GSA news & information

SUPPLEMENT TO GEOLOGY MAGAZINE

THE GEOLOGICAL SOCIETY OF AMERICA

Office of Executive Secretary

Dear GSA Fellows, Members, and Student Associates:

With this issue is initiated the new system of distributing news and information to Fellows, Members, and Student Associates of GSA. The center section of *Geology*, which you are now reading, appears only in those copies of the magazine that are mailed to the membership. Basically, the members' insert will include material that was formerly separately mailed as the *Geologist*, briefs of articles that will appear in a subsequent number of the *Bulletin* so that those ordering separates will have a basis for requesting the items they wish, and the necessary order form for requesting separates.

This center section will also contain, in sequenced form, much of the material of the Society's annual report, announcements of annual and sectional meetings, selected news from the divisions that is of Society-wide interest, and book reviews. Hopefully, in the future, it will also serve as a device for communication and discussion among the membership. The savings to the Society by consolidation of these many items and the elimination of several separate mailings are projected to be significant. In addition, the service to the membership should be more convenient.

Any new system cannot be started instantly. For example, the briefs for the January *Bulletin* and the order form for separates from the January *Bulletin* are included in this center insert in the January issue of *Geology*. When the procedure is fully operative, briefs and order forms for *Bulletin* separates will be in *Geology* one month in advance of the appearance of the article in the *Bulletin*.

To briefly restate the present procedure, all Fellows, Members, and Student Associates who selected the low dues option will no longer receive the monthly *Bulletin*. Instead, each may order up to 36 *Bulletin* separates during the year by using the 12 order forms, one each month, included in the members' insert in *Geology*. These may be as many as 36 different articles or multiple copies of one or more articles, as long as the total does not exceed 36. Separates are prepared from unbound copies of the *Bulletin*. They are in every way the same article that you would read in the bound copy of the *Bulletin*.

The center section of *Geology* is intended to improve service and news dissemination to the GSA membership, while at the same time reducing cost. It is not included in those copies of *Geology* sent to nonmember subscribers. Your cooperation is solicited by being tolerant with us the first few months, by contributing appropriate materials for inclusion, and by giving us your suggestions for future improvements.

Sincerely,

John C. Frye

GeoRef workshop

On-line searching of GeoRef is the subject of a workshop to be held at the American Geological Institute, 5205 Leesburg Pike, Falls Church, Virginia 22041, January 28–29, 1975. GeoRef is a bibliographic data base of geology produced by AGI and available on-line at the search service of Systems Development Corp. The structure of the data base, the nature of GeoRef indexing, and guidelines for effectively searching GeoRef will be discussed. Searches will be structured and submitted on-line via terminals by groups of those attending. Both new and experienced users of GeoRef are welcome. AGI is located about three miles west of Washington, D.C. For further information, contact Betty Clements at (703) 379-2480 or at the above address.

University of Sonora seeks field workers

The University of Sonora in Hermosillo, Sonora, Mexico, offers a bachelor's degree in geology with a mining option through its School of Engineering.

In order to achieve better communication with U.S. universities, the geology department there is offering some support to graduate students at the M.S. or Ph.D. level who might be interested in doing pioneering mapping (quadrangle sheets approximately 40 x 60 km) of basic geology in Mexico. From these areas the student can choose a particularly interesting area for more detailed mapping or more specialized studies. The student will be lent aerial photographs and given topographic and other base maps; wet chemical analyses and thin sections will be available free of charge. Worthwhile results will be published in Spanish at no charge to the student. Undergraduate students at Sonora may serve as field assistants during the summers.

The geology department at Sonora was organized in September of 1974. There are 21 full-time professors; the average age of the faculty is 26.

For information, please write to Guillermo A. Salas, Escuela de Ingenieria, Universidad de Sonora, Hermosillo, Sonora, Mexico.

Employment interview service at Northeastern Section meeting

An employment interview service for both employers and applicants will be available at the Northeastern Section meeting of the Geological Society of America. This service, identical to the one for the national meetings, will be conducted in Syracuse, New York, March 6–8, 1975. Fees for applicants are $7.50; for employers, $15 minimum for three specialty listings and interview space. If more than three specialty listings are required, the fee is $5 for each listing over three.

For further information and the necessary forms, write to Joan Heckman, Membership Assistant, at GSA headquarters, 3300 Penrose Place, Boulder, Colorado 80301.

