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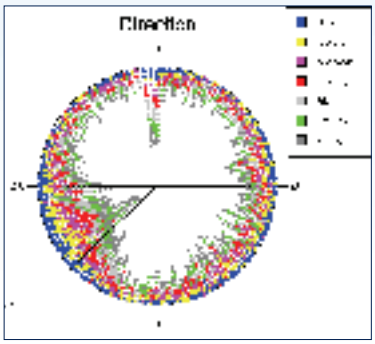

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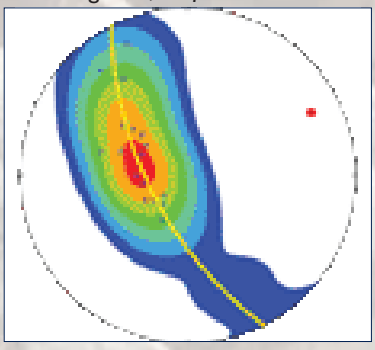

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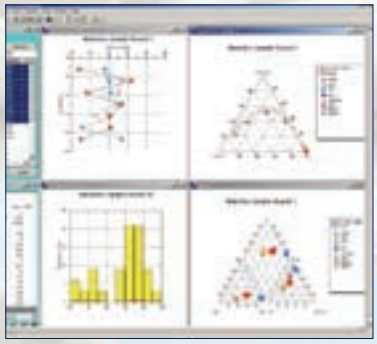

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SCIENCE ARTICLE

Cover: Air oblique view of northern rim of Rangiroa atoll in Tuamotu Archipelago of French Polynesia. Visible islets cap a segment of the annular reef of the atoll rim (circumference ~165 km with ~100 total islets). Open ocean to left, with breaker line on atoll exterior. Interior atoll lagoon on right. See "Pacific atoll living: How long already and until when?" by W.R. Dickinson, p. 4–10.

Erratum: The picture caption on page 21 of the January 2009 *GSA Today* (v. 19, no. 1) erroneously describes the site as mounds built by the Tocobaga Indians. The image is actually from Egmont Key State Park near St. Petersburg, Florida. *GSA Today* regrets the error.

Pacific Atoll Living: How Long Already and Until When?

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ABSTRACT

Modern atoll reefs began to grow after rising postglacial eustatic sea level overtopped degraded carbonate platforms that had been exposed as subaerial limestone plateaus during synglacial drawdowns in sea level. Stable atoll islets atop emergent paleoreef flats did not begin to develop until after the mid-Holocene hydro-isostatic sea level highstand in the tropical Pacific Ocean. Atolls have been occupied since stable islets formed during the last two millennia. Rising global sea level will impact atoll environments adversely for continued habitation once ambient high-tide level rises above the mid-Holocene low-tide level. That crossover will submerge the resistant paleoreef flats that underpin stable atoll islets and subject their unconsolidated sediment cover to incessant wave attack before ambient sea level actually overtops the islets.

INTRODUCTION

Pre-industrial peoples managed to live in many marginal environments—the fringe of the desert, the edge of Arctic ice, or the uphill limit of mountain vegetation—but none more marginal than the nearly seamless blend of land and sea on Pacific atolls, where surfaces of reef islets are generally <3 m above mean sea level.

The isolated atoll environment (Fig. 1) seems timeless, but this impression is misleading. Atolls have been habitable for no more than one or two millennia, and their future viability for human occupation may be limited to centuries or only decades in the face of rising global sea level. This paper reviews evidence for the past evolution of intra-Pacific atolls, and of the carbonate platforms they cap, and then considers their likely future evolution.

PACIFIC ATOLL PROVINCES

Atolls are spread across the tropical Pacific Ocean for 9000 km (Fig. 2), twice the width of the conterminous United States and equivalent to the distance across Eurasia from Great Britain to Korea. Although there are >175 Pacific atolls and isolated coral islets, their net land area is only 1800 km^2 (less than half the size of Rhode Island), and their total population is only 180,000 (average of 100/km^2). Areas of central lagoons are two to three orders of magnitude larger than the combined areas of girdling islets, and the largest lagoons are comparable in size to the land area of all Pacific atoll islets combined.

Atolls developed atop carbonate platforms grown on sinking volcanic edifices (Darwin, 1842). Built either as hotspot chains or at isolated volcanic centers on the Pacific plate, these

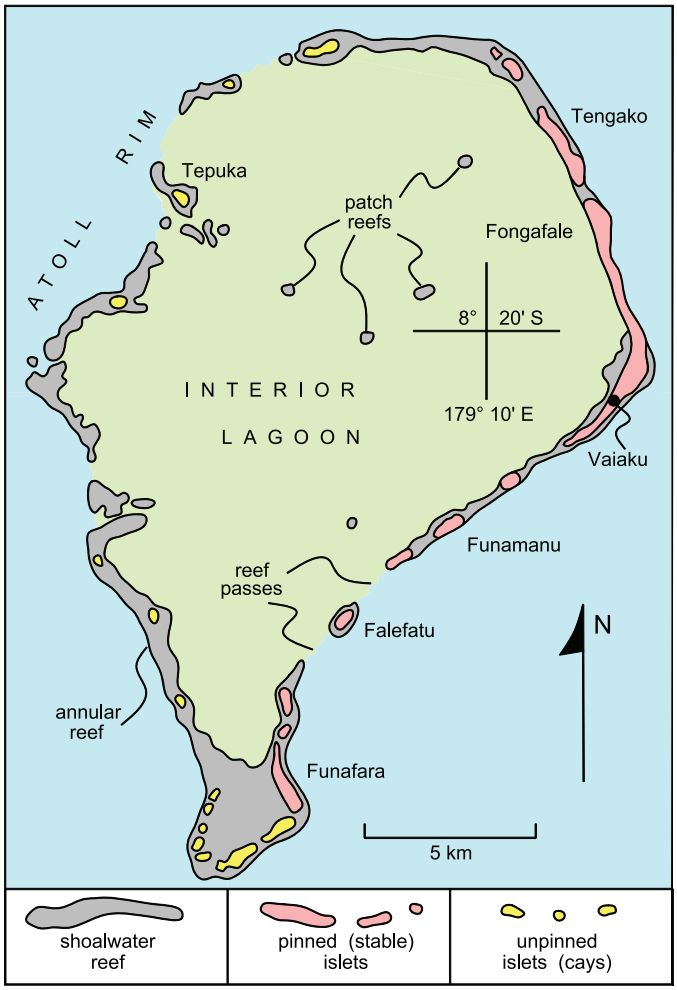

Figure 1. Configuration of the classic atoll of Funafuti (David and Sweet, 1904) in Tuvalu after Dickinson (1999).

edifices subsided as oceanic lithosphere progressively cooled (Scott and Rotondo, 1983a, 1983b). The occurrence of almost-atolls (Davis, 1920), where volcano remnants rise from central lagoons surrounded by barrier reefs of atoll dimensions, encouraged an erroneous supposition, first advanced by Darwin (1842) and later developed in detail by Davis (1928). They posited that atoll reefs grew upward from antecedent fringing reefs formed along the shorelines of foundering islands as they sank within an ocean basin maintaining stable sea level. Daly (1910) first noted, however, that the hypothesis linking ancestral fringing reefs to descendant atoll reefs was not viable because stable sea level was not maintained during Quaternary glacial-interglacial fluctuations. Darwin, working and writing at a time before the Agassiz arguments for Pleistocene glaciation had been advanced, was unaware of inherent fluctuations in Quaternary sea level. The geologic history of atolls is more complex than Darwin and Davis envisioned.

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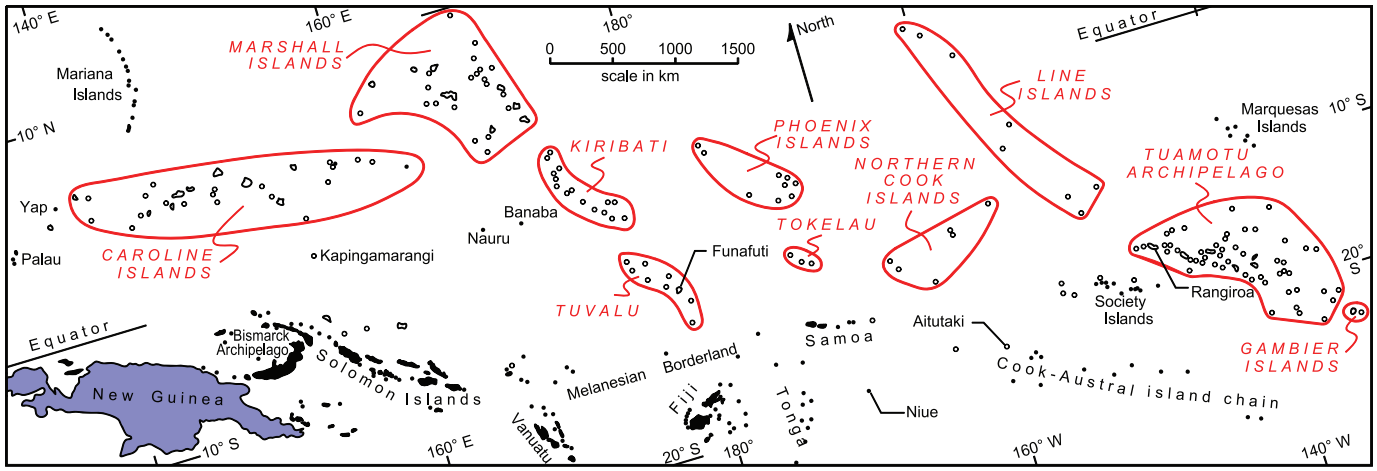

Figure 2. Atoll provinces (in red) of the tropical Pacific Ocean. Open symbols are largely atolls and almost-atolls but also include low-lying reef islands capping table reefs that lack enclosed lagoons. Solid symbols are high islands of volcanic or tectonic origin, including uplifted limestone islands. Islands and atolls too small to show at true scale are shown arbitrarily as solid or open circles.

SYNGLACIAL ATOLL EMERGENCE

At the peak of the last glaciation, eustatic sea level dropped 120 m below modern sea level (Peltier, 2002), but the deepest atoll lagoon floors lie <85 m below modern sea level, with mean-modal-median depths in the range of 20–36 m (Purdy and Winterer, 2001, 2006; Vecsei, 2003). Carbonate platforms now capped by atolls formed emergent limestone plateaus that rose abruptly above the synglacial sea surface like flotillas of giant ships (Fig. 3). Their paleotopography can be gauged from the configurations of emergent paleoatolls uplifted along the forebulges of modern trenches. For example, the uplifted limestone island of Niue (Fig. 2), on the forebulge of the Tonga Trench, has an oval area of ~260 km^2 composed principally of a flat interior plateau (paleolagoon floor) at an elevation of 30–40 m surrounded by an annular ridge at an elevation of 55–65 m, formed by the Pliocene Mutulau paleoreef (Dickinson, 2001).

Holocene atoll reefs began to grow upward disconformably above the degraded surfaces of last-interglacial reefs during the interval 9–8 ka, when postglacial eustatic sea level, which began rising ca. 19 ka (Clark et al., 2004), first overtopped the gradually drowning limestone plateaus (Figs. 4A and 4B). The Holocene reefs reach thicknesses of 14 ± 4 m beneath the seven Pacific atoll rims and barrier reefs that have been cored (Dickinson, 2004).

The annular shape of atoll reefs is not inherited from predecessor fringing reefs, but stems from the saucer profile (Fig. 4A) of emergent carbonate platforms subject to solution weathering during subaerial exposure (MacNeill, 1954). Analogous topography has been described from modern Pacific islands where highstanding solution ramparts are present along the rims of limestone plateaus and emergent coral terraces (Hoffmeister and Ladd, 1945; Flint et al., 1953; Cloud et al., 1956; Tracey et al., 1964). As noted by Purdy and Winterer (2001), the fundamental morphology of atolls and their lagoons is "solution determined rather than growth predicated" (p. 137).

MID-HOLOCENE HIGHSTAND

There is yet another crucial aspect of atoll evolution. As eustatic sea level rose during early Holocene time, growing atoll reefs kept pace or caught up with ambient low-tide levels to construct reef flats standing at elevations of 1.0–2.4 m above modern low-tide level at the time of the mid-Holocene hydro-isostatic highstand in tropical Pacific sea level (Dickinson, 2004). Figure 5 shows areal variations in the magnitude of the highstand within Pacific atoll provinces based on

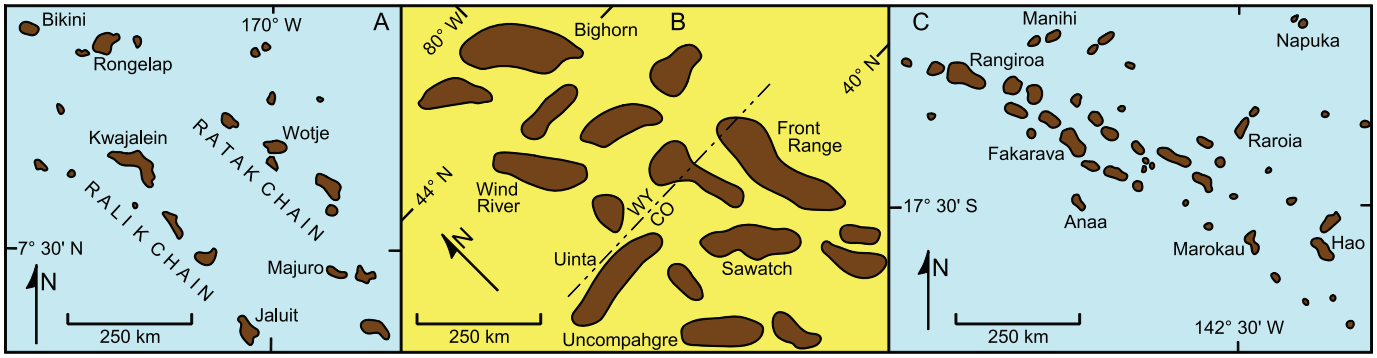

Figure 3. Emergent synglacial limestone plateaus (brown) of the Marshall Islands (A) and Tuamotu Archipelago (C); to convey a graphic sense of their immense geographic extent, Paleogene Laramide uplifts (brown) of the Colorado (CO)–Wyoming (WY) Rocky Mountains (B) are shown at the same scale.

