GSA news & information

SUPPLEMENT TO GEOLOGY MAGAZINE

MARCH 1976

Report of the President

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

The presidents of our Society have generally reached an age when an observable acceleration of time is apparent to them. The presidential year, measured from annual meeting to annual meeting, was shortened to 11 months in 1975, in addition to being normally speeded up by the age effect. Within this foreshortened period much happened, however, some of which was good, some bad. 1975 was a year of ferment, and although some vinegar was produced, I feel the vintage will be of value to the membership for some time to come.

1975 was the first full year under John C. Frye as executive director, and those of us close to the headquarters operation have been at first amazed, and then delighted with the sure way John has taken up the role as leader after a very short learning period on the job. Last year Clarence Allen discussed some of our financial problems and the matter of living with the combination of inflation and concomitant market losses. We came very close to being inundated in red ink; a continued trend would have produced permanent damage to the Society. One of our problems was an archaic bookkeeping system; it was essentially impossible to know how the Society was faring on any reasonably short-term basis, and it was rather like trying to pilot a jet airplane without forward visibility, by being able to see only the contrail, several miles back. Steve Hoskin has set up a modern system; we now know our position at any time, and can make any necessary correction. John, with Steve's help, has taken a good hard look at the problems, and with the full cooperation of the Executive Committee and the Council, a series of corrective fiscal measures have been put in effect, with the goal of a balanced budget by 1976. The details of the fiscal problems will be found in the Report of the Executive Director—suffice it to say that, among other things, the Society had been subsidizing the membership at a time when publication costs were inflating rapidly.

Some of these actions have produced a goodly amount of noise, and it is our aim to develop better communications among headquarters, Council, the sections and divisions, and the membership. This becomes more difficult as the Society grows, but direct personal oral or written contact with Members and Fellows is important, and I urge all of you to get in touch with the executive director, officers, or councilors on issues that you feel should be aired. Several more formal things have been instigated to improve communication. A meeting of the Executive Committee was held in Boulder in January 1975 with a designated officer from each associated society, and improvements were made in such things as annual meeting arrangements and the handling of abstracts and programs. Incidentally, the Cushman Foundation was admitted in 1975 to the group of associated societies of GSA. Another such meeting will be held in January 1976. Some of the section officers have felt "out of touch" with Society affairs, and it was decided that an officer from each section would be invited to attend the Council meetings as an observer. We hope these actions will help promote a two-way increase in understanding, for not only must the Society be sensitive to the wants of the membership, but the membership should understand the problems faced in Boulder.

The section meetings this year were very successful, and it is my impression that they are playing an increasingly important role in amplifying and complementing the presentations and interactions at the annual meeting. I have also been impressed by the size of the student registration

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and the number of student papers presented at those meetings that I have attended.

By the time this appears in print, we will have a better idea of how well the various membership dues option choices fared in terms of budgetary needs. We will also have a much better picture of the membership response to the several publishing ventures involved with the option. Let me remind you that this multiple choice policy is the result of membership suggestions; and, as it is still being tested, we solicit further suggestions as to how various options should be set. A proper scaling of charges is of course essential to the well-being of the Society.

The publication program is one of the two most important functions of the Society (along with the sponsorship of the annual and sectional meetings), and thus the position of science editor is one of the more important positions. Toward the end of the year Bennie Troxel, who has been a most energetic and innovative science editor, resigned to assume a position with the California Division of Mines and Geology. The Executive Committee began an immediate search for a new editor, with the realization that it would be most unlikely that a person of the appropriate calibre would be found in the time before Bennie's departure. By October we had narrowed the field of candidates essentially to a single choice, and although at the time of this writing a firm agreement has not yet been reached, I hope that when this report comes off the press we will be able to announce the name of the new science editor. Since November Warren Hobbs has been interim science editor, and we are most grateful to him for the responsible and professional job he is carrying out.

The Salt Lake City meetings were quite successful and well attended. A number of people commented on the relaxed nature of a meeting in a city of ample size, yet one not bustling with the pressures of a truly large metropolitan area. Our thanks go to the Local Committee and to the highly effective student associates who did so much. I would also personally like to publicly express my appreciation to the GSA headquarters staff, not only for activities related to the Salt Lake City meeting, but for their cooperation, kindness, and grace during the entire year.

Respectfully submitted,

JULIAN R. GOLDSMITH, President

Report of the Executive Director

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

1975 was a year of change, adjustment, and belt tightening for the Society. When the books were closed for fiscal year 1974, it was shown that the Society had incurred an operating deficit of more than one-third million dollars during the year. When this was added to smaller operating deficits incurred during the two previous years, it was apparent that the general reserve fund was fully committed, and that it was essential that operations be put on a basis where income for the year at least equaled the costs of operation. Clearly, this called for measures that would increase income and that would reduce costs. Two complicating factors were that the income from endowments had declined as a result of adverse market conditions and that the cost of "doing business as usual" was inflating at a rate exceeding 10 percent per year.

I am sure that the entire membership is aware of the changes that have been made in the dues structure, accompanied by a series of dues options so that a member is required to pay for only those publications received. Perhaps you are less aware of the increases made in the nonmember subscription prices that place the rates for 1976 at $70 for the *Bulletin* and $18 for *Geology*. Earlier, the pricing structure for book publications also had been realistically adjusted.

Wide ranging economies were instituted. The major cost cutting measure was a 12 percent reduction in personnel in the headquarters staff. Among the many other changes to reduce costs were the discontinuance of *The Geologist* as a separately printed and mailed newsletter, elimination of the separate publication of an annual report, and discontinuance of direct-mail communication and direct-mail book advertising to the members. All of these functions, as well as announcements and registration forms for all meetings, were combined in the News & Information section, printed and mailed with *Geology*. The costs of division newsletters, and other items of

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division business, were shifted to the individual division's dues. Budgets for Annual Meeting and Penrose Conferences are constructed so that the meeting income will pay for the meetings' costs. Modifications in the book publishing program were approved by the Council. These consisted of a policy requiring marketability to be a factor in approval of "hard copy" publication of Memoirs and Special Papers, accompanied by the establishment of a Microform Publications series that may be used to publish—at greatly reduced cost—contributions with smaller sales potential. Also, some of the responsibility for editing and proofreading of book publications is being shifted from the headquarters staff to the authors or volume editors. In the business department, economies have been effected by total computerization of dues billing and meeting preregistration as well as for cost accounting. Minor items such as the change in membership cards and the use of bulk mail rates for distribution of ballots and dues statements result in a significant saving when multiplied by 12,000.

This year's report seems dominated by fiscal matters—and for good reason; budget control was of paramount concern during 1975. Current projections are that the Society will operate within its income during 1976.

Operation of the Society proceeded smoothly during 1975. The resignation of Bennie Troxel as science editor on October 1 caused a temporary "log jam" of *Bulletin* manuscripts, but since Warren Hobbs took over as interim science editor in November, that situation was well on the way to being corrected by the end of the year. The Annual Meeting of the Society in Salt Lake City was an outstanding success and was well attended. All six sections also had successful annual meetings. The employment service was extensively used during the year, and a record number of interviews were arranged at the Salt Lake City meeting. Although financial constraints required a reduction to $50,000 available for research grants, this sum was augmented by contributions from industry and individuals. The flow of manuscripts to the *Bulletin* continued to increase. During 1975, the number of book publications sharply increased above 1974. The Map and Chart series, approved during the previous year, was begun during 1975, as was the approval and initiation of the new Microform Publication series. Three book-length items were published on microfiche during 1975, and at year's end there were 111 standing orders for the series.

