GSA news & information

SUPPLEMENT TO GEOLOGY MAGAZINE

AUGUST 1978

New—and much more flexible—dues structure for GSA in 1979

Two circumstances prompted a year-long study of the dues structure in effect in GSA for the past three years. These were suggestions from many members that they preferred not to be "locked in" to the five package options that have been offered and the introduction of *Part II* of the *Bulletin*, which in itself required a modification of the existing system.

The scheme, now approved by the Council at its meeting May 9-10, 1978, is so flexible and adaptable that it can accommodate any possible future change in the publication program without changing the system. In short, each member will individually build the combination of items that he or she wants. The pricing is established in such a way that if a member wants the exact equal to one of the former five options, he will pay only the inflation increase above the present options.

The way it works is that there will be membership dues in 1979 that include the privilege for the member to buy periodical publications at greatly reduced prices, well below cost in all cases. Basic dues of $20 ($10 to students) are the same as Option A during 1978. The basic dues cover the cost of maintenance of membership files, publication and mailing of *GSA News & Information,* ballots, and other membership-wide mailings, in addition to the member privileges to buy publications. Each Division continues to have dues of $2 per year (the same rate as in 1978), which cover their Division newsletters, ballots, and any special activity the Division wishes to undertake.

The 1979 *Bulletin, Part I* will look (and be) very much like the *Bulletin* during 1978. It will differ because in the front it will have two-page summaries of the longer articles published on microfiche in *Bulletin, Part II,* but the bulk of each monthly 160-page issue will carry papers now "in the mill," similar in type and appearance to the 1978 *Bulletin*.

The established publication prices for members and nonmembers for 1979 are listed below.

1979 DUES STRUCTURE

**Abstracts prices apply only when ordered on dues form*

	Nonmember price: USA Canada Mexico	Nonmember price: All other countries	Member price
Bulletin, Part I	$84.00	$90.00	$25.00
Bulletin, Part II	25.00	28.00	10.00
Geology	25.00	29.00	9.00
Annual Meeting *Abstracts with Programs*	8.00	8.00	3.00*

	Nonmember price: USA Canada Mexico	Nonmember price: All other countries	Member price
Each of 6 section meetings *Abstracts with Programs*	3.00	3.00	1.50*
Membership Directory	NOT AVAILABLE		5.00
10 separates from the conventional articles in *Bulletin, Part I*	NOT AVAILABLE		5.00

Officer and Councilors nominated for 1979

Leon T. Silver . . . . President
Division of Geological and Planetary Sciences
California Institute of Technology
Pasadena, California 91125

Laurence L. Sloss . . . . Vice-President
Department of Geology
Northwestern University
Evanston, Illinois 60201

William B. Heroy, Jr. . . . . Treasurer
Southern Methodist University
Box 274, SMU Station
Dallas, Texas 75275

Helen T. Loeblich . . . . Councilor
Department of Geology
University of California
Los Angeles, California 90024

John D. Moody . . . . Councilor
950 Third Avenue
18th Floor
New York, New York 10022

Raymond A. Price . . . . Councilor
Department of Geological Sciences
Queens University
Kingston, Ontario K7L 3N6

Jack A. Simon . . . . Councilor
Chief, Illinois State Geological Survey
Natural Resources Building
Urbana, Illinois 61801

A PERSONAL MESSAGE

to all Members and Student Associates (those in Option A excepted)

Help us to help you receive your Toronto '78 Abstracts with Programs on time!

The address labels used for the annual meeting book mailing will be generated on **August 15, 1978.** Therefore, your copy will be sent to the address we have on file for you AT THAT TIME. If you know that your address will change by early September—the time the book is expected to be delivered to your door—PLEASE LET US KNOW NOW. **Remember! An address change takes four to six weeks to become effective.**

NOTE By the time you read this, it may be too late to send your address change to us by mail. If so, phone **Membership Department, Geological Society of America, (303) 447-2020.**

— CORRECTION —

The employer's request form in the April 1978 *GSA News and Information* listed the price for booth rental for employment interviewing at the annual meeting as $10 per half day. The price will be $15 per half day at the Toronto meeting.

gsa publications

Decay and Preservation of Stone

Engineering Geology Case Histories Number 11 — Edited by Erhard M. Winkler. 1978. vii + 104 pages, 82 figures, 19 tables. ISBN: 0-8137-4011-8. $10.00.

The accelerated weathering and deterioration of stone monuments and buildings in urban-industrial areas is a subject of increasing interest to architects, builders, and preservationists. This interest led to three symposia held at consecutive annual meetings of the Geological Society of America in 1972, 1973, and 1974.

This volume is composed of selected papers and many striking photographs presented at these meetings. Part 1, Stone Properties and Testing, deals mainly with the properties of durability of stone aggregate. Part 2, Stone Weathering, deals with the chemical and other processes that affect silicates, carbonates, and other common rock types used in construction. It points out many unsolved problems and presents a few experimentally-tested solutions. Part 3, Stone Preservation, discusses the complexities of stone treatment after damage has occurred and summarizes preservation work in Germany and Indonesia.

CONTENTS: PART 1, STONE PROPERTIES AND TESTING. Standard engineering tests for aggregate: What do they actually measure? (by P. P. Hudec). Absorption and other properties of carbonate rock affecting soundness of aggregate (by R. D. Harvey, J. W. Baxter, G. S. Fraser, and C. B. Smith). Behavior of brittle rock in multi-increment creep tests (by C. E. Norman). Aggregates and pavement skid resistance (by F. A. Renninger and F. P. Nichols, Jr.). Direct tensile test for bond strength between Portland cement paste and rock or mineral surfaces (by M. A. Ozol). PART 2, STONE WEATHERING. Progress and problems in rock weathering related to stone decay (by W. D. Keller). Rock weathering on the molecular level (by P. P. Hudec). Stone decay in urban atmospheres (by E. M. Winkler). Stone weathering: A literature review (by E. M. Winkler). PART 3, STONE PRESERVATION. Development of performance criteria for the selection of stone preservatives (by G. Sleater). Certain epoxies, fluorocarbon-acrylics, and silicones as stone preservatives (by K. L. Gauri and M.V.A. Rao). Properties of laser-cleaned Carrara marble surfaces (by J. F. Asmus). Recent advances in stone conservation in Germany (by J. Riederer). Bibliography on stone preservation (by J. Riederer). Weathering and restoration of Borobudur Temple, Indonesia (by G. Hyvert). Conservation of stone: A literature review (by K. L. Gauri).

Order through Publication Sales Department, the Geological Society of America, 3300 Penrose Place, Boulder, Colorado 80301.

PRELIMINARY ANNOUNCEMENT AND CALL FOR PAPERS

NORTHEASTERN SECTION, 14th ANNUAL MEETING
Hershey, Pennsylvania, March 1–3, 1979

The **Northeastern Section** of the Geological Society of America will meet March 1-3, 1979, at the Hershey Motor Lodge & Convention Center, Hershey, Pennsylvania, together with the Eastern Section of SEPM and the Northeastern Section of the Paleontological Society. The meeting is sponsored by the Pennsylvania Bureau of Topographic and Geologic Survey; the Department of Geology, Dickinson College; and the Department of Earth Sciences, Millersville State College.

TECHNICAL SESSIONS will be held Thursday, Friday, and Saturday, March 1, 2, and 3.

To date, **SIX SYMPOSIA** have been scheduled: (1) Mineral Resources in the Northeastern U.S. (*C. B. Sclar and G. C. Stephens*); (2) Trace Elements and Health (*J. Freedman*); (3) Geology of Pennsylvania and the New Geologic Map of Pennsylvania (*T. M. Berg*); (4) Geology of Underground Radioactive Waste Disposal (*J. H. Peck*); (5) A Sampling of Current Research by the U.S. Geological Survey in the Northeastern U.S.: A Symposium on the Occasion of the Centennial (*E. L. Yochelson*); (6) Adirondack Geology (*W. D. Romey*). This symposium will be followed by an evening discussion session.

