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Wave-cut or water-table platforms of rocky coasts and rivers?

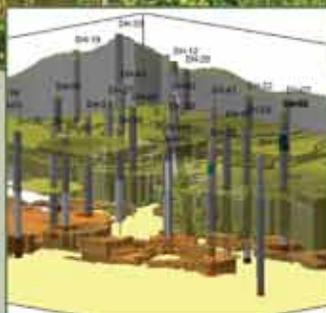
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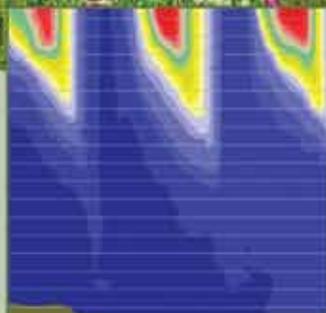


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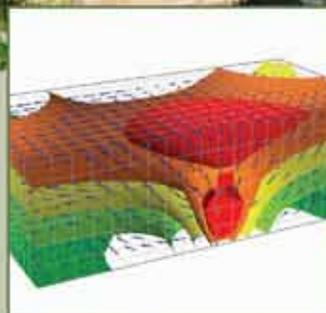


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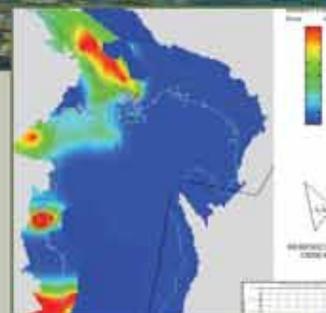


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Cover: Holocene rock platform and comparable Pleistocene terrace in dipping shales and sandstones of the Eocene Coaledo Formation at Sunset Bay, Oregon, USA. This terrace formed at a modern water table by retreat of the saprock cliff, despite continuing uplift due to subduction of the Juan de Fuca Plate. Photo by G.J. Retallack. See related article, p. 4–10.



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Wave-cut or water-table platforms of rocky coasts and rivers?

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ABSTRACT

Despite evidence that weathering plays a role in forming intertidal, estuarine, and fluvial rock platforms, many publications uncritically refer to “wave-cut” or “stream-cut” rock platforms. The alternative explanations of chemical weathering and physical water erosion of rock platforms have been debated since 1839. Our new approach to this long-standing problem introduces data from fluvial as well as coastal rock platforms and documents the saprock-bedrock division of weathering profiles. We report local field evidence for a dominant role of differential weathering of sedimentary beds in an intertidal rock platform at Sunset Bay and a riverside platform near Days Creek, both in southwest Oregon, USA. Despite continuing tectonic uplift, both rock platforms remain within the zone of modern water table and intertidal fluctuation. Above this zone of frequent wet/dry cycling, rock is weakened by subaerial weathering, as documented by decreased rock hardness from the application of a Schmidt hammer, high slaking quantified by wetting-drying experiments, Munsell color indication of elevated oxidation of fine fractures, and peripheral loosening of calcareous fossils. At these sites, the shape and elevation of rock platforms in coastal and fluvial settings appear to reflect differences in strength between bedrock and saprock within the zone of water table fluctuation. In our study sites, waves and floods do not “cut” rock but remove clasts already weakened by weathering to expose the local water table as a bedrock surface. Other local agents of rock removal include salt weathering, eolian abrasion, landslides, debris flows, and fungal, plant, and molluscan bioerosion.

INTRODUCTION

One of the longest running debates in geomorphology concerns whether intertidal rock platforms were created by wave erosion or differential weathering. Henry de la Beche (1839, p. 439) acknowledged the distinction, but emphasized wave action:

In many situations common atmospheric influences so combine with the action of the breakers to produce the destruction of the cliffs, that it may be difficult to say whether the loss of land may be due more to the one than the other: in most cases however, the breakers cause nearly the whole loss, leaving isolated rocks to show, to a certain extent, the destruction they have caused.

Ramsay (1846, p. 327) agreed with primacy of wave erosion: The line of greatest waste on any coast, is the average level of the breakers. The effect of such waste is obviously to

wear back the coast, the line of denudation being a level corresponding to the average height of the sea.

James Dwight Dana, during his United States Exploring Expedition of 1838–1842, was first to note rock platforms as a distinct landform worthy of attention. He also advocated wave action (1849, p. 109):

The water in these cases, has worn away the cliffs, leaving the basement untouched. A surging wave, as it comes upon a coast, gradually rears itself on the shallowing shores; finally, the waters at top, through their greater velocity, plunge with violence on the barrier before it.

But later in the same volume (Dana, 1849, p. 442), a different idea emerges:

The existence of this platform is owing to this protection of the sea from wear and decomposition. Above, the material has disintegrated, and been washed away by the action of streamlets and the waves; but beneath the water these effects do not take place.

Bell and Clarke (1909, p. 30) developed this latter idea further, suggesting a “cooperation of subaerial weathering, which causes the retreat of the cliffs, with marine weathering, which removes the waste so formed.” At the crux of the debate is the relative contribution of terrestrial (largely biochemical) and marine (largely physical) weathering to observed rock platform levels.

The wave erosion explanation has been popular, as indicated by widespread use of the term “wave-cut platform” (e.g., Regarda et al., 2010; A GeoRef search between 1 Jan. 2006 and 1 Apr. 2011 yielded 113 citations for “wave-cut”) and application of wave energy models (Trenhaile, 2008, 2010). Wave erosion also has been confirmed with observations of storm waves (Bartrum, 1924, 1935), varied platform saturation levels (Trenhaile and Mercan, 1984; Trenhaile and Porter, 2007), and erratic distribution of rock strength from Schmidt hammer tests (Kennedy et al., 2011). In contrast, the alternative idea that coastal rock platforms were created by weathering is supported by observation of weathering in flanking cliffs (Bartrum, 1916; Berryman, 1993), diminished energy of waves on platforms (Stephenson and Kirk, 2000a), patterns of differential rock strength by Schmidt hammer (Stephenson and Kirk, 2000b; Kennedy and Beban, 2005), and rock platforms in estuaries and bays protected from ocean waves (Hills, 1949; Kennedy and Paulik, 2006). Furthermore, waves have been observed to destroy (rather than construct) the outer edges of rock platforms by guttering and potholing (de la Beche, 1839; Hills, 1949; Kennedy et al., 2011). Because of this long-running dispute, the term “shore platform” has been urged as a non-genetic alternative to “wave-cut” or “water-layer weathered” (Hills, 1949; Trenhaile, 1987).

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Figure 1. Study sites in southwest Oregon: (A) map; (B) view from the east of the cliff and intertidal rock platform at Sunset Bay; (C) satellite image of sampling sites at Sunset Bay; (D) view from the south of cliff and alluvial rock platform at Days Creek; (E) satellite image of sampling sites at Days Creek.

Here we take a new approach to the problem by simultaneously studying a rock platform beside a stream and the sea, and also by applying new concepts of weathering profiles. Both coastal and streamside cliffs show four distinct layers, recently recognized by Graham et al. (2010): (1) bedrock—hard unweathered rock; (2) saprock—rock with limited oxidative weathering along fractures; (3) saprolite—soft, oxidized, deeply weathered rock; and (4) solum—densely rooted, oxidized, and organic soil profile. The boundary between bedrock and saprock is at the limit of oxidative weathering and fungal hyphal penetration, generally at the water table or river level in alluvial settings. The rock platform beside a river is called a “strath” (Bucher, 1932) or “beveled bedrock platform” (Montgomery, 2004). Strath terraces are former rock platforms elevated well above current stream level because of relative base-level fall, and if covered with alluvium are called fill terraces (Bucher, 1932; Bull, 1979; Montgomery, 2004), comparable with marine terraces overlain by raised beaches or alluvium (Bockheim et al., 1996; Anderson et al., 1999). Such fluvial rock platforms and terraces are widely regarded as “stream-cut” (Bucher, 1932) or “fluvially eroded” (Reusser et al., 2004), which implies that they were created by physical abrasion of pebbles and other tools carried by the stream (Gilbert, 1877; Stock et al., 2005). Strath terrace widening by physical stream abrasion in some places and armoring in others has been attributed to prolonged climatic stability (Fuller et al., 2010; Stark et al., 2010) and to meander migration and cutoff (Finnegan and Dietrich, 2011). In contrast, a role for chemical weathering is supported by observation that strath terraces are flanked on one side by a deep channel and potholes and on the other side by a weathered cliff or soft rock (Montgomery, 2004). Fluvial and pedogenic concepts bring new and instructive perspectives on the perennial problem of the origin of rock platforms.

This paper presents studies of both coastal and fluvial rock platforms from a single region of comparable climatic, water table, and tectonic setting. At each site, a variety of proxies for rock strength and degree of weathering were gathered to answer the following two questions:

1. Are rock platforms cut entirely by focusing of wave and flood energy?
2. Do they reflect differences in rock hardness created by different degrees of weathering?

OREGON FIELD SITES

Oregon sites have two distinct advantages for the study of rock platform genesis and history. First, Oregon has many steeply dipping sedimentary sequences so that the same bed with the same geomechanical and geochemical properties can be traced though the rock platform to cliffs flanking both coasts and streams (Fig. 1). Second, Oregon is tectonically uplifted at known rates from offshore subduction of the Juan de Fuca Plate (Burgette et al., 2009). Our two sites were selected within a similar region for climate, vegetation, soil, and rock type in the interests of experimental design to minimize these potentially confounding variables in platform development:

1. On the coast at Sunset Bay (Armentrout, 1981), in Cape Arago State Park (N43.33573° W124.373586°) near a tide gauge (at Charleston, Oregon, USA: <http://tidesandcurrents.noaa.gov> [accessed 17 June 2010]).
2. Along the South Umpqua River at Days Creek (Imlay et al., 1959), near Canyonville, Oregon, USA (N42.973282° W123.172986°) between two river gauges (USGS, Tiller and Brockway, Oregon, USA: <http://waterdata.usgs.gov> [accessed 19 June 2010]).

Modern soils on the Pleistocene terraces at Sunset Bay and Days Creek are described by Haagen (1989) and Johnson et al. (2003), respectively. Bedrock dip was measured at 57°E on magnetic azimuth 001° at Sunset Bay and 62°E at azimuth 92° at Days Creek. The surface of the flat part of the Sunset Bay platform slopes 2.5° seaward, and the Days Creek rock platform slopes 3.3° to the river. Raw measurements of shale and sandstone at these localities, and a statistical summary of differences between cliffs and platforms, are included in the GSA supplemental data repository¹.

¹GSA Data Repository item 2012153, statistical tests and sample data, is online at www.geosociety.org/pubs/ft2012.htm. You can also request a copy from *GSA Today*, P.O. Box 9140, Boulder, CO 80301-9140, USA; gsatoday@geosociety.org.

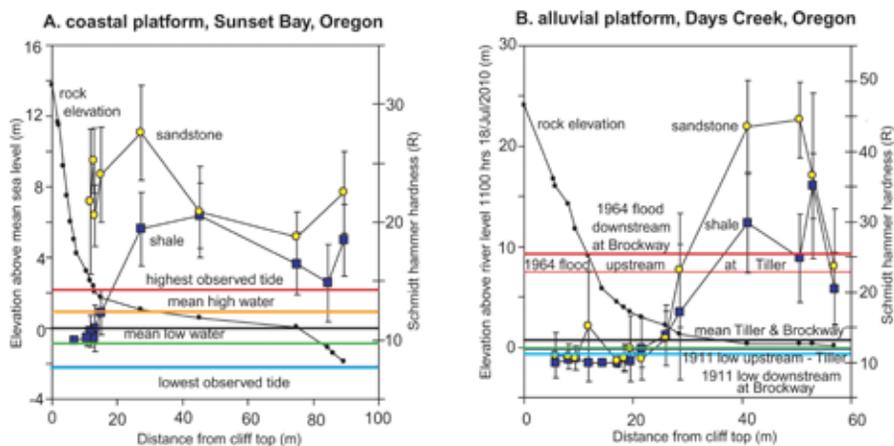


Figure 2. Schmidt hammer measurements (secondary axis) and topographic profile (primary axis) at Sunset Bay (A) and Days Creek (B), Oregon. Colored lines show historic flood and tide levels.

Water table levels on the same geomorphic terrace near Sunset Bay are intersected at an elevation of 49.1 m by the Stictland bore (N43.217123° W124.372686°), drilled from an elevation of 58.2 m (Beaulieu and Hughes, 1975), so that at 2.05 km from the shore, the general slope of the water table is 2.2° seaward. Near Coquille, on a similar fluvial terrace as at Days Creek, the L. Rose bore (N43.18884° W124.101236°), at an elevation of 43.2 m, has the water table at an elevation of 42.9 m (Beaulieu and Hughes, 1975), so that at 560 m from the nearest stream, the general slope of the water table is 2.5°.

Both rock platforms have a flanking cliff and terrace, which represents an uplifted rock platform of the past overlain by coastal and alluvial sands and gravels, and local accumulations of sea shells (Beaulieu and Hughes, 1975). The Whiskey Run terrace, 13.5 m above the intertidal rock platform at Sunset Bay, has been mapped throughout the southern Oregon coast and dated at 80 ka near Cape Blanco, 57 km south of Sunset Bay (Bockheim et al., 1996). Thus, the long-term uplift rate at Sunset Bay was 0.17 mm a⁻¹, comparable with Oregon long-term coastal stream incision rates of 0.2 mm a⁻¹ (Personius, 1995). Since the last great earthquake 312 years ago, geodetic uplift has been 4 mm a⁻¹ for the area around Coos Bay, and this rate exceeds location-specific sea-level rise of 2.3 ± 0.2 mm a⁻¹ (Burgette et al., 2009). Inter-seismic uplift since the last great earthquake in AD 1700 has thus raised this part of the coast 53 cm above sea level. Uplift due to short-term strain is rapid, but it is undone by subsidence during great earthquakes so that long-term uplift is only 5% of the short-term uplift rate.

The age of the bedrock terrace 16.7 m above the river-level platform at Days Creek is unknown, but is probably also ca. 80 ka, because long-term rates of stream incision for this part of the Umpqua River are 0.2 mm a⁻¹ (Personius, 1995). In contrast, short-term interseismic geodetic uplift rates are only 1.5 mm a⁻¹ this far inland on the North America plate (Burgette et al., 2009).

COMPARISONS OF ROCK PLATFORMS AND CLIFFS

If rock platforms were cut by waves alone there would be no difference in weathering or strength of the platform and cliff, but if the platform reflects weathering differences such as bedrock and saprock, there would be differences between platform and cliff. The following observations and experiments were designed to test these alternatives.

Fossil Weathering

Fossil collecting was an initial indication of differences in rock hardness in the platform versus cliff. At both localities, fossils break out in the round from their gray shaley matrix in the cliff, but hammering more often breaks through the fossil within indurated matrix of the rock platform. The fossils are calcitic and aragonitic shells more readily weathered than their illitic, quartzo-feldspathic matrix. Fossil shells were partially dissolved by weathering to form large, wide spaces along fine cracks in the cliff but not in the platform. Sunset Bay exposes the middle Eocene (Lutetian) Coaledo Formation, including sandstones with turritellid gastropods and venericardid bivalves and shales with siderite nodules containing crabs and nautiloids (Armentrout, 1981). The river platform at Days Creek exposes sandstone and shale of the Early Cretaceous (Hauterivian) Days Creek Formation, including sandstones with marine scallops and belemnites and shales with siderite nodules containing ammonites (Imlay et al., 1959).

