

Name: _____

EPSc 484 Problem set #1.

Show work or no partial credit.

Transfer functions (questions mod.from www.geo.arizona.edu/palynology/geos462/000homework.html)

Using the data on the “transferfunction” page of the Excel spreadsheet (from Adam, D.P. 1967. Late Pleistocene and Recent palynology in the central Sierra Nevada, California. In: Cushing, E.J., and Wright, H.E., Jr. (eds.) Quaternary Paleoecology. Yale Univ. Press, New Haven, Conn. p. 275-301.), calculate the transfer function between oak pollen percentage and:

(1) 1 pt Temperature=

(2) 1 pt Precipitation=

(3) 2 pts Use your transfer functions to calculate T and Ppt you’d reconstruct based on an oak pollen % of 15.

(4) 3 pts Discuss your level of confidence in the numbers you just calculated; approximate in a semi-quantitative way the error you’d assign to your calculations (\pm ? Degrees or mm). Is your level of confidence the same for both transfer functions?

(5) 3 pts What would you calculate as T and ppt for 60% oak pollen? Is your confidence the same as in your answers for 15%? Why or why not?

Constructing a pollen diagram.

(For repeated calculations, show at least one example of your work)

You will construct a pollen diagram from real data for a site in SE Missouri (The “Old Field” site, 15 miles SW of Cape Girardeau at the edge of the Mississippi floodplain near the Ozark escarpment.) (data from <http://www.ngdc.noaa.gov/paleo/pollen.html>)

The core consisted of “uniform fibrous peat” (surface to 230 cm), underlain by grey clay (230-245 cm) underlain by red clay (245-265 cm), underlain by sand.

(6) 2 pts Pollen samples were taken only between 20-230 cm. Why do you think the top and bottom of the core were not sampled?

The data below are uncalibrated radiocarbon dates from a pollen core. Use the program Calib 4.4 to calibrate your radiocarbon dates.

Procedure: Go to <http://radiocarbon.pa.gub.ac.uk/calib/calib.html> .
Click on “Data Input Menu”.
Enter the radiocarbon age and error into the blanks in the form.
Click the box next to “enter data” (left hand side of data entry form).
Then click the “Calibrate” button.

You will get text results; for the purposes of this exercise, identify the age range representing the highest “relative area under the probability distribution” for the 1-sigma % area enclosed.

Record that age range in the table below.

For your “calibrated date” calculate the average of upper and lower boundaries on the age range.

To enter each additional date, scroll down through the lower frame and then click the “clear data” box. Then repeat the process. ¹

(7) 4 pts

Depth (cm)	Age	Error	Age range	Calibrated date
53	4830	95		
87.5	6220	110		
137.5	7280	120		
212.5	8810	90		

(8) 2 pts What difficulties does radiocarbon calibration introduce into evaluating chronological trends in multiple radiocarbon dates, comparing dates between researchers/publications, and in general in working with radiocarbon dates ?

(9) 2 pts Why is it still necessary in many situations to calibrate dates? (Following standard procedures, you’ll be sticking with uncalibrated dates for most of the rest of this exercise)

(10a) 3 pts We need to determine ages for each core sample from the radiocarbon ages you’ve been given. First, calculate the sedimentation rate for core segments using the uncalibrated radiocarbon dates.

Depth (cm)	Age	Sedimentation rate (mm/yr)
53	4830	Btwn 53 -87.5 cm=
87.5	6220	Btwn 87.5 -137.5 cm=
137.5	7280	Btwn 137.5-212.5 cm=
212.5	8810	

Using the sedimentation rates you generated, calculate ages (uncalibrated) for each pollen sample. To obtain dates above and below the oldest and youngest dated material, extrapolate using the sedimentation rate from the adjacent interval (e.g., use the sedimentation rate from 53-87.5 cm to determine core sample ages above 53 cm).

(10b) 2 pts Put your answers in the “Uncalibrated age” column in the Excel spreadsheet. Show your work here for determining the age of the sample at 60 cm

(11) 4 pts Using the pollen data on the spreadsheet, calculate pollen sum for each sample. Calculate the total sum, the total arboreal pollen (Group A, trees and shrubs), the total herbaceous pollen (Group B), and the total aquatic pollen (Group Q).

(12) 3 pts How much variation is there in the pollen sums of each sample (smallest sum is x% smaller than biggest sum)? What might cause this variation?

Determine and describe a method to separate out “important” pollen taxa from “unimportant” (in preparation for making a simple pollen diagram). List taxa you will want to display (no more than ~10-12) and discuss why you chose them. Look up the common names of those you chose and record them (you can use <http://plants.usda.gov/index.html> ; just type the name into the search, choose “scientific name”, and you’ll get back a list of species in that genus and their common names). In row 1 of your excel spreadsheet is a code for the environmental group to which each taxon belongs (Explanation of codes is on the next page). Consider getting a representative sample of the different groups when you’re choosing taxa to plot, and fill in the “environment box” with the appropriate term

¹ Non-continuous probability distributions are a reality of calibration because of the fluctuations in 14C production with time- so don’t think you messed something up if that’s what you get.

- (17) 2 pts** Considering the total pollen counts for each sample, how well do you think the pollen grains counted represent the actual vegetation assemblage of this particular place over the time period represented by the length of the core? Give your reasoning.
- (18) 2 pts** Considering the tracers recovered from each pollen sample, which time periods are likely to be more reliable for paleoecological reconstructions? Why?
- (19) 2 pts** Make a graph in pollen diagram style (age on y axis, multiple x axes) where you plot both % and concentration for your chosen taxon as separate lines. Insert it as a separate sheet in Excel and call it "% vs conc"
- (20) 2 pts** How different are the trends? Do you think your overall analysis would be substantially different if you used influx or concentration data instead of percentage?
- (21) 2 pts** Which method of pollen analysis is more useful for paleoenvironmental purposes: determination of pollen influx or pollen percentage for a particular taxon (or are they equal)? Defend your answer.
- (22) 1 pt** Return to your "Pollen diagram %" graph. Just on visual inspection of your pollen diagram, draw horizontal lines separating what you feel are distinct pollen zones. Label them with "A" at the bottom, next up "B", etc. (See Dincauze if needed for definition of pollen zones.)
- (23) 2 pts** What reasoning did you use to place your zone boundaries? (note: there are in use several "boundary finding" computer programs that make the assignment of boundaries objective)
- (24) 2 pts** In general, are upland or bottomland forest plants better represented throughout the core, or are they equally represented? Suggest an explanation for this pattern (or lack thereof).
- (25) 2 pts** Construct a separate graph showing how pollen groups A, B, Q, and X change with depth. (see for example of format the pollen diagram shown in lecture- slide title- "the pollen diagram"; the graph near the right side of the diagram, next to pollen sum). Insert this chart as a separate sheet in Excel, name it "Group pollen diagram".
- (26) 1 pt** Identify (with lines) and label (with letters, starting from A at the bottom) pollen zones on this one as well.
- (27) 3 pts** Did you put your zone boundaries in the same place on each graph? Which do you find more useful for distinguishing pollen zones, and why?
- (28) 4 pts** What do you think the transitions between your pollen zones could represent in terms of vegetation community shifts, landscape change, and/or climate change? Describe the changes between each two adjacent pollen zones, and give your reasoning for your interpretation.
- (29) 2 pts** What could you possibly do to test your hypothesis/hypotheses regarding the causes of the shifts observed in your pollen data?