# Contents

# Acknowledgments

This fifth edition of *Geowriting* is based on earlier editions that were edited by Wendell Cochran, Peter Fenner, and Mary Hill. This edition includes much of their original work; they were not, however, involved in this revision and are not responsible for any errors or changes that may have occurred.

For this fifth edition, the editors wish to acknowledge R. Wayne Davis and Stephanie Webb, who researched and updated entries in the chapter Writer's Guide to Periodicals in Earth Science, and M. Jennifer Sims, who provided updated information for the chapter on Drawings and Photos. Margaret Oosterman provided incisive editing and thoughtful comments, and Julie Jackson devoted considerable time to editing and improving the manuscript.

We appreciate all of these efforts.

Contributions to earlier editions of this book continue to be reflected in the fifth edition. Those contributions include writing, manuscript review, permission to reproduce excerpts, and other help. Those contributors included Gerald M. Friedman, Richard V. Dietrich, Patricia Wood Dickerson, John W. Koenig, Arthur A. Meyerhoff, Thomas F. Rafter, Jr., William D. Rose, Martin Russell, Albert N. Bove, George E. Becraft, A.F. Spilhaus, Jr., Robert McAfee, Jr., Trinda L. Bedrossian, Elizabeth Bennett, Mary Beth Cumming, Jules Braunstein, Kenneth L. Coe, George V. Cohee, Edwin B. Eckel, Josephine F. Fogelberg, William H. Freeman, Douglas M. Kinney, Joel J. Lloyd, Melba W. Murray, Mark Pangborn, Willis A. Shell, Donald G. Turner, Richard J. Vorwerk, Joseph C. Meredith, and Sherman A. Wengerd.

Parts of the chapter Writing for the Media are a slightly different version of material in Geomedia: A Guide for Geoscientists Who Meet the Press by Lisa A. Rossbacher and Rex C. Buchanan (American Geological Institute, 1988). Kenneth K. Landes' paper on abstracts is reproduced by permission from the *Bulletin* of the American Association of Petroleum Geologists, v. 50, September 1966, p 1,992. Excerpts of B. H. Weil's "Standards for writing abstracts," are reprinted by permission from *Journal* of the American Society for Information Science, v. 21, 1970, p. 351; copyright 1970 the American Society for Information Science, Washington, D.C.

# Foreword

Peter Fenner, one of the three original editors of *Geowriting*, conceived the idea for this book. The concept for *Geowriting* was his response to reading the report, "Requirements in the field of geology" (1969) by David M. Delo and Robert C. Reeves. That report to the American Geological Institute recommended more stress on facility in writing. *Geowriting* has proved to be as useful to geoscience writers, editors, and students as its creators hoped. New editors in many geoscience organizations routinely receive copies, and *Geowriting* has become the primary resource for earth-science classes in technical writing.

Although the need for facility in writing has not changed in the past 25 years, typesetting, printing, and map-making technologies have changed significantly. The accessibility of personal computers, sophisticated software, desktop publishing, and digital map production are just a few of the technological advances that writers, editors, and students take for granted. The new edition of *Geowriting* takes those changes into account. The section "Writer's Guide to Periodicals in Earth Science" is new to *Geowriting*. Aspiring authors will find information there on more than 150 earth-science journals.

Like the editors of earlier editions, Robert L. Bates, Marla D. Adkins-Heljeson, and Rex C. Buchanan, have been active members in the Association of Earth Science Editors (AESE). In preparing the fifth edition, they have accomplished the challenging task of incorporating new material into a book that evolved from the contributions of many of their peers. Producing a book for other writers and editors is a daunting assignment, and I am certain that the fifth edition will prove to be as useful as its predecessors.

I am grateful to Bob, Marla, and Rex for their good work and to Wendell Cochran, another of *Geowriting's* original editors, who enthusiastically and skillfully guided the book from concept through four editions. We regret that Bob Bates — the 1981 recipient of AESE's Award for Outstanding Editorial or Publishing Contributions — did not live to see the new edition in print.

***Julia A. Jackson***

Director of Communications and Publications

# Preface

*Geowriting* is an introduction to writing, editing, and printing in earth science. It will help you cope with a process that begins with writing a manuscript and ends when the work is printed. It is a how-to-do-it manual, an outline, and a guide — a resource intended to give a notion of problems, tools, methods, and references for digging deeper.

*Geowriting* will be useful to a variety of people:

- Students (undergraduate and graduate) approaching for the first time the possibility of writing for publication.
- Professors and supervisors who foresee that their students or employees will someday write or edit.
- Scientists who publish infrequently and find it difficult to keep in mind all the related mechanical matters.
- Scientists who find themselves — sometimes unexpectedly — appointed or elected to editorships.

The publication process is similar for all types of publications. To simplify explanations in *Geowriting*, we have used writing, editing, and printing an article for journal publication as an example for all publications. The editors' decisions on what to include and emphasize are not meant to be used as standards for all types of publications, or even all journals. They do hope, however, that the examples and discussions will help you make the choices most suitable for your writing.

The book's arrangement generally follows the mechanical order of publication: writing through editing to printing. Writing, editing, and printing are not treated as independent processes, although each can be done without the others. To a craftsman, writing-editing-printing is an interlocking whole.

CHAPTER 1

# Before You Write — Preparation

Nearly all scientists enjoy research, the actual doing of science. But many say that the most difficult part of their work is sitting down to write about their research. Some find it hard to get started. They're intimidated by staring at a blank page or an empty computer screen. Others find the entire writing process painful, a necessary evil in the accomplishment of their work. Still, writing is unavoidable if they are to record and communicate their results.

Several techniques will help you get started writing. Once you have started, other methods can help you improve your writing. Quite simply, the only way to get better at writing is to write. Like plumbing or cooking or playing basketball, the more you work at writing, the better you get. It may also help to have someone advise you, telling you which mistakes are easily avoidable and giving you hints to improve your work. But the act of writing will help you clarify your thinking and improve your ability to communicate it.

## Choose your writing instrument

Use whatever mechanics appeal most to you. You may want to make the first pass in longhand, or use a typewriter. A personal computer with a word-processing program can make the logistical aspects of writing much easier: you can revise, rearrange, cut, and check spelling and syntax with the touch of a few keys.

## Find your writing method

Professional writers use a variety of mechanical techniques and working conditions. Some writers start early in the morning; some work only late at night. Truman Capote claimed that he wrote the first drafts of all his work while lying in bed. Find the method that works best for you and use it to get the product you want.

## Make an outline

An outline will help make the rest of the job easier. The level of detail in the outline will depend on your writing experience, the complexity and length of the work, and the publication for which you are writing. Many scientific journals have a standard format that consists of an abstract, a statement of the problem, a review of pertinent literature, a description of research methods and results, and conclusions. It may help you to outline your work with a few words of summary under each of these categories or the categories a particular journal requests.

Paleontologist Stephen Jay Gould is well known for writing about geology, natural history, and the history of science. But even in his technical articles, Gould uses a fairly unconventional writing style, avoiding the usual stylistic conventions and writing in a more narrative style and organization. If you are a good enough writer, you may be able to get away with the same thing. For almost all writers, however, a journal's format may have the advantage of providing an established framework within which you can work.

## Think about your audience

A time-honored axiom of writing is to know your audience. You should know the readers' level of understanding of your subject. Some readers will be able to understand complex technical ideas and polysyllabic words without any explanation. After all, the purpose of scientific jargon is to provide a precise and short (though often inelegant) method of communicating technical information. For other audiences, concepts and words may require some definition. You should always keep that level of understanding in mind. Similarly, the audience's level of interest may vary from publication to publication. If you are writing for readers who are unfamiliar with your particular area of expertise, they may require additional explanation to make the relevance of your work clear.

Imagining your audience as one person may help you visualize your readers. That is, think of a person you know who might read your article, such as a colleague or friend. Try to envision this person reading the article, to see if he or she can understand it. Anticipate your reader's questions, both in terms of subject matter and in the technical level of the writing, and then answer the questions. Also, ask yourself what you would like to know as a reader, and then provide that information. Writers should never leave their audience with questions that they could have answered.

You may be your own best audience. You should know, even before you sit down to write, what you want to communicate, which ideas you want to convey. Obviously, you must be interested in and excited about your specific line of research, or you wouldn't have pursued it. You should bring that same interest and excitement to your writing, using your judgment in deciding what is important. If you write about the things that are important to you, you will almost certainly be a better writer.

## Put your ideas on paper

Some writers spend hours on the first sentence of a report. They write nothing beyond that first sentence until they are happy with it, no matter how many times they have to rewrite it. For most researchers, however, a better approach is to get something — anything — down on paper without worrying about the grammar, syntax, or misspelled words. The very act of writing will often help you get started. You don't need to worry too much about the way things come out the first time. There is plenty of time to fix them later.

**BEFORE YOU WRITE — PREPARATION**

- Choose your writing instrument.
- Find your writing method.
- Make an outline.
- Think about your audience.

CHAPTER 2

# Preparing Copy

Editors are busy people. Whatever you can do to make their job easier will help get your work into print.

## Match your work to a journal

Now that you are ready to write, you will want to find a journal that is interested in publishing your work. Decide which journal is most likely to use it; don't submit your work unless you are familiar with a journal's recent issues. You want to make sure your paper and a journal will make the best fit. For example, the *Journal of Paleontology* and the Geological Society of America's *Bulletin* may both use a paper on Devonian brachiopods, but the *Bulletin* is less likely to use one on a specialized aspect, such as the morphology of productids. The last chapter of this book gives specific information on current periodicals in the earth sciences.

## Follow journal or general guidelines for writers

Editorial policies change, so examine recent issues of the journal you have chosen. Do not depend on old issues or on your impression of a journal's content. If a journal has a stylebook or other standard, follow the instructions closely. Some of the rules may seem arbitrary, but follow them anyway — they are designed to fit an editorial system or to meet mechanical requirements imposed by the journal's design or a printer's equipment. Flouting those rules may make extra work for editors. If a journal has no formal suggestions to authors, apply common sense and use a stylebook, such as the *Suggestions to Authors of the Reports of the United States Geological Survey* or *The Chicago Manual of Style*.

**Hard copies.** Stylebooks may specify that manuscripts be submitted on good quality white bond paper (some may even specify the weight). Editors must work with the paper, and they object to paper too stiff to handle, too thin for convenience, too shiny for easy reading, or too hard or slick to take sharp, clear pencil marks. Papers with easy-erase surfaces are particularly troublesome.

Computer printouts should be easy to read and photocopy. Some printers produce hard-to-read type: for example, a lowercase *g* may look like a 9. Some space words so that editors cannot easily count words or characters for estimating printed pages. Many editors actually ban certain types of printouts, notably dot-matrix. Laser printouts are more than adequate. Check a publisher's stylebook for specifications, or send a sample page.

**Electronic copies.** Many journals request that manuscripts be submitted in electronic form as well as on paper. Confirm with a journal the computer system and software that was used so that you can submit a readable diskette or one that can be translated. Submitting a manuscript via electronic mail may also be acceptable and convenient. A paper copy should also be sent to verify the electronic transmission.

