GSA news & information

SUPPLEMENT TO GEOLOGY MAGAZINE

APRIL 1977

Your help is requested . . .

In 1972 a special committee headed by Jack Reed polled the GSA membership as to its feeling about the size of the annual meeting. A substantial number of responders indicated they wished fewer concurrent sessions. This led Council to place a ceiling on the total number of sessions. Since then, however, the Society has grown, the number of volunteered abstracts has increased, and pressure has mounted to enlarge the program. In an attempt to further reduce the number of concurrent sessions, and at the same time avoid a demoralizingly high rejection rate of volunteered abstracts, the 1976 Annual Meeting was lengthened to four days. This reduced concurrent sessions from 10–11 to 8–9 (compared to 1975) and maintained the abstract rejection rate at approximately 30%.

These pressures are not likely to lessen in the immediate future. Program committees for upcoming annual meetings need some strong expression from the membership on how it feels about the size, length, and makeup of the meeting. Please complete the questionnaire at the bottom of this page, detach it, and return it to GSA Headquarters. *But keep in mind this point:* if you vote for fewer total or concurrent sessions, you are voting for a higher abstract rejection rate (in 1976, to have staged 8–9 concurrent sessions in three days instead of four would have meant a rejection rate of 40% instead of 30%).

Prepared by 1976 Joint Technical Program Committee

(1) What is your membership? ☐ GSA

Affiliated Societies: ☐ GIS ☐ MSA ☐ PS ☐ SVP ☐ GS ☐ NAGT ☐ SEG ☐ Cushman

Divisions: ☐ Coal ☐ Engineering ☐ Geophysics ☐ Hydrogeology ☐ Quaternary ☐ History

(2) Did you attend 1976 Annual Meeting? ☐ Yes ☐ No

(3) What length of Annual Meeting would you prefer?

☐ 3 days ☐ 4 days ☐ 5 days

(4) How many concurrent sessions would you prefer?

☐ more than 8-9 ☐ 8-9 ☐ fewer than 8-9

(5) Should the makeup of the Annual Meeting be changed?
(At present, regular technical sessions contain about 70% of the papers presented orally, symposia about 30%; poster sessions are a separate, concurrent entity.)

Technical Sessions ☐ increase ☐ no change ☐ decrease

Symposia ☐ increase ☐ no change ☐ decrease

Poster Sessions ☐ increase ☐ no change ☐ decrease

Other sessions (fill in) ____________________

Return to: Annual Meeting Department
Geological Society of America
3300 Penrose Place
Boulder, Colorado 80301

The how and why of on-line searching of GeoRef

Geologists can search GeoRef from a computer terminal located anywhere in the United States or in other nations served by the Tymshare and Telenet communications networks. (GeoRef is a computerized collection of world-wide references in geology, 1967 to date. It is produced at the American Geological Institute and is the source of GSA's *Bibliography and Index of Geology*.) The search is on-line and interactive, that is, there is immediate, direct contact with the host computer and the contact is in terms of a series of commands from the terminal and responses from the host computer.

SAMPLE SEARCH

Objective: Seismicity of water-flooded areas and areas with fluid injection
Strategy: Words in boldface are typed by searcher, bracketed parts are explanations, and the remainder is the computer's prompts and responses.

SS1: **SEISMIC ACTIVITY OR SEISMICITY OR EARTHQUAKES OR MICROSEISMS OR ELASTIC WAVES OR SEISMOLOGY OR ALL GROUND MOTION: OR VIBRATION OR ALL STRONG MOTION.**

[SS1 is a computer prompt which stands for Search Statement 1. SS1 contains GeoRef index terms related to seismicity. Entering the terms connected by the word "or" causes the computer to search through GeoRef for references indexed with any of those terms. ALL GROUND MOTION: instructs the computer to include any term beginning with the letters GROUND MOTION, that is, GROUND MOTION and GROUND MOTIONS.]

PSTG (12280)

[PSTG stands for Postings. (12280) indicates the number of references in GeoRef which contains at least one of the terms in SS1.]

SS2: **WATER FLOODING OR FLOODING OR FLUID INJECTION OR INJECTION OR INJECTIONS OR WATER STORAGE OR WATER WELLS OR RECHARGE OR ARTIFICIAL RECHARGE OR INJECTION WELLS OR RECOVERY OR SECONDARY RECOVERY.**

[SS2 contains GeoRef index terms related to water flooding and fluid injection.]

PSTG (1486)

SS3: **1 AND 2**

[The word "and" in this search statement instructs the computer to find all references which contain at least one term from SS1 and one term from SS2.]

PSTG (59)

[59 references contain at least one term from SS1 and one from SS2. At this point the searcher can ask the computer to list on the terminal any number of the 59 references. The following is *one* of the 59.]

AN—T76-25535 [Accession number. "T" at beginning indicates a thesis.]
TI— High pressure deformation and fluid flow in sandstone, granite, and granular materials [Title]
AU—Zoback, M. D. [Author]
SO—Doctoral, 1975, Stanford, Diss. Abstr., Int., Vol. 36, No. 5, p. 2128B, 1975 [Source]
CC—22 [Category 22, Engineering and Environmental Geology]
DE—DEFORMATION, EXPERIMENTAL STUDIES, COMPRESSION, STRESS, HIGH PRESSURE, SANDSTONE, GRANITE, SAND, PORE PRESSURE, PERMEABILITY, MICROCRACKS, APPLICATIONS, DILATANCY, EARTHQUAKES, PETROLEUM, FLUID INJECTION, ENGINEERING GEOLOGY, ROCK MECHANICS, MATERIALS, MECHANISM, GRANULAR, FAULTS, SLIDING, FRICTION [Index terms]
LA—EL [English language]

[Based on examining a sample of the references the searcher might decide to expand the search by adding WASTE DISPOSAL and ALL RADIOACTIVE WASTE: to the list of terms in SS2. Then in a series of command-response iterations the searcher might further expand the search by adding other terms to SS2; namely, HYDRAULIC FRACTURING, OIL AND GAS FIELDS, (PETROLEUM and PRODUCTION), (GAS and PRODUCTION), and (FRACTURES and HYDRAULIC). After adding these to the terms in SS2 and combining them with SS1, the total references retrieved are 98. The searcher can then instruct the computer to print the 98 references off-line. The references will be printed at the computer center and mailed the same day to the searcher.]

When the references arrive, some of the 98 won't be relevant and some relevant references won't have been retrieved. Nevertheless, chances are that most of the relevant references out of a total of 310,000 references in GeoRef have been retrieved and are now in his or her hands.

What would this cost? Since the computer's response time is usually immediate, the above search could be completed in ten minutes, provided the searcher could type reasonably well, knew the commands, and also responded immediately. More likely the search would take twenty minutes on-line. If so, the search will cost $47.20, figured at the rates of $75 per hour for connect time, $8 per hour for the communications network and $ .20 per citation printed and mailed. You pay only for the resources you use. There is no cover and no minimum.

On-line searching is not a panecea for all literature search needs. Certain searches are better done through printed reference sources such as GSA's *Bibliography and Index of Geology*. But the on-line search is one of the several bibliographic tools available, and it is sometimes the treatment of choice. It is quick, and it can be thorough, if the search strategy is well-developed. To save dollars, the strategy should be mapped out beforehand. An exhaustive on-line search might be completed in an hour, including preparation time which, if done through printed tools, would require days of effort in a good library.

