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What If the Conveyor Were to Shut Down? Reflections on a Possible Outcome of the Great Global Experiment

W. S. Broecker, *Lamont-Doherty Earth Observatory, Palisades, NY 10964*

ABSTRACT

Suggestions that the ongoing greenhouse buildup might induce a shutdown of the ocean's thermohaline circulation raise the questions as to how Earth's climate would change if such an event were to occur. The answer preferred by the popular press is that conditions akin to those that characterized the Younger Dryas—the last kiloyear cold snap—would return. But this extreme scenario is an unlikely one, for models suggest that in order to force a conveyor shutdown, Earth would have to undergo a 4 to 5 °C greenhouse warming. Hence, the conditions at the onset of the shutdown would be very different from those that preceded the Younger Dryas. Thus, it is unlikely that new climate conditions would be nearly so severe. Unfortunately, because no atmospheric model to date has been able to create the observed large and abrupt changes in climate state of Earth's atmosphere, we lack even the crudest road map. However, as was the case for each of the abrupt changes recorded in Greenland's ice, if the conveyor were to shut down, climate would likely flicker for several decades before locking into its new state. The consequences to agricultural production of these flickers would likely be profound.

INTRODUCTION

Past shutdowns of the Atlantic Ocean's conveyor circulation appear to have played a key role in triggering the large and abrupt global climate changes that punctuated the last period of glaciation including the millennial duration Younger Dryas (Broecker and Denton, 1990). Modeling studies suggest that the ongoing greenhouse warming and consequent strengthening of the hydrologic cycle might trigger yet another such shutdown (Manabe and Stouffer, 1993; Stocker and Schmittner, 1997). To most science writers, this result has been construed as implying that conditions similar to those that prevailed during the Younger Dryas cold event would return. Were this anal-

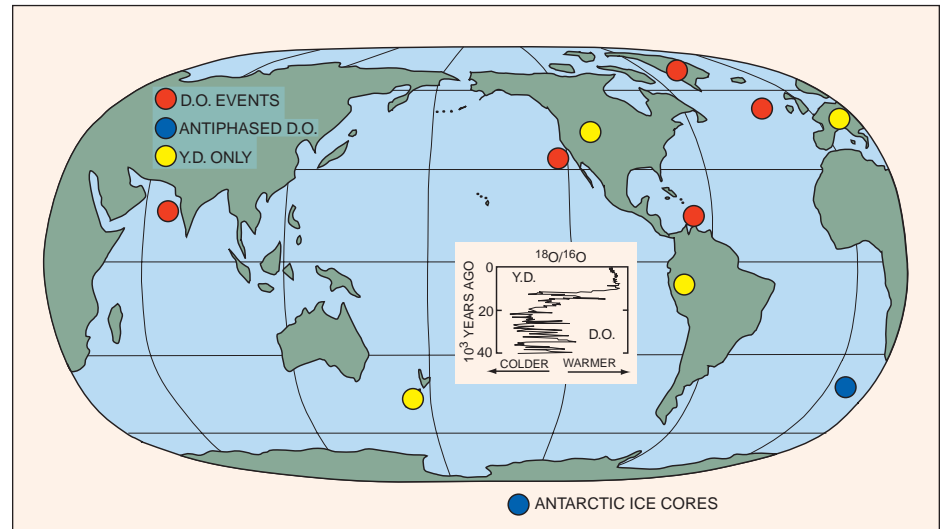


Figure 1. Map showing locations where abrupt climate changes (i.e., Dansgaard-Oeschger events) have been documented in records kept in marine sediments or polar ice (red and blue dots). Yellow dots show those locations where the last of these events (i.e., Younger Dryas) is recorded by major advances of mountain glaciers. While for most of the globe, these events are in phase, in parts of the Southern Ocean and of the Antarctic ice cap, they are clearly antiphased. This switch in phasing at high southern latitudes appears to reflect a seesawing of deep-ocean ventilation between the northern Atlantic and the perimeter of the Antarctic continent.

ogy correct, then indeed a shutdown of the conveyor would have awesome consequences. Iceland would become one large ice cap. Ireland's climate would be transformed to that of Spitzbergen. Winters in Scandinavia would become so cold that tundra would replace its forests. The Baltic Sea would be permanently ice covered, as would much of the ocean between Greenland and Scandinavia. Further, the impacts of such a mode change would not be limited to the northern Atlantic basin; rather, they would extend to all parts of the globe (see Fig. 1). Rainfall patterns would dramatically shift. Temperatures would fall. The atmosphere would become dustier. Finally, the transition to this new state would be completed in decades, and very likely during this transition period, climate would flicker.

But is it realistic to believe that a shutdown of the conveyor a century or so from now would produce the conditions that characterized the last glacial period? The answer is very likely "no," for several reasons. The first has to do with the fact

that during the Younger Dryas, Canada and Scandinavia still had sizable ice caps. The second is that the abrupt part of the warming at the close of the Younger Dryas brought climate only about halfway to its interglacial state (Severinghaus et al., 1998). The other half of the transition was more gradual, reflecting perhaps the post-Younger Dryas retreat of the residual ice caps in Canada and Scandinavia. Finally, modeling studies (Manabe and Stouffer, 1993; Stocker and Schmittner, 1997) that forecast a greenhouse-induced conveyor shutdown do so only after a substantial global warming (4 to 5 °C) has occurred. Hence, the global climate conditions prevailing at the time of the shutdown would be substantially warmer than those that existed just before the onset of the Younger Dryas. For these reasons, the analogy to the conditions that prevailed during the Younger Dryas surely constitutes a worst case scenario.

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If the climate change from Younger Dryas to present is not an apt analogy to that which would accompany a conveyor shutdown, then how might we go about estimating the consequences of such an event? As noted by some readers of my papers that warned of a possible greenhouse-induced conveyor shutdown (Broecker, 1997a, 1997b), I stopped short of presenting a specific scenario, for I was fully aware of the pitfalls associated with any such attempt.

ALLERØD-YOUNGER DRYAS ANALOGY

A less imperfect analogy to what might happen if the conveyor were to shut down is the climate change that accompanied the abrupt transition from the near interglacial conditions that prevailed during the Allerød to the cold conditions that prevailed during the Younger Dryas (see Table 1). The reasons are as follows. First, this transition represents a shutdown rather than a start-up of the conveyor. Second, the melting of the Northern Hemisphere's residual ice caps nearly halted during the Younger Dryas. Hence this analogy is flawed neither by the influence of changing ice cap size nor by that of changing sea level. But it is flawed in that the base state (i.e., the Late

Allerød climate) was different from today's and even more different from that which would prevail at the time of a greenhouse-induced conveyor shutdown. Nevertheless, it is worthwhile to compare the climate of the late Allerød with that of the Younger Dryas.

The contrast between climate conditions during the warm Allerød and cold Younger Dryas is recorded in four major ways (see Fig. 2): (1) pollen and beetle remains in lake and bog sediments tell us about differences in continental temperature, (2) moraines formed during the Younger Dryas record advances of mountain glaciers, (3) planktonic foraminifera shells in marine sediments document decreases in surface ocean temperature, and (4) the oxygen isotope records kept in ice and lacustrine calcium carbonate record shifts in hydrological conditions. These records send a consistent message. Conditions during the Allerød were nearly as warm as those that characterized the Holocene. As clearly shown by pollen records, the beginning of the Bolling-Allerød marked a worldwide transition from glacial to interglacial conditions. The lapse back to cold conditions during the Younger Dryas, while documented at many localities throughout the world, has a puzzling signature. It is clearly recorded by the descent of mountain snowlines in the American Rockies (Gosse et al., 1995),

TABLE 1. CONTRAST IN PROPERTIES OF THE SUMMIT GREENLAND ICE CORES (GISP AND GRIP) DURING THREE PERIODS

	Late Allerød	Younger Dryas	Early Holocene*
Ice accumulation rate (Alley et al., 1993)	13 cm/yr	8 cm/yr	22 cm/yr
δ ¹⁸ O of ice (Dansgaard et al., 1993)	-38‰	-41‰	-35‰
CH ₄ content of trapped air (Chappellaz et al., 1993)	670pdb [†]	480pdb [†]	710pdb [†]
Dust infall rate (Mayewski et al., 1994)	Low	High	Very low

*Full interglacial conditions established.
[†]Parts per billion by volume.

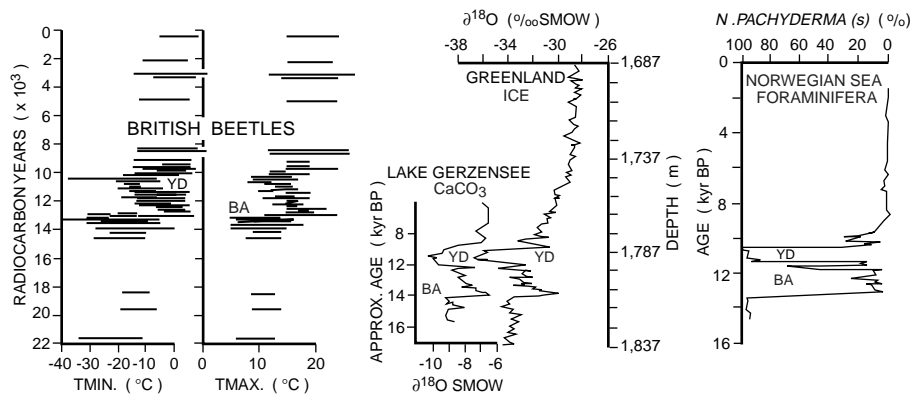


Figure 2. Records demonstrating the profound change in climatic conditions that occurred in the northern Atlantic basin between the Bølling-Allerød (BA) warm interval and the Younger Dryas (YD) cold interval. Left: temperature record based on beetle carapaces (Atkinson et al., 1987). Center: oxygen isotope records from Greenland ice (Dansgaard et al., 1993) and from Swiss lake CaCO₃ (Eicher and Siegenthaler, 1983). Right: abundance of the cold-loving planktonic foraminifera species *N. pachyderma* (left coiling) in the Norwegian Sea (Lehman and Keigwin, 1992).

in the Swiss Alps (Ivy-Ochs et al., 1996), in the tropical Andes (Van der Hammen and Hooghiemstra, 1995; Clapperton et al., 1997), and in the New Zealand Alps (Denton and Hendy, 1994). The oxygen isotope records in Swiss (Eicher and Siegenthaler, 1983) and Polish (Goslar et al., 1995) lakes, tropical mountain glaciers (Thompson et al., 1995) and in the Greenland ice sheet (Dansgaard et al., 1993) make clear that the hydrologic cycle in the region surrounding the northern Atlantic operated quite differently during the cold episodes (late glacial and Younger Dryas) than during the warm episodes (Allerød and Holocene). That these differences in the hydrologic cycle extended well beyond the region around the northern Atlantic is suggested by the substantially lower rate of global methane production during the Younger Dryas as recorded in ice cores from Antarctica and Greenland (Chappelaz et al., 1993; Brook et al., 1996). As the methane content of the atmosphere is set by the areal extent and temperature of the world's wetlands, these systems must on the average have been drier and colder. The dust record preserved in Greenland ice implies that storminess in the Asian deserts from which the dust has been shown to originate (Biscaye et al., 1997) must have been more intense during the Younger Dryas than during the Allerød. Finally, the benthic oxygen proxy for the deep Santa Barbara basin (Behl and Kennett, 1996) for the Arabian Sea (Schulz et al., 1998) and for the Cariaco Trench (Hughen et al., 1996, 1998) suggests major alternation in thermocline ventilation between these times. In contrast, the Younger Dryas is weakly expressed in many pollen records, giving rise to numerous claims that it didn't cause significant climate change outside northern Europe. Even in Switzerland, where the snowline descent and ¹⁸O change are large and thoroughly documented, the Younger Dryas

pollen change is muted. One interpretation for this seeming dichotomy is that while its impacts were global, the Younger Dryas was not simply a return to glacial state. Rather, it lacks an analog and represents yet another mode of operation of the Earth system.

One other aspect of the Allerød-Younger Dryas oscillation must be mentioned. Ice cores from the polar plateau in Antarctica reveal that the millennial-duration climate changes that punctuated the last glacial period were antiphased with respect to those elsewhere in the world (Blunier et al., 1998). During the Allerød, the ongoing warming of the polar plateau came to a halt. Then, at approximately the time of the onset of the Younger Dryas, the warming commenced once again at an even steeper rate than that in progress before the Allerød pause. Based on reconstructions of the radiocarbon content of surface ocean carbon, Hughen et al. (1996) clearly demonstrated that at the onset of the Younger Dryas, the Atlantic's conveyor circulation must have shut down, allowing newly produced ¹⁴C to be backlogged in the atmosphere and upper ocean. Then,

200 years later, the backlogging ceased and the excess ¹⁴C in the atmosphere and upper ocean was gradually drained back down. I suggested that this drain-down was caused by the inception of a new mode of deep water formation in the Southern Ocean, and that this new mode delivered extra heat to the Antarctic continent, reinitiating the stalled warming (Broecker, 1998).

When the difference in base conditions between those that prevailed during the Allerød and those that would prevail when the greenhouse warming has become sufficiently intense to threaten a conveyor shutdown is taken into account, then the picture looks quite different. As shown by the simplistic scenario presented in Figure 3, while conditions in the northern Atlantic basin would likely become cooler than now, for the rest of the world this change might only ameliorate part of the accrued greenhouse warming. But of course, even if the temperature change could be adequately assessed, we would still lack information regarding those aspects of the climate change which would matter the most (rainfall patterns, soil moisture, storminess, dustiness, etc.). One must keep in mind that as the physics of mode changes is so poorly understood, diagrams such as that in Figure 3 are unlikely to portray what would happen if the Earth system were to undergo a mode switch. The consequences of such a change defy prediction.

The last point to be made is that the Allerød to Younger Dryas transition was punctuated by flickers (see Fig. 4). Electrical conductivity measurements on the GISP2 ice core (Taylor et al., 1993a, 1993b) show that the onset of the Younger Dryas was marked by a period of increased dust fall onto the Greenland ice cap which lasted for about 5 years. This brief dust episode was followed by a several-year-long respite. Then came a second and a third episode each followed by respites. Finally, about 45 years after the onset of

Conveyor continued on p. 4

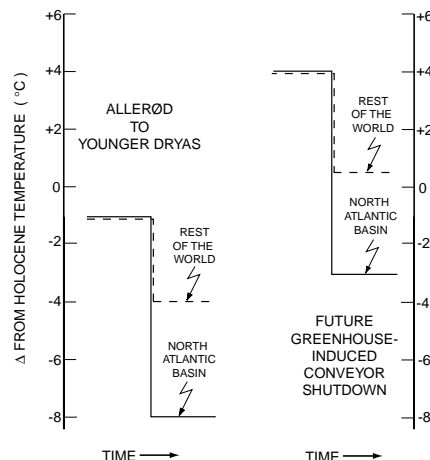


Figure 3. Simplistic scenario of possible impact on Earth temperatures of a greenhouse-induced conveyor shutdown based on an analogy to the Allerød to Younger Dryas transition, but taking into account that Earth temperatures just prior to a greenhouse-induced shutdown would be several degrees warmer than those that prevailed during the Allerød. While this change would likely cause temperatures around the northern Atlantic basin to drop below their present values, for the rest of the world, it would merely alleviate some part of accrued greenhouse warming. While seemingly comforting, this analogy says nothing regarding all-important changes in the hydrologic cycle, which would surely accompany such a mode change.

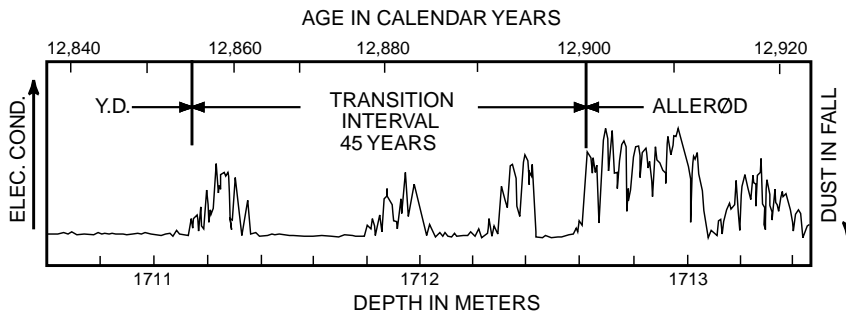


Figure 4. Electrical conductivity of the Summit, Greenland, GISP ice core measured by scraping a pair of electrodes along a fresh ice surface (Taylor et al., 1993a, 1993b). Periods of high dust fall had low conductivity because CaCO_3 in the dust neutralizes proton-bearing acids carried by snow. As annual layers are clearly seen, there is no question regarding duration of each episode.

Conveyor *continued from p. 3*

the first dust episode, Younger Dryas conditions locked in. As similar flickers accompanied all the Dansgaard-Oeschger (D-O) transitions, the likelihood that they would accompany a greenhouse-induced mode switch is reasonably high.

WHAT TRIGGERS THERMO-HALINE REORGANIZATIONS

The trigger for the precipitous Younger Dryas cooling as first proposed by Rooth (1982) was likely the large pulse of fresh water released into the northern Atlantic as a result of the sudden switch in the outlet of proglacial Lake Agassiz from the Mississippi to the St. Lawrence drainage. This switch was triggered by the retreat of the Laurentian ice cap, which formed the northern shoreline of the lake. When the ice dam gave way, the lake surface dropped in a series of steps by about 100 m (Teller and Thorliefson, 1983). The water released flooded eastward into the northern Atlantic and presumably reduced the salinity of surface waters there to the point where deep water could no longer form. Radiocarbon dating places the timing of the drop in lake level resulting from this switch at about 11 000 ^{14}C yr ago (that is, within the dating uncertainty of the time of the onset of the Younger Dryas). Confirmation comes from the record kept in Gulf of Mexico sediments, which reveals that a reduction in the input of low ^{18}O meltwater from the Mississippi occurred at close to this time (Broecker et al., 1989). I published a full account of this scenario as a popularized article entitled "The Biggest Chill" in *Natural History* (Broecker, 1987). Unbeknownst to me, the editors added the following subtitle: "When ocean currents shifted, Europe suddenly got cold." Then they went on to say, "Could it happen again?" At the time, this statement greatly annoyed me because I had carefully avoided any mention of the future in the article itself. But now in retrospect, perhaps I should forgive them.

During the course of the 50 000-yr-duration glacial period, 20 climate shifts

similar to that marking the beginning of the Younger Dryas occurred. It is highly unlikely that each was driven by a sudden influx of ponded meltwater. Rather, there must have been another cause. One possibility is that these shifts were driven by a salt oscillator (Broecker et al., 1990). During times when the conveyor was off, the northern Atlantic region was extremely cold, and fresh water accumulated in the ice caps of Canada and Scandinavia rather than running off to the sea. This allowed the salinity of surface waters in the Atlantic Ocean to rise. When the density of waters in the northern Atlantic became large enough, conveyor circulation was reinitiated. Once in action, the heat released from the conveyor's upper limb caused the ice caps to recede, releasing fresh water to the Atlantic. Surface water salinities were then driven back down to that level where deep water could no longer form, causing the conveyor to shut down. Viewed in this context, one would conclude that during the Allerød, warm ice cap melting drove down the salinity of the northern Atlantic until the shutdown threshold was reached. Likely the surge of water stored in Lake Agassiz merely pushed the system over the brink; i.e., in the absence of such a surge, the system might well have reached this threshold due to the progressive reduction in salinity caused by the ice cap melting. Similarly, greenhouse-driven polar warming and strengthening of the hydrologic cycle during the coming 100 or so years may push the system over the brink once again, bringing the conveyor to a halt. As has been emphasized by many authors (see Rahmstorf, 1996), regardless of the impetus, once the conveyor

is shut down, a fresh water lid forms in the northern Atlantic, temporarily locking ocean circulation into one of its alternate modes of operation.

MODELS TO THE RESCUE?

But wouldn't predictions based on conveyor shutdowns carried out in linked ocean-atmosphere climate models be more informative than analogies to past changes? I would contend that to date no model is up to the task. No one understands what is required to cool Greenland by $16\text{ }^\circ\text{C}$ and the tropics by $4 \pm 1\text{ }^\circ\text{C}$, to lower mountain snowlines by 900 m, to create an ice sheet covering much of North America, to reduce the atmosphere's CO_2 content by 30%, or to raise the dust rain in many parts of Earth by an order of magnitude. If these changes were not documented in the climate record, they would never enter the minds of the climate dynamics community. Models that purportedly simulate glacial climates do so only because key boundary conditions are prescribed (the size and elevation of the ice sheets, sea ice extent, sea surface temperatures, atmospheric CO_2 content, etc.). In addition, some of these models have sensitivities whose magnitude many would challenge. What the paleoclimatic record tells us is that Earth's climate system is capable of jumping from one mode of operation to another. These modes are self-sustaining and involve major differences in mean global temperature, in rainfall pattern, and in atmospheric dustiness. In my estimation, we lack even a first-order explanation as to how the various elements of the Earth system interact to generate these alternate modes. One intriguing proposal implies that excess atmospheric dust lowers the mean residence time of water molecules in the

Conveyor *continued on p. 5*

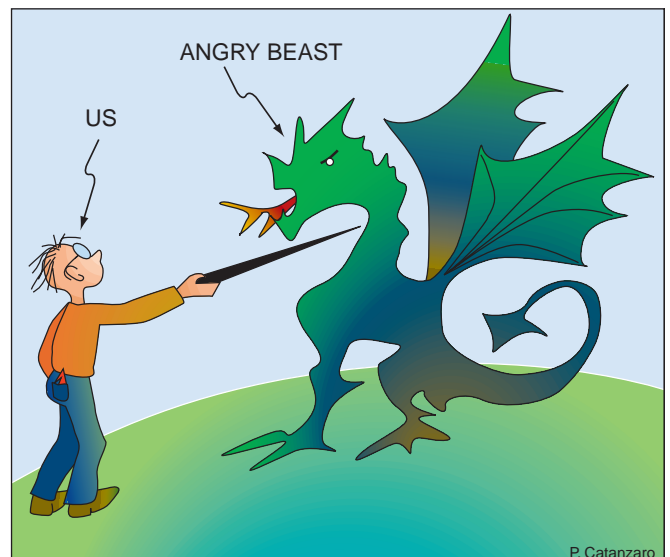


Figure 5. The angry beast. Drawing by P. Catanzaro.

Summer Internships for Undergraduate Geoscience Majors: National Park Service Geology Internships through the Institute for Environmental Education of the Geological Society of America

The Institute for Environmental Education at GSA is offering ten National Park Service undergraduate geology internships for the summer of 1999. Some of the internships involve educating visitors about park geology, others involve working with the park's geologic or paleontologic resources, and some involve both educational and resource management duties. Specific information on the positions and qualifications for each internship are listed in the separate descriptions below.

Internships will be awarded on a competitive basis to junior or senior undergraduate geoscience majors. Applicants must be GSA Student Associates. (Applicants may join GSA by submitting a membership application with their internship application materials.)

Each internship carries a \$2,500 stipend to cover transportation, food, and incidental expenses. Park housing will be provided free of charge. Sponsors for the 1999 internships will be announced in the spring of 1999. Funding for 1998 interns was generously provided by Shell Oil Company Foundation, John F. and Carol Mann, Jr., and the Frank A. Campini Foundation.

Internship applications must include the following: (1) A standard letter-size sheet of paper with: (a) your name, (b) your address at school, (c) your telephone number, (d) your e-mail address (if applicable), (e) the dates you are available for an internship this summer, and (f) your GSA membership number (or attach your completed application for GSA Student Associate); (2) One copy of your resume; (3) One copy of your academic transcript (unofficial is acceptable); (4) One letter of reference from a faculty member in your geoscience department (the letter may be included with your application in a separate, sealed envelope with the signature of the reference across the seal, or it may be mailed separately); (5) For *each* internship you are applying for, a one-page letter explaining your interest in and qualifications for that internship; be sure to specify which internship you are applying for and to specifically address how your education, experience, and interests match the needs and requirements of that particular internship.

Send complete application materials to: Gwenevere Torres, NPS Internship Applications, Geological Society of America, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301.

