GSA news & information

VOLUME 2, NUMBER 10

OCTOBER 1980

Dear annual meeting participant:

Welcome to Atlanta! You will find Atlanta to be a growing new city; several major buildings and a rapid transit (subway) system are under construction in the downtown area. According to projections, Atlanta's new airport terminal will open just before our meeting. But even within the hectic activity typical of any city, in Atlanta you can find the heritage of a slower, more gracious way of life. We offer you a setting conducive to a most productive annual meeting. The Georgia World Congress Center is an ideal facility for all technical sessions, poster sessions, the science theater, the exhibits, and some special events. Social functions are scheduled in hotels and other facilities in downtown Atlanta. A shuttle bus system will connect convention hotels with meeting activities.

The 1980 Annual Meeting includes four full days of technical sessions. Sandwiched around the technical sessions is a program of pre- and post-meeting field trips emphasizing a wide range of southeastern geology. Mini field trips during the meeting will provide an opportunity to visit local outcrops in the Appalachian Piedmont. Within the framework of the technical sessions, the meeting will feature an up-to-the-minute symposium on Mount St. Helens, a GSA Centennial Symposium, and a critical look at resources for the future.

I would like to take this opportunity to thank my colleagues on the Local Committee. I selected each member for the particular characteristics he would bring to the group, and during the more than two years of committee activity, we have worked individually and collectively to plan the best possible meeting. The committee was designed to be representative of the region as well as the many facets of geology. In our efforts we have enjoyed a mutually cooperative working relationship with the GSA staff.

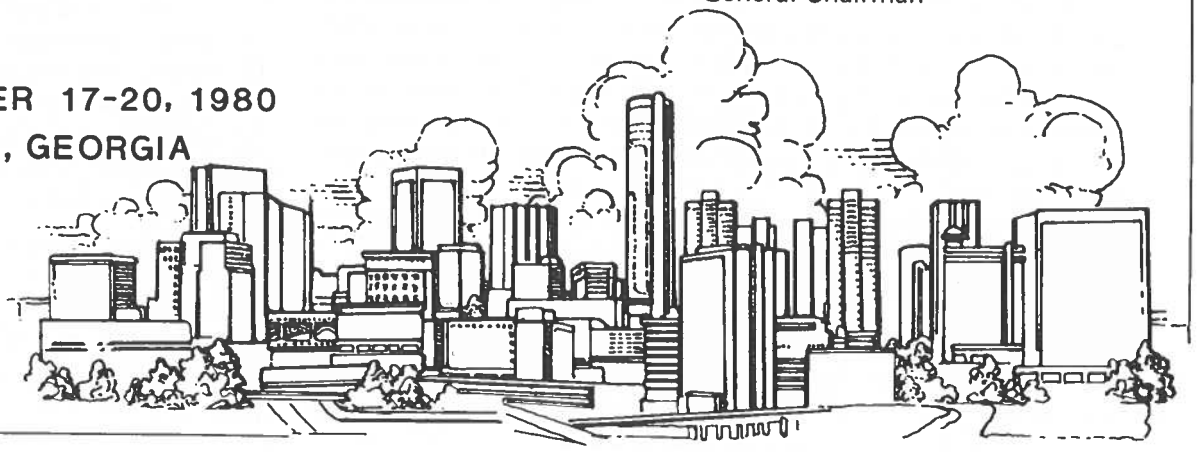
Our work of planning and preparation is nearly finished. Now, you all come to Atlanta and make the 1980 Annual Meeting a great meeting!

Sincerely,

William A. Thomas

William A. Thomas
General Chairman

NOVEMBER 17-20, 1980
ATLANTA, GEORGIA



UPDATE

WITH THANKS TO THE ATLANTA LOCAL COMMITTEE:

This year's Local Chairmen and their committees are to be congratulated on an excellent job of planning and organizing the 1980 Annual Meeting. In its 93 years of meeting, this is the first time GSA has met in Atlanta. The Committee has worked to develop a Southern meeting which attendants will remember for both its quality and hospitality. The Local Committee often remains in the background, unrecognized for its vital contribution to an annual meeting. Make it a priority to identify at least one Local Committee member to whom you can express interest, appreciation, and constructive comments. The following persons deserve your recognition and appreciation:

General Chairman
William A. Thomas, Univ. of Alabama (formerly at Georgia State Univ.)
Cochairman
Charles J. Waag, Georgia State Univ.
Field Trips
Thornton L. Neathery,* Alabama Geological Survey
Robert W. Frey, University of Georgia
Guest Program
William B. Size,* Emory Univ.
Linda E. Size
Howard R. Cramer, Emory Univ.
Publicity
Robert E. Carver,* Univ. of Georgia
J. Hatten Howard III, Univ. of Georgia
Science Theater
David Ogren, Georgia State Univ.
Richard D. Davis
Student Assistants
Norman S. Pottinger, Georgia State Univ.
Technical Program
Robert D. Hatcher, Jr.,* University of South Carolina (formerly at Florida State Univ.)
Charles E. Weaver, Georgia Institute of Technology
Technical Services
W. Robert Power, Georgia State Univ.
Transportation
Michael W. Higgins,* Georgia Geologic Survey
Keith McConnell, Georgia Geologic Survey

*Chairmen

MICHEL T. HALBOUTY TO ADDRESS ANNUAL DINNER

Michel T. Halbouty, recognized in the oil industry as an outstanding geologist and petroleum engineer, will be the after dinner speaker for the 1980 GSA Annual Dinner. He is prepared to inform and challenge us with his topic, "The Centennial Decade: Its Meaning and Significance to Geology." Everyone is welcome to hear Halbouty's address which will begin at approximately 8:30 p.m., Wednesday, November 19, in the Grand Ballroom of the Atlanta Marriott Hotel.

Halbouty is considered an outstanding authority on the geological and engineering problems of North America and is rated as one of the top experts on the geology of Gulf Coast Salt Domes. He is well known as an independent operator and producer of petroleum.

By 1931 Halbouty had received both his B.S. and M.S. degrees in geology and petroleum engineering from Texas A&M University. In May 1956 he received his professional degree in geological engineering also from Texas A&M. In June 1966 Montana College of Mineral Science & Technology conferred on him the degree of Doctor of Engineering, Honoris Causa.

Since completing his degree programs, Halbouty has published 200 papers and several books. He has to his credit a long list of awards which begins in 1965 with the Texas Mid-Continent Oil & Gas Association's Distinguished Service Award and extends to March 1979, when he was elected into membership of the National Academy of Engineering. He served as president of the American Association of Petroleum Geologists from 1966-1967.

Halbouty has been active in the management of several oil-producing firms, but is best known as a private consultant and is recognized as one of the most active independents in the nation.

* * * * * * * * * * * * *

Immediately preceding Halbouty's address will be the awarding of GSA's prestigious Penrose and Day medals. Ceremonies are planned for 8:15 p.m.

SPECIAL EVENTS

In addition to the annual dinner the major social functions will be

Welcoming Party— Hyatt Regency Hotel, Sunday, November 16, 6:30 p.m. to 9:30 p.m.

Alumni Party— Atlanta Marriott Hotel, Monday, November 17, 6:30 p.m. to 8:30 p.m.

Joseph F. Poland Dinner— Atlanta Marriott Hotel, Tara 5 Ballroom, Tuesday, November 18, 6:30 p.m. to 8:30 p.m. Friends and colleagues of Joseph F. Poland are holding this dinner in his honor. It is in conjunction with the Poland Symposium being held Wednesday afternoon, November 19. Anyone wishing to honor this pioneer in subsidence research is welcome to attend and may purchase tickets at the GWCC ticket counter until Monday at 5:00 p.m. Price: $14.

Bluegrass Night— Atlanta Apparel Mart, Tuesday, November 18, 7:00 p.m. to 11:00 p.m. Bluegrass Night will be a unique event held in the remarkable, 9-story, starlit atrium of the new Apparel Mart. It is an evening of regional food and entertainment which promises enjoyment for everyone—even those who are not bluegrass enthusiasts!

Reminder: Tickets are limited. If you want to be guaranteed a place for this special night, order tickets early. Pre-registration forms appeared in the August issue of *GSA News & Information*. Preregistration deadline is October 17.

