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# GUIDELINES FOR AUTHORS

by

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# GUIDELINES FOR AUTHORS

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## INTRODUCTION

The original version of this guide was published in 1980. The primary intent of that guide was to provide a standardized approach to the mechanical processes that are necessary for in-house and outside authors' preparation of manuscripts for printing. Since then, the Florida Geological Survey (FGS) has gone to near-total computer preparation of manuscripts and illustrations. These changes have made it imperative that the Survey's guidelines be updated and revised to reflect the new techniques and technology that are available to most authors. The procedures and conventional usages outlined here supercede those of the 1980 edition.

The editorial standards for every FGS publication -- excellence of presentation, scientific accuracy, clarity of meaning, and technical superiority in printing -- remain as the traditional goals against which each proposed manuscript will be measured.

It is recognized that the final printed products will be diverse. Much of this diversity is in the content, the message, the author's style, and the illustrations. By standardizing symbology, procedures, and materials, it will be possible to decrease production time, thereby saving money. The techniques set forth herein will produce dividends for both the FGS and the authors. Such techniques will produce a standardized format for publications, hence, a more professional look. They will decrease the labors of authors, draftsmen, editors, and printers.

This guide speaks only briefly to grammar, writing style, or related topics. It is not intended to answer every question that may arise as to proper geological terminology or manuscript writing. There are many authoritative publications that may be consulted on these topics. In fact, it is recommended that they be consulted to resolve any questions not answered here. Good references are:

*Glossary of Geology*, 1987, by R.L. Bates and J.A. Jackson (editors): American Geological Institute, Washington, DC.

*Suggestions to Authors of the Reports of the United States Geological Survey*, 1989 (7th ed.), U.S. Government Printing Office, Washington, DC.

## TYPES OF PUBLICATIONS ISSUED BY THE FLORIDA GEOLOGICAL SURVEY

The FGS is concerned not only with geological research, but it also has statutory responsibilities to make surveys of and explorations for the minerals, water supply, and other natural resources of the state. It regulates the exploration for and production of hydrocarbons, and is required to prepare reports and maps pertaining to these activities. The FGS produces a variety of publications to meet the needs of its diverse activities and the needs of industry, the scientific community, other governmental agencies, and the public. These publications range from classic studies that represent major contributions to the knowledge of Florida's geology and natural resources, to interim data publications or general information reports which inform the public about various aspects of geology. No matter what their nature, all FGS publications are subject to critical review. Final assignment of a publication to one of the following series rests with the Survey Chief.

**BULLETINS** are comprehensive reports on geological or related studies. The scope of the report is usually of a broad regional nature, for example: "Springs of Florida," "Geology of Jackson County," or "Stratigraphy and Zonation of the Ocala Group." They may be of any length, but are usually a final report of some phase of a research project and are illustrated in a manner suited to the subject. Subjects may include, but are not restricted to, county reports, systematic areal mapping, water resources reports, paleontological reports, geomorphological reports, and economic minerals reports.

**REPORTS OF INVESTIGATIONS** are comprehensive reports on geological or related studies, but are narrower in scope than Bulletins. These reports usually represent the results of localized studies, or are reconnaissance reports, for example: "Geology of the Western Part of Alachua County," or "Ground-Water Resources of the Hollywood Area." Illustrations may be of any suitable type.

**SPECIAL PUBLICATIONS** are publications not readily assignable to other categories, but which contain geological or related information of significant interest to the scientific community or the public. Examples are: "Summary of the Geology of Florida and a Guidebook to the Classic Exposures," "Guide to Rocks and Minerals of Florida," and "Environmental Geology and Hydrogeology of the Ocala Area." They may be illustrated in any suitable manner.

**INFORMATION CIRCULARS** may be reports of a preliminary nature, such as interim reports on continuing projects, or reconnaissance reports. They may be final to the extent that further work is not anticipated, such as inventory reports or tabulations of data. They may be illustrated with maps or figures. Examples are:

Information Circular 105, 1989: Part I - The Industrial Minerals Industry Directory of Florida.

Information Circular 106, 1989: 1986 and 1987 Florida Petroleum Production and Exploration.

**MAP SERIES** are maps consisting of single sheets. Dimensions are optional, depending on the nature of the material. They may be in color and may be printed on both sides of the sheet. They usually have a brief accompanying text of an explanatory or summary nature, and may include cross sections or other diagrams. Examples are:

Map Series 100, 1980: Environmental Geology Series - West Palm Beach Sheet.

Map Series 131, 1990: Mineral Resources of Alachua County, Florida.

**LEAFLETS** are publications of only a few pages and relate to general areas of interest. Because the text is usually of a general, public-interest or educational nature, they should be illustrated. Color may be used. Some examples are:

Leaflet 13, 1984: Geologic Guide to the State Parks of the Florida Panhandle Coast - St. George Island, St. Joseph Peninsula, St. Andrews and Grayton Beach State Parks and Recreation Areas.

Leaflet 14, 1986: Geology of the State Parks in the Florida Keys.

**POSTERS** are printed on one side only and vary in size. They may be in color. By nature, posters are designed for wide distribution, so the best topics are those with broad public interest or educational content. Examples of posters that have been printed are: "Florida Minerals," and "Selected Cenozoic Benthic Foraminifera From Florida."

**OPEN FILE REPORTS** are less formal in format than the preceding series of publications. They are reproduced by photocopying, as needed. This format lends itself to the rapid promulgation of information or data. Although usually only a few pages long, they may be any length. Illustrations can be any type that photocopy. Some examples are:

Open File Report 30, 1990: Summary of the Geology of Glades County, Florida.

Open File Report 40, 1991: Earthquakes and Seismic History of Florida (revision of Information Circular 93).

## NOTES TO AUTHORS

In order for any manuscript to be considered for publication by the FGS, or for it to be accepted for any form of public record, it must be authored by a licensed professional geologist, as required by Chapter 492, Florida Statutes. This includes any manuscript that makes interpretations of geology or that draws geological conclusions which affect public health or welfare.

Any author who wishes to submit a manuscript to the FGS for consideration for publication should first review it in light of these guidelines. The guidelines presented here should be considered only as minimum requirements. Deviations from these guidelines should first be discussed with the Survey's editor.

While this is not intended to be a manual to dictate styles of writing, authors should note the following common errors and proofread their manuscripts with an eye towards eliminating them. The use of slang, trite expressions, buzz-words, or bureaucratese is categorically wrong for scientific writing. Scientific writing has no use for any of the poor grammar that is in everyday use. By its nature, scientific writing must be precise. An author's work must be capable of being understood by his peers. Anything that allows the reader to ambiguously interpret an author's words destroys the main objective of the writing, which is to communicate facts. Buzz-words, bafflegab, and bureaucratese create an opposite effect; they obscure, water-down, or destroy precision. It is not possible to list all such grammatical errors in this limited space, but a few examples will illustrate what every author should attempt to eliminate.

"The sand overlying the limestone was fairly thick." (Fairly is dimensionless and adds nothing of value to the description of the outcrop. If the author had examined the outcrop, he should be able to state whether the sand was six inches or six-feet thick.)

"Quantities of good rock are available along the river." (Good is interpretive, depending upon the reader's experience. In this case, perhaps the author should have described the rock's mineralogy, or other physical features, and then stated, "Quantities of rock are available along the river that are good for rip-rap."

A multivariate approach to optimizing the obfuscatorial nature of an author's circuitous rendition of a manuscript would probably be a non sequitur. (What more need be said regarding this writing style?)

Buzz-words and bureaucratese are prevalent in all types of written, spoken, and visual communications. The "-ise" syndrome is evident everywhere: costwise, procedurewise, optimize, and so on. Do not append "-ise" to any other word.

The use of the first person singular is discouraged; authors should try to use the passive form. Instead of "I discovered that... ," write, "It was discovered that... ." In scientific writing what is discovered or proposed is usually more important than the discoverer.

It is good practice to devote the opening paragraph of each chapter or major section to a statement of what the section contains.

Avoid internal cross-references using page numbers. The correct page number cannot be determined and inserted until the final page-proof stage of typesetting. Inevitably, a number will be missed or an incorrect number will be inserted.

A company name, trademark, or other proprietary material should not be used in FGS reports unless there are compelling reasons to do so; and then only after permission to do so has been obtained from the proper company authority. This rule applies also to photographs of a company's equipment, property, or operations that are intended as illustrations.

A convention that is followed by the FGS is that both singular and plural names of geological formations, geographical features, and counties are capitalized. For example: "... Ocala and Suwannee Limestones... ," "...St. Johns and Withlacoochee Rivers... ," "...Leon and Wakulla Counties... ."

West-to-east geological cross sections and topographic profiles should be constructed as though viewing from the south (west is on the left side). North-to-south cross sections and topographic profiles should be constructed as though viewing from the west (south is on the right side).

Composite English-metric bar scales must be included on all maps, cross sections, or topographic profiles. A north arrow must be shown on all illustrations, as appropriate.

In paleontological listings or references the formal generic and specific names must be underlined in the text by the author. This is necessary because these names will be typeset in italics. Suprageneric and anglicized names are not italicized, e.g., the author would write: "The genus Spirifer is in the family Spiriferidae which includes the true spirifers." It would be typeset as: "The genus *Spirifer* is... ."

## EDITORIAL REVIEW OF MANUSCRIPTS

Critical review plays a major role in ensuring high quality of scientific reports. Review should be thorough and it should address all aspects of a manuscript.

All manuscripts submitted to the FGS for publication will be reviewed by the FGS editorial review committee. The Survey Chief may request further review by scientists or professionals outside the FGS. While peer review by FGS staff members is a part of their normal duties, it is customary for the author to acknowledge them in the Acknowledgements section.

As the last step in the review process the manuscript will go to the FGS editor, who will mark it with instructions for layout, format, or style.

## GUIDELINES FOR CRITICAL REVIEWERS

The FGS has adopted a standard reviewers' check list that is attached to each manuscript prior to beginning the in-house review process. This check list is to remain attached to the manuscript through the first and **all** subsequent phases of review, until final typesetting.

1. Drafting is time-consuming and complex. Changes in illustrations should be made near the beginning of the review procedure, not during final proofing. For this reason, a first draft of all manuscripts, with all proposed illustrations or photographs, will be routed to drafting staff for comments regarding layout, style, or size. The author will be responsible for modifications before circulating the next draft.

2. A critical reviewer is not a "ghost writer," and no author should expect their report to be rewritten for them. Peer discussion prior to submission of the manuscript may generate new ideas and material, but critical review should not be expected to substitute for such discussion.

3. All data and factual information must be presented clearly, concisely, and unambiguously. While authors and reviewers may disagree on the conclusions which can be drawn from the data presented, there should be no disagreement about the data themselves.

4. Authors may present new hypotheses or variations of previously accepted points of view. Reviewers must ensure that such hypotheses are based on and are reasonable interpretations of the data contained in the report. In some cases the facts may lend themselves to more than one conclusion, and the author should consider presenting such alternative interpretations. Critical reviewers have a duty to point out alternative interpretations or hypotheses to authors, if the scope of the report warrants it. However, the review process is not the place to try to resolve all aspects of differing hypotheses. It is not necessary that author and reviewer agree on a common conclusion. The author is entitled to state his preference among different hypotheses, but he must also be prepared to state the basis for his preference. His preference should be supported by the data presented in the report.

