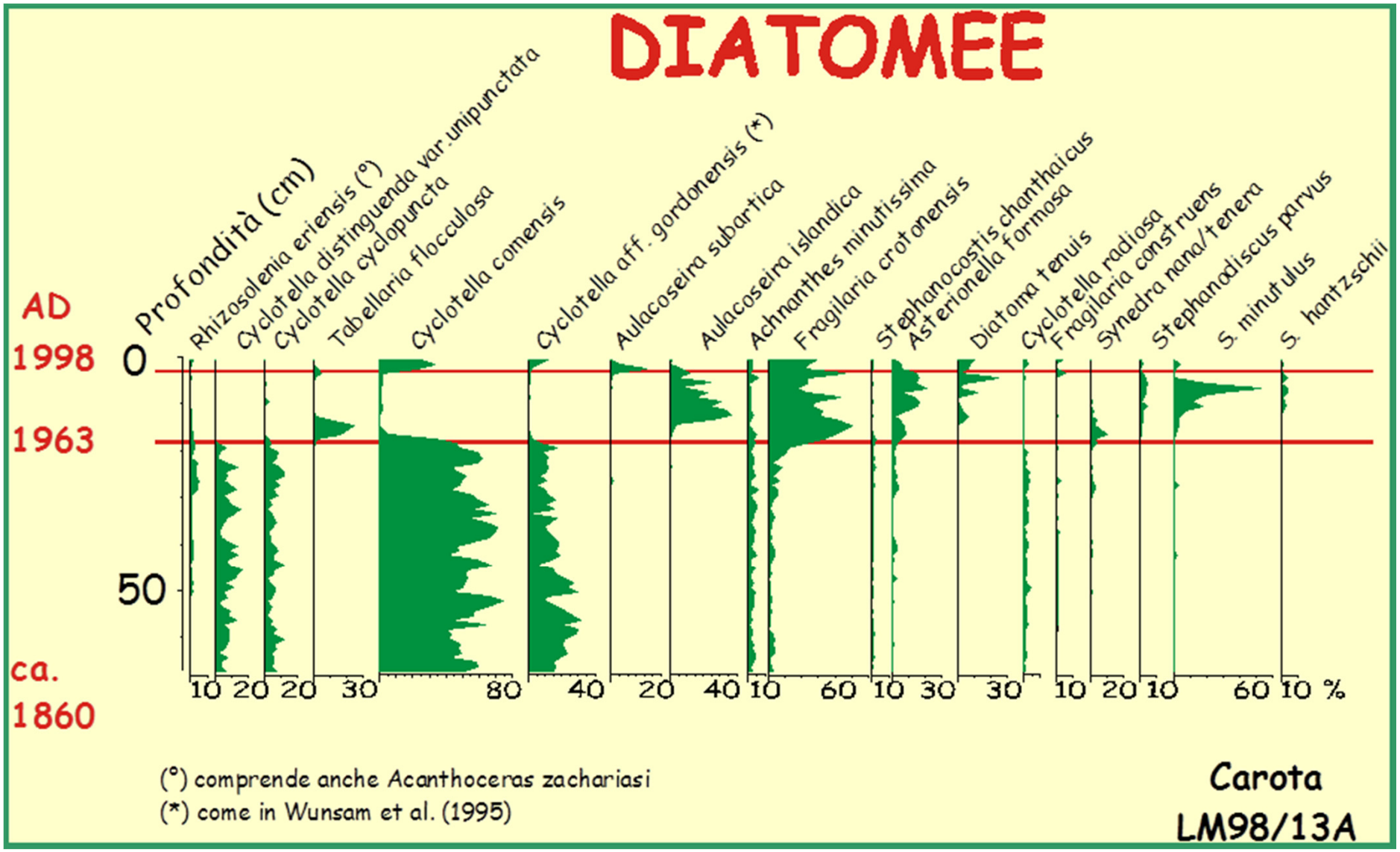
Digestione

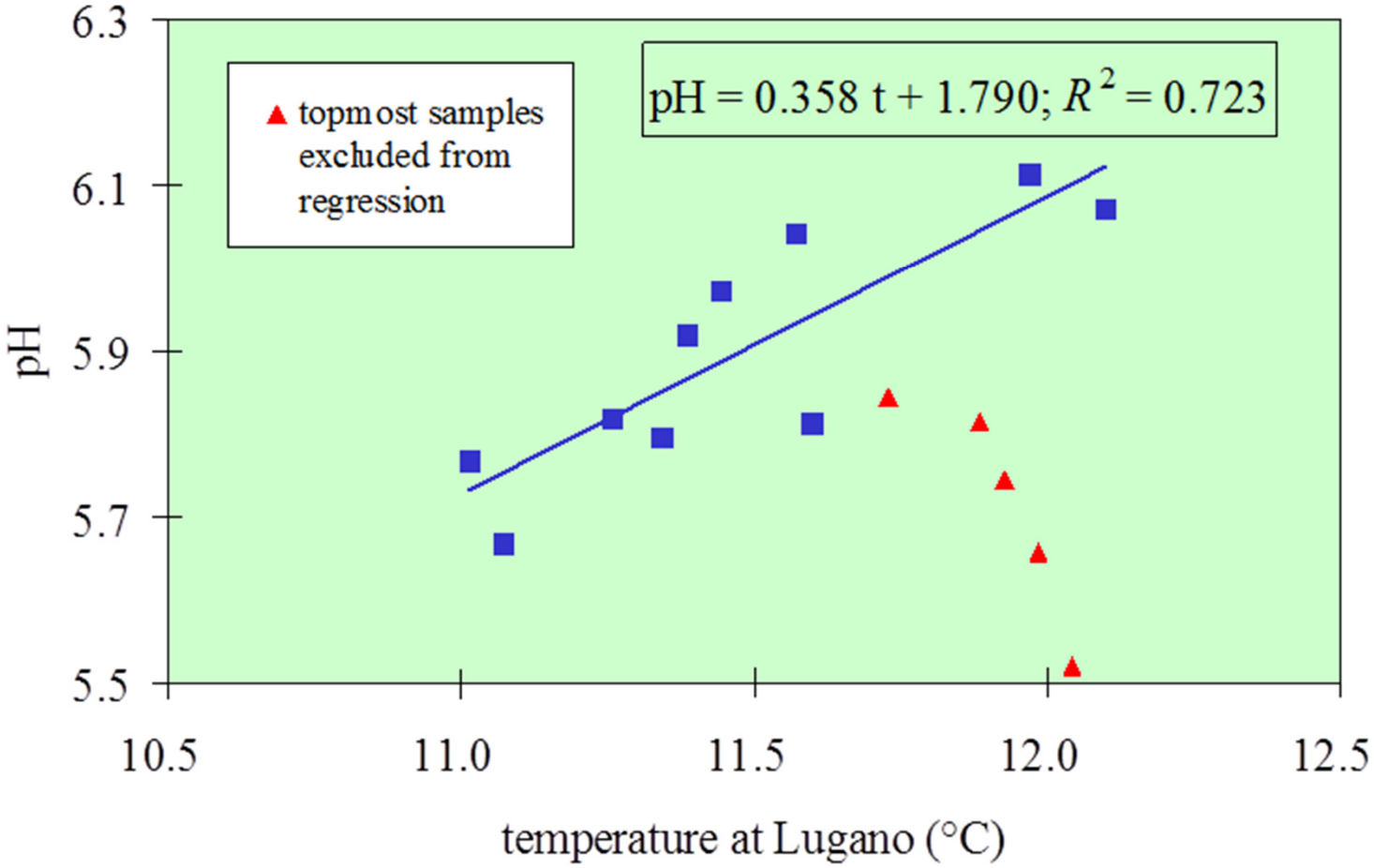
Montaggio
e conteggio

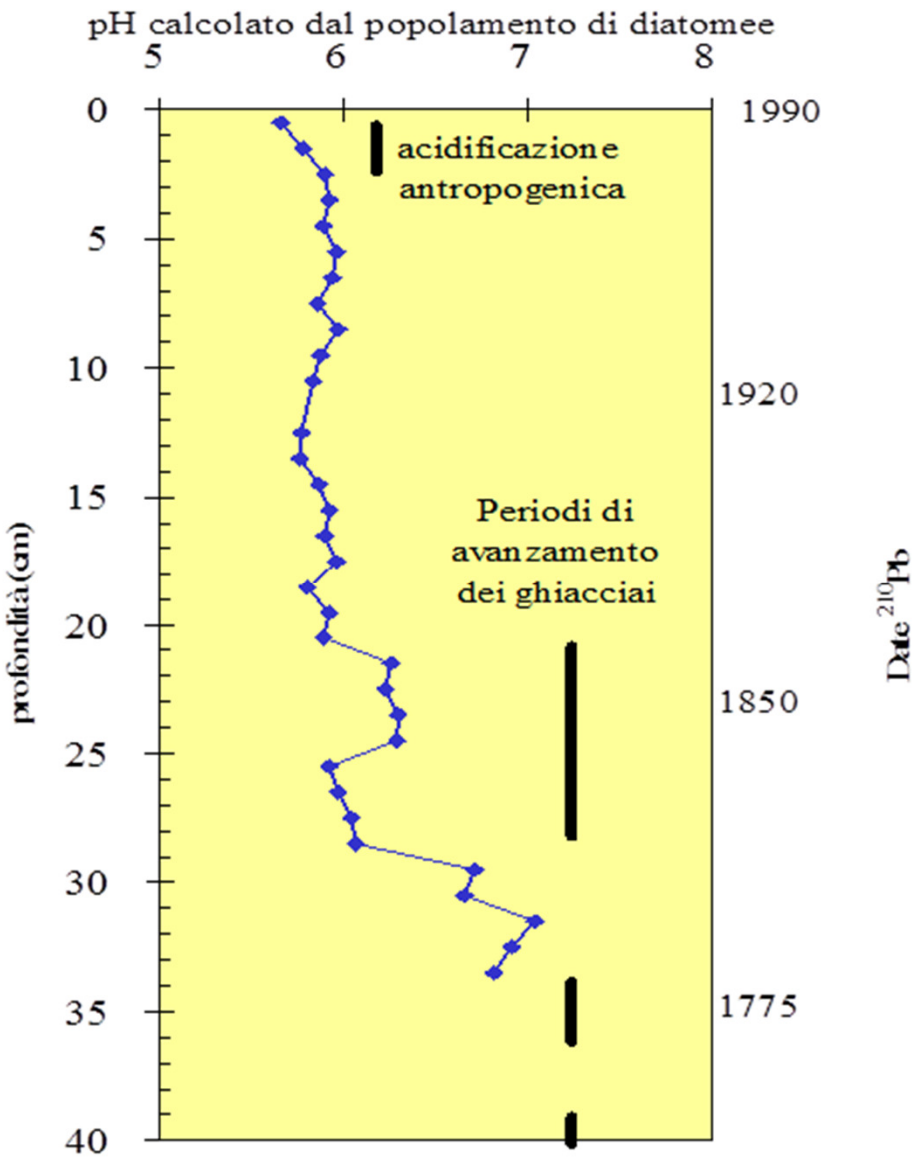
Analisi quantitativa

*Modelli numerici per ricostruire TP*




DIATOMEE
Profondità (cm)
Rhizosolenia eriensis (°)
Cyclotella distinguenda var.unipunctata
Cyclotella cyclopuncta
Tabellaria flocculosa
Cyclotella comensis
Cyclotella aff. gordonensis (*)
Aulacoseira subartica
Aulacoseira islandica
Achnanthes minutissima
Fragilaria crotonensis
Stephanocostis chanthaicus
Asterionella formosa
Diatoma tenuis
Cyclotella radiosa
Fragilaria construens
Synedra nana/tenera
Stephanodiscus parvus
S. minutulus
S. hantzschii
AD
1998
1963
ca.
1860
0
50
10 20 20 30 80 40 20 40 10 60 10 30 30 10 20 10 60 10 %
(°) comprende anche Acanthoceras zachariasi
(*) come in Wunsam et al. (1995)
Carota
LM98/13A


6.3
6.1
5.9
5.7
5.5
pH
10.5
11.0
11.5
12.0
12.5
temperature at Lugano (°C)
topmost samples excluded from regression
pH = 0.358 t + 1.790; $R^2$ = 0.723