In addition, the Northeastern Section of the Paleontological Society will sponsor its second annual seminar: Paleobiology of Siluro-Devonian Reefs (Northeastern North America), followed by a luncheon, business meeting, and chairman's address; and the Eastern Section of SEPM will sponsor a symposium on a topic yet to be determined. With the exception of the USGS Centennial symposium, all of the symposia and the PS seminar are open to unsolicited papers in addition to those invited by the conveners. Anyone who wishes his paper to be considered for inclusion in one of these sessions should attach an extended summary (1,000 to 2,000 words) to the official 250-word abstract submitted for inclusion in the program. Up to 30 minutes will be assigned for presentation of symposium papers, as established by the conveners.

SHORT COURSE. A short course on remote sensing and geology, conducted by Richard Williams, U.S. Geological Survey, is planned.

CALL FOR PAPERS. Papers are invited for presentation at the technical sessions and symposia and/or for poster sessions. Papers of general disciplinary significance as well as those of regional scope will be accepted. Those of narrowly descriptive character and those with little new data and interpretations will have lower priority for inclusion. At the discretion of the program committee, some presentations will be assigned to poster sessions, and potential authors are urged to consider this as a favorable alternative to oral presentation at conventional sessions. Fifteen minutes will be allowed for presentation in the technical sessions (and 5 minutes for discussion).

ABSTRACTS, which are limited to 250 words, must be submitted (camera-ready) on official 1978 forms available from

Abstracts Coordinator Geological Society of America 3300 Penrose Place Boulder, CO 80301 (303) 447-2020	OR	Dr. Noel Potter, Jr. Program Committee Chairman Department of Geology Dickinson College Carlisle, PA 17013 (717) 245-1340

ABSTRACTS ARE DUE November 1, 1978.

Send one original and four copies to

Dr. Noel Potter, Jr.
Department of Geology
Dickinson College
Carlisle, PA 17013

Acceptance or rejection of an abstract will be based on review by the program committee of the abstract as submitted. Abstracts will be judged for information content, originality, correctness of format, and readibility.

STUDENT PAPERS. Three awards ($100, $50, and $25) will be made for the best student papers presented on a research problem. To be eligible, the papers must be by a single author and must be designated on the abstract form as a student paper.

PROJECTION EQUIPMENT will be available for 2" x 2" slides in carousels. Dual projectors and screens will be available. Please bring your own loaded carousel trays, if possible.

EXHIBIT SPACE will be available adjacent to the session area. Individual booths will be 8' x 10', and double booths will be available. Rental costs per booth will be $60 for educational exhibits and $120 for commercial exhibits. For additional information contact *Dr. William D. Sevon, Exhibit Chairman, Pennsylvania Geological Survey, P.O. Box 2357, Harrisburg, PA 17120, (717) 787-6029.*

DETAILED INFORMATION concerning registration, accommodations, and other activities will appear in a later issue of *GSA News & Information* and as a part of the *Abstracts with Programs* for 1979.

ADDITIONAL INFORMATION, REQUESTS, OR SUGGESTIONS should be directed to

Dr. Donald M. Hoskins, Local Committee Chairman
Pennsylvania Geological Survey
P.O. Box 2357
Harrisburg, PA 17120
(717) 787-2379

Announcements for 1979

Papers for all section meetings of the Geological Society of America are invited from GSA Fellows, Members, Student Associates, and nonmembers. Accepted abstracts will be published in the appropriate issue of *Abstracts with Programs*, which will be distributed as a formal publication prior to the section meeting. Depending on limitations set by the individual sections, any author may submit as many abstracts as he or she wishes; however, no more than two from any author or coauthor will be accepted for publication.

Abstracts will be selected on the basis of geologic significance, amount of new information, broad interest, and relevance to the section's geographic coverage.

GSA members are encouraged to order their section meeting book(s) on their dues statement at the special price of $1.50. The member price (ordering other than on dues statement) is $2.50. Nonmember price is $3.

Abstracts, which are limited to 250 words, must be submitted camera-ready on official GSA forms that may be obtained from the local committee officers listed on the facing page or from the

Abstracts Coordinator
Geological Society of America
3300 Penrose Place
Boulder, Colorado 80301

If the typing of the original copy will not reproduce satisfactorily, accepted abstracts will be retyped at GSA headquarters; the senior author will be charged $15. There will be no opportunity for authors to review or revise the retyped material. *Abstracts submitted on other than the GSA form will be returned without consideration for the meeting.*

PLEASE NOTE ABSTRACT DEADLINES. Acceptance or rejection of abstracts will be based on the abstracts as submitted by the author. There will be no opportunity to revise or withdraw them. Final decisions on acceptance or rejection of abstracts are the responsibility of the Program Committee.

POSTER SESSIONS. Some sections will have space for poster sessions during their 1979 meetings. It will be necessary to submit the usual 250-word abstract explaining the material on display. Even though a formal paper is not read, the abstract is printed in *Abstracts with Programs*. Decisions on whether papers are accepted for oral presentations or poster sessions will be made by the Program Committee. The authors, however, may indicate their preference if they so desire.

STUDENT PAPERS are welcomed and encouraged. Some sections give a Best Student Paper award. To be considered for the award, the paper must be by an individual student author, and it must be identified as being a student paper.

ALL SLIDES must be 2″ x 2″ and of a thickness that will fit comfortably in a standard carousel projection magazine. Slides should be designed for easy reading on 10-foot-wide screens by viewers who are as far away as 70 feet. Overhead projectors and chalkboards will be available on request.

DETAILED INFORMATION for registration, housing, field trips, short courses, guest activities, welcoming parties, business meetings and luncheons, and annual dinners, and the like, will be announced in future issues of GSA News & Information, as well as being included in the appropriate issues of *Abstracts with Programs*.

EXHIBIT SPACE may be made available at some section meetings. For information, please write or call the local committee officers listed on the facing page.

SPECIAL NOTE TO MEMBERS LIVING OUTSIDE CONTERMINOUS UNITED STATES

Those who live outside the conterminous United States may receive copies of the 1979 *Abstracts with Programs* for the section meetings too late to take advantage of the preregistration and housing forms. Therefore, those who are planning to attend any of the section meetings are urged to write to the appropriate local committee officers listed on the facing page for copies of the preregistration forms, housing applications, and field trip information.

SECTION MEETINGS

Northeastern

Hershey Motor Lodge
Hershey, Pennsylvania
March 1-3, 1979

ABSTRACT DEADLINE: November 1, 1978

Please submit completed abstracts to
Program Chairman, Noel Potter, Jr.
Department of Geology
Dickinson College
Carlisle, PA 17013
(717) 243-5121, Ext. 355

Southeastern

Virginia Polytechnic Institute and State University
Blacksburg, Virginia
April 26-27, 1979

ABSTRACT DEADLINE: December 7, 1978

Please submit completed abstracts to
Local Committee Chairman, David A. Hewitt
Department of Geological Sciences
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061
(703) 951-6521

South-Central

Folk Center
Mountain View, Arkansas
April 9-10, 1979

ABSTRACT DEADLINE: November 17, 1978

Please submit completed abstracts to
Local Committee Chairman, Norman F. Williams
Arkansas Geological Commission
3815 W. Roosevelt Road
Little Rock, AR 72204
(501) 371-1488

North-Central

Normandy Inn
Duluth, Minnesota
May 10-11, 1979

ABSTRACT DEADLINE: December 21, 1978

Please submit completed abstracts to
Program Chairman, Paul C. Tychsen
Department of Geosciences
University of Wisconsin
Superior, WI 54880
(715) 392-2595

Cordilleran

San Jose State University
San Jose, California
April 9-11, 1979

ABSTRACT DEADLINE: November 9, 1978

Please submit completed abstracts to
Program Committee Chairman, Mary Hill
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
(415) 323-2214

Rocky Mountain

Colorado State University
Fort Collins, Colorado
May 24-25, 1979

ABSTRACT DEADLINE: December 21, 1978

Please submit completed abstracts to
Program Chairman, Tommy B. Thompson
Department of Earth Resources
Colorado State University
Fort Collins, CO 80523
(303) 491-5661

Guidelines for preparing abstracts

Abstracts for GSA meetings serve (1) as a basis for selecting papers, (2) to aid people in deciding which papers they wish to hear at a meeting, and (3) as a published document for reference. Each abstract should, therefore, not only be well presented but also should be informative. Abstracts that contain such statements as "A new model will be presented," "the problem of . . . will be considered," " . . . will be discussed," or "the . . . is described," are inadequate. Such abstracts outline what papers are about, but do not tell what they contributed. They are not informative.

