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Emergence of the aerobic biosphere during the Archean-Proterozoic transition: Challenges of future research

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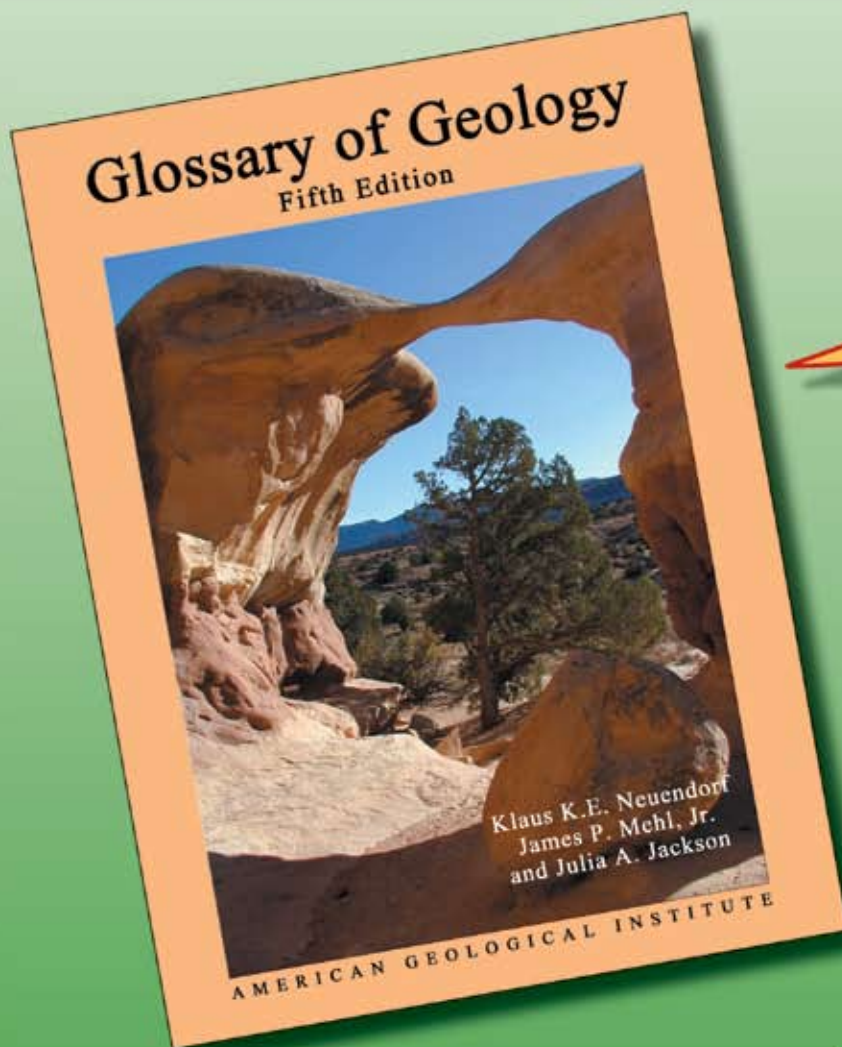
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Cover: Paleoproterozoic (2200 Ma) lacustrine dolostone from the Pechenga Greenstone Belt, northeast Fennoscandian Shield. Width of field is 15 cm. The laminated red (oxidized) dolostone is anomalously enriched in ^{13}C ($\delta^{13}\text{C} = +8\text{‰}$), while the overlying material, representing the oldest known travertines in the world, are ^{13}C -depleted ($\delta^{13}\text{C} = -7\text{‰}$). Note that these rocks have experienced greenschist-facies metamorphism. The ^{13}C -rich dolostones from the Fennoscandian Shield exemplify the evidence for an extreme global perturbation to the carbon cycle at this time, although interpretation of these lacustrine rocks in terms of a global marine $\delta^{13}\text{C}$ excursion is not straightforward. See "Emergence of the aerobic biosphere during the Archean-Proterozoic transition: Challenges of future research," by Victor A. Melezhik et al., p. 4–11.



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Emergence of the aerobic biosphere during the Archean-Proterozoic transition: Challenges of future research

Victor A. Melezhik, Geological Survey of Norway, Leiv Eirikssons vei 39, 7491 Trondheim, Norway; **Anthony E. Fallick**, Scottish Universities Environmental Research Centre, Rankine Avenue, East Kilbride, Glasgow G75 0QF, Scotland; **Eero J. Hanski**, University of Oulu, Linnanmaa, 90014 Oulu, Finland; **Lee R. Kump***, Dept. of Geosciences, Pennsylvania State University, 535 Deike Bldg, University Park, Pennsylvania 16802, USA; **Aivo Lepland**, Geological Survey of Norway, Leiv Eirikssons vei 39, 7491 Trondheim, Norway; **Anthony R. Prave**, University of St. Andrews, St. Andrews, Fife KY16 9AL, Scotland; **Harald Strauss**, Westfälische Wilhelms-Universität Münster, Corrensstraße 24, 48149 Münster, Germany

ABSTRACT

The earth system experienced a series of fundamental upheavals throughout the Archean-Paleoproterozoic transition (ca. 2500–2000 Ma). Most important were the establishment of an oxygen-rich atmosphere and the emergence of an aerobic biosphere. Fennoscandia provides a fairly complete record of the hallmark events of that transition: widespread igneous activity, its association with a possible upper-mantle oxidizing event, the global Huronian glaciation, a rise in atmospheric oxygen, the protracted and large-magnitude Lomagundi-Jatuli carbon isotope excursion, a substantial increase in the seawater sulfate reservoir, changes in the sulfur and phosphorus cycles, a radical modification in recycling of organic matter, and the Shunga Event—the accumulation of unprecedented organic-matter-rich sediments and the oldest known inferred generation of significant petroleum. Current research efforts are focused on providing an accurate temporal framework for these events and linking them into a coherent story of earth system evolution.

INTRODUCTION

The Archean (3800 Ma–2500 Ma) earth system functioned under an oxygen-poor atmosphere, and although oxygen-rich habitats undoubtedly existed once cyanobacteria evolved and began producing oxygen (>2700 Ma; Summons et al., 1999; Brocks et al., 1999), these were restricted to microbial mats or perhaps ephemeral oxygen oases in the surface ocean or in lakes. During this time and the initial 500 m.y.

of the Proterozoic, Earth's lithosphere underwent the assembly of two supercontinents: one, Kenorland, comprising the Laurentian, Fennoscandian, and Siberian shields; the other, the amalgamated Zimbabwe, Kaapvaal, Pilbara, Sao Francisco, and Indian cratons (Aspler and Chiarenzelli, 1998; Williams et al., 1991). Subsequent breakup involved the emplacement of voluminous continental flood basalts, giant radiating dike swarms and layered gabbro-norite intrusions (e.g., Heaman, 1997; Vogel et al., 1998), and deposition of banded iron formations (Pickard, 2003). Profound climatic and biogeochemical events also were occurring, such as icehouse conditions (Young et al., 2001; Evans, 2003), the rise in atmospheric oxygen levels (Bekker et al., 2004), and the largest and longest duration positive excursion of carbon isotopic composition of sedimentary carbonates (Lomagundi-Jatuli Event), which predated deposition of anomalously organic carbon-rich sediments forming giant petroleum fields (Shunga Event; both events are reviewed in Melezhik et al., 1999a, 1999b). It was out of this period of geological upheaval that the aerobic earth system began to emerge, with biogeochemical cycles in the oceans and on land using the highly energetic aerobic pathway. Note though that some workers suggest that deep marine basins and perhaps the global deep ocean itself were euxinic (rich in H₂S) for much of the ensuing Proterozoic (Canfield, 1998; Anbar and Knoll, 2002; Poulton et al., 2004).

Here we present a synthesis of the hallmark features of the Archean-Paleoproterozoic transition in the Fennoscandian Shield (Fig. 1). It is representative of other shield areas and provides important insights into the biogeochemical evolution of the earth system.

Early Paleoproterozoic Environmental Upheavals: Insight from the Fennoscandian Shield

The Fennoscandian Shield comprises Archean, Paleoproterozoic, and Mesoproterozoic domains (Fig. 1). In particular, its eastern part is a composite of Late Archean granite-greenstone belts, Paleoproterozoic rifts, the ca. 1900 Ma Kola Orogen, and multiphase Svecofennian orogens. Paleoproterozoic sedimentary and volcanic successions reach a cumulative thickness of more than 20 km and contain a rich record of nearly 700 m.y. of earth history. Two of the best-explored and best-mapped areas are the Pechenga greenstone belt and the Onega Basin (Fig. 1); both contain exceptionally well-developed and preserved volcano-sedimentary successions (Fig. 2) that span >2505–1970 Ma and record intracratonic rifting, global glaciation (Fig. 3A–3D), and other profound alterations of Earth's surface environments. The research that has been conducted in the past on these rocks provides a series of fascinating vignettes of geologic events, but age control is poor, based largely on whole-rock Rb-Sr ages, and the linkages between these events are not well understood. The challenge for the future is to correlate Fennoscandian events with those recorded on other continents and to weave these observations into a coherent story of the emergence of the aerobic biosphere.

*Corresponding author: lkump@psu.edu



Figure 1. Simplified geological map of the Fennoscandian Shield.

Huronian Glaciation

The first significant environmental event known from the Archean-Paleoproterozoic transition is the seemingly rapid onset of global glaciations from otherwise climatically invariant conditions (Marmo and Ojakangas, 1984). The glaciation is known as the Huronian (after the eponymous Supergroup in Canada) and occurred at 2450–2220 Ma (Young et al., 2001). Some of the best age constraints come from South Africa where 2316 ± 7 Ma glacial diamictites (Hannah et al., 2004) rest unconformably on a variety of sedimentary rocks and banded iron formations (Bekker et al., 2001). Glaciogenic deposits of the Fennoscandian Shield are associated with the Sarioli Group and its equivalents (Marmo and Ojakangas, 1984) and consist of polymict conglomerates, sandstones, diamictites, and varve-like sedimentary rocks with dropstones (Fig. 3A and 3B).

The genesis of this global glaciation(s) remains poorly understood (Evans, 2003). Pavlov and Kasting (2002) linked the event to the collapse of an Archean methane-supported greenhouse effect driven by the rise of atmospheric oxygen (see below). Data from the Fennoscandian Shield and elsewhere suggest an alternative hypothesis involving a network of feedback loops as causative factors. At ca. 2500 Ma, mantle plume-driven continental uplifts emplaced voluminous continental flood-basalts (Heaman, 1997) in low latitudes (Mertanen et al., 1999). This global igneous event has otherwise been linked to mantle redox evolution and the rise of oxygen (Kump et al., 2001; see next section), but the weath-

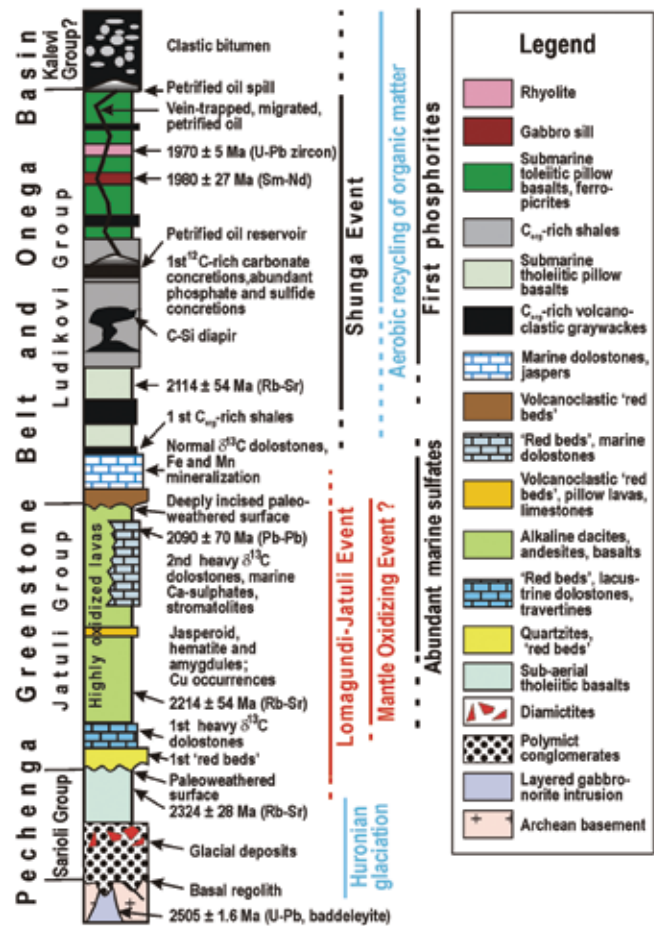


Figure 2. Composite (~10,000-m-thick) Paleoproterozoic section for the Pechenga Greenstone Belt–Omega Basin linked to major environmental events. Radiometric dates are from Hanski (1992), Amelin et al. (1995), and Balashov (1996).

ering of the basalts could have driven the climate system into glaciation without these other feedbacks. The basalt flows subsequently were dissected by rifting, producing major topographic features and drainage patterns in all likelihood similar to those of younger continental flood-basalt provinces (Cox, 1989). This would have enabled deep, subaerial weathering lasting over tens of m.y. of extensive fresh basalt-covered areas and consequent intense consumption of atmospheric CO₂ (Taylor and Lasaga, 1999; Dessert et al., 2001). Low ⁸⁷Sr/⁸⁶Sr ratios for this time interval (Bekker et al., 2003b) add credence to this scenario. Progressively diminishing volcanic CO₂ emissions and a constant burial ratio of inorganic/organic carbon would have reduced atmospheric CO₂ even further, all contributing to global cooling and the onset of icehouse conditions.

The Great Oxidation Event (GOE)

Interestingly, the igneous event in the earliest Paleoproterozoic may have been directly responsible for the rise in atmospheric oxygen content that occurred at this time. S isotope data showing the disappearance of mass independent signatures in sedimentary sulfides provide compelling evidence for a substantial increase in atmospheric oxygen

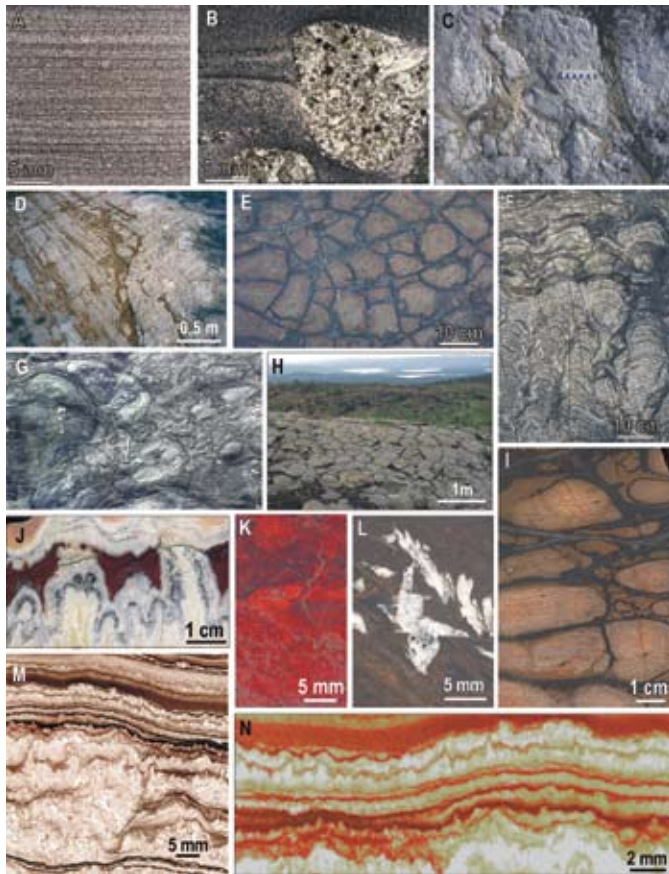


Figure 3. Rocks recording environmental events through ca. 2500–2060 Ma. Intracratonic rifting and glacial deposits from the Sarioli Group of the Pechenga and Imandra-Varzuga Greenstone Belts: (A) varves; (B) “dropstone”; (C) sand-filled cracks and fractures in Archean pegmatite recording incipient extension along the northern shoulder of the Pechenga paleorift; (D) erosional scouring at base of boulder conglomerates on Archean paragneiss (to left). Sedimentary features of Jatuli Group rocks from the Onega Basin: (E) desiccated red mudstone indicating an O_2 -rich atmosphere; (F) dolomitic columnar stromatolites. Volcanites of the Jatuli Group from the Pechenga Greenstone Belt: (G) slumped pillows in rift-basin lake; (H) columnar joints in alkaline basalts; (I) magmatically oxidized dacite. Chemical sedimentary rocks of the Jatuli Group from the Pechenga Greenstone Belt and the Onega Basin: (J) hot-spring travertine; (K) jasper; dolomite-pseudomorphed; (L) rosettes of gypsum with swallow-tail twin morphology; (M) sulfate nodule in former bedded evaporite; (N) bedded evaporite with enterolithic structure.

sometime after 2450 Ma but before 2320 Ma (Bekker et al., 2004) and about the time of the glaciation (Hannah et al., 2004). In Fennoscandia, this period was marked by intracratonic rifting and incursion of shallow-water epeiric seas with widespread deposition of terrestrial “red beds,” microbial carbonates, mature clastic sediments with Fe- and Mn-oxide mineralization (Melezhik, 1984), and voluminous alkaline to tholeiitic volcanites (Fig. 3E–3I) with native copper occurrences. Active hydrothermal systems associated with sub-aerial, rift-bound volcanism were responsible for spectacular travertine deposits and jaspers (Melezhik and Fallick, 2001; Fig. 3J and 3K).

Why and how the GOE occurred remains unknown, but its association with widespread igneous activity is suggestive of a causal connection. Anomalously high organic carbon

(C_{org}) productivity and burial driving high O_2 production, reflected in the Lomagundi-Jatuli $\delta^{13}C$ positive isotope excursion (2330–2060 Ma; see below), originally was considered to be the cause (Baker and Fallick, 1989; Karhu and Holland, 1996), but now is known to significantly postdate the initial accumulation of atmospheric O_2 , as indicated by the mass-independent sulfur isotope data. The lack of a global C isotope excursion between 2450–2330 Ma and the antiquity of oxygenic photosynthesizers (>2700 Ma; Brocks et al., 1999; Summons et al., 1999) suggest that the GOE may instead be related to a decline in the O_2 sink associated with the oxidation of reduced volcanic and metamorphic fluids rather than an increase in the O_2 source. The association of the GOE with widespread plume-related volcanism led Kump et al. (2001) to propose that mantle overturn associated with plume events at ca. 2700 and ca. 2500 Ma may have brought previously subducted, oxidized oceanic lithosphere (or perhaps banded iron formations) from the lower mantle back to the surface, increasing the average redox state of the upper mantle and the oxygen fugacity (f_{O_2}) of volcanic gases, and thus reducing the O_2 sink (Holland, 1978). The ca. 2214 Ma volcanic rocks (Fig. 3G–3I) in the Pechenga Greenstone Belt have high Fe^{3+}/Fe_{total} ratios (124 analyses average 0.37, of which 87% are >0.25; Predovsky et al., 1974), which are in sharp contrast to the majority of other volcanic units (ratios <0.25). While apparently too young to be the “smoking gun” for mantle redox evolution, these rocks highlight the heterogeneity of upper mantle redox state.

The lack of an apparent trend in upper mantle redox state (Delano, 2001; Canil, 2002; Li and Lee, 2004) argues against the mantle redox hypothesis, but the required increase in f_{O_2} is small (Holland, 2002) and may be within the scatter of the data (cf. Li and Lee, 2004). In response to these concerns, Catling et al. (2001) proposed that a change in the oxidation state of the continental crust created the necessary reduction in O_2 sink. Both of these hypotheses rely upon considerable Archean hydrogen loss to space to allow for the oxidation of the crust and/or mantle. Tian et al. (2005) proposed that hydrogen loss rates may have been much below the diffusion-limited rate and thus considerably lower than previously estimated, but this remains a controversial suggestion. Thus, the cause of the GOE remains unresolved and provides considerable motivation for future research on the Archean-Paleoproterozoic transition.

Abundant Marine Calcium Sulfates and Changes in Seawater Composition

Additional evidence for the GOE in Fennoscandia includes ca. 2100 Ma rocks (Fig. 2) containing relatively abundant syngenetic barite (Grinenko et al., 1989) and pseudomorphs after Ca-sulfates. The latter are abundant in the Onega Basin (Fig. 1) and are associated with magnesite and pseudomorphed halite crystals in a 500-m-thick succession covering more than 2000 km². They occur in varied facies: playa mudstones and fenestral stromatolitic sheets, sabkha and supratidal stromatolitic sheets, peritidal to intertidal biostromal and columnar stromatolites and variegated dolostones, and intertidal lenticular-bedded siltstone-mudstone couplets (Melezhik et al., 2000, 2005). Former Ca-sulfates occur mostly as dolomite and

silica pseudomorphs, commonly retaining relics of primary anhydrite (a variety of single and twinned crystal forms) and as diverse nodules, nodular masses with “chicken-wire” structure, and laminites with enterolithic structure (Fig. 3L–3N).

