GSA news & information

SUPPLEMENT TO GEOLOGY MAGAZINE

AUGUST 1977

Applications for Science Editor due September 5

Committee on Publications will consider those qualified

As you all know, GSA has been operating with temporary interim science editors for the past year and a half and will continue to do so for much of the remainder of 1977. The Society, its Officers and Council, and the headquarters staff are all deeply indebted to Warren Hobbs (and to the USGS who made his availability possible) and to Paul Averitt for the competent and effective job they have done, and are still doing, in filling an interim that might otherwise have been quite difficult for the Society and for authors of scientific papers.

During the past year and a half, it has been the intention and hope of the Committee on Publications and the Council to employ Dr. Peter J. Smith as permanent Science Editor for GSA. However, delay after delay, including problems of a visa from England, have so complicated the problem that by mutual agreement negotiations with Dr. Smith have terminated, and we now start again on a search for a Science Editor for GSA.

Applications are solicited for the position of Science Editor. Requirements call for a mature geological scientist who has demonstrated ability in research in some branch of the geological sciences. The position would be in residence at GSA headquarters in Boulder, Colorado. Responsibilities include, in cooperation with the Associate Editors, the selection of reviewers for all manuscripts submitted for the *Bulletin*, Memoirs, Special Papers, Map and Chart series, and Microform Publications. After the peer review, the Science Editor has the responsibility of evaluating the reviews and making the final decision on acceptance or rejection, or specifying the type of modification that would be required prior to acceptance. Text editing, layout, and production work will continue to be done by a competent in-house staff, but the Science Editor is expected to be available to this staff for assistance on technical problems and also to give assistance to the Executive Director in budgeting and administrative matters. Selection of new Associate Editors and communication with the Associate Editors are also responsibilities of the Science Editor.

The format of the *Bulletin* will be modified starting with volume year 1979, as explained on p. 409 of the July 1977 issue of GSA News and Information. and the Science Editor will be responsible for guiding authors into the new format as it develops.

In the course of development of the Society's publication program, it is possible that the new Science Editor will also assume the responsibilities for *Geology*.

The volume of work involved is indicated by the fact that more than 400 manuscripts of a wide range in length are examined each year by the Science Editor, and an additional 200 short manuscripts are examined each year by the editor of *Geology*. The position requires full-time effort.

Leon T. Silver, chairman of the GSA Committee on Publications, is chairman of the search committee. Applications or inquiries should come to the Executive Director. **Applications must be at headquarters BEFORE SEPTEMBER 5, 1977.** They will be sent on to the search committee. Compensation will be comparable to academic salaries; GSA employees are under the TIAA-CREF retirement system.

NORTHEASTERNERS, PLEASE NOTE

The Northeastern Section abstract deadline has been changed from October 13 to November 1, 1977.

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 viii and x of your 1977 *Yearbook*.

Suggestions for consideration for 1978 awards must be received by headquarters by January 15, 1978. They will be forwarded to the appropriate subcommittee chairmen.

To ensure thorough consideration by the particular subcommittee, please back up each suggested nomination with a *brief biographical sketch* and a *summary of his or her chief contributions to geology*. In the case of the Penrose and Day Medals, a *selected bibliography* must accompany the nomination.

Please follow the same procedure for nominating your candidates for the National Medal of Science.

GSA announces medal and award winners for 1977

The 1977 medalists and award winners announced by the Council at its May 1977 meeting are as follows:

Penrose Medal: Robert P. Sharp, Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125.

Day Medal: Akiho Miyashiro, Department of Geology, State University of New York, Albany, NY 12222.

Kirk Bryan Award: Michael Church, Department of Geography, University of British Columbia, Vancouver, British Columbia V6T 1W5, for his paper "Baffin Island Sandur," Canadian Geological Survey Bulletin 216.

Meinzer Award: Not available at press time.

Burwell Award: Richard E. Goodman, 475 Davis Hall, University of California, Berkeley, CA 94720, for his paper "Method of Geological Engineering in Discontinuous Rocks," West Publishing Company, St. Paul, 472 p., 1976.

Cady Award: William Spackman, Department of Geology, Pennsylvania State University, University Park, PA 16802, for outstanding leadership in the field of coal geology.

National Medal of Science: The Council named M. King Hubbert as the Society's nominee for the National Medal of Science.

