A TERM PAPER IN GLACIAL / QUATERNARY GEOLOGY
The opportunity to expand your mind on a topic of your choosing

IMPORTANT DEADLINES:
☐ Paper topic selection is due FRIDAY, SEPTEMBER 18th.
☐ List of ≥10 references is due FRIDAY, OCTOBER 2nd.
☐ Paper outline is due FRIDAY, OCTOBER 16th.
☐ First (not rough) draft of paper is due FRIDAY, NOVEMBER 13th.
   *(This MUST be as complete as a final draft to be acceptable!)*
☐ Final draft is due FRIDAY, DECEMBER 4th; NO EXCEPTIONS!!!
   *(Late penalty for final draft: one letter grade per day, weekends excluded.)*

The topic may be submitted longhand; all other paper items MUST be typed!

The purpose of this writing assignment is to give you an opportunity to explore an area of glacial/Quaternary geology that we will not be investigating in depth in class but which nonetheless can be of tremendous interest to you and others. You should expect to go into more detail than a general discussion at a GE141 level.

CHOOSING A TOPIC

The list below is just a suggestion of potential topics. You may feel free to choose one of these, or you may find a topic of your own. The two caveats or stipulations are: (1) no two people may be working on the same topic, and (2) your topic MUST address some aspect of late Cenozoic climate change or glacial geology. If your topic is not from the following list, I must approve it in advance.

Possible topics might include:

- Origin and formation of drumlins
- The Gowganda Tillite
- Pleistocene environments of Florida
- Origins and formation of fluted till
- Ice Streams of Antarctica
- The Younger Dryas in New England
- Quaternary Environments of the American Southwest
- Origins and formation of deGeer moraines
- Glacial History of the Chilean Andes

FINDING SOURCES OF INFORMATION

GeoRef
You undoubtedly already know that the premier index to the geological literature is GeoRef, which includes all North American geological literature back into the 18th Century, and almost all relevant foreign literature of the past 50 years. You can access this through the Colby Library web page directly. Important here is to use the "advanced search" mode. Maximizing the efficiency of this resource is a skill to be acquired, and you need to be aware that HOW and WHAT you search for are carefully structured.

For example, searching under "glacial" and "Maine" found ANYWHERE will not only yield papers on glacial geology of Maine, but also everything written on glacial topics that refers to Maine or was written by someone in Maine (e.g., George Denton, University of Maine, who's been working almost exclusively in Antarctica for 35 years). But it won't yield a paper on "Glacigenic sediments of Penobscot Bay, Maine," if you just search by words in the title, because the word "glacial" isn't IN the
title. Related topics can yield papers with unusual titles that may not include your specific key words but are nonetheless valuable - e.g., "Pleistocene" and "Maine" for keywords, although these will undoubtedly also yield a great number of references on the Presumpscot Formation and possibly isostatic rebound. "Quaternary" will yield Holocene non-glacial references in addition to those that may be of use. Practice will help you to hone your skills - so you get a maximum of good stuff and a minimum of irrelevant material as a product of your search.

It is important to use **primary sources** as much as possible - these are things like journal articles, symposium proceeding volumes, etc. You want to avoid secondary sources such as textbooks (e.g., "Geology of the National Parks" by Harris and Tuttle), popular magazine articles (e.g., "Earth", "National Geographic"), and things like newspaper reports that, for instance, say in part "according to a story to be published in this Friday's edition of Nature magazine...". **AVOID PARTICULARLY** using pamphlets distributed by "interpretive centers" or parks, as well as web sites. The former are merely regurgitated material, unfortunately too often written by someone who very likely was doing a term-paper-type assignment and who may NOT really know what he/she was talking about. Commonly, these are extremely out-of-date because they've used sources from 1923 and 1955, for example. Web sites can also be changed by a couple of key strokes, and there is NO GUARANTEE WHATEVER that information gathered from such a source is reliable. I could write a lengthy paper "disproving" continental drift that could then be picked up and used by anyone, but there's no assurance that anything I said was not totally garbage only intended to get my name in the news.

**Go to the original sources!** These will be journal articles, maps and bulletins and open-file reports of state geological surveys, and scholarly books such as symposium proceedings (e.g., "The Quaternary of the United States"). For journal articles, we have electronic access to hundreds of journals not in the paper collections - though the electronic versions often are only from the last ten or twenty years or so for full-text versions. (Earlier issues are accessible only through the abstracts, or by ILL.) Even published secondary sources may NOT be that accurate! Books written for the mass market (e.g., Fire and Ice, or Glaciers and Granite, or The Geologic History of the Grand Canyon) are most commonly written by someone who loves an area and who has read a bunch of material and written a popularized account specifically for that market. It does **not** mean they're accurate - some may have even started out as college term papers! **This is particularly true for some of the books of the "ROADSIDE GEOLOGY" series.** Several of the books in this series have come under harsh criticism in recent years for being very inaccurate in places.