All application materials must be postmarked no later than *February 15, 1999*. Electronic submissions will not be accepted. Successful applicants will be notified by April 1, 1999. For more information, call (303) 447-2020, ext. 162, or e-mail gtorres@geosociety.org.

Dates for internships: Three months between May and the end of August 1999, except where indicated; exact starting and ending dates are negotiable.

Capitol Reef National Park, South-Central Utah

Capitol Reef National Park encloses Waterpocket Fold, a 100-mile-long monocline with dramatic sandstone arches, domes, deep narrow canyons, and steep cliffs.

Position: The park needs an intern to assist with public programs, such as geology talks, walks, slide shows, Junior Geologist events, and children's geology day camps. The intern will help staff the visitor center once a week, where one duty

Conveyor *continued from p. 4*

atmosphere (Yung et al., 1996). As water vapor is the most important greenhouse gas, the resulting reduction in its inventory cools the planet. Of course, maintaining the necessary higher atmospheric dustiness would seemingly require increased storminess and decreased vege-

tative cover in the dust source regions. Even if it could be shown that, once created, these very different states of climate could be maintained, the question would remain as to how, in a period of just a few decades, the system is able to jump from one of these operational modes to another. In particular, if the villain is indeed a reorganization of the ocean's

will be broadcasting road and weather information on the park's radio system.

Qualifications: The intern must enjoy working with the public and be comfortable speaking to a variety of audiences. Experience working with children is required, preferably with upper elementary students in an outdoor setting. Knowledge of Colorado Plateau geology is highly desirable. Introductory course work in geology is required, and course work in education is highly desirable. Personal transportation is recommended; the park is 11 miles from groceries and 75 miles from a major commercial area.

Craters of the Moon National Monument, South-Central Idaho

Craters of the Moon lies in a high desert wilderness at the edge of the Snake River Plain, an hour from Sun Valley and three hours from Yellowstone and Grand Teton national parks. The park preserves a surreal "moonscape" of rugged basalt dotted with cinder cones and cut by hundreds of lava tubes and volcanic caves.

Internships *continued on p. 6*

thermohaline circulation, how does it trigger the atmosphere to jump from one mode of operation to another? So, unfortunately, until the major deficiencies that prevent climate models from spontaneously reproducing glacial conditions and from jumping from one quasi-stable

Conveyor *continued on p. 6*

Internships *continued from p. 5*

Position: The park seeks an intern to assist with locating, mapping, and inventorying the park's volcanic caves and their geologic, hydrologic, biologic, and cultural features.

Qualifications: For this field-based internship, the intern must be able to hike for long distances over rugged volcanic terrain in extreme summer weather. Caving experience is highly desirable. Course work in introductory geology and field geology is required; mineralogy and/or igneous petrology course work is desirable. The intern must have experience working with computer databases; experience with GPS mapping and ArcView is desirable. Demonstration of strong organizational skills and the ability to integrate information from many sources are required. Personal transportation is recommended; the park is roughly 25 miles from town.

Denali National Park, South-Central Alaska

Denali's bedrock geology includes Precambrian to Tertiary rock units roughly aligned in east-west belts along the Alaska Range and capped by magnificent 20,320-foot Mt. McKinley, the highest point in North America.

Position: The park needs an intern to identify, label, inventory, and organize rock, mineral, and fossil specimens from the park and surrounding areas and to assist in developing geologic exhibits for a park visitor center. Some fieldwork may also be required for collecting samples and assisting with park projects.

Qualifications: Course work in introductory geology, mineralogy, and field geology is required, and course work in paleontology is highly desirable. The ability to work with computer databases is required; experience with GPS and/or GIS is highly desirable. The intern must be able to hike and work in remote locations and extreme weather. Field work may require tent camping in remote sites.

Florissant Fossil Beds National Monument, East-Central Colorado

Florissant Fossil Beds National Monument contains a wealth of fossils preserved in sedimentary and volcanic Tertiary rock units surrounded by high Rocky Mountain scenery. Among the fossils are petrified sequoia stumps and delicate plants, animals, and insects.

Position: The park needs an intern to assist with public education and other park duties. About 60% of the internship will be giving geology and paleontology talks and programs, leading public tours of active paleontological digs, and staffing the visitor center and museum. About 25% will be completing park projects such as preparing exhibits and bulletins, assisting with paleontological digs, collecting natural resource data, or creating new educational programs. About 15% will be participating in training opportunities in fields such as paleontology, geology, park operations, fire management, natural resource management, and/or natural history.

Qualifications: Strong written and oral communication skills are required. The intern must enjoy working with the public and must be able to present geologic infor-

mation in interesting and understandable ways. Course work in introductory geology, historical geology, and paleontology is required. The intern must be able to hike and work outdoors in the extremes of mountain summer weather. Personal transportation is highly recommended; the park is about 20 miles from a small mountain town.

Dates: About May 26–August 15, 1999; the intern must attend park training in late May.

Fossil Butte National Monument, Southwest Wyoming

Fossil Butte lies within the Wyoming Thrust Belt and contains a remarkable fossil record of Tertiary freshwater fish and a variety of insects, snails, turtles, birds, bats, and plants.

Position: The park needs an intern to help with tasks related to developing a virtual fossil quarry. The intern will help collect, document, and digitally photograph fish fossils in a quarry setting, prepare and curate specimens, and compile a computer database for the collection. The intern may also travel with park personnel to do field work at other paleontological sites, depending on the intern's interests and the park's needs.

Qualifications: Course work in introductory geology and paleontology is required. Course work in biology is desirable. Experience with computer databases and/or photography is desirable. Photographic equipment is available at the park. Personal transportation is recommended in order to take advantage of the region's resources.

Conveyor *continued from p. 5*

mode of operation to another are conquered, these models have little to offer regarding the prediction of the impacts of a conveyor shutdown.

CONCLUSIONS

The fact that we are unable to provide satisfactory estimates of the probability that a conveyor shutdown will occur or of its consequences is certainly reason to be extremely prudent with regard to CO₂ emissions. The record of events that transpired during the last glacial period sends us the clear warning that by adding greenhouse gases to the atmosphere, we are poking an angry beast (Fig. 5).

ACKNOWLEDGMENTS

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REFERENCES CITED

- Alley, R. B., Meese, D. A., Shuman, C. A., Gow, A. J., Taylor, K. C., Grootes, P. M., White, J. W. C., Ram, M., Waddington, E. D., Mayewski, P. A., and Zielinski, G. A., 1993, Abrupt increase in Greenland snow accumulation at the end of the Younger Dryas event: *Nature*, v. 362, p. 527–529.
- Atkinson, T. C., Briffa, K. R., and Coope, G. R., 1987, Seasonal temperatures in Britain during the past 22,000 years, reconstructed using beetle remains: *Nature*, v. 325, p. 587–592.
- Behl, R. J., and Kennett, J. P., 1996, Brief interstadial events in the Santa Barbara basin, NE Pacific, during the past 60 kyr: *Nature*, v. 379, p. 243–246.
- Biscaye, P. E., Grousset, F. E., Revel, M., Van der Gaast, S., Zielinski, G. A., Vaars, A., and Kukla, G., 1997, Asian provenance of glacial dust (stage 2) in the Greenland Ice Sheet Project 2 Ice Core, Summit, Greenland: *Journal of Geophysical Research*, v. 102, p. 26,765–26,781.
- Blunier, T., Chappellaz, J., Schwander, J., Dallenbach, A., Stauffer, B., Stocker, T. F., Raynaud, D., Jouzel, J., Clausen, H. B., Hammer, C. U., and Johnsen, S. J., 1998, Asynchrony of Antarctic and Greenland climate change during the last glacial period: *Nature*, v. 394, p. 739–743.
- Broecker, W. S., 1987, The biggest chill: *Natural History*, v. 96, p. 74–82.
- Broecker, W. S., 1997a, Will our ride into the greenhouse future be a smooth one?: *GSA Today*, v. 5, p. 1–7.
- Broecker, W. S., 1997b, Thermohaline circulation, the Achilles heel of our climate system: Will manmade CO₂ upset the current balance?: *Science*, v. 278, p. 1582–1588.
- Broecker, W. S., 1998, Paleocene circulation during the last deglaciation: A bipolar seesaw?: *Paleoceanography*, v. 13, p. 119–121.
- Broecker, W. S., and Denton, G. H., 1990, What drives glacial cycles?: *Scientific American*, January, v. 262, no. 1, p. 48–56.
- Broecker, W. S., Kennett, J. P., Flower, B. P., Teller, J. T., Trumbore, S., Bonani, G., and Wolfli, W., 1989, Routing of meltwater from the Laurentide ice sheet during the Younger Dryas cold episode: *Nature*, v. 341, p. 318–321.
- Broecker, W. S., Bond, G., Klas, M., Bonani, G., and Wolfli, W., 1990, A salt oscillator in the glacial Atlantic? 1. The concept: *Paleoceanography*, v. 5, p. 469–477.
- Brook, E. J., Sowers, T., and Orchardo, J., 1996, Rapid variations in atmospheric methane concentration during the past 110,000 years: *Science*, v. 273, p. 1087–1091.
- Chappellaz, J., Blunier, T., Raynaud, D., Branola, J. M., Schwander, J., and Stauffer, B., 1993, Synchronous changes in atmospheric CH₄ and Greenland climate between 40 and 8 kyr BP: *Nature*, v. 366, p. 443–445.
- Clapperton, C. M., Hall, M., Mothes, P., Hole, M. J., Still, J. W., Helmens, K. F., Kuhry, P., and Gemmill, A. M. D., 1997, A Younger Dryas icecap in the equatorial Andes: *Quaternary Research*, v. 47, p. 13–28.
- Dansgaard, W., Johnsen, S. J., Clausen, H. B., Dahl-Jensen, D., Gundestrup, N. S., Hammer, C. U., Hvidberg, C. S., Steffensen, J. P., Sveinbjornsdottir, A. E., Jouzel, J., and Bond, G., 1993, Evidence for general instability of past climate from a 250-kyr ice-core record: *Nature*, v. 364, p. 218–220.

Great Sand Dunes National Monument, South-Central Colorado

Great Sand Dunes includes 39 square miles of the continent's tallest dunes—some as high as 750 feet—against a spectacular backdrop of 14,000-foot mountain peaks.

Position: The park seeks an intern to assist with all aspects of visitor education, including developing and giving geology talks and slide programs, creating a park geology pamphlet, and helping staff the visitor center. About 10% of the internship will be spent assisting staff with field projects and research on hydrogeology and dune migration.

Qualifications: The intern must have excellent oral and written communication skills, a desire to work with park visitors, and an ability to present geologic information to the public in interesting, understandable ways. Course work in introductory geology and geomorphology or sedimentology is required. Course work or experience in education is highly desirable. Field work will require the ability to hike at high altitude (8,200+ feet) in extreme summer weather. Interns must bring bedding and cooking and eating utensils. Personal transportation is highly recommended; the park is 35 miles from the nearest town.

Lake Roosevelt National Recreation Area, Northeast Washington

Lake Roosevelt stretches for 130 miles along the Columbia River behind Grand Coulee Dam. The park includes two distinct regions: Paleozoic sedimentary rocks exposed in mountains bordering the northern half of the lake and Tertiary

basalt terrain, modified by huge Pleistocene flooding events, surrounding the southern half of the lake.

Position: The park needs an intern to assist with visitor education by giving campfire talks, making visitor contacts in day-use areas, participating in guided canoe trips, and helping with environmental education and Junior Ranger programs. Other projects may include revising and creating park educational materials. The intern will also assist with evening talks, children's programs, and other visitor services at the Dry Falls Visitor Center, a nearby site operated by the State of Washington.

Qualifications: The intern must enjoy working with the public and must be able to summarize area geology and present it to the public in interesting, understandable ways. Course work in introductory geology and geomorphology is required; course work in glaciology and/or volcanology is desirable. Course work and/or experience in education, communications, or other media fields is also highly desirable. The intern may be able to earn field-geology credit during the summer. Intern must bring her or his own linens. Personal transportation is recommended in order to take advantage of the area's resources.

Dates: Three months, approximately May 23 to Labor Day 1999.

Mount Rainier National Park, South-Central Washington

Mount Rainier, on the Pacific Ring of Fire, is an outstanding example of Cascade Range volcanism. Today, the volcano hosts the largest single-peak glacial system in the contiguous United States, but its his-

tory of eruptions and mudflows warrants its reputation as a significant hazard to surrounding communities.

Position: The park needs an intern to assist with visitor education. About 40% of the intern's time will be spent presenting geology programs for adults and children. About 30% will be spent staffing the visitor center and roving park trails to provide general information. The remaining time will be spent in training, program preparation, and completing park projects such as creating volcano fact sheets, helping to develop activities for an educators' guide to volcanic hazards, or writing geology training information for staff and volunteers.

Qualifications: The intern must be interested in public education, have strong oral and written communication skills, and be able to effectively convey geologic information to the public. Course work in introductory geology, and course work or experience in geomorphology, glaciology, and/or volcanology is required. Course work and/or experience in education is highly desirable. The park is located in a remote area, and personal transportation is highly recommended.

Dates: Approximately June 1 through August 31, 1999.

Oregon Caves National Monument, Southwest Oregon

Oregon Caves is located in geologically complex ophiolitic terrain in the Siskiyou Mountains. The caverns are contained in a metamorphosed Triassic reef that originally developed in a back-arc

Internships continued on p. 8

Denton, G. H., and Hendy, C. H., 1994, Younger Dryas age advance of Franz Josef Glacier in the Southern Alps of New Zealand: *Science*, v. 264, p. 1434-1437.

Eicher, U., and Siegenthaler, U., 1983, Stable isotopes in Lake Marl and mollusc shells from Lobsigensee (Swiss plateau): *Studies in the late glacial of Lobsigensee VI: Revue de Paléobiologie*, v. 2, p. 217-220.

Goslar, T., Arnold, M., Bard, E., Kuc, T., Pazdur, M. R., Ralska-Jasiewiczowa, M. R., Rozanski, K., Tisnerat, N., Walanus, A., Wicik, B., and Wieckowski, K., 1995, High concentration of atmospheric ^{14}C during the Younger Dryas cold episode: *Nature*, v. 377, p. 414-417.

Gosse, J. C., Klein, J., Evenson, E. B., Lawn, B., and Middleton, R., 1995, Beryllium-10 dating of the duration and retreat of the last Pinedale glacial sequence: *Science*, v. 268, p. 1329-1333.

Hughen, K. A., Overpeck, J. T., Peterson, L. C., and Trumbore, S., 1996, Rapid climate changes in the tropical Atlantic region during the last deglaciation: *Nature*, v. 380, p. 51-54.

Hughen, K. A., Overpeck, J. T., Lehman, S. J., Kashgarian, M., Southon, J., Peterson, L. C., Alley, R., and Sigman, D. M., 1998, Deglacial changes in ocean circulation form an extended radiocarbon calibration: *Nature*, v. 391, p. 65-68.

Ivy-Ochs, S., Schluchter, C., Kubik, P. W., Synal, H.-A., Beer, J., and Kerschner, H., 1996, The exposure age of an Egesen moraine at Julier Pass, Switzerland, measured with the cosmogenic radionuclides ^{10}Be , ^{26}Al and ^{36}Cl : *Eclogae Geologicae Helveticae*, v. 89, p. 1049-1063.

Lehman, S. J., and Keigwin, L. D., 1992, Sudden changes in North Atlantic circulation during the last deglaciation: *Nature*, v. 356, p. 757-762.

Manabe, S., and Stouffer, R. J., 1993, Century-scale effects of increased atmospheric CO_2 on the ocean-atmosphere system: *Nature*, v. 364, p. 215-218.

Mayewski, P. A., Meeker, L. O., Whitlow, S., Twickler, M. S., Morrison, M. C., Bloomfield, P., Bond, G. C., Alley, R. B., Gow, A. J., Grootes, P. M., Meese, D. A., Ram, M., Taylor, K. C., and Wumkes, W., 1994, Changes in atmospheric circulation and ocean ice cover over the North Atlantic during the last 41,000 years: *Science*, v. 263, p. 1747-1751.

Rahmstorf, S., 1996, On the freshwater forcing and transport of the Atlantic thermohaline circulation: *Climate Dynamics*, v. 12, p. 799-811.

Rooth, C., 1982, Hydrology and ocean circulation: *Progress in Oceanography*, v. 11, p. 131-149.

Schulz, H., von Rad, U., and Erlenkeuser, H., 1998, Correlation between Arabian Sea and Greenland climate oscillations of the past 110,000 years: *Nature*, v. 393, p. 54-57.

Severinghaus, J. P., Sowers, T., Brook, E. J., Alley, R. B., and Bender, M. L., 1998, Timing of abrupt climate change at the end of the Younger Dryas interval from thermally fractionated gases in polar ice: *Nature*, v. 391, p. 141-146.

Stocker, T. F., and Schmittner, A., 1997, Influence of CO_2 emission rates on the stability of the thermohaline circulation: *Nature*, v. 388, p. 862-865.

Taylor, K. C., Lamorey, G. W., Doyle, G. A., Alley, R. B., Grootes, P. M., Mayewski, P. A., White, J. W. D., and Barlow, L. K., 1993a, The 'flickering switch' of late Pleistocene climate change: *Nature*, v. 361, p. 432-436.

Taylor, K. C., Hammer, C. U., Alley, R. B., Clausen, H. B., Dahl-Jensen, D., Gow, A. J., Gundestrup, N. S., Kipf-tuhl, J., Moore, J. C., and Waddington, E. D., 1993b, Electrical conductivity measurements from the GISP2 and GRIP Greenland ice cores: *Nature*, v. 366, p. 549-552.

Teller, J. T., and Thorleifson, L. H., 1983, The Lake Agassiz-Lake Superior connection, in Teller, J. T., and Clayton, L., eds., *Glacial Lake Agassiz: Geological Association of Canada Special Paper 26*, p. 261-290.

Thompson, L. G., Mosley-Thompson, E., Davis, M. E., Lin, P.-N., Henderson, K. A., Cole-Dai, J., Bolzan, J. F., and Liu, K.-B., 1995, Late glacial stage and Holocene tropical ice core records from Huascarán, Peru: *Science*, v. 269, p. 46-50.

Van der Hammen, T., and Hooghiemstra, H., 1995, The El Abra Stadial, a Younger Dryas equivalent in Colombia: *Quaternary Science Reviews*, v. 14, p. 841-851.

Yung, Y. L., Lee, T., Wang, C.-H., and Shieh, Y.-T., 1996, Dust: A diagnostic of the hydrologic cycle during the last glacial maximum: *Science*, v. 271, p. 962-963.

Manuscript received October 8, 1998; accepted November 16, 1998 ■

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Internships *continued from p. 7*

basin. The caves themselves formed during the Pleistocene. They contain mammalian fossils that may change current understanding of Pleistocene mammal migration to North America.

Position: The park needs an intern to develop and present geologic educational programs and materials for the public as well as to assist park staff with geologic fieldwork. Specific field assignments will depend partly on the interests and experience of the intern but could include caving, fire ecology as it relates to soil science and history, or Pleistocene fossil identification.

Qualifications: The intern must be reliable, self-motivated, and able to communicate effectively with the public. Course work in field geology and mineralogy and/or igneous petrology is required. Experience with thin-section identification and knowledge of regional metamorphism, ophiolite geology, and/or Pleistocene vertebrate paleontology are highly desirable. Experience in caving, photography, graphic drawing skills, basic computer skills, and Internet skills are also desirable. The park is in a remote location, and personal transportation is required to travel from housing to the job site.

Sleeping Bear Sand Dunes National Lakeshore, Northwest Lower Peninsula, Michigan

Sleeping Bear preserves outstanding Pleistocene glacial features in a beautiful forested setting with massive dunes and white sand beaches along the shores of Lake Michigan. Shoreline bluffs rise more than 450 feet above the lake, and the park includes two offshore wilderness islands.

Position: The park needs an intern to assist with visitor education, write geological road logs and self-guided tour brochures for park visitors, present weekly campfire programs and nature hikes, and advise park staff on local geology.

Qualifications: The intern must enjoy working with the public, have strong oral and written communication skills, and be able to present geologic information in interesting and understandable ways. Course work in introductory geology and in geomorphology and/or glacial geology is required. Course work or experience in education and/or public speaking is highly desirable. Experience with literature searches is also desirable. The park is relatively isolated, and personal transportation is highly recommended. ■

Welcome to the Newly Adopted GSA Strategic Plan!

The new GSA Strategic Plan consists of mission and vision statements and six goals, each goal having several objectives expressing ways in which the goals can be achieved. The goals and objectives give equal weight to continuing existing programs and to embarking on new activities, all intended to assure the quality and value of GSA's service to its members, to the geosciences, and to society. Notable new ventures include the integrated natural systems science goal 2 and the proposed changes to the Society's governance model in goal 6.

The plan had its genesis in an 11-member task force convened by Eldridge Moores during his presidency in 1995-1996. The group's deliberations were enhanced by input over the past three years from GSA headquarters staff, some GSA committee chairs, and various ad hoc groups. Throughout the plan's development, the task force provided regular updates to GSA Council and, at the 1998 Annual Meeting, in Toronto, Council approved this final draft, together with recommended action items, timelines, costs, and responsibilities.

In approving the plan, Council emphasized that it is to be regarded as an evolving document. This is where you come in. We are asking you to share any ideas and experiences that can help us in implementing the plan's activities, and we encourage you to look at the plan as an opportunity to participate as a volunteer to extend GSA's contributions to geoscience professionalism, education, and outreach.

Be assured that Council welcomes your input in building GSA's future. With your assistance, the plan will grow and evolve as intended. Please take time to read and consider the plan and then to send your comments to: stratplan@geosociety.org or Don Davidson, GSA Strategic Plan, P.O. Box 9140, Boulder, CO 80301-9140.

On behalf of the planning task force:

Eldridge Moores, Chair

Sue Beggs	Edward Geary
Valerie Brown	Sharon Mosher
Bruce Clark	Daniel Sarewitz
Donald Davidson	David Stephenson
George H. Davis	George Thompson

MISSION STATEMENT AND STATEMENT OF VISION

MISSION:

The mission of GSA is to advance the geosciences, to enhance the professional growth of its members, and to promote the geosciences in the service of humankind.

VISION:

GSA will be a broad unifying scientific society

- fostering the human quest for understanding Earth, planets, and life;
- catalyzing new scientific ways of thinking about natural systems;
- and applying geoscience knowledge and insight to human needs, aspirations, and stewardship of Earth.

GOALS AND OBJECTIVES

GOAL 1. To advance the discovery, development, dissemination, and stewardship of geoscience knowledge.

Objective 1. To maintain the quality and increase the vitality of meetings and conferences.

Objective 2. To maintain the quality and increase the vitality of publications.

Objective 3. To identify and implement new and more effective ways to communicate science.

Objective 4. To promote innovative research.

GOAL 2. To catalyze cooperative interactions among earth, life, planetary, and social scientists who investigate natural systems over varying scales of time and space.

Objective 1. To build a focus on integrative science into the infrastructure and culture of GSA.

Objective 2. To generate cooperative interactions with other organizations.

Objective 3. To promote GSA membership participation in integrated research.

Objective 4. To publish and disseminate the results of integrative natural systems investigations.

GOAL 3. To promote geoscience in the service of society.

Objective 1. To actively foster dialogue with the public and decision-makers on relevant geoscience issues.

Objective 2. To encourage and support member participation in education and societal outreach.

Objective 3. To strengthen the role of geoscience in formal and informal science education.

SUSTAINING

GOAL 4. To attract and sustain a dynamic and viable membership.

Objective 1. To increase and ensure the value of GSA to its members.

Objective 2. To increase and retain the membership base of the Society.

Objective 3. To increase the cultural, disciplinary, professional, and international diversity of the membership.

SUSTAINING

GOAL 5. To maintain GSA and GSA Foundation as financially viable entities.

Objective 1. To exercise due diligence in management and expenditure of Society assets.

Objective 2. To maintain an active development program ensuring supplemental financial support for GSA programs and activities.

Objective 3. To exercise due diligence in management and expenditure of Foundation assets.

