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## Vegetation and climate history of the St. John's Abbey Arboretum (Collegeville, Minnesota) based upon lacustrine fossil pollen

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# Vegetation and climate history of the St. John's Abbey Arboretum (Collegeville, Minnesota) based upon lacustrine fossil pollen

Emily Kiolbasa

College of Saint Benedict | Saint John's University

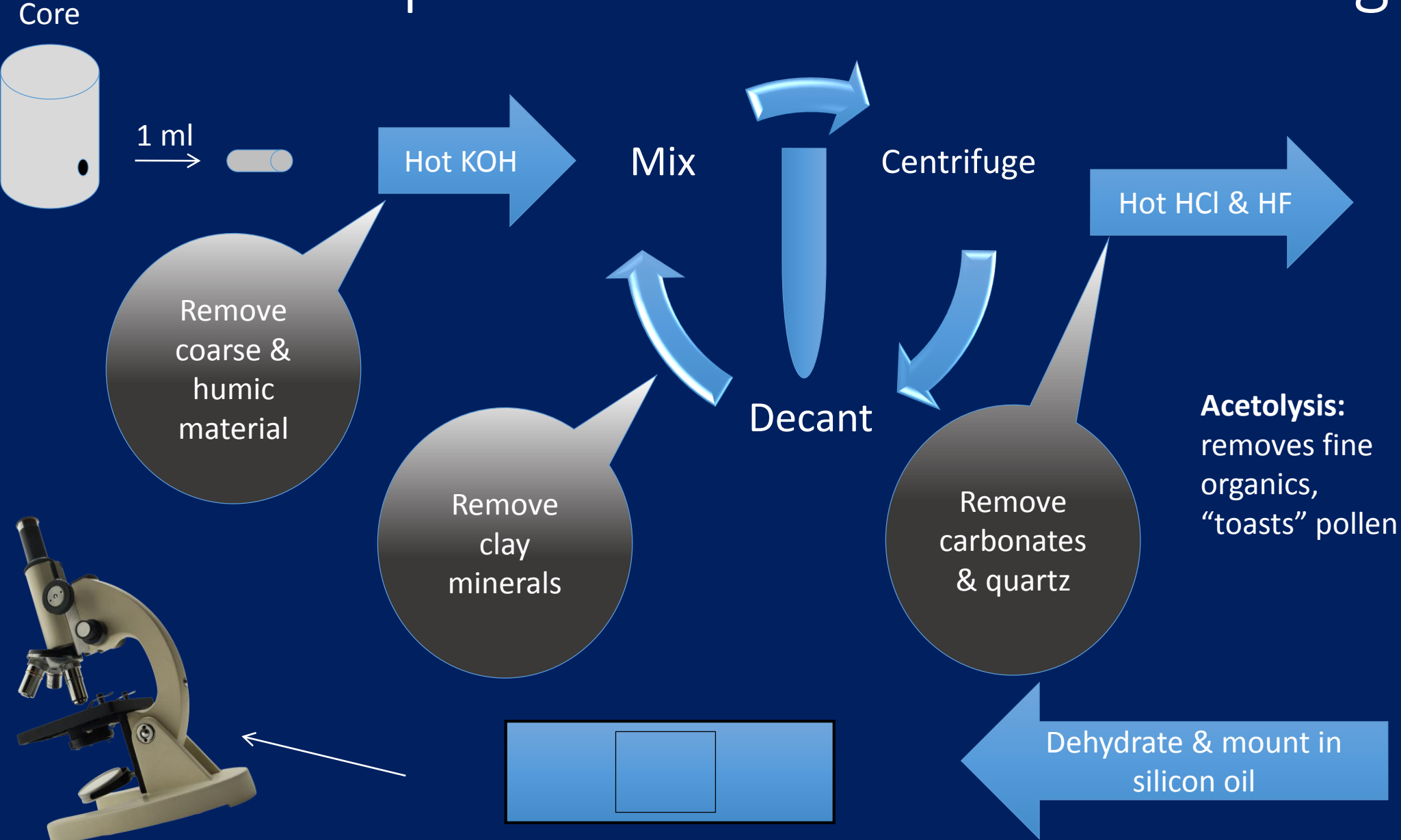
# Obtaining Sediment Samples



- 2 Ha Kettle Lake
- 15.75 m sediment sample
- 16 February 2002
- 5 cm diameter Livingstone sediment corer