Schmidt Hardness

Differences observed during fossil hunting between the hardness of the fossil matrix of cliff and adjacent platforms were quantified by vertical field application of a Schmidt hammer, which measures recoil from impact of a spring-loaded piston. At least 25 measurements were taken at each station as recommended by Niedzielski et al. (2009). Schmidt hardness (*R*) of the instrument (type N Original) was calibrated for impact recoil (*N*) in newtons mm⁻² by the manufacturer (Proseq SA, Switzerland), according to the formula: $N = 1.8R - 13.8$. These results quantify observed fossil adhesion. Fossil collecting in samples with *R* values greater than 30 requires vigorous hammer blows and care to avoid rebound, whereas light picking breaks out fossils from matrix of lower *R* value.

At both Sunset Bay and Days Creek, rock hardness recorded by the Schmidt hammer declines abruptly at the break in slope between the rock platform and the nearby cliff (Fig. 2). Platform hardness is high and variable, but cliff hardness is uniformly low. This also applies to sandstones where they form erosion-resistant ribs well above the level of the platform, thus forming subsidiary cliffs.

Schmidt hardness did not decline due to softness of the exterior of the rock because the piston seldom left a clear mark

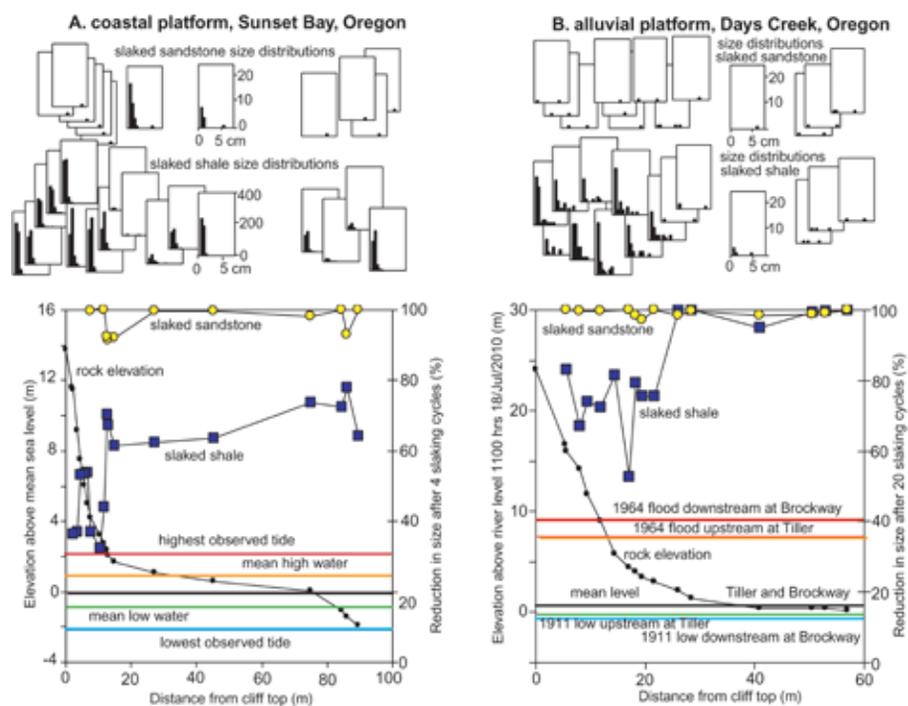


Figure 3. Reduction in size after slaking experiments (secondary axis and size distributions) and topographic profile (primary axis) at Sunset Bay (A) and Days Creek (B), Oregon. Colored lines show historic flood and tide levels.

on the rock. Rather, lack of hardness was due to fractures that absorbed recoil, and hollow echoes suggested that some fractures were subparallel to the surface. Near the tops of the cliffs, fractures vertical to the surface were so numerous that the 1-cm-diameter piston straddled them, and these fractures absorbed much of the impact.

Slaking

Another indication of differential strength between platform and cliff is slaking: the tendency of shaley rocks to flake into pieces with wetting and drying (Trenhaile, 1987). In the interests of time and comparison between distinct fluvial and intertidal regimes, an aggressive laboratory experiment of complete wetting and drying was chosen, rather than replicating tides of cold salt water or river flood cycles (Kanyaya and Trenhaile, 2005). Pieces of rock 5–7 cm across were each immersed in 100 ml of Eugene (Oregon, USA) tap water at room temperature for 24 hours and then dried completely for 24 hours. Sunset Bay shales collapsed into more than 600 pieces after only 4 cycles of this treatment, whereas indurated shales of Days Creek required 20 cycles before they broke down.

Grain size histograms (Fig. 3) show that a large proportion of the shales broke down to grains less than silt size, as easy to move by moderate wind or rain as by waves and floods. Sandstones from both localities were less prone to fragmentation, remaining unaltered or sloughing off only one or two small rock splinters. This observation explains weather-resistant sandstone ribs above the shale platform at both localities: Such lithology-dependent resistance to weathering is commonly observed along rocky coasts (Trenhaile, 1987; Naylor and Stephenson, 2010).

Bulk Density

Bulk density of rock specimens can be another indication of mass depletion in weatherable minerals, and it was measured by

the clod method (Retallack, 1997), in which paraffin-coated specimens ~1.5 cm in size were weighed in and out of water with a temperature of 4 °C. All the rock specimens were remarkably uniform across both transects, with mean and standard deviation of $2.21 \pm 0.04 \text{ g cm}^{-3}$ for 17 Sunset Bay shales, $2.17 \pm 0.10 \text{ g cm}^{-3}$ for 12 Sunset Bay sandstones, $2.56 \pm 0.02 \text{ g cm}^{-3}$ for 15 Days Creek shales, and $2.56 \pm 0.08 \text{ g cm}^{-3}$ for 13 Days Creek sandstones. These errors are close to that for 11 replicates of an independent sandstone standard from the Ediacara Member of South Australia run at the same time: $2.45 \pm 0.02 \text{ g cm}^{-3}$. Despite a statistically significant difference in bulk density of shale in cliff and platform at Days Creek (see supplemental data [footnote 1]), the difference is slight, and well short of rock weakening by geochemical mass transfer of base cations or redox sensitive elements found in saprolites of deep-weathering profiles (Brimhall et al., 1992).

Oxidation Colors

Additional evidence of weathering comes from observations of color using a Munsell chart (Munsell Color, 1975). The scale used here, with hue 5YR taken as 5 and 5Y as 15, has redder hues the lower the number. Except for the uppermost meter of the cliffs, all of the rocks are a little weathered and gray, with reddish hues restricted to fractures in both sandstones and shales (see supplemental data tables [footnote 1]). Truly red fractures are found only near the top of the cliffs. Other specimens have fractures oxidized to yellowish and brownish red only (Fig. 4).

Subaerial oxidative weathering to red hematite and brown goethite is thus restricted to fractures and increases toward the top of the cliff above the rock platform. The uppermost meter of each cliff is a mottled red saprolite, but most of the cliff is saprock. Graham et al. (2010) make a convincing case that vascular plant roots and fungal hyphae aid weathering of such deep cracks in weakened rock (saprock) beneath chemically altered rock (saprolite). Cracks in rock platforms have been used as evidence

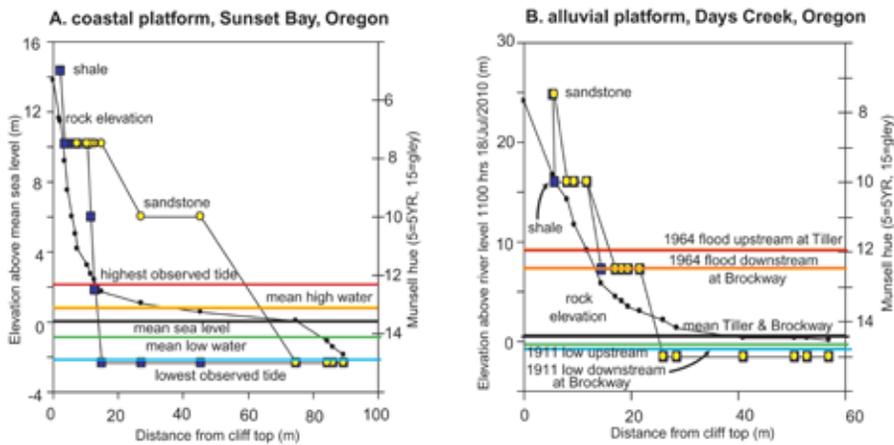


Figure 4. Munsell color (secondary axis) and topographic profile (primary axis) at Sunset Bay (A) and Days Creek (B), Oregon. Colored lines show historic flood and tide levels.

against a role for weathering in platform genesis because of observed variation in saturation (Trenhaile and Mercan, 1984), as expected in zones of water table and intertidal fluctuation (Ollier and Pain, 1996). More to the point of rock strength is the degree of weathering of the cracks, and the colors presented here are evidence that cracks in rock platforms never dried sufficiently to allow oxidized weathering rinds like those in cracks on the flanking cliff.

CONCLUSIONS

This study has revealed a sharp discontinuity in rock strength and oxidation of fractures, but not overall color or bulk density, between the saprock cliff and bedrock platform (Fig. 5). The discontinuity between saprock and bedrock is at the break in slope between the rock platform and the cliff, and the discontinuity is also a seepage point, moist with water or white with powdery salt efflorescences. It approximates the mean water table, above which oxidative weathering in fractures by plant roots and fungal hyphae are permitted. The slope of the rock platform from this break in slope toward mean sea or stream level (2.2° for Sunset Bay and 3.3° for Days Creek) is similar to the accommodation of water table to topography (2.2° to 2.5° calculated from well data of Beaulieu and Hughes, 1975) and well within tidal and river fluctuation (mean ± 0.9 m between mean low and mean high tide at Charleston, and mean ± 1.3 m between mean January and mean August river level at Tiller). Both fluvial and coastal rock platforms are exhuming the surface below which local water table fluctuation inhibited subaerial weathering. Below this level is hard bedrock and no evidence of weathering. Above this level, loose blocks of rock movable by waves and flood are created by a variety of subaerial processes: fungal hyphae, roots of grasses, blackberries and poison oak, honeycomb weathering, salt efflorescences, slaked shale fragments, slump blocks, and debris flows.

The platform profiles are graded to mean water table and sea level despite short-term (10^3 yr) interseismic uplift rates of as much as 4 mm a^{-1} (Burgette et al., 2009) and long-term (10^5 yr) uplift rates of as much as 0.2 mm a^{-1} (Personius, 1995). As in other tectonically uplifted regions (Berryman, 1993; Kennedy and Beban, 2005), long-term uplift or sea-level change over tens of thousands of years exceeds the rate of upland migration of platforms, so that a new platform is initiated at a water table

exposure and an old platform is stranded as an elevated terrace (Bockheim et al., 1996). In both river and coastal cases, the modern rock platforms are efficiently maintained, without steep slopes predicted from relative sea-level change (by Trenhaile, 2010). These observations suggest a role for bioturbation, wind erosion, and mass wasting in creating moveable rocks above the solid bedrock of the platforms. Between storms and floods, we have observed over the past 30 years that these movable rocks are stripped or deposited, depending on the magnitude of the event. Within meandering streams, these different conditions are seen on different banks, the depositional point-bar versus the erosional cut-bank. The cut-bank is largely responsible for exhuming alluvial water tables (Stark et al., 2010).

The rock platforms examined are close to base level, conventionally defined as two slightly different levels: both the lowest level to which streams can cut and also levels of lakes or seas into which rivers flow (Leopold and Bull, 1979). Streams flowing into lakes or the sea have meters of channel excavation below mean river or sea level (Bockheim et al., 1996). Like other rock platforms beside rivers (Montgomery, 2004; Stock et al., 2005), the rock platform near Days Creek (Fig. 1) is a meter or more above the channel thalweg. Thus, rock platforms are above the lowest level to which flooded streams cut by physical abrasion. Similarly, intertidal rock platforms rise above mean sea level and above the zone of intense wave energy at the outer edge of the platform (Stephenson and Kirk, 2000a; Kennedy et al., 2011). Furthermore, the rock platforms observed are not completely level, but slightly sloping and irregular (Figs. 2–4), unlike lake or sea levels, the second criterion of base level.

Floods and storm surges do much to clear rock platforms of debris from slumping and eolian abrasion, as we have observed firsthand at our sites over the past 30 years. Floods and storms, however, do not create the underlying discontinuity in rock strength revealed here within the zone of water table and intertidal fluctuation. Differences in rock hardness and weathering between cliffs and rock platforms support the idea that rock platforms in Oregon were water table platforms, and the uplifted rock surfaces behind them were paleo-water-table terraces stranded by a tectonic regime of long-term tectonic uplift. Similarly, coastal platforms became coastal terraces in tectonically active New Zealand when long-term uplift and lowered water table allowed undercutting at the outer edge (Berryman, 1993; Kennedy and Beban, 2005). Uncritical use of

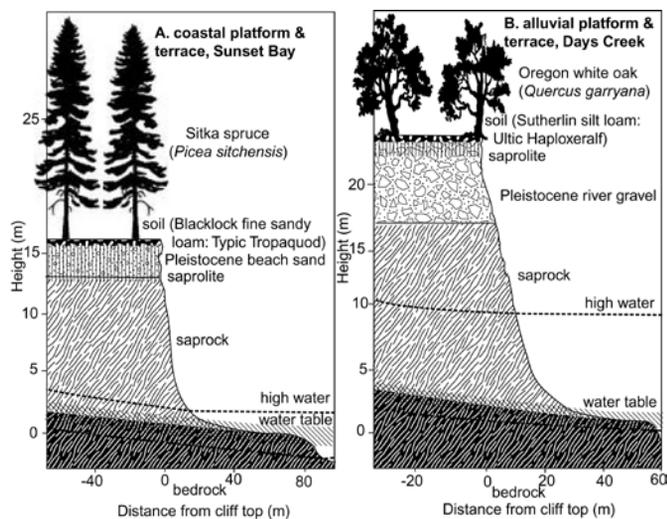


Figure 5. Cartoon of saprock-bedrock boundary at water table in coastal rock platform at Sunset Bay (A) and alluvial rock platform at Days Creek (B), Oregon.

the terms “wave-cut” and “stream-cut” is not recommended, because determining the relative role of physical and biochemical erosion in the formation of Holocene rock platforms and Pleistocene terraces is a non-trivial scientific problem. Our study indicates that some rock platforms are water tables exhumed from overlying weathered saprock.

ACKNOWLEDGMENTS

T.C. Hales, Peter Almond, Barbie Cameron-Smith, and Nathan Sheldon have been generous with discussion and ideas. Permission to study at Sunset Bay was granted by R.S. Johansen of the Oregon Parks and Recreation Division. Accommodation at Oregon Institute of Marine Biology was approved by Richard Emler and Shirley Pedro.

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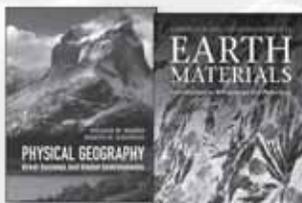
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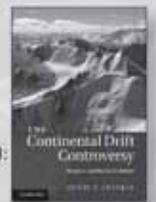
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GSA ANNUAL MEETING & EXPOSITION

4-7 NOVEMBER 2012
CHARLOTTE, NORTH CAROLINA, USA

SCIENCE!

The GSA Annual Meeting in Charlotte has a *great number* of interesting science sessions scheduled.