However, certain conditions must be present before effective on-line searching is possible, namely study of the commands required to interact with the computer and of the data elements and indexing used in GeoRef. To help searchers, System Development Corporation, which operates the host computer, provides the *ORBIT User Manual for GeoRef*. Other tools are the *GeoRef Thesaurus and Guide to Indexing* (AGI, 1977), the *Microform Index Listing for GeoRef* (SDC, 1976), and the *Bibliography and Index of Geology*, useful in checking out GeoRef indexing. Workshops for new users are offered by both SDC and AGI from time to time, and both organizations are ready to answer questions any time. SDC maintains an Action Desk which is staffed during normal working hours and is reached by a toll-free number. So you can contact a knowledgeable human when the computer gives you trouble.

And, of course, access to a terminal is required. A wide variety of terminals are suitable. Any teletype-compatible terminal will work. Current transmission speeds are 10, 15, 30, and 120 characters per second. The most commonly used speed at this time is 30 cps. A suitable 30 cps terminal can be leased for $150 per month. No other equipment except a telephone is required if the terminal has a receptacle for a telephone receiver. Most do.

A call to the SDC Search Service, (800) 421-7229, will provide answers on how to begin searching on-line. Information on selection of index terms, and so forth, relating to the content of GeoRef can be obtained by writing or calling AGI, 5205 Leesburg Pike, Falls Church, VA 22041, (703) 379-2480.

John Mulvihill, GeoRef Project Manager
American Geological Institute
5205 Leesburg Pike
Falls Church, VA 22041
(703) 379-2480

THE SOCIETY OF VERTEBRATE PALEONTOLOGY
TEXAS MEMORIAL MUSEUM
Balcones Res. Ctr. – 10100 Burnet Road
Austin, Texas 78758

Geological Society of America
3300 Penrose Place
Boulder, Colorado 80301

We wish to advise you of the 1977 annual meeting of the Society of Vertebrate Paleontology. The meeting will be held November 10-12, 1977, with post-meeting field trips, at the Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles 90007. Please note that SVP is **not** meeting in conjunction with GSA in 1977, as stated in the December 1976 issue of *Geotimes*.

LETTER

To the Editor

After subjecting myself to the 1976 Geological Society of America Annual Meeting, and after a great deal of reflection, I have compiled several observations and suggestions.

This year's meeting was characterized by an inordinate number of poor presentations. Defective and/or sloppy slide material accompanying ill-prepared talks, while perhaps not the rule, certainly were more than the exception. One would think that a professional would exhibit enough pride in his or her own work to do better.

The virtual absence of talks presenting original, unpublished work was apparent. Papers presenting the results of authors' pet projects, however, abounded.

At least one field trip (the Schwartzwalder Mine tour) suffered from the apparent coercing of the organizers into overbooking the trip. Originally intended for 15 participants, there were approximately 50 underground.

I was also struck by the apparently small percentage of attendees from the industrial community. Considering the number of affiliated societies whose meetings were concurrent with GSA (most notably, Society of Economic Geologists), this is quite surprising. If GSA is not to evolve into a society comprised only of academic participants, it must attract more industrial participants who, after all, are the principal consumers of academic research.

With the above considerations in mind, I hereby submit the following recommendations for future meetings:

1. Unless additional provisions are made, limit the field trips to the number of participants originally specified, regardless of the whining which may result.
2. Reduce the number of talks presented and increase the time allotted for each. This, in conjunction with more scrupulous screening of the potential talks, would limit presentations to those of real or potential geologic or engineering significance.
3. To encourage attendance and participation by the industrial community, GSA should encourage or invite talks dealing with the practical aspects of mining, petroleum development, and engineering geology (that is, engineering geology case histories, geology of specific petroleum reservoirs, and mining operations).
4. Require speakers to submit, in advance, manuscripts of their presentation to be published as preprints, as does AIME. This would force the speakers to get organized before reaching the podium and, hopefully, would result in presentations which are better prepared and more coherent. The audience cannot be expected to decipher what the speaker is leading up to, if the speaker himself does not know.

With these recommendations as a starting point, we can begin to return the GSA Annual Meeting to its proper role in the scientific community: that of a forum for the presentation of original and significant geologic and geological engineering work to those who would benefit from such knowledge.

Richard P. Mignogna
P.O. Box 160
Golden, Colorado 80401

Calendar of Penrose Conferences for 1977

March 21–24, 1977
Tibet
Woodstock Inn, Woodstock, Vermont
Conveners: *Kevin Burke*, Department of Geological Sciences, SUNY, Albany, New York 12222; *Peter Molnar*, Department of Earth and Planetary Sciences, Room 54-7R, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

May 2–6, 1977
Tectonic Significance of Metamorphic Core Complexes in the Cordilleran Hinterland
Tanque Verde Ranch, Tucson, Arizona
Conveners: *Max Crittenden, Jr.*, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, California 94025; *Peter J. Coney* and *George H. Davis*, Department of Geosciences, University of Arizona, Tucson, Arizona 85721

August 29–September 2, 1977
Geostatistical Concepts and Stochastic Methods in Hydrogeology
Harrison Hotel, Harrison Hot Springs, British Columbia, Canada
Convener: *R. Allan Freeze*, Department of Geological Sciences, University of British Columbia, Vancouver, British Columbia, Canada

October 10–14, 1977
An Interdisciplinary Conference on Landslides
Vail, Colorado
Conveners: *Don C. Banks*, U.S. Army Waterways Experiment Station, Vicksburg, Mississippi; *Robert W. Fleming* and *Robert L. Schuster*, U.S. Geological Survey, Denver, Colorado 80225

November 27–December 2, 1977
The Geology of Subaqueous Volcanic Rocks
Miramar Hotel, Santa Barbara, California
Conveners: *Richard V. Fisher*, Department of Geological Sciences, University of California, Santa Barbara, California 93106; *Erich Dimroth*, Sciences de la Terre, Universite du Quebec, Chicoutimi, Quebec, Canada

December 12–16, 1977
Magnetization of Sediments and Magnetostratigraphy
Durango, Colorado (tentative)
Conveners: *Charles E. Helsley*, Director, Hawaii Institute of Geophysics, 2525 Correa Road, Honolulu, Hawaii 96822; *Ed Larson*, Department of Geological Sciences, University of Colorado, Boulder, Colorado 80309

Former Penrose Grant recipients contribute $3,915 to Research Grants Program for 1977

For the second consecutive year, a request for donations for the Research Grants Program of the Geological Society of America has been solicited from past grant recipients. They have responded with a total of $3,915 for distribution to grant applicants for the fiscal year 1977.

Below is a list of donors who contributed so generously from personal funds for this significant program of the Society. The members of the Research Grants Committee and the Council wish to thank these individuals for their support.

Clarence R. Allen
Allan G. Barrows, Jr.
William A. Bassett
Edward S. Belt
Leonard G. Berry
Peter W. Birkeland
Kenneth G. Brill, Jr.
Elwood R. Brooks
William S. Calkin
Thomas J. Carrington
G. Arthur Cooper
Darrel S. Cowan
Harold A. Curran
Zoltan DeCserna
Julie M. Donnelly
G. Nelson Eby
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Robert E. Folinsbee
Helen P. Foreman
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Willis H. White
J. Stewart Williams
C. W. Wolfe
Manfred P. Wolff
Donald L. Woodrow
Frederick F. Wright
Herbert E. Wright, Jr.
Robert E. Zartman
Herman B. Zimmerman

Come to the AGU Spring Meeting May 30-June 3, 1977 Sheraton-Park Hotel Washington, D. C.