Memo to GSA members living outside conterminous United States

Those who live outside the conterminous United States may receive copies of the 1975 *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 chairman for information. (Names and addresses are listed below.) As soon as it is available, a copy of the program section of the *Abstracts with Programs* (containing preregistration forms, housing applications, and field trip information) will be air mailed.

The local committee chairmen are

Northeastern Section, March 6–8, Syracuse, New York
Dan Merriam, Department of Geology, Syracuse University, Syracuse, New York 13210

South-Central Section, March 13–14, Austin, Texas
Robert E. Boyer, Department of Geological Sciences, University of Texas at Austin, Austin, Texas 78712

Cordilleran Section, March 25–27, Los Angeles, California
Terry E. Davis and Robert J. Stull, Department of Geology, California State University, Los Angeles, California 90032

Southeastern Section, April 9–12, Memphis, Tennessee
R. W. Deininger, Department of Geology, Memphis State University, Memphis, Tennessee 38152

Rocky Mountain Section, May 3–6, Boise, Idaho
Kenneth M. Hollenbaugh, Department of Geology, Boise State University, Boise, Idaho 83725

North-Central Section, May 15–17, Waterloo, Ontario
Robert N. Farvolden, Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, N2L 3G1, Canada

Honors and Awards Committee seeks suggestions

The Committee on Honors and Awards needs your help in nominating potential recipients of GSA's highest honors—the Penrose Medal, the Day Medal, and Honorary Fellowship. The criteria for these honors are described in the booklet *Council Rules, Policies, and Procedures*, or you can get a good idea of the kinds of scientists who have been honored in the past by glancing at the lists on pages xi and xiv of your 1974 *Yearbook*.

Suggestions for consideration for 1975 awards must be received by headquarters by February 15, 1975. They will be forwarded to the appropriate subcommittee chairmen.

To insure thorough consideration by the particular subcommittee, please back up each suggested nomination with a brief biographical sketch, a selected bibliography, and a summary of his or her chief contributions to geology.

Publications

Current titles published by GSA

MEMOIRS

138 *Petrology of the Duke Island Ultramafic Complex, Southeastern Alaska.* By T. N. Irvine, 1974, 240 p., $30.00.

139 *A System of Stages for Correlation of Magallanes Basin Sediments.* By M. L. Natland, Eduardo Gonzalez P., Antonio Canon, Mario Ernst, 1974, 216 p., $15.50.

141 *Bibliography of Fossil Vertebrates, 1969–1972.* By J. T. Gregory and others, 1973, 734 p., $26.00.

SPECIAL PAPERS

148 *Carboniferous of the Southeastern United States.* Edited by Garrett Briggs, 1974, 362 p., $20.75.

149 *Lower Triassic Temnospondyli of Tasmania.* By John W. Cosgriff, 1974, 134 p., $11.00.

152 *Late Mississippian and Early Pennsylvanian Conodonts, Arkansas and Oklahoma.* By H. Richard Lane and Joseph J. Straka II, 1974, 144 p., $12.50.

153 *Carbonaceous Materials as Indicators of Metamorphism.* Edited by Russell R. Dutcher and others, 1974, 108 p., $13.50.

154 *Correlation of the Silurian Rocks of the British Isles.* Edited by W.B.N. Berry and A. J. Boucot, 1974, 154 p., $17.75.

MAPS

Age of Ocean Basins Determined from Magnetic Anomaly Lineations. By W. C. Pitman III and others, 26 x 48 in., color, 1974. Folded in 9 x 12 envelope, $7.50; rolled in sturdy mailing tube, $10.00.

Map of Surface Sediment Facies of the Florida–Bahamas Plateau. Compiled by Paul Enos, color, scale—1:3,168,000. Folded in 9 x 12 envelope, $4.00; rolled in sturdy mailing tube, $4.50.

Tectonic Map of China and Mongolia. Compiled by U.S. Geological Survey, color, scale—1:5,000,000. Folded in 9 x 12 envelope, $9.00; rolled in sturdy mailing tube, $12.00.

MEMORIALS

Volume II (1970 decedents)	150 p., $4.00.
Volume III (1971 decedents)	222 p., $6.00.

Scheduled for publication soon:

Memoir 142 — *Quantitative Studies in the Geological Sciences.* Edited by E. H. Timothy Whitten.

Special Paper 156 — *A Review of African Granulites and Related Rocks.* By T. N. Clifford.