5. Does the report present data or results that would be more suited to a different mode of publication, perhaps in a technical journal? If so, the reviewer should suggest to the author that this be considered.

6. If the author has made use of material already published, have proper references been given? Cross check the reference list. It is the responsibility of the author to search out complete references; all the reviewer need do is point out suspected errors or omissions.

7. Is the report too long? Too short? The reviewer should have no hesitation in commenting on apparent wordiness or needless repitition. On the other hand, a more thorough discussion of some topic may be more enlightening to the reader.

8. Pay careful attention to scientific terminology. Do all terms, equations, or analytical procedures conform to current, accepted standards? If in doubt, a reference should be requested by the reviewer. It may be prudent for the author to so reference the text.

9. The reviewer should not hesitate to question the value of any illustration. Perhaps the information could be better shown in a tabular listing.

10. Does the author present data, locations, or other important information in the text, which are not shown on the illustrations? Are data shown on the illustrations which are not referenced in the text? The reviewer should point out suspected inconsistencies for the author to check.

## STANDARD FORMAT FOR PUBLICATIONS

One of the main advantages of following a standard format for publications is that it helps authors to present their material in a logical and orderly manner. Authors should study recent publications of the FGS in order to better understand the following discussion.

## METRIC SYSTEM

The National Metric Conversion Act of 1975 provided for the orderly transition of the United States' system of measurement from English units to metric units. The metric system is also known as SI (Systeme International or International System).

The following conventions should be observed in using and citing the metric system.

1. The symbols are always in Roman type.
2. Symbols are never pluralized, e.g., millimeters = mm, not mms.
3. A period is not used after a symbol, except to end a sentence.
4. When a symbol is comprised of letters, a full space is left between the number and symbol, e.g., 45 kg. An exception is when a symbol such as the degree symbol directly follows a number, e.g., 32° C.
5. Symbols for metric units should always be used; unit names should not be written out except in general terms, such as "...several meters west of ... ."
6. When a decimal fraction of less than 1.0 is used, a zero should always be placed to the left of the decimal point, e.g., 0.78 kg.

In order to prevent much awkward duplication of parenthetical conversions of units within the text of reports, the FGS has adopted the practice of inserting a tabular listing of conversion factors, as shown below. If the standard table does not include every unit used in the manuscript, the author must add the extra units to the table. **This table is placed on the inside front cover of all printed FGS publications.**

**Table 1. Standard conversion factor table, located on the inside front cover.**

*** * * * * Start of Table * * * * ***

**CONVERSION FACTORS and ABBREVIATIONS**

This table of the most commonly used conversion factors is provided for readers who may want to convert English units into metric units.

| MULTIPLY | BY | TO OBTAIN |
|---|---|---|
| inch (in) | 25.4 | millimeter (mm) |
| inch (in) | 2.540 | centimeter (cm) |
| inch (in) | 0.0254 | meter (m) |
| foot (ft) | 0.3048 | meter (m) |
| mile (mi) | 1.609 | kilometer (km) |
| sq. foot ($ft^2$) | 0.09290 | sq. meter ($m^2$) |
| sq. mile ($mi^2$) | 2.590 | sq. kilometer ($km^2$) |
| acre (ac) | 0.4047 | hectare (ha) |
| acre (ac) | 4047.0 | sq. meter ($m^2$) |
| cubic foot ($ft^3$) | 0.02832 | cubic meter ($m^3$) |

| | | |
|---|---|---|
| cubic yard ($yd^3$) | 0.7646 | cubic meter ($m^3$) |
| gallon (gal) | 3.785 | liter (L) |
| gallons per minute (gpm) | 0.06308 | liters per second (L/s) |
| gallons per minute (gpm) | 0.0022 | cubic feet/second (cfs) |
| gallons per minute (gpm) | 0.00006309 | cubic meters/second ($m^3$) |
| cubic feet/second (cfs) | 449 | gallons per minute (gpm) |
| cubic feet/second (cfs) | 0.02832 | cubic meters/second ($m^3$) |
| pound (lb) | 0.4536 | kilogram (kg) |
| ton, short (2,000 lbs) | 0.9072 | megagram (Mg) |
| ton, long (2,240 lbs) | 1.016 | megagram (Mg) |
| Fahrenheit (F) | 5/9 (F-32) | Centigrade |

**Sea Level:** In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929) -- a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929" or "mean sea level (MSL)."Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific coasts, it does not necessarily represent local mean sea level at any particular place.

*** * * * * End of Table * * * * ***

CONTENTS

With the exceptions of map series, posters, and leaflets, all FGS publications have a format that closely follows the **generic** Contents page given below. Examples of cover, title page, cabinet listing page, letter of transmittal, and publication data page are illustrated in Appendix A.

The generic example below shows the order of presentation.

**CONTENTS**

Page

Acknowledgements
Abstract (if used)
Introduction
Main body of text
    Subsections (list titles)
    ...
    ...
Summary or Conclusions
References

Figures
1 ... (list captions)
2 ...
Appendices
A ... (list titles)
B ...

## TITLE OF REPORT

Authors need to choose the title of their report with care, and in accordance with the following requirements. Explicit titles and headings are necessary due to increasing use of computerized indexing and information retrieval systems.

1. The title of the report should state concisely the nature, major discipline, and the location of the study.
2. Chapter headings and subheadings should state all major concepts in their respective sections of the report.

## LETTER OF TRANSMITTAL

A letter of transmittal, to the Governor from the FGS Chief, is included in all FGS publications, except open file reports, map series, posters, and leaflets. It is not an abstract. Its purposes are: 1) to introduce the report to the Governor, who sits as Chairman of the Executive Board of the Department of Natural Resources; and 2) to briefly indicate the purpose and nature of the study, and how the report helps to meet FGS or departmental objectives. It is the author's responsibility to provide a draft of the letter for review by the FGS Chief.

## CONTENTS AND HEADINGS

The contents page lists the headings of the main divisions of the report. The author's draft of the contents page of the manuscript must show the hierarchy and the relative importance of all sectional headings used. This is done by successive indentations, which will be used as a guide in typesetting, as shown by the following **generic** example.

GEOLOGY
Physiography
Northern Highlands
Tallahassee Hills

## ACKNOWLEDGEMENTS

These should be collectively at one place in the front of the report. Assistance rendered by persons regarding scientific contributions or significant editorial review should be acknowledged. Acknowledgement of review by FGS staff has been discussed above. In some cases, acknowledgement may be given to a co-author, as discussed in the following sections on joint and contributed authorship.

Full joint authorship. Each author named should have made a substantial contribution, both to the research and writing of the manuscript. Names may be arranged alphabetically, or may be by senior author first, followed by others. This might be cited as:

Johnson, J.G. and Smith, R.L., 1967, Geology of Leon Quadrangle: Florida Geological

Survey Bulletin X, 120 p.

Common sense must prevail if there are many joint authors. Listings on the cover of a publication of more than three contributors create difficulties for library cataloguers and others who wish to cite the work. The standard style of citation for multiple authors is:

Hatch, W.T., et al., 1978, ...

Contributed authorship. The leader of a project is normally the senior author and has had the major responsibility for assembling the text. In other cases senior authorship must be decided by mutual consent.

There may be instances where contributions of colleagues or junior authors may warrant citation in future references. For example, the senior author may wish to acknowledge significant contributions by student assistants to research projects, such as the compilation or preparation of tables or analytical data (mineral analyses, fossil determinations, gravity charts, maps). The legend or caption for the compilation should clearly state where the work was done, the compiler's or experimenter's name, and the method used. Where possible, such compilations should be grouped together in tabular form or as an appendix, preferably as a separate item at the end of the report. The caption should have the name of the person(s) responsible, so that it may be cited in other publications.

## ABSTRACT

Abstracts are useful for key-word cataloging, and to give the reader a quick review of the report's main contents. An abstract should be included in Bulletins and Reports of Investigations. Depending on the nature of the material, they may be appropriate for Special Publications and Information Circulars, also.

If an abstract is included, it should go before the Introduction on the first page of the main text. An abstract should be brief, as the name implies. It should state the main concept or hypothesis, purpose and scope of the study, and a short recapitulation of results or findings.

## INTRODUCTION

The first paragraph of the Introduction should set forth the study's objectives and how the study contributes to the work of the FGS or Department of Natural Resources. The nature and scope of the study should be described, as well as investigative techniques used.

Other topics that often are included in this section are the location and size of the study area, an explanation of the locality and well numbering system, and references to previous investigations. Depending on the nature of the study, some other topics that may be included are transportation, climate, population, economics, geomorphic features, drainage, and any information that is of peripheral value to the main study.

## TEXT

The arrangement of the sections of the main body of the text will vary due to the nature of the report. In most cases, however, successive sections of a report will pass logically from general information (Introduction, General Geology, etc.), to specific topics, and back to general (Summary).

The largest subdivision of an FGS publication, the chapter, is designated by a major heading, as shown by the example in the above section on Contents and Headings. In the example, "GEOLOGY" is

a chapter heading. Also, note how in this example the successive subheadings go from general to more specific topics.

## SUMMARY AND CONCLUSIONS

In this section of the report the author brings together all of the notable points or conclusions of the report, which have been scattered throughout preceding sections, and, in a logical manner, uses them to emphasize important points or findings.

This section is not an abstract to describe why or how the study was done; such information should be put in the Introduction.

## REFERENCES, SELECTED BIBLIOGRAPHY, OR BIBLIOGRAPHY

Proper and complete references and acknowledgements are very important parts of any scientific paper. Every quotation or use of any part of another's work for reference must be acknowledged. It is illegal to plagiarize, as well as a breach of professional ethics. The recent revisions in copyright laws make this a potentially more serious offense than ever before.

To cite references in the text, the FGS uses the style with names and dates in parentheses, e.g., "...the rocks were found to be 15,000 years old (Roberts, et al., 1987)." However, if the author's name is part of the sentence, it should not be in parentheses, e.g., "The Floridan aquifer system, as defined by Parker (1955), consists of limestones."

It is the responsibility of every author to completely acknowledge all sources of data. In cases of joint authorship, it is the duty of the senior author to ensure that these requirements are met.

Nothing is more liable to arouse the ire of one's colleagues or peers than to make a clumsy or negligent error in misquoting or misreferencing their work, or to misspell their names.

The FGS uses the Geological Society of America's (GSA) format for reference lists or bibliographies, as shown by the following examples. Spell out journal titles. Note that only last names are spelled out; all other names are initialed. References are listed alphabetically by author's surname. For references with two authors, list alphabetically by first author and then alphabetically by second author. For references with more than two authors, list alphabetically by first author and then chronologically, earliest year first. For references that do not match any of the examples given below, write out all information that would help a reader to locate the reference.

Authors must submit their manuscripts with the references arranged accordingly, alphabetically and in this format. Do not expect others to rearrange them as this only promotes errors of transposition.

*The following examples are from the Geological Society of America's brochure "Information For Contributors to Publications of the Geological Society of America."*

**Abstract**

Booth, M.C., 1978, Carbonate formation in Mars-like environments [abs.]: EOS (American Geophysical Union Transactions), v. 59, p. 110.