**AGE of your sources is also significant.** Be suspect of anything published prior to 1950 in particular. Materials from before 1930 should be used with extreme caution - they may be interesting from an historical perspective, but scientifically they are almost invariably going to be totally outdated by more recent work. Estimated ages of events in sources published prior to 1965 should be treated with caution; the first radiocarbon dates were produced in the 1950s, and K-Ar is more recent still.

I've asked to see a list of the sources you've found (minimum of 10) to help ensure you don't put this search off until the last minute, only to find that there's a Ph.D. dissertation at Boston University on your topic, but you don't have time to get it! © This **has** happened!

**Interlibrary Loan**

Bear in mind that the Colby Library is not a major research library, and you may find that a key paper may only be available through Interlibrary Loan (ILL; these usually come now as PDFs via e-mail). **Remember that interlibrary loan services take time** - and though it's far faster than it used to be, it may take a week for something to arrive, possibly longer, though if available through NEExpress it can be here in 24-48 hours. (It may be faster, but don't PLAN on it! This is NOT something to try the week before a paper is due!)
STRUCTURE OF THE PAPER

Initially, you should prepare a structured outline for your paper which will serve well to help you arrange your thinking in a logical manner from beginning to end. Overall you will need an introduction, followed by a discussion of the geological problem, and end with a summary. The introduction should outline, in a short paragraph, why the paper is being written and what you will be discussing. Your overall outline may look something like that below. Remember that your outline headings and subheadings will ALSO be the major headings and subheadings in your finished paper!

(sample outline)

Glacial Geology of the Wunkatunk Quadrangle, Central Maine

A. Abstract
B. Introduction (include location map)
C. Bedrock Geology (short)
D. Pre-Wisconsinan Drift
E. Late Wisconsinan Glacial Record
   1. erosional features
      a. striations and grooves
      b. glacial plucking
      c. roches moutonees
   2. deposits
      a. moraines
         1. end moraines
         2. ground moraine
      b. eskers
      c. glaciomarine delta
F. Summary
G. References Cited

Bear in mind in constructing your outline that in discussing geologic units, you ALWAYS discuss them in order of decreasing age. You start with the oldest unit, and work your way up through the geologic column. This is because it was in this order that they originated!

The ABSTRACT comes first, and should summarize your major findings in one or two short paragraphs, or a page at most. This is usually the last section that is written, but goes at the very beginning of the paper. The introduction states what you are going to do and why it's significant: Why should anyone read your paper? The regional geography part provides the setting that frames your discussion.

The paper should be written in the THIRD person (e.g., 'This paper will outline the geologic history of the Wunkatunk Quadrangle, north of Moosehead Lake in north-central Maine,' rather than 'I will outline the glacial geology of the area surrounding my family's camp north of Moosehead Lake.').

Illustrations, whether photocopies from published works or your own art, are welcome as well. These should be referred to in the text, so readers know to look for them. If these are photocopied, clean up the margins (delete extraneous material) and insert either within the body of the text of sequentially on separate sheets within the manuscript, on the page immediately following the first mention of the figure, and include a reference for each such copied illustration. Number all figures and tables sequentially: the first figure is Fig. 1, the first table is Table 1, etc. Every figure and table needs a short caption telling what it is and why it is important; otherwise, you're saying to the reader, "Here's a related picture. YOU figure out what it has to do with my paper."
FIGURES MUST BE REFERENCED as you would anything else taken from the work of others, unless you've made them up yourself based on written descriptions. If photocopied directly from a published work and unaltered in any way, they are referenced as "from Murphy, 1996". If you've redrawn the figure based on what was in the report, or modified the original even very slightly, it would be properly referenced as "after Murphy, 1996."

REMEMBER, it is critically important that ANY and ALL materials (books, maps, scientific papers, etc.) that you use should be properly referenced. Using the work of others without proper acknowledgment is PLAGIARISM and UNACCEPTABLE in any field of inquiry. [You are urged to read the section on Academic Honesty in the Colby Student Handbook.] The need for acknowledgment of sources is particularly true for ANY direct quotes. A set of examples depicting what is and is not plagiarism is included later in this handout. IF IN DOUBT, YOU SHOULD ALWAYS REFERENCE! Careers have been destroyed when people got a little too free in using the work of others without proper acknowledgment. Once the word is out that someone does this, no one will work with or trust them, and their career is essentially finished. You should also feel free to ask me for help as well. Please just don't wait until the day before the paper is due!

