Report of the Committee on Research Grants

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

The Committee on Research Grants, consisting of Emile A. Pessagno, Robin Brett, NSF conferee, and Walter Alvarez, Chairman, met at Society headquarters in Boulder, Colorado, on April 21 and 22, 1980. The meeting was overshadowed by the death of its new member Robert K. Fahnestock as a result of a light plane accident the day before the meeting. Because Fahnestock died indirectly as a result of serving on the committee, and because he was a distinguished scientist, the committee felt that it would be appropriate for GSA to honor his memory by designating, each year, the best of the research grant applicants in his field, geomorphology and sediment transport, as the recipient of a Robert K. Fahnestock Award. This person would be chosen in the same way that the recipient of the Stearns Award is presently selected. The committee found that Dr. Fahnestock had given his highest rating, an A+, to one applicant, James A. Pizzuto, who submitted a proposal on fluvial geomorphology. The committee recommended that the Council establish this award, and that it be given this first year to Mr. Pizzuto, the one student who particularly impressed Ken Fahnestock during his service on the Research Grants Committee. Subsequently, the Council approved this recommendation.

The committee had at its disposal $81,000, which included industrial donations, donations by past recipients and from dues statements check-offs, funds provided by the Society, and $1,000 from the Harold T. Stearns Fund.

The total number of applications (402) was almost double the number of last year and the overall quality remained high. Support was recommended for 192 or 48% of the total, with an average grant of $422. The committee was impressed by the increase in the proportion of female applicants this year. There were 94 applications from women this year and 52 in 1979. It seems very clear that there will be no lack of exceptional female geologists in the future. The distribution of supported projects among generalized fields is shown in Table 1.

<table>
<thead>
<tr>
<th>TABLE 1.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Requested</td>
<td>Funded</td>
<td></td>
</tr>
<tr>
<td>(1) Paleontology</td>
<td>32</td>
<td>15</td>
</tr>
<tr>
<td>(2) Sedimentology &amp; Stratigraphy</td>
<td>104</td>
<td>31</td>
</tr>
<tr>
<td>(3) Structure &amp; Tectonics</td>
<td>77</td>
<td>48</td>
</tr>
<tr>
<td>(4) Igneous &amp; Metamorphic Petrology</td>
<td>93</td>
<td>53</td>
</tr>
<tr>
<td>(5) Economic Geology</td>
<td>35</td>
<td>14</td>
</tr>
<tr>
<td>(6) Quaternary Geology</td>
<td>33</td>
<td>20</td>
</tr>
<tr>
<td>(7) Geophysics</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>(8) Other</td>
<td>15</td>
<td>3</td>
</tr>
</tbody>
</table>

The committee voted to recommend three recipients for the 1980 Harold T. Stearns Fellowship Award for research on one or more aspects of the geology of the Pacific Islands and one of the circum-Pacific region. They are David L. Kimbrough, University of California, Santa Barbara, Structure, petrology & geochronology of Baja California ophiolitic terranes, Vizcaino Peninsula & Cedros Island; Kristian E. Meisling, California Institute of Technology, Pasadena, Neotectonics of the north frontal fault system of the San Bernardino Mountains, southern California; Richard G. Stanley, University of California, Santa Cruz, Oligocene and early Miocene sedimentation and tectonics in the Santa Cruz Mountains, central California.

The committee singled out eighteen young scientists and their proposals for special mention in the belief that

(continued next page)
they should be brought to the attention of the Council and to the membership of the Society:

Lung Sang Chan, University of California, Berkeley
Karen Kluger Cohen, University of Pittsburgh, Pennsylvania
Cynthia Ann Evans, Scripps Institution of Oceanography, La Jolla
John Joseph Flynn, Columbia University, New York
Christopher J. Hale, University of Toronto, Canada
Robert Hershey, Johns Hopkins University, Baltimore, Maryland
Marie D. Jackson, Johns Hopkins University, Baltimore, Maryland
John W. King, University of Minnesota, Minneapolis
Linda A. Kovach, Johns Hopkins University, Baltimore, Maryland
Frederick W. Kunzinger, Old Dominion University, Norfolk, Virginia
Judy A. Massaia, Johns Hopkins University, Baltimore, Maryland
Charles Merguerian, Columbia University & Lamont-Doherty, New York
James E. Pizzuto, University of Minnesota, Minneapolis
Luis A. Sanchez-Barreda, University of Texas, Austin
Diane R. Smith, Rice University, Houston, Texas
Kim S. Steen, Ohio State University, Columbus, Ohio
Robert B. P. Stevens, Boston College, Newton, Massachusetts
David B. Weishampel, University of Pennsylvania, Philadelphia

Contributions of $2,000 were received from both Marathon and Mobil Oil Corporations in support of the research grants program. Nine promising young earth scientists were partially supported by these funds.

The committee believes the GSA research grant program represents one of the most effective scientific funding mechanisms in the country, yielding an enormous return for the relatively small amount of money expended. If the impact of the program is not to decline further with inflation, the level of funding must increase. This year the committee could easily have awarded to worthy projects at least $20,000 more than was available.

Respectfully submitted,
Walter Alvarez, Chairman; Emilie A. Pessagno, Jr.; Robin Brett, Conference Chair

1980 Research Grants Summary of Committee Recommendations

<table>
<thead>
<tr>
<th>Category I</th>
<th>Number of Applicants</th>
<th>Requested by Applicants</th>
<th>Recommended for Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.S. Student applicants</td>
<td>83</td>
<td>$70,259</td>
<td>$70,259</td>
</tr>
<tr>
<td>Ph.D. Student applicants</td>
<td>66</td>
<td>$109,802</td>
<td>$109,802</td>
</tr>
<tr>
<td>Subtotal</td>
<td>192</td>
<td>$180,061</td>
<td>$180,061</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category II (Alternates)</th>
<th>Number of Applicants</th>
<th>Requested by Applicants</th>
<th>Recommended for Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.S. Student applicants</td>
<td>6</td>
<td>$5,072</td>
<td>$5,072</td>
</tr>
<tr>
<td>Ph.D. Student applicants</td>
<td>8</td>
<td>$9,808</td>
<td>$9,808</td>
</tr>
<tr>
<td>Subtotal</td>
<td>14</td>
<td>$14,880</td>
<td>$14,880</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category III (not recommended for support)</th>
<th>Number of Applicants</th>
<th>Requested by Applicants</th>
<th>Recommended for Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.S. Student applicants</td>
<td>120</td>
<td>$124,552</td>
<td>$124,552</td>
</tr>
<tr>
<td>Ph.D. Student applicants</td>
<td>66</td>
<td>$75,086</td>
<td>$75,086</td>
</tr>
<tr>
<td>Subtotal</td>
<td>186</td>
<td>$200,638</td>
<td>$200,638</td>
</tr>
</tbody>
</table>

| Grant TOTAL | 492 | $420,247 | $420,247 |

<table>
<thead>
<tr>
<th>Council Action</th>
<th>Support all Category I projects</th>
<th>192</th>
<th>$81,000</th>
<th>$81,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding declined (cancellations)</td>
<td>(7)</td>
<td>(2,425)</td>
<td>(2,425)</td>
<td></td>
</tr>
<tr>
<td>Funding returned from prior years</td>
<td>(5,748)</td>
<td>(5,748)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternates awarded</td>
<td>7</td>
<td>3,150</td>
<td>3,150</td>
<td></td>
</tr>
<tr>
<td>YEAR END TOTAL</td>
<td>192</td>
<td>$80,117</td>
<td>$80,117</td>
<td></td>
</tr>
</tbody>
</table>

In June Geology

1. Controls on source and depth of emplacement of granitic magma, by D. W. Hyndman.
3. Ancestral head of Wilmington Canyon, by B. A. McGregor.
5. Carbon isotopes as indicators of dispersal patterns in Devonian-Mississippian shales of the Appalachian Basin, by J. B. Maynard.
7. Temperatures within subglacial debris—A gap in our knowledge, by J. Menzies.

Vol. 3, no. 6 GSA News & Information June 1981

GSA NEWS & INFORMATION (ISSN 0164-5854) is the monthly newsletter of The Geological Society of America, Inc., P.O. Box 9140, Boulder, Colorado 80301. Second-class postage rates paid at Boulder, Colorado, and at additional mailing office.

Prepared from contributions from the staff and membership by John C. Frye, Executive Director; James R. Clark, Production Manager; and June Thomas and Ann H. Fogel, Production Assistants.
WHY AUTHORS SHOULD USE THIS YEAR’S ABSTRACT FORM

For the Annual Meetings

GSA now is accepting abstracts for annual meetings only on the current year’s form. To understand why, it is important to realize that these forms serve two purposes. First, the author-prepared abstract is used for actual paste-up for printing. This eliminates typesetting of the abstracts for the Abstracts with Programs, reducing costs and errors. Image quality is important and format requirements tend to change. Second, the abstract form provides data which are used to determine trends and develop on-going statistics. The criteria for these data are subject to frequent change.

With regard to image quality, in 1980, as in previous years, GSA received hundreds of abstracts typed on photo-copies of old forms, some dating back ten years. Apparently, many organizations vigorously guard that “last copy” of the abstract form they have in the file and photocopy it for use year after year. Unfortunately, when abstract forms are photocopied, the nonreproducing blue lines which define the limits of the abstract usually reproduce in black, complicating the work of paste-up. In addition, the photocopies are often on lightweight paper which allows bleed-through of the hot wax used to cement the abstract to the printing layout. These problems can necessitate retyping of the abstract and a charge to the author.

Those old copies are badly out of date with regard to format requirements, creating additional problems, and even more out of date with regard to the peripheral data requested about the abstract.

Recent examples of the peripheral data problem include changes such as the one on the 1980 form asking authors to indicate a preference as to which of the associated societies should review the abstract. This year, that requirement was dropped and a new clarification was added limiting to one the number of abstracts an author may personally present. Almost every year the category list (of subdisciplines) changes slightly, and of course the abstract deadline changes every year. All such changes must be reflected on the form to be fair to authors and to facilitate the fastest possible processing of abstracts.

Seemingly minor changes, in format or peripheral data, grow in significance with each passing year. The form that was only one year out of date in 1979 is now badly outdated. If we were to continue to accept abstracts on those old forms, we would be creating more and more inconveniences for authors, including unwelcome author charges for retyping, and we would realize a growing amount of remedial work at GSA.