Necrology

Notice has been received of the following deaths: Walter Bryan Jones, University, AL 35486; Roman Kozlowski, Warsaw 22 Poland; Richard S. Lee, Hendersonville, NC 28739; Winnie McGlamery, Tuscaloosa, AL 35401; Alonzo Wallace Quinn, Providence, RI 02906.

You are invited
to join
GSA
at the
Seattle Annual Meeting

A gift will be given to each person who applies for membership on the Special Annual Meeting Membership Application (available only from Membership Services Booth and GSA Book Sales Booth)

This offer is made possible by your friendly GSA Council and GSA Membership Committee.

If you miss this offer in November, watch for it to be repeated next spring at your section meeting.

Council lists nominations for 1978

For Councilor (1978–79) and President (1978)
Peter T. Flawn, San Antonio, Texas

For Councilor and Vice-President (1978)
Leon T. Silver, Pasadena, California

For Councilor and Treasurer (1978)
William B. Heroy, Jr., Dallas, Texas

For Councilors (1978–80)
William C. Bradley, Boulder, Colorado
William R. Dickinson, Stanford, California
Robert N. Ginsburg, Miami, Florida
James B. Thompson, Jr., Cambridge, Massachusetts

Eighth Underwater Mining Institute meeting

Immediately following the GSA Annual Meeting in Seattle, the Eighth Underwater Mining Institute meeting will be held. Their meeting is scheduled for November 10–11, 1977, also in Seattle. The meeting is cosponsored by the University of Alaska and the University of Wisconsin Sea Grant Programs in cooperation with the University of Washington Sea Grant Program and the AIME. Topics will include environmental aspects of coastal zone mining, economics and marine mining, ocean law and deepsea nodule mining, nodule nucleation and metals, nuclear methods in marine minerals exploration, geophysics—some new techniques, conservation and marine mining, new frontiers in marine minerals exploration and mining, and coastal mining in Alaska.

For registration, fees, and arrangements contact Dr. Gregory Hedden, Institute Coordinator, Sea Grant Advisory Services, University of Wisconsin, 1815 University Avenue, Madison, Wisconsin 53706; phone (608) 262-0644.

August BULLETIN briefs

Brief summaries of articles in the August 1977 GSA Bulletin *are provided on the following pages to aid members who chose the lower dues option to select* Bulletin *separates of their choice. The document number of each article is repeated on the coupon and mailing label in this section.*

• 70801—Stream-channel response to floods, with examples from central Texas.

Victor R. Baker, Department of Geological Sciences, University of Texas at Austin, Austin, Texas 78712. (15 p., 19 figs.)

The principle that most geomorphic work is accomplished by relatively frequent events of moderate intensity requires modification for application to stream channels in certain climatic and physiographic settings. Small drainage basins in regions of highly variable flood magnitudes appear to have a high *potential* for catastrophic response. Flash-flood potential for small basins can be regionally mapped by computing the standard deviation of the logarithms of the annual flood peaks. Highly right-skewed flood-frequency distributions indicate that a high potential exists in certain arid regions of the southwestern United States and in the seasonal subtropical-to-steppe climate region of central Texas. High-magnitude flood response is also promoted by physiographic factors, such as hillslope morphology, soils, rock type, and drainage density. The relative importance of overland flow, which produces intense flood peaks, versus interflow and ground-water flow, which produce more uniform streamflow, appears to integrate both the climatic and the physiographic influences on the potential for catastrophic floods.

Another factor in realizing the climatic-hydrologic potential for catastrophic stream-channel response is the resistance of the channel itself to scour. Small limestone streams in central Texas show significant channel modification only during the rare high-magnitude floods characteristic of that region. This is mainly because of the high response threshold required to scour bouldery alluvium and dense valley-bottom vegetation. Effects of especially intense floods on such streams include the following: entrainment of jointed bed rock and boulders as much as 3 m in diameter, uprooting of trees that usually bind coarse-grained point bars, macroturbulent transport of boulders even over divides into adjacent drainages, local scour of chutes on meander bends, and passive boulder deposition on other preflood valley-bottom surfaces.

• 70802—Movement of cobbles in a gravel-bed stream during a flood season.

Paul Ray Butler, Department of Geology and Geophysics, University of California, Berkeley, California 94720. (3 p., 4 figs., 2 tbls.)

