GSA news & information

SUPPLEMENT TO GEOLOGY MAGAZINE

APRIL 1978

GSA plans activities for centennial year in 1988

LETTER FROM THE PRESIDENT

In 1988, just a decade away, the Geological Society of America will celebrate its centennial. I have appointed a Centennial Planning Committee to develop a plan to celebrate the centennial of GSA and to consider any and all appropriate special activities that would, in its 100th year, enhance the Society's capabilities to carry out its fundamental mission—to advance the science of geology.

A number of suggestions have been received by Council, including a special publication or series of publications on North American geology, a capital funds drive to build the endowment, a series of centennial conferences, a very special 1988 annual meeting, and the design of a centennial TV series on geology.

I invite the membership to send their thoughts on the centennial year to Headquarters for consideration by the Centennial Planning Committee. The Committee membership is:

Richard H. Jahns, Chairman
Robert E. Boyer, Vice-Chairman
Clarence R. Allen
Gabriel Dengo
M. Charles Gilbert
Sheldon Judson
David B. MacKenzie
Vincent E. McKelvey
Digby J. McLaren
Guillermo P. Salas
Laurence L. Sloss
M. Gordon Wolman

Ex Officio:
President
Vice-President
Treasurer
Past President
Executive Director

Peter T. Flawn
President
Geological Society of America

GSA *Bulletin* format changes for 1978–1979 explained

Throughout the remainder of 1978, the monthly GSA *Bulletin* will contain 160 pages and 15 to 20 articles printed in the familiar format of the past.

Beginning with the January 1979 issue, the *Bulletin* will be changed to the new, two-part format as discussed in recent issues of *GSA News & Information*. Part I will continue at the 160-page length for the entire 12-month period. It will, however, be a hybrid volume. The front part of each monthly *Bulletin* will contain short summaries of articles submitted throughout 1978. The back part will contain full-length articles in the old format submitted prior to January 1978.

The summary articles in the new format in the front part of the 1979 monthly *Bulletins* will have several advantages over the longer, full-length articles in the old format in the back of the *Bulletins*: (1) They will have a priority in publication and will be published about one year after receipt; whereas the longer articles in the old format will be published about two years after receipt. (2) They will be represented by parallel publication of the long form of the articles in the Part II, microfiche edition, which will go to major public and institutional libraries and individuals all over the world. These copies will be distributed rapidly by first-class mail at low cost. (3) The microfiche edition will have a shelf life of 100 years, longer than that of any book or magazine. Items in this edition will never go out of print because additional copies can be made at any time by low-cost photographic processes. (4) Hard copies of individual microfiche articles can be prepared for anyone who needs them at costs generally less than that required for a hard-copy publication.

By 1980, we expect that Part I of the new two-part *Bulletin* will contain more articles in less space, that publication time will be reduced substantially, that cost of a subscription to Part I will also be reduced, and that cost of a combined subscription to Parts I and II will be no more than the cost of a *Bulletin* subscription alone in the old format would be by that time.

New Members, Fellows, and Students elected

New Members. The following 233 persons have been elected to Membership by committee action during the period from April 1, 1977, to December 1, 1977:

Bern Aarons
Ghazanfar S. Abbas
Daniel J. Acquaviva
Adachi Mamoru
Michele L. Aldrich
Larry W. Anderson
Michael B. Anderson
Marilyn H. Andrus
Charles F. Armstrong
Claudia T. Assini
Alexander S. Avrashov

Mary J. Baedecker
Catherine E. Bard
Robert J. Bascle
Francis X. Bellini
Jeffery C. Bemis
G. Edward Birchfield
Enid Bittner
Ellen F. Black
Ned Bleuer
Henry J. Bokuniewicz
Robert L. Borger
Thomas M. Bown
Arthur L. Bowsher
Leonard R. Brand
Malcom T. Brewerton
Thomas K. Budge
Marjorie M. Bushnell
Robert F. Butler
John W. Buza

Marc I. Casslar
Amelia Castellucci
Robert S. Cathcart
David M. Chambers
Clement G. Chase
Dana K. Clark
Mary J. Combs
Terry R. Courtright
Bruce E. Cox
John E. Crawford
Allen B. Crockett
David. M. Cruden
Edgar F. Cruft
Ellie R. Cyr

Raymond J. Daly
David A. Darko

Geoffrey F. Davies
Karleen E. Davis
Bradley W. Dean
Leland B. Deck
David A. De Gruyter
Kenneth R. Demars
Ronald B. Dent
Jeanne C. Detenbeck
Michael F. Diggles
Daphne E. Di Somma
John S. Dosky
Michael P. Dowling
Richard A. Drabish
Edgar S. Driver
Renaud M. Du Dresnay

Andrea C. Eddy
Martin J. Edwards
Awad A. El-Ghannai
Richard C. Ely
Glenn F. Embree
Reuel F. Emery
Jo Ann J. Erwin

Folajimi Fakiyesi
Saleem M. Farooqui
Charles R. Faust
Peter G. Finckh
Eric R. Force
William Fowler
Philip A. Frame
Thomas P. Frost

Robert G. Gerber
Donald L. Gibbon
Philip D. Gingerich
Karen J. Goodman
David C. Goodner
Arthur J. Gordon
Wulf A. Gose
Ronald L. Grubbs
Mark L. Grummon

James A. Hagerty
Martin J. Haigh
Jayne M. Harbaugh
Christopher A. Harbison
Deborah R. Harden
Sacha J. Has

James N Hauser
Nancy A. Hayden
Mark A. Herndon
David A. Hewitt
Mohammad A. Hoda
Volker Hoeck
Roger F. Holland
David Hoyt
Travis L. Hudson
James D. Huggard
Susan M. Hughes
Richard A. Hunter
Robert H. Husk, Jr.
Roderick A. Hutchinson

Gary D. Johnpeer
Albert P. Johnson
Conrad J. Johnson
Harlan P. Johnson
Robert G. Johnson
Thomas J. Joiner
Kenneth C. Jones

Olgerts L. Karklins
Michael J. King
Carl F. Koch
Christopher R. Kolarz
David B. Koval
James P. Krohn

Jeffrey T. Lawson
Paul Lechler
Carl P. Lehner
Evan C. Leitch
Robert Clay Lewis
James L. Locke
Nina Lockwood
William J. Lutschak

William L. MacBride
James M. Madar
Esther R. Magathan
John D. Mattey
James L. McGregor-Dawson
George M. Meehan
James W. Mercer
Carolyn J. Merry
Russell V. Miller
Lofti A. Mohsen

Joseph N. Moore
Robert P. Morrell
David W. Morton
Ronald H. Mullennex
Mark T. Murphy
Paul M. Murphy
Daniel P. Murray
Edwin O. Murray

Karl A. Naert
Dennis A. Nelson
Steven Wayne Nelson
James Lee Nelson-Moore

Frederick W. Obernolte, Jr.
Fidelis F. Oguntirin
Al J. O'Neill
Anthony C. Onyeagocha
Robert M. Owen
Stephen A. Ovens

Frederick L. Paillet
Joel O. Palmer
Gary W. Parry
Ronald L. Parratt
Ian A. Paterson
Nazario Pavoni
Ronald W. Pearce
Stephen F. Percival, Jr.
Mark E. Petersen
Donald T. Phillips, II
William E. Pitt, Jr.
Francisco C. Ponte

Gary S. Rasmussen
James J. Raymond
Thomas E. Rice
Edward R. Ries
John J. Rippe
William P. Roberts
Dennis A. Rossi
Ronald Rossmann
Willard E. Rubarts

Julia Saunier
Michael Schere
Donald W. Schofield
Kees Schrijver
George F. Sharman

George C. Sharp, Jr.
Kermit E. Shields
J. Ronald Sides
John J. Simms
Ross W. Simon
Janice R. Sletager
Maureen E. Smithwick
Jean Sougy
Marc P. Springer
Gray L. Steele
Michael R. Steen
Peter R. Stevens
Jeffrey P. Stimson
Priscilla L. Strain
James T. Strange
Gene Suemnicht