Realizing that the new policy calls for wide distribution of new forms, this year GSA began the routine of sending packets of forms and first announcements to the geology departments at 550 colleges and universities, to several USGS locations, to all State Geologists’ offices, to a healthy list of commercial and industrial organizations, to the GSA divisions and sections, to all symposia organizers, to all GSA campus representatives, and to those individuals and organizations that requested forms during the previous year. Requests coming in this year for forms are nearly always filled the same day.

In 1980 GSA computerized abstract processing with the result that labor costs were reduced substantially while at the same time we were able to provide additional service to the authors, such as the immediate acknowledgment of receipt we now send and much prompter advice on acceptance and rejection. By 1982 we expect that the complete technical program section of Abstracts with Programs will be typeset automatically from the computer records.

Annual Meeting ABSTRACT DEADLINE: June 5
I was born June 25, 1916, in New York City. After receiving both B.S. and M.S. degrees in geology at the University of New Mexico, my early career was spent in the San Juan Basin of northwest New Mexico with Florence Drilling Company. I was the first to recognize the basin-wide distribution of natural gas which was to develop into the second largest field discovered so far in the United States, and beginning in 1950, I published a number of articles on the San Juan Basin. In 1951, at the first annual meeting of the Rocky Mountain Section of the Aapg, I gave a paper suggesting the presence of a large regional stratigraphic trap possibility in the Gallup sandstone and outlined a general area 10 miles wide and 50 miles long in which it could be found. The Bisti oil field, 2 miles wide and 40 miles long, was found within the outlined area in 1957 after 30 dryholes.

Moving from Albuquerque to Denver in 1959, I soon converted Sundance Oil Company, of which I had been president since 1955, from a small company having one producing royalty in the Ashley Valley Field near Vernal, Utah, to exploring the Denver Basin. In 1964, after four years of indifferent success in which Sundance income had grown from $20,000 to $35,000 a year, I initiated one of the first subsurface geologic mapping programs in which computers were employed to analyze electric well logs for porosity, water saturation, and fluid salinity using the Humble and Archie formulas. This was done under my supervision as a joint research effort with Marathon Oil Company research center in Littleton, Colorado. Out of this came an understanding of the controls and distribution for oil and gas occurrence in the Denver basin and the discovery of a number of fields that increased Sundance’s yearly oil and gas sales to $1,500,000 a year by 1969 and thence led the company into opening an exploration office in Calgary, Alberta, in September 1970.

Out of my experience in the various Cretaceous oil and gas fields of the Rocky Mountain basins, principally the San Juan and Denver basins, I formulated the geologic principles that were so successfully employed in the Alberta syncline in Canada. Ideas contained in my 1973 publication “Entrapment of Petroleum in Isolated Porous Bodies” were a philosophy of exploration that made Sundance Oil Canada, Ltd., the most successful exploration company in Canada in the decade of the 1970s and built the company to its present size of having a discounted present worth of more than one billion dollars.

Presently I am chief executive officer and chairman of the Board of Directors of the Sundance Oil Company. I am a Fellow of the Geological Society of America and the American Association for Advancement of Science and a member of the American Association of Petroleum Geologists, the Society of Economic Geologists, and various local geological societies—RMAG, WGS, and CIPG.

Bob Fuchs started his geological career at Cornell University. His master’s degree was obtained from the University of Illinois, following which he began work as a junior geologist for Mobil Oil. During 13 years with this major oil company, he served in a variety of exploration positions world-wide.

In 1965, Bob left Mobil to work for a research company in the Washington, D.C., area, and shortly thereafter he founded a computer business. This company was sold three years later, at which time he joined forces with two businessmen to form Intercontinental Oil Corporation. This is now a public company located in Denver that is engaged in oil, gas, and uranium exploration and production.

In 1971, Bob founded Geosystems Corporation and is currently its president. Geosystems is a natural resources company that has successfully married geological expertise to investment management concepts. As a result, Geosystems and its partners participate in a broad spectrum of investments in natural resources, from geothermal through petroleum to coal gasification and gold.

In the Geological Society of America, Bob has been very active in financial affairs since the early 1970s and has chaired the Committee on Investments since 1977. He has fulfilled a similar role for the American Association of Petroleum Geologists and is also the incoming president of the AAPG’s Energy Minerals Division.

While working in Venezuela in 1955, Bob met and married Josephine Servello. They now reside in Westport, Connecticut, where both are elected officials in local government. The Fuchs have two sons—Edward, who is employed by Mobil Oil Corp., and Robert, who is a senior in chemical engineering at Cornell.
Michel T. Halbouty's career as an earth scientist spans five decades in the fields of petroleum geology and petroleum engineering, from 1931 when he began to work in his chosen fields, through today as an independent geological consultant and oil and gas producer and operator in Houston. A graduate of Texas A&M University, he holds bachelor's and master's degrees in both geology and petroleum engineering and professional geological engineering and doctor of engineering degrees (HC) from Montana College of Mineral Science and Technology.

Over the years he has continued to research and learn techniques and concepts of advanced oil and gas exploration, production, and development. The newest of these concepts is the use of remote sensing from spacecraft to enhance the overall global petroleum exploration effort. Halbouty has contributed several books and over 200 scientific articles to the literature of petroleum geology and petroleum engineering.

He is an outspoken optimist about the future of the world-energy economy and puts into action what he believes by telling others, applying his knowledge to the existing problems, and offering solutions. As chairman of President Reagan's Energy Policy Advisory Task Force and later as leader of the Transition Team on Energy, he has given much of his time and expertise to help ensure the economic energy stability of our country.

He is a staunch supporter of the geological sciences and contributes his time, as well as financial support, to increased excellence in geological research, education, and applications.

I was born in Xenia, Ohio, in the opening year of the "War to End All Wars," and was educated successively at DePauw University, University of Minnesota, the Texas Company (as a project manager for a seismic crew), Sun Oil Company (as a geologist and physicist), and Princeton University. Work with Harry Hess and Taylor Tom at Princeton began a lifelong interest in the ocean and complexities of mountain systems, particularly those which are still actively forming. My students and I have worked in the Caribbean area from the Virgin Islands to Venezuela, in the Appalachians, the northern Rocky Mountains, the Mediterranean from Spain to Turkey, the northern California Coast Ranges, and the Klamath Mountains. Over the years I have been honored by election to the Council and presidency of the Geological Society of America and the presidency of the American Geophysical Union. Currently, as the knees become more arthritic, my scientific efforts are largely vicarious, but none the less exciting, as a member, and now chairman of the U.S. Geodynamics Committee and a member and vice-chairman of the Board of the UNESCO-IGUS-sponsored International Geological Correlation Programme. The University of Texas at Austin provides a stimulating environment and the necessary financial means to permit these activities.

Hollis D. Hedberg was born in 1903 in the small Swedish farm community of Falun, Kansas, and brought up to work by the side of his father on their homestead wheat farm. He obtained his B.A. degree, Phi Beta Kappa, from the University of Kansas in 1926, his M.S. from Cornell in 1927, and his Ph.D. from Stanford in 1937. He joined Gulf Oil Corporation in 1928 as a geologist in Venezuela, later (in the U.S.) became chief geologist, and then vice-president in charge of exploration. In 1969, he became professor of geology at Princeton University.

He has received many and varied recognitions for his years of service in the geological profession. In 1941, he received the Medalla de Honor de la Instrucción Pública from Venezuela; in 1963, the Sidney Powers Medal of the AAPG and the Distinguished Service Award of the University of Kansas; in 1969, the Certificate of Appreciation from the National Petroleum Council for his work on the Council's Committee on Petroleum Resources under the Ocean Floor; in 1972, the President's Award of the AAPG for his paper on continental margins; in 1973, the Mark Clark Thompson Medal of the National Academy of Sciences and the Human Needs Award of the AAPG; in 1975, the Distinguished Achievement Award of the Offshore Technology Conference and the Wollaston Medal of the Geological Society of London; in 1977, a Doctorate honoris causa from the University of Uppsala in Sweden for his twenty-five years of work in bringing together a consensus on stratigraphic classification which culminated in the publication of the International Stratigraphic Guide; and in 1980, the Penrose Medal of the Geological Society of America.

Hedberg is a member of the National Academy of Sciences and of many of the geological societies, including honorary membership in scientific societies in England, Sweden, and Denmark. He was president of the Geological Society of America in 1960 and president of the American Geological Institute in 1962-1963.

He has published more than 150 scientific papers on compaction of sediments, stratigraphy and stratigraphic classification, petroleum geology and the origin of petroleum, ocean boundaries and the law of the sea, and many other subjects.

GSA NEWS & INFORMATION 85
CINCINNATI, the Queen City, founded on seven hills overlooking the Ohio River, is an excellent site for the November meeting. It is also the site of the inception of GSA—back in 1881. A city with a pronounced Southern exposure, Cincinnatians are gracious with strangers, and best of all, for travelers inclined to gauge a city by the quality and diversity of culinary offerings, its restaurants compare favorably with cities many times larger. We recommend the convenient location of the convention center and hotels and moderate costs for food and lodging.

The Local Committee has initiated an enticing series of events that will round out the more sedate technical program.

Welcoming Party, November 1. Cincinnati Union Terminal is the location for the Sunday night opening reception. Beverages will be available on the rotunda and concourse levels. Browsing through stores and snacking at food stands is encouraged—a good pastime while seeing friends. This will be a cut above the usual hotel ballroom atmosphere.

Oktoberfest, November 3. Plan for a great evening of music and dance from biergartens to opera amid the tradition of German foods and icy beer steins. It will be in Cincinnati’s grand old Music Hall. Unlimited free beer will be included in the ticket price.

Annual Dinner, November 4. As part of the GSA Annual Dinner, Frank Press, incoming president of the National Academy of Science, will address us. We are counting on his background in Washington, D.C., to give us a special perspective. Everyone is welcome to attend this after-dinner address.
Amphibole short course will precede the Cincinnati Annual Meeting

The Mineralogical Society of America will sponsor a Short Course on Amphiboles and Other Hydrous Pyrolytes before the 1981 MSA/GSA Annual Meeting in Cincinnati, Ohio. The Short Course will be held at a conference center near Erlanger, Kentucky, from October 29 (evening) to November 1 (noon). It will include an intensive review of the crystal chemistry, spectroscopy, phase equilibria, igneous and metamorphic petrology, and subsolidus behavior of amphiboles, as well as discussions of the mineralogy and geology of amphibole asbestos and wide-chain pyrolytes. The outstanding lecturers who have been selected for this course will also participate in the preparation of Volume 8 of the MSA Reviews in Mineralogy series. For further information, write to Amphibole Short Course, Mineralogical Society of America, 2000 Florida Avenue, N.W., Washington, D.C. 20009.

