ABBREVIATED VERSION OF THE WRITING OF AN AREAL GEOLOGIC REPORT

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October, 2005

PREAMBLE

This document has been prepared as a guide to the profession writing of areal geologic reports. Areal Geologic Reports are those involved with description and interpretation of the geology found in a specific area. ***You are encouraged to print a copy of this document prior to coming to the field course. In addition, you are encouraged to at least skim the Nilsen (1993) reference for the Hilt project (the first mapping project).***

The document is a synthesis of materials from several sources including the format used by the Geology Department of U. C. Los Angeles and the U. S. Geological Survey as tailored to our needs. The format of this document is abridged from a more thorough document entitled *A Guide to the Writing of Areal Geologic Reports*. That document, replete with examples, will be made available to you at the field station when you arrive.

The report format which follows is tailored to the needs of a geologic field mapping project. If an engineering study, a hydrogeologic report, an Environmental Impact Statement, or a mining report, were to be done, the format would vary but the sections or chapters would remain similar.

Specific instructions as to what information should appear on geologic maps and cross sections will be found toward the end of this document.

I **strongly** encourage you to read the material as soon as possible. **Almost any question you may ask about the writing of areal geologic reports is answered within this pamphlet**. Moreover, some portions such as the introduction and regional geology can be started prior to setting a foot in the field. Also, don't wait until sitting down to write the report only to discover that critical information needed for the report was systematically overlooked while in the field: work on the report at the end of each field day. ***You are strongly encouraged to write a little on your report each evening. You shall find that it takes longer than anticipated to write a professional report: get a head start on it.***

THE AREAL GEOLOGIC REPORT

The annotated outline which follows is designed to help you in the preparation of a geologic report of a field area (the areal geologic report). Remember, this is only a guide. Most geologic reports follow a similar organization but differ from one report to the next depending upon the sort of geology found in an area and the purpose for which the report is written. For example, reports dealing with geochemistry will be quite detailed as far as description of experimental procedure is concerned but may lack detailed description of the field relation of rock units. An areal geologic report will have just the opposite emphasis.

The preparation of a geologic report can be a formidable task. Remember that the principal objective of the report is to give the reader a clear picture of the geology of the region with a minimum of expenditure of time and effort. Strive for the "three Cs": **clarity, conciseness**, and **coherence**. The report should not be repetitious but should always be clear in description and as to conclusions about the area. The first draft of the report may

be either too wordy (in which case eliminate the extraneous verbiage) or not complete enough (which can be evaluated by reading each section and asking the question "have I given the reader a clear picture of the area?"). Never lose sight of the fact that the report is written for an audience conversant with geology but which has never visited the area. Don't leave out details necessary for the reader's understanding of the area. On the other hand, don't bury the reader in unnecessary details; there is a delicate balance here learned only by writing, and writing, and writing.

Before beginning to write the report, develop a complete outline. Decide the exact order to be followed before beginning to write. Continue to "add flesh" to the outline as the project develops.

Always strive for a clear, grammatically correct style. I strongly recommend you read some text such as The Elements of Style by Strunk and White. Work over the original outline and rough drafts with the following aims in mind:

(1) Decrease the total number of words, yet strive to make your descriptions as clear as possible.

(2) Increase the amount of useful explanatory material in your text.

(3) Massage the language and smooth irregularities of grammar, style, and punctuation. Study examples of professional reports in any geologic journal and notice how easily they flow.

(4) Refer constantly to a dictionary (or spell-checker on your word processor) and some text which addresses correct grammar and style. You WILL be graded upon your ability to write as well as your ability to map. You **must** be able to communicate in a clear and effective manner.

Your reports will be double-spaced on 8.5" x 11" paper (one side only) and produced through a word processing program. I strongly suggest that you keep at least two separate floppy disks or CDs with updated copies of your work. Save your work after each ten minutes of writing. Every year, someone loses part or all of their document just before the final draft is to be typed and are penalized (penalties are necessary since it is unfair to those who turn in their reports on time). Don't let that person be you!