SUSTAINING

GOAL 6. To optimize GSA's governance and organizational structure in fulfillment of GSA's mission.

Objective 1. To assess and enhance the effectiveness of GSA governance, committees, and headquarters organization.

Objective 2. To evaluate and strengthen relations among GSA Divisions, Sections, Associated Societies, and Council.

Objective 3. To promote internationalization of the Society. ■

Penrose Conference Volcanic Rifted Margins

Nov. 14-19, 1999
Sana'a, Yemen

Application deadline:
May 14, 1999

Co-conveners: Ian Davison, davison@gl.rhbnc.ac.uk, Joel Baker, joel@gl.rhbnc.ac.uk, and Martin Menzies, menzies@gl.rhbnc.ac.uk—all at Dept. of Geology, Royal Holloway University of London, Egham Hill, Surrey TW20 OEX, United Kingdom, 44-1784-443615, fax 44-1784-471780.

See February 1999 *GSA Today* for full announcement.

Catalysis and Integrated Science: Goal 2 of GSA's Strategic Plan

Cathleen May, Director for Policy and Environmental Issues, Gail Ashley, President, GSA

In adopting the GSA Strategic Plan (see outline in this issue), Council endorsed an adventurous intellectual direction for our Society. The architects of the plan, your representatives in this process, believe that GSA can, and should be, a catalyst for integrated scientific approaches to the Earth system. Goal 2 of the strategy reads, "To catalyze cooperative interactions among earth, life, planetary, and social scientists who investigate natural systems."

The Earth-system science movement is sweeping forcefully through academia and government. Leaders of scientific societies, eyeing trends in funding agency priorities, are scrambling to demonstrate their ability to collaborate across disciplines. The National Science Foundation is funding curriculum development in Earth-system science, while Stanford's Earth System Program is already graduating and placing bachelor's and master's level achievers. Government science and land management agencies finally have a mandate to treat natural systems as whole systems, and to adjust scientific approaches accordingly. If this movement were just another aberrant wave, we would all recognize it as ephemeral. We know, however, that this is a true "sea change," not just another wave. We know it as scientists because we know that the world is complex and must be understood eventually in wholes, as well as in parts. Society knows this too; it is intuitive, and often more sensible to the lay person than reductionism.

GSA is well equipped to be a leader in the Earth-system science movement. Our scientific and professional diversity is a pooled resource of disciplinary depth and breadth, both of which are essential to systemic science. Individually and collectively, we are prone to care about how science can beneficially affect society. As a whole, our membership has retained a strong flavor of the natural scientist or field naturalist even as we specialized along with the rest of science. What then, is the task of leadership, and how will our Society fulfill that role?

The architects of the strategic plan attempted a preliminary answer to that question by outlining four objectives under goal 2 (see this issue). These are paraphrased in italics and explained in more detail below.

- *Building an Earth system focus into the culture of our Society* means doing the things that confer legitimacy in the eyes of our members, our sibling geological

societies, and the variety of other organizations with whom we collaborate. To begin, the president and executive director of the Society will appoint a task force on Earth-system science that will work with the Institute for Environmental Education to generate an explicit scheme for achieving our goal. We will solicit *and use* input from all interested members in designing this "strategy within a strategy." At the same time, we will step up our interactions with other organizations, such as the Ecological Society of America (ESA), and begin planning joint efforts.

- *We need to generate cooperative interactions with other organizations* at a minimum of two scales. At the organizational scale, we have already developed successful joint ventures on the topic of integrated science with ESA and the USGS. We are planning other efforts, focused topically, with these and other organizational partners. At the scale where science is actually done, *by members* of organizations, we hope to build a network of member liaisons. Liaisons will be members of other organizations with which we would like to build interactions. They will do such things as serve on committees of the other organization, convene interdisciplinary technical sessions at the meetings of the other organization, and report items or activities of interest to GSA members, perhaps via the Web site. We would like to begin this process right away, by identifying individuals with cross-disciplinary member affiliations. If you are one of these people and are interested in furthering goal 2, please contact us.
- *To promote participation in integrative systems research by GSA members*, we plan to use many of our existing vehicles to highlight and encourage such research. These include Penrose Conferences; the new Field Conferences; Pardee Symposia, topical sessions, and technical sessions at GSA Annual Meetings; and Graduate Research Grant Awards.
- *To publish and disseminate the results of integrative natural systems investigations* requires exploring traditional and alternative publication venues. Possibilities may include soliciting manuscripts for our current publications, creating an electronic publication or a new journal, books or book series, and co-publication.

Goal 2 is intended to be an adaptive strategy that will guide GSA into leader-

ship on behalf of the geosciences. Thus, we expect this strategy to evolve over time, reflecting changing constraints and opportunities, and striving always to contribute to the mission of our Society. This is perhaps the most challenging of the goals in the Strategic Plan, as it moves our Society in new directions intellectually and organizationally. It requires growing a "collaborative culture" among scientists, and a "consortium culture" among scientific organizations.

Your imagination, creativity, intellect, and commitment are essential to achieve this goal. This is not something that headquarters staff can invent and carry off, or that committees can achieve at once-a-year meetings. If bringing geoscience into productive interactions with life and social sciences is not achieved by and for you, the individual member, then the goal is meaningless. Please see yourself as integral to the shaping of this goal, and communicate your perspective, ideas, experience, and wishes to us as soon and as often as you like. Webster's Dictionary defines a catalyst as "an agent that provokes or speeds significant change or action." We can't think of a more appropriate term for your role in the Earth-systems science movement. ■

About People

GSA Fellow Harmon Craig, Scripps Institution of Oceanography, has been awarded the Balzan Prize (International Balzan Foundation of Milan, Italy), for fundamental contributions to the field of geochemistry.

Fellow Tom Freeman, University of Missouri—Columbia, has received the university Alumni Association's Distinguished Faculty Award for 1998.

Fellow Robert Ginsburg, University of Miami, is the 1998 recipient of the Hollis D. Hedberg Award in Energy from the Institute for the Study of Earth and Man, Southern Methodist University.

Member John C. Steinmetz is the new director of the Indiana Geological Survey (in Bloomington) and state geologist of Indiana.



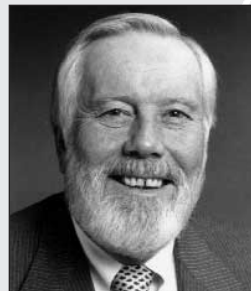
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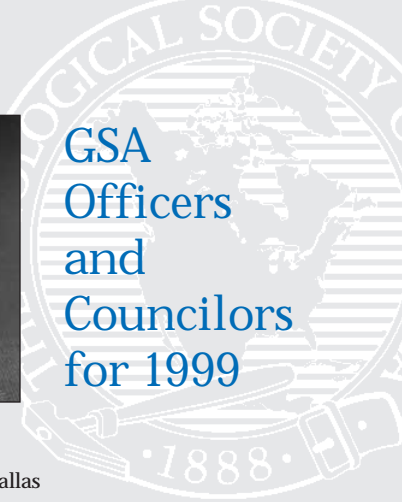
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Rob Van der Voo
University of Michigan
Ann Arbor, Michigan

Carol Simpson
Boston University
Boston, Massachusetts

Stephen G. Wells
Desert Research Institute
Reno, Nevada

ALL APPLICATIONS MUST BE
SUBMITTED ON THE 1999 FORMS
AND POSTMARKED BY
FEBRUARY 1, 1999

1999 Research Grants Program for Students



The primary role of the Research Grants Program is to provide partial support for research in earth science by graduate students at universities in the United States, Canada, Mexico, and Central America. GSA strongly encourages women, minorities, and persons with disabilities to participate fully in this grants program. Eligibility is not restricted to GSA members. New application forms are available each fall in the geology departments of colleges and universities offering graduate degrees in earth sciences. Forms are mailed to GSA Campus Representatives, department secretaries, and chairpersons in the United States, Canada, and Mexico. Application forms and information are available on GSA's Web page, <http://www.geosociety.org>. Applications may be downloaded from the Web but may *not* be submitted by e-mail. They are also available upon request from the Research Grants Administrator, Geological Society of America, P.O. Box 9140, Boulder, CO 80301. *Please use only the current 1999 application and appraisal forms.*

Confidential evaluations from two faculty members are required from candidates for the M.S. or Ph.D. degree and must accom-

pany applications submitted. PLEASE USE THE "APPRAISAL OF APPLICANT" FORMS, WHICH ACCOMPANY THE 1999 APPLICATION FORMS. APPLICATION FORMS WILL NOT BE ACCEPTED BY FACSIMILE OR E-MAIL.

The Geological Society of America awarded over \$300,000 in grants in 1998. The grants went to 187 students doing research for advanced degrees. The average amount awarded was \$1654. The largest grant was \$2500, but there is no predetermined maximum amount. Funding for this program is provided by a number of sources, including GSA's Penrose and Pardee endowments, the National Science Foundation, industry, individual GSA members through the GEOSTAR and Research Grants funds, and numerous dedicated research funds that have been endowed at the GSA Foundation by members and families.

The Committee on Research Grants will meet in April to evaluate applications and award grants. In April, all applicants for grants will be informed of the committee's actions by the Executive Director of the Geological Society of America.

Geosemiosis

Victor R. Baker



Victor R. Baker

ABSTRACT

Geology is both (1) a body of knowledge about Earth, and (2) a way of thinking about Earth. Many geologists, including G. K. Gilbert, T. C. Chamberlin, and W. M. Davis, among others, emphasized the latter. Their vision of geology as a "science of hypothesis" places emphasis on the mode of reasoning by geologists; that is, on the "-ology" of "geology." The logic in "-ology" involves a formal science of sound reasoning, but much current philosophy of science denies that there is a logic to hypothesis generation. Does this mean that the methodological writings of Gilbert, Chamberlin, and others are quaint anachronisms in our modern age of predictive computer models, rigorous theory testing, and high-tech experimental laboratories?

The above question is not merely a matter of arcane epistemology. If geology is just physics, chemistry, mathematics, etc., applied to the earth, then its future will be a reduction of those more fundamental sciences. However, if geology has its own unique mode of reasoning, then cultivation of that reasoning will be critical to advancing understanding of Earth, the home to all humankind.

Geologists have always considered their science to be revealed in rocks, sediments, fossils, and other signs of Earth's processes. Thus, Earth logic is not detached from its objects of study. Instead, the best reasoning ("logic") of geologists is closely tied to a complex system of signs, a semiotic, that is continuous from the natural world through the thought processes of geological investigators. Moreover, this

geological thought is profoundly enriched by a structure of one thing following from another, with antecedent flowing to consequent in logically pure deduction. The realization of that structure, which informs geology as no other science, we call "time."

Nearly a century ago, former GSA President H. L. Fairchild wrote, "Geologists have been far too generous in allowing other people to make their philosophy for them." Even today, some geologists waste a lot of time reading philosophy of science books, in the hope of making their discipline "more scientific." Geology's great intellectual strength does not lie in some generic "scientific method" for testing purported "truths." Geology is a science of connection to our real environment, informed by the action of signs, a geosemiosis, that leads investigators on a fruitful course of hypothesis generation. This mode of inquiry has profound implications for public understanding of science, for achieving a habitable planet, and for advancing creative thought about Earth as a planet. Geologists should be proud of their intellectual tradition, and they need to proclaim its merits if our species is to survive and flourish. Hypothesize outrageously, geologists; you have nothing to lose but your paradigms! ■

Note: The full text of Victor Baker's 1998 GSA Presidential Address will be published in the *GSA Bulletin* in spring 1999.

Coal Geology Division Seeks Nominations for Cady Award

The Coal Geology Division of the Geological Society of America seeks nominations for the Gilbert H. Cady Award for the year 1999. The Cady Award is made for outstanding contributions in the field of coal geology. As defined in the bylaws of the Coal Geology Division of the Society, "coal geology refers to a field of knowledge concerning the origin, occurrence, relationships, and geologic characteristics of the many varieties of coal and associated rocks, including economic implications." The award will be made for contributions considered to advance the field of coal geology within and outside North America. It consists of a certificate and an engraved silver tray. Presentation of this award will be made at the Coal Geology Division Business Meeting and Mixer at the 1999 GSA Annual Meeting in Denver.

Nominations for the Cady Award will be evaluated by the Gilbert H. Cady Award Panel. For the year 1999, the panel consists of members James Staub (Southern Illinois University) and Brenda Pierce (USGS, Reston), and it is chaired by Thomas Demchuk (Conoco, Houston).

Nominations should include: name, office or title, and affiliation of the nominee; date and place of birth, education, degree, honors and awards; major events in the professional career including a brief bibliography; and outstanding achievements and accomplishments that warrant the nomination. Three copies of the nomination are required. For a list of past recipients, see <http://www.mysite.com/coalgeology/page8.html>.

Send nominations to: Thomas D. Demchuk, Conoco Inc., Permian 3048, P.O. Box 2197, Houston, TX 77252-2197, (281) 293-3189; thomas.d.demchuk@usa.conoco.com.

Deadline for submission of nominations is February 28, 1999.

The Coal Geology Division established the award in honor of Gilbert H. Cady; the first award was presented in 1973. Monies for this award are derived from the annual interest income from the Gilbert H. Cady Memorial Fund, which is administered by the GSA Foundation.

CALL FOR

GSA Today Correspondent for Student Matters

GSA seeks a Member or Fellow willing to coordinate and be responsible for a regular (monthly) contribution for *GSA Today* dealing with matters of interest to undergraduate and graduate student members of the Society. GSA headquarters will provide administrative support for the correspondent. The one-year renewable appointment begins in March 1999.

Please send a statement of interest and a short vita to:

Director of Publications
Geological Society of America
P.O. Box 9140
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plehr@geosociety.org

CALL FOR NOMINATIONS REMINDERS

PENROSE AND DAY MEDALS, AND HONORARY FELLOWSHIP

Nominations for 1999 Penrose and Day Medals and for Honorary Fellowship in the Society are due by FEBRUARY 1, 1999.

YOUNG SCIENTIST AWARD (DONATH MEDAL)

The Young Scientist Award is for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences. The award consists of a gold medal called the Donath Medal and a cash prize of \$15,000.

For the year 1999, only those candidates born on or after January 1, 1964, are eligible for consideration. In choosing candidates for the Young Scientist Award, scientific achievement and age will be the sole criteria. Nominations for the 1999 award must include biographical information; a summary of the candidate's scientific contributions to geology (200 words or less); a selected bibliography (no more than 10 titles); and supporting letters from five scientists in addition to the person making the nomination.

Deadline for nominations for 1999 is FEBRUARY 1, 1999.

OFFICERS AND COUNCILORS

The GSA Committee on Nominations requests your help in compiling a list of GSA members qualified for service as officers and councilors of the Society. The committee requests that each nomination be accompanied by basic data and a description of the qualifications of the individual for the position recommended (vice-president, treasurer, councilor).

Deadline for nominations for service in 2000 is FEBRUARY 5, 1999.

DISTINGUISHED SERVICE AWARD

The GSA Distinguished Service Award recognizes individuals for exceptional service to the Society. GSA Members, Fellows, Associates, or, in exceptional circumstances, GSA employees may be nominated for consideration. Any GSA member or employee may make a nomination for the award. Awardees are selected by the Executive Committee, and all selections are ratified by the Council. Deadline for nominations for 1999 is MARCH 1, 1999.

JOHN C. FRYE ENVIRONMENTAL GEOLOGY AWARD

In cooperation with the Association of American State Geologists (AASG), GSA makes an annual award for the best paper on environmental geology published either by GSA or by one of the state geological surveys. The award is a \$1,000 cash prize from the endowment income of the GSA Foundation's John C. Frye Memorial Fund.

The paper must be selected from GSA or state geological survey publications; it must be selected from those published during the preceding three full calendar years; and the nomination must include a paragraph stating the pertinence of the paper.

Nominated papers must establish an environmental problem or need, provide substantive information on the basic geology or geologic process pertinent to the problem, relate the geology to the problem or need, suggest solutions or provide appropriate land-use recommendations based on the geology, present the information in a manner that is understandable and directly usable by geologists, and address the environmental need or resolve the problem. It is preferred that the paper be directly applicable by informed laypersons (e.g., planners, engineers). Deadline for nominations for 1999 is MARCH 1, 1999.

NATIONAL AWARDS

The deadline is April 30, 1999, for submitting nominations for these four awards: William T. Pecora Award, National Medal of Science, Vannevar Bush Award, Alan T. Waterman Award.

Technical Program and Hot Topics Chairs: Call for Nominations

The Technical Program Chair for GSA Annual Meetings, starting in 2001, and the Hot Topics Chair, starting in 1999, will no longer be tied to the meeting site location. This change will give more people the opportunity to organize the Annual Meeting Technical Program or the Hot Topics lunchtime forums.

The Technical Program Chair (TPC) has the final responsibility over the entire technical program, including the review and acceptance of keynote and topical session proposals (January–February) and the scheduling of all sessions for the GSA Annual Meeting (July–early August) in coordination with the Joint Technical Program (JTPC) representatives. This chairmanship also includes active participation over a three-year commitment in the Annual Program Committee, which meets twice a year (usually March and August). GSA reimburses the chair for all travel expenses, including full expenses for attending the prior year's and current year's annual meeting.

The Technical Program Chair must have a broad perspective on the geological sciences and be efficient, organized, fair-minded, flexible, and committed to organizing a dynamic

meeting. Some experience with technical program scheduling would be helpful, especially membership on the GSA Joint Technical Program Committee (JTPC) within the past 5 years, but is not required. In addition, the TPC must be able to work regularly and interactively on the Web and Internet, and must be a GSA member.

The Hot Topics Chair organizes four spirited lunchtime debates during the GSA Annual Meeting and makes sure that the titles of the debates reflect their controversial and lively nature. Responsibilities include locating, organizing, and securing debate organizers who will identify topics and speakers.

If you know of someone who would be an effective Technical Program or Hot Topics Chair, or are interested yourself, please contact the GSA Meetings Department for a nomination form: (303) 447-2020, ext. 186, snace@geosociety.org. Nominations are due January 31, 1999.



Valerie G. Brown

HAPPY NEW YEAR!

January. Named for Janus, the ancient Roman god of portals, portrayed with two faces—one looking back and one looking ahead.

January. By the Gregorian calendar, the commencement of the next succeeding year and, by custom, a time of reflection and resolution. What's more, by common consent, this particular January begins the last year of the 20th century, a fact that is both sobering and exhilarating.

So this January is a particularly good time to look back and look ahead, and to give due consideration to our well-being. To that end, we offer a suggestion for inclusion in your new year's resolutions: that 1999 is the year in which to review your estate plans.

Looking Back...

At the time of writing, the stock market is in the vicinity of 8900 (Dow-Jones index). Do you remember the market valuation at the end of 1994? It was 43% of today's Dow. In four years, your equity investments may have doubled in value. Moreover, in many areas of the country, real estate values have also appreciated at dizzying rates. Therefore, your net worth may now be much greater than you think it is (or thought it ever would be). That's the good news.

On the other hand, at present, while the highest federal income tax rate is 39.6%, the incremental estate tax rate is 37% imposed on taxable estates of \$625,000, increasing to 55% on estates of \$3 million or more. At a minimum, a \$625,000 estate can have a potential tax of \$202,050. While

the unified credit can generally shelter the tax at this level, if the estate is larger the tax bill starts to add up quickly. For example, a \$1 million estate would be liable for \$143,750 in taxes, a \$1.5 million estate for \$358,750. This pain is before any state tax bite. That's the bad news.

Owing to high rates of appreciation in investments and real property, people who hadn't anticipated estate tax liabilities now find that the value of their assets has reached or exceeded the amount that can be transferred free of tax.

Looking Ahead...

New Year's resolutions frequently focus on physical and spiritual well-being. In fact, financial well-being is equally important. Good financial health includes

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periodic reviews of your estate plan to ensure that it's still appropriate for the size and nature of your assets and the circumstances of your life.

If you don't have a formal will, you should. Even if you have a will, changes in asset values, changes in family situations, or changes of residence may mean that the will no longer carries out your intentions. Changes of perspective may mean that you can envision new, philanthropic intentions.

By looking back, you can measure and appreciate what you have gained for yourself and your family. By looking ahead, you may find ways of investing some of that gain for the common geological good. For further information about investments in GSA's program activities, please contact the GSA Foundation office at 1-800-472-1988, ext. 154.

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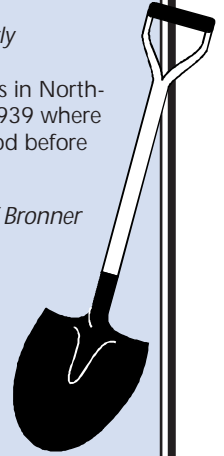
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Additionally, the Trustees are pleased to announce that Julie Wetterholt has accepted the position of Acting Director of Development for the GSA Foundation.

Digging Up the Past

Most memorable early geologic experience:
Walking on outcrops in North-east Greenland in 1939 where no geologist had trod before me.

—F. Eyolf Bronner



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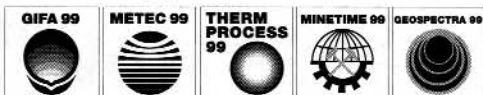
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Excerpt from the list of exhibits

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CORDILLERAN SECTION, Centennial Meeting—1899–1999 95th Annual Meeting

Berkeley, California, June 2–4, 1999

Century of the Pacific Rim: The Past as Prologue to the Future

SETTING

The spectacular San Francisco Bay Area is the setting as Pacific Rim geologists celebrate the centennial of the GSA Cordilleran Section. The program, which commemorates the first meeting of the Section, held in the Bay Area in December 1899, will take place at the University of California, Berkeley, on June 2–4, 1999. The Centennial is hosted by the Department of Geology and Geophysics, the Museum of Paleontology, and the Earth Resources Center of UC Berkeley. Co-sponsors include the Association for Women Geoscientists (San Francisco Bay Area Chapter), Paleontological Society, Seismological Society of America, San Francisco Section of the Association of Engineering Geologists, and the Society of Economic Geologists.

The Cordilleran Section Centennial meeting takes place as California celebrates three sesquicentennial years: the 1848 discovery of gold, the 1849 Gold Rush, and statehood in 1850. The state's focus on California's mining history provides the perfect backdrop for the Cordilleran Centennial meeting.

The Centennial theme focuses on the impact of Cordilleran geoscience on the global geological framework. Technical sessions and field trips will highlight the many geological, geophysical, and paleontological studies that have originated with Cordilleran geoscientists over the past 100 years, and we will look to the future and the contributions that geoscientists and educators can make to the global environment in the next 100 years.

CALL FOR PAPERS

Papers are invited for presentation at symposia and general sessions in both oral and poster format. Symposia will include both invited and volunteered papers. Additional discipline sessions will be scheduled on the basis of submitted abstracts. There will be no separate theme sessions. You may volunteer a paper to be considered for any of the symposia listed below. Indicate its number on the abstract form. Please submit only one volunteered abstract as speaker or poster presenter in symposia or discipline sessions to avoid scheduling conflicts.

Technical sessions will allow 12 minutes for presentation and three minutes for discussion. A few symposia will allow addi-

tional time at the discretion of the organizer. Posters will be on display for four hours, and authors will be present for two hours. Equipment for each technical session consists of two 35 mm carousel projectors and one overhead projector. *If you need video projection, or computer display equipment, you must specifically request it with your abstract.* Details for poster sessions will be sent to participants.

ABSTRACT DEADLINE: February 19, 1999

Abstracts for all sessions must be submitted camera-ready on official 1999 GSA Section meeting abstract forms. Forms are available from Abstracts Coordinator, GSA, P.O. Box 9140, Boulder, CO 80301, (303) 447-2020, ext. 161, ncarlson@geosociety.org.

Send an original and five copies of each abstract directly to George Brimhall, Technical Program Co-chair, Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720-4767.

TECHNICAL PROGRAM

A total of 23 symposia are scheduled for the meeting. These symposia deal with a wide variety of subjects covering the past history of Cordilleran exploration, as well as future directions in Pacific Rim research and major outstanding issues related to tectonics, geologic hazards, resources, and environmental quality.