These evaporites postdate the events leading to irreversible oxidation of terrestrial environments that began prior to 2320 Ma, as evident by subaerial “red beds” (reviewed in Melezhik et al., 1999b). Combined, these features imply that the evaporites apparently precipitated syndepositionally from oxidized, evolved, and modified seawater (Melezhik et al., 2001), and their abundance in conjunction with those reported from elsewhere (Chandler, 1988; El Tabakh et al., 1999; Bekker and Eriksson, 2003) suggests that surface waters were oxidized and that sulfate had started to accumulate in the marine surface realm, a suggestion consistent with the sparse $\delta^{34}\text{S}$ data that exist for this interval (e.g., Strauss, 1993, 2004). Oceanic sulfate abundance remains unknown, but a sizeable sulfate reservoir as early as 2100 Ma would contrast with the view that, prior to the Mesoproterozoic, gypsum precipitation was inhibited by a small marine sulfate reservoir and higher marine carbonate saturation (Grotzinger, 1989; Kah et al., 2004). The irregular, cyclic, secular variations of geochemical parameters known for Phanerozoic terrestrial hydrosphere and atmosphere systems (Budyko et al., 1985; Veizer, 2005) may provide a means of reconciling these conflicting views.

Positive Carbon Isotope Excursion: The Lomagundi-Jatuli Paradox

The key discovery by Schidlowski et al. (1976) of unusually enriched ^{13}C Paleoproterozoic sedimentary carbonates in the Lomagundi province presented geologists with a puzzle. It took a decade for the first realization (Baker and Fallick, 1989) and a further decade for wide international acceptance (Karhu and Holland, 1996) of the Lomagundi-Jatuli Event as one of the major perturbations of the global carbon cycle in deep time, one associated with a series of fundamental changes of Earth’s surface (Fig. 4). In Fennoscandia, the excursion occurred after the glaciation and GOE, between 2330 and 2060 Ma (Karhu, 1993). Interestingly, it is primarily recorded in what we interpret as continental rift-basin lacustrine carbonates having little to no marine influences (Melezhik et al., 1997). The carbon isotopic composition of the carbonate ($\delta^{13}\text{C}_{\text{carb}}$) values display a broad range strongly correlated with environmental setting: playa and sabkha stromatolitic dolostones are most enriched, whereas those from intertidal settings exhibit lower $\delta^{13}\text{C}$ values (Melezhik et al., 2005). These facies-dependent trends suggest that the global $\delta^{13}\text{C}_{\text{carb}}$ excursion was smaller than previously thought, being amplified by up to 8‰ by local environmental factors such as rapid expansion of stromatolite communities in shallow-water evaporative and partly restricted environments, high bioproductivity and enhanced uptake of ^{12}C , and penecontemporaneous recycling of organic matter in cyanobacterial mats with the production and consequent loss of CO_2 (and CH_4 ?). Thus, extracting the global $\delta^{13}\text{C}$ excursion from the Fennoscandian Shield data has been controversial (Karhu, 1993; Melezhik and Fallick, 1996; Shields, 1997; Melezhik et al., 1999b).

Nevertheless, the Paleoproterozoic isotopic excursion is unique in terms of its duration (although age constraints are

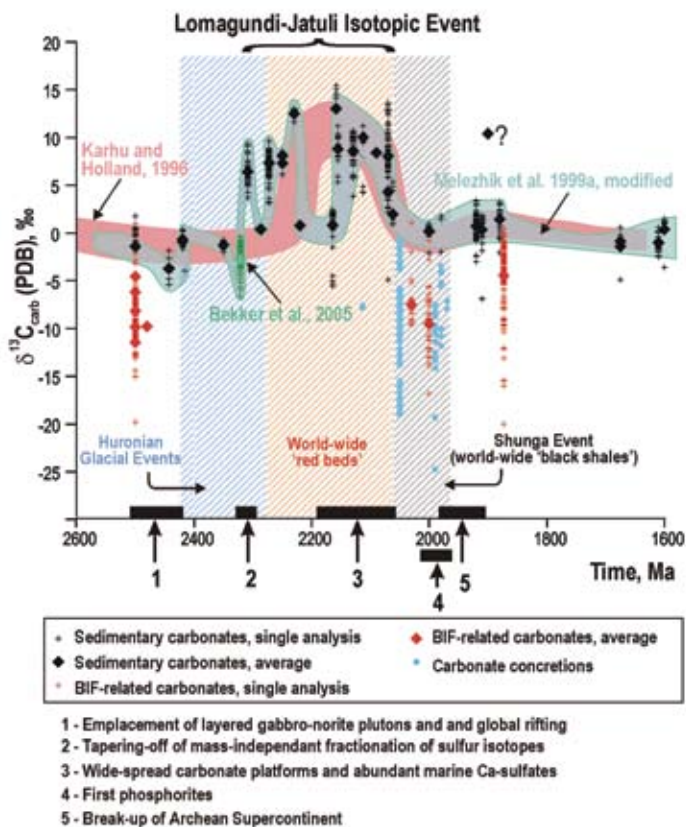


Figure 4. Paleoproterozoic $\delta^{13}\text{C}_{\text{carb}}$ trends of sedimentary and diagenetic carbonates and associated phenomena (modified from Melezhik et al., 1999b, including data from Bekker et al., 2005). BIF—banded iron formations; PDB—Peedee belemnite.

not robust, it appears to be >300 Ma) and ^{13}C enrichment. $\delta^{13}\text{C}$ values of purportedly synchronous deposits ranging from +8‰ to +28‰ (the latter interpreted as a global marine signal by Bekker et al., 2003a) have been reported from elsewhere around the world. Unlike the smooth $\delta^{13}\text{C}_{\text{carb}}$ trend generally depicted, the overall positive excursion is now argued to have two or three positive shifts separated by returns to 0‰ (Melezhik et al., 1999b, Fig. 4) that, unlike many younger isotopic events, do not go significantly below 0‰. Furthermore, there is no geological evidence for enhanced C_{org} accumulation prior to or synchronous with the excursion (although we cannot exclude preservational biases). Instead, it is the termination of the excursions that is followed by formation of a vast reservoir of variably ^{13}C -depleted organic material (–45‰ to –17‰ in the Onega Basin; see below) at a time when associated sedimentary carbonates are isotopically normal (Karhu, 1993; Melezhik et al., 1999a). Thus, determining the global timing of and regional influences on this event and identifying the mechanism(s) responsible for one of the most profound carbon isotopic excursions in earth history still represent major challenges for future research.

C_{org} -Rich Rocks and Earliest Significant Oil Deposits—The Shunga Event

Although Archean oil occurs elsewhere (e.g., Rasmussen, 2005), the most remarkable accumulation of organic matter and inferred generation of petroleum in the Paleoproterozoic

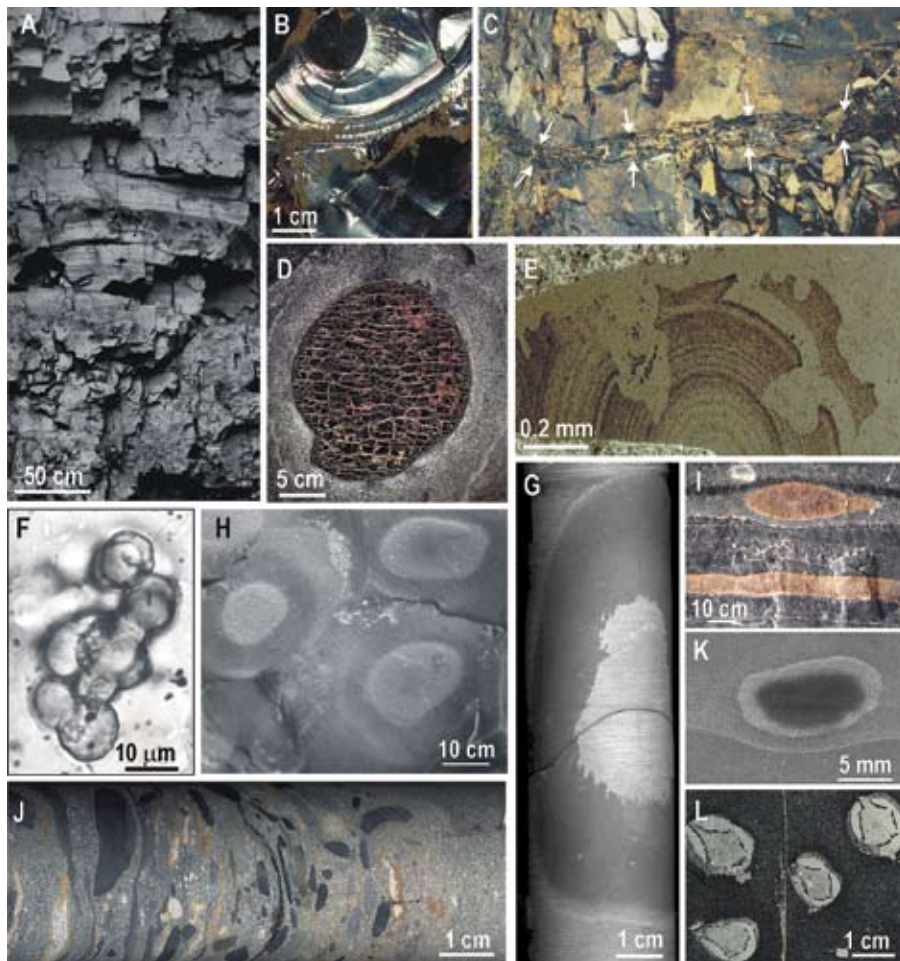


Figure 5. Rocks recording environmental events through 2060–1960 Ma. Petrified oil deposits of the Ludikovi Group from the Onega Basin: (A) semi-lustrous shungite (originally oil shale; 45%–75% C); (B) lustrous layered shungite (originally interbedded-trapped oil; 98.4% C_{org}); (C) pyrobitumen-filled vein (petrified oil) in C_{org} -rich siltstone; (D) pyrobitumen clasts in lacustrine turbiditic graywacke; (E) organosiliceous rock with micron-scale concentric structure (reflected light). Microfossil from the Ludikovi Group in the Pechenga Greenstone Belt: (F) coccoidal microfossil from nonstromatolitic chert interbedded with pillow basalts. Diagenetic concretions and phosphorites of the Ludikovi Group from the Pechenga Greenstone Belt and the Onega Basin: (G) zoned, low- $\delta^{13}C$ calcitic diagenetic concretion in marine “black schist”; (H) calcite concretions in turbiditic graywacke; (I) sideritic diagenetic concretion in lacustrine turbiditic graywacke; (J) phosphorite clasts (black) in graywacke; (K) phosphorus-rich nodules in graywacke; (L) zoned sulphide concretions in “black schist.”

took place in the aftermath of the ca. 2330–2060 Ma Lomagundi-Jatuli Event (Melezhik et al., 1999a, 2004). 2000 Ma deposits rich in matured organic matter have been found in North America, Greenland, West Africa, and NW Russia (reviewed in Melezhik et al., 1999a) and represent the worldwide Shunga Event. In the Onega Basin, organic matter in unusually high C_{org} concentrations (up to 98%; average ~25%) occurs in a 1000-m-thick sedimentary-volcanic succession covering 9000 km². It is termed *shungite*, a black, noncrystalline, dense, glassy mineraloid with high semi-metallic luster and up to >98 wt% C (with traces

of N, O, S, and H). It accumulated in a non-euxinic, brackish lagoonal setting of a volcanically active continental rift (Melezhik et al., 1999a).

Shungite occurs either in situ and stratified, as migrated organosiliceous diapirs, or as redeposited clasts (Fig. 5A–5E; Melezhik et al., 2004). In situ shungite is metamorphosed oil shale ($C < 50\%$) containing autochthonous kerogen residue and allochthonous organic matter ($C = 50\%–75\%$) and bitumen (originally liquid hydrocarbons, $C > 80\%$). The type locality at Shunga (the most significant volume of trapped petroleum in the Onega

Basin) displays good examples of vertical and lateral migration of oil-defining cupola and diapiric bodies. These are organosiliceous rocks (35%–75% SiO_2 and 20%–55% C), considered to be originally gels or mud, with enigmatic concentric microstructures, abundant shrinkage cracks and cryptic fluidal textures, and brecciation caused by multiple fluidization processes. Lastly, clasts of lustrous shungite (<0.1–20 cm) eroded from subaerial oil spills occur in lacustrine volcanoclastic turbidites. In all occurrences, the organic matter suffered complex catagenetic and metamorphic alteration as evident by (Melezhik et al., 1999a): (1) four-modal distribution of C_{org} content (maxima at 5%, 30%, 65%, and 95%); (2) highly variable (–45 to –17‰) and bimodal distribution of $\delta^{13}C_{org}$ (maxima at –28 and –39‰); and (3) low H/C ratios (0.005–0.2). Abundant diagenetic carbonates associated with shungite rocks (Fig. 5H and 5I; $\delta^{13}C_{carb} = -5$ to –26‰) and the presence of diagenetic pyrite ($\delta^{34}S = -22$ to +31‰; Shatzky, 1990) reflect loss of organic matter via bacterial reduction of sulfate during diagenesis.

The integrated data suggest that the organic matter was most likely derived from planktonic microorganisms (it is noteworthy that peculiar microfossils [Fig. 5F] in non-stromatolitic cherts associated with extensive pillow lavas have been reported; Ivanova et al., 1988), but the cause of such unprecedented worldwide accumulation of organic matter at 2000 Ma remains unknown. If the fundamental features of the biologic carbon cycle were established by 3500 Ma (Schidlowski et al., 1975; Hayes et al., 1983; Grassineau et al., 2002), why did it take until 2000 Ma for the oldest known significant accumulation of organic carbon-rich sediments and petroleum deposits? Does this reflect an episode of enhanced biological productivity in a nutrient-enriched ocean that elsewhere supported widespread euxinia? Or was productivity more modest but preservation enhanced?

Fundamental Changes in the Early Diagenesis of Organic Matter

Compilation of global data shows that, with the exception of banded iron formations, $\delta^{13}C$ values of both primary and diagenetic carbonates of

pre-Paleoproterozoic rocks cluster near $0 \pm 3\text{‰}$ (Melezhik et al., 1999b). The end of the Lomagundi-Jatuli Event is marked by the first known appearance, and then worldwide development, of diagenetic carbonate concretions with negative $\delta^{13}\text{C}_{\text{carb}}$ values (Melezhik, 1992; Melezhik et al., 1999b). These are varied (Figs. 5G–5J) and abundant in the 2000 Ma sedimentary successions and are associated with other diagenetic products, such as phosphate nodules (Fig. 5K), all of which are seemingly absent from older rocks. Thus, this first appearance of isotopically light diagenetic carbonate concretions is an important hallmark in biospheric evolution linked to the emergence of “modern-style” recycling of organic matter. Perhaps prior to 2000 Ma fermentative methanogenesis rather than oxidation dominated early diagenetic organic matter remineralization (because of lack of O_2 and SO_4^{2-}). Escape of low $\delta^{13}\text{C}$ methane from the porewaters would have prevented the development of isotopically light porewaters. This hypothesis represents another subject for future research.

Sulfur isotope data ($\delta^{34}\text{S}$) display a narrow range around mantle values, 0‰ (e.g., Strauss, 2002). Bacterial sulfur metabolism has an early origin (ca. 3.47 Ga; Shen and Buick, 2004) and, although multiple lines of evidence of biogenicity are lacking, microbial sulfate reduction under either higher temperature and/or extremely low oceanic sulfate concentration leading to minimal isotopic fractionation has been suggested (e.g., Ohmoto and Felder, 1987; Ohmoto et al., 1993; Habicht et al., 2002). Recent data on mass-independently fractionated sulfur isotopes (Farquhar et al., 2000) suggest that photochemical dissociation of sulfur dioxide in an “oxygen-free” (O_2 partial pressure $<10^{-5}$) atmosphere might have dominated the global Archean sulfur cycle and enabled transfer of both oxidized and reduced sulfur compounds with distinct mass-independent isotope signatures to surface environments.

In contrast, sediments deposited during the early Paleoproterozoic contain sedimentary pyrite displaying a substantially larger isotopic fractionation ($\delta^{34}\text{S}_{\text{sulfate-sulfide}}$). The 2000 Ma successions differ markedly from older rocks by having a high abundance of various diagenetic generations of iron sulfides (Fig. 5L) with $\delta^{34}\text{S}$ values ranging between -22‰ and $+31\text{‰}$ (Melezhik et al., 1998; Shatzky, 1990). Even more negative values, as low as -30‰ , have been reported from the 2320 Ma Timeball Hill Formation, South Africa (Cameron, 1982; Bekker et al., 2004). Based on present understanding (e.g., Canfield, 2001), such values represent evidence for bacterial sulfate reduction and, given the absence of evidence for mass-independent sulfur isotopic fractionation in rocks younger than 2320 Ma, imply a profound change in the operational mode of the global sulfur cycle and concomitant increase in atmospheric oxygen concentration (Pavlov and Kasting, 2002). Subsequently, a rise in oceanic sulfate concentration enhanced the importance of bacterial sulfate reduction as a principal process of organic carbon and sulfur cycling in sedimentary environments. Hence, the global sulfur cycle changed into a mode quite similar to the modern world in which oxidative weathering, riverine delivery of sulfate to the ocean, and biological sulfur cycling dominate over volcanic/hydrothermal S cycling. However, a smaller than present-day isotopic fractionation associated with bacterial sulfate reduction and subsequent pyrite formation may be consistent with

an ocean low in sulfate through 2000 Ma, and probably until the Precambrian-Cambrian transition (e.g., Lyons et al., 2004). The driving forces of these changes remain to be established.

The oldest known phosphorites and phosphate concretions (Fig. 5J and 5K) are commonly associated with sulfides and organic matter in the 2000 Ma successions and reflect a critical change in the Precambrian phosphorous cycle. Although different processes have been proposed for concentrating dissolved phosphate in bottom sediments to levels required for authigenic precipitation, the most common pathway includes organic matter that carries phosphate concentrated by biological activity (Knudsen and Gunter, 2002). The association of phosphate concretions with organic matter in the C_{org} -rich 2000 Ma sedimentary rocks is consistent with such a mechanism. However, high abundance of organic matter is probably not the only factor controlling formation of Paleoproterozoic phosphate concretions. C_{org} -rich layers have also been found in sedimentary sequences older than 2000 Ma (Hayes et al., 1983), but no phosphate concretions have been reported. Thus, it is possible that 2000 Ma sediments record a major change in the diagenetic mineralization of organic matter, perhaps reflecting a substantial increase in the intensity of early-diagenetic sulfate reduction promoted by an overlying, sulfate-enriched ocean (Canfield and Raiswell, 1999) that in turn elevated the concentration of interstitial phosphate. However, determining the factors that controlled the formation of the oldest known phosphate concretions remains an unresolved problem.

QUESTIONS FOR FUTURE RESEARCH

The Archean-Paleoproterozoic transition was a major step in the eventual establishment of the modern earth system. A relative chronology of the transition has been determined, but fundamental questions remain unanswered. (1) Why did global glaciations only occur after the Archean? (Evidence for glaciation at 2900 Ma is restricted to South Africa; Young et al., 1998.) (2) Why did an oxygen-rich atmosphere only appear in the Proterozoic (around 2400 Ma)? Oxygen-rich habitats existed since at least 2700 Ma. (3) What drove the Lomagundi-Jatuli Event, the oldest known positive global carbon isotope excursion? (4) What caused radical change in biogeochemical recycling of organic matter at ca. 2060 Ma? (5) Why didn't large accumulations of organic matter similar to the Shunga Event occur in the Archean? (6) How, out of this suite of biogeochemical global-scale perturbations, did the modern earth system emerge? The recently launched International Geological Correlation Programme Project 509 “Palaeoproterozoic Supercontinents and Global Evolution” will be a focus for internationally coordinated research on this most interesting time period in earth history.

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• Special Publication 248

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• Memoir 30

The Neoproterozoic Timanide Orogen of Eastern Baltica

Edited by D. Gee and V. Pease

The Neoproterozoic Timanide Orogen of eastern Baltica extends from the high Arctic to the southern Ural Mountains and represents significant crustal growth of the northeastern European continental margin in the late Neoproterozoic. This volume, a co-operation between Western European and Russian scientists within the framework of the European Science Foundation's EUROPROBE programme, provides a comprehensive overview of the orogen and represents a new synthesis of Timanian Orogeny. It includes: the pre-Timanian passive margin deposits of the northern and northeastern flank of the East European Craton; the magmatic, metamorphic and structural evolution of the orogen across the Timan Mountain and Pechora Basin regions to the Ural Mountains; the post-Timanian platform successions, important for interpreting the timing of orogeny and the return to an early Palaeozoic passive margin setting; and the extension of the orogen northwards to Novaya Zemlya.