One dictionary (Webster's unabr. 2nd ed.) defines an abstract as "That which comprises or concentrates in itself the essential qualities of a larger thing. . . ." Our abstracts must contain essential information, without added commentary or interpretation. An Abstract differs from a summary in that the latter is usually a restatement, generally at the end of a paper, only of salient findings and conclusions. The abstract, on the other hand, also includes other vital portions of a paper, such as purpose and methods.

The importance of the abstract is stated by K. K. Landes in "The Scrutiny of the Abstract, II" (in Cochran, W., and others, eds., 1973, Geowriting: Washington, D.C., Am. Geol. Inst., 80 p.):

"To many writers the preparation of an abstract is an unwanted chore required at the last minute by an editor or insisted upon even before the paper has been written by a deadline-bedeviled program chairman. However, in terms of market reached, the abstract is *the most important part of the paper*. For every individual who reads or listens to your entire paper, from 10 to 500 will read the abstract.

"If you are presenting a paper before a learned society, the abstract alone may appear in a preconvention issue of the society journal as well as in the convention program; it may also be run by trade journals. The abstract which accompanies a published paper will most certainly reappear in abstract journals in various languages, and perhaps in company internal circulars as well. It is much better to please than to antagonize this great audience. Papers written for oral presentation should be *completed prior to the deadline for the abstract,* so that the abstract can be prepared from the written paper and not from raw ideas gestating in the writer's mind." [*p. 34*]

B. H. Weil, in "Standards for Writing Abstracts" (in Cochran and others), noted the following on the purpose and importance of abstracts:

"A well-prepared abstract enables readers to identify the basic content of a document quickly and accurately, to determine its relevance to their interests, and thus to decide whether they need to read the document in its entirety. Readers for whom the document is of fringe interest often obtain enough information from the abstract to make their reading of the whole document unnecessary. Therefore, every primary document should include a good abstract. Secondary publications and services that provide bibliographic citations of pertinent documents should also include good abstracts if at all possible." [*p. 36*]

"For various reasons, it is desirable that the author write an abstract that the secondary services can reproduce with little or no change. These reasons include the economic pressures on the secondary services caused by continuing increases in the volume of scholarly publication; the need for greater promptness on the part of the secondary services in publishing information about the primary literature; and the growing value of good authors' abstracts in computerized full-text searching for alerting and information retrieval." [*p. 35*]

Weil (ibid.) offers the following recommendations for writing good abstracts:

"Make the abstract as informative as the document will permit, so that readers may decide whether they need to read the entire document. State the purpose, methods, results, and conclusions presented in the document, either in that order or with initial emphasis on findings." [*p. 35*]

"For most papers and portions of monographs, an abstract of fewer than 250 words will be adequate. For notes and short communications, fewer than 100 words should suffice. Editorials and Letters to the Editor often will require only a single-sentence abstract. For long documents such as reports and theses, an abstract generally should not exceed 500 words and preferably should appear on a single page.

"Begin the abstract with a topic sentence that is a central statement of the document's major thesis, but avoid repeating the words of the document's title if that is nearby. . . .

"Write a short abstract as a single, unified paragraph, but use more than one paragraph for long abstracts, e.g., those in reports and theses. Write the abstract in complete sentences, and use transitional words and phrases for coherence.

"Use verbs in the active voice whenever possible; they contribute to clear, brief, forceful writing. The passive voice, however, may be used for indicative statements and even for informative statements in which the receiver of the action should be stressed.

"Avoid unfamiliar terms, acronyms, abbreviations, or symbols; or define them the first time they occur in the abstract.

"Include short tables, equations, structural formulas, and diagrams only when necessary for brevity and clarity." [*p. 37*]

Whereas an abstract should present the quantitative and (or) qualitative information in a paper, Weil (ibid.) points out that this is sometimes impractical.

"However, some discursive or lengthy texts, such as broad overviews, review papers, and entire monographs, may permit the preparation of an abstract that is only an *indicative* or descriptive guide to the type of document and what it is about. A combined *informative-indicative* abstract must often be prepared when limitations on the length of the abstract or the type and style of the document make it necessary to confine informative statements to the primary elements of the document and to relegate other aspects to indicative statements." [*p. 35*]

Penrose Conference Guidelines

PURPOSE

The Penrose Conferences were established by the Geological Society of America in 1969 as an important effort in its promotion of the Earth sciences. The conferences provide the opportunity for exchange of current information and exciting ideas pertaining to the science of geology and related fields. They are intended to stimulate and enhance individual and collaborative research and to accelerate the advance of the science by the interactions and development of new ideas. The conferences consist of a critical mass of active scientists from the Society, the national and international science communities, and students, sequestered in an attractive meeting place for several days of focused discussion. The participants do not seek simply to resolve technical controversies; their objectives are to provide stimulus and excitement for their field, to air new ideas and develop new associations, and to provoke new research on important questions.

SUBJECT/TOPIC

Ideal subjects for conferences are those Earth science topics for which recent work suggests a potential for further significant advances in the near future. Each conference subject should be under current investigation and active discussion by a number of able researchers in the field and/or in the laboratory. Topics should be broad enough so that a range of specialists can discuss them from several points of view, but not so broad that a lack of communication can develop.

CONVENERS

Conveners must have technical competence and be knowledgeable about current activities in the specialized fields that are to be represented at a conference. Responsibility for organizing a conference normally is shared by two or more conveners, each of whom can draw upon his or her own experience and expertise in developing a well-integrated, effective conference program that will foster communication and stimulate research progress among experts in diverse but related fields. At least one of the conveners must be a member of GSA.

SIZE/TIME

It is essential that the conferences be informal. Groups should be small enough that personal discussion among all participants is encouraged, and large enough to provide diversity and depth. As an empirical rule, the maximum number for success is about 70. Normally, the minimum number required to convene a conference is 50.

Commonly, the length of a conference is five days, although exceptions may be made at the discretion of the Penrose Conference Committee. Participants are expected to attend the entire conference.

A period of approximately nine to twelve months between the date of approval by the Penrose Conference Committee and the date of the conference is normally required. In no case should there be less than six months from the time of conference announcement in *GSA News & Information* and *Geotimes* and the conference dates.

Care should be taken to avoid scheduling conferences at the same time as other scientific meetings, especially other GSA meetings. Conveners should check the calendar of events in *Geotimes* or call the Penrose Conference Coordinator to establish suitable dates.

LOCATION

There are no restrictions about holding conferences anywhere in the world, but logistics, costs, and other problems dictate caution in organizing conferences outside of North America. The Penrose Conference Committee is of the opinion that conferences held outside of North America may add an important dimension to the Penrose Conference program. However, such conferences are approved only if there are special circumstances that make a North American site much less appropriate. For a conference convened outside of North America, the cost of special liability insurance must be included in the conference budget.