This was the first year for production of the *Bibliography* by GeoRef under the terms of the contract between GSA and AGI. I am very pleased to report that subscriptions to the *Bibliography* were adequate to place the entire operation in the black, including the cost of a new computer program that will result in future economies. One volume was issued in the *Treatise on Invertebrate Paleontology*. During the year the roster of Fellows and Members increased by 458, or nearly 5 percent. Student Associates at the end of the year numbered 2,179, and total recorded membership (Honorary Fellows, Fellows, Members, Students) stood at 12,012.

Respectfully submitted,

JOHN C. FRYE, Executive Director

Critical readers of manuscripts

John F. Abel, Jr.
Jaime Amorocho
James R. Anderson
R. N. Anderson
Tom Anderson
John T. Andrews
R. Arculus
Tanya Atwater

H. Baadsgaard
Robert G. Bailey
A. K. Baird
Victor R. Baker
Alfred H. Balch
Hugh R. Balkwill
Peter Barker
Allan G. Barrows
Paul C. Bateman
Myrl E. Beck
John Behrendt
John F. Bender
Brock B. Berstein
William Berry
Myron Best
Marion E. Bickford, Jr.
Shawn Biehler
John M. Bird
Peter Birkeland
Pierre Biscaye
Jim Bischoff
Arthur L. Bloom
Enrico Bonatti
A. J. Boucot
William F. Brace
John D. Bredehoeft
William J. Breed
Gerald F. Brem
John A. Brophy
Lucien M. Brush, Jr.
Wilfred B. Bryan
J. D. Bukry
William B. Bull
B. C. Burchfiel
Kevin Burke
C. Wayne Burnham
T. C. Buschbach
J. R. Butler
Frank M. Byers, Jr.

Wallace M. Cady
Lois J. Campbell
Russell H. Campbell
James E. Case
Rodger H. Chapman
Bill Chapple
John Christie
Michael Churkin
Jon F. Claerbout
G. Michael Clark
H. Edward Clifton
Preston Cloud
Donald R. Coates
George V. Cohee
Lewis Cohen
Charles Collinson
Gordon Connally
Harry E. Cook III
Ted Cook
Dexter A. Craig
T. L. Crisman
Max D. Crittenden
Bruce Crowe
K. L. Currie
Robert Curry
Bruce F. Curtis

Frank Dachille
R. D. Dallmeyer
Ian Dalziel
E. Julius Dasch, Jr.
George H. Davis
Walter E. Dean
Peter Deines
Stephen E. DeLong
Gabriel Dengo
Charles S. Denny
Dirk De Waard
John Dickey
Frank W. Dickson
Menno G. Dinkelman
Roberta Dixon
Ernest Dobrovolny
Bruce R. Doe
Donald Doehring
Fred Donath
Thomas W. Donnelly
Avery A. Drake, Jr.
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REPORT OF THE EXECUTIVE DIRECTOR (continued)

Harald G. Drewes
Wendell A. Duffield
David E. Dunn
George Dury
J. Thomas Dutro, Jr.
Jack Dymond

Thomas Early
H. R. Wynne Edwards
John D. Edwards
Don L. Eicher
M. T. El-Ashry
David Elliott
Rudy C. Epis
Anita Epstein
W. G. Ernst
Frank Ethridge
Martin C. Everitt

Donald W. Fisher
George W. Fisher
Richard V. Fisher
Robert L. Fisher
Robert W. Fleming
Jean J. Flint
Richard Foster Flint
Richard M. Forester
R. O. Fournier
Paul J. Fox
William T. Fox
Gordon S. Fraser
Tom Freeman
Mike Fuller

Gordon Gastil
Don Gault
Bruno Gilitti
Robert Ginsburg
Lynn Glover III
S. S. Goldich
R. P. Goldthwait
H. G. Goodell
H. W. Green II
Edward S. Grew
David L. Gross
A. J. Gude
Charles V. Guidotti

B. C. Haimson
Leo M. Hall
Martin Halpern
Warren B. Hamilton
S. R. Hammond
Wallace R. Hansen
Bruce B. Hanshaw
Gilbert N. Hanson
R. B. Hargraves
Edwin L. Harp
James W. Hawkins
Richard L. Hay
Carl E. Hedge
Yvonne Herman-Rosenberg
Robert R. Hessler
David Hewitt

Michael W. Higgins
Glen R. Himmelberg
L. F. Hintze
F. D. Hole
Fred Horz
Richard K. Hose
Keith A. Howard
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Arthur Hussey
W. W. Hutchison
Andrew J. Hynes

John Imbrie
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T. N. Irvine

E. D. Jackson
David James
Stuart E. Jenness
Arvid M. Johnson
J. G. Johnson
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Martin Kane
David Karig
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Michael P. Kennedy
John Kepper
Keith B. Ketner
W. Kidd
John S. King
S. H. Kirby
George Klein
Hon-Yim Ko
John C. Kraft
Ralph Kretz
T. E. Krogh
LaVerne D. Kulm

Theodore C. Labotka
P. W. Lambert
Ralph L. Langenheim, Jr.
Marvin Lanphere
Edwin E. Larson
Roger L. Larson
James R. Lawrence
B. F. Leonard
Estella Leopold
Daniel Livingston
Donald Livingston
Dave Love
Baerbel Lucchitta
Bruce P. Luyendyk

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Ian MacGregor

Roger W. Macqueen
Marshall E. Maddock

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H. E. Malde
Jacqueline Mammerickx
C. John Mann
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Michael Marlow
E. F. McBride
Edwin H. McKee
W. D. Means
G. Medaris
Mark F. Meier
Jim Mercer
Daniel F. Merriam
Art Meyerhoff
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John A. Minch
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P. A. Mohr
Peter H. Molnar
Henry Moore
J. Casey Moore
Ted C. Moore
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P. T. Moyer
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Frederick Nagle
N. P. Nash
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Alan R. Neim
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A. Conrad Neumann
Donald Noble
Warren J. Nokleberg
Rodney D. Norby
Carl E. Norman
William R. Normark
Stephen A. Norton

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John D. Obradovich
Gerhard F. M. Oertel
S. D. Olmore
James R. O'Neil
Tom Ovenshine

Linc Page
Ronald Parker
David Parrish
W.S.B. Paterson
F. J. Pearson
Joe W. Peoples
R. I. Perla
Zell E. Peterman
Mike Peterson
Troy L. Pewe
Joseph Phillips
John A. Philpotts

William G. Pierce
Howard Pincus
George Pinder
Donald Potter

D. M. Ragan
Charles Raymond
Richard Reger
Mitchell W. Reynolds
Lawrence V. Rickard
Michael Roberts
Charles S. Robinson
G. D. Robinson
J. A. Roddick
William Pat Rogers
Arthur W. Rose
William I. Rose, Jr.
John L. Rosenfeld
Peter Roth
D. W. Roy
Robert V. Ruhe

