THE SURVEY PUBLICATION PROCESS

WHEN YOU AS AUTHOR submit a finished manuscript for review, only the first step has been taken in a long process that transforms raw field, laboratory, and other research data into finished scientific reports. Such reports are available to the public on the authority of the Director of the Survey, whose approval is required before any Survey publication can be released. All reports resulting from the official work of Survey employees, moreover, must be approved by the Director before release, whether published within the Survey or elsewhere. As a practical matter, the Director delegates responsibility for approval to the Office of Scientific Publications.

New ways are constantly being explored to reduce the time between submittal of manuscripts and release of printed reports. Automated word processing has greatly facilitated manuscript preparation, and promising new techniques of computer-generated cartography will drastically alter map-making procedures, but technological advances in processing are balanced against increasing publication loads. Many factors may alter scheduling—changed priorities, new programs and projects, mandates from high administrative levels, reorganizations, reassignments of responsible individuals, failures by individuals to set and enforce attainable deadlines, changed appropriations or allotments, and unforeseen geologic contingencies (a volcanic eruption, for example, or a catastrophic earthquake).

REFERENCE BOOKS

All science writers, critics, and editors are likely to have specialized reference books close at hand for their special needs. Additional, more general reference books should be readily accessible also, some closer at hand than others. The books listed here without comment are only a few of the many widely available, excellent general references related to technical writing. This list was generated largely by Malde (1986) and Cochran and Marsh (1986). Most books listed rate at least three stars out of a possible four, but their listing does not constitute special endorsement by STA.

ATLASES

The national atlas of the United States, 1970: Washington, D.C., U.S. Geological Survey, 417 p.

National Geographic atlas of the world (5th ed.), 1981: Washington, D.C., National Geographic Society, 383 p.

The Times atlas of the world, 1980: New York, Times Books, 227 p.

Webster's new geographical dictionary (revised ed.), 1984: Springfield, Mass., Merriam Webster, 1,376 p.

DICTIONARIES

The American Heritage dictionary, second college edition, 1982: New York, Houghton Mifflin, 1,586 p.

Webster's third new international dictionary of the English language unabridged, 1981: Springfield, Mass., Merriam Webster, 2,262 p.

Webster's ninth new collegiate dictionary, 1983: Springfield, Mass. Merriam Webster, 1,563 p.

EDITING AND REVIEWING

Bishop, C.T., 1984, How to edit a scientific journal: Philadelphia, ISI Press, 138 p.

DeBakey, Lois, 1976, The scientific journal; editorial policies and practices; guidelines for editors, reviewers, and authors: St. Louis, Mo., C.C. Mosby Company, 129 p.

Judd, Karen, 1982, Copyediting, a practical guide: Los Altos, Calif., William Kaufmann, Inc., 287 p.

Malde, H.E., 1986, Guidelines for reviewers of geological manuscripts: Alexandria, Va., American Geological Institute, 28 p.

O'Connor, Maeve, 1979, The scientist as editor; guidelines for editors of books and journals: New York, John Wiley & Sons, 218 p.

Plotnik, Arthur, 1982, The elements of editing; a modern guide for editors and journalists: New York, Macmillan, 156 p.

ENGLISH USAGE AND GRAMMAR

Bernstein, T.M., 1965, The careful writer; a modern guide to English usage: New York, Atheneum, 487 p.

Follett, Wilson, 1974, Modern American usage; edited and completed by Jacques Barzun in collaboration with Carlos Baker and others: New York, Warner Paperback Library, 528 p.

Fowler, H.W., 1965, A dictionary of modern English usage (2d ed. revised by Sir Ernest Gowers): New York, Oxford, Oxford University Press, 725 p.

Freeman, M.S., 1983, A treasury for word lovers; *with a foreword* by Edwin Newman: Philadelphia, ISI Press, 333 p.

Gordon, K.E., 1984, The transitive vampire: New York, Times Books, 144 p.

Hill, Mary, and Cochran, Wendell, 1977, Into print; a practical guide to writing, illustrating, and publishing: Los Altos, Calif., William Kaufmann, 175 p.

Johnson, E.D., 1983, The Washington Square Press handbook of good English: New York, Washington Square Press, 309 p.
Strunk, William, Jr., 1979, The elements of style; *with revisions, an introduction, and a chapter on writing* by E.B. White (3d ed.): New York, Macmillan, 85 p.