**Typing.** All copy should be typed, double-spaced, with standard indentions, at least four-centimeter wide margins on all sides, and approximately equal line lengths. That rule applies to all copy, no exceptions. It includes titles, bylines, author identification and affiliation, abstracts, quoted matter, footnotes, tables, lists of references — everything. Doublespace everything. Editors need the space between the lines and in the margins for editorial marks. Also, even spacing and margins help editors estimate how much space your work will occupy in the publication. Try not to use a proportional-space typewriter or printer, which makes copyfitting — estimating space — all but impossible.

Do not add extra spaces between paragraphs or sections. Triple spacing is acceptable, but be sure to use the same spacing throughout. Single spacing is never acceptable. Avoid devices such as single-spacing the abstract, long quotations, or references in an attempt to simulate smaller type. Do not break a word at the end of a line, because an editor or typesetter may mistake the hyphen for a part of the spelling.

Use one side of the paper only. At the top of each page, type a short identification tag in case pages get misplaced — one word, such as your last name, and the page number: *Jones 1, Jones 2, Jones 3.*

**Estimating space.** Some editors welcome an outline of a prospective manuscript because both a writer and editor can then discuss manuscript length in terms of the number of words, typescript pages, and printed pages. As a guide, one 8 1/2-inch by 11-inch, two-column printed page set in 10-point (elite on a typewriter) type equals about three and one-half double-spaced typewritten pages, excluding figures.

**Names.** Provide complete names for people. A text reference to a person's name should match a bibliographic reference. Do not abbreviate names or terms, especially journal names, unless a journal specifically requires it. That job is for the editor, who should not have to find out whether your *Geol.* means *Geologic, Geological,* or *Geologists.*

**Numbers.** If possible, avoid built-up fractions:

$$\frac{a-b}{3(a+c)bx}$$

They are hard to set in type and waste space. Use case fractions: $(a-b)/3(a+c)bx$. If you have typed equations using a word-processing program, find out how to save the file so that the equation format can be retained when the file is accessed. Make sure you send hard copy so that equations can be rebuilt if necessary.

Most science journals use the international metric system. Check to see if the journal you chose does.

**Table.** Avoid rules, which are horizontal or vertical lines. Remember that the editor can add needed rules quickly and neatly; taking unneeded ones out is much more difficult and time-consuming. Use enough space between columns to make the meaning clear but not so much as to make lines of numbers hard to follow with the eye.

**Footnotes.** Avoid using footnotes if at all possible. Many journals will not allow footnotes and will incorporate the material into the text.

**Verification.** Double-check all spellings, quotations, references, equations, formulas, and arithmetic. It is an editor's duty to check some of these, too, but an editor is under time constraints and usually working on several manuscripts at once. The author is responsible for providing correct information and mathematics.

**Permissions.** If you plan to quote extensively from published material or to reproduce another author's photographs, tables, or diagrams, you must get permission in writing from the copyright owner. Many publishers have standard permission forms, which simplify and speed this task. For more information, please refer to chapter 11, Editing and Proofreading.

Avoid trade names, such as Plexiglas, Geodimeter, and Xerox. Carelessness in using them can result in sharp letters and worse from attorneys. Dictionaries usually indicate trade names, which should be capitalized. The trademark or registration symbol is not necessary.

**Artwork.** Photographs and other artwork must be identified in such a way that they will not be damaged. You may write the information on a separate piece of paper and tape it to the back of the artwork. Be sure to include location, scale, and any pertinent credit. If you have artwork done on a computer, check with the editor to see if the journal has the same graphics applications. If not, find out how to save your graphics and text files so that they can be accessed. For more information on artwork, please see chapter 7, Artwork.

**Design.** Do not attempt to specify design or to mark typographic style except for foreign words or phrases, such as names of species. Design and style are an editor's job.

**Number of copies.** For most editors, the original and one copy will suffice. Some editors require multiple copies, however, so check. Note that some photocopying machines use paper that is hard to write on; test all paper with a soft black pencil. Be sure to keep a copy for yourself. Let a journal know if you want your work back and enclose an envelope with your name, address, and sufficient postage.

## PREPARING YOUR MANUSCRIPT

- Select an appropriate journal.
- Match your work to a journal.
- Follow journal or general guidelines for writers.

CHAPTER 3

# Getting It Written

> Scientific research is not complete until the results have been published. Therefore, a scientific paper is an essential part of the research process. Therefore, the writing of an accurate, understandable paper is just as important as the research itself. Therefore, the words in the paper should be weighed as carefully as the reagents in the laboratory. Therefore, the scientist must know how to use words. Therefore, the education of a scientist is not complete until the ability to publish has been established. (From Robert A. Day, *How to Write and Publish a Scientific Paper.*)

We assume that you have decided where to submit your paper and have the appropriate style manual or sheet of instructions. We also assume that you have written an outline from which to proceed.

## Decide on a title

It is wise to devote some care to this label for your product, because readers deserve an accurate statement of an article's contents. Two requirements are involved:

- The title should tell what the paper is about.
- The title should not be long and cumbersome.

Meeting these requirements will also help make your paper easy to cite by future workers. Remember that increasing use is being made of computer-oriented indexing and searching techniques. When indexed, most of the words in your title should help a reader search the literature by key words. Editors sometimes must modify titles of papers; you can help both editor and reader by keeping the title of your article brief and specific. Avoid such words as *introduction, principles, selected, investigations,* and *recent.*

## Express the title clearly

After deciding on the title content, be sure to express the title clearly. A succession of words that seems to make perfect sense to you may not be clear to othrs. In *Abandoned Copper Mine Subsidence Study,* the first word, an adjective, can modify any of the following four words, all of which are nouns. Presumably, the author did not want to refer to an abandoned study. The title may be improved by using a modifying phrase: *Subsidence Study of an Abandoned Copper Mine.* The real subject of the paper, however, is not the study but the subsidence. Why not call it *Subsidence at an Abandoned Copper Mine?*

Another title starts with the words *Submersible Observations.* To the author, both these words are nouns, but to many readers *submersible* is an adjective meaning capable of functioning under water. Relating *submersible* to *observations* is difficult. *Observations from a Submersible* would have done the job nicely.

## Follow writing guidelines

The following section provides some general guidelines for clear writing. The explanations are not intended to be comprehensive but rather to emphasize specific points. The chapter Reference Shelf lists many excellent references that give detailed information.

**Declarative sentences.** A straightforward, declarative sentence is the most useful vehicle in scientific writing. A subject (person, process, or thing) acts on or affects an object or result. Such a sentence is a normal forward-action unit, in which the verb is in the active voice:

> The rocks / contain / plagioclase.
>
> Diagenetic changes / may destroy / the open porous structure.

A number of variations on this basic framework exist. In both sentences, the verbs *(contain, may destroy)* may have adverbs as modifiers, for example, *commonly contain,* and *may ultimately destory.* In the second

sentence, the subject and object are modified by adjectives *(diagenetic, open, porous)*. A phrase adds further meaning: *the open porous structure of the diatomite*.

**Nonrestrictive clauses.** A nonrestrictive, or *which* clause, which is not essential to the meaning of the sentence but adds to it, may be included. Such clauses are set off by commas:

*Many of the rocks contain plagioclase, which has normal zonation.*

**Restrictive clauses.** You may need a restrictive *that* clause, which is essential to the sentence meaning and requires no commas:

*the open porous structure that typifies normal diatomite*

**Passive voice.** An alternative structure turns the sentence around:

Plagioclase / is contained / in the rocks.

The open porous structure / may be destroyed / by diagenetic changes.

The verbs are in the passive voice. That is, the subject of the sentence is being acted upon and is thus passive. Most good writers view the passive voice unfavorably; the active voice is inherently more dynamic and usually shorter. If the rocks contain plagioclase, that's the way to say it. But we don't lay down an absolute antipassive rule. If the sentence subject is the texture and structure of diatomite, it is logical to place the subject first and use the passive voice. You would then discuss the diagenetic changes.

Beware of the passive voice with weak verbs, such as *is seen, is found, was made,* and *was done*. Avoid passive verbs when preparing an abstract (discussed in a later section).

**Subject-verb agreement.** The verb in a sentence must agree with its subject in number, even though subject and verb may be separated:

*A collection of museum-grade minerals, rocks, and fossils was available.*

By putting the verb close to the subject, you will be more likely to notice any disagreement between subject and verb.

**There is/There are.** Starting sentences with the words *There is* or *There are* is permissible, but in general this usage should be avoided. *There is an abundance of fossils* means *Fossils are abundant.*

**Sentence length.** Try to vary the length and complexity of your sentences. No reader likes a paper full of short, choppy sentences, or long sentences with numerous subordinate clauses and other decorations. To test how well you are doing, when you finish a paragraph or a page read it out loud. You should be aware of the sounds that "words make on paper," as E.B. White put it. Rework your sentences until they sound right.

**Paragraph length.** Just as there is no set length for a sentence, there is no predetermined length for paragraphs. When writing for scientific journals, authors should write paragraphs that focus on one idea. They should use as many sentences as necessary, then begin a new paragraph when shifting focus or ideas. Thus, lengthy paragraphs (about eight, 10, or 12 sentences) are permissible in scientific writing, even though they may be frowned on in other types of less formal writing.

**Transitions.** As you shift focus from one paragraph to the next, be sure to include transitions: words or phrases that connect paragraphs. Such transitions make life easier for your readers by telling them how you are changing directions, how the discussion to come is related to the subject they were just reading. Sometimes a single word provides that transition. Words such as *however* or *although* at the beginning of a sentence wave a flag to the reader that you are about to qualify or perhaps even contradict what was written in the preceding paragraph. Sometimes phrases or even entire sentences are necessary to perform a transition. For example, the first sentence in the third paragraph of this chapter acts as a transition sentence:

*After deciding on the title content, be sure to express the title clearly.*

The first part of the sentence describes the purpose of the preceding paragraph, and the second part clues the reader to the rest of the paragraph. That transition sentence ties the two paragraphs together.

## Avoid fancy writing

This sentence is from a letter sent out by a geological consulting firm:

> *To properly categorize and document current investigative methodologies, an intensive data gathering effort must be initiated.*

How does that sound when you read it out loud? Is that the way we normally talk? Of course not. The sentence has dressed up a simple thought to look impressive. To *properly categorize and document* (we will forgive the split infinitive) apparently means to determine or find out. *Current investigative methodologies* is an elaborate way of saying methods or techniques now being used. The sentence winds up with a typical passive voice construction:

> An intensive data gathering effort must be initiated.

By whom? In this final flourish, we may omit *intensive*, as presumably no one would make a lackadaisical data-gathering effort. Note the hyphen, not in the original, but needed because *data-gathering* is a unit modifier of *effort*. Translated into English, the sentence becomes

> *To find out what methods are now being used, we need to obtain information.*

or even

> *We need more data on methods now in use.*

These two suggested revisions are shorter than the original and may be said aloud without embarrassment.

A type of fancy writing that should be avoided is the use of long terms based on classical Latin instead of shorter equivalents from the Anglo-Saxon. *We initiated measurement of the adjacent arenaceous strata* means *We started measuring the nearby sandstone beds*. There are exceptions, when *approximately* sounds better than *about*, or *subaqueous* better than *under water*. One author, however, wrote that dune sands were moved about by *aeolian mechanisms*. He meant wind.