D. A. St. Onge
Michael L. Sargent
W. Z. Savage
Samuel M. Savin
Robert F. Schnabel
David W. Scholl
Tom Schopf
George Schor
M. A. Schuepbach
Stanley A. Schumm
Robert L. Schuster
Henry P. Schwarcz
Dave H. Scott
Glenn R. Scott
Robert F. Sharp
Daniel R. Shawe
Robert E. Sheridan
Jo-Ann Sherwin
Eugene A. Shinn
Eugene M. Shoemaker
Ronald L. Shreve
Eli Silver
G. W. Simila
John D. Sims
Leslie A. Sirkin
James W. Skehan, S.J.
R. A. Slater
Rudy L. Slingerland
William Sliter
James Slosson
Harry Smedes
J. D. Smith
Norm Smith
Stewart W. Smith
Norman Sohl
Choule J. Sonu
Julian Soren
John B. Southard
Henry Spall
Rolfe S. Stanley

Francis G. Stehli
Randolph P. Steinen
Maureen Steiner
David B. Stewart
John C. Stormer
Victor T. Stringfield
Don Swift
David Symons

Hugh R. Taylor, Jr.
R. Taylor
Maurice Terman
Fritz Theyer
Jorn Thiede
R. Thorsteinsson
Robert I. Tilling
Othmar T. Tobisch
Kenneth M. Towe
Peter Trescott
Terry E. Tullis
Ogden Tweto

P. R. Vail
Tj. van Andel
Rob Van der Voo
W. R. Van Schmus
Peter R. Vogt

Clyde Wahrhaftig
R. G. Walker
Theodore R. Walker
Peter L. Ward
John E. Warme
A. B. Watts
William J. Wayne
Charles E. Weaver
Edwin P. Weeks
Johannes Weertman
David Weide
John A. Westgate
John Wheeler
George W. White
Donald Whitehead
James Whitney
Thomas R. Wildeman
H. Williams
Howel Williams
Gar Willis
H. B. Willman
A. O. Woodford
John Wray
Lauren A. Wright
Thomas L. Wright
Chester Wrucke

Robert S. Yeats
Warren Yeend
R. F. Yerkes

Robert E. Zartman
Herman B. Zimmerman

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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 Anthony J. Naldrett, B. Clark Burchfiel, William E. Benson, conferee, and George deVries Klein, Chairman, met in Boulder at Society headquarters on March 10 and 11, 1975. Each member of the committee had studied all proposals prior to the meeting, and the review process was thus extremely efficient.

The committee regretted the necessity that the budget was reduced to $50,000, which forced GSA to award fewer grants with a lower average dollar amount for each grant. Generous industrial donations from The Mobil Oil Corporation, Ashland Oil, Inc., The Gulf Oil Foundation, Texaco, Inc., Marathon Oil Co., Chevron Oil Field Research Co., Union Oil Company, and the Shell Development Co. permitted the committee to augment its awards by $11,500. Three hundred twenty applications were considered, of which 95 were recommended for support at an average of $657. Although the number and quality of applications were higher than in 1974, the committee could only support 30 percent of the applications received (compared to 55 percent supported in 1974). The committee was able to support promising scientists with the most exciting projects but at a considerably reduced rate compared with their requests and their actual needs. The total amount requested was $296,382 and the total recommended for support was $62,430 (see table).

The committee was pleased to award the first Harold T. Stearns Fellowship to Thomas R. Bultman of Yale University. The oil company funds were awarded to successful applicants whose research was relevant to the petroleum field.

The committee recommended to continue solicitation of industrial grants for a second year and also instituted a fund-raising drive from former recipients of Penrose Research Grants for fiscal year 1976.

The Penrose Research Grants represent one of the few sources of funds for the promising young Earth scientists with a need for modest support for dissertation research or for the more senior scientist with a worthwhile project needing only small and noncontinuing funds. The committee is pleased to have been a part of this process.

Respectfully submitted,

ANTHONY J. NALDRETT,
B. CLARK BURCHFIEL,
WILLIAM E. BENSON, Conferee,
GEORGE deVRIES KLEIN, Chairman

1975 RESEARCH GRANTS
SUMMARY OF COMMITTEE RECOMMENDATIONS AND COUNCIL ACTIONS

	Applicants	Requested by applicants	Recommended
Committee recommendations			
Category I (recommended for support)			
Senior investigators	3	$ 2,676	$ 1,500
Doctoral candidates	92	89,711	60,930
Subtotal	95	$ 92,387	$ 62,430
Category II (not recommended for support)			
Senior investigators	27	$ 30,629	
Doctoral candidates	198	173,366	
Subtotal	225	$203,995	
GRAND TOTAL	320	$296,382	$ 62,430
Council action			
Support all Category I projects	95	$ 92,387	$ 62,430
Approved applications withdrawn later	(3)	(2,795)	(1,950)
Alternates awarded	5	4,210	2,600
	97	$ 93,802	$ 63,080
Refunds from past recipients			(658)
TOTAL AMOUNT AWARDED IN 1975			$ 62,422

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Survey of annual meeting attendees completed

The GSA annual meeting has for years been attended by a diversified assemblage of Earth scientists. This very diversity has led to speculation and even inquiry about the range of interests, ages, and society membership of those in attendance. In order to develop at least partial answers to such questions, a series of boxes was provided on the preregistration forms for the Salt Lake City meeting. All respondents were asked to provide information. A total of 1,176 professionals preregistered for the meeting, and the following is a summary of their answers. It is of course possible that those registering on site would have answered differently, but the data provided at least gives a general profile of the meeting population.

First, the age range: The 26-to-35 age group led with 31 percent, followed by the 36-to-45 age group with 28 percent and the 46-to-55 age group with 20 percent. Only 4 percent were over the age of 65.

Type of employment showed a majority of the preregistrants in educational institutions of all kinds (51 percent); government employment (Federal and state) followed (21 percent); followed closely by consultants and industrial and commercial employment (20 percent).

Society affiliations indicated, as would be expected, that 68 percent were members of GSA. The multiple memberships caused the total of this column to reach 184 percent, in spite of the fact that 8 percent of those preregistering indicated no society affiliation. AAPG and SEPM tied for second highest with 20 percent each. Among affiliated societies, MSA was highest with 17 percent, followed by SEG with 13 percent, NAGT with 12 percent, and PS and GS with 10 percent each. AIME members were recorded at 11 percent.

The true diversity of the meeting became apparent in the tabulation of the areas of principal professional interest. Because many respondents checked two or more areas of principal interest, the total of the tabulation comes to 190 percent. As we do not know which was really number one in such cases, the total numbers are given.

A grouping of related subjects (environmental, engineering, hydrogeology, geomorphology, and remote sensing) placed first with 29 percent, and economic geology (including coal) was second with 27 percent. However, geochemistry recorded 20 percent; petrology, 16 percent; sedimentology and structural geology, each 14 percent; and mineralogy, paleontology, and stratigraphy, each 12 percent. Petroleum geology was listed as the principal professional interest by 9 percent, and a miscellany of "others" accounted for 25 percent.

An analysis of the professionals attending the annual meeting (on the basis of the preregistration) showed that 59 percent were between the ages of 26 and 45, half were employed by an educational institution, well over half were members of GSA, and fields of principal interest covered the entire range of the geological sciences.

Former Penrose Grant recipients contribute $4,782 to Research Grants Program for 1976

In response to a request for donations for the Research Grants Program of the Geological Society of America, 110 former recipients of such awards contributed a total of $4,782 for distribution to grant applicants in fiscal year 1976. 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.

Donations are still coming in to headquarters, and names of the donors will be printed later. We were unable to locate current addresses for more than 200 former grant recipients. We would appreciate hearing from them.