Three programs of scholarly exchange with China announced

The Committee on Scholarly Communication with the People's Republic of China (CSCPRC) announces three programs of scholarly exchange in the natural sciences, engineering, social sciences, and humanities between the U.S. and China for 1981–82. The NATIONAL PROGRAM FOR ADVANCED STUDY AND RESEARCH IN CHINA offers opportunities for graduate students and postdoctoral scholars to carry out long-term study (10–12 months) or research (3–12 months) in affiliation with Chinese universities and research institutes. *Application deadline is November 7, 1980.* The DISTINGUISHED SCHOLAR EXCHANGE PROGRAM provides opportunities for American and Chinese senior scholars to spend one to three months in the host country engaging in a combination of research and lecturing. *Application deadline is October 6, 1980.* The CONFERENCES PROGRAM solicits proposals for conferences in the United States or China. *Application deadline is December 1, 1980.*

Inquiries should be addressed to the CSCPRC, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418.

Second International Symposium on the Cambrian System to be hosted by Colorado School of Mines, Golden, Colorado

August 9–13, 1981, has been set as the dates for the Second International Symposium on the Cambrian System to be held at the Colorado School of Mines, Golden, Colorado. There will be field trips before and after. The symposium is cosponsored by the U.S. Geological Survey and the Subcommission on Cambrian Stratigraphy, International Commission on Stratigraphy, International Union of Geological Sciences. For more information, contact Michael E. Taylor, U.S. Geological Survey, Box 25046, MS919, Denver Federal Center, Denver, Colorado 80225. Telephone (303) 234-5934.

Association of Engineering Geologists will hold 1981 annual meeting in Portland, Oregon

The 1981 Annual Meeting Association of Engineering Geologists will be held in Portland, Oregon, September 27 through October 4, 1981, at the downtown Hilton Hotel.

Chairman: Mavis D. Kent, 19443 Wilderness Drive, West Linn, Oregon 97068; telephone (503) 653-4129.

GSA News & Information
Vol. 2, No. 10 October 1980
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Prepared from contributions from the staff and membership by John C. Frye, Executive Director; James R. Clark, Publications Manager; and June Thomas, Judy Hall, and Ann Fogel, Production Assistants.

CENTENNIAL NEWS

1888 – GSA – 1988

WORKSHOPS PLANNED ON PROBLEMS OF REGIONAL GEOLOGICAL SYNTHESIS

Progress in science is often achieved by alternating periods of intense data gathering with periods of introspection and synthesis. The geological sciences in North America are entering a major period of synthesis. During the next 8 to 10 years—the Decade of North American Geology—the North American Plate and its surroundings will be evaluated by means of new tectonic, geologic and geophysical maps, and by a comprehensive series of volumes about its regional geology. An early step in the process of evaluation and synthesis is identification of anomalies or uncertainties—areas where key bits of information are lacking; areas where observations seem to be in conflict with large scale interpretations; or areas where there is no clear consensus about interpretations of observations. To bring some focus to this activity on a continental scale, each sectional meeting of the Geological Society of America in the spring of 1981 is planning a workshop devoted to the discussion of problems of regional geological synthesis. At these workshops, most of the regionally important anomalies and uncertainties in structure, biostratigraphy/paleogeography, geochemistry, geological/geophysical relations, etc., should be identified.

In order to make this inventory of problems available to the geological public where it might serve as a research stimulant, the results of these workshops will be compiled in "Problems of Regional Geologic Synthesis—A Workbook for the Decade of North American Geology," projected to appear early in 1982, which will be the first publication of the Centennial series on Regional Geology.

Suggestions for topics that should be discussed at the workshops are needed. Please send these suggestions to A. R. Palmer, Centennial Science Program Coordinator, Box 9140, Boulder, CO 80301.

Organization of the workshops will be the responsibility of the Coordinator, the GSA sectional program chairmen, and the appropriate leaders of the working groups for the regional synthesis volumes. The times for the workshops will be announced in future issues of *News & Information*.

Necrology

Notice has been received of the following deaths: Clarence Brehm, Mt. Vernon, Illinois; Joseph J. Fahey, Washington, D.C.; James Edward Gill, Ontario, Canada; Charles C. Huston, Toronto, Ontario, Canada; Richard B. Krause, Destin, Florida; R. L. Lupher, Los Angeles, California; Harry V. Welch, San Clemente, California.

Annual Report for 1979—Report of the Treasurer

To the Council and Membership of the Geological Society of America:

This report is for the calendar year 1979. Some consideration is being given to changing our fiscal year to better phase in with our meeting dates and possibly offer some saving in auditing expense. However, further study is necessary before a change is made. The dues paying year, as well as the publishing year, would not necessarily be affected.

For the fourth year in a row, the Society ended in the black. It is important that we build up an operating reserve to provide for possible lean times but also to furnish seed money for the many ambitious plans for our centennial. We are also struggling to hold the line against extraordinary pressures of inflation.

The figures in this report are taken from the unqualified review by our independent auditors, Peat, Marwick, Mitchell & Co. The Audit Committee of the Council, consisting of William C. Bradley, Chairman, Dallas L. Peck, and John D. Moody met with the auditors to review both the scope and the findings of the audit. The auditors made the following comment in their management letter: "We noted no significant weaknesses in internal accounting control or other matters."

As of December 31, 1979, current assets of the Society were $11,918,770, and current liabilities were $2,461,786, for a net worth of $9,456,984.

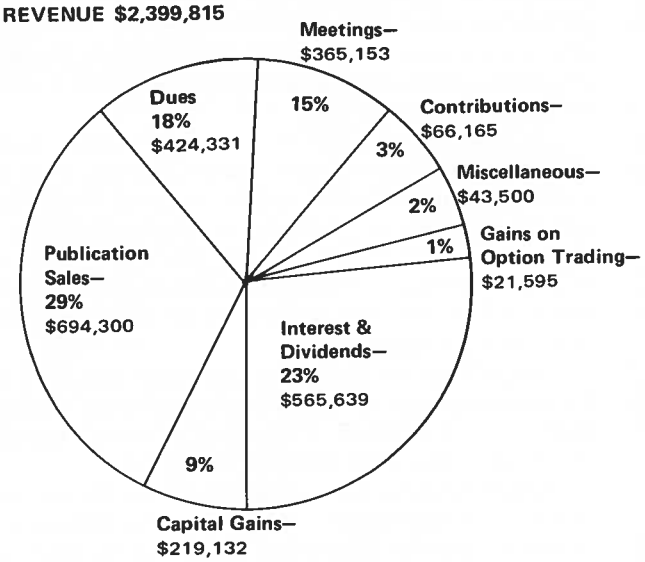
Total operating expenses for 1979 were $1,901,876, and total operating revenue was $1,593,449, which includes $66,165 in contributions. Thus, the operating deficiency was $308,427. This deficiency was made up from income from investments, which consisted of $587,234 in interest and dividends. The favorable difference, $228,807 plus $219,132 in realized capital gains, resulted in a total net gain for the year of $497,939. However, this number will be reduced in early 1980 by $88,275 when we settle up with AGI for the transfer of the *Bibliography and Index of Geology*.

Following are diagrams showing the distribution of revenue and expenses for the year.

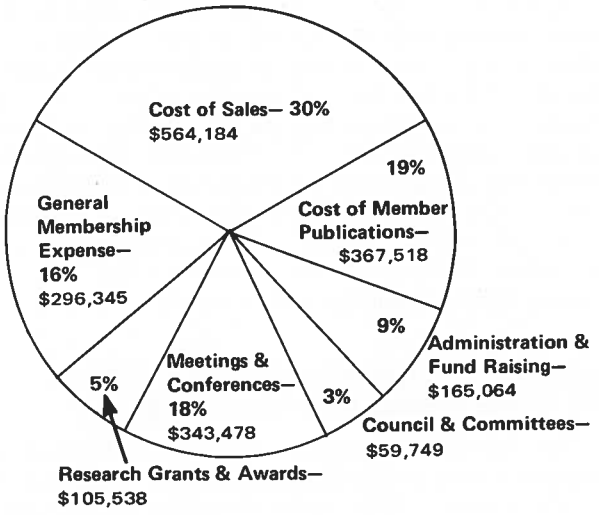
Respectfully submitted,
William B. Heroy, Jr., Treasurer

THE GEOLOGICAL SOCIETY OF AMERICA SOURCE AND APPLICATION OF FUNDS, 1979

REVENUE $2,399,815



EXPENSE $1,901,876



Annual Report for 1979—Report of the Committee on Investments

To the Council and Membership of the Geological Society of America:

The purpose of the Committee on Investments is to advise the Council about investment and reinvestment of the funds, securities, and other capital of the Society. The Committee comprises four members and the Treasurer of the Society. In addition, there is one conferee, and the Budget Committee Member of the Executive Committee serves as a nonvoting ex *officio* member of this Committee.

