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Crustal magnetism, tectonic inheritance, and continental rifting in the southeastern United States

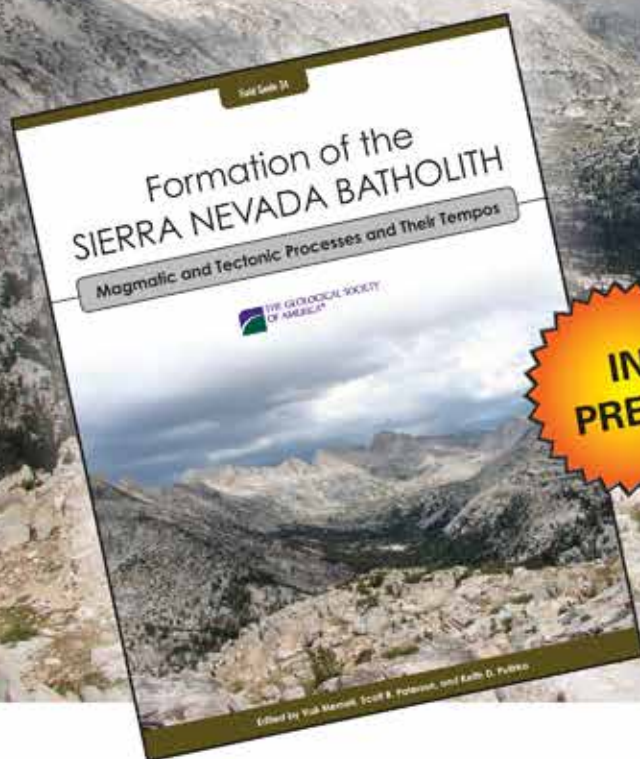


Formation of the SIERRA NEVADA BATHOLITH

Magmatic and Tectonic Processes and Their Tempos

Edited by Vali Memeti, Scott R. Paterson, and Keith D. Putirka

This comprehensive field guide takes you on a six-day, west-to-east geologic journey across the Mesozoic magmatic arc of the central Sierra Nevada in California. It contains a summary of field, structural, geochemical, and geochronologic data collected by a number of researchers on individual intrusions (Guadalupe Igneous Complex and nearby Hornitos pluton, Fine Gold Intrusive Suite, Yosemite Valley Intrusive Suite, Tuolumne Intrusive Complex). This guide also includes data on the basement terranes intruded by these intrusions, Mesozoic volcanic-sedimentary sections, and data derived of several Sierra Nevada-wide data sets (plutonic, volcanic and sedimentary geochronology, strain analyses, structures, and geochemistry). Syntheses of these data sets at the end of the guide focus on magmatic processes from the mineral to the arc scale, as well as contemporaneous tectonics, and the tempos controlling magmatism, deformation, exhumation, and erosion/redeposition in the Sierran arc. | FLD034, 116 p., ISBN 9780813700342 | in press



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Printed in the USA using pure soy inks.



Featured Article

SCIENCE:

- 4 **Crustal magnetism, tectonic inheritance, and continental rifting in the southeastern United States**
E.H. Parker Jr.

Cover: Seismic station deployed in the Coastal Plain of southeastern Georgia for the EarthScope SESAME flexible-array experiment. The 85-station SESAME array is designed to study crustal and mantle structure across the Suwannee-Wiggins suture zone. See related article, p. 4–9.



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Erratum:

In the January, February, and March 2014 issues of *GSA Today*, the GSA elections deadline was incorrectly listed as 13 April. The correct deadline for ballots is 6 April. See p. 60 for more information.

