GSA news & information

SUPPLEMENT TO GEOLOGY MAGAZINE

MAY 1977

Four Penrose Conferences welcome your participation

The Penrose Conferences, sponsored by the Geological Society of America, are interdisciplinary conferences established to promote the science of geology. Informal discussions pertaining to the science of geology and related fields are intended to stimulate individual research and to advance the science by the interchange and development of new ideas.

Conferences for 1977 are listed here, along with deadlines for application. Participation is not restricted to members of the Geological Society of America, and ANYONE interested in attending a Penrose Conference is urged to complete and mail the application form on the back of this page.

There is a common misconception that one must be invited to attend a Penrose Conference. Conveners initially invite only a few key speakers necessary to the organization and success of the conference. Aside from these invitations issued in the early planning stages of a conference, the convener is dependent on indications of interest from those actively working in the field to complete the list of conference participants. Only when more applications are received than can be accommodated is any restriction placed on those who may attend. In order to involve all individuals and to retain the informal character of the conferences, attendance is limited to approximately 70 to 80. Usually the attendance is limited by the nature of the topic itself; however, occasionally a conference is oversubscribed. In this case, the final decision on who will participate will be made by the convener.

Any member of the Geological Society of America who is interested in convening a Penrose Conference may submit a proposal. Proposals are now being accepted for 1978 Penrose Conferences and are reviewed, as received, by the Penrose Conference Committee. Proposals are then recommended for approval (or rejection) by the Society's Executive Committee who reserves full authority for the final approval of conference proposals.

For details concerning the necessary requirements for inclusion in a Penrose Conference proposal, or for any questions regarding the conferences, please write directly to the Penrose Conference Coordinator, Lois Elms, 745 Gilpin Drive, Boulder, Colorado 80303, or phone (303) 494-0392.

REMEMBER: If you are interested in attending any of the Penrose Conferences for 1977, please complete and mail the application form on the back of this page. It will be sent to the convener of the conference in which you indicate an interest, and further information on the conference will be sent to you immediately.

August 29–September 2, 1977, *Geostatistical Concepts and Stochastic Methods in Hydrogeology*

Harrison Hotel, Harrison Hot Springs
British Columbia, Canada

DEADLINE—JUNE 1, 1977

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*

Lion Square Lodge
Vail, Colorado

DEADLINE—JULY 1, 1977

Conveners:
Don C. Banks
U.S. Army Waterways Experiment Station
Vicksburg, Mississippi 39180

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

DEADLINE—AUGUST 1, 1977

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*

Site not yet selected

DEADLINE—OCTOBER 15, 1977

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

Report of the Committee on Research Grants

To the Council and Membership of The Geological Society of America, Inc.:

The Committee on Research Grants, consisting of Gregory A. Davis (substituting for B. Clark Burchfiel), Steven Stanley, William E. Benson (conferee), George deVries Klein (conferee on fund raising), and Anthony J. Naldrett (chairman), met in Boulder at Society Headquarters on March 20, 1976. Each member of the Committee, with the exception of Dr. George Klein whose responsibility was to advise on fund raising, had studied all of the proposals prior to the meeting and the review process thus proceeded very smoothly.

The Committee once again regretted the necessity of a reduced contribution of $50,000 from the Society but were pleased that generous industrial donations provided an additional $15,200. In addition, the excellent response of previous grant recipients to a letter soliciting their help at the time of the present tight budgets provided an additional $5,074.

Two hundred and fifty-six applications were reviewed and support was recommended for 111 or 43 percent of the total, with an average grant of $639. The total amount requested was $223,016 and the amount awarded $70,931, representing 31 percent of that requested.

Mr. J. W. Castle of the University of Illinois at Urbana-Champagne received the Harold T. Stearns award and a number of interesting proposals relevant to industry were designated to receive support from the industrial donations.

The Committee was very impressed with the standard of the proposals reviewed this year and regretted that as a result of the limited funding many good proposals received less support than they deserved. The average grant has not increased over the past fifteen years so that the effective value is very much less than when the grant program was initiated. The Penrose research grants fulfill an important role in providing support, largely field expenses, for a significant number of promising young scientists. The Committee feels that the return in terms of knowledge gained per dollar spent is very great and consequently recommended that the solicitation of industrial support be intensified, that requests for help to former recipients be continued, and that, budget permitting, the Society increase its funding in 1977.

The review process continues to work well, and the members of the Committee feel privileged to have been part of it.

Respectfully submitted,

GREGORY A. DAVIS
STEVEN M. STANLEY
WILLIAM E. BENSON (Conferee)
GEORGE deVRIES KLEIN (Conferee)
ANTHONY J. NALDRETT (Chairman)

1976 RESEARCH GRANTS
SUMMARY OF COMMITTEE RECOMMENDATIONS AND COUNCIL ACTIONS

	Applicants	Amount requested by applicants	Amount funded
COMMITTEE RECOMMENDATIONS			
Category I (recommended for support)			
M.S. Student applicants	26	$ 19,378	$ 14,250
Ph.D. Student applicants	81	75,847	54,330
Post Ph.D. applicants	4	3,530	2,350
Subtotal	111	$ 98,755	$ 70,930
Category II (not recommended for support)			
M.S. Student applicants	67	$ 51,189	
Ph.D. Student applicants	68	61,653	
Post Ph.D. applicants	10	11,419	
Subtotal	145	$124,261	
GRAND TOTAL	256	$223,016	$ 70,930
COUNCIL ACTION			
Support all Category I projects	111	$ 98,755	$ 70,930
Funding declined			
Cancellations	(4)	$ (3,432)	$ (2,850)
Reductions (partial funding elsewhere)			(1,095)
Alternates awarded	5	5,655	2,600
1976 TOTALS	112	$100,978	$ 69,585

Annual Report for 1976
The Geological Society of America

Associated societies name officers for 1977

Geochemical Society

President, *Edwin Roedder*, U.S. Geological Survey, 959 National Center, Reston, Virginia 22092. Vice-President, *Hugh J. Greenwood*, Department of Geological Sciences, University of British Columbia, Vancouver, British Columbia V6T 1W5. Secretary, *Peter R. Buseck*, Department of Chemistry, Arizona State University, Tempe, Arizona 85281. Treasurer, *George R. Helz,* Department of Chemistry, Box 106, University of Maryland, College Park, Maryland 20742. Past-President, *Karl K. Turekian,* Department of Geology, Box 2161, Yale University, New Haven, Connecticut 06520.

Geoscience Information Society

President, *John G. Mulvihill*, American Geological Institute, 5205 Leesburg Pike, Falls Church, Virginia 22041. Vice-President, *Richard D. Walker*, Library School, University of Wisconsin, 600 N. Park, Madison, Wisconsin 53706. Secretary, *Mary W. Scott*, Department of Geology, 102 Leonard Hall, University of North Dakota, Grand Forks, North Dakota 58202. Treasurer, *Katherine L. Keener*, Naval Environmental Support Office, Code: 25111, Naval Construction Battalion Center, Port Hueneme, California 93043. Past-President, *Mrs. Vivian S. Hall*, Geology Librarian, University of Kentucky, 100 Bowman Hall, Lexington, Kentucky 40506.