Much of what follows is similar to suggestions of Robert R. Compton's, Geology in the Field. While our bookstore may have a few copies, it's best that you bring your own (ISBN 0-471-82902-1; Wiley and Sons Publisher).

TITLE PAGE

The first page of the report will be the title page, should contain the title of the report, name of the author, date, course number and name, and be centered on the page. The title of the report should be descriptive of the project (what is the basic emphasis?) and tell **where** it is (e.g.: northern California).

In most long reports, a Table of Contents, illustrations, and tables follows the title page. Your report is short enough to omit this page. However, few notes about figures and tables are in order. All non-text material (such as line diagrams or photographs) other than tables will be labeled **figures**. Maps and cross sections are considered to be figures. All tabulated material shall be called **tables**. There should be no extraneous tables or figures. Use each illustration strategically placed and **always** refer to them somewhere in the text. Every figure or table must be accompanied by a complete title and description or caption. For example, suppose a photograph is taken of an outcrop. There should be something in the photograph used for scale, the name of the geologic unit or units represented in the photograph, and the feature which the author wishes to draw the reader's attention to (such as a normal fault).

ABSTRACT

A brief summary or abstract will be included at the beginning of your report. The abstract will give the reader a clear idea of what the importance of the report might be. It should be a truly informative summary of observations and conclusions about the area and not merely a statement of what was done. It must be as brief as possible. **Never** use phrases such as "the geology will be described...". For an areal geologic report, describe the general geologic setting (to orient the reader), the main rock types and environments of deposition (or metamorphism, or intrusion...), and the structural events or setting.

For the purposes of your report, the abstract (double spaced) should be no shorter than half a page nor longer than a full page. Normally the abstract is the last part of the report to be written after all material is presented and conclusions are drawn. I direct you to abstracts written in professional geologic journals as guides.

INTRODUCTION

Comments in the introduction should be brief and deal only with subjects that enlarge the reader's understanding of the area. The introduction serves to orient the readers: don't overemphasize the introductory material. Some reports during past field courses contained an introduction almost as long as the rest of the report! If your are concise, most, if not all, of the material below may be consolidated into two or three paragraphs. Generally, for your report, the introduction should be no longer than 1.5 double-spaced pages.

By the way, this part of the report can be written very early on in the mapping process (and should be--to save time).

Introductory material should always include: **LOCATION, PURPOSE, PREVIOUS WORK**, and **FIELD WORK**. Locate the area for your reader by means of a brief sentence or phrase or two but rely chiefly on a good index map. Make certain that if you lift a location map from some other source that you give that source credit in your caption. Also, don't forget to locate your field area on the map. In most areal reports a sentence or two will indicate why the report was written (its **Purpose**). A paragraph (or two) mentioning the geologic work in the area (**Previous Work**) by earlier geologists is always necessary. Treat the previous work in chronologic order and always include the full reference of the papers in the List of References Cited at the end of the report. Don't go into exhaustive detail here. Very briefly, mention the writers contribution. Include such topics as amount of time spent in the field, kind of base map used, aerial photos used as well as their scale(s), number of square miles (or kilometers) mapped, and so on (**Field Work**).

Classifications of rocks used later in the report is commonly addressed during description of rock units. However, some authors let the reader know at the outset which schemes are used. Use any classification schemes you wish. Those of Compton are quite acceptable.

Other topics which may be included but aren't necessary for this report are accessibility (how to reach the field area), culture (what the land is used for), physical features (geomorphic features), climate and vegetation, and acknowledgments (thanks Mom & Dad, field partners, the Force, Bart Simpson, etc.).

GENERAL OR DESCRIPTIVE GEOLOGY

The lithology, petrology, and stratigraphy of the rocks in the area are described in this section of the report. If only sedimentary rocks are described, the section may be labeled "stratigraphy".

