## **Group Project 11**

Goal: Examine Pleistocene climate history by looking at climate proxy measurements in ice cores

This group project will use MS Excel to manipulate and plot data. Data from

https://www.ncei.noaa.gov/pub/data/paleo/icecore/antarctica/

making an X-Y plot:

select two columns of the spreadsheet the first column is X, the second is Y use the Insert/Scatter menu



the fill-down command can apply a formula to column Type the formula into the first cell select the column use the Home/fill-down menu



- Load the file Goup1\_depth\_age.xls, make a work copy (this is data from an Antarctic core)
- 2. Spot check the data by viewing the spreadsheet why are some ages negative?
- 3. calculate the ice accumulation rate Ddepth/Dage label Col 3 by typing "Dd/Dt" in row 1 in cell Col C Row 3 type the formula =(A3-A2)/(B3-B2) select Col C from Row 3 end of column and fill down
- 4. plot X=age, Y=Dd/Dt in range Row 3 to end describe the plot, what are the units, do they make sense? why is the beginning and end of the plot different from middle save the plot in a separate document (via screen save) then delete plot from spreadsheet
- 5. Copy and paste-as-values Col C to Col D and then delete Col D



The last interglacial was about 115,000 to 130,000 years ago and the last glacial (ice age) ended about 12,000 years ago. So delete all row outside of the 5,000 to 150,000 year rane (but leave the column names)

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6. Plot the X=age and Y-Dd/Dt.

save the plot in a separate document (via screen save)What is Dd/Dt a proxy for (in the most general terms)What is the overall range of variation?Are the present and last interglacial high or lowcompared the ice age?How stable (constant) was Dd/Dt during the ice age?Is there a Younger Dryas?

- 1. Load the file Goup2\_age\_O18.xls, make a work copy (this is data from an Antarctic core)
- 2. Spot check the data by viewing the spreadsheet why are some ages negative?
- 3. calculate the temperature label Col C by typing "T" in row 1 in cell Col C Row 2 type the formula =(B2/10+30)\*20/16-30 select Col C from Row 2 end of column and fill down
- 4. plot X=age, Y=T

change the Y scale to the range -40 to -60 to improve plot describe the plot, what are the units, do they make sense? what is the overall range in temperature? save the plot in a separate document (via screen save) then delete plot from spreadsheet

5. Copy and paste-as-values Col C to Col D and then delete Col D



6. The last interglacial was about 115,000 to 130,000 years ago and the last glacial (ice age) ended about 12,000 years ago. So delete all row outside of the 5,000 to 150,000 year range (but leave the column names) Make a new plot. You will need to adjust the Y-axis again.

7. save the plot in a separate document (via screen save) Identify the Holocene, last glacial (ice age) and last interglacial What is the overall range of variation in temperature? Do the present and last have the same temperature? How stable (constant) was temperature during the ice age? Is there a Younger Dryas?

FYI: I based the temperature formula on this plot of present-day temperatures. Don't use it for research purposes.



**Figure 1.** Isotope content of snow versus local surface temperature (annual average). Antarctic data ( $\delta D$ , left scale) are from *Lorius and Merlivat* [1977], and Greenland data ( $\delta^{18}O$ , right scale) are from *Johnsen et al.* [1989]

- Load the file Group3\_age\_CO2\_o18.xlsx, make a work copy (this is data from an Antarctic core)
- 2. Spot check the data by viewing the spreadsheet What is the age range? Is CO2 lower or higher than today?
- 3. calculate the temperature label Col D by typing "T" in Row 1 in cell Col D Row 2 type the formula =(C2/10+30)\*20/16-30 select Col D from Row 3 end of column and fill down
- 4. plot X=age, Y=CO2 change the Y scale to the range 150 to 300 to improve plot describe the plot, what are the units, do they make sense? what is the overall range in CO2? save the plot in a separate document (via screen save)
- 5. plot X=age, Y=T (put plot below previous plot) change the Y scale to the range -55 to -40 to improve plot describe the plot, what are the units, do they make sense? what is the overall range in T? compare the two plots. How similar are the shapes save the plot in a separate document (via screen save) then delete the plots

5. Copy and paste-as-values Col D to Col E and then delete Col D



6. The last interglacial was about 115,000 to 130,000 years ago and the last glacial (ice age) ended about 12,000 years ago. So delete all row outside of the 5,000 to 150,000 year range (but leave the column names) Make new plot. You will need to adjust the Y-axes again.

7. plot X=T Y=CO2 (copying COL B to E makes it easier but use a scatter plot with dots not lines adjust the axes again
How well correlated are T and CO2?
How much does T go up for a 100 ppm increase in CO2?
How much has CO2 gone up in your lifetime?

FYI: The O18 to T conversion is very approximate. Don't use it for research purposes.

- Load the file Group4\_age\_dust.xlsx, make a work copy (this is data from an Antarctic core)
- 2. Spot check the data by viewing the spreadsheet What is the age range?
- plot X=age, Y=dust when was dust the highest? how would you describe the overall pattern
- 4. Let's focus on the last 25,000 years. So delete the dataset beyond that time. Replot the data. How sharp is the transition at the end of the Ice Age?
- 5. Let's compare the dust curve to the sea level rise curve below.

A practical problem is the mismatch in direction so the time axis.



6. Maybe one can switch the direction of the axes of Excel plots? You might research that and do it if you can. I would probably just change the sign of the age columns:

Insert a blank column between age and dust, so that the black column is Col B. Then into Row 2 type ==-1\*A2 then select column 2 from row 2 to the end and fill down. When you plot columns B and C, it will have the right direction. If you futz with the axes, you can get if from -24,000 to zero, like the sea level plot.

In a separate document, align the two graphs and study and think about the relationship. When did dust turn off?