Essential qualities of a good site are that it be removed from the distraction of other meetings and other demands on the time and attention of the participants. The site should offer adequate meeting facilities and comfortable surroundings where participants can live, eat, work, and relax together. Climate, accessibility, meals, sleeping accommodations, recreational facilities, and economy should all be considered in selecting a site.

Conveners may suggest specific sites or may indicate to the Coordinator which geographical area would be most suitable for a conference. Selection of the site is made by the Coordinator, in cooperation with the conveners, and with the approval of the Penrose Conference Committee.

PARTICIPATION

Anyone interested in attending a specific conference is encouraged to contact the conveners of that conference. Conveners initially invite a few key speakers necessary to the organization and success of the conference. Aside from these invitations issued in the early planning stages of a conference, the conveners utilize indications of interest from those actively working in the field to complete the list of conference participants. Participation is not restricted to members of the Geological Society of America. GSA members, however, will receive preference when there is a choice between equally qualified persons. The final decision on participation will be made by the conveners, whose decision shall not be subject to appeal. Acceptances for participation are not transferable.

Participation by graduate students is encouraged by providing incentives such as reduced registration fees. The cost of supporting graduate student participation is to be included in each conference budget.

In addition to *GSA News & Information* and *Geotimes*, all conferences are announced in other Earth science journals, newsletters, and so forth.

All participants are expected to live at the conference site. Spouses, families, and others who are not registered participants are requested not to visit the conference site, and are not allowed to participate in conference activities.

All must pay the full conference registration fee. Some exceptions may be made in the case of international guests when outside funding for them can be obtained. As noted above, participants are expected to attend the full conference.

SPONSORSHIP

The Geological Society of America is the principal sponsor of the Penrose Conferences; however, the Society welcomes other societies, organizations, and institutions as co-sponsors. Conveners must identify sponsors in their proposals, and the Penrose Conference Committee reserves the right to approve co-sponsors at the time the proposals are being considered. Recognition is given to co-sponsors in the conference announcements, as well as during the conference.

FINANCING

Each conference must be self-supporting, with financial management provided by the Coordinator. Conveners are required to confer with the Coordinator, who develops a conference budget based on estimated costs. From this budget, a registration fee is established that covers all costs, such as food and lodging, local transportation, field trips, and miscellaneous conference expenses.

Administrative and other expenses incurred in support of the conferences are offset by a surcharge to be included in the registration fee.

At the conclusion of the conference, a financial report is prepared by the Coordinator for the conveners, the Penrose Conference Committee, and the GSA Council.

INITIATION OF A PENROSE CONFERENCE PROPOSAL

Anyone interested in convening a Penrose Conference may submit a proposal; but at least one of the conveners must be a member of the Geological Society of America. Each proposal must contain the following:

1. A short expression of the subject, by title.
2. A short outline of the subject.
3. A short statement explaining how a conference on this subject will meet the objectives that have been established for the Penrose Conferences.
4. An initial list of suggested key speakers and their fields of interest.
5. A tentative outline of sessions.
6. A suggested geographic location.
7. A choice of dates and alternate dates (or at least a preference on the time of year).
8. Anticipated number of participants.
9. A description of any field trip that is a suggested part of the conference.
10. A statement on any international guests who might be considered and the source and amount of anticipated financial support for their participation.
11. A statement indicating the willingness of the conveners to abide by the Penrose Conference Guidelines and to cooperate with the Coordinator.
12. Biographic data on the conveners, including a list of publications and projects that qualify them for leading the proposed conference.
13. Identification of co-sponsors, if any, and their role in the conference.

Requests for information about Penrose Conferences in general should be sent to

Penrose Conference Coordinator
The Geological Society of America
3300 Penrose Place
Boulder, CO 80301

Proposals for Penrose Conferences should be sent to

Executive Director
The Geological Society of America
3300 Penrose Place
Boulder, CO 80301

The Penrose Conference Committee reviews the proposals as they are received. In acceptance of a proposal, the Penrose Conference Committee may offer advice, which in some cases may be a condition of acceptance. The committee chairman will address an advisory letter to the conveners calling attention to any matters that seem likely to pose a problem that must be resolved if the conference is to be successful.

PENROSE CONFERENCE COORDINATOR

The Society provides to conveners, and requires the use of, the services of a Penrose Conference Coordinator to assist in every area of conference planning. The Coordinator assumes responsibility for negotiating arrangements with the conference facility concerning prices, space for meetings and sessions, food, recreation, lodging, transportation, scheduling projection facilities, and handling other administrative chores as they arise.

The Coordinator or a qualified assistant provides on-site assistance during each conference and frees conveners so that they may concentrate on the technical and scientific aspects of the program.

Conveners who have had a proposal approved by the Penrose Conference Committee will receive from the Coordinator (for use as guides) sample letters and forms, as well as a check list that has been found useful by past conveners.

The Penrose Conference Committee requires periodic progress reports from the Coordinator regarding conference planning.

PROGRAM

Care must be taken not to overstructure the program and to allow sufficient time for free discussion by all participants. It is important to note that all participants need not expect to make formal presentations. Contributions also can be presented in informal discussions or in poster sessions.

CONFERENCE REPORTS AND PUBLICITY

The conveners assist the Coordinator in the preparation of the conference announcement that is published in appropriate scientific journals. As soon as the conference is over, the conveners are required to send a brief formal report to the Executive Director of the Society. The report should include an evaluation of the technical and logistical success of the conference based on the participants' comments and the conveners' experience, as well as suggestions for improvement of the Penrose Conference format as a whole.

Within three months, the conveners will prepare and submit a news report for publication in *Geology*. This report will cover the most interesting scientific and technical aspects of the conference, and, wherever appropriate, include recommendations on research opportunities and priorities that were developed during the conference and may be of value to organizations responsible for supporting and coordinating research in the field covered by the conference.

The purpose of the report is to inform those not in attendance of the main trends of thought and discussion that prevailed at the conference. The report should not publish specific data or concepts for which individual participants expect to receive priority through publications authored by them in regular journals of their individual choice. In balancing the opposing needs to inform and to preserve priority, the conveners must perform this task with responsibility and delicacy.

Other similar reports on the conference may be prepared and submitted to other journals for publication, but only after the letter of acceptance to publish the initial report has been received from *Geology*.

As an incentive to free exchange of information and to encourage open and frank discussion, no formal scientific report may be derived from the conference. It is anticipated that symposia, at GSA meetings or elsewhere, may develop from some conferences. These should consist of a related series of formal papers, each reflecting the author's own ideas, rather than a synthesis of what was presented at a particular conference.

The Society hopes and expects that all participants will freely discuss with their colleagues the significant results of their participation. The intent is that the conferences shall promote generation of new concepts and nurture new research efforts in all phases of the Earth sciences.

GUIDELINES

These guidelines, formulated by the Penrose Conference Committee and approved by the GSA Council, provide rules based on experience gained from past conferences; changes and improvements will be incorporated as experience dictates. Once approval has been given by the Society, the conveners are fully responsible for the conference in accordance with the guidelines, and their acceptance implies agreement to abide by them. In cases of flagrant violation of the guidelines, the Executive Director of the Society is empowered to take appropriate action, including postponement or cancellation of the conference.

Recipient, William Christian Krumbein award

John C. Griffiths, Professor Emeritus of Petrography at Pennsylvania State University has been named first recipient of the William Christian Krumbein Award by the International Association for Mathematical Geology founded in Prague, Czechoslovakia, during the XIII International Geological Congress, 1968.

The association instituted the award at the XXV International Geological Congress in Sydney, Australia, in 1976. The award will be presented annually on the basis of (1) original contributions to the science, (2) service to the profession, and (3) support of the association.

Directory of U.S. and Canadian Well Sample, Core Repositories available

The "Index of Well Sample and Core Repositories of the United States and Canada," the revised and updated "yellow pages" for subsurface well sample and core materials, has been prepared as U.S.G.S. Open File Report 77-567. The report is available from Open File Services Station, Branch of Distribution, U.S. Geological Survey, Box 25425, Federal Center, Denver, Colorado 80225, (303) 234-5888. Prices for the 195-page index are $29.25 for each paper copy and $3.50 for each microfiche copy. Orders must be prepaid by check or money order to the U.S. Geological Survey.