Asahiko Taira
Judith F. Tavel
Roger L. Taylor
Harold J. Tholen
Gregory E. Thurow
Charles E. Totman
Edward B. Towne
George G. Tubb
Glennda B. Tucker

Edith Vincent

Daniel P. Waltz
Christopher J. Wayne
Ralph C. Webster
Lawrence E. Wender
Mike E. White
Mark L. Whitehead
Bruce H. Wiley
Helmut Will
James H. Willemin
Robert C. Winegar
Frank J. Wobber
Diane Wolfgram

Douglas M. Yadon
Joe C. Yelderman, Jr.
Walter Yuras

Frederick W. Zimmerman
Frederick P. Zoerner

New Fellows. The following candidates were elected to Fellowship by Council action, at the November 1977 Council meeting:

Jacques V. Avias
Christopher R. Barnes
Robert R. Curry
Ahmed El Goresy
O. A. Erdman
Pierre J. Goossens
Arthur Green

Paul J. Grim
Herwat Helmstaedt
Hans J. Hofmann
Gary D. Johnson
Michael J. Kennedy
Harley J. Knebel
Felix Mendelsohn

James J. Papike
Guy Perrault
Juan A. Proano
Ivar Ramberg
Anthony F. Randazzo
William I. Rose, Jr.
Marc L. Sbar

John G. Sclater
Yotaro Seki
Robert C. Shumaker
Johann Steiner
Desiree E. Stuart-Alexander
John Sutton
James V. Taranik

Patrick Taylor
John F. Tomblin
Peter R. Vail
William R. Walton
Peter L. Ward
Howard G. Wilshire
Brian F. Windley

New Student Associates. Listed below are 335 Student Associates who have become affiliated with the Society during the period from March 1, 1977 to December 1, 1977.

Marvin M. Abbott
Abdelzahir M. Abdelzahir
Reza Abolhassani
Dwaine G. Abraham
James P. Ackerman
Jeffrey B. Aldrich
Philip Allen
Rodney L. Allen
Gary D. Andersen
Jamie Andres
Steven M. Aronoff

Indira L. Balkissoon
Miriam Baltuck
Thomas R. Bard
Mark E. Barnes
Michael L. Batzle
Dean R. Baumann
Julia A. Benham
Raymond Beullac
Clayton Bezzan
Eddy L. Biehl
John M. Bierschenk
Gina Boccetti
John H. Bodine
William P. Bosworth
Marcus E. Bowen
Scott D. Bradley
John C. Branca
Mark T. Brandon
Thomas Brasser
Douglas L. Bremner
Julie K. Brigham
Kay L. Brodersen
Marvar J. Brown

Kenneth E. Carraway
Debra K. Cazes
Chris I. Chalokwu
Stephen C. Chalupa
Ralph E. Chapman
Maureen A. Charron
Eugene W. Chini
Bruce W. Christenson
Felicie J. Chronic
Mark J. Cinque
G. Kent Colbath
J. Calvin Cooper
David H. Crist
Robert E. Curtis
William P. Cutrone

Thomas D. Davies
Richard A. Davis
Dwight C. Dawson, II
Helen E. Dawson
Mark D. Degroot
Helen L. Delano
Edward C. De La Pena
Lance M. Dennis
Neal R. Desmarais
Timothy H. Dixon
Janet A. Docka
Ahmet U. Dogan
Jack E. Dowden
Peter D. Dykema

Boniface E. Egboka
Dennis D. Elrod
Karimeldin Z. Elsamani
Milton B. Enderlin
Robert J. Esser
Larry D. Estes
Anne H. Ewing

Lee H. Fairchild
Richard J. Fantel
Debra K. Feist
Luis O. Fernandez
Kenneth C. Field
Kathryn M. Fiess
Lorraine H. Filipek
Howard J. Fischer
Michael J. Ford
Judy D. Fretwell
Ann K. Freud
Anton R. Friedmann
William J. Fritz

Larry Garmezy
Robert W. Gates
Mark S. Ghiorso
William B. Gibbons
Helene Gignac
James K. Gilland
John Gilliland
Brian R. Globerman
Carol S. Glusman
Alonzo J. Golden
Flora J. Goldstein
David C. Golike
William W. Goodmen
Elizabeth A. Gordon
Richard G. Gordon
Scott R. Grace
Timothy C. Grant
Peter C. Grasel
Anthony H. Green

Peter C. Hackspacher
Michael R. Hannigan
Charles A. Hansen
Clifford G. Hanson
Lucy E. Harding
John R. Harper
Albert D. Harris
Jessica A. Harrison
Daniel D. Hart
Ernest C. Hauser
Bertram Hayes-Davis
Richard W. Hazlett
Rejean J. Hebert
Debra L. Heide
Paul V. Heinrich
Bartley S. Helms
Roy E. Hesler
Edward F. Hill
Bruce R. Hilton
Scott T. Hinschberger
Richard C. Hoeksema
Mary B. Horst
Gary C. Hughes
Margery A. Hulburt

Stanley J. Indest, Jr.
Mark G. Inghram, III

James S. Jackson
Michael C. Jackson
Carl E. Jacobson
Eric W. James
Mark D. Jancin
Karl O. Jepsen
Karen E. Jones
Royce A. Jones
Jeffrey M. Jordan
Teresa E. Jordan
Stephen E. Joseph
Charles F. Julian

Raynold I. Kablanow
Marc J. Kamerling
John A. Karachewski
John S. Kelley
Margaret I. Kimbell
John W. King
Rick L. Kirn
Polly L. Knowlton
Brian F. Koch
William E. Kochanov
Kenneth E. Kolm
Carole R. Kolodny
Kenneth J. Kormendy
Itzchak E. Kornfeld
Fleetwood R. Koutz
Mary J. Kraus
Alan J. Krause
Peter R. Kremer
John F. Krupa
Lung-Chuan J. Kuo
Jerry L. Kuzior

Kaj A. Lang
Erich R. Laskowski
Maynard W. Lassonde
Jennie M. Laursen
Rick Lawrence
Zelinda M. Leao
Mary F. Lee
Theodore D. Lee
Barry H. Lester
William W. Locke, III
Anthony J. Lomando
Patrick A. Longmire
Robert R. Loucks
Raymond P. Lynde

Raul J. Madrid
Rolfe D. Mandel
Terry W. Massoth
George A. Matthews
Steve R. Mattson
Barbara B. Mavko
Penny McAlaster
Steven T. McCarn
Daniel L. McCord
Deborah N. McFarlane
Mark A. McFarlane
Michael J. McFarlane
G. Elizabeth McKittrick
Stephen R. McNutt
James L. McWhirter
Andra Mealey
Helmar A. Meerheim
Kevin R. Melanson
Roger S. Miller
William H. Mills
Raymond A. Mitchell
Richard A. Moody
Michael G. Moore
Lowell R. Morrison
Stanley R. Mortimer
Robert J. Moye, Jr.
Daniel R. Muhs
Scott A. Mulligan
Stephen P. Mulqueen
John M. Munsil
Peter S. Murdoch
Laurence J. Mutti

Bruce K. Nelson
Kenneth R. Nixon
Stephen F. Norte
Peter H. Northrop
Gregory Nowak

Daniel P. O'Haire
David K. Olofin
Brian J. O'Neill
Greta J. Orris
David A. Orsen
Donald R. Osby
Abdelaziz A. Osman
Robert W. Otto
Jonathan T. Overpeck

Charles S. Palmer
Bruce C. Panuska
William Pappas
Rhonda L. Patterson
Norman J. Pearson
Limdamae Peck
Robert G. Perry
Harry W. Petersen
Janis McEwing Peterson
Lee C. Pigage
James A. Podruski
Barbara A. Poppelreiter
Lee Porter
Charles L. Powell, II
Thomas S. Powell
Donald R. Prothero

