

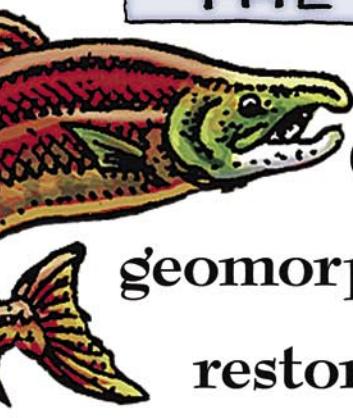
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NOVEMBER 2004



Geology,
geomorphology, and the
restoration ecology
of salmon

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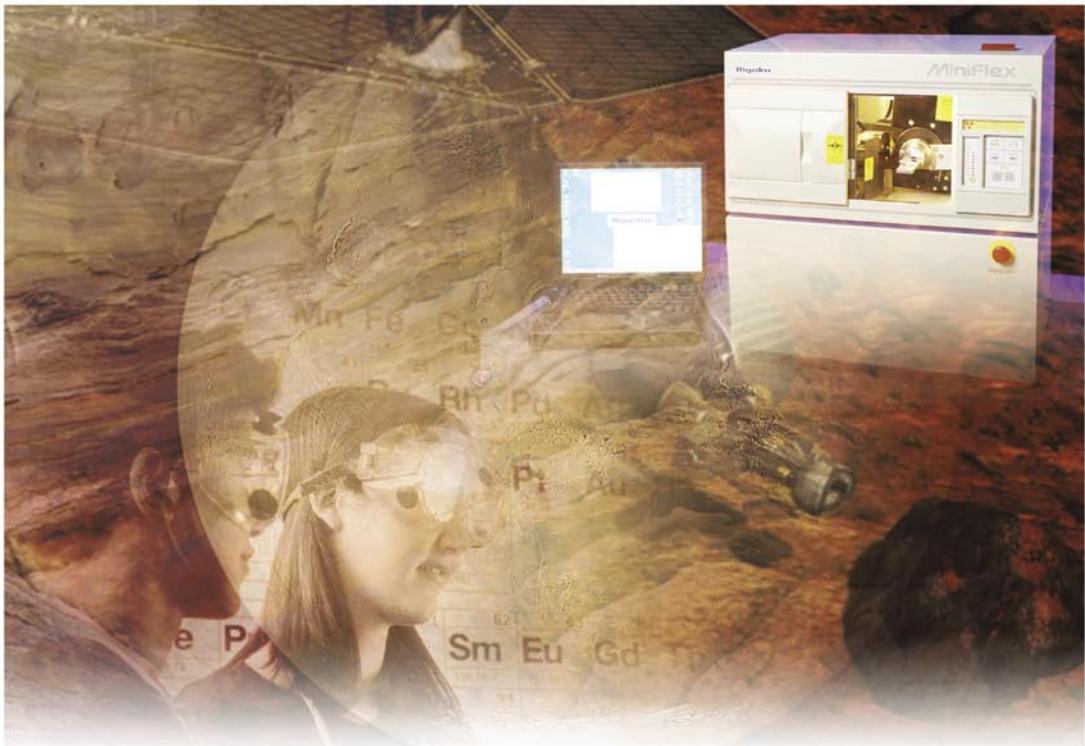
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Geology, geomorphology, and the restoration ecology of salmon

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ABSTRACT

Natural and anthropogenic influences on watershed processes affect the distribution and abundance of salmon across a wide range of spatial and temporal scales, from differences in species use and density between individual pools and riffles to regional patterns of threatened, endangered, and extinct runs. The specific impacts of human activities (e.g., mining, logging, and urbanization) vary among regions and watersheds, as well as between different channel reaches in the same watershed. Consequently, recognizing and diagnosing the nature and causes of differences between historical and contemporary fluvial and watershed conditions and processes can require careful evaluation of both historical and spatial contexts. In order to be most effective, the contribution of geomorphological insights to salmon recovery efforts requires both assessment protocols commensurate with providing adequate knowledge of context, and experienced practitioners well versed in adapting general theory to local settings. The substantial influences of watershed processes on salmon habitat and salmon abundance indicate the need to incorporate insights from geology and geomorphology into salmon recovery efforts.

INTRODUCTION

Salmon have been extirpated across almost half of their historic range in the continental United States (Nehlsen et al., 1991) and individual species are considered as either threatened or en-

dangered under the federal Endangered Species Act throughout much of their remaining range in California, the Pacific Northwest, and New England. Fishing pressure, ocean conditions, and the amount, condition, and accessibility of freshwater habitat all affect salmon abundance, and these historic anthropogenic influences on declining salmon populations are often lumped into the so-called four Hs of harvest (overfishing), hydro (dams), hatcheries, and habitat. Regionally, however, the size of salmon populations relative to their historical levels tracks the extent

and intensity of human development: New England's Atlantic salmon (*Salmo salar*) have dwindled to <1% of their historical population and Pacific salmon (*Oncorhynchus* spp.) account for <10% of their historical abundance in the continental United States, whereas Alaska's Pacific salmon are thought to exceed their historical population (Table 1). Although all four Hs contributed to the decline of salmon in differing (and often unknown) proportions in different watersheds, the general correspondence between the overall condition of salmon populations and the extent of historical

TABLE 1. AVERAGE OF ESTIMATED HISTORIC AND CURRENT SALMON POPULATIONS IN DIFFERENT REGIONS

Region	Historic (1000s of fish)	Current (1000s of fish)	Current/Historic (%)
Alaska	175,160	187,470	>100
British Columbia	68,556	24,800	36
California	3,060	278	9
Puget Sound	20,036	1600	8
Oregon Coast	3,074	213	7
Columbia River	13,072	221	2
Washington Coast	3,935	72	<2

Note: Data from Gresh et al. (2000).



Figure 1. Phylogeny of the Salmoninae (Stearly and Smith, 1993) as drawn by Ray Troll (©2003 Ray Troll).

changes to their river systems implicates habitat degradation as a major factor in historic decreases in salmon abundance (Frissell, 1993). Consequently, insights from geomorphology and geology, as well as ecology, are essential for designing river restoration measures intended to benefit salmon and their ecosystems.

The salmon's life cycle involves residing in fresh water as juveniles before migrating through whole river systems to and from the sea and then finally returning to their natal stream to spawn and die. This characteristic life history makes their abundance strongly dependent on the condition and disturbance history of their home stream and its watershed. Although huge sums are being spent in attempts to restore rivers and salmon in the continental United States—between 2001 and 2003 more than \$130 million was spent on salmon habitat restoration and enhancement projects in Washington State alone—many projects fail due to reliance on “off-the-shelf” concepts and designs instead of site-specific understanding of the disturbance history, habitat conditions, and habitat-forming processes in individual rivers (Kondolf et al., 2003). Recognition that context-dependent physical and biological processes mediate the cascade of linkages between geology, geomorphology, and salmon ecology should provide the foundation for society's efforts to restore robust salmon populations.

Recent advances in understanding the geomorphology of forest channels in general and the historical ecology of Pacific Northwest rivers in particular have documented some of the effects of anthropogenic changes in geomorphic processes and disturbance regimes on salmon populations. Ancient Scottish kings enforced salmon conservation laws aimed at protecting spawning salmon and their ability to access their spawning grounds long before the rise of modern science. Centuries worth of experience in managing salmon in Europe and New England (Montgomery, 2003) and recent landscape-level research (e.g., Montgomery et al., 1999; Rosenfeld et al., 2000; Pess et al., 2002) have shown that the processes that shape riverine habitat lead to strong associations between salmon populations and habitat availability, characteristics,

and quality. Hence, it appears self-evident that salmon recovery efforts should be rooted in understanding of both hydro-geomorphic processes and historical changes to rivers and streams.

GEOLOGY OF SALMON

It is not surprising that fossil salmon are relatively rare given that they generally die in mountain streams, high-energy environments that do not tend to be preserved in the geologic record. Although long a subject of controversy, the recently resolved phylogeny of the Salmoninae (salmon and trout) and the timing of their diversification (Fig. 1) help explain two of the most basic (and curious) aspects of salmon biology: the diversity of the Pacific salmon relative to the Atlantic salmon, and their life history that involves spawning in fresh water, traveling to the sea, and then returning to rivers and streams to spawn (a life history trait referred to as anadromy).

The Atlantic and Pacific salmon are thought to have diverged from a common ancestor in the early Miocene after cooling of the Arctic Ocean isolated the Atlantic and Pacific populations (Stearly, 1992). Differences in resource availability between terrestrial and marine environments have been interpreted as the cause of the development of anadromy in general based on the observation that anadromous species are predominantly found in temperate latitudes where oceans are more productive than

freshwater environments, whereas catadromous species, which migrate from the ocean to feed in fresh water, generally occur in tropical latitudes where oceans are less productive than river systems (Gross et al., 1988). Based on these ideas, Stearly (1992) proposed that global cooling in the Oligocene, which post-dates the earliest fossil of the Salmonidae [the Eocene *Eosalmo driftwoodensis* from British Columbia (Wilson and Williams, 1992)], led to the development of anadromy in ancestral salmon prior to the Miocene divergence of the Atlantic and Pacific salmon. As the climate cooled and the productivity of freshwater ecosystems declined, increased marine productivity made an anadromous life history increasingly advantageous.

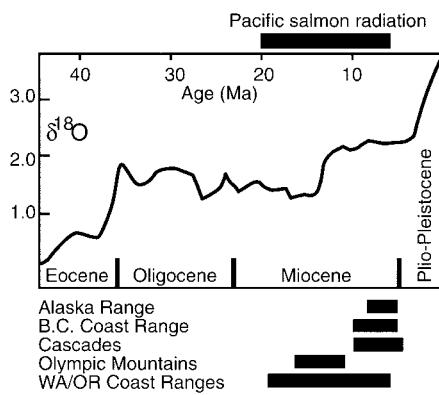


Figure 2. Relationship of radiation of Pacific salmon (top bar) to Miller et al.'s (1987) marine oxygen isotope curve and onset of uplift on Pacific Rim of North America (bottom bars). B.C.—British Columbia; WA/OR—Washington/Oregon. Adapted from Montgomery (2000).

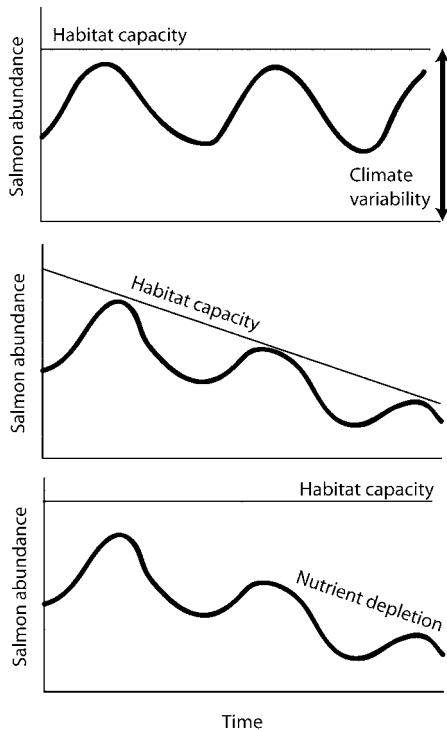


Figure 3. Potential relationships between salmon abundance, habitat capacity, and nutrient availability. Upper panel shows case of population dominantly controlled by variability in climate and marine conditions if habitat capacity is stable; middle panel shows the case of decreasing habitat capacity progressively ratcheting down population during periods of favorable climate; and lower panel shows the scenario wherein habitat is not limiting, due for example to nutrient depletion, loss of access, or excessive harvest. After Lawson (1993).

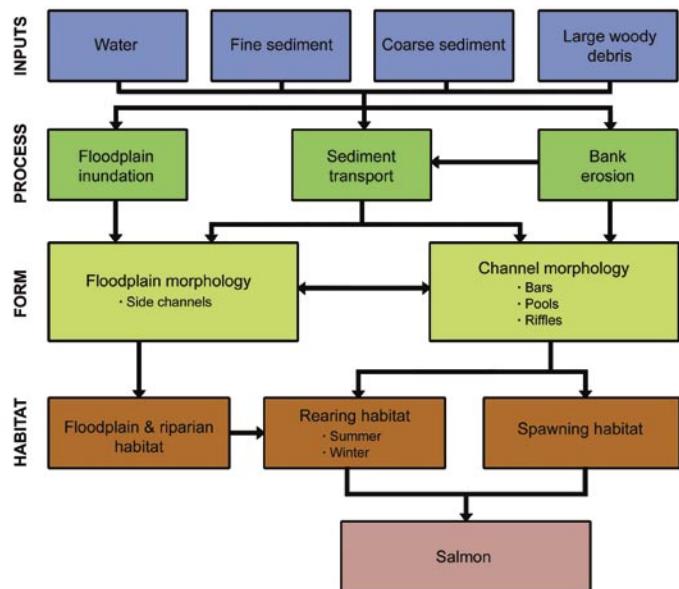


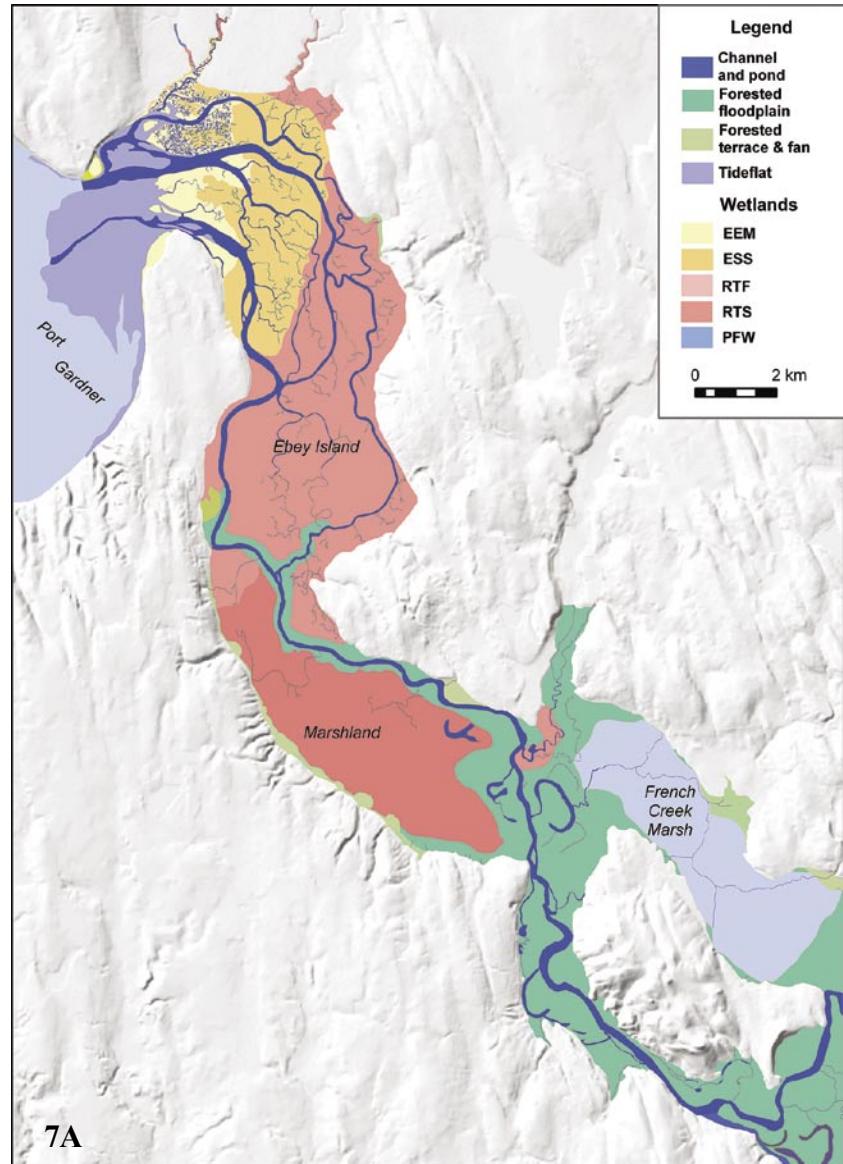
Figure 4. Generalized relationship of watershed inputs to channel processes, channel form, habitat characteristics, and salmon.

Whereas Atlantic salmon changed little in the past 20 m.y., Pacific salmon radiated into distinct species between 20 and 6 Ma (McPhail, 1997). Although the local isolation of populations during Pleistocene glacial advances was thought to have triggered the diversification of salmon, fossil specimens of the modern species of salmon predate Pleistocene glaciations. In addition, DNA evidence shows that Pleistocene glaciation post-dates the radiation of the Pacific salmon (Thomas et al., 1986). The diversification of the Pacific salmon in the late Miocene does, however, coincide with the rise of coastal mountains on the west coast of North America (Fig. 2), and it has been hypothesized that the associated changes in the character of rivers and streams, rather than glaciation, triggered the radiation of the Pacific salmon (Montgomery, 2000). Moreover, a tectonic driver for the radiation of *Oncorhynchus* could explain the different evolutionary trajectories of the Atlantic and Pacific salmon, since there has been little physiographic change, other than that due to glaciation, in eastern North America since the divergence of the Atlantic and Pacific salmon.

As the landscape of the Pacific Northwest evolved, ancestral salmon populations adapted to the region's



Figure 5. A portion of an immense logjam on the Queets River in Olympic National Park, Washington.



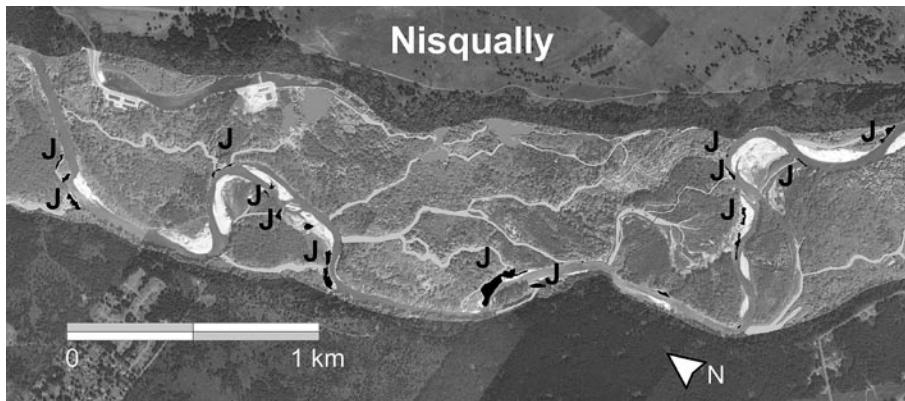


Figure 6. Aerial photograph of a forested reach of the Nisqually River, Washington, illustrating the relationship between the location of large logjams (indicated by Js and black pattern) and inlets to perennial side channels (gray patterns). From Collins and Montgomery (2001).

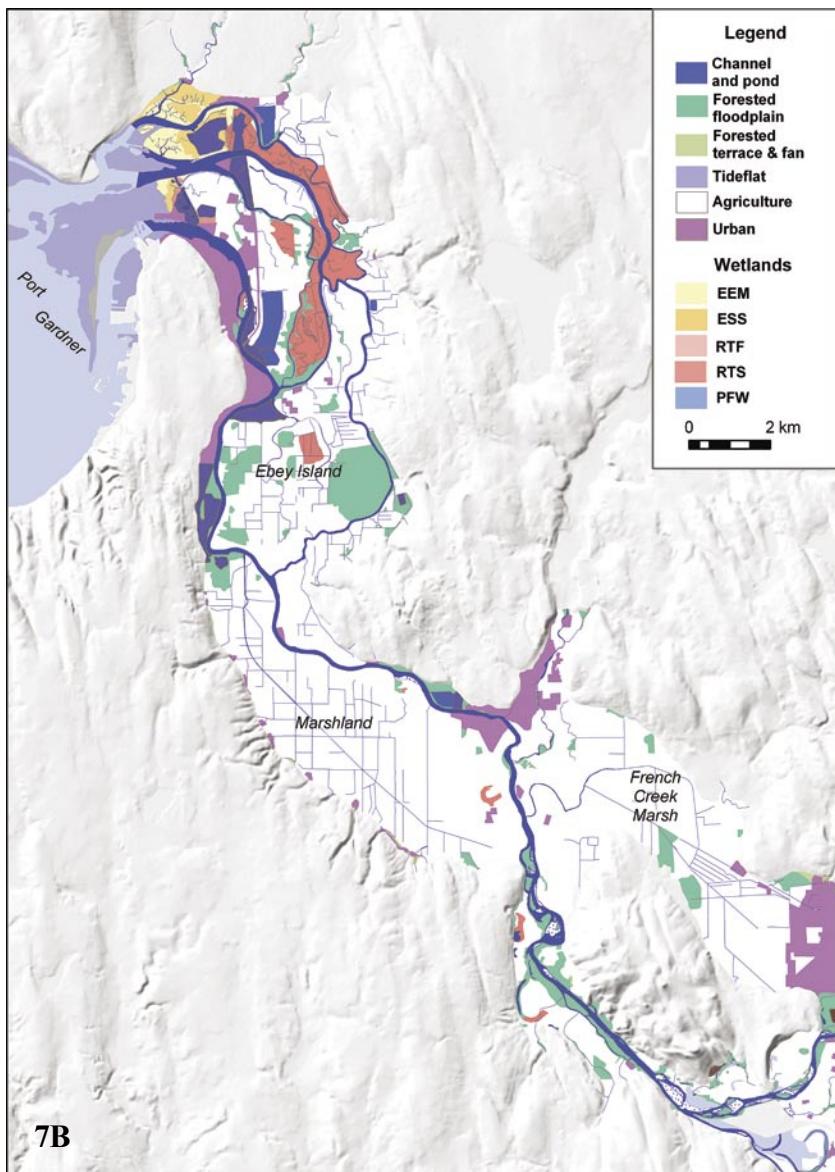


Figure 7 (on this and preceding page). Distribution of freshwater and estuarine habitat along the lower Snohomish River, Washington, (A) ca. 1870 and (B) 1990. EEM—estuarine emergent; ESS—estuarine scrub-shrub; RTF—riverine tidal forested; RTS—riverine tidal scrub-shrub; PFW—palustrine scrub-shrub. Updated by B. Collins after a map in Collins and Montgomery (2001).

changing rivers. Whether or not the diversification of habitat drove salmon speciation, it helped differentiate individual salmon runs as they spread into new streams and reaches in the evolving mountain drainage basins of the West Coast. Although different species of salmon may overlap in run timing and spawning areas, they generally tend to use different summer and winter rearing areas and spend different periods of time in freshwater and estuarine habitats. In general, chinook salmon (*O. tshawytscha*) spawn in large mainstem rivers, coho salmon (*O. kisutch*) use smaller tributaries, sockeye salmon (*O. nerka*) spawn in rivers in close proximity to lakes, and chum (*O. keta*) and pink salmon (*O. gorbuscha*) spawn in channels close to estuarine environments. Salmon adapted to their home streams to the extent that differences in run timing and spawning location both within and among river networks characterize different species and even various runs of the same species.