Mineralogical Society of America

President, *F. Donald Bloss*, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061. Vice-President, *Peter J. Wyllie*, Department of Geophysical Sciences, University of Chicago, Chicago, Illinois 60637. Secretary, *Larry W. Finger*, Geophysical Laboratory, 2801 Upton Street, NW, Washington, D.C. 20008. Treasurer, *Malcolm Ross*, U.S. Geological Survey, 959 National Center, Reston, Virginia 22092. Past-President, *E-an Zen*, U.S. Geological Survey, 959 National Center, Reston, Virginia 22092.

National Association of Geology Teachers

President, *Robert L. Heller*, 515 Administration Building, University of Minnesota, Duluth, Minnesota 55812. Vice-President, *Richard A. Paull*, Department of Geological Sciences, University of Wisconsin, Milwaukee, Wisconsin 53201. Secretary-Treasurer, *Alan R. Geyer*, Bureau of Topographic and Geologic Survey, Department of Environmental Resources, Harrisburg, Pennsylvania 17120. Past-President, *Edward C. Stoever, Jr.*, School of Geology and Geophysics, University of Oklahoma, Norman, Oklahoma 73019.

Paleontological Society

President, *David M. Raup*, Department of Geology and Geography, University of Rochester, River Campus Station, Rochester, New York 14627. President-Elect, *Francis G. Stehli*, Department of Geology, Case Western Reserve University, Cleveland, Ohio 44106. Secretary, *Walter C. Sweet*, Department of Geology, Ohio State University, Columbus, Ohio 43210. Treasurer, *John A. Fagerstrom*, Department of Geology, University of Nebraska, Lincoln, Nebraska 68508. Past-President, *Ellis L. Yochelson*, U.S. Geological Survey, National Museum of Natural History, Washington, D.C. 20560.

Society of Economic Geologists

(Term of office: 1 April, 1977, through 31 May, 1978) (Vice-President does not automatically become President.)

President, *Paul C. Henshaw*, Homestake Mining Company, 650 California Street, 9th Floor, San Francisco, California 94108. Vice-President, *Donald E. White*, 222 Blackburn Avenue, Menlo Park, California 94025. Secretary, *Arnold L. Brokaw*, 185 Estes Street, Lakewood, Colorado 80226. Treasurer, *R. W. Marsden*, Department of Geology, University of Minnesota, Duluth, Minnesota 55812. Past-President, *H. D. Bruce Wilson*, Department of Earth Sciences, University of Manitoba, Winnipeg, Manitoba R3T 2N2. Past-Vice-President, *Walter S. White*, U.S. Geological Survey, 954 National Center, Reston, Virginia 22092.

Society of Vertebrate Paleontology

President, *William D. Turnbull*, Field Museum of Natural History, Roosevelt Road and Lake Shore Drive, Chicago, Illinois 60605. Vice-President, *Peter Robinson*, University of Colorado Museum, Boulder, Colorado 80302. Secretary-Treasurer, *Ernest L. Lundelius, Jr.*, Texas Memorial Museum, Balcones Research Center, 10100 Burnet Road, Austin, Texas 78758. Past-President, *Malcolm C. McKenna*, American Museum of Natural History, 79th and Central Park West, New York, New York 10024.

Cushman Foundation

President, *Emile A. Pessagno, Jr.*, Geosciences Division, University of Texas at Dallas, Box 688, Richardson, Texas 75080. Vice-President, *Don L. Eicher,* Department of Geology, University of Colorado, Boulder, Colorado 80309. Secretary-Treasurer, *Frederick J. Collier*, E-501 U.S. National Museum, Washington, D.C. 20560.

Information for contributors to the BULLETIN revised to meet publication demands

The Geological Society of America publishes scientific papers on all aspects of geology. Its principal outlet is the *BULLETIN*, issued monthly and distributed to members of the Society, schools, and scientific organizations throughout the world. Many more papers are received than can be published. Preference is given to papers that embody new observations, principles, or ideas; papers of usefulness in more than one discipline in the Earth sciences; and papers of broad general interest.

Papers submitted to the Society for the *BULLETIN* are reviewed critically by at least two referees before they are accepted for publication. The review period ranges from several weeks to several months. At the present time, the interval from date of receipt of a manuscript to date of publication is about two years.

After July 1, 1977, papers should *not exceed 40 manuscript pages in length*, including text, references cited, figure captions, tables, and illustrations. (Each illustration, regardless of nature or size, counts as a manuscript page.) Some manuscripts can be shortened by removing detailed record data, particularly tabular data needed only for substantiation. This information may be summarized in the manuscript and the data placed in the GSA depository. The Society will send copies of all such deposited data free of charge to anyone who requests it.

Manuscripts should be typed on letter-sized, opaque paper, on one side only. Do not use onionskin. *ALL MANUSCRIPT MATERIAL, INCLUDING TEXT, REFERENCES CITED, AND FIGURE CAPTIONS MUST BE TYPED DOUBLE SPACED.* Leave at least one-inch margins on top, bottom, and sides of pages. All illustrations should be termed figures, numbered sequentially, and referred to sequentially in the text. Figure captions should be placed on a separate page, following the references cited. For matters of format or style, consult a recent issue of the *BULLETIN*.

Submit two copies of text and neat, clearly legible copies or prints of all illustrations to the Science Editor, The Geological Society of America, 3300 Penrose Place, Boulder, Colorado 80301. Original drafted line drawings and photographs should be retained by the author until they are requested. Authors should also retain at least one complete copy of the manuscript and illustrations, as the Society cannot be responsible for material damaged or lost. Only original drafted illustrations will be returned after an article is published.

Authors will have an opportunity to examine copies of the manuscript and illustrations after review and after editing. All corrections and changes must be made at these times. Authors will also receive galley proofs of the article prior to publication. At that time, only printing errors may be corrected. Authors must assume responsibility for proofreading articles.

Authors may withdraw papers any time prior to formal acceptance. Papers should not be submitted elsewhere while under consideration by the Society.

For further information, call (303) 447-2020 or write to the *BULLETIN* Editor at the above address.

Fulbright-Hays awards in geology announced

About 500 Fulbright-Hays awards will be available in 92 countries for 1978–1979; a number have been programmed in geology.

Australia: fission track dating; *Ivory Coast:* geology (French required); *New Zealand:* earthquake prediction; *Norway:* prognostic mathematical modeling; Quaternary geology of the U.S.; paleontology; *Pakistan:* geology; *Senegal:* geology (French required); *U.S.S.R.:* mathematical modeling of ocean dynamics; *Uruguay:* sedimentology (Spanish required).

Those desiring a copy of the 1978–1979 announcement of Fulbright-Hays award opportunities for university teaching and advanced research abroad should immediately send name, address, highest degree, specialization, and country interest to the Council for International Exchange of Scholars, Eleven Dupont Circle, Washington, D.C. 20036. Applications are due for the American Republics, Australia, and New Zealand by June 1, 1977, and for Africa, Asia, and Europe by July 1, 1977.