Special Paper 159 — *Geology and Stratigraphy of Silurian and Lower Devonian Basin and Basin Slope Limestones, Copenhagen Canyon, Nevada.* By J. C. Matti, M. A. Murphy, and S. C. Finney.

Treatise, Part W, Miscellanea, Supplement 1, Trace Fossils and Problematica. Second edition, revised and enlarged. Volume 1 of 2.

Summary Sheets of Sedimentary Deposits. Compiled by Darwin R. Spearing.

Bathymetric Map of the Bering Shelf. Compiled and contoured by Richard Pratt and Fred Walton.

Increase in publication of short Special Papers

The demands for space in the *Bulletin* are especially keen this year, but not enough money is available to publish all of the articles suitable for publication. As a consequence, several actions are being taken to live within our means: (1) Strict enforcement of the length limitation on *Bulletin* articles; (2) Avoidance of excessive illustrations and auxiliary data; and (3) Careful scrutiny of all articles in order to keep them as brief as possible.

These actions are resulting in the publication of more short Special Papers. They can be published nearly as rapidly as a long *Bulletin* article. Authors of brief Special Papers are usually encouraged to write a very brief summary article for the *Bulletin* or *Geology*. Maps that must be published larger than pages in the *Bulletin* can be printed and sold separately. Authors are encouraged to have a small map with the article in the *Bulletin* and a brief summary statement to accompany the separate map. Articles that must have an accompanying large map are considered for the Special Paper series.

Stricter consideration is being given to all auxiliary data. Some material is being retained in a repository maintained by the Society and some is published on microfiche which is provided with Special Papers and Memoirs.

We feel that such actions are more beneficial than the arbitrary reduction in the number of papers that are published.

Reviews

Introduction to Exploration Geochemistry, by A. A. Levinson (with chapters by B. McCammon and B. Hitchon). Published by Applied Publishing Ltd., Calgary, Alberta, 1974, 612 p., $25.00 ($16.00 student price).

This book is designed primarily for geology students and practicing geologists who are generally unfamiliar with the field of exploration geochemistry. Although emphasis is placed on the geochemistry of trace metals and the search for metalliferous deposits, an excellent chapter by Brian Hitchon reviews the application of geochemistry to the search for crude oil and natural gas. The first portion of the book summarizes the theoretical basis for geochemical exploration, that is, primary and secondary dispersion mechanisms. Next, analytical methods of interest to exploration geochemists are described. Subsequent chapters describe various types of geochemical surveys—stream sediment, soil, rock, atmosphere, and water. A separate chapter devoted to geochemical exploration in Canada deals with the effects of glaciers, permafrost, and muskeg bogs on the dispersion of metals and describes geochemical surveys in parts of Canada that are characterized by these environments. The statistical treatment of geochemical data is reviewed in a chapter by Richard B. McCammon. The appendices contain directions for performing field colorimetric analyses for zinc, copper, molybdenum, and tungsten (Appendix B) and give examples of the statistical analysis of frequency distributions of geochemical data (Appendix C).

The book has a number of good points. The author has synthesized complex subject matter and presented it in a concise and understandable manner. The book contains numerous illustrations of high quality, providing a valuable supplement to the text. The balance achieved by the author between the theoretical and practical aspects of the subject is particularly commendable. With the possible exception of the chapter on statistical treatment of geochemical data, the subject matter is within the grasp of most advanced undergraduate geology students. The book's value as a teaching tool is enhanced by the description of analytical procedures that can be employed in laboratory exercises. The overall utility of the book is enhanced by numerous recent references (including 1973). The chapter on geochemical exploration in Canada deserves special commendation as it constitutes the best overall summary on geochemical exploration in arctic and subarctic terrains currently available in the literature.

Although the book admirably satisfies the basic objectives of the author, a somewhat enlarged scope would greatly increase its utility. A section devoted to the geochemical exploration of specific types of mineral deposits (such as porphyry copper-molybdenum deposits, volcanogenic massive sulfides, and Mississippi Valley deposits) would enhance its value to economic geologists. In addition, a comparison between geochemical and geophysical approaches to various types of mineral deposits would be of value. As specialization in mineral exploration increases, it is important that geochemists, geologists, and geophysicists more fully understand the various approaches to exploration problems.

Certain sections are somewhat weak. The discussion of chemical reactions during weathering is ultracondensed. A broader synthesis of the literature and expansion of this section would be helpful. The discussion of clay minerals could be substantially improved by illustrations of crystal structures and discussion of the crystal chemistry of the major groups of clay minerals. Only four pages are devoted to gaseous geochemistry even though there has been considerable interest and research on this subject during the past five years.