The initial divergence of coho, chinook, and chum salmon may represent adaptation to diversifying habitats in evolving coastal river systems of the Pacific Rim in which salmon runs began to specialize in using mainstem channels (chinook), smaller tributaries (coho), and estuarine habitats (chum) as these environments became increasingly distinct in terms of habitat characteristics while broad coastal plains became coastal mountains. In contrast to the wide geographic distribution of the other Pacific salmon, the range of sockeye salmon—the most recently evolved species of Pacific salmon—does not extend south of the southern extent of Pleistocene glaciation. This strong association with glaciated topography, where lakes are generally more abundant than in unglaciated topography, suggests that sockeye adapted to take advantage of lakes formed in deglaciated terrain. Consequently, the diver-

gence of sockeye salmon well before the onset of Pleistocene glaciation suggests that they evolved near the northern end of their modern range during the late Miocene to early Pliocene onset of Northern Hemisphere glaciation ~6 m.y. ago (Jansen and Sjoholm, 1991).

The dramatic influence of short-term climate variability on salmon abundance (e.g., Mantua et al., 1997; Finney et al., 2002) means that habitat availability defines a ceiling for population size, rather than a simple surrogate for population size. Freshwater ecosystems in the Pacific Northwest tend to be nutrient limited and biologists argue that a large modern nutrient deficit in freshwater systems of the Pacific Northwest may limit salmon population size to less than the available habitat could support (e.g., Gresh et al., 2000). Hence, even with long-term population records it can be difficult to assess whether habitat or nutrient limitations dominate observed variations in salmon abundance (Fig. 3). Nevertheless, it is clear that the amount and character of salmon habitat influences salmon abundance in Pacific Northwest rivers. It is also clear that human influences have radically altered the amount and character of salmon habitat in the United States over the past several centuries.

GEOMORPHOLOGY OF SALMON

In the early decades of the twentieth century, the new science of ecology focused on organisms and their environment, and particularly on how they influenced each other. For much of the second half of the century, however, the predominant view of ecosystems as either steady-state systems or as a one-way succession toward an equilibrium climax community downplayed the importance of geomorphology in governing ecosystem dynamics. Only near the end of the last century did recognition of the importance of disturbance regimes in shaping stream community composition and dynamics bring the role of hydro-geomorphological processes back into mainstream ecological theory (e.g., Pickett and White, 1985). Still, even though geomorphology can be considered a key control on ecosystem dynamics in a disturbance-driven view of the world (e.g., Swanson et al., 1988; Benda et al., 1998; Montgomery,

1999), the relative and absolute importance of the influences of geomorphological processes varies among species.

Salmon habitat is influenced by landscape processes that govern the supply and movement of water, sediment, and wood to and through their rivers and streams (Fig. 4). Salmon runs rely on rivers to provide particular kinds of habitat suitable for spawning, to foster the development of their eggs while buried in streambed gravel, and to shelter their young while they grow, forage, and hide from predators as they run down to the sea (Bjornn and Reiser, 1991). On their way back upriver, returning adults also need deep, sheltered pools in which to rest and clean gravel in which to spawn. A general understanding of salmon ecology therefore rests on understanding the watershed and fluvial processes that create, sustain, and destroy salmon habitat (Swanson, 1991).

At the most general level, nonmarine salmon habitat can be generalized into spawning habitat, summer rearing habitat, and winter rearing habitat. The size of spawning gravel, and therefore their preferred spawning grounds, varies for different salmonids, with larger salmon generally spawning in the coarser substrate of larger channels (Kondolf and

Wolman, 1993). Ideally, spawning habitat includes both appropriately sized gravel and proximity to pools that provide sheltered resting areas. In addition, large fish use deep pools to rest in on their way back upriver to spawn. Pools formed by the interaction of high flows and sediment transport scour into bedrock and flow around stable logs and logjams, providing different types and qualities of summer habitat for juvenile salmon (May and Lee, 2004). Off-channel wetlands and floodplain side channels can provide both summer rearing habitat and refugia from winter high flows (Peterson and Reid, 1984).

The importance of freshwater habitat abundance and quality varies among species of Pacific salmon. Pink and chum salmon, for example, do not spend much time in fresh water, as juveniles migrate to estuarine environments soon after emerging from the gravel. Consequently, the condition of estuarine habitat generally exerts a greater influence on pink and chum salmon runs than does the condition of freshwater habitats. In contrast, juvenile coho and chinook salmon rear for one to two years in rivers and streams before migrating to the marine environment. Consequently, these species are much

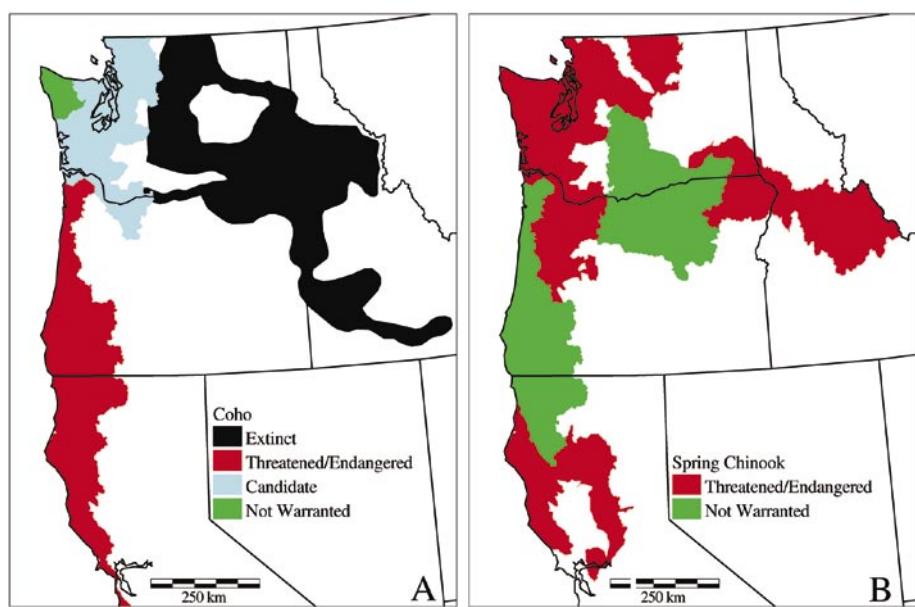


Figure 8. Federal status of (A) coho and (B) spring chinook salmon runs in the western United States, according to the National Marine Fisheries Service (NMFS) as of June 2003. Former extent of now extinct coho salmon runs was digitized from Frissell (1993). NMFS data can be found at www.nwr.noaa.gov/1salon/salmesa/cohoesum.htm for coho and at www.nwr.noaa.gov/1salon/salmesa/chinesum.htm for chinook.

more strongly dependent on the condition of rivers and streams, and their abundance has been related to habitat abundance and conditions across a wide range of scales from differences between pools and riffles (Rosenfeld, 2000) to reach-scale differences in channel type and pool frequency (Montgomery et al., 1999), and watershed-scale patterns of land use (Pess et al., 2002).

Over the past century and a half, many of the changes in the character of salmon habitat in the rivers and streams of the Pacific Northwest resulted either directly or indirectly from loss of stable in-channel wood debris (Fig. 5). The huge trees of the Pacific Northwest's native forests greatly influenced the region's rivers and played important roles in shaping salmon habitat. Historical changes in the size and supply of the wood delivered to rivers and streams changed sediment routing and storage, channel dynamics and processes, and even channel morphology. Many of the geomorphic effects of wood in rivers arise from the influence of "key" pieces of wood large enough to obstruct flow and sediment transport, and thereby stabilize other debris in logjams. Commonly recognized effects of wood on aquatic habitat are manifest at the scale of individual habitat units such as bars and pools (Bisson et al., 1982), but these local influences can generate emergent properties at larger spatial scales by collectively controlling the morphology of channel reaches and valley bottoms. Field surveys of forest channels have shown that the frequency of pools, many particulars of channel morphology such as channel width, the style and distribution of alluvial bedforms, and in places even the extent of gravel streambeds are controlled by the abundance of large logs and logjams (e.g., Keller and Swanson, 1979; Robison and Beschta, 1990; Montgomery et al., 1995; 1996; 2003). In addition, a number of workers have noted how an abundant supply of large wood can split flow into multiple channels and maintain complex, anastomosing channel patterns on forested floodplains unconfined by valley walls (Sedell and Froggatt, 1984; Harwood and Brown, 1993; Abbe and Montgomery, 1996;

Collins and Montgomery, 2001; Collins et al., 2002; O'Connor et al., 2003) (Fig. 6). These large-wood-mediated habitat characteristics made Pacific Northwest rivers natural salmon factories with spawning gravel located in proximity to deep pools for summer rearing, and sheltered floodplain side-channels for winter rearing.

In the decades after the Civil War, the U.S. government embarked on an extensive national program of removing snags from rivers to promote economic development because logs and logjams impeded navigation, and therefore commerce (Ruffner, 1886). The U.S. Army Corps of Engineers recorded pulling more than 65,000 snags from the Willamette River from 1870 to 1950 (Sedell and Froggatt, 1984), and more than 150,000 snags from five Puget Sound rivers since the 1880s (Collins and Montgomery, 2001). As development spread inland and up rivers, valley bottom wetlands were drained and riparian forests were cleared for agriculture, reducing the supply of large trees that could erode into rivers and become new snags (Fig. 7). Studies of the historical characteristics of valley bottoms around Puget Sound also show that the loss of stable logs and logjams converted complex channel forms to simpler channel patterns (Collins and Montgomery, 2001; Collins et al., 2003). Preliminary estimates of the loss of different kinds of salmon habitat from Puget Sound watersheds range from a third to more than two-thirds (Beechie et al., 1994, 2003; Collins and Montgomery, 2001).

An understanding of the extent and effects of anthropogenic changes in watershed processes on salmon habitat adequate for developing strategies for restoring salmon requires answering the questions of what were the rivers like that salmon evolved in, how did salmon habitat and habitat-forming processes change, and what opportunities exist (or can be made) for reversing these changes. Too often, however, river and stream restoration projects are based on ideas or technologies transferred from different geomorphologic contexts and applied in inappropriate situations. Yet understanding the extent of historical anthropogenic modifications to the river systems to which par-

ticular runs of salmon adapted can help guide strategies for restoring rivers and promoting salmon recovery.

RESTORATION ECOLOGY OF SALMON

The evolutionary linkages between landscape processes and salmon have implications for the response of salmon populations to human modifications of watershed processes because salmon evolved in response to geologic and geomorphologic disturbances that differ in character, frequency, and scale from common anthropogenic disturbances. Many natural disturbance processes can be characterized as pulse disturbances, wherein episodic, short-duration disturbance is followed by return to a former state. A key question for salmon restoration efforts is whether a species evolved to respond to infrequent geological disturbances (e.g., glaciations and volcanic eruptions) and more frequent geomorphological disturbances (e.g., floods and landslides) that tend to be spatially asynchronous has the ability to adapt to sustained, regionally synchronous anthropogenic disturbances.

The salmon's life history trait of spending 3–5 yr at sea is well suited for an environment characterized by periodic, but still relatively infrequent, disturbances such as floods and landslides because the bulk of their population is at sea at any one time. However, salmon are ill-equipped to endure anthropogenically induced changes in disturbance regimes that turn formerly infrequent disturbances into frequent (press) disturbances. For example, a shift in the recurrence interval of bed scouring high flow events could turn a formerly pulse disturbance into a press disturbance because egg-to-fry survival is inversely related to the recurrence interval of winter high flows (e.g., Beamer and Pess, 1999). In some densely developed areas of the Puget Lowland where the pre-urbanization 10-yr discharge became the post-urbanization 2-yr discharge (Booth, 1990), fall-spawning salmon were displaced by cutthroat trout that spawn in the spring (Lucchetti and Fuerstenberg, 1992), a time when their eggs are generally safe from high flows.

Debris flows provide another example of a catastrophic pulse disturbance that has become more frequent

in many watersheds as a result of forest management. The direct and indirect effects of debris flows can adversely impact salmonids, but debris flow-deposited logjams can act as habitat forming agents (Everest and Meehan, 1981). Although it is well established that forest clearing on steep slopes increases rates of landsliding (Sidle et al., 1985), far less is known about the net effects on salmon populations other than the obviously high mortality among fish in the channel at the time of a debris flow. However, it is likely that with increasing disturbance frequency, the negative effects of such disturbances increasingly overshadow the positive effects due to habitat formation.

In addition to changes in disturbance regimes, historical anthropogenic effects on salmon habitat include reduced extent and quality of spawning gravel, channel incision due to removal of stable logs and logjams, fewer pools to provide summer rearing habitat, loss of off-channel wetlands and floodplain sloughs that provided winter rearing habitat, increased bed scour, and loss of access to habitat due to blockage by dams. The relative importance of these different effects on salmon habitat depends on the geology, geomorphology, and disturbance history of specific watersheds.

The regional pattern to the distribution of threatened and endangered runs of coho and chinook salmon (Fig. 8) illustrates how broad views of changes in the geomorphology can help focus questions pertinent to restoration strategies and efforts. Spring runs of chinook salmon in Oregon and Washington are considered threatened or endangered in Puget Sound, the Willamette Valley, coastal Washington, but are not considered at risk of extinction in coastal Oregon and the central Columbia River basin. In contrast, coho salmon runs are extinct in the Columbia River basin (Frissell, 1993), are considered threatened or endangered in coastal Oregon, and are a candidate for listing in western Washington. In addition to the effect of dams on the Columbia River system, the difference in these patterns probably reflects the extensive floodplain modifications, gravel mining, and the loss of side channels and freshwater wetlands along large rivers and floodplain habitats used

by chinook salmon in the Puget Sound region and Willamette Valley, and the extensive impacts of splash damming and forestry to the smaller streams used by coho salmon on the Oregon Coast.

Through direct and indirect influences on landscape dynamics, geology and geomorphology affect salmon over a remarkable range of spatial and temporal scales (Fig. 9). Yet, understanding of how specific changes in fluvial and watershed processes influence salmon habitat, as well as salmon themselves, is necessary to confidently align management actions with policy goals. While it would appear obvious that it would be difficult to predict the outcome of management policies aimed at a complex system that we do not understand, even a relatively complete understanding of a natural system does not guarantee optimal resource management. Still, in addressing natural systems characterized by high uncertainty or natural variability, an understanding of both past system behavior and the processes that govern that behavior is necessary to guide confident management decisions.

GEOMORPHOLOGY AND RESTORATION ECOLOGY

It is well known that an understanding of salmon ecology requires understanding habitat conditions. Each

summer, a small army of biologists, foresters, and fishery technicians document habitat characteristics in salmon streams and rivers throughout the Pacific Northwest. Increasingly, geomorphologists participate on such teams, and the growing recognition of the need to involve geomorphologists in habitat assessments and the design of restoration projects is helping to develop and define the professional practice of restoration geomorphology.

Successful river restoration projects aimed at promoting salmon recovery require an understanding of a watershed and its disturbance history, including the effects or legacies of human actions. Although in simple cases such as removing or modifying salmon-blocking culverts or dams, the solution may be obvious (even if not politically feasible), in many cases the diagnosis of restoration issues and design of projects to address them are complex and subjective. Integrating the linked influences of hydro-geomorphic and biological processes often requires synthetic thinking and analyses beyond solving a simple set of closed equations or adopting a standard view or conceptual model. Montgomery and MacDonald (2002) argued that one-size-fits-all channel classifications and restoration guidelines are of limited utility when ap-

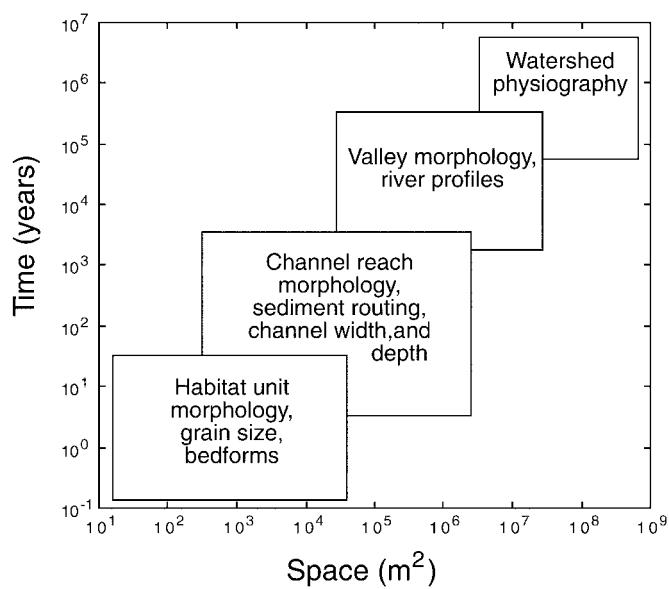


Figure 9. Spatial and temporal scales across which geology and geomorphology influence aspects of salmon habitat.

plied without an understanding of both disturbance history and spatial context within a watershed. Although most professional geomorphologists would agree that restoration design work should be approached cautiously and with the appropriate expertise, the issue of what qualifications and training are necessary to engage professionally in applied fluvial geomorphology is only now beginning to receive the attention it deserves in the scientific community. Yet in applying geomorphology to salmon recovery it is important to guard against the sometimes-naive presumption that professionals in other disciplines (such as hydrologists, foresters, ecologists, and engineers) can reliably provide accurate geomorphic insight.

Given the importance of context in diagnosing and assessing habitat conditions, geomorphologists are needed to help assess the causes of problems and evaluate potential solutions in restoration ecology, much like how geologists are recognized as essential for scoping problems and evaluating potential solutions in geotechnical engineering. It should not be controversial to maintain that an understanding of the extent and cause of anthropogenic impacts on salmon habitat should be central to devising potential measures to reverse or mitigate such effects. In practice, however, many habitat restoration projects are based on standardized approaches and designs or the application of simple generalized conceptual models for what a stream should be like. Although geomorphologists can contribute to restoration ecology by bringing technical expertise to bear on specific problems, an equally important contribution lies in providing the perspective that an appreciation of spatial and temporal context brings to a site-specific understanding of habitat conditions and habitat-forming processes.

The stories of declining salmon runs are remarkably parallel across the English-speaking world, from the rivers of the Pacific Northwest to New England and before that Great Britain (Montgomery, 2003). In each case, the history of salmon records how changes to rivers and their watersheds gradually remade river basins into regions inhospitable to salmon over time spans far longer than social and political pro-

cesses last. In the past, the mismatched time scales over which societal and geomorphologic processes operate have proven problematic for salmon. Today, as society focuses substantial human and economic resources on efforts to restore salmon runs, geomorphologic expertise is essential for ensuring that money and effort are well spent on specific projects and that restoration practices are aligned with strategic policy objectives.

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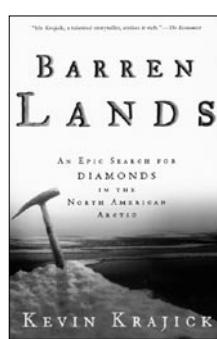
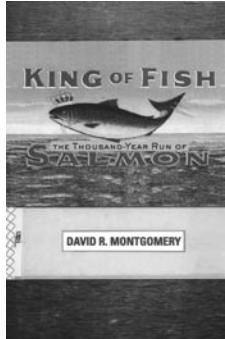
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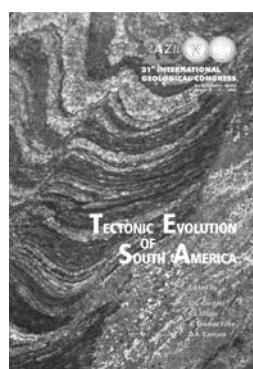
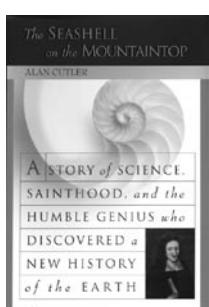
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G. Randy Keller of the University of Texas at El Paso has been named the first science editor of *Geosphere*, GSA's ambitious entry into electronic-only publication. Charged with setting up the journal, he will be working with the geoscience community to add this exciting new dimension to GSA's publication efforts.

"The primary goal of this effort is to address the clear and growing need for timely publication of scientific results and data in ways that cannot be addressed by traditional formats," Keller said. "A secondary goal is to build an interface with other efforts within the scientific community that seek improvements in access to and preservation of data along with easy access to resources such as GIS databases and modeling results."

Keller notes that *Geosphere* is not intended to replace traditional formats, but rather to add to the array of scientific publications with a dynamic and evolutionary journal. "I am both excited and daunted by this challenge," he added.

Keller envisions *Geosphere* as being like *GSA Bulletin*, the *Journal of Geophysical Research*, and other highly regarded journals in that he is seeking high-quality papers from a broad spectrum of geoscience disciplines and locales, the review process will be rigorous, and the goal is a high impact factor. The electronic format of *Geosphere*, however, allows for more flexibility in regard to color, number of pages, and types of images used to communicate ideas. The format also favors rapid publication. Keller welcomes both innovative and traditional-format papers, and he strives toward synergy with other GSA publications.

A member of GSA since 1972, Keller served as an associate editor for *GSA Bulletin* from 1983 to 1989 and helped edit several other journals and special volumes. Keller received his M.S. and Ph.D. degrees at Texas Tech University, held a research position at the University of Utah, and taught at the University of Kentucky before accepting his current post at the University of Texas at El Paso. His research interests focus on integrated studies of the structure and evolution of the continental lithosphere, applications of remote sensing, geoinformatics, and applications of geophysics to studies of water and energy resources. He has helped conduct many large integrated field experiments in North America, Africa, and Europe. He has served numerous professional societies and organizations as an officer and committee member and is particularly concerned with issues involving diversity, professional opportunities and development for students, use of new technologies, and development of cyberinfrastructure.

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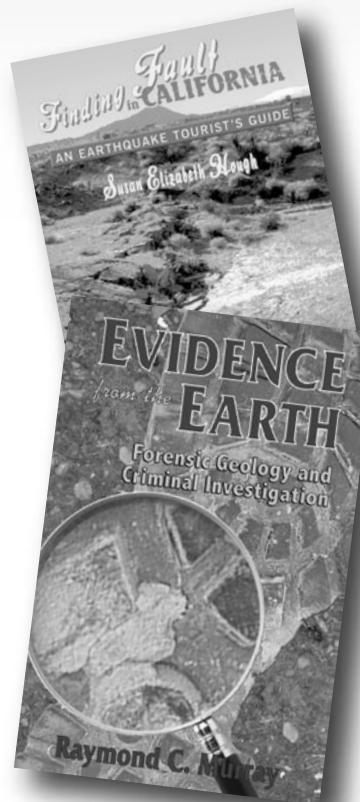
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Call for Applications: Planetary Geology Division's Stephen E. Dwornik Student Paper Award

THE AWARD

Planetary geologist **Stephen E. Dwornik** established this award in 1991 to provide encouragement, motivation, and recognition to outstanding future scientists. Two awards are given annually: one for the best oral presentation, the other for the best poster presentation, with each winner receiving a citation and \$500. The program is administered through the GSA Planetary Geology Division. The GSA Foundation manages the award fund.

CRITERIA

The **Dwornik Student Paper Award** applies to papers presented at the annual Lunar and Planetary Science Conference held each March in Houston. Student applicants must be (1) the senior author of the abstract (the paper may be presented orally or in a poster session); (2) a U.S. citizen; and (3) enrolled in a college or university, at any level of their education, in the field of planetary geosciences. Papers will be judged on the quality of the scientific contributions, including methods and results; clarity of material presented; and methods of delivery (oral or display).

TO APPLY

The application form and instructions are found in the Call for Papers for the 36th Lunar and Planetary Science Conference, to be held March 14–18, 2005, at the South Shore Resort and Conference Center, League City, Texas. Please visit www.lpi.usra.edu/meetings/upcomingmeetings.shtml for more information.