Richard C. Quittmeyer

Frank D. Ramos
Robert L. Ramseur
Richard J. Reeder
Walkyria R. Rey
Brady P. Rhodes
Cheyenne O. Riley
Larky L. Rochester
David L. Rodrick
Shelia J. Roebuck
Glenn R. Roquemore
James L. Rubenstone
Marjorie S. Ryack

Adekumle O. Sallu
Melissa A. Sandstrom
R. Tyler Sauer
Ellyn A. Schlesinger
Craig N. Schriber
Alexander Schriener, Jr.
Paul A. Schroeder
Stephen R. Schutter
Donn C. Schwartzkopf
Eugene S. Schweig III
Robert A. Sedivy
Warren D. Sharp
Buck Sharpton
Kevin L. Shelton
Phillip W. Shoemaker
Eric R. Simonson
Donald E. Singleton
Sharron G. Skipper
Linda C. Slater
Christine M. Slifko
Arthur T. Smith
Cynthia B. Smith
James J. Smith
Lawrence R. Smith
Leonard D. Smith, Jr.
John A. Smoliga
Jon N. Sondergaard
Ann K. Sparkes
Jerry J. Spetseris
Frederick T. Stanin
George Stephens
David R. Strait
Sabrina Y. Strautman
Peter Strugatz
James M. Sullivan
Michael G. Supp
Kenny D. Susewind
Willard J. Swank, Jr.
Barbara A. Swift
Richard A. Swindell

Lin M. Tarr
Grayce S. Teal
Lewis W. Teal
Maria A. Terres
Stephen M. Testa
Richard L. Thiessen
Peter C. Thomas
Markus D. Thomerson
James E. Thurber
Glenn H. Timson
Phyllis R. Tippit
Ping-Hong Tse
Harold A. Tuchfeld

Paul J. Umhoefer

Herbert A. Vogler

William J. Wade
David G. Waggoner
Richard T. Wallace
Thomas R. Warner
Douglas S. Washburn
Donald J. Wason
Thomas J. Wawro
Christopher F. Waythomas
Marylou Weaver
Jeffrey T. Weigen
Paula A. Weiss
Nicholas R. Wemyss
David Wesolowski
Mark T. Wheeler
Peter M. Whelan
Laura R. Whitaker
Roberta E. Widdicombe
Curtis L. Wilbur
Ralph W. Wilcox, III
Gregg Wilkerson
Terry J. Wilson
Gary A. Winter
John P. Wold
George Wong
Alan J. Woods
Paul L. H. Worley

Gary M Yeo

Lorraine Zarrow
Elias Zlotnik
Erick Zubay

GSA committees and representatives . . .

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

EXECUTIVE COMMITTEE

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

AUDIT COMMITTEE

Randolph W. Bromery, Paul A. Bailly, Don U. Deere.

COMMITTEE ON COMMITTEES

John C. Crowell, Richard B. Campbell, Thornton L. Neathery, Allison Palmer, Gordon Swann.

COMMITTEE ON ENVIRONMENT & PUBLIC POLICY

Allen F. Agnew (1978-80), M. Genevieve Atwood, (1976-78), Donald D. Runnells (1976-78), Nathaniel Rutter (1976-78), Robey H. Clark (1977-79), M. Gordon Wolman (1977-79), Hugh R. Wynne-Edwards (1977-79), Charles G. Groat (1978-80), Robert W. Metsger (1978-80).

GSA-TREATISE ADVISORY COMMITTEE

J. Tom Dutro, Jr. (1975-78), Roger L. Batten (1977-80), John C. Frye, Continuing.

HEADQUARTERS ADVISORY COMMITTEE

David B. MacKenzie (1977-79), S. Warren Hobbs (1977-79), Betty M. Miller (1977-79), Bruce F. Curtis (1978-80), John W. Rold (1978-80).

COMMITTEE ON HONORS AND AWARDS

William R. Dickinson, James B. Thompson, Jr., Curt Teichert, Preston Cloud, Edward C. Dapples, Lloyd B. Underwood, Eugene S. Simpson, Don J. Easterbrook.

SUBCOMMITTEE ON THE PENROSE MEDAL AWARD

William R. Dickinson, Richard L. Armstrong (1976-78), Laurence L. Sloss (1977-79), Lynn R. Sykes (1977-79), Richard H. Jahns (1978-80), Helen Tappan Loeblich (1978-80), Raymond A. Price (1978-80).

SUBCOMMITTEE ON THE ARTHUR L. DAY MEDAL AWARD

James B. Thompson, Jr., Peter Robinson (1976-78), Robert E. Zartman (1976-78), Nikolas I. Christensen (1977-79), Allan V. Cox (1978-80).

SUBCOMMITTEE ON HONORARY FELLOWS

Curt Teichert (1976-78), J. Kaspar Arbenz (1977-79), Claude C. Albritton, Jr. (1978-80), Robert E. Folinsbee (1978-80).

SUBCOMMITTEE ON NATIONAL MEDAL OF SCIENCE

Preston Cloud (1977-78), Julian R. Goldsmith (1977-79), Clarence R. Allen (1978-80).

COAL GEOLOGY DIVISION PANEL ON GILBERT H. CADY AWARD

Edward C. Dapples (1975-79), Harold J. Gluskoter (1977-79), William Spackman (Immediate Past Recipient, 1978), S. A. Friedman (Division Chairman, 1978), A. R. Cameron (Division Vice-Chairman, 1978).

ENGINEERING GEOLOGY DIVISION PANEL ON E. B. BURWELL, JR., AWARD

Lloyd B. Underwood, Bernard W. Pipkin, Charles A. Baskerville, Erhard M. Winkler, Raymond T. Throckmorton, Jr., Alan L. O'Neill.

HYDROGEOLOGY DIVISION PANEL ON O. E. MEINZER AWARD

Eugene S. Simpson, R. Allan Freeze, Isaac J. Winograd, John A. Cherry, Martin Mifflin.

QUATERNARY GEOLOGY & GEOMORPHOLOGY DIVISION PANEL ON KIRK BRYAN AWARD

Don J. Easterbrook, John T. Andrews (1977-79), Victor R. Baker (1977-79), Marie Morisawa (1977-79), James B. Benedict (1978-80), William R. Farrand (1978-80), Sidney E. White (1978-80).

COMMITTEE ON INVESTMENTS

Robert L. Fuchs (1978-80), August Goldstein, Jr. (1977-79), Donald A. Parks (1977-79), C. Harry Burgess (1978-80).

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

Conferees: James Boyd (non-voting), Robert E. King (non-voting).

COMMITTEE ON MEMBERSHIP

Joan R. Clark (1977-79), Doris M. Curtis (1977-79), Thornton L. Neathery (1977-79), Richard A. Paull (1978-80), Lee A. Woodward (1978-80).

COMMITTEE ON NOMINATIONS

William C. Bradley, W. G. Ernst, John C. Maxwell, Anthony J. Naldrett, George A. Thompson.

• • •

COMMITTEE ON PENROSE CONFERENCES

Bruce B. Hanshaw (1978-80), David A. Stephenson (1977-79), Tanya M. Atwater (1978-80).

Conferee for 1978: Raymond A. Price.

COMMITTEE ON PUBLICATIONS

Frank E. Kottlowski (1976-78), William W. Hutchison (1976-78), Robert E. Davis (1977-79), Brian J. Skinner (1977-79), Burrell C. Burchfiel (1978-80), Porter Martin Kier (1978-80).

Conferees: Leon T. Silver, Past Chairman; John C. Frye, Executive Director; Vernon E. Swanson, Science Editor; Josephine K. Fogelberg, Production Manager; Contractual Appointments: Fred S. Honkala, Executive Director, AGI; John G. Mulvihill, Manager, GeoRef Project.