Special sessions planned for geologists include:

Geology-Geos 3

Geomagnetism and Paleomagnetism-Terrestrial and Lunar Paleofield Intensity Measurements; Magnetization of Oceanic Rocks and the Source of Marine Magnetic Anomalies

Oceanography-Visual Observations of Geological Processes in the Deep Sea; Sediment Dynamics in the Marine Environment—New Tools for Old Problems

Seismology-Seismic Networks; Recent Developments in Earthquake Prediction; Ocean Bottom Seismology

Tectonophysics-The State of Stress in the Lithosphere; Palmdale Uplift; Crustal Deformation Measurements; Plate Tectonics-Rigid or Ductile?

Volcanology, Geochemistry, and Petrology-Sulfide-Silicate Interactions; Granites and Their Tectonic Framework; Experiments at Super High Pressures; Phase Equilibria and Crystal Chemistry of Micas; Experimental Techniques in Geochemistry; Selection of Data for Thermodynamic Calculations

Union-Energy Futuristics; Plate Tectonics—Ten Years after the Revolution

For information on registration, program summary, and hotel reservations write to:

Meetings, American Geophysical Union,
1909 K Street, N.W., Washington, D. C.
20006.

Call for nominations: AAAS-Rosenstiel Award in Oceanographic Science, 1977

Nominations are invited for the 1977 AAAS-Rosenstiel Award in Oceanographic Science. Consisting of $5,000 and a certificate, this annual award is funded by the Rosenstiel Foundation through the Rosenstiel School of Marine and Atmospheric Sciences of the University of Miami. Its purpose is to honor outstanding achievement and distinction in oceanographic science, including relevant aspects of ocean engineering where significant new principles are concerned, and aspects of atmospheric science with important implications for understanding of oceanic processes.

Because of the multidisciplinary nature of oceanographic science, the award recognizes achievement in three broad areas on a rotating basis. In 1977, the award will emphasize physics and chemistry of the water column and the atmosphere; in 1978, geology, physics, and chemistry of the seabed; and in 1979, biology and living resources.

The 1977 award for achievement in the field of physics and chemistry of the water column and the atmosphere will be presented at the AAAS Annual Meeting in Washington, D.C., February 12–18, 1978. The recipient will also be invited to spend a week at the Rosenstiel School for lectures and discussions with faculty and students.

Nominations should include adequate justification (one or two pages), together with identification of relevant publications, and should be sent to the chairman of the five-member selection panel, Dr. Harris B. Stewart, Atlantic Oceanographic and Meteorological Laboratories, NOAA, 15 Rickenbacker Causeway, Miami, Florida 33149, for receipt *not later than July 15, 1977.*

American Association for the Advancement of Science
1776 Massachusetts Ave., N. W.
Washington, D.C. 20036

Necrology

Notice has been received of the following deaths: Raymond Frank Baker, Pelham, New York; Lorin Delbert Clark, Palo Alto, California; Martin Van Couvering, Pasadena, California; Lincoln Dryden, Port Republic, Maryland; Richard Eugene Fuller, Seattle, Washington; George Burke Maxey, Reno, Nevada; William Low Russell, Bryan, Texas; Carl A. Warmkessel, Fogelsville, Pennsylvania.

We're sorry!

Due to circumstances beyond our control, your April and May issues of the *Bulletin* are going to be late in arriving. Please allow two weeks beyond the time they would usually be received before contacting us about non-receipt of publications.

GSA committees and representatives . . .

PLEASE NOTE: Names of committee chairmen are printed in italics. The president shall be an ex officio member of all committees of the Council. He may designate a member from the Council to represent him.

Executive Committee

Charles L. Drake, Peter T. Flawn, Robert E. Folinsbee, William B. Heroy, Jr., Howard R. Gould (Budget Committee Member of the Executive Committee)

Committee on Committees

Paul A. Bailly, George E. Becraft, Robert E. Boyer, John C. Crowell

Committee on Environment & Public Policy

John H. Moss (1975-1977), Peter H. Given (1975-1977), Howard H. Waldron (1975-1977), M. Genevieve Atwood (1976-1978), Donald D. Runnells (1976-1978), Nathaniel Rutter (1976-1978), Robey H. Clark (1977-1979), M. Gordon Wolman (1977-1979), Hugh R. Wynne-Edwards (1977-1979). Conferee: Harold E. Malde

GSA-Treatise Advisory Committee

J. Tom Dutro, Jr. (1975-1978), Roger L. Batten (1977-1980), John C. Frye (continuing)

Headquarters Advisory Committee

William C. Bradley (1975-1977), Harry C. Kent (1974-1977), S. Warren Hobbs (1977-1979), David B. MacKenzie (1977-1979), Betty M. Miller (1977-1979)

Committee on Honors and Awards

Digby J. McLaren, W. G. Ernst, John Rodgers, Kenneth O. Emery, William H. Smith, Murray R. McComas, R. Allan Freeze, Don J. Easterbrook

Subcommittee on the Penrose Medal Award

Digby J. McLaren (1977), Stanley R. Hart (1975-1977), Henry W. Menard, Jr. (1975-1977), Richard L. Armstrong (1976-1978), Laurence L. Sloss (1977-1979), Lynn R. Sykes (1977-1979)

Subcommittee on Arthur L. Day Medal Award

W. G. Ernst (1977), James R. Heirtzler (1975-1977), Peter Robinson (1976-1978), Robert E. Zartman (1976-1978), Nikolas I. Christensen (1977-1979)

Subcommittee on Honorary Fellows

John Rodgers (1975-1977), Guillermo P. Salas (1975-1977), Curt Teichert (1976-1978), J. Kaspar Arbenz (1977-1979)

Subcommittee on National Medal of Science

Kenneth O. Emery (1975-1977), Preston Cloud (1977-1978), Julian R. Goldsmith (1977-1979)

Coal Geology Division Panel on Gilbert H. Cady Award

William H. Smith (1975-1977), Edward C. Dapples (1975-1977), Jack A. Simon (1977-1979), M. E. Hopkins (Division Chairman, 1977), Samuel A. Friedman (Division Vice-Chairman, 1977)

Engineering Geology Division Panel on E. B. Burwell, Jr., Award

Murray R. McComas (1975-1977), Frank W. Wilson (1975-1977), Lloyd B. Underwood (1976-1978), Bernard W. Pipkin (1976-1978), Erhard M. Winkler (1977-1979), Charles A. Baskerville (1977-1979)

Hydrogeology Division Panel on O. E. Meinzer Award

R. Allan Freeze, George H. Davis, Eugene S. Simpson, Isaac J. Winograd

Quaternary Geology & Geomorphology Division Panel on Kirk Bryan Award

Don J. Easterbrook (Division Secretary), Peter W. Birkeland (1975-1977), Ernest H. Muller (1975-1977), Stephen C. Porter (1975-1977), John T. Andrews (1977-1979), Victor R. Baker (1977-1979), Marie Morisawa (1977-1979)

Committee on Investments

Robert L. Fuchs (1975-1977), Michel T. Halbouty (1975-1977), August Goldstein, Jr. (1977-1979), Donald A. Parks (1977-1979)

Ex Officio: William B. Heroy, Jr., Treasurer (voting); Howard R. Gould, Budget Committee Member of the Executive Committee (non-voting)