CIES will also assist in the administration of about 500 awards in 1978-1979 for Fulbright scholars visiting the U.S. for lecturing and research. In many cases host institutions are expected to assist the scholar with full or partial maintenance. A directory of scholars currently in the U.S. is available on request and inquiries are welcome at any time regarding scholars from abroad for 1978–1979.

1978 International Rift Symposium in Santa Fe

International Rift Symposium on "Rift Zones of the Earth: Tectonics and Magmatism of the Rio Grande Rift" will be held October 8–17, 1978, in Sante Fe, New Mexico. Conference discussion and field trip themes will include regional setting, structure and theoretical models, and origin of continental rifts and their significance to plate tectonics. The conference will be cosponsored by Working Group 4 of the Inter-Union Commission of Geodynamics and the U.S. National Committee for Geodynamics. Registration is limited. For further information, write to Carl Cuntz, 1978 International Rift Syimposium, University of California, Los Alamos Scientific Laboratory, ISD-2, MS 355, Box 1663, Los Alamos, NM 87545.

MINERALOGY AND GEOLOGY OF NATURAL ZEOLITES

A short course sponsored by the Mineralogical Society of America

On November 4 to 6, 1977, the Mineralogical Society of America will sponsor a short-course on the Mineralogy and Geology of Natural Zeolites. The course will be held in Seattle, Washington, immediately preceding the annual meeting of the Geological Society of America and will be limited to about 75 participants from academic, governmental, and industrial organizations. Reduced student-rates will be offered.

Interest in the occurrence and properties of natural zeolites has increased enormously in the last few years. Their formation from volcanic ash in both lacustrine and marine environments and in regions of low-grade, burial metamorphism is of considerable geological import, and the many applications which have been developed for high-grade deposits of these materials in agricultural and industrial technology has transformed the zeolite group of minerals from museum curiosities into important industrial mineral commodities.

Subjects

Crystal Structure
Crystal Chemistry
Saline-Lake Occurrences
Marine Occurrences
Low-Grade Metamorphic Occurrences
Open-Basin Occurrences
Industrial Applications
Mineralogical Characterization

Field Trip

¾ day to zeolite localities in the vicinity of Seattle

Laboratory/Workshop Sessions

X-ray diffraction, petrographic, scanning electron microscopic characterization, crystal model building, hand-specimen identification, field tests

Lecturers and Staff

J. R. Boles	University of California
E. M. Flanigen	Union Carbide Corporation
A. J. Gude	U.S. Geological Survey
R. L. Hay	University of California
F. A. Mumpton	State University of N.Y.
R. A. Sheppard	U.S. Geological Survey
R. J. Stewart	University of Washington
R. C. Surdam	University of Wyoming

For further information and application forms, write to

F.A. Mumpton, Convener
M.S.A. Short-Course
Department of the Earth Sciences
State University College
Brockport, New York 14420 (716) 395-2635

Memorials available on request

There is a supply of preprints available for distribution of the following memorials: Agatin Townsend Abbott, Hans W. Ahlmann, Ernst Valdemar Antevs, Earl Taylor Apfel, Richard William Bayley, Christopher Keith Bell, Bernard William Blanpied, Robert Ware Bridgman, Frank Edward Byrne, Frank Cathcart Calkins, Francis Cameron, Anthony R. Cariani, Frank Rinker Clark, Thomas Pipes Clendenin, Ernst Cloos, Elmer Fred Davis, John Gray Douglas, Helen M. Duncan, Forrest Durham, George Edward Goodspeed, Frank Cook Greene, Jarvis Bardwell Hadley, William Eugene Ham, Claude William Hibbard, Henry V. Howe, Walter Frederick Hunt, Hubert Andrew Ireland, William Harold Irwin, Philip Hennen Jennings, J. Harlan Johnson, George Moses Knebel, Eleanora Bliss Knopf, Marjorie Kitchel Korringa, Virgil Ivor Mann, Phillip Francis Martyn, William J. McMannis, Walter Franklin Pond, Hubert Elias Risser, Alfred Sherwood Romer, Erich Maren Schlaikjer, Robert F. Sitler, George David Swingle, Garvin Lawrence Taylor, Hans Ernst Thalmann, George Dewey Thomas, Francis M. Van Tuyl, Robert Orion Vernon, Max Greg White, Oscar Wilhelm, Merton Y. Williams, Paul Woldstedt, Horace Elmer Wood.

CALL FOR POSTERS REMOTE SENSING SYMPOSIUM

The 1977 Annual Meeting of the Geological Society of America, in Seattle, Washington, will convene a symposium entitled

Geological Applications of Satellite Remote Sensing.

The symposium will be held on Tuesday, November 8, and will include a morning session devoted to invited papers—to be followed by a major afternoon poster session.

Individuals interested in presenting a poster graphically and visually illustrating recent work in applying satellite remote sensing to geologic activities should submit a short (150-word) abstract to Dr. Murray Felsher, GSA Posters, P.O. Box 20, Germantown, Maryland 20767.

MICROFICHE READERS AVAILABLE

Because of a growing interest in microfiche and continued inquiries about the availability of microfiche readers, the following excerpts are being reprinted from Donald B. McIntyre's article in the GSA News and Information, November 1975. The second article, "Directory of firms dealing in microfiche equipment," appeared in the May 1976 GSA News and Information. Don McIntyre was chairman of GSA's Committee on Publications, 1975 and 1976, when he compiled these comprehensive reviews and evaluations. Copies of the complete articles are available on request.

INTRODUCTION

Letters from GSA members and discussion at meetings of the Committee on Publications show that many need advice on selection of equipment for reading our microform publications. The following remarks are personal opinions set down for the committee, but the editor thinks that they may be useful to a wider audience in GSA.

FORMATS

The NMA standard 24x reduction, with 7 rows of 14 columns, has been used in all publications of the Geological Society of America, American Geophysical Union, Dawson Reprints (Journal of Geology, Journal of Petrology), and in a dozen journals published by the American Institute of Physics. The main reason to depart from NMA format is that the standard shape of computer documents is 14" x 11", wider than it is high. Partly to accommodate this, and partly because Computer Output Microform (COM) is generated by the computer directly without first printing a page and then photographing it, COM is usually at 42x reduction, with 208 pages per fiche in 13 rows of 16 columns, or at 48x reduction, with 288 pages in 16 rows of 18 columns.

POCKET READERS

I recommend 15x magnification. Any smaller magnification should be carefully tested by the individual to make sure that it is satisfactory. I can read a 42x COM with a 15x Taylor-Merchant. I find that in using ambient light it is best to look toward a dark background. Although most pocket readers lack mechanical guides for positioning the fiche at a particular frame, I find that searching a fiche is not difficult.

The cheapest reader I know about is Taylor-Merchant's 153L. It costs $29, weighs 3 ounces, measures 6" x 2" x 1", and uses ambient light. This is the one I have. Its only disadvantage is that the holder is not as tight as I would like it to be. This reader is suitable for viewing Kodachrome slides of maps.