Crustal magnetism, tectonic inheritance, and continental rifting in the southeastern United States

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ABSTRACT

The Brunswick magnetic anomaly (BMA) in southern Georgia is coincident with seismic reflectivity marking the deep crustal suture between Laurentia and a crustal block of Gondwanan affinity. The source of the BMA remains enigmatic because of its apparent relationship with both the Permo-Carboniferous Alleghanian orogeny (ca. 315–270 Ma) and the emplacement of the Central Atlantic Magmatic Province (ca. 200 Ma). In this paper, the BMA is modeled using relatively weak (<0.5 A/m) reversed-polarity remanent magnetization in lower crustal rocks (16–24 km depth) outboard of the Laurentian margin. The acquisition of this magnetic signature is consistent with transpression and strike-slip motion along the margin during the initial stage of Alleghanian convergence, which overlaps with the Kiaman Reversed Superchron (ca. 320–263 Ma). Simple magnetic models show that the onshore segment of the BMA can be explained as an effect of continental collision rather than voluminous magmatism along the suture zone. If Central Atlantic Magmatic Province intrusions were not focused along the suture zone, then evidence for tectonic wedging at the crust-mantle boundary associated with Alleghanian convergence may be preserved along the onshore segment of the BMA, rather than over-printed by Mesozoic magmatism.

INTRODUCTION

The Brunswick magnetic anomaly (BMA) coincides with deep seismic reflectivity marking the Late Paleozoic Suwannee-Wiggins suture zone (SWS) between Laurentia and a crustal block of Gondwanan origin (McBride et al., 2005). In southern Georgia, prominent, south-dipping reflectors on Consortium for Continental Reflection Profiling (COCORP) lines crossing the BMA define the lower crustal suture (Figs. 1 and 2) (McBride and Nelson, 1988). The reflectivity is interpreted as a mylonitic zone between Grenville-age North American basement and a Gondwanan crustal block accreted during the Permo-Carboniferous Alleghanian orogeny (Thomas, 2010). Drilling data across the Atlantic Coastal Plain show that the BMA is roughly coincident with the boundary between accreted peri-Gondwanan terranes and the Gondwanan Suwannee terrane (Chowns and Williams, 1983; Dallmeyer et al., 1987). However, rocks related to the Suwannee terrane are found north of the BMA (Tauvers and Muehlberger, 1987), suggesting the magnetic anomaly is more closely associated with the deep crustal suture than the upper-crustal terrane boundary.