DISCIPLINE SESSIONS: Discipline sessions are created by pooling together abstracts submitted to a particular discipline category in order to create a very stimulating session. Please go to www.geosociety.org/meetings/2012/techProg.htm to begin the submission process.



TOPICAL SESSIONS: These sessions are topically focused for a motivating exchange of science. If you are interested in submitting an abstract to a particular topical session, you can review the list at www.geosociety.org/meetings/2012/sessions/topical.asp.



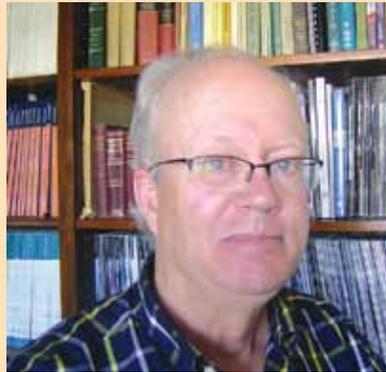
DIGITAL POSTERS: Presenting your science using your own software program was a big success in 2011. Two topical sessions are accepting digital poster presentations: T55 and T59. Read the descriptions at www.geosociety.org/meetings/2012/sessions/topical.asp. We encourage you be a part of the digital poster movement during 2012. Due to the costs of Internet and monitors, the fee to submit an abstract to these sessions is US\$80.

SPECIAL SESSIONS: Special Sessions are up to four hours long and session chairs have flexibility on what they are able to schedule into these sessions. If this piques your curiosity, plan on checking one out during the meeting. You can get more information on these enticing sessions at www.geosociety.org/meetings/2012/sessions/special.htm.



PARDEE KEYNOTE SYMPOSIA: Pardee Keynote Symposia represent leading-edge, interdisciplinary science and address broad, fundamental geoscience issues and/or areas of public policy. Speakers in these sessions are of high standing in their fields. These sessions range from “Digital Speed Dating” to “Understanding Earth through Carbon.” More information on these sessions is online at www.geosociety.org/meetings/2012/sessions/keynote.htm.

Message from the



John Diemer, Local Planning Committee General Chair

2012 GSA Annual Meeting & Exposition Local Planning Committee Chair

Dear GSA and Associated Society members, students, and educators:

You are warmly invited to Charlotte, North Carolina, USA, to participate in the 2012 GSA Annual Meeting & Exposition on 4–7 November. The geoscience community throughout the Southeast is working hard to make this an exciting and stimulating meeting designed to meet your interests and needs.

The meeting, with a broad array of field trips, technical sessions, and short courses, will surely be a good investment in your career and in the education of the next generation of geoscientists. Field trips are planned to investigate recent advances in our understanding of the geology of the Coastal Plain, Piedmont, and Blue Ridge geologic provinces. Technical sessions have been proposed that cover the full range of geoscience research both at home and abroad. Short courses and workshops provide opportunities to learn research methods and skills in an intimate setting. The exhibit hall will have the latest publications and instrumentation on display, and will provide a venue to discuss research and policy initiatives with members of GSA Divisions, Associated Societies, and government agencies. And, of course, opportunities to meet with old and new colleagues will abound!

Located in the Piedmont, and close to both the coast and Appalachians, Charlotte was at the center of the first gold rush in North America. Today it has become one of the major banking and investment centers in the world. As the largest city in the Carolinas, Charlotte has a broad array of cultural institutions, professional sports, a vibrant music scene, and excellent hotels and restaurants. There are greenways, light rail, a comprehensive bus system, and bike lanes throughout the city. And getting to Charlotte is easy as it is well-served by major highways, a growing airport, and passenger rail service.

This is the first time in more than 25 years that the Annual Meeting has been held in the Southeast, so it is an opportunity not to be missed!

John Diemer, Professor of Earth Sciences, UNC–Charlotte

Come to Charlotte in November! You will be most welcome!

Thanks 2012 Organizing Committee!

GSA members, guests, friends: We hope you can take some time before, during, or after the meeting to extend your gratitude to the following member-volunteers who have combined their time and talent toward producing an exceptional meeting experience for all.



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Meeting Schedule AT-A-GLANCE

Beginning with...

Pre-Meeting Field Trips: Wed., 31 Oct.–Sat., 3 Nov.

Short courses: Fri., 2 Nov.–Sat., 3 Nov.

Charlotte Icebreaker: Meet with friends, enjoy a beer, and plan your week in Charlotte! Saturday, 3 Nov., 5–7 p.m.

Sunday, 4 November

Technical Sessions/Oral Presentations, 8 a.m.–noon

Technical Sessions/Poster Presentations (view all day)—authors present 9–11 a.m. or 2–4 p.m.

Lunchtime Lecture #1: GSA Presidential Address & GSA President's Medal Presentation, 12:15–1:15 p.m.

Technical Sessions/Oral Presentations, 1:30–5:30 p.m.

Exhibit Hall opens 2–6:30 p.m.

Exhibit Hall Opening Reception, 4:30–6:30 p.m.

Monday, 5 November

Technical Sessions/Oral Presentations, 8 a.m.–noon

Technical Sessions/Poster Presentations (view all day)—authors present 9–11 a.m. or 2–4 p.m.

Exhibit Hall open 9 a.m.–6 p.m.

Lunchtime Lecture #2: GSA Awards Ceremony, 12:15–1:15 p.m.

Gold Medal Lectures, 2–3:30 p.m.

Technical Sessions/Oral Presentations, 1:30–5:30 p.m.

Afternoon Beer Reception, 4:30–6 p.m.

Alumni Receptions, 5 p.m.–midnight

Subaru Outdoor Life Lecture, 6–7 p.m.

Tuesday, 6 November

Election Day (U.S.)—Make sure to vote early or request an absentee ballot!

Technical Sessions/Oral Presentations, 8 a.m.–noon

Technical Sessions/Poster Presentations (view all day)—authors present 9–11 a.m. or 2–4 p.m.

Exhibit Hall open 9 a.m.–6 p.m.

Lunchtime Lecture #3: Michel T. Halbouty Distinguished Lecturer Scott Tinker, 12:15–1:15 p.m.

Technical Sessions/Oral Presentations, 1:30–5:30 p.m.

Afternoon Beer Reception, 4:30–6 p.m.

Majority of GSA Division & Associated Society Business Meetings, 5:45 p.m. start time

Wednesday, 7 November

Technical Sessions/Oral Presentations, 8 a.m.–noon

Technical Sessions/Poster Presentations (view all day)—authors present 9–11 a.m. or 2–4 p.m.

Exhibit Hall open 9 a.m.–2 p.m.

Lunchtime Lecture #4: The National Election: What do the results mean for science? 12:15–1:15 p.m.

Technical Sessions/Oral Presentations, 1:30–5:30 p.m.

Afternoon Beer Reception, 4:30–6 p.m.

Ending with...

Meeting officially ends Wednesday evening, 7 Nov.

Post-Meeting Field Trip departures begin Wed., 7 Nov.

Last Field Trip ends Sat., 10 Nov.

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- The U.S. National Whitewater Center (400 acres of outdoor recreation & adventure sports: <http://usnwc.org>)
- The EpiCentre (shopping, dining, entertainment, and recreation, two blocks from the convention center: <http://epicentrec.com>)
- NC Music Factory (music and entertainment, 10-min. drive or 30 min. by mass transit: <http://ncmusicfactory.com>)
- Carolina Renaissance Festival and Artisan Marketplace (weekends; 30 min. north: www.royalfaires.com/carolina/)
- Charlotte Regional Farmers Market (three miles from the airport: www.ncagr.gov/markets/facilities/markets/charlotte/fcharmkt.htm)



U.S. National Whitewater Center. Photo courtesy of Visit Charlotte.

GUEST PROGRAM

GSA warmly welcomes all members of the GSA community from near and far. For registered guests, we'll provide a comfortable Hospitality Suite while your geologist companions are busy attending sessions. The suite will offer complimentary refreshments, entertaining and educational seminars, and local experts with plenty of information, ready to answer your questions about the area. A variety of local tours will also be offered for an additional fee. We hope that you'll enjoy an escape from your hotel to learn more about the area from one of the knowledgeable tour guides.

2012 LOCAL TOURS

All Annual Meeting attendees and guests are welcome to register for the following tours. Fees for these tours cover the costs for professional tour guides, transportation, admission, and gratuities. Tours may be canceled if minimum attendance is not met (each tour requires a min. of 24 participants), so please register early! It's also a good idea to check the meeting website periodically for descriptions and news about the tours.

Sunday, 4 November

101. "A Day with the Queen" Charlotte City Tour: US\$28; 9 a.m.–noon.
102. Charlotte Historic Home Tour: US\$39; 1–5 p.m.

Monday, 5 November

103. Reed Gold Mine Adventure: US\$36; 1:30–5:30 p.m.

Tuesday, 6 November

104. Old Salem Moravian Community: US\$95; 9:30 a.m.–5:30 p.m. Lunch included.
105. Wing Haven Gardens and Elizabeth Lawrence House and Garden Tour: US\$36; 1:30–5:30 p.m.

Wednesday, 7 November

106. Harvest Vineyard Tour: US\$98; 9 a.m.–4 p.m. Lunch included.



Charlotte Light Rail. Photo courtesy of Visit Charlotte.



SCIENTIFIC FIELD TRIPS

The Charlotte 2012 field trips are set, and they look to be a great overview of southeastern geosciences, with something for everyone. Nineteen field trips highlight the Holocene to the Precambrian through beautiful Carolina coasts, piedmont, old growth swamps and floodplains, gorgeous Blue Ridge highlands, and more. Visit classic Triassic basin, Appalachian, or passive margin geology; dig up the latest on East Coast fossils; investigate evidence of 19th-, 20th- and 21st-century seismicity; learn how geology and vineyards intertwine; and explore potential natural gas reservoirs. Geoscientists in the southeast have employed everything from old-fashioned compasses and shovels to state-of-the-art cosmogenic isotope and thermochronology techniques to collect new data for this very old part of the continent. Join us before and after the meeting for one of these exciting geo-adventures.

FOURTH ANNUAL PHOTO EXHIBIT CONTEST

Submission deadline: 15 Sept. 2012

Categories

1. **Regional Geology:** Landscapes, features, or geologic activity within the GSA Southeastern Section region;
2. **Abstract Images:** The patterns of geology at any scale, photomicrographs to satellite images.
3. **Geologic Processes Past and Present:** Processes or features resulting from a specific process; for example: an erupting volcano or volcanic rocks that represent ancient eruptions.
4. **Iconic Landscapes:** Iconic geologic landscapes and features; for example: Grand Canyon, Death Valley, etc.

Timeline

- Submit your .jpg files (max. two entries per category) by 15 Sept. to geosocphotos@gmail.com.
- Winners will be notified by 30 Sept.
- Winners must send final files of appropriate size for printing by 10 Oct.

GSA'S CONNECTED COMMUNITIES

www.geosociety.org/meetings/2012/web2.htm



Meeting Bulletin Board

- Connect with other meeting attendees;
- Discuss what you want, when you want;
- Network, coordinate schedules, and plan activities;
- Save money by sharing travel & lodging expenses.

Information entered to this bulletin board is secure and only accessible by login at <http://rock.geosociety.org/forumstudenttravel>.



Twitter

- Get up-to-the-second meeting news by joining more than 5,000 geoscientists, students, agencies, and geoscience companies who follow @geosociety and by watching this year's meeting hashtag, #GEO2012;
- Let others know you'll be tweeting about the meeting on the Twitter Roll at www.geosociety.org/meetings/2012/web2.htm;
- Tweet with #GEO2012 in your message to create a rolling narrative & stretch the meeting's virtual boundaries.



Facebook

Check out GSA's vibrant Facebook page (and its new timeline!) and join 10,000 fans worldwide at www.facebook.com/GSA.1888.



LinkedIn

GSA manages an active LinkedIn group to help you network and stay connected with your professional peers. Build and shape our scientific exchange and move your career forward at www.linkedin.com/groups/Geological-Society-America-1298547?home.



Blog Roll

Let everyone know about your meeting-related blog posts! Add your info to the Blog Roll at www.geosociety.org/meetings/2012/web2.htm. Also, check out GSA's blog, *Speaking of Geoscience™*, at <http://geosociety.wordpress.com>, and learn how YOU can add to the discussion.



Mobile App Encore

Download *m²*, GSA's free meeting app, at www.geosociety.org/mobilemeeting/ and get the meeting at your fingertips.

- View the entire 2012 Annual Meeting technical program;
- Locate the talk you want to hear, add it to your calendar, and pinpoint the location on a map;
- See who's exhibiting and find them on the exhibit hall floor plan;
- Select events to attend and get alerts and reminders.

NETWORK & HAVE FUN!

EXHIBIT HALL OFFERS AN ABUNDANCE OF ACTIVITIES

Make time to stroll through the exhibit hall this year. There is definitely something for everyone!

- Stop by the **GSA Headquarter Services booth** to meet with staff and friends, renew your membership, visit with the Foundation, peruse GSA's most recent books and journals, access a Wi-Fi Hotspot, or just sit down and relax!
- Gain access to **hundreds of exhibitors** ranging from instrumentation companies, publishers, general education products, gems and minerals, as well as companies offering services or other geoscience-related information important to your career.
- Looking for **cutting-edge technology**? Stop by the **Digital Posters** throughout the week. You will also find hundreds of top-notch poster presentations each day.
- Trying to further your **career in the geosciences**? There are multiple options in the exhibit hall. You can even (1) interview onsite at **GSA's Employment Service Center**; (2) take the opportunity to interview potential graduate schools you are interested in attending—the **Graduate School Information Forum** allows you to meet with geoscience departments from more than 70 graduate schools across the country!



BOOST YOUR CAREER

Boost Your Career

SHORT COURSES: LEARN & EXPLORE!

Benefits:

- satisfy your personal interests & curiosity
 - cost-effective
 - continued professional development
 - technical assistance
 - career advancement
 - interact & exchange information with your peers
 - networking
 - large spectrum of topics in geology & education
 - earn continuing education credits
- Learn more on page 25 and check the meeting website for details.

CONTINUING EDUCATION CREDITS

The Annual Meeting offers an excellent opportunity to earn CEUs toward your general continuing education requirements for your employer or K–12 school. Credits are available for technical sessions, short courses, and field trips. Ten contact hours are required for one CEU. For example, one day (8 hours) of technical sessions offers 0.8 CEUs. After the meeting, contact Beth Engle at bengle@geosociety.org for a meeting evaluation form; after GSA receives your evaluation, a CEU certificate will be mailed to you within two weeks.

MENTOR PROGRAMS

GSA runs four mentoring programs at the annual meeting, all designed to

- Concentrate on employment within various sectors (*Geology in Government* and *Geology in Industry*) and specialties (*John Mann Mentors in Applied Hydrogeology*);
- Confront specific issues (*Women in Geology*);
- Facilitate future career choices by sharing resources, skills, and knowledge;
- Enhance professional development;
- Provide networking opportunities with professionals and other students; and
- Provide attendees with critical feedback (for example, the government and industry programs are driven entirely by students' questions).

**THINKING ABOUT GRADUATE SCHOOL?
GRADUATE SCHOOL INFORMATION FORUM**

Sun., 4 Nov., 8 a.m.–6:30 p.m.
Mon.–Wed., 5–7 Nov., 8 a.m.–6 p.m.