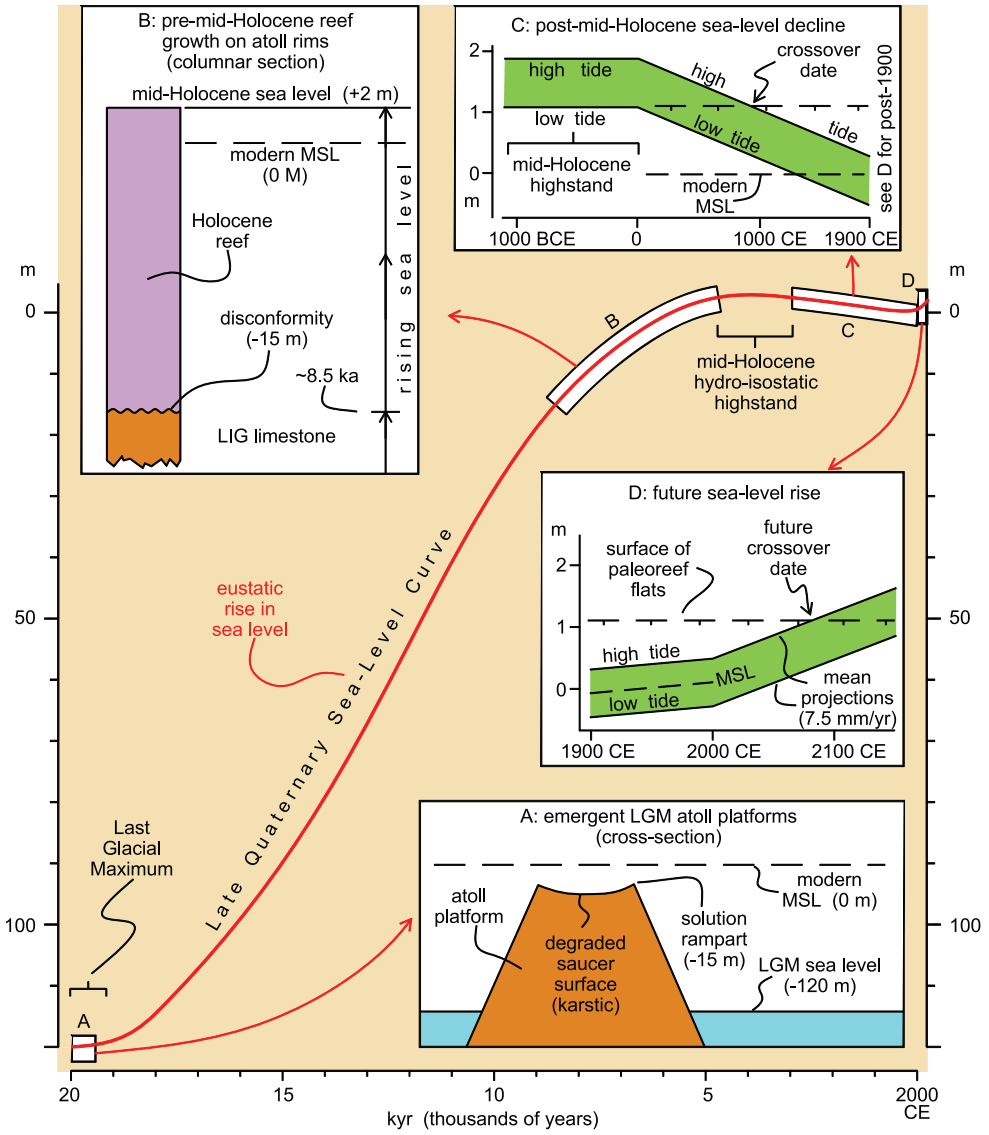

Figure 4. Late Quaternary sea-level curve for tropical Pacific islands (red line) and synoptic effects of changing sea level on atoll evolution (insets). (A) Atoll platforms emergent as subaerial limestone plateaus at Last Glacial Maximum (LGM). (B) Growth of Holocene reef limestone on atoll rims after rising eustatic sea level overtopped the degraded surfaces of Last Interglacial (LIG) paleoreefs (upward limit of reef growth at low-tide level of mid-Holocene hydro-isostatic highstand in regional sea level). (C) Post-mid-Holocene decline in sea level carries ambient high-tide level below mid-Holocene low-tide level (crossover date), fostering the nucleation of stable atoll islets on resistant underpinnings of emergent mid-Holocene paleoreef flats. (D) Projected rise in sea level during continued global warming to carry ambient high-tide level above mid-Holocene low-tide level (overtopping mid-Holocene paleoreef flats at crossover date), thereby allowing fair-weather wave attack on unconsolidated sediment cover of atoll islets. Scale origins: elevation (m): 0—modern mean sea level (MSL); time (kyr): 0—2000 CE.

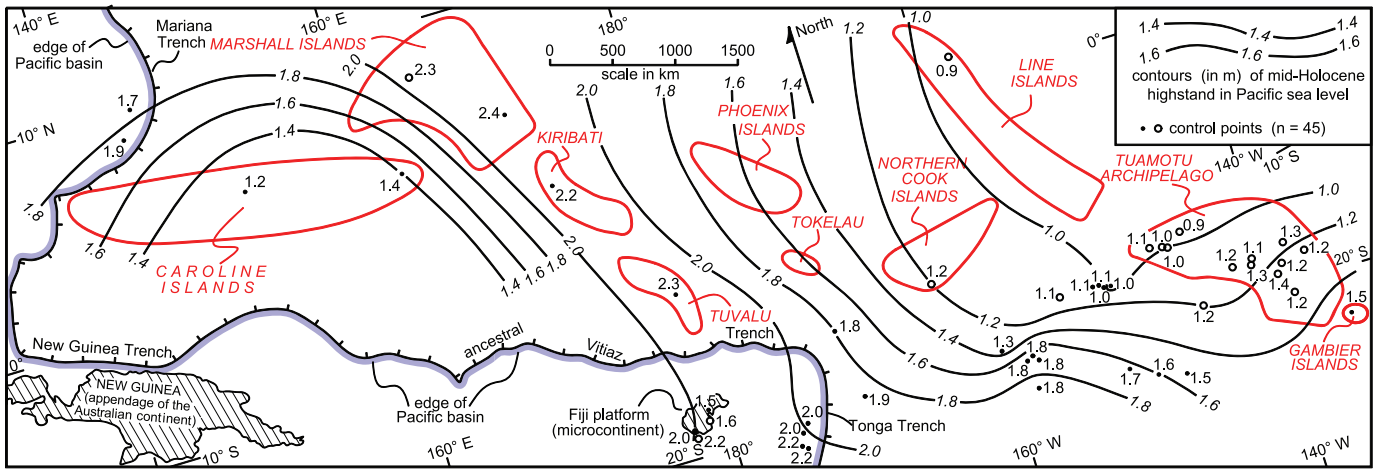

Figure 5. Contours of the magnitude (above modern sea level) of the hydro-isostatic mid-Holocene highstand in regional sea level across the tropical Pacific Ocean; solid dots are control points (number [*n*] = 27) from personal observations (Dickinson, 1998, 1999, 2000, 2001, 2003; Dickinson et al., 1999; Dickinson and Burley, 2007), and open dots are congruent control points (*n* = 18) from others (Pirazzoli and Montaggioni, 1986, 1988; Nunn, 1988, 2000; Woodroffe et al., 1990; Woodroffe and McLean, 1998; Grossman et al., 1998). For contouring, control points within the microcontinental Fiji platform were ignored from the perspective that isostatic upflexure of the platform under the enhanced load of deepening water offshore promoted emergence that partly counteracted sea-level rise (Nakada, 1986).

empirical observations of the elevations of mid-Holocene paleoreef remnants above modern reef flats. An axis of maximum highstand transected atoll provinces along the Marshall-Kiribati (Tongaru)–Tuvalu-Tonga axis, with highstand minima to both the east and west.

The tropical highstand in sea level was a facet of global isostatic adjustment, through slow mantle flowage, to the transfer of mass from circumpolar Pleistocene ice sheets to the Holocene oceans (Dickinson, 2001). Drawdown in tropical Pacific sea level by equatorial ocean siphoning (Mitrovica and Peltier, 1991) transferred the seawater required to cover (a) collapsing submarine arches that had surrounded the surficial loads of ice sheets at high latitudes, and (b) deepening continental shelves that downflexed under the load of augmented meltwater offshore (Mitrovica and Milne, 2002). The theoretical peak of the highstand was 4 ka, but the secular crest of the highstand was broad, and sea levels empirically indistinguishable from highstand conditions persisted locally until ca. 2 ka (Dickinson, 2003). Areal variations in the timing of highstand termination (Table 1) presumably reflect varying mantle properties, such as those associated with the South Pacific superswell (McNutt and Judge, 1990), but are not presently well understood. The post-highstand decline in regional sea level was essentially monotonic and linear (Chappell, 1983; Woodroffe et al., 2000), although available data cannot preclude minor late Holocene fluctuations in sea level superimposed on the dominant secular trend.

TIDAL CROSSOVER DATE

During the highstand, atoll reefs were largely awash, although some transient sand cays may have been thrown up by wave action along the circumferential trends of the annular reef flats. As late Holocene sea level declined at Pacific atolls, however, ambient high tide eventually fell below the surfaces of paleoreef flats constructed at mid-Holocene low-tide level (Fig. 4C). After that crossover date (Dickinson, 2003), which varied from one atoll cluster to another (Table 1), islets could be constructed by wave action atop remnant paleoreef flats underlain by cemented reef limestone resistant to wave attack. Islets of this type, blanketed by unconsolidated surficial sediment emplaced by storm washover but underpinned by solid foundations, are termed *pinned islets* (Dickinson, 2004). These are the stable islets of atolls because they are held in place by firm paleoreef underpinnings that gird their flanks from wave attack (Dickinson, 1999). Transient sand cays that lack underpinnings of mid-Holocene paleoreef flats shift their positions and morphology in irregular patterns under both fair-weather and storm-wave attack on atoll reefs (Richmond, 1992).

Pinned islets are consistently most prevalent on the eastern flanks of atoll rims (Fig. 1), facing the prevailing trade winds of the tropical Pacific. Reef growth is more vigorous along the windward rims of atolls, where reefs are pervasively bathed by wind-driven seawater richer in nutrients than the more stagnant seawater contacting leeward atoll rims. Emergent remnants of mid-Holocene paleoreef flats are consequently more extensive and support more pinned islets along the windward eastern sides of most atolls. The relict reef flats inherited from the mid-Holocene highstand are of signal importance for the existence of stable atoll islets.

Crossover dates for each atoll province can be inferred from local magnitudes of the mid-Holocene highstand, the times of its effective termination, and local tidal ranges (Table 1), but generally fall within the interval 500–1000 CE. Human settlement of atolls was typically delayed until after the crossover date, when stable islets could form on atoll rims (Dickinson, 2003), and atolls have generally not been occupied for more than 1000–1500 yr.

TABLE 1. INFERRED CROSSOVER DATES FOR PACIFIC ATOLL CLUSTERS*

Atoll cluster[†]	highstand magnitude[§] (m)	highstand termination[#] (BCE or CE)	tidal range (m)	past crossover date** (CE)	earliest future crossover date[††] (CE)	latest future crossover date[§§] (CE)
western Caroline Islands[##]	1.6	100 CE	1.2	400	2050	2100
central Caroline Islands	1.2	100 BCE	0.6	500	2060	2120
eastern Caroline Islands	1.4	200 BCE	0.9	600	2050	2100
Marshall Islands	2.4	600 BCE	1.6	700	2080	2160
Kiribati-Tungaru chain	2.2	300 BCE	1.5	1000	2070	2140
Tuvalu	2.3	200 BCE	1.6	1100	2070	2140
Tokelau[##]	1.8	100 BCE	1.0	1000	2080	2160
Phoenix Islands[##]	1.7	100 BCE	1.0	900	2070	2140
northern Cook Islands	1.1	400 CE	0.6	900	2050	2100
Line Islands (Kiritimati)	0.9	300 CE	0.4	800	2050	2100
northern Tuamotu Archipelago	1.0	500 CE	0.3	900	2070	2140
Society Islands (Tupai)	1.0	100 BCE	0.3	500	2070	2140
southern Tuamotu Archipelago	1.2	600 CE	0.4	900	2080	2160
Gambier Archipelago (Temoe)	1.5	300 CE	0.7	900	2070	2140
Cook-Austral chain (Aitutaki)	1.3	200 BCE	0.8	800	2050	2100

Note: BCE—before common era; CE—common era.

*All elevations ± 0.1 m (observational uncertainty) and past dates ± 100+ yr (owing to sparse age control and/or uncertainties in radiocarbon calibrations).

[†]See Figure 2 for location (islands in parentheses are relevant individual atolls or almost-atolls).

[§]From Figure 5.

[#]Adapted from Dickinson (2003).

**Date when declining high tide fell below paleoreef flats built to mid-Holocene low-tide level (adapted from Dickinson, 2003).

[††]Date when rising high tide will submerge mid-Holocene paleoreef remnants if global sea level rises ~1.0 m by 2100 CE.

[§§]Date when rising high tide will submerge mid-Holocene paleoreef remnants if global sea level rises only ~0.5 m by 2100 CE (and continues to rise thereafter at the same rate).

[##]Data interpolated from neighboring island groups (no internal data available).