General questions should be addressed to the program co-chairs: Eldridge Moores, Dept. of Geology, University of California, Davis, CA 95616, (916) 752-0352, moores@geology.ucdavis.edu; or George Brimhall, University of California, Berkeley, (510) 642-5868, brimhall@socrates.berkeley.edu.

Cordilleran Centennial Symposia and Technical Sessions

1. Cordilleran Geology, Past and Future: Impact on Global Geological Framework. Eldridge Moores, Dept. of Geology, University of California, Davis, CA 95616, (530) 752-0352, moores@geology.ucdavis.edu.
2. History of the Cordilleran Section and Its Geoscientists. William Berry, Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720-4767; (510) 642-3925, wberry@

uclink4.berkeley.edu; Michele Aldrich, Hatfield, Massachusetts, 73061.2420@compuserve.com.

3. The Franciscan Complex: Archetype or Atypical Subduction Complex? Sarah Roeske, Dept. of Geology, University of California, Davis, CA 95616, (530) 752-4933, roeske@geology.ucdavis.edu; John Wakabayashi, Hayward, California, (510) 887-1796, wako@tdl.com; Alison Till, U.S. Geological Survey, Anchorage, Alaska, (907) 786-7444, atill@tundra.wr.usgs.gov.

4. Geochronology from a Cordilleran Perspective: Pioneering Methods and Applications. Paul R. Renne, Berkeley Geochronology Ctr., 2455 Ridge Rd., Berkeley, CA 94709, (510) 644-1350, prennen@bgc.org.

5. Earthquake Processes: Seismological Society of America Symposium. Barbara Romanowicz, Doug Dreger, and Tom McEvilly, Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720-4767, (510) 643-5690, barbara@seismo.berkeley.edu, dreger@seismo.berkeley.edu, tom@seismo.berkeley.edu.

6. Great Earthquakes in the Cordillera: The Geologic Record, Facts, Myths, and Fiction. Bill Lettis, Wm. Lettis & Assoc., 1777 Botelho Dr., Walnut Creek, CA 94596, (925) 256-6070, lettis@lettis.com.

7. Cordilleran Plutonism in the Americas. Susan DeBari, Dept. of Geology, Western Washington University, Bellingham, WA 98225, (360) 650-3588, debari@cc.wvu.edu; Brendan McNulty, California State University, Dominguez Hills, Carson, (310) 243-3412, bmcnulty@dhvx20.csudh.edu; Calvin Barnes, Texas Tech University, Lubbock, (806) 742-3106, gical@ttacs.ttu.edu.

8. Evolutionary History of Pacific Rim Biota: Paleontological Society Symposium. Jere Lipps, Museum of Paleontology, University of California, Berkeley, CA 94720-4780, (510) 642-9006, jlipps@ucmp1.berkeley.edu; Carol M. Tang, Arizona State University, Tempe, (602) 965-9878, tang@asu.edu.

9. Paleogeography of the Eastern Pacific Ocean. James Ingle, Dept. of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305, (650) 723-3366, ingle@pangea.stanford.edu.
10. Estuaries and Coast Watersheds of the Pacific Rim. B. Lynn Ingram,

Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720-4767, (510) 643-1474, ingram@socrates.berkeley.edu; Roger Byrne, University of California, Berkeley, (510) 643-9170, arbyrne@uclink4.berkeley.edu.

11. Global Eocene Plate Reorganizations—The Sea-Land Connection. Steven C. Cande, Scripps Institution of Oceanography, MC 215, University of California, San Diego, CA 92093-0215, scande@garess.ucsd.edu.

12. The Effect of Stratigraphic Controls on Subsurface Contaminant Remediation. Seena Hoose, 10394 Bret Ave., Cupertino, CA 95014, (408) 252-5811, hoose@ix.netcom.com.

13. Engineering Geology and Natural Hazards in the Cordillera. Nick Sitar, Dept. of Civil and Environmental Engineering, University of California, Berkeley, CA 94720, (510) 643-8623, nsitar@ce.berkeley.edu; Bob Wright, Harlan, Tate & Assoc., San Francisco, (415) 626-0765, rhw@earthlink.net.

14. El Niño Revisited—Projections, Predictions, Preparations, and Policy. Scott Burns, Dept. of Geology, Portland State University, P.O. Box 751, Portland, OR 97207-0751, scott@ch1.ch.pdx.edu.

15. Tectonics and Volcanism of Western Mexico. Ian Carmichael, Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720-4767, (510) 642-2577, ian@socrates.berkeley.edu; Joanne Stock, Division of Geological and Planetary Science, California Institute of Technology, Pasadena, CA 91125.

16. Undergraduate Research Posters (Council on Undergraduate Research). Susan DeBari, Geology Dept., Western Washington University, Bellingham, WA 98225, (360) 650-3588, debari@cc.wvu.edu. *Poster mode only.*

Pacific Rim Symposia on Ore Deposits and Mine Restoration

Sponsored by the Berkeley Earth Resources Center. George Brimhall, Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720-4767, (510) 642-5868, brimhall@socrates.berkeley.edu.

17. McLaughlin Symposium on Mining Geology. Diane Wolfram, Dept. of Geological Engineering, Montana Tech, Butte, MT 59701, (406) 496-4353, Dwolfram@mtech.edu.

18. Recent Ore Exploration and Discovery in the "Ring of Fire." Eliseo Gonzales-Urien, Placer Dome Inc., 2085 Hamilton Ave. #150, San Jose, CA 95125, (408) 377-3538, 76214.3227@compuserve.com; Hugo Dummett, BHP Minerals, San Francisco, (415) 774-2526; Dummett.Hugo.HT@bhp.com.au.

19. China Geology and Metallogeny. Xuane Mo, China University of Geosciences, 29 Xueyuan Road, Beijing 100083 China, 10-6231-2244 x3106, mxx@sky.edu.cn.

20. Impacts and Remediation of Base-Metal Mining. Charles Alpers, USGS, Placer Hall, 6000 J St., Sacramento, CA 95819-6129, (916) 278-3134, cnalpers@usgs.gov.

21. Impacts of Hydraulic Mining and Placer Gold Processing. Mike Hunerlack and Charles Alpers, USGS, Placer Hall, 6000 J St., Sacramento, CA 95819-6129, (916) 278-3134, cnalpers@usgs.gov.

22. Circum-North Pacific Metallogenesis. Shunzo Ishihara, shunso@gsj.go.jp; Warren Nokleberg, USGS, MS 901, Menlo Park, CA 94025, (650) 329-5732, wnokleberg@isdmnl.wr.usgs.gov.

23. Environmental Impacts of Lode Gold Mining. Roger Ashley, USGS, 345 Middlefield Rd., Menlo Park, CA 94025, (650) 329-5416, ashley@usgs.gov.

FIELD TRIPS

Northern and central California are regions of great scenic beauty and intriguing geology. That geology, well displayed in outcrops that range from seacliff to alpine mountainside, has played an important role in shaping concepts in earth sciences for a century. Field trips offered in conjunction with the Centennial meeting were carefully selected to highlight the breathtakingly diverse range of the exciting geology of northern and central California. These trips look back at geologic relations that influenced society and current scientific thought, as well as forward to challenges that will face earth scientists in the coming century. Because many field trip opportunities lie within easy distance of the GSA Cordilleran Section meeting site in Berkeley, one-day field trips are emphasized in order to afford participants maximum opportunity to sample the superb geology of the region. One-day trips will run over pre- and postmeeting weekends, from Saturday, May 29 to Sunday, June 6. There will be both pre- and postmeeting multi-day trips. A field guide will be published by the California Division of Mines and Geology. For additional information, contact Field Trip Chair Steve Graham, Dept. of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305-2115, (650) 723-0507, graham@pangea.Stanford.edu.

Multi-Day Trips

1. Sierra Nevada Gold Deposits. David Lawler, Farwest Geoscience Foundation, 48 Shattuck Sq., Ste. 108, Berkeley, CA 94704, (510) 549-9694, lawler@webbnet.com.

2. Sutter Buttes Volcano. Brian Hausback, Dept. of Geology, California State University, Sacramento, CA 95819-6043, (916) 278-6521, hausback@csus.edu.

3. Mesozoic Convergent Margin of Central California. Ray Ingersoll, Dept. of Earth and Space Sciences, University of

California, Los Angeles, CA 90095, (310) 852-8634, ringer@ess.ucla.edu.

4. Accretionary Tectonics of the Western Sierra Nevada. Richard Schweickert, Dept. of Geological Sciences, Mackay School of Mines, University of Nevada, Reno, NV 89557-0138, (702) 784-6901, richschw@unr.edu.

5. Sedimentology and Facies Architecture of High-Density Sediment-Gravity-Flow Deposits, Paleocene, Santa Lucia Range, California. Kai Anderson, Dept. of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305, (650) 723-0507, anderson@pangea.stanford.edu.

6. Economic Geology and Environmental Issues at Mercury-Gold Deposits and the McLaughlin Gold Deposit, California Coast Range. Dean Enderlin, Jim Rytuba, USGS, MS 901, 345 Middlefield Rd., Menlo Park, CA 94025, (650) 329-5418, jrytuba@mojave.wr.usgs.gov.

One-Day Trips

7. Hayward Fault—Source of the Next Big One? Sue Hirschfeld, Dept. of Geological Sciences, California State University, Hayward, CA 94542-3088, (510) 885-3000, shirsch@gauss.sci.csuhayward.edu.

8. Sequence Stratigraphy and Mining History of the Black Diamond Mines Regional Preserve. Ray Sullivan, Dept. of Geosciences, San Francisco State University, San Francisco, CA 94132-4001, (415) 338-7730, sullivan@sfsu.edu.

9. Neotectonic and Quaternary Geology of the San Gregorio Fault Zone, Santa Cruz and San Mateo Counties, California. Gerald Weber, 614 Graham Hill Rd., Santa Cruz, CA 95060, (408) 426-1367, jweber@earthsci.ucsc.edu.

10. Depositional and Other Features of the Merced Formation in Sea-Cliff Exposures South of San Francisco, California. H. Edward Clifton, Conoco Inc., Permian 3050, P.O. Box 2197, Houston, TX 77252-2197, (281) 293-6775, h-edward.clifton@conoco.dupont.com.

11. Hills, Hollows, and Channel Networks: Linking Field Studies and Digital Terrain Modeling. William Dietrich, Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720-4767, (510) 642-2633, bill@geomorph.berkeley.edu.

12. The Geology and Wines of Napa Valley. David Howell, USGS, MS 902, Menlo Park, CA 94025, (650) 329-5430, dhowell@octopus.wr.usgs.gov.

13. Tour of a Classic Subduction Complex: The Franciscan Complex of the San Francisco Bay Area, California. John Wakabayashi, 1329 Sheridan Lane, Hayward, CA 94554-4332, (510) 887-1796, wako@tdl.com.

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14. Geology and Natural History of Coastal Northern California (Tomales Bay, Bodega Bay, and the Russian River Regions). Jere Lipps, Museum of Paleontology, University of California, Berkeley, CA 94720-4780, (510) 642-9006, jlipps@ucmp1.berkeley.edu.
15. Del Puerto Ophiolite: Its Petrology and Tectonic Setting. Robert Coleman, 2025 Camino Al Lago, Menlo Park, CA 94025, (650) 854-3641, coleman@pangea.stanford.edu.
16. San Andreas Fault Zone Near Point Reyes: Late Quaternary Deposition, Deformation, and Paleoseismology. Karen Grove, Dept. of Geosciences, San Francisco State University, San Francisco, CA 94132-4001, (415) 338-2617, kgrove@sfsu.edu.
17. Earthquakes on the Calaveras Fault: Fact or Fiction? Keith I. Kelson, William Lettis & Associates, Inc., 1777 Botelho Dr., Ste. 262, Walnut Creek, CA 94596, (925) 256-6070, kelson@lettis.com.
18. Representative Industrial Mineral Mines of the San Francisco Bay Region. Don DuPras and Susan Kohler, California Division of Mines and Geology, Industrial Minerals Division, 801 K St., MS 08-38, Sacramento, CA 95814, (916) 323-0111.

WORKSHOPS

The following workshops are planned: (1) Digital Geological Mapping Using GPS and Laser Range Finders (2) Texture Analysis of Geologic Materials (3) a number of workshops directed to science educators (K-16).

The Roy Shlemon Mentors in Applied Geology Program will hold a workshop for upper-level undergraduate and graduate students. This one-day workshop will address practical aspects of engineering geology. There is no charge for students, but space is limited. Students wishing to attend should write a short note expressing their interest by April 10 to General Chair Doris Sloan (see Detailed Information).

STUDENT SUPPORT

The GSA Cordilleran Section will give awards for the best graduate and undergraduate papers (oral or poster). Papers will be considered for any of the symposia or discipline sessions listed, and students should submit their abstracts on the standard form. Student must be both first author and presenter, and must follow the guidelines for speakers sent out by GSA, and must be a student member or student associate of the Cordilleran Section. We encourage students to present their work at this Centennial meeting.

The GSA Cordilleran Section has \$9,000 available for partial support of its Student Associates who are presenting papers at the meeting. Apply to Cordilleran Section Secretary Bruce A. Blackerby, Dept. of Geology, California State University, Fresno, CA 93740, (209) 278-2955, bruceb@csufresno.edu. Applications should include certification that the student is presenting a paper and is a GSA Student Associate as of February 28, 1999. Applications must be received by March 31, 1999.

EXHIBITS

Exhibits will be located in the Pauley Ballroom along with the poster sessions and food concessions. The central location will ensure maximum exposure to meeting participants. The anticipated large attendance at the GSA Cordilleran Section Centennial meeting will provide exhibitors an easy and cost-effective way to market their products and services. The exhibits area will be open 6-8 p.m. on Tuesday during the Welcoming Party, 9 a.m. to 5 p.m. Wednesday and Thursday, and 9 a.m. to noon on Friday. Exhibitor fee is \$400 for for-profit organizations and \$150 for nonprofit organizations. Please contact Exhibits Chairman Ivan Wong at (510) 874-3014 or e-mail igwongx0@wcc.com for further information and applications. Exhibit space is limited, so early reservations are strongly encouraged.

SPECIAL EVENTS

The Welcoming Party will be held on Tuesday evening, June 1, from 6 to 8 p.m. Business meetings of co-sponsoring organizations and the Cordilleran Section and its committees are planned. Additional events will be announced in the March *GSA Today*.

The Centennial is an occasion for the entire family! A special guest hospitality room will enable guests to plan activities for young and old to take advantage of the Bay Area's spectacular scenery and cultural resources. Look for information on local events, tours, theater, museums, and exhibits, and transportation guides to help you make the best use of your time here.

A public lecture by Wm. Muehlberger on "The Earth from the Space Shuttle: what the astronauts see" will highlight spectacular aerial views of the Pacific Rim and elsewhere from NASA's collection.

One evening is scheduled for alumni get-togethers. If you are interested in arranging an alumni party for your school, please contact General Chair Doris Sloan (see Detailed Information).

HOUSING

Blocks of rooms have been reserved on the UC Berkeley campus and will be available at modest rates to all participants. Information on additional housing

Cordilleran continued on p. 21

"I unequivocally recommend this workshop to my colleagues ... I learned a tremendous amount about both technology and teaching."

Bob Blodgett 1997 ESSTEP participant



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**July 6-17, Boulder, Colorado, or
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Interested faculty must apply as a team (2-4 persons/team) from institutions in the same geographic region; 40 spaces are available in 1999.

For application materials please contact:

Holly Devaul, Education Department
Geological Society of America, P.O. Box 9140, Boulder, CO 80301
(303) 447-2020 x150; fax 303-447-1133; e-mail: hdevaul@geosociety.org.

Applications for 1999 summer workshops are due March 1, 1999.

Funded in part by a grant from the National Science Foundation

WASHINGTON REPORT

Bruce F. Molnia, bmolnia@erols.com

Washington Report provides the GSA membership with a window on the activities of the federal agencies, Congress and the legislative process, and international interactions that could impact the geoscience community. These reports present summaries of agency and interagency programs, track legislation, and present insights into Washington, D.C., geopolitics as they pertain to the geosciences.

Sustaining America

"The latest, nebulous, environmental buzz-phrase boils down to green-tinted, populist, economic responsibility..."

—Reporter Don Hopey of the *Pittsburgh Post-Gazette*, describing sustainable development, in his September 26, 1998, article "Sustainable Development—Whatsat?"

"Sustainable development, a fuzzy buzz-phrase, turns out to be as hard and real as houses on a mountain of slag overlooking a sewage-polluted creek"

—Reporter Don Hopey of the *Pittsburgh Post-Gazette*, in his September 29, 1998, article "Building a Better Community: Sustainable Planning Under Way in the City"

"A future that includes sustainable development will require continued attention to the reduction of pollution and consumption, a broad-based public education process, and input from many usually silent sectors of the Pittsburgh community."

—Reporter Don Hopey of the *Pittsburgh Post-Gazette*, in his September 30, 1998, article "Development Panel Plans for 'Sustainable' Future"

U.S. Environmental Protection Agency Administrator Carol Browner defines "sustainable development" as "not having to choose between a healthy environment and a healthy economy. It means having both...." The Center of Excellence for Sustainable Development defines it as "a strategy by which communities seek economic development approaches that also benefit the local environment and quality of life." My definition includes "meeting the needs of the present without compromising the ability of future generations to meet their own needs." In the United States, this sustainable development issue is now receiving the attention of the Executive Office of the President, if not that of the populace.

On September 28 and 29, 1998, in Pittsburgh, Pennsylvania, the President's Council on Sustainable Development (PCSD) held its latest meeting. In June 1993, the PCSD was established by Presi-

dential Executive Order 12852 to advise the White House on the "emerging topics of sustainable development and sustainability and to develop new approaches to achieve US economic, environmental, and equity goals, and to create a Sustainable America." The PCSD is administered as a federal advisory committee under the guidance of the Federal Advisory Committee Act.

The Council's 29 members are nominated by the President and represent business, government, community, and environmental leaders. Co-chairs are Ray C. Anderson, chairman, president, and CEO of Interface, Inc. and Jonathan Lash, president of the World Resources Institute. Members include John H. Adams, executive director of the Natural Resources Defense Council; Secretary of Interior Bruce Babbitt; Fred D. Krupp, executive director of the Environmental Defense Fund; William D. Ruckelshaus, chairman and CEO of Browning-Ferris Industries,

Inc; John C. Sawhill, president of The Nature Conservancy; and Browner.

The mission of the PCSD is fourfold: (1) to forge consensus on policy by bringing together diverse interests to identify and develop innovative economic, environmental, and social policies and strategies; (2) to demonstrate implementation of policy that fosters sustainable development by working with diverse interests to identify and demonstrate implementation of sustainable development; (3) to get the word out about sustainable development; and (4) to evaluate and report on progress by recommending national, community, and enterprise level frameworks for tracking sustainable development.

To implement this mission, the PCSD charter directs the Council to advise the President on: (1) the next steps in building the new environmental management system for the 21st century by reviewing current environmental management reforms; (2) domestic implementation of policy options to reduce greenhouse gas emissions; (3) policies and approaches that promote sustainable communities; and (4) policies that foster U.S. leadership in sustainable development internationally and facilitate sustainable development in the flow of financial capital from developed to less developed countries. To assist in the development of recommendations on these policy areas, an Environmental Management Task Force, a Climate Change Task Force, a Metropolitan and Rural Strategies Task Force, and an International Task Force have been established.

The PCSD has developed ten national goals for sustainable development. These are: (1) Health and the Environment—Ensure that every person enjoys the benefits of clean air, clean water, and a healthy environment at home, at work, and at play. (2) Economic Prosperity—Sustain a healthy U.S. economy that grows sufficiently to create meaningful jobs, reduce poverty, and provide the opportunity for a high quality of life for all in an increasingly competitive world. (3) Equity—Ensure that all Americans are afforded justice and have the opportunity to achieve economic, environmental, and social well-being. (4) Conservation of Nature—Use, conserve, protect, and restore natural

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Cordilleran *continued from p. 20*

in local hotels and motels will be provided in the final announcement.

REGISTRATION

Preregistration will be handled by GSA headquarters. Registration details and forms will be published March *GSA Today*.

The Cordilleran Section is committed to making every event at the 1999 Centennial meeting accessible to all persons interested in attending. Please indicate special requirements, such as an interpreter or wheelchair accessibility information, on the meeting registration form, or contact General Chair Doris Sloan, at the address in the next paragraph.

DETAILED INFORMATION

For further information, contact Doris Sloan, General Chair, Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720, (510) 642-3703, dsloan@socrates.berkeley.edu. Visit our Web sites: <http://socrates.berkeley.edu/~earthres/GSApage.html> or www.geology.berkeley.edu/geology. ■

Washington Report *continued from p. 21*

resources—land, air, water, and biodiversity—in ways that help ensure long-term social, economic, and environmental benefits for ourselves and future generations. (5) Stewardship—Create a widely held ethic of stewardship that strongly encourages individuals, institutions, and corporations to take full responsibility for the economic, environmental, and social consequences of their actions. (6) Sustainable Communities—Encourage people to work together to create healthy communities where natural and historic resources are preserved, jobs are available, sprawl is contained, neighborhoods are secure, education is lifelong, transportation and health care are accessible, and all citizens have opportunities to improve the quality of their lives. (7) Civic Engagement—Create full opportunity for citizens, businesses, and communities to participate in and influence the natural resource, environmental, and economic decisions that affect them. (8) Population—Move toward stabilization of U.S. population. (9) International Responsibility—Take a leadership role in the development and

implementation of global sustainable development policies, standards of conduct, and trade and foreign policies that further the achievement of sustainability. (10) Education—Ensure that all Americans have equal access to education and lifelong learning opportunities that will prepare them for meaningful work, a high quality of life, and an understanding of the concepts involved in sustainable development.

The Pittsburgh meeting generated a number of policy recommendations that are to be transmitted to the President before the end of January 1999. These include early action principles and technology policies to address global climate change, sustainable communities recommendations, a description of a sustainable Pittsburgh initiative, and a finalization of a set of principles to encourage “early action” and technological innovation to reduce greenhouse-gas emissions. The Climate Task Force, chaired by Steve Percy, chairman and CEO of British Petroleum, is charged with advising the President on domestic policy options and activities that could reduce greenhouse gas emissions. They announced

that the risk of climate change is of sufficient concern and that timely and effective actions should be taken to reduce those risks. They reached agreement on a set of principles for the design of a voluntary program to reduce emissions before any binding requirements are in place. They recommended an incentive-based early action program that: encourages broad-based participation, learning, innovation, flexibility, and experimentation; grants formal credit for legitimate and verifiable measures to protect climate; ensures accountability; is compatible with other climate protection strategies and environmental goals; and includes local, state, and federal government leadership. They desire to “engage community lending institutions and Wall Street CEOs” on climate change.

“Credits for early action will produce earlier reductions in greenhouse gas emissions. The sooner companies get on a gradual ‘glide path’ towards reductions, the better,” said Jonathan Lash, president of the World Resources Institute and co-chair of the President’s Council. “Even before any binding treaties or other requirements are in place, America’s businesses, communities, government agencies and individuals need to get ready to tackle the challenge of climate change. With early action we can develop a program that encourages prosperity while contributing to significant emissions reductions,” said Steve Percy.

The Council also unveiled its plans for a May 2–5, 1999, National Town Meeting for a Sustainable America, to be held in Detroit with more than 3,000 attendees, and to be joined by several thousand more via satellite links and the Internet. Additionally, many thousand more will participate at coordinated local events during the three weeks between Earth Day on April 22, 1999, and the start of the summit on May 2, 1999.

