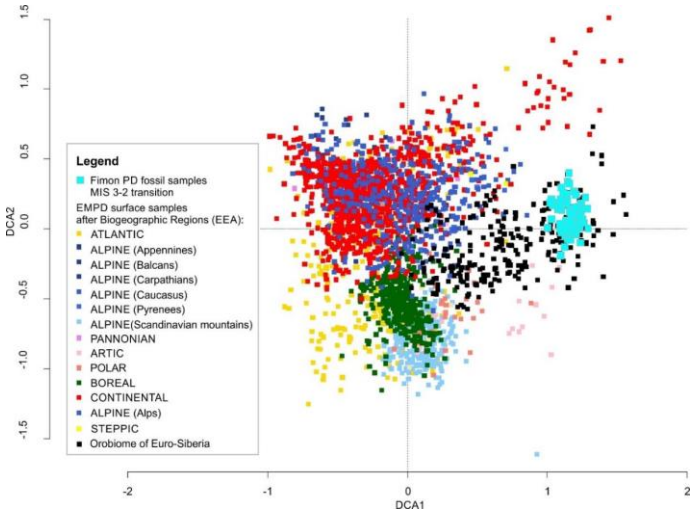
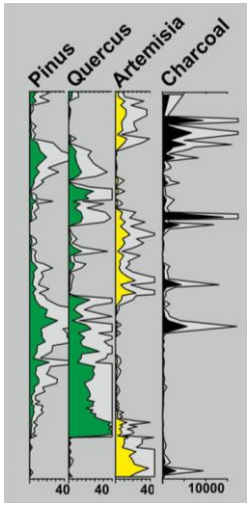
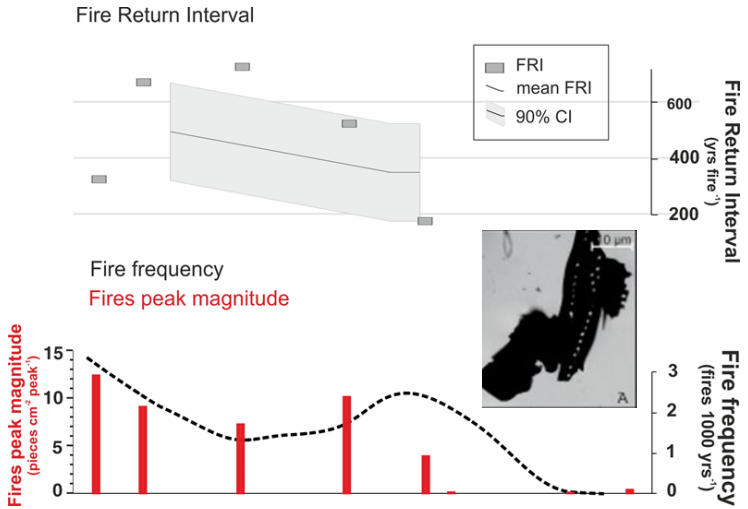
LO STUDIO MICROBOTANICO E LE SUE APPLICAZIONI NELLA RICOSTRUZIONE DEGLI AMBIENTI DEL PASSATO







Federica Badino

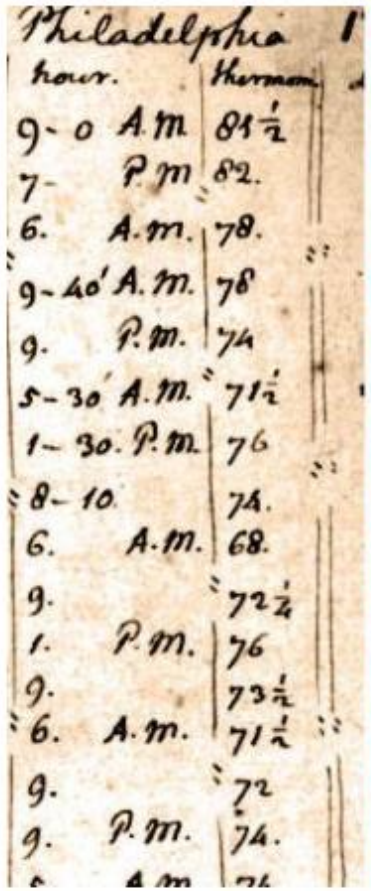
C.N.R. – Istituto di Geologia Ambientale e Geoingegneria

Laboratorio di Palinologia e Paleoecologia, Milano
https://palinologia.disat.unimib.it

TOPICS…

- **Proxy data**
- **History and development of Quaternary pollen analysis**
- **Natural archives and on-site *vs* off-site contexts**
- **Coring tecniques, pollen samples preparation and identification**
- **Palaeoecological analysis and data processing techniques**
- **Examples from published studies**

Paleoclimatologists and palaeoecologists gather proxy data from natural recorders of climate variability


Philadelphia
hour. Thermom.
9- 0 A.M. 81½
7- P.M. 82.
6. A.M. 78.
9-40' A.M. 78
9. P.M. 74
5-30' A.M. 71½
1-30. P.M. 76
8-10 74.
6. A.M. 68.
9. 72½
1. P.M. 76
9. 73½
6. A.M. 71½
9. 72
9. P.M. 74.

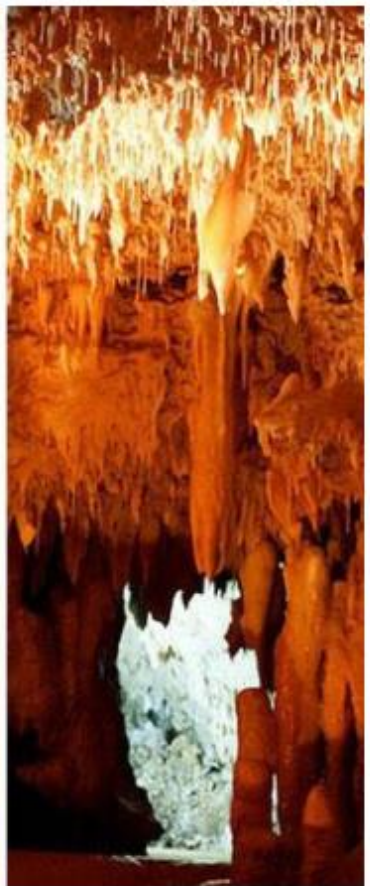
Historical Data

Corals

Pollen

Ice cores

Tree rings



Caves

https://www.ncei.noaa.gov/news/what-are-proxy-data

PALYNOLOGY: The study of pollen grains (produced by seed plants, angiosperms and gymnosperms) and spores (prouced by pteridophytes, bryophytes, fungi…), algae and microcharcoal.

The pollen grain is a container which houses the male gametophyte generation.

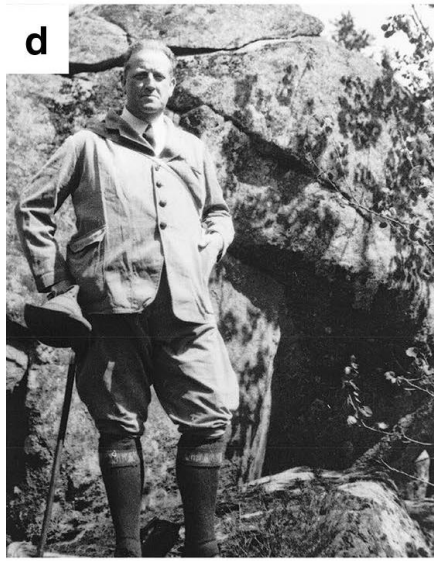
Both pollen and spores require dispersal in space.