REGIONAL GEOLOGY

Although some reports omit this topic, I want you to include it. The regional geologic setting describes the major geologic provinces or terrain in which your field area is located. For instance, if a part of the Hornbrook Formation was being mapped, it would be located unconformably above the crystalline rocks of the Klamath Mountains Geologic Province (those rocks of the province adjacent to the Hornbrook Formation should be described briefly) and stratigraphic below volcanic rocks of the Western Cascade Series (which should be described briefly). It would be logical to refer to the index map on which the regional geology has been superimposed but this is not necessary for the purposes of this report, unless you wish to include it. The general ages of rock units are always necessary.

As it was with the Introduction, the Regional Geology can be written well before the final report is finished. All you need to do is read and incorporate pertinent material from the literature.

DESCRIPTIVE GEOLOGY

The organization of the section on descriptive geology will depend upon the type of geology present and the purpose of the report. It is important to **always** start descriptions with the oldest unit and progress sequentially to the youngest unit.

An example of the suggested organization procedure follows:

EXAMPLE

Descriptive geology

General Features

Franciscan Complex

Distribution and topographic expression
Relations to other formations
Petrology
Composition
Origin
Age and correlation

Monterey Formation

Distribution and topographic expression
Stratigraphy
Thickness
Origin
Age and correlation

GENERAL FEATURES

An introductory paragraph (or, at most, two) describing briefly the kinds of rock in your area is appropriately here: it serves to orient the reader. *Do not be too wordy*: this is an overview of the rock units that are about to be described in detail.

A columnar ("Stratigraphic") section, if present, normally is placed at the end of the "General Features" section where it appears as a figure. You will NOT be required to do a columnar section for this report.

SEDIMENTARY ROCK UNITS

The description of the oldest formation or rock unit in the area follows the "General Features" section. As a general rule, deal with the larger and most significant items first and work toward the smaller, less significant details. It is not necessary to follow the format below rigorously: your needs may be best addressed by a different format. However, once a format is adopted, stick with it throughout the description of each of the rock units. Be consistent!

BOGUS FORMATION

Introductory paragraph:

Include here items such as name of unit, derivation of name, reference as to who first named it, type locality (if important), and indication of whether or not a new name is proposed. If a new name is introduced, you may name a unit ONLY by using the name of a fixed geographical location. Such an example is the Hornbrook Formation, named after the town of Hornbrook, California which was built on the soil and rocks of the formation.

Distribution and topographic expression:

For many reports, these subjects can be covered in one or two sentences along with a phrase giving the principle lithologic character and thickness. Even if the entire unit you are describing is not in your area, you can refer to the literature to derive its reported thickness. Also, if you have constructed your cross section correctly, you can determine the thickness of the rock unit from the cross section.

Lithology:

Start with a summary statement, especially if several members are present, describe the gross and conspicuous features, and then progress toward the minor features. Some of the major categories below may be lumped into a single section if it seems appropriate. The subjects are:

> Field relations.
> Distinguishing features of rocks (which enable separation from other rocks in the field).
> Type of bedding (thick, thin, thinning upward, coarsening upward, etc.)
> Sedimentary structures (this is important information from which you can determine the paleo-environmental reconstruction or make inferences about the environment of deposition). Paleocurrent data, even that reconstructed using a stereonet, are to be discussed here.
> Color (fresh and weathered).Textures.
> Mineralogy of constituents and lateral or vertical variation of those constituents, if necessary.
> Character of cement.
> Soil derived from weathering of the rock (in the Hilt area, soil types and "float-running" may be the best way to locate an elusive contact; let the reader know how he/she can determine what formation exists based on soil type if only soil is present).

Note: Compton gives a general outline of things to be observed at an outcrop. In successive sections on igneous, metamorphic, and sedimentary rocks, he gives additional descriptive advice. I suggest that you adopt a logical descriptive pattern in your text which you can use **consistently** for each rock unit. Also, describe lateral variations, if any, in the units. Areal distribution and variation of rock types may be a clue as to their depositional environment.