In a gravel-bed perennial stream in western Wyoming, 159 cobbles were tagged and placed on the stream bed. Thirty-five percent were recovered after one flood season during which the peak flow was 34 m^3/s. Sixty-one percent of those recovered had been buried. The *b* axis of the tagged rocks ranged from 34 mm to 116 mm. The distance transported ranged from 0 to 420 m; 95% of the recovered cobbles had moved. There is no clear relationship between particle size and distance transported; distance of transport seems to be more closely related to position (stream edge or center) at time of entrainment. Susceptibility to burial seems to be related to both particle size and position at time of entrainment.

• 70803—Stream network volume: An index of channel morphometry.

K. J. Gregory, Department of Geography, University of Southampton, Southampton, SO9 5NH, United Kingdom (6 p., 2 figs., 4 tbls.)

To advance studies of fluvial morphology, of the understanding of the effects of channel character upon streamflow, and of the analysis of channel changes, it is desirable to have a volumetric index of the stream network. A volumetric index is developed by integrating the regression equation which relates channel capacity to total stream length between network limits. This measure of the volume of the network is illustrated for two basins in New South Wales, Australia, which have different drainage densities but comparable network volumes. The index is also employed to demonstrate the reduction in channel volume to 58 percent of that expected, downstream from a reservoir in Yorkshire, England, and to indicate the increase of channel volume to 1.9 times the expected value downstream from an urban area in Yorkshire.

• 70804—Emplacement of the Oman ophiolite: A mechanism related to subduction and collision.

Michael J. P. Welland, Department of Geology, Wayne State University, Detroit, Michigan 48202; A.H.G. Mitchell, Department of Geology and Mineralogy, Parks Road, Oxford, OX1 3 PR, England (present address: c/o U.N.D.P., P.O. Box 650, Rangoon, Burma). (8 p., 6 figs.)

The tectonic succession of the Oman Mountains, including the Semail ophiolite complex, resembles that underlying the Zagros thrust zone of Iran. Palinspastic reconstruction of the Oman sequence indicates a Triassic continental-margin–ocean-basin regime that underwent subduction on its northeastern margin during much of Cretaceous time. The sequence resulted from tectonic incorporation of ocean-basin and margin lithologies into a lower trench slope accretionary prism. Emplacement of large ophiolite (oceanic lithosphere) slices within the accretionary prism may have resulted from attempted subduction of a topographic irregularity such as a recently inactive oceanic rise. Collision, or partial collision, of continental margins resulted in tectonic emplacement of the accretionary prism onto the previously stable platform sequence. This model includes implications concerning the regional tectonic development of the Zagros thrust zone and central Iran and may account for differing characteristics of regions to the northeast and southwest of the Zagros thrust.

• 70805—Origin of the Baltimore Gneiss Migmatites at Piney Creek, Maryland.

Sakiko N. Olsen, Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland 21218. (13 p., 11 figs., 5 tbls.)

The net compositions of neosome plus mafic selvage in two biotitic layered migmatites from the Baltimore Gneiss at Piney Creek, Maryland, closely approximate the paleosome compositions: the migmatization must have occurred in rocks closed to all except possibly volatile components. Anatexis or metamorphic differentiation is indicated as the migmatization mechanism. Parallel tie lines between the neosome, selvage, and paleosome in a modal biotite-microcline plot suggest a subsolidus metamorphic differentiation mechanism in which microcline replaces biotite in the neosome by a reaction such as biotite + $6H^+ \rightarrow$ microcline + 3 (Fe^{++}, Mg^{++}) + $4H_2O$; the Fe and Mg released by the reaction diffuse from the neosome to the selvage; biotite replaces microcline in the selvage by the reverse of the reaction. Anatexis (simple partial fusion) in the Piney Creek rocks is also indicated because (1) the closer a paleosome composition is to the granite minimum the more extensive is the migmatization in the rock; and (2) the neosomes are closer to the granite minimum than the paleosomes.

It is postulated that the Piney Creek migmatites formed by metamorphic differentiation induced by anatexis. Anatexis decreases f_{H_2O} locally because much water must be dissolved in the first melt, thus initiating the reaction by which biotite breaks down to microcline. The f_{H_2O} gradient between the neosome and paleosome maintained by the presence of melts in the neosome drives the meta-

(continued on p. 489)

During the annual meeting, if your name is not listed on the board, please notify the person staffing the locator board desk.