Conferees: James Boyd, Robert E. King

Committee on Membership

Joan R. Clark (1977-1979), E. Julius Dasch, Jr. (1975-1977), Diana Chapman Kamilli (1975-1977), Doris M. Curtis (1977-1979), Thornton L. Neathery (1977-1979)

Committee on Nominations

M. Gordon Wolman, Stanley N. Davis, Robert H. Dott, Jr., James W. Skehan, S.J., Wallace D. Lowry

Committee on Penrose Conferences

Raymond A. Price (1975-1977), Robert E. Riecker (1975-1977), David A. Stephenson (1977-1979)

Committee on Publications

Leon T. Silver (1975-1977), Orson L. Anderson (1975-1977), William W. Hutchison (1976-1978), Frank E. Kottlowski (1976-1978), Robert E. Davis (1977-1979), Brian J. Skinner (1977-1979)

Conferees: S. Warren Hobbs (1977); Don B. McIntyre (1977); John C. Frye, Executive Director; Paul Averitt, Interim Science Editor; Josephine K. Fogelberg, Production Manager

Contractual Appointments: Fred S. Honkala, Executive Director, AGI; John G. Mulvihill, Manager, GeoRef Project

Committee on Research Grants

Burrell C. Burchfiel (1975-1977), Steven M. Stanley (1976-1978), Peter R. Vail (1977-1979). Conferee: William E. Benson

Ad Hoc Committee to Study the Microform Publication Problem

Daniel F. Merriam

Ad Hoc Committee on Minority Group Members in the Earth Sciences

Louis C. Pakiser, Jr., Clyde Wahrhaftig, Randolph W. Bromery, William D. Romey, Samuel Smith

Ad Hoc Headquarters Advisory Art Committee

Edwin B. Eckel, R. Dana Russell, John C. Frye

GSA Representatives to American Association for the Advancement of Science (AAAS)

Murray Felsher (1976-1978): Section E—Geology and Geography; Leo A. Heindl (1976-1978): Section W—Atmospheric & Hydrospheric Sciences

GSA Representatives to American Commission on Stratigraphic Nomenclature (ACSN)

(Term of office to begin at the end of the GSA national meeting.)

Jack E. Harrison (1974-1977), William W. Hay (1975-1978), Malcolm P. Weiss (1976-1979), Robert S. Houston (1977-1980)

GSA Representatives to GSA-AEG-ASCE Joint Committee on Engineering Geology (American Society of Civil Engineers)

Harry F. Ferguson (July 1, 1975-June 30, 1978), Paul L. Hilpman (July 1, 1976-June 30, 1979)

GSA Representative to U.S. National Committee on Geochemistry

Rosemary J. Vidale (July 1, 1975-June 30, 1979)

GSA Representative to U.S. National Committee on Geology

Clarence R. Allen (July 1, 1975-June 30, 1979)

GSA Representative to U.S. National Committee on Rock Mechanics (USNCORM)

Fitzhugh T. Lee (September 1976 through 1979 USNCORM Symposium)

GSA Representative to U.S. National Committee on Tunneling Technology

Arthur B. Cleaves (July 1, 1974-June 30, 1977), Don U. Deere (July 1, 1977-June 30, 1980)

GSA Representatives to GSA-SSSA Inter-Disciplinary Committee (Soil Science Society of America)

Leon R. Follmer, John W. Hawley, Robert V. Ruhe, Peter W. Birkeland

GSA Member of the AGI Governing Board

Charles L. Drake (November 1975-November 1977)

GSA Representative to the AAPG Ad Hoc Committee on Revision of the Stratigraphic Correlation Charts for North America

Mitchell W. Reynolds

GSA Representative to Earthquake Engineering Research Institute

Richard H. Jahns

GSA Representative to Assembly of Mathematical & Physical Sciences (NRC)

John C. Frye (Effective May 1, 1975)

GSA Representative to the Advisory U.S. National Committee for the International Hydrological Program

Stanley N. Davis, David Stephenson (alternate)

BOOK BRIEFS

Environmental Framework of Coastal Plain Estuaries

MEMOIR 133 — Edited by Bruce W. Nelson. 1972. viii + 620 pages. 298 figures (photographs, diagrams, charts, and four foldout maps). 45 tables. Subject and author indexes. Clothbound. ISBN: 0-8137-1133-9. $32.50.

The 31 papers in this volume are based on presentations given in a symposium on estuaries which was part of the 1969 Southeastern Section meeting of the Geological Society of America, held in Columbia, South Carolina. Most of the estuaries discussed occupy drowned river valleys that cut through the eastern coastal plain of the United States.

Coastal plain estuaries are likely to be preserved in the stratigraphic record and illuminate, better than other kinds of estuarine systems, lines of investigation most applicable to geological and environmental problems. Synthesis and analysis of observations from a variety of disciplines enables geologists to contribute to coastal zone management decisions.

With the aid of carbon-14 determinations and by analyzing historical chart records the rates of filling of estuaries, previously largely unknown, can be estimated accurately. The sequential development of estuarine deposits no longer need be based on early concepts of coastal geomorphology, for modern stratigraphic investigative methods define the types of sedimentary units and their structural relations that may be applied directly to interpret older sequences. Furthermore, morphological and microstructural shell architecture recognized in estuarine organisms may be employed paleoecologically to identify stressed environmental conditions preserved in the geological record.

Regional variations in rate of terrestrial sediment supply modify the degree of apparent drowning and yield a variety of submerged physiographic features in systems that are estuarine. Since runoff usually exceeds evaporation in these systems, they are "normal" estuaries. In the Amazon estuary, during minimum discharge, mixing between fresh water and sea water takes place on the continental shelf rather than within a drowned river valley. Such boundary conditions are different from those in estuaries of more familiar character. Odum and Copeland propose to classify estuaries in a way that cuts across specific geographical variations and tries to measure the integrated physical, chemical, geological, and biological impact on resident biological populations. Future workers may find this classification functional, or they may not, but the viewpoint is important.