Merritt J. Aldrich, Jr.
Allan G. Barrows, Jr.
William A. Bassett
Edward S. Belt
Leonard G. Berry
Marion E. Bickford, Jr.
Marland P. Billings
Peter W. Birkeland
Philip R. Bjork
Fred Bodholt
Iris Y. P. Borg
J. Platt Bradbury
J Harlan Bretz
Willis H. Brimhall
Richard L. Burroughs
Donald H. Cadwell
John W. Cady
G. Arthur Cooper
Darrel S. Cowan
John Crawford Crelling
Zoltan De Cserna
Duncan R. Derry
John C. Dohrenwend
G. Nelson Eby
Ralph L. Edwards
John A. Elson
K. O. Emery
Evan J. Englund
William R. Evitt II
Rodney C. Ewing
John A. Fagerstrom
Robert E. Folinsbee
Eugene E. Foord
Helen P. Foreman
Bevan M. French
Richard E. Fuller
Theodore M. Gard
Peter A. Geiser
Donald G. Hadley
Thomas D. Hamilton
John D. Hergenroder
Richard P. Hoblitt
Michael J. Holdaway
Richard Holm
William T. Holser
Richard A. Hoppin
Robert J. Horodyski
Keith A. Howard
Robert F. Hudson
Roscoe G. Jackson
S. Sheldon Judson, Jr.
Suzanne Mahlburg Kay
Kerry R. Kelts
Cecil H. Kindle
George deVries Klein
Donald H. Kupfer
Gary P. Landis
R. L. Langenheim
Robert H. Leeper, Jr.
Ivo Lucchitta
John B. Lucke
Philip A. Lydon
John B. Lyons
Philip G. Malone
Denis E. Marchand
David L. Mari
Martin D. Matthews
David L. Meyer
John W M'Gonigle
Gifford H. Miller
Marvin R. Miller
William M. Neill
Donald C. Noble
Bruce James O'Connor
Lucian B. Platt
Stanislaw J. Poborski
Donald B. Potter
Noel Potter, Jr.
Willis L. Pratt, Jr.
Lawrence D. Ramspott
Anthony Reso
Richard L. Reynolds
Peter D Rowley
Robert T. Ryder
Roger Sassen
John M Saul
Judith A. Schiebout
Robert Scholten
Johannes H. Schroeder
Frederic L. Schwab
Robert B. Scott III
William E. Scott
Robert P. Sharp
Ralph R. Shroba
Leon T. Silver
Daniel P. Spangler
Desiree E. Stuart-Alexander
John R. Sumner
Daniel A. Sundeen
Sam Treves
Stephen Vonder Haar
Richard B. Waitt, Jr.
Detlef A. Warnke
Charles W. Welby
Willis H. White
Donald L. Woodrow
George P. Woollard
Frederick F. Wright
Robert S. Young
Donald H. Zenger

GSA Employment Matching Service available throughout the year

Don't overlook the GSA Employment Matching Service if you are looking for qualified geoscientists to fill a vacancy in your organization. We have more than 400 applicants in our active files, categorized within 25 major specialty headings and 44 subspecialties. Computer printouts of applicant listings in three specialty categories can be obtained for $30, or you can request a more refined search for applicants on a specific job description through our year-round program. Contact Joan Heckman, Membership Coordinator, The Geological Society of America, 3300 Penrose Place, Boulder, Colorado 80301, for further details (telephone 303-447-2020).

The interview service will not be available at any of the 1976 section meetings, but if printouts of applicants are ordered early, recruiters could easily set up informal interviews with applicants who plan to attend the section meetings.

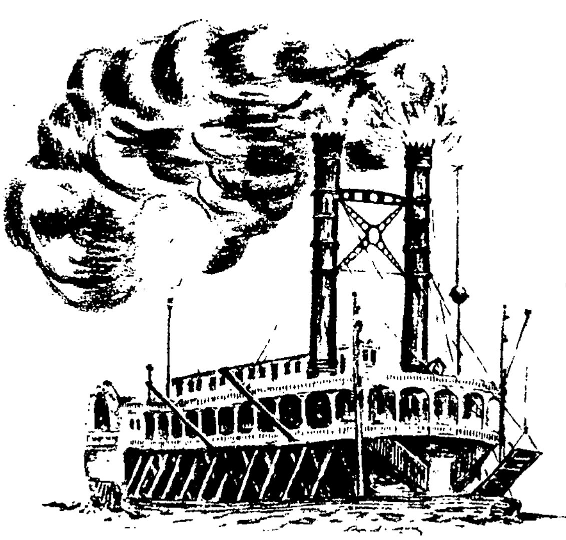
Twenty-five percent of the positions available have been filled by GSA Employment Matching Service applicants from the service at the Annual Meeting in Salt Lake City. Ninety-six positions open at that time have not yet been filled owing to uncompleted personnel processing procedures by the various organizations.

As a follow-up to the employment interview services operated at the Annual Meeting in Salt Lake City, 70 employers involved were sent questionnaires about the service. Fifty-four of them, or 75 percent, responded with the following information:

1. 115 positions were open; 3 organizations had no vacancies but interviewed anyway.
2. 42 respondees said the interview service was satisfactory; 2 said it was not.
3. 762 applicant interviews were conducted from among 258 applicants present.
4. 22 organizations contacted 196 applicants by mail; 5 said they did not; 14 applicants were invited to visit for interviews.
5. 12 said openings had been filled; 41 said they had not.
6. 39 employers said the printout arrived in time; 2 whose requests were late said no.

Necrology

Maurice L. Brashears, Tampa, Florida; Charles E. Kerman, Spring, Texas; Chester R. Longwell, Palo Alto, California; Allen W. Pinger, Salt Lake City, Utah; Woodrow Wilson Simmons, Tucson, Arizona; Walter R. Wagner, Pittsburgh, Pennsylvania.



BOOK BRIEFS

This feature will be included occasionally in the News & Information section to keep members informed of recent books published by the Society.

Cenozoic geology of southwestern High Plateaus of Utah

SPECIAL PAPER 160 – by John J. Anderson, Peter D. Rowley, Robert J. Fleck, and A.E.M. Nairn. 1975. vi + 88 p., 21 figures, 12 tables, $10.75

This report presents three separate papers on the stratigraphy of two remarkably complete, intertonguing and contemporaneously deposited volcanic provinces (Anderson and Rowley), the geochronology of mid-Tertiary volcanism in the region (Fleck, Anderson, and Rowley), and the paleomagnetism of selected volcanic units (Nairn, Rowley, and Anderson). The area discussed comprises part of the southwestern High Plateaus—the southern Tushar Mountains and Markagunt and Sevier Plateaus—and an adjacent part of the Great Basin—the Black Mountains; more than 5,000 km^2, the area embraces virtually the entire flank of the Tertiary volcanic pile centered near Marysvale, Utah.

The report defines new, and redefines some old, stratigraphic units; it also summarizes the literature on the Cenozoic stratigraphy of the region. Petrographic and geochemical aspects are treated only briefly.

The lower Tertiary (Eocene and Oligocene) sequence, more than 800 m thick, consists of continental sedimentary strata and ash-flow tuff; the middle Tertiary (uppermost Oligocene–lower Miocene) sequence comprises a western assemblage, more than 500 m thick, that consists almost entirely of ash-flow tuff derived from Great Basin sources and a contemporaneously deposited and intertonguing eastern assemblage, more than 3,000 m thick, that consists of volcanic and sedimentary strata (Marysvale pile); minor lower and middle Tertiary intrusive bodies also are present; the upper Tertiary (upper Miocene-Pliocene) and Quaternary sequence, at least 350 m thick, consists mostly of detritus shed from upfaulted structures and younger basalt flows. The younger basalt flows and associated sedimentary strata (latest Miocene and younger) probably were synchronous with the faulting that led to the structural formation of the High Plateaus.