Glossaries

Bates, R.L., and Jackson, J.A., eds., 1987, The glossary of geology (3d ed.): Alexandria, Va., American Geological Institute, 788 p.
U.S. Bureau of Mines, 1968, Dictionary of mining, mineral, and related terms: Washington, D.C., U.S. Government Printing Office, 1,269 p.

Report Writing

Bates, J.D., 1980, Writing with precision; how to write so that you cannot possibly be misunderstood (3d revised ed.): Washington, D.C., Acropolis Books, 226 p.
Bernstein, T.M., 1971, Miss Thistlebottom's hobgoblins; the careful writer's guide to the taboos, bugbears and outmoded rules of English usage: New York, Farrar, Straus, and Giroux, 260 p.
Cochran, Wendell; Fenner, Peter; and Hill, Mary, 1984, Geowriting; a guide to writing, editing, and printing in earth science (4th ed.): Alexandria, Va., American Geological Institute, 80 p.
Day, R.A., 1983, How to write and publish a scientific paper (2d ed.): Philadelphia, ISI Press, 181 p.
Kilpatrick, J.J., 1984, The writer's art: Kansas City, Mo., Andrews, McNeel & Parker, 254 p.
Kirkman, John, 1980, Good style for scientific and engineering writing: London, Pitman Publishing Limited, 131 p.
Williams, J.M., 1981, Style; ten lessons in clarity and grace: Glenview, Ill., Scott, Foresman and Company, 238 p.

Style Manuals

The Chicago manual of style, 1982, (13th revised ed.): Chicago, University of Chicago Press, 738 p.
The New York Times manual of style and usage; a desk book of guidelines for writers and editors, 1976 (revised and edited by Lewis Jordan): New York, Quadrangle-Times Books, 231 p.
U.S. Government Printing Office, 1984, Style manual, 1984: Washington, D.C., 479 p.
VanLeunen, Mary-Claire, 1978, A handbook for scholars: New York, Knopf, 354 p.

Other

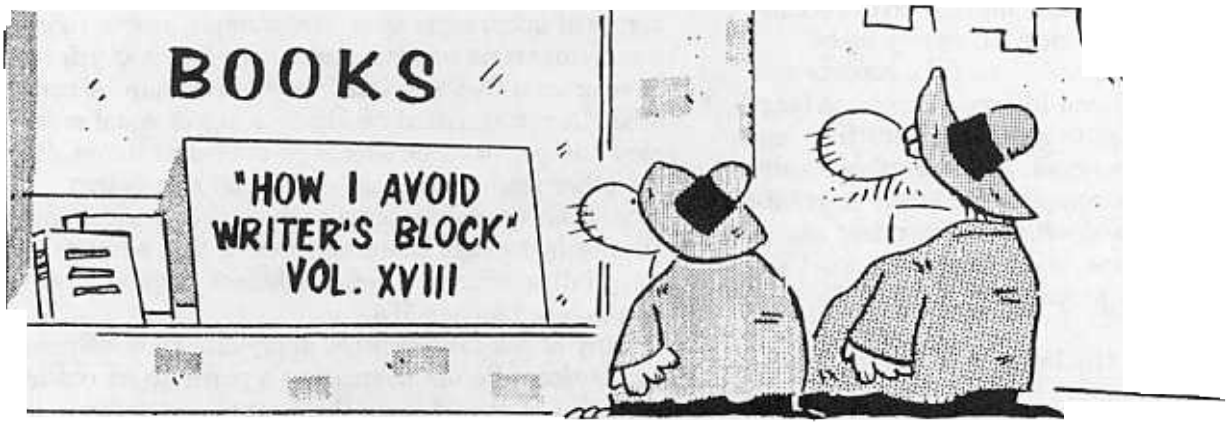
Roget, P.M., 1977, Roget's international thesaurus (4th ed., revised by R. L. Chapman): New York, Crowell, 1,317 p.
Bartlett's familiar quotations (15th ed., edited by E.M. Beck), 1980: Boston, Little, Brown & Co., 1,540 p.
Tufte, E.R., 1983, The visual display of quantitative information: Cheshire, Conn., Graphics Press, 197 p.