One aspect of palynology is the study of fossil pollen grains…

Pollen that has been carried by the wind gets ‘stuck’ on the surface of the lake, and gets deposited with the rest of the sediment at the bottom of the lake.

The beginnings of pollen analysis

100 years ago, Lennart von Post first used pollen analysis to reconstruct past ecosystems



Vegetation History and Archaeobotany (2018) 27:271–309
https://doi.org/10.1007/s00334-017-0630-2

ORIGINAL ARTICLE

CrossMark

One hundred years of Quaternary pollen analysis 1916–2016

H. John B. Birks[1,2] · Björn E. Berglund[3]

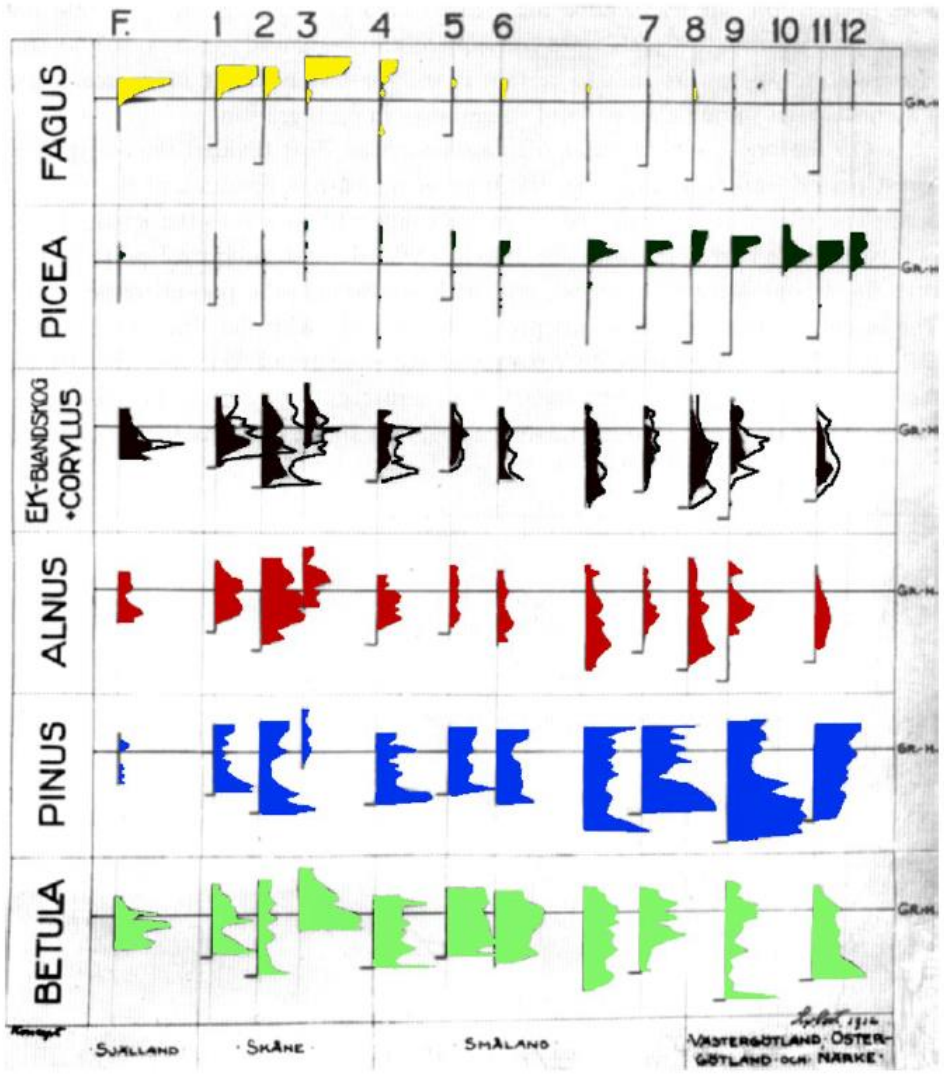
Received: 12 April 2017 / Accepted: 14 August 2017 / Published online: 29 October 2017

Abstract
We review the history of Quaternary pollen analysis from 1916 to the present-day, with particular emphasis on methodological and conceptual developments and on the early pioneers of the subject. The history is divided into three phases—the pioneer phase 1916–1950, the building phase 1951–1973, and the mature phase 1974–present-day. We also explore relevant studies prior to Lennart von Post's seminal lecture in 1916 in Kristiania (Oslo) in an attempt to trace how the idea of Quaternary pollen analysis with quantitative pollen counting and stratigraphical pollen diagrams developed.

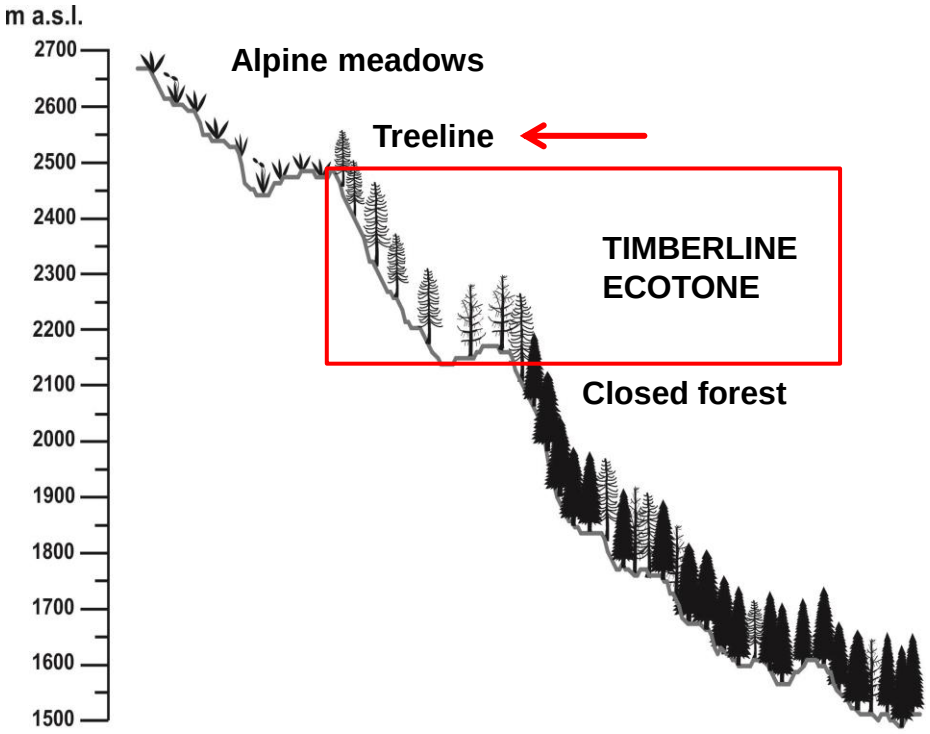
Keywords Concepts · History · Methods · Palaeoclimatology · Pioneers · Pollen-representation studies · Quaternary geology · Taphonomy

His 'time–space' diagram demonstrated the potential of pollen analysis as a means of reconstructing past vegetation patterns in both time and space.