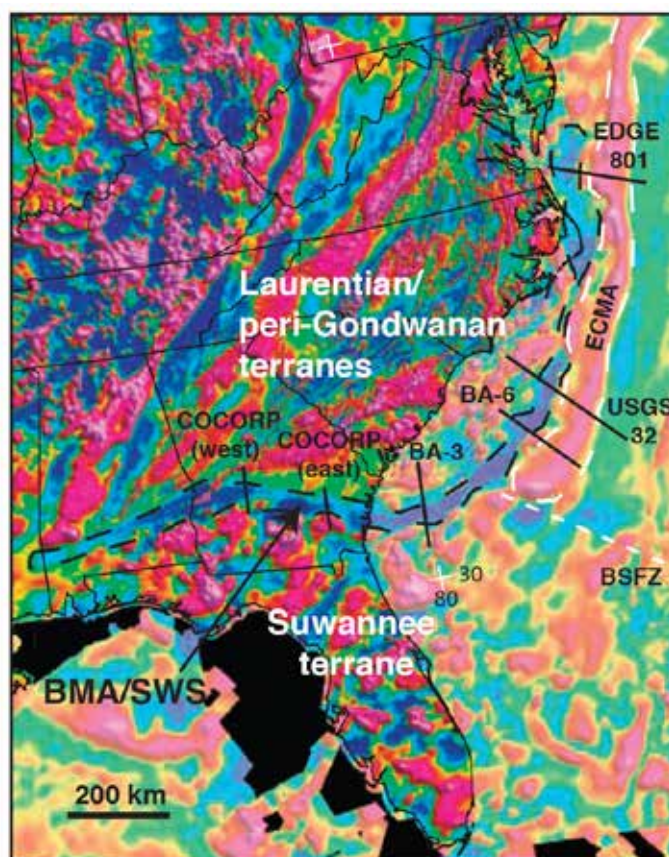


Figure 1. Aeromagnetic map (red = high; blue = low) of the eastern margin of North America showing the approximate locations of existing seismic profiles crossing the Brunswick magnetic anomaly (BMA) and East Coast magnetic anomaly (ECMA). Seismic profiles from EDGE 801, USGS 32, and BA-6 indicate relatively abrupt crustal thinning from ~35 km to ~15 km across the ECMA. Inboard of the ocean-continent transition, crustal thickness estimates range from 35 to 40 km on line BA-3 and 33–36 km for both Consortium for Continental Reflection Profiling (COCORP) transects. Strong dipping reflectivity marking the Suwannee-Wiggins suture (SWS) is evident on EDGE 801, BA-6, and both COCORP transects. The dipping reflectivity and change in crustal structure as the BMA diverges from the ECMA suggest the magnetic low is related to continental collision. BA—Brunswick anomaly; BSFZ—Blake Spur fracture zone. (Map modified from Tréhu et al., 1989; Austin et al., 1990; Sheridan et al., 1993; Lizarralde et al., 1994; North American Magnetic Anomaly Group, 2002; Bartholomew and Hatcher, 2010.)

Mesozoic rifting and emplacement of the Central Atlantic Magmatic Province (CAMP) overprint Alleghanian structure across the southeastern United States. The Triassic–Jurassic South Georgia basin cuts across the BMA (McBride, 1991), and rift basin formation was followed by extensive magmatism across the

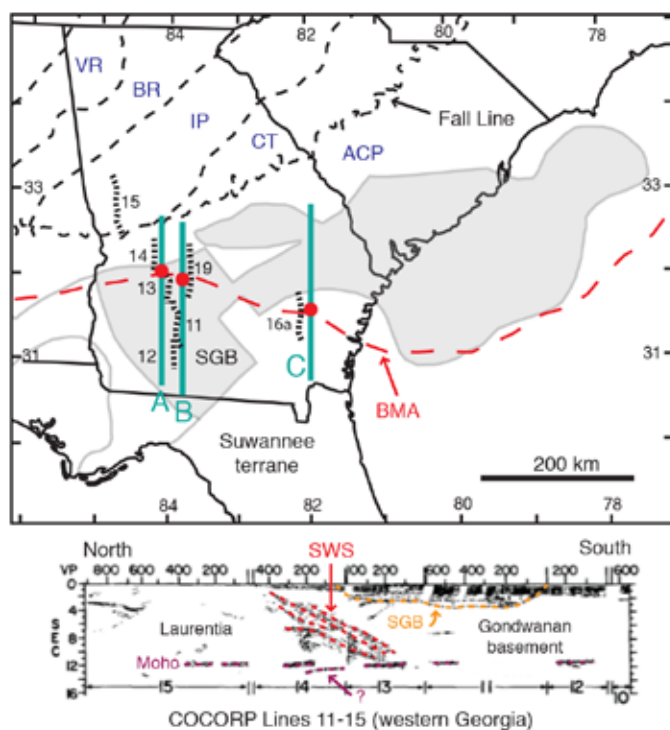


Figure 2. Top: Regional map showing the locations of magnetic profiles (A–C) with respect to selected Consortium for Continental Reflection Profiling (COCORP) lines. The red circle on each profile marks the location of the magnetic minimum within the Brunswick magnetic anomaly (BMA) (dashed line). Dipping seismic reflectors are evident on lines 13, 14, 16a, and 19. The Fall Line marks the onlap of Atlantic Coastal Plain (ACP) sediments onto the exposed terranes of the southern Appalachians. The shaded area defines the inferred extent of mafic magmatism across the South Georgia basin (SGB) and offshore South Carolina. CT—Carolina terrane; IP—Inner Piedmont; BR—Blue Ridge; VR—Valley and Ridge. (Map modified from Dallmeyer, 1988; McBride et al., 1989; Lizarralde et al., 1994) Bottom: Seismic section for COCORP lines 11–15 showing strong dipping reflectivity coincident with the BMA (after McBride and Nelson, 1988).