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JOINT MEETING

102nd Annual Meeting of the Cordilleran Section, GSA; 81st Annual Meeting of the Pacific Section, AAPG; and the Western Regional Meeting of the Alaska Section, SPE
Anchorage Hilton Hotel, Anchorage, Alaska

8–10 May 2006

THEME: NORTH TO ALASKA: GEOSCIENCE, TECHNOLOGY AND NATURAL RESOURCES

The 2006 annual meetings of the Cordilleran Section, GSA; the Pacific Section, American Association of Petroleum Geologists; and the Alaska Section, Society of Petroleum Engineers, will be held jointly at the Hilton Hotel in Anchorage, Alaska. Information about the meeting can be found at <http://anchorage2006.com>.

ENVIRONMENT

The city of Anchorage is located in a natural setting of unparalleled beauty, nestled between the wilderness of the Chugach Mountains and the two arms of upper Cook Inlet. Five mountain ranges and a number of active volcanoes can be seen from the city. The second highest bore tides in North America, numerous glaciers, and land submerged by the largest earthquake in North America are within easy driving distance. Temperatures are mild in early May (50°–60° F), with long hours of daylight.

Anchorage is served by several major airlines through Ted Stevens International Airport, ~5 miles from downtown. The meeting site is the Anchorage Hilton Hotel in the heart of downtown Anchorage. The Hilton is located three blocks from the Alaska Railroad station and several citywide bus routes. It is within easy walking distance of numerous restaurants and clubs, downtown shops, museums, bookstores, and Cook Inlet.

Please make plans to join us and your fellow geoscientists, engineers, and other professionals in a truly amazing state that boasts the nation's largest national parks, largest oil fields, and glaciers the size of other states!

CALL FOR PAPERS

Papers are invited for a variety of technical sessions (oral and poster), including one symposium and many theme sessions. Authors interested in volunteering papers for the symposium should contact the appropriate convener prior to submitting an abstract. Oral presentations in most technical sessions will be 15–20 minutes in length, including three to five minutes for questions. SPE sessions will have 30-minute presentations. Please contact session chairs for format details. All oral sessions will utilize a single digital projector and PowerPoint software. An overhead projector can be made

available in each room. Use of 35 mm slides is discouraged and will only be accommodated by special arrangement with the technical program chair at an additional cost. Requests for slide projectors must be made one month prior to the meeting. Dimensions for poster space can be found at <http://anchorage2006.com>; authors will be required to be present at their poster for at least two hours.

ABSTRACTS

Abstract Deadline: 7 February 2006

Abstracts for all sessions should be submitted online via a link from the meeting Web site <http://anchorage2006.com>. If you cannot submit your abstract electronically, contact Nancy Carlson, +1-303-357-1061. Only one volunteered paper may be presented by an individual; however, a person may be a co-author on other papers. Those invited to the symposium may present an additional paper.

REGISTRATION

Standard Registration Deadline: 1 April 2006

Registration will be available online at <http://anchorage2006.com> beginning 1 Nov. 2005, with a substantial discount for early registration. On-site registration will be available at the Hilton Hotel during the meeting. Further details will be published in the January 2006 issue of *GSA Today* and at <http://anchorage2006.com> as they become available.

ACCESSIBILITY

GSA, AAPG, and SPE are committed to making their meetings accessible to all people interested in attending. Please indicate special requirements (wheelchair accessibility, etc.) on the registration form. The Hilton Hotel is ADA compliant.

FIELD TRIPS

Details of these and possibly other trips are still being finalized. For updated information on field trips, check <http://anchorage2006.com>, or contact the field trip chair, Tom Plawman, at tplawman@gci.net.

1. **Chugach Accretionary Prism and Resurrection Bay Ophiolite.** Dwight Bradley, U.S. Geological Survey, dbradley@usgs.gov, +1-907-786-7434; Marti Miller, U.S. Geological Survey, mlmiller@usgs.gov, +1-907-786-7437.
2. **Late Mesozoic and Cenozoic Forearc Basins of the Matanuska Valley.** Jeff Trop, Bucknell University, jtrop@bucknell.edu, +1-570-577-3089; Tom Plawman, tplawman@gci.net, +1-907-272-1232.
3. **Prince William Sound Tidewater Glacier Tour.** Tom Plawman, tplawman@gci.net, +1-907-272-1232.
4. **Denali National Park: Mesozoic Marine and Cenozoic Nonmarine Basins, Tertiary Volcanics, and the Modern Denali Fault.** Phil Brease, National Park Service, Phil_Brease@nps.gov, +1-907-683-9551.
5. **Kuparuk River Oil Field Tour (tentative).** Gregory Wilson, gregory.c.wilson@conocophillips.com, +1-907-263-4748. Sat., 6 May. Attendance for this no-cost trip to the North Slope will be by lottery.
6. **Dust Storms, Loess Deposition, Volcanic Eruptions, and Soil Formation in the Matanuska Valley**

(tentative). Daniel R. Muhs, U.S. Geological Survey, dmuhs@usgs.gov, +1-303-236-7919.

7. **Anchorage 1964 Earthquake Tour.** Late afternoon–evening during the meeting. Tom Plawman, tplawman@gci.net, +1-907-272-1232.

TECHNICAL SESSIONS

In addition to general technical sessions, the program will include a symposium and a variety of theme sessions. Detailed descriptions of the symposium and theme sessions can be found at <http://anchorage2006.com>.

Symposium

1. **The Brooks Range Orogen: A Symposium in Honor of Gil Mull.** Tom Moore, U.S. Geological Survey, tmoore@usgs.gov, +1-650-329-5713; Marwan Wartes, Alaska Division of Geological and Geophysical Surveys, marwan_wartes@dnr.state.ak.us, +1-907-451-5056.

Theme Sessions

Joint: *Cordilleran Section, GSA, and Pacific Section, AAPG*

1. **Foreland Basin Systems: Archives of Coupled Structural and Sedimentary Processes.** Marwan Wartes, Alaska Division of Geological and Geophysical Surveys, marwan_wartes@dnr.state.ak.us, +1-907-451-5056.
2. **Forearc Basins: Tectonostratigraphy and Resource Potential.** Bob Swenson, Alaska Division of Oil and Gas, robert_swenson@dnr.state.ak.us, +1-907-269-8789.
3. **Geology of the Circum-Arctic.** Tom Homza, Shell E&P Co., thomas.homza@shell.com, +1-907-770-3701; Jim Clough, Alaska Division of Geological and Geophysical Surveys, jim_clough@dnr.state.ak.us, +1-907-451-5030.
4. **Active Tectonics of the Northern Cordillera.** Peter Haeussler, U.S. Geological Survey, pheuslr@usgs.gov, +1-907-786-7447. Coordinates with Chapman conference on Southern Alaska active tectonics to follow this meeting.
5. **Late Paleozoic–Early Mesozoic Paleogeography of Northern Alaska.** Julie Dumoulin, U.S. Geological Survey, dumoulin@usgs.gov, +1-907-786-7439; Mike Whalen, University of Alaska–Fairbanks, mtwhalen@gi.alaska.edu, +1-907-474-5302.

Cordilleran Section, GSA

6. **New Insights into the Origin and Evolution of the Northern Cordilleran Pericratonic Terranes.** Cynthia Dusel-Bacon, U.S. Geological Survey, cdusel@usgs.gov, +1-650-329-5719; JoAnne Nelson, British Columbia Geological Survey, joanne.nelson@gems1.gov.bc.ca, +1-250-952-0438.
7. **Wrangellia—Tectonics and Metallogeny, 30 Years of Progress.** Jeanine Schmidt, U.S. Geological Survey, jschmidt@usgs.gov, +1-907-786-7494; Murray Hitzman, Colorado School of Mines, mhitzman@mines.edu, +1-303-384-2127; Jason Price, Colorado School of Mines.
8. **Accreted Terranes of Western North America: An Update on Current Research on the Construction of the Cordillera.** Robert B. Blodgett, U.S. Geological Survey, rblodgett@usgs.gov, +1-907-786-7416; Erik C. Katvala, University of Calgary, eckatval@ucalgary.ca.

9. **Environmental Issues Associated with Mineralized Regions.** LeeAnn Munk, University of Alaska–Anchorage, aflm@uaa.alaska.edu, +1-907-786-6895; Bronwen Wang, U.S. Geological Survey, bwang@usgs.gov, +1-907-786-7110.
10. **High Latitude–Altitude Hydrogeology and Weathering.** Bronwen Wang, U.S. Geological Survey, bwang@usgs.gov, +1-907-786-7110.
11. **Tectonic Setting of Mineral Occurrences in the Northern American Cordillera.** Bill McClelland, University of Idaho, mcclell@uidaho.edu, +1-208-885-4704; Richard Goldfarb, U.S. Geological Survey, goldfarb@usgs.gov, +1-303-236-2441.
12. **Geoscience Education and Public Outreach in Alaska—Unique Problems, Unique Solutions.** Catherine L. Hanks, University of Alaska–Fairbanks, chanks@gi.alaska.edu, +1-907-474-5562.
13. **Volcano Hazards and Monitoring.** Steve McNutt, University of Alaska–Alaska Volcano Observatory, steve@giseis.alaska.edu, +1-907-474-7131; Chris Nye, Alaska Division of Geological and Geophysical Surveys–Alaska Volcano Observatory, cnye@kiska.giseis.alaska.edu, +1-907-474-7430.
14. **GSA Undergraduate Research Posters.** Jeff Marshall, Cal Poly–Pomona University, marshall@csu.pomona.edu, +1-909-869-3461.

Joint: *Pacific Section, AAPG, and Alaska Section, SPE*

15. **Arctic Gas Resources.** Dave Housenecht, U.S. Geological Survey, dhouse@usgs.gov, +1-703-648-6466.
16. **Viscous Oil: Reservoir Characterization and New Technologies.** Sandy Phillips, BP Alaska, phillis2@bp.com, +1-907-564-4587.
17. **New Development and Field Case Histories.** Sandy Phillips, BP Alaska, phillis2@bp.com, +1-907-564-4587.

Pacific Section, AAPG

18. **Petroleum Geology of Northern Alaska.** Ken Bird, U.S. Geological Survey, kbird@usgs.gov, +1-650-329-4907.
19. **Rural Energy in Alaska.** Travis Hudson, ageology@olypen.com, +1-360-582-1844.
20. **Brookian Reservoirs of the North Slope.** Ken Helmold, Alaska Division of Geological and Geophysical Surveys, kph@dnr.state.ak.us, +1-907-269-8673; Bill Morris, ConocoPhillips, william.r.morris@conocophillips.com, +1-281-293-4463.
21. **Reservoir Characterization: Recent Advances in Appraisal and Development.** Steve Jones, BP Alaska, steve.jones@bp.com, +1-907-564-5831.

Alaska Section, SPE

For all of these sessions, contact Gordon Posposil, BP, pospisp@bp.com, +1-907-564-5769:
Rotary and Coiled Tubing Drilling Applications
Well Integrity Management
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Improved Oil Recovery and Reservoir Management
Production Optimization and Artificial Lift
GEMS Sessions (Short Topics)
Student Papers

STUDENT ACTIVITIES

Roy J. Shlemon Mentor Program in Applied

Geoscience. Sponsored by *GSA Foundation*. Mon.–Tues., 8–9 May, 11:30 a.m.–1 p.m. Lunch provided. Luncheon location will be available at the meeting registration desk. Karlon Blythe, kblythe@geosociety.org. This is a chance for students to discuss career opportunities and challenges with professional geoscientists from multiple disciplines. Plan to attend both free luncheons to hear different presenters. Students will receive FREE LUNCH tickets in their registration packet to attend the Shlemon Programs. However, space is limited: first come, first served.

The John Mann Mentors in Applied Hydrogeology

Program. Sponsored by *GSA Foundation*. Tues., 9 May, 5–6:30 p.m. Location available at the meeting registration desk. Karlon Blythe, kblythe@geosociety.org. This event starts right after tech sessions end. It presents opportunities for students and recent graduates with interest in applied hydrogeology or hydrology as a career to chat over a meal with professionals practicing in these fields of interest. Students will receive a FREE Pizza Supper ticket in their registration packet to attend the Mann Program. However, space is limited: first come, first served.

SHORT COURSES

Alaska's Volcanoes, Earthquakes, and Subduction Zone—Real-Time Earthly Data for Classroom Use.

Sponsored by *NAGT*. Jennifer Adleman, U.S. Geological Survey—Alaska Volcano Observatory, jadleman@usgs.gov, +1-907-786-7019, 4200 University Drive, Anchorage, AK 99508, USA; Cathy Connor, University of Alaska—Southeast, cathy.connor@uas.alaska.edu, +1-907-465-6293.

Application of Ichnology to Petroleum Exploration and Production.

Sponsored by *Pacific Section, AAPG*. Core Workshop. Leader: James MacEachern, Simon Fraser University, +1-604-291-5388, jmaceach@sfu.ca.

SPECIAL EVENTS

Icebreaker Reception. Sun., 7 May, 5–7 p.m., Hilton Hotel.

Welcoming Reception and Opening Remarks. Mon., 8 May, 5–7 p.m., Hilton Hotel.

Alaska Section SPE/Pacific Section AAPG Awards Luncheon. Tues., 9 May, 11:30 a.m.–1 p.m., Hilton Hotel.

AAPG Division of Professional Affairs. Wed., 10 May, 11:30 a.m.–1 p.m., Foraker Room.

Annual Business Meeting. Cordilleran Section, GSA. TBA.

Annual Business Meeting. Pacific Section, AAPG. TBA.

Regional Section Officers' Meeting. Western Region, SPE. TBA.

SPOUSE AND GUEST ACTIVITIES

The municipality of Anchorage is located as far north as Helsinki, Finland, as far west as Honolulu, Hawaii, and covers an area nearly the size of the state of Delaware. It is the hub of south-central Alaska, which offers a wide variety of recreational opportunities from fishing, cruising, and bird watching to rock climbing, rafting, hiking, and sight-seeing.

Cultural attractions include the Alaska Museum of History and Art, Alaska Native Heritage Center, Z.J. Loussac Library,

Alaska Museum of Natural History, the Imaginarium science center, and the Alaska Aviation Heritage Museum. Most attractions are accessible by regularly scheduled bus routes as well as taxi. Anchorage has over 650 miles of hiking, biking, and multi-use trails, many of which wind along the city's greenbelts and creeks.

The Alaska Railroad provides access to Prince William Sound at Seward and Whittier on the Kenai Peninsula, as well as to Denali National Park (home of Mt. McKinley, the highest point in North America), Talkeetna, Fairbanks, and other northern destinations.

For information on visitor attractions, sports, events, and tours, please visit the Web sites for the Anchorage Convention and Visitor's Bureau, www.anchorage.net/2.cfm, and the Municipality of Anchorage, www.ci.anchorage.ak.us/homepage/index.cfm.

STUDENT TRAVEL

The Cordilleran Section of GSA 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 members of the relevant section to apply for support. For more information, contact the Cordilleran Section secretary, Joan Fryxell, +1-909-880-5311.

The Anchorage Hilton is offering student rates for the meeting. See <http://anchorage2006.com> for more details.

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 they should clearly identify their abstracts as student work. For further information, contact Dwight Bradley, +1-907-786-7434, dbradley@usgs.gov.

EXHIBITS

Exhibit booths will be available for commercial and non-profit organizations. For more information or to reserve a booth, contact Tom Walsh, +1-907-272-1232, tpwalsh@alaska.net.

ACCOMMODATIONS

Rooms have been reserved at the Anchorage Hilton Hotel, the meeting headquarters. Special meeting rates are available for professionals as well as students. More information and a link to make hotel reservations are available at the meeting Web site, <http://anchorage2006.com>.

ADDITIONAL INFORMATION

To obtain the most complete and up-to-date information, visit <http://anchorage2006.com>. If you have questions or need further clarification, contact any of the convention co-chairs:

GSA Cordilleran Section: Jeanine Schmidt, +1-907-786-7494, jschmidt@usgs.gov.

Pacific Section, AAPG: Greg Wilson, +1-907-263-4748, gregory.c.wilson@conocophillips.com.

Alaska Section, SPE: Bill Van Dyke +1-907-269-8786, bill_van_dyke@dnr.state.ak.us.

ROCKY MOUNTAIN

58th Annual Meeting
Rocky Mountain Section, GSA
Western State College of Colorado, Gunnison,
Colorado

17–19 May 2006

The 58th Annual Meeting of the Rocky Mountain Section will be hosted by the Geology Program of the Department of Natural and Environmental Sciences, Western State College of Colorado. The meeting will take place on the Western State College campus in Gunnison, Colorado.

ENVIRONMENT

Western State College of Colorado is a small liberal arts college in Gunnison (population 6,000), on the west side of the divide in southwest Colorado. Gunnison lies 200 miles southwest of Denver in a pristine Rocky Mountain valley at an elevation of 7,700 feet with significant year-round outdoor recreational opportunities. Although surrounded by high mountains up to 14,000 feet in elevation, the town is located in a semiarid basin and is typically cool and sunny in May. The resort town of Crested Butte is located 30 miles to the north. Gunnison lies on the eastern margin of the Paleozoic Ancestral Uncompahgre highland and the western tectonic margin of the Laramide Rocky Mountains. Local features of geological interest include the Slumgullion earthflow, San Juan volcanic field, and the Powderhorn carbonatite complex to the south; West Elk volcano and Black Canyon of the Gunnison National Park to the west; and the Laramide Elk Mountain thrust zone to the northeast. Less than one mile south of town is an extensive Folsom archaeological site. Within a two-hour drive are the northern reaches of the Rio Grande rift and Great Sand Dunes National Park.

CALL FOR PAPERS

Papers are invited for theme and general sessions. 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 cannot use their own laptops.

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

ABSTRACTS

Abstracts Deadline: 21 February 2006

Abstracts for all sessions should be submitted online at www.geosociety.org. An abstract submission fee of \$10 will be charged. If you cannot submit your abstract electroni-

cally, contact Nancy Carlson, +1-303-357-1061, ncarlson@geosociety.org.

REGISTRATION

Standard Registration Deadline: 17 April 2006

Cancellation Deadline: 24 April 2006

GSA Headquarters will handle meeting registration (see the February 2006 issue of *GSA Today* for details). Registration will be available online at www.geosociety.org beginning February 2006. On-site registration will be available at Western 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. Western State College of Colorado is ADA compliant.

FIELD TRIPS

Premeeting

1. **Eruptive and Non-Eruptive Calderas, Northeastern San Juan Mountains (Where Did the Ignimbrites Come from?).** (2 days) Mon.–Tues., 15–16 May. Peter W. Lipman, U.S. Geological Survey, plipman@usgs.gov.
2. **Depositional Environments of the Cretaceous Dakota Sandstone, Gunnison Basin.** (1 day) Tues., 16 May. Bruce Bartleson, Western State College of Colorado, +1-970-943-2138, bbartleson@western.edu.

Concurrent

3. **Multiple Folsom Sites in an Intermontane Setting, Tenderfoot Mountain, Gunnison, Colorado.** Mark Stiger, Western State College of Colorado, +1-970-943-2073, mstiger@western.edu; Erik Bjornstad, Western State College of Colorado, +1-970-943-2543, ebjornstad@western.edu.

Postmeeting

4. **Glacial History of the Taylor River Basin, Gunnison County, Colorado.** (1 day) Sun., 20 May. Keith Brugger, University of Minnesota–Morris, +1.320-589-6310, bruggeka@morris.unm.edu; Barry S. Goldstein, University of Puget Sound, +1-253-879-3822, goldstein@ups.edu.

THEME SESSIONS

1. **Structural, Stratigraphic, and Igneous Evolution of the Rio Grande Rift System.** Scott Baldrige, Los Alamos National Laboratory, +1-505-667-4338, sbaldrige@lanl.gov; John Fletcher, Western State College of Colorado, +1-970-943-2367, jfletcher@western.edu.
2. **Tertiary Laramide Evolution of Rocky Mountains.** Jim Coogan, Western State College of Colorado, +1-970-943-3425, jcoogan@western.edu.
3. **Evolution of Pennsylvanian-Permian Ancestral Rocky Mountains—Structure, Stratigraphy, and Tectonics.** Bruce Bartleson, Western State College of Colorado, +1-970-943-2138, bbartleson@western.edu.
4. **Council on Undergraduate Research—Undergraduate Research Poster Session.**

Bill Dinklage, Utah Valley State College, +1-801-863-7607, dinklawi@uvsc.edu.

5. **Geoarchaeology of the Southern Rocky Mountain Region.** Mark Stiger, Western State College of Colorado, +1-970-943-2073, mstiger@western.edu; Casey Dukeman, Western State College of Colorado, +1-970-943-2180, cdukeman@western.edu.
6. **Volcanism of the Southern Rocky Mountain Region.** Allen Stork, Western State College of Colorado, +1-970-943-3044, astork@western.edu.

STUDENT ACTIVITIES

Roy J. Shlemon Mentor Program in Applied

Geoscience. Sponsored by *GSA Foundation*. Wed.–Thurs., 17–18 May, 11:30 a.m.–1 p.m. The location will be available at GSA's on-site registration desk. Karlon Blythe, kblythe@geosociety.org. This is a chance for students to discuss career opportunities and challenges with professional geoscientists from multiple disciplines. Plan to attend both free luncheons to hear different presenters each day. Students will receive FREE LUNCH tickets in their registration packet 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*. Wed., 17 May, 5–6:30 p.m. The location will be available at GSA's on-site registration desk. Karlon Blythe, kblythe@geosociety.org. This event starts right after tech sessions end. It presents opportunities for students and recent graduates with interest in applied hydrogeology or hydrology as a career to chat over a meal with professionals practicing in these fields of interest. Students will receive a FREE pizza supper ticket in their registration packet to attend the Mann Program. However, space is limited: first come, first served.