The locator board and desk will be situated in the registration area of the Center House at the Seattle Center complex.

SPECIAL EVENTS

Cruise and Salmon Bake. You'll want to take home the memory of a remarkable experience that begins and ends with a delightful cruise on Puget Sound. Leaving Pier 56 at Seattle's waterfront on Sunday, November 6, at 3:00 p.m., you will glide along a scenic path past Seattle's mainland, with a full view of islands against a backdrop of the Olympic and Cascade Mountains. Upon arrival at TILLICUM VILLAGE, you'll enjoy succulent clams and nectar before entering the Indian "longhouse" for an authentic Indian Salmon Bake. The dinner is complete and you can go back for seconds! See and hear authentic North Coast Indian dances and view their skills in arts and crafts. The entire island is a natural Marine State Park, with tall fir trees, forest animals, including wild and tame deer. After this unique and satisfying treat, you will return to "the city" for the evening's entertainment.

The cost is $14. It includes salmon dinner, cruise, and bus transportation to and from the waterfront. **Preregistration required for reservations.**

Shuttle buses will run from the Olympic and the Washington Plaza Hotels to Pier 56 from 1:00 to 2:45 p.m.

NOTE: We strongly recommend that participants be in Seattle no later than 12:00 noon on Sunday, November 6. You will need to allow plenty of time to pick up your preregistration packet which will contain your ticket for this event. Tickets will be required to board the boat.

Welcoming Party. The welcoming party will follow the Salmon Bake. Cruise boats will return from the Salmon Bake in time for this traditional event. Plan to meet friends and colleagues at the Grand Ballroom of the Olympic Hotel from 6:00 p.m. to 9:00 p.m. Sunday evening. Drinks will be available at cash bars in the ballroom. No tickets or preregistration required.

Cocktail Party, Annual Dinner, and Presidential Address. These events will be held on Tuesday, November 8, in the Olympic Hotel. The cocktail party is scheduled from 6:00 to 7:00 p.m. in the Spanish Ballroom, the annual dinner from 7:15 to 8:45 p.m. in the Grand Ballroom, and the presidential address from approximately 9:15 to 10:00 p.m. in the Grand Ballroom. The traditional Penrose and Day Medals will be presented at the dinner.

NOTE: Attendance at the annual dinner is not required for admittance to the presidential address.

Post-meeting Hawaii Trip. After the technical sessions are over, plan to relax and enjoy the scenic geology of Hawaii. Spouses and guests are welcome. Fly to Hilo Thursday, November 10, and spend three nights at Volcano House on the lip of Kiluea cauldera. Spend two days examining the existing array of recent volcanic phenomena at Kiluea National Park and hiking among the 1974-75 lava flows and on Crater Rim Road and other trails. See outstanding examples of pahoehoe lava, tree molds, spatter cones, cinder cones, caulderas, lava tubes, rifts, lava cascades, and who knows, maybe even a new eruption! Drive to the beautiful Kona coast for two nights at Kona Lagoon Hotel, then fly to Honolulu for two days at Waikiki or looking at volcanic features and coral reefs. Return to Seattle, November 17.

Group fare of $430 per person includes round trip airfare Seattle-Hawaii-Seattle, all accommodations, transportation by charter bus, interisland flights, transfers to and from airports, tips, and tax. **Limit: 40 participants.** For additional information write or call Don J. Easterbrook, Dept. of Geology, Western Washington State College, Bellingham, WA 98225 (phone: 206-676-3583).

NOTE: Arrangements must be made no later than October 5, 1977, for guaranteed reservations.

SCIENCE THEATER

The Science Theater will provide an opportunity for registrants to view an exciting program of recent films of geologic interest. It will be in operation during session hours near the exhibits in the Exhibition Hall at the Seattle Center.

EXHIBITS

Exhibit space will be available in the Seattle Center Exhibition Hall. If your university, organization, or company is interested in exhibiting, please write or call Fred Handy, Meetings Manager, Geological Society of America, 3300 Penrose Place, Boulder, CO 80301 (phone: 303-447-2020).