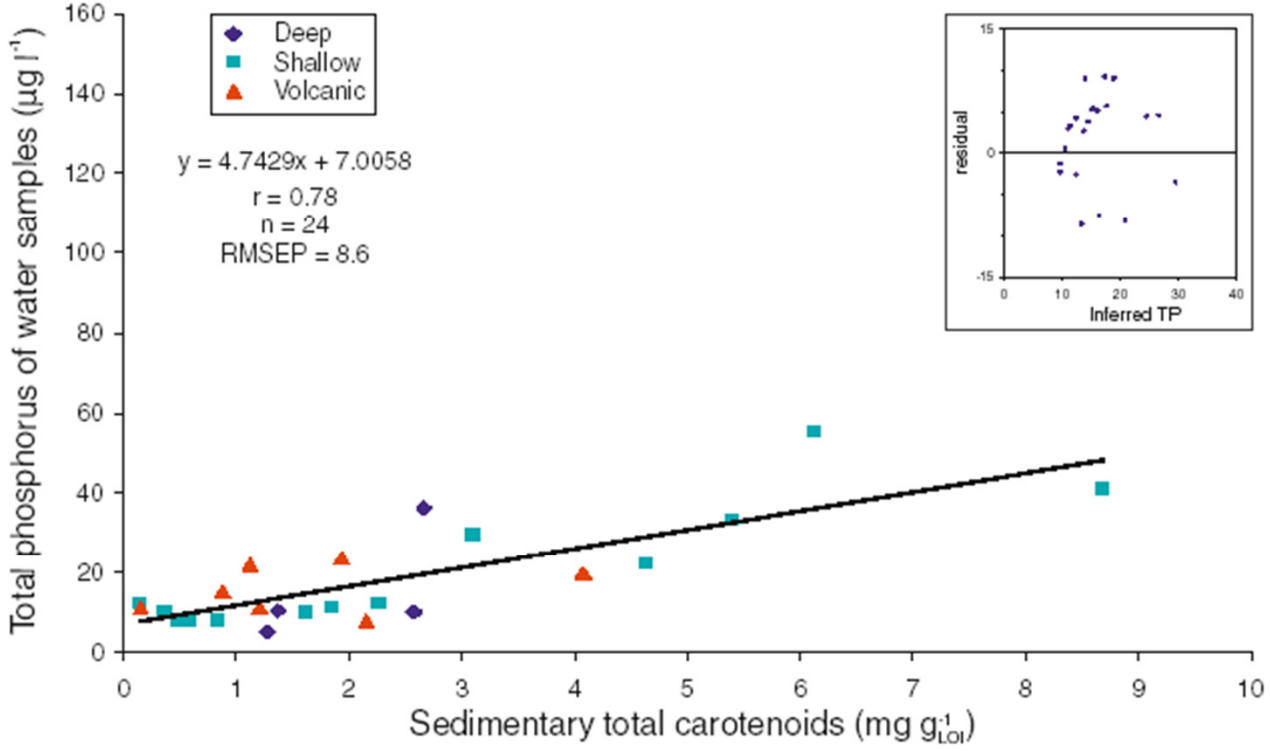

pH calcolato dal popolamento di diatomee
5
6
7
8
0
5
10
15
20
25
30
35
40
profondità (cm)
1990
1920
1850
1775
Date $^{210}$Pb
acidificazione antropogenica
Periodi di avanzamento dei ghiacciai