Getting Started

If geologists could only be brought to realize that the addition of another paper to the swollen flood of our scientific literature involves a serious responsibility, that no man should publish what is not a real consequence, and that his statements when published should be as clear and condensed as he can make them, what a blessed change would come over the faces of their readers.

Archibald Geikie, 1897

Putting down the first word is hard for most authors, including many who have written best sellers. Scientific reports rarely are best sellers, but the pain of writer's block can be no less real to their authors. Just knowing that other writers suffer the same malaise can be reassuring and helpful. Self-discipline is the key. Writer's block and indolence are close relatives, but one is no excuse for the other. Steps outlined on the following pages should help obviate both, though even the most gifted writer must have the self-discipline to see an exercise through to completion, especially if the topic is long and complex. If you know your subject matter, are reasonably well organized, and have completed the few essential preparations described in the next few paragraphs—before you pick up your pencil or sit down at the keyboard—the block will melt away like butter in a hot skillet.



THAVES 12-21

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Steps outlined here apply to routine processing. If a report has special urgency, it may receive priority processing, and some steps may be telescoped or otherwise varied, but the end product generally will be of higher quality if the report has followed established publication channels. Your responsibility as author is to know the style of your publisher, to prepare your report accordingly, and to present your data clearly. Your manuscript "should be able to withstand scrutiny as a good piece of writing, exclusive of the science" (Sindermann, 1982, p. 29).

This section summarizes the steps that you will normally follow in planning and writing a Survey report, beginning when your investigation is authorized and ending with final review and proofing just before printing. Procedures and practices that may be useful at different stages are also suggested. This section is brief, generalized, and mainly chronologic; subsequent parts of STA contain the many details of form, content, arrangement, and expression that are required or suggested for reports of the Geological Survey.

Before Beginning the Investigation

The course and results of investigative or research projects can be foreseen only within widely varying degrees of clarity and assurance. If a project is rather specific, its duration and results can be forecast reasonably well—for example, a geologic study of a particular area in which the objective is well defined and in which the stratigraphic, structural, and other features are fairly well known. On the other hand, such predictions may prove faulty if a project involves research in problems that are little known. To the extent feasible, you as investigator and your supervisor should estimate and tentatively plan the following:

1. The time you will need for the study itself and for the collateral and supplemental tasks, such as searching the literature, making and checking calculations, and making laboratory tests.
2. The number, kind, and size of the reports and maps that you intend to prepare and the length of time you will need to ready them for first transmittal to the supervisor. Maps or other illustrations that will be complex and costly to publish should be discussed with the supervisor and other responsible persons to determine the most efficient methods of preparation.

After Completing the Investigation

After the investigation and its collateral tasks have been completed, you and your supervisor should—

1. Review and evaluate the results and decide what is worth reporting.
2. Consider your possible readership: Where to aim the report(s).
3. Discuss how to present the results most effectively
4. Decide the general types, size, scope, and number of reports or maps that you should prepare.
5. Reevaluate the time needed to prepare and revise a first draft and the date of its transmittal to your supervisor for review. This estimate should be realistic. Adherence to the time schedule is an official obligation, and substantial delays are permissible only for officially prescribed reasons. Your performance in report writing is judged for promptness and care, just as any other assignment is.

Choice of Publication Medium

To select a suitable publication medium you should first consider the size and type of the intended primary readership, the immediacy and permanency of the information, and the size and type of the illustrations. Except for reports aimed at outside scientific journals, the subject matter and size of the manuscript may have less to do with the choice of publication medium than some of the other factors have. The medium, moreover, may be decided by authorities higher than yourself. In any event, you should seek advice and suggestions as to a probable medium early in the manuscript-preparation process; only then can you efficiently plan and prepare the illustrations, text, and tables. Checking table 1 should help you decide where a report best fits. If a report has transient interest and is needed quickly by just a few users, it may be appropriate for the Survey's open files, or if needed quickly by many users it may be published as a Circular.

Maps in black and white are also sometimes open filed for early availability while more finished colored versions are being prepared for publication. If a standard quadrangle map, for example, meets rigid requirements as to base, scale, and size, it is printed in color as a Geologic Quadrangle (GQ) map. A map other than a standard quadrangle but of equal accuracy and permanence should be published in one of the other map series. So, too, should a map that focuses on special features such as geochemical anomalies or hydrologic characteristics or that is intended for printing without color. Guidelines for map preparation are on page 184.