DEADLINE

The deadline for electronic submission will be 5:00 p.m. (U.S. Central Standard Time) Tuesday, January 11, 2005; authors who are unable to submit electronically must send their hard-copy abstracts to the LPI by 5:00 p.m. (U.S. Central Standard Time) Tuesday, January 4, 2005.

Call for Proposals:

Professional Development Short Courses and K-16 Education Workshops for the 2005 GSA Annual Meeting in Salt Lake City

The GSA Committee on Professional Development invites those interested in proposing a short course or workshop to contact GSA headquarters for proposal guidelines. This invitation is also extended to K-12 teachers, teacher trainers, pre-service educators, and undergraduate educators to submit proposals for K-16 education workshops. Committee members are interested in receiving course proposals for the 2005 Salt Lake City Annual Meeting or the 2006 Philadelphia Annual Meeting.

Proposals must be received by January 1, 2005. Selection of courses for 2005 will be made by March 1, 2005.

For those planning ahead, we will also consider courses for 2006 at that time.

For proposal guidelines or information, contact Edna Collis, Program Officer GSA Headquarters 1-800-472-1988, ext. 1034 ecollis@geosociety.org.

GSA DIVISION AND SECTION GRANTS: 2004 Awardees Named

DIVISION RESEARCH GRANTS

Eleven of the fifteen GSA divisions offer grants for outstanding student research within the fields of the respective divisions. Recipients of these grants for 2004 are listed below. The GSA Foundation manages the following funds: Archaeological Geology Division, Coal Geology Division, Engineering Geology Division, History of Geology Division, Hydrogeology Division, Limnogeology Division, Planetary Geology Division, and Quaternary Geology and Geomorphology Division.

Archaeological Geology Division

The Archaeological Geology Division presented the 2004 Claude C. Albritton, Jr., Memorial Student Research Award to Marjorie Heyman, Department of Anthropology, University of Michigan.

Coal Geology Division

The Coal Geology Division presented the annual Antoinette Lierman Medlin Research Awards for 2004. The Field Award went to Jennifer R. Cooper, Department of Geological Sciences, University of Missouri, Columbia, for her dissertation proposal "Coalbed methane in the Raton Basin, Colorado and New Mexico: Thermal effects of mafic intrusions on coal maturation and coalbed methane generation." The Research Award went to David C. Benson, Department of Geosciences, Virginia Polytechnic Institute and State University, for his thesis proposal titled "Sequence stratigraphy of the Lower Pennsylvanian Lee Formation, SW Virginia: Relationship between tectonics and glacioeustasy and sequence development."

Engineering Geology Division

The Roy J. Shlemon Scholarship Awards for 2004 were as follows: Soren K. Clark, First Place Master's Level, Tina L. Gammil, First Place Doctorate Level, and Carl Pierce Jr., Second Place Doctorate Level.

Geophysics Division

The Geophysics Division presented the Allan V. Cox Student Research Award this year for an outstanding student research proposal submitted to the GSA Research Grants Program. The 2004 Cox Award goes to Alan F. Kobussen, University of Wisconsin-Madison, for his project "Seismic anisotropy from peridotite xenoliths." The 2004 Geophysics Division Award was presented to Nicholas Beyrle, University at Buffalo, for his project "Using multiple polarization of ground penetrating radar to generate improved three-dimensional subsurface images of bedrock fractures."

History of Geology

The History of Geology Division presented the History of Geology Student Award for 2004 to Michael C. Rygel, Department of Earth Sciences, Dalhousie University, Nova Scotia, for "Logan in Acadia: Reexamination of nineteenth century measurements of the Joggins Section."

Hydrogeology Division

Awards for outstanding student research from the Hydrogeology Division were presented in 2004 to five students: Joan B. Blahey, University of Arizona, for "Uncertainty in coupled interaction between surface and saturated hydraulic processes," T.J. Fudge, University of Wyoming, for "Creating a spatially integrated melt water input model for Bench Glacier, Alaska," Abhijit Mukherjee, University of Kentucky, for "Study of geochemical evolution of groundwater and fate of arsenic along a regional flow path in the Western Bengal Basin, India," Kelly N. Shultz, University of Akron, for "Hydrogeology investigation of Pond Brook Metro Park and Twinsburg Park and Nature Preserve, Summit County, Ohio," and Liqiong Zhang, University of Nevada-Las Vegas, for "Study of groundwater and radioactive solute transport in the aquifer of Yucca Mountain using an integrated approach."

Limnogeology Division

The Limnogeology Division presented the Kerry Kelts Student Research Awards to Brandy Anglen, Indiana University; Broxton Bird, California State University-Fullerton; and Susan

Herrgesell Zimmerman, Lamont-Doherty Earth Observatory.

Planetary Geology Division

The Planetary Geology Division presents the Stephen E. Dwornik Best Student Paper Awards annually to students who are U.S. citizens and are pursuing advanced degrees in Planetary Sciences. The recipient of the 2004 Oral Presentation Award is Nicholas J. Tosca, State University of New York, Stony Brook. The recipient of the 2004 Best Poster Award is Keith A. Milam, University of Tennessee. The Oral Honorable Mention Awardees went to Sarah K. Noble, Brown University, and Chris H. Okubo, University of Nevada-Reno.

Quaternary Geology and Geomorphology Division

The Quaternary Geology and Geomorphology Division awarded the 2004 J. Hoover Mackin Award to Anders E. Carlson, Oregon State University, for "A Holocene chronology of the Laurentide Ice Sheet, North America." The Arthur D. Howard Research Grant was awarded this year to Nira Salant, Dartmouth College, for "Sediment storage and sedimentation in flow-regulated streams and the impact on aquatic ecosystems."

Sedimentary Geology Division

The Sedimentary Geology Division presented the award for outstanding student research in 2004 to Isla S. Castañeda, University of Minnesota-Duluth, for "A 22,000 year record of tropical paleoclimate and ITCZ variability from Lake Malawi, East Africa, based on bulk and molecular geochemical proxies."

Structural Geology and Tectonics Division

The Structural Geology and Tectonics Division presented its 19th annual awards for outstanding student research this year to Nicholas Austin, Massachusetts Institute of Technology, for "The role of solute impurities and second phases on strain localization in carbonate rocks: Field constraints from the Morcles Nappe, Switzerland," to Eric M. Horsman, University of Wisconsin, for "Comparative rheology of naturally deformed crustal rocks," and to Christen

D. Rowe, University of California–Santa Cruz, for “Evaluating quartz mobility as a control on the up-dip limit of seismicity in subduction thrust systems.”

SECTION RESEARCH GRANTS

Four of the six GSA regional sections award grants for research to students attending colleges and universities within each section’s respective geographical boundaries. The Cordilleran and Rocky Mountain Sections do not currently offer student research grants. Grants awarded in 2004 by the other sections are listed below.

The **North-Central Section** awarded grants for undergraduate research projects to students who attend a college or university within the North-Central Section geographic area. Research proposals are submitted and evaluated competitively. Recipients for fall 2003 are: Nicholas McClean, University of Iowa, for “Microthermometry and laser ablation ICP-MS analysis of fluid

inclusions in ores of the Tri-State zinc-lead district”; Susan Mickiewicz, University of Wisconsin–Oshkosh, for “Understanding magmatic processes using high-silica rocks of the Bishop Tuff, Eastern California, as an example”; Katrina Pekar, University of Dayton, for “Differences between Sn slag and Pb slag from Wier Quarry, Cornwall, UK, based on mineralogical and chemical analyses”; Erica Anne Weller, Ohio University, for “Coleoid Cephalopods from the Lower Carboniferous of North America”; Aaron Regberg, University of Michigan, for “Experimental investigation of dolomite precipitation mechanisms”; Jacqueline Marshall, University of Wisconsin–Oshkosh, for “A geochemical study of volcanic and plutonic rocks in the Sierra Nevada Batholith: Correlating sediment contribution to time scales of batholithic processes”; and William Carlson, Muskingum College, for “Correlation of specific water quality parameters with reclamation techniques.”

The **South-Central Section** did not award any grants in 2004.

The **Northeastern Section** awarded grants to five students in 2004: Brian Martin of Acadia University, Stanley Skotnicki of University of Buffalo, Christopher Stanton of Mary Washington College, Caleb Woolever of Susquehanna University, and Carlos Zatos of Juniata College.

GSA’s **Southeastern Section** awarded the following undergraduate and graduate research grants in 2004: Gerrit R. Bulman of the University of Alabama, James R. Griffin of Auburn University, Loren Petrunk of Auburn University, James P. Turner of Auburn University, Eric D. Anderson of the University of Kentucky, Brad T. Carter of North Carolina State University, Todd D. Grote of West Virginia University, Matthew A. Massey of the University of Kentucky, Jeff Pollock of North Carolina State University, and Gang Wang of the University of Alabama.

GSA Offers Awards in Geomorphology and Micropaleontology

Two of GSA’s most prestigious awards supporting research are made possible by the generosity of the late W. Storrs Cole. Qualified GSA Members and Fellows are urged to apply.

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.

GSA Members and Fellows between the ages of 30 and 65 who have published one or more significant papers on geomorphology are eligible for the award. While the funds may not be used for work that is already finished, recipients of previous awards may reapply if they need additional support to complete their work. The 2005 award is for \$7,600.

The **W. Storrs Cole Memorial Research Award** supports research in invertebrate micropaleontology. This award carries a stipend of \$7,000 in 2005 and will go to a GSA Member or Fellow between the ages of 30 and 65 who has published one or more significant papers on micropaleontology.

For 2005 application forms, visit www.geosociety.org/grants/postdoc.htm. For more information, contact Diane Lorenz, Grants, Awards, and Recognition, GSA, P.O. Box 9140, Boulder, CO 80301-9140, awards@geosociety.org.

Applications must be mailed and must be postmarked on or before February 1, 2005. Applications sent by facsimile or e-mail will not be accepted. The Committee on Research Grants will report its actions to each applicant in April 2005.

**THE GLADYS W. AND W. STORRS COLE
AWARD FUNDS ARE MANAGED BY THE GSA FOUNDATION.**

2004

Biggs Awardee Named

Congratulations to **Gregory S. Hancock**, assistant professor in the Department of Geology at the College of William and Mary, who has been named as the 2004 Biggs Award recipient.

The Biggs Award encourages and rewards excellence in teaching among college-level professors of earth science who are in the early stages of their careers. The award is made possible through support from the Donald and Carolyn Biggs Fund, the GSA Geoscience Education Division, and GSA’s Education and Outreach Program.

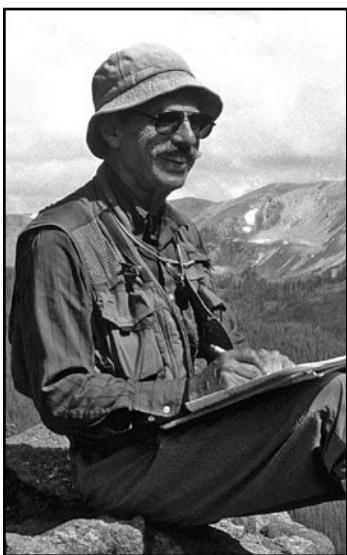
Earth science instructors and faculty members from any academic institution engaged in undergraduate education who have been teaching full time for 10 years or fewer are eligible. (Part-time teaching is not counted in the 10-years-or-fewer requirement.)

For more information, contact awards@geosociety.org or visit www.geosociety.org/aboutus/awards/biggs.htm.



GSA Foundation Update

Donna L. Russell, Director of Operations



Peter Lipman

Peter Lipman Joins GSAF Board of Trustees

Lee J. Suttner, GSA Foundation Trustee

The GSA Foundation Board of Trustees is delighted to announce that Peter W. Lipman has accepted a 5-year term on the Board. Lipman was born in New York City, but grew up mostly in Connecticut. He received a B.S. degree in geology from Yale University

in 1958 and M.S. and Ph.D. degrees from Stanford in 1960 and 1962, respectively. He joined the U.S. Geological Survey shortly after obtaining his Ph.D. From 1991 to 1994, he was chief of the Branch of Volcanic and Geothermal Processes, a position in which he managed 135 survey employees. Since 1995, he has been chief scientist for the USGS project "Eruptive Hazards at Large Volcanoes."

An internationally renowned volcanologist, Lipman is credited with publication of over 200 scientific articles based on his work throughout much of the western United States, Hawaii, Japan, China, and the former USSR. In recognition of his outstanding record of research and professional activities, he received GSA's Burwell Award in 1983 and the Meritorious Service Award from the U.S. Department of the Interior in 1985. In 1984, he was selected as the USGS Mendenhall lecturer.

Lipman is a GSA Fellow and former associate editor of both the *GSA Bulletin* and *Geology*. From 1982 to 1984, he served the Society on the Committee on Investments, the Budget Committee, and the Finance Committee. It was during this period that his advice and financial acumen were of significant value in the Society's successful efforts to address serious budgetary challenges. Because of Lipman's

commitment to the Foundation Board of Trustees, both the Society and the Foundation will continue to benefit from his variety of leadership and business skills. Please join the Foundation in expressing to Lipman gratitude for assuming this important new responsibility.

Research Fund Merged into the GeoStar Fund

The Board of Trustees has approved the merger of the Foundation's Research Fund into the GeoStar Fund. GeoStar is the endowment fund for supporting the advancement of research. Disbursements available from GeoStar for the Research Grants Program at the present time are 5% of net assets.

You are still able to give a research gift that can be used in the current year. Just indicate that your contribution is to be used in the current year on your check or contribution envelope.

GSA's Research Grants program is a wonderful way to provide assistance to graduate students for their proposed research project. Please give generously to this important program using the coupon below.



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—Nazario Pavoni

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Preliminary Announcement and Call for Papers

NORTH-CENTRAL

39th Annual Meeting North-Central Section, GSA Minneapolis, Minnesota May 19–20, 2005

The Minnesota Geological Survey in conjunction with the Department of Geology and Geophysics of the University of Minnesota will host the 2005 annual meeting of the North-Central Section of the Geological Society of America. Meeting dates will be Thursday, May 19 and Friday, May 20 at the Radisson Metrodome on the University of Minnesota campus in Minneapolis, Minnesota.

REGISTRATION

Standard registration deadline: April 18, 2005

Cancellation deadline: April 25, 2005

GSA Headquarters will handle meeting registration. (See Feb. 2005 issue of *GSA Today* for details.) Registration will be available online at www.geosociety.org beginning February 2005. On-site registration: Radisson Metrodome, University of Minnesota.

CALL FOR PAPERS

Abstract Deadline: February 22, 2005

Papers are invited for theme and general discipline sessions in both oral and poster format. Volunteered papers will be considered for any general discipline session as listed on the GSA abstracts form. An individual may be the presenter for only one volunteered paper (excepting symposia papers), but may be co-author on any number of abstracts. Abstracts must be submitted online at www.geosociety.org. An abstract submission fee of \$10 will be charged. Inquiries to: Harvey Thorleifson, North-Central Technical Program Chair, (612) 627-4780, thorleif@umn.edu.

Symposia

1. **Continental Tectonics of Shield Regions.** Daniel Holm, Kent State University, dholm@kent.edu; David Schneider, Ohio University, schneidd@ohio.edu.
2. **Deep Earth Science: Prospects for a Deep Underground National Laboratory.** John Goodge, University of Minnesota–Duluth, jgoodge@d.umn.edu; Dean Peterson, Natural Resources Research Institute, dpeters1@nrri.umn.edu.
3. **Groundwater Sustainability.** Harvey Thorleifson, Minnesota Geological Survey, thorleif@umn.edu; Martin Saar, University of Minnesota, saar@umn.edu.
4. **Lakes—Glacial Lakes, Large Lakes, Small Lakes, Groundwater Interaction.** Sponsored by the Limnogeology Section of GSA. Emi Ito, University of

Minnesota, eito@umn.edu; Steven Colman, University of Minnesota, scolman@d.umn.edu.

5. **The Midcontinent Rift in the Lake Superior Region: A Modern Integration of a Century of Studies.** Jim Miller, Minnesota Geological Survey, mille066@umn.edu; Bill Cannon, U.S. Geological Survey, wcannon@usgs.gov.

Theme Sessions

1. **Arsenic in Drinking Water.** Randal Barnes, University of Minnesota, barne003@umn.edu; Mindy Erickson, University of Minnesota, eric0984@umn.edu.
2. **Developing Approaches to Terrestrial Paleoclimatology.** Sponsored by the Great Lakes Section of the Society for Sedimentary Geology. Greg Ludvigson, Iowa Geological Survey, gludvigson@igsb.uiowa.edu; Jeff Dorale, University of Iowa, jeffrey-dorale@uiowa.edu.
3. **Evolution of Crustal Melts.** Jim Stout, University of Minnesota, jstout@umn.edu; Jim Grant, University of Minnesota–Duluth, jgrant@d.umn.edu.
4. **Forensics in Environmental Geology.** Keith Rapp, Unisys Corporate Environmental Affairs, keith.rapp@unisys.com; Carolyn Boben, Xcel Energy, carolyn.l.boben@xcelenergy.com.
5. **Geologic Development of Midwestern Fluvial & Glaciofluvial Systems.** Curtis Hudak, Foth & Van Dyke and Associates, Inc., CHudak@foth.com; Ed Hajic, Illinois State Museum, erhajic@mac.com.
6. **Geologic Development of the Mississippi River.** Howard Hobbs, Minnesota Geological Survey, hobbs001@umn.edu; Tammy Rittenour, Lund University, TammyRittenour@geol.lu.se.
7. **Geoscience Education: Geology and Citizenship, Research on Learning, Developing Quantitative Skills, Role of State Education Standards in K–12 Classrooms.** Mary Savina, Carleton College, msavina@carleton.edu; Cathy Manduca, Carleton College, cmandu@carleton.edu.
8. **Innovations in Paleontological Methods.** David Fox, University of Minnesota, dlfox@umn.edu; Tim Demko, University of Minnesota, tdemko@umn.edu.
9. **Inquiry-Based, Hands-On, Classroom Exercises, Lab Demonstrations, and Field Investigations in Geoscience Education.** Kate Pound, St. Cloud State University, kspound@stcloudstate.edu; Megan Jones, North Hennepin Community College, Mjones@nhcc.edu; Lee Schmitt, Science Museum of Minnesota, schmitt@smm.org.
10. **Integrating Real and Virtual Field Trips in K–12 Geoscience Education.** Sponsored by the Central Section of the National Association of Geoscience Teachers. Cinzia Cervato, Iowa State University, cinzia@iastate.edu; Rusty Low, University of Minnesota, rflow@cce.umn.edu.
11. **Landscape Development.** Lesley Perg, University of Minnesota, lperg@umn.edu; Kelly MacGregor, Macalester College, macgregor@macalester.edu.
12. **Mid-continental Quaternary History in a Global**

- Context.** Greg Balco, University of Washington, balcs@u.washington.edu; Carrie Jennings, Minnesota Geological Survey, carrie@umn.edu.
13. **New Geoscience Applications for Advanced Visualization Methods, 3-D, Web-Access, and Large Databases.** Paul Morin, University of Minnesota, lpmorin@umn.edu; Emi Ito, University of Minnesota, eito@umn.edu; Harvey Thorleifson, Minnesota Geological Survey, thorleif@umn.edu.
 14. **Precious Metals: PGE & Au in Precambrian Terranes of the Lake Superior Region.** Jim Miller, Minnesota Geological Survey, mille066@umn.edu.
 15. **Soils as Keys to Quaternary Geology and Landscapes.** Randall Schaetzl, Michigan State University, soils@msu.edu; Joe Mason, University of Wisconsin, mason@geography.wisc.edu.
 16. **Unconventional Natural Gas Resources Associated with Glacial Deposits—Shallow Bedrock Gas and Drift Gas.** George Shurr, GeoShurr Resources, geoshurr@frontiernet.net.
 17. **Undergraduate Research in the Geosciences (Poster Session).** Sponsored by the Council on Undergraduate Research. Robert Shuster, University of Nebraska–Omaha, rshuster@mail.unomaha.edu; Karen Fryer, Ohio Wesleyan University, khfryer@owu.edu; David Matty, Central Michigan University, mattymatty1d@cmich.edu.

Workshops

1. **Magnetic Techniques in Environmental Reconstruction.** Subir Banerjee, University of Minnesota, banerjee@umn.edu; Mike Jackson, University of Minnesota, jacks057@umn.edu.
2. **Workshop for Teachers.** Kate Pound, St. Cloud State University, kspound@stcloudstate.edu; Megan Jones, North Hennepin Community College, Mjones@nhcc.edu; Lee Schmitt, Science Museum of Minnesota, schmitt@smm.org.

Field Trips

1. **The Geology of the Mississippi River Valley—Twin Cities Region: Using an Urban River for Inquiry-based Earth Science Education.** Kent Kirkby, University of Minnesota, kirkby@tc.umn.edu; Karen Campbell, National Center for Earth Surface Dynamics.
2. **Granites of the East-Central Minnesota Batholith.** Terry Boerboom, Minnesota Geological Survey, boerb001@umn.edu; Daniel Holm, Kent State University; Randy Van Schmus, University of Kansas.
3. **Classic Precambrian Geology of Northern Minnesota.** Mark Jirsa, Minnesota Geological Survey, jirsa001@umn.edu; Jim Miller, Minnesota Geological Survey.
4. **Sinkhole Anatomy 101: Karst Geology of Southern Minnesota.** Bob Tipping, Minnesota Geological Survey, tippi001@umn.edu; Calvin Alexander, University of Minnesota; Tony Runkel, Minnesota Geological Survey.
5. **Deposits and Landforms of the St. Louis Sublobe.** Al Knaebel, Minnesota Geological Survey, knaebel001@umn.edu; Gary Meyer, Minnesota Geological Survey; Howard Mooers, University of Minnesota–Duluth;

Phil Larson, University of Minnesota–Duluth; Lisa Marlow, University of Minnesota–Duluth.

6. **Late Ordovician Stratigraphy and Paleontology of the Twin Cities Basin.** Bob Sloan, University of Minnesota, ssloan@winona.edu; Mike Middleton, University of Wisconsin–River Falls; Gerry Webers, Macalester College.
7. **Architecture of an Archean Greenstone Belt: Stratigraphy, Structure, and Mineralization.** Dean Peterson, Natural Resources Research Institute, dpeters1@nrri.umn.edu; Mark Jirsa, Minnesota Geological Survey; George Hudak, University of Wisconsin–Oshkosh.
8. **The Western Margin of the Keweenawan Midcontinent Rift System: Geologic Highlights of Archean, Paleoproterozoic, Keweenawan, and Paleozoic Bedrock in Eastern Minnesota and Northwestern Wisconsin.** Terry Boerboom, Minnesota Geological Survey, boerb001@umn.edu; Daniel Holm, Kent State University; Karl Wirth, Macalester College; Laurel Woodruff, U.S. Geological Survey.
9. **Geology and Sedimentology of the Eastern Mesabi Iron Range: The Pokegama Formation and the Biwabik Iron Formation.** Richard Ojakangas, University of Minnesota–Duluth, rojakang@d.umn.edu; Mark Severson, Natural Resources Research Institute; G.B. Morey, Minnesota Geological Survey.
10. **Pre-Wisconsinan and Wisconsinan Glacial Stratigraphy, History, and Landscape Evolution, Western Wisconsin.** Kent Syverson, University of Wisconsin–Eau Claire, syverskm@uwec.edu; Robert Baker, University of Wisconsin–River Falls; Steve Kostka, University of Wisconsin–Madison.
11. **Late Ordovician Lithology and Biostratigraphy of the Southern Margin of the Twin Cities Basin.** Bob Sloan, University of Minnesota, ssloan@winona.edu; Mike Middleton, University of Wisconsin–River Falls; Gerry Webers, Macalaster College.