Post's scientific motto: *"think horizontally, work vertically"*



Reconstructing time-space ecosystem dynamics



TIMBERLINE ECOTONE: the transition zone between closed forest and the most advanced individuals of the forest-forming tree species (***Holtmeier 2009***).

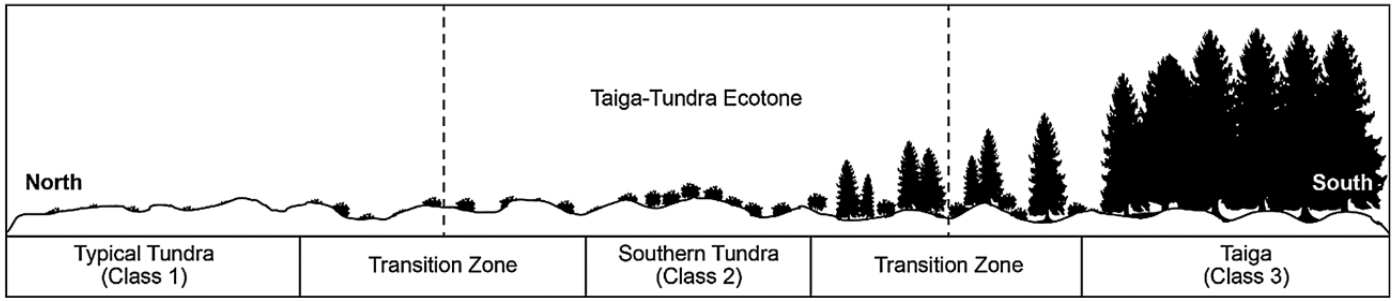


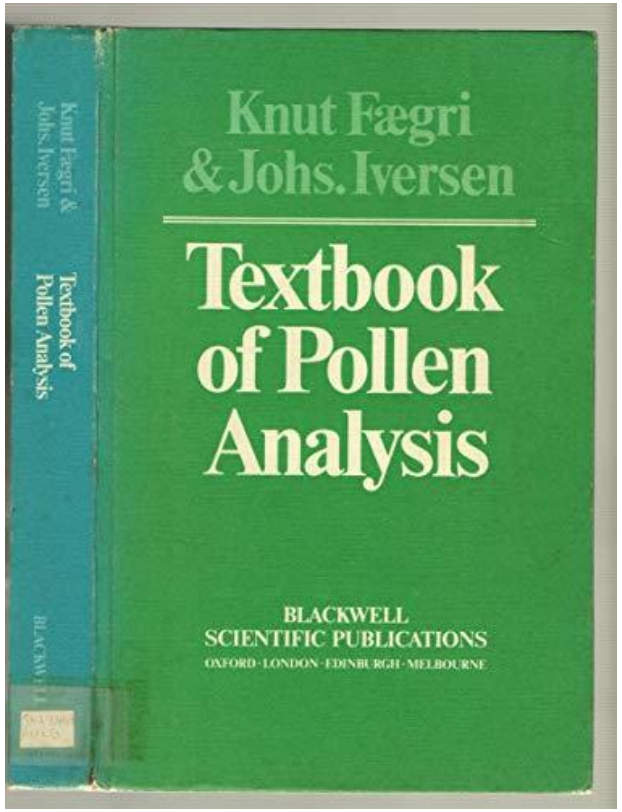
Fig. 3. Schematic illustration of the distinguished classes.

The taiga-tundra ecotone extends over 13.400 km around the northern hemisphere and marks the transition zone between taiga and tundra. This boundary, which separates two biomes, tundra and taiga, corresponds more to a transition zone than as a distinct edge.

Walther et al. 2019

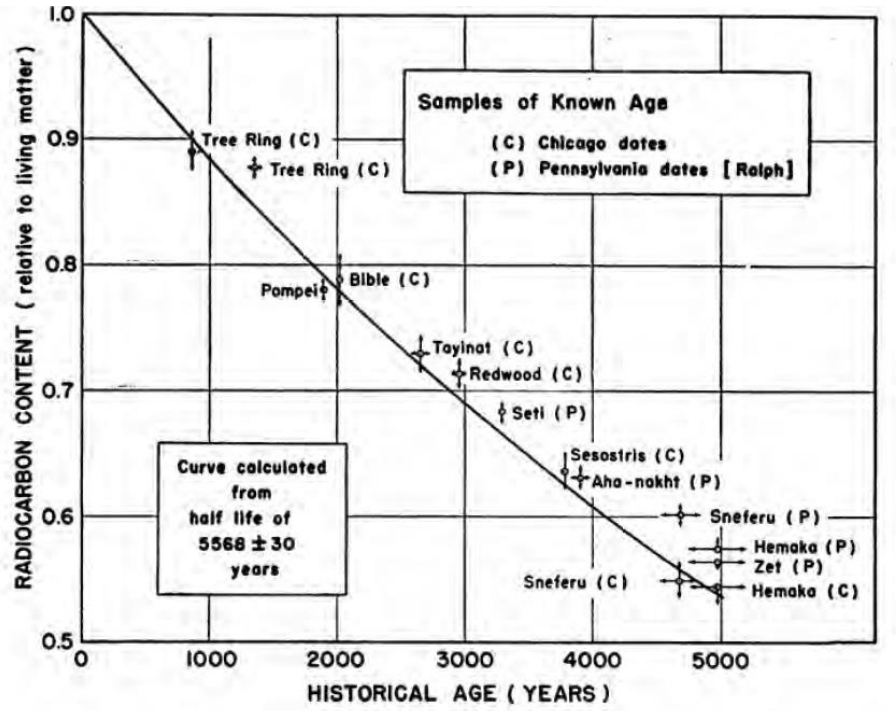
The international ‘explosion’ of pollen analysis

In 1950 a major advance occurred with the publication by Knut Fægri and Johs Iversen of their “Textbook of Pollen Analysis” which provided the foundations for pollen analysis as a botanical and ecological tool for studying past dynamics of biota and biotic systems.