Thirty K-Ar age determinations on 13 different rock units provide a chronology of volcanism of Oligocene to middle Miocene age. Two units (Mount Dutton and Horse Valley Formations) together represent deposition of a wide range of volcanic and sedimentary strata over a period from at least 26 m.y. B.P. until about 19 m.y. B.P. With the exception of the younger basalt and an old andesite (32.8 m.y.), the other units probably represent discrete "events." These data provide a framework for correlation throughout the High Plateaus region and adjacent areas of the Basin and Range province.

The paleomagnetic investigation adds new information on the relative ages and stratigraphic framework of the volcanic rocks; however, paleomagnetic correlation of key units was not always possible. The paleomagnetic study concentrated on ash-flow tuff but also included other types of volcanic rock and associated plutons.

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Gravity field of the northwest Pacific Ocean basin and its margin: Hawaii and vicinity

MAP & CHART 9 – compiled by Anthony B. Watts. 1975. One chart, 35" x 19", in color, with summary statement. Rolled in sturdy mailing tube: $6.00. Folded in 9" x 12" envelope: $5.00

This is the first of a series of new free-air gravity anomaly maps of the northwest Pacific Ocean basin and its margin. The map combines a total of 14,425 surface-ship and pendulum sea gravity measurements with land measurements from the Hawaiian Islands. The map, which averages about 100 km to the inch, is contoured at 25-mgal intervals, and gravity anomaly values have been annotated at maxima and minima points between contours. There is a narrow belt (about 120 to 180 km wide) of large-amplitude positive anomalies (as much as +700 mgal) associated with the Hawaiian Ridge, a narrow belt (about 120 to 180 km) of large-amplitude negative anomalies (as much as –136 mgal) that flank the ridge, over the Hawaiian deep, and a broad belt (about 200 to 300 km) of positive anomalies (as much as +25 mgal) that border and lie outside the negative anomalies. These belts of positive and negative anomalies extend for as much as 1,000 km west-northwestward across the map area. The text discusses the significance of these belts and their correlation with features of sea-floor topography.

March BULLETIN briefs

Brief summaries of articles in the March 1976 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.*

☐ 60301—Regional deep-sea dynamic processes recorded by late Cenozoic sediments of the southeastern Indian Ocean. *J. P. Kennett and N. D. Watkins, Graduate School of Oceanography, University of Rhode Island, Kingston, Rhode Island 02881.* (19 p., 12 figs., 1 tbl.)

Deep-sea sedimentary cores and bottom photographs from the southeast Indian Ocean between long 70°E and 120°E and between Antarctica and lat 30°S were analyzed. Cores from the crest and flanks of the mid-ocean ridge are mostly late Quaternary in age, with only rare breaks in sedimentation. Flanking this zone in deep basins immediately to the south of the ridge in the South Indian Basin and in a broad zone in the western sector of South Australian Basin, there are areas where bottom currents have systematically eroded or inhibited deposition of sediments ranging in age from Quaternary to Pliocene, and occasionally middle Tertiary. This regional deep-basin erosion extends northward between Broken Ridge and the Naturaliste Plateau to the Wharton Basin where sediments as old as Late Cretaceous are exposed. As indicated by disconformities, ocean-floor characteristics and seismic-profile data, much of the shallower, north-trending Kerguelen Plateau has also undergone widespread erosion by bottom currents.

The erosional disconformities in the deep basins have been created by general increase in velocities of Antarctic Bottom Water during the last 2.5 m.y., apparently with major separate pulses during the Brunhes epoch ($t = 0.69$ m.y. to present) and part of the Matuyama epoch ($t = 2.43$ to 0.69 m.y.). Extensive areas of manganese nodules have developed in conjunction with this bottom-current activity, most spectacularly as a vast pavement in the northwestern sector of the South Australian Basin. This feature, which we name the "Southeast Indian Ocean Manganese Pavement," is approximately 10^6 km^2 in area.

The available evidence indicates long-term major erosion by the eastward-flowing Circumpolar Current across the central and southern parts of the Kerguelen Plateau. In the deep basins, high-velocity Antarctic Bottom Water flows eastward through the northern sector of the South Indian Basin, with important northward flow crossing the mid-ocean ridge at 110°E and 120°E into the South Australian Basin. This northward branch traverses the western sector of the South Australian Basin, the Southeast Indian Ocean Manganese Pavement, and then flows between Broken Ridge and Naturaliste Plateau into the Wharton Basin. Major Cenozoic to Late Cretaceous hiatuses in the Wharton Basin revealed by deep-sea drilling suggest that northward-flowing bottom water through this conduit has been a very long term feature.

☐ 60302—The Equatorial Mid-Ocean Canyon: A relict deep-sea channel on the Brazilian continental margin. *John E. Damuth, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964; Marcus A. Gorini, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964, and Instituto de Geociências da Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brasil.* (7 p., 12 figs.)

The Equatorial Mid-Ocean Canyon is an erosional-depositional deep-sea channel which was formed by turbidity-current activity, was active during the Miocene, but is now a relict feature. The canyon parallels the Brazilian continental rise between 3°S to 5°S and 33°15′W to 28°W and descends eastward for at least 1,200 km with a gradient of 1:1,000. The canyon is 5 to 8 km wide and as much as 200 m deep. Although the bathymetric expression of the canyon on the sea floor begins at about 33°15′W, the canyon has been traced westward (upslope) from this longitude in subsurface for at least 75 to 150 km. The trend of this buried portion of the canyon indicates that originally the head of the canyon was on the upper continental rise. The stratigraphic relationship between the canyon and a lower Miocene acoustic reflector of widespread regional extent suggests that the canyon formed during the late early Miocene period. Piston cores from the canyon floor, walls, and levees consist largely of pelagic foraminiferal marls and brown clays which indicate that the canyon has been inactive for at least the past million years. The exact time when the canyon became inactive is still uncertain, but it was probably middle to late Miocene. When active, the canyon channeled terrigenous sediments southeastward along the trend of the Fernando de Noronha Basin. The canyon apparently was abandoned and subsequently buried when the predominant direction of sediment dispersal shifted from southeastward along the Fernando de Noronha Basin to northeastward into the adjacent Guiana Basin, thus making the canyon path obsolete.

☐ 60303—Quaternary volcanism in the Salton Sea geothermal field, Imperial Valley, California. *Paul T. Robinson and Wilfred A. Elders, Department of Earth Sciences and Institute of Geophysics and Planetary Physics, University of California, Riverside, California 92502; and L.J.P. Muffler, U.S. Geological Survey, Menlo Park, California 94025.* (14 p., 12 figs., 5 tbls.)

The Salton Sea geothermal field lies in the Salton Trough, the landward extension of the Gulf of California, an area of active crustal spreading. Surface volcanic rocks of the field consist of five small rhyolite domes extruded onto Quaternary sediments of the Colorado River delta. Two domes are linked by subaqueous pyroclastic deposits; the others are single extrusions with or without marginal lava flows. The domes are low-calcium, alkali rhyolite with 1 to 2 percent crystals. Similar silicic rocks found in wells have been extensively altered by geothermal brines.