On December 31, 1979, the market value of the combined investment accounts of the Society was $8,609,824. Adjusting for transfers to Boulder during

(continued on next page)

1979 of $338,847, this year-end value was $8,948,671. The corresponding value at December 31, 1978, was $8,003,051, indicating an appreciation of 11.8% during 1979. During this same time period, the Standard & Poor's 500 Industrials Index with income increased 18.5%. The equity portion of the portfolio increased in value 25% during 1979.

At the end of 1979, 44% of the investment accounts were in debt and money market instruments and 56% in equities. The income yield of the portfolio at year end was 7.8%, while the corresponding yield a year earlier was 6.9% when the percentage of debt and money market instruments was 51%. This was the result of higher interest rates that were realized on the Society's large cash position.

The program of writing covered-call options on certain securities in the portfolio was terminated during the year. Net income to the Society after deducting program management fees was minimal since inception in late 1976. The Committee's view was that time, talent, and assets could be better employed by concentrating on good investment choices and optimizing income.

Money managers for the portfolio continue to be the Irving Trust Company and Reich & Tang, Inc., both located in New York City. The former also functions as custodian of the Society's securities. On December 31, 1979, Reich & Tang, Inc. was managing approximately 30% of the portfolio.

Respectfully submitted,
R. L. Fuchs, Chairman;
C. Harry Burgess, Thomas W. Stern, Donald A. Parks, Members;
William B. Heroy, Jr., Treasurer;
Jack Simon, ex officio; *Robert E. King,* Conferee

THE GEOLOGICAL SOCIETY OF AMERICA, INC.
INVESTMENTS SUMMARY
December 31, 1979

Description	Book Value	Market Value
PENROSE ENDOWMENT FUND		
Cash Equivalents	$2,254,353.41	$2,209,892.67
Fixed Income	1,665,605.52	1,423,979.30
Equities	3,619,327.44	3,942,458.75
	7,539,286.37	7,576,330.72
COMBINED RESERVE FUND		
Cash Equivalents	382,640.20	377,027.90
Fixed Income	302,091.25	227,613.02
Equities	370,618.55	358,716.63
	1,055,350.00	963,357.55
COMBINED AWARDS FUND		
Cash Equivalents	34,008.44	34,008.44
Fixed Income	63,788.75	52,898.22
Equities	12,006.98	4,700.00
	109,804.17	91,606.66
TOTAL INVESTMENTS	$8,704,440.54	$8,631,294.93

DISPOSITION OF PENROSE INCOME TRANSFERS
FOR CALENDAR YEAR 1979

Net Settlement of 1978 Interfund Obligations of the Awards Funds to the Current Fund			$ 38,847
1979 Interfund Obligations of the Reserve Fund			
Investment Portfolio Management Fees:			
Irving Trust	$24,042		
Reich & Tang	17,568	$41,610	
AGI Dues		17,320	
Support of Institute of Paleontology		20,000	
Research Grants (Net)		68,052	
Unfunded Retirement Expense		6,586	
Routine Council & Committee Expense		59,699	213,267
Support of Current Fund Operations for 1979			86,733
			$338,847

American Institute of Physics offers reduced subscription rates to GSA members

We have received at headquarters the following information and generous offer from the American Institute of Physics:

It is the policy of the Institute to offer reduced-rate subscriptions for its own journals to members of affiliated societies. This offer is limited to one subscription per person to each journal. If any GSA member wishes to take advantage of this offer, he should send his subscription orders, with remittances, directly to the American Institute of Physics, 335 East 45th Street, New York, NY 10017, and include a statement indicating that he is a member of GSA, an affiliated society.

Following is a list of Institute-owned journals showing the member rates that are available to members of our society, and the nonmember rates, for 1980.

	Domestic rates	
	Member Rate	Nonmember Rate
Journal of Applied Physics	$30.00	$150.00
Applied Physics Letters	17.00	85.00
The Journal of Chemical Physics	50.00	260.00
Journal of Mathematical Physics	24.00	150.00
The Physics of Fluids	22.00	135.00
Physics Today	14.00	31.00
The Review of Scientific Instruments	17.00	30.00
Current Physics Index	33.00	105.00
Journal of Physical and Chemical Reference Data	34.00	135.00

A contribution to the AESE "Aids to Geowriting" series

NOUNINESS AND THE MISSING HYPHEN

Robert L. Bates, Ohio State University

In a paper "Preparation of a technical article," Low and Braunstein (1964) set forth a series of highly useful "dos and donts" for the geological writer. They present specific problems of written communication—sentence structure, discrimination in word use, punctuation, and the like—with examples of how they ought and ought not to be handled. But there are two writing problems that Low and Braunstein don't consider, probably because these problems were less serious in 1964 than at present. One is the indiscriminate heaping-up of nouns, and the other is neglect of the unit modifier. I discuss each of these briefly in this note.

Nouniness

Eight or ten consecutive nouns, often with accompanying adjectives, form a sort of clotted prose that no reader should be asked to fight his way through. This kind of writing, known as nouniness or nounspeak, is now epidemic, especially in scientific and technical writing. Editors want material condensed to save space and money, and authors seem happy to oblige, simply by piling up nouns, without hyphens, prepositions, or other connectives. That this makes a bad deal for the reader doesn't seem to concern either editor or author. The result, which may be termed *long noun string use space saving,* is a sort of compositional constipation.

How does such an unfortunate condition develop?

I'm sure you will agree that *field* is a fine upstanding noun. So is *oil.* Put them together and you have *oil field,* two nouns end to end. No problem here, of course. We can even take a third noun, *giant,* and place it in line, making *giant oil field.* This hardly poses any difficulty; but from here on, things get progressively messier. We have at hand the production record of the field, which we designate *giant oil field production record.* This contains some interesting data, which we analyze, giving us a *giant oil field production record data analysis.* We then construct a diagram based on these data—a *giant oil field production record data analysis diagram*—and naturally conclude with a preliminary interpretation. So the paper is entitled *Giant oil field production record data analysis diagram preliminary interpretation.* The journal editor never bats an eye at this atrocious effusion, and that's the way it's printed.

But note the peculiar nature of that title: it must be read backward. The operative word is *interpretation.* All the other words lead up to that. The reader must plow through eight nouns and an adjective before getting to the subject, and then work his way back down the string to find out what the interpretation is about. By using a hyphen and a few prepositions, we can recast the title into readily understandable English: *Preliminary interpretation of a data-analysis diagram of the production record of a giant oil field.* Or, if you prefer, *Data-analysis diagram of the production record of a giant oil field: preliminary interpretation.* We hyphenated *data analysis* to make it a unit modifying *diagram,* and we converted the other terms into prepositional phrases. Editors who object because the revision uses some 15 additional spaces are more interested in saving paper than in serving their readers.

You may say, of course, that this is all imaginary, set up to be knocked down, and probably overdrawn for effect. True, it's imaginary, but in no way is it overdrawn. On the contrary, I should apologize for confecting such a simple, colorless example when better ones show up almost daily. Every one of the following has appeared in the literature. I've translated the first two; why don't you straighten out the others?

Rock noise source location techniques (U.S. Bureau of Mines)—Techniques for locating the source of noise in rocks

Inexpensive student sample splitter (Journal of Geological Education)—Inexpensive sample splitter for students

Canadian Superior Harmattan area gas processing plant sulphur recovery exemption application (Oilweek)

Multiple pulse incoherent scatter correlation function measurements (American Geophysical Union)

Liquid metal fast breeder reactor spent fuel shipping cask (Science)

Heavy mineral magnetic fraction stream sediment geochemical exploration program (Geological Society of America)

In the mail that arrived as I was typing these words, I received from a gentleman with the Department of Energy the title of DOE report GJBX21(80): *Hydrogeochemical and stream-sediment reconnaissance basic data reports computer program requests manual.* Appropriately, the report is issued by the Oak Ridge Gaseous Diffusion Plant. You see what I mean?

The Missing Hyphen

Proponents of nouniness can argue, however mistakenly, that their practice is defensible because it saves space. No such argument can be put forth for leaving the hyphen out of a unit modifier. Here it isn't a matter of space but of common sense. A tectonic lineament roughly coextensive with a part of the 38th parallel has been referred to as the *38th parallel lineament.* This is poor usage; it implies that there are a whole lot of parallel lineaments and this is the 38th. The expression is instantly given its correct meaning by a little hyphen: *38th-parallel lineament.* The first two words make a unit that modifies the third.