# Preparation of Pollen for Counting



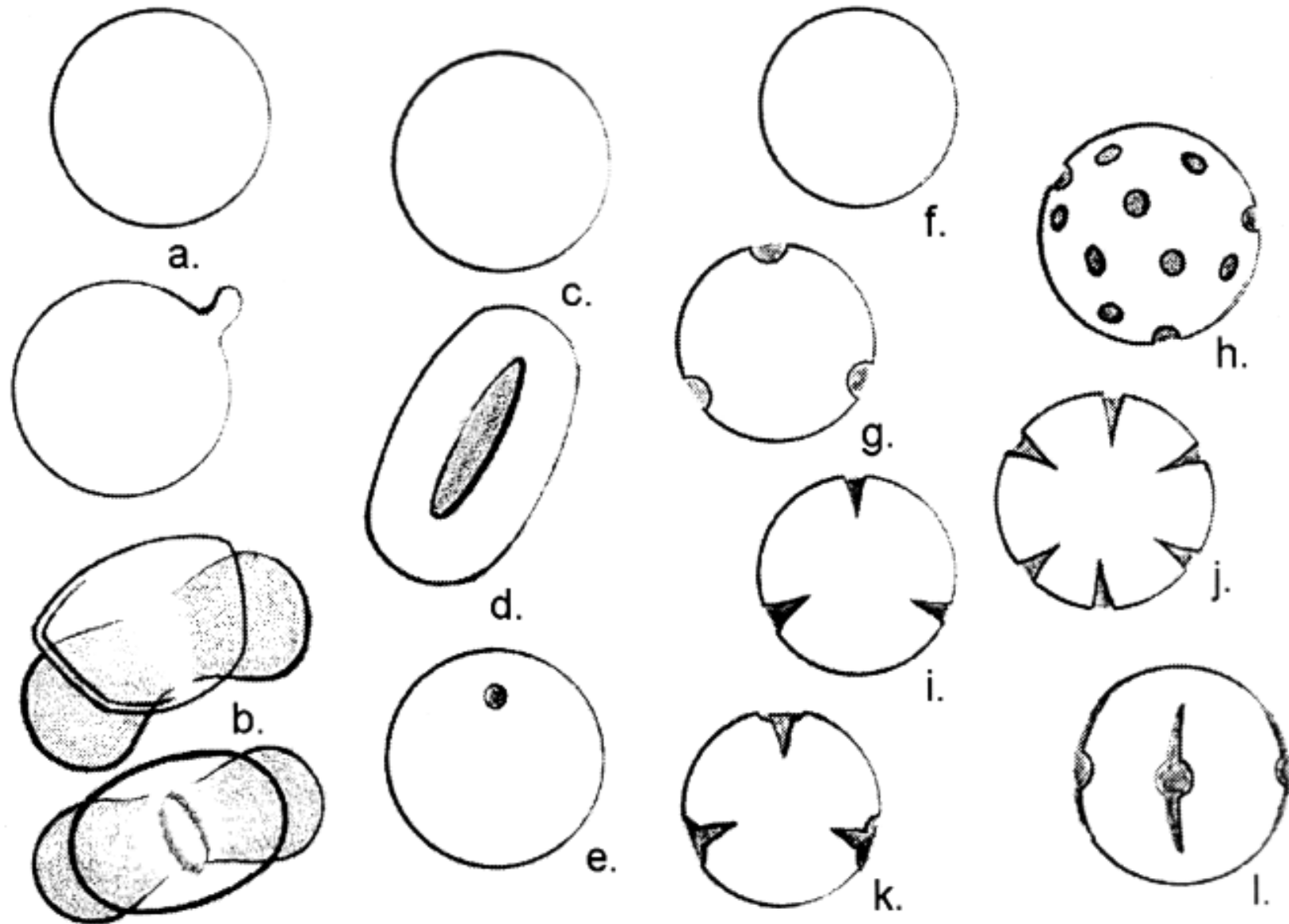


Fig. 5. Some common pollen types of seed plants. Gymnosperms: a, inaperturate; b, winged with an obscure furrow. Monocotyledons: c, inaperturate; d, monocolpate; e, monoporate. Dicotyledons: f, inaperturate; g-h, tri- to periporate; i-j, tri- to stephanocolpate; k-l colporate.