COMMITTEE ON RESEARCH GRANTS

Steven M. Stanley (1976-78), Peter R. Vail (1977-79), William C. Kelly (1978-80).

Conferee for 1978: William E. Benson.

AD HOC COMMITTEE ON MINORITY GROUP MEMBERS IN THE EARTH SCIENCES

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

AD HOC HEADQUARTERS ADVISORY ART COMMITTEE

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

AD HOC COMMITTEE ON CRITERIA FOR GSA ASSOCIATED SOCIETIES

Julian R. Goldsmith, Robert F. Legget, R. Dana Russell, Robert H. Shaver, F. Michael Wahl, E-an Zen.

AD HOC COMMITTEE ON LONG-RANGE PLANNING OF ANNUAL MEETINGS, NO. 3

William R. Muehlberger, William C. Bradley, W. G. Ernst, William R. Dickinson.

AD HOC GSA CENTENNIAL PLANNING COMMITTEE

Richard H. Jahns, Chairman; Robert E. Boyer, Vice-Chairman; Clarence R. Allen; Gabriel Dengo; M. Charles Gilbert; Sheldon Judson; David B. MacKenzie; Vincent E. McKelvey; Digby J. McLaren; Guillermo P. Salas; Laurence L. Sloss; M. Gordon Wolman.

Ex Officio: President, Vice-President, Treasurer, Past-President, Executive Director.

GSA REPRESENTATIVES TO AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS)

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

GSA REPRESENTATIVES TO AMERICAN COMMISSION ON STRATIGRAPHIC NOMENCLATURE (ACSN)

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

William W. Hay (1975-1978), Malcolm P. Weiss (1976-1979), Robert S. Houston (1977-1980), Clarence A. Hall, Jr. (1978-1981).

GSA REPRESENTATIVES TO GSA-AEG-ASCE JOINT COMMITTEE ON ENGINEERING GEOLOGY (AMERICAN SOCIETY OF CIVIL ENGINEERS)

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

GSA REPRESENTATIVE TO U.S. NATIONAL COMMITTEE ON GEOCHEMISTRY

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

GSA REPRESENTATIVE TO U.S. NATIONAL COMMITTEE ON GEOLOGY

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

GSA REPRESENTATIVE TO U.S. NATIONAL COMMITTEE ON ROCK MECHANICS (USNCORM)

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

GSA REPRESENTATIVE TO U.S. NATIONAL COMMITTEE ON TUNNELING TECHNOLOGY

Don U. Deere (July 1, 1977-June 30, 1980).

GSA REPRESENTATIVES TO GSA-SSSA INTERDISCIPLINARY COMMITTEE (SOIL SCIENCE SOCIETY OF AMERICA)

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

GSA MEMBER OF THE AGI GOVERNING BOARD

Charles L. Drake (November 1977-November 1978).

GSA REPRESENTATIVE TO THE AAPG AD HOC COMMITTEE ON REVISION OF THE STRATIGRAPHIC CORRELATION CHARTS FOR NORTH AMERICA

Mitchell W. Reynolds.

GSA REPRESENTATIVE TO EARTHQUAKE ENGINEERING RESEARCH INSTITUTE

Richard H. Jahns.

GSA REPRESENTATIVE TO ASSEMBLY OF MATHEMATICAL & PHYSICAL SCIENCES (NRC)

John C. Frye (Effective May 1, 1975).

Associated societies name officers for 1978

Cushman Foundation

President, *Don L. Eicher,* Department of Geology, University of Colorado, Boulder, Colorado 80309, (303) 492-8141. Vice-President, *William V. Sliter,* U.S. Geological Survey, 345 Middlefield Road, Menlo Park, California 94025, (415) 323-8111. Secretary-Treasurer, *Frederick J. Collier,* E-501 U.S. National Museum of Natural History, Washington D.C. 20560, (202) 381-5675. Past Chairman, *Emile A. Pessagno, Jr.,* Geosciences Division, University of Texas at Dallas, Box 688, Richardson, Texas 75080, (214) 690-2401.

The Geochemical Society

President, *Hugh J. Greenwood,* Department of Geology, University of British Columbia, Vancouver, British Columbia V6T 1W5, (604) 228-2449. Vice-President, *Samuel Epstein,* Division of Geological Sciences, California Institute of Technology, Pasadena, California 91125, (213) 795-6811. Secretary, *Peter R. Buseck,* Department of Chemistry, Arizona State University, Tempe, Arizona 85281. (602) 965-5081. Treasurer, *George R. Helz,* Department of Chemistry, Box 106, University of Maryland, College Park, Maryland 20742, (301) 754-2613. Past President, *Edwin Roedder,* U.S. Geological Survey, 959 National Center, Reston, Virginia 22092, (703) 860-6630.

Geoscience Information Society

President, *Richard D. Walker,* Library School, University of Wisconsin-Madison, 600 North Park Street, Madison, Wisconsin 53706, (608) 263-2919 or 263-2900. Vice-President, *Julie H. Bichteler,* Graduate School of Library Science, University of Texas-Austin, Austin, Texas 78712, (512) 471-3821. Secretary, *Elizabeth C. Behrendt,* U.S. Geological Survey Library, 914 Federal Center, Box 25046, Denver, Colorado 80225, (303) 234-4133. Treasurer, *Robert A. Bier, Jr.,* U.S. Geological Survey Library, 950 National Center, Reston, Virginia 22092, (703) 860-6671. Past President, *John G. Mulvihill,* American Geological Institute, 5205 Leesburg Pike, Falls Church, Virginia 22041, (703) 379-2480.

Mineralogical Society of America

President, *Peter J. Wyllie,* Department of Geophysical Sciences, University of Chicago, Chicago, Illinois 60637, (312) 753-8108. Vice-President, *David R. Wones,* Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061, (703) 951-6521 (Department). Secretary, *Larry W. Finger,* Geophysical Laboratory, 2801 Upton Street, NW, Washington, D.C. 20008, (202) 966-0334. Treasurer, *Malcolm Ross,* U.S. Geological Survey, 959 National Center, Reston, Virginia 22092, (703) 860-6667. Past President, *F. Donald Bloss,* Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061, (703) 951-5151 (Office), (703) 951-6521 (Department).

National Association of Geology Teachers

President, *Richard A. Paull,* Department of Geological Sciences, Univeristy of Wisconsin-Milwaukee, Milwaukee, Wisconsin 53201, (414) 963-4561. Vice-President, *Robert W. Ridky,* Department of Geology, University of Maryland, College Park, Maryland 20742, (301) 454-2024. Secretary-Treasurer, *Alan R. Geyer,* (1977-1979), Bureau of Topographic and Geologic Survey, P.O. Box 2357, Harrisburg, Pennsylvania 17105, (717) 787-5828. Past President, *Robert L. Heller,* 515 Administration Building, University of Minnesota-Duluth, Duluth, Minnesota 55812, (218) 726-7106.

Paleontological Society

President, *Francis G. Stehli,* Dean of Science and Engineering, Case Western Reserve University, Cleveland, Ohio 44106, (216) 368-4436. President-Elect, *Richard E. Grant,* Paleobiology Department, E-206 National History Building, Washington, D.C. 20560, (202) 381-5412. Secretary, *Walter C. Sweet,* Department of Geology and Mineralogy, Ohio State University, 125 South Oval Mall, Columbus, Ohio 43210, (614) 422-2326 (Office), (614) 451-3555 (Home). Treasurer, *John A. Fagerstrom,* Department of Geology, University of Nebraska, Lincoln, Nebraska 68508, (402) 472-2648 (Office), (402) 464-1338 (Home). Past President, *David M. Raup,* Department of Geological Sciences, University of Rochester, Rochester, New York 14627, (716) 275-2414 (Office), (716) 872-3315 (Home).