The expressions below have appeared in the literature without hyphens. I have supplied the missing hyphen in each case, to aid the reader by emphasizing the unit-modifier sense: *high-level terrace, rare-earth element, crude-oil correlation, low-angle fault, mean-dip map, precious-metals staff.* (Show me a "precious metals staff" and I'll show you a beloved group that's working with iron or copper.) The Underwater Mining Institute and the Offshore Technology Conference, being neither under water, off shore, nor hyphenated, are hilariously misnamed.

In some three-word expressions, the adjective goes with the *second* noun. Some years ago I arrived at a Western Resources Conference in Colorado under the impression that it was to be a conference on western resources. Not at all. It turned out to be a western conference on resources—quite a different thing. Other expressions in which the adjective goes with the second noun include *polluted mine drainage, airborne crevasse detection,* and *bilingual valve catalog*

(*continued on next page*)

Articles in *Bulletin, Part II,* October 1980

Articles in *Bulletin, Part II* are listed below. (Summaries only of these articles are in *Bulletin, Part I.*) Articles in *Part II* are not on the separates subscription.

Paper copies of *Part II* in its entirety are available at cost ($10/month) as a special service to those users (members and nonmember subscribers) who request them. Any such order should be addressed to the Publication Sales Department and be accompanied by advance payment, and no discount can be offered for multiple orders or orders for a sequence of months.

1. Petrographic provinces and provenance of the Upper Triassic Luning Formation, west-central Nevada, by Maureen B. Reilly. Doc. no. M01001. (On microfiche: 40 p., 10 figs., 3 tables)
2. Quaternary diversion and incision, Dearborn River, Montana, by Michael G. Foley. Doc. no. M01002. (On microfiche: 37 p., 9 figs., 3 tables)
3. Bed-rock incision by streams, by Michael G. Foley. Doc. no. M01003. (On microfiche: 25 p., 3 figs., 1 table)

Free memorial preprints available upon request

The following memorial preprints are now available and may be obtained by writing to the Geological Society of America, P.O. Box 9140, Boulder, CO 80301:

Thomas Robinson Beveridge, by J. D. Vineyard
William Henry Corey, by P. R. Patten
Robert J. W. Douglas, by R. A. Price and J. O. Wheeler
Harry M. Fridley, by J. C. Ludlum
Theodore Galusha, by M. F. Skinner
Thomas Cleon Hiestand, by W. H. Curry
David Marcel Larrabee, by G. H. Espenshade
Edward Richard Larson, by J. Lintz, Jr.
Thomas W. Mitcham, by P. I. Eimon
Thomas D. Murphy, by S. J. Lefond
Leif Størmer, by H. B. Whittington

In October *Geology*

1. Destruction of St. Pierre, Martinique, by ash-cloud surges, May 8 and 20, 1902, by R. V. Fisher, A. L. Smith, M. J. Roobol
2. Origin and petrology of young oceanic central volcanoes: Are most tholeiitic rather than alkalic?, by R. Batiza
3. Holocene Pacific–North American plate interaction in southern Alaska: Implications for the Yakataga seismic gap, by J. C. Lahr, G. Plafker
4. Mesozoic accretion of exotic terranes along the New Zealand segment of Gondwanaland, by D. G. Howell
5. Age and origin of Ballantrae ophiolite and its significance to the Caledonian orogeny and Ordovician time scale, by B. J. Bluck, A. N. Halliday, M. Aftalion, R. M. Macintyre
6. Tectonic development of southern Narragansett Bay and offshore Rhode Island, by R. L. McMaster, J. de Boer, B. P. Collins
7. Tertiary $\delta^{18}O$ record and glacio-eustatic sea-level fluctuations, by R. K. Matthews, R. Z. Poore
8. Experimental growth of primary anhydrite at low temperatures and water salinities, by R. D. Cody, A. B. Hull

(*Bates, continued*)
(not to mention *huge children's discounts*). Most of these second-nouners can't be fixed by a hyphen, but require a preposition: *Western Conference on Resources, polluted drainage from mines,* and so on.

A word that is tricky in three-word expressions is *bearing. Limestone bearing fossils* is quite OK: the limestone bears the fossils. But in *mica bearing pegmatite,* the mica does not bear the pegmatite; to make sense, the expression must be written *mica-bearing pegmatite. Containing* is another tricky word. To refer to certain mill wastes as *cobalt-containing residues* is instantly understandable. In contrast, calling obsidian and perlite *water containing glasses* is gibberish.

Some editors, for reasons unknown, dislike hyphens and tend to remove them from your carefully crafted copy. If that happens, put them back, and insist that they stay. Remember, saving space is not at issue, but aiding the reader is. Don't let an editor make gibberish out of your prose!

Recommendation: To your copy of Low and Braunstein, or whatever writing guide you use, attach a little note to yourself that says: Avoid long noun string use! and another that says: Maintain unit-modifier alert!

Reference Cited

Low, J. W., and Braunstein, J., 1964, Preparation of a technical article: Amer. Assoc. Petroleum Geologists Bull., v. 48, no. 11, p. 1837–1846.

PRELIMINARY ANNOUNCEMENT AND CALL FOR PAPERS

SOUTH-CENTRAL SECTION, GSA, 15th Annual Meeting
San Antonio, Texas, April 13–14, 1981

THE SOUTH-CENTRAL SECTION of the Geological Society of America will hold its 15th annual meeting in San Antonio, Texas, on April 13–14, 1981. The host will be the Department of Geology at Trinity University, San Antonio, Texas. The Texas Section of the National Association of Geology Teachers will meet with the South Central Division of GSA for the first time in April 1981.

TECHNICAL SESSIONS. Two days of technical sessions will be held on April 13 and 14, 1981, in the San Antonio Convention Center. Six symposia are tentatively scheduled on the following topics: Geopressured Zones in the Gulf Coast Region, Uranium Ore Genesis, Astrogeology, Environmental Geology of the Balcones Fault Region, Geophysical Stratigraphy, and Structures and Volcanism of the Trans-Pecos Region. Technical sessions of voluntary papers will be arranged into appropriate sections after abstracts have been reviewed by the program committee. If you are planning to prepare a paper for the meeting, don't delay. We need your papers to help make this one of the most successful South-Central meetings ever.

ABSTRACTS ARE DUE December 1, 1980.

Send one original and four copies to

Donald E. McGannon, Program Cochairman
Department of Geology
Trinity University
715 Stadium Drive
San Antonio, TX 78284

Abstract forms can be obtained from either the above address or

Abstracts Coordinator
Geological Society of America
P.O. Box 9140
Boulder, Colorado 80301

The use of the GSA section meeting abstract form, completed according to instructions, is required.

All papers in ordinary sessions are to be a maximum of 15 minutes. An additional 5 minutes can be devoted to discussion.

Acceptance or rejection of an abstract will be based upon the abstract as submitted by the author. Authors will be notified of acceptance well in advance of the meeting.

STUDENT AWARDS. Student papers are encouraged and awards will be made to students presenting the most outstanding papers. Student papers should be clearly identified as such and should be authored exclusively by students.

CAROUSEL PROJECTION EQUIPMENT will be provided for 2" x 2" (33 mm) slides only. Only one projector can be used by a speaker. Please bring your own loaded carousel trays if possible.

FIELD TRIPS are tentatively planned for Big Bend National Park, the Uranium Fields of South Texas, and the immediate San Antonio area where environmental problems will be examined.

SPECIAL EVENTS. The Welcoming Party will be held out-of-doors around the picturesque lagoon at the Convention Center in downtown San Antonio.

The traditional Monday night banquet will be preceded by a boat ride and refreshments along the internationally famous Paseo del Rio in downtown San Antonio. The banquet will be a Mexican buffet dinner served in the VIP room at the Convention Center.

Guest events have not yet been arranged, but tentatively planned are a trip to Laredo, Mexico, and a visit to the reknowned San Antonio missions.

ANNOUNCEMENTS concerning registration, motel accommodations, and events for guests will appear in a later issue of *GSA News & Information* and as part of the *Abstracts with Programs* for 1981.