This forum provides an excellent opportunity for students to meet face to face with representatives from top geoscience schools around the country. Last year, almost 70 schools participated in the four-day event, saving students time & travel expenses and giving the schools a chance to meet with some of the best student geoscientists in the world in a relaxed, informal setting.

GSA EMPLOYMENT SERVICE

GSA runs a year-round online employment service database. Prior to the annual meeting, numerous employers post jobs in this database and search résumés so that they can set up interviews during the meeting. Don't miss this opportunity! GSA members can post their résumés for FREE. If you are close to graduating or are looking for a new position — *this service is for you!*

www.geosociety.org/Employment_Service/

OPPORTUNITIES



**Opportunities
to Help & Be Helped**

STUDENT MEMBERS: VOLUNTEER!

Earn FREE meeting registration when you volunteer for ten hours • PLUS a US\$25 stipend for every five hours worked • PLUS get an insider's view of the meeting!

Sign up early online at www.geosociety.org/meetings/2012/stuVolunteers.htm for the best selection of jobs, then register for the meeting as a student volunteer.

GRANT ASSISTANCE

Need financial assistance so you can come to the meeting? GSA's Sections, Divisions, and Associated Societies are ready to help! Various groups are offering grants to help defray your costs for registration, field trips, travel, etc., for the GSA Annual Meeting. Check out the meeting website for application and deadline information. Note: Eligibility criteria and deadline dates vary by grant.

Been helped in the past and ready to give back? Donate to the Student Travel Fund when you register!



CHILD CARE

Sat.–Wed., 7 a.m.–6 p.m. each day: Attend sessions while your children have fun! Check the meeting website for registration information.



ACTION ITEMS

Action Items

DATES & DEADLINES

- Graduate School Information Forum: **Reserve Now!**
- Space request deadline (standard fee): **Tues., 5 June**
- International Section grant application deadline: **Sun., 1 July**
- Abstracts deadline: **Tues., 14 Aug.** (midnight PDT)
- Photo exhibit submission deadline: **Sat., 15 Sept.**
- Early registration deadline: **Mon., 1 Oct.**
- Childcare registration: **Mon., 1 Oct.**
- Housing deadline: **Tues., 9 Oct.**
- Registration cancellation deadline: **Tues., 9 Oct.**
- Field trips begin **Wed., 31 Oct.**
- Meeting officially opens **Sun., 4 Nov.**
- Meeting officially ends **Wed., 7 Nov.**
- Last field trip ends **Sat., 10 Nov.**

INTERNATIONAL VISAS—DO YOU NEED ONE?

Please check the U.S. State Department website at http://travel.state.gov/visa/visa_1750.html. The International Visitors' Office of the Board on International Scientific Organization (from the National Academies of Science website) also has a great site for scientists coming to the U.S.: <http://sites.nationalacademies.org/PGA/biso/visas/>.



REGISTRATION

Early registration deadline: **1 October**

Cancellation deadline: **9 October**

Check the meeting website for more information.

REGISTRATION FEES (all fees are in U.S. dollars)

	Early Reg., June–1 Oct.	Standard & Onsite
Member professional, full mtg.	\$330	\$410
Member professional, one day	\$215	\$245
Member professional 70+, full mtg.	\$255	\$340
Member professional 70+, one day	\$155	\$175
Nonmember professional, full mtg.	\$430	\$510
Nonmember professional, one day	\$285	\$315
Member student, full mtg.	\$109	\$144
Member student, one day	\$70	\$80
Nonmember student, full mtg.	\$149	\$184
Nonmember student, one day	\$90	\$100
K–12 professional, full mtg.	\$50	\$60
High school student	\$40	\$40
Guest or Spouse	\$85	\$90
Field Trip or Short Course only	\$40	\$40
Low Income Country*	50%	50%

*Participants from countries classified as “Low or Lower Middle Income Economies” by the World Bank need only pay 50% of the category fee for full meeting or one day registration. Online registration is not available for “Low or Lower Middle Income Economy” registrants; please fill out a printed version of the registration form (see the meeting website) and mail it to GSA, 3300 Penrose Place, Boulder, Colorado 80301, USA; or FAX to +1-303-357-1070.

When You Register, Don't Forget to

- Register for tours, special events, field trips, and workshops;
- Apply for the Student Travel Grant by 1 Oct.;
- Make your hotel reservation;
- Book your travel; and
- Invite a colleague to attend!

SUBMIT YOUR ABSTRACT

Abstracts submission deadline: Tues., 14 August

Submitting an Abstract

- To begin submission, go to <http://gsa.confex.com/gsa/2012AM/index.epl>.
- The submission fee is US\$45 for professionals; US\$25 for students; and US\$80 for digital posters.
- You may present two volunteered abstracts during the Annual Meeting, *as long as one of these abstracts is a poster (including digital poster) presentation.*

Three Ways to Present

1. **Speaking** (12 min. plus 3 min. of Q&A).
2. **Posters** (horizontal 8-ft. by 4-ft. display board posted 9 a.m.–6 p.m., with authors present either 9–11 a.m. or 2–4 p.m.).
3. **Digital Posters** (horizontal 8-ft. by 4-ft. display board plus an ~40 to 46 inch digital monitor).

QUESTIONS?

2012 Technical Program Chair

Dick Berg, Illinois Geological Survey, rberg@illinois.edu

GSA Technical Program Manager

Nancy Wright, GSA, nwright@geosociety.org



EVENTS REQUIRING TICKETS/ADVANCE REGISTRATION

Several GSA Divisions and Associated Societies will hold breakfast, lunch, or reception awards presentations that require a ticket and/or advance registration. A complete list of ticketed events is available on the meeting website. *Don't forget to purchase a ticket when you register for the meeting.*

HOUSING

New for 2012: Complimentary Internet will be available in all guest rooms when reservations are made through the Visit Charlotte/GSA Housing Bureau (Omni Charlotte Hotel only: You must sign up for the Omni Select Guest Membership to receive free Internet service). To make a reservation and for all hotel information and policies, please go to the meeting website. For a listing of hotels and a map of the area, see page 23.



CHARLOTTE

4-7 NOVEMBER 2012 • CHARLOTTE, NORTH CAROLINA, USA

Photo by Patrick Schneide, courtesy of Visit Charlotte.

Getting to Charlotte



BY PLANE

Charlotte Douglas International Airport (CLT), which won the 2010 “Best Airport” award, serves more than 34 million passengers annually, with more than 670 daily flights and nonstop service to 138 national and international cities. The airport is a 15-minute drive from downtown/Center City. Taxi service is available curbside on the baggage claim level. Fare from the airport to Center City is ~\$25. Hotel courtesy vehicles may also be available. All participating hotels may be contacted through one of four traveler information centers on the baggage claim level. The airport also houses a variety of private shuttle services and car rental agencies that you can search online by clicking on “Visitor Services” and then “Ground Transportation” on the airport website, www.charlotteairport.com.



BY CAR

Highways I-77 and I-85 link Charlotte to hubs across the Northeast, Southwest, and Midwest, and I-40 offers a coast-to-coast link less than an hour north of the city. Visit www.nccommerce.com for further information.



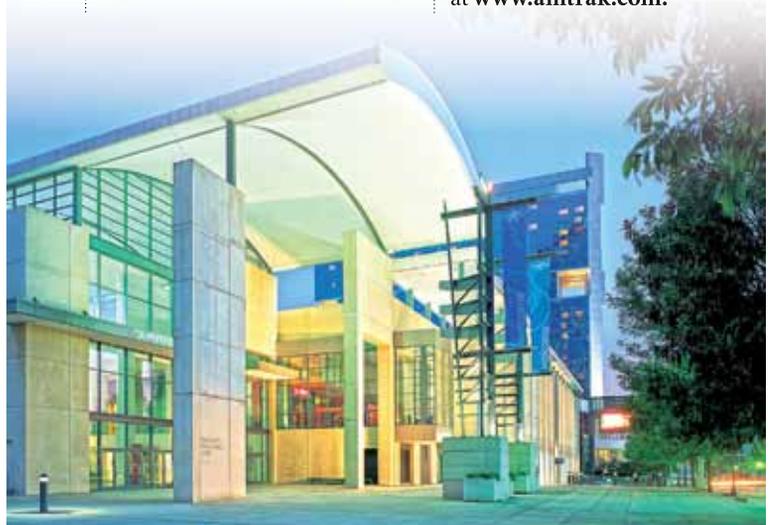
BY BUS

Greyhound offers daily service to and from Charlotte along the East Coast and across the Southeast. Major cities include Raleigh, Atlanta, and Richmond. For more information contact www.greyhound.com.



BY TRAIN

Three Amtrak routes serve Charlotte, “the Queen City,” daily. The *Piedmont* connects Charlotte and Raleigh; the *Carolinian* runs to/from New York; and the *Crescent* travels from New York to New Orleans. More information on Amtrak schedules is available at www.amtrak.com.



Charlotte Convention Center.
Photo by Patrick Schneider,
courtesy of Visit Charlotte.

Geological Society of America Official Uptown Charlotte Hotels



Charlotte's got a lot.

Exhibitors by Category

Computer Software

International Centre for
Diffraction Data
iXRF Systems Inc.

Gems/Minerals Dealers, Jewelry/Gifts

Cornerstone Minerals
Finesilver Designs/Jewelry
Gems & Crystals Unlimited
IKON Mining & Exploration
Komodo Dragon
Natural Earth Craft

General Educational

Products

Cengage Learning
Friendship Publications
Little River Research & Design

Geographic Supplies and Related Equipment

Forestry Suppliers Inc.
Rite in the Rain

Geological Society of America

GSA Environmental &
Engineering Geology
Division
GSA Geoinformatics Division
GSA Geology & Public Policy
Committee
GSA Geology & Society
Division
GSA Geophysics Division
GSA Geoscience Education
Division
GSA History & Philosophy of
Geology Division
GSA Hydrogeology Division
GSA Limnogeology Division
GSA Mineralogy,
Geochemistry, Petrology &
Volcanology Division
GSA Planetary Geology
Division

Geological and Geophysical Instrumentation

ASC Scientific
ASD Inc.
Bruker AXS
elementar Americas

EmCal Scientific Inc.
Gatan Inc.
Geophysical Survey
Systems Inc.
Gran Systems
Horiba Instruments Inc.
IsotopX Inc.
Leica Microsystems
Mala Geoscience USA Inc.
Meiji Techno America
Optech
PANalytical
Retsch Inc.
Rigaku Americas Corporation
Sensors & Software Inc.
Thermo Scientific
UNAVCO

Government Agencies (Federal, State, Local, International)

National Park Service
National Science Foundation
U.S. Forest Service
U.S. Geological Survey

Other

Consortium for Ocean
Leadership
CUAHSI
EARTHTIME
Estwing Mfg. Co.
European Geosciences Union
IRIS Consortium
Subaru of America Inc.

Professional Societies and Associations

AAPG Bookstore & Student
Programs
AASP - The Palynological
Society
American Geophysical Union
American Geosciences
Institute
American Institute of
Professional Geologists
American Meteorological
Society
American Quaternary Assoc.
Assoc. for Women Geoscientists
Assoc. of Earth Science Editors
Assoc. of Environmental &
Engineering Geologists

Clay Minerals Society
Council on Undergraduate
Research
Cushman Foundation
Geochemical Society
Geological Assoc. of Canada
Geological Society of London
Geoscience Information
Society
GeoScienceWorld
International Assoc. of
GeoChemistry
Mineralogical Assoc. of Canada
Mineralogical Society of
America
National Assoc. of Black
Geologists & Geophysicists
National Assoc. of Geoscience
Teachers
National Cave & Karst
Research Institute
National Ground Water Assoc.
National Speleological Society
Paleontological Research
Institution
Paleontological Society
SEPM (Society for Sedimentary
Geology)
Sigma Gamma Epsilon
Society for the Preservation of
Natural History Collections
Society of Economic Geologists
Society of Exploration
Geophysicists

Publications, Maps, Films

Cambridge University Press
Elsevier
ESRI
Jones & Bartlett Learning
Kendall Hunt Publishing
McGraw-Hill Company
Micropaleontology Project
Nature Publishing Group
Pearson
Springer
Taylor & Francis
Treatise on Invertebrate
Paleontology
University of California Press
University of Chicago Press—
The Journal of Geology
W.H. Freeman
W.W. Norton

Waveland Press Inc.
Wiley-Blackwell
Yale University Press

Services

(Exploration, Laboratories, Consulting, etc.)

Beta Analytic Inc.
DOSECC
Environmental Isotope Lab
Geoinformatics for the
Geosciences
GNS Science—Rafter
Radiocarbon Laboratory
Isotope Tracer Technologies
Olympus
Ruen Drilling Inc.

State Surveys

Assoc. of American State
Geologists

Universities/Schools

Baylor Univ. Dept. of Geology
Cooper Center, California State
Univ.—Fullerton
EarthScope
Gemological Institute of
America
Geocognition Research Lab
Mississippi State Univ.
National Centre for
Groundwater Research &
Training
Texas A&M Univ. Dept. of
Geology & Geophysics
Univ. of Nevada—Las Vegas
Univ. of Nevada—Reno
Univ. of Texas at Austin
Jackson School of
Geosciences

Short Course Program

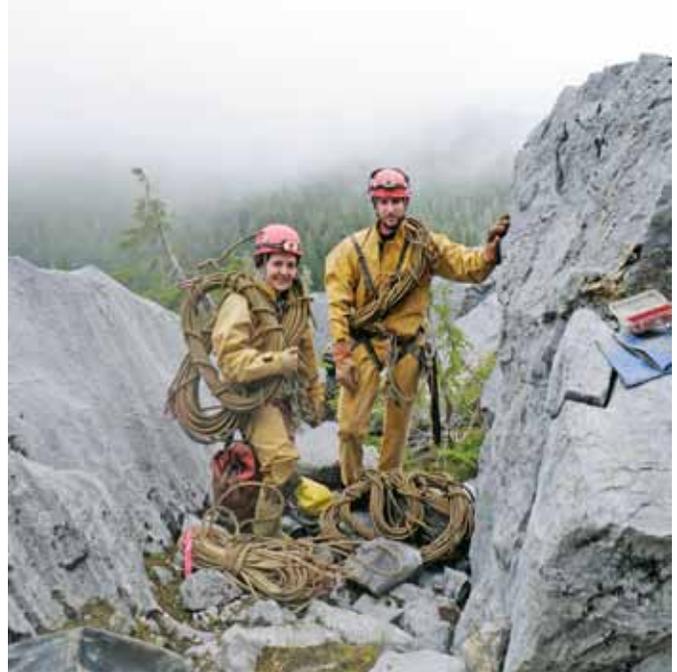
Early registration deadline: **1 October**

Registration after 1 October **costs an additional US\$30**

Cancellation deadline: **9 October**

The following short courses are open to all. Early registration is highly recommended to ensure course viability. Check the meeting website or contact Jennifer Nocerino at jnocerino@geosociety.org for course abstracts and additional information.

- **Can I take a short course if I am not registered for the meeting? YES!** You're welcome to—just add the meeting nonregistrant fee (US\$40 by 1 Oct.) to your course enrollment cost. Should you then decide to attend the meeting, your nonregistrant payment will be applied toward meeting registration.
- **GSA K–12 teacher members:** You are welcome to take short courses without registering for the meeting or paying the nonregistrant fee.