GSA COMMITTEE ON MINORITIES

The Committee on Minorities in the Geosciences will be sponsoring the second special one-day program on career opportunities in the geosciences for about fifty secondary-school teachers and career counselors and selected minority students from the Seattle Public Schools on Wednesday, November 10, 1977. The program will consist of a morning series of talks and films on the nature of the geosciences and geoscience careers, followed by a field trip in the Seattle area to demonstrate the role of geology in providing essential information for the safe development of urban areas and in preserving the quality and beauty of our environment. The morning session (8:30-11:30 a.m.) will be open to the public, free of charge. The afternoon field trip is by invitation only. (See program under heading "Committee Meetings" for the location of the room.)

GROUP ACTIVITIES

Space assignments for meetings, breakfasts, luncheons, dinners, and cocktail parties have been made and no further space is available for group events.

GUEST PROGRAM

A variety of activities have been planned for those not attending the technical sessions. **Registration as a guest at the annual meeting is a prerequisite for participation. Badges must be worn.** The tours will highlight some of the most interesting aspects of the Pacific Northwest. Costs listed include transportation, admission fees, lunch, tax, and gratuities. **Please note that tours are restricted to adults only.**

Monday, November 7

SEATTLE POTPOURRI. A collage of scenic areas in Seattle including morphic differentiation and should also create an a_{SiO_2} gradient leading to the observed quartz migration from the selvage to the neosome.

• 70806—Craters as "fossils"; the remote dating of planetary surface materials.

George E. McGill, Department of Geology and Geography, University of Massachusetts, Amherst, Massachusetts 01002. (9 p., 5 figs.)

The need to determine relative ages of materials and surfaces on moons and planets other than the Earth has resulted in the development of dating techniques that are based on the density or the morphology of craters and that supplement the classical techniquqes of physical stratigraphy. As is the case with the fossil-based relative time scale on Earth, crater-based relative ages can, in principal, be calibrated with radiometric ages of returned samples. Relative ages determined by crater density or crater morphology rest on a small number of basic assumptions concerning the morphology of fresh craters, the randomness of crater-formation processes, and the rates and areal constancy of crater-degradation processes. The validity of these assumptions varies from planet to planet. Despite the problems and controversies that inevitably accompany the development of major new techniques, the basic principals underlying the use of craters to determine relative ages are well established and logically sound.

• 70807—Structural analysis of the Silurian-Devonian rocks of the Royalton area, Vermont.

Bertram G. Woodland, Department of Geology, Field Museum of Natural History, Chicago, Illinois 60605. (13 p., 18 figs.)

Structural analysis of Silurian-Devonian schists of the Waits River and Gile Mountain Formations in the Royalton area, Vermont, provides clear evidence of three Acadian deformational phases and polymetamorphism. Structurally, the Royalton area lies within the Connecticut Valley-Gaspé synclinorium. The Gile Mountain Rocks are part of the western band of the formation, which has its southern termination in the study area and extends northward to join the eastern band around the northern end of the calcareous Waits River Formation of the Strafford-Willoughby arch.

The earliest deformation (D_1), is recognized by a pervasive schistosity (S_1) generally parallel to bedding (S_0) and by rarely identified folds (F_1). The second deformation (D_2) has left the most widespread imprint, with an S_2 cleavage or schistosity and open to moderately flattened folds (F_2) in schistosity, parallel to bedding (S_0/S_1). Least easily recognized is the third deformation (D_3), with sparse open folds in S_2.

The western band of the Gile Mountain Formation is interpreted as the westward- and downward-facing nose—the Royalton synform—of a large D_1 recumbent fold—the eastern Vermont nappe. D_2 structures have generally been regarded as synchronous with and genetically related to formation of domes and the Strafford-Willoughby arch. However, the D_2 structures are interpreted here as predoming, with D_3 structures related to the doming deforming them.

Compressive buckling and variable flattening imposed during D_2 upon a variably oriented S_0/S_1 may have been the result of emplacement of higher nappes (now removed by erosion), which increased the depth of burial promoting prograde metamorphism.

• 70808—Coarsening-upward cycles in the alluvium of Hornelen Basin (Devonian) Norway: Sedimentary response to tectonic events.

R. J. Steel, S. Mæhle, H. Nilsen, S. L. Røe, A. Spinnangr, Geological Institute, University of Bergen, 5000 Bergen, Norway (present address: Mæhle and Spinnangr: Statoil, Lagardsvm. 78, 4000 Stavanger, Norway; Nilsen and Røe: Oljedirektoratet, Lagardsvn. 80, 4000 Stavanger, Norway). (11 p., 8 figs.)