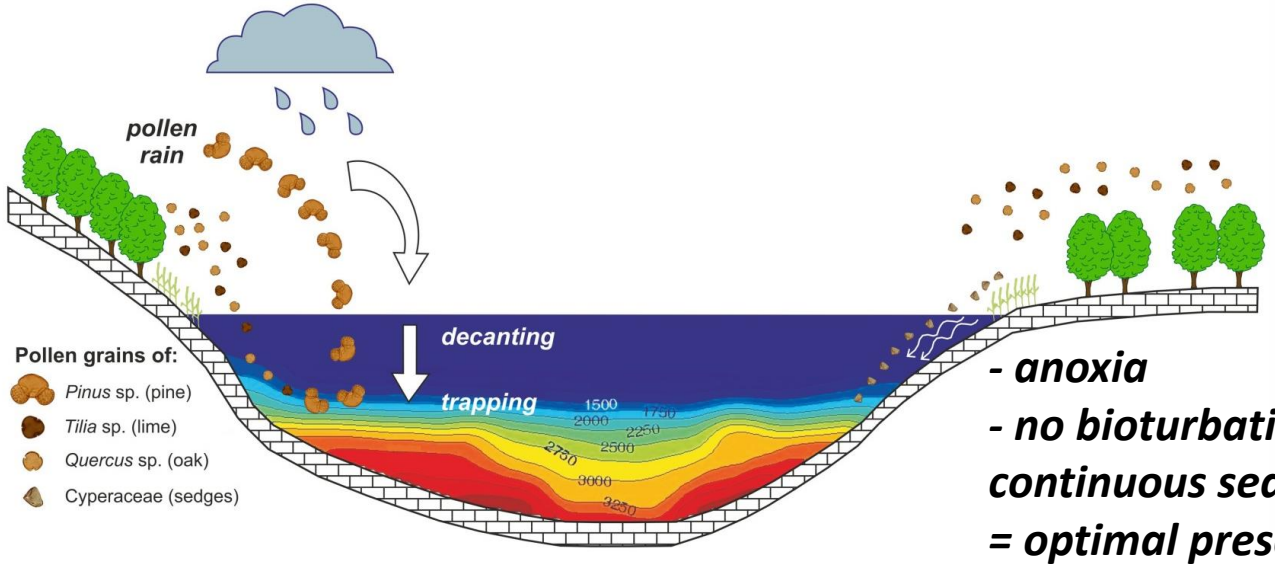


Radiocarbon dating and absolute pollen analysis

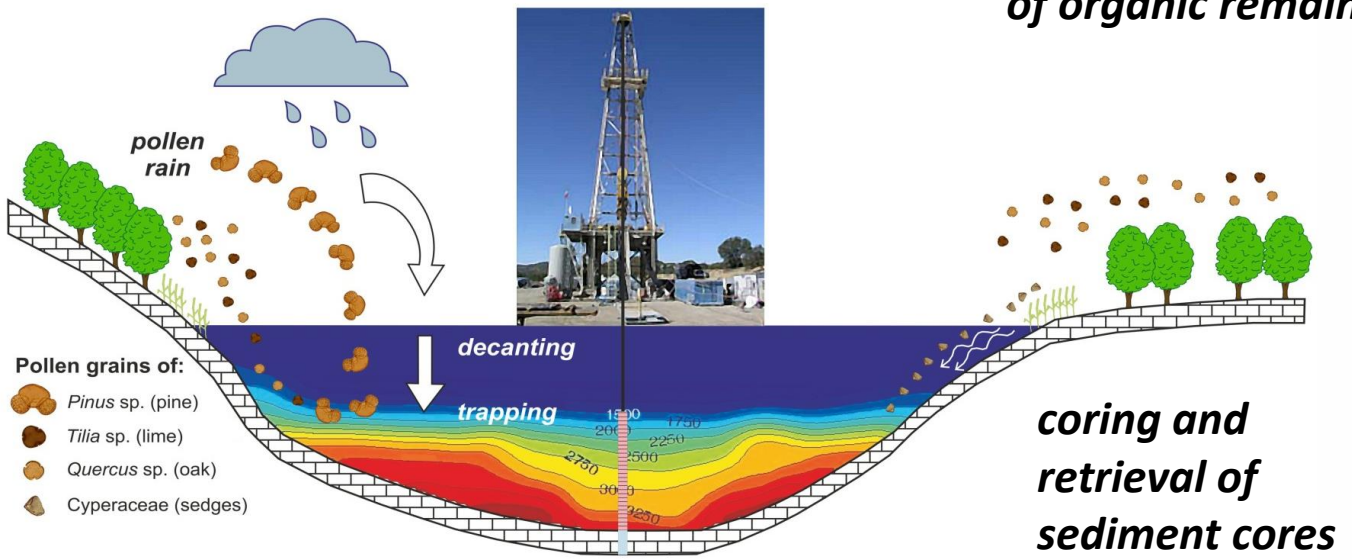
- ✓ The development of radiocarbon dating by Libby in the early 1950s provided a means of deriving an absolute chronology for events in the late-glacial and Holocene.
- ✓ Radiocarbon dating freed pollen analysis from being a relative chronological tool and allowed the temporal and spatial patterns in pollen stratigraphies to be compared rigorously
- ✓ In the last 30 yrs developments in radiocarbon dating, particularly the use of accelerator mass spectrometry (AMS), allow the dating of very small amounts of material and deriving robust age-sediment depth models



Libby's "Curve of Knowns" compared the known age of historical artifacts with their age as determined by radiocarbon dating. The agreement between the two, within a small margin of error, demonstrated the accuracy of the technique. This version was presented by Libby during his Nobel Lecture in 1960; an earlier version appeared in 1949.



- anoxia
- no bioturbation and continuous sedimentation
= optimal preservation of organic remains



coring and retrieval of sediment cores

Coring and sampling tecniques

A) and B) Undisturbed peat and lake sediments corers (russian corer); C) coring through the deposits of the Lolair lake (Aosta valley); D) core from lake deposits obtained with a russian corer.

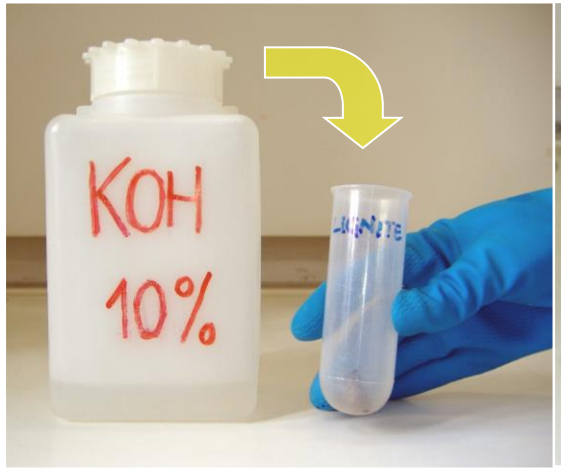
Coring and sampling tecniques

A) Deep continuous corings with scientific purposes (idraulic extrusion and specific feed).

B) and C) Cores of lacustrine and glaciolacustrine sediments obtained with the core drilling equipment.