EXHIBITS

Booths and table space will be available in the ballroom near the poster sessions. Contact Peter McSwiggen, McSwiggen and Associates, (612) 781-2282, PMcS@McSwiggenAssoc.com.

WORKSHOPS

Roy J. Shlemon Mentor Program in Applied Geoscience. Sponsored by GSA Foundation. Thursday, May 19, and Friday, May 20 from 11:30 a.m.–1 p.m., location available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real-life issues, including professional opportunities and challenges that await students after graduation. Plan to attend both free luncheons to hear different presenters each day. Students will receive in their registration packet FREE LUNCH tickets to attend both Shlemon Programs. However, space is limited. First come, first served.

The John Mann Mentors in Applied Hydrogeology Program. Sponsored by GSA Foundation. Thursday, May

19, 5–6:30 p.m., location available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This evening event presents mentoring opportunities for undergraduate and graduate students and recent graduates with declared interest in hydrogeology as a career to interact and network with practicing hydrogeology professionals. This focused, small-scale event features FREE refreshments for participants. Participant eligibility is limited to those students who have declared their career interest to be hydrology or hydrogeology on their GSA membership

applications and who have registered online for this meeting. An e-mail invitation will then be sent to those qualified students. Keep in mind that only a quick response to the invitation will secure you a seat, as attendance at this Mann Mentor event is limited!

ACCESSIBILITY

GSA is committed to making its meetings accessible to all people interested in attending. Please indicate special requirements (wheelchair accessibility, etc.) on the registration form. The Radisson Metrodome is ADA compliant.

ADDITIONAL DETAILS

Details about social events, business meetings, and student travel support and awards will be published in the February 2005 issue of *GSA Today*. See the GSA Web site, www.geosociety.org/sectdiv/Northc/05ncmtg.htm, for more information. Requests for additional information should be addressed to General Chairs Carrie Jennings, carrie@umn.edu, or Barbara Lusardi, lusar001@umn.edu, (612) 627-4780, Minnesota Geological Survey, 2642 University Avenue, St. Paul, MN 55114.

Come to Minnesota for the GSA North-Central Section Meeting • May 19–20, 2005

Carrie Jennings and Barbara Lusardi, General Chairs, GSA North-Central Section Meeting

We have adopted a digital elevation map (see www.nced.unm.edu/posters if this copy of *GSA Today* does not include a map) as our flagship graphic because it demonstrates how we are centrally located within the section and within the continent and how we are positioned among varied geologic terranes. The Canadian Shield lies to the north and northeast, basalt and sedimentary rock of the mid-continent rift to the east, rocks of the Paleozoic seas to the south and east, and the Cretaceous Interior Seaway to the west. Continental glaciation affected the entire region by eroding deep troughs, depositing thick till sequences, altering drainage history, or creating eolian deposits.

As you can see in the striking digital elevation model on our poster, prominent highlights of our geology are the effects of the fast-moving streams of ice that flowed within the Laurentide Ice Sheet, located mainly in Canada. The paths of ice-stream tributaries that fed the James and Des Moines lobes in the Dakotas and Minnesota snake around Tertiary-cored highlands in Western Manitoba and eastern Saskatchewan. Large fields of drumlins, rogen moraine, and fascinating moraines appear within these troughs. These ice streams and others like them fed discrete ice lobes that moved into Minnesota and the Great Lakes states through structural lows or areas of erodible sediment and rock. These lobes have their own landform suites, owing mainly to varying textures of till. A field trip will visit the ice lobe confluence area in central Minnesota. Theme sessions will be devoted to both unraveling the stratigraphic record preserved in nearly a kilometer of till and using soils to interpret glacial landscapes.

You can also see Precambrian rocks of the Canadian Shield from northern Minnesota into

Ontario that were swept clear of any saprolite cover during glaciations but were otherwise little altered. The variable resistance of metamorphic and igneous rocks to chemical weathering allows areas of ancient granitic and gneissic crust to be delineated from narrower greenstone belts. Field trips and sessions will focus on the Archean through Proterozoic history of this area as well as the mineral potential and underground lab possibilities.

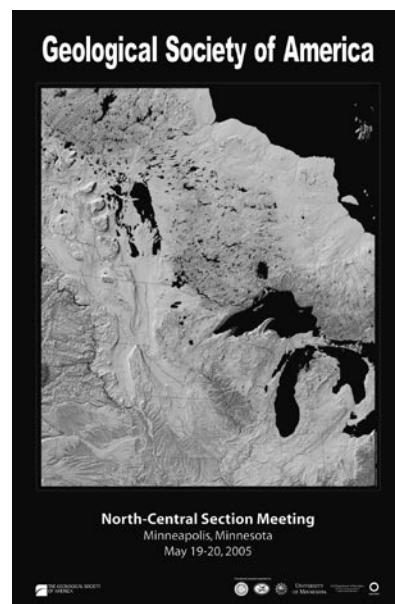
The Mesabi Iron Range, another field trip destination, is located parallel to and immediately south of the narrow, zig-zagging ridge of the Giants

Range in northeastern Minnesota. It originally formed at the margins of a seaway occupying the Keweenawan Rift basin, and its eastern counterpart can be identified in northern Wisconsin and the Keweenaw Peninsula of the Upper Peninsula of Michigan. The rift, of course, lies beneath the deep Lake Superior basin and trends southwest and then south through the state. A symposium will be devoted to summarizing a century of geologic research on the rift.

The Paleozoic seas reached into southeastern Minnesota, and flat-lying layers of clastic and carbonate rocks underlie all of the states south and east of Minnesota. The deep incision of the Minnesota and Mississippi rivers during glaciations led to the dissection of these units, providing accessible exposures as close as the Twin Cities metropolitan area, where the meeting will be held. The potential for karst is highest in the southeastern part of the state, and a unique field trip will focus on the excavation of a sinkhole.

The southeast has been called "The Driftless Area," but the only truly "driftless" area lies across the Mississippi River in Wisconsin. Regions not affected by Late Wisconsinan glaciation are otherwise easily identified by the dissected nature of the landscape. Structure, joints, and wind appear to be the main controls on drainage orientation. Theme sessions are planned on the evolution of the Mississippi River and fluvial and glaciofluvial systems in the Midwest.

To find out more, come to Minnesota—the confluence of major rivers, the intersection of ice lobes, the former rift in the continent, the margin of seaways, for this unique meeting of geologic terranes.



Download this map for free at
www.nced.unm.edu/posters.



Preliminary Announcement and Call for Papers

ROCKY MOUNTAIN

57th Annual Meeting Rocky Mountain Section, GSA Mesa State College, Grand Junction, Colorado

May 23–25, 2005

The 57th Annual Meeting of the Rocky Mountain Section will be hosted by the Geology Program within the Department of Physical and Environmental Sciences, Mesa State College. The meeting will be held on the campus of Mesa State College.

ENVIRONMENT

Located in Grand Junction, Colorado, Mesa State College is a medium-sized (6,000 students) liberal arts college. Grand Junction (population 116,000) is the largest city in western Colorado. The high desert climate (elevation 4,600 feet) is typically mild and sunny during May, perfect for the planned field trips. Local geological attractions include Colorado National Monument, the Book Cliffs, Unaweep Canyon, Dinosaur Journey Museum, Riggs Hill and Dinosaur Hill Outdoor Museums, Rabbit Valley Dinosaur Quarry, and the Museum of Western Colorado. Within a two-hour drive are Arches National Park, Canyonlands National Park, the Black Canyon of the Gunnison National Park, and Dinosaur National Monument.

CALL FOR PAPERS

Papers are invited for symposia, theme, and general sessions. Authors interested in volunteering papers for symposia should contact the appropriate symposium convener before submitting abstracts. Technical session presentations will generally be 12 minutes in length with three minutes for questions. Some sessions may use a longer format. Only digital-media presentations will be allowed (sorry, no slides). Since a centralized computer system will be used, speakers are not allowed to use their own laptops.

Poster space will be 4 by 8 feet. A limited number of tables will also be available upon request. Authors are required to be present for at least one hour at the end of the day.

ABSTRACTS

Abstract deadline: February 22, 2005

Abstracts for all sessions should be submitted online at www.geosociety.org. If you cannot submit your abstract electronically, contact Nancy Carlson, (303) 357-1061, nCarlson@geosociety.org.

REGISTRATION

Standard registration deadline: April 18, 2005

Cancellation deadline: April 25, 2005

GSA Headquarters will handle meeting registration. (See Feb. 2005 issue of *GSA Today* for details.) Registration will be

available online at www.geosociety.org beginning February 2005. On-site registration: Mesa State College.

ACCESSIBILITY

GSA is committed to making its meetings accessible to all people interested in attending. Indicate special requirements (wheelchair accessibility, etc.) on the registration form. Mesa State College is ADA compliant.

FIELD TRIPS

For additional information regarding field trips, please contact either the trip leader or the field trip chair, Gigi Richard, (970) 248-1689, grichard@mesastate.edu. A field trip guidebook will be supplied to all field trip participants and will be available for purchase by other attendees during the meeting. Field trip leaders and those interested in contributing related papers should contact the editor, Larry Jones, (970) 248-1787, lajones@mesastate.edu, for formatting and deadline information.

Premeeting

1. **Geological History of the Uncompahgre Plateau and Unaweep Canyon: From Permian Glaciers to Plio-Pleistocene Neotectonics.** (2 days) Sat. and Sun., May 21–22. Andres Aslan, Mesa State College, (970) 248-1614, aaslan@mesastate.edu; William Hood, Mesa State College; Lynn Soreghan, University of Oklahoma; Michael Blum, Louisiana State University.
2. **Dinosaur Quarries of Western Colorado and Eastern Utah.** (2 days) Sat. and Sun., May 21–22. John Foster, Museum of Western Colorado, (970) 858-7282, jfoster@westcomuseum.org; Rod Scheetz, consulting paleontologist.
3. **Colorado River Raft Trip, Grand Junction to Westwater.** (3 days) Fri.–Sun., May 20–22. John Pitlick, University of Colorado, Boulder, (303) 492-5906, pitlick@colorado.edu.
4. **Hydrological Systems and Geoarchaeology of Canyonlands National Park, Island in the Sky District.** (1 day) Sun., May 22. Kenneth Kolm, Blasland, Bouck & Lee, Inc., Golden, Colorado, (303) 231-9115, kkolm@bbl-inc.com.

Concurrent

5. **Geology of Colorado National Monument.** (half-day) Tues. afternoon, May 24. William Hood, Mesa State College, (970) 241-8020, WHood@compuserve.com.
6. **Viniculture Geology, Chemistry, and Biology of the Grand Valley, Colorado.** (half-day) Mon. afternoon, May 23. Harold (Skip) Hase, Mesa State College, (970) 248-1161, shase@mesastate.edu; Larry Madsen, Mesa State College; Rick Ballard, Mesa State College.

Postmeeting

7. **The Uravan Mineral Belt.** (1 day) Thurs., May 26, 8 a.m.–5:30 p.m. William Chenoweth, U.S. Department of Energy (retired), (970) 242-9062, cheno@earthlink.net; Craig S. Goodknight, Edward T. Cotter, and Richard D. Dayvault, S.M. Stoller Corp., Grand Junction.

8. **Canyon of LoDore Raft Trip, Green River.** (4 days) Thurs.-Sun., May 26-29. Jack Schmidt, Utah State University, (435) 797-1791, jack.schmidt@usu.edu.
9. **Upheaval Dome Impact Crater (?), San Rafael Swell, and White Canyon Areas, Utah: Evidence Supporting a Major Bolide Impact Event Horizon Near the Permian-Triassic Boundary.** (2 days) Thurs. and Fri., May 26-27. Joe Fandrich, Mesa State College, (970) 256-9029, jfandrich@hotmail.com; Jared Morrow, University of Northern Colorado.
10. **Stratigraphy, Sedimentology, and Energy Resources of Cretaceous Rocks in the Book Cliffs Area, Western Colorado and Eastern Utah.** (2 days) Thurs. and Fri., May 26-27. Rex Cole, Mesa State College, (970) 248-1599, rcole@mesastate.edu; Robert G. Young, consulting geologist.

SYMPOSIA

For additional information regarding symposia, contact the individuals listed below or the technical program co-chairs, Andres Aslan, (970) 248-1614, aaslan@mesastate.edu, or Rick Livaccari, (970) 248-1081, rlivacca@mesastate.edu.

1. **Water Resources in the Colorado River Basin and the Western U.S.** Robert Ward, Colorado State University, (970) 491-6308, Robert.Ward@colostate.edu; Gigi Richard, Mesa State College, (970) 248-1689, grichard@mesastate.edu.
2. **Selenium-Sodium-Salinity-Sediment in the Upper Colorado River Basin: Origins and Impacts.** Richard Grauch, U.S. Geological Survey, Denver, (303)

236-5551, rgrauch@usgs.gov; Paul von Guerard, U.S. Geological Survey, Grand Junction, (970) 245-5257, pbvongue@usgs.gov.

3. **Buried Riches to Hazardous Wastes—Western Colorado's Uranium Legacy.** William Chenoweth, U.S. Dept. of Energy (retired), (970) 242-9062, cheno@earthlink.net; Craig Goodknight, S.M. Stoller Corp., (970) 248-6550, cgoodknight@gio.doe.gov.
4. **Bolide Impact Characteristics, Event Horizons, and Impact Structures in North America.** Joe Fandrich, Mesa State College, (970) 256-9029, joefandrich@hotmail.edu; Jared Morrow, University of Northern Colorado, (970) 351-2483, jared.morrow@unco.edu.

THEME SESSIONS

For additional information regarding theme sessions, contact the individuals listed below or the technical program co-chairs, Andres Aslan, (970) 248-1614, aaslan@mesastate.edu, or Rick Livaccari, (970) 248-1081, rlivacca@mesastate.edu.

1. **Sustainability of Groundwater Resources of the Colorado Plateau.** Kenneth Kolm, Blasland, Bouck & Lee, (303) 231-9115, kkolm@bbl-inc.com.
2. **The Colorado River System: Hydrology and Fluvial Processes.** Gigi Richard, Mesa State College, (970) 248-1689, grichard@mesastate.edu; John Pitlick, University of Colorado, Boulder, (970) 248-1689, pitlick@spot.colorado.edu.



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3. **Selenium-Sodium-Salinity-Sediment in the Upper Colorado River Basin: Origins and Impacts.** Richard Grauch, U.S. Geological Survey, Denver, (303) 236-5551, rgrauch@usgs.gov; Paul von Guerard, U.S. Geological Survey, Grand Junction, (970) 245-5257, pbvongue@usgs.gov.
4. **Late Cenozoic Evolution of the Rocky Mountains and Colorado Plateau.** Eric Leonard, Colorado College, (719) 389-6513, eleonard@coloradocollege.edu; Andres Aslan, Mesa State College, (970) 248-1614, aaslan@mesastate.edu.
5. **Precambrian Geology of Western Colorado.** Karl Karlstrom, University of New Mexico, (505) 277-4346, kek1@unm.edu.
6. **Sedimentology, Stratigraphy, and Energy Resources of Cretaceous Rocks in the Book Cliffs Area of Western Colorado and Eastern Utah.** Rex Cole, Mesa State College, (970) 248-1599, rcole@mesastate.edu.
7. **Paleoenvironments and Paleoecology of the Upper Jurassic Morrison Formation of the Western U.S.** John Foster, Museum of Western Colorado, (970) 2420-0971, jfoster@westcomuseum.org; Steve Hasiotis, University of Kansas, (785) 864-4941, hasiotis@ku.edu.
8. **Current Topics on Regional Vertebrate Tracks in the Modern Western Interior of the U.S.** Debra Mickelson, University of Colorado, Boulder, (303) 722-9995, Debra.Mickelson@colorado.edu; Martin Lockley, University of Colorado, Denver, mlockley@carbon.cudenver.edu.
9. **Quaternary Tectonics and Earthquake Hazards in the Rocky Mountain Region.** Vince Matthews, Colorado Geological Survey, (303) 866-3028, vince.matthews@state.co.us; Verner Johnson, Mesa State College, (970) 248-1672, vjohnson@mesastate.edu.
10. **Terrestrial Planetary Geology in North America.** Joe Fandrich, Mesa State College, (970) 256-9029, joefandrich@hotmail.edu; Jared Morrow, University of Northern Colorado, (970) 351-2483, jared.morrow@unco.edu.
11. **Council on Undergraduate Research—Undergraduate Research Poster Session.** Kim Hannula, Ft. Lewis College, (970) 247-7463, hannula_k@fortlewis.edu.

WORKSHOPS

- Introduction to Geographic Information Systems and Global Positioning Systems.** (2 days) Sat. and Sun., May 21–22. Ann B. Johnson, Higher Education Manager, Environmental Systems Research Institute (ESRI), ajohnson@esri.com; Dave Fosdek, ESRI; Verner Johnson, Mesa State College. This course will introduce the use of GIS in geology-related applications using ArcGIS, ArcMap, ArcCatalog, and Spatial and 3-D Analyst extensions. Experience with ArcGIS is not necessary, but familiarity with Windows OS would be beneficial. Focus will be hands-on use of ArcGIS including ModelBuilder, data access, and analysis, Geoprocessing with ArcTools, and the Geodatabase.

Roy J. Shlemon Mentor Program in Applied Geoscience. Sponsored by GSA Foundation. Mon., May 23, and Tues., May 24, 11:30 a.m.–1 p.m., location available at GSA's registration desk. Students will receive in their registration packet FREE LUNCH tickets to attend both Shlemon Programs. However, space is limited.

John Mann Mentors in Applied Hydrogeology Program. Sponsored by GSA Foundation. Mon., May 23, 5–6:30 p.m., location available at GSA's registration desk. Mentoring opportunities for students with declared interest in applied hydrogeology as a career to interact and network with practicing hydrogeology professionals. Invitation only; FREE refreshments.

SPECIAL EVENTS

Ice Breaker. Sun., May 22, 5 p.m., W.W. Campbell College Center, Mesa State College.

Annual Banquet and Business Meeting. TBA
Rocky Mountain Section Board Meeting. TBA

SPOUSE AND GUEST ACTIVITIES

Grand Junction has numerous facilities and opportunities for guests and spouses. The area is rapidly gaining recognition of its high-quality vineyards, championship golf courses, restaurants, museums, and shopping venues. Within minutes of downtown are many areas for mountain biking, rafting, hiking, rock and fossil collecting, and photography. Half-day trips to Colorado National Monument and winery tours will be available. For additional general information, contact the Grand Junction Visitor and Convention Bureau at 800-962-2547, or www.visitgrandjunction.com.

STUDENT TRAVEL

The Rocky Mountain Section and the GSA Foundation have made travel grants available for students who are presenting oral or poster papers. Students must be currently enrolled and must be Rocky Mountain GSA members. Students should contact Kenneth Kolm at (303) 231-9115 or kkolm@bbl-inc.com.

STUDENT AWARDS

Awards will be given for best student oral (undergraduate or graduate) and poster (undergraduate only) presentations. To be eligible, students must be lead authors and presenters and should clearly identify their abstracts as student work.

EXHIBITS

A limited amount of exhibit space may be available at \$250 per booth for commercial organizations and \$100 per booth for nonprofits. Contact Rex Cole at (970) 248-1599 or rcole@mesastate.edu.

ACCOMMODATIONS

An excellent selection of hotels and motels are available, but are located several miles from the Mesa State campus. Special GSA rates will appear in the February 2005 *GSA Today*. For students or those on a budget, a limited number of on-campus apartments may be available.

ADDITIONAL INFORMATION

For additional information, please contact one of the committee members: General Chair Rex Cole, (970) 248-1599, rcole@mesastate.edu; Vice Chair and Technical Co-chair Andres Aslan, (970) 248-1614, aaslan@mesastate.edu; Technical Co-chair Rick Livaccari (970) 248-1081, rlivacca@mesastate.edu; Field Trip Chair Gigi Richard, (970) 248-1689, grichard@mesastate.edu.

UPCOMING DEADLINES

Committee Service

Nominations Due January 15, 2005

Candidates are needed for service on the following GSA committees: Annual Program; Arthur L. Day Medal Award; Education; Geology and Public Policy; Honorary Fellows; Joint Technical Program; Membership; Minorities and Women in the Geosciences; Nominations; Penrose Conferences and Field Forums; Penrose Medal Award; Professional Development; Publications; Public Service Award; Research Grants; Young Scientist Award.

Candidates are also needed for GSA representatives to the North American Commission on Stratigraphic Nomenclature, the AAPG Publication Pipeline Committee, the AGI Environmental Geoscience Advisory Committee, and the AAAS Consortium of Affiliates for International Programs. Service begins July 2005 for all positions except NACSN, which begins November 1, 2005, and Joint Technical Program, which begins January 1, 2006.

For complete information on committee service, current vacancies, and required qualifications, see the October 2004 issue of *GSA Today*. Nomination form and instructions are available at www.geosociety.org/aboutus/commtees/

Officers and Councilors

Nominations Due August 1, 2005

The GSA Committee on Nominations requests nominations for officers (vice president and treasurer) and councilors to serve on the GSA Council beginning in 2006. Each nomination should be accompanied by basic data and a description of the qualifications of the individual for the position recommended.

The online nomination form is available at www.geosociety.org/aboutus/commtees/, or you may send materials for committee, officer, and councilor nominations to Ruth Harrison, GSA, P.O. Box 9140, Boulder, CO 80301-9140, (303) 357-1000, ext. 0, 1-800-472-1988, ext. 0, rharrison@geosociety.org.

Medals and Awards

Nominations Due February 1, 2005

Nominations of candidates are requested for the following medals and awards: Penrose Medal, Day Medal, Honorary Fellows, Young Scientist Award (Donath Medal), GSA Public Service Award, and Distinguished Service Award. For details on the awards and nomination procedures, see the October 2004 issue of *GSA Today*, go to www.geosociety.org, or call (303) 357-1028. Materials and supporting information for any of the nominations may be sent to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140.

National Awards

Nominations Due April 30, 2005

Candidate nominations are needed for the following national awards: William T. Pecora Award, National Medal of Science, Vannevar Bush Award, and Alan T. Waterman Award. For details, see the October 2004 issue of *GSA Today*. Nominations should be sent to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140.

GSA Fellows

Nominations Due January 15, 2005

The Committee on Membership requests nominations of members to be elevated to GSA Fellow status. Any GSA Fellow may nominate up to two members per election cycle for this honor. Two other supporting signatures are needed, along with a letter stating the member's qualifications to be evaluated on the basis of eight established criteria. For updated information, a list of the criteria, and a new nomination form, please see www.geosociety.org/members/fellow.htm or contact Diane Lorenz, (303) 357-1028, awards@geosociety.org.

2005 Subaru Outstanding Woman in Science Award

(Sponsored by Subaru of America, Inc.)

Nominations Due February 1, 2005

This award is given to a woman who has made a major impact on the field of the geosciences, based on her Ph.D. research. For nomination, eligibility, and award details, see the October 2004 issue of *GSA Today*, visit www.geosociety.org, or call (303) 357-1028. Send nominations and supporting material to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140.

John C. Frye Environmental Geology Award

Nominations Due March 31, 2005

In cooperation with the Association of American State Geologists, GSA makes an annual award for the best paper on environmental geology published either by GSA or by one of the state geological surveys. For details, see the October 2004 issue of *GSA Today*, visit www.geosociety.org, or call (303) 357-1028. Nominations must be sent to Program Officer, Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140.