Society of Economic Geologists

(Term of office: April 1, 1978, through May 31, 1979; vice-president does not automatically become president.) President, *Siegfried Muessig,* Getty Oil Company, 3810 Wilshire Boulevard, Los Angeles, California 90010, (213) 381-7151. Vice-President, *Stewart R. Wallace,* 8700 West 14 Avenue, Lakewood, Colorado 80215, (303) 233-0585. Secretary, *Arnold L. Brokaw,* 185 Estes Street, Lakewood, Colorado 80226, (303) 233-7170. Treasurer, *Ralph W. Marsden,* Department of Geology, University of Minnesota-Duluth, Duluth, Minnesota 55812, (218) 726-7237. Past President, *Paul C. Henshaw,* Homestake Mining Company, 650 California Street, San Francisco, California 94108, (415) 981-8150. Past Vice-President, *Donald E. White,* 222 Blackburn Avenue, Menlo Park, California 94025, (415) 325-3966 (Home), (415) 323-2367 (Office).

Society of Vertebrate Paleontology

President, *Peter Robinson,* Director, University of Colorado Museum, Boulder, Colorado 80309, (303) 492-6165. Vice-President, *S. David Webb,* Curator in Vertebrate Paleontology, Florida State Museum, University of Florida, Gainesville, Florida 32611, (904) 392-1721. Secretary-Treasurer, *Ernest L. Lundelius, Jr.,* Texas Memorial Museum, Balcones Research Center, 10100 Burnet Road, Austin, Texas 78758, (512) 471-5257 or (512) 836-0440. Past President, *William D. Turnbull,* Field Museum of Natural History, Chicago, Illinois 60605, (312) 922-9410.

Roster of women in the geoscience professions

The first Roster of Women in the Geoscience Professions, compiled from names voluntarily sent to the Women Geoscientists Committee of the American Geological Institute, is available for distribution. Copies may be obtained free of charge, while they last, by writing to Dr. Ursula B. Marvin, Smithsonian Astrophysical Observatory, 60 Garden Street, Cambridge, Massachusetts 02138.

All professional women geoscientists are urged to add their names to the next issue of the Roster by sending the following information to the above address before *June 1, 1978*.

- - - - - - - - - - - - - - - - - - - -

ROSTER OF WOMEN
IN THE GEOSCIENCE PROFESSIONS
(This roster does not include students)

Name _____

Education: Highest degree earned _____

_____ Year _____

Institution _____

Major Field: _____

Additional specialities of training or experience: _____

_____

_____

Professional societies: Memberships and offices held: _____

_____

_____

_____

Professional awards, fellowships, honors: _____

_____

_____

Employer and job title: _____

_____

Office telephone number: _____

Mailing address: _____

_____

_____

Send to: Dr. Ursula Marvin
Smithsonian Astrophysical Observatory
60 Garden Street
Cambridge, MA 02138

Siliceous deposits, topic of Penrose Conference in Aug.

A Penrose Conference on "Siliceous Deposits," sponsored by the Geological Society of America and the International Geological Correlation Program, will be held at the University of British Columbia, Vancouver, Canada, August 20 through 25, 1978. Conveners of the conference are James R. Hein, U.S. Geological Survey, Menlo Park, California; W. R. Danner, University of British Columbia, Canada; and Raymond Siever, Harvard University, Cambridge, Massachusetts.

There is now occurring a revolution in the study of siliceous deposits. Deep-sea samples recovered by the Deep Sea Drilling Project, the recognition that siliceous deposits are source rocks for major accumulations of hydrocarbons and that they are associated with iron and manganese deposits, and the need to establish a global geochemical silica budget has accelerated research concerning siliceous deposits. This conference will gather together geologists, geochemists, paleontologists, and oceanographers from many countries in order to transmit and integrate the latest thoughts of each group. Sessions are being planned on (1) Modern environments of silica deposition; (2) Mineralogy, geochemistry, and biogeochemistry of silica; (3) Micropaleontology; (4) Deep Sea Drilling Project results; (5) Tertiary siliceous deposits on continental crust; (6) Mesozoic, Paleozoic, and Precambrian cherts; (7) The distribution of siliceous deposits in space and time.

Three days will be occupied with discussions, some formal, but emphasis will be placed on informal working discussions with participation by all those present. In addition, two days will be spent viewing the bedded cherts of the Cache Creek Formation and other features of geologic interest in British Columbia. Also, an optional postmeeting field trip to the San Juan Islands may be organized. The registration fee will probably be under $175 per person, which will include lodging, meals, and field trip. Attendance will be limited to 55 persons. Application deadline is May 15, 1978. If you are interested in attending this conference, please write to James R. Hein.

Headquarters learned that Dr. Ian Campbell, 1968 GSA President, passed away in his sleep on Saturday, February 11, 1978. Ian's great, but gentle, impact on the science and on the profession will be with us always.

COMMITTEE NOMINATIONS SOUGHT

The Committee on Committees requests help from all members. As is customary, an entirely new committee has been appointed by Vice-President Leon T. Silver. Its sole purpose is to look for talent to serve GSA as members of our committees and as our representatives to other organizations.

The Committee on Committees will do its work late this summer and will present at least two nominations for each open position to the Council at its October meeting in Toronto. During that meeting, individual councilors may or may not add other names to the lists for consideration. The entire Council will then select appointees for all positions, thus completing the process of bringing new blood into Society affairs.

The Committee on Committees for 1978 is made up of the following people: *John C. Crowell* (chairman), *Richard B. Campbell, Thornton L. Neathery, Allison Palmer, and Gordon Swann.*

This group is broadly based, both geographically and in disciplines, but its members cannot possibly know all the GSA members who are potential candidates for serving the Society. You can help them immensely by volunteering yourself or by suggesting names of others who you think should be considered for any of the openings.

Mere listing of names for these positions will be helpful to the committee, *but you can be far more helpful* and will ensure more thorough consideration of your candidates, *if you will attach a note explaining the special qualifications of your candidates* for particular jobs. Please be sure that your candidates are Members or Fellows of the Society.

If you can think of a better or more democratic process for providing governance of the Society, please let us know. If you think the present system is at least adequate, do your part by suggesting candidates!

Listed below are all GSA committees and organizations to which GSA has representatives. Appointments to fill vacancies will be made by the Council at its fall meeting. (Duties of the committee members are described in the manual *Council Rules, Policies, and Procedures.*)

CUT HERE

PLEASE RETURN THIS FORM TO HEADQUARTERS BY AUGUST 10, 1978

GSA Committees	**Members suggested to serve on committees**
Day Medal	
Environment & Public Policy	
Headquarters Advisory	
Honorary Fellows	
Investments	
Membership	
Nominations	
Penrose Conferences	
Penrose Medal	
Publications	
Research Grants	
Treatise Advisory	

GSA Representatives to:	**Members suggested to serve as GSA Representatives**
AAAS	
ACSN	
GSA-AEG-ASCE Joint Comm. on Engineering Geology	
U.S. Natl. Comm. on Geochemistry	
U.S. Natl. Comm. on Geology	
U.S. Natl. Comm. on Rock Mechanics	
U.S. Natl. Comm. on Tunneling Technology	

Remarks: _____

_____

_____

Signature (optional) _____

1978 Joint Technical Program Committee

Chairman . . . . . J. Jeffrey Fawcett
General Chairman, Local Committee Paul M. Kavanagh
Chairmen, 1977 JTPC . . . . . John T. Whetten
R. Scott Babcock
Chairman, 1979 JTPC . . . . . Richard Berry
President, GSA, ex officio . . . . . Peter T. Flawn
Executive Director, GSA, ex officio . . . . John C. Frye
GAC Representatives . . . . . G. Norris
John A. Westgate
GSA Representatives-at-Large . . . . . .
L. Trowbridge Grose (1976-78)
Donn S. Gorsline (1976-78)
Richard B. Taylor (1976-78)
J. J. Papike (1977-79)
Lee A. Woodward (1977-79)
MAC Representatives . . . . . G. M. Anderson
F. J. Wicks