Hattin, D.E., 1977, Petrology of the Smoky Hill Chalk Member, Niobrara Chalk (Upper Cretaceous) in the type area, western Kansas: Geological Society of America Abstracts with Programs, v. 9, p. 603.

**Book**

Le Bas, M.J., 1977, Carbonatite-nephelinite volcanism, an African case history: New York, John Wiley & Sons, 347 p.

**Journal**

Cebull, S.E., and Russell, L.R., 1979, Role of the Melones fault zone in the structural chronology of the North Yuba River area, western Sierra Nevada, California: Geological Society of America Bulletin, Part I, v. 90, p. 225-227; Part II, v. 90, p. 528-544.

Brabb, E.E., 1978, Paleogene correlated: Geotimes, v. 23, no. 3, p. 20.

Christiansen, R.S., and Lipman, P.W., 1972, Cenozoic volcanism and plate tectonic evolution of the western United States - Part II, Late Cenozoic: Royal Society of London Philosophical Transactions, ser. A, v. 271, p. 249-284.

**Congressional Report or Law**

U.S. Congress, Senate Committee on Interior and Insular Affairs, 1949, National resources policy, Hearings: U.S. 81st Congress, 1st session, 470 p.

U.S. Inter-Agency Committee on the Arkansas-White-Red River Basins, Minerals and Geology Work Group, 1955, Minerals and Geology, Part 2, Section 16, *of* Arkansas-White-Red River Basins Report: U.S. 81st Congress, 2nd Session, section 205, Public Law 516.

**Foreign Paper**

Godfriaux, I., 1964, Sur le metamorphisme dans le zone pelagonienne orientale (region de L'Olympe, Grece): Societe Geologique de France, Bulletin, ser. 7, v. 6, p. 146-162.

**Guidebook**

Stearns, D.W., 1971, Mechanisms of drape folding in the Wyoming province: Wyoming Geological Association, 23rd Annual Field Conference, Guidebook, p. 125-144.

**In Press**

Ritter, D.F., 1982, Complex river terrace development in the Nenana Valley near Healy, Alaska: Geological Society of America Bulletin, v. 93 (in press).

**International Geological Congress**

Burek, P.J., 1972, The paleogeographic pattern of Europe and North Anerica around the Paleo-Mesozoic boundary and its significance for initial rifting in the North Atlantic: International Geological Congress, 24th, Montreal, Abstracts, p. 256.

**Map**

Bayley, R.W., and Muehlberger, W.R., compilers, 1968, Basement rock map of the United States, exclusive of Alaska and Hawaii: U.S. Geological Survey, scale 1:2,500,000, 2 sheets.

Perry, R.K., and others, 1977, Bathymetry of the Norwegian-Greenland and western Barents Seas: Geological Society of America Map and Chart Series MC-21, scale 1:2,333,230 at lat 71° N.

Williams, J.R., Pewe, T.L., and Paige, R.A., 1959, Geology of the Fairbanks (d-1) quadrangle, Alaska: U.S. Geological Survey Geologic Quadrangle Map GQ-124, scale 1:63,360.

Zietz, I., Gilbert, F., and Kirby, J.R., compilers, 1972, Aeromagnetic map of New England: U.S. Geological Survey Open-File Map, scale 1:250,000.

**No Author Given**

Oil and Gas Journal, 1952, Where are those Gulf Coast salt domes?: v. 51, no. 14, p. 130, 133-134.

**Open-File Report**

Doe, B.R., 1976, Lead isotope data bank: U.S. Geological Survey Open-File Report 76-201, 104 p.

**Paper in a Government or University Serial Publication**

Bailey, E.H., and Blake, M.C., Jr., 1974, Major chemical characteristics of Mesozoic Coast Range ophiolite in California: U.S. Geological Survey Journal of Research, v. 2, p. 637-656.

Hay, R.L., 1963, Stratigraphy and zeolitic diagenesis of the John Day Formation of Oregon: University of California Publications in Geological Sciences, v. 42, p. 199-262.

Phillips, K.N., 1968, Hydrology of Crater, East, and Davis Lakes, Oregon, *with a section on* Chemistry of the lakes, by A.S. Van Denburgh: U.S. Geological Survey Water-Supply Paper 1859-E, p. E1-E60.

**Paper in a Multiauthor Volume**

Bowin, C., 1972, Puerto Rico Trench negative gravity anomaly belt, *in* Shagam, R., and others, eds., Studies in Earth and space sciences: Geological Society of America Memoir 132, p. 119-132.

Thayer, T.P., 1967, Chemical and structural relation of ultra-mafic and feldspathic rocks in Alpine intrusive complexes, *in* Wylie, P.J., ed., Ultramafic and related rocks: New York, John Wiley, p. 222-239.

**Proceedings from a Symposium or Conference (include year of conference if it differs from publication year)**

Baar, C., 1972, Creep measured in deep potash mines vs. theoretical predictions, *in* Proceedings, Canadian Rock Mechanics Symposium, 7th, Edmonton: Ottawa, Canada, Department of Energy, Mines and Resources, p. 23-77.

MacLeod, N.S., Walker, G.W., and McKee, E.H., 1976, Geothermal significance of eastward increase in age of upper Cenozoic rhyolite domes in southeastern Oregon, *in* Proceedings, Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, May 1975, Volume 1: Washington, DC, U.S. Government Printing Office (Lawrence Berkeley Laboratory, University of California), p. 465-474.

**Second Edition of a Book**

Press, F., and Seiver, R., 1978, Earth (second edition): San Francisco, W.H. Freeman and Co., 649 p.

**Single Paper Published in Separate Parts**

Johnson, D.W., 1938 (v. 1), 1939 (v. 2), Origin of submarine canyons: Journal of Geomorphology, v. 1, p. 111-129, 230-243, 324-340; v. 2, p. 42-60, 133-158, 213-236.

**Thesis**

Saleeby, J.B., 1975, Structure, petrology and geochronology of the Kings-Kaweah mafic-ultramafic belt, southwestern Sierra Nevada foothills, California [Ph.D. thesis]: Santa Barbara, University of California, 286 p.

**Treatise**

Hantzschel, W., 1975, Trace fossils and Problematica (second edition), *in* Teichert, C., ed., Treatise on invertebrate paleontology, Part W, Miscellanea, Supplement 1: Boulder, Colorado, Geological Society of America (and University of Kansas Press), 269 p.

*** * * * * End of Example * * * * ***

The reference section(s) follows the main body of the text and may be entitled either "References," or "Selected Bibliography," or "Bibliography," in accordance with the following categories.

1. Every FGS publication requires a reference section titled **REFERENCES**. Each publication listed in this section must have been referred to and cited at least once in the text. All citations referenced in the text must be included in this section.

**Optional reference** sections may be appended as noted below:

2. The term **Selected Bibliography** is used when the author adds to a "References" list some other publications that are directly related to the subject of the report, but which were not cited in the report.

3. The term **Bibliography** is used when the author has attempted to list all references bearing on the subject, even if they only indirectly relate to the report.

Only material that has been published or is "in press" should be cited in a reference list or bibliography. The term "in press" means that a manuscript has actually gone to a printer to be printed, and copies are expected to be ready for distribution in a short period of time.

Unpublished material (W.T. Door, unpublished report, 1978) or personal communications (D. Crockett, pers. comm., 1979) should be identified as such in the text, but they are not included in the reference list.

Material of limited circulation (theses, open file reports, consultant's reports, and the like) may be included, but it must be stated where they may be obtained if a reader might desire to inspect the original citation.

If no author's name is given for a publication, the agency responsible for the report should be substituted.

## ILLUSTRATIONS

Illustrations include figures and plates, either of which may be line drawings or photographs. Authors should carefully consider the final sizes of their figures during manuscript preparation and the rough drafting stage. The section on "Preparation of Illustrations" should be consulted for guidelines on planning and layout of illustrations.

All individual photographs are referred to as "Figures," except grouped photographs of fossils or grouped microphotographs, which are called "Plates."

Illustration titles listed on the Contents page should not be longer than two typed lines. Figure captions that are longer than two typed lines in the manuscript should have a condensed version for its contents listing.

Fold-outs, tip-ins, and pocket material should be avoided. They are expensive to print and difficult to prepare. Planning during manuscript preparation can generally provide alternate solutions, such as reduced sections or facing-page illustrations.

In cases where an author uses an illustration that was published previously, acknowledgement must be clearly shown, either on the illustration or in the caption. Copyright clearance may be necessary, in which case the author must obtain it. The following rules apply to acknowledgement of illustrations. An example of a citation is: "Adapted from Gilluly, 1977."

after: possible redrafting, but no changes in information
modified: some changes in information
adapted: radical changes made to basic reference

### APPENDICES

An appendix is the place for detailed or voluminous information that will not fit readily in the main text. Such information includes analytical procedures, lengthy stratigraphic columns or descriptions of measured sections, and tabulations of numerical data.

### INDEX

Certain publications may require an index, such as Bulletins or Special Publications. If an index is required, the author will need to prepare one after second review of the manuscript. Commonly included subjects are personal names, geographic names, company names, names of rocks and minerals, geological processes, geological units, formations, or provinces.

## PREPARATION AND REVIEW OF ILLUSTRATIONS

### REVIEW PROCEDURE

The first drafts of all reports are routed to the FGS cartographic section for review and comment. Any suggested changes should be discussed with the cartographers, and revised figures should be prepared for circulation with the second draft.

Reviewers should thoroughly check all maps and diagrams to make sure that all captions, titles, legends, or lettering agrees with and is consistent with the text and table of contents.

Manuscripts that are submitted to the FGS by outside authors should not include final drafted figures, but rather, figures that are in a highly finished, preliminary state, and consistent with these guidelines. This will allow for review and comment before the author has to produce final figures. Photographs should be unmounted, and suggested crop-lines may be indicated in the margins with blue pencil.

### STANDARD DIMENSIONS FOR ILLUSTRATIONS

Dimensions of bound publications of the FGS are 8.5 by 11 inches. The layout and dimensions for a standard page are shown in Figure 1. The dimensions within the margins of a standard page are 6.5 by 9 inches, which allows a one-inch-wide margin on all sides. All material - including captions - must fit within this field. To ensure that illustrations will fit this format, authors should plan the dimensions of their original art before doing the first draft of any figure. If in doubt, an early consultation with the FGS editor or cartographers will preclude later revisions. Legibility after reduction should be a primary consideration in planning all figures' dimensions and the information to be included.

Photographs may need to be cropped or reduced. This does not need to be done for the first draft, but the author should check with the editor or cartographers if dealing with oversize prints or slides.

Remember, all figures and tables must have their own caption, to be placed outside the borders of the figure. A legend on a figure cannot substitute for a caption. Therefore, allowance must be made for a caption within the margins of the field. Allow for a minimum height of one-half inch, or more if the caption will be lengthy.