SPECIAL EVENTS

Ice Breaker. Tues., 16 May, 5 p.m., Aspinnall-Wilson Center, Western State College of Colorado Foundation.

Annual Banquet and Business Meeting. TBA.

Rocky Mountain Section Board Meeting. TBA.

STUDENT TRAVEL

The Rocky Mountain Section of GSA 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 GSA Rocky Mountain Section members. Students should contact Kenneth Kolm at +1-303-231-9115, 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 will be available at \$250 per booth for commercial organizations and \$100 per booth for nonprofits. Contact Robert Fillmore at +1-970-943-2650 or rfillmore@western.edu.

ACCOMMODATIONS

A wide selection of hotels and motels is available in Gunnison within walking distance of the Western State campus. Special GSA rates will appear in the February 2006 issue of *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 Robert Fillmore, +1-970-943-2650, rfillmore@western.edu; Vice Chair and Technical Sessions Chair Allen Stork, +1-970-943-3044, astork@western.edu; or Field Trip Chair Jim Coogan, +1-970-943-3425, jcoogan@western.edu.

Abstracts submission through
13 Dec. 2005
Standard registration through
20 Nov. 2005


BACKBONE OF THE AMERICAS

PATAGONIA TO ALASKA


3-7 April 2006 • Mendoza, Argentina

Backbone of the Americas—Patagonia to Alaska is a GSA specialty meeting co-convened with the Asociación Geológica Argentina. The principal themes are ridge collision, shallow subduction, and plateau uplift along the Americas. Field trips are planned to Patagonia, the Chilean flat-slab, or Central Andean Puna plateau before and after the meeting. Suzanne Kay and Victor Ramos are meeting co-chairs.

Co-convened by:



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See www.geosociety.org/meetings/06boa/ to submit abstracts, register, and to sign up for e-news.

Call for Geological Papers

2006 GSA Section Meetings

SOUTH-CENTRAL SECTION

6–7 March 2006

University of Oklahoma, Norman, Oklahoma

Abstract Deadline: 6 December 2005

Information: Neil Suneson, Oklahoma Geological Survey,
University of Oklahoma, 100 E Boyd St., Rm N131,
Norman, OK 73019-0628, +1-405-325-3031, nsuneson@ou.edu

NORTHEASTERN SECTION

20–22 March 2006

Radisson Penn Harris Hotel and Convention Center
Camp Hill/Harrisburg, Pennsylvania

Abstract Deadline: 13 December 2005

Information: Noel Potter, Dickinson College, Dept. of
Geology, Carlisle, PA 17013-2896, +1-717-245-1340,
pottern@dickinson.edu

SOUTHEASTERN SECTION

23–24 March 2006

Marriott Hotel, Knoxville, Tennessee

Abstract Deadline: 5 January 2006

Information: Claudia Mora, University of Tennessee, Dept. of
Earth and Planetary Sciences, 1412 Circle Drive,
Knoxville, TN 37996-1410, +1-865-974-5499, cmora@utk.edu

NORTH-CENTRAL SECTION

20–21 April 2006

Student Center, University of Akron, Akron, Ohio

Abstract Deadline: 25 January 2006

Information: John Szabo, Dept. of Geology, University
of Akron, Akron, OH 44325-4101, +1-330-972-8039,
jpszabo@uakron.edu

CORDILLERAN SECTION

(Joint Meeting with PSAAPG and SPE-A)

8–10 May 2006

University of Alaska, Anchorage, Alaska

Abstract Deadline: 7 February 2006

Check future issues of *GSA Today* for more information.

ROCKY MOUNTAIN SECTION

17–19 May 2006

Western State College, Gunnison, Colorado

Abstract Deadline: 21 February 2006

Information: Rob Fillmore, Western State College, Dept. of
Natural and Environmental Sciences, Gunnison, CO 81231-
0001, +1-970-943-2092, rfillmore@western.edu

Invitation from GSA's History of Geology Division

Northeastern Section

Meeting, 20–22 March 2006

Abstract Deadline:
13 Dec. 2005

GSA's History of Geology Division invites your participation in a session at the Northeastern Section Meeting 20–22 March 2006 (see your September *GSA Today* for more information) to explore the evolution of our understanding of Appalachian geology via such topics as geomorphology, structural geology and tectonics, stratigraphy, paleontology, petrology, and mapping.

Although the rocks have changed very little in the past two hundred years, there have been major changes in the interpretation of those rocks by geologists involved in Appalachian studies. These changes have come in both the theories applied and in the methods of collecting and analyzing data. An example of a session contribution might be an exploration of the application of successive techniques or ideas to the same question and how this changed the understanding of the problem. Much past work was, and still is, synergistic, in that advances in one area can lead to reinterpretation of data from another discipline. A paper tracing such connections would prove to be useful as well as intriguing.

Notable geologists, some of whom are still working, have contributed to Appalachian studies. We welcome retrospectives of their careers and the ideas they espoused, which may have changed over their working lives. Descriptions of the role of state surveys, as well as the roles played by local politics and funding, are other possibilities.

The History of Geology Division encourages student participation at both undergraduate and graduate levels by way of the history of the ideas they are exploring for a thesis or senior project.

Please join us for our session as we, with your contributions, explore the changing landscape of Appalachian geology over the past two hundred years.

Sally Newcomb

William Brice

GSA History of Geology Division

UPCOMING DEADLINES

Medals and Awards

Nominations Due 1 February 2006

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 GSA Distinguished Service Award. For details on the awards and nomination procedures, see the October 2005 issue of *GSA Today*. For the new online nomination form, go to www.geosociety.org/aboutus/awards/, or call +1-303-357-1028. 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, USA.

GSA Fellows

Nominations Due 1 February 2006

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 letters in addition to the online nomination form are needed. For details on nomination procedures, see the October 2005 issue of *GSA Today*, visit www.geosociety.org/members/fellow.htm, call +1-303-357-1028, or e-mail awards@geosociety.org.

2006 Subaru Outstanding Woman in Science Award (Sponsored by Subaru of America, Inc.)

Nominations Due 1 February 2006

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 details on the award and nomination procedures, see the October 2005 issue of *GSA Today*. For the new online nomination form, go to www.geosociety.org/aboutus/awards/ or call +1-303-357-1028. Send nominations and supporting material to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140, USA.

John C. Fry Environmental Geology Award Nominations Due 31 March 2006

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 2005 issue of *GSA Today*, visit www.geosociety.org, or call +1-303-357-1028. Nominations must be sent to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140, USA.

Student Research Grants 2006

Online submission must be completed by Wednesday, 1 February 2006, at 11:59 p.m. (MST).

The GSA student research grant application process is available **only** online. No paper applications or letters will be accepted. The site will be available for submissions by mid-November.

In an effort to fund more GSA Student Members, students may now only receive GSA graduate student research grant money once at the Master's level and once at the Ph.D. level. This policy affects all GSA research grantees retroactively. Those who have applied for grant funding but who did not receive a grant are welcome to apply again.

For further information on the 2006 Research Grant Program, see the October 2005 issue of *GSA Today*, visit www.geosociety.org/grants/gradgrants.htm, call +1-303-357-1028, or e-mail awards@geosociety.org.

Congressional Science Fellowship Applications Due 1 February 2006

For application information for the 2006–2007 GSA–U.S. Geological Survey Congressional Science Fellowship, visit www.geosociety.org/science/csf/ or contact Ginger Williams, GSA Headquarters, +1-303-357-1040, gwilliams@geosociety.org.

National Awards

Nominations Due 30 April 2006

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 2005 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, USA.

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New at the GSA Bookstore

Net Dextral Slip, Neogene San Gregorio–Hosgri Fault Zone, Coastal California: Geologic Evidence and Tectonic Implications
by William R. Dickinson, Mihai Ducea, Lewis I. Rosenberg, H. Gary Greene, Stephan A. Graham, Joseph C. Clark, Gerald E. Weber, Steven Kidder, W. Gary Ernst, and Earl E. Brabb
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A Typology of Sculpted Forms in Open Bedrock Channels
by Keith Richardson and Paul Anthony Carling
SPE392, 108 p., ISBN 0-8137-2392-2
\$55.00, member price \$44.00

The Mojave-Sonora Megashear Hypothesis: Development, Assessment, and Alternatives
edited by Thomas H. Anderson, Jonathan A. Nourse, James W. McKee, and Maureen B. Steiner
SPE393, 712 p. plus index, CD-ROM, plates, ISBN 0-8137-2393-0
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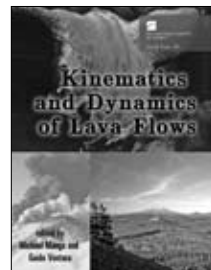
Caribbean–South American Plate Interactions, Venezuela
edited by Hans G. Avé Lallemant and Virginia B. Sisson, 2005
SPE394, 331 p. plus index, plates, ISBN 0-8137-2394-9
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Isotopic and Elemental Tracers of Cenozoic Climate Change
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2006 Birdsall-Dreiss Lecturer

David Blowes of the University of Waterloo has been selected as the 2006 Birdsall-Dreiss Lecturer for 2006. This lecture series is sponsored by the GSA Hydrogeology Division. At the request of interested institutions, he will present one of the two lectures described below.

David Blowes teaches in the Department of Earth Sciences at the University of Waterloo, where he has held the Canada Research Chair in Groundwater Remediation since 2001. He is a member of the Waterloo Institute for Groundwater Research. He received his B.Sc. in earth sciences from the University of Waterloo, then went on to complete M.Sc. and Ph.D. studies specializing in hydrogeology and aqueous geochemistry at the same institution. In 1991, he joined the University of Waterloo faculty, and now holds the rank of professor. He teaches courses on groundwater geochemistry and hydrogeology. His research focuses on the release and transport of dissolved metals from mine wastes, transport of dissolved metals and nutrients in aquifers, and remediation of groundwater contaminated by dissolved metals and nutrients. He has published over 100 professional papers and presented more than 100 professional talks, and has co-edited three volumes on the environmental effects of sulfide mineral oxidation in mine wastes. He has participated in review panels for the Natural Sciences and Engineering Research Council of Canada and for government agencies in Canada, the United States, Australia, and Europe. He has also acted as a consultant for private companies and government agencies.

To request a visit to your institution, contact David Blowes, Department of Earth Sciences, University of Waterloo, 200 University Avenue West, Waterloo, Ontario N2L 3G1, Canada, +1-519-888-4878, blowes@uwaterloo.ca. The Hydrogeology Division is particularly interested in including liberal arts colleges in the itinerary. The Division will pay transportation expenses; the host institution will provide local accommodations.

LECTURE TOPICS

Permeable Reactive Barriers for Treating Groundwater Contaminated by Dissolved Metals

In situ techniques for treating contaminated groundwater have evolved rapidly over the past decade. Permeable reactive barriers were among the first of these new approaches and now are applied widely. Permeable reactive barriers are installed by excavating a portion of the contaminated aquifer and replacing the aquifer materials with a reactive material tailored to treat the target contaminants. More than 150 reactive barriers have been installed since the initial installations in the mid-1990s. These barriers treat a variety of contaminants, including dissolved metals, nutrients, mine drainage, halogenated hydrocarbons, and petroleum derivatives. Reactive barriers designed to treat dissolved metals rely on removing the metal from the water and retaining it in the reactive mixture through precipitation or adsorption reactions. Most frequently, metal retention is achieved by changing the oxidation state of

the metal and precipitating a secondary mineral that is sparingly soluble under the conditions that prevail in the barrier.

During this presentation, I will focus on the development of reactive barrier systems for treating dissolved metals, describing the steps from bench-scale testing to full-scale implementation. The presentation will include the results of laboratory testing, conducted to assess the properties of reactive materials, field installations, long-term monitoring, and the development and application of reactive transport models, used to understand the interaction of physical and chemical processes within reactive barriers and to predict their long-term performance. I will describe our continuing efforts to understand, refine, and extend the limitations of this developing technology.

Predicting, Preventing, and Remediating Acidic Drainage from Sulfide-Bearing Mines and Mine Wastes

The generation of acid mine drainage and the accompanying release of high concentrations of dissolved metals plague mining districts throughout the world. Without adequate control, acidic, metal-laden drainage devastates river courses and contaminates aquifers. Acidic drainage results from the biologically mediated oxidation of sulfide minerals in mine workings and mine wastes, and the transport of the reaction products along groundwater and surface water flowpaths. Over the past two decades, our understanding of the complex interactions between hydrogeology, microbiology, geochemistry, and mineralogy has advanced significantly. At the same time, reactive transport models have evolved rapidly to a high level of sophistication, providing a framework for

integrating these highly coupled processes. Combining reactive transport modeling with the results of detailed field and laboratory studies provides an unprecedented ability to predict the potential impacts of mining activities and mine-waste disposal facilities prior to closure. Our improved understanding of the causes of acidic drainage has led to the development of new approaches to mine-waste disposal, including the segregation and selective disposal of sulfide minerals in subaqueous repositories or in cemented paste backfill and codisposing sulfide wastes with organic carbon to prevent sulfide oxidation and to promote sulfate reduction and secondary sulfide precipitation. At sites where acidic drainage persists, new and often passive approaches for remediating contaminated surface water and groundwater are providing new opportunities to protect water resources.

This presentation describes conceptual models of the hydrogeochemical evolution of mine wastes and illustrates these conceptual models with examples from minesites throughout the world. I will describe approaches that can be used to understand and model the predominant physical and biogeochemical processes that control the extent and duration of contaminant release and provide examples of new techniques that are being developed to protect water resources from future contamination and to restore groundwater and surface water quality.



David Blowes

2006 JAHNS DISTINGUISHED LECTURER



Jerry D. Higgins

Jerry D. Higgins has been named the 2006 Jahns Distinguished Lecturer.

The Association of Engineering Geologists and the Engineering Geology Division of the Geological Society of America (GSA) jointly established the Richard H. Jahns Distinguished Lectureship in 1988 to commemorate Jahns and to promote student awareness of engineering geology through a series of lectures offered at various locations around the country throughout the year. Richard H. Jahns (1915–1983) was an engineering geologist who had a diverse and distinguished career in academia, consulting, and government.

Higgins has served on the geology and geological engineering faculty at the Colorado School of Mines (CSM) since 1986. He received a B.S. geology degree from Missouri State University (1969) and M.S. geology and Ph.D. geological engineering degrees (1975 and 1980) from the University of Missouri–Rolla. Prior to coming to CSM, Higgins served on the civil engineering faculty at Washington State University and as a geological engineer with a consulting engineering firm and with the City of Springfield, Missouri.

Higgins has taught many engineering geology courses and short courses. His major areas of research are slope stability, rockfall analysis and mitigation,

debris flow mechanics, seismic hazard assessment, geotechnical design in loess, characterization of expansive bedrock, construction materials characterization, and engineering geologic mapping. He has completed over \$1.4 million in funded research from government and private industry. He was a contributing author to the Transportation Research Board (TRB) publication “Landslides: Investigation and Mitigation,” coauthored the internationally known Colorado Rockfall Simulation Program (CRSP), authored testing standards for flexible fence rockfall barriers, and has published numerous technical papers on engineering geology. Presently, he is part of a TRB task force preparing a book on rockfall science. He has given numerous invited presentations and workshops in the United States and Europe on slope instability, erosion, and geological hazards assessment, and has been retained as a consultant on numerous private and public projects involving landslide, rockfall, and debris flow problems.

An active member of the Association of Engineering Geologists since 1975, Higgins has served as chair of GSA’s Rocky Mountain Section and chair of the Academic and Student Affairs Committee, and has planned numerous technical symposia at national meetings.

He is a member of the TRB Engineering Geology and Rockfall committees. He served five years as the geological engineering representative to the ABET Inc. Engineering Accreditation Commission, and presently serves on the ABET board of directors. He is also active on the SME Education and Curricular Issues committee and serves as a trainer for geological engineering accreditation evaluators.

The 2006 Jahns lecture titles include: “Rockfall Analysis and Mitigation,” “Engineering Geology of Expansive Soils and Bedrock,” “Site Characterization for Slope Stability Assessment,” and “Preparation for Careers in Engineering and Environmental Geology.” Abstracts for these presentations are available by e-mail from the author.

Requests for scheduling lectures should be directed to Jerry Higgins at jhiggins@mines.edu.

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. and W. Storrs Cole Award funds are managed by the GSA Foundation.

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 2006 award is for US\$8,200.

The **W. Storrs Cole Memorial Research Award** supports research in invertebrate micropaleontology. For 2006, this award carries a stipend of US\$7,500 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.

2006 application forms are available at www.geosociety.org/grants/postdoc.htm. For more information, contact Grants, Awards, and Recognition, GSA, P.O. Box 9140, Boulder, CO 80301-9140, awards@geosociety.org, or call +1-303-357-1023.

Applications must be received via post on or before 1 February 2006.

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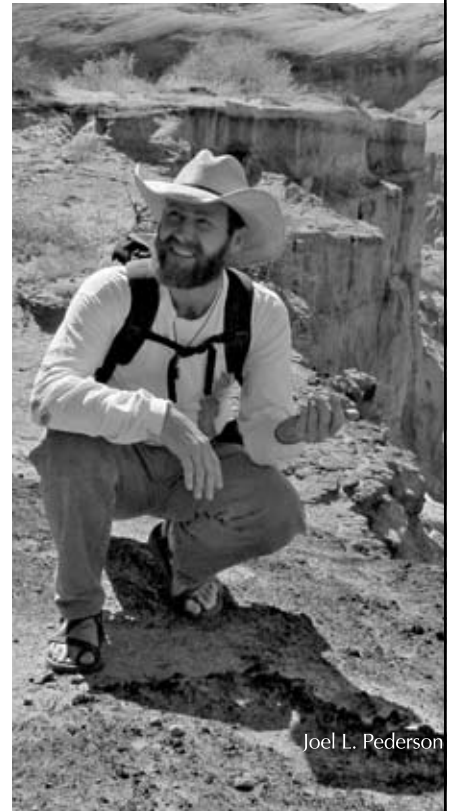
2005 Biggs Awardee Named

Congratulations to **Joel L. Pederson**, associate professor in the geology department at Utah State University, who has been named as the 2005 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. These funds are managed by GSA Foundation.

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.



Joel L. Pederson

Call for Applications



Apply for the GSA-USGS Congressional Science Fellowship for 2006-2007

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 2006. Prospective candidates should be GSA members with a broad geoscience background 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.

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 U.S. residents.

Deadline to apply: 1 February 2006

For application information, visit www.geosociety.org/science/csf/
or contact Ginger Williams, GSA Headquarters +1-303-357-1040, gwilliams@geosociety.org.

GSA RETIREES OR NEAR-RETIRES

Are You Looking for a Place to Put Your Books to Good Use?

George D. Klein, *GSA Conferee to AAPG Publication Pipeline Committee*

Senior GSA members who are retired or contemplating retirement share a common problem. What should they do with their personal geological libraries? Fortunately, a solution exists. Donate them to the AAPG Publication Pipeline Committee, which will arrange for your books to fill voids in geological libraries overseas!

Since 2001, books have been flowing overseas to university and public agency libraries thanks to AAPG's Publication Pipeline Committee. Chaired by Rick Wall, this committee's mission is to improve geoscience education in developing countries by providing used geoscience books and periodicals at no cost to university libraries and other libraries that request them. Because of war or civil unrest, lack of funds, fire, or natural disasters, many overseas libraries need basic library resources for use in higher education and training, which is critical to the continued development of their countries.

Donated books and journals come from North American geoscientists or companies that have consolidated their

facilities. The AAPG Publication Pipeline committee collects, inventories, boxes, stores, and distributes these donated geoscience periodicals and books. Shipment overseas is arranged by multinational companies as part of their regular shipments to areas where they operate.

Since 2001, the committee has distributed nearly 17 tons of books. Companies underwriting shipping costs include ConocoPhillips (and its predecessor, Conoco) and ChevronTexaco. When the Baylor University library systems merged their geology branch library into their main library, their duplicate holdings were shipped to the University of Kabul in Afghanistan with the cooperation of the U.S. Geological Survey and the U.S. AID program. Preparations are under way to make another shipment to Afghanistan.

Senior GSA Members and Fellows reaching retirement age who wish to donate their personal geological books and journals to the AAPG Publication Pipeline Committee are invited to contact the committee chairman, Rick Wall, at rwall@sampson.com or rwall1@hotmail.com.