The three purposes of this event are: (1) to present the concepts and opportunities of sustainable development to the public; (2) to showcase ideas, technologies, and practices that reflect an integrated approach to economic, environmental, and social equity goals; and (3) to spark further action and national dialogue on sustainable development. The PCSD anticipates that this event will: (1) result in the development of a pledge to a sustainable future for citizens, communities, and the country; (2) foster new projects and multi-level partnerships among government, industry, community groups, and academia; and (3) publicize existing and planned sustainable communities to increase the nation’s awareness of sustainable development options. For more information contact: National Town Meeting Coordinator, PCSD, 730 Jackson Pl., NW, Washington, DC 20503, (202) 408-5296, infopcsd@aol.com, <http://www.sustainableamerica.org>. ■

GSA
1999-2000

Congressional Science Fellowship

The Geological Society of America is accepting applications for the 1999–2000 Congressional Science Fellowship. The Fellow selected will spend a year, or optionally 16 months, in the office of an individual member of Congress, a congressional committee, or a congressional support agency for the purpose of contributing scientific and technical expertise to public policy issues and gaining firsthand experience with the legislative process. The American Association for the Advancement of Science conducts an orientation program to assist the Fellow in seeking a congressional staff position.

CRITERIA

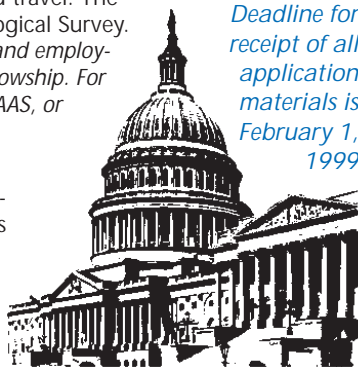
The program is open to highly qualified Ph.D. earth scientists. Candidates are expected to show exceptional competence in some area of the earth sciences, to have a broad professional background, to be cognizant of matters outside their area of expertise, and to demonstrate a strong interest and some experience in applying scientific knowledge toward the solution of societal problems.

AWARD

The 1999–2000 GSA Congressional Science Fellow will receive a one-year stipend of \$42,000, or \$56,000 for 16 months. The Fellow will also receive limited allowances for health insurance, relocation, and travel. The fellowship is funded by GSA and the U.S. Geological Survey. *(The fellowship is available only to U.S. citizens, and employees of the USGS are ineligible to apply for this fellowship. For information about other programs, contact the AAAS, or the Geological Society of America.)*

TO APPLY

Procedures for application and detailed requirements are available in the geology departments of most colleges and universities in the United States or upon request from: Cathleen May, Director, IEE, Geological Society of America, P.O. Box 9140, Boulder, CO 80301-9140.



Deadline for receipt of all application materials is February 1, 1999

New GSA Members

The following Members were elected by Council action during the period from February to October 1998. (An asterisk indicates a transfer from Student Associate to Member status.)

*Andrew P. Abban	Renee E. Bourke	Tyler S. Cruickshank	Stephen Flint	*Michelle L. Haskin
Bill Abrahams-Dematte	Jerry C. Bowling	Cherie L. Cumberland	*Eric A. Flodin	KamalEldin M. Hassan
Nancy K. Adams	*Scott A. Bowman	*Kathleen M. Cummins	*Rebecca M. Flowers	James B. Hayes
Elizabeth A. Addington	Daniel P. Bowser	Kevin J. Cunningham	*Stephanie A. Foggia	Steven a. Haynes
Russell Agostaro	*Alexander S. Bradley	*Brian S. Currie	Camille M. Fontanella	*Jordan E. Hegedus
Naveed Akhtar	*Robert J. Brady	Kristina A. Curry	*Deryk J. Forster	Edward A. Hegnauer
Said M. Al-Rashidy	*John F. Bratton	Chris R. Cuyler	Mark A. Fortuna	Martin Heiligmann
Abdussalam A.S. Alamouri	Tracy A. Brennan	*Barry W. Dalkey	*Shannon K. Foster	*Daniel Heimgartner
Arshad Ali	*Howard B. Brenner	George R. Dasher	Barbara A. Fowler	Kristen A. Hein
James E. Almendinger	Lindell C. Bridges	Thomas A. Davidson	T. Kenneth Fowler	*Nicole A. Heller
Helge Alsleben	Leslie N. Bright	John J. Davis	Antony C. Fraser-Smith	Paula J. Helm
Elizabeth L. Ambos	*Joe S. Brinton	Katherine L. Davis	*Andrea K. Freeman	Carey A. Hengstenberg
*Lee Amoroso	*Robert C. Britts	*Steven R. Dawes	Douglas S. Frink	Frank C. Hernandez
*Diana Elder Anderson	Gregory R. Brooks	*Reginald G. Dawkins, Jr.	*Robert Frodeman	Raul S. Herrera
*Kai S. Anderson	*James F. Brooks	Cornel E. J. de Ronde	Anna I. Fyodorova	Alisa S. Herrick
Gretchen H. Andreasen	Margaret P. Brooks	James H. Dean	*Forest J. Gahn	*Daniel Heimgartner
*Frank G. Andrews	*Brook E. Prosi	Larry L. Dearborn	John W. Gale	Kari K. Hetcher
Robert E. Andrews	Jason H. Broughton	Nebojsa Dedic	Lindsay E. Gall	*Christopher S. Hiatt
Charles F. T. Andrus	Fred Brovold	Kevin L. DeFosset	Eric W. Garcia	*Eric Hiatt
Vladimir E. Andrusovich	*Mikael S. Brown	*Shane C. DeGross	*Juan-Carlos	Nicholas H. Hinz
Ruslan M. Anisimov	*Steven M. Brown	Jennifer M. DeMonge	Garcia y Barragan	Mark Hladik
*George P. Aponte Clarke	*Michelle L. Bruce	William J. Desmarais	Carlos Garcia-Herrera	Thomas B. Hoane
Kendra A. Arbesman	Christopher J. Brummer	Cris L. DeWolf	Anthony P. Gartrell	*Michael F. Hochella, Jr.
Alexandra M. Arnott	*Kristine M. Bryan	*Steven P. DiBenedetto	Dean L. Garwood	Richard F. Hoefling
*Stacy L. Aron	*Chris C. Bryarly	Enrico Dinelli	Stephanie B. Gaswirth	*Steven M. Hoffman
*Astrid E. Arts	*Nancy Buening	*Ron M. Dixon	*Michael N. Gaud	Susan A. Hollander
Amanda W. Ash	Andrew R. Bukata	Sara N. Doane	*Matt I. Gavette	John E. Hollberg
*Angela K. Ashurst	Alexander P. Bump	James P. Doerner	Igor J.C. Gavriloff	*Troy Rasbury Holt
*Beth N. Astley	Stefan Burla	Christopher C. Dorion	Dana H. Geary	Gwynn M. Holzschuh
*Sheri L. Atencio-Church	*Kathleen Burnham	Stephen Q. Dornbos	*Cynthia J. Gefvert	James G. Honey
*Paul K. Atkinson	Jim P. Buschur	Karen J. Downey	Nurgul Gelik	Jason A. Hooten
*Christopher D. Augustine	Jonathan Bush	Peter J. Dressel	Rebecca R. Ghent	*Karin A. Hoover
David E. Babcock	Richard R. Bush	Jaclyne M. Drummond	*Brandy D. Gibson	Kevin B. Hopkins
Gombosuren Badarch	Michael C. Byerley	Jeffrey A. Drzewiecki	Ron K. Giesler	*Andy Horn
Racheal E. Bailey	*Todd M. Byrd	Maureen A. Duda	*Mary L. Gillam	Benjamin C.
Santo Bains	*James K. Campbell	Gary G. Dunn	Nicholas A. Gioppo III	Horner-Johnson
*David J. Barclay	Benjamin T. Cancemi	*Richard K. Dunn	David Giorgis	*Brian K. Horton
Michael J. Barden	Eric C. Cannon	Janet M. Dunphy	Harland L. Goldstein	*Sara C. Hotchkiss
*Christina E. Barker	Douglas A. Carlson	Matthew A. Duty	*Julie F. Gott	Niels Hovius
Jane Barling	Edessa Carr	Tommy G. Dye, Jr.	Bryan E. Gottfried	*Douglas A. Howard
Charles A. Barlow	*Neil A. Caudill	Jeff Dykes	Carrie D. Graff	Katherine A. Howe
*Matthew A. Barner	Marty R. Cawthon	*Cary R. Easterday	Regan G. Grandy	*James R. Howell
Scott D. Barnes	*Daniel A. Cenderelli	Christine G. Easterling	*John P. Granville	*Rachael C. Howse
Thomas O. Barnwell, Jr.	Ziya S. Cetiner	Timothy T. Eaton	Julian C. Gray	Michael Hsieh
*Tristand L. Barrett	Rebekah J. Chace	Timothy K. Ehrlich	*Jessica K. Graybill	Sophia C. Hsu
Michael D. Bartosek	Chun-Hsiang Chang	Baher A.H. El Kalioubi	*Joe D. Gregson	Jinbo Hu
G. Scott Bates	Bennett G.K. Chong	Omar R. El-Mahdy	Gerald F. Greiner	Paul F. Hudson
Bradley M. Battista	Dennis E. Cigainero	Mercy O. Elegbe	Jane M. Grimes	*Christina L. Hulbe
Mary E. Baxter	Mark D. Claassen	Scott A. Elias	*William S. Grimes	Scott M. Hulseapple
Martin A. Becker	James C. Clark, Jr.	Kathleen Ellis	Julia P. Griswold	Brian B. Hunt
Joseph V. Beeman	Brandon H. Coates	Alfred M. Elser	*Christian J. Gross	*Caren A. S. Hurlbut
*Brian D. Begley	*Hermione A. P. Cockburn	Michael C. Emilio	Teresa A. Grout	John E. Huss
*Deborah L. Beier	David V. Colbert	Merritt S. Enders	Rafael Guardado	Bushra M. Hussaini
Julie D. Bell	Jennifer M. Cole	Mark A. Engle	*Laura A. Guertin	Michael E. Hutchinson
*Jacob S. Benner	Gustavo A. Colina	*Nathan English	Sean S. Gulick	David M. Hyman
Benjamin Benumof	Matthew R. Colmer	Paul D. Epstein	Robert J. Gunthorpe	Mark D. Izold
*Andrew P. Berkoski	*Marc A. Conger	*Stephanie N. Erickson	J. Brady Gutta	Iffat Jabeen
Patricia A. Bernot	Alfred R. Conroy, Jr.	Julie A. Esdale	*Zane A. Hamiel	*Noel W. Jackson
Emile A. Bettez	James M. Cooper	*Richard M. Essex	*Victoria E. Hamilton	*John M. Jaeger
*Katharina Billups	Sherri R. Cooper	*David A. Evans	Lisa C. Hammersley	Stephen A. Jenkins
*Marianne Binkin	*Celeste A. Cosby	*Kevin R. Evans	*Gregory S. Hancock	*Marcia L. Jensen
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*Heather M. Bittner	*Ryan J. Cozart	Meliktu Fanuel	*Jennifer S. Hango	Dazhi Jiang
*Wayne V. Bloechl II	Martha E. Craft	*Andrew H. Feldman	*Diane J. Hanley	Aaron W. Johnson
Julie E. Blue	*Jessie L. Crain	*Katherine M. H. Fernald	*Lori M. Hanson	*Neil A. Johnson
Christian O. Boehm	*Barry L. Crawford	Leni G. Field	Eric V. Hargrave	Thomas M. Johnson
*Matthew J. Bokus	*Todd N. Creamer	*Eve L. Fine	Ruth M. Harper-Arbie	Serge Jolicoeur
Gabriella Bolford	*Juliet G. Crider	Jeffrey A. Fink	Ross D. Hartleb	Gregg L. Jones
*Mark T. Bolivar	*Dianna M. Crilley	Martin D. Finn	*Ebbe H. Hartz	
Mary R. Booker	James M. Cronoble	Brendan R. Fisher	*Anne M. Harvey	
Lonny R. Boring	James L. Crowley	Mark J. Fisher	Barbara B. Harvey	

New Members
continued on p. 24

New Members
continued from p. 23

- *James V. Jones
Murray I. Jones
Patricia K. Jones
*Maurice E. Kaasa, Jr.
Takeshi Kakegawa
*Birgitta E. Kalinowski
David S. Kane
Connie L. Kaplan
*Daniel B. Karner
Sandeep Karwa
*Mary E. Kauffman
Donald A. Keefer
*William R. Keller
Meredith A. Kelly
Drew G. Kennedy
Stacy A. Kerkela
Charlie M. Kerwin
Victor E. Khain
*Md. Khalequzzaman
Karl W. Kibler
Gerald D. Kidd
Roger A. Kiers
*Diann S. Kiesel
*Cara B. Kiger
Cheol-Woon Kim
Kari A. Kimball
*Hiroto Kimura
Allen P. King
Robert S. King
*Michael Kirchenbauer
Dirk M. Kirste
Michele M. Kissell
*Robert T. Klein
Katrin Kleinert
*Steven J. Klick
*Kurt M. Knesel
Chris G. Knickerbocker
*Jasper Knight
Rebecca L. Knight
Stuart R. Knoop
Kevin G. Koenig
Patrick C. Koeppele
*Irina Kogan
Bryan M. Kommeth
*Joseph J. Konczyk
*Michael E. Konen
*Carla M. Koretsky
Gotthard M. Kowalczyk
*Ronald A. Kral
Jurgen Kraus
Gary W. Krizanich
William J. Kwitnicki
Russell J. Kyle
Nuruddin Ladha
Melissa J. Lafreniere
Leonardo E. Lagoeiro
Michael T. Landrum
*Katherine E. Langer
*Tom J. Lapen
*Matthew K. Larsen
John P. "Pete" Laux III
Jay A. LeBeau
Sophie Leblanc
Suzanne F. Leclair
*Richard W. Lederer, Jr.
Jennifer N. Lee
*Young-Joon Lee
Mark S. Leeper
*John W. Leffew
P. Christine Leo
Katherine C. Leonard
Kenneth E. Lepper
*Gordon Levin
Hee nam Lew
Jared F. Lewis
- Jing Li
Sheila M. Lindenberg
Ulf G. Linnemann
*Mike K. Liquori
*John H. Loeffel
*Leslie Kahn Logan
Shannon L. Logan
Amy G. Lombardo
*Robert Lopez
*Andrew M. Lorrey
Sarah S. Low
Adrian M. Lowe
Anthony R. Lowry
Kenneth L. Loy
Nathaniel B. Ludlum
*Sebastian Luening
*Donald K. Lumm
*Sara E. A. Lyle
James R. Lyons
Suzanne N. Lyons
Kerry V. Magruder
*Margaret M. Maher
Doris Maicher
*Adam C. Maloof
*Ned Mamula
Sara A. Marcus
Jeffrey Mariga
*Michelle J. Markley
*Adam R. Mars
Heather L. Marsh
*Jennifer P. Martin
Ronald E. Martin
Christine R. Martinez
Cynthia M. Martinez
J. Graydon Martz
Audeliz Matias
Ari Matmom
*Jeffrey M. Matthews
*Scott H. Matthews
Sara E. Matyiko
J. Craig Mauldin
Agnes Mazot
*Brian W. McArdell
*Randolph A. McBride
*Constance E.
McCambridge
Paul J. McCarthy
Phil J. A. McCausland
*Richard G. McClean
*Melanie M. McCleary
Jennifer McClung
*Clifford R. McCrary III
Michelle Marie McGee
Rebecca E. McGuire
Gordon C. McKeague
*Noel C. McKenzie
John S. McKeown
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*Jerry F. McManus
Marcia K. McNutt
*Kevin R. McRae
*Monique E. Meier
Figen A. Mekik
*Erik B. Melchiorre
Shari J. Mendrick
John W. Merck, Jr.
*Matthew F. Mercurio
Mandana Meriano
Audrey W. Meyer
Edward G. Meyers
Scott C. Michand
*Elizabeth J. Miksa
*Brian L. Millard
Amy A. Miller
*Jonson W. Miller
David K. Mitchell
*Karen J. R. Mitchell
Mark D. Mitchell
- *David M. Mixon
Richard W. Mixer
*Stephen J. Mojzsis
*M. Ann Molineux
G. William Monaghan
Salma B. Monani
*Laura J. Moore
Amy G. Morgan
*Lee H. Morse
Andrea Moscariello
*Angela M. Moss
*Claire E. Muirhead
Stephanie K. Mulica
*Lona D. Mullinax
*John L. Muntean
Lawrence C. Murdoch
Peter C. Naiden
Remo Nardini
Enrique H. Nava-Sanchez
*Virginia Anne Newbern
*Mark D. Nicholls
Mary H. Nichols
Chrissie Nienaber-Roberts
A. Wade Nollkamper
*Katy Farness Noltmier
Philip M.
Novack-Gottshall
*Jon S. Novick
Patrice Z. Nsoga Mahob
Francisco E. Nullo
*Emilie E. Nyberg
Andrew A. Nyblade
*Yuet-Ling O'Connor
Kyoko Ohashi
Jill A. Oliver
*Lynn K. Oliver
Margaret M. Olsen
*Alana A. Olson
*Dan J. Oros
Ryan M. Ott
Rick E. Otto
William M. Pagano
*Patricia A. Painter
*Stephen L. Palmes
Yucheng Pan
Robert Panek
James D. Pankey
Lisa M. Paquette
*Mary A. Parke
Erika L. Parkin
David S. Parks
Kathi A. Peacock
Jason R. Pemberton
Jason T. Penney
Katarina S. Persson
Andreas Peterek
*James W. Peters
Mark A. Petersen
Curt D. Peterson
Vladislav A. Petrov
Lucille W. Petruny
Paul R. Picha
Janette M. Piemonte
Valerie Jill Podet
Eric R. Pogue
Dennis M. Poland
*Victor J. Polyak
Bryan Pool
John P. Pope
Nicholas J. Preston
Gretchen M. Price
Paul J. Prijatelj
Sian H. Proctor
Calvin K. Prothro
Ethan E. Prout
Peir K. Pufahl
Keith D. Putirka
*Patrick S. Rabideau
- Brian A. Rafferty
*Margaret A. Rafter
Audrey Hughes Rager
*David W. Ramsey
John W. Randall
*Usha Rao
*R. Ragnar Rasmussen
Christopher C. Rauber
Alexa C. Rayias
Steven P. Recio
*Thomas M. Reed
Leslie F. Reid
*Samantha L. Reif
Jonathan W. Remo
*Joseph Fury Renda
Matthew T. Richards
Scott W. Richards
Tobey C. Richards
*Peter E. Riemersma
Andrew W. Rigor
Kristi A. Rikansrud
Richard K. Rinkenberger
Tammy M. Rittenaur
Elizabeth A. Robbins
*Meredith S. Robertson
Beverly D. Robinson
Mark S. Robinson
Lizzette A. Rodriguez
*Jack V. Rogers II
Hugh R. Rollinson
Miriam J. Gomez Roman
*John J. Romano
*Mark A. Rosin
Deborah-Ann C. Rowe
*Peter E. Rumelhart
Christopher L. Rupe
Brian G. Rusk
*Erin Z. Ryan
Mark D. Sackett
*James C. Sagebiel
Ted L. Sager
*Anna M. Salvagno
Irene C. Sanchez Montero
Rajeev K. Sasidharan Nair
*Peter E. Sauer
Edward W. Sawyer
*Michael L. Sawyer
Peter A. Schade
Daniel S. Scheierer
William M. Schill
Renata da Silva Schmitt
*Kerri Ann Schneider
*Matthew O. Schrenk
Werner F. Schreyer
*William A. Schroeder
*Michael Schulz
Karen R. Schurr
Eric M. Schwartz
Bridget D. Scontras
Ross Secord
Sin C. Senh
M. Steven Shackley
Charu Sharma
Danielle R. Sharp
Shaw-Wen Sheen
Purnima A. Shivdasan
Heather A. Short
Abdulrahman A. Shujoon
*John C. Sieving
*Roger G. Sigler
Jagmohan Singh
Michael J. Singleton
*Darren B. Sjogren
*Raymond L. Skelly
Catherine C. Skilliter
Jane A. Skinner
Bryan R. Sladky
Jennifer E. Slate
- Mark L. Slater
*Thomas J. Slusser
*Angela E. Smith
*Heather Laurina Smith
Jeffrey J. Smith
Letitia Maile Smith
Lynne E. Smith
Nancy A. Smith
Robin L. Smith
*Ute D. Smith
Joseph P. Smoot
Derek A. Sondergaard
Leanne V. Spurgeon
Jeannine M. St. Clair
*Kristen E. K. St. John
*Carol J. Stack
Leslie C. Stanberry
Richard J. Stancliffe
Richard A. Statom
Douglas H. Steil
Seth A. Stein
*Robert W. Stephenson
Liane M. Stevens
Michelle N. Stevens
*Emily M. Stewart
*Shawn E. Stickler
Joanne C. Stott
Nicholas H. Strater
*Luther M. Strayer IV
Richard A. Sturn
*Christopher Sumner
Kerang Sun
Aviva Sussman
George E. Sutton, Jr.
*Susan K. Swanson
Brett D. Swartz
*Gary E. Tackman
Katsumi Takayasu
Yuhong Tang
Richard J. Taylan
*Bruce B. Taylor
Maria Luisa G. Tejada
*Jane L. Teranes
*Dennis O. Terry, Jr.
Mya Mya Than
*Lisa D. Thieme
Charley S. Thompson
David M. Thompson
Jinmei Tian
*David H. Tomlinson
John R. Toth
Craig H. Tozer
David W. Trabert
*David L. Trauger
*Carol Treadwell-Steitz
Janis D. Treworgy
*Ester Trivino
Charade A. Truesdell
Gia C. Truong
Christian A. Tryon
*Rita Tull
John P. Tunks
Anthony F. Turano
Brad W. Turner
*Michael A. Urban
*Jessica A. Ustick
*George H. Uzzelle IV
*Martin C. Van Boskirk
*Mark D. Vanderbilt
*Olivier Vanderhaeghe
Sarah J. VanGalder
Kenneth J. Vernon
Richard F. Viso
Randall H. Wade
Hugh M. Wagner
*Kristoffer T. Walker
John J. Walsh
Robert S. Warrender

New GSA Associates

The following Associates became affiliated with the Society during the period from February to October 1998.