Many of the factors listed apply also to non-Survey publications. Before submitting a paper to an outside journal, you should learn the journal's preference as to subject matter, length, and illustrations policy by

scanning recent issues and by checking the journal's policy statements, specifications, and style. Most publishers have their own rules of style, either devised by themselves or by some other publisher whose style fits their needs. Some stylistic conventions are neither technically right nor wrong, and they may differ appreciably from one publisher to another. Publication style is just intended to provide guidance to authors and editors in preparing their reports and to provide internal editorial consistency.

The Detailed Outline

> Many details have been omitted which would have been given had the facts been presented as they were collected * * * but it was thought that such a method would result in encumbering geological literature with a mass of undigested facts of little value.
>
> *J.W. Powell, 1876*

You are now ready to draw up a more detailed outline. Done carefully and thoughtfully, this task is one of the most constructive and profitable steps in all your preparations. Without careful planning, even the most experienced author will fritter away time in marshaling thoughts and will waste even more time later in recasting the manuscript to supply the missing logic and completeness. In the long run the hours or days spent drawing up a well-rounded outline are thoroughly justified.

As a background, familiarize yourself with the general order of topics in most Geological Survey reports by leafing through recently published ones and by studying this volume, where many details of form and arrangement are explained. Many reports follow a rather conventional pattern, particularly reports that summarize a survey of an area and present scientific and economic conclusions. Reports on more abstract research may be organized more diversely, especially where an order of treatment must be chosen to bring out clearly and convincingly the solutions to complex problems and the evidence for the resulting theories and conclusions.

From these examples and suggestions, and with due thought to the nature and purpose of the proposed report and the needs of the readers, you can then choose the most logical and appropriate order. At this stage it would be wise to discuss your plans with local editors and graphic specialists. Outline the organizational pattern as a tentative, more or less detailed table of contents, with headings and subheadings to indicate the topics to be discussed. For a rather brief and simple report, such a generalized outline may suffice for arranging the material and doing the actual writing. You must sort out all notes and observations, omit what is irrelevant, and arrange what will be included. Ideas may be set down on cards or sheets of paper, with one topic per card or sheet. Later, each topic may be developed in greater detail—perhaps on a word processor. The cards or sheets help exclude irrelevant material and help prevent the omission of important data. They also enable you to add, subtract, combine, or rearrange data as the report progresses, to ensure order and balance.

Try during this planning stage to reach tentative conclusions about illustrations and tables. Illustrations can show at a glance what could not possibly be described in the text, or what would require many words to explain. Carefully chosen photographs can illustrate significant features not otherwise easily depicted. Concise tables can summarize data that otherwise would be difficult for the reader to assimilate.

One other point should be borne in mind at this stage: If advice and decisions about the use of new geographic and geologic names will be required from the Board on Geographic Names or from the Survey's Geologic Names Committee, you should anticipate such needs as early as possible.

The First Draft

Writing the first draft is the longest and most arduous part of authorship. To express information and ideas clearly, concisely, logically, and convincingly, and to prepare copy for illustrations, requires thought and perseverance. Authors and supervisors, moreover, should avoid the start of new duties until the first draft of a manuscript-in-progress is finished. When your manuscript is complete, you and your supervisor should carefully monitor its movement through review, editing, and the various other processing channels leading to publication. Conscientious and thorough execution of these tasks brings many rewards, including personal satisfaction, speedier handling of the manuscript by fellow workers, higher quality and quicker publication, and greater value to the reader.

Methods of drafting manuscripts vary widely, and no rule or guide fits the needs of all. Each author develops personal techniques and habits. Working from a topical outline, an author usually drafts out one topic before taking up another. This method provides continuity of thought and completeness of coverage. Not all sections, however, need be written in the order of their appearance in the finished report—for example, the abstract and the introductory material should be prepared after the rest of the text has been written.

The manuscript may be written in various ways, each of which has adherents. One author may focus attention solely on the subject matter, completing the first draft without interrupting the flow of thought to

criticize and improve the writing. Adherents believe this method results in a clear, though roughly cast, exposition of the author's ideas.