southeastern United States prior to Atlantic seafloor spreading (McBride et al., 1989). Approximately 1–2 km of Atlantic Coastal Plain sediments now cover the basin and suture zone, and it is unknown whether the origin of the BMA is ultimately related to continental collision or rift-related mafic intrusions concentrated along the suture (Fig. 2). Lower crustal seismic reflectors coincident with the magnetic low in southern Georgia (McBride and Nelson, 1988), offshore South Carolina (Austin et al., 1990), and offshore Virginia (Sheridan et al., 1993) suggest the source of the anomaly is related to continental collision (Fig. 1). On the other hand, the BMA appears to merge with the East Coast magnetic anomaly (ECMA), a prominent magnetic high interpreted to result from rift-related mafic underplating and magmatism along the ocean-continent transition (Fig. 1) (Holbrook et al., 1994). Discontinuous magnetic highs south of the BMA, extension across the South Georgia basin, and flood basalts/sills within rift basin strata suggest the BMA may represent a continuation of the ECMA (McBride and Nelson, 1988; McBride et al., 1989). Distinguishing between these alternatives is important for understanding the role of inherited structure

during continental rifting and emplacement of CAMP intrusions in the southeastern United States.

In this paper, the BMA is modeled using reversed-polarity remanent magnetization in lower crustal rocks (16–24 km depth) along the SWS and outboard of the Laurentian margin. Strong remanent magnetization (>3.0 A/m) of exhumed granulites in other collision zones (e.g., Australia, Adirondacks, Sweden) suggests that remanence may be the source of long-wavelength magnetic anomalies in the deep crust (McEnroe et al., 2004, and references therein). The reversed-polarity remanent magnetization of Gondwanan basement blocks may have been acquired during the Kiaman Reversed Superchron (ca. 320–263 Ma), the longest reversed polarity event in Earth's history (Garcia et al., 2006). New magnetic models assuming relatively weak remanence (<0.5 A/m) provide a simple explanation for the long-wavelength character of the BMA and the coincidence with seismic reflectors along its entire length.

ALLEGHANIAN OROGENY

The Permo-Carboniferous Alleghanian orogeny in the southern Appalachians involved transpression and dextral strike-slip motion along the North American margin followed by terrane transport over Grenville-age continental crust along the Blue Ridge–Piedmont megathrust (Hatcher, 2010). Sub-horizontal reflections on COCORP profiles crossing the orogenic belt suggest that a major detachment underlies the Blue Ridge and Inner Piedmont and possibly extends eastward beneath the Atlantic Coastal Plain (Fig. 2) (Cook and Vasudevan, 2006). In southern Georgia, the detachment is interpreted to merge with seismic reflectors marking the Suwannee-Wiggins suture (McBride et al., 2005; Steltenpohl et al., 2008), but it may also cross over the suture and merge with a proposed Alleghanian suture marked by the Gulf Coast–East Coast magnetic anomalies (Hall, 1990). Alternatively, the detachment may terminate near the Central Piedmont suture zone, and the peri-Gondwanan Carolina terrane may underlie much of the Atlantic Coastal Plain in the southeastern United States (Fig. 2) (Hibbard et al., 2010).

In southern Georgia, the deep crustal suture is interpreted to separate Grenville-age Laurentian crust from Gondwanan basement (McBride et al., 2005). The collision of the crustal block underlying the Suwannee terrane is generally considered a Permo-Carboniferous event, though accretion may have occurred during the Late Devonian (Hibbard et al., 2010).

MESOZOIC CONTINENTAL RIFTING

The Atlantic and Gulf of Mexico rifts developed outboard of the Suwannee-Wiggins suture during the Mesozoic, leaving Gondwanan lower crust and the Suwannee terrane attached to North America. Alleghanian faults and post-orogenic collapse structures were reactivated during Mesozoic extension (Steltenpohl et al., 2013), and the Suwannee terrane was possibly down-dropped from higher crustal levels (Steltenpohl et al., 2008). The Triassic-Jurassic South Georgia basin formed along the boundary between accreted peri-Gondwanan terranes and the Suwannee terrane (McBride et al., 1989; McBride, 1991). Beneath the Coastal Plain, the basin separates the Suwannee terrane from the buried Brunswick-Charleston terrane for most of the length of the BMA (Hatcher, 2010).