For additional information please write

Donald McGannon
Department of Geology, Trinity University
715 Stadium Drive, San Antonio, TX 78284

CALENDAR OF SECTION MEETINGS FOR 1981

SOUTHEASTERN
University of Southern Mississippi, Hattiesburg, Mississippi
March 19–20, 1981
Abstract deadline: October 28, 1980

CORDILLERAN
Valle Grande Hotel, Hermosillo, Sonora, Mexico
March 25–27, 1981
Abstract deadline: October 15, 1980

NORTHEASTERN
Bangor Civic Center, Bangor, Maine
April 9–11, 1981
Abstract deadline: October 31, 1980

SOUTH-CENTRAL
Trinity University, San Antonio, Texas
April 13–14, 1981
Abstract deadline: December 1, 1980

ROCKY MOUNTAIN
Rapid City Civic Center, Rapid City, South Dakota
April 16–17, 1981
Abstract deadline: November 17, 1980

NORTH-CENTRAL
Iowa State University, Ames, Iowa
April 30–May 1, 1981
Abstract deadline: November 27, 1980

PRELIMINARY ANNOUNCEMENT AND CALL FOR PAPERS

NORTH-CENTRAL SECTION, GSA, 15th Annual Meeting
Ames, Iowa, April 30–May 1, 1981

The Department of Earth Sciences of Iowa State University, Ames, Iowa, will host the 15th Annual Meeting of the North-Central Section of the Geological Society of America on April 30 and May 1, 1981.

TECHNICAL SESSIONS on Thursday, April 30, and Friday, May 1, will include the following: Mineralogy and geochemistry, petrology, structural geology, geophysics, sedimentology, paleontology, stratigraphy, economic geology, geomorphology, environmental and engineering geology, hydrogeology, Quaternary geology, and general geology. Papers on these and other areas are solicited. Other sessions may be arranged after abstracts have been received by the program committee.

TENTATIVE SYMPOSIA (April 30, May 1):

(1) Late Wisconsin and Holocene Sedimentation (George R. Halberg)
(2) Geologic Aspects of Mining and Reclamation (Lyle V. A. Sendlein)
(3) Modeling of High Temperature Petrologic Processes
I (Bert E. Nordlie)
II (V. Rama Murthy)
(4) Cretaceous of the Mid-Continent Region (Robert L. Brenner)
(5) Pennsylvanian Sandstone Bodies, Forest City and Eastern Interior Basin (John Lemish)
(6) Paleoecology (Wayne I. Anderson)
(7) Conodonts (including a workshop) (Gilbert Klapper)

ABSTRACTS. Abstracts, which are limited to 250 words, *must* be submitted camera ready on official abstract forms available from:

Carl F. Vondra
Program Committee Chairman
Department of Earth Sciences
Iowa State University
Ames, Iowa 50011
(515) 294-5867

or

Abstracts Coordinator
Geological Society of America
P.O. Box 9140
Boulder, Colorado 80301
(303) 447-2020

ABSTRACTS ARE DUE November 27, 1980. Acceptance or rejection of an abstract will be based on the abstract as submitted by the author.

Send one original and four copies to

Carl F. Vondra
Program Committee Chairman
Department of Earth Sciences
Iowa State University
Ames, Iowa 50011
(515) 294-5867

PROJECTION EQUIPMENT. All slides must be 2" x 2" and fit a standard 35-mm carousel projector.

STUDENT AWARDS. Student papers are encouraged, and awards will be made to students presenting the most outstanding papers. Student papers should be clearly identified as such and should be authored exclusively by students. Prizes awarded for student papers with more than one author will be divided among the authors.

TENTATIVE FIELD TRIPS: Field trips will be scheduled for Saturday and Sunday, May 2 and 3.

(1) Pennsylvanian Sandstone Bodies in Central Iowa (John Lemish)
(2) Cretaceous Deposits in Iowa, South Dakota, and Minnesota (Robert L. Brenner)
(3) Pleistocene of Central Iowa (George R. Halberg)
(4) Coal Mining and Reclamation in Southeastern Iowa (Lyle V. A. Sendlein)

DETAILED INFORMATION concerning registration, motel and hotel accommodations, and other activities will appear in a later issue of *GSA News & Information* and as a part of the *Abstracts with Programs* for 1981.

ADDITIONAL INFORMATION, REQUESTS, OR SUGGESTIONS SHOULD BE DIRECTED TO:

Donald L. Biggs, Local Committee Chairman
Department of Earth Sciences
Iowa State University
Ames, Iowa 50011
(515) 294-5373

FIRST PRINCIPLES OF THE SCIENCE OF MINING AND SALT MINING

Microform Publication 10 – Translated from the German by Kenneth V. Bordeau and Elvi Legel Bordeau, 1980. 193 pages on two 24x microfiche. ISBN: 0-8137-6010-0.
. . . . . **$4.00**

This work, *Erste Gruende der Berg und Salzwerkskunde Erster Teil welcher die Mineralogie enthaelt,* published in Germany between 1773 and 1791, is a 12-volume treatise on applied mineralogy, mining technology, and metallurgy. It was prepared by Franz Ludwig Cancrinus (1738–1816) at the height of a busy career as a mining engineer, advisor to the governments of Germany and Russia, and as a prominent government official. The treatise immediately became a standard reference work. It was translated into Russian, and part of it was translated into French. This new translation into English covers only the first part of the treatise, which deals mainly with the topic of mineralogy. Cancrinus discovered and described several new ore minerals, and the mineral cancrinite was named in his honor.

Although the 18-year period during which Cancrinus' treatise was prepared marks an early stage in the proliferation of science that preceded and accompanied the Industrial Revolution, Cancrinus draws extensively on the past and on his personal experience. The work of many of his contemporaries seems to have been unknown to him, or at least was largely ignored. Viewed in retrospect, the treatise is seen as a scientific Rosetta stone because it provides a bridge from the primitive science of an earlier era to the beginning of modern science. It also provides a view of the scientific attainments of a well-educated, competent mining engineer of the period.

Students of mineralogy and of the history of geology and related sciences will find much of interest in this 200-year-old report.

CONTENTS

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Interdisciplinary studies of peat and coal origins

Microform Publication 7 (newly reprinted). Edited by Peter H. Given and Arthur D. Cohen. 1977, reprinted 1980. 174 pages, 50 figures, and 23 tables on two 98-frame microfiche for use with 24× readers $4.00

This publication, the proceedings of a symposium, contains nine full length papers and five abstracts (as reprinted, references to the full texts to which the abstracts relate are now provided). It is indeed highly interdisciplinary in scope and approach; geology, organic geochemistry, plant ecology, and microbiology are fields represented. Some papers reconstruct features of ancient peat swamps, including their floristic assemblies, from the geology of Carboniferous coals and from the paleobotany of coal balls. Other work considers trace element distribution and the origin of tree islands in the Okefenokee Swamp, and the leaching of humic matter from it. Different phenomena are noted in a study of trace elements in a raised peat bog in Maine. Other organic geochemical contributions included deal with fatty acid diagenisis and the ^{13}C content of dissolved organic matter in a mangrove swamp and a salt marsh, respectively. Studies bearing on the role of microorganisms in peats deal with the living and fossil alga, *Bottryococcus*, with the fungal and meiofaunal decay of mangrove leaves, the fate of ^{14}C-labelled cellulose in peats and with production and composition of marsh gases. The central unifying core of the publication is the consideration of peat as the precursor of coals.

Geologic map and cross section of the eastern Ouachita Mountains, Arkansas

MC-28F—By George W. Viele. 1979. In color, 46″ × 28″. Scale, 1:250,000. With 8-page text ..... Folded: $9.00; rolled: $10.50.

The Ouachita Mountains fold and fault belt in central Arkansas, as portrayed on this cross section, is the result of ancient southward subduction of the North American continental plate beneath the Llanorian microcontinental plate.