Another author mentally assembles ideas and thoughts in their best perceived order, then ponders how best to express them clearly, logically, and forcefully. This author writes deliberately—weighing not only what to say but also how to say it. The resulting first draft will be superior to a more rapidly written draft and later will require less recasting to achieve polish. Most authors wisely read and work over their manuscripts many times, a step greatly facilitated by the use of word processors. You should doublecheck for logic, order of treatment, prominence given significant features, completeness, accuracy, irrelevant material, confusing statements and disagreements of facts, and repetition, and for compliance with the requirements and suggestions given in this volume.

At this stage you should also prepare near-final copy for all maps, charts, diagrams, tables (to be reproduced from office printers such as daisywheel and laser printers), and photographs. Reviewers and editors will need copies, which illustrators will later put into form for publication. Whether to complete this task before or during the writing of the manuscript depends on the complexity of the material, but the tables at least should be compiled and the illustrations and their titles should be firm enough to be cited and discussed at appropriate places in the text. Suggestions for preparing illustrations are given on subsequent pages.

While preparing the text and illustrations, you can profit greatly by consulting fellow workers on both general and specific topics. Also, you may ask knowledgeable associates to preview all or parts of the manuscript. Such informal previews require comparatively little effort on your part or your reviewer's, but they pay large dividends. You may wish to again consult text or map editors about stylistic matters.

Preparing and Checking Report for Technical Review

The next step is to prepare the typescript for formal technical review. Authors using word processors may combine this step with the previous one. The first keyboarding should be done in accordance with the practices specified on pages 250–264. Several stages of review and revision will follow, and eventually some or many pages must be redone at least once before the manuscript is sent to the printer. If the report will go to several reviewers, you might make extra copies for simultaneous review; the advantages of so doing must be weighed against the additional effort of reconciling comments and transferring responses to a single copy.

When your typescript ("hard copy") is prepared, proofread it thoroughly to eliminate typographical errors and omissions. Word processors offer programs that will catch most spelling errors, but only you can detect omissions or words correctly spelled but wrongly used. At this time you should also check the accuracy of the whole report, including illustrations, quotations, mathematics, and citations of publications. The report should meet all requirements as to content, format, and supplemental information such as acknowledgments. Then you are ready to submit the completed document to your project supervisor, accompanied perhaps by a suitable memorandum of transmittal explaining any special circumstances and suggesting reviewers.

Technical Review and Revision

The report is reviewed by professional colleagues within the originating office. It may also be sent to other offices if all or parts of it relate to their fields. The sequence of steps that follows next may vary in different Divisions of the Survey, but the objectives are the same: to assure the best possible science and presentation. If your report is being processed by the Water Resources Division, its routing procedure is outlined on page 30. The procedures immediately following apply to all Divisions. At least one reviewer should be specially qualified by knowledge and interest in the problems discussed. Another reviewer might read the report for general content. Both must strive to assure scientific validity and clarity. To that end they call attention to weak spots in text and illustrations through marginal notes and interlineations, or through attached memorandums if their questions and suggestions are complex. See also guidelines for reviewing technical reports and maps (p. 226).

Knowing the purpose of the review and the spirit in which the comments are made, you must try to profit from them. Every comment should be thoughtfully considered, all questions raised by the reviewers should be addressed, and appropriate changes or corrections should follow. Unaccepted differences with the reviewer must be explained, either in the margin of the manuscript or on an attached memorandum. If the differences are substantial, or if there seem to be misunderstandings, you should elaborate by written responses attached to the manuscript. The Survey encourages informal consultations and discussions between reviewers and authors to clarify viewpoints and reach agreement. Such interactions are not generally possible, however, for reports written for outside journals. There, the journal editor usually acts as intermediary.

Stratigraphic names and correlations are checked at this point by the Geologic Names Unit (GNU) to assure consistency and compliance with the established usage. Instructions from GNU must be strictly followed, unless GNU modifies them after further discussion. Your designated approval officer signs off approval when satisfied that your paper is ready to go forward for further processing, and sends it to the appropriate publications office. Manuscript copy from this point forward is referred to as "mill copy," a term used repeatedly in STA.

After the report leaves your office it receives further processing if it is intended for formal Survey publication. (Outside papers originating in the Geologic Division are checked further only on request.) Maps, diagrams, and other illustrations involving geology are examined by a geologic map editor, who looks for errors and inaccuracies and also indicates changes in format necessary to assure clarity, conformity with Survey practices and standards, and economical printing. Reviewers' comments and other papers must stay with the manuscript; review markings on text and illustrations must not be erased.