GSA DIVISION REPRESENTATIVES

Archaeological Geology . . . . . John C. Kraft
Coal Geology . . . . . A. R. Cameron
Engineering Geology . . . . . Richard H. Jahns
Geophysics . . . . . D. B. Slemmons
History of Geology . . . . . C. G. Winder
Hydrogeology . . . . . John A. Cherry
Quaternary Geology and Geomorphology . . . . . .
William B. Bull

ASSOCIATED SOCIETY REPRESENTATIVES

Cushman Foundation . . . . . Don L. Eicher
Geochemical Society . . . . . Kenneth R. Ludwig
Geoscience Information Society . . . Richard D. Walker
Mineralogical Society of America . . . Donald R. Peacor
National Assn. of Geology Teachers . . Robert W. Ridky
Paleontological Society . . . . . N. Gary Lane
Society of Economic Geologists . . . Robert S. Houston
Society of Vertebrate Paleontologists . . . . . .
Judith A. Van Couvering

ASSOCIATED SOCIETY CONFEREES

Cushman Foundation . . . . . None Appointed
Geochemical Society . . . . . Martin Goldhaber
Geoscience Information Society . . . . Julie H. Bichteler
Mineralogical Society of America . . . . . Peter Robinson
and second conferee
National Assn. of Geology Teachers . . None Appointed
Paleontological Society . . . . . Joseph T. Gregory
Society of Economic Geologists . . . Arnold L. Brokaw
Society of Vertebrate Paleontologists . . . . . .
None Appointed

April BULLETIN briefs

Brief summaries of articles in the April 1978 Bulletin *are provided on the following pages and 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.*

• 80401—Transected folds: A study illustrated with examples from Canada and Scotland.

Graham John Borradaile, Geologisch Instituut, Universiteit van Amsterdam, Amsterdam, The Netherlands. (13 p., 21 figs.)

Transected folds have contemporaneous cleavage that is not parallel to their axial surface but cuts through the axial surface and both limbs with the same sense. Such folds can develop with perfectly synchronous formation of folds and cleavage. This may occur in rocks undergoing a bulk coaxial strain history or in an approximately coaxial phase of a more complex strain history in which the strain axes do rotate relative to the deforming rocks. In a noncoaxial strain history, transected folds may also arise by a different mechanism, in which cleavage formation is slightly delayed relative to fold formation. This may be achieved where the grain-shaping (cleavage-forming), intragranular deformation mechanisms are initially suppressed because rock flow is more easily accommodated by intergranular movement. The temporary local volume increases required by this "grain-boundary sliding" may occur during dewatering.

Transected folds may readily occur and have already been described in many areas. Therefore, field mapping

techniques assuming a special geometrical relationship between folds and cleavage should be used only where the degree, or absence, of transection of folds by their contemporaneous cleavage has been established.

• 80402—The extraordinary striated outcrop at Saqsaywamán, Peru.

Tomas Feininger, Escuela Politecnica Nacional, Quito, Ecuador. (10 p., 6 figs., 1 tbl.)

An outcrop of andesite with an extraordinary striated surface stands facing the Inca ruins of Saqsaywamán, near Cusco, Peru. The andesite has an aplitic texture and is considerably altered. The striations, which range from microgrooves to channels a metre deep, are equally well developed regardless of the attitude of the surface on which they occur. The striated surface is deformed. It is cut by hairline fractures (microjoints), conjugate shears, and locally has been thrust over itself. The andesite with its striated surface has been deformed, both in a plastic and in a brittle fashion, due to collapse in response to loss of support from below.

The andesite reached the Earth's surface along an eruptive fissure. The first materials ejected were hot but solid blocks which built an elongated, steep-sided mound. Later, viscous lava was extruded through the crest of the mound and flowed down its flanks. The stretching of the lava during flowage caused its surface to become striated, analogous to the striations on the surface of pulled taffy. The hairline fractures, conjugate shears, and thrusts were produced by the changing conditions of stress during the different stages of the flow. Compaction of the pyroclastic mound during and after flowage of the viscous lava caused first plastic collapse and then brittle collapse of the andesite.

• 80403—A model of the development of continental shelves having erosional origin.

Tsuguo Sunamura, Coastal Engineering Laboratory, University of Tokyo, Tokyo 113, Japan. (7 p., 8 figs., 3 tbls.)

During the postglacial sea-level rise, wave action has played an important role in the formation of continental shelves that have an erosional origin. On this basis, a mathematical model of shelf development was completed; the modeling was done by incorporating (1) coastal cliff erosion and (2) the Flandrian transgression. The result was given by the following two equations:

$$X_* = -W_0 + \frac{AW_0}{h_a}(1 - 2e^{-at} + e^{-2at}) + \frac{2Ac}{h_a}\left[\frac{3}{4a} - \left(t + \frac{1}{a}\right)e^{-at} + \frac{1}{2}\left(t + \frac{1}{2a}\right)e^{-2at}\right]$$

and

$$Z_* = -h_a + A(1 - 2e^{-at} + e^{-2at}),$$

where X_* and Z_* = the coordinates showing a continental shelf profile; c = cliff recession rate; t = time; h_a = ultimate abrasion depth expressed by

$$\left(\sinh \frac{2\pi h_a}{L}\right)\left(\frac{H_0}{H}\right) = 9.33 L_0^{1/3}\left(\frac{H_0}{L_0}\right),$$

where H_0 and L_0 = deep-water wave height and length, respectively, and H and L = wave height and length, at a water depth of h_a, respectively; W_0 = the initial width of wave-cut terrace given by

$$W_0 = W_p - (2 \times 10^4)c,$$

where W_p = the present terrace width, defined as the horizontal distance from the present coastline to the location providing a water depth of h_a; A = 125 m; and $a = 1.98 \times 10^{-4}$ yr^{-1}.

The validity of this model was investigated in the Byobugaura area of Japan, facing the Pacific Ocean. The result showed that the present model could explain in full the first essentials of continental shelf development.

• 80404—Petrology and regional significance of the Roxboro Metagranite, North Carolina.

David F. Briggs, M. C. Gilbert, L. Glover III, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061 (present address, Briggs: Department of Geosciences, University of Arizona, Tucson, Arizona 85721). (11 p., 8 figs., 3 tbls.)

The pluton located at Roxboro, North Carolina, is predominantly a light gray to medium gray, microphaneritic metagranite. Phenocrysts of plagioclase, quartz, and perthite are accompanied by porphyroblasts of epidote. Relict igneous textural relationships suggest two possible fractional crystallization models, in both of which the order of crystallization was plagioclase, quartz, and then K-rich feldspar. A crude approximation of the composition of the original plagioclase phenocrysts is An_{25} to An_{40}. Based on the composition of locally present granophyre, the pluton was emplaced under almost dry conditions with a P_{total} of about 350 bars and a temperature in the vicinity of 950 °C. The shallow depth of emplacement suggests that the Roxboro Metagranite represents the root of a volcanic sequence that once unconformably overlay the presently exposed sequence. During the middle Paleozoic, this granitic intrusive was metamorphosed at a minimum pressure of about 3 kb and a temperature of approximately 400 °C. A foliation, as shown by stringers of mainly biotite and epidote, was produced by the deformational phase accompanying regional metamorphism. All K-rich feldspar is now nearly pure microcline ($\sim Or_{97}$), and all plagioclase is now nearly pure low albite (Ab_{97-99}). Such feldspar compositions accompanied by late growth of ferristilpnomelane indicate a re-equilibration under lower grade conditions than those realized during the peak of the major regional metamorphic event.

• 80405—Geological significance of Rb-Sr isotopic data of northern Chile crystalline rocks of the Andean orogen between latitudes 23° and 27° South.

Martin Halpern, Geosciences Program, The University of Texas at Dallas, Richardson, Texas 75080. (11 p., 7 figs., 3 tbls.)