Basaltic rocks occur as xenoliths in the domes and as subsurface dikes, sills, or flows. The xenoliths consist of low-potassium tholeiitic basalt similar to that of the East Pacific Rise. Subsurface basaltic rocks are mineralogically similar to the xenoliths but have undergone extensive hydrothermal alteration.

Numerous partly melted granitic xenoliths in the domes show various degrees of either cotectic melting along quartz-feldspar grain boundaries or disequilibrium incongruent melting of hydrous ferromagnesian minerals. These rocks are sodic granite containing notably higher SiO_2, CaO, and Na_2O and lower total iron than the enclosing rhyolite. Compositions and textures suggest that the granite xenoliths are fragments of basement rather than the crystallized equivalents of the rhyolite magma.

The bimodal basalt-rhyolite assemblage of the Salton Sea geothermal field is believed to have formed by partial fusion in two stages of mantle peridotite, forming successive rhyolitic and basaltic melts. After formation, the rhyolitic magma was partly contaminated by continental crust material.

☐ 60304—Rb-Sr geochronology and tectonic setting of the Peekskill pluton, southeastern New York. *Douglas G. Mose, Department of Chemistry, George Mason University, Fairfax, Virginia 22030; Nicholas M. Ratcliffe, Department of Earth and Planetary Sciences, The City College of the City University of New York, New York, New York 10031; A. Leroy Odum, Department of Geology, The Florida State University, Tallahassee, Florida 32306; and John Hayes, Department of Geology, Brooklyn College, Brooklyn, New York 11210.* (5 p., 3 figs., 1 tbl.)

The Peekskill Granite pluton in southeast New York is a steep-walled, shallow intrusion in a major fault zone between Grenville rocks of the Reading Prong and Cambrain-Ordovician rocks of the Manhattan Prong. Emplacement of the pluton postdated folding during the Taconic orogeny and postdated the intrusion of the Cortlandt mafic complex. The pluton was probably emplaced during or following the development of the fault zone.

Rb/Sr whole-rock analyses show that the pluton crystallized about 371 ± 14 m.y. ago with an initial $^{87}Sr/^{86}Sr$ ratio of 0.7074 ± 0.0002. The field relationships and age determinations indicate that the northwestern part of the Manhattan Prong was affected by brittle fracture and faulting and by igneous activity during the Acadian deformation.

☐ 60305—Biotite-induced grussification of the Boulder Creek Granodiorite, Boulder County, Colorado. *Dana Isherwood, Department of Geological Sciences, University of Colorado, Boulder, Colorado 80302; Alayne Street, Geography Department, Cambridge University, Cambridge, England.* (5 p., 7 figs., 3 tbls.)

Grus formation in the Precambrian Boulder Creek Granodiorite of Colorado is the result of biotite expansion along basal cleavages. A petrographic study of the grus, impregnated in plastic resin to retain its original fabric, reveals expanded biotite fragments separated by void space with numerous microfractures through quartz and feldspar grains. Mineral alteration during grussification includes hornblende solution and argillation of feldspar. X-ray analysis of the weathered biotite indicates the formation of hydrobiotite and biotite-hydrobiotite interlayer combinations. Chemical changes in the composition of the biotite are not excessive and consist mainly of oxidation of Fe^{+2} to Fe^{+3} with replacement of K^{+1} by water molecules. These changes have decreased the biotite density from 3.08 g/cm^3 to 2.50 g/cm^3. Modal analyses of fresh and weathered samples suggest that grussification is a function of biotite content: the greater the biotite percentage, the greater the susceptibility for granular disintegration to occur. The formation of microfractures and the expansion of the biotite have reduced the bulk density from 2.67 g/cm^3 for the original rock to 1.98 g/cm^3 for the grus.

☐ 60306—Magnetic lineations in the southern part of the Central Indian Basin. *John G. Sclater, Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139; Bruce P. Luyendyk, Department of Geological Sciences, University of California at Santa Barbara, Santa Barbara, California 93106; and Linda Meinke, Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.* (8 p., 7 figs.)

A lineated sequence of distinctive residual magnetic anomalies has been observed in the southern part of the Central Indian Basin. These anomalies, which strike N45°W, have been identified as anomalies 7 through 15 and were formed by a ridge spreading at a half-rate of 2.5 cm/yr. They terminate abruptly against a N45°E-trending fracture zone between 82° and 85°E. At 27°S, 84°E, the fracture zone appears to change direction abruptly to N10°E. The mean depth drops 250 m across the fracture zone. The lineations are offset right laterally to the south, and the anomalies to the east, north of 27°S, are tentatively identified as 18 through 22, trending N100°E. This

change in lineation pattern can be explained only by a reorientation of the direction of the Southeast Indian Ridge from east-west to northwest-southeast between the times of anomalies 18 and 15 ($\sim$ 43 to 39 m.y. B.P.). This was the same time that India collided with Eurasia; the time correlation may be evidence of a relationship between the formation of the Himalayas and an abrupt change in the direction of relative motion of the Indian and Antarctic plates at the Eocene-Oligocene boundary. Anomaly 20 abuts the Ninetyeast Ridge opposite site 253, which has a middle Eocene basal sediment age. Thus the ridge has the same age as or is slightly younger than the Indian plate to which it is attached. The magnetic data also indicate that the Southeast Indian Ridge between the Ninetyeast Ridge and 85°E jumped 11 degrees to the south between 63 and 53 m.y. B.P. This is approximately the time that Australia started to separate from Antarctica.

☐ 60307—Early Precambrian tectonic-igneous evolution in the Vermilion district, northeastern Minnesota. *Paul K. Sims, U.S. Geological Survey, Denver, Colorado 80225.* (11 p., 6 figs., 2 tbls.)

The Vermilion district and adjacent areas are part of the greenstone-granite terrane of northern Minnesota and consist of a thick succession of subaqueous volcanic rocks, derivative sedimentary rocks, and intrusive granitic rocks, which formed during the interval 2,750 to 2,700 m.y. ago. The volcanic-sedimentary succession now constitutes an eastward-trending, upright, tight anticlinorium between flanking granitic batholiths. The folding was broadly contemporaneous with emplacement of the oldest recognized plutonic rocks, which range in composition from granite to tonalite, and is attributed to compression caused by the relative upwelling and convergence of the buoyant granitic bodies. Metamorphism of the supracrustal rocks to greenschist and, locally, middle-amphibolite facies accompanied the folding. Later, anorogenic monzonite–quartz monzonite and other syenitic rocks intruded the supracrustal rocks, apparently as diapirs. Regional strike-slip faulting followed emplacement of the anorogenic plutons. The principal fault, named the Vermilion fault system, transects several greenstone-granite complexes; within the district, stratigraphic offsets indicate a right-lateral strike-slip separation of 17 to 19 km along the fault. The strike-slip faulting marked the transition from an unstable crust dominated by vertical tectonic movements to a more stable crust capable of sustaining regional fractures.

☐ 60308—Energy transport in thick sequences of compacting sediment. *J. M. Sharp, Jr., Department of Geology, University of Missouri, Columbia, Missouri 65201; and P. A. Domenico, Department of Geology, University of Illinois, Urbana, Illinois 61801.* (11 p., 10 figs., 1 tbl.)

This investigation synthesizes the theories of energy transport and gravitational compaction of sediment to develop a deterministic model capable of generating pore-fluid pressure, porosity, and temperature distributions throughout the accumulation of basin sediment. Abnormal pore-fluid pressures develop with increasing rates of sediment accumulation and decreasing hydraulic diffusivity. Sediment temperature distributions depart from typical linear profiles characteristic of steady-state conduction and have increasing rates of sediment accumulation and decreasing hydraulic diffusivity.