GSA research grants awarded to 124 applicants

At its March meeting, the 1978 Committee on Research Grants reviewed 269 applications and recommended 124 of them to the Council for financial support. Twenty-seven grants were awarded to M.S. student applicants, 96 to students working toward Ph.D. degrees and one to a post-Ph.D. applicant. The total amount awarded was $85,000, with grants ranging from $200 to $1,200 each. These funds consist of $67,861 provided by the endowment fund, $13,350 contributions from industry, $1,185 donations by past recipients, $1,654 donations received with dues payments, and $950 income from the Harold T. Stearns Fund.

Harold T. Stearns Award

Susan M. Karl, Stanford University, is the 1978 recipient of the Harold T. Stearns Fellowship Award for research on one or more aspects of the geology of the circum-Pacific region. Ms. Karl's project is entitled "Age and geologic significance of radiolarian cherts in the melange facies of an upper Mesozoic subduction complex, southern and southeastern Alaska."

Outstanding Mention

The committee singled out seven young scientists and their proposals for special mention in the belief that they should be brought to the attention of the membership of the Society. These persons are:

David James Borns, University of Washington, Seattle: Blueschist metamorphism of the Stuart Fork Formation in the Yreka-Fort Jones area, Klamath Mountains, California.

Mark P. Cloos, University of California, Los Angeles: Petrogenesis of high-grade blueschists, eclogites, and amphibolites of California and Oregon.

Susan M. Karl, Stanford University: Age and geologic significance of radiolarian cherts in the melange facies of an upper Mesozoic subduction complex, southern and southeastern Alaska.

James E. Quick, California Institute of Technology: Petrochemical study of the Trinity peridotite, Klamath Mountains, northern California.

Warren D. Sharp, University of California, Berkeley: Structure, petrology, and geochronology of the late Paleozoic and early Mesozoic igneous and metamorphic rocks of the western Sierra Nevada foothills near Sonora, California.

John F. Thompson, University of Toronto: Intrusion and crystallization of gabbros, central Maine, and genesis of their associated Ni-sulfides.

James E. Wright, University of California, Santa Barbara: Geology and U-Pb geochronology of the western Paleozoic and Triassic subprovince, southern Klamath Mountains, California.

Donations received from industry

The following nine companies or foundations made generous donations to augment our funding: Alcoa Foundation, Chevron Oil Field Research Co., Gulf Oil Foundation, Marathon Oil Co., Mobil Oil Corp., Phillips Petroleum Foundation, Inc., Shell Development Co., Texaco, Inc., Union Oil Co. of California.

Recipients of donations from industry

Twenty promising young Earth scientists were chosen as recipients of these donations from industry. The names of the recipients, their institutions, and research project titles are as follows:

Steven B. Bachman, University of California, Davis: The coastal belt of the Franciscan Complex: Depositional history and margin tectonics.

David A. Barnes, University of California, Santa Barbara: Late Mesozoic sedimentation and tectonics, Vizcaino Peninsula-Isla Cedros, Baja California Sur, Mexico.

Peter B. Davies, Stanford University: Mechanisms of deep seated, natural salt dissolution, and associated collapse structures in bedded salt deposits.

Robert Daniel Francis, Scripps Institution of Oceanography: The evolution of copper in ordinary igneous rocks.

Virginia S. Gillerman, University of California, Berkeley: Comparative petrology of tungsten- and copper-bearing skarns at the Railroad mining district, Nevada.

Elisabeth Krause Goodwin, University of Oklahoma, Norman: Fracture densities in a drape fold from the Wyoming province.

Thomas A. Hauge, University of Southern California: The mechanisms problem of the Heart Mountain detachment fault, Wyoming.

Robert G. Jefferis, Pennsylvania State University: Fracture analysis at rock stress measurement sites in Iceland.

James Elliott Mericle, University of South Florida, Tampa: Tectonic implications of the South Florida embayment and the Charlotte Harbor embayment.

Larry Thomas Middleton, University of Wyoming, Laramie: Sedimentology of the Middle Cambrian Flathead Sandstone and its implications on the chronology and energy of the Cambrian transgression in Wyoming.

Nina M. Morgan, Oxford University, England: Paleoecology of Waulsortian Reefs (Lower Carboniferous).

Rainer J. Newberry, Stanford University: A geochemical approach to the genesis of Sierran tungsten-molybdenum skarns.

Barry Charles Richards, University of Kansas, Lawrence: Mississippian stratigraphy and depositional environments in the southwestern District of Mackenzie & southeastern Yukon Territory, Canada.

Douglas Kevin Strickland, University of Kansas, Lawrence: Lower Dresbachian biostratigraphy and paleoenvironments, east-central Great Basin.

James Bryan Tapp, University of Oklahoma, Norman: Relationships of rock cleavage fabrics to incremental strain paths.

John F. Thompson, University of Toronto: Intrusion and crystallization of gabbros, central Maine, and genesis of their associated Ni-sulfides.

Cheryl K. Wilgus, University of Oregon, Eugene: Evaporites of the Permian-Triassic boundary of the Western U.S.A.: A stable isotope study.

Loretta Ann Williams, Princeton University: Sedimentary environments and diagenesis of the Bear Gulch Limestone (middle Carboniferous, central Montana).

Ralph Henry Willoughby, University of Kansas, Lawrence: Middle Cambrian biostratigraphy and depositional environments of the Conasauga Group in eastern Tennessee and southwestern Virginia.

Kevin M. Wilson, University of New Hampshire, Durham: The degradation of organic matter in the near-shore carbonate sediments of Bermuda: Its effect on carbonate diagenesis.

Applications for 1979 grants

Application forms and detailed instructions for 1979 grants will be sent, upon request, by the Executive Director, Geological Society of America, 3300 Penrose Place, Boulder, Colorado 80301. **PLEASE WRITE FOR NEW FORMS.** The deadline for filing applications is **FEBRUARY 15, 1979.**

August BULLETIN briefs

Brief summaries of articles in the August 1978 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.*

• 80801—A lower Paleozoic trench-fill sequence, New World Island, Newfoundland.

W. S. McKerrow, Department of Geology and Mineralogy, Parks Road, Oxford OXI 3PR, England; L.R.M. Cocks, Department of Palaeontology, British Museum (Natural History), Cromwell Road, London SW7 5BD, England. (12 p., 8 figs.)

The lower Paleozoic facies sequence on New World Island, Newfoundland, can be matched with those of modern deep-sea trenches. New World Island is located immediately to the west of the suture of the early Paleozoic Iapetus Ocean. Its steeply dipping, well-exposed rocks, more than 13 km thick, comprise the following units: (1) the Dunnage Formation (5 km thick), which is interpreted as a mélange produced by tectonic shear along a zone of subduction; graywacke clasts in it may be remnants of an abyssal-plain turbidite succession; (2) the Dark Hole Formation (as much as 500 m thick): graptolitic (Caradoc) laminated mudstones and siltstones, which may correspond to a fine-grained seaward facies of the trench floor; (3) the Milliners Arm Formation (new name) (as much as 5.2 km thick): graywacke turbidites, which may correspond to a coarse-grained axial channel facies with longitudinal sediment dispersal and possibly marginal deep-sea fan development; (4) the Big Muddy Cove Group (new name) (as much as 3.5 km thick), which includes chaotic masses of basalt and Ordovician sediments of the Summerford Group in a mudstone matrix with Llandovery brachiopods; this is interpreted as an olistostrome and may correspond to a (base of) slope facies; and (5) the Goldson Group (as much as 1.4 km thick) with lenses of redeposited clastic material, which may represent small slope basins and some deep shelf deposits with the same *Stricklandia* subspecies as in the Big Muddy Cove Group. The uppermost part of the Goldson Group contains shallow-water sandstones with *Eocoelia curtisi.*

• 80802—Beach topography and beach cusps.