Total rock and mineral ages of Chilean diorite to rhyodacite igneous rocks are middle(?) to late Paleozoic near the Argentine frontier, Permian-Triassic along the Pacific coast (as well as some 125 km inland), and Jurassic to Holocene from the Pacific coast to the Argentine border. To the east, in northwestern Argentina, plutonic igneous rocks fall within two age groups, latest Precambrian to Paleozoic and Early Cretaceous.

Copper mineralization in the Imilac region is radiometrically dated as late Paleozoic. This is the first evidence of metalliferous deposits of this age in northern Chile. Analyses of ten samples of quartz-plagioclase porphyry from the middle Tertiary El Salvador mine give an average Sr^{87}/Sr^{86} initial ratio of 0.7033 ± 0.0004 (2σ) suggests that these copper porphyries did not originate from sialic crustal source rocks. El Salvador porphyries have uniform strontium isotopic composition and marked fractionation trends with respect to rubidium and strontium concentrations.

The initial Sr^{87}/Sr^{86} ratios of igneous rocks with Rb/Sr ratios less than one and of pre-late Cenozoic age range between 0.703 and 0.706. The late Cenozoic volcanic rocks have Sr^{87}/Sr^{86} ratios of 0.7058 to 0.7069.

• 80406—Upper Mesozoic flysch of Tierra del Fuego and South Georgia Island: A sedimentologic approach to lithosphere plate restoration.

R. D. Winn, Jr., Department of Geology & Geophysics, University of Wisconsin, Madison, Wisconsin 94706 (present address: Denver Research Center, Marathon Oil Company, P. O. Box 269, Littleton, Colorado 80160). (15 p., 12 figs., 1 tbl.)

The South Georgia Island segment of the North Scotia Ridge is interpreted as having once been adjacent to Tierra del Fuego, South America. The upper Mesozoic graywackes, mudstones, and tuffs of South Georgia (Cumberland Bay and Sandebugten strata) and Tierra del Fuego (Yahgan Formation and Tekenika Beds) are the infill of a marginal basin that formed between the South American continent and an active calc-alkalic arc. The former arc site is now occupied by the Patagonian batholith; ophiolites represent the former basin sea floor.

Sediment gravity flow fabrics, sedimentary structures, and bedding styles and relatively deep-water trace fossils (*Phycosiphon, Helminthopsis, Taenidium, Zoophycos, Chondrites, Scalarituba?, Lophoctenium?*) indicate deposition on submarine fans. Paleocurrent and petrographic analyses indicate bilateral infilling of the basin. The only known possible sources for the Sandebugten sandstones are silicic volcanic and interbedded sedimentary rocks of the Jurassic Tobifera Formation of South America; this evidence indicates former juxtapositioning of South Georgia and Tierra del Fuego. The Sandebugten-type sandstones and the Jurassic volcanic rocks have abundant quartz and plagioclase, uncommon potassic feldspar, and essentially no pyroxene and amphibole. Lithic fragments in these sandstones have identical counterparts in the Jurassic volcanic and sedimentary rocks. The Yahgan and Cumberland Bay clastic rocks were eroded chiefly from calc-alkalic volcanic rocks positioned south of their depositional areas. The latter sandstones are made up dominantly of andesite and dacite tuff and flow fragments. Plagioclase is common; quartz, ferromagnesian minerals, and mafic volcanic fragments are uncommon. Basin closure and deformation occurred during the Late Cretaceous Andean orogeny when the rocks were metamorphosed to prehnite-pumpellyite grade. South Georgia was translated relatively eastward, probably as the result of collision of the Drake Passage spreading zone with the continent during Oligocene to Miocene time.

• 80407—The Selkirk fan structure of the southeastern Canadian Cordillera.

Richard L. Brown, Clinton R. Tippett, Department of Geology, Carleton University, Ottowa, Ontario, Canada K1S 5B6 (present address, Tippett: Department of Geological Sciences, Queen's University, Kingston, Ontario, Canada K7L 3N6). (11 p., 9 figs.)

The Selkirk fan structure evolved by superposition of two distinct phases of deformation upon strata previously involved in nappe formation (phase I).

Phase II folds are dominant on the southwestern flank of the Selkirks where the folds are strongly overturned toward the southwest. Phase III folds are dominant on the northeastern flank where the strata are overturned toward the northeast. The fan structure is located where northeastward-dipping phase II axial surfaces are overprinted and transposed by steeply dipping to vertical phase III axial surfaces.

Granodioritic plutonism and the main growth of metamorphic porphyroblasts occurred after phase II and before the onset of phase III. Depths of burial compatible with the peak of regional metamorphism were maintained at least until the later stages of phase III deformation.

The evolution of the fan structure may be explained in terms of initial underthrusting of the southwestern flank of the Selkirk terrane by the Shuswap metamorphic complex followed by underthrusting of the northeastern flank by basement rocks of the Rocky Mountain foreland.

• 80408—Scour and fill in steep, sand-bed ephemeral streams.

Michael G. Foley, Department of Geology, University of Missouri-Columbia, Columbia, Missouri 65201. (12 p., 10 figs., 1 tbl.)

The traditional idea that entire long reaches of alluvial stream channels in semiarid regions are scoured at high flood discharges and subsequently filled in the waning flood phase (mean-bed scour and fill) can be challenged. The alternative concept that mean-bed elevation varies but little during a flood and that both scour and fill occur concurrently at different migrating loci within a reach (local scour and fill) is also consistent with published field data. Field and laboratory investigations

reported herein suggest that mean-bed scour and fill in a straight uniform channel is minor compared to local scour and fill caused by bedform migration and, furthermore, that maximum local scour and fill may occur during the waning flood phase in some instances.

The field experiment, utilizing a rectilinear array of maximum-scour indicators (scour-cords), produced data for contoured plots of maximum scour and fill in an ephemeral stream bed during two floods. In the first flood, 24 cm of scour and fill was measured for a bankfull flow depth of 23 cm. In the second, maximum scour and fill was at least 66 cm for a bankfull flow depth of 34 cm. Estimates of antidune amplitudes for the two floods, based on theoretical models and laboratory and field observations, are 27 to 61 cm and 44 to 92 cm, respectively. This indicates that all scour and fill measured by the scour-cord array could have been caused by antidune migration.

Laboratory experiments were conducted in an 18-m long nonrecirculating flume with automated controls for rates of sediment and water input. A series of experiments in a 26.7-cm-wide sand-bed channel with rigid walls, at grade for a simulated flood patterned after those typical of ephemeral streams, showed that mean-bed scour and fill was less than 3% of local scour and fill. For these experiments, mean sand size was 0.3 mm, channel slope was 0.009, maximum water depth was 40 mm, maximum local scour and fill was 22 mm, and maximum mean-bed scour and fill was 0.6 mm. Maximum mean-bed elevation variation was thus only two sand-grain diameters. Maximum local scour and fill took place near the end of the simulated floods, when bedform amplitudes were the greatest.

Antidune amplitudes calculated for flows in the Arroyo de los Frijoles, New Mexico, are larger than published values of scour and fill for unit discharges greater than 0.5 $m^3/m \cdot s$ (5 cfs/ft). Below that threshold discharge, the antidunes that formed at maximum flood discharge are smaller than the dunes that probably form during the waning flood, and calculated antidune amplitudes are less than reported scour and fill.

• 80409—Near-bottom magnetic measurements between the FAMOUS area and DSDP sites 332 and 333.

David Greenewalt, Ocean Sciences Division, Naval Research Laboratory, Washington, D.C. 20375; Patrick T. Taylor, Sea Floor Division, Naval Ocean Research and Development Activity, Bay St. Louis, Mississippi 39520. (6 p., 6 figs.)