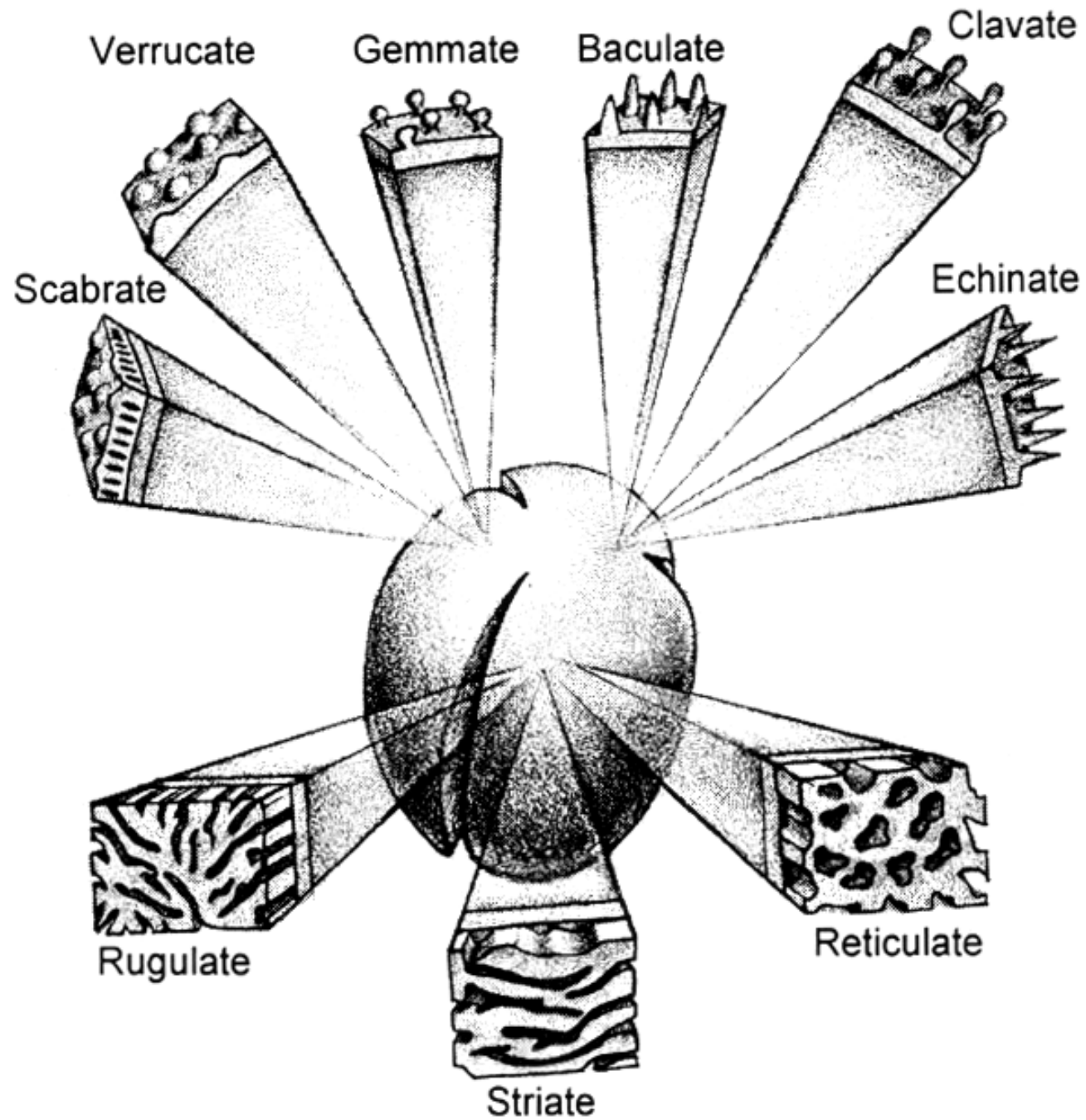
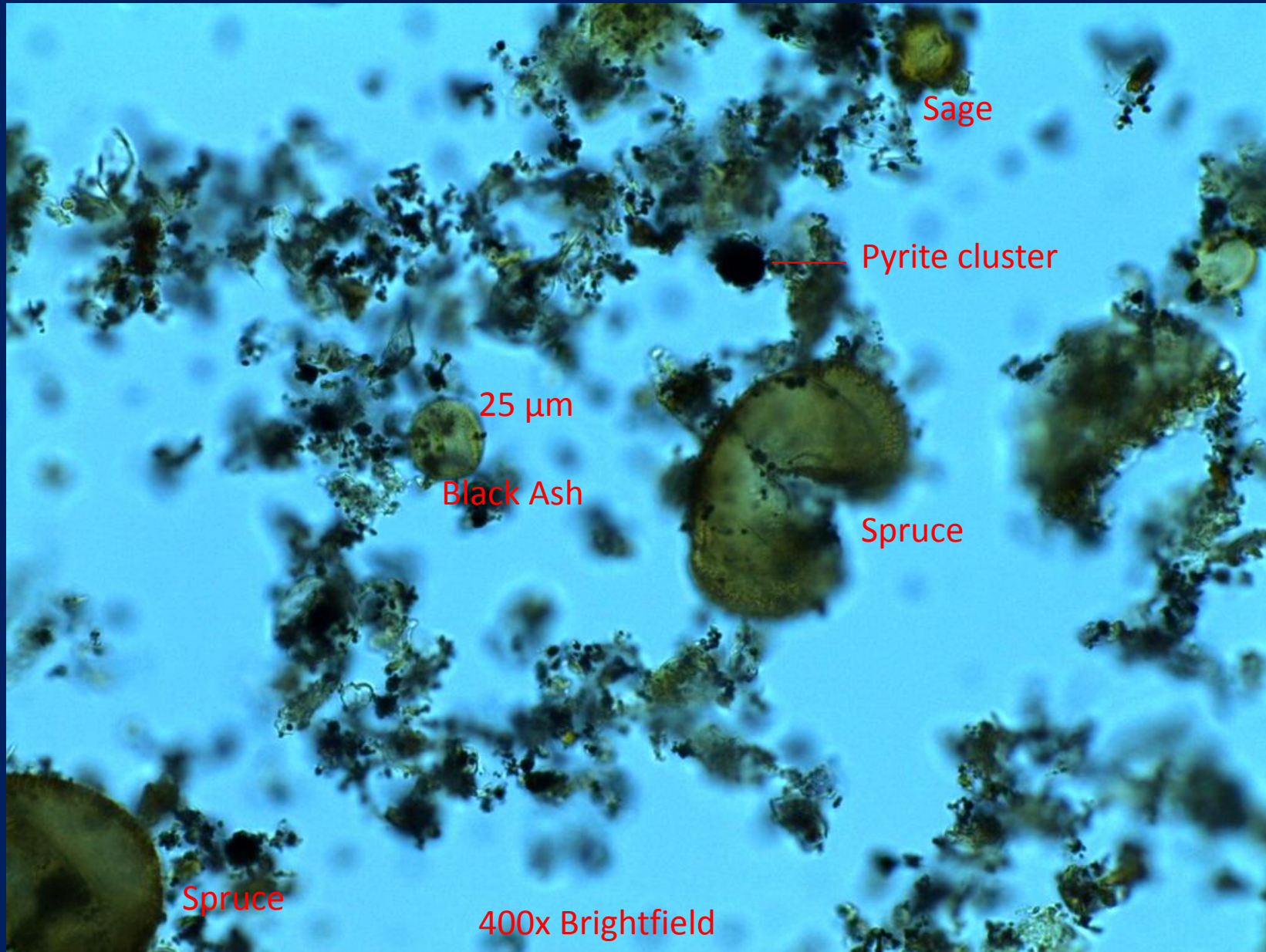
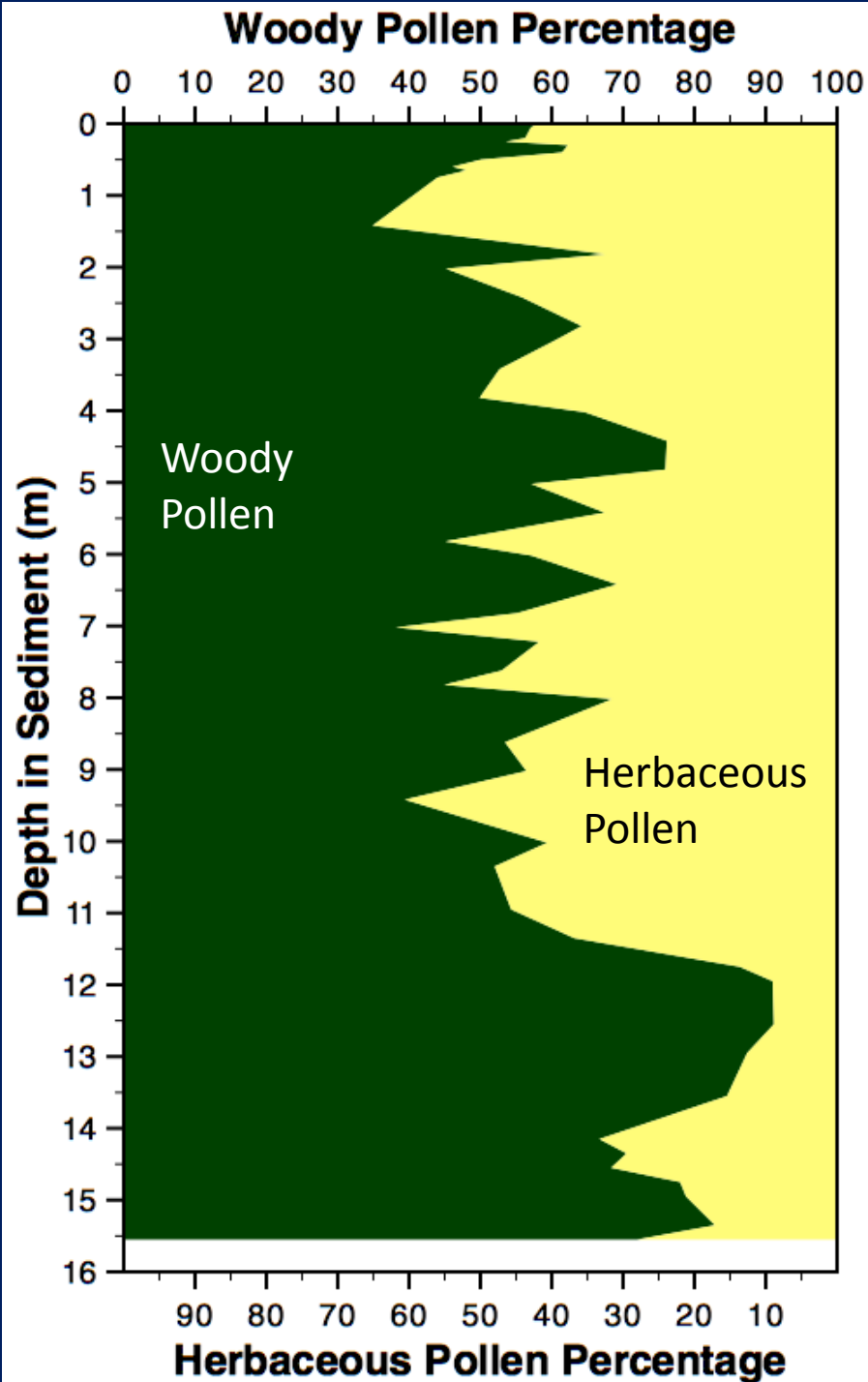


Fig. 7. Sculptural elements and patterns of the pollen exine.