2001-2004 AAPG PUBLICATION PIPELINE COMMITTEE BOOK DONATIONS OVERSEAS

| Year | Recipient institution(s) | Country | Organization that donated shipping | Book tonnage |
|------|--|-----------------------|--|--------------|
| 2001 | Nigerian Universities; distributed by NAPE (Nigerian Association of Petroleum Explorationists) | Nigeria | Conoco | 2.0 |
| 2003 | Universidad de Tucuman | Argentina | International Assoc. of Argentine Petroleum Geologists | 0.7 |
| 2003 | Various universities in Thailand AND the Cambodian National Petroleum Authority | Thailand and Cambodia | Chevron Corp. (also paid for local distribution) | 2.5 |
| 2004 | 15 Universities via IATMI (The Association of Indonesian Petroleum Engineers-Houston chapter) | Indonesia | ConocoPhillips (Schlumberger assisted with clearing customs) | 3.2 |
| 2004 | Kabul University | Afghanistan | U.S. AID and U.S. Geological Survey | 2.0 |
| 2004 | Niger Delta University | Nigeria | Chevron Corp. | 5.7 |

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2005 Memories



Art Hussey, Bowdoinham, Maine, and J.R. Ouellette, Pawtucket, Rhode Island (*The Owl and the Pussy-Cat*).



Bob Shuris, Kennebunkport, Maine; Art Hussey, Bowdoinham, Maine; Jerry Helmstetter, Bridgewater, New Jersey; and Joan Baldwin, Dana Point, California.

Livingston, Montana, GeoHostel



Bob Beringer, Ventura, California.



Sheila Roberts, University of Montana—Western, co-leader.



Rob Thomas, University of Montana—Western, co-leader.

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Livingston group at Devils Slide, just north of Gardiner, Montana, and Yellowstone Park. Photo by Sheila Roberts.

GeoHostel™ 2006



The Tectonic Development of Southern California, from the Beaches of San Diego to the San Andreas Fault

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Scientific Co-Leaders:

Monte Marshall, San Diego State University, Emeritus. Marshall received his Ph.D. from Stanford University in 1971. He was a research geophysicist with the U.S. Geological Survey from 1971 to 1974 and a professor of geology and geophysics at San Diego State University from 1975–2001. Marshall's research specialties include paleomagnetism and plate tectonics;

application of geophysical techniques to structural problems, especially the location; and definition of active faults in southern California.

Mario V. Caputo, Mt. San Antonio College, Walnut, California. A member of GSA for 30 years, Caputo teaches geoscience at Mt. San Antonio College, where he has been four-time recipient of the *Outstanding Educator Award*. His published studies include petrology, paleogeography, and architecture of Middle Jurassic strata of southern Utah, coastal geomorphology of California and Gulf of Mexico, and eolian limestones of the Bahamas. Over the years, he has led a host of student field trips along coastal San Diego County.

Michael J. Walawender, San Diego State University, Emeritus. Former head of the geological sciences department at San Diego State University (SDSU), Mike has published numerous articles on the Peninsular Ranges batholith and has led a variety of field trips for both students and professional geologists. Nearly 100 senior and Master's theses were completed at SDSU under his direction. He is also the author of a popular book on the geology of the San Diego area.

Description

Beginning and ending in San Diego, with three days near the Salton Sea, this GeoHostel will focus on the "big picture" of southern California geologic history over the past two billion years. We will begin with the sedimentary rocks along the coast and look at what surface faulting and gravity surveys tell us about the formation of the San Diego harbor and coastline. We will then traverse the Peninsular Ranges and look for evidence of magmatic arc accretion, pluton formation, and the nature of the intruded crust. Finally, we will examine the faults that initiated the Salton Trough and are currently uplifting, folding, and segmenting parts of the desert floor. We will end by hiking along a world-class exposure of the current main strand of the San Andreas fault and see how the shear has folded the sedimentary rocks and brecciated the Cretaceous to 2 Ga basement.

Accessibility

GSA is committed to making its activities accessible to all people interested in attending. Please notify Edna Collis, ecollis@geosociety.org, +1-303-357-1034, if you have any special requirements (wheelchair accessibility, etc.). The Best Western Seven Seas and Best Western Date Tree Hotel are ADA compliant.

Fees and Payment

US\$1495 for GSA members; US\$1545 for spouses; US\$1595 for nonmembers. A US\$200 deposit is due with your reservation and is refundable through 1 February, less a US\$20 processing fee. The balance is due 1 Feb. 2006. Min.: 25; max.: 36. **Included:** Classroom programs and materials, field trip transportation, lodging for six nights (single occupancy or double for couples), breakfast and lunch daily, and welcoming and farewell events. **Not included:** Transportation to and from San Diego, California, transportation during hours outside field trips, alcoholic beverages, and other expenses not specifically included.

To register for this trip, please fill out and return the registration form below:

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GeoCorps America™ Participants 2005

GSA would like to recognize these Members who contributed to the GeoCorps America™ program this year. With the help of these outstanding individuals, the National Park Service, US Forest Service, and Bureau of Land Management were able to complete necessary field projects to reach their land management goals.

For more information about GSA's GeoCorps America™ program, go to the GeoCorps Web site, www.geosociety.org/geocorps.

2005 GeoCorps America™ Participants

| | | |
|--------------------|--|------------|
| Rebekah Ost | Rogue River Siskiyou National Forest | Oregon |
| Travis Kelly | Rogue River Siskiyou National Forest | Oregon |
| Karen Merrill | Sierra National Forest | California |
| Seth Ames | Sierra National Forest | California |
| Greg Miller | Arapaho Roosevelt National Forest | Colorado |
| Ryan Weidert | Arapaho Roosevelt National Forest | Colorado |
| Angela Isaacs | Tongass National Forest | Alaska |
| Ashley Dere | Los Padres National Forest | California |
| Krista Modelli | Los Padres National Forest | California |
| Gabriel Fuson | Rogue River Siskiyou National Forest | Oregon |
| Peter Douglas | Rogue River Siskiyou National Forest | Oregon |
| Mindy Sue Vogel | Idaho Panhandle National Forest | Idaho |
| Carrie Check | White Sands National Monument | New Mexico |
| Jamie Stanley | Grand Canyon National Park | Arizona |
| Mary Caress | Craters of the Moon National Monument | Idaho |
| Kathryn Wetherell | Craters of the Moon National Monument | Idaho |
| Stephanie Shepherd | Sunset Crater Volcano National Monument | Arizona |
| Anthony Menicucci | Fossil Butte National Monument | Wyoming |
| Carrie Williamson | Fossil Butte National Monument | Wyoming |
| Janet Bader | Rocky Mountain National Park | Colorado |
| Kristen Borseth | Mount Rainier National Park | Washington |
| Hillary Sletten | Mount Rainier National Park | Washington |
| Julia Haas | Walnut Canyon National Monument | Arizona |
| Stephanie Kyriazis | Bryce Canyon National Park | Utah |
| Torrey Nyborg | Death Valley National Park | California |
| Bronson Barton | Petrified Forest National Park | Arizona |
| Megan Unger | Zion National Park | Utah |
| Patrice Barlow | Yellowstone National Park | Wyoming |
| Malinda Smith | Carlsbad Caverns National Park | New Mexico |
| Heather Hoey | Mammoth Cave National Park | Kentucky |
| Andrea Prichard | Oregon Caves National Monument | Oregon |
| Nicole Moore | Mesa Verde National Park | Colorado |
| ReBecca Hunt | Glacier National Park | Montana |
| Joseph Hall | Florissant Fossil Beds National Monument | Colorado |
| Simon Masters | Dinosaur National Monument | Utah |
| Janice Gillespie | Devils Tower National Monument | Wyoming |
| Erin Doak | Wupatki National Monument | Arizona |
| Craig Hill | Bureau of Land Management, Alaska | Alaska |

Here are a few



Nicole Moore

MESA VERDE NATIONAL PARK, COLORADO

This summer I worked at Mesa Verde National Park as a park educator and interpreter. My objective was to integrate geology into the educational programs provided at the park. I felt quite a responsibility in this task, since the focus at Mesa Verde for the past 100 years has been the cultural aspects of the park, rather than the natural resources. I developed a Web page on the geology of the area, as well as a geology brochure for park visitors. This entailed extensive research on my part, as well as strenuous hikes throughout the park to capture photographs of the geologic features and formations in the area. I have been able to further develop my skills as a geologist, in particular by communicating complex geologic concepts to those without a scientific background, a valuable resource since I wish to become a professor.

of the field stories from this year's participants



Stephanie Kyriazis

BRYCE CANYON NATIONAL PARK, UTAH

My summer at Bryce Canyon National Park has refined my ability to communicate scientific concepts to the public in an engaging manner and improved my skills as a research scientist. I was given the opportunity to independently coordinate education and research projects, and to engage in dialogue and work with local research geologists.



Travis Kelly

ROGUE RIVER SISKIYOU NATIONAL FOREST, OREGON

Over the course of the summer, I was exposed to many aspects of what it takes to be a geologist on a National Forest, as well as what it means to be a public resource manager. The primary goal of my project was to update the rock quarry inventory and enter the information into the Geopoint database (computerized database of all the rock quarry information). By updating the quarry inventories, I was able to increase my rock identification skills, as well as learn about the processes involved in rock extraction. Throughout the summer, I gained valuable experience in a number of applied fields of geoscience. This opportunity has given me insight into what I want to pursue as a professional.



Seth Ames

SIERRA NATIONAL FOREST, CALIFORNIA

This summer I worked as a geologist on the Sierra National Forest. I worked on three primary projects: a soil compaction assessment, a cave inventory, and a water quality monitoring project. I am grateful that I had the opportunity to help protect some of our nation's most valuable natural resources. The experience and knowledge I gained as a GeoCorps America™ participant will be indispensable as I start my career in the geosciences.

Call for Proposals:

Professional Development Short Courses and K-16 Education Workshops

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 extended to K-12 teachers, teacher trainers,

preservice educators, and undergraduate educators to submit proposals for K-16 education workshops. Committee members are interested in receiving course proposals for the 2006 GSA Annual Meeting in Philadelphia or the 2007 GSA Annual Meeting in Denver.

Proposals must be received by 1 January 2006. Selection of courses for 2006 will be made by 1 March 2006. We will also consider courses for 2007 during this time.

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



A New Fund in the Foundation

We are pleased to announce that the Ian Campbell Endowment Fund has been established within the Foundation. The following article by Robert Jordan relays the history of the award as well as its current recipient and recent changes.



Samuel S. Adams

Congratulations to Samuel S. Adams on receiving the 2005 AGI Medal in Honor of Ian Campbell. The special nature of the Campbell Medal acknowledges the magnitude of Sam Adams' outstanding, generous contributions to our science and profession. Adams has indeed earned this highest recognition of the American Geological Institute.

Adams is also the first recipient under the revitalized structure of the Ian Campbell Endowment within the GSA Foundation.

Time necessarily removes witnesses to history. To appreciate Sam Adams' accomplishments, we should remember Ian Campbell and the reasons select colleagues are honored in his name. Generations removed from his touch benefit from the example, the standard, Campbell established.

Ian Campbell was a great mentor, part as was the duty of a teacher, but infinitely more as he gently, firmly guided contemporaries and successors in support of geology. The Campbell Medal is unique in preserving the example of a truly unusual person for service to his profession.

Our awards tend to recognize accomplishments in science, discoveries, and special feats, but the Campbell Medal addresses the context, the substance, in which such events

are possible. Ian Campbell's academic contributions earned respect, but he excelled with an impressive record of presidencies, chairmanships, memberships, and generic contributions that addressed the essence of geology. This unique award celebrates service in the light of this example.

Many serve and we are grateful to all. Why do we express ultimate gratitude with the Medal in Honor of Ian Campbell? Testimony is found in his life, the history of the medal, and the careers of the recipients.

Ian Campbell was born in Bismarck, North Dakota, in 1899. After a B.S from Oregon and Sc.D. from Harvard, he joined Cal Tech in 1931. Throughout his career, he was supported by Catherine (Kitty) Campbell, herself the first woman to earn a Harvard Ph.D. in geology. Ian's teaching is remembered as generous time given in wise counsel. His work spanned all levels of all aspects of geology. Mount Ian Campbell stands tall in the Sierra Nevada to remind us of his work for California and the U.S. Geological Survey.

Campbell continued at Cal Tech until appointed State Geologist of California in 1959. He reached mandatory retirement in 1969. Presidencies of four major geological organizations (GSA, AGI, AASG, and MSA) signaled his commitment to service.

Campbell's impact shows in the origins of the medal. When he succumbed to cancer in 1978, the outpouring from state geologists included generous personal contributions to establish a memorial. Because Campbell's inspiration extended beyond AASG, an encompassing host was sought with visibility to extend his example. The medal thus became the highest award of our AGI federation, and its stage is GSA's Annual Meeting awards ceremony.

A gathering of medalists at AASG in 2004 understood that as memories fade, the inspiration of the Medal might not be adequately conveyed to future generations. They pledged generously; Ian's touch showed in the pledge of AASG itself to match their contributions. The GSA Foundation emerged



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to house the endowment created to perpetuate the objectives of the award. The integrity with which AGI has administered the medal and selected recipients continues, the rekindled support of AASG is evident, and the solid institutional base of GSA Foundation and broad stage of GSA are assured. The scientific texture is clearly strong, but the strength of the fabric lies in the contributions to geology. That is the character that draws us together and the statesmanship that binds us and represents us in the wider community.

Ian Campbell's Presidential Address to GSA in 1969 bears the most unusual title in geological literature: "Mene, Mene, Tekel, Upharsin." The "Handwriting on the Wall" warns of division's perils; Campbell used it to advocate unity in presenting geology in the service of man.

The honor given Sam Adams is great and deserved. As the first backed by the Campbell Endowment, it represents revitalization of qualities essential to our professional activities. I offer my greatest compliment: Ian would be proud of Sam.

Robert R. Jordan
Centreville, Delaware

Past Campbell Medalists

| | |
|------|-------------------------|
| 1981 | Richard H. Jahns |
| 1983 | Hollis D. Hedberg |
| 1984 | Konrad B. Krauskopf |
| 1985 | Robert L. Heller |
| 1986 | William B. Heroy Jr. |
| 1987 | Charles J. Mankin Jr. |
| 1988 | John D. Haun |
| 1989 | Grover E. Murray |
| 1990 | Philip E. LaMoreaux |
| 1991 | William L. Fisher |
| 1992 | Donald C. Haney |
| 1993 | Peter T. Flawn |
| 1994 | Dallas L. Peck |
| 1995 | Gordon P. Eaton |
| 1996 | Robert R. Jordan |
| 1997 | M. Gordon (Reds) Wolman |
| 1998 | Charles G. (Chip) Groat |
| 1999 | Priscilla C.P. Grew |
| 2000 | Luna B. Leopold |
| 2001 | Kenneth N. Weaver |
| 2002 | Frank H.T. Rhodes |
| 2003 | Edward C. Roy Jr. |
| 2004 | Ernest A. Mancini |

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December 2005 224 pp.
0-19-517181-0 \$29.95

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The Quest to Measure the Earth
Edwin Danson

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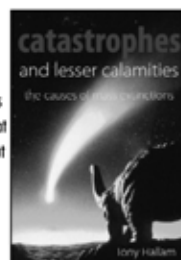
November 2005 272 pp.
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Tony Hallam, University of Birmingham (Emeritus)

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2005 192 pp.
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AFTER THE EARTH QUAKES

Elastic Rebound on an Urban Planet
Susan Elizabeth Hough, U.S. Geological Survey, and **Roger G. Bilham**, University of Colorado

Elastic rebound is one of the most basic tenets of modern earthquake science, the term that scientists use to describe the build-up and release of energy along faults. *After The Earth Quakes* focuses on this theme, using a number of pivotal and intriguing historic earthquakes as illustration. The book concludes with a consideration of projected future losses on an increasingly urbanized planet, including the near-certainty that a future earthquake will someday claim over a million lives.

November 2005 416 pp.
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SURVIVING ARMAGEDDON

Solutions for a Threatened Planet
Bill McGuire, University College London

What do earthquakes, magma, asteroid 1950DA and global warming have in common? Not only are they all natural disasters already under way, but they are ones scientists are now working to prevent, predict, or at least limit their impact on civilization as we know it. This book provides solutions rather than problems to natural and man-made disasters that threaten our planet, and concludes optimistically with ways to use technology to protect our society from global catastrophe, as well as to foster an environment where all life on earth can thrive.

2005 248 pp.
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Changes to GSA Graduate Student Research Grant Eligibility Beginning 2006

In an effort to fund more GSA Student Members, students may now only receive GSA graduate student research grant money once at the Master's level and once at the Ph.D. level. This policy affects

all GSA research grantees retroactively.

Those who have applied for grant funding but who did not receive a grant are welcome to apply again.

Please see www.geosociety.org/grants/gradgrants.htm for further details. The 2006 online application system will be available by mid-November of 2005, and **online applications will be due by Wed., 1 February 2006, at 11:59 p.m. (MST).**

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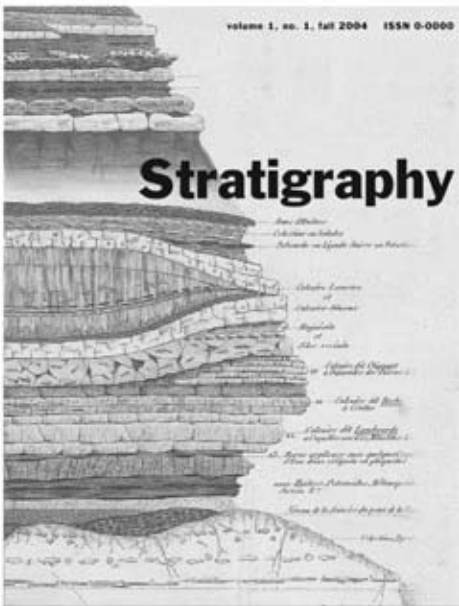


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"Stratigraphy explains geology" – Y. Gladenkov



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GSA Awards First Annual Prizes for Science Fair Excellence

At the 2005 Intel International Science and Engineering Fair in Phoenix, Arizona, the Geological Society of America awarded prizes for science and engineering projects investigating the earth and related sciences. The winners and their schools will receive a free subscription to *GSA Today* as well as a cash prize. Projects were judged on their demonstration of a high level of understanding of earth science concept(s), how the earth is a system, and use of innovative methods to explain concepts.

\$1,000 AWARD

Yingqiuqi Lei

Robert F. Kennedy Community High School,
Flushing, New York

"Mining the Past: Geochemical Analyses of Fossil Teeth and Sediment Illuminate Ancient Environments."

\$750 AWARD

Paul Macdonald Magyar

Classical High School, Providence, Rhode Island

"Characterizing Martian Soil Analogues
with Optical Microscopy."

\$250 AWARD

Meghan Combs

Joplin-Inverness Public Schools, Joplin, Montana

"The Amount of Particulate Matter of Iron Creek
in the Sweet Grass Hills to Determine Erosion."

Congratulations to these students!



From left to right: Paul Macdonald Magyar, Yingqiuqi Lei, Carleton Moore (Arizona State University, GSA's representative), and Meghan Combs.

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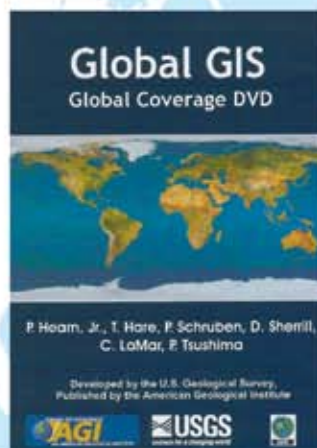
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- Utility lines
- Population density
- Geology
- Ecological Regions
- Historical seismicity (epicenter locations)
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- Ore Deposits
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- Landcover and landuse
- Vegetation index
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The Department of Geosciences at Florida Atlantic University seeks to fill a tenure-track faculty position in hydrogeology beginning August 2006. The specific area of research is open and might include one or more of the following: contaminant transport and reactions on a variety of scales; theory and applications of geophysical methods; analysis of water resources and related policy; hydrologic impacts of climate variability and climate change; soil physics and unsaturated zone processes; and hydrogeochemistry and geomicrobiology. Interest and expertise in multidisciplinary research approaches is an asset. The successful candidate is required to teach some combination of the following: Introductory Hydrogeology, Engineering Geology, Water Resources, Hydrogeochemistry and Geomicrobiology, as well as courses in the candidate's particular area of expertise. The ability to teach geology field courses is a plus, but not required. The rank is at either the Assistant or Associate level. The successful candidate will join the Department of Geosciences, which includes Geography and Geology degree programs. The selected candidate should demonstrate potential for conducting externally funded research, be an enthusiastic teacher at the undergraduate and graduate levels, and be well qualified to direct the research of students. A Ph.D. in Geology or a related discipline is required at the time of appointment. Salary is competitive with excellent benefits. Further information about the Department can be found at www.geosciences.fau.edu. Applicants should send a letter of application, current full *curriculum vitae*, a statement outlining the nature of teaching philosophy and research interests, and names and contact information of four references. E-mail applications will not be accepted. Applications should be directed to the Hydrogeology Search Committee Chair, Department of Geosciences, Florida Atlantic University, Boca Raton, FL 33431. Review of applications will begin Dec. 1, 2005, and will continue until the position is filled. Florida Atlantic University is an Equal Opportunity/Equal Access Institution.