J Paleolimnol (2011) 45:433–445
DOI 10.1007/s10933-010-9421-9

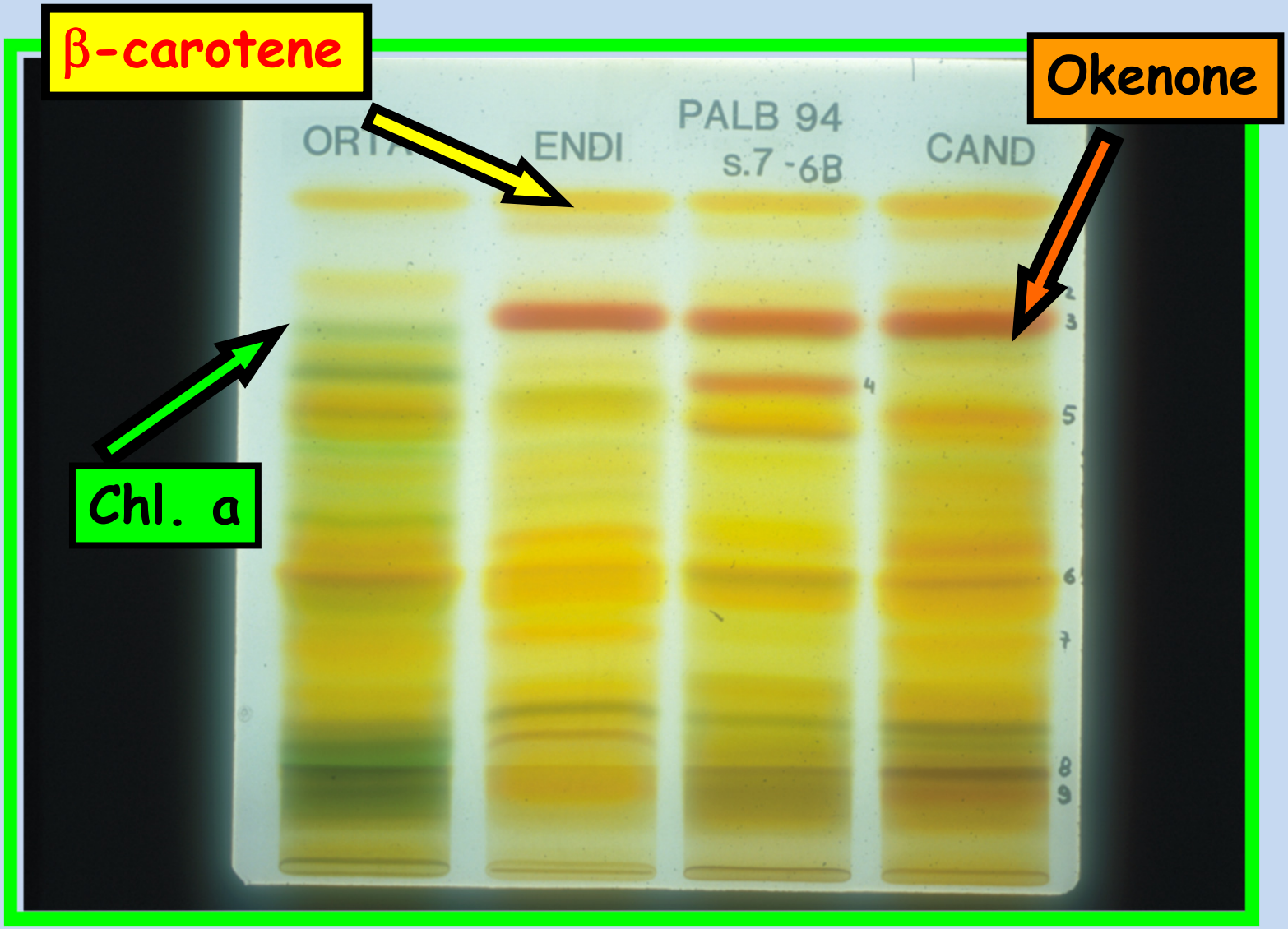
ORIGINAL PAPER

# Use of sedimentary pigments to infer past phosphorus concentration in lakes

Piero Guilizzoni · Aldo Marchetto · Andrea Lami · Stefano Gerli · Simona Musazzi



# A proposito dei pigmenti:



Tab. 1. Location and morphometric features of the study lakes.