501. **New Developments in Fluorescence Spectroscopy to Characterize Dissolved Organic Matter.** Fri., 2 Nov., 8 a.m.–5 p.m. US\$35; includes continental breakfast and lunch. Limit: 25. CEU: 0.8. Rose Cory, Univ. of North Carolina–Chapel Hill; Adam Gilmore, HORIBA Instruments Inc.
502. **Sequence Stratigraphy for Graduate Students.** Fri.–Sat., 2–3 Nov., 8 a.m.–5 p.m. US\$25; registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$25 upon signing in at the course. Limit: 55. CEU: 1.6. Art Donovan, BP; Morgan Sullivan, Chevron; Bret Dixon, Anadarko; Bob Stewart; ExxonMobil.
503. **Field Safety Leadership.** Fri.–Sat., 2–3 Nov., 8 a.m.–5 p.m. US\$25; includes continental breakfast and lunch, plus registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$25 upon signing in at the course. Limit: 24. CEU: 1.6. Stephen Oliveri, ExxonMobil Corp.; Kevin Bohacs, ExxonMobil Upstream Research Company; Amy Ruf, ExxonMobil Upstream Research Co.
504. **Introduction to Petroleum Structural Geology.** Fri.–Sat., 2–3 Nov., 8 a.m.–5 p.m. US\$25; includes continental breakfast and lunch, plus registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$25 upon signing in at the course. Limit: 30. CEU: 1.6. Peter Vrolijk, ExxonMobil Upstream Research Co.; Peter Hennings, ConocoPhillips; J. Steve Davis, ExxonMobil Upstream Research Co.
505. **Volcanic Crisis Awareness.** Fri., 2 Nov., 8 a.m.–5 p.m. and Sat., 3 Nov., 8 a.m.–noon. FREE. Limit: 30. CEU: 1.2. Bruce Houghton, Univ. of Hawaii; Lydia Morikawa, Univ. of Hawaii.
506. **Structural and Stratigraphic Concepts Applied to Basin Exploration.** Fri.–Sat., 2–3 Nov., 8 a.m.–5 p.m. US\$25; includes continental breakfast and lunch, plus registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$25 upon signing in at the course. Limit: 30. CEU: 1.6. Lori Summa, ExxonMobil Upstream Research Co.; Bob Stewart, ExxonMobil Exploration Co.
507. **Best Practices for Preparing Workforce and Transfer Students in Two-Year Colleges for Geoscience Careers.** Sat., 3 Nov., 8 a.m.–4 p.m. US\$25; includes lunch. Limit: 50. CEU: 0.7. Eric Baer, Highline Community College; Robert Blodgett, Austin Community College District.
508. **Instructional Approaches to Access, Accommodation, and Inclusion of Students with Disabilities in the Geosciences.** Sat., 3 Nov., 8 a.m.–5 p.m. US\$35; includes lunch. Participants will be reimbursed the cost of the short course registration after attending. Limit: 50. CEU: 0.8. Christopher Atchison, Georgia State Univ.; Brett Gilley, Univ. of British Columbia; Gina Ceylan, Univ. of Missouri.
509. **Near-Surface Geophysics for Non-Geophysicists.** Sat., 3 Nov., 8 a.m.–5 p.m. US\$110; includes lunch and course materials. Limit: 45. CEU: 0.8. Gregory Baker, Univ. of Tennessee.

GSA ANNUAL MEETING & EXPOSITION

510. **Estimating Groundwater Recharge.** Sat., 3 Nov., 8 a.m.–5 p.m. US\$140; includes lunch. Limit: 35. CEU: 0.8. Richard Healy, U.S. Geological Survey; Bridget Scanlon, Univ. of Texas at Austin.
- 511A. **Active Lectures in Classrooms of All Sizes.** Sat., 3 Nov., 8 a.m.–noon. US\$45 for one course—OR get two for one!—US\$45 for combined courses (add 511C or 511D); includes lunch. Limit: 40. CEU: 0.4. Mark Leckie, Univ. of Massachusetts—Amherst; Jessica Smay, San José City College; Karen Kortz, Community College of Rhode Island.
- 511B. **Teaching about Hazards in the Geoscience Classroom.** Sat., 3 Nov., 8 a.m.–noon. US\$45 for one course OR get two for one!—US\$45 for combined courses (add 511C or 511D); includes lunch. Limit: 40. CEU: 0.4. John McDaris, Science Education Resource Center at Carleton College; Wendi Williams, Northwest Arkansas Community College.
- 511C. **Making the Invisible Visible: Assessing Higher Order Thinking in your Students.** Sat., 3 Nov., 1–5 p.m. US\$45 for one course—OR get two for one!—US\$45 for combined courses (add 511A or 511B); includes lunch. Limit: 40. CEU: 0.4. Bruce Herbert, Texas A&M.
- 511D. **Design an Effective Field Experience.** Sat., 3 Nov., 1–5 p.m. US\$45 for one course—OR get two for one!—US\$45 for combined courses (add 511A or 511B); includes lunch. Limit: 40. CEU: 0.4. David Mogk, Montana State Univ.; Steven Whitmeyer, James Madison Univ.
512. **Using the Grand Challenges to Improve Instruction of Scientific Literacy and Quantitative Reasoning.** Sat., 3 Nov., 8 a.m.–5 p.m. US\$46; includes continental breakfast and lunch. Limit: 20. CEU: 0.8. James D. Myers, Univ. of Wyoming; Mark E. Lyford, Univ. of Wyoming; Alan R. Buss, Univ. of Wyoming.
513. **Research Initiatives in Northern Hemisphere Quaternary Non-Marine Ostracoda, Workshop II.** Sat., 3 Nov., 8 a.m.–5 p.m. US\$20; includes lunch, plus registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$20 upon signing in at the course. Limit: 30. CEU: 0.8. Alison Smith, Kent State Univ.; David J. Horne, Queen Mary Univ. of London.
514. **Rationale and Methods for Regional 3-D Geological Mapping by Geological Survey Agencies.** Sat., 3 Nov., 8 a.m.–5 p.m. US\$85; includes lunch. Limit: 40. CEU: 0.8. Harvey Thorleifson, Minnesota Geological Survey; Richard Berg, Illinois State Geological Survey; Hazen Russell, Geological Survey of Canada.
515. **Education Research I: Conducting Qualitative Geoscience Education Research.** Sat., 3 Nov., 8 a.m.–12 p.m. US\$70. Limit: 35. CEU: 0.4. Julie Sexton, Univ. of Northern Colorado.
516. **An Inquiry Approach to Teaching Plate Tectonics.** Sat., 3 Nov., 8 a.m.–noon. US\$25, includes lunch, plus registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$25 upon signing in at the course. Limit: 50. CEU: 0.4. Davida Buehler, GSA.
517. **U-Pb Geochronology and Hf Isotope Geochemistry Applied to Detrital Minerals.** Sat., 3 Nov., 9 a.m.–5 p.m. US\$41, includes continental breakfast and lunch. Limit: 50. CEU: 0.7. George Gehrels, Univ. of Arizona.
518. **Using a Constructivist Approach to Teach Rocks.** Sat., 3 Nov., 1–5 p.m. US\$25, includes lunch, plus registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$25 upon signing in at the course. Limit: 50. CEU: 0.4. Davida Buehler, GSA.
519. **Mars for Earthlings: Teaching Modules Integrating Earth and Planetary Science.** Sat., 3 Nov., 1–5 p.m. US\$20; registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$20 upon signing in at the course. Limit: 30. CEU: 0.4. Marjorie Chan, Univ. of Utah; Julia Kahmann Robinson, Univ. of Utah.
520. **Getting Started in Undergraduate Research for New and Future Faculty.** Sat., 3 Nov., 1–5 p.m. US\$25. Limit: 20. CEU: 0.4. Lydia Fox, Univ. of the Pacific.
521. **Recalling Optical Mineralogy: Teaching it with Newer Methods and its Role in Current Mineralogy Research.** Sat., 3 Nov., 8 a.m.–noon. US\$25. Limit: 30. CEU: 0.4. Mickey Gunter, Univ. of Idaho.
522. **Communicating Science: Tools for Scientists.** Sat., 3 Nov., 1–5 p.m. US\$25; registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$25 upon signing in at the course. Limit: 30. CEU: 0.4. Tiffany Lohwater, AAAS; Christa Stratton, GSA; Kasey White, GSA.
523. **Education Research II: Conducting Quantitative Geoscience Education Research.** Sat., 3 Nov., 1–5 p.m. US\$70. Limit: 35. CEU: 0.4. Julie Sexton, Univ. of Northern Colorado.
524. **Quantitative Literacy and Geology in the National Parks.** Sat., 3 Nov., 1–5 p.m. US\$20; this fee will be refunded upon completion of the course. Limit: 20. CEU: 0.4. H.L. Vacher, Univ. of South Florida; Mark Rains, Univ. of South Florida; Tom Juster, Univ. of South Florida; Mark Horwitz, Univ. of South Florida; Mark Hainsworth, Emory and Henry College; Susan Sachs, Great Smokey Mountains National Park.

GSA ANNUAL MEETING & EXPOSITION

525. **Terrestrial Laser Scanning (Ground-Based LiDAR) Methods and Applications in Geologic Research & Education.** Sun., 4 Nov., 8 a.m.–5 p.m. US\$36; includes lunch. Some financial support is available for students; see the meeting website for more information. Limit: 20. CEU: 0.8. David Phillips, UNAVCO; John Oldow, Univ. of Texas at Dallas; Carlos Aiken, Univ. of Texas at Dallas.

526. **Introductory Remote Sensing for Geoscientists.** Sun., 4 Nov., 9 a.m.–5 p.m. US\$83; includes lunch. Limit: 20. CEU: 0.7. John Chadwick, College of Charleston.

527. **X-Ray Diffraction in Geosciences.** Sun., 4 Nov., 9 a.m.–5 p.m. US\$35, includes lunch, plus registrants will receive a coupon redeemable at the onsite GSA bookstore for US\$25 upon signing in at the course. Limit: 100. CEU: 0.7. Sandeep Rekhi, PANalytical; James Kaduk, Poly Crystallography Inc.; Andrew Payzant, Oak Ridge National Laboratory; Daniel Deocampo, Georgia State Univ.; Surendra Saxena, Florida International Univ.; Saugata Datta, Kansas State Univ.

528. **Engaging ALL Students: Effective Strategies for Teaching Diverse College Students.** Sun., 4 Nov., 9 a.m.–5 p.m. US\$35, includes lunch. Limit: 40. CEU: 0.7. Tim Slater, Univ. of Wyoming; Karen Kortz, Community College of Rhode Island; Stephanie Slater, CAPER Center for Astrophysics & Physics Education Research; Jessica Smay, San José City College.

GSA ASSOCIATED SOCIETY COURSES

GSA will not be handling registration for these courses; contact conveners listed with the course.

Reconstructing Earth's Deep-Time Climate—The State of the Art in 2012. Sat., 3 Nov., 8 a.m.–5 p.m. FREE. Limit: 200. Registration is not necessary; just show up to attend (check the meeting website for details and contact information). Linda Ivany, Syracuse Univ.; Brian Huber, Smithsonian Institution.

Your Research—Published This Year!

GSA TODAY has openings in its 2012–2013 editorial calendar for both science and Groundwork articles.



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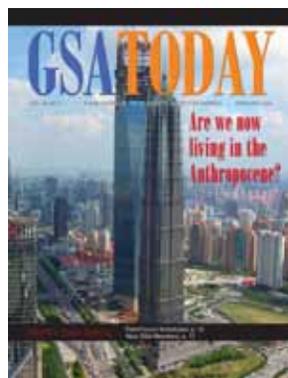
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Scientific Field Trips

Field-trip chairs: Missy Eppes, meppes@uncc.edu;
Jerry Bartholomew, jbrthlm1@memphis.edu.

GSA contact: Beth Engle, bengle@geosociety.org.

Please contact trip leaders directly if you have questions about trip details; leader contact information and expanded trip descriptions are listed on the meeting website. All trips begin and end in Charlotte at the Charlotte Convention Center unless otherwise indicated.

401. **Geology and Landform Development of the Georgia Coastal Plain–Cumberland Island to the Okefenokee Swamp.** Wed.–Sat., 31 Oct.–3 Nov. US\$325. Leaders: Chester W. Jackson, Georgia Southern Univ.; Frederick Rich. This trip begins in St. Marys, Georgia, and ends in Charlotte, North Carolina
402. **Igneous Activity, Metamorphism, and Deformation in the Mount Rogers Area, SW Virginia and NW North Carolina: A Geologic Record of Precambrian Tectonic Evolution of the Southern Blue Ridge Province.** Thurs.–Sat., 1–3 Nov. US\$344. Leaders: Richard Tollo, George Washington Univ.; and J.N. Aleinikoff.
403. **The Neocadian Orogenic Core of the Southern Appalachians: A Geo-Traversal through the Migmatitic Inner Piedmont from the Brushy Mountains to Lincolnton, North Carolina.** Thu.–Sat., 1–3 Nov. US\$245. Leaders: Arthur J. Merschat, USGS; Robert D. Hatcher, Heather E. Byars, and William Gilliam.
404. **The New Madrid Seismic Zone.** Fri., 2 Nov. US\$79. Leader: Roy B. Van Arsdale, Univ. of Memphis. This trip begins and ends in Memphis, Tennessee. GSA's Environmental and Engineering Geology Division (EEGD) is sponsoring this trip and will reimburse EEGD student member attendees US\$100 and regular EEGD member attendees US\$30. To join EEGD, contact GSA at gsaservice@geosociety.org. For reimbursement, contact Bill Schulz at wschulz@usgs.gov.
405. **Late Proterozoic to Mesozoic Petrologic and Ductile-Brittle Structural Relationships along the Alleghanian Nutbush Creek Fault Zone and Deep River Triassic Basin in North Carolina.** Fri.–Sat., 2–3 Nov. US\$185. Leaders: David E. Blake, Univ. of North Carolina–Wilmington; Edward F. Stoddard, Philip J. Bradley, and Timothy W. Clark.
406. **Hydrology Field Research in the Congaree River Floodplain: Engaged Learning about Research, Resource Management, and Education at Congaree National Park.** Fri.–Sat., 2–3 Nov. US\$218. Leaders: David C. Shelley, Congaree National Park; Timothy J. Callahan.
407. **Traversing Suspect Terranes in the Central Virginia Piedmont: From Proterozoic Anorthosites to Modern Earthquakes.** Fri.–Sat., 2–3 Nov. US\$211. Leaders: Christopher Bailey, College of William and Mary; Brent E. Owens.
408. **The Early-Middle Mississippian Borden-Grainger–Fort Payne Delta/Basin Complex: Field Evidence for Delta Sedimentation, Basin Starvation, Mud-Mound Genesis, and Tectonism during the Neocadian Orogeny.** Fri.–Sun., 2–4 Nov. US\$360. Leaders: Frank R. Ettensohn, Univ. of Kentucky; Devi Prasad Udgata, Robert Thomas Lierman, Charles E. Mason. This trip begins in Morehead, Kentucky, and ends in Charlotte, North Carolina.
409. **Disequilibrium in Landscape Evolution of the Southern Appalachian Mountains.** Sat., 3 Nov. US\$96. Leaders: James A. Spotila, Virginia Tech; Philip S. Prince.



Weston Lake, Congaree National Park; photo by Theresa Thom, NPS.



Craterlet on Ten Mile Hill after the 31 Aug. 1886 Charleston, South Carolina, earthquake. Photo courtesy USGS.