This insight was initially advanced by Pirazzoli and Montaggioni (1986) for the Tuamotu Archipelago, which they judged could not have been occupied before 800 CE. Archaeological investigations elsewhere have shown that human occupation of the almost-atoll of Aitutaki (Fig. 2) in the southern Cook Islands was delayed until as late as 1200 CE (Allen and Wallace, 2007), and there is no robust evidence for occupation of the atolls in the northern Cook Islands any earlier (Dickinson, 2003). The oldest known habitation sites in Tuvalu (Dickinson et al., 1990) and Tokelau (Best, 1988) similarly date from ca. 1000 CE. However, radiocarbon ages for cultural sites date back to the first millennium CE for multiple atolls in the Marshall Islands (see references in Dickinson, 2003). The somewhat earlier occupation of the Marshall Islands may have been promoted by the comparatively large local tidal range (Table 1), allowing for pre-crossover emergence of mid-Holocene paleoreef flats to elevations high enough above ambient low-tide levels to foster nucleation of habitable atoll islets.

RISING SEA LEVEL

During the twentieth century, global sea level rose at a persistent mean rate of 1.7–1.9 mm/yr (Douglas, 1997) due to combined eustatic and steric effects (Miller and Douglas, 2004). If we assume that the indicated rate of sea-level rise has persisted since the onset of global warming ca. 1908 (Jones et al., 1999), the aggregate rise over the past century can be hindcast as 180 mm. Satellite altimetry suggests that the rate increased to ~2.5 mm/yr over the last decade of the twentieth century and to ~4 mm/yr during the first decade of the present century (Beckley et al., 2007), but continued satellite observations are required to distinguish a lasting secular trend from a transient effect. A steady rise in sea level at ~2.5 mm/yr might have been maintained, however, through the whole latter half of the twentieth century, were it not for the impoundment of water in artificial reservoirs on land (Chao et al., 2008). In any case, the increase in the rate of sea-level rise over the past 15 yr would sum to only an additional 20 mm of net rise, for an aggregate of 200 mm over the past century. This centennial trend in past global sea level cannot readily be detected on shorelines of Pacific islands because of (a) seasonal fluctuations of 100–200 mm in local sea level as trade winds wax and wane, and (b) multi-annual fluctuations of as much as 500 mm in regional sea level between El Niño and La Niña phases of the Southern Oscillation (Cane, 2005) as episodic shifts in prevailing winds blow seawater back and forth across the ocean basin (Sherwood and Howorth, 1996).

If continued long enough or enhanced by further global warming, a future rise in sea level is a clear threat to atoll dwellers (Roy and Connell, 1991). Forecasts of future global sea levels are inherently uncertain, but a postulated sea-level rise in the range of 0.5–1.0 m by the year 2100 is the most likely estimate based on various studies (Raper and Braithwaite, 2006; Rahmstorf, 2007; Meier et al., 2007; Pfeffer et al., 2008). This range of projected change in sea level would carry ambient high tide above mid-Holocene low tide at most atolls, in effect producing another crossover date from rising rather than falling sea level (Fig. 4D). The indicated crossover dates (Table 1) are in the latter half of this century (2050–2080 CE) for rapid future rise in sea level (~10 mm/yr) or in the first half of the next century (2100–2160 CE) for a slower net rate of rise (~5 mm/yr). Projection of the historic rate of sea-level rise (≤2.5 mm/yr) into the future would delay the crossover date until 2200 CE or later, but persistence of the past rate of sea-level rise cannot be expected unless extant predictions of accelerating sea-level rise from enhanced global warming are invalid.

After the future crossover date, stable pinned islets composed of unconsolidated sand resting on the remnant surfaces of inherited mid-Holocene paleoreef flats will be exposed to potentially devastating fair-weather wave attack (Dickinson, 1999). Flanking buttresses formed by the erosional edges of the cemented paleoreef flats protect the islet interiors from surf except during hurricanes and cyclones with strong waves and high storm surges, but their shielding would be lost once paleoreef flats are submerged. Stable islets might thus be destroyed by wave attack long before rising sea level ever overtops their surfaces.

The projected future crossover dates in Table 1 provide a provisional basis for gauging when higher sea levels may become an existential threat to atoll dwellers. Given substantive uncertainties in future forecasts for global sea level, the inferred dates must be regarded as indicative rather than conclusive. Even so, prudence dictates that contingency planning should begin soon for atoll populations potentially at risk from rising sea level. Adaptation to changing conditions may eventually become infeasible on many atolls.

CONCLUSIONS

The annular Holocene reefs of modern intra-Pacific atolls grew during the past 8–9 ka after rising postglacial eustatic sea level overtopped the degraded remnants of last-interglacial reefs exposed to subaerial weathering during the last glaciation. Raised atoll rims do not reflect the upward growth of ancient fringing reefs surrounding volcanic islands that have subsided beneath atoll lagoons, but were produced as solution ramparts rimming carbonate platforms exposed to the atmosphere during synglacial drawdowns in sea level. A mid-Holocene hydro-isostatic highstand in tropical Pacific sea level drowned atoll rims and built reef flats above modern sea level. Human occupation of most atolls was delayed until ambient high tide fell below the mid-Holocene low-tide level. After that crossover date, stable atoll islets formed with underpinnings of resistant mid-Holocene paleoreef flats to protect the flanks of the islets from wave attack. If rising future sea level overtops the mid-Holocene reef remnants, atoll islets will become subject to enhanced erosion long before sea level overtops the surfaces of the islets. My hazard analysis underscores the importance of understanding the geomorphic history of atolls for estimating the risks associated with a rise in sea level during future global warming.

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GEOLOGIC PAST

Highlighting Past Articles from *GSA Bulletin*

"Geology in the World War and After"

Whitman Cross, *GSA Bulletin,* March 1919

In his presidential address delivered to the Society on 31 Dec. 1918 and published in *GSA Bulletin* in March 1919 (v. 30, p. 165–188), Whitman Cross lauds the termination of "the great World War," and labels it "the war of the Age of the Natural Sciences" (p. 165)—one "in which all the resources of science have been called into play" (p. 166). His *GSA Bulletin* article covers six main points:

1. The Role of Geology in Earlier Wars

Cross cites examples from the Crimean and Boer wars as well as "the contest between the Japanese and the Russians in Manchuria," which convinced many that "extended earthwork defenses or trenches … might prove to be the dominant kind of warfare in the future" (p. 167). Cross explains that "the routes of approach and the positions for defense have been and must always be determined primarily by topographic and geographic positions" (p. 166), but the study of topographic geology was not always incorporated into the plan of battle (as recognized in studies of the Civil War; e.g., Whisonant and Ehlen, 2008). Though not employed in earlier wars to study the lay of the land, geologists were "utilized in practically all armies in the last few decades … in the limited field of the engineering problems" of fortification and water supply (p. 167).

2. Conditions at the Beginning of the War

"The greatly increased application of geological knowledge in the present war has been due, first of all, to the development of position warfare" (p. 167), an important facet of which is trench warfare, writes Cross. "It would seem," he notes, "that the Germans may have prepared in some measure for trench warfare … for they dug in with amazing rapidity after the first battle" (p. 168). Yet, according to Cross, the German army "had planned a different kind of campaign" and "their study of position warfare was far from thorough" (p. 168). What the Germans did have was a particularly ingenious retired captain, Walter Kranz, who, a year before the outbreak of the "Great War," had published an article calling for the elevation of geology from the status of scientific "stepchild" to an essential facet

of modern warfare. Kranz' article had such great impact that once the United States entered the war, U.S. censors declared that "publications which permit to be recognized the effectiveness of geology or kindred sciences in the service of the army are not permissible in the technical as well as in the daily press" (p. 169, quoting the 25 May 1917 *New York Times*; see also Goldstein, 2001).

3. Organization of Geological Work in the Allied and German Armies

"When the war broke out no one of the armies engaged possessed any organized geological service" (p. 169). Once the Germans realized that they had been forced into position warfare, however, they immediately put together a geological service of "perhaps 75 to 200 men" (p. 170). The British army established a "small advisory corps of geologists," but the Italian, Belgian, and French armies "apparently had no particularly organized geological force" (p. 170). "The American Expeditionary Corps," Cross writes, "had the advantage of possessing in its Engineer Corps … one of the most broadly trained American geologists, Alfred H. Brooks" (p. 170), who soon developed a staff of geologist-officers under him.

4. Geological Service on the Western Front

Several geoscience specialties were of particular value at the front: (1) **engineering geology**; (2) **stratigraphic geology and lithology**—providing information on "the variety of geological formations" (p. 172) across the expansive battleground, "ranging from the dune sands and marshes of Flanders to the crystalline rocks of the Vosges Mountains," and crossing "sections of Tertiary, Cretaceous, Jurassic, and Triassic sediments, including chalk, limestone, sandstone, shale, marl, clay, and various transition rocks, as well as valley and slope deposits of recent age" (p. 172); (3) "**hydrographic geology**" to ascertain the presence of ground- and surface waters for the troops; and (4) **medical geology** (though not labeled as such) as seen when, during tunneling efforts, troops "were greatly afflicted by sores of special character. Three thousand to four thousand were incapacitated. The medical corps could not understand the prevalence of this trouble … [until] … the clay material of the tunnel walls was closely examined and found to act like fullers' earth in removing the natural greases from the skin, which thus dried and cracked, permitting ready infection" (p. 175).

5. The Work of the Division of Geology and Geography in the National Research Council

Cross' knowledge "of the use made of geology in several of the principal armies engaged in this war" (p. 171) was a result of his association with the National Research Council (NRC). The NRC formed in 1916 and was reorganized in 1918 in light of the "emergency conditions of the war" (p. 176). Under the NRC, specific roles for geologists during wartime were outlined, including fuel and "war minerals" location and mining; map making and interpretation; road and fortification construction; water supply location; and instruction of military officers in the "vital significance of natural features of the battle terrain" (p. 178). NRC scientists put together three earth-science textbooks for educating military officers, but their publication was delayed "by strikes and ravages of the influenza epidemic" (p. 181).

6. Geology after the War

Here, Cross examines "how much of good and how much of evil" came from "thousands of scientific men [leaving] their laboratories and class-rooms to plunge with intense earnestness into war problems" (p. 185). He concludes that "the greatest benefit to science … lies in the fact that there has never before been a period in the history of the world when the truth of the proverb, 'Knowledge is power,' was so clearly demonstrated" (p. 185). On the other hand, according to Cross, one of the "evils" coming out of the war was "the idea that devotion to research for its own sake is perhaps a form of selfishness, as contrasted with the utilization of knowledge, which is laudable public service" (p. 186). To the contrary, Cross argues, "Such a conception fails to recognize the more fundamental truth that scientific research is itself a public service of the highest type" (p. 186).

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Egmont Key, near St. Petersburg, Florida, USA. Photo courtesy Visit St. Petersburg/Clearwater.

UTD Conference Center. Courtesy Melissa Fenton.

Mount Katahdin, the highest mountain in Maine, USA. Photo courtesy Convention and Visitors Bureau of Greater Portland.

March

02 Early registration deadline for the **North-Central** Section Meeting.

04 Applications to attend the **Penrose Conference,** "Plumes and Their Role in Whole Mantle Convection and Recycling," in Pico, the Azores, are due by e-mail to penrose2008@els.mq.edu.au. Learn more at www.geosociety.org/penrose/09azores.htm.

12–13 GSA's **Southeastern** Section meets in St. Petersburg, Florida, USA.

13 **GSA elections** begin. Learn more at www.geosociety.org.

16–17 GSA's **South-Central** Section meets in Dallas, Texas, USA.

20 Expressions of interest for the **Field Forum,** "Structure and Neotectonic Evolution of Northern Owens Valley and the Volcanic Tableland, California," are due via e-mail to David Ferrill, dferrill@swri.org.

22–24 GSA's **Northeastern** Section meets in Portland, Maine, USA.

31 Nominations for the **John C. Frye Environmental Geology Award** are due. Learn more at www.stategeologists.org/awards_honors, or contact GSA Grants, Awards, and Recognition at +1-303-357-1028 or awards@geosociety.org.

April

02 Nominations for the Quaternary Geology and Geomorphology Division's **Don J. Easterbrook Distinguished Scientist Award** and **Farouk El-Baz Award for Desert Research** are due. Send nominations for the Easterbrook award to Marith Reheis, USGS, MS980, Federal Center, P.O. Box 25046, Denver, CO 80225-0046, USA; +1-303-277-1843; mreheis@usgs.gov. Nominations for the El-Baz award should go to Paul R. Bierman, Univ. of Vermont, Dept. of Geology, Delehanty Hall, Burlington, VT 05405-0001, USA; +1-802-656-4411; pbierman@zoo.uvm.edu.

2–3 GSA's **North-Central** Section meets in Rockford, Illinois, USA.

06 Early registration deadline for the **Cordilleran** and **Rocky Mountain** Section Meetings.

12 **GSA elections—**ballots must be postmarked or submitted electronically by this date.

April continued

20 Applications to attend the **Penrose Conference,** "Low $\delta^{18}O$ rhyolites and crustal melting: Growth and redistribution of the continental crust," in Twin Falls, Idaho, and Yellowstone National Park, Wyoming, USA, on 9–13 Sept. 2009 are due by e-mail to Peter Larson, plarson@wsu.edu; Ilya Bindeman, bindeman@uoregon.edu; or John Wolff, jawolff@wsu.edu. See p. 15 for more information.

May

01 Applications for the **History of Geology Student Award** are due. Learn more at http://gsahist.org/HoGaward/awards.htm or contact Jane P. Davidson at jdhexen@unr.edu.

01 Applications to attend the **Penrose Conference,** "Tectonic Development of the Amerasia Basin," at the Banff Centre, Alberta, Canada, on 4–9 October 2009 are due to Victoria Pease, vicky.pease@geo.su.se, or Lawrence Lawver, lawver@utig.ig.utexas.edu. See p. 16 for more information.