The best optics that I have seen are on D.O. Industries' Exac-tics. It costs $60 (at 10x; more for the 15x that I would recommend), weighs 15 ounces, measures 8" x 2½" x 4", and uses three C batteries. A 110V adapter can be purchased.

The Microvision R24-48 reader is an attractive, compact design, with folding index guides, and costs $80. My eyes found it difficult to adjust to this reader, but practice might make this easier.

LAP READERS

The best lap reader appears to be Bell & Howell's "Briefcase Reader," manufactured by their Micro Design Division; it costs $145. Dimensions open: 10 3/8" high x 3½" wide x 6¼" deep. Dimensions closed: 10 3/8" high x 9 5/16" wide x 3 3/8" deep. The screen size is 6 5/8" x 9". Weight: 5 lbs. 10 oz. This reader is a new version of Micro Design's former Companion Model 220. The new reader is better as well as being at a slightly lower price. I know one college library that has several readers of the older model for checkout by students. I have purchased the "Briefcase Reader" for our geology library at Pomona College.

Another good lap reader is Micobra's K-100 Escort costing $139. I found this reader to be very satisfactory, although it is not as compact or portable as Bell & Howell's "Briefcase Reader." Weight is less than 5 lbs. Screen size: 7 1/3" x 10". It has a well-designed system for "turning the page" in moving from frame to frame.

Visidyne's Voyager II reader, which costs $149, is rather similar to the Micobra lap reader. I prefer the Micobra.

PORTABLE READERS

Bell & Howell's "Briefcase Reader," described above as a lap reader, qualifies as portable. The cost is $145.

Washington Scientific Industries manufactures truly portable readers built into a briefcase. The Informant I is for full-size images of 8½" x 11" documents or for three-quarter magnification of COM. The cost is $199 with one lens; additional lenses cost about $50 each.

The Taylor-Merchant 300XF is a projector capable of throwing an image on a wall or screen. Cost is $85. A fitted briefcase is available for $33.

Northwest Microfilm advertises a unit, NMI 75, that is said to be portable, with built-in carrying handle. Weight: 15 lbs.

DESK READERS

Here I include simply the more compact of the library readers. The best known are Eastman Kodak's Ektalite Series for 8½" x 11" documents, No. 120 at $105 and No. 220 (with a larger screen) at $160; other magnifications are available, especially for COM. Ektalite readers have plastic gears and the quality of the curved image could be improved.

Data View has several readers sitting on 10" x 10" bases. These readers are modular and easily adapted to changing needs. A dual-lens reader with an 8½" x 10¾" screen costs $185; with a 10½" x 11¼" screen the cost is $195. These readers seem well made and have good optics.

The Quantor 305 can be used as a desk reader. It produces a three-quarter-size image of COM and costs $185. This reader is the one used in our business office.

Northwest Microfilms NMI 75 also produces a three-quarter-size image of COM. The base is 9" x 8". I do not have the price, and I have not seen this reader.

(Next page, please)

BOOK BRIEFS

Geology of the Arisaig Area, Antigonish County, Nova Scotia

SPECIAL PAPER 139 — By Arthur J. Boucot, John F. Dewey, David L. Dineley, Raymond Fletcher, William K. Fyson, John G. Griffin, Charles F. Hickox, W. Stuart McKerrow, and Alfred M. Ziegler. 1974. x + 192 pages. 30 figures. 14 plates on 4 foldouts in pocket. 13 tables. Index. ISBN: 0-8137-2139-3. $13.00.

The Arisaig area of Nova Scotia was selected for this study because it provides the most continuous and best exposed sections of marine Silurian and early Lower Devonian rocks in the Appalachian Mountain system. The village of Arisaig lies on Newfoundland Strait, 15 mi northeast of Antigonish. The area studied extends along the coast from McAras Brook (3 mi southwest of Arisaig) to McKinnons Brook (3 mi northeast of Arisaig) and includes the nearby related regions of Cape George and Lochaber. The coast sections have been the subject of several investigations, but no previous workers have mapped the formations inland in detail.

The rocks of the Bears Brook Volcanic Group and the Arisaig Group were emplaced between orogenic events of Late Ordovician and Middle Devonian ages. The 5,000 ft of sedimentary rocks in the Arisaig Group make up the only fossiliferous section within Nova Scotia containing representatives of every stage of the Silurian Period. The brachiopod evidence and primary structures in some of the rocks (for example, channels and current bedding) strongly point to very shallow water deposition for the greater part of the section. This succession of siltstones and mudstones is unique world-wide in providing an almost continuous faunal record of very shallow water conditions rather than an alternation of diverse depth environments. The *Eocoelia* and related benthic animal communities persist from the lower Llandovery through the entire Silurian and well into the lower Gedinnian portion of the Lower Devonian System. It seems probable that the source of the sediments lay some tens of miles to the north and northwest, and for the lower part of the group, possibly to the southeast. The only times when conditions changed radically were during the deposition of the red member of the Moydart Formation and the Knoydart Formation; both are nonmarine, but neither shows any significant increase in grain size.

These rocks relatively unmetamorphosed (never higher than the chlorite facies), have been intensely folded and faulted, beginning with disturbances associated with the Middle Devonian Acadian orogeny and extending into later Paleozoic and possibly Triassic time. The complex structure is outlined here in more detail than in previous reports. During Gedinnian time, the entire region became a site of nonmarine, Old Red Sandstone–type deposition, but there is no evidence for any stratigraphic break between the underlying marine and the overlying nonmarine beds. The Devonian vertebrates are similiar to those found in the Welsh Borderland of England.

The rhyolitic and basaltic volcanic rocks underlying the marine Silurian rocks of the Arisaig area are described in some detail for the first time; their precise age is still uncertain, although a Late Ordovician or Early Silurian age is likely.

The Arisaig succession is discussed in relation to the paleogeography of the adjacent part of the Appalachians.

CONTENTS: Acknowledgments. Abstract. Introduction. Purpose and Scope of the Investigation (by W. S. McKerrow and A. J. Boucot). Previous Geological Work (by W. S. McKerrow). Work by Present Authors (by W. S. McKerrow). Geological Setting (by W. S. McKerrow). Physical Features. Topography and Superficial Deposits (by W. S. McKerrow and C. F. Hickox). Topographic Nomenclature (by W. S. McKerrow). Tides and Tide Marks (by W. S. McKerrow). General Geology. Description of Formations. Browns Mountain Group (by W. S. McKerrow). Bears Brook Volcanic Group: Dunn Point Formation, McGillivray Brook Formation, Malignant Cove Formation (by J. F. Dewey and A. M. Ziegler). Arisaig Group: Beechhill Cove Formation, Ross Brook Formation, French River Formation, Doctors Brook Formation, McAdam Brook Formation, Moydart Formation, Stonehouse Formation (by W. S. McKerrow, A. J. Boucot, and C. F. Hickox). Arisaig Group: Knoydart Formation (by D. L. Dineley and C. F. Hickox). Structural Geometry and History (by J. F. Dewey and W. K. Fyson). Geological History. Bears Brook Volcanic Group: Dunn Point Formation, McGillivray Brook Formation, Malignant Cove Formation (by J. F. Dewey). Arisaig Group: Beechhill Cove Formation, Ross Brook Formation, French River Formation, Doctors Brook Formation, McAdam Brook Formation, Moydart Formation, Stonehouse Formation (by W. S. McKerrow, A. J. Boucot, and D. L. Dineley). Lochaber Area (by A. J. Boucot). Lower Paleozoic Rocks of the Cape George Area (by J. G. Griffin, A. J. Boucot, and R. Fletcher). Regional Relations (by A. J. Boucot). Acadian Orogeny (by A. J. Boucot and W. S. McKerrow). Appendix: Fossil Localities (by W. S. McKerrow). General References. Index.