410. **Historic Mill Ponds & Piedmont Stream Water Quality: Making the Connection near Raleigh, North Carolina.** Sat., 3 Nov. US\$102. Leader: Karl W. Wegmann, North Carolina State Univ. This trip begins in Raleigh, North Carolina, and ends in Charlotte, North Carolina.
411. **Kirk Bryan Field Trip: Piedmont Potpourris: New Perspectives on An Old Landscape (and Some of its Younger Parts).** Wed., 7 Nov. US\$81. Leaders: M.C. Eppes, Univ. of North Carolina–Charlotte; Anne J. Jefferson, Karl Wegmann, Paul R. Bierman, Ryan McKeon.
412. **Significance of the Geology of the Talladega Belt to Southern Appalachian Tectonics.** Wed.–Fri., 7–9 Nov. US\$248. Leaders: James F. Tull, Florida State Univ., Clinton I. Barineau. This trip begins in Charlotte, North Carolina, and ends in Atlanta, Georgia.
413. **Of Mushwads and Mayhem: Disharmonically Deformed Gas Shale in the Southern Appalachian Thrust Belt.** Wed.–Fri., 7–9 Nov. US\$294. Leaders: William A. Thomas, Geological Survey of Alabama; Jack C. Pashin. This trip begins in Charlotte, North Carolina, and ends in Birmingham, Alabama.
414. **Geology, Geography, and Environment of Viticulture in the Upper Hiwassee River Basin, Southwestern North Carolina and Northern Georgia—Terroir of an Emerging American Wine-Producing Area.** Wed.–Fri., 7–9 Nov. US\$319. Leader: Joseph Forrest, Resource Geoservices LLC.
415. **The Fractured Foundation of the Post-Orogenic (Mesozoic-Cenozoic) Southern Appalachian Piedmont and Coastal Plain in Georgia and South Carolina.** Wed.–Fri., 7–9 Nov. US\$300. Leaders: Mervin J. Bartholomew, Univ. of Memphis; Fredrick J. Rich, John M. Garihan, Mark A. Evans.
416. **Late Quaternary Geology and Geomorphology of Floodplain Deposits in Congaree National Park.** Thurs.–Fri., 8–9 Nov. US\$222. Leaders: David C. Shelley, Congaree National Park; Scott P. Werts, Douglas Dvoracek, William H. Armstrong.
417. **The Great 1886 Charleston Earthquake: Visible Damage from the Largest United States Earthquake of the 1800s.** Thurs.–Fri., 8–9 Nov. US\$194. Leaders: Erin K. Beutel, College of Charleston; Norman Levine, Steven C. Jaume, Pradeep Talwani. GSA's Environmental and Engineering Geology Division (EEGD) is sponsoring this trip and will reimburse EEGD student member attendees US\$100 and regular EEGD member attendees US\$30. To join EEGD, contact GSA at gsaservice@geosociety.org. For reimbursement, contact Bill Schulz at wschulz@usgs.gov.
418. **Geology of Ediacaran-Earliest Cambrian Rocks of the Western Carolina Terrane in South Carolina.** Thu.–Sat., 8–10 Nov. US\$308. Leaders: Allen J. Dennis, Univ. of South Carolina–Aiken; John W. Shervais, Dennis LaPoint.
419. **Stratigraphy, Paleontology, and Geological Resources of the Upper Triassic Newark Supergroup Basins, North Carolina and Southern Virginia.** Thurs.–Sat., 8–10 Nov. US\$338. Leaders: Andrew B. Heckert, Appalachian State Univ.; Kenneth B. Taylor, Vincent P. Schneider.

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John Geissman

GSA Alerts Provosts, Deans, and Department Heads across North America of the Critical Need for Strong Geoscience Education

Two Position Statements prepared by the Geology and Public Policy Committee (GPPC) were endorsed by GSA Council at its October 2011 meeting: “The Importance

of Teaching Earth Science” and “Expanding and Improving Geoscience in Higher Education.” Consistent with growing inter-society efforts to promote the importance of a sound geoscience education to all facets of society, Council also recommended that these two position statements be sent to deans and provosts of colleges and universities throughout the United States, Canada, and Mexico.

In January 2012, GSA mailed the position statements along with a personal cover letter for each provost, dean, and department head at more than 150 institutions, ranging from the “tier ones” to liberal arts colleges with strong geoscience programs.

The cover letter emphasized the value of a strong, adequately supported geoscience department and drew the importance of a well-trained geoscience workforce to the attention of each administrator. In this vein, the letter cited the most recent American Geosciences Institute (AGI) workforce evaluation, which documents critical future workforce needs that are essential to the sustainability of humankind.

A final wave of follow-up e-mails was sent in early February, with copies of the position statements and cover letters attached.

Although the impact of such an initiative is never simple to gauge, the fact that all responses received to date have been appreciative and positive indicates to me that the effort was clearly worthwhile. **The following are some examples:**

“Please rest assured that the dedication of the Geological Society of America to geology and geosciences education is shared by those of us at The City University of New York.”

—Alexandra W. Logue, Executive Vice Chancellor and University Provost, CUNY

“Many thanks for your message. The University of Wyoming is completely on board with GSA’s position statements. Our geoscience expertise spans at least 6 departments in 3 colleges, and among our recent initiatives are a School of Energy Resources and a partnership with the National Center for Atmospheric Research in running a geoscience-oriented supercomputer. UW’s students have access to some truly spectacular educational opportunities. In addition, through our Science and Mathematics Teaching Center, UW provides high-caliber educational resources for science teachers in Wyoming’s K–12 school districts.” —Myron B. Allen, Provost and Vice President for Academic Affairs, University of Wyoming

“I agree that California’s workforce needs well-prepared and highly educated science students, including those in the geosciences, and I want to assure you that the University of California is doing its best to do its part in meeting those needs. ... Like others in the nation, the University of California is dedicated to improving science education for students throughout the educational pipeline. It is important to all of us that more students be prepared to meet and fill critical science, technology, engineering, and mathematics employment needs in the state, nation, and world. I commend you and your colleagues for bringing attention to specific needs in geoscience.” —Mark G. Yudof, President, University of California

“Thank you for the statements you sent me regarding the Geological Society of America’s positions on teaching earth science and on geoscience in higher education. These statements clearly articulate the Society’s perception of earth science in education and indicate the importance of earth science knowledge for many national and international issues. They are a good reminder to those in positions such as mine to consider earth science when considering the future development of the sciences on campus.” —Perry J. Brown, Provost and VP for Academic Affairs, University of Montana

“Thank you for your message and the attached position statements that pertain to enhancing the importance of, and improving and expanding the field of earth and geosciences in higher education. I agree with the positions of GSA in placing a strong emphasis on these topics. Here at Hope, we have recently developed a sequence of science courses for elementary and middle school education students, and we have specifically included the topics as described in the statements. Also, our Geology and Environmental Sciences department is experiencing a positive growth in the scope of our program that is ultimately attracting more students to the major. So your statements come at a good time. I will work closely with Dr. Brian Bodenbender, Chair of GES, to accomplish some of the goals described in the statements.” —Moses Lee, Dean, Natural and Applied Sciences, Hope College

“Thank you for your communications. I certainly strongly support our Earth Science research and education activities, and I know that the President and Provost do too.” —Marc Kastner, Dean, School of Science, MIT

“Thank you for your letter and position papers. Rest assured that UNH takes these matters seriously, not only at the grass-roots faculty level, but also as an institution. You will be pleased to know that just recently we established a ‘Center for Excellence in Geosciences Education,’ funded internally as

part of our 'New Ventures' initiative at UNH (www.eos.unh.edu/Spheres_0711/unhbrella.shtml). Thank you and GSA for your leadership on this important, national issue." —Harlan Spence, Director, Institute for the Study of Earth, Oceans, and Space

I believe that all of us share the common hope that the future of geoscience departments in higher education will be as promising as absolutely possible, for clear and obvious reasons!

It is likely that some institutions with geoscience departments were missed in this endeavor, and I apologize. Please let me know if your provost, dean, and/or department chair or head needs to be sent our communication and we will follow up as soon as possible. As a final note, please do not forget the "Building Strong Geoscience Departments" (<http://serc.carleton.edu/departments/>) effort organized by the Science Education Resource Center at Carleton College and supported by the National Science Foundation. Thanks!

*John Geissman, President, Geological Society of America
Professor, University of Texas at Dallas
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GEOLOGIC PAST

Highlighting Articles from Past Issues of *GSA Bulletin*

“The New Geology”

Morgan J. Davis, *GSA Bulletin*, February 1970

In his 1969 address as retiring GSA president (published in 1970 in *GSA Bulletin*, v. 81, no. 2, p. 331–336), Morgan J. Davis acknowledged his good fortune to have been able to serve during “the most momentous year the geological profession has ever known.” The Apollo 11 lunar landing in July 1969 offered geologists the opportunity to study “**the first rocks ever brought, by man, back to Earth from another member of our solar system**” (p. 331 [more than 40 pound of rocks!]). Geologists also gained a greater understanding of Earth through astronaut photography, which allowed them to view “significant geological features in a context never before possible” (p. 332).



The moon landing, Davis believed, marked the beginning of a “new geology,” incorporating a variety of disciplines, including, in this case, a reinvigorated planetary geology branch. Even having said this, Davis reminded his listeners that planetary geology was not a new idea; in fact, years earlier (1926) GSA benefactor R.A.F. Penrose designed the medal that now symbolizes one of GSA’s highest honors “to show the gradual extension of the study of geology to the moon and possibly other planets” (p. 331).



Davis also addressed other great changes, “far greater than many geologists and geophysicists are yet willing to admit” (p. 331), that he believed required a rethinking of the profession and philosophy of geology. “Geology,” he wrote, “is changing whether *we* change or not.” While not negating the conventional view of what a geologist was and did and acknowledging that many “classical aspects of the profession” would not change, he cited what he perceived as an evolution of geology, noting, “Today, we have new geologists practicing new geology,” and, “It is no longer easy to pinpoint the career possibilities of the geologist” (p. 332).

Because of this shift in the profession, Davis stressed that “the first and most fundamental of our responsibilities is to assure that there are adequate numbers of well-trained geologists available to meet the needs of society” (p. 333). Davis discussed reasons for the shortage of qualified geologists and called for “all practicing geologists ... [to] encourage more widespread use of courses in earth science in secondary school,” while emphasizing, “we must then do them justice at the college level” (p. 333).

“Some of our institutions of higher learning are *still* training geologists for yesterday’s jobs with yesterday’s methods” (p. 333). Davis found this unacceptable: “So broad is the scientific background needed by the geologist of the future that college curricula in many cases must be completely rearranged and overhauled” (p. 333).

Davis saw a need for a change in curricula even for established specialties, such as petroleum geology, noting, “There are not enough qualified petroleum geologists available today to satisfy the needs of the industry” (p. 333). “Furthermore,” he wrote, “there are misconceptions about the future of the extractive industries” (p. 334). Davis argued that not only was the need for more geologists to work in the extractive industries greater than ever, in fact, the need for quality education in these areas was ever-expanding. “The geology of minerals increasingly cuts across disciplinary boundaries” requiring the “adoption and integration of new knowledge into other branches of geology” (p. 334), including chemistry, physics, biology, engineering, and computer science.

Davis then focused on two specific “offshoots” of what he called “the branching out of the profession”: oceanography and environmental geology. With regard to oceanography, Davis had “no doubt” of the inevitability that geologists would soon be extracting minerals from the sea floor, citing, among other developments, the recent first use of a small research submarine for geological observation.

With regard to environmental geology, Davis expressed encouragement in seeing a branch of the profession focusing on the application of geology to the “physical and social environment in which we live.” In his view, this new specialty “should be nurtured to the end that the geologist can be of more service to mankind” (p. 334). While supporting essential “purely scientific investigations,”

Davis pointed out the critical need for professional geologists to apply their science to the “urgent social problems” of the day, noting that “we have, or should have, the prime responsibility for upgrading the quality of our terrestrial environment in any way we can” (p. 335).

Davis then discussed the need for quality graduate training focusing both on research and on producing geoscientists “who can apply what they have learned ... [and] function in a pragmatic atmosphere” (p. 335).

Finally, Davis called for the profession to “bring about constructive changes ... to keep pace with the multiple metamorphoses taking place in the world” (p. 335). A professional geoscientist, Davis maintained, should not only embody core competence and integrity, but he or she must also demonstrate strong leadership qualities. He argued that earth scientists should not be exempt from their “public responsibility as citizens,” but indeed must “never become so preoccupied with our science ... that we neglect the one activity that ... will do the most to assure us unquestioned professional respect: *service*” (p. 335). He continued, “Let us take a more aggressive stance on those

issues which fall into our general area of expertise,” to ensure that those in public office have the best technical information on which to base policy decisions.

The “New Geology” in Davis’ mind was a profession and a discipline that would “continue to flourish and to serve society well” when supported by a strong academic base and a healthy branching out into subdisciplines in order to meet the changing needs of society. He ended his address with a quote from Tuzo Wilson, ““There has never been such a time of great opportunities for distinguished achievement in the geologic sciences!”” (p. 336).

Current GSA President John Geissman’s article on p. 31 argues that the same can be said today and he has issued a call to action for institutions of higher learning, emerging geoscientists, and geoscientists in general to help meet the new and growing “critical future workforce needs that are essential to the sustainability of humankind.”

You can read Davis’ full presidential address at <http://gsabulletin.gsapubs.org/content/81/2/331.full.pdf+html>.



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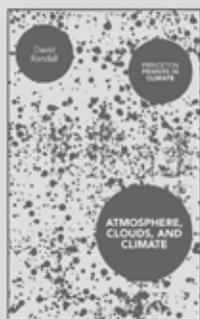
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The Kerry Kelts Student Research Awards of the Limnogeology Division for undergraduate or graduate student research is named in honor of Kerry Kelts, a visionary limnogeologist and inspiring teacher. This year, **one** award of US\$1,000 for research related to limnogeology, limnology, or paleolimnology is offered. To apply, send a summary of the proposed research, its significance, and how the award will be used (five-page max.) in PDF format (include your name in all PDF file titles) along with your name and a short CV (two-page max.) to the chair of the Limnogeology Division, Daniel M. Deocampo, at deocampo@gsu.edu. Awards will be announced at the Limnogeology Division Business Meeting and Reception at the 2012 GSA Annual Meeting in November.

Division members: GSA hopes to increase the number of these awards in the future, and your membership dues help with this important activity. If you are interested in supporting this awards program more substantially, please send your donations, designated for the Kerry Kelts Research Awards of the Limnogeology Division, to GSA Grants, Awards & Recognition, P.O. Box 9140, Boulder, CO 80301-9140, USA.

Questions? Contact GSA Grants, Awards & Recognition, P.O. Box 9140, 3300 Penrose Place, Boulder, CO 80301-9140, USA, +1-303-357-1028, awards@geosociety.org.

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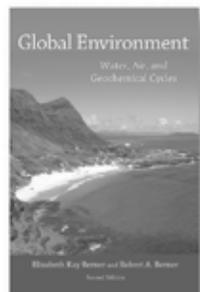
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GSA Today began publishing in 1991, but until now, the first five years of science articles were not available online. Originally published in a tabloid format, these large-size articles were scanned into PDF form and are now posted in the *GSA Today* online archive at www.geosociety.org/gsatoday/archive/. All Presidential Addresses published in *GSA Today* have been added online at www.geosociety.org/gsatoday/PresAddress.htm, and the Geologic Past article series is now up to date (see www.geosociety.org/gsatoday/geologicPast.htm). Please let managing editor Kea Giles (gsatoday@geosociety.org) know what else you'd like to see as we expand *GSA Today's* online presence.