7–9 GSA's **Cordilleran** Section meets in Kelowna, British Columbia, Canada.

11–13 GSA's **Rocky Mountain** Section meets in Orem, Utah, USA.

11–15 **Penrose Conference:** "Plumes and Their Role in Whole Mantle Convection and Recycling," in Pico, the Azores.

26 Last day to sign up for the GSA GeoVentures **"Galapagos Islands—A Place Born of Fire"** teacher trip running 26 June–6 July 2009. See www.geoventures.org for more information.

Abstract Deadline: 11 August 2009
Technical Program: 18–21 October 2009

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Juvenile *Tyrannosaurus rex,* Jane. Photo courtesy Rockford Area Convention & Visitors Bureau.

Pierce Lake, Rock Cut State Park, Illinois, USA. Courtesy Rockford Area Convention and Visitors Bureau.

Spring in the south Okanagan Valley, about an hour south of Kelowna, British Columbia. Photo courtesy Robert Young.

Changes to GSA Section Rules and Boundaries

Barb EchoHawk, *GSA Sections & Divisions Communications Liaison*

The annual dues of GSA members currently include membership in one GSA geographic section. Section affiliation is determined by a member's geographic location, unless the member requests transfer to a different Section. Beginning this year, GSA members may belong to any number of additional Sections for a minimal fee.

GSA Extends Geographic Sections into México

GSA has extended its geographic sections to include several states in México. GSA Section boundaries are now as follows:

Cordilleran Section

USA—the states of Alaska, California, Hawaii, Nevada, Oregon, and Washington, and that part of Arizona south of latitude 35°N; **Canada—**the Province of British Columbia, the Yukon Territory, the Northwest Territories, and the Nunavut Territory; **México—**the Distrito Federal (Mexico City) and the states of Aguascalientes, Baja California, Baja California Sur, Chiapas, Colima, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México State, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Querétaro, San Luis Potosi, Sinaloa, Sonora, Tlaxcala, and Zacatecas.

Rocky Mountain Section

USA—the states of Colorado, Idaho, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming, and that part of Arizona north of latitude 35°N; **Canada—**the provinces of Alberta and Saskatchewan; **México—**the state of Chihuahua.

North-Central Section

USA—the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin; **Canada—**the Province of Manitoba, and that part of the Province of Ontario west of the 89th meridian.

South-Central Section

USA—the states of Arkansas, Kansas, Louisiana, Oklahoma, and Texas; **México—**the states of Coahuila, Nuevo León, Tabasco, Tamaulipas, and Veracruz.

Northeastern Section

USA—the District of Columbia (Washington, D.C.) and the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; **Canada—**the provinces of New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, Quebec, and that part of Ontario east of the 89th meridian.

Southeastern Section

USA—the states of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia, and the Commonwealth of Puerto Rico; **México—**the states of Campeche, Quintana Roo, and Yucatán.

THE GEOLOGICAL SOCIETY OF AMERICA®

SCIENCE ▪ STEWARDSHIP ▪ SERVICE

PENROSE CONFERENCE SCHEDULED

Low $\delta^{18}O$ rhyolites and crustal melting: Growth and redistribution of the continental crust

Twin Falls, Idaho, and Yellowstone National Park, Wyoming, USA

9–13 September 2009

CONVENERS

Peter Larson, *Washington State University, School of Earth and Environmental Sciences, Pullman, Washington 99164-2812, USA, plarson@wsu.edu*

Ilya Bindeman, *University of Oregon, Dept. of the Geological Sciences, 1272 University of Oregon, Eugene, Oregon 97403, USA, bindeman@uoregon.edu*

John Wolff, *Washington State University, School of Earth and Environmental Sciences, Pullman, Washington 99164-2812, USA, jawolff@mail.wsu.edu*

Application deadline: 20 April 2009

DESCRIPTION AND OBJECTIVES

In the past several years, there has been a renewed interest in the genesis of low-$\delta^{18}O$ rhyolites and shallow magma genesis. This resurgence has been stimulated by a combination of the application of new analytical techniques and the discovery of voluminous low-$\delta^{18}O$ rhyolites in the Snake River Plain, Idaho, USA. Low-$\delta^{18}O$ rhyolites are important because oxygen is the most abundant element in igneous rocks, and it provides fundamental evidence about crustal processes that form rhyolite magmas.

The meeting will include keynote presentations by HP Taylor, K. Muehlenbachs, C. Harris, and G. Bergantz.

LOGISTICAL INFORMATION

Proposed Itinerary

Tues., 8 Sept.	Arrive in Twin Falls, Idaho, USA.
Wed., 9 Sept.	Overview of Low-$\delta^{18}O$ Magmas: A Historical Prospective Low-$\delta^{18}O$ Basalts
Thurs., 10 Sept.	The Genesis of Rhyolite Magmas Snake River Plain Low-$\delta^{18}O$ Rhyolites
Fri., 11 Sept.	Field Trip—Conference moves from Snake River Plain to Yellowstone National Park
Sat., 12 Sept.	Recycling of Rhyolite Magmas Constraints of Shallow Crustal Melting
Sun., 13 Sept.	Low-$\delta^{18}O$ Rhyolite Sources: Hydrothermal Alteration Rhyolites: What Now?
Mon., 14 Sept.	Departures from Twin Falls or Bozeman, Montana, USA.

Application

The conference will be limited to about 75 attendees, and participants must apply to attend. Participants will have to commit to attending the full five days of the meeting. To apply, please e-mail the conveners by Monday, 20 April 2009: Peter Larson, plarson@wsu.edu; Ilya Bindeman, bindeman@uoregon.edu; or John Wolff, jawolff@mail.wsu.edu. The e-mail must include a letter of intent with a brief statement of interests, the relevance of your recent work to the themes of the conference, the subject of your proposed presentation, and contact information. Once you have been selected to participate, we will forward your contact information to GSA, and they will send you detailed registration information.

Attendees and Estimated Cost

Participation of graduate students is encouraged, and partial support to attend the meeting is being actively sought by the organizers. Participants must make their own travel arrangements to and from Twin Falls, Idaho, USA. We anticipate the registration fee to be ~US$1300 per person for double occupancy, to cover six nights' hotel lodging (8–13 September), meals, guidebook, and transportation between Twin Falls, Idaho, and Yellowstone National Park. This fee will be confirmed by the end of March; check www.geosociety.org for updates.

PENROSE CONFERENCE SCHEDULED

Tectonic Development of the Amerasia Basin

Banff Centre, Alberta, Canada

4–9 October 2009

CONVENERS

Lawrence Lawver, *University of Texas at Austin, Institute for Geophysics, 10100 Burnet Road, R2200, Austin, TX 78758-4445, lawver@utig.ig.utexas.edu*

Victoria Pease, *PetroTectonics Centre, Dept. of Geology & Geochemistry, Stockholm University, SE-106 91 Stockholm, Sweden, vicky.pease@geo.su.se*

CO-CONVENERS

Ruth Jackson, *Natural Resources Canada, 1 Challenger Drive, Room H-507 Dartmouth, Nova Scotia B2Y 4A2, Canada, rujackso@nrcan-rncan.gc.ca*

Sergey Drachev, *ExxonMobil Russia, Inc., 31 Novinsky Boulevard, 5th floor, 123242 Moscow, Russia, sergey.s.drachev@exxonmobil.com*

Application deadline: 1 May 2009

OVERVIEW

This Penrose Conference on the tectonic development of the Amerasia Basin will be held at the Banff Centre in Alberta, Canada, from 4–9 October 2009. The Conference will be limited to about 60 participants, and all participants must apply by **1 May 2009** to attend.

The tectonic development of the Amerasia Basin is as debated today as it was in 1995 when the first Penrose Conference on the subject was held. The age and spreading history of the ocean floor is still relatively inaccessible to direct sampling because of persistent ice cover and therefore is known mostly from "remote" geophysical methods. The identification of spreading centers, magnetic anomalies, and fracture patterns associated with the Amerasian Basin seafloor is obscured in places by younger magmatism and overprinted by both compressional and extensional tectonics. Furthermore, much of the onshore geology has only been mapped at a reconnaissance scale; the lack of age control on units, structural fabrics, timing of fold and thrust belts, etc., makes it difficult to constrain the opening of the Basin on the basis of circum-Arctic geology.

Since the 1995 meeting, there have been various marine, aerogeophysical, and geological studies around the Arctic, with major projects in Russian territory, two seasons of aerogeophysical work by the Naval Research Lab in the Canada Basin, and a number of shipboard cruises aboard *USCGC Healy* and various Canadian ships. Integrated Ocean Drilling Program (IODP) drilling of Lomonosov Ridge in 2004 produced a number of important, high-impact papers concerning the Cenozoic history of the Arctic Ocean and its conversion from possibly nearly fresh water in the early Cenozoic to truly saline now. Unfortunately, even with the new data, we still have no definitive answers as to how and when the Amerasian Basin developed.

Furthermore, global climate change and Article 76 of the United Nations Convention on the Law of the Sea (UNCLOS 76) make understanding the tectonic development of the Arctic region even more important. Global warming and the resulting diminution of Arctic sea and land ice, in combination with the potential expansion of sovereign economic zones in the Arctic, have dramatic consequences for (1) environmental changes already affecting marine and land biota, including humans; and (2) exploration for oil, gas, and mineral rights in the circum-Arctic region. Thus, the tectonic development of the Arctic region is of great relevance not only to our understanding of global tectonics, but also to understanding the framework of the known and estimated oil and mineral resources of the Arctic, our understanding of Earth's climate system, the distribution of flora and fauna, and ultimately the historic distribution of humans on Earth. This, combined with the enthusiasm of invited speakers (100% positive response!), indicates to us that the time is right for a repeat of the 1995 conference. We expect an excellent mix of well-informed scientists, graduate students, and industry representatives, with much to discuss.

This Penrose Conference will (1) summarize the current state of knowledge, and (2) identify both regions and techniques with the potential to answer specific questions (such as whether or not the Alpha-Mendeleev Ridge is volcanic or extended shelf/crust) in order to make the advances necessary for understanding this critical region of the Arctic. We hope this Penrose Conference will spur new field mapping and sampling

programs, new geophysical data acquisition campaigns, and, with today's technology, even inspire the direct sampling of the Amerasian Basin via ocean drilling projects.

As a complement to the presentations, the Conference will include a one-day excursion to the foreland fold and thrust belt of the Canadian Rockies. Deformation in the Rockies indicates that folding and subsidence were driven by far-field collision of terranes impacting the western margin of North America. This deformation is similar to that predicted along the Brooks Range of Alaska and parts of far eastern Siberia, both as subduction related deformation and as a result of the opening of the Amerasian Basin via the "rotational" hypothesis—thus allowing useful comparisons to Arctic deformation.

LOGISTICAL INFORMATION

Tentative Schedule

Sun., 4 Oct. Arrive in Banff

Mon., 5 Oct. Geophysical perspectives I (ridges & highs)

Tues., 6 Oct. Continental margin perspective

Wed., 7 Oct. Excursion through the Front Range of the Rockies

Thurs., 8 Oct. Geophysical perspectives II (shelves & basins)

Fri., 9 Oct. Resource perspectives (morning only) and lunch

Fri., 9 Oct. Afternoon/evening departures

Application

Application Deadline: 1 May 2009

Please contact Victoria Pease, vicky.pease@geo.su.se, or Lawrence Lawver, lawver@utig.ig.utexas.edu, with a letter of intent that includes a brief statement of interest, the relevance of your recent work to the Conference themes, the subject and mode (oral or poster) of your proposed presentation, as well as contact information. We strongly encourage graduate students to apply; partial NSF support may be available for students. Once you have been selected to participate, we will forward your contact information to GSA, and they will send you detailed registration information.

THE GEOLOGICAL SOCIETY OF AMERICA®

2009 GSA OFFICER AND COUNCILOR NOMINEES

GSA's success depends on you—its members—and the work of the officers serving on GSA's Executive Committee and Council.

You will receive a postcard with instructions for accessing your electronic ballot via our secure Web site, and biographical information on the nominees will be online for you to review at that time. Paper versions of both the ballot and candidate information will also be available.

Please help continue to shape GSA's future by voting on the nominees listed here.

GSA Elections Start 13 March 2009

PRESIDENT

July 2009–June 2010
Jean M. Bahr
University of Wisconsin
Madison, Wisconsin, USA

VICE PRESIDENT

July 2009–June 2010
Joaquin Ruiz
University of Arizona
Tucson, Arizona, USA

TREASURER

July 2009–June 2010
Jonathan G. Price
Nevada Bureau of Mines & Geology
Reno, Nevada, USA

COUNCILOR Position 1

July 2009–June 2013

Lisa D. White
San Francisco State University
San Francisco, Calif., USA

Cassandra Runyon
College of Charleston
Charleston, S.C., USA

COUNCILOR Position 2

July 2009–June 2013

George O. Linkletter
ENVIRON International Corporation
Irvine, Calif., USA

Ricardo A. Astini
Universidad Nacional de Córdoba
Córdoba, Argentina

COUNCILOR Position 3

July 2009–June 2013

Robert B. Finkelman
University of Texas–Dallas
Richardson, Tex., USA

J. Douglas Walker
University of Kansas
Lawrence, Kan., USA

Ballots must be submitted electronically or postmarked by 12 April 2009.

Travel and Costs

We will stay at the Banff Conference Centre, where all meals are included. The cost will be US$1100 per person from Banff Airport (round trip), based on double occupancy. Those requesting a single room (limited availability) will pay an additional US$320 for the week.

We are in the process of applying for sponsorship to help defray costs. We hope to be able to secure funds such that students can attend without cost and that academic participants can attend for only the cost of plane fare to Calgary, the nearest major airport.