ASSISTANT PROFESSOR, MINERALOGY/ PETROLOGY MIDWESTERN STATE UNIVERSITY

The Department of Geosciences invites applications for a tenure-track position at the Assistant Professor level for Spring or Fall 2006. Applicants should have a Ph.D. in geosciences, a broad professional background, and strong interpersonal skills. Duties include teaching Introductory Geology, Mineralogy, Petrology, appropriate upper level courses, and student advising. Preference will be given to individuals with research and field experience and resulting publication in refereed journals. MSU is a comprehensive public university serving approximately 6500 students. Send application letter, vita, and names and addresses of three references to Dr. P. Stephens, Chair, Department of Geosciences, 3410 Taft Blvd., Wichita Falls, Texas 76308; email: pamela.stephens@mwsu.edu. Screening begins November 1, 2005. Applications will be accepted until position is filled. EOE/ADA.

SEDIMENTOLOGY/STRATIGRAPHY UNIVERSITY OF ALABAMA

The Department of Geological Sciences invites applications for a tenure-track faculty position in sedimentology and stratigraphy, beginning August 2006. The position

will be filled at the Assistant Professor level. The candidate will be expected to: teach introductory geology, undergraduate sedimentology & stratigraphy, and graduate courses in sedimentology and sequence & seismic stratigraphy; attract and supervise master's and doctoral students; and obtain external research funding. Possible areas of research emphasis include the evolution of coastal systems, basin evolution and stratigraphic architecture, sedimentology, and sequence & seismic stratigraphy. This position complements existing research programs in petroleum geology, geophysics, tectonics, environmental studies, hydrogeology, paleoclimatology, and paleontology. Related departmental equipment includes a multi-channel seismic data acquisition system, ground penetrating radar, CHIRP sub-bottom profiler, geoprobe, and vibrator. A state-of-the-art stable isotope laboratory, and computational resources and software supporting geodynamical modeling, seismic data processing, interpretation, and subsurface mapping are also available. Applicants should send a vita, statements of research and teaching interests, and contact information for four referees to Dr. Carl Stock, Sedimentology/Stratigraphy Search Committee Chair, The University of Alabama, Department of Geological Sciences, Box 870338, Tuscaloosa, AL 35487-0338. Further information is available on our Web site at <http://www.geo.ua.edu>. Review of applications will begin on January 9, 2006, and continue until the position is filled.

The University of Alabama is an Equal-Opportunity, Affirmative-Action Employer. Applications are solicited from women and minority candidates.

STRUCTURAL GEOLOGY AND ENVIRONMENTAL GEOCHEMISTRY FACULTY POSITIONS AT THE UNIVERSITY OF TENNESSEE-KNOXVILLE

The Department of Earth and Planetary Sciences (<http://web.eps.utk.edu>) invites applications for two tenure-track faculty positions starting Fall 2006. Successful candidates are expected to develop strong, externally funded research programs involving graduate and undergraduate student supervision and publication. Post-doctoral experience and the ability to complement one or more existing departmental strengths (crustal structure and seismology, Earth systems history, geochemistry, hydrogeology and environmental science, and planetary geoscience) are desirable.

STRUCTURAL GEOLOGY: Assistant Professor—open to candidates with a Ph.D. in Earth Sciences, Geology or a related discipline, with experience in structural geology, and a strong emphasis on field geology that focuses on almost any aspect of lithospheric deformation and related processes. The successful candidate is expected to teach undergraduate courses, and graduate courses in his/her specialty, as well as participate in field geology courses at all levels. Candidates are encouraged to take advantage of the regional geologic setting of the southern Appalachians.

ENVIRONMENTAL GEOCHEMISTRY: Assistant Professor—open to candidates with a Ph.D. in Earth Sciences, Geology, Geochemistry, or a related discipline. We seek an individual with expertise in topics such as organic contaminants, biogeochemistry, aqueous geochemistry, low-temperature geochemistry, isotope geochemistry, or biomarker analysis, with a broad emphasis on environmental problems. The successful candidate is expected to teach undergraduate courses, and graduate courses in his/her specialty. In developing a research program, the individual may take advantage of the Department's strong ties with nearby Oak Ridge National Laboratory and the UT Center for Environmental Biotechnology. This position carries with it the **Jones Environmental Geochemistry Endowment**, which partially supports the candidate's research and teaching program.

UT-Knoxville is the flagship campus for the UT system and is located close to Oak Ridge National Laboratory and the Great Smoky Mountains National Park. The Department comprises an energetic group of tenure-track, research and teaching faculty, post-doctoral researchers, and about 100 graduate and undergraduate students. Instrumentation available for research and teaching includes GC-IRMS, GC-MS, ICP-AES, LC-MS, AFM, XRD, XRF, EPMA, Vibroseis and seismic recording equipment, LANDMARK software license grant for 3D graphics and seismic processing, and other facilities. The university welcomes and honors people of all races, creeds, cultures, and sexual orientations, and values intellectual curiosity, pursuit of knowledge, and academic freedom and integrity. Applicants should e-mail their résumé, letter describing research and teaching interests, and list of 3 references in .pdf format to Dr. Chris Fedo, Search Committee Chair, Dept. of Earth and Planetary Sciences, University of Tennessee, Knoxville, TN 37996-1410; Phone 865-974-6002; Fax 865-974-2368; E-mail: cfedo@utk.edu. Supplementary materials, such as copies of refereed publications, can be e-mailed or mailed to Dr. Fedo at the above address. Review of applications will begin on December 15, 2005, and will continue until both positions are filled.

The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services.

DEPARTMENT OF EARTH SCIENCES AND MINERAL EXPLORATION RESEARCH CENTRE FACULTY POSITION IN HYDROGEOLOGY

The Department of Earth Sciences at Laurentian University invites applications for a tenure-track faculty position in Hydrogeology to be filled in July 2006. We are particularly interested in candidates with interest in field-based studies and contaminant transport modeling in glaciated terrains. The successful candidate will be expected to teach in the Geology and Environmental Earth Science programs. The latter is an interdisciplinary program involving the Departments of Earth Sciences, Geography and Biology, Supervision of MSc and Ph.D. students within a vigorous, externally funded research program is expected. Applicants must have obtained a Ph.D. by the time of appointment. Faculty and students in the Department of Earth Sciences have access to outstanding computing and geochemical analytical facilities (<http://laurentian.ca/geology/facilities.html>), as well as a modeling and scientific data visualization facility (<http://www.mirarco.org/aboutvtr.php>) for multidimensional immersion. Additional information about the Department can be found at (www.laurentian.ca/geology).

Applicants should send curriculum vitae, including a complete list of publications, a statement of teaching interests, an outline of long- and short-term research goals, and the names and mail/e-mail addresses of 4 academic referees to: Faculty Search Committee, Department of Earth Sciences, Laurentian University, Sudbury, Ontario P3E 2C6, Canada. E-mail: DES@laurentian.ca, Fax: (705) 675-4898. Review will begin on November 1, 2005, although applications will be considered until the position is filled.

Laurentian University is a bilingual institution and an equal opportunity employer. It has a policy of passive bilingualism (English/French) as a condition of tenure. The university is committed to equity in employment and encourages applications from aboriginal peoples, members of visible minorities, and persons with disabilities.

ENVIRONMENTAL GEOSCIENTIST UNIVERSITY OF ILLINOIS AT CHICAGO (UIC)

The Department of Earth and Environmental Sciences announces a tenure-track faculty position in the field of environmental geoscience. We seek an outstanding individual who will begin in August 2006 at the rank of Assistant Professor. Research areas of interest include geobiology (e.g., geomicrobiology, biogeochemistry, biomineralogy), Earth systems history (e.g., Earth's surface processes in response to global change, sedimentary geology, paleoecology), hydrogeology (e.g., reactive mass transport, surface water-groundwater interactions), or others that complement our existing strengths in geochemistry, mineralogy, Quaternary geology, paleontology, and geodynamics. Creative and energetic candidates will apply quantitative analytical techniques to investigate near-surface processes. The successful applicant will establish an independent, externally-funded research program and will teach effectively at undergraduate and graduate levels. The Department is an expanding, dynamic unit with an emphasis on integrative research approaches (www.uic.edu/depts/geos). We have state-of-the-art laboratories for aqueous, organic, stable isotope, and mineral-water interface geochemistry, mineralogy, X-ray crystallography, Quaternary geochronology, and sedimentology. Additional analytical facilities (e.g., high resolution transmission electron microscopy) are available in UIC's Research Resources Center (www.rrc.uic.edu), and through active research programs with Argonne National Laboratory (e.g., Advanced Photon Source) and the Field Museum of Natural History.

Applicants must have a Ph.D. and should submit statements of research and teaching interests, CV, and contact information for four professional references to: Faculty Search, Department of Earth and Environmental Sciences, University of Illinois at Chicago, 845 West Taylor Street, MC-186, Chicago, IL 60607-7059. Applications should be received by November 23, 2005, although the search will remain open until the position is filled. Located in the heart of Chicago, UIC is one of the nation's leading research universities and an Affirmative Action/Equal Opportunity Employer (www.uic.edu).

FACULTY POSITION EARTH SURFACE PROCESSES UNIVERSITY OF WISCONSIN-MADISON

The Department of Geology and Geophysics at the University of Wisconsin-Madison seeks an Earth Surface Processes geoscientist for an assistant professor, tenure-track position. A starting date of August 2006 is anticipated. We are seeking an individual interested in the physical aspects of Earth Surface Processes, in the modern to recent geological record. We are particularly interested in a quantitative and field-oriented geologist. Specialties may include, but are not limited to, glacial geomorphology, Quaternary geology, tectonic geomorphology, submarine geomorphology, and geologic hazards.

A Ph.D. is required at the time of the appointment. The successful candidate is expected to develop an active research program, including supervision of graduate students. Teaching responsibilities include courses at the undergraduate and graduate levels.

Applicants should submit a resume, statement of research and teaching interests, and the names and addresses of at least three references to Dr. Basil Tikoff, Earth Surface Processes Search Chair, Dept. of Geology & Geophysics, University of Wisconsin - Madison, 1215 W. Dayton St., Madison WI 53706-1692. To ensure full consideration, applications must be received by January 15, 2006.

For additional information, please visit: www.geology.wisc.edu. UW-Madison is an equal opportunity/affirmative action employer and encourages applications from women and minorities. Unless confidentiality is requested in writing, information regarding applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

COAL GEOLOGY SOUTHERN ILLINOIS UNIVERSITY-CARBONDALE

The Department of Geology at Southern Illinois University Carbondale invites applications for a tenure-track position in coal geology at the rank of assistant professor with a start date of Aug. 16, 2006. Post-doctoral experience is preferred. The applicant should demonstrate the existence of, or potential for developing, an internationally recognized, externally funded research program. We prefer a coal geologist who will advance our long-standing, internationally recognized coal petrology program (<http://mccoy.lib.siu.edu/projects/crelling/>; <http://mccoy.lib.siu.edu/projects/crelling2/atlas/>). The successful applicant is expected to teach courses in introductory geology and undergraduate and graduate courses in their area of expertise. Normal teaching load is one to two courses per semester. Applicants must hold a Ph.D. or show that they will complete all degree requirements by the time of appointment.

Review of applications will begin January 15, 2006 and continue until the position is filled. Applicants should submit a curriculum vitae, a statement of teaching and research interests, and the names and addresses of at least three referees to: Dr. Jack Crelling, Search Committee Chair, Department of Geology, Mailcode 4324, Southern Illinois University Carbondale, 1259 Lincoln Drive, Carbondale, IL 62901. Fax: (618) 453-7393. E-mail: jcrelling@geo.siu.edu.

Southern Illinois University Carbondale is a large, research-oriented institution situated in a pleasant small-town setting southeast of St. Louis. SIUC is seeking to enhance interdisciplinary research as it strives to be a top 75 public research university (<http://news.siu.edu/s150/>). The Geology Department has a full-time faculty of 10 with about 40 undergraduate and 30 graduate students and offers Bachelor and Master degree programs in geology and participates in the interdisciplinary Environmental Resources and Policy Ph.D. program. SIUC has energy programs and facilities that provide opportunities for collaborative research including the Coal Research Center, the Center for Advanced Friction Studies, and the Mining and Mineral Resources Program.

For further information, please visit our comprehensive Web site www.science.siu.edu/geology. SIUC is an affirmative action/equal opportunity employer that strives to enhance its ability to develop a diverse faculty and staff and to increase its potential to serve a diverse student population. All applications are welcomed and encouraged and will receive consideration.

CALIFORNIA STATE UNIVERSITY-FRESNO ANNOUNCES TWO POSITIONS

Paleontologist: Assistant Professor (Tenure Track); Vacancy # 06STM085

We seek a broadly trained earth scientist with research and teaching expertise in the area of paleontology, with a background in stratigraphy, historical geology and field geology. This tenure-track position will complement our existing strengths in Geomorphology, Oceanography, Geophysics, Sedimentary and Igneous Petrology, Hydrogeology, and Structural Geology. The successful candidate will be expected to seek funding and support a research program that directly involves both undergraduate and M.S. graduate students. Teaching responsibilities may include introductory Geology, Stratigraphy, Paleontology, Historical Geology, Field Geology, and upper division courses in the candidate's specific fields of interest.

Additional information about our department is available at: <http://www.csufresno.edu/geology/>.

Qualifications & Academic Preparation: An earned doctorate (Ph.D.) in Geology, Paleontology or a 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: Stephen Lewis, Search Chair, California State University, Fresno, Department of Earth & Environmental Sciences, 2576 E.

San Ramon Ave, MS/ST 24, Fresno, CA, 93710-8039. The position will be open until filled. To ensure full consideration applicants are encouraged to have all application information on file by January 12, 2006.

Faculty Position in Environmental Sciences—Climate/Global Change; Vacancy # 06STM084

Department of Earth and Environmental Sciences of California State University, Fresno seeks a broadly trained environmental scientist who applies diverse modern approaches to conduct research in the areas of Atmosphere and Climate or Global Change, including related fields, (e.g., Glaciology or Palynology). Teaching responsibilities may include undergraduate courses in environmental sciences, and graduate courses specializing in the environmental aspects of the atmosphere, the hydrosphere and their interactions. Other expectations include developing a sustainable, externally funded research program in environment science, supervising thesis research, and mentoring of students at the undergraduate and graduate levels. The successful candidate may be called on to teach in a distance education mode. Additional information about our department is available at: <http://www.csufresno.edu/geology/>. This is a tenure-track appointment at the assistant professor level. An earned doctorate (Ph.D.) in a field of Environmental Sciences or related fields is required. Please send a c.v., statement of research and teaching interests, and at least three letters of reference to Professor John Suen, Search Chair, California State University, Fresno, Department of Earth & Environmental Sciences, 2576 E. San Ramon Ave, M/S ST 24, Fresno, CA, 93710-8039, before January 12, 2006 for full consideration. The position will be open until filled.

TENURE-TRACK FACULTY POSITION GEOPHYSICS, UNIVERSITY OF MINNESOTA DEPARTMENT OF GEOLOGY AND GEOPHYSICS

The Department of Geology and Geophysics at the University of Minnesota-Twin Cities invites applications for a tenure-track faculty position in geophysics. We are seeking a person broadly trained in geophysics with a research focus related to the earth and/or planetary bodies that will complement the current strengths of the geophysics program in mineral magnetism, rock and mineral physics, seismology, geodynamics, and geological fluid dynamics. The successful candidate is expected to initiate a strong externally funded research program.

The N.H. Winchell School of Earth Sciences includes world-class laboratories in high pressure rock deformation, experimental petrology and geochemistry, the Limnological Research Center, and three NSF-funded research centers: the Institute for Rock Magnetism, the National Center for Earth-Surface Dynamics, and the National Lacustrine Core Repository as well as the Minnesota Geological Survey, which is active and influential in regional geophysical surveys. Other campus-wide resources within walking distance of the department include the Materials Characterization Facility (www.charfac.umn.edu), Supercomputer Institute (www.msi.umn.edu), Digital Technology Center (www.dtc.umn.edu), and OMNI, a multi-disciplinary organization for Minnesota Nanotechnology Initiatives (www.nano.umn.edu).

The department encourages and rewards innovative research and excellence in teaching. Teaching duties reflect the expertise of the candidate and include both undergraduate and graduate levels. Appointment will be at the rank of assistant professor and begin as early as August 2006. A Ph.D. degree must be earned by the time of the appointment. The review of completed applications will begin November 15, 2005 and continue until an appointment is made. Complete applications include (1) curriculum vitae, (2) complete list of publications, (3) statement of research interest, (4) statement of teaching interests, and (5) names, addresses and e-mail addresses of at least four references. Send application to Chair, Geophysics Search Committee, Department of Geology and Geophysics, University of Minnesota, 310 Pillsbury Dr., S.E., Minneapolis, MN 55455 USA.

Further information concerning the Department, its faculty and their research programs can be obtained at www.geo.umn.edu. Questions may be addressed to Professor Bruce Moskowitz at bmosk@umn.edu.

The University of Minnesota is an equal opportunity educator and employer.

TENURE-TRACK ASSISTANT PROFESSOR ENVIRONMENTAL GEOCHEMISTRY COLLEGE OF CHARLESTON

The Department of Geology and Environmental Geosciences at the College of Charleston invites applications for a tenure-track assistant professor position in Environmental Geochemistry beginning in August 2006. Candidates will also be expected to contribute to an interdisciplinary program leading to a Master's degree in Environmental Studies. We also have a strong interest in candidates with a Ph.D. in biogeochemistry, soil chemistry, or geochemistry of water resources who will develop a research program involving environmental applications of geochemistry. The successful candidate will demonstrate a serious commitment to both graduate and undergraduate teaching and research, and have a strong background in field and laboratory methods per-

tinued to their discipline. The candidate will be expected to: (1) teach an undergraduate-level course in geochemistry, one or more graduate-level courses in environmental geochemistry, and undergraduate introductory geology courses; (2) develop a successful research program that leads to professional publications; (3) supervise Master's student thesis research, and (4) seek external funding for research. For more information about the department, visit <http://www.cofc.edu/~geology/>.

Interested persons should send a letter stating their interest in the position, curriculum vitae, statements of teaching philosophy and research interests, unofficial academic transcripts, and names of three references to: Geochemistry Search Committee, Department of Geology and Environmental Geosciences, College of Charleston, 66 George Street, Charleston, SC 29424. Review of applications will begin January 9, 2006 and continue until the position is filled. The College of Charleston is an AA/EO/ADA employer and does not discriminate in employment or the provision of services on the basis of disability.

POSITION: ASSISTANT OR ASSOCIATE PROFESSOR DEPARTMENT OF GEOLOGICAL SCIENCES UNIVERSITY OF TEXAS AT EL PASO

DESCRIPTION: The Department of Geological Sciences, University of Texas at El Paso, is inviting applications for a full time tenure-track position in structural geology beginning in September 2006. We are particularly interested in finding candidates with a strong interdisciplinary focus who can collaborate with existing faculty having research interests in neotectonics, geophysics, remote sensing, basin analysis, petrology and environmental/engineering geology. The region offers many exciting research topics as we are located in one of the most geologically diverse terrains in the world.

The Department of Geological Sciences supports undergraduate, M.S. and Ph.D. degrees in Geological Sciences as well as interdisciplinary undergraduate, M.S., and Ph.D. programs in Environmental Science and Engineering. The candidate is expected to teach introductory geology classes as well as our upper division structural geology course and graduate classes that serve the Geological Sciences program. The candidate is also expected to help supervise student theses and dissertations related to structural geology. The Department is housed in a spacious building that contains extensive analytical and computing facilities. In addition, the collaborative research environment on our campus affords easy access to a superb variety of analytical equipment in other departments. Form more information about activities and facilities, visit our Web site at <http://www.geo.utep.edu>.

QUALIFICATIONS REQUIRED: The candidates must have Ph.D. degrees at the time of appointment. We are seeking candidates capable of building active research programs and who enjoy collaborative research.

APPLICATION PROCEDURE: Candidates should submit a letter of application, curriculum vitae, description of teaching and research interests, and the names of three people willing to provide professional references to: Diane Doser, Chair, Department of Geological Sciences, The University of Texas at El Paso, El Paso, Texas 79968, doser@geo.utep.edu. Review of applications will begin immediately and continue until positions are filled, however highest consideration will be given to applications received prior to December 31, 2005.

GEOSPATIAL SCIENCE BOWLING GREEN STATE UNIVERSITY

The Departments of Geology and Geography, and the Center for Environmental Programs invite applications for a tenure-track, Assistant Professor position in Geospatial Science beginning August 2006. We are seeking a person with interdisciplinary interests in GIS/Remote Sensing as applied to areas such as natural resource exploration/management/protection, environmental monitoring/management, emergency response & management, and/or economic development. The appointment will be made in one or more of the three units, depending on the candidate's area(s) of expertise. The candidate will be expected to develop and maintain an active, externally-funded research program that emphasizes interdisciplinary work in GIS/Remote Sensing. The candidate will also be expected to teach undergraduate and graduate courses in one or more of the three units. Salary for the position is competitive and commensurate with peer institution levels for rank and position and in keeping with candidate experience and credentials. The three units have a combined faculty of 22. We are in the process of formalizing an academic structure that will facilitate collaboration in the area of Geospatial Science. Extensive facilities to support research and teaching in GIS/Remote Sensing include: three teaching labs with a total of 40 workstations, ARC IMS servers, large format color plotters, large and small digitizers and scanners, color printers, laser rangefinders, sub-meter GPS receivers, ruggedized tablet and pocket PCs for mobile GIS, portable field spectrometers (300–2500 nanometer and 2–15 micrometer wavelength ranges), and ESRI, ENVI, ERDAS, PCI, and ERMapper site licenses.