CONTENTS: Introduction (by Bruce W. Nelson). Part I. Limiting Conditions: Functional Classification of Coastal Ecological Systems of the United States (by H. T. Odum and B. J. Copeland); Recent Investigations in Stratified Flows Related to Estuarial Hydraulics (by Emmanuel Partheniades); Influence of Mineral-Water Reactions in Estuaries on Boron Budget in the Oceans (by Robert C. Harriss); Comparison of Conditional Stability Constants of North Carolina Humic and Fulvic Acids with Co^2 and Fe^3 (by Ronald L. Malcolm); Amazon River Estuarine System (by Ronald J. Gibbs). Part II. Interacting Processes: Transport and Deposition of Sediments in Estuaries (by Robert H. Meade); Biodeposition as a Factor in Sedimentation of Fine Suspended Solids in Estuaries (by Dexter S. Haven and Reinaldo Morales-Alamo); Spatial and Temporal Distribution of Suspended Sediment in Narragansett Bay and Rhode Island Sound (by Robert W. Morton); Suspended Sediment Transport in Delaware Bay (by B. L. Oostdam and Robert R. Jordon); Distribution and Transportation of Suspended Sediment in Upper Chesapeake Bay (by J. R. Schubel); Sediments of the James River Estuary, Virginia (by Maynard M. Nichols); Rio de la Plata Estuary Environments (by Carlos M. Urien). Part III. Organism Responses: Ecology of Bacteria in Estuarine Systems (by E. J. Ferguson Wood); *Ammobaculites*, Foraminiferal Proprietor of Chesapeake Bay Estuaries (by Robert L. Ellison); Effect of Environmental Gradients in the Rappahannock River Estuary on the Molluscan Fauna (by Tudor T. Davies). Part IV. Retained Products: Regional Clay Mineral Facies in Estuaries and Continental Margin of the United States East Coast (by John C. Hathaway); Source of Recent Nearshore Marine Clays, Southeastern United States (by D. R. Pevear); Mass Physical and Engineering Properties of Some York River Sediments (by Richard W. Faas); Strontium Isotope Composition and Sediment Transport in the Rio de la Plata Estuary (by Pierre E. Biscaye; Techniques for Use of Organic and Amorphous Materials in Source Investigations of Estuary Sediments (by James Neiheisel); Processes Affecting Gas Distributions in Estuarine Sediments (by William S. Reeburgh); Texture and Organic Carbon Content of Bottom Sediments in Some Estuaries of the United States (by David W. Folger); Interstitial Community and Sediments of Shoal Benthic Environments (by Nelson Marshall); Biogeochemical Variables in Bottom Sediments of the Rappahannock River Estuary (by Bruce W. Nelson); Recent Estuarine Sediment History of the Roanoke Island Area, North Carolina (by Michael P. O'Connor, Stanley R. Riggs, and Don Winston); Erosional and Depositional Estuarine "Terraces," Southeastern United States (by John H. Hoyt); Santee Submergence, Example of Cyclic Submerged and Emerged Sequences (by D. J. Colquhoun, T. A. Bond, and D. Chappel). Part V. Effects of Man: Benthic Diversity in a Tropical Estuary (by Barry A. Wade); Marine Geology and Estuarine History of Mobile Bay, Alabama. Part I. Contemporary Sediments (by John J. Ryan and H. G. Goodell); Effects of Man-Made Works on the Hydraulic, Salinity, and Shoaling Regimens of Estuaries (by Henry B. Simmons and Frank A. Herrmann, Jr.); Effect of Increasing Depth on Salinity in the James River Estuary (by Maynard M. Nichols). Indexes.

Precambrian Geology of North Snowy Block, Beartooth Mountains, Montana

SPECIAL PAPER 157 — By Rolland R. Reid, William J. McMannis, and John C. Palmquist. 1975. viii + 136 pages. 95 figures (including 6 foldouts, one a geologic map in color). 12 tables. Paperbound. ISBN: 0-8137-2157-1. $16.00.

The area encompasses parts of the Emigrant and Mount Cowen 15′ quadrangles, which comprises part of the North Snowy block in the northwestern corner of the Beartooth Mountains of south-central Montana. The principal area of investigation involves a rectangular block approximately 10.4 km east-west by 13.2 km north-south.

Previous work on the Precambrian rocks of the Beartooth Mountains has been conducted mainly in terrain dominated by gneiss. The North Snowy block reveals a somewhat more detailed picture of Precambrian events than has emerged from earlier studies in the region.

The northwestern part of the Beartooth Mountains is divisible into structural blocks separated by major faults; the rocks here are treated as seven formations composing the North Snowy Group. All the formations are newly named and described herein. The dominating structural feature in the North Snowy block is a fragmented nappe that extends for 22.5 km. Its axial surface strikes northeast and dips northwest, bisecting an amphibolite core with flanks made up of symmetrical repetitions of metasedimentary and gneiss units; throughout the nappe structure the main foliation parallels the axial surface. Five sets of deformation structures were recognized in the field. There is a general progression represented from more mafic to more silicic gneiss through an 800-m.y. time span, beginning about 3,000 m.y. B.P.

Zircon morphology, relict igneous texture, rotated metamorphic xenoliths, and relict intrusive contacts support an origin for the gneisses of the North Snowy block by intrusion and consolidation followed by metamorphism parallel to older lines (synkinematic). The only rock attributable to granitization is a sheared gneiss unit.

There were at least four successive orogenies in the Beartooth Mountains, each differing in grade of metamorphism and geometry of structures. The first three were accompanied by widespread granitic intrusion. The four orogenies are, from oldest to youngest, the Pine Creek (about 3,000 m.y. B.P.), the Beartooth (about 2,600 m.y.), and two unnamed orogenies (about 2,200 m.y. and 1,700 m.y.).

The basement blocks of the northwestern part of the Beartooth Mountains have had a long history of development. Most of them were outlined by shear zones at least as early as 1,700 m.y. B.P.; the Pine Creek Lake–Mount Cowen block was split by the Marten Peak reverse fault after 1,176 m.y. B.P.; major wrench movements, Precambrian in age, accentuated the westerly and northerly borders. Fractures of the area are grouped into four sets.

Most of the major faults that were initiated in Precambrian time were reactivated during Late Cretaceous and early Cenozoic time. These later movements were apparently largely dip slip, with stratigraphic displacements ranging from perhaps 900 to more than 1,800 m.

CONTENTS: Acknowledgments. Abstract. 1. Introduction: summary of major relations, local area and methods, previous work. 2. Description of rock units: general, formal rock units (North Snowy Group, Barney Creek Amphibolite, George Lake Marble, Jewel Quartzite, Davis Creek Schist, Mount Delano Gneiss, Pegmatite A, Mount Cowen Gneiss, Pegmatite B, Falls Creek Gneiss, Pegmatite C), other rock units (General, Sheared gneiss ("Sgn"), Anthophyllite Schist, Metaorbiculite, Pegmatite, Pegmatite E, Metadiabase, Leucocratic gneiss, Pegmatite D, Quartz-filled extension fracture, Unmetamorphosed diabase dikes, Marten Peak fault breccia, Paleozoic and Mesozoic sedimentary rocks, Tertiary volcanic rocks, Tertiary dacite intrusions, surficial deposits). 3. Structural sequence: Introduction, Silicate paragenesis, Polyphase deformation (General, D_1 structures, D_2 structures, D_3 structures, D_4 structures, D_5 structures), Structural geometric analysis (Introduction, Whole area, Subareas, Structure stations), Petrofabric analysis, Summary. 4. Zircon morphologic analysis: Description (General, Davis Creek Schist zircons, "Sgn" gneiss unit zircons, Para-amphibolite zircons, banded plagioclase-quartz gneiss zircons, Mount Delano Gneiss zircons, Mount Cowen Gneiss zircons, Falls Creek Gneiss zircons, pink leucogranitic gneiss zircons), Analysis. 5. Metamorphic facies. 6. Geochronometry. 7. Tectonics. 8. Faulting, basement blocks, fracture patterns, and Laramide structure: description of faults (west- to west-northwest-striking faults, north-northeast-striking faults, northeast-striking faults, other faults), formation of basement blocks and ancestry of Laramide structures, fracture patterns (fracture set 1, fracture sets 2 and 3, fracture set 4), Laramide tectonics. 9. Geologic history. Appendix 1: Chemical compositions. References cited.

Conodont Paleozoology

SPECIAL PAPER 141 — Edited by Frank H. T. Rhodes. 1972. x + 296 pages. 98 figures. 24 tables. Index. Paperbound. ISBN: 0-8137-2141-5. $13.50

The 11 papers in this volume represent a selection from a two-day symposium on conodont paleozoology organized by F.H.T. Rhodes for the 1970 North-Central Sectional Meetings of the Geological Society of America, held in East Lansing, Michigan. The symposium was attended by over 90 micropaleontologists and included invited papers by specialists from Australia, Canada, Sweden, the United Kingdom, the United States, and West Germany.