J. Michael Watson
 *Janine Weber-Band
 Benning L. Wentworth III
 *Timothy N. Whalen
 Josh C. Whipple
 Arthur P. White
 Tina M. White
 *Stephanie K. Whitlatch
 *William W. Whitley
 Jessica L. Wichtowski
 David I. Wiegand
 Karen S. Wignall
 *Jennifer L. Wiley
 M. Justin Wilkinson
 *David A. Williams
 Katherine W. Williams
 Scott T. Williams
 Travis M. Williams
 *Wendi J. W. Williams
 *Jeremy B. Wilson
 Michael C. Wilson
 *Amy Sue Wilt
 Joseph L. Winesette
 Kari A. Wirth
 William D. Witherspoon
 Wendy S. Wolbach
 Stephen A. Wolfe
 *Keith L. Woodburne
 Paul A. Woodell, Jr.
 Terri L. Woods
 Wallace B. Woolfenden
 Meredith R. Worden
 Jeremiah B. Workman
 Raphael A. J. Wuest
 Fei Xu
 *Leslie Yale
 *Katsuyuki Yamashita
 Haruo Yamazaki
 Oleg V. Yapaskurt
 *Christopher C. Yarnell
 Kevin M. Yeager
 *Aaron M. Yecies
 Nathan Yee
 *R. Aileen Yingst
 Jennifer S. Yu
 *Mary Lynn Yurko
 Kimo K. Zaiger
 Edward A. Zarecky
 Patricia A. Zedler
 *Darla K. Zelenitsky
 Chunfu Zhang
 Libo Zhang
 Liu Zhifei
 Yan Zhuang
 *Matthew K. Zimmerman
 *Sarah B. Zimmerman
 *John-Paul Zonneveld
 Rainer Zuehlke ■

Rubens Acevedo
 Ruben Acosta
 Sherry L. Adams
 C. Shawn Adkins
 Maziar Ahvari
 James A. Allen
 Vincent A. Amoroso
 Alison M. Anders
 Megan L. Anderson
 Norman Andree
 Karen L. Andrus
 Elyse J. Apicello
 Kathleen A. Arford
 Tahira Arshed
 Ariel D. Auffant
 Shannon H. Baer
 Stephen M. Ballou
 Theresa Barber
 Kelly Batten
 Blakely R. Bear
 Delia L. Beckman
 Mark C. Begley
 Ronald M. Bek
 Leta M. Berardi
 Kelly L. Bergman
 Melissa A. Berke
 Robyn E. Berner
 Ren Irene F. Bernik
 Robert A. Bevilacqua
 R. Jason Biga
 Eric L. Bilderback
 Andria L. Bilich
 Clyde R. Blackwelder
 Aron L. Boros
 Shannon M. Brooks
 Cyndi K. Brown
 Gordon H. Brown
 Tasha A. Brown
 Deanna Buck
 Daniel A. Bunk
 Benjamin C. Burke
 Summer Burton
 Jerrie L. Camp
 Deirdra Cantrell
 James L. Carter
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 Amanda C. Cavin
 Helena Chacon
 Rena J. Chadwick
 Michael A. Charles
 Kirk Chatawanich
 Sean M. Chelius
 Rebecca A. Choyce
 Matthew K. Y. Chuang
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 Jason T. Collins
 John E. Collins, Jr.
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 Anthony A. Dame
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 Andy L. Davis
 Michael D. Deats
 Stephanie M. Deckard
 Jason M. Dell
 James R. Denniston
 Kimberly D. Dimmick
 Kelly M. Donahue
 Eron E. Drew
 Shana G. Driscoll
 Pamela J. Dugan
 Gregory Dumond
 Kevin R. Eastham
 Shawn A. Eichelberger
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 Justin J. Gallagher
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 R. Natasha Galvez
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 Filip M. Gieszczykiewicz
 Lisa D. Gilley
 Laura A. Gilpin
 Natalie B. Givens
 Rima M. Givot
 Danney R. Glaser II
 Heather R. Golding
 Mauricio A. Gonzalez Guillot
 Jose E. Gonzalez
 Sarah H. Gonzalez
 Bill A. Goodman

Roberta Goold
 John H. Gordon, Jr.
 Eric S. Gottlieb
 Catherine A. Gough
 Trevor G. Graff
 Michael Gregory
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 Paul R. Hanson
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 Susan L. Klosterman
 Beth B. Knauer
 Tara A. Kniskern
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 David Kozlowski
 Jill C. Krukoski
 Alexandra E. Krull
 Jill R. Kurtz
 Gene A. Kurz
 Scott W. Kutza
 Paul D. Lake
 Susan S. Lane
 Andrew W. Larrabee
 Tino Laubrock
 Chris P. Laverack
 Charles E. Leiserson, Jr.
 Loretta A. Leist
 Larry S. Levine
 Elijah M. Levitt

Kriket Little
 Nancy F. Little
 Carrie J. Lofgren
 Anna L. Loose
 Derrick W. Lucey
 John B. MacCormack
 Matthew W. Magener
 Julie A. Malburg
 Maureen C. Mann
 D. Jason Manzo
 Jessica F. Marcus
 Uwe C. Martens
 Elizabeth L. Mascia
 Renee L. McCarter
 Kerry M. McClain
 Amanda J. McCutcheon
 Gary S. McDowell
 Sean P. McGinnis
 Chris R. W. McIntosh
 Claire M. McKee
 Kirsten J. McLaughlin
 Ariane M. Mercadante
 Joseph R. Michalski
 Tara T. Middleton
 Michael J. Mikutaitis
 Karrie L. Miller
 Kurtz K. M. Miller
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 Jamie M. Monte
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 Heidi Munk
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 Elisabeth S. Nadin
 Jason C. Naiden
 Michelle K. Nannen
 Erica M. Napoleoni
 Daniel L. Narsavage
 Bernie G. Neumann
 Mike G. Nicholis
 Carrie L. Novak
 Torrey G. Nyborg
 Megan A. O'Connor
 James W. O'Rourke
 Marin Odak
 Pawel Olejczyk
 Tom J. Olson
 Kathleen M. Overman
 Penelope M. Padmore
 J. Shane Parrish
 Anne K. Paterson
 Timothy J. Pauley
 Christopher J. Pellowski
 Jessica Corrine Pendegraph

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POSITION AVAILABLE

Executive Director

The Geological Society of America (GSA) is seeking an individual to assume the duties of Executive Director as early as June 1, 1999. The selected individual will:

- Work with the Executive Committee and Council of GSA to implement a newly adopted Strategic Plan. Work closely with GSA Foundation Board and staff to coordinate and promote the directions and policies of the GSA Council.
- Maintain collaborative relationships with representatives of other national and international geoscience societies and organizations and actively pursue joint ventures that enhance the financial and scholarly status of the Society;
- Lead the GSA Headquarters staff of 65 persons. Articulate the vision and mission of the Society to staff and members through teamwork and collaborative efforts. Society activities include membership services, meetings; publications; education, public policy, and outreach; marketing/strategic communications; financial services; and information technology activities.

The new Director will work at the GSA headquarters in Boulder, Colorado, and will hold a position with competitive compensation and benefits.

REQUIREMENTS

- Provide leadership to diverse groups such as committees, associated societies, staff, and volunteers through collaborative teamwork.
- Commitment to strong interpersonal communication among and between staff, members, and volunteers. Proven record of motivating staff to develop new sources of revenues and to use technology to improve efficiencies.
- Master's degree in geosciences; Ph.D. preferred. Extensive management experience and achievements in the areas of accrual budgeting, financial planning and investments, and personnel management. Additional preparation in education, marketing, and/or business management encouraged.
- Commitment to geoscience research, public outreach and education programs, and scholarly publishing.
- Familiarity with marketing and public relations is important.
- Demonstrated familiarity with the geoscience community and GSA programs.

Submit a resume, the names and addresses of three references, and a letter describing your interest in the position to:

Executive Director Search Committee
The Geological Society of America
P.O. Box 9140
Boulder, CO 80301-9140

The deadline for applications or nominations is March 15, 1999.

New Associates *continued from p. 25*

David C. Percy
Duane C. Peterson
Michael W. Pfeifer
George E. Philips
Brian F. Platt
Laura A. Plitnik
Jason E. Poll
James H. Powell, Jr.
Matthew S. Powell
Kristen L. Power
Chad J. Pyatt
Garrett J. Quinn
Jeffrey M. Rahl
Lorraine M. Raley
Diane L. Ramirez
Bryant M. Reasnor
Stephen G. Redak
Stephan M. Regenfuss
Raquel L. Reinhardt
Theodore R. Ressler
Catherine A. Riihimaki
Mark Rits
Thomas A. Roberts
Kenneth R. Robitaille
Virginia T. Rodriguez
Regina G. Rone
Jodi E. Rosoff-Berkowitz
Bradley D. Ross
Kristi L. Ross
Angelo Pio Rossi
Keith A. Rudman
Juan A. Ruiz
Matthew T. Santner
Pete Saputo
Kenneth E. Savko
Annie M. Schaub
Renee D. Scherr
Jennifer L. Schick
Steven P. Schlinder
Mark E. Schlundt
Shawn D. Schmelzer
Chad C. Schopp
Ann M. Schwarz
Rebecca L. Scott
Stephen M. Scoville
Michelle G. Segal
Amber S. Seibert
Nicole M. Senczakiewicz
Carol A. Shaheen
Shawn A. Shapiro
Jeffrey M. Sheehan
David C. Shelley
Jason B. Shelton
Heath A. Shive
Jonathan M. Shub
Steve M. Silva
Emily Silverman
Paula M. Sime
Stephen R. Simmons
Chantal E. Simonpietri
Sarah Linell Simpkins
Jimmy P. Slusher
Rebecca E. Smith
Megan A. Snyder
Steven Sobieszczyk
Rachel M. Sobrero
Donald S. Sorbello

Jason R. Sorenson
Joseph M. Souney, Jr.
Robert M. Specia
Colin C. Steely
Kurt J. Steffen
Ryan S. Steigerwalt
Meredith C. Stephens
John H. Steup
Sarah W. Stevens
Pamela K. Stewart
Kevin R. Stitzinger
Keith W. Stuart
Michael D. Sturdy
Tina L. Styzle
Eugene Szymanski, Jr.
Adam P. Tagliamonte
Ta-Shana A. Taylor
Marissa A. Theall
Hannah J. Thomas
Jason F. Thomason
Matthew L. Thornton
Ann M. Tilia
Jason Tinant
Erin Todd
Christine C. Tonn
Jessica S. Toubman
Braxton B. Townsend III
Kristy L. Tramp
Simon M. Tregurtha
Kathryn A. Trembl
John R. Trimble
Joseph W. Truesdale
Christopher M. Turner
Carsten G. Vahle
Ryan G. Vannier
Van Vathanasin
Lauren J. Vigliotti
Mark A. Villeneuve
Kate Visser
Erik C. R. Wachtmeister
Heidi M. Wadman
Jennifer Allene Waggoner
Joan H. Walby
Selena M. Walko
Patrick J. Walter
Philip M. Ward
David A. Warholak
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Elizabeth A. Wettstone
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Jeffrey D. Wilcox
Lemuel Curly Williams, Jr.
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John R. Wilson
Brian L. Wingard
Amy L. Winkle
Donald A. Wood
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Kaplan B. Yakin
Mary T. Young
Steve L. Young
Melissa E. Yovanovich
Joanna H. Zarakowski
Alison M. Ziegler
Andrew S. Zimmerman ■

New GSA Fellows

Gary J. Axen	Anne M. Grunow	George R. McGhee
E. Scott Bair	Mary Jo Hall	Garry D. McKenzie
Anna K. Behrensmeyer	Susan D. Halsey	Marcia K. McNutt
Daniel F. Belknap	Kip V. Hodges	Robert K. Merrill
Steven R. Bohlen	John P. Hogan	Kenneth G. Miller
Samuel A. Bowring	W. Steven Holbrook	Claudia I. Mora
Maarten J. De Wit	Eugene D. Humphreys	Christopher Paola
Steven G. Driese	Deborah R. Hutchinson	Edward C. Roy, Jr.
Trevor Dumitru	Mary J. Kraus	Bruce N. Runnegar
Craig S. Feibel	Lawrence A. Krissek	Elisabeth C. Schwarzman
Mark D. Feigenson	William T. Laprade	Rudy L. Slingerland
Antony C. Fraser-Smith	Peter E. Malin	Karl H. Wiebe
William J. Gregg	Charles R. Marshall	Terry J. Wilson

1999 GSA SECTION MEETINGS

SOUTH-CENTRAL SECTION —

March 15–16, 1999, Lubbock, Texas. Information: Calvin Barnes, Dept. of Geosciences, Texas Tech, Lubbock, TX 79409-1053, (806) 742-3106, gical@ttu.edu. *Registration deadline: February 5, 1999.*

NORTHEASTERN SECTION —

March 22–24, 1999, Providence, Rhode Island. Information: O. Don Hermes, Dept. of Geology, University of Rhode Island, Green Hall, Kingston, RI 02881, (401) 874-2192, dhermes@uriacc.uri.edu. *Registration deadline: February 12, 1999.*

SOUTHEASTERN SECTION —

March 25–26, 1999, Athens, Georgia. Information: Samuel E. Swanson, Dept. of Geology, University of Georgia, Athens, GA 30602-2501, (706) 542-2415, sswanson@uga.cc.uga.edu. *Registration deadline: February 19, 1999.*

ROCKY MOUNTAIN SECTION —

April 8–10, 1999, Pocatello, Idaho. Information: Scott S. Hughes, Dept. of Geology, Idaho State University, 785 South 8th Ave, Pocatello, ID 83209-8072, (208) 236-4387, hughscot@fs.isu.edu. *Registration deadline: March 5, 1999.*

NORTH-CENTRAL SECTION —

April 22–23, 1999, Champaign-Urbana, Illinois. Submit completed abstracts to: C. Pius Weibel, Illinois State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820-6964, (217) 333-5108, weibel@igs.uiuc.edu. *Abstract deadline: January 11, 1999.*

CORDILLERAN SECTION —

June 2–4, 1999, Berkeley, California. Submit completed abstracts to: George Brimhall, Dept. of Geology & Geophysics, University of California, Berkeley, CA 94720-4767, (510) 642-5868, brimhall@socrates.berkeley.edu. *Abstract deadline: February 19, 1999.*

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Edward E. Geary and Cathleen May, Education, Outreach, and Policy Department, GSA

To Promote Geoscience in the Service of Society

With the approval of Council in October 1998, GSA has released its new strategic plan for comment and review (see this issue of *GSA Today*). We hope that you will take the time to review it and make suggestions to strengthen it. This plan has been developed over the last two years by over 100 GSA members. It is the result of heated debate, constructive dialogue, and creative synthesis of the ideas generated by GSA members, councilors, division officers, and committee representatives, as well as staff. We feel it is an exciting and dynamic vision of GSA's future. This plan is about YOU, our members, and how to serve you better, it is about the future of our science and profession, and it is about our responsibility to the Earth on which we live.

Goal 3 of the plan is a "call to arms" to all GSA members "to get involved." If we are to thrive as a scientific society and as a profession in the 21st century, all of us in the geosciences must reach beyond the boundaries of our discipline to other organizations, and to the public, the decision-makers, and the children who will shape our future. To do this, we must stress the importance and relevance of the geosciences and actively "Promote Geoscience in the Service of Society." Under goal 3 there are three main objectives: (1) To actively foster dialogue with the public and decision-makers on relevant geoscience issues, (2) To encourage and support member participation in education and societal outreach, and (3) To strengthen the role of geoscience in formal and informal science education. Following is a brief summary of what we are currently doing to promote geoscience in the service of society, and what we are thinking about doing in the near future.

Current Activities

Fostering dialogue with the public and decision-makers on relevant geoscience issues:

- The Congressional Science Fellowship Program supports the placement of outstanding earth scientists in the offices of members of Congress or congressional committees. This ongoing partnership between GSA and the U.S. Geological Survey has yielded a cadre of professional scientists and policy advisors. The unique experiences of the Fellows are an enduring and important resource for the geoscience community and for society.
- Our mentor programs, the Roy J. Shlemmon Mentorship and the Mann Mentorship in Applied Hydrogeology connect the applied and academic geology

communities, for the express benefit of graduate and advanced undergraduate students. Their common goals are to: expose geology students to the scientific challenges presented by the applied fields and inform students about professional opportunities outside academia. We hope to institute "virtual mentorships" covering the entire breadth of our science as well as Earth-system science via the World Wide Web, as GSA's web technology improves.

- Special workshops, designed to focus a disparate group of experts on a single, complex topic, are a primary tool for policy outreach. In 1998, IEE cosponsored two such workshops, one examining the utility and credibility of predictive modeling of natural systems, and one examining the social, cultural, and scientific impediments to conducting integrated, multidisciplinary science. Workshops in 1999 will address the needs of national parks for integrated science dealing with coastal ecosystems, and methods for increasing the scientific literacy of the media.

Encouraging and supporting member participation in education and outreach:

- Partners for Education Program (PEP): One of GSA's great success stories, this program has grown by leaps and bounds during the past six years. Now, with over 1800 active volunteers (including 600 e-mail partners), PEP builds connections between geoscientists, educators, students, and parents. PEP volunteers may visit classrooms, lead geology field trips, volunteer as docents at local museums, or answer student questions about the geosciences via the Internet. The opportunities are endless and the rewards are tremendous. If you want to make a difference in your community, this is a program you should learn more about.
- Annual and Section Meetings: Six years ago, there was only one topical session on education at the GSA Annual Meeting and not much talk about education



Visualization of earthquake data at the National Earthquake Information Center. ESSTEP 1998.

at the Section meetings. Today, at almost every GSA meeting, you will find a variety of dynamic technical sessions, workshops, field trips, and social activities for geoscientists and K-12 faculty interested in education. If you have never been to one of these events, you may want to save some room on your 1999 Annual Meeting schedule to help urban Denver students learn about the Earth via "Geoscience Day," a geo-field trip sponsored by our Committee on Minorities and Women. If you don't have an entire day to spend, we suggest you sign up for, or stop by, one of the education workshops or technical sessions at our 1999 Annual or Section meetings.

- National Park Internships: This program began two years ago with two undergraduate student interns in two national parks. Last year, we had six student interns in six different national parks. This year we hope to place ten interns in ten national parks. Undergraduate student interns do a variety of activities, from mapping fossil localities and creating resource databases using GPS and GIS, to collecting and curating samples, helping with field mapping, leading campfire talks, and improving the geology information and materials available to the park staff and the public. This program has turned out to be a great learning experience for the students and a great benefit to the parks.
- Earth Science Week: Started last year by the American Geological Institute, and endorsed by President Clinton and over 30 state governors, Earth Science Week provides all of us in the geoscience community with the opportunity to get involved in geoscience outreach. Look for this event to become one of the premier public geoscience events in the country over the next two to three years. This year, Earth Science Week, will be from October 10-17, 1999. If you would like to get involved in the fun and festivities, and promote the geosciences in your community, just give us a call or send us an e-mail.

Strengthening the role of geoscience in formal and informal science education:

- The Earth and Space Science Technological Education Project (ESSTEP): This is a fantastic professional development opportunity for teams of faculty in grades 8 through 16. Funded in part by a grant from the National Science Foundation, faculty participating in this project learn how to effectively integrate computer, information, and visualization technologies into their classrooms and

laboratories using a variety of innovative teaching and assessment techniques. While faculty are the direct beneficiaries of this project, improved student learning in the earth, space, and environmental sciences is the ultimate goal. If you and some of your colleagues are interested in taking advantage of this upcoming summer opportunity, and getting paid to boot, please contact Holly Devaul at hdevaul@geosociety.org for



Mapping using laser range-finding binoculars. Cypress College, ESSTEP 1998.

more information. Space is limited, and selection of teams is highly competitive, so please apply before March 1, 1999, and call us if you have any questions.

- Geoscience Education Through Intelligent Tutors (GETIT): Another collaborative project funded in part by the National Science Foundation, GETIT is an innovative, interactive, multimedia curriculum that helps students learn about energy in the earth system. Created by Cambrian Systems Incorporated, this CD-ROM learning product promotes individualized student learning about physical and earth science concepts, mathematics, and the nature of science. It is designed primarily for middle and high school students, but many college faculty have told us that they want it for their courses as well! Look for its release in early 1999.

Future Plans

As we move forward to achieve the goals and objectives of goal 3 during the coming years, we look forward to developing a number of new education and outreach initiatives. Ideas that are currently under discussion or development include:

- The Colorado Rock Park Project, a unique outdoor exhibit on the geology of Colorado, and the nation's first installation to assemble a representative sample of real rocks and fossils from a large area and place them in a spatial context. Visitors will explore the connections among landscape, geology, our cultural and natural history, and their daily lives. This prototype rock park is intended to foster appreciation, understanding, and curiosity about the landscape that will lead to further discover-

- ies. If our initial efforts are successful, look for state, regional, and local rock parks to spring up around the country.
- Collaborating with other members and organizations to develop a clearing-house for information and resources on Earth-systems science.
- Developing more mentorship and internship opportunities for undergraduate and graduate students in national parks, government agencies, and geoscience businesses and industries.
- Encouraging and supporting the development of student PEP chapters at colleges and universities across the country.
- Working with other organizations to build a world-class Web site for geo- and earth-systems science information, resources, educational materials, and career opportunities.
- Catalyzing the development of a strategic plan that would help school districts and high schools around the country with implementation of the Earth and Space Science Standards.
- Experimenting with new presentation and audience participation techniques for education workshops and technical sessions at GSA Annual and Section meetings.
- Developing educational product lines for our members, educators, and the public.

During the past six years we have seen member involvement in education and outreach activities increase from less than 1% to over 10%. During the next five years we would like to see even more GSA members taking an active role in promoting the geosciences. We invite you to join us as we reach out beyond the borders of our discipline to the public, to the decision makers, and to the children who will shape the future of our planet.

There are numerous opportunities to be involved, and there are numerous excuses not to be involved. Yes, it does take time, but the rewards are well worth the effort, both personally and for the people you interact with. In any event, it is up to you to decide how much time you can spend and what type of outreach you would like to do. Here are just a few examples of the ways you can be involved:

- Become a PEP volunteer or recruit another PEP volunteer.
- Help to organize a PEP student chapter at your college or university.
- Review educational and scientific Web sites for us.
- Translate your research in geo- and Earth-systems science into interesting, easy-to-read articles that we can disseminate to educators and the public.
- Send us examples of your best educational activities in geo and/or Earth-systems science.
- Let us know what types of outreach activities you are already doing or would like to do in your state or community.

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- Lead a local geology or Earth-systems field trip for the public.
- Volunteer to judge at your local science fair.

If you need help getting started, if you need information or educational resources, or if you have a great education or outreach idea to share with us, please give us a call at (303) 447-2020, ext. 162 or 145, or send us an e-mail at educate@geosociety.org. ■

GSA ON
THE WEB

Visit the GSA Web Site at <http://www.geosociety.org>. From our home page you can link to many information resources. Here are some highlights:

Research Grant information and application forms are now available on GSA's web page, <http://www.geosociety.org>. Evaluation from two faculty members are required on GSA appraisal forms. Applications and appraisals may be downloaded from the Web but will not be accepted by e-mail or facsimile. The deadline is February 1st each year for grants awarded in April.

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The Geological Society of America

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Appreciation and Thanks

The geoscientists listed here have completed the term 1996–1998 as Associate Editors for the *Bulletin* or Editorial Board members for *Geology*. GSA appreciates the contributions these people have made in evaluating manuscripts for the two journals; their volunteer efforts have helped us to maintain high scientific standards in the *Bulletin* and *Geology*.

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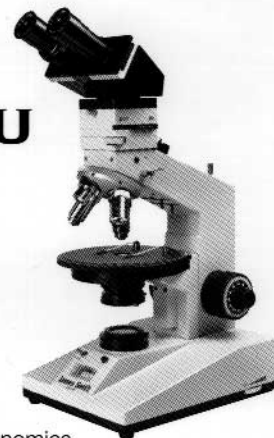
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If you wish to be considered, please submit a curriculum vitae and a brief letter describing why you should be chosen. If you wish to nominate another, submit a letter of nomination and the individual's written permission and c.v. Send nominations and applications to Peggy S. Lehr, Director of Publications, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, by April 14, 1999.

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Two GSA awards for support of research are a testimony to the generosity of the late W. Storrs Cole. The Gladys W. Cole Memorial Research Award provides support for the investigation of the geomorphology of semiarid and arid terrains in the United States and Mexico. It is to be given to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers on geomorphology. Funds cannot be used for work already accomplished, but recipients of a previous award may reapply if additional support is needed to complete their work. The amount of this award in 1999 will be \$11,000.

The second award, the W. Storrs Cole Memorial Research Award, was established to support research in invertebrate micropaleontology. This award will carry a stipend of \$9,000 in 1999 and will be given to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers on micropaleontology.

Additional information and application forms may be requested from the Research Grants Administrator, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, e-mail lcarter@geosociety.org.

All applications must be postmarked on or before February 1, 1999. Actions taken by the Committee on Research Grants will be reported to each applicant in April.

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GeoHostel

Geology of the Lewis and Clark Expedition— *The Three Forks of the Missouri River to the River of No Return, Montana and Idaho*

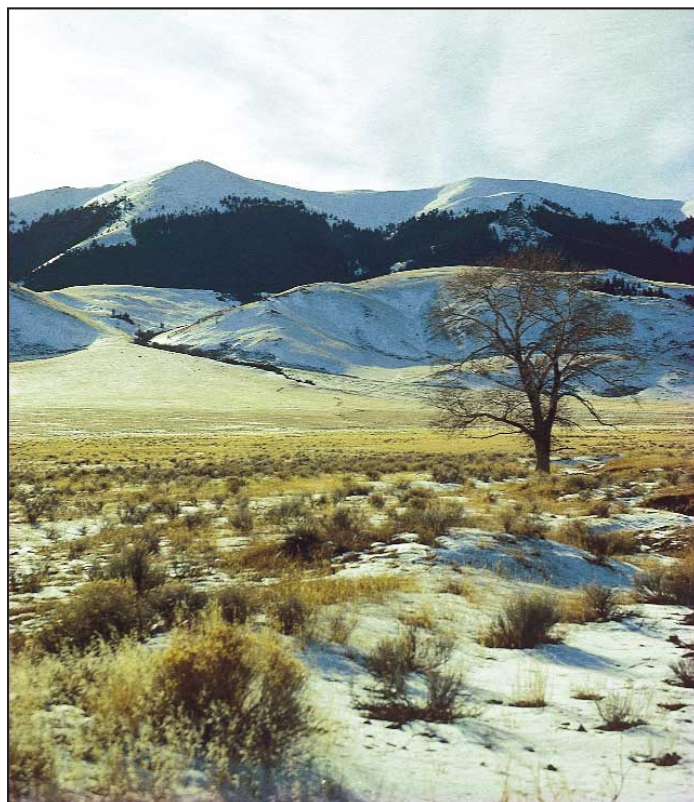
Western Montana College of the University of Montana,
Dillon, and Stagecoach Inn, Salmon, Idaho
July 17–22, 1999, (Saturday through Thursday)
5 days, 6 nights

Scientific Leaders

*Rob Thomas and Sheila Roberts,
Western Montana College, Dillon, Montana*

Rob Thomas is currently an associate professor and chair of the Department of Environmental Sciences at Western Montana College in Dillon. Rob developed an interest in the geology of the Lewis and Clark Expedition as a result of 13 years of research and teaching in southwestern Montana. His focus has been on the origin and timing of extensional tectonism in southwestern Montana, the dynamics of carbonate platform development and destruction, Cambrian mass extinctions, and field-based geoscience program development.