Applicants are required to have a Ph.D. at the time of employment.

Candidates should send a letter of application, curriculum vitae, statements of research and teaching interests and goals, and three current letters of recommendation to: Chair, Faculty Search Committee, Department of Geography, Bowling Green State University, Bowling Green, OH 43403. Finalists will be required to provide a transcript for the highest degree.

Applications must be postmarked by January 2, 2006. Bowling Green State University is an Equal Employment Opportunity/Affirmative Action employer and encourages applications from women, minorities, veterans, and persons with disabilities.

HIGH-TEMPERATURE GEOCHEMIST UNIVERSITY OF COLORADO AT BOULDER

The Department of Geological Sciences, University of Colorado at Boulder, invites applications for a tenure-track position in high-temperature geochemistry. We anticipate hiring at the assistant professor level, but applications at other levels will be considered from those who would strengthen the Department's diversity. We seek applicants with a demonstrated potential for innovative research; postdoctoral experience is beneficial. Any applicant specializing in the study of high temperature Earth processes and whose work complements existing research programs in the Department will be considered. However, applicants in igneous and metamorphic rock geochemistry and geochronology, rock/fluid interaction, and stable isotope geochemistry are preferred. The successful candidate will be expected to contribute to our undergraduate teaching program, including non-major course offerings, and provide graduate level courses in his/her specialty. Information regarding the Department can be found at <http://www.colorado.edu/GeoSci/>.

Applicants should send a current CV, statements of teaching and research interests, and the names of at least three potential references to: Chair, Geochemist Search, Department of Geological Sciences, University of Colorado, 399 UCB, Boulder, CO 80309-0399.

Inquiries for additional information should be directed to Dr. G. Lang Farmer (farmer@colorado.edu). Review of applications will begin on December 15, 2005. Applications will be accepted until the position is filled. The University of Colorado at Boulder is committed to diversity and equality in education and employment.

STATE UNIVERSITY OF NEW YORK COLLEGE AT ONEONTA EARTH SCIENCES DEPARTMENT ASSISTANT PROFESSOR IGNEOUS/METAMORPHIC PETROLOGY

The Earth Sciences Department at the College at Oneonta invites applications for a tenure track position at the rank of Assistant Professor with a start date of August 2006. This is a continuing position with an initial appointment of two years. The expectation includes instruction, research, student advisement, college service, continuing professional development, desire to teach in a primarily undergraduate environment and to involve undergraduates in research. The College is part of the SUNY system and enrolls 5,700 liberal arts and professional students. It is located in the western Catskill Mountains of the Appalachian Plateau. The nine-member Earth Sciences Department is multi-disciplinary, with undergraduate programs in geology, water resources, earth science, earth science education, environmental earth science and meteorology. The College offers a master's degree program with concentrations in geology and hydrogeology. The department has a strong history of excellence in teaching, faculty-student mentoring, and continued contact with alumni. For additional information, see the College's home page at <http://www.oneonta.edu>. Duties: Teach courses in mineralogy, igneous/metamorphic petrology, earth materials, introductory geology, and general earth science. Qualifications Required: Ph.D. in geology or related field. Applicant must have a strong background in igneous and/or metamorphic petrology and mineralogy. Preferred: Expertise in geochemistry; orientation toward field applications; experience in or interest in supporting K-12 earth science. To Apply: Send application letter, resume, copies of graduate transcripts, and have three professional references send letters to: Dr. Peter Muller, Chair Search Committee, Box GSA, #1030-D, Earth Sciences Department, SUNY Oneonta, Oneonta, NY 13820-4015. SUNY Oneonta is an EEO/AA/ADA employer. Women, minorities, and persons with disabilities are encouraged to apply.

IGNEOUS PETROLOGY/VOLCANIC HAZARDS CALIFORNIA STATE UNIVERSITY-LOS ANGELES

The Department of Geological Sciences seeks to fill a tenure-track position in igneous petrology, volcanology, or volcanic hazards at the assistant professor level, with a starting date of September 2006 and at an initial salary commensurate with qualifications and experience. A Ph.D. in geology from an accredited institution of higher education is required. The successful applicant must demonstrate a potential for or a record of research, scholarly and/or creative activity involving students whenever possible, and a potential for effective teaching

using a variety of methodologies. A demonstrated ability and/or interest in working in a multi-ethnic, multicultural environment and proficiency in oral and written communication are also required. Duties will include teaching at the undergraduate and graduate level. Teaching responsibilities will include igneous/metamorphic petrology, optical mineralogy, introductory courses, and advanced courses in applicant's area of expertise. We seek applicants capable of integrating laboratory and field instruction. Maintaining an active research program, mentoring and advising students at the undergraduate and graduate level, and participating in University service are expected. Applicant documentation should include a statement of teaching and research interests, a detailed curriculum vita, three letters of recommendation, and transcripts from institutions awarding highest degree. Employment is contingent upon proof of eligibility to work in the United States and completion of the University's Application for Academic Employment form. Review of applications will begin on November 14, 2005, and will continue until the position is filled. Address applications, required documentation and/or requests for information to: Dr. Kim Bishop, Search Committee Chair, California State University, Los Angeles, 5151 State University Drive, Los Angeles, CA 90032-8203, kbishop@calstatela.edu, (323) 343-2409. Department Web Page: www.calstatela.edu/dept/geology.

TENURE-TRACK ASSISTANT PROFESSOR POSITION STRATIGRAPHY/SEDIMENTOLOGY/ PALEONTOLOGY

CALIFORNIA STATE UNIVERSITY-CHICO

The Position: The Department of Geological and Environmental Sciences, California State University, Chico invites applications for a tenure-track position in Stratigraphy/Sedimentology/Paleontology beginning in the Fall 2006 semester. The candidate must possess a Ph.D. in Geology with a specialty in Stratigraphy, Sedimentology or Paleontology or a closely related field (by no later than the Fall 2006 appointment date) and must have the potential for excellent teaching, a demonstrated ability and willingness to teach field courses at the undergraduate level and a record of research.

As a university that educates students of various ethnic and cultural backgrounds, we value a diverse faculty and staff. CSU, Chico welcomes applicants who are knowledgeable about and interested in working within a cross-cultural learning environment.

The Department: The Department of Geological and Environmental Sciences includes 13 full-time faculty, about 30 graduate students and 130 undergraduate majors and offers programs leading to degrees in Geology, Geosciences (with options in hydrology and science education), and Environmental Science; and master's degrees in Geosciences and Environmental Science. The Department has a wide range of field and laboratory equipment for research and instruction in all the above disciplines. The Department also maintains a computer laboratory equipped with Sun and IBM workstations for student and faculty use. Campus support services, such as the library, are easily accessible.

The University: California State University, Chico is a fully accredited, state-supported member of a 23-campus CSU system serving approximately 16,000 students.

The Community: Located in the Sacramento Valley near the foothills of the Sierra Nevada, Chico retains the charm of a small town with reasonable cost of living while offering excellent medical services, public and private schools, and many cultural and recreational activities.

Application/Nominations: Candidates must submit a letter of application which includes teaching and research interests and teaching philosophy, complete academic transcripts (unofficial, verifiable transcripts are acceptable), three current letters of reference, samples of written and published materials and a curriculum vitae.

Closing Date: Application review begins **January 6, 2006**. Applications received after that date may be considered. Send application materials to: Dr. Richard Flory, Chair, Department of Geological and Environmental Sciences, California State University, Chico, Chico CA 95929-0205, Phone: 530-898-5262, Email: rflory@csuchico.edu.

For disability-related accommodations, call 530-898-6192, or TDD 530-898-4666.

For more information on the department and to view the full job description visit our Web site at www.csuchico.edu/geos/.

CSU, Chico only employs individuals lawfully authorized to work in the U.S. An EOE/AA/ADA employer.

THE UNIVERSITY OF WESTERN ONTARIO DEPARTMENT OF EARTH SCIENCES CANADA RESEARCH CHAIR, GEOPHYSICS-TIER I

The Department of Earth Sciences (<http://www.uwo.ca/earth>) at The University of Western Ontario (<http://www.uwo.ca>) wishes to enhance its prestigious, interdisciplinary research program through appointment of a Tier 1 Canada Research Chair (<http://www.chairs.gc.ca>) in an area of strategic importance to the Department and

the University, as outlined in the University's Strategic Research Plan (http://www.uwo.ca/research/general/VP_AVPIR.html).

The successful candidate will normally be appointed at the rank of Professor (tenured) and nominated as a Tier 1 Canada Research Chair. The appointee will introduce a unique, independently funded research program that complements or strengthens the following research fields: Properties of Natural and Synthetic Materials; Planetary and Solar System Evolution; Lithospheric Processes; Surficial and Environmental Systems. With research strengths in physics of natural materials, seismology and geodesy, the Geophysics group contributes to these fields. Although classroom-teaching responsibilities will be reduced, the successful candidate will be expected to teach at the undergraduate and graduate levels.

The closing date for applications is December 31, 2005. The starting date for the appointment will be July 1, 2006, or thereafter.

A detailed curriculum vitae, a research plan, and the names of three references should be sent to: Dr. H. Wayne Nesbitt, Chair, Department of Earth Sciences, The University of Western Ontario, London, Ontario N6A 5B7, Canada.

This position is subject to budgetary approval. Applicants should have fluent written and oral communication skills in English. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. The University of Western Ontario is committed to employment equity and welcomes applications from all qualified women and men, including visible minorities, aboriginal people and persons with disabilities.

GEOLOGICAL MATERIALS NORTHWESTERN UNIVERSITY

The Department of Geological Sciences at Northwestern University invites applications for a tenure-track position at the assistant or early associate professor level, for an appointment to begin Fall 2006. We seek an energetic and creative scientist with expertise in field-oriented, laboratory, theoretical, and/or remote sensing studies of geological materials. Although mineralogical-petrological expertise is desirable, any innovative approach to understanding the origin, composition and physical-chemical properties of geological materials will be considered. Deadline for applications is Dec. 15, 2005. Applicants should submit a letter of application, curriculum vitae, description of teaching and research objectives and accomplishments, selected reprints and preprints of published work, and the names and addresses of three or more referees to: Faculty Search Committee, Department of Geological Sciences, 1850 Campus Drive, Northwestern University, Evanston, Illinois 60208-2150. Northwestern is an Equal Opportunity/Affirmative Action Employer.

TENURE TRACK FACULTY POSITION THE COLORADO COLLEGE

The Department of Geology invites applications for a new tenure track position beginning in August 2006. We seek applications in any of the following areas: (1) geophysics applied to lithospheric or surface processes; (2) paleontology/geobiology; (3) geochronology applied to a wide range of geological problems. Candidate's expertise should complement but not duplicate the Department's existing strengths (more information about Colorado College and the Department of Geology is available at <http://www.coloradocollege.edu>). Appointment at the rank of Assistant Professor is anticipated. A Ph.D. is required and postdoctoral experience is desirable.

Teaching responsibilities will include: upper level courses that will enhance our present curriculum and field-based Introductory Geology. Ability to establish a dynamic research program and to mentor undergraduate research is essential. Interaction with the Environmental Science Program and participation in the College's interdisciplinary programs is desirable.

Applicants must be committed to high-quality, innovative undergraduate teaching, including field-oriented courses. Colorado College is a private liberal arts college distinctive for its modular "Block Plan" calendar, which lends itself to field- and project-based teaching. The academic year is divided into eight 3-1/2 week blocks. Students take and faculty teach one course at a time, with a maximum enrollment of 25 students per class. The College supports faculty research through release time and internal grants. The Department has six tenure-track faculty and four staff positions, a large group of dedicated majors, and excellent field, laboratory, and computer facilities for teaching and research.

The successful candidate will support and contribute to the goal of achieving greater diversity at Colorado College, and will be able to work effectively with the many constituencies in a college environment. Candidates are encouraged to apply and identify their strengths or experiences in contributing to greater diversity.

Send statement of teaching and research interests, curriculum vitae, and have three letters of reference sent by December 15, 2005 to: Eric Leonard, Chair, Department of Geology, Colorado College, Colorado Springs, CO 80903.

EQUAL OPPORTUNITY EMPLOYER—The Colorado College welcomes members of all groups and reaffirms its commitment not to discriminate on the basis of race, color, age, religion, sex, national origin, disability, or sexual orientation in its educational programs, activities, and employment practices.

**CHAIR OF THE DEPARTMENT OF
EARTH AND ATMOSPHERIC SCIENCES
SAINT LOUIS UNIVERSITY**

Saint Louis University, a Catholic Jesuit institution dedicated to student learning, research, health care, and service, is seeking applicants for the position of Chair of the Department of Earth and Atmospheric Sciences.

We seek an individual, preferably with administrative experience or abilities, to head a dynamic and diverse department of talented and energetic faculty with interests in Meteorology, Geology, and Geophysics. The new Chair will be expected to take a leadership role in increasing undergraduate and graduate enrollment, developing cooperative programs with other departments and national laboratories, balancing the needs and goals of the solid earth and atmospheric divisions of the department, and maintaining its strong research programs. The Candidate should have a Ph.D. in the atmospheric or solid earth sciences and a strong record of scholarly activity suitable for appointment at the rank of Professor. Exceptional individuals at the advanced level of Associate Professor may also be considered.

The Carnegie Foundation classifies Saint Louis University as a Doctoral/Research University-Extensive. The Department (<http://www.eas.slu.edu>) offers undergraduate degrees in Meteorology, Geology, Environmental Science, and Geophysics. An M.S. degree is offered in Geology, and Ph.D. degrees are offered in Meteorology and Geophysics.

To apply, send a letter of application, statements addressing research, teaching, and administrative philosophies, curriculum vitae, and a list of 5 potential referees with brief remarks indicating their relationship to the applicant to: Steven W. Buckner, Search Committee Chair, Monsanto Hall room 125, Saint Louis University, 3501 Laclede Ave., St. Louis, MO 63103. Electronic materials are acceptable and may be sent to buckners@slu.edu. Review of applications will begin December 9.

Saint Louis University is an Affirmative Action, Equal Opportunity Employer, (AA/EOE), and encourages nominations and applications of women and minorities.

**GEOGRAPHY/EARTH SCIENCE
SHIPPENSBURG UNIVERSITY OF PENNSYLVANIA**

Department seeks a broadly trained geoscientist/environmental geographer whose expertise complements existing departmental strengths for a tenure track Assistant Professor position beginning August 2006. Responsibilities: Teach undergraduate and graduate courses including introduction to geology, historical geology, and oceanography, plus additional courses in area of expertise. Preference will be given to candidates with a strong commitment to undergraduate teaching and with demonstrated interest in field-based teaching and student/faculty collaborative research. A demonstration of teaching effectiveness will be required as part of the interview. Candidates should address their commitment and ability to work with geographers in an interdisciplinary department focused on environmental science. Requirements: A terminal degree from an accredited institution is required for tenure (ABD at the time of hire may be considered). All candidates must furnish proof of eligibility to work in the U.S. upon appointment. Review of applications begins November 15, 2005 and will continue until position is filled. Qualified candidates should send letter of interest, curriculum vitae, official undergraduate and graduate transcripts, and three letters of reference to: Dr. William L. Blewett, Chair, Department of Geography and Earth Science, Shippensburg University of Pennsylvania, 1871 Old Main Drive, Shippensburg, PA 17257-2299. Phone: (717) 477-1685. Fax: (717) 477-4029. See www.ship.edu/~geog for more details. Shippensburg University is an Equal Opportunity Employer.

**ANALYTICAL/FORENSIC/
ENVIRONMENTAL CHEMISTRY
ARKANSAS STATE UNIVERSITY**

Arkansas State University is an Equal Opportunity/Affirmative Action Employer with a strong institutional commitment to the achievement of excellence and diversity among its faculty and staff.

In support of this commitment, the Department of Chemistry and Physics at Arkansas State University invites applications for a tenure track Assistant Professorship in analytical/forensic/environmental chemistry commencing August 2006. A Ph.D. is required. For more information see <http://chemistryand-physics.astate.edu/facopenings.htm>.

**TENURE TRACK GEOLOGY
WASHINGTON & LEE UNIVERSITY**

The Geology Department at Washington and Lee University (geology.wlu.edu) seeks applicants for a new tenure track, Assistant Professor position to begin Fall 2006. A Ph.D. is required. The successful candidate will be an excellent teacher and scientist in a specialty that

www.salemstate.edu/eo-hr

Salem



STATE COLLEGE

Geological Sciences Tenure Track Faculty

Seeking a specialist in earth surface processes, or a specialty that complements existing departmental strengths. Responsibilities include teaching undergraduate students, participating in departmental and college-wide committees, advising students, developing curriculum, and continuing professional development through creative or scholarly activity in the discipline. Typical teaching load is 12 hours. The position is advertised pending available funding. Required is a BS/BA and ABD status in Geological Sciences at the time of appointment and a commitment to excellence in undergraduate student research, fieldwork and K-12 teachers-in-training and in-service programs

A Ph.D. in Geological Science is preferred as is experience in and commitment to teaching in a multiracial, multiethnic environment with students of diverse backgrounds and learning styles, as well as in distance learning and instructional technologies, and candidates who enjoy serving as role models and mentors for a diverse student body.

The salary is competitive and commensurate with education and experience.

Application review will begin immediately and continue until an adequate pool is developed.

Application Instructions: Send us a letter of application, resume, appropriate transcripts and three letters of reference. Reference Code: 06-AA-F-GLS-ESP. **Office of Human Resources & Equal Opportunity, 352 Lafayette Street, Salem, MA 01970; Fax: 978-542-6163; Email: eo-hr@salemstate.edu (Word Attachments Only)**

SALEM STATE COLLEGE IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. PERSONS OF COLOR, WOMEN AND PERSONS WITH DISABILITIES ARE STRONGLY URGED TO APPLY.

complements and builds on the existing strengths of our faculty. We seek a colleague who is dedicated to diverse teaching approaches, is enthusiastic about teaching intensive major/non-major field geology courses, and will develop a strong research program including collaboration with undergraduates. W&L is a nationally ranked, highly selective liberal arts college. Our department is well equipped for high quality teaching and research, is ideally situated for field studies in the Appalachian Mountains of southwestern Virginia, and is a member of the Keck Geology Consortium. A resume, teaching and research statements emphasizing how the candidate's methods, interests, and experience will enhance our program, and 3 letters of reference should be sent to David Harbor (harbord@wlu.edu), Geology Department, Washington and Lee University, Lexington, VA 24450. Review of applications will begin immediately and continue until the position is filled. Washington and Lee University is committed to the development of a campus climate that supports equality and diversity. Minorities and women are encouraged to apply. Equal Opportunity Employer.

**MIAMI UNIVERSITY
GEOLOGY MUSEUM MANAGER**

The Limper Geology Museum of the Department of Geology at Miami University invites applications for a full-time staff position beginning October 1, 2006. Applicants must hold a master's degree in Geology or a related field at the time of appointment; a Ph.D. is preferred. Applicants also must have at least three years of relevant professional experience. A working knowledge in the geology and paleontology of the southwestern Ohio region is desirable. The successful applicant will assume a leadership role in promoting geoscience education within and outside the university community through integration of Limper Geology Museum resources with primary, secondary, and higher education curricula. The successful applicant also will be responsible for day-to-day museum operations, coordinating teaching and research use of and managing museum facilities and collections, organizing and hosting museum visitation and functions, developing new museum displays, pursuing funding opportunities to support museum activities and new acquisitions, maintaining a database of existing and new museum holdings, and assisting the department chair with infrastructure and facilities planning and management. Teaching opportunities may be available.

The Department of Geology currently consists of ten faculty members, two technical staff members, forty

undergraduate majors/minors and twenty-five graduate students. The Limper Geology Museum collections contain over 190,000 specimens. Please visit www.muohio.edu/geology/ for more information.

Miami University, with 17,000 students, is located in a small-town setting within a one-hour drive of Cincinnati and Dayton. Interested candidates should submit a packet containing a letter of application, curriculum vitae, statement of qualifications and achievements specific to the position responsibilities cited above, transcripts, and names and contact information of three professional references to be sent to: Limper Geology Museum Search Committee, Department of Geology, Miami University, 114 Shideler Hall, Oxford, OH 45056 (fax: 513.529.1542). Applications will be accepted until December 16, 2005 or until the position is filled. Miami University is an equal opportunity/affirmative action employer.

MISSISSIPPI STATE UNIVERSITY

Mississippi State University, Department of Geosciences, invites applications for one new full-time, non-tenure track INSTRUCTOR (9-month appointment with additional summer teaching and salary available and expected). M.S. degree required for the position. The position is in the Geosciences Distance Learning Programs and begins January 1, 2006.