Hornelen Basin (Devonian) is filled with ∼25 km of sediments, mostly sandstones. These sedimentary rocks are spectacularly organized into more than 150 basin-wide cycles, each on the order of 100 m thick, most of which coarsen upward. The cycles are otherwise complex, consisting of marginally derived fanglomerates and laterally equivalent, longitudinally dispersed alluvial plain sediments.

The basin-wide nature of the cycles, the fact that the coarsening-upward occurred at the same time in both marginal and axial facies, and because successive alluvial fan bodies coarsen upward whether they are composed of debris flow or of stream deposits suggest that the cycles are allocyclic and that they are the basin's response to the lowering of its floor. In their marginal development, the cycles are commonly segmented, consisting of coarsening-upward subcycles of the order of 10 to 25 m thick. The geometry and internal details of these suggest that they also were tectonically generated.

It is likely that the 10 to 25-m coarsening-upward sequences, representing aggrading base-level conditions, were the basic sedimentary response to basin-floor subsidence. The 100-m cycles represent additional complexity in style of subsidence. Progressive eastward overlap of successive 100-m units suggests that at this interval the locus of subsidence abruptly shifted in a proximal direction, by ∼0.25 km.

A dextral wrench fault model is proposed to account for this pattern of basin filling.

• 70809—Textural characteristics of drift from some representative Cordilleran glaciers.

Hugh H. Mills, Department of Geological Sciences, University of Washington, Seattle, Washington 98195 (present address: Department of Chemistry and Geology, Clemson University, Clemson, South Carolina 29631). (9 p., 14 figs.)

Particle-size analyses of more than 300 samples of drift from Nisqually, Paradise, and South Cascade Glaciers in the Cascade Range of Washington, from Athabasca Glacier in Alberta, Canada, and from other alpine glaciers show that textural differences exist both between glaciers and between glacier subenvironments. Differences between glaciers probably reflect bedrock terrane and are shown by the percentage of silt + clay in the $<-1.00\ \phi$ fraction, which increases in the following order: Nisqually and Paradise (volcanic bedrock), South Cascade (metamorphic and plutonic bedrock), and Athabasca (sedimentary bedrock). Differences between subenvironments are shown best by analyses of samples which include clasts as large as -6.67 ϕ; average frequency curves of these samples show that basal tills lack dominant modes in the coarse fraction and may have dominant modes in the fine fraction at about 4.00 ϕ, whereas sediments of other subenvironments possess dominant modes in the coarse fraction at or above about -5.00 ϕ. Mean size and sorting increase, and percentage of silt + clay decreases in the following order: basal till, recessional-moraine till, end-moraine till, ablation drift, and stratified drift. Skewness, but not kurtosis, also varies with subenvironment.

A comparison of alpine drift with continental ice-sheet drift from Ontario shows that, in general, alpine drift is coarser, but that alpine basal till is comparable to ice-sheet basal till. When comparing nonglacial diamictons to alpine drift, it may be possible to distinguish the former from the sediments of one glacier subenvironment but not from those of another.

• 70810—K-Ar dates from Upper Cretaceous volcanic rocks in the subsurface of west-central Mississippi.

Daniel A. Sundeen, Department of Geology, University of Southern Mississippi, Hattiesburg, Mississippi 39401; Philip L. Cook, AMOCO Production Company, Box 50879, New Orleans, Louisiana 70150. (3 p., 1 fig., 1 tbl.)

Volcanic rocks have been reported from a number of exploratory wells located throughout central and northwestern Mississippi. K-Ar dates have been determined for two samples obtained from a cored igneous section in southern Humphreys County, Mississippi. A biotite analcimite taken from a depth of 1,287 m (4,224 ft) yielded an age of 91.3 ± 3.4 m.y. A phonolite from a depth of 1,576 m (5,172 ft) yielded an age of 78.3 ± 2.9 m.y. These K-Ar dates are in agreement with crosscutting relationships present in the local stratigraphy. In the vicinity of the well site, the volcanic section is overlain by transgressive chalk of the Upper Cretaceous Selma Group.

• 70811—Gravity field of the buried shield in the Punjab Plain, Pakistan.

Abul Farah, Mohammad A. Mirza, Mohammad A. Abmad, Mohammad H. Butt, Geological Survey of Pakistan, Quetta, Pakistan. (9 p., 9 figs., 1 tbl.)