Three recently measured near-bottom magnetometer profiles (57, 35, and 45 km long) extend across the axial valley of the Mid-Atlantic Ridge to Deep Sea Drilling Project (DSDP) sites 332 and 333. Analyses of these data, using forward and inverse methods of interpretation, reveal the magnetic polarity of the rocks from the present to 3.32 m.y. B.P. Interval spreading rates range from 0.57 to 1.27 cm/yr; this variation occurs across and along the strike of the ridge flank. Our data do not reveal any previously undetected polarity events; however, our results do indicate the presence of three normal polarity events within the Matuyama reversed epoch. The DSDP sites 332 and 333 appear to lie at a polarity transition zone in the Gilbert reversed epoch at the end of the Cochiti normal event.

• 80410—Cleavages in deformed psammitic rocks from southeastern Australia: Their nature and origin.

D. R. Gray, School of Applied Geology, University of New South Wales, Kensington 2033 Australia (present address: Department of Geological Sciences, Virginia Polytechnic Institute and State University, 4044 Derring Hall, Blacksburg, Virginia 24061). (14 p., 17 figs.)

Cleavages in deformed psammatic rocks from southeastern Australia range from spaced rough cleavages (morphological equivalents of slaty cleavage in psammites) to crenulation cleavages. The microstructure of these cleavages suggests that solution transfer processes play an important part in their development, and that their morphology is dependent on features of the preexisting fabric (the fabric existing prior to cleavage formation). Former mechanical hypotheses (Leith, 1905; Wilson, 1946) do not explain the observed cleavage microfabrics. There is a general lack of cataclastic textures and of any significant internal deformation of shape-modified grains. These grains, however, have corroded, irregular boundaries typical of dissolution. Rough cleavage development requires dissolution about individual grains, whereas the development of "zonal" and "discrete" crenulation cleavages requires dissolution on existing rough cleavage seams along the limbs of developing microfolds. Cleavage differentiation in each case is due to the dissolution of quartz and feldspar and the passive concentration of phyllosilicates, opaques, and iron oxides along the cleavages. However, crystallization and/or recrystallization of mica may also contribute to the final cleavage fabric, particularly in rough cleavage fabrics where mica beards are well developed.

• 80411—Explosive volcanic activity in the Mediterranean over the past 200,000 yr as recorded in deep-sea sediments.

J. Keller, Mineralogisches Institut der Universität Freiburg, Hebelstrasse, 40, 78 Freiburg, West Germany; W.B.F. Ryan, D. Ninkovich, Lamont-Doherty Geological Observatory, Palisades, New York 10964; R. Altherr, Mineralogisches Institut der Universität Freiburg, Hebelstrasse, 40, 78 Freiburg, West Germany. (14 p., 16 figs., 6 tbls.)

As many as 20 air-borne tephra layers have been identified in the upper Quaternary sequence of deep-sea cores from the eastern Mediterranean. Petrographical examination based on refractive index, phenocryst content, and chemical composition of the volcanic glass distinguishes the parent magma types: (1) tephritic, (2) alkalic-trachytic, (3) peralkalic-pantelleritic, and (4) calc-alkalic andesitic to rhyodacitic and alkali-basaltic. Tephra layers could be correlated with the following source volcanoes: Somma-Vesuvius, Roman district, Phlegraean Fields and Ischia, Pantelleria, Aeolian Islands, Mount Etna, and

Aegean arc. The distribution for single layers has been traced over more than 2,000 km.

• 80412—Volcanic structure of the crest of the Puna Ridge, Hawaii: Geophysical implications of submarine volcanic terrain.

Daniel J. Fornari, Lamont-Doherty Geological Observatory and Department of Geological Sciences, Columbia University, Palisades, New York 10964; Alexander Malahoff, National Ocean Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20852; Bruce C. Heezen, Lamont-Doherty Geological Observatory and Department of Geological Sciences, Columbia University, Palisades, New York 10964. (12 p., 10 figs.)

The morphology of submarine volcanic terrain on the crest of the Puna Ridge, Hawaii, was observed during two manned submersible dives in water depths of as much as 2,000 m. Steep-walled linear ridges 30 m high, trending 060°, and composed of lava pillows and narrow fissures with the same strike were the principal volcanic features observed on the ridge crest. Lava tunnels, tubes, and pillows frequently were observed to be partially broken through, thereby exposing water-filled voids, which are inferred to be interconnected to great depths within the extrusive submarine volcanic pile. Low compressional wave velocities reported by other authors for the crustal layer composed of submarine volcanic extrusives and the low effective density of this layer, as determined from published surface gravity observations, are attributed to the large intraflow and interflow porosity of submarine volcanic terrain. Areal variations in heat flow through the crust of submarine volcanic features are also attributed to the high porosity and consequent permeability of submarine volcanic terrain which is likely to persist to the bottom of the submarine extrusive pile.

• 80413—Kings River ophiolite, southwest Sierra Nevada foothills, California.

Jason Saleeby, Department of Geology and Geophysics, University of California, Berkeley, California 94720. (20 p., 7 figs.)

In the lower Kings River area, rocks older than the Sierra Nevada batholith include a disrupted and metamorphosed ophiolite. The Kings River ophiolite consists of tectonically emplaced slabs as much as 20 km long that are separated by serpentinite-matrix melange zones and by crosscutting plutons of the batholith. Within the slabs, various segments of the original ophiolite section are preserved. From the base upward, the reconstructed section consists of (1) a harzburgite zone (more than 4 km thick), (2) a transition zone between ultramafic and mafic tectonites and cumulates (2.5 km thick), (3) a gabbro zone with cumulates (2 km thick), (4) a mafic-dike zone (0.7 km thick), and (5) a pillow-basalt zone (1.8 km thick). The pillow basalt is overlain by at least 20 m of metalliferous radiolarian chert. After tectonic mixing and em-

placement into the Sierran terrane, the ophiolite was metamorphosed to the hornblende-hornfels facies by the batholith.

The Kings River ophiolite is interpreted as a disrupted fragment of oceanic crust and upper mantle. Isotopic ages along with structural and petrographic data indicate that the igneous part of the section originated in latest Paleozoic or possibly earliest Mesozoic time. Intense deformation of the ophiolite began at its point of origin. Deep levels of the ophiolite were penetratively mylonitized, intermediate levels were deformed by ductile faulting, and upper levels were deformed by brittle shear. As deformation and disruption progressed, serpentinization of the ophiolite's lower levels also progressed. Serpentinization and differential tectonic movements were concentrated along zones that became serpentinite-matrix melange. The inclusion of only ophiolite-assemblage rocks in the melange zones indicates that the melange mixing was oceanic.

The ophiolite originated and began its deformational history at a mid-ocean spreading center where that center was cut by a transverse fracture zone. The progression from brittle to ductile behavior with stratigraphic depth during initial deformation is attributed to a steep thermal gradient, typical of an ocean ridge. Progressive deformation and distruption and, ultimately, ophiolite emplacement occurred along a wrench zone that cut obliquely into western North America and truncated earlier-formed tectonic elements. The wrench zone is believed to have been an extension of the mid-ocean fracture zone that widened and became more complex with time. During the later stages of wrench movement, a component of eastward underthrusting commenced. Disrupted ocean floor of the wrench zone was left as an accretionary hanging wall of a newly formed subduction zone. A Jurassic volcanic arc was built across the already weakened oceanic basement as it underwent transverse shortening and continued wrench movements in response to oblique subduction. Final truncation of North American tectonic elements and emplacement of the ophiolite probably overlapped in time with arc activity. Similar deformation and truncation zones are a common feature in modern subduction-arc complexes of the circum-Pacific.

• 80414dr—Spreading history of the eastern Indian Ocean and India's northward flight from Antarctica and Australia: Discussion and reply.

Discussion: *Howard A. Meyerhoff, GeoSurveys, 3625 South Florence Place, Tulsa, Oklahoma 74105; A. A. Meyerhoff, Meyerhoff, Cox, and Schell, Inc., P.O. Box 4602, Tulsa, Oklahoma 74104.*

Reply: *B. D. Johnson, C. McA. Powell, J. J. Veevers, School of Earth Sciences, Macquarie University, North Ryde, New South Wales, 2113, Australia.*

GSA news & information