If you have any questions as regards format, look at any article in a recent issue of Geology, The Bulletin of the Geological Society of America, or Quaternary Research. You may also wish to consult the Suggestions to Authors of the Reports of the United States Geological Survey.

Do NOT use Appendices in your paper, either for maps or figures or other information. These should be fully incorporated into the text of your paper if they are important. If they're not that important, they shouldn't be there in the first place. Appendices are most appropriate for lengthy tables of data in a highly technical study, but most frequently are used as a simple way of avoiding incorporating non-text materials into a report.

THE TECHNICAL ASPECTS OF WRITING

As indicated above, the paper should be written in the third person. Perhaps obviously, it should be written in clear, concise English. It should ALWAYS be typed, double-spaced, with one-inch margins on all sides. (Figure captions and references should be typed single-spaced on your final draft; type them double-spaced on the first draft.) NOTHING should be hand-written on either your draft or final copy: not page numbers, reference citations, or anything else. Set page numbers by opening "View" and choosing "header and footer" on a Mac. (Various word-processing software for PCs will have their own ways of doing this.) You should have a title page, with the title of your paper centered about 1/3 of the way down the sheet, and in the lower right-hand corner: your name, the class, and the date; for dates, use formal notation: e.g., "October 17, 2012" as opposed to "10/17/12;" this latter is informal shorthand inappropriate for any formal work, despite what your computer may tell you.

The main body of the paper starts on the second page, with the paper title repeated at the top of the page. All subsequent pages should be numbered. The references should begin on a new page, and should include ONLY those papers that are actually cited in the text of your paper; the appropriate page heading is "References Cited", not "Bibliography". [The latter is used in some other fields, and is a listing of works you consulted without actually citing them in the paper; don't use this form here or in any scientific writing.]

Using the computer editor is a relatively painless, easy-to-learn way to get professional-looking results. One nice advantage of this is that you can use the computer to check your spelling. The computer will go through your entire manuscript and list those words it doesn't recognize (uh, like "Waterville!"). This will include any technical terms (e.g., 'geomagnetic') as well as words you have simply misspelled, such as 'worj' for 'work'. HOWEVER, note that a spell-checker will NOT catch or correct grammatical errors, such as using "their" for "there", "do" for "due", "lead" for "led",
etc. You have to **proof-read** your paper to catch these as well as more blatant errors such as leaving a word out of the middle of a sentence. Grammar-checkers are good, but not perfect, at catching some of the dumb errors.

**References** in geology, and the sciences in general, are handled differently than they are in the social sciences and humanities. For instance, in most scientific papers, footnotes are **not** used. It is preferred to state, for instance, that "Battifarano (1996) studied the tillites of the Pothole Formation and concluded they were Triassic in age," rather than "The Pothole Formation tillites are Triassic in age* [footnote: *Battifarano, 1996, p. 42]". In you cite TWO papers by the same author, published the same year, the **first** you cite would be Hill, 1996a and the second would be Hill, 1996b. Remember, the reason for these in the first place is to provide a resource for your readers. Something may be of peripheral interest to **YOU** from Jackson's paper, but someone else reading your paper might well wish to follow it up and find out what this author had to say in more detail. You can readily find yourself in this precise position - when someone else references something in passing that may be the MAIN focus of your own paper. **YOU** will want to be able to look it up yourself to find out more, and there are few things more frustrating than to discover you have a reference that doesn't exist as given! This IS important!

Citing a paper by two authors is OK - e.g., "Biette and Churchill (1997) have shown conclusively that the Waterville Formation is Ordovician in age, rather than Silurian as previously thought." If there are three or more authors, use the first author's last name, *with 'and others' or et al.* (which is an abbreviation for the Latin *et alii*, which means 'and others'). Thus, "It was shown recently that the Waterville Formation under Colby College is a significant sink for light hydrocarbons (Lamom and others, 1997 or Lamom *et al.*, 1997)." **Be consistent internally:** that is, don't use "*et al.*" in one place, and "*and others*" in another. [Note that in scientific papers in general, **MLA reference format is NOT used!**]

If you have a technical report that isn't comparable to the examples given, look in a recent issue of the *G.S.A. Bulletin, Geology, or GSA Today* (several copies may be found in the Lounge) to see how it was handled there. In the references section, all references cited are listed alphabetically by the last name of the first author and chronologically by date (oldest first); **ALL** authors' names are given for papers with multiple authors. Sandreuter, 1996a will be listed before Sandreuter, 1996b. **DOUBLE-CHECK** your references for accuracy and completeness, and make sure you don't mix them up yourself! **Remember** that the reason for putting references in the paper in the first place is so people can find them!