Editing

Editing follows technical review. The editorial staff prepares for the printer all manuscripts that are to be published by the Survey. The editors examine (1) the content and rank of headings, (2) the form of the footnotes and the citations of publications, (3) the use of geographic names, (4) the form of tables and sections, and (5) the various features of typographic style—such as capitalization, punctuation, spelling, and sizes and styles of type—as well as many other details. Much of this work follows prescribed rules, including those of the U.S. Government Printing Office Style Manual.

The Author and the Editor

Editing serves another purpose: The editors approach the manuscript as detached but sympathetic readers who look at it from the viewpoint of the intended readership. Most editors are gentle people whose overriding concern is to maintain the quality of their publications. Most of them suffer silently the brickbats of short-tempered authors and seldom seek or receive the plaudits they deserve. They try to understand your ideas, and in trying to help express those ideas as clearly and concisely as possible, they make suggestions about organization, paragraphing, grammar or rhetoric, how to recast obscure passages, how to eliminate repetitious or irrelevant matter, and many other topics. These suggestions are made solely to improve the report. You as author might be reassured to remember that editors have helped polish the manuscripts of F. Scott Fitzgerald, Ernest Hemingway, James Michener, and many other talented writers, and with their blessings and gratitude (Garfield, 1985).

Editors, like authors, are not infallible, and they occasionally prick points of authorial tenderness. Oddly enough, some scientists are more sensitive to assaults on their grammar and rhetoric than on their technical prowess. Recognizing your own frailties as an author is one step toward harmony with all your supporting staff.

Editorial changes usually are made to rectify perceived shortcomings. Editors may inadvertently alter an author's meanings, especially obscure meanings, but if an editor or a critic feels compelled to make a change or raise a question, something in the manuscript probably needs attention. And before you protest that your "colleagues will understand what is meant," realize that the Survey, too, wants them to understand but also wants its products grammatically correct, syntactically clear, and logically put together. With a bit of introspection, you can avoid such tiresome marginal cliches as, "Stet! You changed my meaning," or "A geologist [or hydrologist, or astrogeophysicist] would understand," or "Nitpicking!" Take heart, and save your energy for more productive ends.

Perceptive authors and editors alike recognize that science editing is an art in shades of gray, not in black and white. Tactful editorial comment, therefore, must be tentative, discreet, and needed. After all, the names of authors, not editors, grace title pages, book spines, and file cards. Authors receive lasting praise for all their pearls of wisdom, but they also take the knocks for any blunders. Editors just go to unmarked graves. You as author should remember that your editors and critics stand briefly in the stead of your readers—readers who will ultimately judge the merits of your writings. As the last filter between you and your readers, your editors should be seen as collaborators, not adversaries. For their part, and to minimize the chances of misreadings, editors can help by making their comments neatly and legibly with a well-sharpened pencil. Few things bother authors more than blatant, illegible markings all over their reports.

When your edited manuscript is returned, you must carefully examine all suggestions and corrections. Make sure that the intended meaning has not really been altered, and if any change seems out of line, try to reconcile it with the editor without delay. Changes must be avoided that would conflict with the official approval of the report. When all such conflicts are resolved, your report is forwarded for Director's

approval, though the exact sequence of events may vary from Division to Division.

Director's Approval

The high quality and scientific integrity of Geological Survey publications have earned wide respect for the Survey for more than 100 years. Survey investigations best serve the public at large, rather than serving special interest groups or individuals. Approval by the Director is the final step in the processing of a report before its release for production and publication.

All interpretive writings in which the Survey has a proprietary interest, including abstracts, letters to the editor, and all writings that show the author's title and Survey affiliation must be approved by the Director before release or publication. The Survey has a proprietary interest in all data and manuscripts derived from research or investigations funded by the Survey. The objectives of the Director's review are to final-check the technical quality of the report and to make certain that the report meets Survey publication standards and is consistent with policies of the Survey and Department of the Interior. Director's approval ensures that (1) each publication is impartial and objective, (2) its conclusions do not compromise the Survey's official position, (3) the report does not take an unwarranted advocacy position, and (4) the report does not criticize or compete with other governmental agencies or the private sector.

The Director has delegated approval authority to the Associate Chief, Office of Scientific Publications, Geologic Division. Reports may acknowledge official authorization by using the wording "Manuscript approved for publication (month/day, year)".