Coring and sampling tecniques

Sampling



KOH 10%

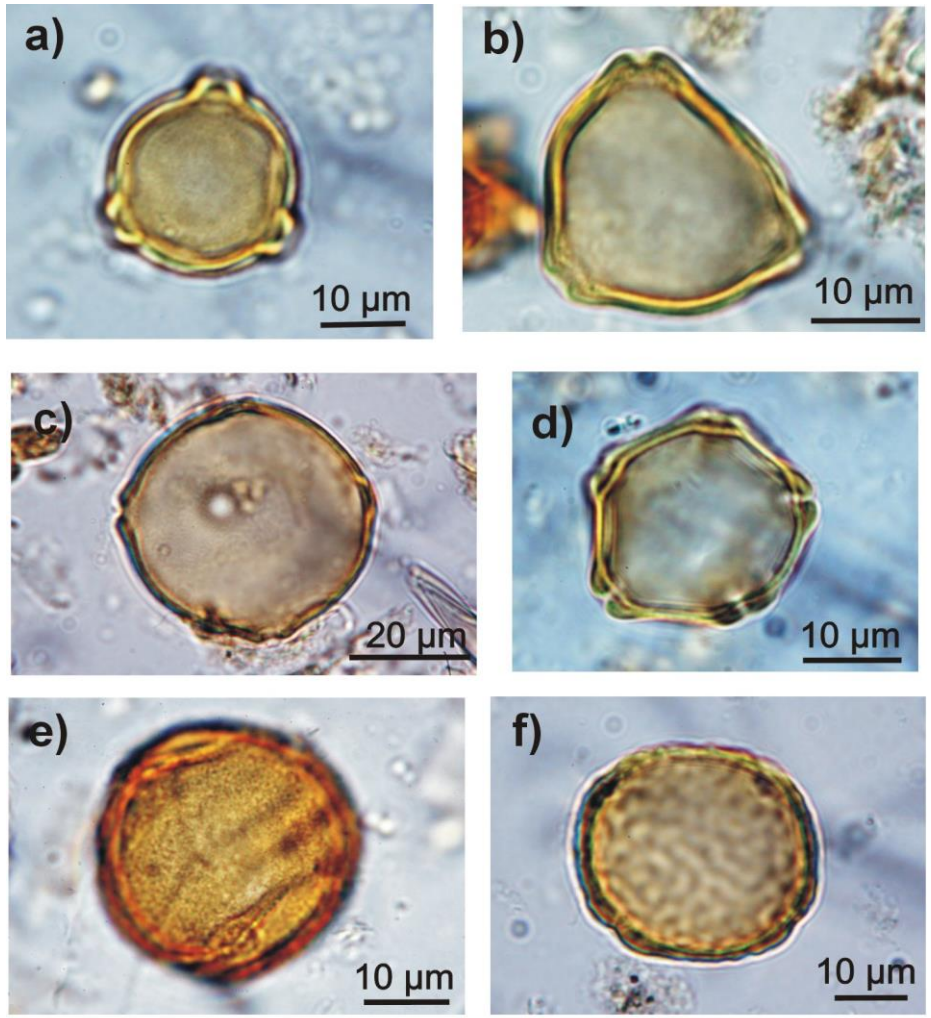
HCl + HF

Pollen samples

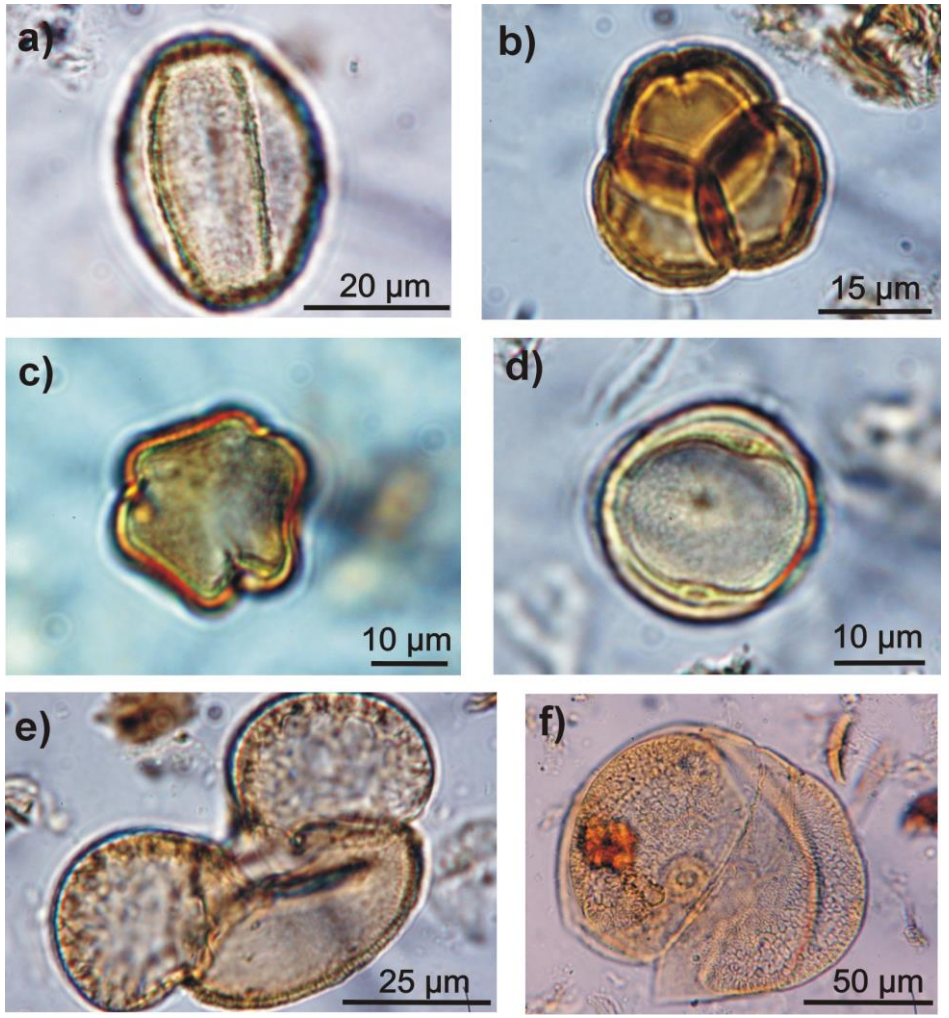
Sieving (250 micron)

Light microscope (X400, X630, X1000 magnifications)

