

**Background Information for  
Paleobotany Exercise: 200,000 Years of  
Pollen and Environmental Change**

**This activity has been used in a course on Quaternary paleontology at Boise State University, Boise, Idaho. The activity provided an opportunity for students to walk-through the steps associated with collecting data on pollen assemblages and using this information to evaluate environmental change. It is a “virtual lab” experience where the pollen assemblages (“pollen slides”) and the pollen key are provided as PowerPoint images as a substitute for using actual pollen slides and microscopes. The activity provides experience in data gathering, pattern recognition, and interpretation. It can be used as a stand-alone project, but it can also be used as part of a set of exercises that lead to an activity that integrates a variety of proxy data (paleobotanical and paleozoological) to examine environmental change.**

**Christopher Hill**

**Boise State University**

**Chill2@boisestate.edu**

# Quaternary Paleontology

## Paleobotany Exercise

Overview. The objectives of this exercise are to gain experience: 1) identifying and counting pollen, 2) creating meaningful tables and graphic images (pollen diagrams), 3) interpreting the patterns of pollen in terms of past environments. Remember that there are two ways to interpret the pollen assemblage. First, what does the variety of pollen types indicate about the environment at any single time? Second, what do the patterns of pollen change indicate about the patterns of climate or environmental variability over time?

In this exercise you will study a set of samples collected from the western North America. The samples are from a sediment core from a lake basin. There are 8 samples. The top of the core dates to today, the bottom of the core extends to about 220,000 years ago.

Taxon Name	Pollen Type 1
Sample 1	Today (or Recent)
Sample 2	
Sample 3	20,000 years ago
Sample 4	
Sample 5	130,000 years ago
Sample 6	
Sample 7	
Sample 8	220,00 years ago

Assignment. Here are the things you will do for this assignment.

1. Identification and counting of pollen. For each pollen slide, you need to identify the pollen types and their frequencies. Typically you will only be able to identify the pollen grains to genus level only. Use the key to compare knowns with unknowns.

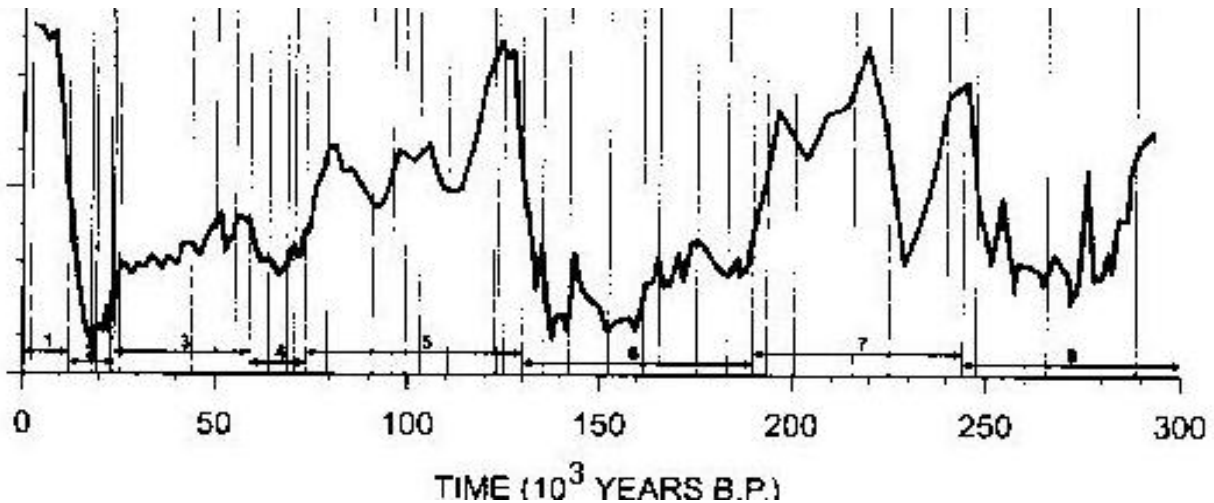
Make a chart with the raw counts. Convert these into relative frequencies (percentages) for each slide (time level). Here is an example of a count sheet:

	Pollen Type 1	Pollen Type 2	Pollen Type 3	Total Identifiable Pollen	Unknowns
Sample 1					
Sample 2					
Sample 3					
Sample 4					
Sample 5					

- Study the pollen types. Can they be grouped into sets based on what kinds of environments or climates they might indicate? If so, create a second table that combines these environment/climate diagnostic pollen assemblages. Use these tables to create a pollen diagram.