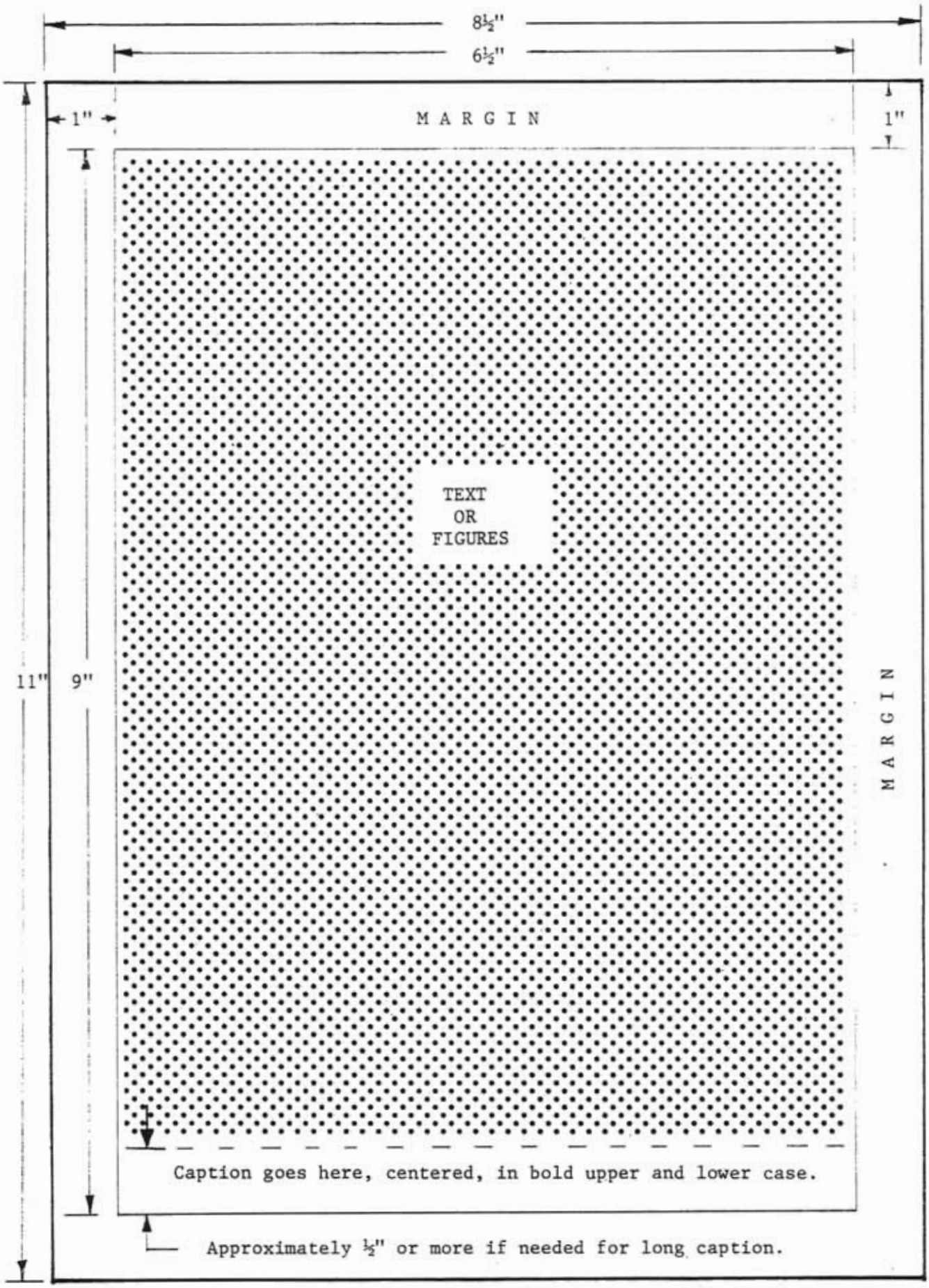



**Figure 1. Layout and dimensions for a standard page in Florida Geological Survey publications.**

## LOCALITY AND WELL NUMBERING SYSTEM

Any publication that makes reference to localities or to well locations must include the standard explanation of the locality and well numbering system used in Florida. This system is shown in Figure 2, and the standard explanation to be used in the text is presented below in its entirety.

*** * * * * Start of Example of Standard Text * * * * ***

There are two numbering systems used in this report. One is a well numbering system based on sample number assignments. The Florida Geological Survey maintains a sample repository of drill cuttings from wells. Each well is assigned a unique accession number, such as W-14719, which is used to identify samples from that well.

The second numbering system used in this report is a well and locality numbering system based on the location of the well or locality, and uses the rectangular system of section, township and range for identification (Figure 2). The number consists of six parts. These are: 1) a prefix letter designating either L for locality, or W for well, 2) a two-letter county abbreviation code, 3) the township, 4) the range, 5) the section, and 6) the quarter/quarter location within the section.

The basic rectangle is the township, which is 6 miles on a side and encompasses 36 square miles. It is consecutively measured by tiers both north and south of the Florida Base Line, and an east-west line that passes through Tallahassee, as Township north or south. This basic rectangular is also consecutively measured both east and west of the Principal Meridian, a north-south line that passes through Tallahassee, as Range east or west. In recording the township and range numbers, it is customary to leave off the T of the township numbers and the R is left off of the range numbers (e.g., 7S, 9W). Each township is divided equally into 36 one-mile-square blocks called sections, and are numbered 1 through 36, as shown in Figure 2.

The sections are divided into quarters with the quarters labeled "a" through "d." In turn, each of these one-quarter sections is further subdivided into quarters with these quarter/quarter sections labeled "a" through "d" in the same manner. The "a" through "d" designation may be carried to any extent needed.

As an example, the location of well W-14719 (WGf-7S-9W-12cd) on Figure 2 would be in the center of the southwest quarter of the southeast quarter of section 12, Township 7 South, Range 9 West, Gulf County.

*** * * * * End of Example * * * * ***

## GEOLOGIC MAPS, STRATIGRAPHIC COLUMNS, AND CROSS SECTIONS

### LEGENDS

Every map must have the following information, as shown on Figure 3.

1. North arrow.
2. Composite bar scale of miles and kilometers, or other appropriate units of measure.
3. A legend that shows the symbols used and that briefly explains the map's function, e.g., county road map, well location map, or cross section location map.

The map's legend may be necessarily brief due to space limitations. In such cases note that the figure's caption does not simply repeat the map's legend, but is used to expand and clarify the map's function.

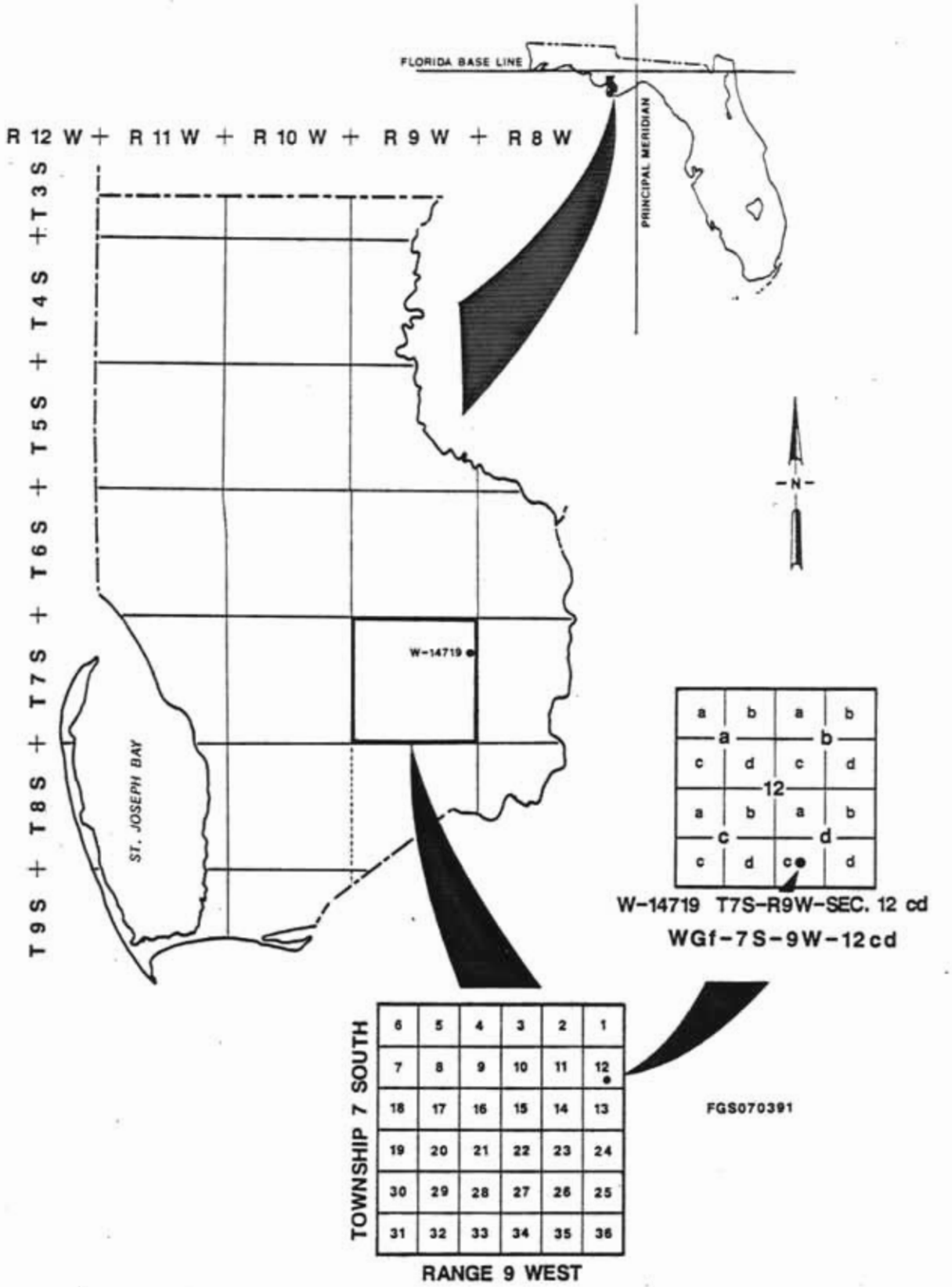
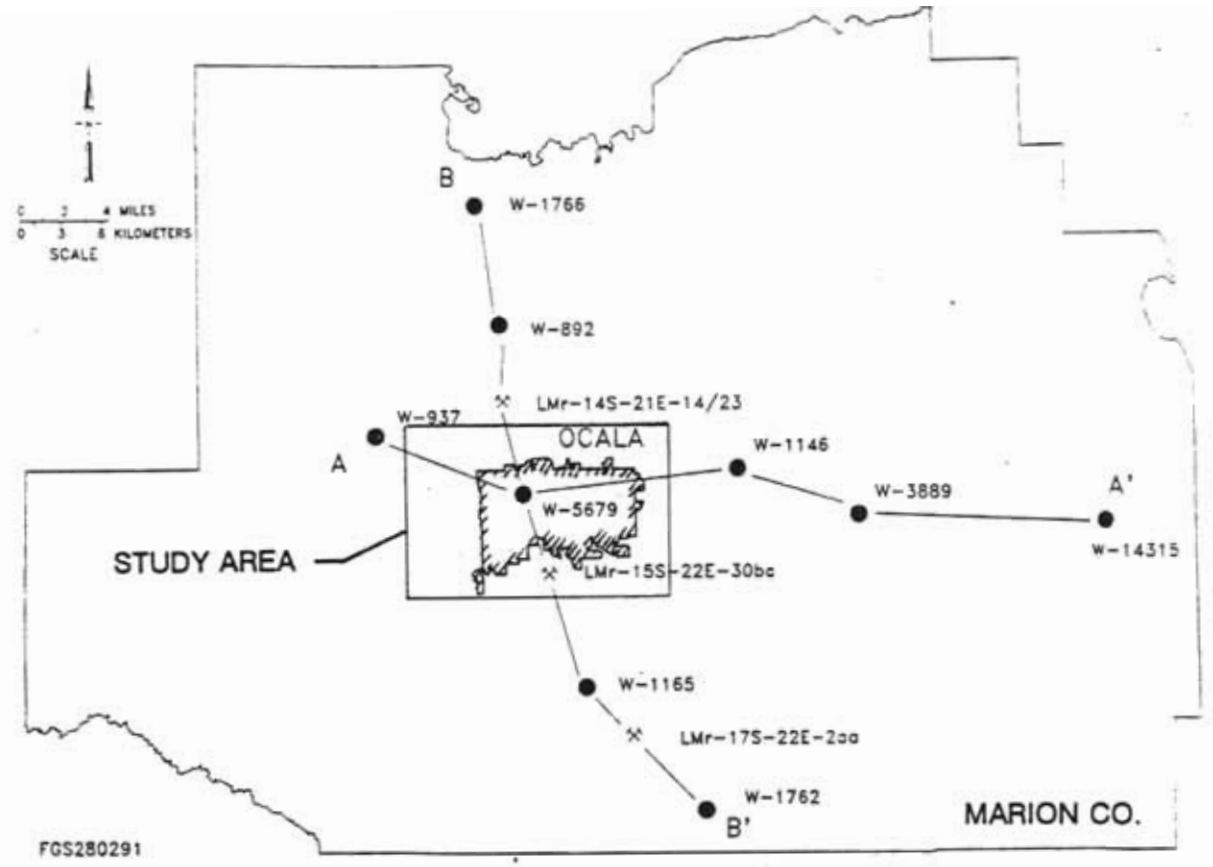