1981 ANNUAL MEETING COMMITTEE

<table>
<thead>
<tr>
<th>General Chairman</th>
<th>Warren Huff</th>
<th>University of Cincinnati</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-Chairman/Treasurer</td>
<td>Malcolm Annis</td>
<td>University of Cincinnati</td>
</tr>
<tr>
<td>Field Trips</td>
<td>Lois Campbell</td>
<td>University of Kentucky</td>
</tr>
<tr>
<td></td>
<td>Thomas Roberts</td>
<td>Emery Industries Inc.</td>
</tr>
<tr>
<td>Guest Program</td>
<td>Terry &amp; Marie Huizing</td>
<td>Miami University, Ohio</td>
</tr>
<tr>
<td>Publicity</td>
<td>Robert McWilliams</td>
<td>Xavier University</td>
</tr>
<tr>
<td>Science Theatre</td>
<td>Napoleon Bryant</td>
<td>University of Cincinnati</td>
</tr>
<tr>
<td>Student Assistants</td>
<td>Kees DeJong</td>
<td>Consolidated Resources of America, Inc.</td>
</tr>
<tr>
<td>Technical Program</td>
<td>Norman Hester</td>
<td>Kentucky Geological Survey</td>
</tr>
<tr>
<td>Technical Services</td>
<td>Martin Noger</td>
<td>Northern Kentucky University</td>
</tr>
<tr>
<td>Transportation</td>
<td>Raman Singh</td>
<td>U.S. Army Corps of Engineers</td>
</tr>
<tr>
<td></td>
<td>David Lienhart</td>
<td></td>
</tr>
</tbody>
</table>

Reduce . . . and Enjoy

For the sake of economy in a year of cutbacks, we suggest the following ways to save in '81 while enjoying the annual meeting:

1. Preregister.
2. Prepurchase the Abstracts with Programs.
3. Arrange a carpool. For Surveys—how about a vanpool?
4. Book your excursion airfare NOW while still available. It usually costs nothing to cancel. Check with a travel agent; services are free.
5. Register for a hotel room in August when the housing forms first become available. This will help assure your first choice.
6. Walk or use the free shuttle. Try to arrange four persons to a cab when traveling to and from the airport or use the airport bus.
7. Reminder, weekday prices at most restaurants are less than those on weekends. (Many of the best restaurants are closed Sunday anyway!)

We are doing our best to hold the expenses of putting on a meeting to a reasonable minimum. We predict the registration fee will not be increased for 1981—a bargain compared to the general inflation rate.

About 2/3 of meeting attendees preregister. Note on your calendar: Register for the GSA meeting by OCTOBER 2. Refunds are permitted until October 15.

We look forward to meeting with you. See you in Cincinnati!

Cell for proposals for the Centennial Symposium: 1982 Annual Meeting—New Orleans

The Council of the Society has authorized the designation of a featured Centennial Symposium for each annual meeting during the decade of the 1980s. This symposium will be a part of the Centennial Program and of the Decade of North American Geology. The President of the Society will make the final selection from suggestions and proposals made by the Program Review Committee, the Council, divisions, sections, and the membership at large. Proposals are being accepted for the 1982 meeting in New Orleans.

The featured symposium should focus on pacsetting trends and current breakthroughs in research having broad interdisciplinary impact on the science of geology. Suggestions and proposals of titles and subjects should be sent before October 2, 1981, to

A. R. Palmer, Centennial Science Program Coordinator
Geological Society of America
P.O. Box 9143
Boulder, CO 80301

Annual Meeting Field Trips—See Next Page

GSA NEWS & INFORMATION  87
FIELD TRIPS

The Cincinnati area has a long history of attracting geologists because of its abundantly fossiliferous strata and its position on the crest of the Cincinnati Arch. Within easy reach are karst features, coal-producing regions, glacial sediments, Paleozoic rocks from Ordovician through Permian age, as well as shores of large lakes. Within reasonable distances, the Appalachians and the Ozarks are also accessible.

For further information concerning any field trip, contact either Lois J. Campbell, Chairman, or Thomas Roberts, Co-Chairman, Department of Geology, University of Kentucky, Lexington, KY 40506 (606) 257-3758. Unless otherwise indicated, all trips originate and terminate in Cincinnati.

Premeeting

1. Upper Ordovician (Richmondban) Stratigraphy and Paleozoology of southeastern Indiana and Southwestern Ohio (1 day). John K. Pope, Roy H. Reinhart, and Wayne D. Martin, Miami Univ., Oxford, OH; and Helen B. Hay, Earlham College, Richmond, IN.

2. Stratigraphy of Devonian and Lower Mississippian Agglutinate Foraminifera of Northwestern Kentucky and Southern Indiana (2 days. Origin. Louisville, KY). James E. Conkin, Univ. of Louisville; and Barbara M. Conkin, Jefferson Community College, Louisville, KY.


4. Mississippian-Pennsylvanian Boundary in the Central Part of the Appalachian Basin (4 days. Origin. Princeton, WV). Kenneth J. Englund and Thomas W. Henry, USGS, Reston, VA; John C. Horne, Colorado School of Mines; and Frank R. Ettensohn and John C. Fenm, Univ. of Kentucky. (Mississippian-Pennsylvanian Boundary Group, SEPM.)


6. The Serpent Mound Cryptosexplosion Structure, Southwestern Ohio (1 day. Same trip as postmeeting 16). Stephen P. Reidel, Rockwell Hanford Operations, Research Dept., Richland, WA; and Frank L. Kouchy, College of Wooster, Wooster, OH.


8. Hydrogeology of the Mammoth Cave Region, Kentucky (4 days). James F. Quinlan, National Park Service, Mammoth Cave, KY; and Ralph Ewers, Cumberland Karst Research Lab., Stab, KY.

9. Quaternary Deposits of Southern Ohio (3 days). R. P. Goldthwait, Ohio State Univ.; D. P. Stewart, Miami Univ.; D. A. Franz, Syracuse Univ.; and Michael J. Quinn, Shell Oil Co., New Orleans, LA.


Postmeeting

11. Paleoenvironmental Interpretation of the Middle Ordovician High Bridge Group in Central Kentucky (1 day). Gary L. Kuhnhein, Eastern Kentucky Univ., Richmond, KY; George Grabowski, Rice Univ., Houston, TX.


14. Coal and Coal-Bearing Strata of Southwestern Kentucky (4 days). James C. Cobb, Norman C. Hester, and Donald R. Chestnut, Kentucky Geological Survey; and James C. Hower, Inst. for Mining and Minerals Research, Univ. of Kentucky (Coal Geology Division).

15. Precambrian Geology and Mineralization, the St. Francois Mountains, Southeastern Missouri (3 days. Origin. and Term.: St. Louis, MO. Hqds: Flat River, MO). Eva B. Kivansanyi and Arthur W. Hebrank, Missouri Geological Survey, Rolla, MO; and Richard F. Ryan, Pilot Knob Pellet Co., Ironon, MO.

16. The Serpent Mound Cryptosexplosion Structure, Southwestern Ohio (1 day. Same trip as 6). Stephen P. Reidel, Rockwell International, Geosciences Group, Richland, WA; and Frank L. Kouchy, College of Wooster, Wooster, OH.

17. Geoarchaeology of the Flint-Mammoth Cave System and the Green River Valley, Western Kentucky (2 days). Julie Stein, Univ. of Washington; Patty Jo Watson, Washington Univ. in St. Louis; and William B. White, Penn State Univ. (Archaeological Geology Division).

18. Engineering Geology of Cincinnati (1 day). Robert W. Fleming, USGS, Denver, CO; Arvid M. Johnson, Univ. of Cincinnati; and James E. Hough, Consulting Geol., Cincinnati. (Engineering Geology Division)


ABSTRACTS DEADLINE
Abstracts must arrive on or before JUNE 5

PREREGRISTRATION DEADLINE
OCTOBER 2

CINCINNATI
annually in october 2-5, 1981

JUNE 1098
In late 1981 or early 1982, GSA will move its publications warehouse from Burlington, Vermont, to a new location, as yet undetermined. To reduce inventory in preparation for this move, we offer the items in this special sale list at major savings.

SAVE 50% TO 75% OFF REGULAR PRICES ON THESE GSA MEMOIRS • MAPS • SPECIAL PAPERS

SALE BEGINS MAY 15, 1981

Orders Must Be Postmarked On Or Before November 30, 1981
All Sales Subject To Terms And Conditions Listed on Next Page
GSA PUBLICATIONS
WAREHOUSE REMOVAL SALE

"We’d rather sell them than move them. . ."

TERMS AND CONDITIONS OF SALE

PRICES/DISCOUNTS: Reduced prices are shown in green in this list and are net. No additional discounts of any kind will be allowed. GSA member discount may not be applied to these prices due to the large reduction already reflected here.

TIME OF SALE: Items on this special sale list may be ordered anytime from May 15, 1981, through November 30, 1981. Inventories are limited and orders will be filled on a first-come first-served basis. GSA will make no substitutions unless you specify them on the order form.

ITEMS ON SALE: This is a special sale list. Only those items on this list are available at these prices. Other GSA publications are available at regular prices; please see GSA’s latest Price List for complete details and terms of sale on items other than those listed here.

NUMBER OF COPIES: You may order as many copies of each title as you like at these prices, subject only to prior sale.

MINIMUM ORDER: $10.00 minimum order at these prices plus $2.50 handling charge. No exceptions. You may, of course, combine orders for several individuals to make up the minimum but remember the entire order must be shipped to one address.

PAYMENT TERMS: All orders must be accompanied by payment in full. Enclose check, draft, money order, or UNESCO coupons in U.S. funds.

SHIPPING ADDRESSES: All items on any order must be shipped to the same single address. No multiple-addressee shipments.

RETURNS: No returns will be allowed except for damaged items, which will be replaced if still available at time of claim; otherwise, refund will be made on such damaged items. If damage occurs, please write GSA Publication Sales; do not send the damaged item, but hold for instructions.