Drilling data show that an extensive network of mafic dikes and sills is present beneath the Atlantic Coastal Plain (Chowns and Williams, 1983). Geochronological constraints indicate that the magmatism is closely related to the emplacement of the Central Atlantic Magmatic Province at ca. 200 Ma (Heatherington and Mueller, 2003). The J-reflector on regional seismic reflection profiles across the basin and offshore South Carolina was initially interpreted as an extensive subsurface basalt flow or diabase sill beneath the Coastal Plain (shaded area, Fig. 2) (McBride et al., 1989). However, Heffner et al. (2012) recently interpreted the J-reflector as simply the base of the Coastal Plain based on re-analysis of well data and seismic reflection profiles. In general, the relationship between dike and sill complexes emplaced within the South Georgia rift strata and lower crustal intrusion and underplating along the suture remains uncertain.

CRUSTAL STRUCTURE ACROSS THE BMA AND ECMA

In the eastern United States, the transition from largely unmodified crust beneath the Coastal Plain to highly stretched, transitional crust across the continental margin occurs over a distance of ~75 km (Lizarralde and Holbrook, 1997). On EDGE line 801 (Fig. 1), crustal thickness decreases from 35 to 15 km across the ECMA (Sheridan et al., 1993). On lines USGS 32 and BA-6 across the Carolina trough (Fig. 1), elevated velocities (6.5–7.5 km/s) indicative of mafic underplating are largely restricted to thinned crust along the ECMA, while 35-km-thick continental crust inboard of the ECMA with V_p of 6.4–6.8 km/s appears unmodified by rift magmatism (Tréhu et al., 1989; Holbrook et al., 1994). In general, crustal thinning and underplating appear to be highly focused along the ocean-continent transition (Lizarralde and Holbrook, 1997).

As the BMA diverges from the ECMA, evidence for crustal thinning and magmatic underplating becomes limited. A velocity model for Line BA-3 (Fig. 1), which crosses the BMA offshore, indicates that crustal thickness is ~35–40 km across the entire profile (Lizarralde et al., 1994). Middle and lower crustal velocities are 6.4–6.75 km/s, and there is a thin, poorly resolved 7.2 km/s layer at the base of the crust. On the eastern and western COCORP transects crossing the onshore segment of the BMA (Figs. 1 and 2), discontinuous Moho reflectors indicate uniform crustal thickness of 33–36 km with little relief at the crust-mantle boundary (McBride and Nelson, 1988). Truncation of dipping reflectors marking the SWS suggests that the Moho formed as a result of Mesozoic extension (McBride and Nelson, 1988), though this interpretation is not unique.

PREVIOUS MAGNETIC MODELS

McBride and Nelson (1988) modeled the source of the onshore segment of the BMA as a tabular mafic intrusive complex outboard of the suture zone beneath the South Georgia basin. They make two important assumptions: (1) induced magnetization of high susceptibility mafic rocks dominates the magnetic signature; and (2) the discontinuous magnetic highs that flank the south side of the BMA are paired with the continuous magnetic low (Fig. 1). In their model, the high-low pair is generated by a south-dipping block outboard of the suture. As the trend of the BMA changes from E-W to N-S off the Georgia coast, the disappearance of the magnetic low is related to the azimuthal