A comparison of model output with data from the Gulf of Mexico geosyncline demonstrates that gross fluid pressure, porosity, and temperature distributions are explained by the model. Lateral movement of pore fluid to faults in combination with lithically induced hydraulic and thermal parameter variations explain cases of departure from the general patterns. Sediment in the Gulf of Mexico geosyncline may have been subjected to abnormal pressure since Cretaceous time; sediment presently in the near offshore may now be at its maximum pore-fluid pressure and minimum temperature at any given depth.

☐ 60309—Hydrogeology of the South Fork of Long Island, New York. *Charles W. Fetter, Jr., Department of Geology, University of Wisconsin-Oshkosh, Oshkosh, Wisconsin 54901.* (6 p., 8 figs., 4 tbls.)

The South Fork of Long Island, New York, is underlain by unconsolidated Pleistocene and Cretaceous sediments resting on crystalline bedrock. A two-layered aquifer system contains fresh ground water with saline ground water in the deeper strata. The average horizontal hydraulic conductivity of the upper aquifer is 49 m/day and of the lower aquifer is 25 m/day.

The average annual precipitation of 1.14 m is the only natural source of fresh water. After consumptive losses the precipitation provides about 1.85×10^8 m^3/yr to recharge the water table. Discharge of fresh ground water occurs primarily as undersea outflow to the ocean at the perimeter of the area. The safe yield of the area is estimated to be 9.15×10^4 m^3/day.

☐ 60310—Large-scale recumbent folding in the Valley and Ridge province of Alabama. *Charles E. Shaw, Weaver Oil and Gas Corporation, 2700 S. Post Oak Road, Suite 1500, Houston, Texas 77027 (present address: 6340 Crab Orchard, Houston, Texas 77027).* (12 p., 12 figs.)

Large-scale recumbent folds are recognized in the Coosa Valley in Shelby and Talladega Counties, Alabama, on the basis of map pattern, structural data gathered in the field, and top sense derived from stratigraphic sequence and primary sedimentary features. Recumbent folds at two structural levels deform rocks ranging in age from Ordovician to Mississippian.

The structure evolved in three stages. Westward-directed recumbent folding about north-trending axes in Early Mississippian time was followed by refolding about upright northeast-trending axes in Pennsylvanian or later time. During or after the late folding, the area was arched by a broad, gently southeast-plunging cross anticline over which northeast structural axes were locally rotated to north-south and east-west trends.

Recumbent folding was accompanied by soft-sediment deformation within the Mississippian Floyd Shale, which in Shelby County is interpreted as flysch that was deposited during this folding. The Floyd grades upward and laterally into marine molasse (Parkwood Formation) and later into nonmarine molasse (Pottsville Formation) of

Pennsylvanian age. Mississippian Floyd Shale is the youngest unit involved in the recumbent folding.

The Alabama nappes probably were formed by gravitational sliding of cover rocks toward the west or southwest into the Floyd flysch basin.

☐ 60311—Seasonal reversal of flood-tide dominant sediment transport in a small Oregon estuary. *Sam Boggs, Jr., Department of Geology, University of Oregon, Eugene, Oregon 97403; and Charles A. Jones, Department of Geology, Chadron State College, Chadron, Nebraska 69337.* (8 p., 13 figs., 3 tbls.)

The Sixes River in southwestern Oregon has a summer discharge of only about 2 m^3/sec. During these low-discharge conditions, a flood-dominated system of bottom tidal currents develops in the estuary, and a deltalike sill, as much as 1.5 m in height, builds across the mouth of the estuary by upstream progradation. Flood-tide currents move across this sill at velocities of as much as 90 cm/sec 15 cm above the bottom, but the velocity of ebb-tide currents usually does not exceed about 40 cm/sec.

Dispersal patterns of dyed sediment injected at the river mouth during low river discharge show that flood-tide currents transport sand across the sill and up the estuary as far as 0.8 km (about one-fourth the length of the estuary) in a single flood-tide phase. During ebb tide, the sill impedes movement of salt water along the estuary bottom, producing a sharply stratified two-layer water system. Although tracer experiments show that some find sand is removed from the estuary during the ebb phase, primary sedimentary structures and the mineral composition of the sand indicate that flood-tide dominance of the bottom tidal currents causes a net gain of marine sediment in the estuary while the sill is in place.

River discharge after winter storms may increase to more than 400 m^3/sec, and large quantities of detritus, including gravel, are transported downstream into and through the estuary. High river discharge also causes erosion of the sill, greatly reducing the sediment-trapping capacity of the estuary. The finer fluvial detritus, together with fine marine sediment deposited during the summer, is swept from the estuary, leaving it floored largely by gravel. Thus, the hydraulic sediment-trapping mechanisms observed in the estuary of the Sixes River appear to be effective only on a seasonal basis under present hydrologic conditions.

☐ 60312—Erosion of submarine outcrops, La Jolla submarine canyon, California. *Harold D. Palmer, Westinghouse Ocean Research Laboratory, P.O. Box 1488, Annapolis, Maryland 21404.* (6 p., 4 figs.)

Observations made from a submersible operating within the sinuous central segment of La Jolla submarine canyon have provided spectacular examples of erosion at two outcrops below a depth of 300 m. One outcrop displays extensive destruction through bioerosion of siltstone members. Burrowing and grazing activity of galatheid crabs has led to slumping and spalling where cavities cluster, intersect, or parallel the face of this outcrop.

A second site on the outside wall of a right-angle bend in the canyon axis revealed an undercut extending 23 m beneath the vertical canyon wall. A well-established encrusting fauna reaching to the canyon floor indicates that abrasive high-velocity currents have not occurred at this site for at least 6 months. The depth of this feature requires that the process responsible for such erosion take place on the sea floor. Sediment samples from the fan and fan valley below this part of the canyon reveal coarse deposits lacking features typical of turbidites, yet indicative of high-velocity submarine currents. It is concluded that the undercut is a relict erosional feature remaining from a previous period (Pleistocene) when runoff producing the latest rapid rise in sea level must have generated "submarine floods" charged with coarse detritus.

☐ 60313—Form, genesis, and deformation of central California wave-cut platforms. *W. C. Bradley, Department of Geological Sciences, University of Colorado, Boulder, Colorado 80302; and G. B. Griggs, Division of Natural Sciences, University of California, Santa Cruz, Santa Cruz, California 95064.* (17 p., 16 figs., 5 tbls.)

Modern and ancient wave-cut platforms on Ben Lomond Mountain in central California are broadly similar in shape. They have a seaward slope composed of two segments: a steeper, slightly concave inshore segment, with gradients of generally 0.02 to 0.04 (20 to 40 m/km), and a flatter, planar offshore segment with gradients of 0.007 to 0.017 (7 to 17 m/km). The flattest inshore and offshore gradients measured were, respectively, 0.015 (15 m/km) and 0.005 (5 m/km), suggesting that these are close to minimum gradients for erosional platforms in central California. The inshore segments are generally 300 to 600 m wide and extend to a depth of 8 to 13 m. Platforms are widest in areas where soft sandstone crops out and where there has been least uplift.