The regional Bouguer anomaly data of the Punjab Plain, Salt Range, and Potwar Plateau, covering an area of about 135,000 km^2 (lat 29°00′ to 33°30′N, long 71°00′ to 74°30′E), have been determined. Inferences have been drawn on the assumption that the gravity anomalies reflect the buried features of the Precambrian basement, with density of 2.7 g/cm^3 as compared to an average of 1.9 g/cm^3 for the sedimentary cover. The Sargodha–Shah Kot ridge of the Punjab Plain is inferred to be a horstlike block of raised continental crust extending northwestward with gentle dips. Our interpretation of the gravity data indicates that the shield elements with increasing sedimentary cover can be followed northward beneath the southward thrust of the Himalayas, as suggested by Gansser.

• 70812—K-Ar and fission-track dating of ash partings in coal beds from the Kenai Peninsula, Alaska: A revised age for the Homerian Stage–Clamgulchian Stage boundary.

Don M. Triplehorn, Solid-Earth Sciences Program, University of Alaska, Fairbanks, Alaska 99701; Donald L. Turner, Geophysical Institute and Solid-Earth Sciences Program, University of Alaska, Fairbanks, Alaska 99701; Charles W. Naeser, U.S. Geological Survey, Denver, Colorado 80225. (5 p., 3 figs., 1 tbl.)

K-Ar and fission-track mineral ages determined from ash partings in upper Tertiary coal beds from the Kenai Peninsula, Alaska, establish an age of approximately 8 m.y. (late Miocene) for the Homerian Stage–Clamgulchian Stage boundary at the type section at the Homerian Stage and a late Miocene age for the early part of the Clamgulchian Stage. Our data do not support the concept that there is an "Arcto-Tertiary geoflora" which is different in age from similar floras at lower latitudes.

This study demonstrates, for the first time, that volcanic ash partings contained wholly within coals are valuable for radiometric dating and stratigraphic correlation.

• 70813—Sedimentation and climatic patterns in the Santa Barbara Basin during the 19th and 20th centuries.

Andrew Soutar, Peter A. Crill, Scripps Institution of Oceanography, La Jolla, California 92093 (12 p., 12 figs., 11 tbls.)

The thickness of annual sediment laminations in the Santa Barbara Basin is compared to southern California drought-resistant tree growth and to regional indices of rainfall and temperature. The rate of sedimentation was found to be independent of temperature, but it is highly correlated with rainfall and tree growth. We suggest that sedimentation, like tree growth, is a function of the amount of rainfall in the prior seasons as well as the current season. The natural filter displayed by the sedimentation and tree-growth records can be described by a simple mathematical model which, in the case of sedimentation, can be related to upstream aggradation or to distributional processes on the shelf.

The pair of laminae that constitute a single year's sediment accumulation are directly related. This suggests that the process of detrital sediment delay and redistribution operates primarily in the marine environment. The density difference that distinguishes "winter" laminae and "summer" laminae is ascribed to the interaction of the seasonal rate of deposition and the growth of a mat-forming organism endemic to the surface sediment of the Santa Barbara Basin.

• 70814—Petrology and mineral chemistry of peridotite nodules included in Tertiary basaltic rocks of northeast Brazil.

Alcides Nóbrega Sial, Institute of Geosciences, UFPe, Recife, C.P. 1538, Brazil. (4 p., 1 fig., 1 tbl.)

The Tertiary volcanic suite in central Rio Grande do Norte and Northern Paraiba, which is composed of ankaratrites,

basanites, and olivine baslts with basanitic affinities, forms plugs, necks, flows, and dikes that cut the Precambrian basement and Cretaceous sediments of the Apodi basin in a north-south trend. Xenocrysts of olivine, orthopyroxene, clinopyroxene, spinels, and granular and sheared spinel-lherzolite and harzburgite nodules are found as inclusions in several necks and plugs. The entire xenolithic suite was derived from depths of approximately 64 to 55 km. The mineralogical and textural aspects of the nodules, as well as their mineral chemistry, are discussed.

• 70815—Relative erodibility of source-area rock types, as determined from second-order variations in alluvial-fan size.

Roger LeB. Hooke, William L. Rohrer, Department of Geology and Geophysics, University of Minnesota, Minneapolis, Minnesota 55455. (6 p., 4 figs., 3 tbls.)