PHONE INQUIRIES: Telephone orders cannot be accepted. Because brisk sales are expected and the present warehouse is remote from GSA Headquarters, questions about availability cannot be answered by telephone.
**SPECIAL WAREHOUSE SALE ORDER FORM**

(Date) **USE ONLY**

MAY 15 – NOV. 30, 1981

**SHIP TO:**

Address

________________________________________

________________________________________

City State Zip

PAYMENT ENCLOSED □ Check □ M.O. □ UNESCO coupons

(U.S. funds only)

<table>
<thead>
<tr>
<th>Qty</th>
<th>Series and Number</th>
<th>Price each</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subtotal

Carry forward to page 2

Sales Tax: Denver metro residents add 3%; Boulder residents add 5%; other Colorado residents add 3%.

**EACH ORDER MUST TOTAL AT LEAST $10.00**

Plus $2.50 handling charge

---

**SPECIAL WAREHOUSE SALE ORDER FORM**

(Date) **USE ONLY**

MAY 15 – NOV. 30, 1981

**SHIP TO:**

Address

________________________________________

________________________________________

City State Zip

PAYMENT ENCLOSED □ Check □ M.O. □ UNESCO coupons

(U.S. funds only)

<table>
<thead>
<tr>
<th>Qty</th>
<th>Series and Number</th>
<th>Price each</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subtotal

Carry forward to page 2

Sales Tax: Denver metro residents add 3%; Boulder residents add 5%; other Colorado residents add 3%.

**EACH ORDER MUST TOTAL AT LEAST $10.00**

Plus $2.50 handling charge
Engineer Geology

Application of Geology to Engineering Practice: Berkeley Volume. 

Sidney Paige, Chairman. 1950. ... $9.99 $5.00

ENGINEERING GEOLOGY CASE HISTORIES. A series of case histories, epurbone, dealing with the special geological problems confronted by construction engineers.

3 Symposium on Rock Mechanics, edited by Parker D. Trask. 1959 ... $2.25 $1.00

4 Focuses on land subsidence, foundation treatment, geology of a highway tunnel, grouting, a landslide, edited by Parker D. Trask and George A. Kiersch. 1963 ... $2.25 $1.00

5 Deals with investigations of dam sites, a landslide and a radioactive waste disposal site, edited by George A. Kiersch. 1964 ... $2.25 $1.00

6 See below for description ... $2.25 $1.00

7 See below for title ... $2.25 $1.00

8 See below for title ... $2.25 $1.00


9 Vol. 6 is a collection of general case histories on dams, tunnels, highways, and underground construction; No. 7: Some Legal Aspects of Engineering Practice; No. 8: Engineering Seismology—The Works of Man; No. 9: Geologic Factors in Rapid Erosion; No. 10: Geologic Mapping for Environmental Purposes. ... $2.99 $1.00

Maps and Charts

Geologic Map of the Alaska Peninsula Southwest of West Bay. C. A. Burk. 1965. Two sheets in color, each 50" x 41". Contour intervals at 200 and 1,000 ft. Scale: 1:250,000. Part 2 of Memoir 99. ... Folded: $9.99 $4.00


Physiographic Diagram of the North Atlantic Ocean. Bruce C. Heezen and Marie Tharp. 1965, revised 1968. In color, 75" x 40". Scale: 1,500,000. Lat 17°-50°N, long 0°-82°W; based on continuous echo-sounding traverses at 20-200, 200-500, 500-1,000, and 1,000-1,500 fathom relief. ... Folded: $9.99 $4.00

Physiographic Diagram of the Western Pacific Ocean. Bruce C. Heezen and Marie Tharp. 1971. In color, 52" x 41". Scale: 1,100,000,000, Lat 30°N-40°S, long 102°-150°W. Depths in metres ... Folded: $9.99 $4.00

MC-1 Glacial Map of the United States East of the Rocky Mountains. Compiled and edited by a N.R.C. committee. Richard F. Flint, Chairman. 1959. Two sheets in color, each 44" x 37". Scale: 1:1,750,000. ... Folded: $9.99 $4.00


MC-4 Tectonic Map of China and Mongolia. Compiled by U.S. Geological Survey (principally by Maurice J. Terman) for A.R.P.A. and released in limited edition in 1967 as Vol. II. Tectonics in Asia and Eastern Europe: re-edited and reinterpreted in 1973. Two sheets in color, each 43" x 34". Sheet 1 includes map and legend; sheet 2, nine schematic cross sections, 10x vertical exaggeration; inset maps at 1:20,000,000 show tectonic regions. Scale: 1:5,000,000. ... Folded: $9.99 $4.00


MC-7 Bathymetric Map of the Bering Shelf. Compiled and compiled by Richard Pratt and Fred Walton. 1974. In black and white, 43" x 35". Scale, approx. 20 nautical miles to the inch. Contour interval, 50 metres. Note: the geology of this area is described in Special Paper 151. ... Folded: $4.99 $2.00


MC-12 Gravity Field of the Northwest Pacific Ocean Basin and Its Margin: Philippine Sea. Anthony B. Watts. 1976. A free-air gravity anomaly map, contoured at 25-mgal intervals. In color, 35" x 51", with a 6-page summary statement. ... Folded: $5.99 $2.00

MC-13 Metallogenic Provinces of Mexico and Geochronologic Chart of Mexico (Contribution to the Metallogenetic Chart of North America). Guillermo P. Salas. 1976. In color, 65" x 45". Scale, 1:2,000,000. ... Folded: $7.99 $3.00

MC-14 Geologic Map of the Humboldt Lopolith and Surrounding Terrane, Nevada. Robert C. Speed. 1976. In color, 40" x 30". Scale, 1:1,000,000. With 4-page text and one fold-out figure in black and white. ... Folded: $9.99 $2.00


MC-16 Reconnaissance Geologic Map of Coastal Sonora between Puerto Lobos and Bahia de los Angeles. R. H. Mann, Daniel Kranzberger, and others. 1977. In color, 17" x 47". Scale, 1:1,500,000. Note: The geology of this area is described in Geological Society of America Bulletin, v. 88, no. 2, p. 189-198. ... Folded: $9.99 $2.00

MC-17 Bathymetry of the East and Southeast Asian Seas. J. Ummertich, K. L. Fisher, F. J. Emmel, and S. M. Smith. 1977. In color, 43" x 47". Contour interval: 1,000 metres; Scale at equal, 1:6,442,194 or 1.74 cm per degree of longitude. ... Folded: $9.99 $2.00

MC-18 Late Quaternary Geology of the Lower Granite Reservoir Area, Lower Snake River, Washington. Hallet Ham- lott. 1977. In color, 38" x 25". Scale, 1:250,000. Mapped to 1,200-foot contour. ... Folded: $6.95 $3.00


MC-21 Bathymetric of the Norwegian-Greenland and Western Barents Seas. Compiled by R. K. Perry, H. S. Fleming, N. Z. Cherkis, R. H. Feden, and J. V. Masingill for the U.S. Naval Research Laboratory. 1977. In color, 42" x 57". Scale, 1:3,333,230 at lat 71°N. Ship tracks are shown on the reverse side for obverse viewing. ... References. ... Folded: $9.99 $3.00

Reduced prices in effect for orders postmarked on or before Nov. 30, 1981.

*No envelope. All other maps in 9" x 12" printed envelope.
Taxonomic Revision of the Superspecific Groups of the Cretaceous and Cenozoic Tilletiidae. Freydoun Afschar. 1969 ........................ $10.00 $4.00

Regional Geochronology of New England and Adjacent Quebec: Wallace M. Cadby. 1969 .......... $14.00 $5.00

Great Basin Lower Devonian Brachiopoda. J. G. Johnson. 1970 ........................................ $15.00 $5.00


Environmental Geochemistry in Health and Disease. Edited by Helen L. Cannon and Howard C. Hoppin. 1971 ........ $19.50 $9.00

Comparative Study of Low-Grade Metamorphism in the California Coast Ranges and the Outer Metamorphic Belt of Japan. W. G. Ernst, Y. Seki, H. Onuki, and M. C. Gilbert. 1970 ........ $20.00 $8.00

Relation of Shell Formation to Life Habits in the Bivalvia. Steven M. Stanley. 1970 .................. $14.00 $5.00


Symposium on Cenodont Biostratigraphy. Edited by Walter C. Sweet and Sig M. Bergstrom. 1970 .......... $19.50 $5.00


Paleogeography and Geological History of Greater Antilles. K. M. Khudoley and A. A. Meyerhoff. 1971 ........ $17.00 $8.00

Caribbean Geosynclinal, Tectonic, and Petroleum Studies. Edited by Thomas W. Donnelly. 1971 ........ $21.00 $10.00

Annotated Bibliographies of Mineral Deposits in the Western Hemisphere. John D. Ridge. 1972 .......... $14.00 $5.00

Studies in Earth and Space Sciences (Harry H. Hess Volume). Edited by Reginald Shagam and others. 1972 ........ $20.00 $10.00

Environmental Framework of Coastal Plain Estuaries. Edited by Bruce W. Nelson. 1973 ........ $25.50 $16.00


A System of Classifications of Cretaceous Sediments. M. L. Natland and others. 1974 ........ $15.00 $7.00


Quantitative Studies in the Geological Sciences. Edited by E. H. Timothy Whitten. 1975 ........ $20.00 $9.00

Cenozoic History of the Southern Rocky Mountains. Edited by Bruce M. Curtis. 1975 ........ $25.00 $13.00

Special Papers

Numerical Structure Factor Tables. M. J. Buenger. 1941 .................. $5.75 $2.00

Marysvale, Utah, Uranium Area. Paul F. Kerr, Gerald P. Brophy, Harry M. Dahl, Jack Green, and Louis E. Woolard. 1957 .................. $12.00 $5.00

Mechanics of Thermal Contraction Cracks and Ice-Wedge Polygons in Permafrost. Arthur H. Lachenbruch. 1962 ........ $32.00 $1.00

Pre-Tertiary Stratigraphy and Structure of Northwestern Nevada. J. N. Silberling and Ralph J. Roberts. 1962 .................. $10.00 $1.00

Early Investigations of the Devonian System in New York, 1656-1836. John West Wells. 1963 ........ $25.00 $2.00

Glacial Geology across the Crest of the Sierra Nevada, California. Joseph H. Birman. 1964 ........ $12.75 $4.00

Stratigraphy and Structure of the Boundary Mountain Anticlinorium in the Errol Quadrangle, New Hampshire-Maine. John C. Green. 1964 .................. $25.00 $2.00

Interpretation of Planar Structure in Drill-Hole Core. Mark S. Lyons. 1964 .................. $25.00 $2.00