Field Trip

There will be an all day, mid-week field trip to look at the Foreland fold and thrust belt of the Canadian Rockies. The trip will be by bus and involve little hiking. Robust footwear is not needed, but be prepared for wet weather. Lunch and beverage will be provided.

International Activities of The Geological Society of America

THE GEOLOGICAL SOCIETY OF AMERICA®

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Mark Cloos, *GSA International Division, cloos@mail.utexas.edu*

Jack Hess, *GSA Executive Director, jhess@geosociety.org*

Mark Cloos

Jack Hess

International Secretariat

Expanding GSA's role globally benefits the geosciences and our members, and GSA now has dedicated resources to coordinate international initiatives. During its May 2008 meeting, GSA Council approved the establishment of a part-time International Secretariat position at GSA Headquarters in Boulder. Wesley Hill has shifted her role from the Education and Outreach department in order to fill this new position and coordinate GSA's global activities. The overall goal of the International Secretariat is to broaden GSA's participation in the global geoscience community as well as to better serve GSA members in 97 countries.

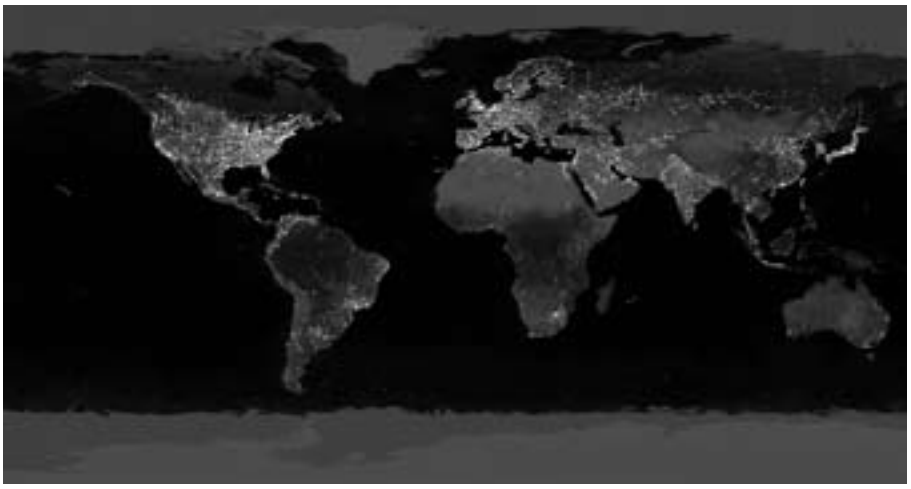
International Membership

The Geological Society of America has had an international outlook since its beginning, because geology has no political boundaries. GSA's current membership is ~22,000, with ~2,700 members, or 13%, representing 97 countries. About 92% of our members are from the United States, Canada, and Mexico. Sixteen countries account for another 6% of the membership. So about 70 countries account for just 2% of the GSA membership. Our global reach is great, but the fact is nearly half of the countries are represented by five or fewer members. Twenty-three countries have only one GSA member. This should be a matter of concern.

Meetings and Publications

Our meetings have significant international representation. At the 2007 annual meeting, talks were presented by geoscientists listing 54 different countries as their base of operation. Twenty-four countries were listed on at least five presentations, with the UK (listed on 67 presentations), Germany (27), Japan (23), and Australia (22) leading the way. Eleven countries were represented by two to four abstracts and 19 countries by just one international presenter. The 2007 meeting numbers parallel GSA's membership.

As our science is inherently international in scope, one of the goals of GSA must be to foster the worldwide acquisition, dispersal, and application of geoscience knowledge. One way we do this is via our publications—journals, special papers, memoirs, and field guides. These publications are held in such high regard that more than 50% of submissions are from non–North American geoscientists. Many of the papers and volumes are entirely devoted to the geology of parts of the world other than North America.



Earth City Lights. Credit Data courtesy Marc Imhoff of NASA GSFC and Christopher Elvidge of NOAA NGDC. Image by Craig Mayhew and Robert Simmon, NASA GSFC.

Along with the annual meeting, we foster geoscience knowledge through Penrose conferences, Field Forums, and periodic specialty meetings. Our members encourage their international students and collaborating scientists to attend our meetings, but for many, financial costs are a serious barrier to participation. Each year, numerous international students who return home are not able to maintain their membership. GSA Council has taken the following action to increase international participation in our activities:

Reduced Dues: In 2005, yearly dues were reduced to US$20 for professionals and US$6 for students from countries classified as other than "high income" by the World Bank. The membership from these countries is now 639, an increase of 49% since 2005. GSA's overall membership has only increased by 13%, so this growth in members from countries that have a less than "high income" classification can be taken as a direct indicator that Council's action is having the desired effect. We suspect that the greatest benefit is still to come as students maintain GSA membership upon return to their home country.

Reduced registration costs: Starting with the 2007 annual meeting, the registration fee for participants from these countries was reduced by 50% compared

to the fee for participants from "high-income" countries. This will again be advertised prominently for the 2009 Portland meeting. It is time to contact your colleagues in qualifying countries and encourage them to join or rejoin GSA.

GSA's International Division

In 1990, the International Division of GSA was created. This Division has long been small in size but large in impact. The membership has hovered around 225 since inception, but the renewal rate is usually the highest of all Divisions. The fundamental purpose of the International Division is to foster international participation in GSA; thus, it is a service arm of GSA rather than a disciplinary grouping.

Session Sponsorship: The International Division routinely sponsors theme sessions with an international focus at GSA's annual meetings. Often, the chosen topics have attracted so many participants that they have required two or three sessions.

Travel Grants: The longest running unique contribution of the International Division has been the awarding of Travel Grants to encourage the participation of young geoscientists from outside of North America. Over the years, most of the grants have gone to professional geoscientists who are 25 to 35 years old but some go to students. All grantees must have submitted an abstract that was accepted for presentation. Most years, travel grants between US$500 and US$1000 have been awarded to five to 10 applicants. For the 2007 meeting, 12 international travel grants were awarded representing eight countries that totaled US$12,650. Where does this money come from? This money comes from the dues paid by International Division members, earnings from two modest endowments, a yearly fund raising drive directed to members of the International Division, and allocations from the available funds in the GSA Foundation.

International Division travel grants are never enough to pay the full costs of attending the meeting. The International Division Awards Committee selects the grantees with an eye toward financial need and geographic distribution. The recognition provided by their selection for an award commonly enables the grantees to obtain matching funds from their home institutions or governments. At this point in time, ~125 young international geoscientists have benefited from the program. These scientists have enriched the GSA meetings they attended and for many it is a memorable moment in their career. This program nucleates and fosters international collaborations and usually generates a lifetime of good will. The expansion of the International Travel Grants program is one of the objectives of the GSA Foundation.

Specialty Meetings: Another activity spawned in the International Division is international specialty meetings: two Earth System Processes meetings, and the 2007 Backbone of the Americas meeting. The Backbone of the Americas specialty meeting, spearheaded by Suzanne Mahlburg Kay and Víctor Ramos, was very successful. Attendance was ~450, with substantial participation by South American geoscientists. Sessions were well attended; meeting logistics and housing ran smoothly; pre-, syn-, and post-meeting field trips were successes, participant costs were modest; and GSA and the Geological Society of Argentina both made a small profit. Legacies of the meeting include a GSA Field Guide book and a GSA Special Paper.

Career Contribution Award: The International Division periodically presents a Career Contribution Award, and it also coordinates the East Asian Geoscience and Environmental Research (EAGER) Award program created by Ric Terman in 2003. This fund provides a yearly US$5,000 grant to a student or post-doctoral scholar working in one of seven countries in East Asia.

The Future

In May 2008, GSA Council voted that by 2010, the International Division would transition to become GSA's seventh Section. Members residing outside North America would automatically become members of the International Section, depending on Council approval of the proposed Section's by laws.

GSA Council and the International Division Management Board will continue to work toward enhancing our ability to foster international geosciences via collaboration. This is, of course, a never-ending objective, but we seek measurable accomplishments over the next three years. Specific short-term goals include expanded international membership, increased funding for travel grants for international geoscientists, creation of an international distinguished lecturer program, and another specialty meeting that matches the high standard set by the Backbone of the Americas meeting.

What do YOU think we should be doing internationally? Please send any ideas you have to Mark Cloos, International Secretary, cloos@mail.utexas.edu.

THE GEOLOGICAL SOCIETY OF AMERICA®

Impact the Future of Geoscience— Serve on a GSA Committee!

2010–2011 COMMITTEE VACANCIES
Deadline: 15 July 2009

This is your chance to influence the future of your Society and your science. GSA invites you to volunteer or nominate one of your fellow GSA members to serve on Society committees or as a GSA representative to other organizations. Students and younger members are especially encouraged to participate, both as committee volunteers and as nominators.

Go to **www.geosociety.org/aboutus/committees** and follow the link to our online form, or download the form and complete it on paper. If you use the paper form, please return it to Pamela Fistell, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA; fax +1-303-357-1070. *Please use one form per candidate.* **Questions?** Contact Pamela Fistell, +1-303-357-1044; +1-800-472-1988 ext. 0; pfistell@geosociety.org.

If you volunteer or nominate another, please give serious consideration to the specified qualifications for serving on a particular committee, as outlined in this article, and be sure that your candidates are GSA members or Fellows.

Nominations received at GSA headquarters by **15 July 2009** on the official online or mailed one-page form will be forwarded to the Committee on Nominations. The committee will present at least two nominations for each open position to the GSA Council at its fall meeting. Appointees will then be contacted and asked to serve, thus completing the process of bringing new expertise into Society affairs. **Terms begin 1 July 2010 (unless otherwise indicated).**

Academic and Applied Geoscience Relations (AM, T/E)
Two member-at-large vacancies (three-year terms)

Strengthens and expands relations between GSA members in the academic and applied geosciences. Proactively coordinates the Society's effort to facilitate greater cooperation between academia, industry, and government geoscientists. **Qualifications:** must be a member of academia, industry, or government who is committed to developing better integration of applied and academic science in our meetings, publications, short courses, field trips, and education and outreach programs and must also be a member of a GSA Division.

Annual Program Committee (AM, B/E)
One member-at-large vacancy (four-year term)

Develops a long-range plan for increasing the quality of the annual meeting and other Society-sponsored meetings in terms of science, education, and outreach. Evaluates the technical and scientific programs of the annual meeting. **Qualifications:** broad familiarity with different disciplines, previous program experience, and/or active involvement in applying geologic knowledge to benefit society and raise awareness of critical issues.

Arthur L. Day Medal Award (T/E)
Two member-at-large vacancies (three-year terms)

Selects candidates for the Arthur L. Day Medal. **Qualifications:** knowledge of those who have made "distinct contributions to geologic knowledge through the application of physics and chemistry to the solution of geologic problems."

Education (AM, B/E, T/E)
Four vacancies: one graduate educator representative vacancy (graduate student supervisor), one two-year college faculty representative, one informal science educator (museum, visitor center, interpretation officer) (four-year terms), and one undergraduate student (two-year term)

Work with other members representing a wide range of education sectors in the development of informal, pre-college (K–12), undergraduate, and graduate earth science education and outreach objectives and initiatives. **Qualifications:** ability to work with other interested scientific organizations and science teachers' groups to develop pre-college earth science education objectives and initiatives.

Geology and Public Policy (AM, B/E, T/E)
One member-at-large vacancy (three-year term)

Translates earth science knowledge into forms most useful for public discussion and decision making. **Qualifications:** experience with public policy issues involving the science of geology; ability to develop, disseminate, and translate information from the geologic sciences into useful forms for the general public and for GSA members; and familiarity with appropriate techniques for the dissemination of information.

Joint Technical Program Committee (T/E)
One environmental geoscience representative (three-year term begins 1 Jan. 2010)

Assists in finalizing the GSA Annual Meeting technical program: reviews abstracts or provides names of reviewers to evaluate abstracts, participates in Web-based activities in the selection and sched-

***Extensive time commitment required • AM—Meets at the Annual Meeting • B/E—Meets in Boulder or elsewhere • T/E—Communicates by phone or electronically**

uling of abstracts, and participates in topical session proposal review. **Qualifications:** must be familiar with computers and the Web, be a specialist in one of the specified fields, and be available in mid-late July for the organization of the electronic technical program.

Membership (B/E)
Two member-at-large vacancies (three-year terms)

Contributes to the growth of GSA membership and attends to members' changing needs. Focuses on attracting and retaining students, professionals working in industry, and those studying and working outside the United States. Reviews and makes recommendations for Fellowship to Council. **Qualifications:** experience in benefit, recruitment, and retention programs is desired.

Minorities and Women in the Geosciences (AM)
Three member-at-large vacancies (three-year terms)

Stimulates recruitment and promotes positive career development of minorities and women in geoscience professions. **Qualifications:** familiarity with the employment issues of minorities and women; expertise and leadership experience in such areas as human resources and education is desired.

Nominations (B/E, T/E)
Two member-at-large vacancies (three-year terms)

Recommends nominees to GSA Council to serve as GSA Officers and Councilors, committee members, and Society representatives to other permanent groups. **Qualifications:** familiarity with a broad range of well-known and highly respected geological scientists.

Penrose Conferences and Field Forums (T/E)
Two member-at-large vacancies (three-year terms)

Reviews and approves Penrose Conference proposals and recommends and implements guidelines for the success of the conferences. **Qualifications:** past convener of a Penrose Conference or a Field Forum.

Penrose Medal Award (T/E)
Two member-at-large vacancies (three-year terms)

Selects candidates for the Penrose Medal. Emphasis is placed on "eminent research in pure geology, which marks a major advance in the science of geology." **Qualifications:** familiarity with outstanding achievers in the geosciences that are worthy of consideration for the honor.