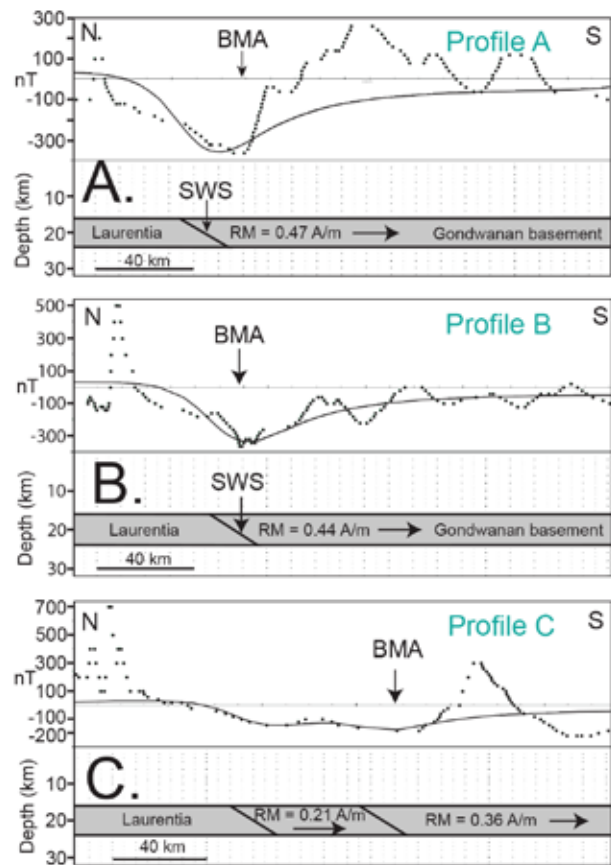


Figure 3. Observed total magnetic intensity (dots) and magnetic models (solid line) for profiles A–C. Magnetic profiles were obtained from Zietz et al. (1980) and then shifted to the datum of Daniels (2001). The present field is modeled using a magnetic declination of 0°, inclination of –63°, and total field intensity of 52,500 nT, based on 1977 values when the surveys were flown. The continuous magnetic low is modeled using remanent magnetization oriented toward the south (arrow). All lower crustal blocks are modeled with a susceptibility of $k = 0.01$ SI. The position of the Suwannee-Wiggins suture (SWS) is based on Consortium for Continental Reflection Profiling (COCORP) seismic reflectivity. (A) Model for profile A showing general agreement with the magnetic low. The flanking magnetic high to the south is interpreted as a separate anomaly. (B) Model for profile B showing close agreement with the long-wavelength signature of the magnetic low. (C) Model for profile C using two crustal blocks with slightly different remanent magnetizations (RM). BMA—Brunswick magnetic anomaly.

dependence of the anomaly. The major implication of this model is that the ECMA and BMA have a common source related to mafic magmatism.

REMANENT MAGNETIZATION OF LOWER CRUSTAL ROCKS

Remanent magnetization of lower crustal granulites is a possible source of long-wavelength magnetic anomalies originating in the deep crust (McEnroe et al., 2004), and the common assumption of induced magnetization of magnetite-bearing rocks for analysis of crustal-scale anomalies may not be completely justified (McEnroe et al., 2001). Rock magnetism and petrologic studies show that magnetite-bearing rocks can retain a strong remanent component over long periods of geologic time (Kelso et al., 1993; McEnroe and Brown, 2000). In the Arunta Block of Australia, felsic-to-mafic granulites possess a median remanent

magnetization of 4.1 A/m, compared with induced magnetization of <1.0 A/m (Kelso et al. 1993).

The recognition of strong magnetism associated with the hematite-ilmenite solid solution series is also an important consideration in crustal magnetism studies (Robinson et al., 2002). Magnetization of hematite-ilmenite exsolution microstructures is thermally stable (demagnetization occurs between 530 and 650 °C) and resistant to alternating field demagnetization (McEnroe et al., 2004). These properties suggest that magnetite (Curie temperature = 580 °C) is not the only important magnetic phase at lower crustal depths (McEnroe et al., 2004). Exhumed granulites in Sweden containing hematite-ilmenite exsolution lamellae and minor magnetite are characterized by strong remanent magnetization of ~9.2 A/m (McEnroe et al., 2001).

NEW MAGNETIC MODELS

The magnetic models presented here are based on thin-skinned tectonic models of the southern Appalachians (Cook and Vasudevan, 2006) and the interpretation that deep crustal reflectivity marks the suture between Grenville-age Laurentian basement and Gondwanan lower crust (McBride et al., 2005). The BMA is modeled as the juxtaposition of lower crustal blocks with differing magnetic character (e.g., Daniels et al., 1983). Gondwanan crustal blocks may have acquired a localized remanent magnetic signature during Alleghanian transpression focused in deep crustal levels outboard of the Laurentian margin. Inboard of the suture, the thin-skinned nature of the orogen suggests that Grenville lower crust behaved as a stable block and escaped pervasive lower crustal metamorphism. The presence of Alleghanian granitoids north of the suture (Heatherington et al., 2010) is attributed to westward over-thrusting of rocks onto the Laurentian margin during the final stages of continental collision (e.g., Hatcher, 2010), rather than heating and metamorphism of Grenville lower crust by ductile thickening.