Subdivisions or minor units (if any)

Members and tongues ("Mick Jaggers") can be described here.

Contacts

Describe relations with rock units above and below. Mention only the type of contact of a unit if it has already been described elsewhere. For instance, if the lower contact of a unit has been described with the underlying unit, merely mention the type of contact during the description of the younger unit. Then describe the upper contact of the younger unit completely.

Age and correlation

Any fossils can be mentioned here. Cite the literature dealing with earlier work in the area or rocks which are believed to be correlated to the field area. If another author is cited, make certain to cite the full reference in the list of references cited. In addition, when making correlations from the field area to another where formally-defined units are present, state the reasons which support the correlations.

Origin

Draw conclusions from the preceding evidence concerning the environment of deposition. By all means, don't draw any conclusions that can not be supported by evidence which has been presented earlier. If speculations are being made based on little evidence, make it clear that speculations are being made.

Some authors will not make interpretations in this part of the report but will wait until discussing the Geologic History. I prefer that you make preliminary interpretations here while the details of rock descriptions are fresh in the reader's mind.

Once again, present your data first, then (and only then) draw conclusions based upon that data. You'd be surprised at the number of conclusions submitted which were simply not based on stated observations. I look **very** unfavorably upon unsupported conclusions. For instance, if you infer deposition by a turbidity current, cite evidence for characteristic structures of turbidity deposits before drawing the conclusion.

Consider alternative hypotheses as long as there may be more than one possible explanation. If appropriate, select the most likely possibility. Don't consider patently ridiculous ideas just to "pad" the report.

IGNEOUS OR METAMORPHIC ROCK UNITS

Similar headings or subjects apply to igneous and metamorphic rocks, although the manner of treatment of each is usually quite different.

Name and derivation of the name of the rock unit

Some igneous and metamorphic rock units are given names, such as the South Fork Mountain Schist, Dinky Creek Granodiorite, etc., although this is not a universal practice.

Areal distribution, topographic expression, and manner of weathering

Petrology, lithology, or petrology

Mineralogy, fabric, etc. Describe any variations present.

Thickness

Thickness is applicable to certain metamorphic rocks, or if the unit is a flow, dike, or sill.

Relation to adjacent rock units (contacts)

Origin

Age and correlation

STRUCTURE

For most reports, it is not desirable to describe each fault and fold separately. Instead they may be grouped together according to similarity of trend or style and described together. If a separate structural map is included, give the name, location, and principal characteristics of each feature and thereby omit much extraneous text. If this system is followed, the written description can be concerned principally with generalizations and interpretations.

Structural diagrams or figures are often included so that descriptions can be made more lucid. This is especially true in complicated areas where, for example, where attention is to be drawn to relations between faults, veins, and other units or in the case of superimposed folds. A neat block diagram, sketch, or photograph may serve to make these relations clear where no amount of descriptive material could do so.

In your report, you will include at least one calculation of **net slip** or **stratigraphic separation** along a fault which passes through your area. The results of those calculations will be included in this section but the calculations themselves will be placed in an appendix to the report. A handout regarding calculation of these measurements will be given during the course. Instruction will be given in how to calculate the measurements and what field evidence to look for.

Topics you may wish to include are:

General Features

Include a summary description of the structural pattern of the region. If there is anything particularly significant concerning the structural geology of the area, a comment or two is appropriate.

Folds

Areal extent.
Symmetry and fold style.
Age of folding; superposition of folding.

Faults

Evidence for faulting (offset rock units, truncation of rock units, abrupt change in strike and dip, springs, sag ponds, etc.)
Extent.
Orientation.
Slip and separation (see above).Stress field which may have generated them (if possible).
Relative age (when did the faults form?).
Note: important regional faults or folds may be named.

Joint patterns: there will be no time to infer the ramification of joints in the area.

Regional tilting: to which directin and when did the tilting occur?