Professional Development (T/E)
Two vacancies: one student representative and one Councilor/former Councilor (three-year terms)

Directs, advises, and monitors GSA's professional development program, reviews and approves proposals, recommends and implements guideline changes, and monitors the scientific quality of courses offered. **Qualifications:** familiarity with professional development programs or adult education teaching experience.

Publications (AM, B/E, T/E)
Two vacancies: one member-at-large and one Councilor (four-year terms)

Nominates candidates for editor positions, approves editorial boards, reviews the quality and health of Society publications, and explores the initiation of new ventures, including electronic publishing. **Qualifications:** extensive publications experience.

Research Grants* (B/E)
Six member-at-large vacancies (three-year terms)

Evaluates student research grant applications and selects grant recipients. **Qualifications:** should have experience in directing research projects and in evaluating research grant applications.

Young Scientist Award (Donath Medal) (T/E)
Two vacancies: one member-at-large and one Councilor/former Councilor (three-year terms)

Investigates the achievements of young scientists to be considered for this award and makes recommendations to Council. **Qualifications:** should have knowledge of young scientists with "outstanding achievement(s) in contributing to geologic knowledge through original research which marks a major advance in the earth sciences."

GSA REPRESENTATIVES TO OTHER ORGANIZATIONS

GSA Representative to the GSA and AASG Selection Committee for the John C. Frye Memorial Award in Environmental Geology

One GSA Representative vacancy (three-year term begins 1 July 2010)

Fosters communication within the community about issues related to serving the broader international community; helps identify and focus on the highest priority environmental informational needs and issues best addressed by the geoscience community. **Qualifications:** well-acquainted with GSA programs in environmental geoscience.

North American Commission on Stratigraphic Nomenclature (AM, possibly B/E)
One GSA Representative vacancy (three-year term runs November 2010–November 2013)

Develops statements of stratigraphic principles, recommends procedures applicable to classification and nomenclature of stratigraphic and related units, reviews problems in classifying and naming stratigraphic and related units, and formulates expressions of judgment on these matters.

COMMITTEE, SECTION, AND DIVISION VOLUNTEERS:

COUNCIL THANKS YOU!

GSA Council acknowledges the many member-volunteers who have contributed to the Society and to our science through involvement in the affairs of the GSA. GSA would not be what it is today without you.

***Extensive time commitment required • AM—Meets at the Annual Meeting • B/E—Meets in Boulder or elsewhere • T/E—Communicates by phone or electronically**

GSA's Section Meeting Mentor Programs Offer Students Career Advice and Connection

Students:

Make sure you attend one or more of the 2009 Section Meeting Mentor Programs to meet with practicing geoscientists who will answer your questions and share insights about a variety of geoscience careers.

Professional Geologists:

Looking for a way to influence the future of geoscience?

Mentors are needed for both the Roy J. Shlemon Mentors in Applied Geology and the John Mann Mentors in Applied Hydrogeology programs. Past mentors have given us glowing feedback, both as they have benefited personally and for the opportunity to positively impact the next generation of geoscientists. Contact Gary Lewis, glewis@geosociety.org, for more information.

Happening this month

SOUTHEASTERN
St. Petersburg, Florida, USA

Shlemon Mentor Program Luncheons
Thurs., 12 March, 11:30 a.m.–12:30 p.m.
and 12:30–1:30 p.m.

Mann Mentors in Applied Hydrogeology Luncheon
Fri., 13 March, 11:30 a.m.–1 p.m

SOUTH-CENTRAL
Dallas, Texas, USA

Shlemon Mentor Program Luncheon
Mon., 16 March, 11:30 a.m.–1 p.m.

Mann Mentors in Applied Hydrogeology Luncheon
Tues., 17 March, 11:30 a.m.–1 p.m.

NORTHEASTERN
Portland, Maine, USA

Shlemon Mentor Program Luncheons
Mon., 23 March, 11:30 a.m.–12:30 p.m.
and 12:30–1:30 p.m.

Mann Mentors in Applied Hydrogeology Luncheon
Tues., 24 March, noon–1:30 p.m.

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Coming soon

NORTH-CENTRAL
Rockford, Illinois, USA

Shlemon Mentor Program Luncheons
Fri., 3 April, 11:30 a.m.–12:30 p.m.
and 12:30–1:30 p.m.

Mann Mentors in Applied Hydrogeology Luncheon
Thurs., 2 April, 11:30 a.m.–1 p.m.

CORDILLERAN
Kelowna, British Columbia, Canada

Shlemon Mentor Program Luncheons
Thurs., 7 May, 11:30 a.m.–12:30 p.m.
and 12:30–1:30 p.m.

Mann Mentors in Applied Hydrogeology Luncheon
Fri., 8 May, 11:30 a.m.–1 p.m.

ROCKY MOUNTAIN
Orem, Utah, USA

Shlemon Mentor Program Luncheon
Mon., 11 May, 11:30 a.m.–1 p.m.

Mann Mentors in Applied Hydrogeology Luncheon
Tues., 12 May, 11:30 a.m.–1 p.m.

Learn more at www.geosociety.org/mentors/.

Initial Report:

David Szymanski

2008–2009 GSA-USGS Congressional Science Fellow

Quantifying Change on Capitol Hill

"Prepare for a big change" is probably the most common advice that incoming Congressional Science Fellows receive from former Fellows. I left the laboratory in late August 2008 expecting change—a familiar word after the last election cycle. Like most scientists, I expected to be able to quantify the personal and professional changes I was about to experience, but I was mistaken. It turns out there are very few metrics for these types of change in D.C., aside from election numbers (but I do have a little bit of advice: avoid using the term "delta" to describe change next time you have a meeting on the Hill).

It is a remarkable opportunity to be in our nation's capitol during one of the most exciting and difficult periods in recent U.S. history. In this first report as the 2008–2009 GSA-USGS Congressional Science Fellow, I will give you a brief recap of my experiences up to the end of the 110th Congress and look ahead at some science policy issues for the 111th Congress.

Shortly after arriving in Washington, D.C., I joined a class of more than 130 science and technology policy Fellows for an intense two-week orientation program coordinated by the American Association for the Advancement of Science (AAAS). Each year, ~100 Fellows join various offices in the executive branch, while the remaining Fellows—like the 34 in my cohort—spend their fellowship year working on science policy in congressional offices. The AAAS orientation program introduces incoming scientists to the life on the Hill in a marathon series of lectures, exercises, and networking functions across the city, ranging in subject from history and science policy to the bizarre dance that is the federal budget process.

Immediately after orientation in early September, congressional Fellows set out to interview in countless Senate and House offices. In perhaps the most uplifting revelation to a scientist entering Washington, I quickly learned that science Fellows are a hot commodity on the Hill. Beyond being cheap labor (and we are—fellowships are fully funded by either AAAS or partner organizations like GSA-USGS), congressional Fellows have an exceptional reputation for their contributions to House and Senate offices. Nearly every piece of legislation has some component of science or technology, from basic research and development programs and space exploration to healthcare and land management.

Over the course of seven days, I completed 22 interviews—including second and third interviews—in fourteen separate House and Senate offices. After the first day, I learned to schedule consecutive interviews on one side of Capitol Hill or the other—House and Senate offices are separated by the length of the U.S. Capitol and then some, and D.C. is a sauna in late summer. To get the most exposure to work environments and legislative goals in congressional offices, I interviewed with personal and committee offices in both chambers. It is said that Congress is like 535 small businesses; each office culture is different, and Fellows need to find the right fit for a productive experience.

In the end, I found that "right fit" and accepted an offer to serve in the office of Senator Jon Tester (D-Mont.), where I am working on energy and natural resource policy. I am quickly learning that scientific breadth is more important here than the depth required in academia. This is not to say that data are unappreciated on the Hill—it's simply that uncertainty and time are luxuries when it comes to the confluence of competing interests.

This is the most important piece of information for a scientist engaging in public policy: Scientific data are part of a policy solution, not the solution itself. This should not be viewed as an anathema, but rather an opportunity to learn how to communicate science for policy development under those competing interests. By the time this article is in print, the first session of the 111th Congress will be in full swing. When I arrived in my Senate office after returning from the GSA Joint Annual Meeting in Houston last fall, Congress had just passed the Emergency Economic Stabilization Act of 2008, securing US$700 billion for the Troubled Asset Relief Program (TARP). Prior to the subprime mortgage debacle coming to a head in September, it looked like energy and climate change were going to top the list of national priorities, but instead, the national economy dominated the end of the 110th Congress and will likely dominate the 111th Congress as well.

As you read this, the new Congress will most likely have passed, and the president signed into law, a large economic stimulus bill. At the time of this writing (December 2008), legislators have already begun debate on the best way to jumpstart the economy, and energy and climate change may still play a central role. Senators Harry Reid (D-Nev.) and Debbie Stabenow (D-Mich.) have independently introduced bills designed to create additional "green-collar" jobs by investing in energy efficiency programs, alternative energy technology and infrastructure development, and natural resource conservation. The idea behind such programs is that economic development, clean energy, and climate change mitigation are not mutually exclusive. But creating effective legislation to stimulate the economy and simultaneously curb greenhouse gas emissions is not easy, which means scientists can help inform the debate.

The key is learning how to inform the debate in light of complex decisions and competing interests. Based on my

continued on p. 24

continued from p. 23

short time in Congress, my impression is that skepticism about climate change and science in general is on the decline. But the mere acceptance of scientific data does not lessen the burden of political decision making. In terms of energy policy, for example, the biggest question is how to change from a fossil fuel–based economy to one based on clean, renewable alternatives. There is no single "right" way to do this, but scientific analysis can help make more prudent decisions.

In the coming months, I hope to provide you with a glimpse of how scientists can help inform the legislative process. How can scientists quantify change in Washington, D.C.? Like our democracy itself, it's all in the numbers. We are not just constituents; we scientists also shape policy, from inside and outside the Washington beltway. The more scientists who get involved, the better the outcome. Even in these difficult economic times, I am convinced that this is an unprecedented time for earth scientists to help guide U.S. science policy. I am grateful to GSA and the USGS for the opportunity to be part of the change.

This manuscript is submitted for publication by David Szymanski, 2008–2009 GSA-USGS Congressional Science Fellow, with the understanding that the U.S. government is authorized to reproduce and distribute reprints for governmental use. The one-year fellowship is supported by GSA and by the U.S. Geological Survey, Department of the Interior, under Assistance Award No. 08HQGR0141. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. government. Szymanski can be reached at David_Szymanski@tester.senate.gov.

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Sponsored by the Rocky Mountain Association of Geologists

The Tooth of Time, New Mexico.

Volunteer to teach and demonstrate area geology to high school–age boys and girls in back-country New Mexico (at French Henry mining camp, Baldy Town, or Cypher's Mine). This summer, volunteers will be allowed to arrive a day early and leave a day late and can work for up to two weeks on a first-come, first-served basis. Students who would like to volunteer must show proof of enrollment in a graduate-level program.

The 2009 program begins 14 June and ends the week of 9 August. Only 54 spots are available this summer, so sign up early!

For more information and to sign up, contact Ed Warner, P.O. Box 480046, Denver, CO 80248-0046, USA, +1-720-904-0560, ewarn@ix.netcom.com. Alternate contact: Bob Horning, P.O. Box 460, Tesuque, NM 87594, USA, +1-505-820-9290, rrhorning@grappawireless.com.

Learn more about the geology of the area at http://pubs.usgs.gov/pp/pp_505/html/pdf.html.

UNESCO Geoparks Initiative

Heidi Bailey, *Volunteer, Florissant Fossil Beds National Monument*

Wesley Hill, *Geological Society of America*

Local people and land managers working together—this is the idea behind the United Nations Educational, Scientific and Cultural Organization (UNESCO) Global Geoparks Network. A Geopark is a regional partnership of people and managers working to promote Earth heritage through education and sustainable tourism. Earth heritage is the history of our planet—the interactions between geology, nature, and culture. People around the world are embracing this concept because Geoparks place the power and benefits directly in their hands. A Geopark is born when local people and public lands join to create a shared vision for a sustainable future.

A Geopark is not a new category of protected land. The land remains entirely in the hands of local people and existing land management systems. Local, state, or national governments retain control of the public lands within a Geopark. Private land remains in the hands of private owners. When a site or area is designated a Geopark, it continues to be managed by public and private partnerships. This bottom-up partnership approach is the reason for the success of this initiative, which has blossomed from its roots in Europe into a global phenomenon in less than 10 years.

Sites with an interest in promoting the heritage of their area—whether geological, natural, or cultural—are invited to consider the UNESCO Geopark designation. A Geopark is not truly a park—it is a collaboration of people banding together to create a unique destination identity based on Earth heritage.

UNESCO created the Global Geoparks Network framework in response to requests from international experts seeking to conserve Earth's most precious geological resources. The Global Geopark Network was formed by UNESCO in 2004, and the network has nearly doubled in size since its inception. UNESCO awards Geopark status to sites around the world that demonstrate exemplary conservation, education, and tourism programs. Currently, 57 Geoparks grace the landscapes of 18 countries worldwide.

UNESCO's Geoparks initiative is very different from the UNESCO World Heritage program. Countries wishing to join the Geoparks initiative do not sign an official convention of any type. Furthermore, UNESCO does not have any management jurisdiction over Geoparks but serves strictly in the role of quality control of the international guidelines and designation criteria. The reason for developing a separate initiative for Geoparks is that the World Heritage program designates very few sites based strictly on geological significance. The majority of World Heritage Sites are localities designated for their historical or cultural significance. Geoparks embrace a larger territory that emphasizes the interaction between geology, Earth heritage, culture, and tourism.

Giants Causeway, Ireland.

One benefit of the program is the exciting exchange of ideas that occurs when people with a common goal join together to make a difference. Those involved in a Geopark partnership are constantly striving to improve the quality of people's lives and conservation of the local environment. A second benefit is the protection of geological sites, natural areas, and cultural traditions. When people are made aware of the beauty and fragility of Earth's resources, preservation and conservation programs thrive. A final benefit is the incentive for young people to build a future in their local areas due to improved educational opportunities and increased employment prospects. All involved can benefit from a Geopark site.