The Instructor will be teaching a wide variety of courses in three distance learning programs—one in geosciences for teachers and two in meteorology. The successful applicant is expected to have a broad background in geoscience with extensive computer knowledge. Applicants need to be able to teach a wide range of courses. Interest in leading summer field courses for teachers in various locations across the country is desirable. Interest in distance learning techniques is essential.

The position will require the teaching of a wide variety of geology courses. Courses to be taught may include geology of North America, geomorphology, rocks and minerals, earthquakes and volcanoes, historical geology, physical geology and physical geography.

The Geoscience Distance Learning Programs offer B.S. and M.S. degrees in Geoscience. The distance learning programs have enrollments of over 750 undergraduate and over 300 graduate students. Enrollments are expected to continue to increase and new courses are being added. The department offers seventeen undergraduate courses and twenty-two graduate courses by distance learning. The Department of Geosciences is growing rapidly and currently has 11 tenure-track faculty, 9 instructors and three staff members.

CLASSIFIED ADVERTISING

Candidates should submit a letter of application, curriculum vitae, copies of transcripts, and the names of three people who may be contacted for letters of recommendation. Applications must be made online at <https://www.jobs.msstate.edu/>. Official transcripts should be sent to: Dr. Darrel W. Schmitz, Search Committee Chair, Department of Geosciences, P.O. Box 5448, Mississippi State, MS 39762.

Screening of applicants will begin November 1 and continue until the position is filled. Women and minorities are encouraged to apply. Mississippi State University is an Affirmative Action/Equal Opportunity Employer.

PLANETARY GEOLOGIST OHIO UNIVERSITY

The Department of Geological Sciences at Ohio University invites applicants for a tenure-track appointment at the assistant professor level in planetary mineralogy to begin September 2006. We are seeking a qualified individual with expertise in the geological processes operating on extraterrestrial planets and active interest in planet and solar system evolution. This position will expand and complement the department's existing strengths in earth and environmental systems and tectonics and allows for collaboration within Ohio University's Astrophysical Institute. Candidates should be able to teach mineralogy/petrology and planetary geology and be familiar with geologic field methods. Excellence in teaching at both the undergraduate and graduate level and supervision of graduate student research must be accompanied by the establishment of a strong research program supported by external funding. The successful candidate will possess a Ph.D. in Geological Sciences or a related discipline.

Applicants should send vitae, a description of research interests, a statement of teaching philosophy, and the names and addresses of three referees to: Search Committee Chair, Department of Geological Sciences, 316 Clippinger, Ohio University, Athens, OH 45701-2979. Applications should be received by December 12, 2005, but will be considered until the position is filled. Ohio University is an affirmative action employer: women and minorities are especially encouraged to apply. Ohio University is a Research-Extensive institution, enrolling 19,500 students on the Athens campus and more than 8,000 students on five regional campuses. For further information concerning the College of Arts and Sciences, the Department of Geological Sciences and the Astrophysical Institute, visit www.cas.ohiou.edu, www.ohiou.edu/geology and www.phy.ohiou.edu/~astro.

PRESIDENT'S PROFESSOR MINERAL AND ENERGY RESOURCES ENGINEERING COLLEGE OF ENGINEERING & MINES UNIVERSITY OF ALASKA FAIRBANKS

The College of Engineering and Mines at the University of Alaska Fairbanks, acting on an initiative from University of Alaska President Mark Hamilton, seeks applications for a Professor of Mineral and Energy Resources Engineering to lead the development of the Geological, Mining, and Petroleum Engineering Programs and related research activities within CEM. The President Professor of Mineral and Energy Resources Engineering will assume the leading role in research and education within the general area of Mineral and Energy Resources Engineering and its applications to the issues of resource identification, evaluation, and development in the arctic and sub-arctic environments of Alaska and elsewhere. This is a regular, full time Faculty position that is term funded for five years with an initial appointment of two years. An extension to the full five year term will be made contingent to a position performance evaluation at the end of the second year. The successful applicant will enjoy freedom to pursue his or her own research in addition to fulfillment of the leadership role.

Established as the original site of the University of Alaska in 1917, the University of Alaska Fairbanks (UAF) is a multi-campus university based in Fairbanks, the state's second largest city, with seven extended campuses spanning two-thirds of the state. Fairbanks is a vibrant community offering a wide range of cultural as well as outdoor activities and amenities typically found only in much larger cities. The UAF campus is located on a scenic hill on the edge of Fairbanks that offers a majestic view of the Alaska Range and access to ski and hiking trails through miles of boreal forest. UAF is the doctoral degree-granting unit of the University of Alaska statewide higher education system and includes over 10,000 students with an annual operating budget of \$340 million including \$113 million in FY04 research expenditures.

The College of Engineering and Mines consists of six ABET accredited undergraduate programs which include civil and environmental, electrical and computer, geological, mining, mechanical, and petroleum engineering. Masters and Ph.D. graduate programs are also offered. The research arm of the College, the Institute of Northern Engineering, administers approximately \$10M/year in research funds.

Minimum qualifications for the position are an earned doctorate in engineering or a related field at the time of appointment (at least one academic degree in engineering), qualifications for the rank of Professor, advanced background and demonstrated leadership in mineral and energy resources engineering, teaching experience at the undergraduate and graduate levels, and knowledge of issues related to mineral and energy resources engineering in Alaska. A strong candidate will possess, in addition to the qualifications above, strong interpersonal and communication skills, experience working with private and public external constituencies, and the ability to advocate for the College and to acquire funding from external sources.

APPLICATION: A complete vacancy announcement can be downloaded from our Web site at <http://www.uakjobs.com>. Please follow instructions provided on Web page.

Person(s) hired by the University of Alaska must comply with the provisions of the Federal Immigration Reporting and control Act of 1986 and must possess a valid social security card. All Nonresident Aliens must provide proof of eligibility to work. The University of Alaska is an equal employment opportunity/affirmative action employer and educational institution. Your application for employment with the University of Alaska is subject to public disclosure under the Alaska Public Records Act. Women and minorities are encouraged to apply. Applicants needing reasonable accommodation to participate in the application and screening process should contact the local human resources office.

ASSISTANT PROFESSOR OF GEOSCIENCES TWO TENURE TRACK POSITIONS IDAHO STATE UNIVERSITY

The Department of Geosciences at Idaho State University seeks applicants for two tenure-track Assistant Professor positions beginning August 2006, or possibly January 2006: (1) Geomorphology and Earth Systems Science and (2) Sedimentary Geology and Paleontology. Preference will be given to applicants with an in-hand doctoral degree in geosciences, strong field-oriented interests, and demonstrated teaching and research experience.

To apply, send a vita, personal statement of background and experience relevant to the position, including teaching, research, and service activities, and the names and contact information of three references to: Department of Geosciences, Geomorph/EES or Sed/Paleo Faculty Search, Campus Box 8072, Idaho State University, Pocatello, Idaho, 83209-8072. E-mail contact: geology@isu.edu. Review of applications for each position will begin October 15, 2005, and continue until the position is filled. Interested persons should see the departmental Web site for further information (<http://www.isu.edu/geology/>).

Position I. Geomorphology and Earth Systems Science

We seek an outstanding geoscientist with specialization in surficial processes, paleoclimatology or a related field. Interdisciplinary Earth Systems Science (EES) and expertise in geotechnologies applications (GIS, GPS, and/or remote sensing) are essential to teaching and research. Expertise in fluvial geomorphology and quantitative surficial processes is preferred, along with strong interests and applications in field geology. The successful candidate will contribute to a new undergraduate EES program and a proposed new graduate program in watershed science. Also desired is a willingness to serve as departmental liaison with the university's interdisciplinary GIS Training and Research Center (<http://giscenter.isu.edu/>), and to enhance integration of geotechnologies applications and interdisciplinary topics into the Geosciences curriculum. Instructional duties include undergraduate and graduate courses in introductory-level Earth Systems Science, senior-graduate level Global Environmental Change, and courses in the candidate's specialty area.

Position II. Sedimentary Geology and Paleontology

We seek an exceptional individual with specialization in sedimentary geology and paleontology, or in a closely related area. Preference will be given to candidates with strong interests and applications in field geology, and to those willing to serve as the departmental liaison to the Idaho Museum of Natural History (<http://imnh.isu.edu/>) located on campus. The successful candidate will complement and contribute to existing academic programs that focus on geotemporal and geospatial aspects of regional geology. An extensive paleontological collection is available. Instructional duties include undergraduate and graduate courses in sedimentary geology, paleontology, general geology, and the candidate's specialty area.

Idaho State University is an equal opportunity employer.

ACTIVE TECTONICS AND/OR ENGINEERING GEOLOGY CALIFORNIA STATE UNIVERSITY-NORTHBRIDGE

The Department of Geological Sciences invites applications for a tenure-track faculty appointment at the assistant professor level. Requirements are a Ph.D.,

an established record of published research in the area of active tectonics and/or engineering geology, a demonstrated record of teaching ability, and strong field skills. Preference will be given to applicants with experience in obtaining research funding, and who have research interests that complement and enhance existing departmental strengths. Teaching assignments will include undergraduate courses in geologic field mapping, a senior and/or graduate course in the hire's specialty, and, on a rotational basis, physical science for prospective K-5 teachers or appropriate general-education courses.

To apply send as e-mail attachments a *curriculum vitae*; statements of teaching and research interests; and names and addresses of at least three referees to j.d.yule@csun.edu. Include "Active Tectonics/Engineering Geo Application" in the subject line. Ancillary materials, such as copies of recent publications, may be mailed to: Dr. Doug Yule, Department of Geological Sciences, California State University, 18111 Nordhoff Street, Northridge, CA 91330-8266. Review of applications will begin December 1, 2005 and continue until the position is filled.

For additional information see: www.csun.edu/geology. The University is an EO/AA educator and employer. Candidates will be expected to provide effective instruction to students of diverse backgrounds in a multicultural setting. Position is subject to final approval of budget.

SEDIMENTOLOGIST, LAFAYETTE COLLEGE

Tenure-track Assistant Professor beginning Fall 2006. We seek a geologist with primary training and research interests in Sedimentology with secondary interests in fields such as Paleoenvironments, Paleontology, Paleobotany, or Geochemistry. 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 responsibilities include courses in sedimentology, historical geology, and participation in the core curriculum (First-Year Seminar or Values and Science/Technology). Applicants should 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 Dru Germanoski, Head, Dept. of Geology and Environmental Geosciences, Lafayette College, Easton, PA 18042-1768. We will interview at the Geological Society of America meeting in Salt Lake City; however, applications will be accepted through Jan. 15, 2006, or until position is filled. EEO/women and minorities encouraged to apply.

UNIVERSITY OF WYOMING GEOHYDROLOGIST

The Department of Geology and Geophysics at the University of Wyoming invites applications for a tenure-track position in geohydrology at the assistant professor level. Higher rank (associate professor) is possible for individuals with an established research program and demonstrated ability to secure external funding. Ph.D. is required at time of appointment, August 2006. We seek an individual who shows the potential to develop an internationally recognized, externally funded research program and who will be involved in the undergraduate and graduate teaching mission of the department. We welcome applicants with any specialization within the general field of geohydrology, including those who will build on departmental strengths in sedimentation, energy research, seismology, tectonics and structural geology. Additional information on the Department can be obtained on our Web page (<http://home.gg.uwyo.edu/>).

Applications should include a statement of research and teaching interests and accomplishments, curriculum vitae, graduate transcripts, and the names and contact information of three references. Review of completed applications will begin January 3, 2006. Send an electronic copy of your application to: Ms. Carol Pribyl at cpribyl@uwyo.edu; if you have additional application materials to send, please direct them to the Geohydrology Search Committee, Prof. Carol Frost, Chair, Department of Geology and Geophysics, University of Wyoming, 1000 E. University Ave., Dept. 3006, Laramie, WY 82071.

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

O.K. EARL AND TEXACO POSTDOCTORAL FELLOWSHIPS

The California Institute of Technology announces two fellowships in Geological and Planetary Sciences beginning with the 2006-07 Fall term. 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. Fellows are eligible to participate in Caltech's health and dental program. For fellowship details, please

visit www.gps.caltech.edu.

Materials in support of an application should include a curriculum vitae, list of publications, and a one-page statement of research interests. These should be sent in word or .pdf format to: chairman@gps.caltech.edu. The candidate should also request that three letters of reference be sent to the same email address. **All applications and references are due by Friday, December 16, 2005.**

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

TENURE TRACK POSITIONS EARTH SYSTEMS SCIENTISTS BOSTON COLLEGE

The Department of Geology and Geophysics at Boston College anticipates hiring two faculty in the broad area of Earth Systems Science over the next two years, with one position beginning Fall 2006. Areas of expertise might include but are not limited to environmental geochemistry, stable isotope geochemistry, biogeochemistry, and sedimentary processes. 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. The appointment is expected to be made at the Assistant Professor level, but outstanding individuals qualified for appointment at a 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: Faculty Search Committee, Department of Geology and Geophysics, Devlin Hall 213, Boston College, Chestnut Hill, MA 02467-3809. Electronic applications will be accepted, but only as a single PDF-file e-mail attachment sent to geo_position@bc.edu. Review of applications will begin on November 15, 2005. Department faculty will be available at the GSA and AGU fall meetings 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.

GEORGIA SOUTHERN UNIVERSITY

The Department of Geology and Geography invites applications for a tenure-track Assistant Professor in coastal geology. A Ph.D. in geology or a closely related field must be completed by the position starting date of August 1, 2006. Preference will be given to candidates who have active research projects on the Atlantic Coast of the United States, who apply GIS to their research, and who have prior undergraduate teaching experience. Full text of the advertisement, including information about the department, faculty, and the complete position announcement with all qualifications and application instructions, is available at <http://cost.georgiasouthern.edu/geo/>.

Screening of applications begins December 1, 2005, and will continue until the position is filled. Applications and nominations should be sent to: Dr. Charles H. Trupe, Department of Geology and Geography, Georgia Southern University, P.O. Box 8149, Statesboro, GA 30460. E-mail: CHTrupe@GeorgiaSouthern.edu.

Georgia is an open records state. Georgia Southern University is an AA/EO institution. Individuals who need reasonable accommodations under the ADA in order to participate in the search process should contact the search chair.

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 2006. We seek an outstanding individual who will combine field- and laboratory-based 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. Possible areas of emphasis could include (but are not limited to): (1) watershed-scale studies of organic and chemical compound transport, (2) biochemical processes in groundwater and surface waters, (3) geothermal fluid processes and geophysical fluid modeling, and (4) hydrologic and paleohydrologic studies of lake and river 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. Experience in industry and in numerical modeling of groundwater flow would provide an added benefit to our students.

The Department of Geology and Planetary Science is equipped with state-of-the-art analytical facilities, including stable and radiogenic isotope labs, ICP-AES instrumentation, a sediment core lab and carbon analyzer, an infrared spectroscopy laboratory, GIS and remote sensing computer laboratories with a multi-terabyte server, a paleomagnetic laboratory, and geophysical survey instruments including reflection seismic system and frequency and time domain electromagnetic systems. Additional information can be found on our Web site: <http://www.geology.pitt.edu/>.

Review of applications will begin on December 15, 2005. Qualified applicants should submit a curriculum vitae that includes a statement of research and teaching interests, current and past grant support, copies of relevant publications, and the names and contact information of at least four references. Send all information to Hydrogeology Search Committee, Department of Geology and Planetary Science, 200 SRCC, University of Pittsburgh, Pittsburgh, PA, 15260, USA.

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.

COASTAL SEDIMENTOLOGY BROOKLYN COLLEGE

The Department of Geology seeks to fill a new tenure track position in Coastal Sedimentology. The successful candidate will be expected to expand upon initiatives to integrate GIS into the curriculum, and teach courses related to sedimentology, oceanography, and GIS. The successful candidate will also be expected to maintain an active research program (a portion of which should focus upon aspects of the New York City region), contribute to collaborative research within the department, college, and the CUNY Earth and Environmental Sciences doctoral program, and supervise student research.

The successful candidate must have a Ph.D. Experience with ArcGIS is essential. The candidate should be able to demonstrate teaching and research ability in the areas listed. Teaching experience, professional recognition in his/her field, a balance of field and laboratory experience, and a history of collaborative research would enhance an application.

Salary is competitive and commensurate with qualifications and experience. Send curriculum vitae, three letters of recommendation, and writing sample or research plan to: Michael Hewitt, Assistant Vice President for Human Resource Services, Brooklyn College, 2900 Bedford Avenue, Brooklyn, NY 11210-2889. Review of applications will begin on November 1 and continue until position is filled.

SURFACE HYDROLOGY 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 surface hydrology, with an emphasis on water resource management. This appointment will be at the assistant rank starting September 1, 2006. Expertise in hydrodynamics, hydroclimatology, or water quality issues, and research and teaching capability in applied GISciences would be highly desirable. A Ph.D. is required at the time of appointment. Additional information about the position and the department is available at <http://www.csamontclair.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. Duke Ophori (ophori@mail.montclair.edu), Hydrology Search Committee Chair, 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.

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 2007. 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 2007 begins in October 2006.

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, 2005. Appointments will start October

2006 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.

Opportunities for Students

Earth Sciences Graduate Fellowship. The New Mexico Bureau of Geology and Mineral Resources, a division of New Mexico Tech, is soliciting candidates for the Kottlowski/Bureau Fellowship. The fellowship, for an incoming Ph.D. candidate in the Department of Earth and Environmental Science, offers a 12-month, \$22,000 stipend plus full coverage of tuition. The fellowship is renewable for up to three years. Additional funding is available to cover some laboratory and field expenses.

All Ph.D. applicants to the Department will be considered for the fellowship. The successful candidate may have interests in any earth or environmental science specialty, but will be expected to do a project within the state or of particular interest to the state, under the direction of advisors from both the Bureau and the Department. Application deadline is 1 February 2006. Applicants will automatically be considered for other support within the Department.

New Mexico Tech is a highly rated science and engineering university with more than 60 earth science faculty shared between the academic division and the Bureau. More complete descriptions of the fellowship, of New Mexico Tech, and of the Bureau are available at <http://www.nmt.edu/> and <http://geoinfo.nmt.edu/>.

Opportunities for Students: The Department of Geology at Kansas State University is seeking qualified applicants for its M.Sc. program. Located in the Flint Hills of Kansas, our department offers a wide-array of state-of-the-art computing, geophysical and microscopy equipment either in-house or through cross-campus collaborations. Areas of disciplinary strength include petroleum geology, geophysics/tectonics, geoscience education, geochemistry, and sedimentology/paleobiology. Recent students have completed field research in New Zealand, Colorado, Brazil, and the Aleutians. Assistantships are available beginning January 2006. For more information, please see <http://www.k-state.edu/geology/>, or contact the Geology Graduate Program Coordinator, Dr. Matthew Totten (mtotten@ksu.edu). Kansas State University is an equal opportunity/affirmative action employer.

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 1/15/06. Oregon State and Portland State Universities are committed to equality in education.

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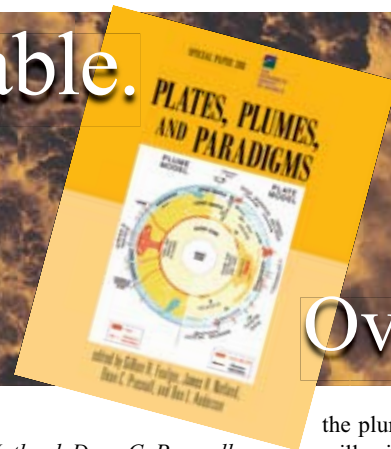
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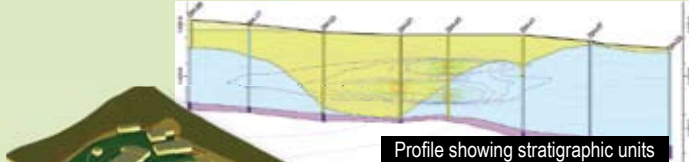
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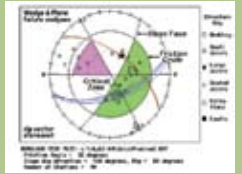


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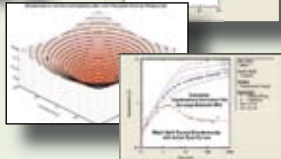
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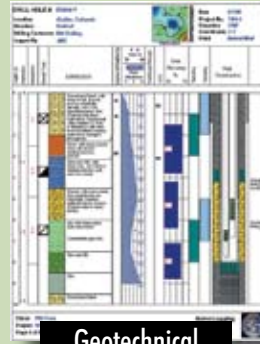
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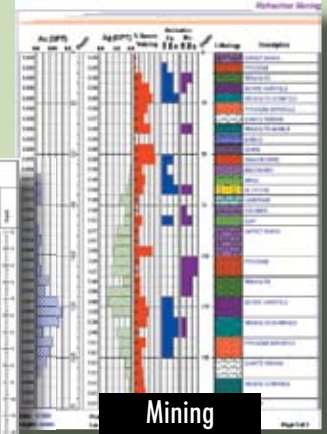
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