Other structures such as boudins, lineations (eg: slickenlines along faults, fault chatter), etc. if not related to any of the above structures.

GEOMORPHOLOGY

Although chapters on geomorphology and economic geology are common in areal geologic reports, you may not wish to include them as separate chapters. In that case, include such material in other chapters, such as the Descriptive Geology chapter.

If you wish to include a separate geomorphology section, in a discussion of the origin of the landform of your area, devise an outline which serves your purpose. Topics might include:

General Features

A summary paragraph will serve to orient the reader and to focus his attention on the principal geomorphic features of the area. In some areas it may be desirable to include a geomorphic map on which are shown the erosion surfaces, old stream courses, possibly surficial features (such as landslides or stream terraces), and the like.

Topographic expression of formations and structures

A few comments concerning these subjects should be included. Do not repeat statements already made in the Descriptive Geology chapter but treat the subjects such as the topographic expression of faults and rock units, the development of dip slopes, consequent or subsequent streams, valley profiles, extent of alluvium, development of stream terraces, and so on.

Denudation processes

In this section, discuss the ways in which the topography is being denuded. Pay special attention to the relative importance and cumulative effect of such processes such as chemical weathering, mechanical weathering, mass wasting processes (including landslides), erosion, degradation, and aggradation.

Stage of geomorphic cycle

As this is part of the old Davis cycle, most recent workers omit this section. However, you might choose to include it.

Special problems

Particular problems such as origin of sediments, regional correlation of erosion surfaces, and so on may need special attention.

GEOLOGIC HISTORY

Unless the report is extremely limited in its scope, the geologic history is one of the most important chapters. Commonly the basic purpose of most areal geologic mapping is to determine the geologic history, rock

distribution, and characteristics of the area. Therefore, try to summarize the preceding material concerning lithology, structure, and geomorphology, presenting a chronology of the sedimentary and tectonic events which have occurred and the environmental conditions that have existed in the area. If conclusions and interpretations have been drawn in the Descriptive Geology chapter, turn your attention to summarizing those conclusions and drawing tectonic implications, if appropriate. Tables, reconstructions, or palinspastic maps may convey some of this information.

REFERENCES

At the end of every report, a list of references cited must be included. While a list of references commonly used for the Hilt project will be placed on a computer drive in Microsoft Word format, the following information is made available for your general information. Note: you may "lift" the references ***you used*** (and will cite in your report) from the drive to put in your document, not the entire list of references placed on the drive. Unless you use all of them.

BIBLIOGRAPHIC REFERENCES

The purpose of a bibliographic reference is two-fold: first, to show the reader the source of the reference, and, second, to enable the reader to locate additional material if he/she wishes to find more information on the subject. It is desirable that this be achieved with minimum confusion and maximum clarity. Many forms have been developed but the one we will follow is that of the Geological Society of America.

A. **Within the text**, references to sources of information are given in parentheses without resorting to footnotes. The form is:

Author's last name, followed by a comma, and then the year of the publication. If necessary, specific pages are included after the year of publication.

For example:

... sedimentary facies of the Kennett Formation reflects topography of islands, submerged highs, and basins, developed during the final stages of Devonian arc construction in the Eastern Klamath Mountains (Watkins and Flory, 1986, p. 753).

B. **At the end of the paper**, a complete list of all references cited is given. Items are listed in alphabetical order by author. When more than one paper by the same author is cited, each is listed chronologically under his name. The form followed in the bibliography is:

name of author, surname first, followed by a comma; year of publication, followed by a comma; title of the paper or book in full followed by a colon; series of publication or location and publisher (if a book), with standard abbreviations, followed by a comma; and volume and page reference or total number of pages (if a book) with standard abbreviations.

For example:

Babcock, E. A., 1974, Geology of the Northeast Margin of the Salton Trough, Salton Sea, California: Geol. Soc. America Bull., v. 85, p. 321-332.