The area of an alluvial fan is approximately proportional to the 0.9 power of the area of the drainage basin discharging to the fan. The constant of proportionality is, in part, a function of the erodibility of the bedrock in the source area. By using multiple linear-regression techniques to analyze this functional relationship in three groups of fans in Death Valley, California, and vicinity, we determined coefficients of relative erodibility for some of the dominant rock types. Comparison of these coefficients with weathering characteristics observed in the field and with changes during weathering experiments in the laboratory suggests that fracture density is more important than mineralogy in determining rock erodibility.

• 70816—Ophiolite obduction and geologic evolution of the Oman Mountains and adjacent areas.

W. K. Gealey, Chevron Overseas Petroleum Inc., P.O. Box 7643, San Francisco, California 94120. (9 p., 4 figs.)

Structural and stratigraphic relationships in the Oman Mountains developed by Late Cretaceous collision between the northern passive margin of the African continent and an island arc. Field relationships and metamorphic facies indicate that ophiolite obduction was accomplished by continental underthrusting of the forearc limb of an island-arc edifice at considerable depth. Uplift of the ophiolite slab resulted from both compressional shortening and isostatic interaction of the continental crust with the mantle rock it underthrust. This model may apply to many other major ophiolite areas of the world, specifically Newfoundland, Cuba, northern Venezuela, Cyprus, the Urals, eastern Celebes, New Guinea, and New Caledonia.

Events preceding the Mesozoic convergence of Africa and Eurasia and resultant Oman collision include late Paleozoic rifting in the present Turkey-Iran area, which produced a microcontinent comprising the Menderes and Kirsehir massifs of Turkey and the Rezaiyeh-Esfandagheh belt of Iran, separated from Eurasia by a northerly arm of the Tethys and from Africa by a southerly arm of the Tethys. Central Iran and central Afghanistan-southern Pamir-Karakorum are believed to have been a part of Gondwana positioned between Somalia and India. They too were affected by late Paleozoic rifting but did not reach their present position until early Tertiary time, driven north along with India by sea-floor spreading of anomaly 28 time and later.

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• 70817—Geology in American education: 1825–1860.

Markes E. Johnson, Department of the Geophysical Sciences, University of Chicago, Chicago, Illinois 60637.
(7 p., 2 tbls.)

The year 1825 is a landmark in the history of American geological education owing to innovations pioneered by William Maclure and Amos Eaton. School systems devised independently by them offered a wide background in early nineteenth century science, including for the first time practical experience in field geology. To learn by doing was the simple maxim employed in education. Eaton's Rensselaer School at Troy, New York, and Maclure's School of Industry at New Harmony, Indiana, soon developed into the most successful training centers for students of field geology in the United States. State and Federal involvement in the surveying of natural resources expanded toward the middle of the nineteenth century. Between 1830 and 1860, 56 geological surveys were conducted in 33 states or territories. The Troy and New Harmony schools provided leaders and participants for nearly half (48%) of these projects. The most prominent students were David Dale Owen, of New Harmony, and James Hall, of the Rensselaer School.

• 70818dr—Allometric change of landforms: Discussion and reply. (4 p.)

Discussion: *Nicholas J. Cox, Department of Geography, University of Durham, South Road, Durham DH1 3LE, United Kingdom.*

Reply: *William B. Bull, Geosciences Department, University of Arizona, Tucson, Arizona 85721.*

• 70819dr—Paleogeographic and paleotectonic models for the New Zealand geosyncline in eastern Gondwanaland: Discussion and reply. (8 p., 7 figs., 2 tbls.)

Discussion: *John R. Griffiths, Department of Geological Sciences, University of British Columbia, Vancouver, British Columbia, Canada V6T 1W5 (present address: Department of Geology, University of Tasmania, GPO Box 252C, Hobart, Tasmania, Australia 7001).*

Reply: *Peter M. Austin, School of Earth Sciences, Flinders University of South Australia, Bedford Park, South Australia 5042.*

• 70820dr—Gravity-induced folding off a gneiss dome complex, Rincon Mountains, Arizona: Discussion and reply. (6 p.)

Discussion: *C. H. Thorman, U.S. Geological Survey, Box 25046, Denver Federal Center, Denver, Colorado 80225.*

Reply: *George H. Davis, Department of Geosciences, University of Arizona, Tucson, Arizona 85721.*

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