Bibliography of Continental Drift and Plate Tectonics

SPECIAL PAPER 142 — By Tina Kasbeer. 1972. xiv + 96 pages. Paperbound. ISBN: 0-8137-2142-3. $6.75.

Bibliography of Continental Drift and Plate Tectonics, Volume II

SPECIAL PAPER 164 — By Tina Kasbeer. 1975. vi + 152 pages. Paperbound. ISBN: 0-8137-2164-4. $13.00.

These two bibliographic volumes, which contain a combined total of 2,784 entries, are prefaced by the author's statement that "the annotations are not those of a professional geologist or geophysist." On the other hand, the annotations are guaranteed to show no favoritism of specialty.

Citations listed in the Origin and Development sections represent the most important papers written by those who made some original or substantial contribution to the idea and to its development; works of authors most often cited by others; and historical summaries of the concept by authors.

Arrangement is chronological, by the date of publication, if known, or by the date of presentation to an audience, if this is the case. Subarrangement is by the last name of the author. The number of references or footnotes in the article or work is included if ten or more in number.

The indexes list authors of publications, by last name, with the dates referring to the chronological entry. Selected cross-references are made to articles citing another entry.

CONTENTS — Special Paper 142. Section I: Origin and Development through 1971. Author Index with Selected Cross-References. General Articles. Sea-Floor Spreading and Mid-Ocean Ridges. Paleomagnetism and Rock Magnetism. Section II: Convection Currents. Other Lines of Evidence: Glacial, Evaporites, Paleontological. Expansion Theory. Monographs. Symposia: Aspects of Tethyan Biogeography; Continental Drift (1962); Continental Drift (1965); Continental Drift (1966); Continental Drift, Theory (1928); Continental Drift, Theory (1951); Continental Drift, Present Status; Continental Drift, Secular Motion of Pole; Geophysical Studies on Evolution of Earth's Interior; Gondwanaland Revisited; History of the Earth's Crust; Megatectonics of Continents and Oceans; North Atlantic—Geology and Continental Drift; Polar Wandering and Continental Drift (1958); Polar Wandering and Continental Drift (1960); Problem of Land Connections Across South Atlantic; Problem of Oceanization in Western Mediterranean; Rock and Paleomagnetism; Structure of Crust and Mantle; World Rift System. Master Index of Authors, Sections I and II.

CONTENTS — Special Paper 164: Origin and Development. General Articles. Sea-Floor Spreading. Paleomagnetism. Convection. Expansion. Other Lines of Evidence. Mineral and Fuel Exploration. Seismological Aspects. Monographs. Symposia and Special Issues: Archaen Rocks; Australia and Continental Drift; Continental Drift; Continental Shelves—Origin and Significance; East African Rifts; Experimental Petrology and Global Tectonics; Exploitation des Océans; Geological Interpretations from Global Tectonics with Applications for California Geology and Petroleum Exploration; Geology and Stratigraphy of the Gondwana System; Geophysical Exploration of the Ocean Bottom; Global Tectonics and Sea-Floor Spreading; Implications of Continental Drift to the Earth Sciences; Mechanisms of Plate Tectonics; Nature of the Solid Earth; Ocean Basins and Margins; Organisms and Continents through Time; Plate Tectonics; Recent Movements of the Earth's Crust and Continental Drift in Connection with Deep Structure; Structure et Dynamique de la Lithospherè; Studies in Earth and Space Sciences; Time and Place in Orogeny; Western Pacific, Island Arcs, Marginal Seas, Geochemistry. Author Index.

Bibliography of Theses in Geology, 1967-1970

SPECIAL PAPER 143 — Edited by Dederick C. Ward. 1973. viii + Bibliography, 160 pages, and Subject Index, 274 pages. Paperbound. ISBN: 0-8137-2143-1. $17.00.

This bibliography is the final monograph in the series that was inaugurated in 1958 by John and Halka Chronic and the Petroleum Research Corporation. Monographic supplements were published by the American Geological Institute for the periods 1958-1963, 1964, and 1965-1966. Citations of masters and doctoral theses for 1971 and subsequent years have been published in the monthly issues of the GSA *Bibliography and Index of Geology* since July 1972 where they continue to be cited and indexed. At present, there are no plans to publish future titles in a separate publication.

Theses cited in this bibliography were obtained by soliciting the geoscience departments listed in the 1968 and 1970 editions of the AGI *Directory of Geoscience Departments, United States and Canada.* The bibliography consists of five sections: (1) listing of the theses grouped into 21 intra-disciplinary categories corresponding generally to the published format of v. 36 of the GSA *Bibliography and Index of Geology*; (2) subject index, following the form of the GSA *Bibliography and Index of Geology*; (3) author index arranged alphabetically; (4) index of geologic names, a listing of the stratigraphic units included in titles of the theses listed within the volume; and (5) list of degree-granting institutions, with mailing addresses.

CONTENTS: Preface. Bibliography. 01 Areal Geology. 02 Economic Geology. 03 Engineering and Environmental Geology. 04 Extraterrestrial Geology. 05 Geochemistry. 06 Geochronology. 07 Geohydrology. 08 Geomorphology. 09 Igneous and Metamorphic Petrology. 10 Marine Geology. 11 Mineralogy and Crystallography. 12 Miscellaneous. 13 Paleobotany. 14 Paleontology, General. 15 Paleontology, Invertebrate. 16 Paleontology, Vertebrate. 17 Sedimentary Petrology. 18 Soils. 19 Solid-Earth Geophysics. 20 Stratigraphic and Historical Geology. 21 Structural Geology. Subject Index. Author Index. Index of Geologic Names. Directory of Colleges and Universities.

Review and Index Through 1975 of Genus Candona (Ostracoda) in North America (exclusive of Pre-Quaternary Species)

MICROFORM PUBLICATION 6 — By Larry N. Stout. 1976. 82 pages on one 98-frame fiche for use on 24x readers. ISBN: 0-8137-6006-2. $3.00.

The purpose of this paper is to collate and review the widely scattered information published prior to 1976 that bears on the ostracode genus *Candona* in the nearctic realm. Citations of European species in the North American literature are indexed only where there is clear reference to or probable bearing on nearctic material. Ostracodes reported from Greenland are not considered. Tertiary and older fossils are not considered, principally because the author is not familiar with pre-Quaternary species; there are apparently no demonstrable relations between those species and the much better known species of Quaternary age which are treated here.