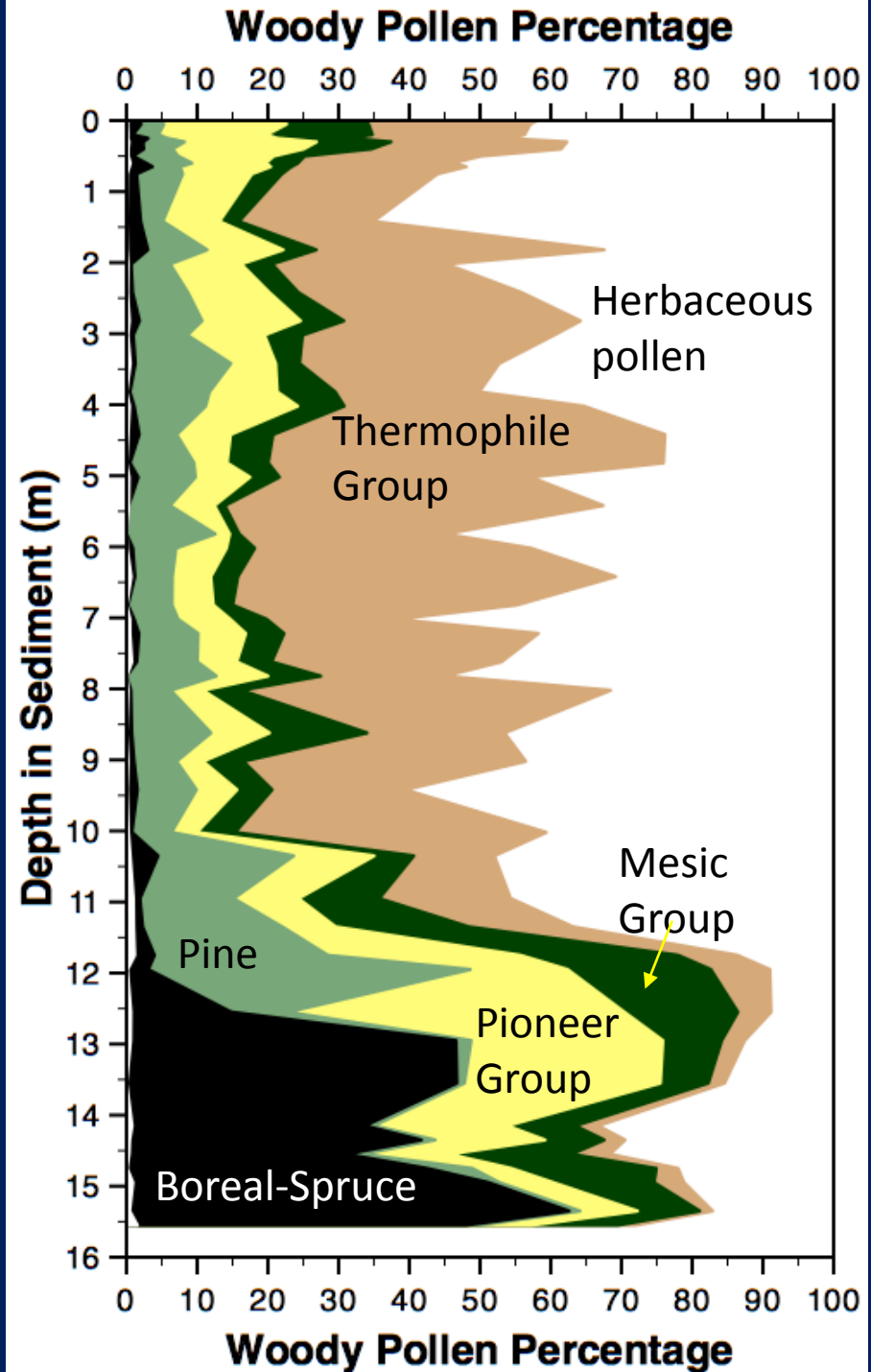
# Sample from about 15 m deep





For most of its late-glacial and post-glacial history, the pollen in Lake Hilary has been a relatively even mix of woody and herbaceous types





## Change over time of woody pollen percentages

### Pioneer Group:

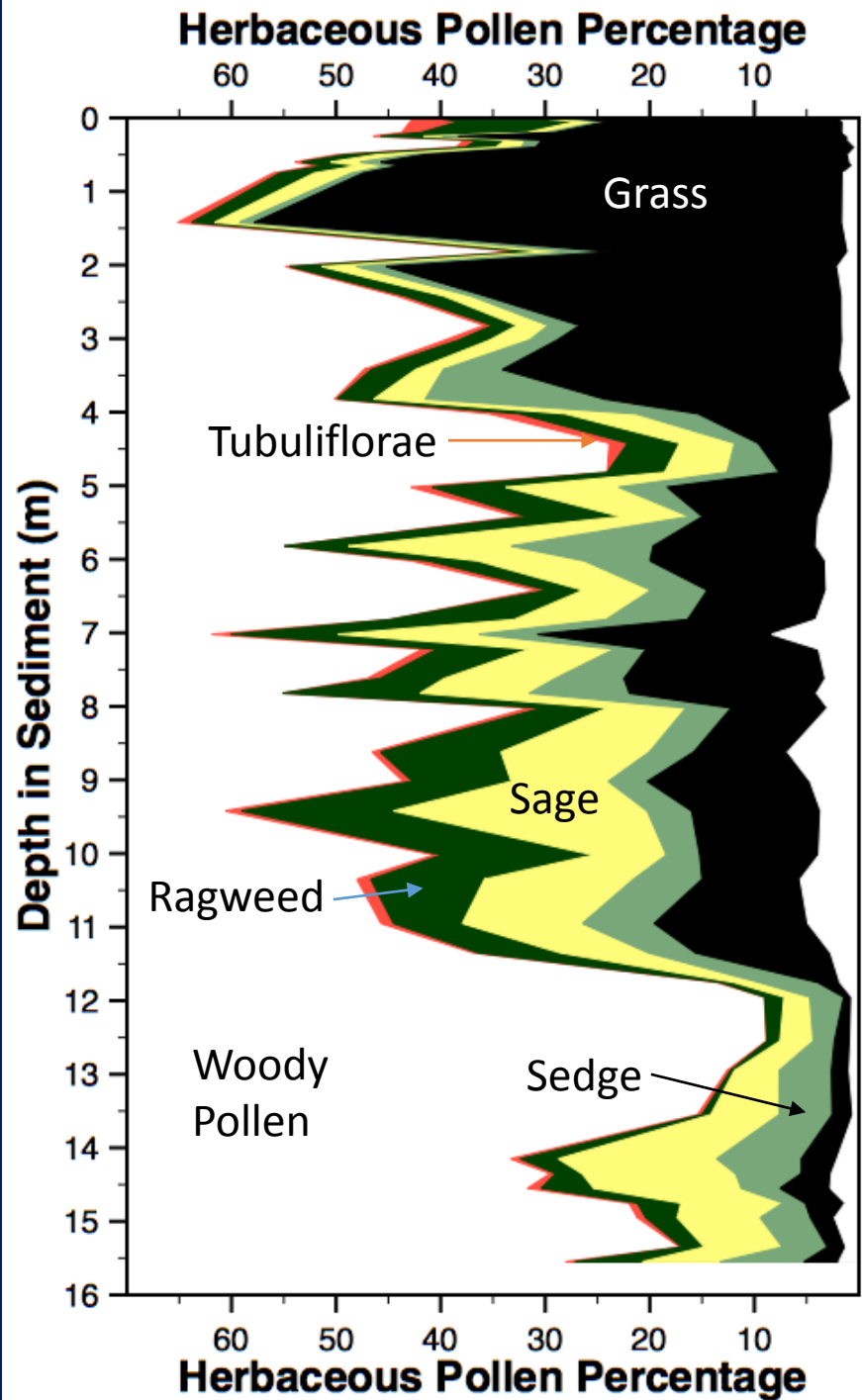
- Alder
- Aspen
- Birch
- Hazel
- Willow

### Mesic Group:

- Black and Green Ash
- Elm
- Ironwood
- Basswood
- Maple

### Thermophile Group:

- Mainly Oak
- Walnut
- Butternut
- Hickory
- Hackberry



Change over time of herbaceous pollen percentages

Modern analogs were identified using the squared chord distance metric.

