Lab Reports: Format

Why write a lab report? I view this exercise of report writing as a step on the path to finding your own professional voice. Here are my goals for this effort. Students can learn the conventions of writing a laboratory report, a document that you will need to prepare countless times during your career in science. Students can learn approaches to describing data accurately (in tables and graphics, as well as in words); gain experience finding the balance between appropriate interpretation and over-interpretation of data; become further familiar with the use of spreadsheets and graphics programs; gain experience working as a team and as an individual, while reflecting on the ethics, responsibilities, and timeliness of good work. I suspect that you could add to this list, and I hope you will.

Lab reports are due one week after the conclusion of a procedure (see syllabus). The final interpretative report due at the end of the semester will be an oral discussion.

Lab reports must be done using a word processor. Graphics must be done using a software package, like Excel or SigmaPlot. Computer literacy is a prerequisite of this course. Use a 12 point font, 1.5-line spacing, and use the spelling and grammar checkers or your word processors (set to U.S. English). When tempted to use a personal pronoun (I, we, etc.), don’t: use the passive voice. The active voice is welcome in all other cases. Set the grammar checker for technical writing. Take the grammar checker’s advice on all other matters.

You will work in teams of two and will share results with all of your classmates. You may discuss the lab with your classmates, but everyone must do their own calculations and hand in a lab report written in their own words. Please review the University definitions of plagiarism.

Results should be handled as follows. Calculate the results for your team’s samples, and e-mail a copy of the spreadsheet to me so I can check calculations from the raw data to the end-product numbers. Distribute the checked results to your classmates via e-mail attachments ASAP. Be sure to include the raw data as hard copy in the appendix. The methods should include only your procedure on your samples (see below), whereas the results, graphs, tables, and discussion should include everyone’s results, in addition to your own. This means everyone depends on you for timely calculation and distribution of results so lab reports can be handed in on time.

Lab reports should contain the following sections: Remember that interpretation of
paleoenvironment is the ultimate objective of each lab.

1. An introduction describing the purpose of the lab (paleoenvironment using ___ to ___).
   a. Discuss the utility of the procedure learned in the lab, specifically how it applies to paleoenvironmental interpretation. Why is this procedure done? For example, if you measure Atterberg limits, tell me what Atterberg limits are and what they are used for. **You may use references from the library and WWW to support your answer.**
   b. Cite any work that you draw from. It is important to your reputation to give credit where credit is due.

2. List of lab supplies and equipment used. This is mandatory. The utility of this list will be evident if you ever want to repeat these procedures. Additionally, you will learn the proper names of common scientific supplies and equipment.

   a. Describe only methods in the methods section (no results, no interpretation).
   b. Describe your (team) results, not others.
   c. Reference the lab handout, and discuss only the steps that were not on the lab handout. So, the section may read like this. “The procedures outlined in handout Lab04 (Brunner, 2005, written communication) were used in the carbonate analysis with one amendment. The samples were acid rinsed two times in 5% HCl as directed, but then rinsed an additional three times in 10% HCl in order to completely dissolve the carbonate.” If you did nothing else that varied from the lab handout, then there is no need to mention it; the reference covers it. (Note that this approach is NOT standard for scientific reports. Typically, the routine steps are to briefly summarize all methods and describe in detail unusual and novel steps. But to shorten the writing effort, I will allow this abbreviated step.)
   d. **Discuss any problems with your methods.** If possible, communicate this information to your classmates so they can adjust their interpretations. “One carbonate value was much lower than the rest although the sample did not appear visually much different from the others. Upon more careful inspection of the filters, it was realized that not all of the carbonate had dissolved, resulting in too low a value.”

4. Results.
a. Put your raw data and calculations into an appendix. Raw data are the measured weights wet and dry of core samples taken for various purposes, the weight of pre-weighed beakers and weighing boats, etc. They include all the basic numbers you collect in lab.

b. Calculate the results for your team’s samples and **E-mail the spreadsheet of your raw data and the calculations to me.** When I have checked your calculations then distribute the results to your classmates.

c. In your lab report, present suitable **tables AND graphs** of all of the results, yours and everyone else’s. **Always graph results** (everybody’s results), and use these when discussing the data.

d. Describe the notable trends in the results. For example, by convention geologists describe how variables change (or don’t change) down-core (generally, from top to bottom). My approach is to describe overall trends, then describe the most notable deviations from the trends, both overall trends and deviations are described starting at the top of the core and working downward. Always describe results from sections of sediment (outcrops or cores) from the top down. This is a geology convention, time tested. (In contrast, discuss interpretations from the bottom to the top in proper time sequence.)

e. Example: The carbonate content decreased downcore overall from 80% at the surface to 10% at the base of the core (100 cm). However, two samples at 50 cm and 88 cm departed from the trend, being dramatically larger (100%).

5. Discussion

a. The discussion sections serves several purposes. It is the place where you can compare your results to other data sets collected earlier in the semester or to other data sets from the scientific literature. The comparisons are limited to points that can accomplish the next objective—Interpretation of the paleoenvironment. (Do not discuss methods or describe results in the discussion section.)

b. Interpret the results, describing processes and events from the bottom to the top of the core in proper time sequence. This also is a geology convention. (Results are described from top to bottom, discussion and interpretation are done from the bottom up in proper time sequence.) For example, “Based on the increase in calcium carbonate up-core, either the productivity of carbonate-producing organisms increased, dissolution of carbonate decreased, or the amount of terrigenous material diluting the carbonate decreased over time.” Be conservative in your interpretations—cover all the logical bases and don’t over-
interpret your data.

c. When available (made available by me), compare published values to your own. Are the results similar? If the published numbers are different from yours, explain why as best you can with your current experience. Such comparisons are a very important aspect of data analysis. A good scientist is well informed about comparable work; ignorance of published work is sloppy academics.

d. Any questions asked in the handouts for a lab should be addressed in the interpretation section of your lab report.


7. Appendix - for raw data.

8. Tips:
   a. Check the axis labels of your graphs
   b. Check the significant figures of your calculations (see the handout on significant figures on the lab website. Visit the recommended websites and do the exercise).
   c. Make sure all is phrased in your own words. Practice your writing in order to find your own professional voice, your own manner of expressing facts, ideas, and concepts.
   d. Strive to represent the reality of the lab results. Your audience, the people you are writing for, is your scientific peers.