## Don't let your modifiers dangle

Every adjective, adverb, phrase, or clause modifies some term in a sentence. An obvious rule is that the modifier must go near, preferably next to, the term modified. This sentence was in a book:

> *Beginning 4 billion years ago, the authors show how microbes invented all of life;s essential systems.*

To avoid implying excessive age for the authors, the sentence might well have been rephrased:

> *The authors show how microbes, beginning 4 billion years ago, invented all of life's essential systems.*

Keep modifiers next to what they modify, lest absurdity result. A special case is the adverb that floats unattached:

> *Hopefully, the job will be done this week.*

There is nothing in this sentence for hopefully to modify. It should be replaced by *We hope* or *It is hoped*. Floating adverbs do not belong in serious writing. The author who wrote *This study was gratefully supported by the National Research Council* should have said *I am grateful to the National Research Council for its support*. Of course, such adverbs can be used correctly. We speak hopefully when we say you won't misuse them.

## Nouniness and how to avoid it

No doubt you will agree that *field* is a fine upstanding noun. So is *oil*. Put them together and you have *oil field*, two nouns end to end. No problem here. We can even take a third noun, *giant*, and place it in line, making *giant oil field*. This phrase hardly poses any difficulty, but from here on things get progressively messier. We have the production record of the field, which we designate *giant oil field production record*. This phrase contains some interesting data, which we analyze, giving us a *giant oil field production record data analysis*. We then construct a diagram based on these data — a *giant oil field production record data analysis diagram* — and

naturally conclude with a preliminary interpretation. So the paper is entitled *Giant Oil Field Production Record Data Analysis Diagram Preliminary Interpretation.*

Readers should never be asked to fight their way through such clotted prose — nine nouns and an adjective, all in a heap. The cure for such writing is the phrase. By using a few prepositions, we can recast the title into English that is immediately understandable:

> *Preliminary Interpretation of a Data-Analysis Diagram of the Production Record of a Giant Oil Field*

or, if you prefer:

> *Data-analysis Diagram of the Production Record of a Giant Oil Field: Preliminary Interpretation.*

We hyphenate *data-analysis* to make it a unit that modifies *diagram,* and we convert the other terms into prepositional phrases. Nothing can be done to make that title a model of graceful prose, but at least we can make it comprehensible.

Each of the following titles has appeared in geological literature. Can you translate them into English?

> *Canadian Superior Harmattan Area Gas Processing Plant Sulphur Recovery Exemption Application*
>
> *Multiple Pulse Incoherent Scatter Correlation Function Measurements*
>
> *Heavy Mineral Magnetic Fraction Stream Sediment Geochemical Exploration Program*

## Unit modifiers

We have already mentioned a type of three-word expression in which the first two words modify the third — as in *three-word expression.* Although putting a hyphen between the first two words clearly aids the reader, this bit of help is often omitted. For example, a tectonic lineament roughly coextensive with a part of the 38th parallel has been referred to as the *38th parallel lineament.* This phrase is poor usage; it implies that there are a lot of parallel lineaments and this is the 38th. The expression is given its correct meaning by a hyphen: *38th-parallel lineament.* The first two words make a unit that modifies the third.

Such expressions as the following require a hyphen: *high-level terrace, rare-earth element, low-angle fault, mean-dip map.*

Somethimes editors will remove hyphens for reasons that are not obvious to authors. If you think a hyphen is needed, discuss its value with the editor. Its inclusion may be needed.

## Sexist language

Sentences that refer only to one sex when they could equally apply to both can often be corrected (and shortened) by using plural constructions. For example:

> *The geologist should use the reflection and refraction profiles when he is uncertain of the dip of underlying formations.*

might be rewritten:

> *Geologists should use reflection and refraction profiles when they are uncertain of the dip of underlying formations.*

Instead of writing

> *When the geologist begins, he or she should visit the site immediately,*

write

> *Geologists should begin by visiting the site immediately.*

## Spelling

If you have trouble remembering that *consistent* is spelled with an *e* and *resistant* with an *a*, don't feel bad; our language is full of teasers like that. Help is always available. The most obvious source is the dictionary. Keep one nearby and don't be embarrassed to use it. The *Glossary of Geology* and the *Dictionary of Geology* are also helpful. If you use a word processor, use the spelling checker with it.

For quick reference, you may want to make a list of words that give you trouble. The following list seems to bother some geologists.

*symmetrical (two m's)*

*consistent, persistent*

*desiccate* (one *s*, two *c*'s)

*discernible*

*eustasy, isostasy* (no *c*'s)

*fluorite, fluorspar*

*liquid, liquefy*

*occurred, occurrence* (two *c*'s, two *r*'s)

*permeable, permeability*

*phosphorus*

*predominant, resistant*

*soluble*

*Mohs*

## Punctuation

The best way to learn about this subject is to note how various punctuation marks are used in material that you read, and to use references such as those listed in the chapter Reference Shelf. Counsel here is brief.

**Comma.** A comma, which seems to give the most trouble, marks a slight pause in the flow of words. For example, in the preceding sentence, the *which* clause stands out from the main sentence and is enclosed by commas.

**Semicolon.** A semicolon marks a slightly longer pause than a comma.

**Period.** For a full stop, or period, William Zinsser remarks that there isn't much to say about it except that "most writers don't reach it soon enough." (*On Writing Well*)

**Colon.** The most common use of a colon is to tell what's coming.

**Dashes.** A long dash separates:

*No vestige of a beginning — no prospect of an end.*

Some writers also use dashes to denote a more emphatic form of parentheses:

*The sea left behind layers of shale and limestone — generally shale in the shallow sea and limestone where it was deeper — along with deposits of coal.*

A hyphen connects, as in unit modifiers such as *low-angle fault*, and between syllables at the end of a line of type.

**Apostrophe.** An apostrophe denotes possession. The general rule is an apostrophe goes inside an s if the possessor is singular, outside if plural: *the rock's age, the pebbles' average size.* Depending on your stylebook, you may write *the 1980's* or *the 1980s*.

## Quoting

You may sometimes want to quote the words of another writer. You should repeat these words verbatim, enclose them in quotation marks, and cite the source from your list of references, for example (*Snarf, 1984*). Copyright permission is necessary for quotations of several paragraphs or a page or more. Or you may rephrase another author's remarks in your own words — as long as you give the source.

## References

You should have a list of references at the end of your article. The entries must be in the format required by the journal to which you send your paper. Journal editors are fanatics in this matter, so be sure to follow the instructions in the journal's guidelines to authors. If guidelines are unavailable, use a recent journal issue as a model. If you aren't writing for a publication but are preparing a document such as a company report, adopt a format for the references and use it consistently. Spell authors' names correctly and verify all information. Listing references is loaded with opportunities for error.

Software packages are now available that let you compile references as you work, then make style adjustments according to your avenue of publication. These packages can help you make sure that your reference style is appropriate and consistent.

**TO GET YOUR MANUSCRIPT WRITTEN**

- Decide on a title.
- Express the title clearly.
- Follow writing guidelines.
- Avoid fancy writing.

CHAPTER 4

# Revise!

One widespread misconception about professional writers is that they get it right the first time. Not many do. The difference between ordinary writing and good writing often lies in revision. Revision is far more radical than checking copy for grammatical mistakes, punctuation problems, and syntax errors. It requires looking at every word, every sentence, and every paragraph to make sure that each is where it is supposed to be and says what you want it to say. With every reading, ask these questions:

- Does the sequence of sentences make sense in a paragraph, or should some sentences be moved?
- Does the order of the paragraphs flow logically from one to the next?
- Are the paragraphs connected by transitions?

Revise as much as necessary. Revision often requires reworking a manuscript several times before it is finished. As you revise, consider the following guidelines.

## Use action verbs

Verbs are the action part of a sentence; good writing usually uses active, visual verbs, not nondescript verbs, such as *is*, *was*, or *have*. One mode of revision is to underline all the verbs. Underlining may help you pay special attention to them and show if you are using vivid active verbs or dull passive ones.

Also, look to the readability of your sentences. If a verb is placed far from a subject, your readers may have trouble following the sentence meaning. Placing the verb close to the subject may help.

## Vary sentence length

Don't use all long or all short sentences. A short sentence on the heels of a long one often has substantial impact.

## Shorten manuscript

Look for ways to shorten your manuscript. Research has shown that short words are usually easier to understand than long ones; short sentences are easier than long ones; and short paragraphs are easier than long ones. Shorter versions also get your ideas across in less space, making readers more likely to read them.

## Seek colleague advice

You may want to show your manuscript to colleagues before you submit it, partly for technical reasons but also for readability. The sentences that seem the clearest to you may cause your readers confusion. The results may be, at least at first, somewhat painful. Writing is such a personal process— our words become so much a reflection of ourselves that they are like flesh and blood — that criticism can be hard to take. Most writers learn, however, that such criticism is most profitable and heads off mistakes later. You should understand that dealing with critical analysis is part of the professionalization of your work; that is, criticizing your writing can lead to improvement, the same way that you may benefit from critical suggestions about research techniques or other facets of your work. If your colleagues can help you in the revision process — shortening, polishing, improving — take all the help you can get.

## REVISING

- Use action verbs.
- Vary sentence length.
- Shorten manuscript.
- Seek colleague advice.

CHAPTER 5

# On Citing Sources

When writing a technical paper, you must identify information you have used from other sources and the sources themselves. This accountability gives professional credit where credit is due.

Avoid trouble for yourself, editors, reviewers, and publishers: Find out if a particular citation style is required. Most journals do require a specific style, and those styles vary widely. So use the journal stylebook if one exists. If one is not available, study examples in a recent journal issue.

If all else fails, devise a style suitable to the subject matter and use it consistently. Aim for simplicity and utility. Long bibliographies are a good place to see examples of citation styles.

Rules for reference citations may seem complex, but they are necessary. Much editorial time is spent cleaning up reference lists, showing how poorly the rules are understood — and how much editors value them.

The following checklist shows the elements that should be included in a list of references:

- Author's surname and given name or initials. List the author's name the way the author uses it; or the editor's surname and given name.
- Publication date. The year usually suffices.
- Title of work, such as a journal article or book chapter.
- Special category of publication, such as abstract, edited work, editorial, or photograph.
- Title of publication, such as book, journal, symposium issue, or field guide.
- Volume number. Include part number and issue number, if the pages are not numbered consecutively, such as in a publication in which each article, chapter, or section is paginated separately.
- Name of publisher.
- Place of publication. Needed for nonserial publications.
- Page reference. Use the total number of pages if the entire publication was used, or list the pages of the part that was used in your work.
- Information that will enable a person to locate the reference if it is unpublished.

It is a good idea to spell out rather than abbreviate titles, particularly to avoid confusion when citing foreign and uncommon sources of literature. Space saved by abbreviations, many editors contend, is not worth the frustration for readers who cannot decipher abbreviations or for editors who must check and correct them.

Verify all information. Listing references is loaded with opportunities for error.

References should be listed at the end of your paper and should include only those sources you have cited in the body of the paper. Thus, a list of references differs considerably from a bibliography, which should include references pertinent to your topic, even if they are not cited in your paper.