$$SCD = \left( \sqrt{p_{i,j}} - \sqrt{p_{i,k}} \right)^2$$

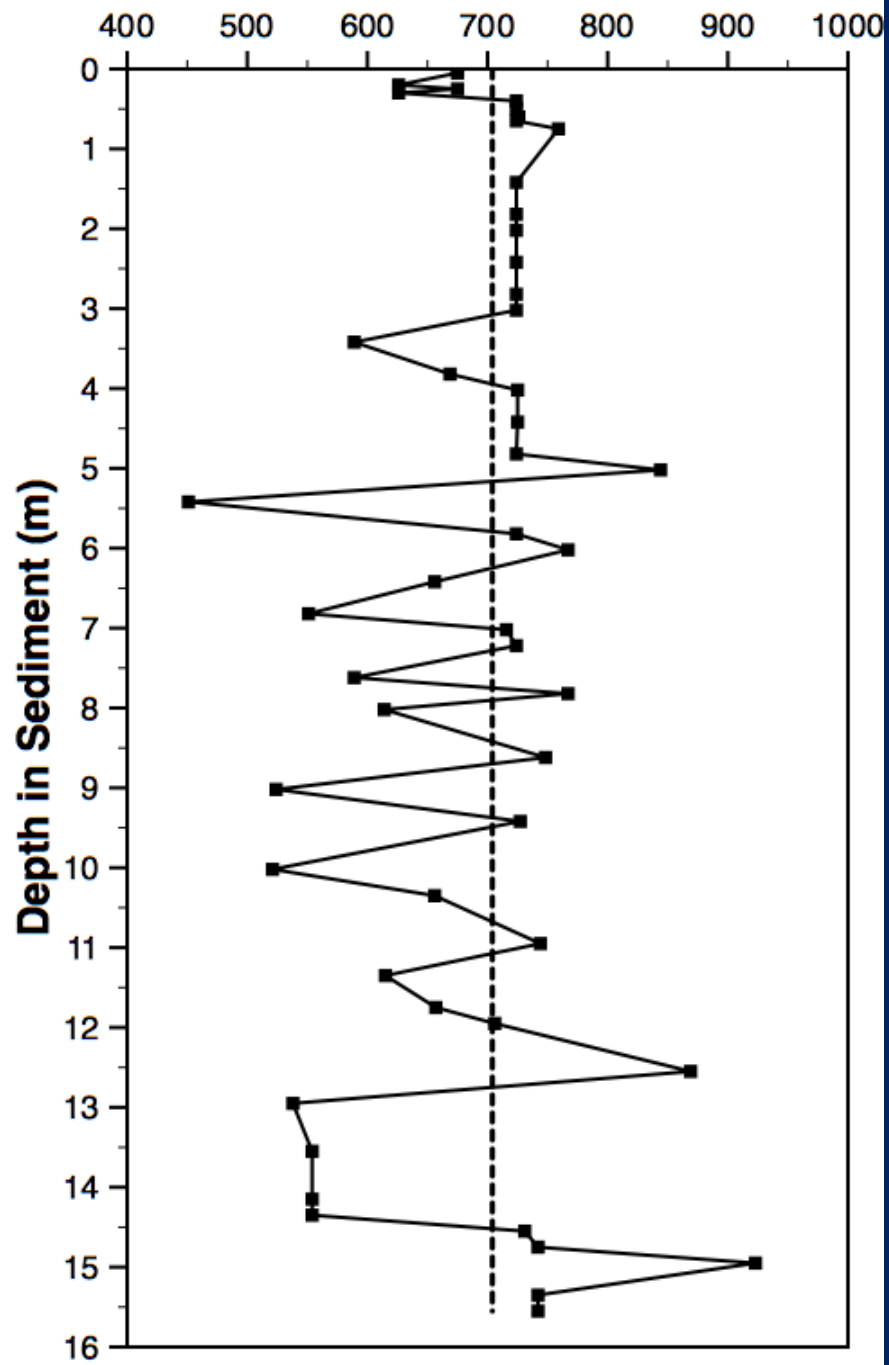
$p_{i,j}$  = proportion of pollen type  $i$  in sample  $j$

$p_{i,k}$  = proportion of pollen type  $i$  in sample  $k$

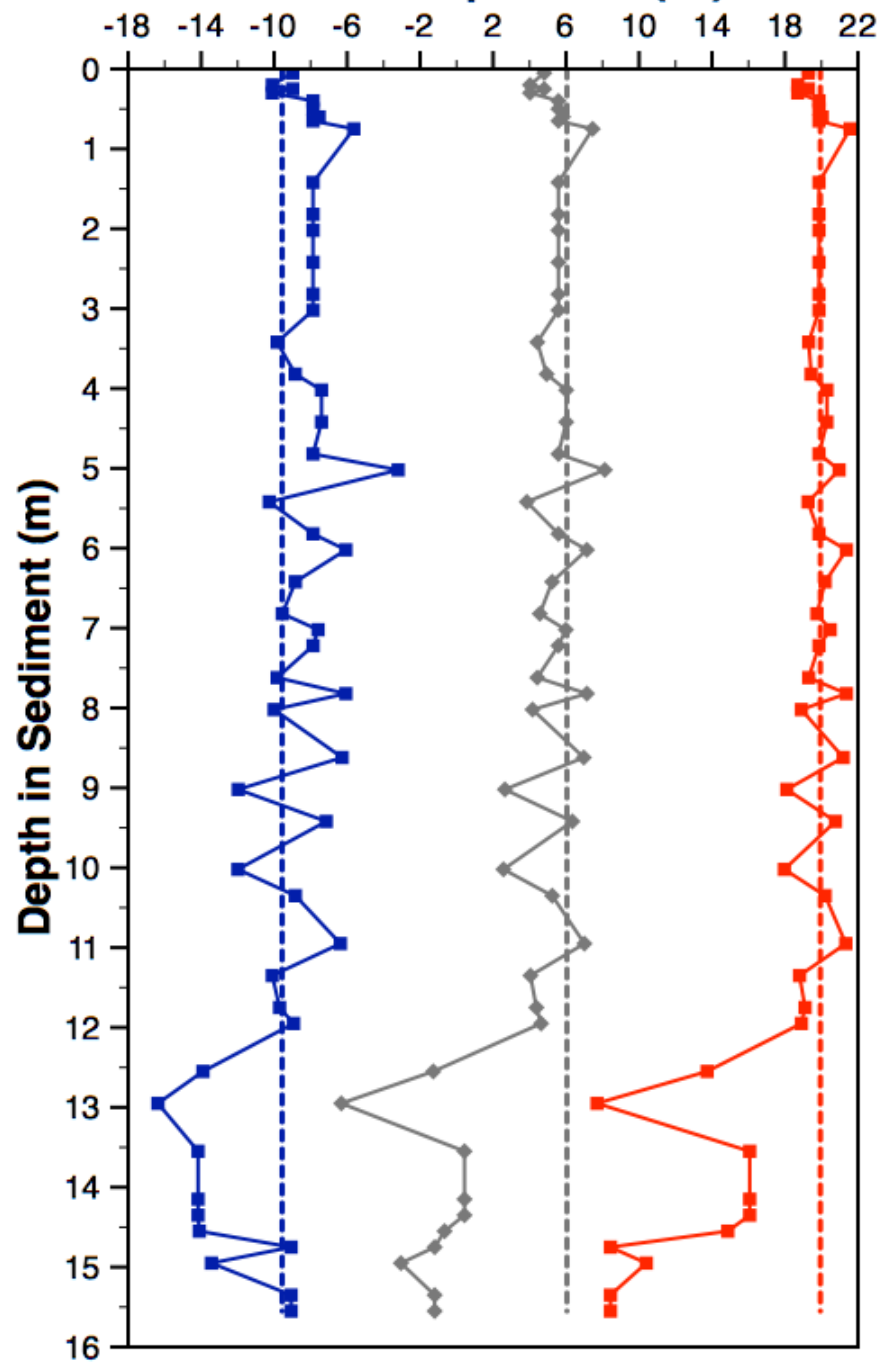
- Each depth compared with samples from North American Surface Sample Set (Whitmore 2005).
- Modern samples with a SCD less than or equal to 0.12 are considered to be analogs of past pollen assemblages.
- Many older samples do not have modern analogs because similar modern pollen assemblages are not observed.
- Ecosystem label for no analog samples comes from closest match in Surface Sample Set
- Surface data set is the source of climatic data