Sheila Roberts is currently an associate professor of geology in the Department of Environmental Sciences at Western Montana College in Dillon. Her focus has been on Pleistocene paleoclimates recorded in saline lacustrine sediments. Sheila is also a strong advocate for service-learning in the geosciences, and has mentored her students on a number of community service projects along the Lewis and Clark trail in southwestern Montana. As a native Montanan, Sheila is an enthusiastic and knowledgeable guide to the history and geology of the Lewis and Clark Expedition.



Along the Lewis and Clark Trail in southwest Montana. Photo by Rob Thomas.

Description

From 1804 to 1806, Meriwether Lewis and William Clark journeyed through the recently acquired Louisiana Territory on the order of President Thomas Jefferson. Arguably, the pivotal leg of the expedition was in present-day Montana and Idaho, from the three forks of the Missouri River, over the Continental Divide, to the River of No Return. This trip is a geological and historical tour of that famous landscape. Our expedition will have two base camps, Dillon, Montana, and Salmon, Idaho. The geological component of this GeoHostel will include field trips to see Archean metamorphic rocks, Proterozoic and Phanerozoic sedimentary rocks, Quaternary glacial deposits, hot springs and caverns, Sevier and Laramide compressional structures, and Tertiary extensional structures associated with the northern edge of the Yellowstone hotspot track. The historical component will include stops at important landmarks from the Lewis and Clark expedition such as the Three Forks, Beaverhead Rock, Clark's Lookout, Camp Fortunate, and the Continental Divide. The trip will also include a full-day raft trip on the Salmon River—the "River of No Return"—to see the spectacular geology of the river's canyon.

Lodging, Meals and Ground Transportation

The group will stay on Saturday, Sunday, Monday, and Thursday nights at Western Montana College, Dillon, and on Tuesday and Wednesday nights at the Stagecoach Inn in Salmon, Idaho. All lodging is based on single occupancy or doubles for couples. Meals will include plenty of hors d'oeuvres at the Welcoming Reception and Orientation on Saturday evening, daily breakfasts and sack lunches, dinner on Sunday, and a hearty farewell dinner on Thursday evening. Field trip transportation will be provided in air-conditioned, 15-passenger vans.

Alternative Housing in Dillon, Montana

Costs of alternative (non-Western Montana College) housing would be *in addition* to the GeoHostel fee. Reservations should be made directly by the registrant. Several motels are located in Dillon. GSA has reserved a small block of rooms at the following properties:

Centennial Inn, A Victorian Bed & Breakfast. Advance reservations are strongly recommended. Call the Centennial Inn direct at (406) 683-4454. Current double-room rate is \$75.00 per night.

Best Western Paradise Inn. Advance reservations are strongly recommended. Call Best Western direct at (406) 683-4214. Current double-room rate is \$57.00 per night.

Fee and Payment

\$750 for GSA Members. \$800 for Nonmembers.

A \$100 deposit is due with your reservation and is refundable through June 1, less \$20 processing fee. Total balance is due: June 1. Maximum number of participants: 32

Included: Classroom programs and materials; field trip transportation; lodging for six nights (single-occupancy, or double for couples); breakfast and lunch daily, dinner on Sunday, river raft trip, and welcoming and farewell events.

Not included: Transportation to and from Dillon, Montana; transportation during hours outside field trips; and other expenses not specifically included. ■

1999 Penrose Conferences

March

March 25–31, Mid-Cretaceous to Recent Plate Boundary Processes in the Southwest Pacific, Arthur's Pass, New Zealand. Information: Suzanne L. Baldwin, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721, (520) 621-9688, fax 520-621-2672, baldwin@geo.arizona.edu.

June

June 21–27, Terrane Accretion along the Western Cordilleran Margin: Constraints on Timing and Displacement, Winthrop, Washington. Information: J. Brian Mahoney, Dept. of Geology, University of Wisconsin, Eau Claire, WI 54702-4004, (715) 836-4952, fax 715-836-2380, mahonej@uwec.edu.

August

August 17–22, The Marine Eocene-Oligocene Transition, Olympia, Washington. Information: Donald R. Prothero, Dept. of Geology, Occidental College, 1600 Campus Road, Los Angeles, CA 90041, (213) 259-2557, fax 213-259-2704, prothero@oxy.edu.

November

November 14–19, Volcanic Rifted Margins, Sana'a, Yemen. Information: Martin Menzies, Dept. of Geology, Royal Holloway, University of London, Egham Hill, Egham, Surrey TW20 OEX, United Kingdom, 44-1784-443105, fax 44-1784-471780, menzies@gl.rhbc.ac.uk.

1999 Meetings

February

February 24–27, Karst Modeling, Charlottesville, Virginia. Information: Arthur Palmer, Dept. of Earth Sciences, State University of New York, Oneonta, NY 13820-4015, (607) 436-3064, fax 607-436-3547, palmeran@oneonta.edu.

March

March 1–4, International Conference on Mathematics/Science Education & Technology, San Antonio, Texas. Information: <http://www.aace.org>.

March 18–19, 15th Annual Mining and Land Resource Institute, Reno, Nevada. Information: Mining and Land Resource Institute, American Association of Professional Landmen, 4100 Fossil Creek Blvd., Fort Worth, TX 76137, (817) 847-7700, fax 817-841-7704.

March 21–25, Third Inter-American Dialogue on Water Management, Panama City, Republic of Panama. Information: Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC), P.O. Box 873372, Panama 7, Panama, phone (507) 228-7072, fax 507-228-3311, cathd3@sinfo.net, <http://www2.usma.ac.pa/~cathalac/dialogue3.htm>; or Inter-American Water Resources Network (IWRN), Technical Secretariat, Organization of American States, Unit of Sustainable Development, 1889 F Street, Washington, D.C. 20006, (202) 458-3556, fax 202-458-3560, iwrn@oas.org, <http://iwrn.ces.fau.edu/>.

April

April 5–7, CoastalGeo Tools '99, Charleston, South Carolina. Information: Steve Meador, NOAA Coastal Services Center, 2234 South Hobson Ave., Charleston, SC, 29405-2413, (843) 740-1334, fax 843-740-1315, smeador@csc.noaa.gov.

May

May 10–12, American Water Resources Association Annual Spring Specialty Conference, Atlanta, Georgia. Information: Atlanta Specialty Conference, 950 Herndon Pkwy., Suite 300, Herndon, VA 20170-5531, (703) 904-1225, fax 703-904-1228, awrahq@aol.com.

August

August 6–11, International Association of Mathematical Geologists 5th Annual Conference, Trondheim, Norway. Information: Stephen Lippard, Department of Geology and Mineral Resources Engineering, Norwegian University of Science and Technology, 7034 Trondheim, Norway, phone 47-73-594-828, fax 47-73-594-814, iamg99@geo.ntnu.no, <http://www.geo.ntnu.no/igb/iamg99/>.

September

September 19–22, North Atlantic Minerals Symposium, Dublin, Ireland. Information: NAMS, John Morris, Geological Survey of Ireland, phone 353-1-604-1473, fax 353-1-668-1782, morrisjo@tec.irg.gov.ie, or NAMS, Baxter Kean, Geological Survey of Newfoundland and Labrador, (709) 729-5946, fax 709-729-4491, bfk@zeppo.geosurv.gov.nf.ca.

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The Department of Geosciences invites applications for a tenure-eligible faculty opening in tectonics, to be filled by August, 1999. We seek applicants interested in carrying out teaching and research in the framework of large-scale tectonics problems and processes, such as those related to development of orogenic belts, growth of continents, linkages between crustal deformation and mantle dynamics, role of fluids in crustal processes, tectonics and magmatism, and interactions between tectonic processes and global climate. We are looking for individuals who approach broad-based tectonics problems from a geological perspective, yet who also draw substantively from geophysics and/or geochemistry, perhaps in part through harnessing data sets issuing from new and emerging technologies. Primarily we wish to attract applicants whose interests reside in understanding the processes that drive and control the dynamics of interaction of major components of Earth-scale tectonic systems. Rank is at the level of Assistant Professor. A Ph.D. or equivalent degree is required.

The Department of Geosciences is committed to sustained excellence in tectonics research, to innovation in the tectonics curriculum both at the undergraduate and graduate levels, and to leadership in graduate student training. The selection process will begin January 15, 1999, and will continue until the position is filled. Interested applicants should submit a curriculum vitae, a statement of research and teaching interests, and a list of at least three references (with addresses, e-mail, phone, and fax numbers) to: Joaquin Ruiz, Chair, Department of Geosciences, The University of Arizona, Tucson, AZ 85721; phone (520) 621-6024; Fax 520-621-2672; chair@geo.arizona.edu.

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Candidates are expected to complement existing areas of departmental expertise, and to develop strong cross-disciplinary research and teaching in such domains as: crust and mantle processes; sediment, water, atmosphere, life interactions.

Applications should include a statement of research accomplishments and future directions, curriculum vitae, copies of significant publications, names of at least three professional references, and be received by January 8, 1999. Address applications to: Search Committee, Dept. of Geological Sciences, 1847 Sheridan Road, Northwestern University, Evanston, IL 60208-2150.

Women and members of minority groups are encouraged to apply. Northwestern is an Affirmative Action and Equal Opportunity Employer.

KECK GEOLOGY CONSORTIUM SUMMER UNDERGRADUATE STUDENT/FACULTY RESEARCH PROJECTS

We seek two geoscientists who can provide research expertise and mentor ethnic minority students in our undergraduate research groups. The first position is for a geoscientist with expertise in GPS, field susceptibility, magnetics, electromagnetic conductivity, and/or electrical resistivity to assist in delineating an early 19th century Jamaican slave village. The second opening is for hydrologist, sedimentologist, or water geochemist to help assess human impact and natural remediation in a Pennsylvania watershed. Candidates may be employed in academia, industry, or government. A stipend of \$4500 and all expenses are paid for participation in a 5 week summer project. Interested persons should contact Dr. Cathryn A. Manduca, Keck Geology Consortium Coordinator at (507) 646-4425 or e-mail: cmanduca@carleton.edu. Positions are contingent on funding.

DIRECTOR AND STATE GEOLOGIST KANSAS GEOLOGICAL SURVEY

THE UNIVERSITY OF KANSAS, LAWRENCE, KS
The Kansas Geological Survey (KGS), Univ. of Kansas (KU), seeks a Director/State Geologist. Requires a doctorate in the geosciences with an outstanding record of research accomplishment, upper-level administrative experience, and knowledge of natural resources and environmental aspects of their use. Must have demonstrated the ability to work in a university setting, to deal effectively with public policy issues, and to obtain financial support for research programs. The successful candidate will also have qualifications suitable for an appointment in an academic department of KU.

The KGS is a premier earth-science research and service institution, with a reputation for excellence and scientific leadership. The KGS annual state-funded budget is \$5.8 million, plus \$2 million in external grants and contracts.

For a complete job description and application procedure (Ref #J00008363) contact Rex Buchanan, 1930 Constant Ave., Lawrence, KS 66047 (785) 864-3965, e-mail: rex@kgs.ukans.edu or visit the web site <http://www.kgs.ukans.edu/Director/index.html>. The position is open until filled with review of applications to begin 19 February 1999. Anticipated start date of 1 July 1999. Salary \$115,000 to \$130,000. KU is an EO/AA employer.

NORTHERN KENTUCKY UNIVERSITY PETROLOGIST/MINERALOGIST

Position as tenure-track Assistant Professor in geology begins August, 1999. Ph.D. in geology and teaching experience in geology required.

Applicants should possess a strong commitment to undergraduate teaching and conducting a modest research program. Teaching experience in mineralogy, igneous and metamorphic petrology is desirable. Successful candidate will teach introductory courses in geology, advanced undergraduate courses and labs (petrology, mineralogy, optical mineralogy and structural geology), lead field trips, and collaborate with faculty from various disciplines in the development and teaching of integrative science courses. Send letter of application, curriculum vitae, a separate statement of teaching philosophy and research interests, and the names, addresses, phone numbers, and e-mail addresses of three references to: Dr. John Filaseta, Chair of Geology Search Committee, Department of Physics and Geology, Northern Kentucky University, Highland Heights, KY 41099-1900. Applications will be accepted until Feb. 23, 1999. Additional information about the university and department can be found at: <http://www.nku.edu/~physics/>.

Northern Kentucky University's goal is to become a pre-eminent learner-centered metropolitan university with a primary focus on the intellectual, ethical and career development of its students. By offering its students broad access with the opportunity to succeed, the University actively contributes to the social, economic and cultural vitality of the northern Kentucky/greater Cincinnati region and the entire Commonwealth of Kentucky. In support of these commitments, the University encourages and supports a culture of scholarly achievement, intellectual freedom and creative problem solving. As part of a commitment to its own multicultural community, the University aggressively seeks to enhance our aspirations and who will take pleasure and pride in making its priorities an integral part of their professional lives. NKU is an AA/EOE. Women and minorities are strongly encouraged to apply.

NICHOLAS CHAIR OF EARTH AND OCEAN SCIENCES DUKE UNIVERSITY

The Division of Earth & Ocean Sciences (EOS) of the Nicholas School of the Environment (NSOE) at Duke University invites applications for a distinguished, tenured, full-professor appointment as a Nicholas Chair of Earth and Ocean Sciences. We are seeking an outstanding scientist with an established record of scholarly achievements in the earth and ocean sciences. We are particularly interested in scientists who work at a broad scale and examine the physical, chemical or biological processes and exchanges that occur at the interfaces of the atmosphere, biosphere, hydrosphere, and lithosphere. Those with expertise in (i) climate studies on various time scales, (ii) coastal oceanography, (iii) biogeochemistry, and (iv) surficial processes are especially encouraged to apply. The successful candidate will be expected to continue to develop their existing research program, as well as play an appropriate role in educational programs within Duke University. We are also interested in candidates whose research interests will foster linkages within NSOE and with other elements of Duke University.

EOS currently includes 14 full-time faculty, and 3 faculty with secondary appointments from other academic units. This position is one of 4 Distinguished Nicholas Chairs to be appointed in the Nicholas School of the Environment and part of a series of faculty hires in EOS focusing on processes affecting the Earth's surface and oceanic realms.

Duke University offers a wide range of supporting facilities and resources, including computational equipment, analytical instrumentation, the Duke University Marine Laboratory, and the R/V Cape Hatteras (jointly operated by Duke and the University of North Carolina). Please see our web site at <http://www.eos.duke.edu> for additional information.

Interested individuals should send a letter of interest and vitae to: Chair, Nicholas Chair Search Committee, Division of Earth & Ocean Sciences, Box 90230, Duke University, Durham, NC 27708-0230. The review of applicants will begin on February 1, and will continue until the position is filled. Duke University is an Equal Opportunity/Affirmative Action Employer.

DIVISION OF EARTH SCIENCES NATIONAL SCIENCE FOUNDATION (NSF) ARLINGTON, VA 22230

NSF's Division of Earth Sciences seeks qualified candidates for two leadership positions: (1) Head, Research Grants Section (EP99-2). This section coordinates the Division's core disciplinary programs (e.g. geology &

Classifieds continued on p. 38

TORONTO



1998 Meeting Statistics



TECHNICAL PROGRAM

Abstracts submitted	2,433
Abstracts presented	2,410
Abstracts rejected or withdrawn	23
Percentage of abstracts accepted	98.7%
Poster presentations (including theme posters)	676
Oral presentations	1,734
Oral presentations, discipline sessions	605
Oral presentations, theme sessions	785
Oral presentations, symposia	344
Highest number of concurrent oral sessions	17
Total number of sessions (including posters)	176
Theme sessions in poster format	8
Theme sessions in oral format	53

REGISTRATION

Professional	2,700
Student	1,465
Exhibitor	584
Guest	225
Total attendance	5,124

SHORT COURSES

Number of GSA-sponsored courses	8
Participants	161

FIELD TRIPS

Number of trips	12
Participants	358
Number of participants in one-day trips	223

EXHIBITS

Number of booths	217
Number of exhibiting companies	154

EMPLOYMENT SERVICE

Applicants	172
Employers	36
Interviews	271
Positions available	90



1999 Annual Meeting and Exposition



Denver, Colorado
October 25-28
Colorado Convention Center

Due date for Pardee Keynote Symposia and topical session proposals:
January 6, 1999

Electronic Proposal Form Available
November

Proposal form and guidelines available from:
GSA Web site, www.geosociety.org
November *GSA Today* (guidelines),
GSA Meetings Dept.
(303) 447-2020, ext. 133, or
fax 303-447-0648.

Proposals for Pardee Symposia must be submitted electronically.

GENERAL CO-CHAIRS

Mary J. Kraus
(303) 492-7251, fax 303-492-2606, kraus@spot.colorado.edu
David Budd
(303) 492-3988, fax 303-492-2606, budd@spot.colorado.edu
Both at Dept. of Geosciences, Campus Box 250,
University of Colorado, Boulder, CO 80309-0250

TECHNICAL PROGRAM CHAIRS

Craig Jones
(303) 492-6994, fax 303-492-2606, cjones@mantle.colorado.edu
G. Lang Farmer
(303) 492-6534, fax 303-492-2606, farmer@terra.colorado.edu
Both at Dept. of Geosciences, Campus Box 399,
University of Colorado, Boulder, CO 80309-0399

FOR FIELD TRIP INFORMATION

Call Edna Collis at GSA (303) 447-2020, ext. 134, ecollis@geosociety.org.
See November *GSA Today* for a preliminary list of trips.

Crossing Divides

DENVER MINI-CALENDAR

- 1999** www.geosociety.org/meetings/99
 January 6 — Symposia and Topical Proposals due to Technical Program Chairs
 April 1 — Call for Papers published and distributed
 May 1 — Electronic Abstract Submittal Form available on the GSA Web site
 June 1 — Registration and housing information printed in June *GSA Today*
 July 12 — Abstracts Deadline
 September 17 — Preregistration and Housing Deadline

Classifieds continued from p. 35

paleontology, tectonics, petrology & geochemistry, and hydrologic sciences). (2) Head, Special Projects Section (EP99-3). This section coordinates the Division's multidisciplinary and infrastructure activities (e.g., continental dynamics, instrumentation & facilities, education and human resources, and geophysics).

Appointment to these Senior Executive Service positions may be on a career or a 2- to 3-year limited term basis, with an ES-1 (\$106,412) to ES-3 (\$116,495) salary range. Alternatively, the incumbent may be assigned under Intergovernmental Personnel Act provisions. Applicants must have a Ph.D. or professional experience in at least one of the major subdisciplinary fields of the Earth Sciences, substantial research administrative experience, and demonstrated leadership ability.

The announcements, including position requirements and application procedures, are located on NSF's Homepage at www.nsf.gov/home/chart/work.htm. Applicants may also obtain a copy of the announcements by contacting the Executive Personnel and Development Branch on (703) 306-0755 (hearing impaired individuals may call TDD (703) 306-0189). Applications must be received by February 5, 1999.

NSF is an Equal Opportunity Employer.

MIT — PROFESSOR OF GEOBIOLOGY

The Department of Earth, Atmospheric, and Planetary Sciences at MIT invites qualified candidates to apply for a new faculty position in Geobiology. The level of the appointment will depend on qualifications. We seek an outstanding biologist deeply interested in both research and teaching who has specific expertise in the interactions between biological organisms and/or systems and geologic, hydrologic, oceanic, or atmospheric processes. Of special interest is the evolution over time of organisms and ecosystems through the joint action of biological and environmental dynamics. One or more of the current programs at MIT in the earth, atmospheric, hydrologic, oceanic, biological, climatic, and planetary sciences are expected to provide a significant and welcome resource to the new faculty member for interdisciplinary studies. Interested scientists should send a curriculum vitae, a one-page description of research plans, and arrange for three letters of professional references to: Professor Ronald G. Prinn, Head, Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Bldg. 54-918, Cambridge, MA 02139-4307, or by e-mail: rgp@mit.edu; Fax: 617-253-8298. MIT is an Equal Opportunity/Affirmative Action Employer.

PALEOBIOLOGY AND SURFICIAL PROCESSES BOWLING GREEN STATE UNIVERSITY

The Department of Geology invites applications for two tenure-track assistant professor positions starting in August, 1999. In both cases, the successful applicant is expected to teach effectively at the undergraduate and graduate level, maintain an active research program in designated specialty (i.e., paleobiology or surficial processes), supervise M.S. thesis projects, and contribute to the departmental emphasis in environmental geology (GIS, remote sensing, hydrogeology, and engineering geology) and natural resources. In addition, participation in the summer field geology camp (New Mexico and Colorado) would be desirable.

(1) Paleobiology: We seek an invertebrate paleobiologist with additional areas of specialization that are open but could include the Phanerozoic history of biodiversity, global environmental change, animal-sediment relationships or related topics. Teaching assignments could include introductory geology, historical geology, invertebrate paleobiology, and advanced courses in the candidate's specialty insofar as they advance the department's mission.

(2) Surficial Processes: We seek a quantitative geomorphologist with additional areas of specialization that are open, but could include coastal geomorphology, glacial geomorphology, pedology, or related topics. Teaching assignments could include introductory geology, geomorphology and advanced courses in the candidate's specialty insofar as they advance the department's mission.

Departmental facilities include: GIS/remote sensing laboratory (SGI & Sun workstations), classroom computing facility, geochemistry laboratory (AAS, SEM, XRD), sedimentology and hydrology laboratories, mineral kinetics laboratory, geophysical equipment (magnetometer, gravity meter, resistivity, shallow seismic, GPS), optical petrology laboratory, sample preparation facilities, sediment core laboratory, and field vehicles.

A Ph.D. is required by the time of employment. Applications (including a complete resume, a statement of teaching interests, a statement of research interests, and

three current letters of recommendation) should be sent to Chair, Faculty Search Committee, Department of Geology, Bowling Green State University, Bowling Green Ohio, 43403. Applications should be received no later than February 1, 1999. BGSU is an AA/EEOC employer, and women, minorities, veterans, or individuals with disabilities are urged to apply.

**CHAIR, DEPARTMENT OF GEOLOGY
EAST CAROLINA UNIVERSITY, GREENVILLE, NC**
Applications are invited for the position of Chair, Department of Geology, College of Arts and Sciences, East Carolina University, effective August 1999.

The successful candidate will be charged with guiding the continuing development of a dynamic science department consisting of 9 faculty strongly committed to excellence in teaching and research. The Geology Department has BS Professional and MS graduate degrees, and is one of the lead departments (geology, biology, and social sciences) in a recently approved interdisciplinary Ph.D. program in Coastal Resource Management to start in August 1999.

East Carolina University is the third largest of sixteen institutions in the University of North Carolina system with an enrollment of 17,500 students. The university consists of a College of Arts and Sciences, eleven professional schools, and a School of Medicine and has recently achieved Doctoral II status. The university and department are members of the N.C. Oceanographic Consortium and have close working ties with personnel at sister institutions having coastal and marine programs.