C. Rigorously, a **Bibliography** is an exhaustive list of references about a particular topic, a **List of References** is a more modest account of articles concerned with a topic, and a **List of References Cited** lists only those to which reference is made in the text. You will use only the **List of References Cited** for the Hilt report.

D. If you cite material already cited by another author, then give both authors credit by writing:

... influxes of clayey and silty sediments occurred during desiccation and was mainly derived from the Colorado River (Merriam and Bandy, 1965, in Babcock, 1974).

This approach is also useful in case you couldn't (or didn't) read the article which was cited in the article you did read.

INFORMATION CONCERNING MAPS AND CROSS SECTIONS

Introductory Comments

Much of the information concerning maps, cross sections, and geologic reports can be found in Compton (chapter 16) or in the Suggestions to the Authors of the Reports of the United States Geological Survey. However some comments which will amplify the above material are in order. You may secure the map, legend, and cross section to a single sheet of paper you either bring with you or buy locally (we have some low tech butcher paper, for the economy-minded). Securing them to the base paper can be done by tape, gluing, or by taking to a local printer (for the less economy-minded). The choice is yours but ugly maps show a lack of care (or good time-budgeting skills); on the other hand, snappy maps with errors or which are incomplete are unacceptable.

MAPS

(1) Maps will be inked. You will use the standard geologic map symbols in appendix 7 of Compton (p. 372-375). Lines which indicate faults will be notably thicker than those for contacts. As an example, if you are using a triple aught (3 x 0) point for contacts, use a number 2 point for faults. The faults should be **easily distinguished** from depositional contacts but not be garishly thick.

(2) The title should be easily noticed but not overwhelming. The thickness of the letters should be much more pronounced than any line on the map. See the title on the Medford Geologic Quadrangle.

(3) Don't forget to include a scale and north arrow if they are not already on the map. Your name and the date of your work should appear near the title but hopefully in more humble print. Also include a reference system (UTM, latitude/longitude, or Township and Range) along the borders of the map.

(4) Each map will have a geologic legend which shall be firmly attached to the map. There are many acceptable ways to construct a legend. See any geologic map.

(1) Ages of the rocks where known are shown. The youngest unit is at the top of what amounts to a very simplified stratigraphic column.

(2) The letter symbols for the formations or members appear in the appropriate boxes. The first letter refers to the geologic system (Tertiary, Cretaceous, etc.) and is always capitalized. See any good geologic text for standard abbreviations of the systems. If age refinements are no better than Cenozoic, Mesozoic, or Paleozoic, then the symbols Cz, Mz, and Pz respectively may be used. If the rocks in question are pre-Cenozoic, pre-Mesozoic, pre -Paleozoic, or pre-Cambrian, the symbols are respectively pC, pm, pP, or pC.

The second letter in the symbol is obtained from the first letter of the unit or formation name and is not capitalized.

Use of three or more symbols generally is to be discouraged. However, you may decide that a formation may be subdivided into various members which are mappable. The first letter of the name of the member (or a number, if numbers are used) appears in the symbol and is not capitalized. For example, the **O**sburger Gulch member of the **H**ornbrook Formation of Cretaceous (**K**) age is abbreviated **Kho**.

There are, of course, variations on the above symbols. Consult me if you have any questions or innovations.

If the age of a rock unit is unknown, then lower cased symbols describing the rock type are used. Traditionally, more than one letter is used. For example, quartz diorite of indeterminate age is abbreviated qd and granite is abbreviated gr.

(5) The formation, member, or unit name appears followed by a short description of the rock types. "Siltstone and sandstone" is an insufficient description. Describe the rock types with an eye to those characteristics which serve to immediately set apart that formation, member or unit from all others in the area.

(6) Where unconformities or fault contacts exist between units, the types of unconformities or faults are stated.

(7) Separation of stratified and non-stratified (intrusive) rocks is strongly suggested (see the Medford Quadrangle, which will be made available to you at the field station).