Mean Annual Precipitation (mm)

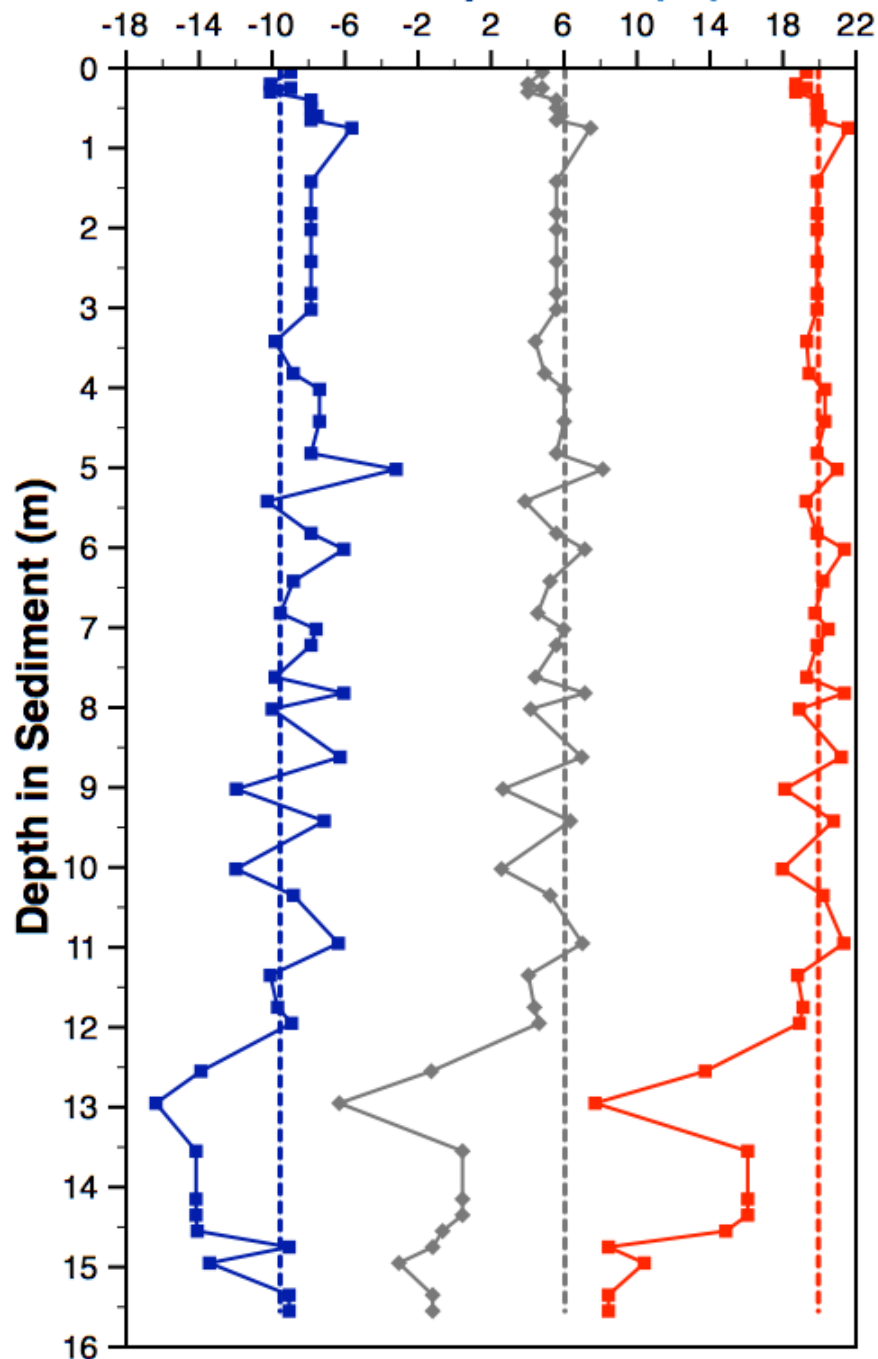


Mean Temperature (°C)