The section trends about N20°E over a distance of 257 km (160 mi). The north end of the section is marked by the town of Mountain View on the south flank of the Ozark uplift. From this point the section extends southward and crosses, in succession (1) the Arkoma basin, which was both a structural and depositional basin during the Paleozoic, and was part of the North American platform; (2) the frontal thrust belt, which is characterized by many large faults overthrust to the north in strata of Pennsylvanian age; the fault planes dip steeply at the surface, but flatten at depth; (3) the Maumelle chaotic zone, which is characterized by folded and contorted strata (broken formation) of older Pennsylvanian age than that exhibited at the surface in the frontal thrust belt; these older Pennsylvanian units are deep-water flysch deposits; (4) the Benton uplift, in which strata of Early Ordovician to Early Mississippian age are compressed in stacks of multiple folded nappes characterized by penetration fabrics; (5) the Marzan basin and the Trap Mountains, which comprise strata ranging in age from Early Ordovician to Pennsylvanian; in these zones deformation is less intense than that in the Benton uplift, and the deformation decreases steadily southward; and (6) the Gulf Coastal Plain, which conceals older rocks at the southern end of the section. The section ends at the Chevron No. 1 Cabe well, which provides stratigraphic data to a depth of 4,276 m (14,025 ft) through the veneer of mainly Tertiary and Cretaceous Coastal Plain sediments into gently dipping strata of Triassic, Permian, and Pennsylvanian ages.

The plate-tectonics history of the eastern Ouachita fold and fault belt is characterized by two phases. The first phase consisted of late Precambrian to early Paleozoic rifting, opening of an ocean between the North American plate and the Llanorian plate, and slow accumulation of slope and abyssal deposits in this ocean throughout early and middle Paleozoic time. The second phase was closing of the ocean, the onset of subduction of the North American plate, and subsequent joining and locking of the two plates. In this process the slope and abyssal deposits on the subducted plate were scraped off and incorporated as an accretionary wedge on the overriding plate. The highly deformed strata in the Benton uplift constitute this accretionary wedge.

Strata in the Maumelle chaotic zone were deposited in the final stages of the remnant sea between the closing plates and were, in part, incorporated in the subduction complex. The major nearly horizontal suture between the overlying and underlying plates is believed to lie on the north margin of the Benton uplift in the Maumelle chaotic zone.

The gradual closing of the North American and Llanorian plates and the final juncture and compression between these plates formed the many and varied structures in the Ouachita Mountains that extend northward as far as the Arkoma basin and southward under the Gulf Coastal Plain.

Geologic cross section of the continental margin off San Luis Obispo, the southern Coast Ranges, and the San Joaquin Valley, California

MC-28G—B. M. Page, H. C. Wagner, D. S. McCulloch, E. A. Silver, and J. H. Spotts. 1979. In color, 58″ × 42″. Scale, 1:250,000. With 12-page text ..... Folded: $10.00; rolled: $11.50.

This multicolored cross section and strip map across the continental margin in southern California begins in the abyssal depths of the Pacific Ocean west of San Luis Obispo. The section and map extend eastward at about lat 35°13′N up the continental slope, then across a broad, deeply submerged shelf-like region, and intersect the shore line at the mouth of Diablo Canyon about 15 km south of Morro Bay. At the shore line, the section bends sharply northeastward and extends across the southern California Coast Ranges, including the anomalous Salinas Valley in the center, then across the Kettleman Hills, the San Joaquin Valley, and ends in the foothills of the Sierra Nevada.

The most interesting of the many factual and interpretative features shown are three structural and stratigraphic elements indicative of westward motion of the continental margin. The westernmost of these elements is a trench at the base of the continental slope. This trench, which has been delineated by means of seismic reflection, gravity, and magnetic surveys, is filled with sediment of late Tertiary and Quaternary age. It is characterized by a graben-like structure in the center, and by low-angle thrust faults that dip beneath the continental slope at the juncture between the trench fill and the slope. The trench is interpreted as the locus of an inactive subduction zone, though faulted Quaternary strata at the juncture of trench and slope suggest that underthrusting on a minor scale still occurs from time to time.

The southern California Coast Ranges comprise three large units of basement rock that have been emplaced by major tectonic movements. The central unit, the Salinian block, is bounded on the southwest by the Rinconade and Sur-Nacimiento fault zone, and on the northeast by the San Andreas fault. The block is interpreted as a displaced slice of a plutonic arc of late Mesozoic age. In the present setting, the block is bounded on both sides by rocks of the Franciscan Complex, which is interpreted as a quasi-contemporary subduction assembly. Another upper Mesozoic assembly, the Great Valley sequence, consists of forearc basin deposits. It is prominently exposed along the west side of the San Joaquin Valley, and outliers of this sequence occur in the Franciscan terrane on both sides of the Salinian block. These three rock types, which represent a plutonic arc, a subduction zone complex, and forearc basin deposits, must have been arranged originally in the normal pattern for an arc-trench system. The present anomalous pattern has been produced largely by right-hand strike slip movement of at least 300 km along the San Andreas fault, and by related movements along the Rinconade and Sur-Nacimiento fault zone. Most of the present continental motion seems to be concentrated along the San Andreas fault.

In the Sierra Nevada foothills along the east side of the San Joaquin Valley, the Sierran basement complex includes a distinctive belt of melange, which is shown at the northeast end of the section. The melange consists of blocks of ophiolitic rocks of late Paleozoic and earliest Mesozoic ages, and blocks of radiolarian chert, all in a highly sheared serpentine matrix. The melange presumably formed along an oceanic fracture zone and, together with some of the adjoining rocks to the southwest, was accreted to the continent in early Mesozoic time.

Cross section of the southern Coast Ranges and San Joaquin Valley from off-shore of Point Sur to Madera, California

MC-28H—Donald C. Ross and David S. McCulloch. 1979. In color, 49″ × 41″. Scale, 1:250,000. With 4-page text. ..... Folded: $9.50; rolled: $11.00.

The onshore segment of this newly-published cross section extends 186 km eastward from Point Sur, and transects the Point Sur fault zone, the Salinian block, the San Andreas fault zone, the Diablo Range, the Panoche Hills, and most of the width of the San Joaquin Valley. The offshore segment extends 88 km westward from Point Sur across the narrow continental shelf and down the continental slope.

The Point Sur and San Andreas fault zones divide the cross section into three distinct geologic terranes:

1. West of the Point Sur fault zone in a narrow strip along the coast, contorted Franciscan rocks and serpentine are predominant. This assemblage, perhaps admixed with small amounts of ophiolite and marine sediment, forms the acoustic basement of the continental shelf and slope. The acoustic basement is overlain by sedimentary rocks of Miocene age, characterized by many small-scale, east-dipping thrust faults and local folds. These beds are overlain in turn by sediments of late Tertiary and Quaternary ages that, in general, are unfaulted on the continental shelf and slope, but are strongly faulted by imbricate underthrusting and overthrusting at the bottom of the slope. The structural disturbance at this position suggests a generally dormant subduction zone along which intermittent activity has occurred as recently as the Quaternary.

2. The Salinian block, which lies between the Point Sur and San Andreas fault zones, comprises the Santa Lucia Range, Sierra de Salinas, the Salinas Valley, and the Gabilan Range. In this block, metamorphic rocks of Paleozoic age have been deformed and intruded by a variety of granitic rocks of Mesozoic age. The block contains no rock characteristic of the Franciscan assemblage, and it resembles a continental basement terrane. The Point Sur fault zone and its southward continuation, the Nacimiento fault zone, probably mark a major break between continental basement (Salinian block) and oceanic basement (Franciscan assemblage).

The Salinian block is believed to be underlain by a northeast-dipping substratum composed of the Franciscan assemblage admixed with ophiolite. This substratum is only a few km below the surface at the Point Sur fault zone, and is 10 to 15 km below the surface at the San Andreas fault zone. The Salinian block may be displaced laterally because of the pronounced right-hand strike slip movement on the San Andreas fault zone, and related movements on the Point Sur-Naciemento fault zone.

Cross section of the central Klamath Mountains, California

MC-28I—Gregory A. Davis, Clifford J. Ando, Patricia H. Cashman, Lee Goullaud. 1979. In color, 50″ × 30″. Scale, 1:62,500. With 6-page text .. Folded: $10.00; rolled: $11.50

A stacked sequence of three thin thrust plates, bounded by two major sub-horizontal east-rooted faults, of middle Paleozoic and Jurassic ages respectively, is shown on this newly published geologic cross section. Each thrust plate forms a distinctive geologic terrane, or subprovince. The section, which is about 70 km long, extends generally east-west across the central Klamath Mountains in Siskiyou and Trinity Counties, northern California. The center of the section is 8 km south of the small town of Cecilville.