After the Director has approved your report, an important milestone has been reached, and toasts are in order all around. Beyond that point no further change may be made in the text or illustrations, except of an editorial nature, unless the proposed change is submitted through official channels, is suitably endorsed, and is formally approved.

Checking Drafted Illustrations

Maps and other illustrations prepared by the illustrators (graphics specialists and cartographic technicians) are reexamined by several designated persons, including map and text editors and you as author. Long experience has shown that errors, especially omissions, may appear in the drafting itself and in the wording on the illustrations, despite the skill and care of the illustrators. As the person most familiar with the details, you must thoroughly scrutinize the illustrations at this stage before approving and returning them. To minimize the need for corrections and revisions, please submit the best and clearest possible drafts of your illustrations to the graphics staff before final preparation begins. Corrections or other changes made on illustrations may require changes in the text. Important revisions must be submitted through official channels for approval.

Galley and Page Proofs

Your last step before the manuscript is published is to examine proofs of the text and proofs of maps and other illustrations. This step should be thorough, and there is a special need for promptness to avoid delaying publication. How to read proof is outlined on page 265. The chief purpose of proofreading is to detect errors introduced during typesetting and reproduction. Because the manuscript was fully prepared and polished before its transmittal for reproduction, you must not attempt further factual revision at the proof stage. Some minor changes from copy may be permitted in galleys to correct errors of fact that have escaped notice during earlier reviews, but changes in proofs are costly and are permitted only to correct definite errors. Any other changes require exceptional justification. When the report has been published, several copies are furnished to you as author for personal disposition.

Word Processors: Changing the Way Scientists Write

Rapid technological advances in computer word processing are changing how scientists write. Rather than laboriously composing in longhand or on a typewriter, many authors now keyboard their thoughts directly into the storage disk of a computer. Word-processing systems thus increase the efficiency and accuracy of preparing text and of editing and revising typed reports.

A word processor is a computer geared to generate, edit, process, and print text material. It is a software-based, microprocessor-controlled typing system. Large (mainframe) and small (personal) computers have many capabilities, including word processing. Until recently, word-processing functions were fairly difficult to learn and operate, but new systems are increasingly simple and versatile. STA provides no operator instructions; it merely outlines the advantages of the new technology.

A word-processing system consists of an electronic keyboard, a video display, a means of storing data in readable form on a magnetic disk or tape, and a printer. The system should feature easy entry of text

and equations, elementary formatting, simple revision, and effortless printing. After typescript ("hard copy") is printed, the report follows conventional Survey review and editing procedures, but all changes and corrections are made on the word-processing disk. Then, after revision and approval of the manuscript, the disk version can be formatted for automatic typesetting and transmittal to the typesetter via telecommunication techniques. The goal of word processing is to keyboard data only once and to deal with machine-readable copy thereafter.

The ease of entering information and, most importantly, the ease of making corrections affect the quality of reports prepared on the word processor. Scientists are quick to recognize that as they type they may develop ideas and lines of reasoning completely separate from the part of the report they are working on. Once keyboarded into the word processor, these thoughts can be tagged or coded and quickly moved as a unit to more proper places in the report, or even stored for later use. The scientist can then continue with the original report until the next idea strikes.

Many scientists are slow and inaccurate typists, but once they are used to the ease of keyboarding corrections on word processors, their typing speed commonly improves, because typographical errors are so easily rectified. Most scientists simply proofread and correct their material on the video screen before printing hard copy (although hard copy has to be proofed also). Many word-processing programs now include spell-correction packages that catch many typographic mistakes.

Before the advent of word processors, the turn-around time from manuscript submittal to typist and return could be as long as several weeks or even months. The scientist's concentration on the subject and train of thought were broken during such a period, and valuable time was lost refreshing memories, checking references and notes, and getting back on track with the research paper. In addition, revisions were reluctantly made on the typescript because of the long turn-around time and extra work involved in retyping, but nowadays, as authors are encouraged to keyboard and correct their own reports, they can expend their full energies on the manuscript from conception to completion without distractive waiting periods and delays in the typing pool.

Accessibility is important. A word processor or computer terminal should be on the scientist's desk or nearby where the manuscript can be brought up conveniently onto a viewing screen. Translating an idea to text easily and conveniently and being able to devote periods as short as several minutes to a manuscript can only improve efficiency and productivity.