Student Research Grants

Online submission must be completed by midnight, February 1, 2005, MST.

The GSA student research grant application process is now available only online. Although the current forms have not changed significantly, the process for submitting applications and appraisal letters is accessible only online only through GSA's password-protected Web site. No paper applications or letters will be accepted. The site should be live by mid-November. For information on the 2005 Research Grant Program for Students, see the October 2004 issue of *GSA Today*, visit www.geosociety.org, call (303) 357-1028, or e-mail awards@geosociety.org.

Congressional Science Fellowship

Applications Due January 21, 2005

For application information for the 2005–2006 GSA–U.S. Geological Survey Congressional Science Fellowship, visit www.geosociety.org/science/csf/, or contact Ginger Williams, GSA Headquarters, (303) 357-1040, gwilliams@geosociety.org.

PROPOSED STATEMENT ON VISAS FOR FOREIGN SCIENTISTS AND STUDENTS: Panel Seeks Help

In response to increased State Department restrictions which are delaying or preventing outstanding young international students from receiving student F-1 visas and impeding the issuance of B-1 and J-1 visas to visiting science professionals and researchers, GSA Council has appointed a panel to prepare a position statement on visa restrictions. The panel seeks your help in crafting the statement.

Throughout its history, the United States has benefited enormously from an influx of foreign-born scientists and engineers whose talents and energy have driven many of our advances in scientific research and technological development. In 2001, approximately half of the graduate students enrolled in the physical sciences and engineering at U.S. universities came from other nations. According to the Council of Graduate Schools, there has been a 32% decrease in the number of international graduate student submissions for fall 2004 compared to fall 2003. At the same time, Australia has experienced a 16.5% increase in the number of foreign students. The United States' decrease in foreign students has occurred since the enactment of the USA Patriot Act of 2001 and the Enhanced Border Security and Visa Entry Reform Act of 2002. Science and engineering studies in particular have been affected, since they are more likely to be listed as one of the sensitive subjects on the government's Technology Alert List, which triggers a greater security check by the Visas Mantis program, a program designed to protect against the transfer of sensitive technologies. Several scientific leaders have noted that the country is squandering its goodwill and competitive advantage by forcing international scholars and students to jump through these additional bureaucratic hoops. Furthermore, the growing perception abroad of the United States as unfriendly to foreign scientists and students is

something that could be much more difficult to repair than simply reversing the current restrictive policies.

Scientific and engineering research has become a truly global enterprise. International conferences, collaborative research projects, and the shared use of large experimental facilities are essential for progress at the frontiers of these areas. Visa restrictions, if not hindering, are at least reducing international collaborations at U.S. experimental facilities, making it more difficult for the facilities to acquire international support and for U.S. scientists and engineers to enjoy reciprocal access to important facilities abroad. In addition, the lengthy security check and changing security measures (the National Security Entry Exit Registration System of 2002 has now been replaced by Student and Exchange Visitor Information System of 2004) has kept many foreign scholars and students from attending academic meetings in the United States, including individuals who are invited speakers. Another consequence is that international scientific organizations are choosing to hold their future meetings in Europe and other venues rather than deal with the difficulties of obtaining U.S. visas. Not only is this an economic issue for convention centers, hotels, and restaurants, but it reduces the participation of U.S. scientists at the international level, in part due to the continued decrease in funding for foreign travel or outright ban of travel by the U.S. government (i.e., medical doctors to Cuba).

It is important to make our nation safe both by decreasing terrorism and by limiting inappropriate transfer of technology. However, the current visa policy, which was adopted to keep out foreigners who might harm citizens of the United States, is also having serious unintended consequences for the health and status of American science and engineering. The professional visits of foreign scientists and engineers and the

training of highly qualified foreign students are important for maintaining the vitality and quality of the U.S. research enterprise. This research, in turn, underlies national security and the health and welfare of both our economy and society. Many scientific, academic, and professional organizations are urging reforms in the current visa policies. In May 2004, a group of leading scientific, engineering, and educational organizations representing nearly 95% of the U.S. research community sent a statement to President Bush and Congress with six practical recommendations for solving the current visa processing crisis. The organizations are resolute in their support of a secure visa system and believe that it is possible to have a system that is timely, transparent, provides for thorough reviews, and still welcomes the brightest minds in the world. The recommendations are: (1) extend the validity of Visas Mantis security clearances for international students, scholars, and scientists from the current one-year period to the duration of their course of study or academic appointment; (2) establish a timely process by which exchange visitors holding F and J visas can revalidate their visas, or at least begin the visa renewal process, before they leave the United States to attend academic and scientific conferences, visit family, or attend to personal business; (3) create a mechanism by which visa applicants and their sponsors may inquire about the status of pending visa applications, and establish a process by which applications pending for more than 30 days are given priority processing; (4) provide updated training of consular staff, establish clear protocols for initiating a Visas Mantis review, and ensure that screening tools are being used in the most appropriate manner; (5) revise visa reciprocity agreements between the United States and key sending countries, such as China and Russia, to extend the duration of visas each country grants citizens of the other, thereby reducing the number of

times that visiting international students, scholars, and scientists must renew their visas; and (6) implement a fee-collection system for the Student and Exchange Visitor Information System that allows for a variety of simple fee payment methods that are quick, safe and secure, including payment after the individual arrives in the United States.

On July 21, Senator Norm Coleman introduced a bill entitled International Student and Scholar Access Act of 2004 which is designed to improve access to graduate schools in the United States. This bill has been read twice and referred to the Committee on the Judiciary. Several of the items in the bill are of direct concern to GSA and its members: the direction to the president to consult with organizations that participate in international exchange programs, the development of guidance documents and training of consular officers to ensure that only cases of concern are subjected to special review, and the development of coordinated procedures between the Departments of State, Commerce, Education, and Homeland Security including the issuance of visas which span the entirety of a research project with ability to travel between countries. Therefore, the development of a position statement on visas

for scholars and students is necessary so that GSA as a society is in a position to respond to proposed legislation and to encourage the government to reexamine their recently established visa policies.

For current information about the topics mentioned above, check these sites: www.nas.edu, www.acs.edu, www.gao.gov, <http://opendoors.iienetwork.org>, <http://congress.org>.

GSA's panel on Visas for Foreign Scientists includes Mark Cloos, University of Texas at Austin; Jonathan Fink, Arizona State University; Harry Y. McSween, University of Tennessee; Tapani Ramo, University of Helsinki; Co-Chair Tammy L. Dickinson, National Research Council; and Co-Chair Melanie Barnes, Texas Tech University.

Panel members would like to have input from a broad range of GSA members on this issue (contact panel co-chair Melanie Barnes, melanie.barnes@ttu.edu). They are particularly interested in examples of how the current visa policies are affecting your research programs and interactions with foreign scientists. Please feel free to share this concern and ask for input from your colleagues both here and abroad.

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FIELD FORUM REPORT

Processes on the Early Earth

JULY 4–9, 2004

Kaapvaal Craton, South Africa

Conveners and Reporters:

Wolf Uwe Reimold, Impact Cratering Research Group, School of Geosciences, University of the Witwatersrand, Johannesburg, South Africa

Carl R. Anhaeusser, Economic Geology Research Institute, School of Geosciences, University of the Witwatersrand, Johannesburg, South Africa

Ken A. Eriksson, Department of Geosciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA

Axel Hofmann, School of Geosciences, University of the Witwatersrand, Johannesburg, South Africa

Roger L. Gibson, Impact Cratering Research Group, School of Geosciences, University of the Witwatersrand, Johannesburg, South Africa

Christian Koeberl, Department of Geological Sciences, University of Vienna, Vienna, Austria

Bruce M. Simonson, Geology Department, Oberlin College, Oberlin, Ohio, USA

Frances Westall, Centre de Biophysique Moléculaire, CNRS, Orléans, France

The first-ever Field Forum hosted jointly by GSA and the Geological Society of South Africa was held in South Africa July 4–9, 2004. The 42 participants from 13 countries gathered to investigate and debate recent developments dealing with “Processes on the Early Earth.” Themes within the forum included: accretionary processes; the age of the Earth and the oldest rocks on Earth; early heavy impact on the Earth and Moon; Archean crust formation and geodynamics; impact flux through time; traces of impact events in Archean strata; significance of large impact events for development of early life; earliest formation of life on Earth; early sedimentary processes; and Archean oceans. Discussion was facilitated by two superlative Archean field localities in the Kaapvaal Craton: the Barberton Mountain Land and the Vredefort Dome—the central uplift part of the world’s largest and oldest meteorite impact structure. Together, these terrains provided an opportunity to examine events spanning at least 1000 m.y. of Archean history and crustal environments ranging from the surface to the deep crust.

Participants included experts in several of these fields, but also a number of newcomers and postgraduate students, thus providing an opportunity for multilevel exchange. Invited lectures set the scene, and field examinations involved both traditional introductory talks and short reviews by experts on specific subjects, such as impact spherule layers and the record of the early atmosphere, *inter alia*. A mixture of evening overview talks and presentations in the field, with poster presentations by all participants, was chosen for this event. Highlights follow.

An overview of the geology (including stratigraphy, chronology, geodynamic models, and historical aspects) of the Barberton greenstone belt (BGB) by Carl Anhaeusser (University of Witwatersrand) set the scene for the first day in the field. Field observations in the vicinity of the Komati Formation type section in the Komati River valley followed, as did a series of stops in surrounding granitoids, providing an introduction to granite-greenstone relationships and 3.5–3.2 Ga tectonics in the southern parts of the belt. This included a detailed discussion of

high-grade metamorphic (possible core complex) granitoids in close proximity to low-grade mafic-ultramafic rocks by Annika Dziggel (University of Aachen). Nick Arndt (University of Grenoble) gave an in-depth overview of the current understanding of the petrogenesis of Archean mafic-ultramafic volcanic sequences. New evidence for high-grade, low-geothermal gradient metamorphism, presented by Annika Dziggel, challenged the view that BGB metamorphism was shallow-level and associated with high geothermal gradients. This view also suggests that the lowermost part of the greenstone succession is, in fact, a distinct structural unit juxtaposed by tectonics.

The second day involved the study of the Komati River gorge section in the Songimvelo Nature Reserve (led by Axel Hofmann, University of Witwatersrand) through 3.45–3.3 Ga metasedimentary and metavolcanic rocks of the Kromberg Formation, which included aspects related to early surface processes, earliest microfossil evidence and hydrothermal activity, as well as pyroclastic ultramafic magmatism. The visit of the Komati River gorge in the Songimvelo Nature Reserve yielded several surprises: elephants took a fleeting interest in the group, and a serious case of geo-vandalism was observed. Many prime exposures along this exceptional traverse had been recently drilled for paleomagnetic and other analysis, thus defacing a series of what were once photogenic exposures. In the afternoon, Carl Anhaeusser led the excursion to exposures of spinifex-textured komatiite and pillowed basaltic komatiite exposed in some of the xenoliths in the area south of the BGB. In addition, outstanding river sections exposing TTG (trondhjemite-tonalite-granodiorite) gneisses and migmatites were examined.

The evening session comprised an overview by Ken Eriksson (Virginia Polytechnic Institute, Blacksburg) of the intriguing 3.3–3.2 Ga Fig Tree and Moodies Group metasediments (including the earliest tida-lites) from the northern part of the BGB, which was followed by Bruce Simonson’s (Oberlin College) presentation on impact spherule layers as the only available witnesses of Archean and Paleoproterozoic impact activity and sedimentological processes related to their deposition, types of meteoritic projectiles, and the nature of the early target regions.

Day 3 began with a field presentation on Archean atmospheric and seawater conditions by David Catling (University of Washington) at an impressive outcrop of jaspilitic banded iron formation. An impact spherule layer was visited in the Barite Valley Syncline area, before heading off to the northern part of the belt to study the oldest known tidal deposits of the Moodies Group in Sheba Creek, Eureka Syncline (Fig. 1). A stop on the basal Moodies conglomerate at Izzy's Pass completed the field program for the day. The evening session began with a presentation by Patricia Corcoran (University of Western Ontario, London), who linked modern sedimentological processes with observations on Archean metasediments of the Slave Province, Canada, followed by poster viewing and debate. The quality of posters presented was of a high standard and covered a wide spectrum, from regional geological, to geochemical, to geodynamic issues, mostly on Archean and early Proterozoic topics.

The next day involved the transfer from Barberton to the Vredefort Dome (a distance of approximately 400 km), after break-out groups visited either the Msauli Chert type section with microfossil-bearing carbonaceous cherts and accretionary lapilli beds (in contrast to the impact spherule layer site visited earlier), the Stolzburg layered ultramafic complex, or the giant stromatolites of the Malmani Group in the Transvaal Supergroup. All participants reconvened in the evening near Vredefort for a feast of local (Free State) cuisine (which must also be considered as the coldest barbecue most of us had ever attended). Despite the late hour, Roger Gibson (University of Witwatersrand) then presented a review of the various geodynamic models for the evolution of the Kaapvaal Craton, with Cristiano Lana (Imperial College) adding the specific Vredefort basement-derived version. The field stops during the ensuing two days examined various aspects of the Meso- and Late Archean evolution of the central Kaapvaal Craton, a period that was marked by the change from granite-greenstone tectonics to the development of broad supracrustal basins that have experienced comparatively little subsequent disturbance. Central to this transition were events at ca. 3.1 Ga that are manifested by voluminous postorogenic

granitoid plutonism across large parts of the craton; however, the Vredefort region shows a somewhat anomalous pattern, with intense polyphase deformation, high-grade metamorphism and TTG plutonism at this time, suggesting that it represents a 3.1 Ga craton margin. Delegates had the opportunity to examine the evidence for magmatic and tectonic thickening of the granite-greenstone crust at Vredefort during this event, and to examine new evidence for syn- to late-orogenic extensional collapse that exhumed the high-grade terrane and facilitated the deposition of the basal units of the supracrustal sequence as early as 3.074 Ga. Excellent quarry and road exposures proved particularly informative in examining the complex and unusual deformation features (shatter cones, breccias) that accompanied the dome-forming impact event at 2.02 Ga.

The final evening session was devoted to early impact processes and geochemistry, with Christian Koeberl (University of Vienna) providing a seminal talk on the earliest impact record of the solar system and especially Earth, followed by a talk on the early geochemical record by Jan Kramers (University of Bern). If anything, the excellent record of interaction and debate that was characteristic of the entire Field Forum was surpassed that evening, with questions regarding the apparent paucity of the impact record during the first half of the Earth's existence being animatedly debated.

The week after the Field Forum, the Geoscience Africa 2004 conference was held at the University of the Witwatersrand in Johannesburg. This conference also entailed a weeklong symposium on "Birth and Growth of Continents," with much attention to Archean and early Proterozoic geodynamics.

Sponsoring Organizations

- ▼ National Research Foundation of South Africa, a significant sponsorship which allowed the participation of a number of postgraduate students from several countries.
- ▼ Council for Geoscience (Geological Survey of South Africa), which supported the participants with relevant publications.

Participants

Wlady Altermann
 Carl R. Anhaeusser
 Nick Arndt
 David Banks
 Jay Barton
 Mauricio Carneiro
 David Catling
 Patricia Corcoran
 Sjoukje de Vries
 Annika Dziggel
 Ken Eriksson
 Roger Gibson
 Jelte Harnmeijer
 Russell Hartlaub
 Axel Hofmann
 Antti Kallio
 Karl Keizars
 David King
 Hanan Kisch
 Kouki Kitajima
 Christian Koeberl
 Jan Kramers
 Philippe Labrot
 Cristiano Lana
 Jared Morrow
 Paula Ogilvie
 Beate Orberger
 Alexander Otto
 Roland Pease
 Lucille Petruny
 Daniele Pinti
 Wolf Uwe Reimold
 Ulrich Riller
 Vincent Rouchon
 Tracy Rushmer
 John Shervais
 Bruce Simonson
 Edward Simpson
 Slava Solomatov
 Frances Westall
 Martin Wille
 Shuhai Xiao

GeoVentures™ 2005

For complete details on GeoVentures or for full itineraries, contact Edna Collis, Program Officer, 1-800-472-1988, ext. 1034, fax 303-357-1072, ecollis@geosociety.org.



For Students Only!

GeoTrip Eastern Australia— Fossils, Intrusions, Caves, and Coasts

June 16–June 27, 2005
Departs from Sydney, Australia
(10 days, 11 nights)

Trip Leaders:

Gary Lewis, Director, GSA Education and Outreach Department. Gary, a geologist and educator, has been leading trips in Australia since 1989. Prior to his work as director of Education and Outreach at GSA, he worked for the Australian Geological Survey for 9 years and at CSIRO (Commonwealth Scientific & Industrial Research Organisation). Gary studied at Sydney University.

Greg McNamara, paleontologist and geoscience educator. Greg studied at Monash University in Melbourne and has worked at James Cook University in Far North Queensland. He has been the manager of education programs at the Australian Geological Survey, as well as at museums and other institutions.

This special trip for students has been designed to increase your field knowledge of a range of sedimentary and igneous terrains. Come "downunder" and spend time examining huge sedimentary basins, mapping intrusions, identifying fossil assemblages, and visiting caves. For almost half of this trip you will be housed less than 100 yards from a pristine beach and estuary. As well as having great geological experiences, you will also have time to visit famous landmarks in Sydney and the Australian national capital, Canberra. While this trip is held in Australia's winter, temperatures are mild and weather is normally dry. All accommodations are in dorms or cabins, and participants will need to supply their own sleeping bags. Once in Australia, you might like to visit some of the other famous places, such as the Great Barrier Reef or Uluru (Ayers Rock) before or after the GeoTrip. Optional extras include a kayaking experience along a section of rugged coastline or into a pristine lake.

Fees and Payment: \$1,525 for GSA student members, \$1,625 for nonmembers. \$200 deposit is due with your reservation and is refundable (less \$75) through May 1. Balance is due May 1. Minimum participants: 12 (*firm*); maximum: 20. **Included:** Ground transportation within Australia, all accommodations, all park entry fees, field guides, all breakfasts, most lunches, four dinners. **Not included:** Airfare to and from Sydney, optional side excursions (caves and kayaks), alcoholic beverages, personal expenditures, and any other expenses not specifically included in the itinerary.

Register before December 24 and you can be part of a special airfare deal. We can obtain round-trip Los Angeles–Sydney airfares for around \$1,150 (dependent on exchange rates and tax changes). If you wish to be part of this special airfare, please contact Jenelle Nicholls, Jenelle.nicholls@flightcentre.com.au, and mention that you are part of this GSA GeoTrip (leader Gary Lewis). Airfares from other destinations can also be arranged. Jenelle also can assist you with other pre- or post-GeoTrip excursions.

For more information, contact
geoventures@geosociety.org.

REGISTER TODAY!

Send a deposit to hold your reservation; please pay by check or credit card.
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ANNOUNCEMENTS

Meetings Calendar

2005

- February 6–9 31st Annual Conference on Explosives & Blasting Technique, Orlando, Florida, USA.
Information: www.isee.org.
- February 17–21 2005 AAAS Annual Meeting, Washington, DC. **Information:** www.aaas.org/meetings/Annual_Meeting/02_PE/PE.shtml.
- July 3–7 Waves 2005: 5th International Symposium on Ocean Wave Measurement and Analysis, Madrid, Spain. **Information:** www.cedex.es/waves2005/.

About People

GSA member **Harvey Parker**, a Seattle-based consulting civil engineer, was elected in Singapore to a three year term as president of the International Tunneling Association (ITA), an organization, composed of 53 Member Nations, based in Lausanne, Switzerland. Parker is ITA's representative to the United Nations and its spokesperson on sustainable development and tunnel security.

AWG Announces Outstanding Educator

The Association for Women Geoscientists will present GSA Member Patricia Manley with its 2004 Association for Women Geoscientists Foundation Outstanding Educator Award at the GSA Annual Meeting in Denver. One of her former students wrote of Manley, who is an associate professor of geology at Middlebury College, "...she treats students like colleagues." Another student wrote, "...Pat realized in me a potential that at that time, I did not realize in myself." Read more at www.awg.org.

Call for Applications:



Apply for the GSA-USGS Congressional Science Fellowship for 2005–2006

Opportunities to serve as a Congressional Science Fellow are rare, unique experiences. This position may be a good fit for you. It will enable you to work directly with national leaders and put your expertise and experience to work helping shape science and technology policy on Capitol Hill.

The Congressional Science Fellow will be selected from top competitors early in 2005. Prospective candidates should be GSA members with broad geoscience backgrounds and excellent written and oral communication skills. Minimum requirements are a master's degree with at least five years professional experience or a Ph.D. at the time of appointment.



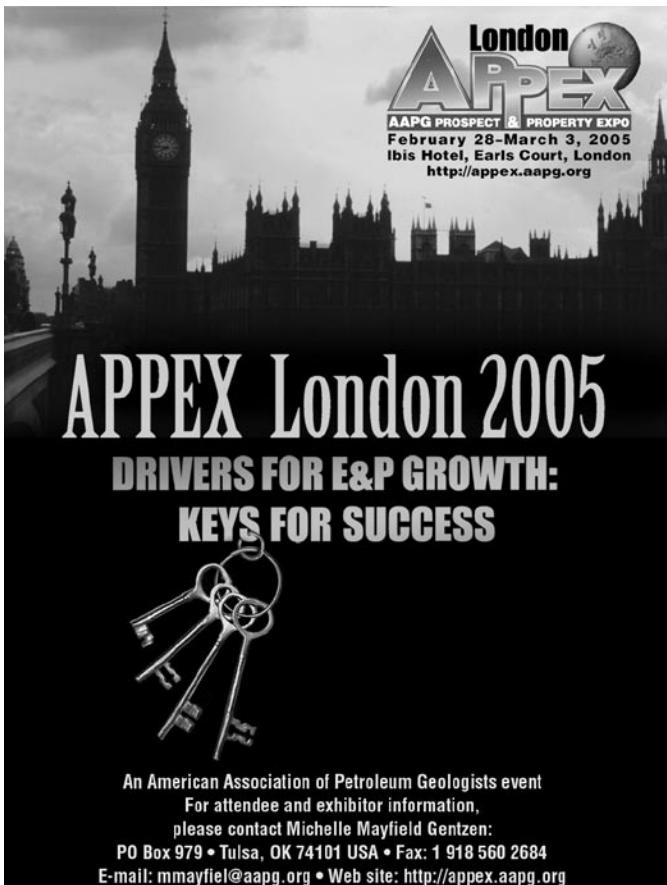
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A black and white poster for the AAPG PROSPECT & PROPERTY EXPO, February 28–March 3, 2005, Ibis Hotel, Earls Court, London. The poster features a silhouette of the Palace of Westminster and Big Ben against a cloudy sky. The text includes "London APPEX AAPG PROSPECT & PROPERTY EXPO February 28–March 3, 2005 Ibis Hotel, Earls Court, London <http://appex.aapg.org>". Below this, the main title "APPEX London 2005" is displayed in large, bold, sans-serif letters. Underneath, the subtitle "DRIVERS FOR E&P GROWTH: KEYS FOR SUCCESS" is shown in a smaller, bold font. To the right of the subtitle is a stylized illustration of several interlocking keys. At the bottom, there is contact information: "An American Association of Petroleum Geologists event For attendee and exhibitor information, please contact Michelle Mayfield Gentzen: PO Box 979 • Tulsa, OK 74101 USA • Fax: 1 918 560 2684 E-mail: mmayfiel@aapg.org • Web site: <http://appex.aapg.org>".