The Eastern Klamath subprovince forms both the easternmost end of the section and a conspicuous klippe in the center of the section. The rocks underlying this sub-

province are the oldest exposed along the line of the section and are also the highest structurally. These rocks are divided into two distinctive mappable units. The oldest is the Trinity Complex, a serpentinized ultramafic unit of probable Ordovician age. This unit is considered to be the basement of a Paleozoic island arc system. In the klippe, the Trinity is overlain by low-grade metasedimentary rocks of probable Silurian age. These younger rocks are in fault contact with the Trinity Complex in some places but are considered to be an island-arc sequence deposited on the Trinity. The Trinity Complex is in fault contact with underlying younger rocks of the Central Metamorphic subprovince.

The Central Metamorphic subprovince comprises two widespread metamorphic units of upper greenschist-to-amphibolite grade. Both units are of Devonian age. The older unit is the Salmon Hornblende Schist, which is of metaigneous origin and is considered to have been part of an oceanic crust. The younger unit is the Grouse Ridge Formation, which is largely of metasedimentary origin and is considered to have been deposited on the Salmon Hornblende Schist. In the eastern part of the subprovince, the metamorphic grade increases upward toward the contact with the Trinity Complex. At the contact between the metasedimentary Grouse Ridge Formation and the overlying serpentinized ultramafic Trinity Complex, the two diverse units are intermixed and interfingered on a large scale. These relations suggest eastward subduction in post-Devonian time of an oceanic crust (Salmon Hornblende Schist) and overlying sedimentary strata (Grouse Ridge Formation) beneath the older Trinity Complex.

The Devonian rocks of the Central Metamorphic subprovince have been displaced westward relative to underlying Mesozoic rocks of the Western Paleozoic and Triassic subprovince along the major Siskiyou thrust fault of Jurassic age, which is the most conspicuous structural feature on the cross section. The horizontal displacement along this fault, well established by exposures in windows, is at least 24 to 32 km.

The Western Paleozoic and Triassic subprovince lies west of the trace of the Siskiyou thrust fault. The sequence of rock in this subprovince is 7,600 to 9,100 m thick and includes sedimentary and volcanic rock and mafic intrusives. Some rocks in this sequence exhibit low-grade metamorphism, but bedding and primary textural features are typically preserved. Gabbro and diabase, the lowest units observed in the subprovince, are exposed in the core of the conspicuous North Fork antiform. These rocks may make up the plutonic crustal part of a disrupted ophiolitic sequence on which the sedimentary and volcanic rocks accumulated.

The older structural features portrayed on the cross section have been disturbed by younger high-angle faults, folds, and many plutonic rocks that range in composition from granite to gabbro. These structural features are also very thin, and the lowest described is above sea level. Exposures in the Trinity River Canyon south of the section reveal that a still deeper thrust fault underlies most of the area traversed by the section. A drill hole located at a topographically low site in the Western Paleozoic and Triassic subprovince might penetrate subducted Franciscan rock at relatively shallow crustal depth.

Geologic map of the Ronda ultramafic complex, southern Spain

MC-29—Margaret T. Lundeen and Masaaki Obata. 1979. In color, 45″ × 41″. Scale, 1:50,000. With 4-page text by John S. Dickey, Jr., M. T. Lundeen, and M. Obata. ..... Folded: $7.50; rolled: $9.00.

The Ronda ultramafic complex is probably the largest, best exposed, and most accessible high-temperature peridotite intrusive body in the world. It crops out in a mountainous terrain on the southern coast of Spain near the southwest end of the Betic Cordillera. This major alpine mountain belt extends southwestward across the the Baleraic Islands to and along the southern coast of Spain to Cadiz.

The Ronda ultramafic complex crops out conspicuously in the central half of this newly published map together with several associated stratigraphic and structural units as follows:

1. The Casares unit of Paleozoic to Jurassic(?) age, to the northwest. It exhibits substantial zoned thermal metamorphism.
2. The underlying Ronda ultramafic complex of unknown age, in the center. It is subdivided into four zones according to decreasing pressure as exhibited by mineral facies.
3. The Nieves unit of Upper Triassic to Jurassic age, to the north.
4. The Blanca unit of Paleozoic to Triassic(?) age, to the east.
5. The Malaguide complex of Ordovician to Cretaceous age, to the south.

The generalized stratigraphy of these units is described and shown graphically in the text accompanying the map.

Mapped outcrops and thermal metamorphic relations suggest that early in the geologic history of the Betic Cordillera the Ronda ultramafic complex and the Casares unit came together deep in the mantle. This juncture resulted in thermal metamorphism in the Casares unit. Subsequently, the two fused units rose steeply toward the surface, and while still hot were thrust northwestward on a low-angle plane over the Blanca unit. At this structural contact, the Blanca unit is brecciated, mylonitized, and annealed to the cordierite grade. A large outcrop of the Blanca unit in the valley of Rio Guadaiza near the center of the map is interpreted as a window in the thrust plane.

The major structure thus outlined has been modified and partly obscured by two kinds of secondary faults (1) east-trending and southward dipping faults and (2) north-trending, high-angle faults.

These and other interpretations of the complex structure of this part of the Betic Cordillera are shown on two detailed structure sections.

The 4-page text includes a detailed tabular summary of the tectonic evolution of the map area as compared to that in the northeastern part of the Betic Cordillera.

OCTOBER BULLETIN SEPARATES

Summaries

At the request of members, the Summaries section may be ordered as one separate by those who have purchased the separates option. To order, write "October Summaries" on coupon.

• S01001—Petrographic provinces and provenance of the Upper Triassic Luning Formation, west-central Nevada: Summary.

Maureen B. Reilly, John A. Breyer, Department of Geology, Texas Christian University, Fort Worth, Texas 76129 (present address, Reilly: Gulf Oil Exploration and Production Co., P.O. Box 1635, Houston, Texas 77001); John S. Oldow, Department of Geology, Rice University, Houston, Texas 77001. (3 p., 1 fig.)

• S01002—Quaternary diversion and incision, Dearborn River, Montana: Summary.

Michael G. Foley, Department of Geology, University of Missouri-Columbia, Columbia, Missouri 65211 (present address: Battelle Pacific Northwest Laboratories, P.O. Box 999, Richland, Washington 99352). (2 p., 2 figs.)

• S01003—Bed-rock incision by streams: Summary.

Michael G. Foley, Department of Geology, University of Missouri-Columbia, Columbia, Missouri 65211 (present address: Battelle Pacific Northwest Laboratories, p.O. Box 999, Richland, Washington 99352). (2 p., 1 fig.)

Bulletin Briefs

Titles and abstracts of conventional articles in the October 1980 GSA Bulletin, Part I *are provided on the following pages to aid members who have purchased the separates option to select* Bulletin, Part I *separates of their choice. See instructions for ordering on page 163.*

• 01004—Use of altered volcanic ash falls in stratigraphic studies of coal-bearing sequences: An example from the Upper Cretaceous Ferron Sandstone Member of the Mancos Shale in central Utah.

T. A. Ryer, R. E. Phillips, B. F. Bohor, R. M. Pollastro, U.S. Geological Survey, Federal Center, Denver, Colorado 80225. (8 p., 11 figs.)

Coal beds most commonly occur in stratigraphic units characterized by rapid lateral facies changes for which determination of time relationships and correlation of facies are difficult. The Ferron Sandstone Member of the Mancos Shale in central Utah is such a unit. The Ferron records the activity of a delta system that prograded in a northeasterly direction into the Interior Cretaceous seaway during late Turonian time. The Ferron consists of five delta cycles, each of which includes one coal zone. Each of the coal zones contains at least one, and usually several, laterally persistent kaolinitic claystone partings. Laboratory study of the partings demonstrates that they represent altered volcanic ash falls. These partings have proven particularly useful in reconstructing the depositional history of the C coal bed of the Emery coal field. They permit division of the C coal bed into four isochronous units. The coal bed accumulated in a basin that developed concurrently with subsidence of the delta plain during both the constructive and destructive phases of the third delta cycle of the Ferron. The area of peat accumulation expanded in both seaward and landward directions during the interval of time represented by the coal. Peat accumulation was terminated by transgression of the sea across the seaward part of the peat deposit, where prodelta and delta-front strata of the fourth delta cycle now disconformably overlie the coal. In its landward part, the C coal bed is overlain, with no evidence of erosion, by delta-plain strata of the fourth cycle.

• 01005—Rb-Sr glauconite isochron of the Eocene Castle Hayne Limestone, North Carolina.

W. Burleigh Harris, Victor A. Zullo, Department of Earth Sciences, University of North Carolina at Wilmington, Wilmington, North Carolina 28403. (6 p., 4 figs., 1 tbl.)