Taken as a whole, these points do not seriously detract from a very good book that will undoubtedly be widely adopted as a textbook and be widely read by explorationist geochemists.

Robert N. Carpenter
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Glossary of Soil Science Terms. Published by Soil Science Society of America, Madison, Wisconsin, revised 1973, 33 p., $1.00.

The evolution of soil science terminology has occurred with such rapidity during the last two decades that nonspecialists often find their technical vocabulary outdated. New terms have been added and well-established terms abandoned. A terminology gap exists between the educational system and the professional soil scientist, and this problem is apparent when reading recent geology textbooks dealing with the subject of soil systems.

The **Glossary of Soil Science Terms** is the latest attempt of the SSSA to remedy the problem. In the period 1956–1973 several revisions of definitions of soil terms were published in the SSSA Proceedings. This most recent publication includes all preceding revisions and appendices and adds two revisions on soil microbiology and biochemistry and on soil tillage terminology. The task of keeping the **Glossary** updated is not made easier by the dynamic nature of the new **Soil Taxonomy** of the U.S. Department of Agriculture. Appendix II, which deals with the nomenclature of the new taxonomy, was approved in 1967 and already needs revision.

Knowledge of defunct terminology is required in order to better understand recent textbooks and older research papers. The stamping of the word OBSOLETE across an abandoned definition, making it illegible, is frustrating and another style should be used in future revisions.

Given the dynamic nature of soil nomenclature, and the lack of international and even national agreement on usages, the **Glossary** is very helpful; indeed an even greater number of entries would be welcome.

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BULLETIN briefs

Each month the center section of Geology will contain the titles and other pertinent information on the articles appearing in an issue of the Bulletin. The information will usually be taken from the original abstract but may be augmented. It is intended to aid in the selection of separates of the articles for the members' use and personal files. The Document Number of each article is repeated on the coupon that appears at the end of the listing of the articles in order to provide a convenient method to obtain copies of the complete articles.

FROM JANUARY BULLETIN:

☐ **50101 – Gravity Effect of Downgoing Lithospheric Slabs beneath Island Arcs.** *A. B. Watts and M. Talwani, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964.* (4 p., 3 figs.)

Geophysical data from the northwestern Pacific suggest that the total gravity effect of a downgoing slab beneath island arcs is small and limited in extent to the region of the island arc and trench. The total effect is small either because the density contrast associated with the downgoing slab is small or because the slab is in some manner compensated. The small total effect suggests that it is not possible to obtain details of the configuration of the slab from gravity data alone. The small total effect also suggests that the large positive gravity anomaly associated with some island arcs from satellite data must originate from sources other than the downgoing slab.

☐ **50102 – Magnetic Polarity Stratigraphy of Pliocene-Pleistocene Terrestrial Deposits and Vertebrate Faunas, San Pedro Valley, Arizona.** *Noye M. Johnson, Department of Earth Sciences, Dartmouth College, Hanover, New Hampshire 03755; Neil D. Opdyke, Lamont-Doherty Geological Observatory and Department of Geology, Columbia University, Palisades, New York 10964; Everett H. Lindsay, Geoscience Department, University of Arizona, Tucson, Arizona 85721.* (8 p., 11 figs., 1 tbl.)

Twelve superposed magnetic polarity zones in Pliocene-Pleistocene valley fill span the time from the upper Gilbert Epoch through the Brunhes Epoch. The magnetic-polarity zones for 64 km in the valley serve as chronostratigraphic units. The position of mammalian fossils within the chronostratigraphic zones define four mammal datum planes for the upper San Pedro Valley, including the first appearance of *Lepus* sp. at 1.9 m.y. *Lepus* sp. marks the first occurrence of a definitive Irvingtonian land mammal in the San Pedro Valley and thus places the local boundary of the Irvingtonian Land Mammal Age shortly below the Olduvai event. This position equates approximately with the Pliocene-Pleistocene boundary of the pelagic marine record.

☐ **50103 – Microstructure of Slates from Lady Loretta, Queensland, Australia.** *M. A. Etheridge and M. F. Lee, Department of Geology and Mineralogy, University of Adelaide, Adelaide, South Australia 5001, Australia.* (10 p., 13 figs., 2 tbls.)