The papers show how the use of scanning electron microscopy has revolutionized knowledge (though not yet understanding) of the internal structure and surface architecture of conodonts. Neutron activation analysis has revealed a whole range of isotopes, some of which may have diagnostic value in phylogenetic studies. Studies in North America, Europe, and Australia have shown the degree to which particular conodonts are controlled by facies and are geographically restricted. The recognition of consistent associations between discrete conodont elements has extended the application of provisional multi-element nomenclature and raised fundamental question for future taxonomic work. The recognition of detailed evolutionary sequences and homeomorphic trends promises even more refinement in conodont studies in stratigraphic and paleoecologic problems. In addition, the discovery of remains of a hitherto unknown type of fossil organism associated with conodont assemblages provides another major clue to the nature of the elusive conodont.

CONTENTS: Preface. I. Structure and Affinities of Conodonts: Ultrastructure of Some Ordovician Conodonts (by C. R. Barnes, Daniel B. Sass, and Eugene A. Monroe); Conodont-Bearing Animals from the Bear Gulch Limestone, Montana (by W. Melton and H. W. Scott); Neutron Activation Analysis of Selected Conodonts (by L. E. Bradshaw, J. A. Noel, and R. J. Larson); On the Affinities of Conodonts (by M. Lindström). II. Phylogeny, Homeomorphy, and Evolution of Conodonts: Phylogeny and Homeomorphy in Carboniferous Gnathodids (by R. L. Austin); Micromophologic Studies of Platform Conodonts (by F.H.T. Rhodes, Joan Robinson, and J. A. Williams); Evolutionary, Ecologic, and Geographic Observations on Conodonts During Their Decline and Extinction (by L. Cameron Mosher). III. Conodont Ecology and Geographic Distribution: Lower Paleozoic Conodont Provincialism (by C. R. Barnes, Carl B. Rexroad, and James F. Miller); Upper Paleozoic and Triassic Conodont Distribution and the Recognition of Biofacies (by E. C. Druce); Pennsylvanian Conodont Paleoecology (by Glen K. Merrill). IV. Postscript: Conodont Research: Programs, Progress, and Priorities (by F.H.T. Rhodes). Index.

April BULLETIN briefs

Brief summaries of articles in the April 1977 GSA Bulletin *are provided on the following pages to aid members who chose the lower dues option to select* Bulletin *separates of their choice. The document number of each article is repeated on the coupon and mailing label in this section.*

☐ 70401—Project FAMOUS: Its origin, programs, and setting. *J. R. Heirtzler, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543; Tj. van Andel, Department of Geology, Oregon State University, Corvallis, Oregon 97331 (present address: Department of Geology, Stanford University, Stanford, California 94305).* (7 p., 3 figs., 1 tbl.)

Project FAMOUS was organized to provide data on the details of the spreading process of the Mid-Atlantic Ridge. From 1971 until 1974, when a series of manned submersible dives to the inner Rift valley floor took place, numerous cruises were undertaken to define the chief characteristics of the American and African plates and the line of their common origin. New technology was required and used on several cruises. At the same time, major outfitting of submersibles and training of scientists and pilots for submersible diving were undertaken.

A detailed picture of the inner rift valley has emerged between two fracture zones at latitudes of about 36°30′ and 37°N. The width of the inner valley floor here is approximately 1 to 5 km, with the narrow part nearly midway along this 40-km-long inner valley. There is a series of low, apparently young hills along the center line of the valley floor, which are intensely fissured. Most of the American submersible dives occurred on the floor of this rift valley between the latitudes of 36°47′ and 36°50′N.

On the north, this rift valley segment is offset approximately 20 km to the east (right laterally) by fracture zone A. The dives by French submersibles were primarily in this fracture zone and in the rift valley floor north of the American dive area.

To the south, the rift valley segment is offset about 20 km to the west by fracture zone B. Two of the American dives took place there. Although in these fracture zones the zone of sheared rocks has a width of nearly 20 km, the currently active part of each fracture zone is less than 1 km wide.

☐ 70402—Deep-water temperatures in the FAMOUS area. *U. Fehn, M. D. Siegel, G. R. Robinson, H. D. Holland, Department of Geological Sciences, Harvard University, Cambridge, Massachusetts 02138; D. L. Williams, Theoretical and Applied Physics, U.S. Geological Survey, Denver, Colorado 80225; A. J. Erickson, Geology Department, University of Georgia, Athens, Georgia 30602; K. E. Green, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543.* (7 p., 8 figs.)

The distribution of water temperatures in the FAMOUS area was investigated during the years 1972–1974. Forty-seven vertical temperature profiles were taken and bottom-water temperature measurements along 110 km of traverses were carried out during the course of four cruises. Potential temperatures in the FAMOUS area were found to range between 3.53° and 3.85 °C below a depth of 2,200 m. These temperatures are almost 1 °C higher than temperatures outside the axial zone of the Mid-Atlantic Ridge at comparable depths. The potential temperature in deep waters was observed to increase from 3.53 °C in the western part of fracture zone B to 3.80 °C in the eastern part of fracture zone A. Vertical temperature gradients are smaller than 1×10^{-4} °C/m at depths below 2,200 m in the various basins of the FAMOUS area. Between 2,000 and 1,800 m, the temperature differences between the different parts of the area gradually disappear; above 1,500 m, there are no significant differences between water temperatures in the ridge and those in the surrounding ocean.

The observed near-bottom temperature distribution in the FAMOUS area is related to the bottom topography. The temperatures in the various basins are determined mainly by their sill depth; the observed south-north increase of deep-water temperatures and the velocity of bottom-water currents in the area can be related quantitatively to hydrologic effects. The influence of hydrothermal activity and of heat flow through the ocean floor on the temperature distribution in the area is neglible.

☐ 70403—Project FAMOUS: Operational techniques and American submersible operations. *Robert D. Ballard, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543; Tjeerd H. van Andel, School of Oceanography, Oregon State University, Corvallis, Oregon 97331 (present address: Department of Geology, Stanford University, Stanford, California 94305).* (12 p.)

The diving operations associated with Project FAMOUS utilized an advanced deep-diving submersible with many capabilities, including a highly accurate positioning system. As the capabilities and mode of operation of this submersible in the context of a major research project are not well known, the operational techniques are described in some detail. Project FAMOUS dive operations relied upon extensive regional and intermediate-scale surface-ship studies prior to and during the dive period. These provided the basic geological and geophysical context in which the studies by the submersible *Alvin* were placed. The detailed bathymetric charts provided by the U.S. Navy on the basis of multi-narrow-beam echo-sounding, precision submersible navigation, advanced submersible data logging, and post-cruise processing systems furnished an accurate frame of reference for the dive operations as well as for the subsequent studies of the tectonic and volcanic processes within the rift on a scale not hitherto possible. The integration of the dive data with this and other surface ship information was subject to various difficulties which are discussed. Dive tracks adjusted to the basic frame of reference of the Navy bathymetry, a revised bathymetric chart for the dive area, and sample locations and particulars are provided. The FAMOUS operations furnished, in addition to the scientific results, a much better understanding of the best mode of operation for detailed deep-sea-floor studies that utilize a combination of surface ship and submersible techniques. The lessons learned during this project are discussed in some detail.