Major storm waves now break in water 7 to 12 m deep. We conclude that inshore platform segments were associated with storm-wave surf zones and that offshore segments were associated with the zone of deep-water wave transformation. A gradient of 0.005 for the offshore segment would keep wave energy at the bottom constant. A steeper gradient for the inshore segment would enable backwash undertow to counteract the strong onshore movement of surf, so that available coarse sediment could be moved laterally. Slopes less than the minimum would so dissipate wave energy in offshore areas that the surf zone would not be able to provide the needed longshore transport for coarse sediment, and beach progradation would result. Thus, platforms have a shape that allows efficient conversion of wave energy into erosion and longshore transport; their seaward gradient is not used for the downhill transport of sediment. Platform gradients decrease with time, at least until the minimum is achieved. Whether the offshore segments were eroded at their existing depths or were eroded by surf zones as sea level rose remains a matter of controversy.

Ben Lomond platforms have been uplifted and progressively tilted in a seaward direction, indicating that late Tertiary domical uplift has continued into Quaternary time. Uplift rates have ranged from 0.16 m/1,000 yr near Santa Cruz to 0.26 m/1,000 yr near Greyhound Rock. Tilts have varied from 0.001 (1 m/km) for the lowest prominent platform to 0.009 (9 m/km) for the highest platform (which may be as old as 10^6 yr). Because of uplift, platforms must have been cut at times of eustatically high sea level.

☐ 60314—Topographic expression of superimposed drainage on the Georgia Piedmont. *Albert C. Staheli, Department of Geology, Georgia State University, Atlanta, Georgia 30303.* (3 p., 4 figs.)

The Brevard zone separates two regions on the Georgia

Piedmont that have different drainage styles. Streams on the northwestern Piedmont have trellis drainage, which suggests that they have undergone a different evolution than streams that have dendritic drainage, on the southeastern Piedmont. It is concluded that Coastal Plain sediment covered the southeastern Georgia Piedmont to at least the Brevard zone. Consequent streams developed a dendritic drainage on this cover and became superimposed across buried resistant northeast-trending geologic structures. Trellis drainages, however, developed as a result of subsequent streams being controlled by Piedmont structures on areas of thin or no Coastal Plain sediment cover.

☐ 60315—Tectonic interpretations of the East Caroline and Lyra Basins from reflection-profiling investigations. *Dale L. Erlandson, Theodore L. Orwig, Glenn Kiilsgaard (deceased), James H. Mussells, and Loren W. Kroenke, Hawaii Institute of Geophysics, University of Hawaii, Honolulu, Hawaii 96822.* (10 p., 9 figs.)

Reflection profiles taken by the Hawaii Institute of Geophysics in 1970 and 1971 are the basis for a new bathymetric chart of the East Caroline and Lyra Basins. Bordered on the east and west by areas of high elevation, the Ontong Java Plateau and the Eauripik Ridge, respectively, the two basins are separated from each other by the Mussau Trough and Mussau Ridge and bounded by the Manus Trough on the south. An analysis of the reflection profiles shows that the rectilinear pattern evident throughout the region results from a set of northeast and northwest cross-trends that appear to be structurally controlled. Using the concept of an extinct sea-floor spreading center to explain the formation of most of the topographic features found in this region, these cross-trends become northeast traces of transform faults that intersect northwest-trending structural features originally developed along the axis of spreading. We interpret data obtained at Deep Sea Drilling Project (DSDP) sites 62 and 63 as evidence for a late Oligocene cessation of spreading. Subsequent motions of the Pacific and Indian plates resulted in strike-slip motion along the previously active transform faults, thus increasing offsets observed in the southern Eauripik Ridge and forming the grabens associated with the Kiilsgaard and other fracture zones.

☐ 60316—Sound-producing dune and beach sands. *John F. Lindsay, Marine Science Institute, University of Texas at Galveston, Galveston, Texas 77550; David R. Criswell, Lunar Science Institute, 3303 Nasa Road 1, Houston, Texas 77058; T. L. Criswell, Battelle Pacific, Northwest Laboratories, Richland, Washington 99352; and B. S. Criswell, Department of Microbiology, Baylor University College of Medicine, Houston, Texas 77001.* (11 p., 12 figs., 3 tbls.)

Field and laboratory investigations have confirmed differences between the acoustic and seismic emissions of "singing" and "booming" sands and revealed that booming grains possess extremely smooth surfaces. Singing sand is the most common of the two types of sound-producing sands. It occurs widely as a beach sand and consists of well-rounded highly spherical grains that have a well-sorted highly symmetric grain-size distribution. Sound is produced when the sand is mechanically sheared, possibly causing the closely packed grain array to dilate in a coherent manner. Frequency (>500 Hz) is controlled by grain size, and amplitude may in part relate to grain morphology. Booming sand is a relatively rare phenomenon that occurs in some desert regions. This sand produces a low-frequency ($f_0 \approx 80$ Hz) sound during avalanching. The process efficiently (≈ 0.1 to 1 percent) produces very narrow band seismic energy in the 50- to 80-Hz range. Simultaneously produced audio signals are broader band but are composed of signals that peak at the same fundamental frequencies as the seismic emissions. In addition, the acoustic emissions display first and second harmonics. Acoustic production is $\approx$400 times less efficient than seismic energy production. Booming occurs in quartz and carbonate sand grains that are well sorted, fine skewed, and mesokurtic. The individual quartz sand grains are only moderately well rounded. When compared to normal eolian grains, however, they have highly polished surfaces that are smooth on the 1-μm scale. The exceptional smoothness of the grains may facilitate booming. The effective Q (magnification factor) and compressibility (k) of the grain system may be the key physical quantities involved in booming. Thus, whereas booming is rare in the terrestrial environment, it may be common in the high-Q soils of the moon and the nearly waterless dune environment of Mars.

☐ 60317—Rates of production of the main magma types in the central Andes. *P. W. Francis, Department of Earth Sciences, The Open University, Walton Hall, Milton Keynes MK7 6AA England; and C. C. Rundle, Geochemical Division, Institute of Geological Sciences, Gray's Inn Road, London WC1X 8NG England.* (7 p., 2 figs., 2 tbls.)

Six new K-Ar dates for young volcanic rocks in the area between lat 21° and 22°S in the Andes of northern Chile have been determined. Two groups of volcanic rocks are present: extrusive lava flows and domes of andesitic composition and extensive sheets of ignimbrite. Both groups are less than 10 m.y. old. We estimate that 2×10^3 km^3 of andesitic rocks and 1.5×10^3 km^3 of ignimbrite lie within the study area. Andesitic rocks have been erupted at an estimated rate of between 1.7×10^{-6} km^3 and 2.9×10^{-6} km^3/yr/1 km of length of the active belt, and ignimbrite at a rate of 1.3×10^{-6} km^3/yr/1 km of length. The total volume of ignimbrite is less than is suggested by the huge area covered by ignimbrite sheets.

In order to estimate the volume and rate of production of a comparable strip of the Coastal batholith of Peru, two extreme models were used for the shapes of batholiths in depth: one assumes a tabular shape with a thickness of 5 km, the other an inverted teardrop shape extending to a depth of 30 km. Rate of production estimates for these two models range from 2.9×10^{-6} km^3/yr/1 km to 9.9×10^{-6} km^3/yr/1 km of length. Whichever model is used, the rate of production is broadly comparable with that of the Sierra Nevada batholith in California.

The rate of extrusive volcanism is about two orders of magnitude less than that at the Icelandic constructive plate margin and several times less than the rate of intrusion of batholithic material. Volumetric data do not explicitly support any particular one of the many hypotheses for the genesis of destructive plate margin magma types.

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