Also, if you are reading a review paper that summarizes much of what is known on a major aspect of your topic, and if the author of the paper you're reading references several other peoples' work, **you should go to the original sources as much as possible.** THEY MAY BE MIS-CITED! (I myself published a paper on Early and Middle Pleistocene materials which were cited by another worker as Early and Middle Wisconsinan; the Wisconsinan is just part of the Late Pleistocene! This author mis-correlated the age of my study section by some 1.5-2.0 million years as a result, and anyone using her paper as the source for my data would also, therefore, be making a serious mistake.) The same error has certainly been made by others. If Wight wrote the review in 1992, and cited *obscure and unavailable* works by Wall (1943), Thomas (1921) and Calvin(1937), in your own writing you will have to provide a reference that cites (Wall, 1943; Thomas, 1921; and Calvin, 1937, all as cited by Wight, 1992). **All** of these references will go in your references at the end of the paper. Such secondary citations, however, will **not be acceptable** for any materials available in print or on-line via the Colby libraries.
EXAMPLES OF WHAT DOES AND DOES NOT CONSTITUTE PLAGIARISM

Plagiarism is the use of another's work without proper acknowledgment of her or his contributions, thereby implying (or in the most egregious cases, declaring) that the thoughts, the work presented is your own original contribution. This is a serious offense in any intellectual endeavor; legally, it's called fraud. Penalties are stiff and covered fully in the student handbook. Examples are presented here to help you recognize when you may be slipping into that mode in your writing. When in doubt, provide a reference! At the beginning level, they will be more numerous than they would be if you were presenting your own original research.

The original text:

"Environmentalists are also questioning whether EPA and USDA have adequate legal authority to regulate biotechnology. Margaret G. Mellon of the Environmental Law Institute, says USDA has little to rely on except the National Environmental Policy Act in attempting to protect the environment. This statute simply requires that actions be examined for their environmental impact, but provides scant regulatory authority. ‘What the department needs are marching orders from Congress to protect broad environmental interests, rather than just those of agriculture,’ says Mellon.”

Proper use of source:

There are major problems faced by the Department of Agriculture in trying to protect the environment. According to Margaret Mellon of the Environmental Law Institute, the only legal statute available to the USDA is the National Environmental Policy Act, which provides very little authority for the USDA to regulate activity (Crawford, 1986).

Plagiarism:

There are also questions as to whether EPA and the USDA have adequate legal authority to regulate the new biotechnology. For instance, USDA has little to rely on other than the National Environmental Policy Act in attempting to protect the environment. That statute requires that the agency examine actions for their environmental impact, but doesn't provide the USDA with any significant authority to regulate actions.

The USDA further argues that regulation is the responsibility of the EPA to....

This is the most common and serious kind of error. The problem in this second example is that, even though much of the material is NOT quoted directly from the article by Crawford, it is simply rephrased from that source without proper acknowledgment. Whether the offense is a direct quote, or a paraphrased passage such as the above, failure to acknowledge properly a source you used is considered plagiarism.

Plagiarism:

Environmentalists are questioning whether EPA and USDA have adequate authority to regulate biotechnology. The USDA has little to rely on except the National Environmental Policy Act in trying to protect the environment. This law requires that actions be examined for their environmental impact, but provides little regulatory authority. "What the department needs are marching orders from Congress to protect broad environmental interests, rather than just those of agriculture," says Margaret Mellon of the Environmental Law Institute (Crawford, 1986).

The problem here is that even though a reference is cited, much of the text of what is written is only SLIGHTLY reworded (paraphrased) from the original text yet is not cited as a quote. It is nonetheless close to a direct quote in many places. Key is that you are supposed to be putting this material into your own words, not just stringing together passages from all your sources into some sort of coherent whole. You need to include a second reference to Crawford, 1986, preferably after the first sentence in the paragraph, to make it clear that this is your source for most of this material.
**SAMPLE REFERENCES: THIS IS TO SHOW PROPER Formatting!**

*(NOTE that these are reverse-indented: the first line is flush left, and subsequent lines for a single entry are indented!)*

**[Book]**


**[Theses and Dissertations]**


**[Journal article, single author]**


**[Journal article, multiple authors]**


**[Article in edited volume]**


**[Published abstract]**


**[USGS Professional Paper]**


**[USGS Bulletin]**


**[Other Federal Publications]**


**[State Geological Survey Report]**


**[Published Map]**


**[Web sites – often the hardest to cite properly]**


**Unpublished and unusual source materials require special consideration; ASK FOR HELP!**