If you possess this professional background, have experience in applying scientific knowledge to societal challenges, and share a passion for helping shape the future of the geoscience profession, GSA invites your application. The fellowship is open to U.S. citizens or permanent residents of the U.S.

Deadline to apply: January 21, 2005

For application information, visit www.geosociety.org/science/csf/index.htm, or contact Ginger Williams, GSA Headquarters, (303) 357-1040, gwilliams@geosociety.org.

Ads (or cancellations) must reach the GSA Advertising office one month prior. Contact Advertising Department, (303) 357-1053, 1-800-472-1988, ext. 1053, fax 303-357-1070, crawford@geosociety.org. Please include address, phone number, and e-mail address with all correspondence.

Classification	Per Line for 1st month	Per line each add'l month (same ad)
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Agencies and organizations may submit purchase order or payment with copy. Individuals must send prepayment with copy. To estimate cost, count 54 characters per line, including all punctuation and blank spaces. Actual cost may differ if you use capitals, centered copy, or special characters.

**ASSISTANT PROFESSOR IN
RADIOGENIC ISOTOPE GEOCHEMISTRY
DEPARTMENT OF GEOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS**

We seek a radioisotope geochemist addressing fundamental problems of Earth processes, evolution, and origin. The successful candidate will have strong laboratory and analytical skills, and the background to establish a vigorous, highly visible, interdisciplinary research program in the Earth sciences. Preference will be given to individuals whose interests complement our existing research strengths and who will be effective mentors and teachers in our graduate and undergraduate programs.

For more information about our research and teaching programs we encourage potential candidates to visit the U.C. Davis Geology Department website <http://www.geology.ucdavis.edu>.

A Ph.D. or equivalent degree in the geological sciences is required at the time of appointment. Applicants should send a curriculum vitae, a statement of research/teaching interests, and contact information (including e-mail) for at least three references: Chair, Geology Search Committee, Department of Geology, One Shields Avenue, University of California, Davis, Davis, CA 95616-8605, Phone: (530) 752-0350, Fax (530) 752-0951, E-mail: geo-search@geology.ucdavis.edu.

The position will be effective starting July 1, 2005. To ensure full consideration, applications should be received by January 5, 2005. The position will remain open until filled.

The University of California is an affirmative action/equal-opportunity employer. The University undertakes affirmative action to assure equal employment opportunity for minorities and women, for persons with disabilities, and for special disabled veterans, Vietnam era veterans, and any other veterans who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized.

**TENURE-TRACK POSITION
IN REMOTE SENSING & GIS
TEXAS TECH UNIVERSITY**

The Department of Geosciences at Texas Tech University invites applications for a tenure-track position with expertise in geoscience applications of remote sensing and geographic information systems (GIS). The position will be filled at the Assistant Professor level by Fall 2005. A Ph.D. in a geoscience-related discipline will be required at the time of appointment. The successful candidate is expected to develop graduate and advanced undergraduate courses that utilize geospatial information technologies—GIS, remote sensing, and global positioning systems. The person is also expected to establish an externally-funded research program and supervise MS and Ph.D. students.

Texas Tech is one of the four major state-supported multi-disciplinary universities in Texas. It consists of ten colleges, Graduate School, School of Law, Health Science Center, with ~28,000 students enrolled. The Department of Geosciences consists of seventeen faculty, 11 in solid earth science and 6 in atmospheric science. The solid earth specialties cover major areas of geology, geochemistry, and geophysics. The atmospheric group specializes in severe storms, wind energy, and airborne hazardous substances. Details about the Department, its faculty, and research facilities may be found at www.gesc.ttu.edu. In addition to the Department, the successful candidate will work closely

with a multidisciplinary group of scientists at a newly constructed geo-IT research facility in the Experimental Sciences Building on campus (http://gis.geog.ttu.edu/texastech_gis/index.htm).

Review of applicants will begin on December 1 and continue until the position is filled. Applicants should submit a letter of application, curriculum vitae, a statement of teaching and research interests, and names and contact information (including e-mail address) of at least 3 professional references. Applications should be sent to Dr. Seiichi Nagihara, GIS Search Committee Chair, Department of Geosciences, Texas Tech University, Lubbock, TX 79409-1053. Send questions regarding the position to seiichi.nagihara@ttu.edu.

Texas Tech University is an equal opportunity/affirmative action institution.

**QUEENS COLLEGE
ENVIRONMENTAL GEOLOGY/ECOLOGY**

The School of Earth and Environmental Sciences at Queens College invites applications for the tenure track position of Assistant Professor, to begin with the Fall semester, 2005. The PhD. is required. Candidates must have research interests and demonstrated abilities in some aspects of environmental geology or of ecology. It is preferred that candidates have a demonstrated commitment to teaching and have experience in seeking and obtaining external funding to support their research program. Preference will be given to those candidates with a working knowledge in Geographic Information Systems.

Duties will include teaching undergraduate through doctoral-level courses, establishing a quantitative and field-based research program in geosciences or environmental sciences, such as for example: ecological engineering, wetlands science, coastal science. Preference will be given to candidates who utilize interdisciplinary approaches to environmental problems. Duties will also include supervising student research; interacting with other faculty research programs; participating in student advising and curriculum development.

The appointment will be at the Assistant Professor level. The salary level will vary between \$35,031 and \$61,111, depending on experience and qualifications. Excellent benefits.

Letters of application addressing the preferred qualifications, a curriculum vitae, transcripts of all degrees, and three letters of reference should be sent to Dr. Daniel Habib, Chair of Search Committee, School of Earth and Environmental Sciences, Queens College of the City University of New York, 65-30 Kissena Boulevard, Flushing NY 11367-1597. Address queries to Dr. Habib at 718-997-3300 or Daniel_habib@qc.edu.

Queens College is an equal opportunity/affirmative action employer.

**EARTH SYSTEM SCIENCE, ENVIRONMENTAL GEOLOGY, OR EARTH SURFACE PROCESSES
CALIFORNIA STATE UNIVERSITY, LONG BEACH**

The Department of Geological Sciences invites applications for a tenure-track position at the assistant professor level to begin Fall 2005. A Ph.D. in Geological Sciences or Earth Sciences with a strong background in Earth Systems Science (including oceanography, paleoceanography, paleoclimatology, Quaternary geology, marine geology, geochemical cycles), Environmental Geology (including hydrogeology and geologic hazards) or Earth Surface Processes (including geomorphology and neotectonics) is required. Full Position description may be viewed at: <http://seis.natsci.csulb.edu/deptweb/Deptwebpage.html>. Review of applications will commence January 24, 2005. Contact Dr. Stanley Finney, Chair, Department of Geological Sciences, California State University, Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840-3902 Telephone: (562) 985-4809; Fax: (562) 985-8638; Email: sfinney@csulb.edu. CSULB IS AN EQUAL OPPORTUNITY EMPLOYER.

**VANDERBILT UNIVERSITY, DEPARTMENT OF
EARTH AND ENVIRONMENTAL SCIENCES
TWO TENURE-TRACK POSITIONS
SOLID-EARTH DYNAMICS
AND SEDIMENTARY SYSTEMS**

The Department of Earth and Environmental Sciences at Vanderbilt University invites applications for two tenure-track faculty positions in the general areas of Solid-Earth dynamics and Sedimentary Systems. These positions, effective the Fall 2005 semester, are at the Assistant Professor level.

We seek individuals who are aimed at the highest standards of scholarship in teaching and research, and who will be attracted by opportunities at Vanderbilt for interaction with a diverse, enthusiastic faculty and student body in the Earth and environmental sciences and related fields. The research specialties are open; we welcome applications from candidates pursuing

theoretical, experimental and/or field-based work. In Solid-Earth Dynamics we are particularly interested in those studying dynamical aspects of crustal processes (deep, shallow or surface). For the Sedimentary Systems position we are especially interested in those connecting process work with interpretations of the history and variability of ancient and/or modern systems.

Applications should include a vita, a statement of research and teaching interests, and names of at least three references (including mail and e-mail addresses and phone numbers). Select applicants will be later asked to provide student evaluations of teaching (if available). Applications should be submitted by e-mail in PDF, MS-Word or Corel-WP format to: EESpositions@vanderbilt.edu. Up to three representative papers may be sent via normal mail to: Search Committee, Department of Earth and Environmental Sciences, Vanderbilt University, 2301 Vanderbilt Place, Nashville, TN 37235. Review of applications will begin 10 December 2004. For more information contact John Ayers (Solid-Earth Dynamics) or Molly Miller (Sedimentary Systems). Vanderbilt is an equal opportunity/affirmative action employer. Women and minorities are especially encouraged to apply.

**AMERICAN UNIVERSITY OF ARMENIA (AUA)
(AFFILIATE OF THE UNIVERSITY OF CALIFORNIA)
DIRECTOR AND ASSISTANT PROFESSOR
ENVIRONMENTAL CONSERVATION
AND RESEARCH CENTER (ECRC)**

AUA seeks an Environmental Scientist at the Assistant or Associate Professor level to direct the ECRC. The successful candidate will lead the Academic Program in Environmental Science and Conservation (a component of the Research Center) and will be expected to teach an introductory course on environmental science and conservation and oversee original student research projects. As research center director, the candidate will establish an externally funded research program, building on the Center's record in contributing towards Armenia's sustainable development through public outreach, professional collaboration, and original research.

Application deadline is December 18, 2004.

Applicants should send a curriculum vitae, statement of teaching and research interests, and three letters of recommendation to:

American University of Armenia Corporation; 300 Lakeside Drive, 4th Floor ; Oakland, CA 94612; Attn: Gaiane Khachatrian; Recruitment Coordinator. Email: Gaiane@aauac.net ; Fax: 510-208-3576; Website: www.aaua-mirror.com.

AUA is an affirmative action, equal opportunity employer.

**COLORADO SCHOOL OF MINES
DEPARTMENT OF GEOLOGY AND GEOLOGICAL
ENGINEERING, ASSOCIATE PROFESSOR OF
STRATIGRAPHY/SEDIMENTOLOGY**

Applications are invited for an anticipated tenure-track position in the field of Stratigraphy/Sedimentology at the associate professor level. The Department of Geology and Geological Engineering has a strong tradition in applied undergraduate and graduate education and offers a B.S. (Geological Engineering), as well as Master's (MS and ME) and Ph.D. degrees with sub-disciplines of petroleum, mineral exploration, groundwater engineering, and geotechnical engineering. The Department has 21 faculty, 5 supporting staff, and approximately 60 undergraduate and 110 graduate students. Programs are enhanced through close collaboration with the departments of Petroleum Engineering, Geophysics, Chemistry and Geochemistry, Environmental Science and Engineering, and Mining Engineering. Information about the school, the Petroleum Program, and the department can be found at <http://www.mines.edu/Academic/geology>.

CSM houses numerous research centers and programs related to petroleum exploration and production, including the Chevron Texaco Center of Research Excellence (CoRE), the Colorado Energy Research Institute, the Slope and Basin Consortium, the Lewis Shale Consortium, the Potential Gas Agency, and the Rocky Mountain Petroleum Technology Transfer Center. The CoRE effort, in particular, is a multi-year, industry-funded project that is focused on integrated stratigraphic-structural studies. The successful candidate will have the opportunity to directly interact with this program. CSM maintains a total research volume on the order of \$30 million per year, with sponsors including private industry, DOE, NSF, DOD, and USEPA.

Responsibilities: The successful candidate will be expected to teach at the undergraduate and graduate levels, direct graduate research, and develop a strong, externally funded interdisciplinary research program.

Qualifications: Applicants must have a Ph.D. in a science or engineering field. Preference will be given to

applicants with specialties in sequence stratigraphy and sedimentology and their applications to reservoir modeling. Experience with deep-water clastic systems is desirable. Experience with petroleum-related research studies and/or petroleum industry experience would be highly advantageous. The successful candidate must demonstrate strong interpersonal and communications abilities, and provide a record of successful collaborative research/teaching experiences.

To Apply: Applicants must send a letter of application, resume, brief statement of professional goals with an emphasis on teaching and research objectives, and names and addresses of three professional references to: Colorado School of Mines, Office of Human Resources, Search #04-051030, 1500 Illinois Street, Golden, CO 80401. Review of applications will begin no later than December 3, 2004.

CSM is an EO/AA employer and is committed to enhancing the diversity of its campus community. Women, minorities, veterans, and persons with disabilities are encouraged to apply.

ASSISTANT PROFESSOR, EARTH SCIENCES UNIVERSITY OF CALIFORNIA, SANTA CRUZ

The Department of Earth Sciences at the University of California, Santa Cruz seeks applicants for a tenure-track position, effective July 1, 2005. Open until filled, the initial review will begin on November 22, 2004. For full details, see our website: <http://www.es.ucsc.edu/jobs> or contact Roxanne Woodling (roxanne@es.ucsc.edu or 831-459-4478). AA/EOP employer.

ASSISTANT PROFESSOR, PALEONTOLOGY UNIVERSITY OF WYOMING

The Department of Geology and Geophysics (<http://home.ggs.uwyo.edu>) invites applications for a tenure-track, assistant professor position in paleobiology. A Ph. D. is required at the time of appointment beginning August, 2005. Specialty is open and may include; for example, such diverse fields as vertebrate and invertebrate paleontology, paleoecology, paleoclimate reconstruction, and evolutionary biology in a geologic context. Expectations include developing an internationally recognized, funded research program and teaching graduate/upper-level courses in the specialty and an introductory level course in paleobiology/paleontology. The Department has a renowned vertebrate collection, a smaller invertebrate collection, and excellent research facilities. The University is developing strong interdisciplinary programs in Ecology, Molecular and Cellular Life Sciences, Earth System Science, and Environment and Natural Resources.

Applications should include a statement of research and teaching interests and accomplishments, curriculum vitae, and the names and contact information of three references. Review of completed applications will begin November 29, 2004. Send application materials to: Paleobiology Search Committee, Dept. of Geology & Geophysics, University of Wyoming, 1000 E. University Ave., Dept. 3006, Laramie, WY 82071.

The University of Wyoming is an equal opportunity affirmative action employer.

GEOBIOLOGY/PALEOECOLOGY/PALEOBIOLOGY WESLEYAN UNIVERSITY

The Department of Earth and Environmental Sciences at Wesleyan University, a highly selective liberal arts college, invites applications for a tenure-track position in the areas Geobiology, Paleoecology, or Paleobiology to be filled at the assistant professor level. Our department offers a B.A. and an M.A. degree. We seek a colleague who will have a strong earth science background, contribute to the Environmental Studies curriculum, and be an excellent educator. The new faculty member will be required to teach an upper level course in Geobiology, a course accessible to non-majors, a course in the Environmental Studies curriculum, and courses of the candidate's choice. Candidates who use quantitative methods in their research are especially encouraged to apply.

The successful candidate will have or will be developing a strong record of published research, the ability to secure extramural funds, and the vision to establish a strong research program involving undergraduate students.

Applications received by December 1, 2004 will receive full consideration. He or she must have a Ph.D. by the start date. We anticipate that the successful candidate will begin July 1, 2005. Please send letter of interest, curriculum vitae, statements of research and teaching interests, and three letters of reference to: Dr. Suzanne O'Connell, Chair, Dept. of Earth and Environmental Sciences, Wesleyan University, Middletown, CT 06459. Questions about the position should be sent via email to: soconnell@wesleyan.edu. Wesleyan University is an equal opportunity/affirmative

action employer. Women and minorities are encouraged to apply.

ONE-YEAR SABBATICAL REPLACEMENT BRYN MAWR

Bryn Mawr College seeks a one-year sabbatical replacement for the 2005–06 year to teach a one-semester undergraduate course in mineralogy, plus two intermediate courses and one advanced course, within the areas of optical mineralogy, igneous-metamorphic petrology, high-temperature geochemistry, mineral physics, or related topics. Applicants should submit a CV, a description of possible courses and three reference names to: Geology Search, Department of Geology, Bryn Mawr College, 101 N. Merion Ave., Bryn Mawr, PA 19010 (email: bedwards@brynmawr.edu). Members of the Department will be at the GSA meetings in Denver. For details: <http://www.brynmawr.edu/geology/> and <http://www.brynmawr.edu/provost/>.

ASSISTANT PROFESSOR POSITION IN ENVIRONMENTAL SCIENCE & GEOLOGY UNIVERSITY OF MARY WASHINGTON

The Department of Environmental Science and Geology at the University of Mary Washington seeks applications for a full-time, tenure-track position, at the rank of Assistant Professor, to begin at the start of the 2005–2006 academic year. The Ph.D. is required at the time of appointment. The Department seeks a broadly trained individual with expertise in the area of soils or geomorphology, especially as related to contemporary earth surface processes. A research background that includes a mix of both field-based and laboratory techniques, environmental monitoring and the use of GIS tools is highly desirable. In addition to introductory physical geology, the successful candidate will teach a class in environmental science, soils and their ecosystems, and geomorphology. Additional upper-level courses in the candidate's field of expertise may also be developed. The University of Mary Washington is a highly selective, primarily undergraduate, public institution that stresses teaching excellence and the engagement of students in research projects. The Department is housed in the Jepson Science Center which possesses modern labs and extensive networked computer facilities. The University is well located for interesting field trips and research as it is on the margin between Coastal Plain sediments and Piedmont crystalline rocks and is within the Rappahannock River watershed which drains to the Chesapeake Bay. Funds are available to support faculty and undergraduate research projects. Applicants are encouraged to visit the University website for additional information about the University of Mary Washington and the Department of Environmental Science and Geology: <http://www.umw.edu>.

Please send a letter of application, statements of teaching and research interests, curriculum vitae, undergraduate and graduate transcripts (unofficial transcripts acceptable), and the names and addresses of three references by 5:00 pm, December 22, 2004. Postmarks will not be honored. Apply to: Chair of the Search Committee, Department of Environmental Science and Geology, University of Mary Washington, 1301 College Avenue, Fredericksburg, VA 22401.

In a continuing effort to enrich its academic environment and provide equal educational and employment opportunities, the University of Mary Washington actively encourages women and minorities to apply.

MICROBIAL ECOLOGY AND PALEOECOLOGY UNIVERSITY OF KANSAS

The Department of Geology at the University of Kansas seeks applications for an academic year, tenure-track faculty position in the field of microbial ecology and paleoecology. We seek an outstanding colleague who applies quantitative analytical techniques to the characterization of modern and ancient microbial communities and whose research contributes to the understanding of modern microbial systems and the reconstruction and evolution of microbial communities and their activity preserved in the rock record. Priority consideration will be given to individuals with expertise in molecular biology or novel isotopic techniques applied to the study of microbial communities. The successful candidate will be expected to establish an externally funded interdisciplinary research program, direct graduate students, and participate in teaching graduate and undergraduate students. Refer to www.geo.ku.edu and links for additional information about the department and the University of Kansas. Appointment will begin August 18, 2005, or later.

Applicant must have a completed Ph.D. degree by the starting date. Applicants must submit with their letter of application separate statements of teaching and research interests, Curriculum Vitae, and the name and contact information of at least three references. Send all

material to Microbial Ecology and Paleoecology Search; Attention: Luis A. González, Department of Geology, 1475 Jayhawk Blvd., 120 Lindley Hall, University of Kansas, Lawrence, KS 66045-7613 (tel. 785-864-2743; fax 785-864-5276, e-mail: lgonzlez@ku.edu). Review of completed applications will begin November 15, 2004, and will continue until the position is filled. EO/AA Employer. The University of Kansas is committed to increasing the ethnic and gender diversity of its faculty and we strongly encourage applications from underrepresented group members. This position is contingent of final budgetary approval.

AQUEOUS GEOCHEMISTRY COLLEGE OF WILLIAM & MARY

The Department of Geology at the College of William & Mary invites applications for an anticipated tenure-track assistant professorship beginning August 2005. The successful candidate will teach undergraduate courses in introductory geology, environmental geology and aqueous geochemistry, supervise undergraduate research, and maintain an active research program. We seek research expertise in low-temperature aqueous geochemistry, chemical hydrogeology, contaminant fate and transport in surface and groundwater systems or a similar specialization. The successful candidate will participate in growing the College's interdisciplinary environmental science and policy program. Ph.D. required. Applicants should submit a statement of their teaching and research experience and goals, a vita, and contact information for three references to Christopher M. Bailey, Department of Geology, College of William & Mary, Box 8795, Williamsburg, VA 23187. E-mail: cmbaile@wm.edu. Review begins December 1, 2004, and will continue until an appointment is made. The College is an EEO/AA university.

UNIVERSITY OF ROCHESTER, GEODYNAMICS

The Department of Earth and Environmental Sciences at the University of Rochester invites applications for a tenure-track assistant professor position in geodynamics to begin in the 2005–2006 academic year. We are interested in a dynamic educator and researcher, who can build an externally funded program within a small research university setting. The field of specialization is open, and includes geodynamic modeling, seismology, geomorphology, geodesy and planetary science. Preference will be given to applicants who can build programs involving undergraduates and graduates that complement our existing strengths in geochemistry, paleomagnetism, petrology, structural geology, sedimentology and tectonics. For more information about the Department, see www.earth.rochester.edu. Applicants should send a curriculum vitae, select reprints, a statement of research and teaching goals, and the names of at least four references to the address below.

Chair, Geodynamics Search, c/o Kathy Lutz, Department of Earth and Environmental Sciences, 227 Hutchison Hall, Rochester, NY 14627, Ph. (585) 275-5713, FAX (585) 244-5689.

The review of applicants will begin on November 15, 2004. The University of Rochester is an equal opportunity employer.

UNIVERSITY OF TEXAS AT AUSTIN, GEOSCIENCES TWO ASSOCIATE CHAIR POSITIONS

The University of Texas at Austin's Jackson School of Geosciences is seeking to fill two Associate Chair positions in its Department of Geological Sciences.

THE ASSOCIATE CHAIR FOR CURRICULUM AND INSTRUCTION oversees teaching, advising, and student recruiting activities of the Department, under the direction of the Department Chairman, and serves as the executive assistant to the Chairman. Minimum qualifications are a Master's degree in an Earth or related science. A Ph.D. in an Earth or related science is preferred. The position requires excellent public speaking skills, and management experience in budget preparation and administration, via industrial, academic, government, or military service. As the leader of student recruiting, this person serves as a professional representative of the Department, and may be involved in off-campus activities, and may participate in the instruction of selected courses. The appointment will be a 12-month salaried position in the University of Texas at Austin Administrative and Professional staff category. Salary level is negotiable, and depends upon qualifications and experience. Please send a complete resume and a written statement of interest in this position to: Chairman, The University of Texas at Austin, Geol Sci Dept., 1 University Station C1100, Austin, TX 78712-0254. The position will be filled no later than August 1, 2005. For information on the Department, see <http://www.geo.utexas.edu>

Background check conducted on applicant selected. The University of Texas at Austin is an Affirmative Action/Equal Opportunity Employer.