Ecology and Oceanography of the Coral Reef Tract, Abaco Island, Bahamas. John F. Storr. 1964 ........ $32.00 $2.00


International Studies on the Quaternary. Edited by H. E. Wright Jr., and David G. Frey. 1965 ........ $20.00 $5.00


Scapolite in the Belt Series in the St. Joe-Clearwater Region, Idaho. Anna Hietanen. 1967 .................. $6.00 $3.00


Relation of Geology and Trace Elements to Nutrition. Edited by Helen L. Cannon and David F. Davidson. 1968 ........ $5.00 $2.00

Pedology of Cornucopia Tonalite Unit, Cornucopia Stock, Wallowa Mountains, Northern Oregon. William H. Taubenek. 1967 .................. $7.00 $1.00

The Damaran Epigenetic in the Upper Proterozoic-Lower Paleozoic Structural History of Southern Africa. Tom. N. Clifford. 1967 .................. $3.00 $2.00

Hydrology of Limestone Terranes in the Coastal Plain of the Southeastern United States. V. T. Stringfield and H. E. LeGrand. 1966 .................. $3.00 $1.00

Loess Deposits of Mississippi. E. L. Krivitsky and W. J. Turnbull. 1967 .................. $4.00 $2.00

Stratigraphy and Paleocology of the Saka Formation (Cincinnatian) in Indiana, Ohio, and Kentucky. Craig B. Hatfield. 1968 .................. $2.00 $1.00

Lower Pennsylvanian Ammonoids from Floyd Formation of Arkansas and Oklahoma. James A. McBride. 1968 .................. $4.75 $2.00

Time and Space Relationships of the Taconic Allochthon and Autochthon. Ean Zen. 1967 .................. $7.50 $3.00


Tectonic, Plutonic, and Metamorphic History of the Central Kootenay Arc, British Columbia, Canada. Percy Crosby. 1968 .................. $7.50 $3.00

Pre-Cretaceous Sedimentation and Metamorphism in the Winchester Area, Northern Peninsular Ranges, California. Henry P. Schwarz. 1969 .................. $2.75 $1.00

Origin and Paleoclimatic Setting of the Patterened Ground in the Donnelly Dome Area, Alaska. Troy L. Pewe, Richard E. Church, and Marvin J. Andresen. 1969 .................. $4.00 $2.00

Miscellany


Memorials, Volume I (1969 decedents) .................. $35.00 $2.00

Memorials, Volume II (1970 decedents) .................. $35.00 $2.00

Memorials, Volume III (1971 decedents) .................. $35.00 $2.00

Memorials, Volume IV (1972 decedents) .................. $35.00 $2.00

Ten-Year Indexes to Geological Society of America Bulletin Volumes 41-50 (1930-1939) .................. $6.00 $3.00

Volumes 61-70 (1950-1959) .................. $12.00 $5.00

Volumes 71-80 (1960-1969) .................. $12.00 $6.00

Reduced prices in effect for orders postmarked on or before Nov. 30, 1981.
Special Papers


105 Geology and Paleontology of a Late Pleistocene Basin in Southwest Kansas. Gerald E. Schultz. 1969 ........................................... $6.95 $2.00

106 Late Paleozoic and Mesozoic Continental Sedimentation, Northeastern North America. Edited by George deVries. 1968 ........................................... $11.50 $5.00


108 The Blockhauzen Landslide. Ronald L. Shreve. 1968 ........................................... $6.95 $3.00

109 Archaeological Evidence for Eustatic Change of Sea Level and Earth Movements in the Western Mediterranean During the Last 2,000 Years. N. C. Fleming. 1969 ........................................... $7.95 $3.00

110 Biostratigraphic Classification of the Marine Triassic in North America. N. J. Silberling and E. T. Tozer. 1968 ........................................... $9.95 $1.00

111 The Palisades Still, New Jersey: A Reinvestigation. Kenneth R. Walker. 1969 ........................................... $7.95 $1.00

112 Pleistocene-Recent Stratigraphy, Evolution, and Development of the Apalachicola Coast, Florida. Jon E. Schnableand H. Grant Goodell. 1968 ........................................... $9.75 $1.00

113 Louver, Middle, and Upper Cambrian Fossils in the Taconic Sequence of Eastern New York: Stratigraphic and Biostratigraphic Significance. John M. Bird and Franco Rasetti. 1968 ........................................... $6.95 $1.00

114 The Cloudy Pass Epizonal Batholith and Associated Subvolcanic Rocks. Fred W. Caten. 1969 ........................................... $8.95 $1.00

115 Claudenville Formation, Middle Ordovician Flysch, Northern Gaspe Peninsula, Quebec. Paul Enos. 1969 ........................................... $6.75 $1.00

116 Petrology and Structure of the Vounios Ophiolitic Complex of Northern Greece. E. M. Moores. 1969 ........................................... $4.65 $1.00


118 Geochemistry and Petrology of the Rocky Hill Stock, Teton County, Virginia. George W. Putman and John T. Alford. 1969 ........................................... $8.45 $2.00

119 The Caballos Nouculite, Marathon Region, Texas. Earle F. McBride and Alan Thomson. 1970 ........................................... $6.75 $3.00

120 Radiometric Dating and Paleontologic Zonation. Edited by Orville I. Bandy. 1970 ........................................... $6.75 $3.00

121 Stratigraphic Analysis of a Deep Ice Core from Greenland. Chester C. Langway Jr. 1970 ........................................... $7.05 $3.00

122 Symposium on Palynology of the Late Cretaceous and Early Tertiary. Edited by Robert Kosanke and Aurel T. Cross. 1970 ........................................... $3.65 $5.00

123 Geology and Regional Metamorphism of Some High-Grade Cordilleran Gneisises, Front Range, Colorado. Dolores J. Gable and Paul K. Sims. 1970 ........................................... $4.95 $2.00


125 Biostratigraphy and Lower Permian Fusulinidae of the Upper Delta River Area, East-Central Alaska Range. Ronald G. Petocz. 1970 ........................................... $6.25 $2.00


127 Thermodynamic Properties of Water at 1,000°C and 10,000 Bars. C. Wayne Burnham, John R. Holloway, and Nicholas F. Davis. 1969 ........................................... $9.65 $1.00

128 The Taconide Zone and the Taconic Orogeny in the Western Part of the Northern Appalachian Orogen. Ean Zen. 1972 ........................................... $6.95 $3.00


131 Geology of the Arisaig Area, Antigonish County, Nova Scotia. Edited by A. J. Boucot. 1974 ........................................... $13.95 $6.00

140 Geochronology in Relation to Health and Disease. Edited by Helen L. Cannon and Howard C. Hoppes. 1972 ........................................... $6.75 $2.00

141 Conodont Paleozoology. Edited by D. M. Newell. 1973 ........................................... $10.50 $5.00

142 Bibliography of Theses in Geology, United States and Canada, 1967-1970. Edited by Dederick C. Ward. 1973 ........................................... $47.05 $5.00


144 Upper Mississippian Ammonoids from Arkansas and Oklahoma. Bruce W. Saunders. 1973 ........................................... $6.95 $2.00

145 Carboniferous of the Southeastern United States. Edited by Garrett Briggs. 1974 ........................................... $14.95 $5.00

146 Lower Triassic Terrigenous of Tasmania. John W. Considine Jr. 1974 ........................................... $13.00 $4.00

147 Contributions to the Geology of the Bering Sea Basin and Adjacent Regions. Edited by R. B. Forbes. 1975. Note: See MC-7 which is a bathymetric map of the Bering shelf. ........................................... $19.90 $8.00

148 Late Mississippian and Early Pennsylvanian Conodonts, Arkansas and Oklahoma. H. Richard Lane and Joseph J. Straka II. 1974 ........................................... $10.95 $5.00

149 Correlation of the Silurian Rocks of the British Isles. A. M. Ziegler and others. 1974 ........................................... $17.95 $8.00

150 Trace Element Geochemistry in Health and Disease. Edited by Jacob Freedman. 1975 ........................................... $15.00 $5.00


152 Precambrian Geology of North Snowy Block, Beartoorn Mountains, Montana. Rolland R. Reid, William J. McMinnis, and John C. Palmquist. 1975 ........................................... $16.00 $8.00

153 Geology of Romania. B. C. Burchfiel with contributions by M. Bleahu. 1976 ........................................... $19.75 $5.00

154 Silurian and Lower Devonian Basin and Basin-Slope Lime- stones, Copenhagen Canyon, Nevada. Jonathan C. Matti, Michael A. Murphy, and Stanley C. Finney. 1975 ........................................... $9.95 $4.00

155 Silurian Conodonts from Wills Mountain Anticline, Virginia, West Virginia, and Maryland. Charles T. Halch. 1975 ........................................... $10.95 $5.00

156 Cenozoic Stratigraphy of the Transverse Ranges and Adjacent Areas, Southern California. Michael O. Woodburne. 1975 ........................................... $11.00 $5.00


158 Bibliography of Continental Drift and Plate Tectonics. Volume II. Tina Kasbeer. 1975 ........................................... $18.00 $5.00

159 Geochronology of Precambrian Rocks in the St. Francois Mountains, southeastern Missouri. E. E. Bickford and D. G. Mose. 1976 ........................................... $6.75 $3.00


161 Magnetic and Gravity Anomalies in the Great Valley and Western Sierra Nevada Metamorphic Belt, California. John W. Cadby. 1976 ........................................... $9.95 $4.00

162 Dietr Stratigraphy and Human Settlement in Minnesota. J. Platt Bradbury. 1976 ........................................... $15.95 $3.00

Reduced prices in effect for orders postmarked on or before Nov. 30, 1981.
GSA WILL NEED AN EXECUTIVE DIRECTOR IN 1982

Read on if you want to help
the entire earth science community in North America.

The Geological Society of America is seeking an earth scientist with proven managerial experience and achievements, and with a working knowledge of the publication business to replace its Executive Director, who will retire by mid-1982.

THE EXECUTIVE DIRECTOR...

...is in charge of GSA Headquarters, with its staff of over 40 people in the Membership, Meetings, Publications, and Controller Departments, and the Data Processing and Mailing Service units.

...coordinates (1) publications of GSA.
(2) annual GSA meetings arrangements, and
(3) activities of all GSA committees, sections, divisions, and relations with associated societies.

...is responsible for implementing the directives and policies of the Council and the Executive Committee of GSA; also coordinates headquarters' work with the Centennial Science Coordinator and the President of the GSA Foundation.