Microbotanical identification

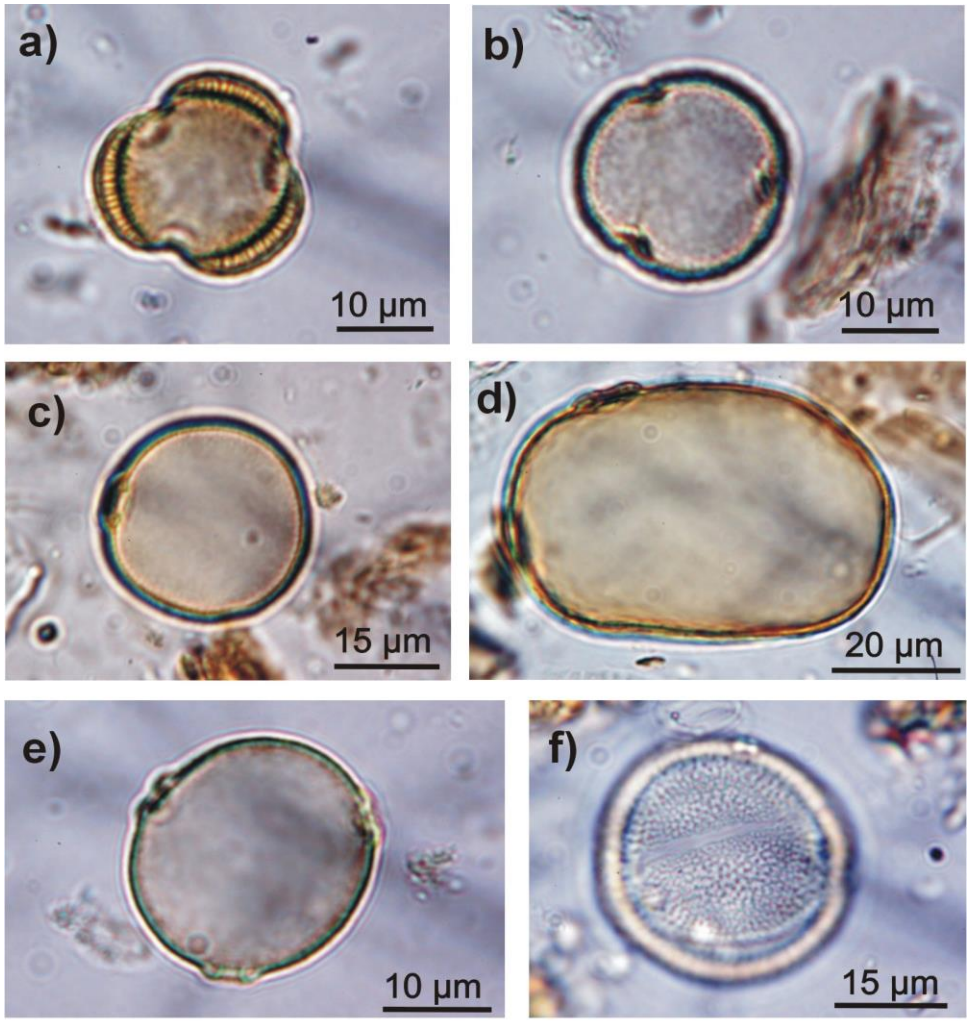


a) *Betula* sp.; b) *Corylus avellana*; c) *Carpinus betulus*; d) *Alnus tipo glutinosa*; e) *Fagus sylvatica*; f) *Ulmus* sp.

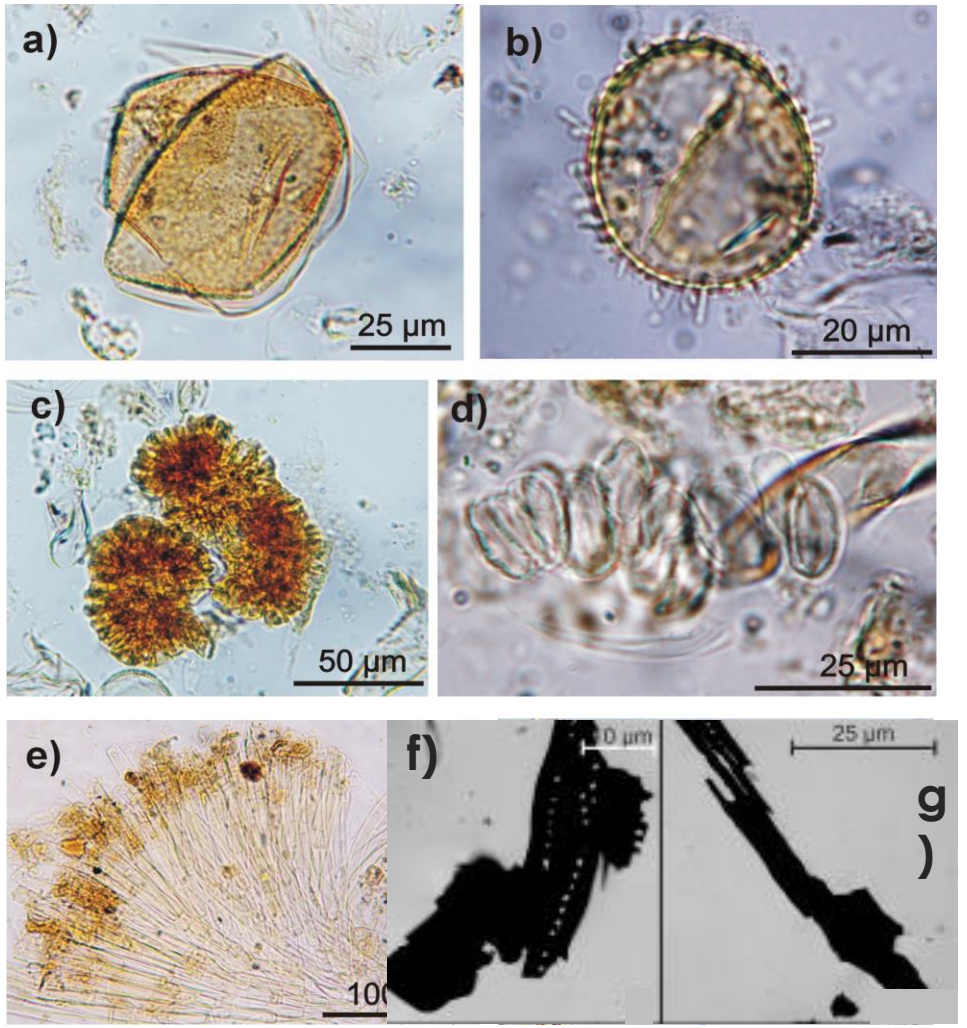


a) *Quercus sp. cad.;* b) *Ericaceae;* c) *Vitis vinifera;* d) *Vitis vinifera;* e) *Pinus tipo sylvestris/;mugo;* f) *Picea* sp.

Microbotanical identification



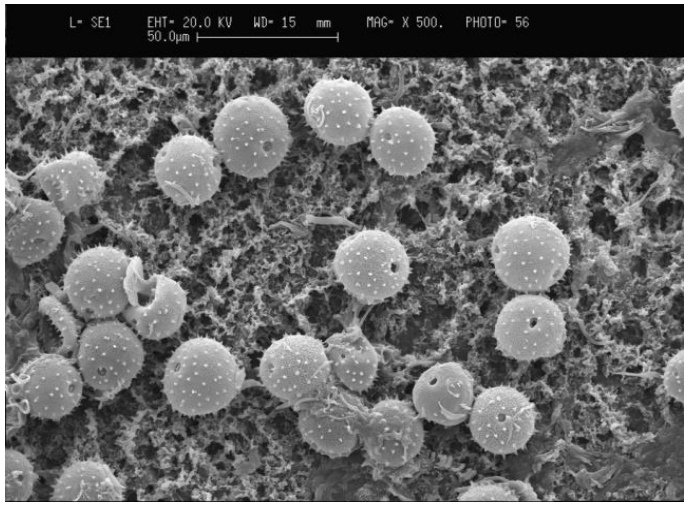
a) *Artemisia* sp.; *b) Rumex acetosa* type; c) *Gramineae;* d) *Secale cereale;* e) *Cannabis/Humulus sp.;* f) *Mentha* type

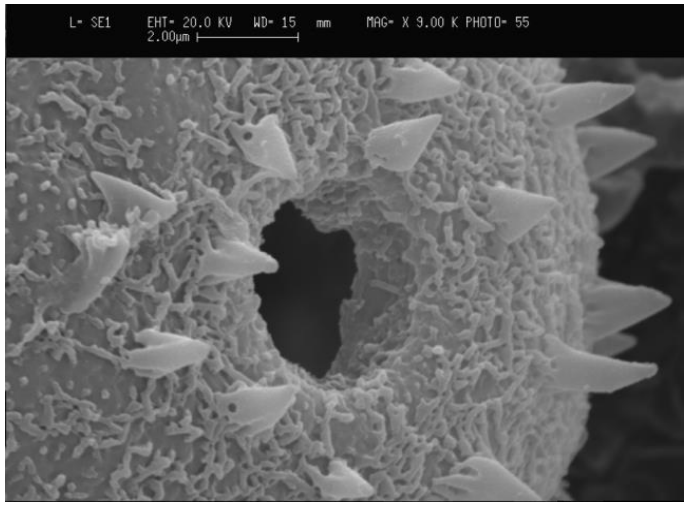


a) *Equisetum* sp.; b) Nympheae; c) *Botryococcus* sp.; d) *Scenedesmus* sp.; e) *Gleotrichya* sp.; f) and g) wood charcoal.