It has been estimated that 15,000 serial publications include papers pertinent to geology. GeoRef, the database produced by the American Geological Institute and used to compile the *Bibliography & Index of Geology*, includes about 4,000 serial titles annually; some 2,000 of these include about 95 percent of the world's geological literature. GeoRef is an excellent source to search for references when preparing a paper. The database is available in many academic libraries, as a set of CD-ROMs, and on-line. GeoRef is easily searchable and often is the first step in any literature search.

Other databases commonly used for literature searches in the earth sciences are the Science Citation Index and the National Technical Information Services listing compiled by the Department of Commerce and covering reports from federal agencies and contractors.

CHAPTER 6

# Abstracting the Essence

The most-read part of a paper may be its abstract. Effective abstracts are concise, summarize conclusions and recommendations, and are amenable to computer storage and retrieval. In terms of number of readers, an abstract is easily the most essential part of a technical paper.

To help explain what an abstract is, we have included two views of abstracts. View one, by Kenneth K. Landes, was published in the *Bulletin* of the American Association of Petroleum Geologists in 1966 (Vol. 50, No. 9, p. 1992). View two is an excerpt from "Standards for writing abstracts" by B.H. Weil.

## View One

A Scrutiny of the Abstract, II

ABSTRACT

> A partial biography of the writer is given. The inadequate abstract is discussed. What should be covered by an abstract is considered. The importance of the abstract is described. Dictionary definitions of "abstract" are quoted. At the conclusion a revised abstract is presented.

For many years I have been annoyed by the inadequate abstract. This became acute while I was serving a term as editor of the *Bulletin* of the American Association of Petroleum Geologists. In addition to returning manuscripts to authors for rewriting of abstracts, I also took 30 minutes in which to lower my ire by writing "A Scrutiny of the Abstract." This little squib has had a fantastic distribution. If only one of my scientific outpourings would do as well! Now the editorial board of the Association has requested a revision. This is it.

The inadequate abstract is illustrated at the top of the page. The passive voice is positively screaming at the reader! It is an outline, with each item in the outline expanded into a sentence. The reader is told what the paper is about, but not what it contributes. Such abstracts are merely overgrown titles. They are produced by writers who are either (1) beginners, (2) lazy, or (3) have not written the paper yet.

To many writers the preparation of an abstract is an unwanted chore required at the last minute by an editor or insisted upon even before the paper has been written by a deadline-bedeviled program chairman. However, in terms of market reached, the abstract is the *most important part of the paper*. For every individual who reads or listens to your entire paper, from 10 to 500 will read the abstract.

If you are presenting a paper before a learned society, the abstract alone may appear in a preconvention issue of the society journal as well as in the convention program; it may also be run by trade journals. The abstract which accompanies a published paper will most certainly reappear in abstract journals in various languages, and perhaps in company internal circulars as well. It is much better to please than to antagonize this great audience. Papers written for oral presentation should be *completed prior to the deadline for the abstract*, so that the abstract can be prepared from the written paper and not from raw ideas gestating in the writer's mind.

My dictionary describes an abstract as "a summary of a statement, document, speech, etc...." and that which *concentrates in itself the essential information* of a paper or article.... May all writers learn the art (it is not easy) of preparing an abstract containing the *essential information* in their compositions. With this goal in mind, I append an abstract that should be an improvement over the one appearing at the beginning of this discussion.

ABSTRACT

> The abstract is of utmost importance, for it is read by 10 to 500 times more people than hear or read the entire article. It should not be a mere recital of the subjects covered. Expressions such as "is discussed and "is described" should *never* be included! The abstract should be a condensation and concentration of the *essential information* in the paper.

## View Two

An abstract, as defined here, is an abbreviated, accurate representation of a document. The following recommendations are made for the guidance of authors and editors, so that abstracts in primary documents may be both helpful to their readers and reproducible with little or no change in secondary publications and services.

Make the abstract as informative as the document will permit, so that readers may decide whether they need to read the entire document. State the purpose, methods, results, and conclusions presented in the document, either in that order or with initial emphasis on findings.

For various reasons, it is desirable that the author write an abstract that the secondary services can reproduce with little or no change. These reasons include the economic pressures on the secondary services caused by continuing increases in the volume of scholarly publication; the need for greater promptness on the part of the secondary services in publishing information about the primary literature; and the growing value of good authors' abstracts in computerized full-text searching for alerting and information retrieval.

In the proposed standard the term *abstract* signifies an abbreviated accurate representation of a document without added interpretation or criticism and without distinction as to who wrote the abstract. Thus, an abstract differs from a brief *review* of a document in that, while a review often takes on much of the character of an informative or informative-indicative abstract, its writer is expected to include suitable criticism and interpretation. While the word *synopsis* was formerly used to denote a resume prepared by the author, as distinct from an abstract (condensation) prepared by some other person, this distinction no longer has real meaning.

## Types of abstracts

An abstract should be *informative;* that is, it should present quantitative and qualitative information. Space limitations may influence the amount of information you can present but not the quality. Informative abstracts are especially desirable for texts describing experimental work and documents devoted to a single theme. Discursive or lengthy texts, however, such as broad overviews, review papers, and entire monographs, may permit an abstract that is only an *indicative* or descriptive guide to the type and contents of a document. A combined *informative-indicative* abstract must often be prepared when limitations on the length of the abstract or the type and style of the document make it necessary to confine informative statements to the primary elements of the document and to relegate other aspects to indicative statements.

Abstracts should not be confused with the related, but distinct, terms *annotation, extract,* and *summary.* An *annotation* is a note added to a title or other bibliographic information of a document to comment or explain, such as the notes on the references shown in the chapter entitled Reference Shelf in this book. An *extract* signifies one or more portions of a document selected to represent the whole. A *summary* is a restatement within a document (usually at the end) of its salient findings and conclusions and is intended to complete the orientation of a reader who has studied the preceding text. Because other vital portions of the document (for example, the purpose and methods) are not usually condensed into a summary, the term should not be used synonymously with *abstract.*

## Format

For long documents, such as reports and theses, an abstract generally should not exceed 500 words and preferably should appear on a single page. Most papers and portions of monographs require fewer than 250 words. Fewer than 100 words should suffice for notes and short communications. Editorials and Letters to the Editor often will permit only a single-sentence abstract.

Begin an abstract with a topic sentence that is a central statement of a document's major thesis, but avoid repeating the words of a document's title if the title is nearby.

In abstracts specifically written or modified for secondary use, state the type of the document early in the abstract if the document type is not evident from the title or publisher or if it will not be clear from the remainder of the abstract. Explain either the author's treatment of the subject or the nature of the document,

for example, theoretical treatment, case history, state-of-the-art report, historical review, report of original research, or literature survey.

Write a short abstract as a single, unified paragraph; use more than one paragraph for long abstracts, for example, those in reports and theses. Write complete sentences, using transitional words and phrases for coherence.

Avoid terms, acronyms, abbreviations, and symbols that may be unfamiliar to your readers unless you define them the first time they occur in the abstract. Include short tables, equations, structural formulas, and diagrams only when necessary for brevity and clarity. Try not to cite references.

A well-prepared abstract enables readers to identify the basic context of a document quickly and accurately, to determine its relevance to their interests, and thus to decide whether they need to read the entire document. Readers for whom the document is of fringe interest often obtain enough information from the abstract to make their reading of the whole document unnecessary. Therefore, every primary document should include a good abstract. Secondary publications and services that provide bibliographic citations of pertinent documents should also include abstracts if at all possible.

CHAPTER 7

# Drawings and Photos

Drawings, photographs, and maps are the usual artwork for articles. *Line drawings* are created by solid black lines, so they can be printed with text material. *Photographs* (both black-and-white and color) are continuous-tone images in which the images have a full range of tones from black to white. For printing, a screening process reduces these tones to evenly spaced dots of varying shape, size, and number. The density of the dot areas varies in direct proportion to the intensity of the image area they represent. *Maps* Can be either line drawings or color images.

Preparation of geologic maps is discussed in chapter 8, Readying the Map. Most geologic maps are printed in four-color process from separate plates for each color, prepared from drawings or negatives that a cartographer makes. However, it is possible to scan hand-colored maps electronically and to make color separations from the scan for process color printing. Full-color maps can also be produced by computer digitization and printing through electrostatic means (where light is reflected onto an electrically charged drum and toner is fused to the paper in the areas retaining a charge, such as a laser printer) or by pen or drum plotters. Making photographic copies of hand-colored maps is possible but expensive.

Good graphics are a must. Take the same care with artwork that you do with an original piece of research. Good graphics and good research make possible a magnificent presentation.

## Photos

Almost everyone can take photographs. For that reason, perhaps, a photograph is the form of illustration most abused. If you want to support your paper with good photos, take care that you are proficient with the camera or hire a qualified photographer.

**Taking photos.** Each photograph should be accurate and clear. Most nonprofessional photographers stay too far away from their subjects. If you know a geologic unit thoroughly, communicate this intimacy in your photograph. Get close to the subject, or plan to crop closely when you make the print.

Wait for good natural light if you are taking exterior photographs, or add light if you cannot wait. A poorly lighted photograph seldom shows the subject well and will be a poor illustration when printed.

If you do not know the general requirements for good photo composition, consult a how-to art or photography book. With care, you can take photographs that will improve your scientific contribution. If you do not feel that you can handle the photography needed for your manuscript, hire a technical or scientific photographer. The gain in artistic quality for your manuscript will probably be well worth their charge.

To find out what size photographic print to submit, ask the editor of the publication you are writing for or check the publication stylebook. Generally, editors prefer photographs that are slightly larger than the printed version will be. Allow an editor to determine the percentage of photo reduction or enlargement. Prints should generally have a high gloss to display a maximum amount of detail. Photographs also can be electronically scanned and turned into digital data; currently, quality of digitized photographs is often comparable to that of the original. Check with your editor on which is preferred. Advances in technology will make possible a digitized file of photographs that at least equal the quality in an original, and a digitized file has the capability of being enhanced electronically.

**Handling photos.** Cleanliness, neatness, and care are watchwords with all artwork. Once you have a good photographic print suitable for reproduction, treat it with great care. Don't dent it with paper clips, and never staple artwork. Identify it so that an editor can tell which photograph matches which caption. Refrain from writing on the back in such a way that the writing comes through as embossed lines on the front. To be safe, use rubber cement or tape to attach a caption (with your name, date, illustration number, and article title) on the back of each photo. Be sure the top of the photograph is marked clearly.

Do not write on the face of artwork, even if you would like lettering to appear on the printed picture; when the photograph is screened for printing, your lettering will be screened, too. If you want to draw lines or identify objects in a photograph, do the drawing and lettering on a transparent plastic overlay. The overlay needs to be clearly marked to assure proper registration — that is, so that marks on the overlay will be printed exactly where you want them to be printed. Generally, little circles with crosses in them, called bull's-eyes, are used for registration. Art stores stock them in adhesive rolls and in sheets. Place register marks outside the margins of both pieces of art, one aligned exactly over the other. Three marks on each sheet should guarantee registration.

Art stores also stock letters and numerals in a variety of styles and sizes, as well as symbols and patterns, suitable for doing professional lettering on your overlay or drawing if you are expected to submit final copy. Once you have made an overlay or drawing, treat it with care. If a drawing has been made with anything that can smear, such as pencil or charcoal, spray it with a fixative. Cover all artwork with a protective sheet of paper. Remember that any writing, even erased pencil lines drawn for lettering, or writing on a sheet of paper on top of a photograph, may leave pressure marks that will show when printed.