Association for Women Geoscientists

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The hands that cradle the Rock

GSA Position Statement DRAFT

Rewarding Professional Contributions

Originally adopted May 2001; revised December 2011

GSA members are invited to submit comments and suggestions regarding the following *Position Statement draft* by 15 July 2012 at www.geosociety.org/positions/comments.asp?position=Rewarding.
Go to www.geosociety.org/positions/ to learn more.

POSITION STATEMENT

The Geological Society of America (GSA) affirms and supports positive contributions to geoscience, public perception of the geosciences, and the professional stature of individual geoscientists, all of which are derived from the time, effort, talent, and scholarly activity invested by geoscientists in public policy, education, and research on teaching and learning. As such, GSA recommends that geoscientists in academia and government service receive formal recognition and reward for such efforts through positive performance evaluations, reappointments, promotions, and tenure reviews. GSA also encourages support, by means of appropriate reassigned time or travel assistance, to those individual geoscientists engaged in substantive scholarly and professional activity on issues of public policy, education, and research on teaching and learning.

PURPOSE

The purpose of this position statement is to (1) encourage members to involve themselves professionally in the domains of public policy, education, and research on teaching and learning; (2) recognize specific efforts by geoscientists directed toward the enhancement of earth science in these domains; and (3) recognize the valuable scholarship and professional activities of those members participating in the domains of public policy, education, and research on teaching and learning.

RATIONALE

Efforts by geoscientists directed toward the better understanding of the geosciences in the arenas of public policy, education, and research on teaching and learning constitute valuable scholarship and professional activity. GSA's recognition and support of those efforts reflect the Society's mission to promote the geosciences. Applying the results of geoscience research in the arena of public policy and providing education at all levels improves communities and enhances society while showing the importance of public support of research geoscientists. Research on teaching and learning in the geosciences not only contributes greatly to the effectiveness and stature of geoscience education, it is a rapidly maturing research field with many external funding sources, peer-reviewed journals, and a vibrant community. Many, but far from all, academic units in the geosciences are aware of the current state and value of research on geoscience teaching and learning and its important contribution to the geoscience community at large. The Society's explicit affirmation of the value and importance of its members' contributions to public policy, education, and the scholarship of teaching and learning will serve to expand and inform personnel decisions based on those activities.

RECOMMENDATIONS

The Society Recommends the Following Actions

Geoscientists are encouraged to

1. Engage in scholarly and service activities, including research, publications, and presentations on geology and public policy;
2. Participate in policy development related to earth systems and earth processes; and
3. Advance geoscience education and curricular reform and produce research, publications, and presentations on pedagogy and curricular innovation.

Supervisors, administrators, institutional/organizational leaders, and department peers are encouraged to

1. Be aware of the current state and value of research on teaching and learning in geoscience and its important contribution to the geosciences community;
2. Recognize and reward efforts in geoscience public policy, education, and research on teaching and learning through positive performance evaluations, reappointments, promotions, tenure consideration, and awards;
3. Support by the appropriate reassigned time or travel assistance those geoscientists engaged in substantive scholarly and professional activity on issues of public policy, education, and research on teaching and learning; and
4. Include these areas when establishing criteria for recognition, evaluation, advancement, promotion, and granting tenure.

OPPORTUNITIES FOR GSA AND GSA MEMBERS TO HELP IMPLEMENT RECOMMENDATIONS

To strengthen and sustain the professional contributions of its members to geosciences public policy, education, and research on teaching and learning, the GSA recommends that members:

1. Value the contributions of their peers in these areas of scholarship;
2. Continue to stress the value and importance of contributions in these areas of scholarship to internal and external institutional stakeholders; and
3. Serve in positions of academic or organizational leadership in order to recognize and reward contributions in these areas of scholarship.

Inquiries about GSA or this position statement should be directed to GSA's Director for Geoscience Policy, Kasey S. White, at +1-202-669-0466, kwhite@geosociety.org.

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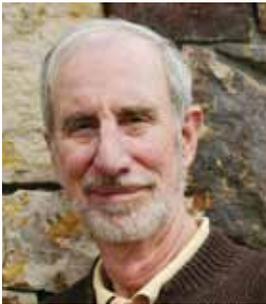


GSA FOUNDATION UPDATE

P. Geoffrey Feiss, GSA Foundation President



Some Thoughts from the Foundation on the Eve of GSA's 125th Anniversary



We are about eighteen months from 27 December 2013—the official 125th birthday of the Geological Society of American (or the American Geological Society as it called itself for its first year or so). The GSA Foundation, on the other hand, is a relative newcomer, having come into existence in 1980 to raise the funds needed for GSA's

centennial—what soon became known as the Decade of North American Geology (or “DNAG”).

In spite of what *Wikipedia* says, “DnaG” is not just “a bacterial primase which synthesizes short RNA oligonucleotides during DNA replication.” So, what was the real DNAG, as opposed to DnaG, all about?

The Decade of North American Geology DNAG

For our many members too young to remember the excitement of that decade, culminating in the Centennial Annual Meeting in Denver in 1988, complete with a symphonic production by an orchestra of GSA members, allow me to shine a spotlight on the most tangible highlight of that celebration. Under the patient and wise leadership of Pete Palmer, hundreds of North American geologists were persuaded, corralled, cajoled, and browbeaten into producing twenty-eight volumes, six centennial field guides, four special topical volumes, twenty-three continent-ocean transects, five different geophysical maps of North America, a North American geological timescale, and the 1:5,000,000 bedrock geologic map of North America—a geo-tour-de-force of mind-boggling proportions. One of the many benefits of being president

of the GSA Foundation is that an entire bookcase in my office is filled with an increasingly rare full set of these publications.

In our digital age, many younger geoscientists, and I fear the vast majority of our student members, have probably never held a DNAG volume, field guide, or map in their hands. I urge you to remedy this oversight soon if you are among this group. Go to your nearest university library and spend a few hours marveling at the magnitude of this effort to put into one place (a very big place) the sum of our knowledge of North American geology in the last quarter of the twentieth century. Be warned—you may find many hours pass before you can escape to see the light of day again. *No* geologist will *not* be enthralled by some portion of what lies between the covers and within the map envelopes of this *magnum opus*.

How did this come about? In addition to the vision, energy, and dedication of GSA's leadership at the time, many geologists gave enormously of their time to author and create these works. The USGS and other federal agencies, state surveys, and universities were generous in lending their staff and facilities to assist in the creation of the DNAG products. And, it was not inexpensive. Many members contributed financially, as did some twenty-five corporations, predominantly in the mineral and energy industry—look at the acknowledgment page of any volume you may pick up to sense the level of this support.

Which brings me to thinking about what the legacy of this monumental effort is—thirty years on and beyond? It occurs to me, as it has to others, that it may be our generation's responsibility—on the eve of the GSA's 125th birthday—to assure that this remarkable compilation of knowledge stays accessible to all. That perhaps means a comparable project to digitize the entire corpus of the DNAG volumes and maps.

I would enjoy hearing from GSA members who share an interest in seeing this legacy preserved in the digital age with thoughts about how we might make that happen.



If you would like to make a contribution to the Foundation, please go to www.gsafweb.org/makeadonation.html or contact Anna Christensen, Chief Development Officer, GSA Foundation, +1-303-357-1007, achristensen@geosociety.org.

2013 GSA Annual Meeting & Exposition

125th Anniversary:

*Celebrating Advances in Geoscience — Our Science, Societal Impact
and Unique Thought Processes*

27–30 October • Denver, Colorado, USA

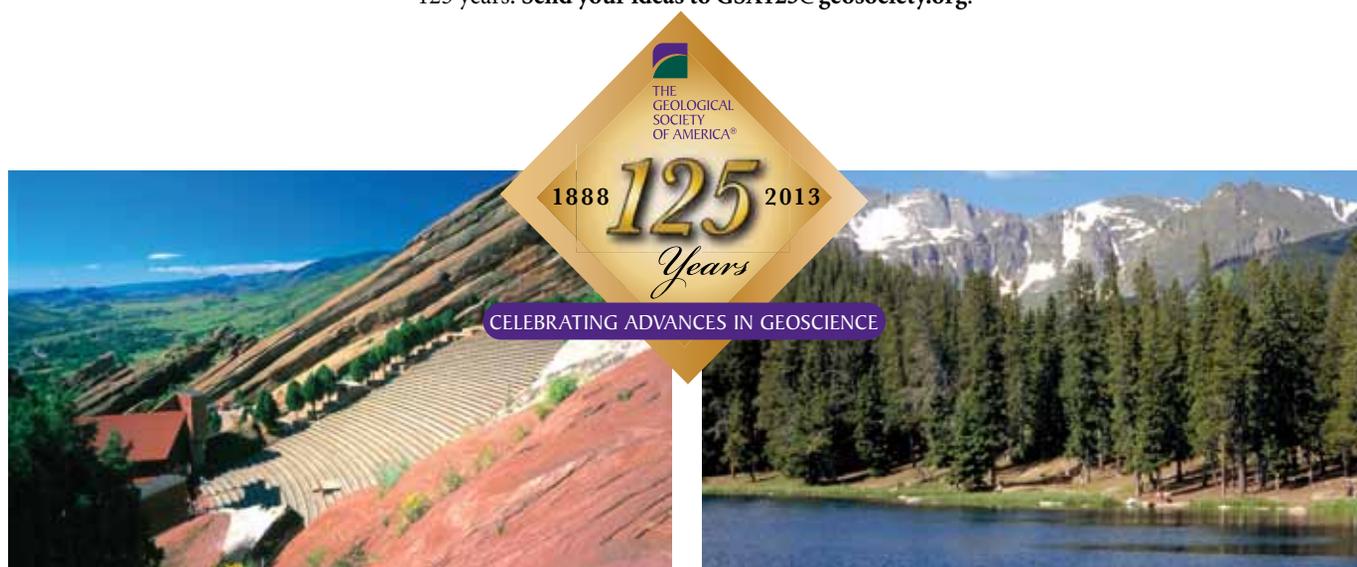
Now is the Time to Plan

GSA is calling all members, Divisions, Sections, and Associated Societies to help plan its 2013 meeting as well as our year-long celebration.

Here are some ways to get involved:

- 1 Plan **field trips** to classic localities that demonstrate our scientific advances;
- 2 Propose **Penrose Conferences** and **Field Forums** to explore current controversies, drawing on our advances and planning for future resolution of current debates;
- 3 GSA's Divisions and regional Sections have great opportunities to get involved through **special sessions, field trips, workshops, lectures**, and more, both during meetings or throughout the year;
- 4 **Pardee sessions** will cover reoccurring controversies and themes over the past 50 years, focusing on current perspectives, and we encourage **topical session proposals** and **special lectures** focusing on this theme;
- 5 Members of GSA's Associated Societies—**Sponsor sessions** at your society's annual meetings and at GSA; sponsor a field trip, topical session, publication, or meeting; or create other events to celebrate the geosciences.

Help make the 125th Anniversary Celebration an event to remember for the next 125 years: **Send your ideas to GSA125@geosociety.org.**



We are the geosciences; let's celebrate!

Invest in the Future—Serve on a Committee!

2013–2014 Committee Vacancies

Deadline for nominations & volunteer applications: 15 July 2012
Terms begin 1 July 2013 (unless otherwise indicated)

ACADEMIC AND APPLIED GEOSCIENCE RELATIONS COMMITTEE

Three members-at-large vacancies (3-year terms; AM, T/E)

This committee is charged with strengthening and expanding relations between GSA Members in applied and academic geosciences. As such, it proactively coordinates the Society's effort to facilitate greater cooperation between academia, industry, and government geoscientists. **Qualifications:** Committee members must work in academia, industry, or government and be committed to developing better integration of applied and academic science in GSA meetings, publications, short courses, field trips, and education and outreach programs. Members must also be active in one or more GSA Divisions.

ANNUAL PROGRAM COMMITTEE

One member-at-large vacancy, one Councilor/former Councilor vacancy (4-year terms), and one student representative vacancy (2-year term) (AM, B/E)

This committee 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, and evaluates the technical and scientific programs of the annual meeting. **Qualifications:** Committee members must have a broad familiarity with different disciplines as well as previous program experience or active involvement in applying geologic knowledge to benefit society and to raise awareness of critical issues.

ARTHUR L. DAY MEDAL AWARD

Two member-at-large vacancies (3-year terms; T/E)

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

COMMITTEE ON EDUCATION

One member-at-large vacancy; one pre-college educator (K–12) vacancy; one two-year college faculty vacancy (4-year terms); one graduate student vacancy (2-year term) (AM, B/E, T/E)

This committee works with GSA members representing a wide range of education sectors to develop informal, pre-college (K–12), undergraduate, and graduate earth-science education and outreach objectives and initiatives. **Qualifications:** Members of this committee must have the ability to work with other interested scientific organizations and science teachers' groups.

DIVERSITY IN THE GEOSCIENCES COMMITTEE

Three member-at-large vacancies (3-year terms; AM, T/E)

This committee provides advice and support to GSA Council and initiates activities and programs that will increase opportunities for people of ethnic minority, women, and persons with disabilities and raise awareness in the geosciences community of the positive role these groups play within the geosciences. The committee is also charged with stimulating recruitment and promoting positive career development for these groups. **Qualifications:** Members of this committee must be familiar with the employment issues these groups face; expertise and leadership experience in such areas as human resources and education is also desired.

E-GSA COMMITTEE

One member-at-large vacancy and one M.S. student vacancy (3-year terms; AM, T/E)

This committee is charged with improving communications with and among all GSA stakeholders. **Qualifications:** Members must have experience beyond basic e-mail and telephone media, such as SMS (texting) and MMS (multi-media messaging service), and facility with social networks, virtual communities, blogs, or other emerging technologies.

GEOLOGY AND PUBLIC POLICY

One member-at-large vacancy (3-year term; AM, B/E, T/E)

This committee provides advice on public policy matters to Council and GSA leadership by monitoring and assessing international, national, and regional science policy; formulating and recommending position statements; and sponsoring topical white papers. This committee also encourages active engagement in geoscience policy by GSA members. **Qualifications:** Members should have 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

Two environmental geoscience vacancies; one marine/coastal geology vacancy (2-year terms run 1 Dec. 2012–30 Nov. 2014; T/E)

Members of this committee help finalize the technical program for GSA's annual meetings by participating in the Web-based selection and scheduling of abstracts, as well as topical session proposal review. **Qualifications:** Members must be familiar with computers and the Web, be a specialist in one of the specified fields, and be available in late July–mid-August for the organization of the annual meeting technical program.

MEMBERSHIP

Two member-at-large vacancies (academia) (3-year terms; B/E)

This committee draws its members from academia, industry, and government; contributes to the growth of GSA membership; and attends to the changing needs of Society members by focusing on attracting and retaining students, professionals working in industry, and those studying and working outside the United States. This committee also reviews and makes recommendations for Fellowship to Council. **Qualifications:** Committee members should have experience in benefit, recruitment, and retention programs.

NOMINATIONS

Two member-at-large vacancies (3-year terms; B/E & T/E)

This committee recommends nominees to GSA Council for the positions of GSA Officers and Councilors, committee members, and Society representatives to other permanent groups.

Qualifications: Members must be familiar with a broad range of well-known and highly respected geoscientists.