THE ASSOCIATE CHAIR FOR RESEARCH

serves as the chief sponsored projects officer of the Department, under the direction of the Chairman. The position involves assisting faculty in proposal preparation, submission, and reporting; oversight of research support staff, related facility budgets, and administrative support for technical matters (purchasing, renovations, staffing) in support of Department research facilities. The Associate Chair will assist faculty in disseminating research results to the public and other audiences using the web and other media. Minimum qualification is a Masters degree in an Earth or related science. Preferred qualification is a Ph.D. in an Earth or related science. The position requires excellent skills in technical writing, and experience in budget and proposal preparation for Federal and other granting agencies. A combination of industry, academic, or government service may be useful, but some direct experience in an academic research environment is a necessary qualification. The appointment will be a 12-month salaried position in the University of Texas at Austin Administrative and Professional staff category. Salary level is negotiable, and depends upon qualifications and experience. Please send a complete resume and a written statement of interest in this position to: Chairman, The University of Texas at Austin, Geol Sci Dept., 1 University Station C1100, Austin, TX 78712-0254. The position will be filled no later than August 1, 2005. For information on the Department, see <http://www.geo.utexas.edu>.

Background check conducted on applicant selected. The University of Texas at Austin is an Affirmative Action/Equal Opportunity Employer.

**CALIFORNIA STATE UNIVERSITY, FRESNO
LECTURER, GEOLOGY**

This position is for the spring 2005 semester, with the possibility of continuation into the 2005–2006 academic year. We seek a broadly trained geologist who has the ability to teach courses covering a wide range of topics. Courses may include: Introductory Geology, Natural Sciences (for prospective teachers), Paleontology, Geomorphology, and Environmental Science. Specific teaching assignments are dependent on the needs of the Department. This position is for the spring 2005 semester; the possibility exists that this successful candidate may continue into the 2005–2006 academic year. Additional information about our department is available at: <http://www.csufresno.edu/geology/>.

Qualifications & Academic Preparation: An earned doctorate (Ph.D.) in Geology, Geophysics, or related Earth Sciences field is preferred. The ability to work effectively with faculty, staff, and students from diverse ethnic, cultural, and socioeconomic backgrounds is required. Applicant packets should include: a CV, statement of research and teaching interests, at least three letters of reference, and contact information for referees. Application materials may be sent to: Keith Putirka, Search Chair, California State University, Fresno, Department of Earth & Environmental Sciences, 2345 E. San Ramon Ave, MS/MH 24, Fresno, CA, 93740-8031. The position will remain open until filled. To ensure full consideration applicants are encouraged to have all application information on file by Dec. 1, 2005; interviews are anticipated to take place during the AGU meeting in San Francisco.

**CALIFORNIA STATE UNIVERSITY, FRESNO
ASSISTANT PROFESSOR
(TENURE TRACK)/CONVERSION (ABD)**

EARTH SURFACE PROCESSES/NEO-TECTONICS
We seek a broadly trained geologist who applies diverse modern approaches and tools to conduct research in the areas of Geomorphology, Fluvial Processes, Quaternary geology, and/or Neo-tectonics. This tenure-track position will complement our existing strengths in the fields of Geophysics, Paleoclimatology, Sedimentary and Igneous Petrology, Hydrogeology, Structural Geology. The candidate will be expected to seek funding to support a research program that directly involves both undergraduate and graduate students. Teaching responsibilities will include introductory geology, and Geomorphology/Surface Processes, possibly with applications to Engineering Geology. Additional information about our department is available at: <http://www.csufresno.edu/geology/>.

Qualifications & Academic Preparation: An earned doctorate (Ph.D.) in Geology, Geophysics, or related Earth Sciences field is required for appointment to a tenure-track position. The ability to work effectively with faculty, staff, and students from diverse ethnic, cultural, and socioeconomic backgrounds is required. Candidates are expected to demonstrate a commitment to and potential for excellence in teaching, research, and scholarly activity, including successful extramural research funding.

Applicant packets should include: a CV, statement of research and teaching interests, at least three letters of reference, and contact information for referees. Application materials may be sent to: Keith Putirka, Search Chair, California State University, Fresno, Department of Earth & Environmental Sciences, 2345 E. San Ramon Ave, MS/MH 24, Fresno, CA, 93740-8031. The position will be open until filled. To ensure full consideration applicants are encouraged to have all application information on file by January 17, 2005.

**SEDIMENTARY GEOLOGY
DEPARTMENT OF GEOLOGICAL SCIENCES
ARIZONA STATE UNIVERSITY**

We are seeking applicants for a tenure track faculty position at the Assistant or Associate Professor level to help build our teaching and research programs in Sedimentary Geology. Required qualifications: Evidence of research and teaching achievement appropriate to rank; Ph.D. in Geological Sciences or a related field at the time of appointment. Desired qualifications: Expertise in sedimentary geology (physical and/or chemical) with applications to the rock record. Individuals who will complement our existing programs in planetary geology, isotope geochemistry, astrobiology, biogeochemistry, geobiology, and tectonics are particularly encouraged to apply. The successful candidate will be expected to develop a vigorous research program and be strongly committed to teaching at both the undergraduate and graduate levels. To learn more about our department and related disciplines at ASU, please visit <http://geology.asu.edu/>. Desired start date: 16 August 2005. Please send a letter of application describing current research and teaching interests, a curriculum vitae, and the names, addresses, telephone numbers, and e-mail addresses of three references to: Sedimentary Geology Search Committee Chair, Department of Geological Sciences, Arizona State University, Box 871404, Tempe, AZ 85287-1404, U.S.A. (email: geology@asu.edu), Fax: 480-965-8102, Phone: 480-965-5081. The closing date for receipt of applications is 22 November 2004; if not filled, then every two weeks thereafter until the search is closed. Arizona State University is an Equal Opportunity/Affirmative Action employer.

**LABORATORY MANAGER
AUSTIN PEAY STATE UNIVERSITY**

Full time Laboratory Manager in Geosciences. Primary duties include assisting in the instruction of survey laboratories, preparing mineral, rock and fossil specimens, curating an extensive geological collection, monitoring equipment inventory, supervising students and similar duties. Master's degree in Geology or Geosciences with at least 18 graduate hours in Geology required. For complete view of responsibilities, qualifications, and application procedure, please view the following website: www.apsu.edu/hrhomepage. APSU is an AA/EOE. Minorities, women and members of other protected groups are encouraged to apply.

**UNIVERSITY OF NORTH CAROLINA
AT CHAPEL HILL
EARTH SURFACE CHRONOLOGY**

The Department of Geological Sciences at the University of North Carolina at Chapel Hill invites applications for a tenure-track faculty position at the assistant professor level to begin July 1, 2005.

We seek applicants who pursue research in near-surface processes through low-temperature or cosmogenic chronometry. The successful applicant will use chronologic methods to quantify the timing and rates of tectonic, geomorphologic, sedimentologic, climatic/oceanographic, hydrologic or biologic events and processes. We are interested in candidates who use absolute dating techniques to decipher exhumation history, land-surface evolution, sediment transport and deposition, or high-resolution stratigraphy. Departmental equipment includes a multi-collector thermal ionization mass spectrometer with complete element-separation and clean-lab facilities, an SEM, a DCP, and access to other instruments (ICP-MS w/laser, electron microprobe, gas source mass spectrometers) in the Marine Sciences Department and at Duke University and N.C. State University.

Applicants must hold a Ph.D. at the time of appointment, and postdoctoral and teaching experience is highly desirable. The successful candidate is expected to establish a vigorous, externally funded research program and to demonstrate excellence in undergraduate and graduate education.

Applicants must submit a letter of application, vita, statements of research and teaching interests, and the names and contact information for four references to Surface Chronology Search, Department of Geological Sciences, CB # 3315 Mitchell Hall, University

of North Carolina, Chapel Hill, NC 27599-3315. We will begin reviewing applications December 1, 2004 and continue until the position is filled, and will initiate the interview process by early January of 2005. For more information on the department and the university see www.geosci.unc.edu. Members of the department will be present at the GSA meeting in Denver and AGU meeting in San Francisco.

The University of North Carolina at Chapel Hill is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

**TURNER POSTDOCTORAL FELLOWS
THE UNIVERSITY OF MICHIGAN**

The Department of Geological Sciences invites applications for Turner Postdoctoral Fellows, which are positions of two-year duration that are open to any area in the Geological Sciences. We offer a competitive compensation package that includes benefits and a travel/research fund. Applicants are encouraged to collaborate with existing researcher(s) at the University of Michigan or to propose an independent research project, which cost-share salary with other sources involving research and/or teaching responsibilities. Visit our Department webpages for more information on faculty and research (<http://www.geo.lsa.umich.edu>); contact Profs. Eric Essene (essene@umich.edu), Ben van der Pluijm (vdpluijm@umich.edu) or Lynn Walter (lwalter@umich.edu) for additional information. Please submit a curriculum vitae, a brief (3 pages or less) research proposal and names of at least three references by January 7, 2005 to: by email, turnerpdf@umich.edu; by mail, Turner Postdoctoral Committee, Dept. of Geological Sciences, 425 E University Ave., Univ. of Michigan, Ann Arbor, MI 48109-1063.

The University of Michigan is an affirmative action/equal opportunity employer.

**GEOSCIENCE PROFESSORSHIPS
UNIVERSITY OF MICHIGAN,
GEOLOGICAL SCIENCES**

The Geological Sciences Department at the University of Michigan anticipates that one or more faculty positions will be available with a September 2005 start date. The position or positions will be enhanced by the newly established Henry N. Pollack Professorship Endowment. We are seeking candidates at the Assistant, Associate or Full Professor level.

The department plans to fill positions over the coming years in several areas spanning the general fields of Earth System Science and Geological Hazards. Applicants with strengths in any of the following fields are especially encouraged to apply: Physical and chemical processes at the atmosphere-hydrosphere-land interface; Interactions between biological and geological processes; Neotectonics; Processes that occur in coastal environments; and Seismology. Priority will be given to applicants that complement existing strengths in the Geological Sciences and/or interactions with other closely related departments at the University of Michigan.

The successful candidate is expected to establish an independent research program and to contribute to undergraduate and graduate teaching programs. Applicants should send a curriculum vitae, a statement of present and future research plans, a statement of teaching experience and interests, and the names of at least three persons who can provide letters of recommendation. Additional information about the department can be found at: www.geo.lsa.umich.edu.

Applications should be sent to: Joel D. Blum, Chair, Department of Geological Sciences, 425 E. University Avenue, University of Michigan, Ann Arbor, MI 48109-1063.

For full consideration applications should be received before January 3, 2005. The University of Michigan is a non-discriminatory/affirmative action employer. Women and minorities are encouraged to apply. The University is supportive of the needs of dual career couples.

SURFACE PROCESSES, BOSTON UNIVERSITY

The Department of Earth Sciences at Boston University invites applications for a tenure track position at the Assistant Professor level in Surface Processes, starting September 1, 2005. We seek an applicant whose research emphasizes quantitative studies that link landscape evolution, sediment transport, hydrologic processes, tectonics, and/or climatic change. We encourage applications from individuals who apply field-based, theoretical, and/or experimental approaches to Surface Processes.

The successful applicant will be expected to supervise graduate thesis work in M.A. and Ph.D. programs, maintain an externally funded research program, and teach at all levels in the Earth Sciences curriculum. We seek an applicant whose research complements departmental expertise in glacial geomorphology, paleoclimate

reconstruction, biogeochemistry, hydrologic processes, lithospheric deformation and tectonics, and/or coastal processes. Interaction is encouraged with various departments including Geography, Chemistry, and Physics, as well as the Center for Remote Sensing and the B.U. Marine Program. For more information about the Department, see <http://www.bu.edu/ES>. A Ph.D. at the time of appointment is required. Applicants should send a curriculum vitae, a statement of research and teaching interests, and the names and addresses of at least three referees to: Search Committee Chair, Department of Earth Sciences, Boston University, 685 Commonwealth Ave., Boston MA 02215 USA; email: earth@bu.edu. Review of applications will begin on December 1, 2004. Women and underrepresented minorities are particularly encouraged to apply. Boston University is an equal opportunity/affirmative action employer.

TWO TENURE-TRACK ASSISTANT PROFESSORS PALEONTOLOGY AND IGNEOUS/METAMORPHIC PETROLOGY STATE UNIVERSITY OF WEST GEORGIA

The Department of Geosciences at the State University of West Georgia seeks a **Paleontologist** and an **Igneous and/or Metamorphic Petrologist** for full-time tenure-track Assistant Professor positions beginning August 2005. For details regarding each position, please see <http://www.westga.edu/~geosci>. Candidates should submit a letter summarizing research interests and teaching philosophy as well as a curriculum vita, copies of transcripts, and names of three professional references. Materials should be sent to Dr. Randy Kath (petrology) or Dr. Julie Bartley (paleontology), Search Committee Chair, Department of Geosciences, State University of West Georgia, Carrollton, GA 30118. Application review will begin on November 1 (Paleontology) and December 1 (petrology) and continue until position is filled.

The Department of Geosciences offers undergraduate degrees in geography, geology, and earth science education. Its thirteen tenure-track faculty members and lab coordinator are strongly committed to high quality undergraduate education and vigorous faculty-student research. Located fifty miles west of Atlanta, the State University of West Georgia is a growing regional university of the University System of Georgia with an enrollment of approximately 10,000. The State University of West Georgia is an equal opportunity/affirmative action employer.

DIRECTOR WITH FACULTY APPOINTMENT ENVIRONMENTAL MANAGEMENT DOCTORAL PROGRAM EARTH AND ENVIRONMENTAL STUDIES MONTCLAIR STATE UNIVERSITY

Montclair State University invites applications for Director of its interdisciplinary Doctorate in Environmental Management. This position holds faculty appointment within the Department of Earth and Environmental Studies. Duties include recruitment, admissions, and advising, and allows administrative and research release time. The successful candidate is expected to maintain an active, funded research program, and be willing to teach relevant courses within the department and doctoral program.

Rank and field open, with preference for a candidate capable of merging relevant disciplines within environmental management and a research area aligned with one or more of the department's strengths in environmental modeling, urban/metropolitan studies, coastal/marine studies, environmental geology, natural resource management, and global environmental change. Candidates must have a record of excellence in scholarly publications, teaching, and service; academic leadership experience; and doctoral faculty and advisor experience. A complete listing of job requirements, qualifications, and application procedures, as well as information about the Earth & Environmental Studies Department and Environmental Management doctoral program, can be found at <http://www.csam.montclair.edu/earth/eesweb/>. Send applications to Dr. Robert Taylor, Search Committee Chair, taylorr@mail.montclair.edu, Dept. of Earth & Environmental Studies, Montclair State University, Montclair, NJ 07043. Review of applications will begin immediately and continue until the position is filled, for a potential start as early as January 2005. Montclair State University is an Equal Opportunity/Affirmative Action Employer. Qualified women, minorities, and individuals with disabilities are encouraged to apply.

SEDIMENTOLOGY/STRATIGRAPHY MONTCLAIR STATE UNIVERSITY

The Department of Earth and Environmental Studies at Montclair State University invites applications for a

full-time, tenure-track faculty position in sedimentology and/or stratigraphy at the assistant rank starting September 1, 2005. Applicants who can demonstrate research potential or experience in applied environmental sedimentology/stratigraphy and have a strong field-based approach are strongly encouraged to apply. A Ph.D. is required at the time of appointment. Additional information about the position and the department is available at <http://www.csam.montclair.edu/earth/eesweb>. Applicants should send cover letter, CV, three letters of recommendation, and a statement of professional goals, research interests, and teaching philosophy to: Dr. Matthew Gorring (gorringm@mail.montclair.edu), Search Committee Chair (V-F23), Dept. of Earth & Environmental Studies, Montclair State University, Montclair, NJ 07043. Review of applications will begin immediately. Montclair State University is an Equal Opportunity/Affirmative Action Employer. Qualified women, minorities, and individuals with disabilities are encouraged to apply.

PENNSYLVANIA STATE UNIVERSITY FACULTY POSITION IN SOLID EARTH GEOSCIENCES

The Department of Geosciences at Penn State University invites applications for a tenure-track faculty position in Solid Earth Geosciences at the assistant professor level. We seek an outstanding candidate who will complement and broaden our existing strengths in active tectonics, lithospheric evolution and dynamics, earthquake and field seismology, experimental geophysics, and cryospheric dynamics. We are particularly interested in individuals who creatively combine observational, theoretical, experimental and/or analytical techniques to address problems in lithospheric deformation, and who are poised to take advantage of emerging opportunities and new initiatives in the solid Earth geosciences.

Applicants should demonstrate a strong record of scholarship and the potential for developing an internationally recognized research and teaching program at Penn State. Review of applications will begin December 1, 2004, and will continue until a suitable candidate is found. Applications should include a complete vita, details of published work, a statement outlining teaching and research interests, and names and addresses of four or more references. Send application materials to: Search Committee Chair, Department of Geosciences, 503 Deike Building, The Pennsylvania State University, University Park, PA 16802.

Penn State is committed to affirmative action, equal opportunity and the diversity of its workforce. Women and members of underrepresented groups are encouraged to apply. For more information on the Department of Geosciences go to <http://www.geosc.psu.edu>.

TENURE TRACK POSITION, BOSTON COLLEGE STRUCTURAL GEOLOGY/ACTIVE TECTONICS

The Department of Geology and Geophysics at Boston College anticipates hiring three new Earth Systems Scientists over the next three years. The first position, to begin in fall of 2005, is in the area of Structural Geology/Active Tectonics. The successful candidate will be expected to develop an externally funded research program integrated with excellence in teaching within the geology/geophysics/environmental geoscience curriculum at both the undergraduate and graduate levels. Teaching responsibilities include Structural and Field Geology as well as other courses in the candidate's area of research expertise, which could also include fields such as crustal dynamics, paleoseismology, and/or basin analysis. The appointment is expected to be made at the Assistant Professor level, but outstanding individuals qualified for appointment at higher rank will be considered. Information on the Department, its faculty, and research strengths can be viewed on the Department's web page at www.bc.edu/geosciences. Applicants should send a curriculum vita, a statement of teaching and research interests, and the names and contact information of at least three references to Professor Alan Kafka, Chair, Department of Geology and Geophysics, Devlin Hall 213, Boston College, Chestnut Hill, MA 02467-3809. Review of applications will begin on December 1, 2004, and applications must be received by January 15, 2005 to receive full attention. Department faculty will be available at the GSA and AGU meetings this fall to interview applicants. Boston College is an academic community whose doors are open to all students and employees without regard to race, religion, age, sex, marital or parental status, national origin, veteran status, or handicap.

HYDROGEOLOGY TENURE-TRACK POSITION UNIVERSITY OF PITTSBURGH

The Department of Geology and Planetary Science at the University of Pittsburgh invites applications for a tenure-track position in hydrogeology at the Assistant

Professor level, pending budgetary approval. The position will begin in the Fall Term 2005. We seek an outstanding individual who combines field-based and laboratory studies with hydrologic modeling to build an interdisciplinary research program focused on hydrologic systems and water resources. Preference will be given to candidates whose expertise will strengthen existing research groups in the department. Areas of possible interaction include: (1) watershed-scale studies of organic and chemical compound transport, (2) volcano-hydrothermal systems, (3) hydrology of abandoned coal mines, and (4) paleohydrology of lacustrine systems.

Qualifications include a Ph.D. at the time of appointment, as well as demonstrated excellence in teaching, research, and intellectual leadership. The successful candidate will be expected to develop a vigorous, externally funded research program, including supervision of M.S. and Ph.D. students and undergraduate research projects. Strong teaching and communication skills are essential for this position, and the candidate will have the opportunity to teach both undergraduate and graduate courses in her/his areas of expertise. Industry experience and collaboration would provide an added benefit to our students.

Qualified applicants should submit a curriculum vitae that includes: a statement of research and teaching interests, current and past grant support, and copies of relevant publications. Also include the names and contact information for at least four references to Hydrogeology Search Committee, Department of Geology and Planetary Science, 200 SRCC, University of Pittsburgh, Pittsburgh, PA, 15260, USA.

Applications should be received before December 15, 2004. For additional information, see our web site: <http://www.geology.pitt.edu>.

The University of Pittsburgh is an Affirmative Action, Equal Opportunity Employer. Women and members of minority groups under-represented in academia are especially encouraged to apply.

HARD ROCK GEOLOGY, CORNELL COLLEGE

Cornell College, a private undergraduate liberal arts college, invites applications for a tenure-track appointment in its Department of Geology. The successful candidate will teach hard rock courses, including Mineralogy and Igneous and Metamorphic petrology, and will develop an upper-level course in his/her area of expertise. The new hire will also teach Physical Geology, and will develop an introductory course for non-majors and a mid-level course that may be integrated into the College's inter-departmental Environmental Studies program (Geologic Hazards, for example). The new faculty member will be expected to continue the department's strong commitment to student-faculty research. Analytical facilities include an XRD, alpha spectrometers, luminescope, wet chemistry lab, and ArcGIS workstations. The nearby University of Iowa Department of Geosciences houses a stable isotope lab and a newly completed clean lab for radioisotopic analysis. Appointment at the Assistant Professor level to begin in the fall of 2005, pending administrative approval. Ph.D. required and post-doctoral or college teaching experience preferred. Cornell College has attracted national attention for its distinctive academic calendar under which faculty members teach and students take one course at a time in month-long terms. The College is committed to excellence in teaching and research, and encourages interdisciplinary interests among its faculty. Send paper copies of letter of application, curriculum vitae, and three letters of recommendation to: Ms. Ann Opatz, Office of Academic Affairs, Cornell College, 600 First St. West, Mount Vernon, Iowa 52314-1098. Formal consideration of applications begins December 1, 2004. Cornell College is an EOA/AA employer and encourages applications from women and minorities. Visit our website at www.cornellcollege.edu.

SEDIMENTOLOGY/STRATIGRAPHY TENURE-TRACK POSITION DEPARTMENT OF GEOLOGY APPALACHIAN STATE UNIVERSITY

Department of Geology at Appalachian State University invites applications for a tenure-track position at the Assistant Professor level, beginning August 2005. The candidate must have a Ph.D. and possess a strong commitment to undergraduate education and research. We seek a geologist with expertise in sedimentology and stratigraphy, with a field-based research program. Candidates are expected to take advantage of the regional geologic setting of the Southern Appalachians in their teaching of upper-level courses. Applications must include a letter of interest, vita, a statement of career goals, copies of transcripts of all college and university work (official copies due upon employment), and the names and contact information (including e-mail) of

three referees familiar with the applicant's work in teaching and scholarship. Send applications to Dr. Steven J. Hageman, Chair of Search Committee, Department of Geology, Appalachian State University, P.O. Box 32067, 195 Rankin Science Bldg., Boone, NC 28608-2067. Review of completed applications will begin November 15, 2004 and will continue until the position is filled. Appalachian State, located in the Blue Ridge Mountains of western North Carolina, is a comprehensive university and a member of the University of North Carolina System. The Department of Geology offers several B.A. and B.S. degrees. Appalachian State University is an Equal Employment Opportunity/Affirmative Action employer. www.geology.appstate.edu.

TWO TENURE-TRACK FACULTY POSITIONS UNIVERSITY OF THE PACIFIC

STRUCTURAL GEOLOGY AND HYDROGEOLOGY

The Department of Geosciences at the University of the Pacific invites applications for two tenure-track positions. The first position is in the area of structural geology/neotectonics. The second position is in the area of hydrogeology. The successful candidates will be expected to (1) have a strong commitment to undergraduate education, (2) teach introductory geosciences/environmental science courses as well as upper level courses in their area of expertise, (3) contribute actively to a new environmental science major to be housed in the department, (4) develop an active research program that includes undergraduates, and (5) participate in the university general education/freshman seminar program. Preference will be given to candidates with experience and ability to teach in one or more of the following areas: GIS, field geology, soils, geophysics, and local/regional environmental issues. Applicants should send a letter of interest, CV, statement of teaching philosophy and research plans, names and full contact information of three references to: Lydia K. Fox, Chair, Department of Geosciences, University of the Pacific, 3601 Pacific Avenue, Stockton, CA 95211 (email: lkfox@pacific.edu). See <http://www1.uop.edu/cop/geology> for more information. The University of the Pacific is an equal opportunity/affirmative action employer encouraging excellence through diversity.