...works at the graciously modern GSA Headquarters building in Boulder, Colorado, a beautiful university and research town at the foot of the Rocky Mountains, 28 miles northwest of Denver International Airport.

...holds a position with attractive compensation and comprehensive benefits.

If you are a mature, broadly trained earth scientist and if you are intrigued by this opportunity, mail your résumé with references and your questions, in strictest confidence, to

Executive Director Search Committee
Geological Society of America
P.O. Box 9140
Boulder, Colorado 80301

THE GEOLOGICAL SOCIETY OF AMERICA

1888
UPDATE

Announcing 22nd U.S. Symposium on Rock Mechanics

The 22nd U.S. Symposium on Rock Mechanics will be presented this year at the Massachusetts Institute of Technology from June 29 to July 2, 1981.

Designed for mining, civil, and petroleum engineers; geophysicists; and rock physicists, the conference will present papers and discussions concerning energy, mineral extraction, civil construction, and waste disposal.

Both the research and applications areas will be examined in concurrent sessions in each of the following topic areas: heat and fluid flow, fragmentation and fracture propagation, deformation of rock masses, and site characterization. State-of-the-art papers in each of these areas will commence the symposium.

In addition, a special plenary session will address the transfer of technology from research to practice through paper presentations and then panel discussions between session chairmen, state-of-the-art speakers, and the audience.

Field trips will be conducted through Boston's Massachusetts Bay Transportation Authority's Red Line extension tunnel, as well as through the Seabrook Nuclear Power Station cooling water tunnel.

For additional information, contact the Seminar Office at (617) 253-7461.

FIRST ANNOUNCEMENT AND CALL FOR PAPERS

FIRST ANNUAL CONFERENCE ON THE MANAGEMENT, ANALYSIS AND DISPLAY OF GEOSCIENCE DATA

January 27-29, 1982
Colorado School of Mines
Golden, Colorado

Mathematical Geologists of the United States

The conference will provide a forum for geoscientists, mathematicians, statisticians, and computer scientists to discuss progress in theoretical and applied approaches. The program will include invited review papers on the following topics:

- General
- Advances in geostatistics
- Developments in geomatics
- Computer applications
- Computer graphics
- Database management

Contributed papers are invited on any of these topics. Suggestions or contributions on other, related topics will also be considered by the organizing committee. Those wishing to submit an abstract should send a tentative title and an outline of their paper to: Richard B. McCammon, U.S. Geological Survey, National Center 920, Reston, VA 22092. The deadline for receiving this information is August 15, 1981.

Impact of Richards's Equation:
Semi-Centennial Session

In 1931, L. A. Richards proposed an equation for transient flow of water in partially saturated soils (Capillary conduction of liquids through porous media: Physics, 1, 318-333, November 1931). In modern notation this equation is

$$\nabla \cdot \left( \frac{kk_r(p)}{\mu} (\rho g \nabla z + \nabla p) \right) = \frac{\partial \theta}{\partial \xi},$$

where $k$ is intrinsic permeability, $k_r$ is the relative permeability as a function of capillary pressure, $\mu$ is fluid density, $g$ is acceleration due to gravity, $z$ is elevation above datum, $p$ is fluid pressure, $\theta$ is volumetric moisture content, and $\xi$ is time. Richards's equation can be considered as the forerunner of modern analysis of transient fluid flow in porous media, used in such earth-sciences disciplines as hydrogeology, soil science, soil mechanics, and petroleum engineering. Fifty years after the publication of Richards's equation it is worthwhile to step back and reassess its impact, its validity and limitations, its extensions and applications.

Accordingly, a day-long special session entitled, "Impact of Richards's Equation: A Semi-Centennial Session," is being organized by the Hydrology Section of the American Geophysical Union, during the annual fall meeting, San Francisco, December 7-11, 1981. The session will consist of invited as well as contributed papers dealing with theoretical aspects, laboratory studies, field applications, and mathematical solutions. Those who desire to contribute presentations are requested to send an abstract in standard AGU format no later than July 1, 1981, to T. N. Narasimhan. Authors of accepted abstracts will be notified by August 1, 1981. For further details, contact anyone listed below. The session is being co-sponsored by appropriate sections of the American Society of Civil Engineers, the Hydrogeology Division of the Geological Society of America, the Soil Science Society of America, and the American Society of Agricultural Engineers.

Jacob Rubin
Water Resources Division
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
(415) 323-8111, ext. 2141

Paul R. Day
Department of Plant and Soil Biology
University of California
Berkeley, CA 94720
(415) 642-0341

T. N. Narasimhan
Chairman of Special Session
Earth Sciences Division
Lawrence Berkeley Laboratory
Berkeley, CA 94720
(415) 486-5655

John F. Stone
Department of Agronomy
Oklahoma State University
Stillwater, OK 74078
(405) 624-6417

Memorial Preprints Ready For Free Distribution

The following memorial preprints are now available for distribution, free of charge, by writing to GSA, P.O. Box 9140, Boulder, CO 80301:

Eugene Rudolph Eller
by Daniel B. Sass
Robert Joseph Hackman
by John S. Pomeroy
John Everts Lamar
by H. B. Willman
Margaret Fuller Boothe
by Doris Osterwald
Calendar of Penrose Conferences for 1981–1982

April 28–May 2, 1981
SIGNIFICANCE & PETROGENESIS OF MYLONITIC ROCKS
Harbor Island Sheraton, San Diego, CA

Conveners: Arthur W. Snoke, Department of Geology, University of South Carolina, Columbia, SC 29208; Victoria Todd, U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, CA 92039; Jan A. Tullis, Department of Geological Sciences, Brown University, Providence, RI 02912.

May 10–15, 1981
TIMING OF OROGENIC ACTIVITY IN THE APPALACHIAN-CALEDONIAN SYSTEM
Ann Jordan Lodge, Alexander City, AL

Conveners: William A. Thomas, Department of Geology & Geography, University of Alabama, University, AL 35486; James F. Tull, Department of Geology & Geography, University of Alabama, University, AL 35486

September 6–14, 1981
CONTROLS OF PLATFORM EVOLUTION
Hotel Europa-Palace, Isle of Capri in Naples Bay, Italy

Conveners: James Lee Wilson, Department of Geological Sciences, The University of Michigan, 1006 C. C. Little Building, Ann Arbor, MI 48109; Bruno D’Argenio, Geological Institute, University of Naples, 10 Largo San Marcellino, 80138 Napoli, Italia

April 11–16, 1982
THE ANTARCTIC PLATE: A GLOBAL PERSPECTIVE
Skyland Lodge, Shenandoah National Park, Virginia

Conveners: Ian W. D. Dalziel, Lamont-Doherty Geological Observatory, Columbia University, Palisades, NY 10964; David H. Elliott, Institute of Polar Studies, The Ohio State University, Columbus, OH 43210

September, 1982
THE SONOMA OROGENY AND PERMIAN TO TRIASSIC TECTONISM IN WESTERN NORTH AMERICA
Winnebago, NV

Conveners: John H. Stewart, U.S. Geological Survey, Mail Stop 26, 345 Middlefield Road, Menlo Park, CA 94025; Hubert Gabrielse, Geological Survey of Canada, 100 West Pender Street, Vancouver, BC V6B 1R8 Canada; Walter S. Snyder, Lamont-Doherty Geological Observatory, Columbia University, Palisades, NY 10964

First or second week of October 1982
MODELS OF DIAGENESIS IN CLASTIC RESERVOIRS
Santa Barbara, CA

Conveners: James R. Wood, Jr., Chevron Oil Field Research Company, 3282 Beach Boulevard, La Habra, CA 90631; James R. Boles, Department of Geological Sciences, University of California, Santa Barbara, Goleta, CA 93106; Ian E. Hutchison, c/o James R. Wood, Jr., Chevron Oil Field Research Company, 3282 Beach Boulevard, La Habra, CA 90631

Call for symposia for combined Northeastern-Southeastern Section meeting, March 1982

A variety of symposia are being organized for the combined NE-SE GSA meeting in Washington, D.C., March 25–27, 1982. This notice is both a call for additional symposia and an announcement by conveners of sessions being organized.

“Grenville terranes of the Appalachians” will cover a wide spectrum of topics concerning the Grenville province of eastern North America. A symposium volume will be published for which manuscripts are due by July 1, 1981. Symposium speakers will primarily be selected from contributors to the volume. Interested persons should contact Mervin J. Bartholomew, VDMR Office c/o Department of Geological Sciences; VPI & SU, Blacksburg, VA 24061. Telephone (703) 961-7647 (or leave messages at 961-6894 or 961-6027).

“Weathering and soil genesis in the eastern U.S.” will cover topics of interest to soil scientists, geomorphologists, and Quaternary geologists. Recent studies in the Atlantic and Gulf Coastal Plains, the Appalachian Piedmont, and the Mid-Continent focusing on the processes of soil genesis, rates of soil genesis, and relationships of soils to geomorphology and climate. Interested persons should contact Milan J. Pavich or Helaine W. Markewich, U.S. Geological Survey, 926 National Center, Reston, VA 22092. Telephone (703) 860-6421.


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

ONLY 6 MONTHS 'TIL CHRISTMAS
SHOP NOW!

Sterling Silver Dogwood Necklaces
(remainder of guest gifts from the 1980 Annual Meeting)
Order of 10 or more .................. $3.50 each* or
Single order ......................... $5.00 each*
Make check payable to the Geological Society of America. Mail to Meetings Department, GSA, P.O. Box 9140, Boulder, CO 80301.
*Please include an additional 50 cents for shipping and handling.

* * * * * * * * * * * * * * * * * * * * * * * * * * * *
NEW GSA PUBLICATIONS

Geologic cross section of the central Oregon continental margin


The geologic cross section of the central Oregon continental margin (near latitude 45°N) extends 130 km westward from the Coast Range to the abyssal plain and serves to illustrate that both compressional and extensional forces have operated during Cenozoic time. The geologic data used to construct the cross section are from detailed onshore geologic mapping, from subsurface information in the Standard-Union Nautilus No. 1 offshore test well and in Deep Sea Drilling Project (DSDP) sites 174 and 175, and from the interpretation of 24-channel and high-resolution seismic reflection profiles and magnetic and gravity data.