| | Variable / Lake | Latitude (N) | Longitude (E) | Altitude (m) | Lake surface (km2) | Catchment area (km2) | Mean depth (m) | Maximum depth (m) | Volume (10^6m^3) | Theoretical renewal time (year) | Bedrock - lithology | Site-type | Present trophic conditions | Geomorphic origin | Drilling-technique | Depth of drilling (m) | Core bottom age (k yrs) | Dating techniques applied: Radiometric, varve counts, lithological correlation | Dating techniques applied: C-14 calib. | Sedimentation rate (cm/y) (*) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nord Italia | Paione Superiore | 46° 11' 39" | 08° 11' 26" | 2269 | 0.014 | 0.55 | 5.1 | 11.7 | 69 | 0.09 | orthogneiss and grey gneiss | high alpine | oligotrophic | glacier circus | gravity | 8 | 0.2 | Pb, Cs | | |
| | Paione Inferiore | 46° 10' 14" | 08° 11' 26" | 2002 | 0.014 | 1.14 | 7.4 | 13.5 | 103 | 0.06 | orthogneiss and grey gneiss | high alpine | oligotrophic | glacier circus | gravity | 13 | 0.2 | Pb, Cs | | |
| | Colbricon | 46°17'02" | 11°45'55" | 1910 | 0.013 | 0,361 | 3.8 | 8 | 49 | 0.5 | Crystalline | high alpine | mesotrophic | glacier circus | gravity | 8 | 0.5 | Pb-210, Cs-137, C-14 | | 0.15 |
| | Tovel | 46°15'40" | 10°56'56" | 1178 | 0.38 | 39.11 | 19.26 | 39 | 7.4 | 0.05 | Carbonatic | high alpine | oligotrophic | glacial | gravity | 39 | 0.4 | Pb, Cs | | |
| | Ledro | 45°52'36" | 10°45'02" | 655 | 2.187 | 101.2 | 35 | 48 | 75.8 | 0.85 | calcareuos | sub-alpine | mesotrophic | glacial | gravity | 48 | | Pb-210, Cs-137 | | |
| | Ghirla | 45°55'01" | 08°49'20" | 442 | 0.28 | 15.4 | 11 | 14 | 3 | 0.1 | Carbonatic | sub-alpine | mesotrophic | glacial | | | | | | |
| | Montorfano | 45°46'57" | 9°08'15" | 397 | 0.46 | 1.9 | 3.5 | 7 | 1.9 | 1.5 | | sub-alpine | oligotrophic | glacial | freeze | 7 | 0.2 | | | |
| | Segrino | 45°49'45" | 9°16'02" | 374 | 0.38 | 3.4 | 3.2 | 9 | 1.2 | 0.4 | Carbonatic | sub-alpine | mesotrophic | intermorenic | freeze | 9 | 0.15 | Pollen | | 0.35 |
| | Avigliana Grande | 45°03'59" | 7°23'14" | 352 | 0.914 | 10.7 | 19.5 | 26 | 16.2 | 2.3 | Carbonatic | sub-alpine | eutrophic | glacial | freeze-corer, gravity | 26 | 12 | Pb-210, Cs-137, C-14 | | |
| | Endine | 45°46'40" | 9°56'18" | 334 | 1.74 | 36.7 | 5.1 | 9 | 12 | 0.3 | Carbonatic | sub-alpine | eutrophic | glacial | freeze | 9 | 0.2 | Lithol. change | | |
| | Orta | 45°48' | 8°23' | 290 | 18.14 | 116 | 71.3 | 143 | 1294.1 | 8.5 | Calcareous schists | sub-alpine | mesotrophic | fluvioglacial | gravity | 30 | 0.35 | Pb-210, Cs-137 | | 0.19 |
| | Lugano | 45°58' | 9°01' | 271 | 48.7 | 565.6 | 134 | 288 | 6.5 | 8.2 | complex | sub-alpine | meso-eutrofic | glacial | gravity | | | | | |