The 11-m-thick lectostratotype of the Castle Hayne Limestone in New Hanover County, North Carolina, consists of lower phosphate pebble biomicrudite; middle bryozoan biosparrudite; and upper bryozoan-sponge biomicrudite. The relative age of the Castle Hayne Limestone is equivocal. The planktic foraminiferal fauna and part of the molluscan fauna suggest that the entire formation should be correlated with the Gulf Coast Claibornian Stage (middle Eocene), whereas calcareous nannofossils, bryozoans, barnacles, and some molluscs indicate that the upper bryozoan-sponge biomicrudite is a Gulf Coast Jacksonian Stage (upper Eocene) equivalent. Because of problems correlating the Castle Hayne Limestone to equivalent Gulf Coast stages, the lectostratotype was dated by application of the Rb-Sr glauconite isochron.

Five hand-picked glauconite concentrates analyzed for Rb, Sr, and Sr-isotopic composition yielded an isochron age of 34.8 ± 1 m.y. ($\lambda Rb87 = 1.42 \times 10^{-11} yr^{-1}$) with an initial $(Sr^{87}/Sr^{86})_0$ ratio of 0.7083 ± 0.0004. The determined initial $(Sr^{87}/Sr^{86})_0$ ratio is in good agreement with previous estimates of the Sr-isotopic composition of sea water during the Eocene. Although the age is younger than the value of 37 m.y. earlier proposed for the Eocene/Oligocene boundary, it agrees with fission-track and K-Ar ages of tektites and microtektites, and K-Ar ages of bentonites and glauconites in upper Eocene marine and nonmarine units throughout the world.

• 01006—Remanence resetting by shock-induced thixotropy in the Seminary Till, Scarborough, Ontario, Canada.

D.T.A. Symons, M. Stupavsky, C. P. Gravenor, Department of Geology, University of Windsor, Windsor, Ontario N9B 3P4, Canada. (6 p., 7 figs., 1 tbl.)

The paleomagnetic reliability of the remanent magnetism of the Pleistocene Seminary Till is examined. The lack of correlation in remanence direction between two profiles 0.7 m apart in the till, as well as the large within-core variation of 13° between specimen pairs, suggests the possibility that the sampling procedures cause significant errors. Laboratory experiments on several kinds of unconsolidated glacial sediments show significant thixotropic remanence resetting toward the ambient magnetic field caused by hammer shocks during sampling. Significantly different and significantly higher precision results are obtained from cores that have been drilled by diamond bit from oriental blocks of till than are obtained by driving polycarbonate plastic tubes into the till. Plastic-tube cores also have a distorted magnetic fabric caused by flow deformation. The six tills studied to date in Ontario, including the Seminary Till, yield far-sided pole positions reflecting an average 13° shallowing of the remanence inclination. For normally polarized till, the primary DRM inclination error substantially exceeds 13° but is reduced to this figure by secondary thixotropic resetting. For reversely polarized till, the primary DRM inclination error is further increased by the addition of the resetting error.

• 01007—Remnants of a pre–Late Jurassic ocean in northern Turkey: Fragments of Permian-Triassic Paleo-Tethys?

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An ophiolitic suture zone and associated active continental margin sequences of mid-Jurassic age are found in northern Turkey exposed in inliers surrounded by an extensive Upper Cretaceous to Eocene volcanic blanket. The pre–Late Jurassic rocks of the eastern Black Sea Mountains (eastern Pontide tectonic zone) consist of two distinct lithologic associations: a "continental" assemblage represents a Permian to Early Jurassic north-facing magmatic arc, whereas an "oceanic" assemblage, including a locally metamorphosed ophiolite suite overlain by deep-sea sediments, is believed to represent the vestiges of an oceanic realm that existed north of the arc during the ?Permian to Jurassic interval. During the mid-Jurassic, the oceanic assemblage underwent penetrative deformation and was overthrust by the continental assemblage. The latter has not been penetratively deformed except for a wide zone of intense cataclasis along its basal thrust. The southern part of the continental assemblage was affected by east-west gravity faulting and basaltic and some trachytic volcanism during the Early Jurassic. We interpret the Permian to mid-Jurassic geological record of the eastern Pontides as the expression of the progressive contraction of a Permian-Jurassic ocean with a south-dipping subduction zone. Its closure resulted in the overthrusting of the continental assemblage onto the oceanic assemblage. Regional considerations suggest that the suture forms a part of an orogenic belt stretching from the mid-Jurassic South Rhodope Orogen through the early to mid-Mesozoic orogenic zones of the peri–Black Sea regions, northern Iran, Afghanistan, central Tibet, and China. This orogenic belt resulted from the closure of Permian-Triassic Paleo-Tethys. The oceanic assemblage we describe is believed to be a part of the floor of this ocean, whereas the continental assemblage is viewed as a part of a previously defined Cimmerian continent.

• 01008—Tertiary faulting beneath Wadi Al-Batin (Kuwait).

A. Mohammad Al-Sarawi, Geology Department, Ohio University, Athens, Ohio 45701 (present address: Geology Department, Coastal Research Divison, University of South Carolina, Columbia, South Carolina 29208). (9 p., 14 figs.)

Geophysical (electric logs and seismic lines) and hydrological data (pumping test) have been utilized to determine the structural character of faults beneath the Wadi Al-Batin. These Miocene–late Eocene faults are oriented parallel to the southern Arabian Shield fault lines, which trend northeast-southwest. Three subsurface cross sections were correlated to seismic lines and pumping test data. Seismic lines show a discontinuity within the stratigraphy as they pass through fault lines, and the pumping test shows a break in the drawdown slope as it passes through barrier boundaries.

• 01009—Calculation of the refractive index of silicate glasses from chemical composition.

B. N. Church, W. M. Johnson, Ministry of Energy, Mines and Petroleum Resources, Victoria, British Columbia V8V 1X4, Canada. (7 p., 3 figs., 7 tbls.)

The prediction of refractive index from silicate analyses increases the scope of Mathews' arc fusion method for the determination of fine-grained igneous rocks. This is possible by replacing the specific gravity factor in the classical Larsen

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(Gladstone) equation by a set of empirically derived coefficients for the major oxides. This yields the new equation:

$$(n - 1) = 0.460\,(\text{W.F.})_{SiO_2} + 1.158\,(\text{W.F.})_{TiO_2} + 0.581\,(\text{W.F.})_{Al_2O_3} + 1.090\,(\text{W.F.})_{Fe_2O_3} + 0.897\,(\text{W.F.})_{FeO} + 0.903\,(\text{W.F.})_{MnO} + 0.767\,(\text{W.F.})_{MgO} + 0.795\,(\text{W.F.})_{CaO} + 0.505\,(\text{W.F.})_{Na_2O} + 0.495\,(\text{W.F.})_{K_2O} \pm 0.007$$

where (n) is the refractive index, ($n - 1$) the refractivity, and (W.F.) the weight fraction of the oxides present. Calculations of ($n - 1$) values for test samples are precise to ± 0.007 which is about the same as the estimated error at source due to inhomogeneities in the prepared glass.

The refractive index of rock glass is a measure of basicity that provides a ready means of linking microscope observations with chemical composition to assist classification, petrological interpretation, and mapping of volcanic or other aphanitic igneous rocks.

• 01010—New evidence for magmatic intrusion beneath the Rio Grande rift, New Mexico.

James N. Towle, U.S. Geological Survey, Denver, Colorado 80225. (5 p., 4 figs.)

An analysis of the geomagnetic variation field across the Rio Grande rift has identified two concentrations of telluric current flow beneath the rift caused by channeling of telluric currents in electrically conductive structures in the crust and upper mantle. A shallow conductor nearly coincides with a very strong reflection in a high-resolution seismic-reflection profile across the central Rio Grande graben which has been attributed to a lens at mid-crustal depth. The deep (>30 km) conductor is 200 km wide and may indicate anomalously high temperatures and, by inference, a thinning of the lithosphere beneath the rift.

• 01011—Pre-Triassic fit and alpine tectonics of continental blocks in the western Mediterranean: Discussion and reply. (6 p., 1 fig.)

Discussion: *Georges H. Mascle, Station de Géodynamique sous-marine, Université Pierre et Marie Curie Paris, BP 48, 06230 Villefranche sur Mer, France.*

Discussion: *Jacques Bourgois, Université Pierre et Marie Curie, Département de Géotectonique, Tour 26, E1, 4, Place Jussieu, 75230 Paris Cédex 05, France.*

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