An important feature shown beneath the inner shelf on the cross section is a deep marginal basin which contains more than 7,000 m of Cenozoic sedimentary and volcanic rocks that accumulated on a lower to middle Eocene oceanic crust. The western margin of this basin is interpreted as being bounded by a transcurrent fault which juxtaposed a thick sequence of lower Eocene graywackes on the west against the oceanic crust on the east. A linear magnetic anomaly with a steep gradient marks the contact between the graywackes and volcanic rocks along the transcurrent fault. Based upon subsurface information from five deep offshore test wells drilled south of the cross section, a dextral separation of about 200 km is required along this fault in late middle to early late Eocene time.

The outer continental shelf and upper slope are presumed to be underlain by an upper Oligocene to middle Miocene melange wedge similar to the tectonically complex Hoh assemblage along the west side of the Olympic Mountains. In Pleistocene time, the melange wedge and overlying Pliocene (?) strata are inferred to have been uplifted during several compressive episodes along a series of eastward-dipping imbricate thrust faults. The Pliocene (?) strata are considered to be trench deposits which form the lower part of the sedimentary sequence beneath the lower slope and abyssal plain.

The lower continental slope is underlain by a folded and faulted sequence of Pliocene and Pleistocene abyssal strata. Compressive deformation of these strata is inferred to result from thrusting and folding of upper plate strata in the zone that lies at the base of the slope.

Beneath the abyssal plain at the western end of the cross section, upper Tertiary and Pleistocene strata have a thickness of about 3,500 m. These strata rest on an oceanic crust that produces a magnetic anomaly, which correlates with Anomaly 5, indicating a late Miocene age. On the seismic record, the upper surface of this oceanic crust appears to dip gently eastward beneath the base of the upper slope.

The present Oregon continental margin is interpreted to be part of an upper plate above a low-angle, east-dipping megathrust along which the Pacific plate is underthrusting the North American plate. Major zones of vertical crustal movements in the upper plate, resulting from this under-

Geologic cross sections from Patton Ridge to the Mojave Desert, across the Los Angeles Basin, Southern California


The cross section extends northeastward from the deep Pacific Ocean with thin oceanic crust, across the complex southern California Borderland, and onshore across the Los Angeles Basin and the San Gabriel Mountains to within the Mojave Desert. The Borderland region, from the Patton Escarpment to the margins of the Cortes Bank, is underlain by Upper Cretaceous and older metamorphic rocks probably related to the Franciscan Formation farther north in the California Coast Ranges. Similar basement underlies the region from the San Clemente Ridge to the vicinity of the Newport-Inglewood zone of folds and faults. The Cortes and Tanner Bank areas, in contrast, consist of Upper Cretaceous and younger sedimentary rocks overlying basement of unknown character. Northeast of the Newport-Inglewood zone, the basement consists of sialic gneissic, granitic, and schistose rocks ranging from Precambrian to late Mesozoic in age. The deformed Vincent Thrust system, of Late Cretaceous (?) age, lies within this region and places gneissic and granitic rocks on top of schist of probable Mesozoic age.

Upper Cenozoic sedimentary strata, now deformed and displaced by major fault systems, were deposited in several basins. Faults shown on the cross-section include major strike-slip faults, such as the San Andreas, and thrust faults, such as the Vincent and Sierra Madre. Deformation accompanying sedimentation characterizes the region and has proceeded intermittently during both Mesozoic and Cenozoic times.

Roster is open to all women geoscientists

The Women Geoscientists Committee of the American Geological Institute is currently revising its Roster of Women in the Geoscience Professions. The second edition, published in 1978, contained the names, addresses, and specialties of over 800 women geoscientists. We hope the third edition, scheduled for publication in late 1981, will enlarge on this and reflect the increasing participation of women in the earth sciences. The roster is open to all professional women employed in any aspect of the geosciences. Upon completion, the roster will be available to interested individuals, societies, and institutions. Data forms for submission may be obtained from Women Geoscientists Committee, AGI, 5205 Leesburg Pike, Falls Church, VA 22041.
MAY BULLETIN BRIEFS

Article Summaries

- Geology and petrology of some polymetamorphosed amphibolites and associated rocks in northeastern Taiwan: Summary.
  J. G. Liou, Department of Geology, Stanford University, Stanford, California 94305; W. G. Ernst, Department of Earth and Space Sciences, University of California, Los Angeles, California 90024; Diane E. Moore, U.S. Geological Survey, Menlo Park, California 94025 (2 figs.)

- Characteristics and origin of Egyptian Younger Granites: Summary.
  Jeffrey K. Greenberg, Wisconsin Geological Survey, 1815 University Avenue, Madison, Wisconsin 53706. (11 figs., 3 tables)

Articles Complete in the May Issue of Part I

- Structure and petrology of pelitic schists in the Fremont Peak pendant, northern Gabilian Range, California.
  David John, Geology Department, Stanford University, Stanford, California 94305 (present address: U.S. Geological Survey, M.S. 41, 345 Middlefield Road, Menlo Park, California 94025). (7 figs., 1 table). Supplementary data appear in Part II.

The Fremont Peak pendant is the largest of many small exposures of “Sur Series” metasedimentary rocks in the northern Gabilian Range along the eastern edge of the central Salinian block, California Coast Ranges. Two periods of folding and three periods of metamorphism were identified in pelitic schists. Early east-west-trending, isoclinal folding accompanied by sillimanite-grade metamorphism formed the dominant structural features. This dynamothermal event predate emplacement of middle Cretaceous (105- to 110-m.y.-old) granitic plutons.

Two later periods of thermal metamorphism, during emplacement of granitic plutons, locally reached garnet-corindite grade with estimated maximum temperatures and pressures of about 710 °C (± 50 °C) and 4.2 kb (± 1 kb) and XH2O in the fluid phase of 0.40 to 0.75. The reaction forming garnet-corindite assemblages (quartz + biotite + sillimanite = garnet + cordierite + K-feldspar + vapor) probably occurred over a temperature range of 50 °C or more due to the effect of minor components (Na, Ca, Mn, and Ti).

The structural and metamorphic sequence seen in the Fremont Peak pendant is very similar to those found in other exposures in the central Salinian block.


The Cycladic blueschist belt consists of two distinctive segments separated by a broad zone of superposed granitic and high-temperature metamorphic rocks. The northern segment contains early metamorphic fold axes and parallel glaucophane lineations that trend ~060° with a progressive increase in metamorphism toward the southeast. The southern segment contains similar fold axes and glaucophane lineations that trend ~310° with an apparent increase in metamorphism toward the northwest. Radiometric dating of metamorphic minerals from both segments give apparent ages of about 40 to 80 m.y.

These data suggest the existence of late Mesozoic or early Cenozoic subduction zones in the Aegean region that subsequently collided.

- Folds in fihn.
  Charles J. Waag, Department of Geology, Georgia State University, University Plaza, Atlanta, Georgia 30303, and Foundation for Glacier and Environmental Research, and Juneau Icefield Research Program, Seattle, Washington 98109. (8 figs.)

Folds in fihn on glaciers of the Gilkey Trench, Alaska, have been observed during years of heavy snowfall and reduced ablation. The fihn folds were formed by upbuckling and decollement resulting from intense lateral shortening within the underlying glacier ice. Trends of the fihn fold axes were normal to the shortening direction (α3), and subparallel to foliations in the glacier ice and the ice-flow direction (α2). Extensional crevasses normal to the fold trends were also common in the area of the fihn folds. Peculiar parallelogram patterns formed by recrystallization of the lowermost centimetre of fihn were exposed in the ablated cores of some
folds. The patterns were consistently oriented with respect to the firm fold axes and englacial structures, and they seem to reflect the same stress field.

- Comparison of sediment sound-velocity functions from conjugate margins.

(2 figs., 1 table)

A comparison of velocity functions from 15 regions within the conjugate margins of the Norwegian-Greenland Sea, Southeast Indian Ocean, North Atlantic, and South Atlantic Ocean shows that velocity functions are not significantly different across most conjugate margins. One major exception is the segment from the Blake Plateau to New England in the western North Atlantic, and its counterpart in northwest Africa. Here the velocity gradients are consistently steeper or the African side compared with those on the North American side. The reason for this unexpected difference was sought in the geologic literature of the two margins. Published studies of these two margins show that although total subsidence and sediment thickness of each of the margins are about equal, the older beds (pre-Cenozoic) are much thicker on the African side. This fundamental difference in depositional history seems to be the major cause of the difference in velocity profiles. Possible differences in the distribution of salt along the margins of Africa and North America are not considered a likely source for the trans-Atlantic differences in the velocity functions. The North Atlantic data therefore illustrate that velocity increases more rapidly with depth in sections biased toward greater proportions of older beds; that is, sedimentation rates decrease as the basin ages. These studies also reveal that sound-velocity profiles are sensitive to the early conditions of deposition on passive margins.


Peter F. Barker, Department of Geological Sciences, University of Birmingham, P.O. Box 363, Birmingham B15 2TT, United Kingdom; Richard L. Carlson, Department of Geophysics, Texas A&M University, College Station, Texas 77843; David A. Johnson, Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543 (Co-Chief Scientists).

Pavel Cepel, Bundesanstalt für Geowissenschaften und Rohstoffe, Postfach 510153, 3000 Hannover 51, Federal Republic of Germany; William Coulbourn, Deep Sea Drilling Project, A-031, Scripps Institution of Oceanography, La Jolla, California 92038; Luiz A. Gamboa, Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York 10964; Norman Hamilton, Department of Geology, University of Southampton, Southampton S09 5NH, United Kingdom; Ubirajara Melo, Petrobras, Centro de Pesquisas e Desenvolvimento, Leopoldo a. Miguez de Mello [Cepes], Cidade Universitaria, Quadra 7 Ilha do Fundao, CEP 21.910 Rio de Janeiro RJ, Brazil; Claude Pujol, Department de Geologie et Oceanographie, University of Bordeaux 1, 33405 Talence, France; Alexander N. Shor, Lamont-Doherty Geological Observatory, Palisades, New York 10964; Alexey E. Suszynov, P. P. Shirshov, Institute of Oceanology, USSR Academy of Sciences, Kraskov St. 23, Moscow, USSR; Leonard R. C. Tjalma, Cities Service Technology Center, 4500 S. 129th E. Avenue, Tulsa, Oklahoma; William H. Walton, Charles T. Main, Inc., Boston, Massachusetts 02199; Wolfgang Weiss, Bundesanstalt für Geowissenschaften und Rohstoffe, Postfach 510153, 3000 Hannover 51, Federal Republic of Germany. (12 figs., 2 tables)

In order to investigate South Atlantic paleocirculation and the tectonic and sedimentary history of the Rio Grande rise, D/V Glomar Challenger occupied four sites during Deep Sea Drilling Project (DSDP) Leg 72: Site S15 in the Brazil basin, Site S16 near the crest of the Rio Grande rise, and Sites S17 and S18 on the lower western flank of the rise.