The preferred orientation of mica in dolomitic slaty siltstone units from Lady Loretta, Queensland, Australia, and its relation to grain size and shape show that the larger, thicker grains have (001) subparallel to bedding, and the thinnest grains have (001) parallel to cleavage. Mica orientation depends primarily on bedding-cleavage angle and it bears little relation to bulk composition within the restricted range observed. The shapes of quartz- and dolomite-rich blebs in two specimens were measured to determine the orientation and shape of their finite strain ellipsoid. The $\lambda_1\lambda_2$ plane of this ellipsoid is at a low angle to the mica (001) preferred orientation defining the slaty cleavage. This is interpreted to be due either to a difference in strain between the blebs and their matrix, or to the operation of a mica-orienting mechanism that is not related rigorously to the finite strain. Predominantly mechanical orienting mechanisms are considered to be incompatible with the bimodal orientation and grain shape of mica. It is suggested that there was a well-defined preferred orientation in bedding, imposed during diagenesis, and that the cleavage mica grew with a strong preferred orientation during the deformation.

☐ **50104 – Land Use Site Reconnaissance by Computer-Assisted Derivative Mapping.** *Stephen E. Tilmann, Sam B. Upchurch, Graham Ryder, Department of Geology, Michigan State University, East Lansing, Michigan 48824.* (12 p., 5 figs., 2 tbls.)

A comprehensive and rapid technique for the areal reconnaissance and geologic evaluation of land utilizes computer-assisted data storage, retrieval, manipulation, and display of geologic data (factors) to demonstrate suitable areas for specific uses. Both continuous field data (for example, hydrologic maps) and point data (for example, water-well data) are used as data sources, and derived-data maps (for example, soil maps and geologic maps) are sources of multiple factors. Factors critical to determining the suitability of the land for a given use are compiled by constructing individual factor matrices on a grid, each cell of which represents a unit parcel of land. For each factor, matrix cells are assigned numeric values proportional to the suitability of the factor for the intended land use project. The matrices are weighted according to the project requirements and are summed. The potential optimal sites can then be identified by high summations. A combination of block perspective drawings and contour maps display the results in an easily understood format. The technique is illustrated by a pilot project designed and conducted to locate optimal sites for solid-waste, liquid-waste, and on-site septic waste disposal facilities in Roscommon County, Michigan.

☐ **50105 – Feldspathization as a Result of Deformation.** *R. P. Wintsch, Department of Geological Sciences, Brown University, Providence, Rhode Island 02912.* (4 p., 4 figs., 1 tbl.)

A model for metamorphic differentiation relying on the contrasting equilibria between the intergranular solution and both mineral recrystallization reactions and surface exchange reactions has been developed. Deformation at constant temperature and pressure will tend to increase the surface area of the minerals present, which in turn will increase the relative influence of surface reactions on the chemistry of the intergranular solution. Cation exchange on muscovite surfaces shifts the alkali/H^+ activity ratio of the solution into a feldspar

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stability field and results in the crystallization of feldspar.

☐ **50106 – Evidence for a Western Extracontinental Land Source During the Devonian Period in the Central Andes.** *Peter E. Isaacson, Department of Geology, Oregon State University, Corvallis, Oregon 97331.* (8 p., 4 figs.)

An intracratonic sedimentary basin of mid-Paleozoic age in the central Andes apparently received sediments from a western land source. The strata thicken and generally become coarser grained to the north and west in the Devonian rocks of Bolivia. Rate of subsidence in the basin was slightly exceeded by rate of sedimentation. Devonian brachiopod community studies suggest that a shallow marine environment persisted in the region throughout the time of deposition of the Devonian rocks. An absence of bedded carbonate rocks indicates a cold climate. Outcrops of sialic basement relicts in the Cordillera Occidental are concluded to be portions of a buried land mass.

☐ **50107 – Relations between Planimetric and Hypsometric Variables in Third- and Fourth-Order Drainage Basins.** *David N. Wilcock, School of Biological and Environmental Studies, New University of Ulster, Coleraine, Northern Ireland.* (4 p., 3 figs., 3 tbls.)

Analyses of relief distribution and drainage distribution within individual drainage basins suggest that relative density (F/D^2), a dimensionless variable describing a planimetric characteristic of stream organization in a basin, is related to the hypsometric integral (*HI*), a dimensionless variable describing the distribution of relief within a basin.

The nature of this relation seems to be important in explaining much of the scatter in the graphical relations between F (stream frequency) and D (drainage density).