## Cropping

Be sure to obtain a clear photograph in good focus, cropped (trimmed) as you would like it. If the photofinisher has not cropped it enough, you can indicate further cropping to an editor by making a paper mask to go around the photo on all sides. The mask will not interfere with the system used to mark cropping limits and reductions for the printer. Suggestions for cropping follow:

- Enhance a subject. Crop a photo to stress its purpose. If a caption reads "The rock is horizontally layered," then the best cropping would probably be horizontal.
- Crop tightly to a subject, maintaining good composition and photographic interest.
- Crop to improve composition. Reduce distractive elements, focus on a subject, and improve balance and relationship of design elements in a photo.
- Crop to remove photographic blemishes.
- Watch the scale. A graphic scale is by far the best type of scale. If an object indicates a scale in a photograph, don't crop out that object unless you show the scale in some other manner. If you must use a caption that gives a mathematical scale for the photo, be sure that the scale is maintained in printing. You will need to recalculate a scale if a different size photo is used.
- Do not crop people out of a photo if they contribute to reader interest in the subject or if they indicate scale or depth of field. (Do not, however, allow people to distract from the purpose of a photo.)
- Vary the shapes of photos to add interest to a page. Unless uniformity is a deliberate means of design, avoid it. Uniformity does not ensure quality.
- In general, make sure that scenics, or photographs encompassing large areas, will be printed larger than close-ups.

## Scales

A scale in a photograph should be identified in a caption (for example, 20-meter tree). If a photograph has no scale, you may add a *graphic scale* on an overlay or state the *mathematical scale* (amount of magnification or reduction) in a caption. Your editor should take mathematical scales into account when calculating printing enlargements and reductions. But editors sometimes forget or miscalculate — so graphic scales are greatly preferred.

Line maps and figures, illustrations that do not need to be converted into dots for printing, should be drawn clearly to present a neat, legible appearance when printed. In general, they should be drawn larger than they will be when printed — 15 percent larger works best. That way, lines will appear cleaner but the size of the drawing is not changed dramatically. Any lines or letters must remain bold and clear after being reduced.

If you can afford it, you may want to have your drawing reduced photographically or by photocopier to show you exactly how it will look when printed. Some editors prefer to use a reduced photographic negative and a positive print rather than original artwork. If your artwork is publishable without changes,

this is an excellent option; if not, you may be asked for originals. If your budget cannot bear the cost of a negative, you can have your drawing reduced by a photocopier to check your work. A printed illustration will be much better than a photocopy, but don't let faith in the printing process blind you to faults in your drawing.

To save wear and tear on original artwork, you may wish to submit only photocopies of your drawings (but never of the photographs) until your article has been accepted for publication. Photocopies, however, are *not* suitable for publication. If you have created graphics on a computer, find out if the journal uses the same graphics software that you use. If so, you can send a copy of your graphic on a diskette. An editor can then revise a graphic if necessary and place the figure in electronic form in a page layout. Always include a printed copy of a graphic in the event that electronic transfer fails. If you have hand-drawn graphics, an editor may still have them digitized through scanning so that they can be placed electronically.

## Size and shape

The proportions your drawing or photograph will have if reduced can be determined in several ways. The easiest way is to use a reducing lens or a simple proportional-scale device (both are available at art stores). Other ways use graphic and mathematical methods. Such methods will tell you if your reduced drawing or photograph is the right shape, but not if it will be legible.

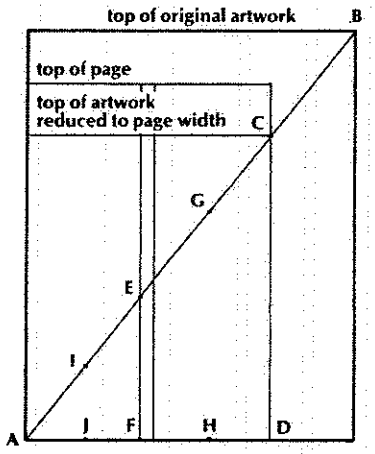
Although as author you should plan your drawings to fit the format of the journal selected, you should not mark reductions on illustrations. An editor is responsible for marking the illustration size reduction for a printer.

Some journals require a border around each illustration. Check to see if a border is required; if not, let the editor decide whether your artwork will be improved by a border. (Too much bordering can kill an illustration.)

## Figuring reductions

Figuring reductions for artwork is generally done by an editor or designer. Very rarely, an author will have to figure reductions. If you must calculate reductions, the graphic method or a mathematical method should help you:

**Graphic method.** The graphic method uses a diagonal line and a ruler to figure reductions. If you assemble your work on a light table, you will be able to see easily the different layers of pages you are using.




- Make a dummy of the page shape used in the journal, as shown in the figure. Note that the figure shows a page with a two-column layout.
- Place a tissue overlay over the dummy page.
- If an illustration is to be within page or column margins, place the lower left corner of the illustration at A, under the dummy. On the tissue overlay, very lightly draw a diagonal line from A to B, at the upper right corner of the illustration.
- To reduce an illustration to a page width, measure the illustration height from C (where the margin intersects line to the bottom of the page at D. That measurement is the height of the reduced illustration.
- To reduce an illustration to a column width, measure the illustration from E to F.
- Any intermediate width can also be measured (for example, at G-H or I-J).

**Mathematical method.** Set up a simple ratio-and-proportion equation, for example:

present width : present height = reduced width : reduced height

5 inches : 4 inches = 2.5 inches : y inches

Solve the equation: $5y = 4(2.5)$. The reduced height (y) will be 2 inches.

## Writing captions

Check to see if a journal requires captions for all artwork or uses a specific caption style. A single word or phrase may be sufficient for some journals; others may require complete sentences. Writing captions has no hard-and-fast rules. Maintain consistency in style, whether you use single words or simple declarative sentences. Perhaps you need a caption that states *Figure 1*; perhaps it should state *Figure 1: Map shows the southeast corner of the northwest part of the Eldorado 15-minute quadrangle, Boulder County, Colorado.* In identifying features on a photograph, use either letters or numbers on an overlay and explain them in a caption. Give all necessary credits. You do not need to identify people in the distance in photographs unless they provide necessary information. Courtesy requires that you identify people in a foreground. You must supply a typed list of your captions with your manuscript. Key each caption to the correct piece of artwork so that the editor does not have to worry about mixing them up.

It is both an editor's and an author's job to make sure captions are as clear, complete, and concise as possible. The author should mark the position of each illustration in the margin of a manuscript, so that pertinent text will be printed as closely as possible to the illustration. Before you send the text and artwork to press, check again to be sure that each piece of artwork and each overlay is identified and clearly marked for reduction. You must be especially careful to mark each illustration so that the printer cannot possibly confuse them.

Label each illustration outside the margin, where the label will not be printed. As author, you must identify yourself, your article, and your illustration; for example, *Robert F. Smith, Ross ice sheet, figure 1, green over-lay.* An editor can add the journal name and other necessary information.

## Printing in full color

Full-color printing is expensive, because color is complicated and difficult to reproduce accurately. A good example is minerals, which are often colorful to the eye, but their colors are difficult to reproduce. A photographic reproduction of a mineral rarely does justice to the mineral; consequently, a printed illustration is rarely an accurate representation of the original mineral.

The main reason that printed color does not always show accurately colors of actual objects or colors seen in color transparencies (or color slides) and color prints lies in the different ways color is seen, photographed, and printed. When colors you see are photographed, the colors are reproduced chemically. When these chemically produced colors are translated into printer's ink, a different system of color is used. A printing process called full-color process printing reproduces the full range of colors. Full-color printing uses four colors, called process colors. When printed, the process colors appear as tiny dots of solid color, which are combined in various sizes and patterns to duplicate the full range of colors in an original print or transparency. Colors are mixed optically, by the eye of the viewer.

Two types of color photographs can be made: photos made from color negatives, from which you can have photographic prints made in color or in black and white; and color transparencies, which are see-through positives. Either can be used to make printing plates after the colors are separated photographically or electronically. If you are using color photographs, ask the editor which kind of color photo will best fit the journal's production methods: a color print or a color transparency. If you plan to publish in black and white, take black-and-white photographs. A color photograph can be printed in black-and-white, but the printed image will not be as clear as one made from a black-and-white photograph.

Hand-drawn color artwork for full-color process printing may be sent to the printer separated by the artist, in which case you will submit overlays for the various colors and shades of color to be printed, or unseparated. Colors in an unseparated illustration (for example, a painting or a color drawing) must be separated to be printed.

A color scanner may be available to digitize your artwork. Check with your editor to find out if you can use color in a publication and in what form the editor wants your work.

## Preparing slides for lectures

If you are like most scientists, you will not make many color photographs or slides with publication in mind. Instead, you will make them to illustrate talks and papers to be given to students, colleagues, or the general public. You will, no doubt, want to add other slides to them to complete your lecture.

In preparing slides, keep in mind the proportion of a 3-inch by 5-inch card, vertical or horizontal. If you are using 8 1/2-inch by 11-inch paper to prepare your illustration to be shot as a slide, use 18- to 24-point type (0.25-0.33 inch), preferably Helvetica or another clear, easy-to-read, sansserif typeface. Use uppercase and lowercase letters, because all uppercase letters are extremely difficult to read in a slide. Line weights should be proportionally heavy.

When you prepare illustrations, keep in mind that they may be slides. Rarely will a printed diagram, map, or drawing become a good slide without extra work. References listed in the chapter Reference Shelf provide guidance for creating effective slides. The following suggestions by Duncan Heron for preparing and presenting a slide talk are reprinted from the *AGI Data Sheets* (American Geological Institute, third edition, 1989).

The purpose of a slide talk is to communicate one or more ideas to an audience. Data are presented as maps, graphs, charts, and photographs. Gathering scientific data is often a long and expensive process. Prepare your presentation as carefully as you gathered your data, and consider the following aspects: copy, production, and showmanship.

## Copy

Design and art production are separate but closely related parts of preparing slide copy. Try to follow these rules for a design:

- Keep the design simple with only one idea per slide.
- Plan your design at a 2:3 ratio, using either 6" x 9" or 8" x 12" paper.
- Keep the format horizontal.

Once you have a design, show it to a colleague and briefly explain the point of the diagram. Then remove the diagram and ask questions. You should quickly know if your design works.

You or an artist may prepare the art, using many methods, including a computer (CAD); dot-matrix graphs do not, however, make good slides. Slide copy must be bold: Letter size, line weights, and symbols should be large. Remember these guidelines for art production:

- Letter size is a function of copy size and viewing distance. Using Pratt and Ropes' (1978, *35-mm Slide*, AAPG) assumption that maximum seating distance is six projector screen widths, to determine minimum letter size, take the longest dimension of the slide image area and multiply by 2. This gives the type point size. Convert to inches by multiplying point size by .014. Some examples follow.

| Longest image dimension | Point Size | Inch Size |
|---|---|---|
| 9 | 18 | 0.25 |
| 12 | 24 | 0.33 |
| 18 | 36 | 0.50 |

- Line weights should be thicker than those in journal illustrations. A minimum of 1/32" is used with a 6" x 9" image area. Make prime data lines two times heavier, or 1/16".
- Bullet size for 6" x 9" should be no smaller than 0.10". Use a larger size for the most important data points.
- Letter style should be simple and uniform. Avoid script and gothic, outlined, and similar fancy letter styles.