**Figure 2. Locality and well numbering system used by the Florida Geological Survey. Each numbered section is one-mile square.**




EXPLANATION

- WELL LOCATION
- QUARRY
- LINE OF CROSS SECTION
- CITY LIMITS

**Figure 3. Map showing necessary legend information.**

Figure 3 also demonstrates the manner in which additional information may be added to a location map to enhance its value to the reader. Locations of cross sections should be distinctively identified. It is suggested that township and range markings be added around the margins to facilitate locating points of interest.

In addition to the minimum information required in its title and legend, a geologic map also should have an explanation column. An example of the conventional format for an explanation column to accompany a geologic map is shown in Figure 4. This conventional format also may be used on stratigraphic columns or cross sections.

### LITHOLOGIC AND STRATIGRAPHIC SYMBOLS

Symbols and lettering used on illustrations for FGS publications may be of three general types: computer generated, commercially available press-on (commonly called "zip-a-tone"), or mechanically produced (such as Merlin). Free-hand lettering is unacceptable. Free-hand drawings may be used in special circumstances, but not for technical illustrations.

Criteria used in choosing symbols, patterns, and size of letters should be:

1. CLARITY. Will the letters or pattern drop-out if the figure is reduced? For optimum clarity the author should carefully consider the type of base map to be used, and how much geological, cultural, or other details are to be illustrated. Perhaps two or more illustrations would be better than one cluttered map.
2. STANDARDIZATION. Conventional symbols for common lithologies should be used, e.g., the blocky symbol for limestone or the use of random dots for sand. Do not invent new symbols for common lithologies.

### COLOR

Color is a very effective way of depicting information, to show distinguishing characteristics, or to emphasize some aspect of a report or map. If an author proposes to use color, preliminary drawings should be submitted to the FGS editor for review. The following considerations should be used in selecting colors.

If more than one colored diagram or map is to appear in a publication, the colors should be coordinated. For example, units of the same age or lithology on different illustrations should have the same colors.

In selecting colors, and in specifying them to printers, preference must be given to light, transparent, color values and to pastel shades. Not only are they more aesthetically pleasing than dark, solid colors, but more importantly, lighter colors allow for the retention of legibility of overprinted legends, text, contours, and other information. Special care must be taken with color selection if any map information is to be printed in a light halftone.

## FLORIDA SYSTEMS

### LETTER SYMBOLS

Appendix B shows the letter symbols for the names of geological formations and members that are in current usage by the FGS. Proposals for new geological names or symbols must be approved by the FGS. The FGS uses the criteria established by the North American Stratigraphic Code, published by the North American Commission on Stratigraphic Nomenclature, as a guide for nomenclatural changes.

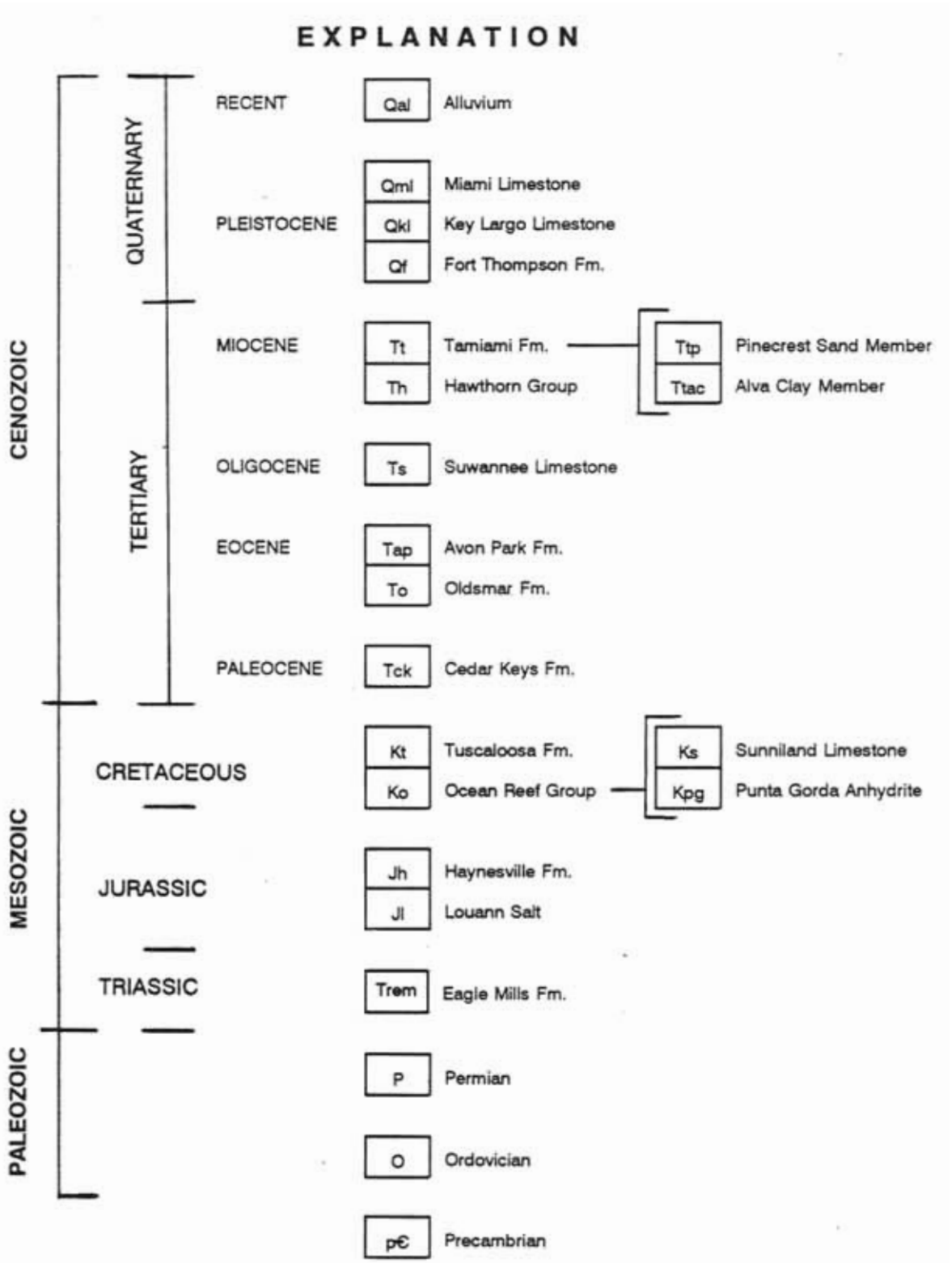



**Figure 4. Conventional format for an explanation column to accompany a geologic map, a stratigraphic column, or a cross section. This is a pattern explanation, organized by age, and is an illustrative section only. It is not meant to represent all stratigraphic units found in Florida at any given location, which will vary with each report.**

If an author needs to create a new letter symbol, the following guidelines should be used. The new symbol should be based on practicality. No symbol should include more than four (4) letters. Important factors to be considered in coining a new symbol are the number of units or members shown and the rock types of the area under discussion.

The first letter of the symbol is the geologic age of the formation. The second letter of the symbol is the first letter of the formation's name, as in Tt for Tamiami Formation of Tertiary age. If a formation name consists of two or more words, such as Fort Thompson Formation of Quaternary age, there is a choice of symbols - in this example either Qft or Qf. If members of the Fort Thompson Formation are mapped, the first letter of the formation name is commonly used with the first letter of the member's name, as in Qfc, where "c" stands for the Coffee Mill Hammock Member of the Fort Thompson Formation. This method keeps the symbol from becoming too long and unwieldy. To dispel possible confusion in some cases, it may be necessary to use more than one letter from each formation or member, as can be seen from the several members of the Tamiami Formation. For clarity, symbols for the Buckingham Limestone and the Bayshore Clay Members use the first letters of both words of their names, Ttbl and Ttbc, respectively.

## ABBREVIATIONS FOR FLORIDA COUNTY NAMES

When space is at a premium, such as on maps, graphs, charts, or tabular listings, the conventional abbreviations for Florida county names shown in Table 2 may be used.