It is suggested that, within any sample of drainage basins, the distribution of individual basin *HI* values about the sample mean *HI* value might influence the value of k in the relation $F = jD^k$.

☐ **50108 – Paleosalinities within a Pliocene Bay, Kettleman Hills, California: A Study of the Resolving Power of Isotopic and Faunal Techniques.** *J. Robert Dodd, Department of Geology, Indiana University, Bloomington, Indiana 47401; Robert J. Stanton, Jr., Department of Geology, Texas A&M University, College Station, Texas 77843.* (14 p., 16 figs., 1 tbl.)

Pliocene sediments of the Kettleman Hills, California, were deposited in a marine embayment. Faunal and sedimentologic data from the upper Pliocene *Pecten* zone indicate a decreasing salinity trend south and southwestward. In general, the least diverse faunas and coarsest sediment are in the west-central part of the area, near an apparent small delta, and are relatively distant from the entrance of the embayment. Salinity and substrate are probably the main factors controlling the composition of the eight fossil communities recognized by Q-mode cluster analysis. Oxygen and carbon isotopic age determinations were made on faunal specimens in order to determine paleosalinities. The salinities calculated range from normal marine in the north and east parts of the Kettleman Hills to brackish in the west-central part. Comparison of fossil and modern communities provides the means for detailed paleoenvironmental reconstruction by establishing analogous modern settings. Environmental interpretation, based on isotopic analysis, is similar to interpretations based on faunal analyses but, in addition, provides more quantitative estimates of the paleotemperature and salinity.

☐ **50109 – Evidence of Shoreface Retreat and In-Place "Drowning" during Holocene Submergence of Barriers, Shelf off Fire Island, New York.** *John E. Sanders, Department of Geology, Barnard College, Columbia University, New York, New York 10027; Naresh Kumar, Department of Geology, Columbia University, New York, New York 10027.* (12 p., 12 figs., 1 tbl.)

The barriers on the shelf off Fire Island, Long Island, New York, have responded to submergence through the contrasting processes of in-place drowning and landward retreat.

In-place drowning is indicated by evidence of a relict shoreline 7 km seaward of the present beach. This inferred relict shoreline is tentatively dated at 8,500 to 9,000 yr B.P.

At about 7,500 yr B.P., the breaker zone is inferred to have moved suddenly 5 km landward from this relict barrier to form a new chain of barriers. Two cores collected seaward of the present beach contain back-barrier salt-marsh peat which has been dated at 7,750 ± 125 and 7,585 ± 125 radiocarbon years and demonstrate that the barrier migrated continuously landward and eventually became the modern barrier.

☐ **50110 – A Carboniferous Subduction Complex in the Harz Mountains, Germany.** *Timothy A. Anderson, Bundesanstalt fuer Bodenforschung, 3 Hannover-Buchholz, Federal Republic of Germany.* (6 p., 4 figs.)

Rocks in the Harz Mountains probably accumulated during an episode of Carboniferous subduction. Oceanic crust moving relatively southeast was consumed at a Benioff zone dipping southeast. Pelagic and abyssal sediments, graywacke, basalt, keratophyre, and other rocks were emplaced at the leading edge of the overriding plate. Present-day northwestward structural imbrication (vergence) reflects the original dip of the Benioff zone. As a block typical of the northern part of the Variscan belt of Europe, the origin of the Harz Mountains by subduction suggests that much of the northern margin of the belt may have originated in the same manner.

☐ **50111 – Crystallization of Alkali Feldspar and Quartz in the Haplogranite System $NaAlSi_3O_8$–$KAlSi_3O_8$–SiO_2–H_2O at 4 kb.** *Jeffrey C. Steiner, Richard H. Jahns, William C. Luth, Department of Geology, Stanford University, Stanford, California 94305.* (14 p., 13 figs., 2 tbls.)

Experimental studies at 4 kb and from 650° to 1000°C have generated composition paths for liquid and crystal fractions as functions of temperature and bulk composition. Attention has been devoted mainly to silicate liquid that is saturated with quartz and an

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alkali feldspar but unsaturated with respect to an aqueous vapor phase.

Compositions of the crystal fraction that separates from the liquid under equilibrium conditions through the temperature range 700° to 655°C have been calculated for an array of bulk compositions. Equilibrium crystallization history is characterized by numerous shifts and some reversals along paths that describe the composition of the crystal fraction. The various paths demonstrate that intensive parameters such as temperature, pressure, and H_2O fugacity cannot be uniquely determined from the composition of a specific fraction.