| | Sirio | 45°49'29" | 7°89'53" | 271 | 0.3 | 2.6 | 18 | 46 | 5.4 | 5.7 | crystalline | sub-alpine | eutrophic | Glacial-tectonic | gravity | 46 | 2.0-1.9 | Cs-137; C-14 | | 0.7 |
| | Monate | 45°47'40" | 8°39'52" | 266 | 2.5 | 6.3 | 18 | 34 | 45 | 7.9 | Crystalline | sub-alpine | oligotrophic | glacial | freeze | 34 | 0.3 | | | |
| | Alserio | 45°47'06" | 09°12'48" | 260 | 1.23 | 17.05 | 5.32 | 8.1 | 6.54 | 1.9 | Carbonatic | sub-alpine | mesotrophic | intermorenic | gravity ,freeze | 8 | 0.15 | vanes | | 0.4 |
| | Pusiano | 45°48'09" | 9°16'34" | 259 | 5.26 | 94.3 | 13.3 | 25 | 69.2 | 1 | calcareuos | sub-alpine | eutrophic | intermorenic | gravity | 25 | 0.3 | Pb-210, Cs-137 | | 0.31 |
| | Lucone | 45°33' | 10°29' | 249 | | | | | | | | | | | piston | | | C-14 | | |
| | Comabbio | 45°45'53" | 8°41'24" | 243 | 3.59 | 15.3 | 4.6 | 7.7 | 16.62 | 1.47 | Crystalline | sub-alpine | eutrophic | glacial | gravity | | | | | |
| | Varese | 45°48'48" | 8°75'45" | 238 | 14.8 | 111.5 | 10.7 | 26 | 160 | 1.8 | Carbonatic | sub-alpine | hypertrophic | morraine | freeze | 25 | 0.15 | Pb-210, Cs-137 (10) | | 0.79 |
| | Candia | 45°19' | 7°54'2 | 226 | 1.49 | 8.27 | 4.73 | 7.7 | 7.21 | 6.5 | Crystalline | sub-alpine | Meso-eutrophic | morraine | gravity | 7.7 | 2 | Pb-210, Cs-137 | | 0.56 |
| | Annone Est | 45°48'34" | 9°20'59" | 224 | 3.81 | 28.1 | 6.3 | 11 | 24 | 1.4 | Carbonatic | sub-alpine | freeze | intermorenic | freeze | 11 | 0.15 | Pollen | | 0.35 |
| | Annone Ovest | 45°49'02" | 9°19'59" | 224 | 1.7 | 14.7 | 4 | 10 | 6.8 | 0.8 | Carbonatic | sub-alpine | freeze | intermorenic | freeze | 10 | 0.15 | | | |
| | Como | 46°00' | 9°16' | 198 | 145 | 4509 | 154 | 410 | 22500 | 4.5 | Carbonatic | sub-alpine | eutrophic | fluvioglacial | gravity | 410 | 0.1 | Pb-210, Cs-137 | | 0.66 |
| | Maggiore | 45°57' | 8°40' | 194 | 212 | 6599 | 176.5 | 370 | 37506 | 4.1 | complex | sub-alpine | oligotrophic | fluvioglacial | gravity | 20 to 300 | 0.15 | Pb-210, Cs-137 | | 0.2-1.0 (**) |
| | Mergozzo | 45°96'6" | 8°46'18" | 194 | 1.83 | 10.4 | 45.4 | 73 | 83 | 6 | Crystalline | sub-alpine | oligotrophic | fluvioglacial | gravity | 70 | 0.4 | Pb-210, Cs-137 | | 0.19 |
| | Iseo | 45°44' | 10°04' | 186 | 60.9 | 1736 | 123 | 251 | 7600 | 4.1 | Carbonatic | sub-alpine | eutrophic | glacial | gravity | 250 | 0.1 | Lithol. change, Pb-210, Cs-137 | | 0.73-0.83 |
| | Garda | 45°40' | 10°42' | 65 | 368 | 2240 | 133 | 350 | 49030 | 27 | Carbonatic | sub-alpine | Meso-eutrophic | Crystalline | gravity | 344 | 0.15 | Lithol. change | | 1.3 |