- Color should be used to emphasize the important point of the slide and to replace cross-hatching and other patterns. Colors used on maps or sections should conform to U.S. Geological Survey usage for rock types.

## Production

Turning the finished artwork into a slide is essentially a copying process. Try to follow these rules for manual production:

- Use a copying stand equipped with 3200 K lights.
- Use a 35-mm SLR camera in the manual mode.
- Use daylight slide film with an 80A blue filter, or use tungsten film and no filter.
- Align the copy so that it fills the frame and is square with the border of the frame.
- Use anti-glare glass if reflections are a problem.
- In the manual mode, determine the exposure on a gray card (a neutral test card with 18% reflectance).
- Make extra exposures by bracketing one stop above and one stop below the gray card reading.

Electronic slide production also is widespread. Presentation software, film recorders, slide scanners, and software to enhance photographs are all available and constantly improving.

## Showmanship

A polished slide talk is a result of well-planned slides, careful integration of the slides with oral presentation, and practice. One cannot over-emphasize practice. Some guidelines follow:

- Clean and preload your slides.
- Make certain the slide on the screen corresponds to what you are saying. The slide acts as a prompt-card. When you change to another point, change to a related slide. If you don't have a related slide, leave the screen black or use a neutral gray blank slide.
- Never return to a previous slide. Use a duplicate.
- Look at the audience, not the screen.
- Do not overuse a pointer.
- Avoid the phrase "I apologize for this slide, but..." If you must apologize for a slide, do not use it. If you must use a poor slide, do not apologize.

### PREPARING YOUR ILLUSTRATIONS

- Use clear photos in good focus.
- Handle photos with care.
- Label each illustration outside the margin.
- Include a graphic or mathematical scale in captions.
- Write clear, complete, concise captions.
- Use uppercase and lowercase letters in slides.

CHAPTER 8

# Readying the Map

Had we but world enough and time, we could produce maps slowly and beautifully as we once did. But the world is shrinking and time speeding, and today's demands are for maps today. The usefulness of maps is the major reason for increasing demand. Geologic maps are sophisticated tools, capable of presenting millions of bits of data in an extremely efficient manner.

Before you undertake to make a map, consult with an editor to find out a journal's size and printing limitations; an editor should check with a printer. At most state geological surveys, geologists may consult with the cartographic supervisor as soon as they receive a map-making assignment, and long before starting field work. The supervisor supplies the best possible base map to use. Most likely, the base map will be especially compiled for the job and printed in green on heavy translucent Mylar film. The map can be drawn directly on this base, without fear that it will stretch or shrink out of scale. After compilation, several techniques can be used to produce a finished map. Three methods are described.

## Preprinting preparation

To prepare a map for conventional full-color process printing, begin by making an Ozalid print (a blueprint) of the map for checking and editing. When the map is ready for a cartographer, the green base can be photographically eliminated, leaving only an author's black lines representing the geological data to be transferred. If needed, the green lines can be retained as check points; because they are green, they are easily separable from a geologist's black lines. Decisions are made on colors, screens, and patterns so the cartographer can proceed. It is necessary to correctly register the different layers of the map (such as the base, culture, geology, etc.) at this time for precise color registration during printing. Registry holes can be punched at a printer's or cartographer's shop. Bull's-eyes are applied to all sides in an irregular fashion to show clearly the top and bottom of a map. The map is transferred to a special film that is coated with an opaque layer, called a scribe coat, then photographically transferred to a film with a coating that can be peeled off to expose areas. The cartographer scribes — or cuts the film away — to make negatives of a map, one sheet of film for each color and pattern. These negatives must be registered, or the lines of the map will not match up and will be distorted in printing.

## Camera separation

In camera separation of hand-colored maps for four-color process printing, the initial procedure is similar to that for the conventional method: Authors compile field data on scale-stable green- or blueline copies of base maps. After the map has been approved, however, the author covers the linework or data with an overlay of frosted film and adds color by pencil, acetate film, or other mediums. When the overlay (which becomes the camera-ready copy) has been colored, checked for accuracy, and reviewed and approved by the author, four negatives are prepared. One is a combination negative of the base map (probably screened), lettering, and other positive work. The others are negatives prepared by photographing the colored overlay three times, once each with a filter of the primary colors for photography or light (blue, green, and red). Each overlay is made into a plate, which is printed in black, yellow, magenta, and cyan. Again, several elements make up the complete map: the base (usually area or county borders, screened so as to not detract from the black-line data), the frosted-film overlays for black-line data and lettering, and one overlay for each color. Each overlay must be registered with the others.

The following steps must be taken to prepare registered artwork:

1. Register a frosted-film overlay by hand-punching registry holes and adding bull's-eyes to a scale-stable base map. A graphic arts department of a photo supply store should have register pins and punch. The overlay will become the black-line base art or database. The database will usually have been drafted in ink, but it can also be scribed (where film is cut away to create a negative). Inked lettering and type can be put directly on the data overlay unless they are on paper or other opaque material. If so, another overlay must be prepared.

2. A separate overlay for type must be exactly registered to the database overlay. The type itself can be a mixture of strip film, cutup typewritten paper, or photocopy held in place with transparent tape. (For uniform results, you should stick to a single medium.)
3. The frosted-film overlay for color is prepared last; then, after registration, hand coloring can begin.

## Computerized cartography

Personal computers make drafting maps much quicker than hand-drawn methods. Computer-generated maps are made with commercially purchased mapping applications (using existing data sets) or a scanner and a drafting program.

To generate maps using computers, map data are entered into a computer in numerical form, or an existing map is digitized — converted into numbers. Data sets generated on a digitizing table from a paper or Mylar map are entered into a computer. Numbers are manipulated and combined with additional base-map files, such as county boundaries and township-and-range lines. Once data are digitized, they can be displayed using map-making software packages that are commercially available. A map can be edited on a computer screen, or it can be plotted, using such computer-driven plotters as drum, pen, or electrostatic plotters, and edited on paper. Corrections are entered on a computerized version.

Once a computerized map is completed, a final product can be plotted and printed. Depending on the type of plotter, the map may be produced in black-and-white, in a limited number of colors, or in full-color. These maps can then be printed. However, problems may arise during printing, because patterns applied by a plotter may conflict with screen angles applied by a printer. Computers can also be used to speed printing. For example, some types of plotters can be used to produce scribe coats.

Generating maps by computer allows much easier updating or correction, so that new versions of a map can be produced quickly. In addition, by using Geographic Information System (GIS) software, maps can be generated at a variety of scales or with any combination of thematic elements.

Page-size, black-and-white maps for book and journal publication can be scanned into digital form to be used as a template in a drafting program. A template is a file that acts as a starting point for other illustrations. After a map is scanned, a file can be opened in a drawing program and drafted. Patterns and screen tints, explanation text, and other labels can be added to areas on a map. A map can be saved in a format that can be imported into a page composition program. All corrections can be made electronically and a floppy disk used for printing. Small, colored flat-color (spot color) maps can also be produced this way, with color separation for four-color process printing done electronically at a printer.

## Limits of size and paper

Before settling irrevocably on a certain style or size of a map, you should be aware of certain limits. Paper size and press size need to be considered. Large maps can obviously present much more detailed information than smaller maps. Large maps, however, besides being unwieldy, do not endure; they are often folded incorrectly so many times that soon they disintegrate into a mass of crinkles. A major publisher of geologic maps has a press that will accommodate paper up to 42 inches by 58 inches. That size map is so large that one must crawl across it to see detail at the center; it may serve in a library or classroom, but it is almost unmanageable in the field.

With the advent of computers, the same map can be produced at a variety of scales. The scale of a map should reflect the scale at which data were collected and meant to be displayed. For example, if data for a geologic map were originally compiled at a scale of 1:100,000, the same map can be generalized and reproduced at 1:500,000 with a loss in detail but no loss in accuracy. The same 1:100,000 map cannot be reproduced at the more detailed 1:24,000 scale without giving a false sense of the map's accuracy.

Although authors seldom have control over the kind of paper used, editors do — they should insist on long-lasting, acid-free paper in durable, acid-free pockets. Paper containing much sulfur disintegrates quickly on library shelves.

## Symbols

Commonly used symbols for topographic maps are included in U.S. Geological Survey publications. There is no universally recognized standard for geologic map colors or symbols, such as contacts, lithologic types, and structural relationships. To choose the most appropriate symbols for your map, consider the following suggestions:

- Review the U.S. Geological Survey system for geologic map symbols, which is discussed in *Suggestions to Authors* (See chapter 8, Reference Shelf, "Stylebooks" section). Map symbols are also listed in chapter 8, "Symbols" section.
- Review other maps drawn to similar scales — if any exist — to show features similar to yours that have been mapped in other locations.
- Most important, include a complete legend or explanation that defines all the symbols you use in your map, including the significance of various tints, lettering styles, and other overprints used.

## Checklist

Maps, legends or explanations, and cross sections should be checked for the following:

- Completeness.

  All units are labeled.

  Formations in the legend and cross section are also on the map.

  Geographic locations mentioned in the text are shown on the map.

- Correctness.

  Plotting is correct.

  Names are spelled correctly.

  Spelling on the map agrees with that in the text.

  Locations described in the text and shown on cross sections agree with the map.

  Numbers are correct.

  Names and ages in the legend agree with those on the map and in the text.

  Symbols in the legend are also on the map and those on the map are also in the legend.

  Colors and patterns in the map and cross sections match those in the legend.

  Dips drawn in a cross section agree with those on the map.

  Scale is appropriate to data presented.

  Colors or black-and-white are used correctly to show data.

- Title. A concise, yet complete, title should include subject and location. Include the state, possibly the county, and perhaps the country, for example, *Geologic map of Kern County, California, U.S.A., or Map of the tectonic features of the United States.*

- Author, compiler, contributors, and sources of data or base maps.

- Scale, preferably both graphic and numerical.

- Contour interval and datum, where appropriate.

- Fieldwork or compilation dates.

- Publication or copyright date.
- Publisher name and location.
- Distributor name and location, if needed.
- Identification of series and sheet if more than one sheet is used, for example, *Economic Mineral Investigation 3: sheet 2.*
- Arrows showing true and magnetic north, and declination.
- Sponsors, drafters, and cartographers (so labeled). These contributors need to be labled as such (for example, Dow Jones, cartographer) so that they are clearly differentiated from the map's authors.
- Geographic reference points and grids, such as township-range grid; longitude-latitude; Army Map Service grid.
- Lines of cross sections.
- Identification in upper right corner, for example, *Map Sheet 54, Dubuque quadrangle.*
- Color or pattern block and explanation of all units on the map; most maps will include age designations and abbreviated lithology.
- Explanation of symbols.
- Horizontal scale, if different from the map or separated from it.
- Vertical scale or vertical exaggeration.
- Orientation.

For United States national map-accuracy standards, write to the U.S. Geological Survey, Reston, Va. 22092. A published map meeting these requirements should say in the legend, *This map complies with national map-accuracy standards*. Given the litigious nature of today's society, a disclaimer may also be appropriate for certain maps, particularly those that may be a source of information for economic or health-related decisions. Disclaimers can clarify the standards of accuracy used in a map's compilation, and they can state that the publisher is not responsible for decisions based on a map.