(8) A list of all the structural symbols (such as bedding, faults, etc.) used on the maps should follow the list of stratified and unstratified rocks (see the Medford Quadrangle). See Compton, pages 372-375 for common symbols. Any symbol which appears on your map will be in your legend!

(9) For the purpose of this report, the rock units will be lightly colored so that the distribution of the individual units will be easily noticed. The coloring should not be so heavy that the geologic symbols are made obscure.

(10) In some field areas, alluvial material will form a thin veneer over underlying units whose identity is known. In those cases, some enterprising field course participants have placed a mylar overlay which can be lifted away from the main map to show the underlying units. The mylar exhibits the "overburden" units.

CROSS SECTIONS

(1) Cross sections may appear as figures within the text or preferably as a separate figure upon which all the cross sections (if there is more than one section) appear. The separate cross section figure will be placed along with the map in a pocket at the back of the report. The separate figure approach is preferred because all cross sections may be easily compared side by side with the map (hint: make certain that the geology on the map coincides with that of your cross section).

(2) When selecting your cross section lines, select both the location (and number) of cross sections to be drawn which will give the reader the most information about the area. Example: a cross section drawn parallel to strike is generally less instructive than one drawn perpendicular to strike, unless you are trying to show certain features such as facies changes or cross-cutting structures. If there are faults in the

area, more than one cross section may be useful to show faulting relations. Extra credit is given during the Hilt project if more than one cross section is drawn.

(3) As with maps, all cross sections should have a title, scale, your name, and date.

(4) There will be **no vertical exaggeration**! Horizontal and vertical scales will be the same.

(5) Letter symbols for the units may appear above the surface (see Compton, page 349) or below it, depending upon your preference. Don't forget to use these symbols in all unlabeled portions of your cross section; don't just rely on your coloring scheme since colors won't reproduce well on the conventional xerox-type machines.

(6) Folding in cross sections is generally represented by folded contacts, not by drawing in axial planes--unless you are trying to show something special. Sometimes "form lines"are used which are internal to units when the unit is so thick that you can not show the extent of folding easily. See me if you have questions.

(7) Faults are generally shown as solid lines below the surface and, if necessary, by short dashes above the surface. Doubtful faults or doubtful extensions of faults to depth may be indicated by broken lines with or without question marks. Cross sections are commonly extended to about 4000' below the surface depending upon the scale of your map and the reliability of your data. Don't be afraid to extend your data to this depth; we all know that cross sections are educated guesses.

(8) Cross sections are traditionally drawn as if the viewer were standing in the southern portion of the map **looking north**.

(9) Don't forget to label the ends of your cross sections so the reader can find them on the map. Also, label the directions (N, S, E, W, NE, NW, SW, SE) on each end of the cross section. Label important cultural or topographic features which will help the reader readily correlate features on the cross section with those on the map.

LAST---

I am often asked "How long (how many pages) should my report be?" The most honest and useful answer is "Just as long as it has to be to convey the appropriate information." Somehow that is not satisfactory. Very well, if you must have some guidelines:

* Each report will be submitted in word-processed format using a font no larger than 12 point. Double-spacing is required; one sided only.
* Half to a full page for the abstract;
* No more than one page for the introduction;
* Nearly half a page for the Regional Geology;
* No less than 6 pages nor more than 10 pages for the Descriptive Geology (depending on whether paleo-environmental interpretations are included);
* No less than 2 nor more than 4 pages for the Structural Geology section;
* No less than 1 nor more than 3 pages for the Historical Geology section (depending on whether paleo-environmental interpretations are included).

That comes to a total of between 11 and 19.5 pages, without the Title and the List of References Cited pages or room for photographs or diagrams. 19.5 pages, in my estimate, is too long.

Past grading for the Hilt project is as follows: about 25% of the grade comes from the map, 15% from the cross section, 45% from the report content, and 15% from mechanics (spelling, grammar, etc) of the report. Some extra credit is allowed for an extra cross section as well as useful diagrams and photographs. This year's percentages may vary slightly from the above.