Currently, the United States is not participant in the UNESCO Geoparks initiative but is in the process of gaining further information. Due to differences in land management policies, a U.S. Geoparks program would look slightly different from the European system, so several federal agencies and scientific organizations are researching and discussing the benefits of inclusion in this global initiative. A panel discussion on U.S. Geoparks will be held during the George Wright Society conference in Portland, Oregon, USA, on 4 March 2009.

To help get Geoparks established in the United States, you can write an e-mail of support to Wesley Hill at GSA, whill@geosociety.org.

For more information, go to **www.unesco.org/science/earth/.**

Donna L. Russell, *Director of Operations*

GSA Foundation's Cornerstone Initiative

The Cornerstone Initiative was created to provide priority annual funding for the Greatest Needs Fund as established by GSA. The GSA Foundation is therefore striving to increase available funding for the following GSA membership areas of concern:

International Travel

Scientists from outside the United States, including those from developing countries, benefit greatly from attending GSA meetings. Their presence also enriches the sessions for North American geologists. Increased funding will provide additional travel revenue for these foreign scientists.

Student Research Grants

GSA's Research Grants Program provides partial support for graduate thesis research in the geological sciences for students at universities in the United States, Canada, Mexico, and Central America.

Mentor Programs

These programs provide students with the opportunity to speak with mentors from the applied geosciences and learn about career choices. The programs operate at Section meetings as well as the annual meeting, and their impact grows each year.

GeoCorps Program

GeoCorps™ America places geoscientists within National Parks, Forest Service, and Bureau of Land Management (BLM) lands as summer interns. Interns can be university students, professionals (including teachers), or retirees. Since the program began, 240 interns have been placed in jobs across the United States.

Penrose Conferences

Penrose Conferences provide the opportunity for the exchange of current information and advances pertaining to the science of geology and related fields. The Cornerstone level of funding provides support for student participation in the conferences.

Field Forums

Field Forums offer the opportunity for the exchange of current knowledge and ideas in a field setting. They are designed after Penrose Conferences to stimulate individual and collaborative research, thereby accelerating the advance of the geosciences by interactions in the field.

Congressional Science Fellow

Congressional Science Fellows work as special legislative assistants within the congressional staff system and thus contribute to more effective use of scientific and technical knowledge in government. The requested level of annual support would enable GSA to sponsor two Congressional Fellows per year, provided the USGS continues to match funds.

For further information regarding the Cornerstone Initiative or a complete listing of programs supported by the Greatest Needs Fund, please contact the Foundation office at +1-303-357-1054 or drussell@geosociety.org.

Levels of funding:
Penrose Circle: US$500
Cornerstone: US$1,000
Founders: US$2,500
Legacy: US$5,000

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THANKS to Our Donors!

On behalf of the Foundation's Board of Trustees and staff, I would like to express our ***sincere appreciation*** to every 2008 donor to the GSA Foundation. GSA member contributions are vital to provide funding for the advancement of the geosciences. GSA membership has grown over the past few years, and the science in our world is ever-changing, so the challenge of providing continued support to the geosciences remains. Thank you for making a difference in the future of the science.

—Donna Russell

Most memorable early geologic experience:

In 1962, I looked downward into the crater of Popocatepetl (17,887 ft.) and wondered how Francisco and Montano, two conquistadors of Cortes, collected sulfur there in 1521.

—Paul T. Krutak

FACULTY POSITION AVAILABLE IN GEOSCIENCES

THE UNIVERSITY OF TEXAS AT DALLAS

The Department of Geosciences at the University of Texas at Dallas is seeking up to two tenure/tenure track faculty members in the broad field of tectonics with interests in fundamental processes and in the application of tectonic principles to energy and environmental issues. These positions are available for the 2009-2010 academic year and may be at any academic rank, depending on qualifications. We seek individuals who have developed, or have the potential to develop, vibrant, sustained externally funded research programs that complement existing departmental strengths and who will contribute effectively to the Department's educational programs at the BS, BA, MS and PhD levels.

This departmental expansion in tectonics will play a pivotal role in the University's strategic emphasis on energy and the environment. We are seeking individuals who will complement and expand departmental strengths in structural geology, active and ancient tectonics, isotope geochemistry, geophysics, geospatial science, and computational geoscience, and who will enhance collaboration with other departments in the School of Natural Sciences and Mathematics and programs in geospatial science with the School of Economics, Political, and Policy Studies and the Jonsson School of Engineering and Computer Science. We hope to build upon our traditional collaboration with the petroleum industry in areas that may encompass carbon dioxide sequestration, water and mineral resources, and to expand the use modern high-resolution positioning and imaging technology to characterize and model surface processes associated with crustal deformation.

The Department of Geosciences has strong undergraduate and graduate programs and UTD is a relatively young, growing university. It attracts very talented students (mean freshman SAT > 1200) and is situated in a vibrant metropolitan area that is undergoing rapid growth.

The search committee will begin evaluating applications as soon as possible and will continue until the positions are filled. Applications should include a complete resume, a statement of research interest and the names and contact information of five professional references and send to: Academic Search #20097, The University of Texas at Dallas, 800 W. Campbell Road, AD 42, Richardson, TX 75080-3021. Indication of gender and ethnic origin for affirmative action statistical purposes is requested as part of the application process but is not required for consideration.

Questions about the position may be directed to the Department Head, Professor John S. Oldow (oldow@utdallas.edu). Electronic applications can be sent to jobsrch@utdallas.edu. UTD is an equal opportunity/affirmative action employer and encourages application from candidates who would enhance the diversity of the university's faculty and administration.

Classified Rates—2009

Ads (or cancellations) must reach the GSA advertising office no later than the first of the month, one month prior to the issue in which they are to be published. Contact advertising@geosociety.org, +1.800.472.1988 ext. 1053, or +1.303.357.1053. All correspondence must include complete contact information, including e-mail and mailing addresses. To estimate cost, count 54 characters per line, including punctuation and spaces. Actual cost may differ if you use capitals, boldface type, or special characters. Rates are in U.S. dollars.

Classification	Per Line for 1st month	Per line each addt'l month (same ad)
Positions Open	$8.50	$8.25
Opportunities for Students		
First 25 lines	$0.00	$4.50
Additional lines	$4.50	$4.50
Fellowship Opportunities	$8.50	$8.25

Positions Open

GEOLOGY LECTURER, WASHBURN UNIVERSITY

Washburn University's Physics/Astronomy Department invites applications for 1-year Lecturer position in Geology, with possibility of renewal, beginning August 2009. QUALIFICATIONS: MS in Geology required, Ph.D. preferred; should have strong commitment to undergraduate education; university level teaching experience helpful. Submit curriculum vitae, statement on teaching philosophy, transcripts, three letters of recommendation to: Chair Search Committee, Department of Physics/Astronomy, Washburn University, 1700 SW College Ave, Topeka, KS 66621 or e-mail (steve.black@washburn.edu). Application review begins 15 May 2009 and continues until suitable candidate identified. See www.washburn.edu/cas/physics for further department information. Employment at Washburn University may be conditioned upon satisfactory completion of a background check. Washburn University is an EOE.

DIRECTOR, CARBON MANAGEMENT RESEARCH CENTER, UNIVERSITY OF WYOMING

The University of Wyoming invites applications for a distinguished scientist to direct the university's new Carbon Management Institute within the School of Energy Resources. The director will take responsibility for leading a multi-year, multimillion-dollar federal- and state-funded initiative to design and implement a geologic carbon sequestration demonstration in western Wyoming in cooperation with industrial partners. In addition, the director will coordinate all carbon management research at the university, serve as a resource to state government and industry, and provide outreach to the state and nation.

We are seeking an individual who combines a commitment to both scientific excellence and national impact on critical scientific and technical problems facing Wyoming and the United States, world-class scientific credentials with a strong ethic of service to the scientific community, and enthusiasm for promoting the careers of young scientists.

Preferred qualifications include: (1) an earned doctorate; (2) demonstrated leadership in directing and communicating a vision and strategy to a multidisciplinary research team and coordinating with government agencies and industry; (3) experience in carbon dioxide injection, MMV, or other relevant sequestration activities; and (4) an internationally recognized record of teaching and research in relevant scientific or technical fields including, but not limited to, geomechanics, petrophysics, fluid mechanics, seismology, kinetics, geochemistry, structural geology, hydrology, reactive transport modeling of water-rock-hydrocarbon-CO_2 systems, or well construction engineering. The successful candidate will be expected to build and lead a research team that conducts cutting edge basic and applied research, technology development, and implementation of a geologic sequestration demonstration project. We welcome applicants from all sectors, including academia, industry and government laboratories.

The School of Energy Resources is an interdisciplinary institute dedicated to energy-related teaching and research in support of state, national, and international energy-related activities. We seek a person with the ability to cooperate productively with SER professors in geosciences, mathematics, chemical and petroleum engineering, economics, and other energy-related fields. The SER is an ambitious, new state-funded institute within the University of Wyoming that requires innovative, forefront researchers with the ability to produce benefits tangible to UW and SER stakeholders and supporters. Information about the School of Energy Resources is available at uwyo.edu/SER.

Applications should include a statement of leadership experience, research interests, curriculum vitae, and the names and contact information for at least three individuals who can provide letters of evaluation. Review of completed applications will begin 15 March 2009. Send an electronic copy of your application to: Ms. Sarah Schulmeyer at sschulme@uwyo.edu; if you have additional application materials to send, please direct them to the Carbon Sequestration Search Committee, School of Energy Resources, University of Wyoming, Department 3012, 1000 East University Avenue, Laramie, WY 82071-2000, USA.

The University of Wyoming is an equal opportunity/affirmative action employer, and we welcome applications from women and people from underrepresented groups.

CHEMIST/PHYSICAL SCIENTIST U.S. GEOLOGICAL SURVEY (USGS)

The USGS, Central Energy Resources Team, is soliciting interest from qualified individuals for one Chemist/Physical Scientist position in Lakewood, Colorado. Successful applicants will have qualifying education and expertise in the concepts, principles, and practices of physical and analytical chemistry, mass spectroscopy, gas chromatography, elemental analysis, and high vacuum technology. Knowledge of petroleum/coal geology/geochemistry is highly desirable. He/she will be responsible for the operation and maintenance of three continuous flow (CF) stable isotope ratio mass spectrometers (IRMS) and related peripherals necessary to acquire stable isotopic data. The incumbent must additionally develop new techniques and procedures with an emphasis on compound-specific gas-chromatography (GC)-IRMS for stable carbon and hydrogen isotopes. Candidates must be able to work as part of an analytical laboratory team, and exchange technical information related to sample analysis, data interpretation, and QA/QC with analysts and other research scientists.

Applications (resume and application questions) for this vacancy must be received online via USAJOBS *BEFORE* midnight Eastern Time (Washington D.C. time) on the closing date of this announcement. If you fail to submit a complete online resume, you will not be considered for this position. Requests for extensions will not be granted. If applying on-line poses a hardship for you, please speak to someone in the Servicing Personnel Office listed on the announcement PRIOR TO THE CLOSING DATE. For assistance and questions contact the Office of Human Resources at +1-303-236-9586 or hdorsey@usgs.gov.

Effective 27 February 2009, USAJOBS can be accessed at www.usajobs.opm.gov. Announcement numbers are CR-2009-0237, CR-2009-0238, CR-2009-0239, and CR-2009-0240. This is a full time permanent position (Chemist/Physical Scientist, GS-1320/1301-09/11/12) with a salary range of $49,970–$94,200 depending upon qualifications. The closing date is 20 March 2009.

U.S. Citizenship is required. USGS is an Equal Opportunity Employer.

HYDROGEOLOGY, MONTANA TECH

The Department of Geological Engineering at Montana Tech invites applications for a tenure-track position in Hydrogeology. The successful candidate will be expected to teach a variety of undergraduate and graduate courses related to Montana Tech's Geological Engineering degree program, which is accredited by ABET. Development of a funded program of research with publishable results is expected. Responsibilities also include student advising and recruiting. The appointment will be at the rank of Assistant Professor, starting in August 2009. A Ph.D. in an appropriate field of engineering or earth science (at least one degree must be in a related engineering field) is required prior to commencement of the employment contract. Experience in the use of groundwater modeling code, such as MODFLOW, is required. A PE license, or EIT certificate, is preferred. Candidates must have excellent communication skills in both spoken and written English. Review of applications will begin on 1 April 2009, and the position will remain open until filled. Applicants should send a resume, transcripts, a statement of teaching and research interests and the names, addresses, and telephone numbers of three professional references to Cathy Isakson, Personnel Office, Montana Tech, 1300 West Park Street, Butte, Montana 59701, USA, or e-mail to cisakson@mtech.edu.

SCIENCE TEACHING FELLOW (STF)
SCIENCE EDUCATION
DEPARTMENT OF GEOLOGICAL SCIENCES
UNIVERSITY OF COLORADO AT BOULDER

Applications are invited for a post-doctoral Science Teaching Fellow (STF) in Science Education in the Department of Geological Sciences at the University of Colorado, Boulder. The position is an integral part of the Science Education Initiative at CU-Boulder; a program focused on the enhancement of teaching and learning in our undergraduate courses. Candidates must hold a doctoral degree in Geological Sciences, possess a strong commitment to science education, and have excellent organizational and interpersonal communication skills. Familiarity with current pedagogical research and assessment techniques is not required, but advantageous.

The Science Teaching Fellow will serve as the departmental liaison with the Center for Science Education, directed by Professor Carl Wieman of the Department of Physics (www.colorado.edu/sei/). Responsibilities include working in coordination with our Geological Science faculty to: Develop an integrated plan of course evaluation and innovation; identify specific learning goals that represent faculty-consensus; develop valid assessments of student learning for undergraduate courses; participate in and supervise the development of new pedagogical techniques, materials and practices for improving student learning in the undergraduate courses; and publish assessment tools and findings in earth science education journals. The STF will collaborate with and learn from a cohort of Fellows working towards similar goals in geological sciences and other center-funded departments.