Taxon Name	Climate Set 1	Climate Set 2	Climate Set 3	Total Identifiable Pollen
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample 6				
Sample 7				
Sample 8				

- What kinds of environments are indicated for each sample? Provide a summary for each layer (each pollen assemblage sample) that 1) describes the frequencies of pollen types and 2) relates these values to potential environments.
- What kinds of patterns do you see when comparing the differences in the samples over time as depicted in the pollen diagram? Compare them to the patterns of global climate change over the time period the sediment sequence containing the pollen was accumulating. Below is an example of the global record of environmental change reflected in the stable isotope record for the last 300,000 years.



5. Provide a report that describes and interprets the pollen diagram that you have created based on your pollen counts.

## **Guide to Paleobotany (Pollen) Assignment Report for Quaternary Paleontology**

**Title:** (One sentence)

Should be informative and identify the problem that you investigated in the exercise. Also include your name on a second line.

**Introduction:** (One page or less)

Should include a statement of the goal or objective. Briefly describe project, significance, background information. Avoid the use of the first person in this section and throughout the exercise write-up.

**Materials and Methods:** (One sentence to several paragraphs.)

Be brief, but include meaningful information. Someone reading this section would know how to complete the exercise. This is your procedures section.

**Results:** (no limit in page numbers, need to describe your data)

Present the facts and only the facts – no discussion or interpretation – in this section. Include all tables and figures, each with all axes and parts labeled and with appropriate captions. Graphs should be drawn on graph paper or using a computer graphing program. Tables from the lab manual can be inserted into your report.

















**Interpretations/Discussion/Conclusion:** (at least one page, could be more)

Interpret your results and state your conclusion. State the significance of your results. Discuss any limitations. Link to regional and global scale environmental change. Your entire text should be free of spelling errors, as well as grammatical mistakes.

**Bibliography:** (remember to also include references within the text of your report)

Any information that is not common knowledge and/or is not your personal observation or discovery **MUST** be cited properly to avoid plagiarism. It should be very clear from where you obtained the information for your report.

**Fossil pollen grains are distinguished primarily by their form and their surface sculpture. The following Key distinguishes 17 basic pollen classes.**

- A. Pollen in groups of four grains..TETRADS 
- AA. Pollen in groups of more than four grains..POLYADS 
- AAA. Pollen grains free
- BB. Aperture one or grain without apertures
  - C. With bladders or meridional ridges
    - D. With bladders.....VESICULATE 
    - DD. With deep meridional ridges.....POLYPLICATE 
  - CC. Without bladders or meridional ridges
    - D. No distinct apertures.....INAPERTURATE 
    - DD. One aperture
      - E. Aperture elongate.....MONOCOLPATE 
      - EE. Aperture +/- circular.....MONOPORATE 
- BB. More than one aperture
  - C. Without lacunae in a fixed geometrical pattern
    - D. Apertures not fused
      - E. Furrows present, no free pores
      - F. Furrows without distinct pores or transverse furrows
        - G. Three furrows.....TRICOLPATE 
        - GG. More than three furrows
          - H. All furrows meridional....STEPHANOCOLPATE 
          - HH. Furrows not meridional....PERICOLPATE 
      - FF. Furrows with distinct pores or transverse
        - G. Three furrows.....TRICOLPORATE 
    - EE. Three pores present, no furrows
      - F. Three pores.....TRIPORATE 
      - FF. More than three pores
        - G. Pores in an equatorial zone....STEPHANOPORATE 
        - GG. Pores evenly distributed.....PERIPORATE 
    - DD. Apertures fuses to rings etc. ....SYNCOLPATE 
  - CC. With lacunae in a fixed geometric pattern
    - D. Lacunae elongate (pseudocolpi).....HETEROCOLPATE 
    - DD. Lacunae not elongate.....FENESTRATE 