Paths also have been outlined, for a variety of bulk compositions, from the maximum temperature for separation of quartz + alkali feldspar to the solidus temperature of 655°C under conditions of perfect fractional crystallization in which successive precipitates are immediately isolated from the silicate liquid. These crystal fraction paths are marked by discontinuities that indicate abrupt, discrete changes in composition, and with falling temperature, they tend to focus toward a compositional area centering about 20 $NaAlSi_3O_8$, 45 $KAlSi_3O_8$, 35 SiO_2.

The melting of crystalline assemblages that represent the haplogranite system can be considered as the inverse of equilibrium crystallication, fractional crystallization, or some combination of these idealized processes. Thus the composition path for an equilibrium crystal fraction can also serve for the tracing of compositional changes in a residue formed during equilibrium melting.

The experimentally determined complexities of crystallization are reasonable indications of what can occur under natural plutonic conditions and are potentially most useful for the testing of genetic models based upon detailed studies of rocks. They lead to the conclusions that (1) the bulk composition of a granitic plutonite is not sufficient for estimating conditions under which the rock was formed and (2) experimental data obtained for the haplogranite system under conditions that include the presence of an aqueous fluid phase ($P_{H_2O} \approx P_{fluid} = P_{total}$) are highly restricted in their pertinence to the crystallization histories of most granitic plutonites.

☐ **50112 – Late-Quaternary Marine Invasion in Maine: Its Chronology and Associated Crustal Movement.** *Minze Stuiver, Departments of Geological Sciences and Zoology and Quaternary Research Center, University of Washington, Seattle, Washington 98195; Harold W. Borns, Jr., Department of Geological Sciences and Institute for Quaternary Studies, University of Maine at Orono, Orono, Maine 04473.* (6 p., 4 figs.)

Recession of the ice margin at a rate of 0.3 km/yr or more in coastal areas in central Maine between 13,000 and 12,700 yr B.P. resulted in a large-scale marine submergence of this region. Isostatic uplift brought the region above sea level by 12,100 yr B.P. Model calculations show the existence of an inland sea in the later stages of emergence. The chronology of these events is given by ^{14}C dates on shells and seaweed from the Presumpscot Formation. Several criteria applied indicate age reliability of the shell dates within a few hundred years. ^{14}C ages of the earliest grown organic material in kettles often lag behind the time of deglaciation.

☐ **50113 – Campbellton Sequence, Manganiferous Beds adjoining the Dunnage Melange, Northeastern Newfoundland.** *Marshall Kay, Department of Geological Science, Columbia University, New York, New York 10027.* (4 p., 3 figs., 1 tbl.)

The Campbellton sequence of probable Cambrian and early Ordovician age lies south of the Loon Bay batholith, which intrudes the Dunnage Melange on the north. The Loon Harbour Formation at the base of the sequence consists of hundreds or thousands of meters of volcanic rocks. The succeeding Luscombe Formation, 300 m thick, consists of siliceous argillite with 50 m of manganiferous argillite near its base. The succeeding Riding Island Graywacke is 1,000 m thick. The origin of the sequence is compatible with the hypothesis that the ocean floor of the Protacadic Ocean was subducted in the Dunnage Melange.

☐ **50114 – Effects of Sample Handling on the Composition of Marine Sedimentary Pore Water.** *Matthew H. Hulbert, Mark P. Brindle, Center for Marine and Environmental Studies, Lehigh University, Bethlehem Pennsylvania 18015.* (2 p., 1 tbl.)

Three sediment samples from the Gulf of Mexico abyssal plain were subjected to five representative handling and storage procedures before the pore water was expressed and analyzed for Na^+, K^+, Mg^{2+}, and Ca^{2+}. The observed alterations in major cation concentrations during storage did not appear to be entirely related to temperature. Samples stored at *in situ* temperatures unexpectedly displayed greater changes than those which were stored at room temperature and subsequently rechilled.

☐ **50115 – Morphology and Tectonic Evolution of the East-Central Pacific.** *Jacqueline Mammerickx, Roger N. Anderson, Henry W. Menard, Stuart M. Smith, Scripps Institution of Oceanography, La Jolla, California 92037.* (8 p., 5 figs.)