Roger N. Dubois, Department of Geography, University of Maryland Baltimore County, Baltimore, Maryland 21228. (7 p., 10 figs.)

The development of beach cusps was studied along the northern shore of Delaware from June 9 through June 30, and from July 28 through August 10 of 1976. At the study site, the formation of beach cusps was dependent upon the existence of a tidal berm in the developing stage and of a favorable backshore topography. Beach cusps developed as follows: after an erosional event on a sandy beach, a berm developed at low tide. The swash extended over the berm and ponded between the berm and the backshore. The stream flow from the ponded water to the sea cut closely spaced channels through the berm. As the tide rose, the berm and channels migrated landward. When the tide fell, the swash could no longer overtop the berm, and no water was ponded landward of the berm. Since no water was returning seaward through the channels, the channel form could not be maintained, and the swash flared the channels into bays. A series of beach cusps appeared on the beach as the tide continued to fall. The spacing between cusps was irregular and was attributed to the irregular size of swash salients. At high tide, the horizontal distance from the berm crest to the backshore (L) was less than 12 m. At high tide where L was greater than 12 m, no beach cusps formed. Although a tidal berm developed, there was no effective backwash to cut through the berm. As the new tidal berm developed and as the swash overtopped the berm crest, the swash continued landward and during a short period of time flooded a portion of the backshore. No cusps were observed to develop after a tidal berm had been constructed; berms and cusps developed together.

• 80803—Ancestral Niagara River drainage: Stratigraphic and paleontologic setting.

Parker E. Calkin, Department of Geological Sciences, State University of New York at Buffalo, 4240 Ridge Lea Road, Amherst, New York 14226; Carlton E. Brett, Museum of Paleontology, University of Michigan, Ann Arbor, Michigan 48104. (15 p., 6 figs., 3 tbls.)

The modern Niagara River was inititated as a multi-outlet river-lake system following the last ice retreat from the area about 12,300 yr B.P. This system extended from Early Lake Erie to the contemporaneously formed Glacial Lake Iroquois in the Ontario basin. The last major ice advance and one subsequent glacial oscillation associated with the ice retreat are recorded in sequences of glaciolacustrine deposits and till along the present gorge wall and within older bedrock spillways. Dated wood overlying Iroquois silts and till within the Lockport spillway, east of Niagara, suggest that the multi-outlet (Lake Tonawanda) phase of the drainage ceased about 10,900 yr B.P. with concentration of the outflow, and hence major gorge recession, at Lewiston. Radiocarbon analysis of mollusks from river gravels at the top of the Niagara Gorge at Whirlpool Park indicate that cataract recession from Lewiston to this site of intersection with the much older buried St. Davids Gorge occurred after 9800 yr B.P. Lake Tonawanda persisted near the present site of Niagara Falls until about 1,000 yr ago; however, dated mollusks imply that deposition here was interrupted by intense scouring shortly before 3800 yr B.P., which may have been a response to the closing of the North Bay outlet of the upper Great Lakes and consequent large increase in discharge through Lake Erie.

Mollusks which occur in the ancient Niagara River gravels are well preserved and distinctly zoned. The Lake Tonawanda fauna, heretofore undescribed, includes about 15 species, all of which are extant in the region.

• 80804—The geology and evolution of the Cayman Trench.

Michael R. Perfit, Bruce C. Heezen, Lamont-Doherty Geological Observatory, Palisades, New York 10964; and Department of Geological Sciences, Columbia University, New York 10027 (present address, Perfit: Research School of Earth Sciences, The Australian National University, Canberra, Australia A.C.T. 2600; Heezen, deceased). (20 p., 10 figs., 1 tbl.)

The geology and stratigraphic relationships of the Cayman Ridge, Nicaraguan Plateau, and mid-Cayman spreading center, which have been determined from the succession of rocks recovered at 80 dredge stations in the Cayman Trench, are consistent with the inferred crustal structure of the region deduced from published geophysical data. The Cayman Ridge and Nicaraguan Plateau are composed of metamorphic, plutonic, volcanic, sedimentary, and carbonate rock units that typically crop out along continental margins and in island arcs. In contrast, the trench floor is composed of mafic and ultramafic rocks identical to those recovered from the major ocean basins.

Our petrographic, radiometric, and paleontologic data are correlated with the regional geology of Central America and the Greater Antilles and suggest that the Cayman Ridge and Nicaraguan Plateau developed as a single, broad island arc during the Laramide Orogeny. By late Eocene time, volcanism had greatly diminished, uplift and erosion had exposed the underlying igneous rock, thick clastic sequences had been deposited in newly formed grabens, and a zone of east-west axial accretion had been created between the rifted ridge and plateau. An average spreading rate of 0.4 cm/yr across the mid-Cayman spreading center since the Eocene accounts for approximately 300 km of left-lateral displacement between the Cayman Ridge and Nicaraguan Plateau. The geologic histories of the ridge and plateau differ slightly after the Eocene, but general subsidence, at an average rate of 6 cm/1,000 yr, caused progressive restriction of carbonate banks and reefs to a few isolated islands and algal pinnacles.

The pre-Cretaceous history of the Cayman Trench has been extrapolated from the Paleozoic-Mesozoic geology and structure of Central America and Cuba, while the Cretaceous to Holocene evolution of the trench has been related to the relative motions between the North American, South American, and Caribbean plates. Plate convergence during the Cretaceous caused southerly subduction of oceanic lithosphere beneath the ancestral Cayman Ridge–Nicaraguan Plateau, which subsequently led to the formation of a chain of volcanic islands to the south, along the North American–Caribbean plate boundary. Numerous ophiolite-like outcrops that fringe the north Caribbean margin are believed to reflect a Late Cretaceous closure of this subduction zone. Early Tertiary left-lateral shear and tensional stresses along this plate boundary split the Cayman Ridge from the Nicaraguan Plateau, and a small spreading center was created in the rift. Declining isotherms beneath the ridge and plateau caused general subsidence and local tectonic re-equilibration in late Tertiary time.

• 80805—Evolution of part of the Nevadan orogen in northwestern Mexico.

Howard S. Mullan, Department of Geology, University of Liverpool, Liverpool L69 3BX United Kingdom (present address: Department of Geology, University of Calabar, P.M.B. 1115, Calabar, Nigeria). (14 p., 7 figs.)

The geology of the polyorogenic El Fuerte region is described here, with particular reference to the effects of the late Mesozoic Nevadan orogeny. On a gneissose basement of probable Precambrian age, possible upper Paleozoic sediments and silicic volcanic materials were deposited, isoclinally folded (D_S1), and eroded prior to the deposition of a thick sequence of Cretaceous mafic volcanic rocks and subordinate limestones. The West Mexican batholith is represented by prekinematic mafic plutons and late-kinematic to postkinematic granitoids.

Upright isoclines (D_N1) dominate the structure, but two later fold phases are recognized. The youngest phase may be partly related to strike-slip displacement along the Torreon-Monterrey lineament. Granite emplacement contemporaneous with or postdating D_N3 folding has produced widespread contact metamorphism overprinting the lower greenschist facies assemblages that were stable during the earlier Nevadan folding.

By Paleocene time, erosion had exhumed the granite-metamorphic complex, which was then covered by volcanic equivalents of still later granites, gently folded,

eroded, and re-covered by Miocene ignimbrite sheets. Quaternary basalts and fluviatile deposits complete the succession.

• 80806—Mechanics of thin-skinned fold-and-thrust belts.

William M. Chapple, Department of Geological Sciences, Brown University, Providence, Rhode Island 02912. (10 p., 5 figs., 1 tbl.)