**Table 2. Abbreviations for Florida county names.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Alachua | Aa | Flagler | Fg | Lafayette | Lf | Palm Beach | Pb |
| Baker | Bk | Franklin | Fk | Lake | Lk | Pasco | Ps |
| Bay | By | Gadsden | Ga | Lee | Le | Pinellas | Pi |
| Bradford | Bf | Gilchrist | Gr | Leon | Ln | Polk | Po |
| Brevard | Bv | Glades | Gl | Levy | Lv | Putnam | Pu |
| Calhoun | Cn | Gulf | Gf | Liberty | Lb | St. Johns | Sj |
| Charlotte | Ch | Hamilton | Hm | Madison | Md | St. Lucie | Sl |
| Citrus | Ci | Hardee | Hd | Manatee | Mn | Santa Rosa | Sr |
| Clay | Cy | Hendry | Hy | Marion | Mr | Sarasota | Sa |
| Collier | Cr | Hernando | Hr | Martin | Mt | Seminole | Se |
| Columbia | Co | Highlands | Hi | Monroe | Mo | Suwannee | Sw |
| Dade | Dd | Hillsborough | Hl | Nassau | Na | Sumter | Sm |
| DeSoto | Ds | Holmes | Ho | Okaloosa | Oa | Taylor | Ty |
| Dixie | Dx | Indian River | Ir | Okeechobee | Oe | Union | Un |
| Duval | Du | Jackson | Ja | Orange | Or | Volusia | Vo |
| Escambia | Es | Jefferson | Jf | Osceola | Os | Wakulla | Wk |
| | | | | | | Walton | Wl |
| | | | | | | Washington | Ws |

# APPENDIX A

## STANDARD FORMATS OF TYPICAL PAGES FOR FLORIDA GEOLOGICAL SURVEY PUBLICATIONS

FLORIDA GEOLOGICAL SURVEY

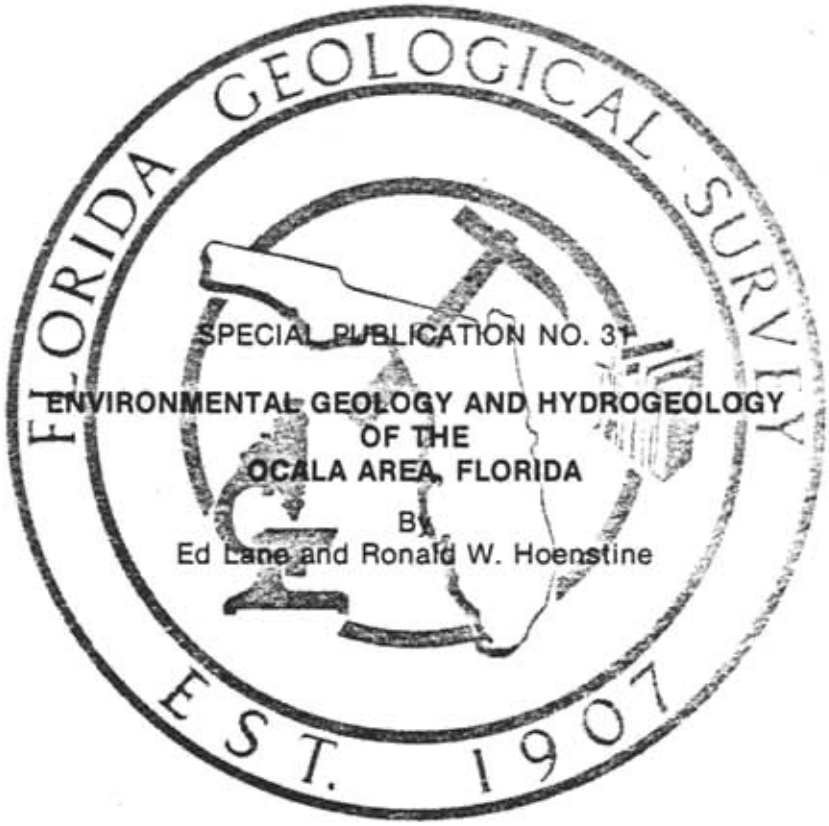
SPECIAL PUBLICATION NO. 31

1991

STATE OF FLORIDA
**DEPARTMENT OF NATURAL RESOURCES**
Tom Gardner, *Executive Director*

**DIVISION OF RESOURCE MANAGEMENT**
Jeremy A. Craft, *Director*

**FLORIDA GEOLOGICAL SURVEY**
Walter Schmidt, *State Geologist and Chief*




SPECIAL PUBLICATION NO. 31

# ENVIRONMENTAL GEOLOGY AND HYDROGEOLOGY OF THE OCALA AREA, FLORIDA

By
Ed Lane and Ronald W. Hoenstine

Published for the

**FLORIDA GEOLOGICAL SURVEY**

Tallahassee
1991

**Figure A1. Cover 1 (outside front cover), with title on spine. [Note that these examples of Figures 1-14 were taken from Special Publication 31, 1991. Personnel names will need to be changed, as required.]**

## CONVERSION FACTORS AND ABBREVIATIONS

This table of the most commonly used conversion factors is provided for readers who may prefer to use metric units instead of the English units given in this report.

| MULTIPLY | BY | TO OBTAIN |
|---|---|---|
| inch (in) | 25.4 | millimeter (mm) |
| inch (in) | 2.540 | centimeter (cm) |
| inch (in) | 0.0254 | meter (m) |
| foot (ft) | 0.3048 | meter (m) |
| mile (mi) | 1.609 | kilometer (km) |
| sq. feet ($ft^2$) | 0.09290 | sq. meter ($m^2$) |
| sq. mile ($mi^2$) | 2.590 | sq. kilometer ($km^2$) |
| acre (ac) | 0.4047 | hectare (ha) |
| acre (ac) | 4047.0 | sq. meter ($m^2$) |
| cubic foot ($ft^3$) | 0.02832 | cubic meter ($m^3$) |
| cubic yard ($yd^3$) | 0.7646 | cubic meter ($m^3$) |
| gallon (gal) | 3.785 | liter (L) |
| gallons per minute (gpm) | 0.06308 | liter per second (L/s) |
| gallons per minute (gpm) | 0.0022 | cubic feet/second (cfs) |
| gallons per minute (gpm) | 0.00006309 | cubic meters/second ($m^3/s$) |
| cubic feet per second (cfs) | 449 | gallons per minute (gpm) |
| cubic feet per second (cfs) | 0.02832 | cubic meters/second ($m^3/s$) |
| pound (lb) | 0.4536 | kilogram (kg) |
| ton, short (2,000 lbs) | 0.9072 | megagram (Mg) |
| ton, long (2,240 lbs) | 1.016 | megagram (Mg) |
| Fahrenheit (F) | 5/9 (F-32) | Centigrade |

**Sea Level:** In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929) -- a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929" or "mean sea level (MSL)." Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific coasts, it does not necessarily represent local mean sea level at any particular place.

**Figure A2. Cover 2 (inside front cover), conversion factors.**

**FLORIDA GEOLOGICAL SURVEY**
**903 W. TENNESSEE STREET**
**TALLAHASSEE, FLORIDA 32304-7700**

Walter Schmidt, Chief

Peter M. DoUbins, Admin. Asst.
Jessie Hawkins, Custodian
Alice Jordan, Librarian
Sandie Ray, Admin. Secretary
Vanessa Allred, Library Asst.

**GEOLOGICAL INVESTIGATIONS SECTION**

Thomas M. Scott, Senior Geologist/Administrator

Jon Arthur, Petrologist
Paulette Bond, Geochemist
Dianne Brien, Research Asst.
Ken Campbell, Sedimentologist
Cindy Collier, Secretary
Mitch Covington, Biostratigrapher
Joel Duncan, Sed. Petrologist
Bob Fisher, Research Asst.
Rick Green, Research Asst.
Mark Groszos, Research Asst.
Kent Hartong, Research Asst.
Jim Jones, Cartographer
Clay Kelly, .Research Asst.
Ted Kiper, Cartographer
Nancy LaPlace, Research Asst.
Milena Macesich, Research Asst.
Mel Martinez, Research Asst.
Ted Maul, Research Asst.
Robert Mince, Research Asst.
John Morrill, Driller
Larry Papetti, Research Asst.
Albert Phillips, Asst. Driller
Frank Rupert, Paleontologist
Frank Rush, Lab Tech.
Tom Seal, Research Asst.

**MINERAL RESOURCE INVESTIGATIONS**
**AND**
**ENVIRONMENTAL GEOLOGY SECTION**

Jacqueline M. Lloyd, Senior Geologist/Administrator

Ed Lane, Env. Geologist
Ron Hoenstine, Env. Geologist
Steve Spencer, Economic Geologist

**OIL AND GAS SECTION**

L. David Curry, Administrator

Brenda Brackin, Secretary
Robert Caughey, Dist. Coordinator
Joan Gruber, Secretary
Don Hargrove, Engineer
Scott Hoskins, Dist. Coordinator
Barbara McKamey, Secretary
Marycarol Reily, Geologist
Koren Taylor, Research Asst.
Charles H. Tootle, Pet. Engineer

**Figure A3. Cover 3 (inside back cover), FGS personnel list.**

STATE OF FLORIDA
**DEPARTMENT OF NATURAL RESOURCES**
Tom Gardner, *Executive Director*

**DIVISION OF RESOURCE MANAGEMENT**
Jeremy A. Craft, *Director*

**FLORIDA GEOLOGICAL SURVEY**
Walter Schmidt, *State Geologist and Chief*

SPECIAL PUBLICATION NO. 31

# ENVIRONMENTAL GEOLOGY AND HYDROGEOLOGY OF THE OCALA AREA, FLORIDA

By
Ed Lane and Ronald W. Hoenstine

Published for the

**FLORIDA GEOLOGICAL SURVEY**

Tallahassee
1991

**Figure A4. Inside title page.**

**DEPARTMENT**
**OF**
**NATURAL RESOURCES**

**LAWTON CHILES**
*Governor*

**JIM SMITH**
*Secretary of State*

**BOB BUTTERWORTH**
*Attorney General*

**TOM GALLAGHER**
*State Treasurer*

**GERALD LEWIS**
*State Comptroller*

**BETTY CASTOR**
*Commissioner of Education*

**BOB CRAWFORD**
*Commissioner of Agriculture*

**TOM GARDNER**
*Executive Director*

**Figure A5. Cabinet listing page.**

LETTER OF TRANSMITTAL

FLORIDA GEOLOGICAL SURVEY
Tallahassee

June 1991

Governor Lawton Chiles, Chairman
Florida Department of Natural Resources
Tallahassee, Florida 32301

Dear Governor Chiles:

The Florida Geological Survey, Division of Resource Management, Department of Natural Resources, is publishing as Special Publication No. 31, *Environmental Geology and Hydrogeology of the Ocala Area, Florida*, prepared by staff geologists Ed Lane and Ronald W. Hoenstine. This report presents data on the geology and hydrology of the Ocala area, which is one of the fastest growing urban areas in Florida. This report is timely because of the growth rate, and the information will be of significant use to local, county, and state planners, as well as to the private sector. The data will assist these groups to develop and implement long range plans to effectively manage this growth.

Respectfully,

Walter Schmidt, Ph.D.
State Geologist and Chief
Florida Geological Survey

**Figure A6. Letter of transmittal.**

Printed for the

Florida Geological Survey

Tallahassee
1991

ISSN 0085-0640

**Figure A7. "Printed for" page.**

## CONTENTS



## FIGURES



**Figure A8. First page of Contents.**

## ACKNOWLEDGEMENTS

The authors wish to thank the following people and organizations who gave freely of their time and information. Their assistance provided a firm foundation for this study. Gary Maddox, Department of Environmental Regulation, who provided land use data and water quality data; Earl Blankenship, Solid Waste Administrator, Marion County Board of Commissioners, for information on the Marion County landfill; Philip Cosson, Planner, City of Ocala, for statistical data for Ocala; Dennis G. Thompson, Planning Director, Division of Planning, Marion County Board of Commissioners, for statistical data on Marion County; the Economic Development Council of Ocala for business and economic information; and G. C. Phelps, U.S. Geological Survey, for information on the aquifer systems in the Ocala area. In addition, the authors appreciate the efforts of Ken Campbell, Richard Johnson, Jim Jones, Ted Kiper, Jackie Lloyd, Frank Rupert, Walter Schmidt, Tom Scott, Steven Spencer, and Bill Yon in reviewing this report.