Site S15 recovered sediments deposited by Antarctic Bottom Water (AABW) entering the Brazil basin through the Vema channel. We penetrated 617 m of rapidly accumulated, terrigenous and siliceous muds and mudstones before encountering an unconformity spanning 20 to 25 m.y. between the late Oligocene and early Eocene. The hiatus brackets the time of the proposed onset of AABW flow in the southwestern Pacific at ∼37 m.y.; however, evidence in the sediments at Site S15 suggests the presence of bottom-water circulation in the Brazil basin by early Eocene time.

Sites S17 and S18 recovered calcareous sediments deposited under the influence of AABW and North Atlantic Deep Water (NADW) within the Vema channel. At both sites, an increase in the abundance of the AABW indicator species N. umbonifera during the late Pliocene implies that AABW extended to significantly shallower depths at that time than it does today. Detailed carbonate analyses at Site S18 may extend the late Pleistocene climatic signal through the entire Pleistocene and perhaps into the Miocene.

At Site S16, near the crest of the Rio Grande rise, we penetrated 1,250 m of dominantly calcareous sediments and 21 m of basaltic basement rocks of Santonian-Coniacian age. With the exception of some minor hiatuses in the middle and late Miocene, sedimentation at this site was continuous for the past 80 m.y. Magneto-stratigraphic and biostratigraphic control is excellent, and the section may therefore be useful as a stratigraphic reference. The Cretaceous-Tertiary boundary was recovered intact and is directly comparable with the Italian Gubbio section. This interval may also provide some new evidence pertaining to the proposed association between mass extinctions and geochemical anomalies at the boundary.

The igneous basement rocks recovered at Site S16 are T-type Mid-Ocean Ridge Basalts (MORB), similar to those found on Iceland, and are unlike the alkaline basalts exposed on Tristan da Cunha. Their chemistry, together with the occurrence of shallow-water fossils in vein fillings, suggests that these basalts were erupted on an anomalously shallow part of the Mid-Atlantic Ridge. A Santonian-Coniacian age for basement is inferred from the age of the overlying sediments and is consistent with the identification of magnetic anomalies 33 and 34 on the rise to the east of the site.

The basal sediments and underlying volcanic basement recovered at Site S15 may provide constraints on the subsidence history of the Rio Grande rise. However, this history may have been complicated by a middle Eocene episode of tectonic and volcanic activity, as suggested by ash layers,
volcaniclastic sediments, and slump blocks in the mid-Eocene sediment section. The occurrence of reef debris in this interval implies that the uppermost part of the rise was very shallow and perhaps subaerial during this time.

• Late Cenozoic deformation in the forearc region: Matanuska Valley, Alaska.
  Ronald L. Bruhn, Terry L. Pavlis, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah 84112. (10 figs., 1 table)

Brittle deformation in the crust commonly occurs by simultaneous movements on multiple sets of faults. The principal shortening and extension directions in faulted rock can be determined using a deformation axis technique. This technique can also be applied in regions where earthquakes occur on faults of several different orientations if a representative sample of focal mechanism solutions is available. The shortening and extension directions are defined for only the last increments of deformation unless the deformation path is co-axial. In the latter case, the deformation axis orientations are valid for finite strains. No assumptions concerning the angular relationships between the fault planes and the stress or strain axes are required.

A period of extensive faulting occurred in the western Matanuska Valley, Alaska, during the Neogene. Deformation proceeded by simultaneous movements on three fault sets, the number required to accommodate a general, three-dimensional brittle deformation. The fault system consisted of two sets of northward-trending conjugate strike-slip faults and a set of east-northeast–trending reverse faults. North-northwestward crustal shortening was accompanied by lateral and vertical extension.

The geometry and displacements of mesoscopic faults in the interior of two large reverse fault zones indicated that cataclastic deformation during faulting occurred in a flattening strain field. The principal incremental shortening direction in both fault zones was oriented at a large angle to the fault strike, while the two extension axes were subparallel to the fault zone. The incremental strain axes were oriented in a manner consistent with reverse slip across the faults. Finite reverse slip across the two fault zones clearly occurred; this conclusion is based on evidence for stratigraphic separation.

The Matanuska Valley is located about 50 km above the subduction zone. The contemporary direction of horizontal principal shortening is predicted to be north-northwest based on the orientation of the Pacific–North American plate slip vector and the nature of ground displacements following the 1964 (M = 8.5) subduction zone earthquake. A deformation axis plot for focal mechanisms of earthquakes (Bhattacharaya and Bisswas, 1979) at depths between 20 and 60 km in the area surrounding the Valley indicates north-northeast lateral and vertical shortening strains with west-northwest extension. The principal horizontal shortening directions in the regions immediately west of the Matanuska Valley trend west-northwest as indicated by the orientations of large folds and the displacement along a Holocene scarp of the Castle Mountain Fault system.

• Lower Ordovician through Lower Devonian cratonic margin rocks of the southern Great Basin.
  Richard H. Miller, George A. Zilinsky, Allison Center, Department of Geological Sciences, San Diego State University, San Diego, California 92182 (3 figs.)

Lower and middle Paleozoic rocks in the southeastern Great Basin include thin sequences of gray, generally unfoliiferous, dolostones that were deposited in cratonic margin paleoenvironments. The recovery of age-diagnostic conodonts from a 295-m-thick section of Mountain Springs Formation indicates that Lower and lower Middle Ordovician, Upper Ordovician, and upper (?) Lower Devonian rocks occur in the section. Distinct unconformities provide evidence for a Middle Ordovician hiatus and a Silurian through Early Devonian hiatus. These cratonic sequence rocks are laterally replaced within 15 to 20 km to the west and northwest by thicker miogeoclinal rocks. The northeastward trend of this facies change provides a good marker where it intersects the south side of the Las Vegas shear zone; location of the same facies change on the north side of the shear indicates right-lateral separation of ∼40 km.

• Rb-Sr and U-Pb geochronology and distribution of rock types in the Precambrian basement of Missouri and Kansas.
  M. E. Bickford, K. L. Harrower, W. J. Hoppe, B. K. Nelson, and R. L. Nusbaum, Department of Geology, University of Kansas, Lawrence, Kansas 66045; John J. Thomas, Department of Geology, Skidmore College, Saratoga Springs, New York 12866. (26 figs., 1 table). Supplemental data in Part II.

Basement rocks in Kansas and Missouri are known largely from cores and cuttings from deep drilling. These rocks may be divided into a northern terrane, underlain by rocks consisting of abundant granite commonly showing cataclastic textures, and metavolcanic to metasedimentary rocks; and a southern terrane underlain almost exclusively by rhyolitic flows and ash-flow tuffs and epizonal granite plutons. The northern terrane is interrupted in central Kansas by mafic igneous rocks and flanking arkosic sedimentary rocks of the Central North American Rift System.

Data from 63 Rb-Sr whole-rock analyses yield ages ranging from 1,153 to 1,748 m.y., but these are considered to represent only the minimum ages of the rocks. Ages derived from U-Pb analyses of suites of zircon zircons from 22 rock samples indicate that some rocks of the northern terrane were formed 1,610 to 1,650 m.y. ago. These are apparently intruded by younger granite plutons formed 1,450 to 1,470 m.y. and 1,340 to 1,380 m.y. ago. Rocks of the southern terrane were formed 1,460 to 1,480 m.y. ago in the St. Francois Mountains terrane of southeastern Missouri and its buried equivalents but are about 1,380 m.y. old in southwestern Missouri and southern Kansas. Rocks of the Central North American Rift System in Kansas are assumed to be about 1,100 m.y. old by geophysical and drill-hole extension to their outcrop in the Lake Superior region where they have been dated.

Both the northern and southern terranes are notable

SEPARATES PROGRAM DISCONTINUED FOR 1981

GSA NEWS & INFORMATION
for the great abundance of granitic rocks and the scarcity of intermediate to mafic igneous rocks. Quartzite is the most abundant of granitic rocks and also the most abundant metamorphic rock. Although the decrease of ages from north to south in the mid-continent region suggests their sequential accretion at the edges of a pre-existing continent, the rock assemblages are not consistent with convergent plate margin suites of the Andean type. The great volumes of rhyolite and epizonal granite of the southern terrane may represent melting of thickened, somewhat older crust following accretion at the continental margin.

Major element chemical data are presented for basement rocks from Kansas, Oklahoma, and Texas, and these are compared with the compositions of similar rocks from the St. Francois Mountains. Names and locations are given for wells from which samples were obtained.

* Ice fabrics from a borehole at the top of the south dome, Barnes Ice Cap, Baffin Island.

RoGer Leb. Hooke, Peter J. Hudleston, Department of Geology and Geophysics, University of Minnesota, Minneapolis, Minnesota 55455. (4 figs., 1 table)

Crystallographic fabrics from a bore hole at the top of the south dome of Barnes Ice Cap, Baffin Island, Canada, were studied. Fabric intensity in coarse ice increases with increasing depth and the pattern changes from an initial weakly oriented one to one involving two C-axis maxima within a small circle centered on the vertical. The two maxima are aligned in a plane in the direction of maximum horizontal extension; they are distinct at 180 m and then dominate the fabric until about 215 m; below this depth, the circular pattern dominates. Fine ice displays similar but more variable fabric patterns, complicated by the inheritance of a vertical single maximum from the initial state.

Measured surface strain rates suggest a coaxial deformation history intermediate between pure shear and uniaxial compression. Such stress configurations are known to lead to two-maximum and small-circle fabric patterns, respectively, on the basis of experiments and models involving plastic basal glide alone. With increasing strain, the angle between the two maxima, or the opening angle of the small circle, decreases in a similar manner in both the natural fabric diagrams and in the fabrics predicted by models of plastic glide. Both the two-maximum and the small-circle patterns are considered to be equivalent to the single maximum pattern found in ice subjected to simple shear. In all cases, the fabric becomes well defined at natural octahedral unit shears of about 1.0; and in all cases, the fabric development is largely controlled by basal glide.

* Threshold of critical power in streams.

Discussion: David Alexander, Department of Geography, University College London, Gower Street, London WC1E 6BT, England.