It is difficult to characterize the present state of taxonomy of Genus *Candona*, since no unifying or comprehensive systematic work—that is, no revision—has ever been accomplished; the widely variable quality of taxonomic work is noteworthy, and on the whole, advancement has not gone past the initial descriptive level.

Specific, subspecific, and "unavailable" names are entered in the index in alphabetical order, followed by the few unnamed described and (or) illustrated forms in chronological order. Under each entry is a chronological index to the literature, including page and illustration numbers, as well as reported geographic and geologic range. Intervals of Quaternary geologic time have been generalized. There is a total of 102 entries, including 97 names.

Brief annotations of several kinds are given after certain of the literature citations; mainly, these indicate those citations that merely represent checklists, faunal lists, or trivial mentions and thus will aid the reader in distinguishing such papers from those of greater taxonomic significance.

Following the index under each entry are notes and subjective annotations pertaining to validity and synonymy. The author's taxonomic views are based upon familiarity with the literature and upon his own published and unpublished studies of fossil and modern ostracodes, mainly in Missouri. It is hoped that these annotations, which constitute the review, will help prevent further propagation in the literature of dubious names and call attention to a variety of taxonomic problems which previously have been overlooked and even ignored.

For species of probable validity, an assessment of known range is given. Additional distributional information from unpublished sources (theses and the author's collections) is cited where such sources are judged reliable and where a substantial contribution to knowledge of range is gained.

This index is intended to be exhaustive, but undoubtedly some trivial use of names and some obscure faunal lists have been overlooked; the author believes that no paper of taxonomic significance has been omitted from consideration. There are 118 references cited.

May BULLETIN briefs

Brief summaries of articles in the May 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.*

☐ 70501—Tectonic evolution of the FAMOUS area of the Mid-Atlantic Ridge, lat 35°50′ to 37°20′N. *Ivar B. Ramberg, Department of Geology, Stanford University, Stanford, California 94305 (present address: Department of Geology, Oslo University, Blindern, Oslo 3, Norway); Dale F. Gray, Department of Geophysics, Stanford University, Stanford, California 94305; Robert G. H. Raynolds, Department of Applied Earth Sciences, Stanford University, Stanford, California 94305.* (12 p., 13 figs.)

The FAMOUS area, which straddles the Mid-Atlantic Ridge on the southwest extension of the Azores Plateau in the Atlantic Ocean, has been studied by means of morphotectonic and magnetic anomaly analysis. Major morphologic elements are (1) the rift valleys and associated fault blocks, (2) the transform faults, and (3) diagonal linear trends intersecting the azimuths of the rift valleys and transform faults. Within the past 6 m.y. the area has been characterized by a reorientation of the spreading axis, from an oblique trend toward an orthogonal pattern relative to the transform faults. The long and nearly continuous early spreading axis, with a strike of N50°E, broke up into smaller rift segments, which progressively rotated to their present strike (about N23°E) and now appear to be recombining through asymmetric spreading to form the continuous axis it now has. The process involved complex migrations of the larger rift segments through asymmetric spreading, as well as jumping of shorter rift segments and migration of transform faults, the latter mechanism leading to the diagonal troughs. The presence of parallel spreading axes and the propagation of rift axes may be due to coupling across transform plate boundaries. These boundaries are complex shear zones with tension cracks and en echèlon fault scarps deviating from the overall trend of the zone; this implies that the fracture zones might be leaky. The reorientation of the spreading axis in the FAMOUS area seems not to be a unique event but a phenomenon that has been repeated periodically. It has tentatively been correlated with recurrent plume activity below the Azores Plateau.

☐ 70502—Deep-tow studies of the structure of the Mid-Atlantic Ridge crest near lat 37°N. *Ken C. Macdonald, Institute of Geophysics and Planetary Physics, Scripps Institution of Oceanography, La Jolla, California 92093 (present address: Marine Physical Laboratory and Geological Research Division, Scripps Institution of Oceanography, La Jolla, California 92093); Bruce P. Luyendyk, Department of Geological Sciences, University of California, Santa Barbara, California 93106* (16 p., 16 figs., 2 tbls.)

A detailed study of the structure of the Mid-Atlantic Ridge median valley and rift mountains near lat 37°N (FAMOUS) was conducted using a deep-tow instrument package. The median valley may have either a very narrow inner floor (1 to 4 km) and well-developed terraces or a wide inner floor (10 to 14 km) and narrow or no terraces. The terraces appear to be non–steady-state features of the rift valley. The entire depth and gross morphology of the median valley may be accounted for by normal faulting, while volcanic relief contributes to the short-wavelength topography (<2 km). Most faults dip toward the valley axis an average of 50°, and the blocks are tilted back 2° to 3°. Fault dip is asymmetric about the valley axis. Active crustal extension in the inner floor and inner walls has the same sense of asymmetry as the local spreading rates, reaching a maximum of 18 percent. Thus, asymmetric spreading appears to be accomplished by asymmetric crustal extension on a fine scale as well as by asymmetric crustal accretion. Spreading is 17° oblique to the transform faults and shows no indication of readjusting to an orthogonal system, even on a fine scale. Eighty percent of the decay or transformation of median-valley relief into rift-mountain topography is accomplished by normal faults that dip away from the valley axis. Most of the outward-facing faulting occurs near the median-valley–rift-mountain boundary. Tilting of crustal blocks accounts for only 20 percent of the decay of median-valley relief. Most long-wavelength topography in the rift mountains has a faulted origin. As in the median valley, volcanic relief is short wavelength (<2 km) and appears to be fossil, originating in the median-valley inner floor. Bending of large faulted blocks toward nearby fracture zones suggests that spreading-center tectonics is affected by fracture-zone tectonics throughout the length of the rift in the FAMOUS area. Both the crustal accretion zone and transform fault zone are narrow, only 1 to 2 km wide, over short periods of time. In the course of millions of years, however, they apparently migrate over a zone 10 to 20 km wide.

☐ 70503—Magnetic study of basalts from the Mid-Atlantic Ridge, lat 37°N. *H. Paul Johnson, Cooperative Institute for Research in Environmental Sciences, University of Colorado/NOAA, Boulder, Colorado 80309 (present address: Department of Oceanography, University of Washington, Seattle, Washington 98195); Tanya Atwater, Department of Earth and Planetary Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.* (11 p., 14 figs., 1 tbl.)

An intensive paleomagnetic and rock magnetic study has been carried out on the basalt samples from the FAMOUS area of the Mid-Atlantic Ridge at lat 37°N. In addition to the samples obtained by the submersible *Alvin* from the floor and walls of the central rift valley, dredge and rock-drill samples were taken on a line perpendicular to the axis of the ridge out to a distance of 30 km from the central valley. Although the rocks from the floor of the central valley were roughly uniformly magnetized, a strong decrease in remanence intensity occurred at the valley walls. This progressive decrease continued until the remanent intensity was reduced by a factor of 5 at a distance 10 km and farther from the ridge axis. The other magnetic parameters of weak-field susceptibility, median demagnetizing field, Q, and Curie temperature were also roughly constant in samples from the valley floor. However, the rise in Curie temperature, which began at the valley walls, was well correlated with the decrease in remanent intensity and Q, an increase in the median demagnetizing field, and a sharp increase and then slow decrease in susceptibility; this rise can be attributed to the low-temperature oxidation of titanomagnetite to titanomaghemite. Of the 9 vertically oriented samples that were obtained from the valley floor and inner west wall, seven were normally magnetized and two were reversely magnetized. The two reversely magnetized units from the valley floor and east wall may be from blocks of older, pre-Brunhes crust that have not yet moved out of the rift valley. Comparison of the magnetic results of the surface rocks with models of the associated magnetic anomalies suggests that the oceanic magnetic layer can be represented by a permeable zone of pillow basalts roughly one km thick and that the oxidation state of these pillows progressively increases with time.