**Figure A9. Acknowledgement.**

# ENVIRONMENTAL GEOLOGY AND HYDROGEOLOGY OF THE OCALA AREA, FLORIDA

By
Ed Lane, P.G. #141 and Ronald W. Hoenstine, P.G. #57

## INTRODUCTION AND PURPOSE

Florida is experiencing phenomenal population growth. A significant part of this growth is occurring in the Ocala area, which is one of the fastest growing urban areas in the nation. Ocala, which had a 1987 population of 44,980, is projected to have an annual growth rate of 4.64 percent through 1995 (Thompson, 1988). Rapid urban growth places unusual stresses on the environment due to the demands of energy, construction, transportation, water supplies, and waste disposal. This report is designed to help local governments mitigate the impacts of society's pressures on the environment.

The principal objectives of this report are to interpret and summarize available cultural information and scientific data. By integrating cultural, climatological, geological, and hydrological data the report will illustrate the importance that geology plays in land-use planning for the Ocala urban area. Graphics are emphasized as a means of presenting data in a format that can be readily used by the public, scientists, planners, water managers, and public policy makers.

## LOCATION AND TRANSPORTATION

The City of Ocala is located in north-central peninsular Florida, approximately in the center of Marion County (Figure 1). The air-mile circles on Figure 1 show that Ocala also lies about equidistant from both extremes of the state's extent, from Pensacola in the western panhandle to Miami near the southern tip of the peninsula.

This central location makes Ocala a natural hub of Marion County's transportation system (Figure 2). Several of the state's major roads pass near or through Ocala: Interstate 75, US 27, US 41, US 441, US 301, and State Highways 40 and 475. A beltway encircling Ocala utilizing existing and new roads is currently being considered. CSX Transportation (formerly the Seaboard Coast Line Railroad) has several routes that branch out of Ocala, eventually connecting to Gainesville, Jacksonville and points north, and south to Tampa, Orlando, and Miami. Several airlines have scheduled service to Ocala Municipal Airport.

## CLIMATE

Ocala's location in north-central peninsular Florida is reflected in its humid, subtropical climate. Its annual average temperature is 71.1°F, varying from low averages of approximately 58°F in December and January to high averages of about 82°F during July and August (Figure 3).

Rainfall distribution for Ocala is shown in Figures 4 and 5. Summer is the "wet" season, caused by an increase in thunderstorm activity (Figure 4). Figure 5 shows substantial fluctuations above and below annual average rainfall, with the widest extremes for the period occurring within two years of each other, in 1982 and 1984. The high rainfall of 1982 was due mainly to a series of April thunderstorms that struck north central Florida from Marion County southward to Brevard County. Hail the size of golf balls covered the ground in many areas. On April 8, thunderstorms dropped up to 12 inches of rain over Marion County, and additional rains of April 9 produced storm totals up to 20 inches, causing flooding and 150 sinkholes, with heaviest damage in the Ocala area (NOAA, 1982). This incident is discussed in more detail in the Environmental Hazards section.

## MAP COVERAGE

A total of 32 U.S. Geological Survey topographic maps are required to completely cover Marion County (Figure 6). These maps, which were used as base maps to plot field data, are 7½ minute quadrangles drawn at a scale of

**Figure A10. First page of text.**

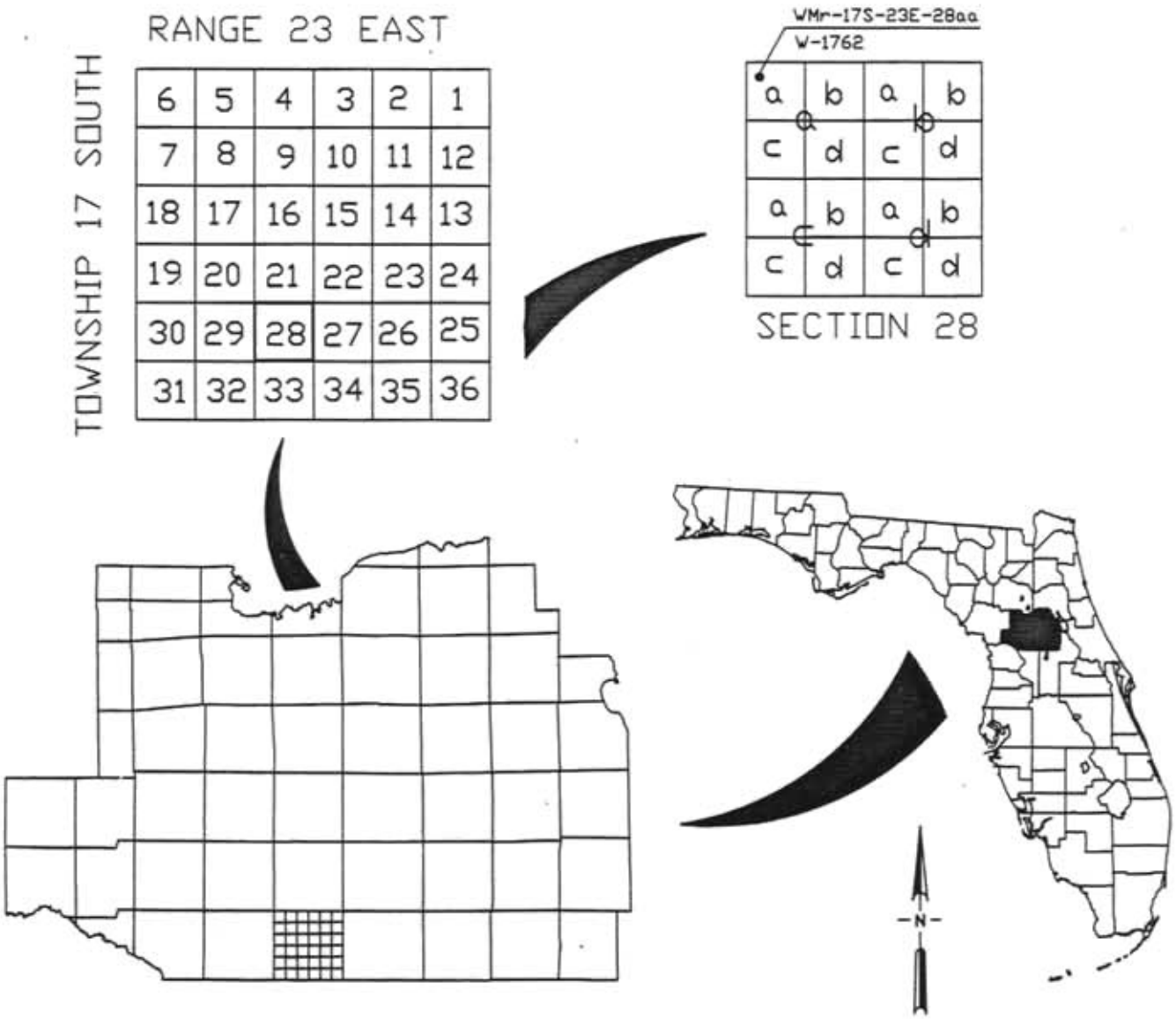
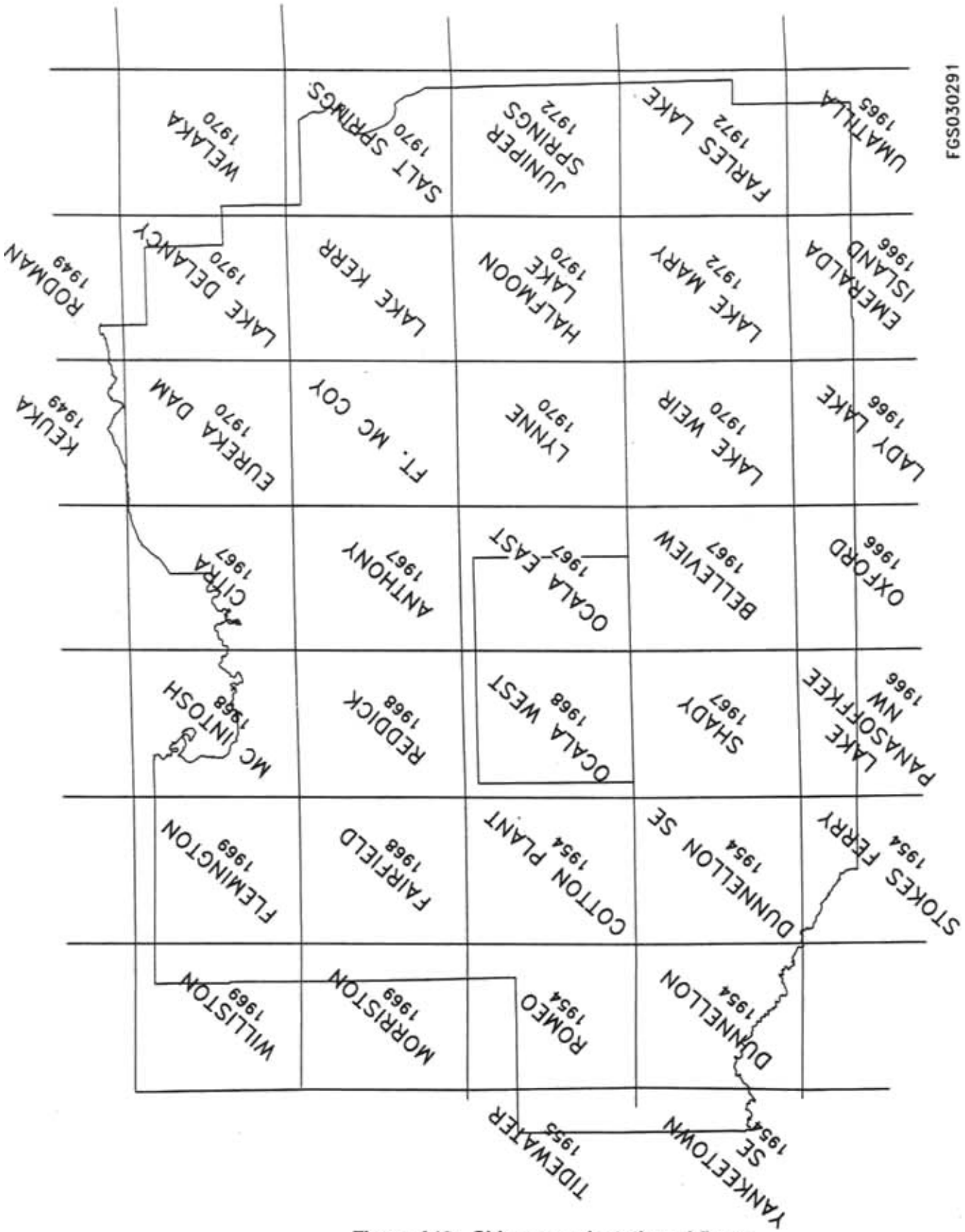



**Figure 7. Locality and well numbering system.**

**Figure A11. Full-page straight illustration.**




FGS030291

Figure 6. Topographic map coverage of Marion County, U.S. Geological Survey 7·1/2 minute quadrangles.