☐ 70404—Morphology and tectonics of the inner rift valley at lat 36°50′N on the Mid-Atlantic Ridge. *Robert D. Ballard, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543; Tjeerd H. van Andel, School of Oceanography, Oregon State University, Corvallis, Oregon 97331 (present address: Department of Geology, Stanford University, Stanford, California 94305)* . (24 p., 21 figs., 2 tbls.)

A segment of the inner rift valley of the Mid-Atlantic Ridge was investigated in detail from the American submersible *Alvin*. Fifteen traverses were made across the floor and up the first major fault scarps in the valley walls. The asymmetric morphology of the inner floor is found to be the primary result of volcanic activity modified by tectonic activity. Analysis of the tectonic features revealed that the rift is evolving within a single stress field that has its least principal strain axis (the compressional axis) aligned with the valley axis of N20°E. This is in contrast to the direction normal to plate divergence (N0°E). The tectonic elements in the inner floor are primarily vertically dipping tension fractures, whereas the fault scarps of the flanking walls are closer to a 60° dip and reflect a component of downdip shear. The information base obtained from *Alvin* was broadened with information collected in the area with more conventional techniques.

Through an analysis of this information, primarily the topography, it was possible to extrapolate the detailed observations obtained from the submersible to intervening areas to produce a comprehensive geological interpretation of the study area. An evolutionary model was developed which suggests that the inner rift is a product of axial volcanic activity. Shortly after formation, the original volcanic edifice is modified by vertical collapse, which leads to a reduction of the bottom relief. This process is reversed in the outer portions of the valley as uplift begins. Tensional extension changes into vertical shear as the volcanic blocks are incorporated into the walls and elevated. During the various stages of uplift, readjustment takes place on the terraces, which results in the preservation of the original volcanoes as recognizable units. This model, which spans 180,000 yr of inferred time, is examined in detail in an attempt to identify its weaknesses as well as to delineate the specific factual constraints upon which it is built. Alternate interpretations are proposed and tested in a similar fashion; the result is the identification of key problems that need to be solved.

☐ 70405—A geothermal study of the Mid-Atlantic Ridge near 37°N. *David L. Williams, U.S. Geological Survey, Federal Center, Denver, Colorado 80225; Tien-Chang Lee, Department of Earth Sciences, University of California, Riverside, California 92502; Richard P. Von Herzen, Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543; Kenneth E. Green, Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139; Michael A. Hobart, Lamont-Doherty Geological Observatory, Palisades, New York 10964.* (10 p., 7 figs., 2 tbls.)

A suite of 101 well-navigated heat-flow stations was used to investigate lithospheric cooling on the Mid-Atlantic Ridge near 37°N. Measurements in two topographic depressions marking the intersection of transform faults with axes of sea-floor spreading show evidence of hydrothermal circulation in basement rocks. One of these depressions appears to have been subjected to a recent bottom-water temperature change which severely biases the heat-flow data. Some of the evidence suggests that transform faults are more permeable than other regions of the ocean crust and therefore may cool much faster.

We also measured the heat flow in rift mountains extending from 10 to 35 km west of the spreading axis. The data here also suggest that a hydrothermal system is presently active in the crustal rocks. Although hydrothermal vents have not yet been unambiguously identified on the sea floor, hydrothermal circulation seems likely to be the dominant mode of cooling oceanic crust near spreading axes where sediment cover is thin (that is, few tens of metres) or nonexistent.

☐ 70406—Near-bottom magnetic anomalies, asymmetric spreading, oblique spreading, and tectonics of the Mid-Atlantic Ridge near lat 37°N. *Ken C. Macdonald, Institute of Geophysics and Planetary Physics, Scripps Institute of Oceanography, La Jolla, California 92093 (present address: Marine Physical Laboratory and Geological Research Division, Scripps Institute of Oceanography, La Jolla, California 92093).* (15 p., 14 figs., 2 tbls.)

A detailed study of the magnetic anomalies of the Mid-Atlantic Ridge crest near lat 37°N (FAMOUS) was conducted using a deeply towed instrument package. The most recent expression of the accreting plate boundary in rift valley 2 is an alternating series of linear central volcanoes and depressions that are marked by a sharp maximum in crustal magnetization only 2 to 3 km wide. Spreading in the FAMOUS area is highly asymmetric, with rates of 13.4 mm/yr to the east and 7.0 mm/yr to the west. At 1.7 m.y. B.P., the sense of asymmetry reversed in direction, with spreading faster to the west; this resulted in a gross symmetry when averaged through time. The change in spreading asymmetry occurred in less than 0.15 m.y. Spreading in the FAMOUS area is 17° oblique. Even on a fine scale there is no indication of readjustment to an orthogonal plate-boundary system. Spreading has been stably oblique for at least 8 m.y., even through a change in spreading direction. The presence of negative polarity crust within the Brunhes normal epoch in the inner floor has been observed and may be due to old crust left behind or to recording of a geomagnetic field event. Crustal magnetization decays to 1/e its initial value in less than 0.6 m.y. The rapid decay may be facilitated by very intense crustal fracturing observed in the inner floor. Crustal magnetic sources may be approximated (mathematically) by a uniformly magnetized layer 700 m thick.

Magnetic studies indicate that over 90 percent of the extrusive volcanism occurs within the rift inner floor and is extremely rare in the rift mountains. Magnetic anomaly transition widths vary from 1 to 8 km with time and appear to reflect a time-varying median-valley structure. The valley has either a wide inner floor and narrow terraces, in which case the volcanic zone is wide and magnetic anomalies are poorly recorded (wide transition widths), or it has a narrow inner floor and wide terraces—the volcanic zone is then narrow and anomalies are clearly recorded (narrow transition widths). The median valley of any ridge segment varies between these two structures with time. At present rift valley 2 has a narrow inner floor and volcanic zone (1 to 3 km), whereas rift valley 3 is at the opposite end of the cycle with a wide inner floor and volcanic zone (9 to 11 km).

☐ 70407—Compositional variations of young basalts in the Mid-Atlantic Ridge rift valley near 36°49′N. *W. B. Bryan, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543; James G. Moore, U.S. Geological Survey, Menlo Park, California 94025.* (15 p., 16 figs., 6 tbls.)

Fifty acoustically positioned samples of fresh basalt were collected by the submersible *Alvin* from the median valley of the Mid-Atlantic Ridge during the French American Mid-Ocean Undersea Study (FAMOUS) in the summer of 1974. The samples show regular compositional variations from the center of the rift valley (central lava flows) out to the rift valley walls (flank lava flows). The central lava samples show higher ratios of olivine relative to clinopyroxene and plagioclase phenocrysts and contain chrome spinel. Glasses of the flank lava samples are enriched in SiO_2, TiO_2, K_2O, H_2O, and FeO/MgO relative to central lava samples.

Studies of the thickness of palagonite and manganese crusts indicate that the flank lava flows are considerably younger than the inferred spreading age of the crust on which they occur. Flank lavas are generally older than central lavas, but notable exceptions occur.

The composition of the flank lava glass can be derived by the removal of approximately 29 wt percent of analyzed phenocrysts (in the ratio 5.7 plagioclase, 2.5 olivine, 1.8 clinopyroxene) from the central lava glass. In addition, other processes (possibly involving volatile transfer) must enrich the flank lavas in K_2O, TiO_2, and H_2O.

A model is proposed whereby this crystal fractionation occurs in a shallow, narrow (6-km-wide) magma chamber underlying the median valley. The chamber is compositionally zoned, and central lavas are fed from dikes tapping its hotter axial zone, whereas flank lavas are fed from the cooler, differentiated melt on the margins. The nature of the chemical variations in the lavas permits an estimate of the composition and thickness of the cumulates forming at the base of the chamber.