Mapping of the East Pacific Rise between the equator and 40° S. shows the location and trend of nine active fracture zones and the probable location of a few more. An area of relatively shallow sea floor west of Easter Island marks a second active spreading center. New data indicate that segments of several fracture zones exist on either side of the rise and can be correlated across that feature. Newly identified segments of the fossil Galapagos Rise indicate that its southern part is significantly deeper than the northern segments. At 15° S., 120° W., the topographic configuration of the East Pacific Rise is markedly asymmetric: the western part is shallower than 2,000 fm (3,750 m) and occupies twice the area of that part to the east of the rise crest.

☐ **50116 – Coulee Alignment and the Wind in Southern Alberta, Canada.** *Chester B. Beaty, Department of Geography, University of Lethbridge, Lethbridge, Alberta, T1K 3M4, Canada.* (10 p., 9 figs., 1 tbl.)

The distinctive pattern of alignment and geographical distribution of more than 250 coulees in the plains of southern Alberta shows

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that the coulees have a mean orientation of N. 70° E., and their spatial distribution displays a concentration in the area from Lethbridge west to the Rocky Mountain front.

Action of postglacial wind, operating to initiate surface furrows (by wind-driven snow or rain) that were enlarged by running water, accounts for the three outstanding characteristics of the aligned coulees: (1) their preferred orientation approximates the mean direction of the strongest chinook winds in the southern Alberta plains; (2) their geographical distribution coincides with that part of the region experiencing the most pronounced chinooks; and (3) they are almost exclusively located on windward topographic surfaces.

☐ 50117 – **Catastrophic Debris Streams (Sturzstroms) Generated by Rockfalls.** *Kenneth J. Hsü, Geological Institute, Swiss Federal Institute of Technology, Zurich, Switzerland.* (12 p., 8 figs., 2 tbls.)

Large rockfalls commonly generate fast-moving streams of debris that have been called "sturzstroms." The geometry of sturzstrom deposits is similar to that of mudflows, lava flows, and glaciers. Sturzstroms can move along a flat course for unexpectedly large distances and may surge upward by the power of their momentum. A currently popular hypothesis to account for their excessive distance of transport suggests that sturzstroms slide on air cushions. Contrary to that hypothesis, evidence is herein presented to support Heim's contention that sturzstroms indeed flow.

The flow of a sturzstrom can be compared to a flow of a mass of concentrated cohesionless grains in a fluid medium. Frictional resistance to such grain flow is, according to Bagnold, less than that for sliding of rigid bodies because of the buoyancy of an interstitial fluid which serves to reduce the effective normal pressure of the entrained grains. The presence of sturzstrom deposits on the Moon indicates that the interstitial fluid is not necessarily a compressed gas or a wet mud. The dispersion of fine debris and pulverized rock dust among the colliding blocks may have provided an uplifting stress during the motion of some terrestrial and lunar sturzstroms.

Preliminary results suggest that a bentonite suspension of a certain consistency is a suitable material for scale models and that the flow of thixotropic liquids is kinematically similar to sturzstroms. The parameter "excessive travel distance" is introduced to replace the expression "equivalent coefficient of friction" as a measure of mobility of sturzstroms. There is, on the whole, a positive semilog correlation of the excessive travel distance to the size of the fallen mass. Exceptions to the rule include on the one extreme the unusual mobile Huascaran rockfall which gave rise to a sturzstrom with a dense interstitial mud and, on the other extreme, the least mobile Vaiont rockslide which remained a sliding block.

☐ 50118 – **Plate Tectonic Interpretation of the Paleozoic History of the New England Fold Belt.** *E. C. Leitch, Department of Geology and Geophysics, University of Sydney, Sydney, N.S.W. 2006, Australia.* (4 p., 3 figs.)

Major middle-upper Paleozoic paleogeographic elements in both the northern and southern parts of the New England Fold Belt comprise a western volcanic chain, a forechain basin, and an eastern nonvolcanic arc-platform-trench complex. These elements developed above a west-dipping subduction zone. Temporary halts in subduction led to minor deformational episodes. During the Late Devonian period, the northern part of the belt was displaced eastward by movement on the west-northwest–striking Tenterfield fault. Behind the displaced arc immediately north of the fault, an intra-arc basin developed. This was largely filled by sediment during the Carboniferous and was deformed at about the end of the Carboniferous period by reversal of movement on the fault.

Subduction ceased throughout the belt in Early Permian time and was followed by major orogenesis. At a late stage in deformation, right-lateral movement on the Demon fault displaced certain of the paleogeographic elements.

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