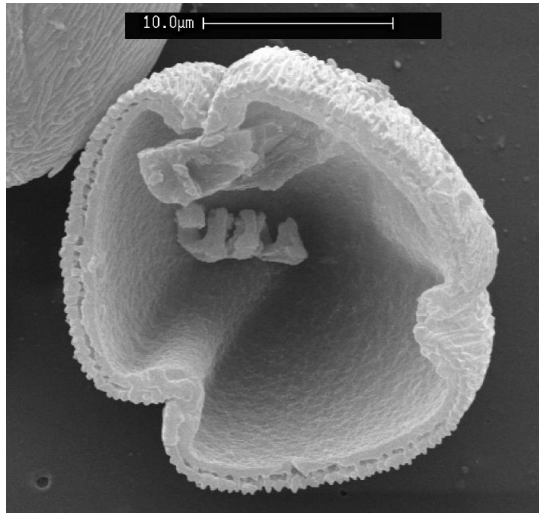
Modified from Furlanetto, 2013

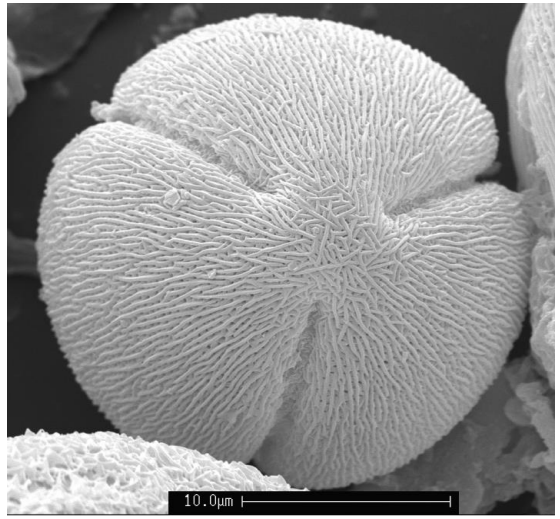
Microbotanical identification





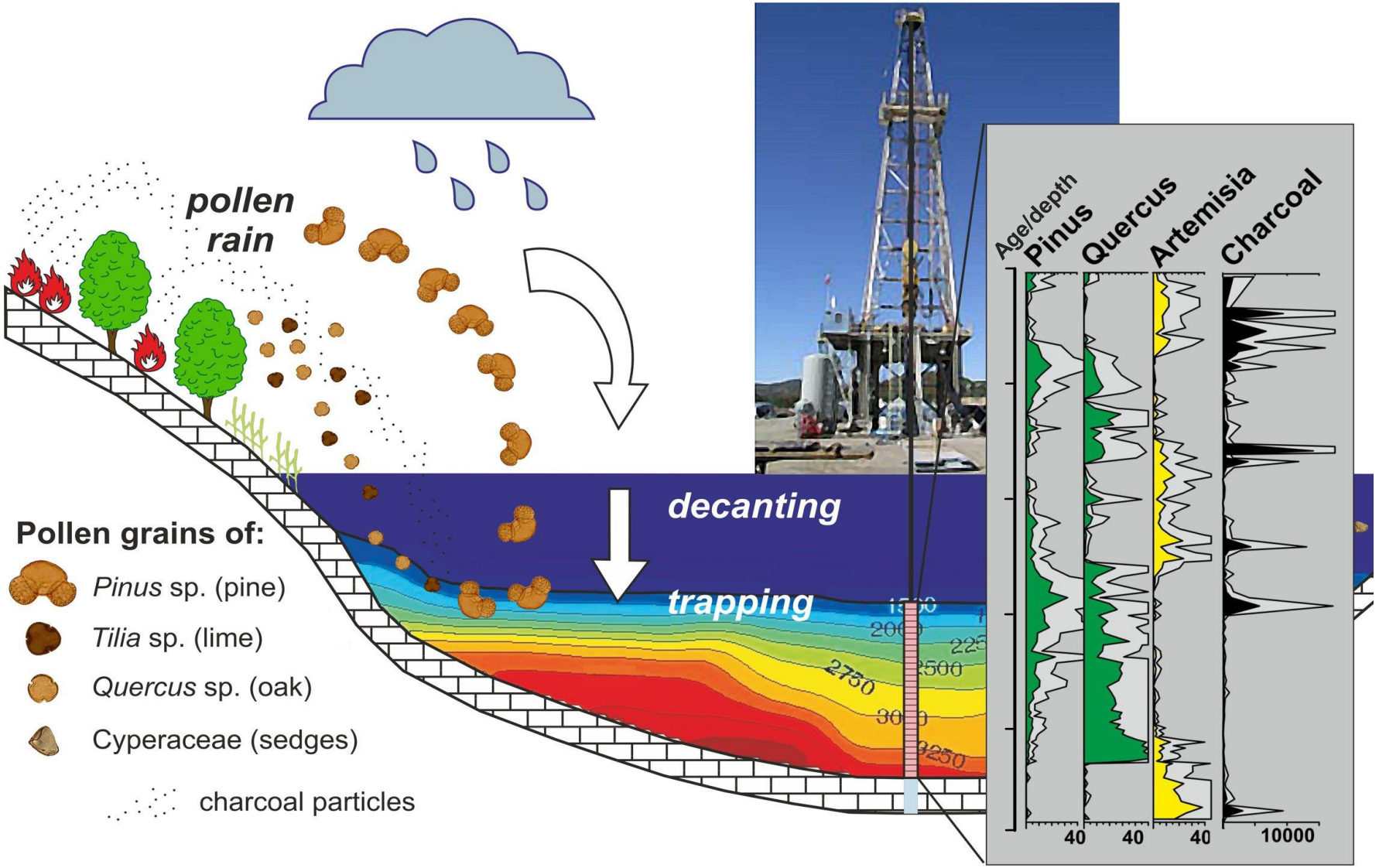
Campanula barbata



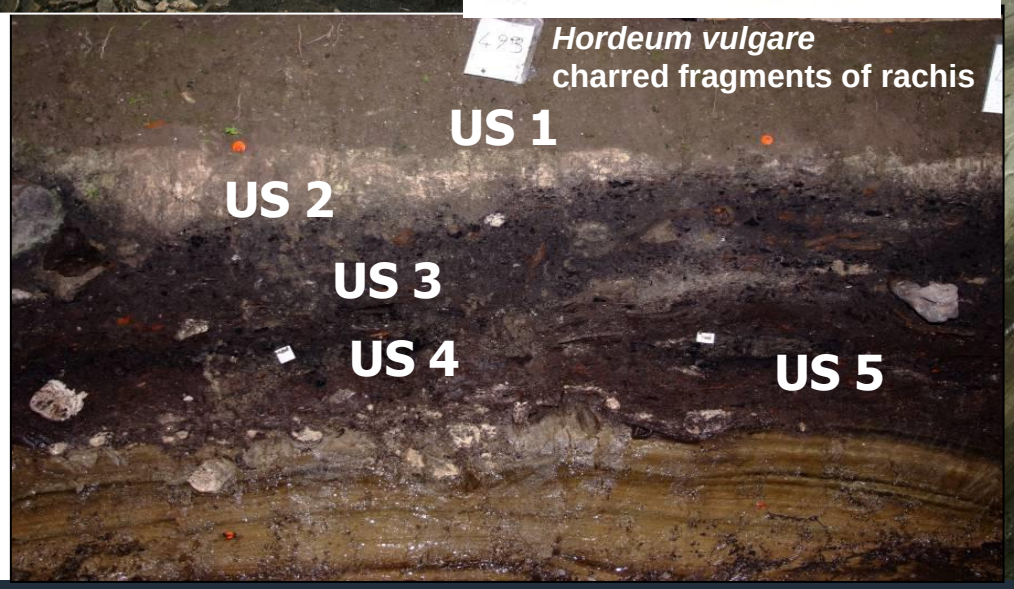


Helianthemum oelandicum subsp. italicum

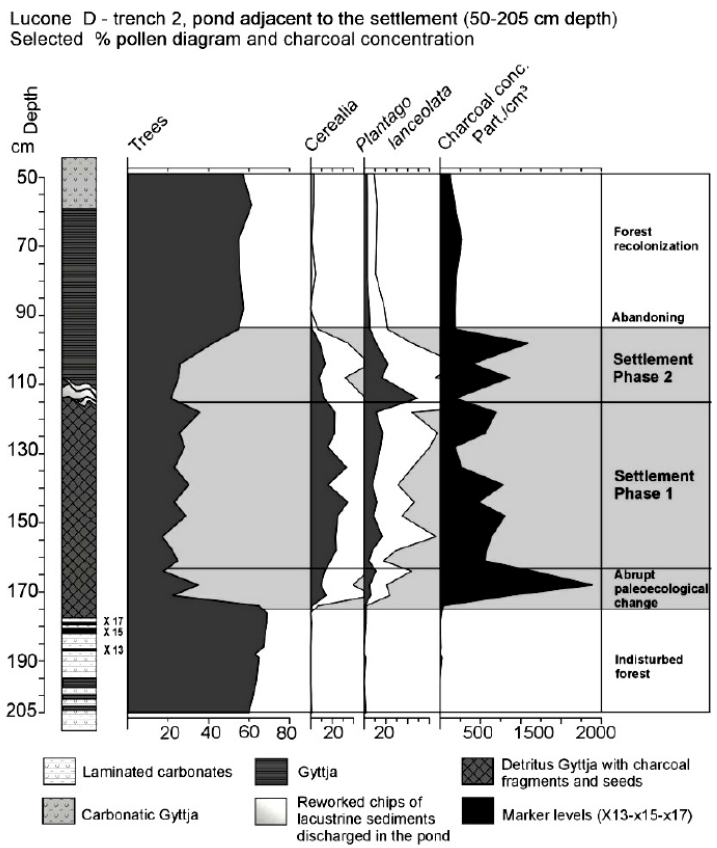