☐ 70504—Physiography and structure of the inner floor of the FAMOUS rift valley: Observations with a deep-towed instrument package. *Bruce P. Luyendyk, Department of Geological Sciences, University of California, Santa Barbara, California 93106; Ken C. Macdonald, Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543 (present address: Institute of Geophysics and Planetary Physics, University of California, San Diego, La Jolla, California 92093).* (16 p., 14 figs., 2 tbls.)

A deep-towed instrument survey was made of the floor of the rift valley in the Mid-Atlantic Ridge near lat 37°N (FAMOUS project). Near-bottom bathymetry, side-looking sonar (SLS), and wide-angle photography are among the data brought to bear on the definition of the American-African plate boundary and the intrusion-extrusion zone between these plates. The valley floor is 1 to 4 km wide and contains eight elongate shield volcanoes that occupy 40% of the axis. Where the volcanoes—called central highs—are absent, there are sometimes shallow depressions—called central lows. Photographic data show three components to the near-bottom environment: massive pillow lavas, well-sorted rock fragments, and sediment cover. Sediment is ubiquitous in all the photos but is scarcest along the axis of the valley floor. Pillows appear the freshest on the central highs except for one locality found at the extreme east side of the valley floor. The rock fragments are evidently pillow joint blocks and are associated with spalling off steep flow fronts and fracturing from faulting. Less well sorted fragments are associated with the large-throw step faults at the edges of the valley floor. Pillow elongation approaches 10:1 and possibly indicates flow directions both across and along contour. Numerous fissures and small-throw step faults were also seen. The SLS records show that the smoothest areas are the well-sedimented regions off the central highs that are yet to be broken by faulting at the floor edges. More than 700 faults were mapped in the valley-floor region. They trend parallel to valley strike (N17°E) and are generally absent within 500 m of the axis. Fault density is highest at the east inner floor edge, reaching $35/km^2$. Fissures are present in photos but are not readily recognized with SLS data. Flow edges or ridges also align near N17°E, but some trend across strike. SLS point targets 25 m high and about 50 by 50 m represent volcanic conelets (haystacks). These align in groups and often are associated with faults. They are not detected away from the axis.

The floor is intensely fractured with fissures and small-throw vertical faults as are parts of the inner walls; this is evidence that the region of tensional faulting is at least

5 km wide. The absence of faults near the axis due to volcanic burial suggests that the extrusion zone is as much as 1 km wide. The construction process in the floor is virtually entirely volcanic, but much of this relief is obscured by the intensive shear (normal) faulting found beyond the inner walls. Many geomorphic features of the floor have direct analogy with those in the Icelandic rift valley and the East Pacific Rise, although there are differences in scale.

☐ 70505—Ocean-bottom seismograph observations on the Mid-Atlantic Ridge near lat 37°N. *T.J.G. Francis, Cooperative Institute for Research in Environmental Sciences, University of Colorado/NOAA, Boulder, Colorado 80309 (present address: Institute of Oceanographic Sciences, Blacknest, Brimpton, Reading, RG7 4TJ England); I. T. Porter, Institute of Oceanographic Sciences, Blacknest, Brimpton, Reading, RG7 4TJ England; J. R. McGrath, U.S. Naval Research Laboratory, Washington, D.C., 20390.* (14 p., 18 figs., 1 tbl.)

Ocean-bottom seismographs were deployed twice in the FAMOUS area in 1973. Few earthquakes were observed on the first occasion, but 515 were recorded on the second with magnitudes ranging from 0 to 2.5. These occurred both in the median valley and in the fracture zone adjacent to the instruments. The latter events have been interpreted as activity along a single Riedel fracture cutting obliquely across the trend of the fracture zone. Only a crude velocity structure could be determined on the basis of the earthquake observations. A superficial surface layer with a compressional velocity of 2.7 km/s overlies a main layer with a P velocity of 5.0 km/s and a S velocity of 2.4 km/s. The low-velocity surface layer and the high ratio of P to S velocities for the main layer (2.08) reflect the highly fissured, water-saturated nature of the crust. The earthquake foci are thought to lie in the low-velocity surface layer. Finally, in spite of numerous small earthquakes, an acoustical analysis of the hydrophone data indicates that distant shipping traffic is the dominant source of ambient noise on this part of the Mid-Atlantic Ridge in the frequency band 5 to 32 Hz.

☐ 70506—Seismic evidence for a narrow zone of partial melting underlying the East Pacifice Rise at 21°N. *Ian Reid, John A. Orcutt, William A. Prothero, Institute of Geophysics and Planetary Physics, University of California, San Diego, La Jolla, California 92093* (5 p., 5 figs.)

Analysis of a seismic-refraction profile on the crest of the East Pacific Rise at 21°N reveals considerable lateral inhomogeneity in the velocity structure. A split profile, of a total length of 120 km, was shot to a tripartite array of ocean-bottom seismometer capsules on or close to the spreading axis. The recorded travel times and amplitudes indicate the presence of a low-velocity zone in the immediate vicinity of the spreading axis, at a depth of about 2.5 km below the sea floor. This low-velocity zone is not evident a few (∼10) kilometres from the axis.

Additional structural evidence was obtained from a deployment of the capsules at the intersection of the East Pacific Rise crest with the Rivera Fracture Zone, at 20°N. A group of small earthquakes was recorded by the seismometers, and, for ray paths traversing or close to the rise crest axis, the shear waves appear to be anomalously attenuated, particularly at shorter periods. While the evidence is not conclusive, it suggests the presence of a shear-attenuative region beneath the rise crest, presumably identical with the low-velocity zone and consistent with the interpretation of this zone as a region of partial melting.

☐ 70507—Evolution and origin of Ceará Rise: An aseismic rise in the western equatorial Atlantic. *Naresh Kumar, Robert W. Embley, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964.* (12 p., 8 figs.)

The Ceará Rise is an aseismic rise located in the western equatorial Atlantic between latitudes 3° and 8°N, and longitudes 38° and 48°W. An analogous feature, the Sierra Leone Rise, is located in the eastern equatorial Atlantic. These two rises on the two sides of Atlantic are bounded by the same fracture zones and are approximately equidistant from the ridge axis. The northern boundary of the two rises is formed by the 8°N fracture zone, whereas the southern boundary is formed by the 4°N fracture zone.