Lago Lugano 2010
Varese, Comabbio, Monate, Pusiano, 2010-2011
Tovel, 2001
Lago Maggiore 1998-2010
Colbricon, 2010
Ledro, 2012
Lago di Avigliana 2008
Garda 2011
Bolsena
Bracciano,
Albano
Nemi
(Paliclas 1994)
Monticchio 2006

# Sequenze sedimentarie per le quali la compilazione del database è completa

| Nome carota: | Luogo di estrazione | coordinate | data campionamento | quota | Stima del periodo totale coperto e della risoluzione temporale: | Quantità misurate (proxy): | Tipologia dei dati: |
|---|---|---|---|---|---|---|---|
| | | | | m slm | Anno Domini | | |
| AL94_1E | Lago di Albano | 41°45'10"N, 12°39'57"E | mag-94 | 292 | 1994 - 0; 50 anni | LOI, DW, Nitrogen, Total carbon, Organic Carbon, algal biomass, algal pigments, diatoms | 1 |
| Als01_4 | Lago di Alserio | 45°47'11"N, 9°13'00"E | apr-01 | 260 | 2001 - 1582; 5 anni | LOI, DW, CaCO3, Nitrogen, Total carbon, Sulphur, algal pigments, diatoms | 1 |
| COL10_2 | Lago di Colbricon Inferiore | 46°17'02"N, 11°45'55"E | apr-10 | 1910 | 2008 - 1500; 10 anni | LOI, DW, algal biomass, algal pigments, diatoms | 1 |
| LM98_13A | Lago Maggiore | 45°54'42"N, 8°33'00"E | apr-98 | 194 | 1998 - 1854; 2 anni | LOI, DW, algal biomass, algal pigments, diatoms | 1 |
| NM94_1b | Lago di Nemi | 41°42'37"N, 12°42'10"E | mag-94 | 322 | 1994 - 0 | LOI, DW, CaCO3, Nitrogen, Organic Carbon, algal biomass, algal pigments, diatoms | 1 |
| OR07_2A | Lago d'Orta | 45°48'44"N, 8°23'35"E | set-10 | 290 | 2007 - 1638; 10 anni | LOI, DW, algal pigments, diatoms | 1 |
| PaiS93_1 | Lago Paione Superiore | 46°10'32.99"N, 8°11'28.11"E | set-93 | 2000 | 1993 - 1800 | LOI, DW, CaCO3, Nitrogen, Total carbon, Organic Carbon, Sulphur, algal biomass, algal pigments, diatoms | 1 |
| PUS_10_2_3 | Lago di Pusiano | 45°48'30"N, 9°16'52"E | apr-10 | 259 | 2010 - 1729; 3-10 anni | LOI, DW, CaCO3, Nitrogen, Total carbon, Organic Carbon, Sulphur, algal biomass, algal pigments, diatoms | 1 |
| SIR03_G | Lago Sirio | 45°29'13"N, 7°53'02"E | ott-03 | 271 | 1996-1600; 15 anni | LOI, DW, algal biomass, diatoms | 1 |
| Tov01_5 | lago di Tovel | 46°15'40"N, 10°57'05"E | set-01 | 1178 | 1990 - 1623; 5 anni | LOI, DW, CaCO3, Nitrogen, Total carbon, Organic Carbon, Sulphur, algal biomass, algal pigments, diatoms | 1, 2 |
| Var10_10 | Lago di Varese | 45°49'51"N, 8°43'08"E | set-10 | 238 | 2009-1850; 2 anni | LOI, DW, CaCO3, algal biomass, algal pigments, diatoms | 1 |

# Attività future

1. Estendere il database disponibile
2. Confrontare la risposte della comunità biologiche al cambiamento climatico e l'interazione con altri fattori
3. Valutare la sincronicità della risposta fra ambienti localizzati in aree geografiche differenti
4. Discriminare il « peso » dei fattori locali rispetto a quelli globali nell'influenzare la risposta delle comunità biologiche.

…. non solo paleo-termometri

Remote lake palaeolimnology is developing unique datasets for each region investigated that benchmark current trends with respect to past, purely natural variability in lake systems.

the time-series available provide relatively short temporal perspectives (a few decades at best) and, moreover, only a limited number of variables that pertain to ecosystem processes. Proxies contained in sediment archives provide a complementary view, with a much longer temporal perspective and a richer array of information, including biodiversity.

The palaeolimnology has much to offer in terms of evaluating the spatial and temporal dimensions of the Earth system change.

Downscaling from global to local understanding and mapping the regional impacts of atmospheric forcing deserve dedication and networking

Upscaling from regional to global The ultimate challenge of palaeolimnology at remote sites is to upscale regional information in a coherent way to evaluate globally the state of the biosphere

The focus is on lake sediments and their unrivalled potential to provide continuous, high resolution (sub-decadal) time-series for a wide range of proxy data for changes in the lake, catchment and atmospheric systems over decadal/centennial timescales up to the present (Oldfield 1977).

Grazie per l'attenzione