Field of specialization is open, but it should complement and dovetail with the new Ph.D. program. Requirements include: (1) A Ph.D. with a strong record of funded research and significant publications, (2) A clear vision of the future of earth sciences and a record of excellence in undergraduate and graduate teaching, (3) Excellent leadership capabilities and interpersonal skills, and (4) Administrative experience at the department level or equivalent. Appointment will be at the rank of tenured full professor with competitive salary and start-up funds.

Submit a letter of application outlining your qualifications; research, teaching, and administrative philosophy; reasons for seeking the position; a current vita; copies of all degree transcripts (official copies required at time of employment); and names and contact information of four persons willing to provide recommendations. Send the completed package to: Dr. Robert Bernhardt, Chair of Search Committee, Department of Mathematics, East Carolina University, Greenville, NC 27858-4353. The position is open until filled; screening begins on January 15, 1999.

An Equal Opportunity/Affirmative Action University. Accommodates individuals with disabilities. Applicants must comply with the Immigration Reform and Control Act.

FLORIDA ATLANTIC UNIVERSITY

Florida Atlantic University, Charles E. Schmidt College of Science, Department of Geography and Geology invites applications for two positions for the 1999-2000 academic year. Both positions require an earned Ph.D. and appointment begins mid-August 1999.

Position 1. Tenure-track assistant professor of geology. The Department seeks additional faculty support in stratigraphy and sedimentology, modern field methods, and undergraduate field camp. Additional areas of expertise and interest from within the following: environmental geology, engineering geology, hydrogeology, and paleoenvironments. Documented ability and interest in quality teaching and a record of or demonstrable aptitude for funded research required.

Position 2. A non-tenure-track visiting faculty member to support our hydrogeological modeling program. Ability to teach graduate groundwater flow modeling and assist in an ongoing groundwater research program in south Florida is essential.

Responsibilities include appropriate teaching, scholarship, and service in support of the Department's baccalaureate and masters programs. The Department consists of 13 full-time geologists and geographers along with several part-time faculty and adjunct instructors. Salary is competitive.

Applications should include a summary statement of qualifications and interests, academic transcript, curriculum vitae, and a list of references (references will be contacted directly). Apply: Ronald R. Schultz, Chair, Department of Geography and Geology, Florida Atlantic University, Boca Raton, FL 33431. Phone (561) 297-3250, Fax 561-297-2745, e-mail SchultzR@fau.edu. Please visit our web site at <http://www.geogool.fau.edu> for further information on our programs and faculty interests. FAU is an Equal Opportunity/Equal Access/Affirmative Action Institution. Closing date is February 20, 1999. Positions are subject to availability of funding.

LECTURER IN EARTH SCIENCE EDUCATION UNIVERSITY OF NORTHERN COLORADO

Earned master's or doctorate from an accredited institution in some area of the earth sciences, with demonstrated expertise in science education, or earned master's or doctorate in science education with expertise in the earth sciences. Successful middle/high school teaching experience required. College-level teaching experience and the ability to involve undergraduate and graduate students in research are desired. Responsibilities include teaching an equated load of 12 credits per semester and service: introductory-level courses, earth science concepts for elementary teachers, and secondary science methods. Participation is required in the teacher education partnership schools program. Salary commensurate with qualifications and experience; benefits comprehensive. Starting date: August 18, 1999. For complete position announcement, application process, contacts, and information about the Department, go to: <http://met.unco.edu>. Screening will begin Dec. 15, 1998 and continue until a candidate is selected.

UNC is an AAEO employer and is committed to fostering diversity in its student body, faculty and staff.

SCHOOL OF GEOLOGY AND GEOPHYSICS AND THE OKLAHOMA MUSEUM OF NATURAL HISTORY ASSISTANT PROFESSOR/ASSISTANT CURATOR OF MICROPALAEONTOLOGY OR PALEOBOTANY

The University of Oklahoma announces a position starting July 1, 1999, for an Assistant Curator of Micropaleontology or Paleobotany in the Oklahoma Museum of Natural History and Assistant Professor (tenure-track) in the School of Geology and Geophysics. This is a full-time (12-month) joint appointment. The successful candidate will have access to state-of-the-art facilities in the School of Geology and Geophysics housed in the Sarkeys Energy Center, and in the new Sam Noble Oklahoma Museum of Natural History, which is scheduled to be completed in March, 1999.

We seek a field-oriented, specimen-based paleontologist who uses surface or subsurface data from marine and/or terrestrial microfossils, or plant macrofossils, to address major problems in paleoecology, paleoclimatology, paleoceanography or stratigraphy. The successful candidate will also demonstrate expertise in the core paleontological areas of systematics and biostratigraphy. As a museum curator, responsibilities will include extensive scholarly research, and significant dedication to collection care, development and interpretation. In addition to ensuring adequate care of the collections, the curator also assists in the interpretation of his/her discipline to the public. He/she will work with the museum's exhibits and education staff to design displays and to provide public programs and instructional aids. Duties as a faculty member in the School of Geology and Geophysics include the development of a vigorous program of research and teaching at the undergraduate and graduate levels. Supervision of graduate students will be a central component of the teaching responsibilities, and the successful candidate should be able to contribute to programs in basin analysis and petroleum geosciences.

The successful candidate should show strong research potential as demonstrated by a record of publication and presentations at conferences. He/she will also demonstrate success, or potential for success, in gaining external research funding. Excellent communication skills, both in public speaking and in university teaching, are required; experience in display work, public programming or related activities will be an asset. Candidates should have prior experience in collection care and management, as demonstrated by work with repository collections, assembly of collections or use of collections.

Salary will be commensurate with experience. Candidates should have completed all requirements for the Ph.D. at the time of application; post-doctoral experience will be an asset.

Applicants should send a curriculum vitae, statement of teaching and research interests, and arrange for 3 letters of reference to be sent to Dr. Stephen Westrop, Search Committee Chair, School of Geology & Geophysics, University of Oklahoma, 100 E. Boyd Avenue, Norman, OK 73019. Screening of candidates will begin February 1, 1999, and will continue until the position is filled. For additional information about the University and the Museum, please visit our Web Sites at <http://www.ou.edu/> and <http://www.omnh.ou.edu>. Women and minorities are encouraged to apply. The University has a policy of being responsive to the needs of dual-career couples. The University of Oklahoma is an equal opportunity/affirmative action employer.

**CALIFORNIA INSTITUTE OF TECHNOLOGY
PROFESSORIAL APPOINTMENT
IN EARTH AND PLANETARY SCIENCES**

The Division of Geological and Planetary Sciences at the California Institute of Technology invites applications from geological and/or planetary scientists for a tenure-track position at the assistant professor level, although candidates seeking tenured professorial positions will also be considered. The initial term of appointment for a non-tenured position is normally four years, and appointment is contingent upon completion of the Ph.D. degree. We are seeking highly qualified candidates who are committed to a career in research and teaching, without regard for area of specialization in the earth and planetary sciences. Areas of interest in the Division include, but are not limited to, geochemistry, geobiology, global scale environmental systems, fundamental processes in the evolution of the earth, atmospheric and ocean system studies, seismology and physics of earthquakes, and planetary science and astronomy.

Applications should include a curriculum vitae, a list of papers published and submitted (with refereed papers indicated), a brief essay describing the applicant's research interests and the program of research he or she proposes to carry out at Caltech, together with the names and addresses of at least three references (including e-mail addresses if available).

Applications should be sent to Marcia Hudson, Mail Stop 170-25, California Institute of Technology, Pasadena, CA 91125, USA.

Caltech is an Equal Opportunity/Affirmative Action employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

**FORT LEWIS COLLEGE
ASSISTANT PROFESSOR OF GEOLOGY**

Tenure-track position anticipated Fall, 1999. Ph.D. required. Primary teaching responsibilities include stratigraphy, sedimentology, paleontology, historical geology. Must be active in research/scholarly work, especially undergraduate research. Expertise in petroleum geology, environmental geology, hydrogeology, structural geology, or geophysics desirable. Additional teaching obligations may include general education courses. Send letter of application, resume, statement of teaching and research goals, and names and addresses of three references, postmarked by February 15, 1999, to: Dr. Douglas C. Brew, Department of Geology, Fort Lewis College, 1000 Rim Drive, Durango, CO 81301-3999. Official transcripts will be requested of semi-finalists. FLC is an AA/EEO.

**SEDIMENTARY GEOLOGY/HYDROGEOLOGY
OBERLIN COLLEGE**

The Department of Geology at Oberlin College invites applications for a non-continuing faculty position in the College of Arts and Sciences. The appointment is for one year beginning July 1, 1999.

In the fall semester, the incumbent will teach an introductory course in Environmental Geology and an advanced undergraduate course in either Sedimentary Geology or Surface Processes. In the spring semester, she or he would teach an intermediate undergraduate course in Hydrogeology and an additional elective course appropriate to her or his expertise. He or she will also be expected to supervise undergraduate research projects.

Among the qualifications required for the appointment is the Ph.D. degree in hand or expected by December 1999. Candidates must demonstrate interest and potential excellence in undergraduate teaching. Successful teaching experience at the college level is desirable.

The Department consists of four full-time faculty members. We currently have about 30 junior and senior majors, with approximately equal numbers of men and women. The faculty encourage students to conduct Honors and other research projects. The Department has extensive teaching collections as well as a technician for preparation of rock samples and thin sections. Northern Ohio offers excellent exposures of clastic and carbonate sedimentary rocks. In addition, the College has a yearly competition for research grants for which all faculty may apply.

To be assured of consideration, letters of application, including a curriculum vitae, graduate academic transcripts, and three letters of recommendation should be sent to Steven F. Wojtal, Chair, Department of Geology, Oberlin College, Oberlin OH 44074 (steven.wojtal@oberlin.edu) by February 21, 1999. Application materials received after that date may be considered until the position is filled. Salary will depend on qualifications and experience. Oberlin College has admitted women since its beginnings in 1833 and has been historically a leader in the education of African-Americans.

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Opportunities for Students

Keck Geology Consortium. Undergraduate Research Opportunities. The Keck Geology Consortium has openings in its summer research program for both sophomore and junior students. Junior students who have declared a geology major are invited to apply for any of six projects involving four weeks of summer research followed by term or year of independent study at the student's home institution. Sophomore students who are members of ethnic groups underrepresented in the sciences and have completed one geology course are invited to apply for five weeks of research studying human impact and natural remediation in a Pennsylvania watershed or using geophysics to delineate an early 19th century Jamaican slave village. Students receive a stipend of \$1200 and expenses. Applicants must be U.S. citizens or permanent residents and have a faculty sponsor who agrees to supervise their work at the home institution. Information and application materials are available at www.carleton.edu/curricular/GEOL/resource/keck/keck.html or from Dr. Cathryn A. Manduca, Keck Geology Consortium Coordinator at (507) 646-4425, or e-mail: cmanduca@carleton.edu. Student selection will begin Feb. 14, 1999. Positions are contingent on funding.

Studies in Faulting, University of Nevada, Reno. Applications are invited from outstanding students for graduate work on faulting and brittle tectonics, with emphasis on field work, kinematics, and fault mechanics. 1-2 new positions are anticipated to start in August 1999, subject to funding. The successful applicants will possess strong academic skills, be highly motivated, and have demonstrated prior experience in research. Ph.D. applicants preferred. Applicants must also have background and/or experience in higher mathematics/numerical analysis; M.S. degree in geology or geophysics would be an asset. Related attributes include good interpersonal skills along with proficiency in computer applications including Unix systems; engineering courses would be a plus. UNR is located in a setting ideal for field work and world-class recreation.

Qualified and interested students should contact Dr. Richard Schultz, Geomechanics-Rock Fracture Group, Geological Engineering Program, Department of Geological Sciences/172, University of Nevada, Reno, NV 89557-0138; (508) 289-3459; E-mail (preferred), rschultz@lgs.jussieu.edu. For information on specific program areas visit <http://www.unr.edu/homepage/schultz>. Application materials and Departmental information are available from ramos@mines.unr.edu.

Graduate Studies in Geology & Geophysics, Boston College. The Department of Geology & Geophysics at Boston College invites applications for graduate study. Students can earn M.S. degrees in Geology or Geophysics, or a Masters of Science in Teaching (M.S.T.) in Geology. In addition, we now have a 3-year combined M.S./M.B.A. program involving the Carroll Graduate School of Management and the Department of Geology and Geophysics. We seek applicants with undergraduate degrees in a variety of subject areas, including biology, chemistry, computer science, earth science, engineering, environmental studies, and mathematics.

Research opportunities are available in areas such as interpretive tectonics, structural geology, seismology, and environmental geology and geophysics. See our web page <http://www.bc.edu/geology> for further specialties, and details about laboratory facilities.

Boston College offers both Teaching and Research Assistantships, and participates in an aggressive internship program.

For more information, or an application, contact Dept. of Geology & Geophysics, Boston College, Devlin Hall

213, Chestnut Hill, MA 02467-3809. Phone (617) 552-3640; Fax 617-552-2462; e-mail: john.ebel@bc.edu. Applications received by February 1, 1999, will receive fullest consideration.

Paleontology Internship. Florissant Fossil Beds National Monument in Colorado is offering volunteer summer positions for undergraduate or graduate student interns in paleontology. The area's paleontology consists of late Eocene plants and insects. Interns assist with projects in paleontology, including excavation, preparation and cataloging of fossils, inventory and monitoring of sites, database entries, and research. Qualifications include course work for a degree in geology or biology, with an emphasis in paleontology. Academic credit may be arranged. Applications should include a resume, transcript, two letters of reference, and a letter outlining the applicant's specific interests. Those who propose to use a portion of their time for self-initiated research should include a statement explaining their areas of potential research interest, and, if selected, will be required to submit a formal research proposal. The program is scheduled for June 1 to August 21, although some flexibility may be possible. Benefits consist of housing and a daily stipend of \$12. A personal vehicle is strongly recommended. Applications must be received by March 20 and should be sent to Herb Meyer, Paleontologist, Florissant Fossil Beds National Monument, P.O. Box 185, Florissant, CO 80816. For more information, e-mail Herb_Meyer@nps.gov.

Jonathan O. Davis Scholarship, administered by the Quaternary Sciences Center, Desert Research Institute. The family and friends of Jonathan O. Davis, a prominent geologist and geoarchaeologist, have established an endowment which provides an annual scholarship of \$2,000. Jonathan was tragically killed in an automobile accident in December 1990. It is the wish of his family and friends to support graduate students working on the Quaternary geology of the Great Basin and surrounding areas.

The scholarship is open to graduate students enrolled in an M.S. or Ph.D. program at any university in the United States. "Quaternary geology" encompasses a wide range of topics normally considered as part of the Quaternary sciences. The research, however, must have a substantial geologic component or demonstrate a strong reliance on geological techniques.

Applications should include: (1) a cover letter explaining how the individual qualifies for the award (please include your social security number); (2) a current resume or vitae; (3) 2-page, single spaced description of the thesis/dissertation research which also clearly documents the geological orientation and research significance; (4) a letter of recommendation from the thesis/dissertation supervisor that emphasizes the student's ability and potential as a Quaternary scientist.

Applications must be post-marked by March 1, 1999. Applications should be addressed to: Executive Director, Quaternary Sciences Center, Desert Research Institute, 7010 Dandini Blvd., Reno, NV 89512. Contact: Mary Ann Moran, (702) 673-7458; or e-mail mmoran@dri.edu.

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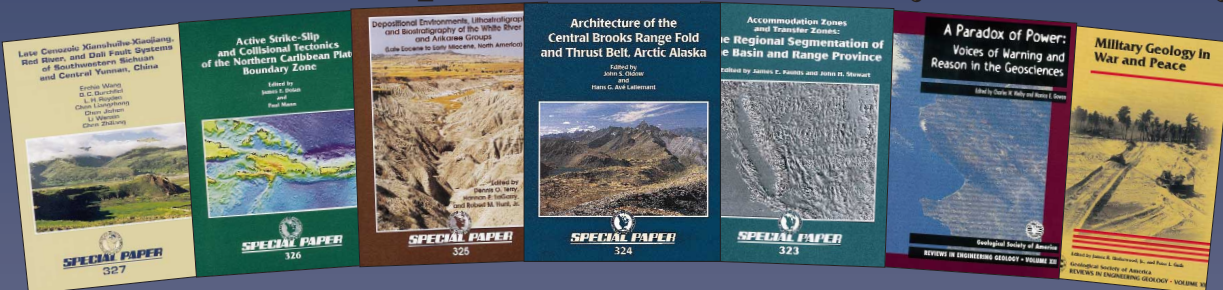
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Military Geology in War and Peace

edited by J. R. Underwood, Jr., P. L. Guth, 1998

In warfare, military geologists pursue five main categories of work: tactical and strategic terrain analysis, fortifications and tunneling, resource acquisition, defense installations, and field construction and logistics. In peace, they train for wartime operations and may be involved in peace-keeping and nation-building exercises. The classic dilemma for military geology has been whether support can best be provided by civilian technical-matter experts or by uniformed soldiers who routinely work with the combat units. In addition to the introductory paper this volume includes 24 papers, covering selected aspects of the history of military geology from the early 19th century through the recent Persian Gulf war, military education and operations, terrain analysis, engineering geology in the military, use of military geology in diplomacy and peacekeeping, and the future of military geology.

REG013, 256 p., ISBN 0-8137-4113-0, \$76.00, Member price \$60.80

A Paradox of Power: Voices of Warning and Reason in the Geosciences

edited by C. W. Welby and M. E. Gowan, 1998

The 13 papers in this volume illustrate issues and opportunities confronting geologists as they bring their knowledge and understanding to bear in matters related to public health and welfare. Public decisions and decision-making processes in the face of geologic complexity and uncertainty are the subject of the first group of papers. In the second group, several "voice of warning" papers illustrate the use of geologic knowledge and research to warn the public of health hazards derived from geologic materials and processes. A third group of papers, in the "voice of reason" section, describes use of geologic knowledge to help lower the costs of mitigation and avoidance of geologic hazards. Finally, ethical and philosophical questions confronting geoscientists are discussed and issues of "truth" as related to the legal process and questions about the adequacy of information in making decisions about long-term radioactive waste disposal are discussed.

REG012, 185 p., ISBN 0-8137-4112-2, \$64.00, Member price \$51.20

Active Strike-Slip and Collisional Tectonics of the Northern Caribbean Plate Boundary Zone

edited by J. F. Dolan, P. Mann, 1998

This volume presents an integrated set of four chapters on the geological, geophysical, and seismological nature of a 1,000-km-long segment of the active Caribbean-North America plate boundary between Puerto Rico and southern Cuba. The complex plate boundary zone revealed by these combined onland and offshore data encompasses an along-strike transition from oblique subduction to strike-slip deformation; a zone of active collisional underthrusting of high-standing Bahamas carbonate banks; a major restraining bend similar in character to the Big Bend region of the San Andreas fault system in California; and opposing subducted slabs that collide in the upper mantle beneath western Puerto Rico. This is the first comprehensive description of the Septentrional fault—the major plate-boundary, sinistral strike-slip fault—and the offshore zone of predominantly contractional deformation formed between the obliquely colliding Bahamas banks and the island of Hispaniola. The authors also discuss earthquakes, while placing constraints on the mechanics and geometry of the deep plate boundary, as well as on the orientation of relative plate motions. This combined data set delineates the relations between plate motions, the active faults that accommodate these motions, the earthquakes generated by these faults, and the seismic hazards that the earthquakes pose to this densely populated and rapidly developing region.

SPE326, 186 p., indexed, ISBN 0-8137-2326-4, \$60.00, Member price \$48.00

Late Cenozoic Xianshuihe-Xiaojiang, Red River, and Dali Fault Systems of Southwestern Sichuan and Central Yunnan, China

by E. Wang, B. C. Burchfiel, L. H. Royden, Chen Liangzhong, Chen Jishen, Li Wenxin, 1998

The Tibetan plateau and its surrounding mountain ranges and basins are a natural laboratory in which to study geological processes ranging from continental collision tectonics to effects of plateau development on climate. Three active fault systems, the Xianshuihe-Xiaojiang, Red River, and Dali, offer clues about the extrusion of crustal fragments eastward from the Tibetan plateau, how far back into time the present pattern of deformation can be projected, and the relation between these fault systems and the intracontinental deformation of the India-Eurasia collision zone. The region of these fault systems is an example of rapid changes in partitioning of strain during 5 m.y. in a rotational tectonic regime.

SPE327, 112 p., ISBN 0-8137-2327-2, \$41.00, Member price \$33.00

Tectonics and Geochemistry of the Northeastern Caribbean

edited by E. G. Lidiak and D. K. Larue, 1998

This up-to-date account of the geology of the northeastern Caribbean plate boundary region is the first general summation of this region since the publication of the DNAG series volume (H) on the Caribbean region (1990). The primary focus of this Special Paper is on the tectonics and geochemistry of the plate boundary, with emphasis on the island of Puerto Rico, the Puerto Rico trench, and adjacent areas. Following an introductory chapter on tectonic setting and stratigraphic correlations of the volcanic strata in Puerto Rico, five papers deal with geochemical aspects of these and related igneous rocks. A second group of three papers explores the tectonics and stratigraphy of Tertiary and younger rocks along the north coast of Puerto Rico and in the adjacent Puerto Rico trench. This volume is an excellent companion to GSA Special Papers 262 and 295; all three concern the circum-Caribbean plate margins.

SPE322, 222 p., indexed, ISBN 0-8137-2322-1, \$68.00, Member price \$54.40

Accommodation Zones and Transfer Zones: The Regional Segmentation of the Basin and Range Province

edited by J. E. Faulds and J. H. Stewart, 1998

The heterogeneous distribution of strain produces regional segmentation of extended terranes and a variety of fault-related structures known as accommodation zones and transfer zones. Interest in such structures has increased rapidly in recent years, owing to the recognition that segment boundaries may act as barriers to earthquake rupture, commonly host large hydrocarbon accumulations, and are critical for understanding the three-dimensional geometry of extensional orogens. This volume focuses on the geometry, kinematic development, and origin of regional segmentation structures within the Basin and Range province of western North America. Contributions range from analysis of individual structures to broad regional syntheses, including a new map of Basin and Range structures and tilt domains. Several papers discuss the implications of regional segmentation structures in assessing seismic hazards, hydrocarbon and mineral resources, and ground-water supplies. On the basis of characteristic geometries in the Basin and Range and other extended terranes, a new classification for regional segmentation structures is also proposed.

SPE323, 257 p., 1 color plate, ISBN 0-8137-2323-X, \$60.00, Member price \$48.00

Architecture of the Central Brooks Range Fold and Thrust Belt, Arctic Alaska

edited by J. S. Oldow, H. G. Avé Lallemant, 1998

The 17 papers in this volume present the results of a decade of geological and geophysical research centered largely along a north-south transect through the central Brooks Range of Arctic Alaska. Investigations and results center on a comprehensive description of the rocks and their tectonic evolution from the foreland to the hinterland of the orogen; the geometry and kinematics of contractional and extensional structures, regional and local stratigraphic relations, thermochronology, and the deep crustal structure of the Brooks Range and parts of the North Slope; and detailed descriptions of the major lithotectonic assemblages composing the orogenic belt. This volume offers a unique perspective of a fold-thrust belt and should prove useful in the study of other contractional belts around the world.

SPE324, 268 p., ISBN 0-8137-2324-8, \$70.00, Member price \$56.00

Depositional Environments, Lithostratigraphy, and Biostratigraphy of the White River and Arikaree Groups (Late Eocene to Early Miocene, North America)

edited by D. O. Terry, Jr., H. E. La Garry, R. M. Hunt, Jr., 1998

The Paleogene-Neogene transition in nonmarine rocks of the North American midcontinent lies within the White River and Arikaree Groups of late Eocene to early Miocene age. This volume presents current lithostratigraphic revision and magnetostratigraphy of these fine-grained volcanoclastic sediments, known for over a century for their abundant fossil mammals. Interbedded tuffs, paleomagnetic zonation and mammalian faunas in the White River and Arikaree rocks provide a revised correlation to other important areas of similar age within North America at a critical time in Earth history—the dawn of the Neogene.

SPE325, 224 p., ISBN 0-8137-2325-6, \$69.00, Member price \$55.20

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