## PREPARING YOUR MAPS

- Check journal size and printing limitations.
- Choose appropriate map symbols.
- Include a complete legend.
- Use checklist when verifying maps, legends or explanations, and cross sections.

CHAPTER 9

# Rules for Geologic Names

Things, time, places, and events form the basic framework for writing geological reports. Over the years, stratigraphers, structural geologists, and other specialists have named these categories to aid communications. Certain conventions have been adopted so that names have a similar meaning for everyone.

## Stratigraphic classification

The following information about names and their usage has been adapted from several sources, primarily the U.S. Geological Survey (USGS), the American Commission on Stratigraphic Nomenclature, and the International Subcommission on Stratigraphic Classification.

Stratigraphic classification is a systematic organization of rock strata into units with reference to any or all of the characteristics or properties they possess, especially lithologic character, fossil content, age and time relationships, seismic and magnetic properties, electric-log characteristics, mineral assemblages, lithogenesis, and environments of deposition or formation. Lithozones, biozones, chronozones, mineral zones, and other zones usually designate minor stratigraphic intervals in their classification categories. A zone name is capitalized when used as a formally named unit.

In general, formally named stratigraphic units are capitalized when used in their entirety. For example, in the Hutchinson Salt Member of the Wellington Formation, all proper names are uppercase; if only Hutchinson salt is used, the "s" in salt is lowercase. The Names Committee of the USGS prefers that plural formal names retain capitalization, contrary to most style manual rules for plurals of formal nouns; for example, when referring to both the Lansing Group and the Kansas City Group together, preferred USGS usage is Lansing and Kansas City Groups rather than Lansing and Kansas City groups.

o Lithostratigraphic units are bodies of rock strata characterized by a unique lithology or a combination of lithologic types not present in adjacent units. The formation is the fundamental mappable unit of lithostratigraphic classification. Formally named formations are capitalized, for example:

*the Dundee Limestone, a Middle Devonian formation in the Michigan basin*

*the Flathead Sandstone, a sandstone deposited on a Cambrian sea floor in what is now Wyoming*

A formation may be subdivided into members, such as the formally named *Ferron Sandstone Member in the Mancos Shale*, or the informally named *green shale member.* Members may be divided into beds, for example, such as the Fence-post limestone bed in the Pfeifer Shale Member. Two or more associated formations having significant lithologic features in common may be included in a group, such as the *Cisco Group.*

o Biostratigraphic units are designated by fossil content or by paleontologic character that differentiates them from adjacent units. The basic unit is the biozone. Formally named biozones are capitalized:

*the Heterostegina Assemblage Zone of the Gulf Coast area*

*the Cardioceras cordatum Range Zone*

o Chronostratigraphic units are bodies of rock formed during some specified interval of geologic time. Examples of formally named units are *Phanerozoic Eonothem, Paleozoic Erathem, Silurian System, Middle Silurian Series,* and *Tonawandan Stage.* Corresponding geochronologic units, representing the time during which the chronostratigraphic units were formed, are *eon, era, period, epoch,* and *age.* Thus, rocks of the Silurian System were deposited in the Silurian Period of the Paleozoic Era.

The stratigraphic column in this chapter is organized to allow generalized correlation between measured time and occurrence of time-rock units.

## Guides to usage

A series of guides to U.S. stratigraphic usage have been prepared by the American Commission on Stratigraphic Nomenclature. The latest revision, entitled *Code of stratigraphic nomenclature,* is available from the American Association of Petroleum Geologists. The guide is an explicit statement of principles and practices for classifying and naming stratigraphic units. Some conventions from the guide follow.

o Words used in formal names of rock-stratigraphic (lithostratigraphic) units are capitalized:

*Ash Creek Group, Chinle Formation, Kirtland Shale, Church Rock Member, Sonsela Sandstone Bed*

Informal names, as an unnamed sandstone bed in the Chinle Formation, are not capitalized: *a Chinle sandstone bed.*

o Capitalization of formal and informal names of time (geochronologic) and rock-time (chronostratigraphic units) follows similar conventions:

*Paleozoic Era, Devonian Period, Cenomanian Stage, Cenomanian Age*

but

*Devonian time, Devonian age, and Paleozoic age*

The last example is a mixture of formal and informal time terms.

o Formal names of zones are capitalized, except for the italicized or underscored species name of a plant or animal:

*Buliminia excavata* Concurrent-range Zone

o The terms *lower, middle,* and *upper* are capitalized when they describe formal series subdivisions of a system; *early, middle,* and *late* are the corresponding formal (and therefore capitalized) time terms:

*Upper Cretaceous rocks were deposited in Late Cretaceous time.*

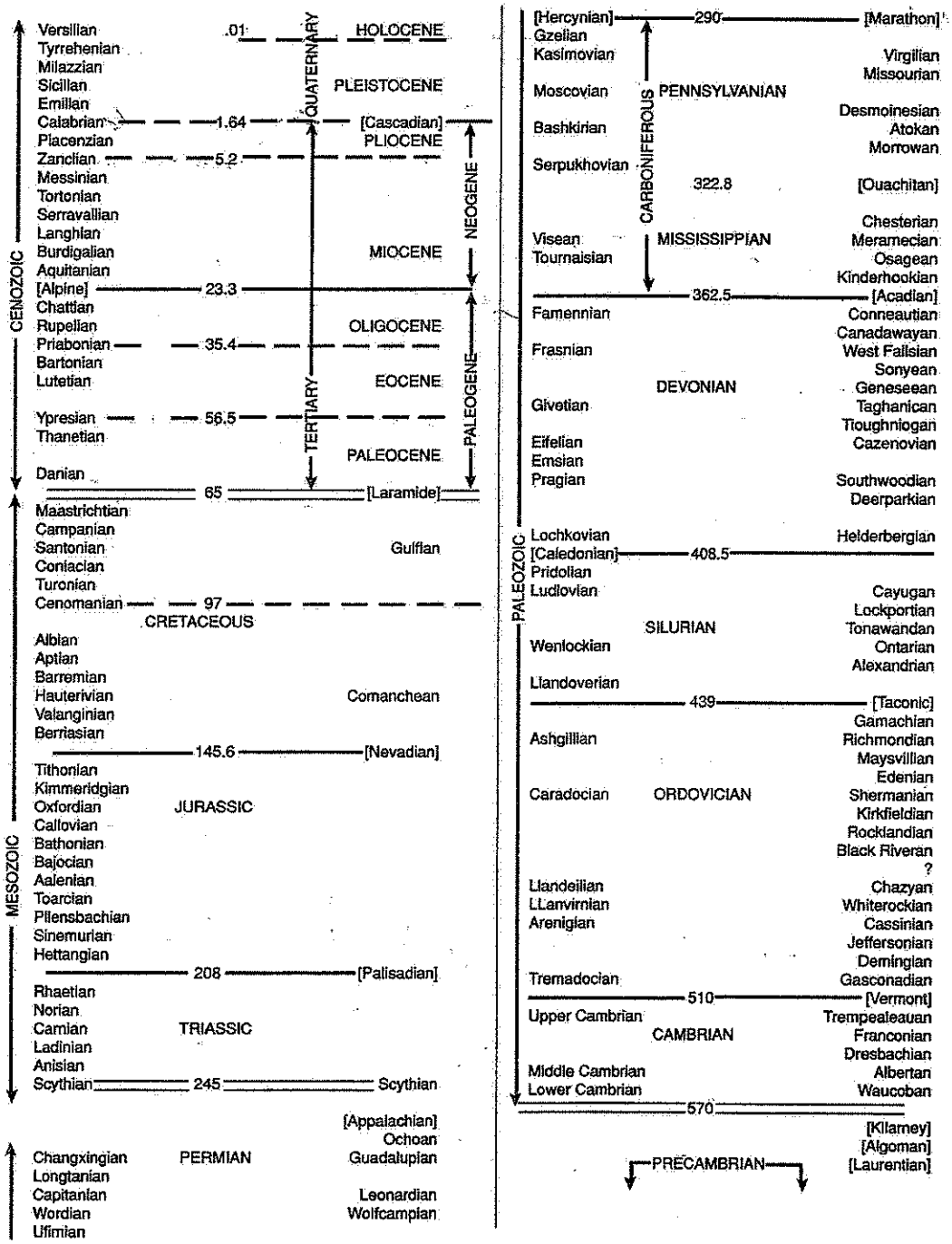
o The terms *lower, middle,* and *late* are lowercased when they describe informal chronostratigraphic units. The corresponding informal time terms *early, middle,* and *late* are lowercased when they describe subdivisions of eras; formal series of the Tertiary, such as *lower Pliocene* or *early Pliocene;* and provincial series, such as *lower Atokan* or *early Atokan.* Distinction between formal and informal chronostratigraphic terms are found in *Suggestions to Authors.*

Proposed lithostratigraphic units should be described and defined clearly for easy recognition. An intent to introduce a new name and the important factors that led to discrimination of the unit should be clearly stated. A definition should give the geographic or other feature from which the name is taken and the specific location of one or more representative sections near the geographic feature. Specific reference to location in section, township, and range, or other land divisions should be included. Thickness, lithology, color, and age of the unit should be given.

## U.S. Geological Survey bulletins

U.S. Geological Survey Bulletins 896, 1056-A, 1056-B, 1200, 1350, 1502-A, 1520, 1535, 1564, 1565 (all lexicons and reference works on stratigraphic nomenclature) provide definitions and published references to formally named geologic units in the United States. These publications are also available on CD-ROM. For questions on specific place names, check with the Board on Geographic Names (c/o U.S. Geological Survey, Reston, VA 22092). Fossil names should adhere to conventions of the International Rules of Zoological Nomenclature and the International Code of Botanical Nomenclature.

This chart shows general correlations between absolute time—in numbers—and the occurrence of formally named rock-time units. Dates at system or series boundaries are in millions of years (approximations, of course). The smaller divisions are stage names except for the Cambrian series listed. European (left) and North American classifications given. Brackets mark major orogenic climaxes.




Information compiled from U.S. Geological Survey *Suggestions to Authors* (7th ed., rev. and ed. by Wallace R. Hansen, 1991; *Geological Time Table* (3rd ed., comp. by F. W. B. Van Eysinga, rep. 1983, Elsevier Scientific publishing Co.); and *A Geologic Time Scale 1989* (by W. Brian Harland, Richard L. Armstrong, Allen V. Cox, Lorraine E. Craig, Alan G. Smith, and David G. Smith, 1990, Cambridge University Press).

CHAPTER 10

# Judgment by Peers

Every manuscript submitted for publication should represent an author's best efforts. Ideally, it has been written, rewritten, set aside for a cooling period, rewritten again, and polished. Even if all these steps are taken and a manuscript is an author's best effort, it will still benefit from technical review. An author is too close to the work; a fresh, objective look by someone else is essential to spot errors in fact or reasoning, methodological problems, inconsistencies, or poor presentation that obscures what an author has tried to convey.