☐ 70408—Sr-isotope, K, Rb, Cs, Sr, Ba, and rare-earth geochemistry of basalts from the FAMOUS area. *William M. White, Graduate School of Oceanography, University of Rhode Island, Kingston, Rhode Island 02881; W. B Bryan, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543* (6 p., 4 figs., 2 tbls.)

Ten basalt samples recovered from the FAMOUS area were selected so as to obtain representatives of a wide geographical and compositional range. The samples were analyzed for $^{87}Sr/^{86}Sr$, K, Rb, Cs, Sr, Ba, and rare-earths. Sr-isotope ratios fall in the narrow range of 0.70288 to 0.70307, which implies that these samples were derived from an isotopically homogeneous source. The FAMOUS area lies in a geochemical transition zone between the Azores Plateau and "normal" ridge areas south of lat 33°N. The LIL (large-ion-lithophile) and Sr-isotope geochemistry of FAMOUS basalts is thus influenced by the Azores mantle plume; this results in higher Sr-isotope and LIL concentrations in these basalts than is typical of Mid-Atlantic Ridge basalts. Trace-element distributions in FAMOUS area basalts cannot be entirely accounted for by fractional crystallization models that are based on major-element chemistry. The LIL distribution in FAMOUS basalts could be due to variable extents of partial melting. Zonation within the magma chamber may result from incomplete mixing of successive batches of magma entering the chamber and could be further enhanced by fractional crystallization. The variation in partial melting would require significant increases in mantle temperature over a relatively short period of time. According to this model, the Mount Pluto magma represents the highest degree of partial melting and may mark the initiation of a new cycle of eruptive activity in the median valley.

☐ 70409—Morphology and tectonic evolution of the rift valley at lat 36°30′N, Mid-Atlantic Ridge. *Ivar B. Ramberg, Department of Geology, University of Oslo, Blindern, Oslo 3, Norway; Tjeerd H. van Andel, Department of Geology, Stanford University, Stanford, California 94305.* (10 p., 9 figs., 2 tbls.)

In the FAMOUS area on the Mid-Atlantic Ridge, four rift-valley segments trend slightly east of north and are separated by short right-lateral transform faults. From north to south, the valleys are designated rift valleys 1, 2, 3, and 4, respectively. Of these, rift valley 2 has been studied extensively by manned submersibles. We describe the characteristics of rift valley 3 on the basis of detailed bathymetric charts. Rift valley 3 has an 8-km-wide inner floor with a central volcanic ridge and is bordered by steep inner walls, terraces, and outer walls. Although the structure and dimensions are similar to those of rift valley 2, the inner floor is significantly wider and contains more trains of volcanic hills. One of these is lobate and irregular and defines the position of the ridge axis. Individual volcanoes, formed at the axis, appear to rift on either one or the other side and are then transported by sea-floor spreading, while being modified by along-strike faulting. At the walls, the hills are uplifted in units. Reconstruction of the evolution of the inner rift shows a history similar to that of rift valley 2, with minor oscillation of the axis over a 1-km-wide zone with transient transforms. In rift valleys 2 and 3, as well as in other segments of the Mid-Atlantic Ridge, the distance from the axis to the inner walls is correlated with the spreading rate, suggesting that crustal age and associated properties of the lithosphere control the beginning of uplift. The differences between rift valleys 2 and 3 are caused mainly by differences in spreading-rate asymmetry and by some historic events.

☐ 70410—Composition and phase chemistry of sulfide globules in basalt from the Mid-Atlantic Ridge rift valley near 37°N lat. *Gerald K. Czamanske, James G. Moore, U.S. Geological Survey, Menlo Park, California 94025.* (13 p., 6 figs., 2 tbls.)

The electron microprobe was used to determine the bulk composition of immiscible sulfide globules trapped in the glass phase of 25 fresh submarine basalt samples from the Mid-Atlantic Ridge. Twenty-three samples represent a spectrum of primitive through differentiated tholeiites from the FAMOUS dive area; two are differentiated basalts from the Reykjanes Ridge. The analyzed globules range in diameter from 11 to 233 μm. On the average, they constitute only 0.0022 volume percent of the rocks and contain less than 1.5 percent of the sulfur. Compositions of the globules change with differentiation as measured by Fe/(Fe+Mg) or TiO_2 content of the host glass. Globules in glass containing 0.66 to 1.0 wt percent TiO_2 typically contain 20 to 26 wt percent Ni + Cu and have an average atomic Ni/Cu of 1.6. With differentiation toward 1.6 wt percent TiO_2, Ni + Cu content of the globules falls to less than 10 wt percent and atomic Ni/Cu falls to 0.4.

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Sulfur-content of the host glasses shows a strong correlation with FeO content, increasing from 840 ppm to 1,370 ppm as FeO content increases from 8.0 to 12.6 wt percent. Reference to experimental studies shows that this relationship is consistent with sulfur saturation of the host glass at liquidus temperatures. Crystal fractionation is considered to be the dominant factor in keeping the differentiating melt at sulfur saturation.

The sulfide globules may have persisted in the basaltic melt from its place of formation by partial melting in the mantle, or they may have exsolved from the melt as it became sulfur-saturated in a high-level magma chamber. Globule abundance and composition indicates adjustment to the composition of the melt in which they were trapped. Material balance calculations suggest that one-third of the Cu and commensurate amounts of S, Ni, and Fe have settled from the magma as immiscible globules.

The sulfide globules contain less than 4 wt percent magnetite, compatible with low f_{O_2} in the magma. Three sulfide phases coexisted in the globules at about 600 °C: monosulfide solid solution, intermediate solid solution, and pentlandite. At lower temperatures, the intermediate solid solution has broken down, and the monosulfide solid solution has exsolved a second generation of pentlandite.

☐ 70411—Density and *P*-wave velocity of rocks from the FAMOUS region and their implication to the structure of the oceanic crust. *Edward Schreiber, Department of Earth and Environmental Sciences, Queens College, Flushing, New York 11367; Paul J. Fox, Department of Geological Sciences, State University of New York at Albany, Albany, New York 12222 and Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964.* (9 p., 4 figs., 3 tbls.)

In the laboratory the bulk density and the compressional wave velocity as a function of varying confining pressure (0.0001 to 6.0 kb) was measured for 25 samples. Nineteen of these samples were fresh, unaltered basalts and, on the basis of their mineralogy, could be separated into olivine basalt (7), plagioclase basalt (9), and pyroxene basalt (3). The basalts had textures typical of extrusive and shallow intrusive volcanics. Of particular interest during the study was the effect of varying basalt mineralogy at confining pressures representative of the estimated lithostatic confining pressure of layer 2A. At 0.5 kb confining pressure, the average compressional wave velocity is olivine basalt (7) 5.62 km/sec (σ0.31), plagioclase basalt (5) 5.49 km/sec (σ0.19), pyroxene basalt 5.45 km/sec (σ0.32). There is no significant difference between the velocities of the three basalt groups, thus suggesting that at 0.5-kb confining pressure the control on velocity is principally textural. The other six samples (serpentinite (3), metagabbro (1), greenstone (1), and metabasalt breccia (1)), were recovered from the escarpments of fracture zone B. These rock types and their measured compressional wave velocities are typical of rocks recovered from transform faults.

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