The salary for this one-year, renewable appointment will be competitive and commensurate with experience. Applicants should submit a vita and a statement of teaching philosophy and experiences, and have three letters of recommendation sent to: Prof. Stephen J. Mojzsis, Dept. of Geological Sciences, University of Colorado, 399 UCB, Boulder, CO 80309-0399, USA, or e-mail the materials to mojzsis@colorado.edu.

Review of applications will begin on 9 March 2009, and continue until the position is filled. Women and minorities are encouraged to apply. The University of Colorado at Boulder is strongly committed to diversity and equality in education and employment.

Opportunities for Students

A fully funded NSF RA is available for a Ph.D. student at UNC-Charlotte beginning fall 2009. This multidisciplinary project seeks to document the role of the sun in initiating and propagating rock fractures through numerical modeling, field work and rigorous instrumentation of boulders in the field. The successful candidate will work closely with all aspects of the investigation but will specifically be responsible for instrumentation and data analysis portions of the study. M.S. (or possibly B.S.) degree in earth sciences or related field with coursework, experience and/or background in surface processes, solid mechanics, and/or data acquisition and analysis preferred. The student will be co-advised by Dr. Martha Cary Eppes (Soil Geomorphologist) and Dr. Kimberly Warren (Geotechnical Engineer) and will be a student in the multidisciplinary Infrastructure and Environmental Systems (INES) Ph.D. program at UNC-Charlotte. Contact Dr. Eppes (meppes@uncc.edu; +1-704 687-5993) or Dr. Warren (kawarren@uncc.edu; +1-704 687-6395) for more information.

2009 Graduate Student Grant Program: The Spackman Award. The Society for Organic Petrology (TSOP) invites applications for graduate student research grants, the Spackman Award. The purpose of the grants is to foster research in organic petrology by providing support to graduate students from around the world.

Size of the Spackman Award: Monetary awards up to a maximum of US$1,000 will be granted. All applicants are invited to enjoy a year's free student membership in TSOP.

Use of the Spackman Award: Grants are to be applied to expenses directly related to the student's thesis program, such as fieldwork, laboratory analyses, etc. A portion (not to exceed 25%) of the funds may be used to attend TSOP Annual Meetings. Funds should ***not*** be used to purchase capital equipment, to pay salaries, tuition, room, or board during the academic year. Funds must be spent within 18 months of receipt of the award.

Application Deadline: TSOP Spackman Award application deadline is 15 May 2009. Grants will be awarded in September 2009.

Detailed information and an application form are on the TSOP Web site, www.tsop.org/grants.htm or applications may be obtained from Prof Colin Ward, Chair, TSOP Research Committee, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW, 2052 Australia; e-mail: c.ward@unsw.edu.au.

Coming to April/May's *GSA Today*

Science Article: "Understanding the Great Ordovician Biodiversification Event (GOBE): Influences of paleogeography, paleoclimate, or paleoecology?" by T. Servais et al.

Commentary: 2009 GSA Geologic Time Scale

News about the 2009 GSA Annual Meeting in Portland, Oregon, USA, 18–21 October

- Important dates and deadlines, including a new, later abstract deadline
- Topical and Discipline Sessions
- Registration dates and prices

Read *GSA Today* online at **www.geosociety.org/pubs.**

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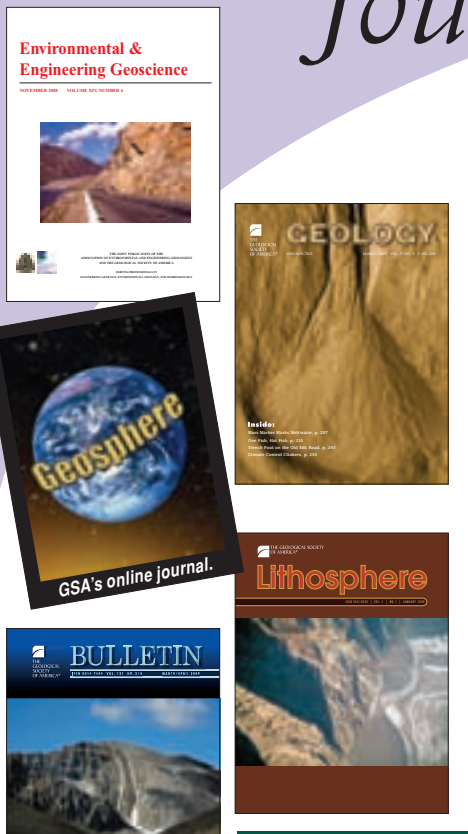
Journal Highlights



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Submitting a Manuscript?

The manuscript submission Web sites for *GSA Bulletin*, *Geology*, and *Geosphere* have moved:

- *GSA Bulletin*: www.editorialmanager.com/gsabulletin/
- *Geology*: www.editorialmanager.com/geology/
- *Geosphere*: www.editorialmanager.com/geosphere/

Questions?

Contact editing@geosociety.org.

Find *Environmental & Engineering Geoscience* at http://eeg.geoscienceworld.org.

You'll soon be able to find GSA's newest journal, *Lithosphere,* online as well.

www.gsapubs.org

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Call for Papers

Lithosphere

THE GEOLOGICAL SOCIETY OF AMERICA®

The Geological Society of America is now accepting manuscripts for *Lithosphere*, a journal to be launched this year. *Lithosphere* will focus on tectonic processes at all scales that affect the crust and upper mantle, from the surface to the base of the lithosphere, and will highlight research that addresses how the surface, crust, and mantle interact to shape the physical and chemical evolution of the lithosphere at all spatial and temporal scales.

SUBMIT YOUR MANUSCRIPT ONLINE AT
http://www.editorialmanager.com/lithosphere/

FOR DETAILS ON MANUSCRIPT SUBMISSION, VISIT
http://www.geosociety.org/pubs/lithosphere/lsGuide.htm

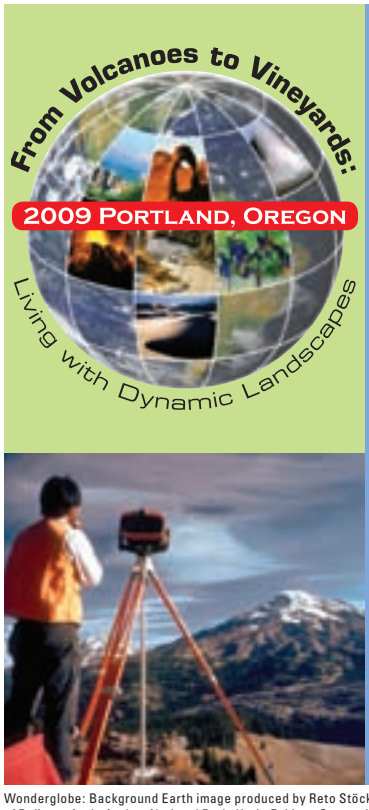
Lithosphere welcomes contributions from a wide variety of earth science disciplines, including (but not limited to), structural geology, geodynamics, geophysics, seismology, tectonic geomorphology, petrology, and geochemistry, as well as results from integrative, interdisciplinary projects (e.g., Canada's Lithoprobe, EarthScope in the United States). The journal particularly encourages articles that address how complex systems in the solid Earth operate and how coupling between those systems occurs.

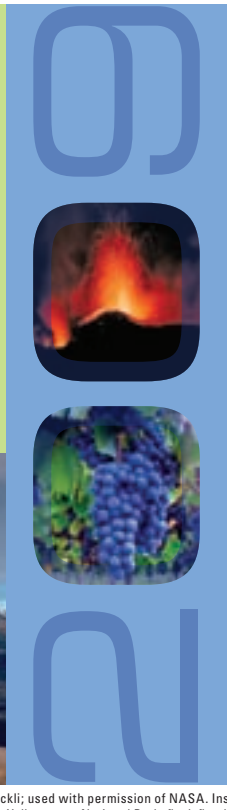
Formats will include:

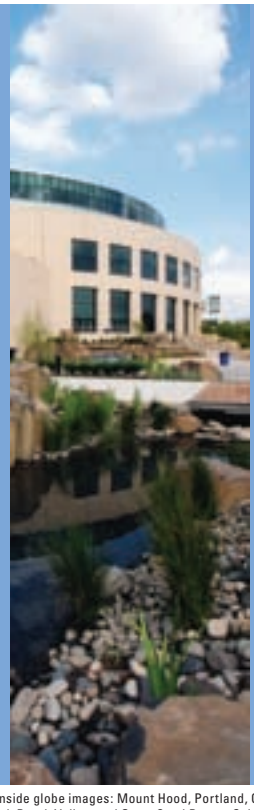
- short research contributions (letters) of new and innovative ideas and concepts;
- longer research articles with complete presentations of field-based and other data sets, experimental results, theoretical analyses, or numerical simulations;
- review articles that facilitate communication among disciplines;
- brief overviews of articles in the issue; and
- special issues or sections devoted to a topic.

For information on article submission and other updates, please follow the *Lithosphere* links at

www.geosociety.org/pubs/







From Volcanoes to Vineyards: Living with Dynamic Landscapes

An Invitation to GSA's 2009 Annual Meeting & Exposition

18–21 October ✷ Portland, Oregon, USA
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Wonderglobe: Background Earth image produced by Reto Stöckli; used with permission of NASA. Inside globe images: Mount Hood, Portland, Oregon; image courtesy Travel Portland. Erupting volcano photo by Ulrich. Photos of Delicate Arch, Arches National Park, Utah; Echinus Geyser, Yellowstone National Park; flash flood, Death Valley; and Great Sand Dunes, Colorado, by John Karachewski. Photo of USGS scientist conducting electronic distance measurement, South Sister Volcano, Oregon, by Lyn Topinka; used with permission of USGS. Oregon Convention Center rain garden; photo used with permission from the Oregon Convention Center.

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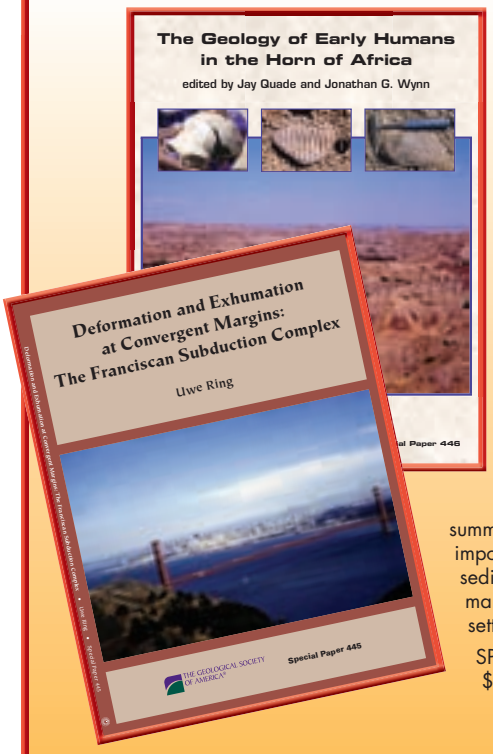

The Geology of Early Humans in the Horn of Africa

edited by Jay Quade and Jonathan G. Wynn, 2008

Summarizing new geological research in the Horn of Africa—a region well known for the record of human evolution—this volume focuses on four research projects that surround the long-studied Hadar Research Area. These research projects—Dikika, Gona, Hadar, and Ledi-Geraru—cover the geology of most of the Lower Awash Valley. The authors' new research and inter-project collaborative efforts help to explain the chronology and context of some of our earliest ancestors.

SPE446, 234 p., ISBN 9780813724461
$60.00, member price $48.00

Deformation and Exhumation at Convergent Margins: The Franciscan Subduction Complex *by Uwe Ring, 2008*

The Franciscan subduction complex formed a long-lived accretionary wedge of Late Jurassic through Oligocene age that fringed the western edge of the North American Cordillera. This volume summarizes absolute finite-strain data from the Franciscan subduction complex and brittle strain data from important faults in and above this complex. Because the Franciscan is generally considered a prototypical sediment-rich subduction complex, its tectonic evolution is important for understanding convergent plate margins, and the results outlined in this volume may have broad implications for other subduction-zone settings.

SPE445, 61 p., ISBN 9780813724454
$40.00, member price $28.00

Investigations into the Tectonics of the Tibetan Plateau

edited by B. Clark Burchfiel and Erchie Wang, 2008

This volume includes a variety of papers on the tectonics of the Tibetan Plateau and the Iranian Plateau that were presented at the first joint meeting between the Geological Society of America and the Chinese Academy of Sciences. Each paper deals with a different aspect of the geology and/or the geophysics of the tectonic evolution of the plateau. Although most of the papers discuss areas in the northeastern part of the plateau, one concentrates on the complexity of the Cenozoic shear zones in Yunnan and one focuses on the late Cenozoic extensional tectonism along the western margin of the Iranian Plateau. Several papers discuss aspects of Tibetan tectonics not covered in any other papers and arrive at unique interpretations.

SPE444, 122 p., ISBN 9780813724447
$48.00, member price $34.00

Landslides and Engineering Geology of the Seattle, Washington, Area

edited by Rex L. Baum, Jonathan W. Godt, and Lynn M. Highland, 2008

This volume brings together case studies and summary papers describing the application of state-of-the-art engineering geologic methods to landslide hazard analysis for the Seattle, Washington, area. An introductory chapter provides a thorough description of the Quaternary and bedrock geology of Seattle. Nine additional chapters review the history of landslide mapping in Seattle, present case studies of individual landslides, describe the results of spatial assessments of landslide hazard, discuss hydrologic controls on landsliding, and outline an early warning system for rainfall-induced landslides.

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