PENROSE CONFERENCES AND FIELD FORUMS

Two members-at-large vacancies (3-year terms; T/E)

This committee reviews and approves Penrose Conference and Field Forum proposals and recommends and implements guidelines for the success of these meetings. **Qualifications:** Committee members must be past conveners of a Penrose Conference or a Field Forum.

PENROSE MEDAL AWARD

Two member-at-large vacancies (3-year terms; T/E)

Members of this committee select candidates for the Penrose Medal Award. Emphasis is placed on “eminent research in pure geology, which marks a major advance in the science of geology.”

Qualifications: Members should be familiar with outstanding achievers in the geosciences worthy of consideration for the honor.

PROFESSIONAL DEVELOPMENT

One student representative vacancy and one councilor/former councilor vacancy (3-year terms; T/E)

This committee 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:** Members must be familiar with professional development programs or have adult education teaching experience.

PUBLICATIONS

One member-at-large vacancy (4-year term; AM, B/E, T/E)

This committee nominates candidates for science editor positions, approves editorial boards, reviews the quality and health of Society publications, and explores the initiation of new ventures, including electronic publishing. **Qualifications:** Members must have extensive publications experience.

RESEARCH GRANTS

Six member-at-large vacancies (3-year terms; B/E)

Committee members evaluate student research grant applications and select grant recipients. **Qualifications:** Members should have

experience in directing research projects and in evaluating research grant applications. **Extensive time commitment required** 15 Feb.–15 Apr. 2014.

YOUNG SCIENTIST AWARD (DONATH MEDAL)

One member-at large and one councilor/former councilor vacancy (3-year terms; T/E)

Committee members investigate the achievements of young scientists who should be considered for this award and make recommendations to GSA Council. **Qualifications:** Members 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 & AASG Selection Committee for the John C. Frye Memorial Award in Environmental Geology

One vacancy (3-year term begins 1 July 2013)

Fosters communications 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:** Members must be well-acquainted with GSA’s environmental geoscience programs.

North American Commission on Stratigraphic Nomenclature

One vacancy (3-year term runs Nov. 2013–Nov. 2016; AM, possibly B/E)

This committee 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, over the years, have contributed to the Society and to geoscience through involvement in the affairs of the GSA. Your time, talent, and expertise are the bedrock of a solid and lasting Society.



Classified Rates—2012

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 boldface 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 add'l month (same ad)
Positions Open	\$8.95	\$8.70
Fellowship Opportunities	\$8.95	\$8.70
Opportunities for Students		
First 25 lines	\$0.00	\$4.75
Additional lines	\$4.75	\$4.75

Positions Open

RESEARCH ASSISTANT PROFESSOR POSITION

UNIVERSITY OF TEXAS AT EL PASO

The Dept. of Geological Sciences at the University of Texas at El Paso seeks applicants for a 75% Research Assistant Professor position in support of the department's analytical facilities including a Nu Instruments MC-ICP-MS, Cameca microprobe, and Perkin-Elmer ICP-OES. Responsibilities will include maintenance, repair and operation of the department's major analytical equipment; training and supervision of both internal and external users; and participation in research projects. In addition, seeking of extramural support for research projects is strongly encouraged, and an additional 25% salary may be raised. The position requires a Ph.D. and extensive experience with major research instrumentation. Good communication skills are essential to interact with users with a range in skill levels. For more information on the department, see: <http://www.geo.utep.edu>. Review of applications will begin immediately and will continue until the position is filled. Only electronic submissions will be considered and must include "Research Assistant Professor Position Application: YOUR NAME" in the email "Subject"). Complete applications will consist of a letter of application, detailed CV, names of at least three references to Dr. Laura Serpa, Chair, Geological Sciences, e-mail: lfserpa@utep.edu.

The University of Texas at El Paso is an Equal Opportunity/Affirmative Action Employer. The University does not discriminate on the basis of race, color, national origin, sex, religion, age, disability, genetic information, veteran status, or sexual orientation in employment or the provision of services. This position is security-sensitive and subject to the Texas Education Code 51.215, which authorizes the employer to obtain criminal history record information. An employment offer is contingent on completion of a satisfactory criminal background investigation.

CLIMATE CHANGE, ASSISTANT PROFESSOR TUFTS UNIVERSITY

Tufts University invites applications for a full-time, tenure-track position as an Assistant Professor of Earth and Ocean Sciences in the area of Climate Change, beginning 1 Sept. 2013. This position resides in the Dept. of Earth and Ocean Sciences, but is part of a multidisciplinary cluster-hiring initiative designed to deepen and broaden the Environmental Studies program as well as to enhance traditional academic departments.

The successful candidate will be expected to teach an undergraduate introductory course in climate science and one or more upper level courses in a field related to the person's expertise. At least two courses will count toward both the EOS and the Environmental Studies majors, and the successful candidate will work with others in the cluster hire to create a capstone experience for students in the program. We are particularly interested in those with research interests in the geological record of climate change, methods for interpreting climate change, or implications of climate change that may span a range of temporal scales.

Qualifications include a Ph.D. by time of appointment in an Earth and Ocean Science discipline; demonstrated potential for research supported by external funding; and preferably teaching experience at the college level. The applicant should be able to fit into a small, well-equipped department where teaching diverse student populations is highly valued, and will be able to work with the Environmental Studies faculty to offer courses that also complement that interdisciplinary program.

A letter of application, statement of teaching and research interests, transcripts, CV, and the names and addresses of three references should be sent to Professor Jack Ridge, Chair, Dept. of Earth and Ocean Sciences, Tufts University, Medford, MA 02155, USA (jack.ridge@tufts.edu). Review of applications will begin 15 Sept. 2012 and will continue until the position is filled. Tufts University is an Affirmative Action/Equal Opportunity employer. We are committed to increasing the diversity of our faculty. Members of underrepresented groups are strongly encouraged to apply.

INSTRUCTIONAL SUPPORT SPECIALIST SUNY GENESE0

The SUNY Geneseo Dept. of Geological Sciences invites applicants for a staff position as an Instructional Support Specialist beginning Fall 2012. Responsibilities of the position include operation and maintenance of departmental equipment (e.g., rock prep. facilities, XRF, XRD, SEM, etc.), training of undergraduate students on use of equipment, assisting with development and organization of weekly lab exercises, assisting with field trip logistics, and curating departmental collections (rocks, maps, fossils). The successful applicant must have an MS degree in Geosciences or a related area at the time of appointment. Required experience includes demonstrated interest in and aptitude for teaching, demonstrated ability to develop laboratory exercises using current pedagogy, interest in outreach and superior organizational, written and oral communication abilities. Must also be able to bend and lift up to 40 pounds. Position opportunities include mentoring undergraduate students in research and club activities.

The College strives to provide a diverse learning environment in which to prepare students for an increasingly multicultural society and interconnected world. For further information about SUNY Geneseo, please see our homepage at <http://www.geneseo.edu>.

To apply, submit an online professional application at <https://jobs.geneseo.edu> and attach a cover letter, vita, and references. Applicants should arrange for academic transcripts and three recent letters of recommendation to be sent directly to: Scott Giorgis, Chair, Department of Geological Sciences, 1 College Circle, Geneseo, NY 14414, USA.

To ensure full consideration, complete applications should be received by 15 Aug. 2012. All applicants are subject to drug and criminal background checks.

SUNY Geneseo is an Affirmative Action/Equal Opportunity, Equal Access Employer committed to recruiting, supporting, and fostering a diverse community of outstanding faculty, staff, and students. The College actively seeks applications from women and members of underrepresented groups.

GEOSCIENTISTS

CHEVRON, HOUSTON, TEXAS

Chevron seeks a Rock Mechanics Research Scientist in Houston, Texas. M.S. in Geology, Rock Mechanics, or related+ 2 yrs exp. & exp. w/rock mechanical & mechanical earth modeling & data integration (geological, geomechanical & geophysical); finite element analysis; and geological interpretation. Mail résumé: Chevron, 1500 Louisiana St., Houston, TX 77002, USA; attn.: V. Ching, ref. job 172.

FACULTY POSITION

STRUCTURAL GEOLOGY/ACTIVE TECTONICS

UNIVERSITY OF UTAH

The Dept. of Geology & Geophysics at the University of Utah invites applications for a tenure-track faculty position in structural geology and/or active tectonics available as early as spring semester 2013. We anticipate hiring at the Assistant Professor level but will consider exceptional candidates at the Associate Professor level. Applicants must have a Ph.D., and the successful candidate is expected to build a productive and internationally visible research program. Expertise in structural geology is desirable but a broad range of field-oriented tectonic specialties will be considered. For further details and to apply, please go to <http://utah.peopleadmin.com/postings/13949>.

The University of Utah is an Equal Opportunity/Affirmative Action employer and educator. Minorities, women, and persons with disabilities are strongly encouraged to apply. Veterans preference. Reasonable accommodations provided. For additional information, go to www.regulations.utah.edu/humanResources/5-106.html.

The University of Utah values candidates who have experience working in settings with students from diverse backgrounds, and possess a strong commitment to improving access to higher education for historically underrepresented students.

GSA Today Classifieds and Web-Only Exclusives

Advertise open positions and opportunities for students in *GSA Today* and reach **more than 25,000 readers**. GSA also offers Web-only ads, with more than 6,000 views each month. Go to www.geosociety.org/classiads/ to learn more.

While you're there, check out the goods and services in GSA's **GeoMart Geosciences Directory** at

www.geosociety.org/classiads/geoMart.htm.

Geology/Geotechnical Engineer opportunities in Australia's coal mining industry

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Stellar Recruitment is representing a world renowned multinational mining company to identify **Geologist's** (Mine, Project and Resource) and **Geotechnical Engineer's** from the US, South America and Canada interested in a career in **Australia**. Our client has vacancies across their coal mining operations in Queensland and New South Wales from **graduate to management level** in site based and corporate roles.

The company is a world leader in finding, mining and processing resources, with over 70,000 employees in more than 40 countries. Their current coal interests in Australia include a portfolio of sites, including 7 of the largest and most technologically advanced coal mines in Queensland's Bowen Basin and New South Wales's Hunter Valley region. They have an exciting growth profile to capitalize on increasing global demand for metallurgical and steaming coal.

To express your interest or to find more information on the roles, the company and the location, please contact:

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President – Americas
+(1) 720 932 8198
tahlia@stellarrecruitment.com

Applications close beginning of June.

LIFESTYLE

A move to Australia will provide you and your family an excellent quality of life with job security, personal development, being part of a community, great educational and sporting facilities, medical care and lifestyle. Plus of course, Australia has sun, surf, adventure and a strong economy.

BENEFITS

This opportunity will enable you to play a crucial part in our client's growth strategy and be a part of the Australian mining boom. Other benefits include:

- 5 weeks paid vacation leave
- 9% employer contribution to pension plan
- Heavily subsidized health benefits
- Full relocation and repatriation
- Excellent job security
- Structured career planning and development programs
- Annual bonus scheme
- Attractive stock ownership scheme

THE EXPERIENCE REQUIRED

- Degree qualifications in Geology, Engineering or similar discipline
- 1 to 15 years post graduate experience is ideal
- Demonstrated experience working as a Mine Geologist, Resource Geologist, Project Geologist or Geotechnical Engineer within a coal mining environment
- Commitment to safety and promoting a positive safety culture
- Advanced skills in mining software will be highly regarded

Our client will be flying interested and qualified candidates to Denver, Colorado in mid June to conduct face-to-face interviews with the Australian hiring managers.

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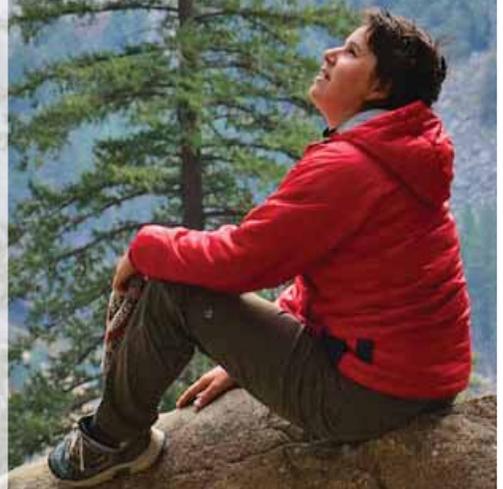
Application deadline: **2 July**

The upcoming GeoCorps America fall/winter season runs from September 2012 through May 2013. All fall/winter 2012-2013 GeoCorps positions are posted and open for application.

Past/Current GeoCorps Participants:

Please consider attending this fall's GSA Annual Meeting, which will feature the third annual GeoCorps Alumni Reception, and provides a great venue for presenting your GeoCorps work!

www.geosociety.org/geocorps/

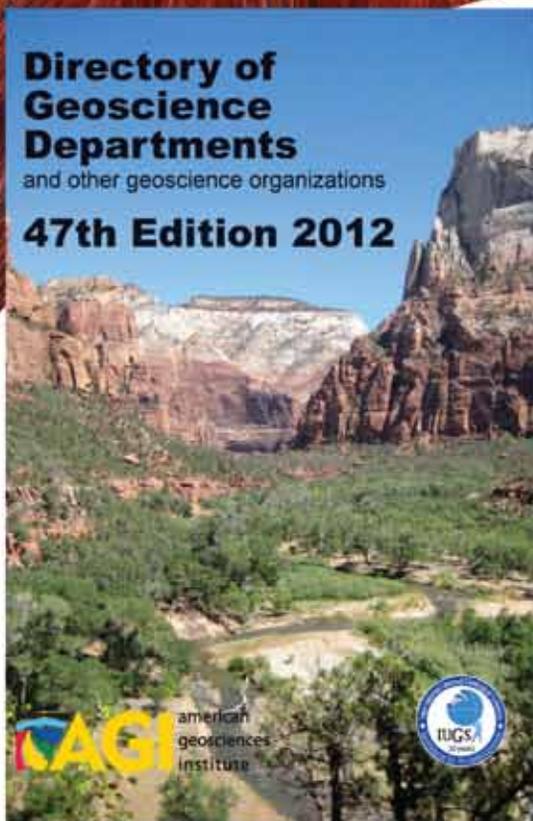


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THE GEOLOGICAL SOCIETY
OF AMERICA®

Publications Highlights

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In December 1978, in an attempt to reduce cost, increase speed of publication, and publish more papers, *GSA Bulletin* began printing short summaries of articles in the Part I version of the journal. Complete articles were located in Part II, which was only available in microfiche.

By November 1981, H.R. Gould, in his retiring address as president of The Geological Society of America, acknowledged that “Most authors didn’t want to write for microfiche, and most readers didn’t want to read articles in that format.” The journal subsequently abandoned the microfiche experiment, and the papers that appeared in that format were practically lost to history.

Until now.

GSA is pleased to announce that all of the microfiche-only content prepared from 1979 to 1981 is now available online.



Start reading at www.gsapubs.org.

E-Book Options

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More than 230 volumes from four GSA books series are online at www.gsapubs.org. And you can take advantage of this collection in a way that suits your personal interests with a Bloc of Docs subscription.

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Your library can subscribe annually to the whole collection, to Special Papers only, or to a collection of the Memoir, Field Guide, and Reviews in Engineering Geology volumes. (Have your library contact us at editing@geosociety.org for more information on institutional subscription options.)

<http://books.google.com>

GSA offers **Special Papers, Memoirs, Field Guides, and Reviews in Engineering Geology** volumes through Google Books. These books can be viewed online or downloaded and offer several attractive features.

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Popular Out-of-Print Titles are Still Available



from GSA



get the inside knowledge

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