Pollen records



Pollen depositional contexts

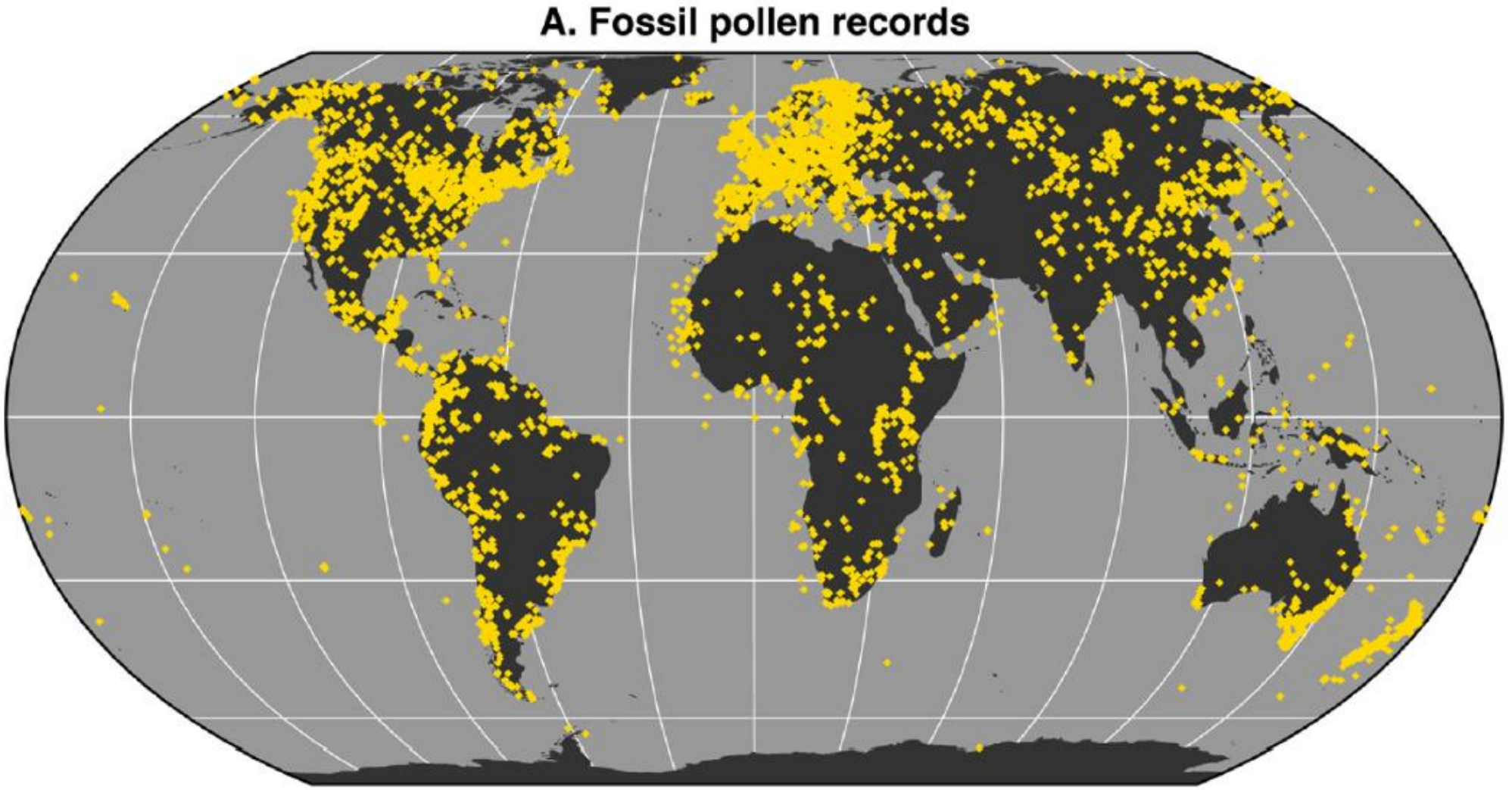


Bronze Age - Lucone, Polpenazze del Garda (Brescia, Northern Italy)



Badino et al., 2011

Pollen records



Compilation of existing fossil records from the Neotoma Paleoecology Database (Williams et al., 2018)