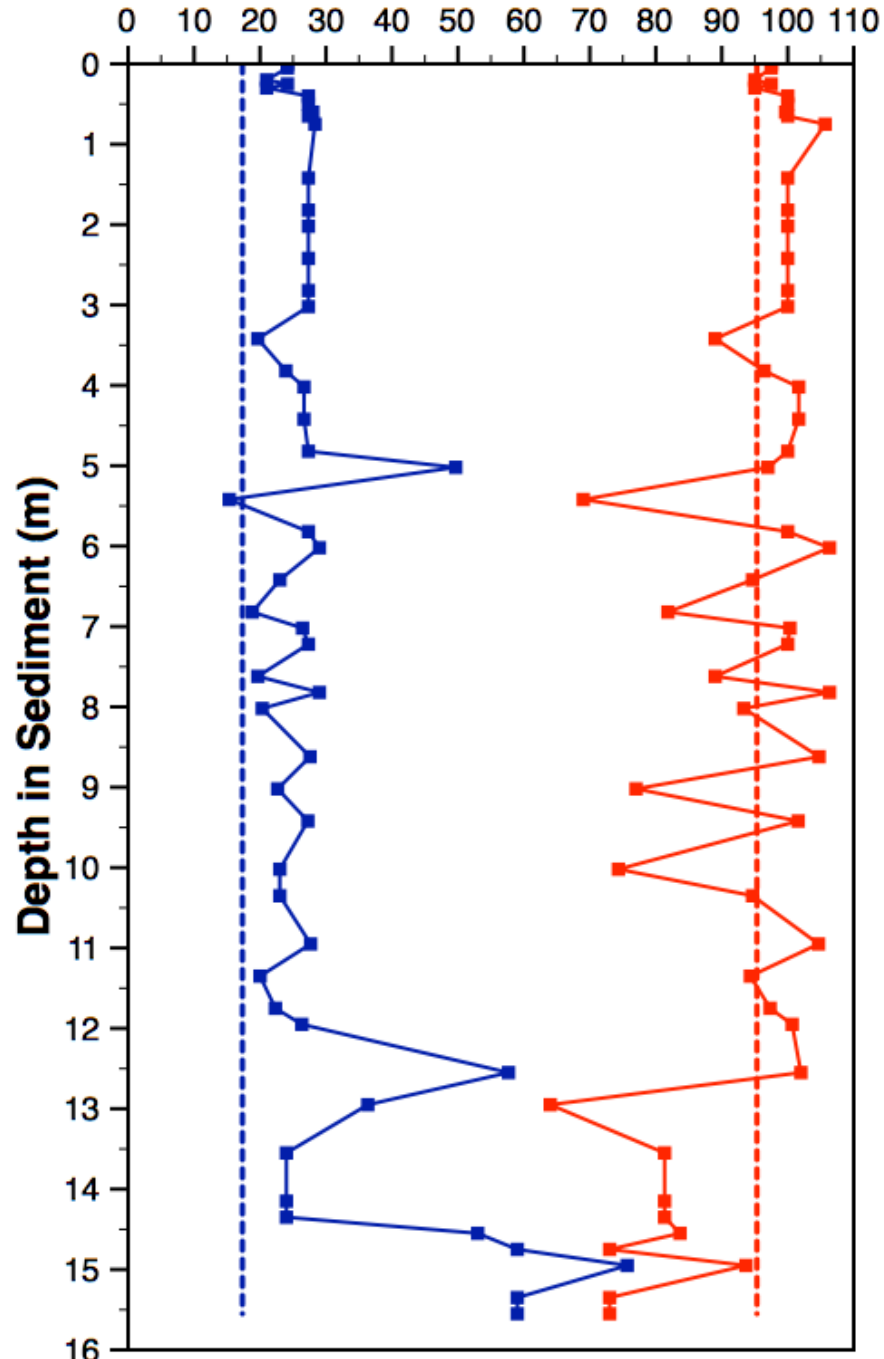


- Dec-Jan-Feb Mean ——— (blue line)
- Annual Mean ——— (grey line)
- Jun-Jul-Aug Mean ——— (red line)
- 1981-2010 Average - - - - - (dashed line)

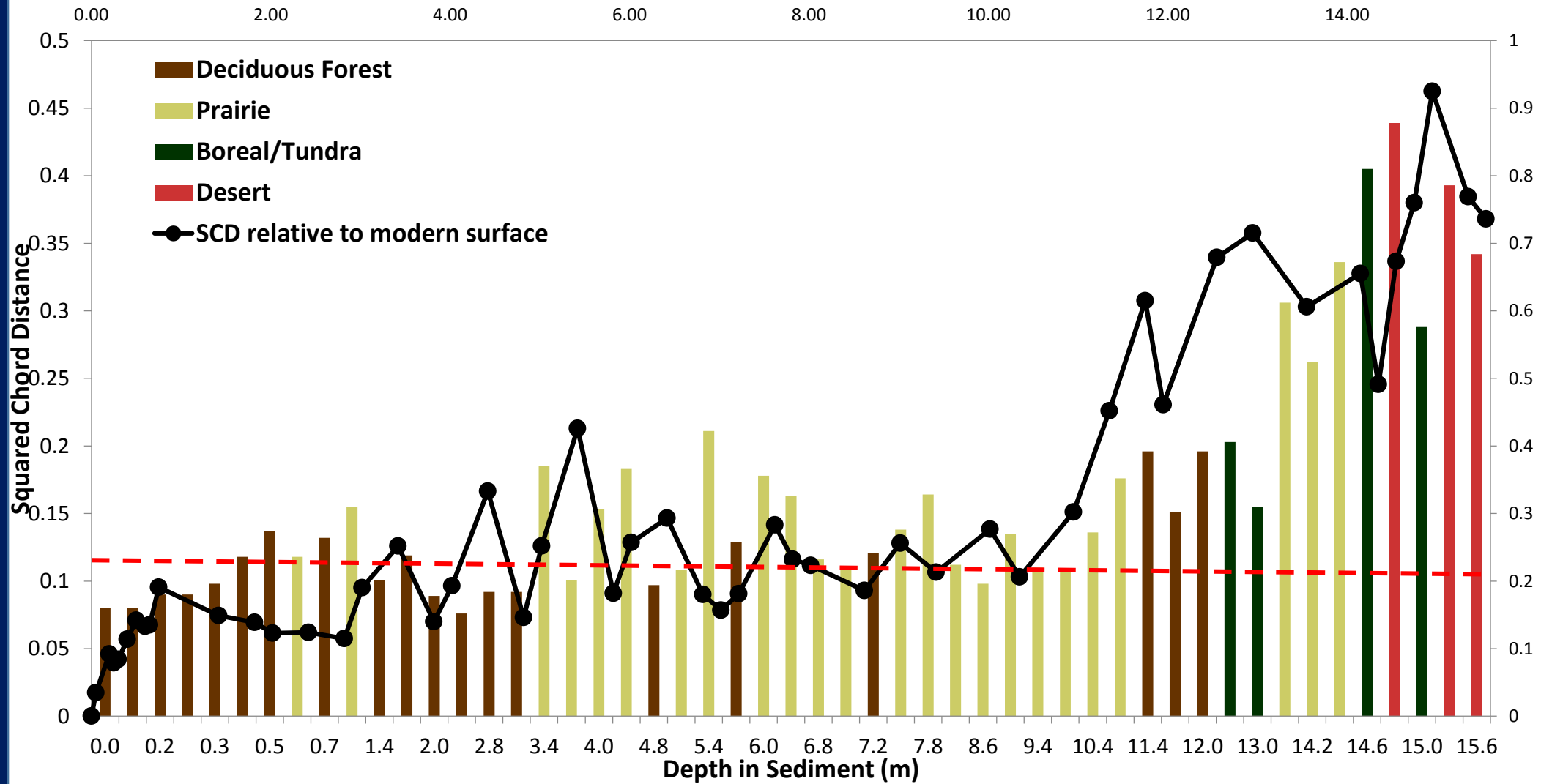
### Mean Temperature (°C)