Seismic-profiler records show that the acoustic basement under the Ceará Rise is smooth in areas where it is also the shallowest. Moreover, areas of smooth and shallow acoustic basement coincide with the presence of a seismic layer with a velocity of 3.5 km/sec overlying the oceanic layer 2. These observations indicate that volcanic extrusives probably account for the basement relief of the Ceará Rise.

On the basis of the drilling data and on the basis of its distance from the Mid-Atlantic Ridge, we suggest that the Ceará Rise originated approximately 80 m.y. ago. At that time, the region of the Mid-Atlantic Ridge located between the 4° and 8°N fracture zones underwent a period of extensive volcanic extrusion. This volcanic pile reached a thickness of 2 km. As the spreading continued at the ridge, the volcanic pile was split into two segments. The western segment formed the Ceará Rise; the eastern segment formed the Sierra Leone Rise. The Ceará Rise has continuously subsided since its formation and has been covered by calcareous and siliceous pelagic sediments. However, a large influx of terrigenous sediments from the Brazilian margin, which coincided with the growth of the Amazon Cone since early Miocene time, has buried the western part of the rise under several kilometres of terrigenous sediments. The onlapping of terrigenous sediments over the flank of the rise has continued until at least the end of Pleistocene time.

☐ 70508—Late Quaternary sedimentation in the western equatorial Atlantic. *John E. Damuth, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964.* (16 p., 15 figs., 1 tbl.)

The late Quaternary terrigenous sediments of the continental margin and abyssal plains of the western equatorial Atlantic consist predominantly of hemipelagic silty clay rich in organic detritus with interbeds of redeposited silts and sands; deposition was cyclic and was controlled by glacial-interglacial climatic fluctuations. The redeposited beds are graded as much as several metres in thickness, and were episodically deposited by turbidity currents and related mass flows. Although the terrigenous component of the hemipelagic sediments was also transported to abyssal depths via gravity-controlled bottom flows, the pelagic component (foraminifera) of these sediments indicates that accumulation occurred relatively slowly (5 to

>30 cm/10^3 yr) and continuously for periods of as much as 100,000 yr. Thus some near-bottom process (other than simple downslope flow), such as redistribution and deposition by contour-following bottom currents, apparently was responsible for deposition of the hemipelagic sediment; however, evidence for such contour-current deposition is sparse.

The hemipelagic and redeposited sediments were continuously deposited during relatively long intervals (~90,000 yr) of low sea level that accompanied the Wisconsin and previous glacial phases. During these intervals the continental shelf was emergent, and river sediments were discharged directly into submarine canyons from where they could easily be transported downslope to the continental margin and abyssal plains. In contrast, during the relatively short intervals (5,000 to 20,000 yr) of high sea level that accompanied the Holocene, beginning of the Last Interglaciation (125,000 to 115,000 yr B.P.), and beginning of previous interglacial phases, the locus of river sedimentation migrated landward across the continental shelf. The low gradient and great width of the shelf plus strong longshore currents prevented seaward movement of sediment beyond the innermost shelf. Thus terrigenous sedimentation was briefly, but completely, halted throughout the entire basin and only pelagic sediments were deposited.

☐ 70509—Structure of the northern Brazilian continental margin. *R. E. Houtz, W. J. Ludwig, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964; J. D. Milliman, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543; J. A. Grow, U.S. Geological Survey, Woods Hole, Massachusetts 02543.* (9 p., 8 figs., 2 tbls.)

Results from two-ship seismic refraction profiles and supplementary data from several sonobuoys show that typical oceanic crust underlies both the landward and seaward sides of the North Brazilian Ridge. The Ceará Rise is also an oceanic structure, probably formed by local tectonic activity. Sediments of the upper Amazon Cone are more than 11 km thick, but they thin both landward and seaward. Owing to the great sedimentary thickness, refraction arrival times from oceanic basement could not be identified, but basement is assumed to extend under the cone.

☐ 70510—Sound-velocity characteristics of sediment from the eastern South American margin. *Robert E. Houtz, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964.* (3 p., 3 figs., 1 tbl.)

The eastern margin of South America has been divided into 14 zones, each with a characteristic sound-velocity distribution relative to depth below the sea floor, as determined from sonobuoy data. Regressions of sound-velocity data determined from one-way travel time for each region can now be used to compute thickness from vertical reflection data.

The velocity characteristics of the Pelotas Basin and Pelotas Rise are similar to those of the Amazon Cone and some other large deltaic deposits, which suggests that the discharge of the Rio de la Plata may have formerly been diverted along the shelf to the north. The velocity characteristics of the Rio Colorado Basin show that it is distinct from and cuts across the Argentine shelf and Argentine Rise. The Falkland Plateau velocity data are identical to the Argentine Rise contourites, suggesting a common provenance. Velocity characteristics in the adjacent Pelotas and Santos Basins are quite different, suggesting that the Torres Arch has been an important barrier for some time.

☐ 70511—Genesis and transformation of metalliferous sediments from the East Pacific Rise, Bauer Deep, and Central Basin, northwest Nazca plate. *G. Ross Heath, Graduate School of Oceanography, University of Rhode Island, Kingston, Rhode Island 02881; Jack Dymond, School of Oceanography, Oregon State University, Corvallis, Oregon 97331.* (11 p., 12 figs., 7 tbls.)

Analytical data for northwest Nazca plate sediments can be described in terms of a mixture of hydrothermal, detrital, hydrogenous, and biogenous material. Fe, Mn, Cu, Zn, Ni, Ba, Si, and Al are more than 50 percent hydrothermal in East Pacific Rise samples from lat 10° to 25°S. The first four elements are dominantly hydrothermal in the Bauer Deep and Central Basin as well. Seventy to 80 percent of the Ni, 60 to 80 percent of the Ba, and 30 to 60 percent of the Cu and Zn in Bauer Deep and Central Basin sediments are hydrogenous. Si, Ba, and Zn are dominantly biogenous on the northern East Pacific Rise crest, where more than one-third of the Cu also is derived from this source. Detrital Al and Si are dominant away from the rise crest, particularly in the Central Basin, where about 40 percent of the Fe and 15 percent of the Zn may also be detrital. Much of the hydrothermal Fe and biogenous Si have been transformed to an iron-rich smectite. The proportion of total Fe bound in this phase varies from less than 20 percent on the southern rise crest to about 40 percent in the Bauer Deep.

The distribution of each element is governed by (1) supply from the four basic sources; (2) lateral transport by bottom currents moving east and then south across the northern East Pacific Rise and Bauer Deep to the Central Basin and moving west from the Peru Basin to the Central Basin; and (3) transformation of the unstable metalliferous hydroxides into more stable smectite and ferromanganese oxyhydroxides.

☐ 70512—Post-Pleistocene history of the United States inner continental shelf: Significance to origin of barrier islands: Discussion and reply. (3 p.)

Discussion: Ervin G. Otvos, Jr., Geology Division, Gulf Coast Research Laboratory, Ocean Springs, Mississippi 39564.

Reply: Michael E. Field, U.S. Geological Survey, Pacific-Arctic Branch of Marine Geology, Menlo Park, California 94025; David B. Duane, Grants Management Program, National Sea Grant Program, NOAA, Washington, D.C. 20235.

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