**Figure A12. Sideways orientation of figure.**

**Figure 18. City drainage well in bottom of a sinkhole connecting to the upper Floridan aquifer system. This type of well is used to control flooding by diverting urban runoff into the cavernous limestone aquifer. Florida Geological Survey photograph.**

## KARST IN THE OCALA AREA

There are a variety of karst features in the Ocala area. Figure 22 shows the extent to which the area's topography has been dissected by karst features. Silver Springs is a spectacular example of a cavernous spring, as shown in Figure 19d. It is the source of Silver River, and a major discharge point for water from the Floridan aquifer system, with flows ranging from 539 to 1,290 cubic feet per second (834,000,000 to 1,997,000,000 gallons per day) (Rosenau et al., 1977). These quantities of water can dissolve and carry away in solution as much as 541 tons of

One of these wells is located west of the city of Ocala, at the Ocala Airport (section 19b, Township 15S, Range 21E). This six-inch well is drilled to a depth of 90 feet below land surface into the upper Floridan aquifer system. Table 3 lists the specific parameters analyzed and their respective values for this well. All of the values are within established U.S. Environmental Protection Agency (EPA) units for potable water.

In addition to the ambient network wells, DER and the St. Johns River Water Management District (SJRWMD) are in the process of establishing a Very Intense Study Area (VISA) network within the city of Ocala. This VISA is located in the east-central part of the study area (Figure 27) and is

**Figure A13. Half-page figure showing placement of text.**

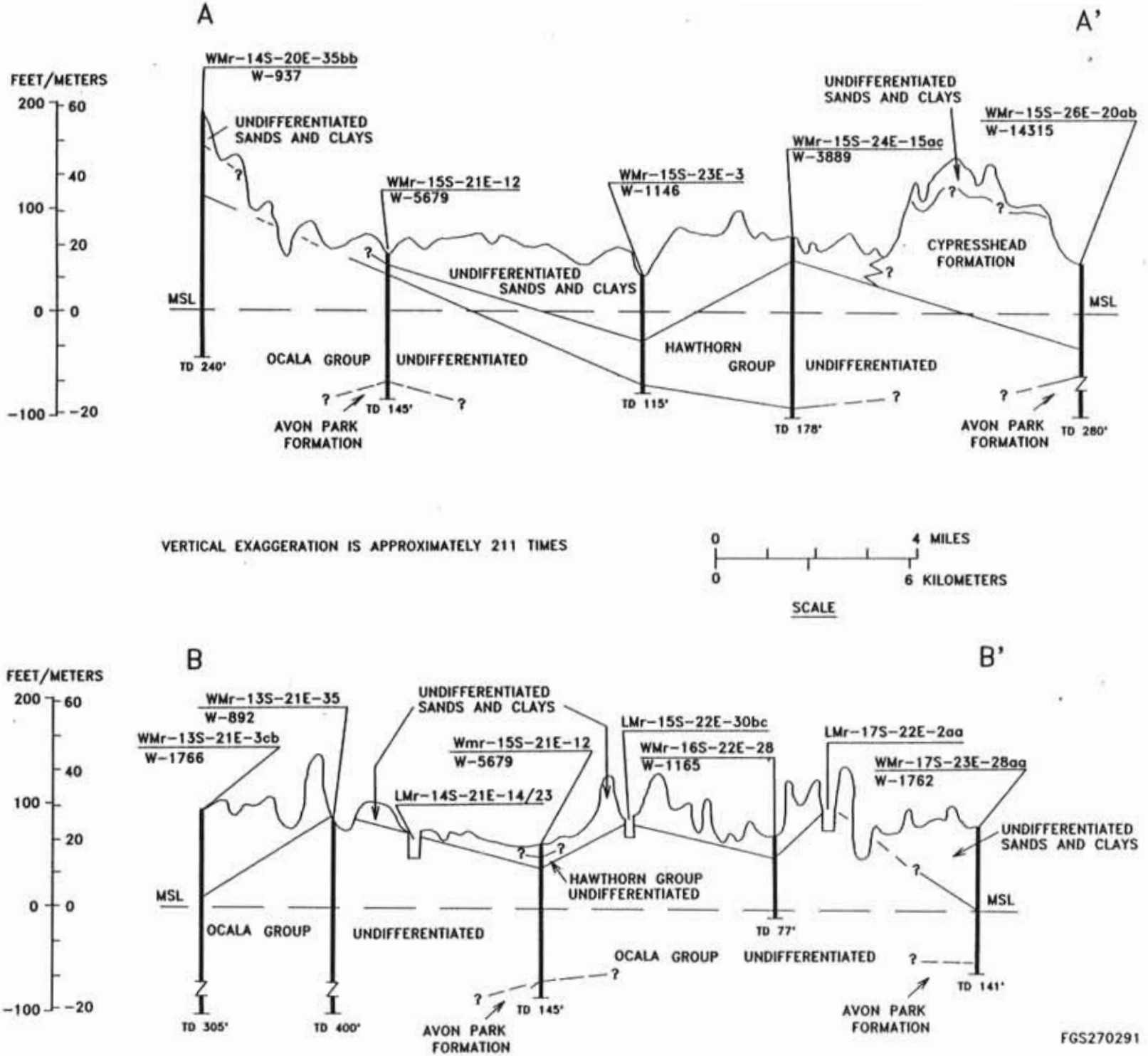



Figure 12. Cross sections A-A' and B-B'.

Figure A14. Two sideways figures combined on one page.

# APPENDIX B

## LETTER SYMBOLS FOR NAMES OF FLORIDA GEOLOGIC FORMATIONS

## APPENDIX B

LETTER SYMBOLS FOR NAMES OF FLORIDA GEOLOGIC FORMATIONS

| SYSTEM | FORMATION or MEMBER | LETTER SYMBOL |
|---|---|---|
| | **RECENT or PLEISTOCENE** | |
| QUATERNARY | undifferentiated units | Qu |
| | Lake Flirt Marl | Qlf |
| | Pamlico sand | Qp |
| | Anastasia Formation | Qan |
| | Miami Limestone | Qml |
| | Key Largo Limestone | Qkl |
| | Fort Thompson Formation | Qf |
| | Coffee Mill Hammock Member | Qfc |
| | Okaloakoochee Member | Qfo |
| | **PLIOCENE** | |
| TERTIARY | Caloosahatchee Formation | Tc |
| | Ayers Landing Member | Tca |
| | Bee Branch Member | Tcb |
| | Fort Denaud Member | Tcf |
| | Cypresshead Formation | Tch |
| | Citronelle Formation | Tci |
| | Miccosukee Formation | Tm |
| | Jackson Bluff Formation | Tjb |
| | Tamiami Formation | Tt |
| | Ochopee Limestone Member | Ttol |
| | Pinecrest Sand Member | Ttp |
| | Buckingham Limestone Member | Ttbl |
| | Alva Clay Member | Ttac |
| | LaBelle Clay Member | Ttl |
| | Ortona Sand Member | Ttos |
| | Murdock Station Member | Ttms |
| | Bayshore Clay Member | Ttbc |

TERTIARY

**PLIO - MIOCENE**

| | |
|---|---|
| Intracoastal Formation | Til |
| Red Bay Formation | Trb |
| Yellow River Formation | Tyr |
| Alachua Formation | Tal |
| Hawthorn Group | Th |
| Statenville Formation | Tst |
| Coosawhatchie Formation | Tco |
| Charlton Member | Tcoc |
| Marks Head Formation | Tmh |
| Penney Farms Formation | Tp |
| Peace River Formation | Tpr |
| Bone Valley Member | Tprbv |
| Arcadia Formation | Ta |
| Tampa Member | Tat |
| Nocatee Member | Tan |
| Torreya Formation | Tty |
| Dogtown Member | Ttyd |
| Sopchoppy Member | Ttys |
| Bruce Creek Limestone | Tbc |
| Pensacola Clay Formation | Tpc |
| Escambia Sand Member | Tpce |
| Shoal River Formation | Tsr |
| Oak Grove Member | Tsro |
| Chipola Formation | Tc |
| St. Marks Formation | Tsm |
| Chattahoochee Formation | Tce |

**OLIGOCENE**

| | |
|---|---|
| Suwannee Limestone | Ts |
| Duncan Church beds | Tsd |
| Byram Formation | Tb |
| Bucatunna Clay Member | Tbb |
| Marianna Limestone | Tml |
| Chickasawhay Limestone | Tch |

**EOCENE**

| | |
|---|---|
| Ocala Limestone (or Group) | To |
| Crystal River Formation | Tcr |
| Bumpnose Member | Tcrb |
| Steinhatchee Dolomite member (informal) | Tcrs |
| Williston Formation | Tw |
| Inglis Formation | Ti |
| Avon Park Formation | Tap |
| Lisbon Formation | Tl |
| Lake City Formation (now combined with Avon Park Formation) | Tlc |

| | | |
|---|---|---|
| TERTIARY | Tallahatta Formation | Tta |
| | Hatchetigbee Formation | The |
| | Bashi Marl Member | Theb |
| | Oldsmar Formation | To |
| | **PALEOCENE** | |
| | Cedar Keys Formation | Tck |
| | Midway Formation | Tm |
| UPPER CRETACEOUS | Selma Group | Ksg |
| | Pine Key Formation | Kp |
| | Lawson Limestone | Kl |
| | Eutaw Formation | Ke |
| | Atkinson Formation | Ka |
| | Tuscaloosa Formation (or Group) | Kt |
| | Pilot Sandstone Member | Ktps |
| | Upper member | Ktu |
| | Middle member | Ktm |
| | Lower member | Ktl |
| | Massive Sandstone Member | Ktms |
| LOWER CRETACEOUS | Big Cypress Group | Kbc |
| | Dollar Bay Formation | Kbcd |
| | Gordon Pass Formation | Kbcg |
| | Marco Junction Formation | Kbcm |
| | Ocean Reef Group | Ko |
| | Rattlesnake Hammock Formation | Korh |
| | Lake Trafford Formation | Kolt |
| | Sunniland Limestone | Kos |
| | Glades Group | Kg |
| | Punta Gorda Anhydrite | Kgp |
| | Lehigh Acres Formation | Kgl |
| | Able Member | Kgla |
| | Twelve Mile Member | Kglt |
| | West Felda Shale | Kgls |
| | Pumpkin Bay Formation | Kp |
| | Bone Island Formation | Kbi |
| | Ft. Pierce Formation | Kfp |
| | Hosston Formation | Kh |
| JURASSIC | Cotton Valley Group | Jcv |
| | Haynesville Formation | Jh |
| | Buckner Anhydrite (Lower Haynesville Fm) | Jba |
| | Smackover Formation | Js |
| | Norphlet Formation (or Sandstone) | Jn |
| | Louann Salt | Jl |
| | Werner Anhydrite | Jwa |
| | Wood River Formation | Jwr |

| | | |
|---|---|---|
| TRIASSIC | Eagle Mills Formation | Trem |

Paleozoic and Precambrian rocks are known from a few wells, but their ages and systemic affinities have not been established. In these cases, the author may assign them standard systemic letter symbols as research data indicates, in accordance with the section entitled "Letter symbols for geologic systems."