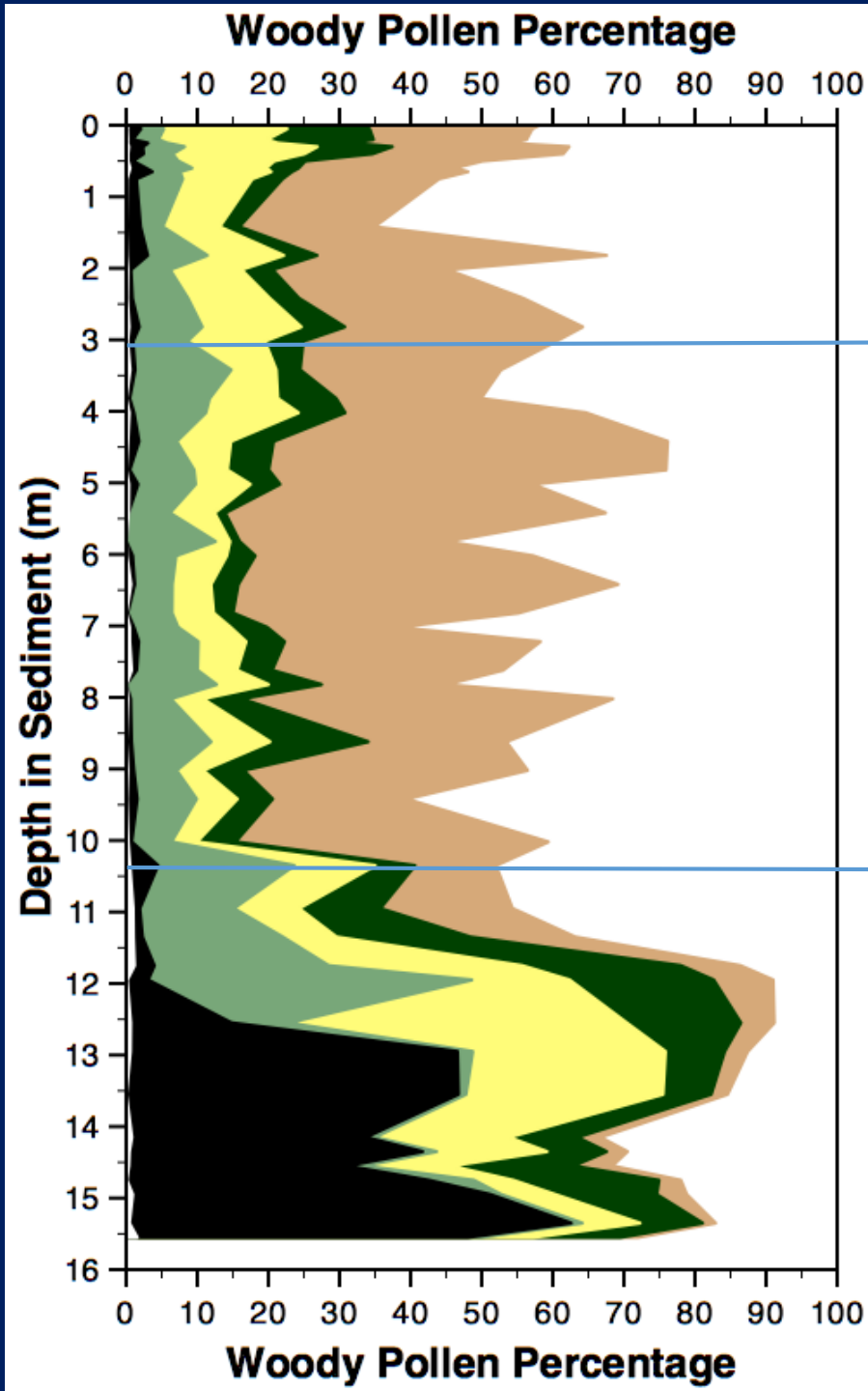
### Mean Monthly Precipitation (mm)



Dec-Jan-Feb Mean ———  
Annual Mean ———  
Jun-Jul-Aug Mean ———  
1981-2010 Average - - -



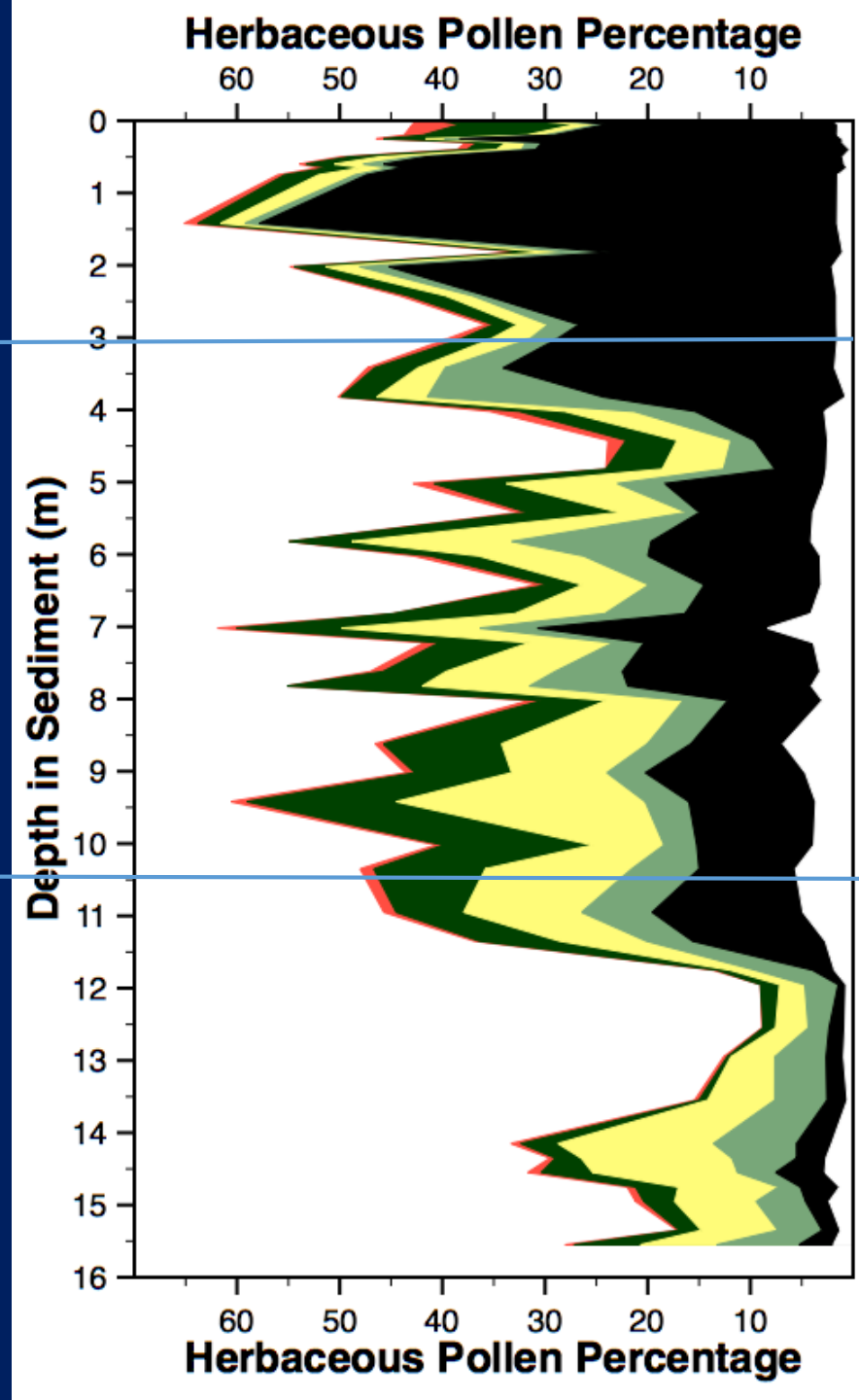




**Deciduous Forest**  
 Most have modern analog  
 Temp. & precip. similar to modern

**Prairie-dominated**  
 About half with modern analog  
 Summer precipitation often  
 lower than modern values

**No modern analog**  
 Contains Boreal, Desert, and  
 Prairie features  
 Lower summer temperatures  
 Lower summer precipitation  
 Higher winter precipitation



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