The essential characteristics of thin-skinned fold-and-thrust belts include the following: a wedge-shaped deforming region, thicker at the back end from which the thrusts come; a weak layer at the base of the wedge; and large amounts of shortening and thickening within the wedge. These characteristics are incorporated into an analytical model of a perfectly plastic wedge, underlain by a weak basal layer and yielding in compressive flow.

The model is sufficiently flexible to be applied to a variety of tectonic situations. In each situation the model shows that shortening of the wedge and sliding over its base can occur for reasonable values of the yield stress of the wedge and of the weak basal layer, of the surface topographic slope, of the back slope of the basal layer, and of the thickness of the wedge.

The present model differs markedly from the conventional concept of gravity gliding in that it shows that horizontal compressive stresses can play a major role in overcoming the resistance to basal sliding. In addition, the model suggests that the topographic slope, when necessary, can be a result of the compression within the wedge itself; no additional outside agency for producing the topographic slope need be postulated. Thus, the model suggests that a surface topographic slope is in general neither a necessary nor a sufficient condition for the formation of a thin-skinned fold-and-thrust belt.

• 80807—Sedimentation and tectonic controls in the Early Jurassic Central High Atlas trough, Morocco.

Christopher W. Lee, Christopher J. Burgess, Department of Geology and Oceanography, University College of Swansea, Swansea SA28PP, Wales, Great Britian (present address, Burgess: Department of Geology, Victoria University of Wellington, Private Bag, Wellington New Zealand). (6 p., 5 figs.)

Stratigraphical and sedimentological studies of Lower Jurassic deposits at the western end of the Central High Atlas Mountains, Morocco, has led to a reappraisal of the tectonic significance of this linear feature during the critical period of the opening of the Atlantic Ocean. Lower Jurassic deposits south and east of Marrakech represent an extremely shallow water and supratidal marine carbonate accumulation that formed in fault-controlled basins at the western end of the trough. The basins were aligned east-northeast, and the character and distribution of the deposits strongly suggest that no connection with the basins of the Western High Atlas existed. To the east, sediments indicate more open conditions, but no evidence of bathyal or abyssal conditions was seen.

Sedimentation was probably structurally controlled by vertical tensional and compressional movements as the result of reorientation of stress between major strike-slip faults. Volcanic flows and shallow intrusions, which occur at the base of the Jurassic sequence, and associated carbonate and clastic sediments show no evidence of being part of ophiolite sequences; they more closely resemble extrusive basalt sequences associated with rifting as seen in the Triassic of the eastern United States and the Tertiary of northwest Europe. Evidence from this area suggests that the High Atlas seaway represented only an arm of the Tethyan Ocean, which extended along a long-standing zone of crustal weakness.

• 80808—Papoose Flat pluton: A granitic blister in the Inyo Mountains, California.

Arthur G. Sylvester, Department of Geological Sciences, University of California, Santa Barbara, Santa Barbara, California 93106; Gerhard Oertel, C. A. Nelson, J. M. Christie, Department of Earth and Space Sciences, University of California, Los Angeles, Los Angeles, California 90024. (15 p., 11 figs., 3 tbls.)

The Papoose Flat pluton (75 to 81 m.y. old) is one of several Mesozoic granitic bodies in the White-Inyo Range which are regarded as satellites of the Sierra Nevada batholith. The pluton, composed chiefly of quartz monzonite with K-feldspar megacrysts, crops out as an elongated east-trending dome, 16 km long and 8 km wide. It was emplaced within the southwest limb of the major southeast-plunging Inyo anticline, consisting of virtually unmetamorphosed late Precambrian and Cambrian sedimentary rocks.

Stratigraphic units around the western half of the pluton have a regionally metamorphosed aspect and are tectonically and concordantly thinned to as little as 10% of their regional thicknesses without loss of stratigraphic identity or continuity. Around the discordant eastern contact, however, wall-rock textures are hornfelsic, and there is little or no attenuation of the stratigraphic succession. Foliation, lineation, and preferred orientation of minerals are well developed in the western half of the pluton and its wall rocks and, together with the boudinaged wall rocks, are consistent with the geometry of strain required for attenuation of the stratigraphic succession.

The structural evidence indicates that the granite penetrated discordantly through lower formations in the anticline and formed a "blister" in the fold limb beneath the stretched higher formations. Metamorphic mineral assemblages of the wall rocks suggest a maximum temperature of metamorphism of less than 600 °C and a pressure of less than 2.5 kb.

Note: A detailed, colored structural map, structural cross sections, and a palinspastic map of the pluton have been prepared to accompany this paper. Entitled "Geologic Map, Cross Sections, and Palinspastic Map of the Papoose Flat Pluton," GSA Map and Chart Series MC-20, it may be ordered from the Geological Society of America.

• 80809—Arakapas fault belt, Cyprus: A fossil transform fault.

K. O. Simonian, I. G. Gass, Department of Earth Sciences, The Open University, Milton Keynes, MK7 6AA, England. (11 p., 7 figs., 1 tbl.)

It is widely accepted that the Troodos massif of Cyprus is a fragment of oceanic lithosphere formed at a constructive margin beneath a small marginal sea some 85 m.y. ago. The Arakapas fault belt is an elongate east-west fracture zone where an intensely brecciated basement of ocean crust is overlain by a variety of mafic volcanic rocks and clastic sediments. While constructive margin processes were still active elsewhere on the massif, the Arakapas fault belt existed as a trough with a rugged bathymetry formed of numerous fracture zones between which were relatively undeformed blocks. The north-south–trending dikes of the main massif swing progressively westward into an east-west alignment as the fault is approached. This deviation could be due to horizontal drag along the fault, but dike injection into a sygmoidal stress field prior to the development of the fault is considered. Onto the rugged bathymetry, in which fault scarps and associated scree deposits are still identifiable, mafic lavas were extruded, and a variety of sediments, produced by the submarine erosion of bathymetric highs within and on the flank of the trough, were deposited. Some of the volcanic rocks within the fault belt are more primitive than those of the main massif, and this is interpreted as owing to a higher percentage of melt in the underlying mantle and easier egress for the basaltic magmas. The metamorphic imprint indicates that the thermal gradient in the fault zone was steeper than elsewhere on the massif and that quantities of circulating sea water were greater. Later, once this part of the fault zone had moved well outside the constructive margin offset, serpentinite masses were emplaced and normal and reverse faulting occurred. Structural, petrochemical, and sedimentary features combine to suggest that the Arakapas fault belt is a fossil transform fault.

• 80810—Oxidation state of iron in the Littleham Mudstone Formation of the New Red Sandstone Series (Permian-Triassic) of southeast Devon, England.

E. M. Durrance, Department of Geology, University of Exeter, Exeter EX4 4QE, Devonshire, England; R. E. Meads, R.R.B. Ballard, Department of Physics, University of Exeter, Exeter EX4 4QE, Devonshire, England; J. N. Walsh, Department of Geology, Kings College, The Strand, London WC2R 2LS England. (10 p., 5 figs., 3 tbls.)