UNIVERSITY OF WEST FLORIDA

ASSISTANT PROFESSOR, HYDROGEOLOGY

The Department of Environmental Studies, University of West Florida, invites applications for a tenure-track assistant professor position in hydrogeology beginning August 2005.

We seek candidates with expertise in applied groundwater hydrology or water/land surface interactions. Interest in environmental issues is highly desirable. Candidates will be expected to teach both lower

and upper-division classes in geology and hydrology, and graduate courses in their field of specialization.

Applicants are expected to develop an active research program and should be committed to peer-reviewed publication. They should demonstrate evidence of, or potential for, excellent teaching skills. A Ph.D. in geology or related discipline is required at the time of appointment. Salary is commensurate with qualifications and experience.

The Department of Environmental Studies offers B.S. and M.S. degrees in Environmental Science and a Certificate in Geographic Information Science. Over 120 undergraduate majors specialize in tracks in natural science, environmental policy, and geography. The department is housed in a renovated building with new research and teaching facilities. The department maintains the university-wide GeoData Center, which has extensive GIS capabilities. Personnel include 7 full-time faculty, several adjunct faculty, and a GIS Coordinator. For more information on the department see <http://uwf.edu/environmental/>.

Apply at <http://jobs.uwf.edu>. Candidates are requested to attach to the electronic application a statement of research and teaching interests and experience, and a curriculum vitae. Official transcripts and three sealed letters of reference should be sent to Dr. Johan Liebens, Department of Environmental Studies, University of West Florida, 11000 University Parkway, Pensacola, FL 32514. For information contact Dr. J. Liebens at phone (850)474-2065, fax (850)857-6036, or email liebens@uwf.edu. Review of applications will begin November 15, 2004 and will continue until the position is filled.

The University of West Florida is an Equal Opportunity/Access/Affirmative Action Employer. A police background screening is required.

ASSISTANT PROFESSOR OF HYDROGEOLOGY HAMPshire COLLEGE

Hampshire College is seeking an earth scientist for a full-time Assistant Professor position in water geoscience and hydrogeology, with interests in water resource management. A Ph.D. is required.

We seek an accomplished, energetic scientist whose innovative teaching engages undergraduates in genuine research. Candidates' abilities to combine undergraduate teaching and research in exciting ways will be weighed more heavily than their specific disciplines. We seek an active participant in our Women in Science Program and an individual who will take a leadership role in promoting diversity in the sciences. The successful applicant will complement our existing strengths in earth and environmental science, sustainable technology, ecology, and agriculture. See our program descrip-

tion at <http://ns.hampshire.edu>.

Hampshire College, an independent liberal college, offers a stimulating and supportive environment for interdisciplinary teaching and collaborative research. We emphasize discussion, projects, and written evaluations rather than lectures, exams, and grades. We seek scientists whose innovative teaching engages students in genuine research at the introductory and advanced levels. Applicants should discuss their ideas for integrating research and teaching in their application letter. Hampshire College is a member of the Five College consortium which offers extensive possibilities for research collaboration.

Application review begins September 15, 2004, for a position starting July 1, 2005. Please send a letter of application, vitae, descriptions of courses, ideas for research and interdisciplinary collaboration, and three letters of reference to: Laurie Smith, Assistant Professor of Hydrogeology Search, School of Natural Science, Hampshire College, Amherst MA 01002.

Affirmative Action/Equal Opportunity Employer. hr.hampshire.edu.

U.S. GEOLOGICAL SURVEY MENDENHALL POSTDOCTORAL RESEARCH FELLOWSHIP PROGRAM

The U.S. Geological Survey (USGS) invites applications for the Mendenhall Postdoctoral Research Fellowship Program for Fiscal Year 2006. The Mendenhall Program provides opportunities to conduct research in association with selected members of the USGS professional staff. Through this Program the USGS will acquire current expertise in science to assist in implementation of the science strategy of its programs. Fiscal Year 2006 begins in October 2005.

Opportunities for research are available in a wide range of topics. The postdoctoral fellowships are 2-year appointments. The closing date for applications is December 1, 2004. Appointments will start October 2005 or later, depending on availability of funds. A description of the program, research opportunities, and the application process are available at <http://geology.usgs.gov/postdoc>. The U.S. Geological Survey is an equal opportunity employer.

POMONA COLLEGE

FACULTY POSITION IN PETROLOGY/MINERALOGY

The Geology Department at Pomona College, the founding member of the Claremont Colleges, invites applications for a tenure-track position at the level of Assistant Professor beginning July 1, 2005. Candidates with significant teaching experience are encouraged to apply. We seek a colleague with a strong and enthusiastic commitment to providing a quality undergraduate education in a liberal arts environment and to establishing an active



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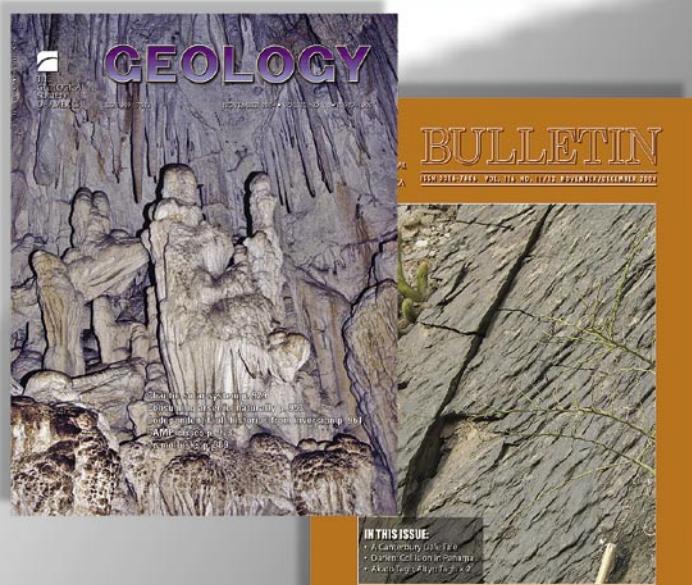
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research program involving undergraduates. Teaching responsibilities are expected to include mineralogy, igneous/metamorphic petrology, introductory and specialty courses. We seek a colleague who applies integrative field and lab based approaches to petrologic problems - the ideal candidate will have a research direction which diversifies our existing research programs. Applicants should send a letter of interest, curriculum vitae, undergraduate and graduate transcripts, a statement of teaching philosophy, a summary of research plans and three letters of reference to Pet-Min Search, Geology Department, Pomona College, Claremont, CA 91711. Web address: <http://www.geology.pomona.edu>; email: GeoFacSearch@pomona.edu. Review of completed applications will begin November 24, 2004 and will continue until the position is filled. Pomona College is an equal opportunity employer, and it especially invites applications from women and members of underrepresented groups.

FACULTY POSITION/GEOLOGY MARSHALL UNIVERSITY

Marshall University seeks applications for a tenure track appointment as Assistant or Associate Professor of Geology beginning August 15, 2005. The successful applicant will teach advanced courses in Mineralogy, Petrology, and Geochemistry and General Geology and Earth Materials Lab. An earned doctorate in Geology is required and several years of post secondary teaching experience is preferred. A vigorous, externally supported program of undergraduate research is expected and a research focus on environmental geochemistry is highly desirable. Department resources include an extensive rock and mineral collection, thin and polished section preparation lab, X-ray Diffractometer, ICP and AA Spectrometer, and SEM with EDS.

Candidates must submit a letter of application, curriculum vitae, undergraduate and graduate transcripts, a statement of teaching and research interests, and the names and contact information (including e-mail addresses) for three references to Prof. Ronald Martino, Department of Geology, Marshall University, Huntington, WV 25755. Review of applications will begin in November continue until the position is filled.

Marshall University is an EO/AA employer. Women and minorities are encouraged to apply. For additional information about the Department of Geology and Marshall University, please visit the website www.marshall.edu.

O.K. EARL AND TEXACO POSTDOCTORAL FELLOWSHIPS CALIFORNIA INSTITUTE OF TECHNOLOGY

The California Institute of Technology announces two fellowships in Geological and Planetary Sciences. The O.K. Earl and Texaco Postdoctoral Fellowships are awards funded by endowments from Orrin K. Earl, Jr. and the Texaco Philanthropic Foundation. Each fellowship carries an annual stipend of \$46,000 plus a research expense fund of \$2,000 per year and one-way travel costs to Pasadena. The duration of each appointment is normally two years, contingent upon completion of the Ph.D. degree and good progress in the first year, beginning with the 2005-06 Fall term. Fellows are eligible to participate in Caltech's health and dental program.

These fellowships have been established to support the research of scientists typically within two years after receipt of the Ph.D. The intent of the program is to identify and support innovative and creative work in the earth and planetary sciences, with particular emphasis on interdisciplinary work. Applicants with training in physics, chemistry, biology, or computer sciences are urged to apply. The Division is currently active in geobiology, geochemistry, geology, geophysics, petrology, seismology, environmental science and engineering, and atmospheric and planetary sciences. It is expected that each fellowship recipient will be hosted by a division professor (designated by the Chairman) who will provide both financial support and intellectual guidance.

Materials in support of an application should include a curriculum vitae, list of publications, and a one-page statement of research interests. The candidate should also request that three letters of reference be sent directly to the **Chairman, Division of Geological and Planetary Sciences, MC 170-25, California Institute of Technology, Pasadena, CA 91125**. Attention: Prize Postdoctoral Fellowships. For convenience, applications and references may be sent to: chairman@gps.caltech.edu. All applications and references are due by Friday, December 17, 2004.

Fellowship candidates will automatically be considered for other available postdoctoral positions at Caltech in their fields of interest.

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

FACULTY POSITION IN EARTH SURFACE PROCESSES AND CLIMATE NORTHWESTERN UNIVERSITY

The Department of Geological Sciences at Northwestern University invites applications for a tenure-line assistant professorship to begin in the fall 2005. Fields of interest include numerical models of climate and paleoclimate that investigate the links between biosphere-hydrosphere-lithosphere and climate, and/or analysis of geological, paleobiological, biogeochemical, or physical data relevant to the evolution of Earth's climate system and surface environment. Candidates whose expertise complements existing departmental research efforts in these fields would be favored. Application review will begin December 15, 2004. Applicants should submit a letter of application, curriculum vitae, description of teaching and research objectives and accomplishments, reprints and preprints, and the names and addresses of three or more referees. Please send material to: Surface Processes Search Committee, Department of Geological Sciences, 1850 Campus Drive, Northwestern University, Evanston, Illinois 60208-2150. AA/EOE. Applications from women and members of minority groups are especially welcome.

LAFAYETTE COLLEGE, GLOBAL CHANGE GEOLOGIST

Tenure-track Assistant Professor beginning fall 2005. We seek a geologist with training and research interests in Global Change, such as earth scientists using geological, chemical, physical, geophysical, biogeological, or isotopic techniques to understand Earth System Science, with a focus on broad questions of importance to humans. Ph.D. required, evidence of high-quality teaching and research preferred.

Individual must have a strong interest in teaching undergraduates and establishing and maintaining an active research program involving undergraduates. Teaching includes an upper-level specialty course, development of an introductory course, and participation in the core curriculum (First-Year Seminar or Values and Science/Technology). Applicants may describe additional courses they may wish to teach.

Lafayette College is a private undergraduate liberal arts college with an engineering division and 2,200 students.

Send cv, separate statements of teaching and research interests, graduate and undergraduate transcripts, and three reference letters to Dr. Germanoski, Head, Dept. of Geology and Environmental Geosciences, Lafayette College, Easton, PA 18042-1768. We will interview at the GSA meeting in Denver; however, applications will be accepted through Jan. 31, 2005, or until position is filled. EEO/women and minorities encouraged to apply.

Opportunities for Students

Ph.D. Student Assistantships, Oregon State and Portland State Universities are offering ten Ph.D. research assistantships to explore all aspects of the Earth's subsurface microbial biosphere. Tuition and stipend are provided by the NSF IGERT program and the two universities. Students will work in interdisciplinary teams of engineers, oceanographers, microbiologists, microbial ecologists, geologists, soil scientists, and chemists to solve environmental problems, to understand global chemical cycles, and to determine the impact of subsurface microorganisms on surface ecosystems. More information can be found at: <http://oregonstate.edu/dept/igert>, or Martin R. Fisk, College of Oceanic and Atmospheric Sciences, Oregon State University, mfisk@coas.oregonstate.edu. Students from all scientific backgrounds are encouraged to apply to departments represented by IGERT faculty at either institution. U.S. citizens or permanent residents can be supported by IGERT funds however students of all nations can participate in the program. Review of applications starts 1/15/05. Oregon State and Portland State Universities are committed to equality in education.

Research/Teaching Assistantships, Graduate Program of Hydrologic Sciences, University of Nevada, Reno. Applications are encouraged for graduate teaching/research assistantships beginning July 1, 2005. Positions carry an annual stipend of approximately \$17,000 - \$18,000 as well as health insurance and a tuition waiver. Students interested in the area of ground water, surface water and aqueous geochemistry are encouraged to apply. Additionally, funded assistantships are available in contaminant transport and watershed hydrology, as well as scholarships and doctoral fellowships offered through UNR and the Desert Research Institute. Completed application packages are due January 10, 2005 and should be mailed to: University of Nevada, Reno, Graduate Program of

Hydrologic Sciences, Mail Stop 175, LMR 267, Reno, NV 89557-0180. Information on assistantships and fellowships in the Hydrologic Sciences Graduate Program can be found at www.hydro.unr.edu or by calling 775-784-6250.

Graduate Study Opportunity, The Dept. of Geography and Earth Sciences at UNC Charlotte is accepting applications for MS and Ph.D. students. Full funding including out-of-state tuition waivers is available. Areas for potential student research include: surface and groundwater hydrology, vadose zone processes, geochemistry, biogeochemistry, mineralogy, structural geology, remote sensing, soil science, soil geomorphology, Quaternary geology, surficial processes, fluvial processes and depositional environments, clastic and carbonate sedimentology, basin analysis, stratigraphy, coastal geology, paleoecology, macro- and micropaleontology, environmental geology, hydrology and sedimentology, applied climatology, and numerical weather prediction and tropical meteorology. Our department hosts extensive field and analytical equipment and facilities including ICPMS, XRF, GIS and cartographic laboratories. We are located in the beautiful Piedmont of North Carolina with easy access to pristine beaches and to the Blue Ridge Mountains. Application deadline: January enrollment: November 25, 2004; Fall enrollment: February 15, 2005 or until positions are filled. Contact ges@unc.edu or visit our website www.geearth.unc.edu for more information.

Graduate student opportunities: Structural Geology of Earthquakes, U of Oklahoma. We are seeking a Ph.D. or Master's level student for research in Structural Geology of Earthquake Processes. The student will study earthquake processes at focal depth by near-field observations in deep gold mines of South Africa (faculty-staff.ou.edu/R.Zevez.Reches-1.nelsam). The work includes comprehensive analysis of the structure and composition of active fault-zones before and after earthquakes. It involves working under strenuous conditions in mining environment as deep as 3,600 m below ground surface. The research is conducted in the University of Oklahoma, Norman, OK (geology.ou.edu) in collaboration with investigators at USC, USGS, Stanford, Princeton and a few South African institutes.

Interested candidates with background in Structural Geology, Rock Mechanics, Earthquake Mechanics or Geochemistry, are invited to send their CV and names of three references to Dr. Ze'ev Reches (reches@ou.edu) or Dr. Tom Dewers (tdewers@ou.edu). Closing date: November 1, 2004 or until a suitable individual is found.

Environmental Sciences Ph.D. Program and Fellowships. The Environmental Sciences Ph.D. Program at Wright State University provides a strong interdisciplinary focus on stressor fate and effects in 3 areas of faculty expertise: Environmental Toxicology & Chemistry, Environmental Stressors, and Environmental Geophysics and Hydrogeology. There are over 30 program faculty from the Departments of Biological Sciences, Chemistry, Geological Sciences, Pharmacology & Toxicology, and Physics. Wright State University is located in Dayton, Ohio with a student enrollment of approximately 17,000. The ES program began in 2002 and is a program of excellence with internationally recognized research. Research and Teaching Assistantships are available (>\$18,000 stipend + tuition & fee waiver). In addition, the prestigious YSI Fellowship is available for \$25,000 (+ tuition & fee waiver) to outstanding applicants. Students are encouraged to apply to the program and for financial awards with either a B.S. or M.S. degree from a relevant major (e.g., biology, chemistry, geology, physics, toxicology, environmental sciences). There is no deadline for applications, however review of applications will begin in January with awards made at any time. For more information see www.wright.edu/academics/envsci.

Student Assistantship, Department of Geological Sciences, University of Kentucky, Lexington, KY 40506. Applications are invited for an anticipated 2-3 year Research Assistantship leading to the M.S. or Ph.D. degree. The position involves evaluation of paleo-stresses on ancient seismogenic faults, using frictional heating of faulted coals. The field area encompasses the southern Appalachian fold/thrust belt. Laboratory activities will include vitrinite reflectance measurements, fluid inclusion analyses and microstructural characterization of fault rocks. The position provides for a competitive stipend, full tuition and health insurance and it can start in Spring or Fall of 2005. Interested applicants should contact Kieran O'Hara at geokoh@uky.edu.

Books—New Releases

COASTAL GEOLOGY, NC Sea Grant: *Drowning the North Carolina Coast: Sea-Level Rise and Estuarine Dynamics* by S. Riggs & D. Ames, 152 pgs, full-color photos & maps, \$25. **The Soundfront Series**, ideal for property owners, resource managers; \$20/4-guide set. **The Dune Book**, by S. Rogers & D. Nash, Award-winning! \$5. Bulk order discounts. 919/515-9101, www.ncseagrant.org.

DISSENSIONS, by George D. Klein. Fictional account of surviving intrigue in academe and winning at the highest level. \$19.54 (softcover—ISBN: 1-4134-4210-2), \$29.69 (hardcover—ISBN: 1-4134-4211-0), plus S & H. Xlibris. 1-888-795-4275. <http://www.xlibris.com/bookstore/bookdisplay.asp?bookid=22528>.

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Mary C. Eberle, B.A., M.S., contract editor for the Geological Society of America and other geological outfits, invites you to inquire about her editing services. She can distinguish "early" from "lower" and "basalt" from "basite." Clarity and consistency are her goals. www.wordrite.com.

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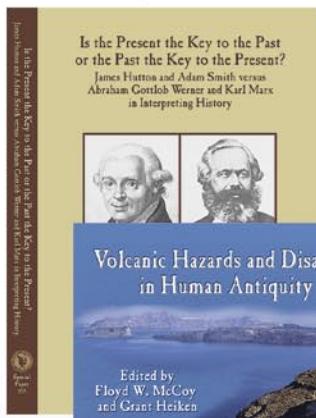
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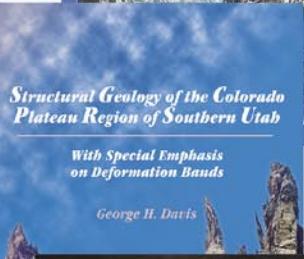
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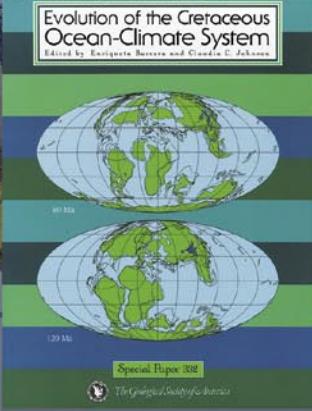


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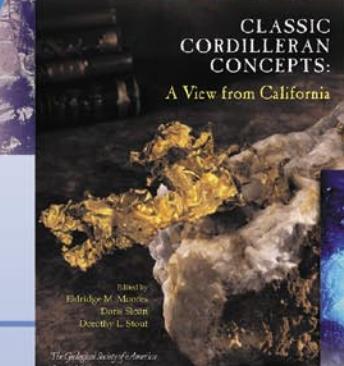
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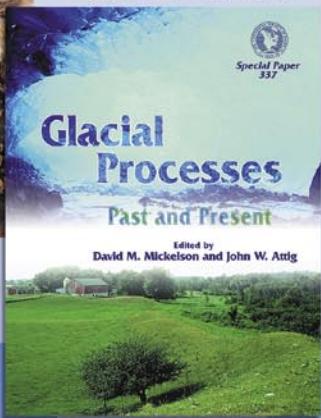


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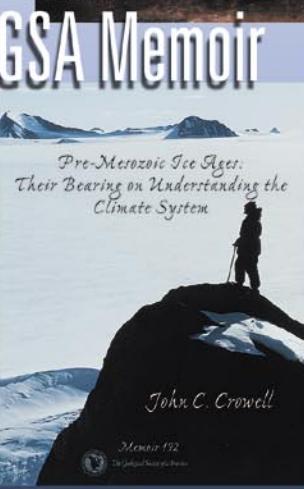
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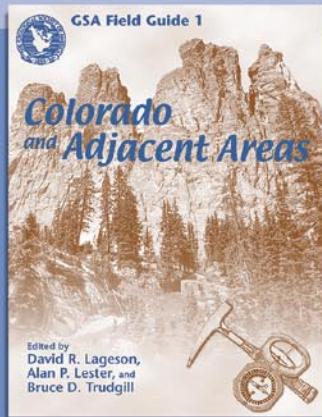


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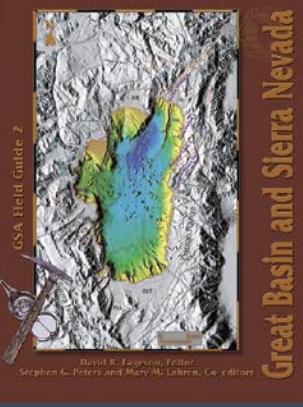


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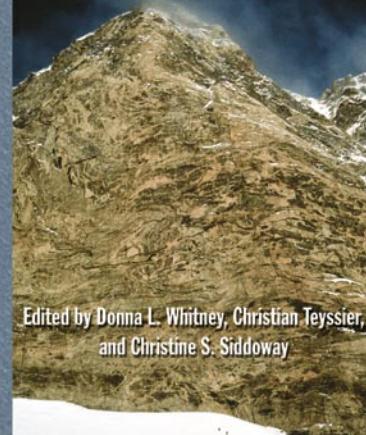
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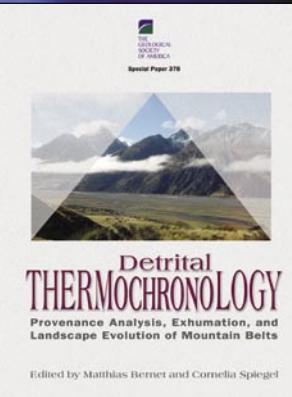
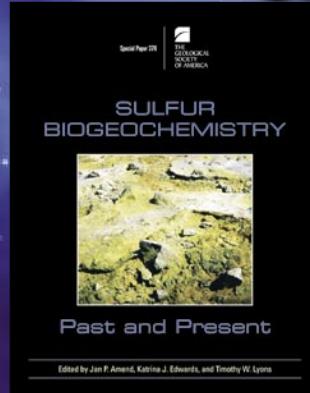
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