Technical review may be sought from colleagues either during or after preparation of a manuscript. Advice from such sources is helpful, if not indispensable, in the formulation of ideas; but it is seldom sufficient in itself. Colleagues usually already know a good deal about an author's project from earlier conversations, and hence may fall into the same traps as an author. Moreover, colleagues' reviews are apt to be cursory. Review by coworkers, professors, or superiors, though highly recommended, should not replace objective review by outsiders.

Large research organizations that produce publications, as well as journals that publish formal papers submitted by the technical and scientific community, usually maintain a technical-review system for manuscripts. The purpose is to provide independent advice to an editor on the technical quality of submitted manuscripts, to aid in selection or rejection of manuscripts, and to help authors in improving their presentations. Technical review is considered an essential part of the writing-publishing process.

Manuscripts submitted for publication range from poor to excellent. Not surprisingly, the overall quality, both in thought and expression, is directly related to the quality and quantity of the technical review a manuscript has already undergone. Differences between manuscripts from independent geologists or small, understaffed and overworked college faculties and from larger institutions that can maintain elaborate systems for manuscript processing and in-house review can be great.

## Typical review system

Technical-review systems are almost as numerous and varied as the publishing houses that have adopted them. The system described is reasonably comparable to those followed by many earth-science journals.

In this review system, the editor, usually a volunteer, is responsible for a society's entire publication program. The editor's chief responsibility is to make final decisions on the technical and scientific quality of all papers and books that the society publishes. No one geologist can know enough about all the earth sciences to make the required judgments. Instead, the editor relies heavily on a group of associate editors and on technical reviewers chosen by them.

When a new manuscript is received, the editor scans it just enough to decide which associate editor is most likely to be able to pass judgment. These associate editors, all volunteers, are chosen to provide as broad a spectrum as possible of topical and geographic knowledge of the specialties that are collectively known as earth science.

The associate editor is asked in advance, usually by phone, if he or she has the time and the requisite knowledge of the subject matter to deal with the new manuscript promptly. If so, the associate editor selects one or more technical reviewers who are broadly or specifically knowledgeable in the subject matter, and who are able and willing to review the manuscript for the society.

The associate editor and the technical reviewers are asked to read a manuscript and advise on its acceptability from the standpoint of scientific soundness, originality, breadth of interest, and length. In judging length, some compromise is usually desirable between the author's need to tell a complete story and the editor's need to conserve space.

Technical reviewers send recommendations to the associate editor as written commentaries or as marks and notes throughout the text. The associate editor reviews the manuscript and the reviewers' comments

and advises the editor of the combined results. The editor must make the final judgment on publication — acceptance as is, acceptance upon revision, or rejection — and transmit it to the author. Reviewers may remain unknown to the author, unless they agree to have their names made known. The author may also be anonymous to reviewers. Many publishers believe that an anonymous review process provides more valuable criticism of manuscripts.

Organization and style also are examined by technical reviewers, because no research results, no matter how excellent, will be read or understood if they are poorly expressed. Matters of style and expression are considered less important at the review stage; they can be improved later while the manuscript is being polished and prepared for the printer. The chief objective of the technical-review process is to help the editor decide whether to accept a given manuscript, not to rule on details of its presentation.

## After a review process

A review process is not intended to stifle an author scientifically nor to dictate preconceived notions held by technical reviewers. No reputable publisher wants to act as a scientific censor. Publishers seek scientific excellence, neatly and clearly presented. The purpose of a review process is to find such excellence and to help an author bring out the best in a manuscript for the ultimate advancement of science.

A tiny fraction of submitted manuscripts comes through the review gauntlet unscathed; these are recommended for publication virtually without change. They may be turned over to a managing editor, whose staff will prepare them for publication.

A number of manuscripts are rejected after they have been reviewed. Rejection may be based on judgments that the subject matter belongs more properly in some other publication. Other reasons may concern elements that reviewers were asked to consider, such as relevance and currency of research as well as adequacy of supporting data, references, cost of illustrations, and manuscript length. Editors realize that, no matter how firmly rejected, most manuscripts will inevitably come back to them or go to other journals. That is good, for almost every piece of research contains some elements of truth that deserve publication somewhere.

A vast majority of reviewed manuscripts are returned to authors with requests for revision, which range in scope from minor to major. A major revision may require what amounts to a completely new paper. In such cases, an editor may put the new version through the review process again, often using different reviewers from those who read the earlier version. For minor revisions, an editor may read enough of the revised version to be sure that an author has made a conscientious effort to follow reviewers' advice. If so, the manuscript is accepted for publication and put in the mill.

## Author and reviewer

Authors react to criticism of their manuscripts in a variety of ways. Some welcome help, or at least acquiesce gracefully; others fly into a rage and see ignorance, if not foul play, in every mark made by technical reviewers.

Although authors seldom believe it until they become reviewers themselves, reviewers are usually people of good will, genuinely trying to help an author. Reviewing can be a thankless job. Rarely does a reviewer read a manuscript that contains some germ of new thought within his or her specialty. More often, a reviewer is an unpaid volunteer, doing a job out of loyalty to science and to the publishing society or institution.

Authors should approach reviewer comments with an open, cool mind. A reviewer is on their side, and every comment deserves thorough and objective consideration.

## Fairness — and tact

Changes of prejudice, self-dealing, and other forms of foul play come quickly to the minds of a few authors when they receive their manuscripts back from a review process. Dealing with such charges fairly constitutes one of the more delicate responsibilities of a journal editor.

It is sound policy to accept charges of foul in good faith. An author should be offered another hearing by a new set of reviewers and should be given a chance to nominate some of the reviewers. Often authors are offered the opportunity to nominate reviewers in an initial review process. Regardless of how such charges are handled, an editor must be the final arbiter. If an author disagrees with a reviewer's comments and refuses to make revisions, an editor may request that the author respond to the review in a written rebuttal, which is published along with the article.

In cases where a reviewer points out plagiarism or duplicate submission of a manuscript, an editor should attempt to verify the charge and communicate with an author at the level of seriousness that journal policy and transgression dictate.

## IMPROVING YOUR MANUSCRIPT

- Technical review is helpful — if not indispensable.
- The purpose of a review process is to bring out the best in a manuscript for the ultimate advancement of science.

CHAPTER 11

# Editing and Proofreading

With the advent of word processing and electronic publishing, it is increasingly important that authors take responsibility for making manuscripts complete, accurate, and well written. You should submit the best copy you possibly can, making sure that it conforms to the style of the journal that will publish it.

## Editing

Editing is intended to be flexible and to enhance an author's expression of scientific information. Style rules should not be so rigid that they cannot bend.

After a manuscript has gone through a review process, it is ready to be copy edited. Copy editors do the following tasks:

1. Identify and number all parts of an parts of an author's manuscript and artwork, such as illustrations, tables, and photographs.
2. Check for organization, grammar, and punctuation.
3. Make sure that a title is specific and concise and includes a locality, if appropriate; that an abstract is short, informative, and specific; and that the body of the text is concise and the style consistent.
4. Query an author on points of clarity, need to condense, and if necessary, suggest another choice of words.
5. Check cited references in the text against a reference list or bibliography to make sure no omissions or superfluous entries occur.
6. Mark a manuscript for style, such as italics and boldface.
7. Make sure that the order of headings and subheadings is logical and consistent.
8. Proportion artwork and check it for spelling, drafting, captions, and credits.
9. Make sure that all necessary permissions have been obtained and that they are properly worded in the text.
10. Return a manuscript to an author for final approval.
11. Reread a manuscript when it is returned to incorporate changes or additions.

Until the time comes when there is no editor between you and the reader, your responsibility ends with your approval of an edited manuscript. An editor marks a manuscript for a typesetter and marshals proofs through the printing process. Proofs are sheets of printed material that are checked against a manuscript and upon which corrections are made. At this stage, camera-ready copy has not yet been produced. Authors may be called on to read one or more proofs, but editors check author notes and relay changes to a printer.

## Conclusive clarity

The first aim in editing manuscript copy or marking proofs is clarity. Clarity in this sense is used to mean making marks that everyone — author, editor, reviewers, and typesetters — can understand. Manuscript copy and proofs should be marked so clearly that the type can be set by a typesetter who knows no English — only the alphabet.

Manuscripts should be double or triple spaced so that a change can be inserted where it is needed. Manuscript copy should read in a continuous line, without distracting detours from the middle of a page to a margin and back again. Such detours invite typesetter errors. Margins should be reserved for instructions to a printer.

Each person who marks a manuscript or proofs should use a pencil — never a pen — that is a different color from that used by others. Initialing the copy will show the color that each person is using.

Copy editors correct author's work and prepare it for typesetting or word processing. Proofreaders correct a typist's or a typesetter's work. Copy editing marks and proofreading marks are generally the same. The difference is how they are shown. Copy editors work with double-spaced text, so they have room to

mark changes in the text. Proofreaders work with galley or page proofs that have little space between lines. They mark changes twice: in the text and in the margin. The point of change is marked by a caret (^), and the correction or correction symbol is marked in the margin. When a line requires more than one change, marginal corrections are assembled in the proper order, separated by slash marks. If the number or juxtaposition of changes seems likely to be confusing, the best course is to kill the entire word or line and insert the proper form in the margin.

Generally accepted symbols are shown in the figure on the next page. A few common ones have been omitted because of duplication or ambiguity. (We see no reason to encourage use of, say, a half dozen variations of the deletion symbol.) In general, anything not to be set in type should be circled: for example, an editor's query to an author or instructions to a printer.

## Proofreading

The best tool for an accurate proofreader is a skeptical mind. Mistakes cost money if they are repaired, and embarrassment if they are not. Editors and authors must each assume that no one else will read proofs; they alone are responsible. Authors may find it helpful to proof by reading one copy of a paper aloud to another person, who checks it against the original manuscript. Techniques to slow down your reading may make it easier to find errors. Some proofreaders read only one line at a time, covering the lines below with a ruler or paper. Others proofread a manuscript from back to front to concentrate on individual words rather than on the content of a paper. Read proof as if petting a porcupine: very, very carefully.

Most typesetting machines produce copy ready to be pasted down for printing by offset methods. Copy can be corrected by reinstructing the storage tape and "replaying" the entire copy, or corrections may go back to the operator, who either resets the lines required or produces words or letters to be used for correction. Authors and editors should send in as clear, unequivocal copy as possible and refrain from making "nice" but unnecessary changes.

## Hyphen hassles

Words that break at the end of lines are hyphenated according to the word-processing program used. While many such programs are very sophisticated and are correct most of the time, others often break words in inappropriate places (such as *inco-rrect* and *prod-uce*). Mistakes are costly and troublesome and require a live person to deal with them.

In the days when only printers printed, the problem was not great, because they knew, as a part of their business, how to split words properly. Today, you may be your own typesetter. Basic principles for hyphenation follow:

- Try to avoid splits.
- Split words by syllables; consult a dictionary when in doubt.
- Distribute splits over a page so that they do not call attention to themselves (for example, four or more lines ending with a hyphen is unacceptable).
- Avoid splits at the end of pages or before tables or illustrations.
- Break words in logical places so that readers will not guess the finish incorrectly.

In geological work, you should mark a manuscript and check the proof to make sure a typesetter has not improperly run together rock and mineral terms or other technical phrases. For example, if the first half of a term such as *dihexagonal-dipyramidal* appears at the end of a line, it may very well show up as *dihexa-gonaldipyramidal*.