The Littleham Mudstone Formation of southeast Devon consists predominantly of red lutites of Late Permian or Early Triassic age. Present within the lutites are spherical pale patches that have sharp boundaries against the red lutite and often contain dark, organic centers rich in uranium and vanadium. Chemical and Mössbauer analysis of the oxidation state of iron in this formation shows that the red lutite contains an average total iron content of about 5.5%, with an Fe^{2+}/Fe^{3+} ratio of 0.16, while the pale material has a total iron content of 2.7%, with an Fe^{2+}/Fe^{3+} ratio of 1.2. In the pale material, iron is present only within silicate (clay material) lattice sites, but the red lutite contains hematite as well. The hematite has an important superparamagnetic component and is considered to have a bimodal grain size distribution with two modes of occurrence: as interlayer crystals within clay minerals and as external coatings or grains. The Fe^{2+}/Fe^{3+} ratios and total iron content show that the red lutite is not merely the pale material with hematite added, but that about 50% of the Fe^{2+} in the clay mineral lattice in the pale material is oxidized to Fe^{3+} in the red lutite. This change in oxidation state is not coincident with the pale-red boundary but begins within the pale patches. The mechanism by which this occurred is considered to be an in situ oxidation that produced the red lutite, accompanied by the precipitation of ferric hydroxide from solution. This process is inhibited in the pale patches where Fe^{2+} ions would be more soluble and readily removed. Geotechnical tests on the lutites show that the spherical patches must have formed after a thickness of 1,000 to 1,300 m of overlying strata had been deposited. This thickness encompasses the whole of the Triassic beds of southeast Devon and implies that the reddening occurred at the end of Triassic or in Early Jurassic time. It is suggested that the reddening was aided by a change from arid to humid climate that occurred in the area at this time.

• 80811—Upper Quaternary sediments of the Colombia Basin: Spatial and stratigraphic variation.

Warren L. Prell, Department of Geological Sciences, Brown University, Providence, Rhode Island 02912. (15 p., 24 figs., 1 tbl.)

The spatial and stratigraphic variations of upper Holocene and upper Quaternary sediments in the Colombia Basin reflect the terrigenous influx from South America and Panama. Calcium carbonate, composed of foraminifers and coccoliths, accumulates uniformly across the basin and is modified by terrigenous dilution and carbonate dissolution which reflect bathymetry. Glacial sediments of the Colombia Basin are lower in carbonate, have higher total accumulation rates, and thicken toward the continental margin in comparison to interglacial sediments. Carbonate accumulation is relatively constant between glacial and interglacial intervals, whereas clay accumulation greatly increases.

The primary cause of carbonate variation in Colombia sediments is the terrigenous influx due to rapid erosion of shelf and upper slope sediments during eustatic lowering of sea level. This relationship should be true for most marginal basins and much of the Atlantic Ocean. This mechanism for variation of sediment composition implies that the carbonate record reflects not only climatic and ice-margin fluctuations but also changing erosional and depositional environments.

• 80812—George Hoggart Toulmin and James Hutton: A fresh look.

R. S. Porter, Churchill College, Cambridge CB3 0DS, England. (3 p.)

According to Gordon L. Davies (1967), George Hoggart Toulmin (1754–1817) probably plagiarized from James Hutton, and was not important in the history of geology. But Toulmin's views differed from Hutton's in important respects, and he was perhaps more indebted to Georges Louis Leclerc de Buffon and to John Brown. That Toulmin translated the geological writings of J.A.C. Chaptal shows that his interest in geology was a lasting one.

• 80813—Biostratigraphic and tectonic implications of ^{40}Ar-^{39}Ar dates of ash layers from the northeast Gulf of Alaska.

L. G. Hogan, K. F. Scheidegger, L. D. Kulm, J. Dymond, School of Oceanography, Oregon State University, Corvallis, Oregon 97331; N. Mikkelsen, University of California, San Diego, Scripps Institution of Oceanography, La Jolla, California 92093. (6 p., 4 figs., 1 tbl.)

Ash layers from Deep Sea Drilling Project site 178 in the northeast Pacific Ocean have been dated by the ^{40}Ar-^{39}Ar stepwise heating technique to resolve published discrepancies concerning the length of time explosive volcanism has affected the eastern Aleutian arc and Alaskan Peninsula. The results of the investigation indicate that the record of ash-fall deposition at site 178 extends back at least 6.5 m.y. Assuming that 6.5 m.y. ago marks the onset of renewed calc-alkalic volcanism of the volcanic arc, proposed models of continuous and discontinuous motion between the Pacific and North American lithospheric plates can be evaluated. If appreciable time elapsed between the onset of subduction and the onset of arc volcanism, the 6.5-m.y. record of ash-fall deposition in the northeast Pacific is most compatible with models of continuous plate motion throughout late Cenozoic time.

• 80814—Time-space relationships between late Quaternary rhyolitic and andesitic volcanism in the southern Taupo volcanic zone, New Zealand.

B. P. Kohn, Department of Geology and Mineralogy, Ben Gurion University of the Negev, Beer Sheva, Israel; W. W. Topping, Joint Sciences Department, Ambassador College, Pasadena, California 91123. (7 p., 4 figs., 1 tbl.)

About 9,800 yr ago a major pulse of andesitic volcanism lasting about 100 yr began in the Tongariro volcanic center at the southern end of the Taupo volcanic zone in North Island, New Zealand. Immediately following the onset of this intense period of andesitic volcanism, two voluminous rhyolitic eruptions from the Taupo volcanic center, located a few kilometres northeast of the Tongariro volcanic center, occurred after a period of quiescence of about 10,000 yr.

The andesite volcanism marks a change in composition of titanomagnetite, which shows lower vanadium, chromium, cobalt, and nickel contents when compared with older andesites. Titanomagnetites analyzed from fresh rhyolite lapilli erupted from the Taupo volcanic center show a similar change in vanadium, nickel, and cobalt contents. Their composition falls into two distinct chemical groupings, which correspond to an older (about 9,800 to 8,850 yr) and younger (about 6,300 to 1,820 yr) rhyolitic Taupo magma previously distinguished on the basis of major-element glass chemistry and iron-titanium oxide equilibration temperatures.

It is suggested that the timing of eruption of the andesite at about 9800 B.P. is related to that of the older Taupo rhyolitic magma, or that both were initiated by the same external trigger. Subsequent large-scale rhyolitic eruptions of the younger Taupo magma, however, showed no obvious temporal relationship to the later intermittent andesite activity.

• 80815—Deep-sea origin of Ordovician pillow basalt and associated sedimentary rocks, northern Nevada.

Chester T. Wrucke, Michael Churkin, Jr., Chris Heropoulos, U.S. Geological Survey, Menlo Park, California 94025. (9 p., 6 figs., 2 tbls.)

Greenstone pillow lavas interlayered with pelagic sedimentary rocks of Ordovician age in the Independence Mountains, in the northern Shoshone Range, and at Battle Mountain, Nevada, accumulated at depth in a relatively quiet marine environment. The pillows, commonly 20 to 90 cm across, form layered deposits a few metres to 100 m thick within lower or middle parts of Ordovician formations. Outer parts of some pillows have vesicles averaging only 0.06 to 0.08 mm in diameter, forming 0.05% or less (by volume) of the rock; at many localities, no vesicles were found. Pillows at one locality are conspicuously vesicular from core to rim and have vesicles averaging 0.7 mm in diameter that make up 13% to 15% by volume of the rock. These data, when compared with data from modern lavas, indicate that the nonvesicular and slightly vesicular pillows were emplaced at depths of 4 km or more and that highly vesicular pillows accumulated at depths of about 600 m.

Well-developed varioles occur only at the outer edge of the weakly vesicular and nonvesicular pillows; well-formed varioles and abundant vesicles are apparently not compatible in Ordovician pillows of northern Nevada.

Corroborative evidence of the deep-water origin of most of the greenstone is found in the associated sedimentary rocks, which belong to a belt of graptolitic shale and chert extending from Nevada to Alaska. Formations along the western part of this belt contain more greenstone and less shale than the rocks farther east, which grade eastward into limestone and shale that is transitional into carbonate rock and quartzite of the miogeosyncline. This transition indicates deposition in progressively shallower water from west to east, resembling facies changes across modern continental margins. Rocks along the eastern side of the graptolitic shale and chert belt have abundant current- and gravity-produced structures that suggest a turbidite origin on the continental slope. The scarcity of these structures in the sedimentary sections along the western part of the belt, the abundance of thin beds, and the depth of water indicated by the pillow lavas suggest that these rocks are quiet-water deposits laid down across the lower part of the continental rise and onto the abyssal ocean floor.

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