The primary goal of this study is to model the continuous long-wavelength magnetic low. Although the anomaly is often considered a high-low pair, there is no direct evidence indicating that the onshore flanking highs are related to the long-wavelength magnetic low. Because the overall magnetic character of the Suwannee terrane can be characterized by random magnetic highs (Fig. 1), these discontinuous anomalies are interpreted as separate features. No attempt has been made to model the short-wavelength features because of the variability of the flanking magnetic signature along strike.

In the model for profile A (Figs. 2 and 3A), Laurentian and Gondwanan lower crust possess the same magnetic susceptibility ($k = 0.01$) typical of granulite-facies assemblages (Kelso et al., 1993), but the lower crust outboard of the Laurentian margin is modeled with relatively weak remanence of 0.47 A/m oriented toward the south (opposite the present magnetic field). The assumed horizontal inclination of the remanent vector is supported by paleomagnetic reconstructions that show the southern margin of North America at equatorial latitudes during the formation of Pangea (van der Voo and Torsvik, 2001). The position of the SWS is based on seismic reflectivity on COCORP lines 13 and 14 (Fig. 2). In the model, the lower crustal blocks extend from 16 to 24 km depth. Assuming a relatively low geothermal gradient of 22 °C/km (e.g., Arthur, 1982), the depth to

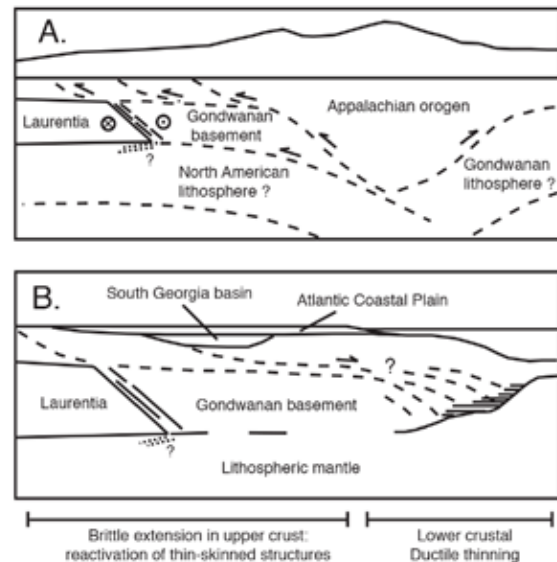


Figure 4. Conceptual tectonic model for the southeastern United States. (A) Strike-slip motion along the deep crustal suture followed by the initiation of Alleghanian thin-skinned thrusting on the eastern flank of accreted Gondwanan basement. (B) Simple shear extension along the Atlantic margin controlled by reactivation of thin-skinned structures (after Lister et al., 1991). Localized ductile thinning along the margin suggests that complex structure (tectonic wedging) may be preserved along the Suwannee-Wiggins suture zone.

the 550 °C isotherm is ~25 km. Above this depth, remanent magnetization of rocks containing magnetite and/or hematite-ilmenite will be stable (McEnroe et al., 2004). The slightly different magnetic signature between the two blocks produces the prominent magnetic low coincident with suture zone reflectivity on the western COCORP transect. The magnetic high is interpreted as a separate feature of unknown origin.

The contrast between profiles A and B is intended to show that the flanking magnetic highs are localized, while the long-wavelength magnetic low is a continuous anomaly. In Figure 3B, the Gondwanan basement is modeled with a remanence of 0.44 A/m. Again, the position of the suture zone is based on seismic reflectivity on COCORP lines 13, 14, and 19 (Fig. 2). The long-wavelength magnetic low (~300 nT) generated by the two blocks closely matches the observed profile.

The BMA along profile C in southeastern Georgia is relatively broad (80 km wide) and lower in amplitude (~200 nT) compared with profiles A and B (Fig. 3C). A slight contrast of 0.15 A/m between two blocks outboard of the margin accounts for the broad anomaly on this profile. In the model, the edge of the Laurentian margin is roughly coincident with dipping reflectivity imaged on line 16a of the eastern COCORP transect (Fig. 2).

DISCUSSION

The long-wavelength aeromagnetic low associated with the BMA can be modeled using contrasts in remanent magnetization between Laurentian basement and Gondwanan crustal blocks underlying the Suwannee terrane. The magnetic models are consistent with tectonic models for the southern Appalachians involving transpression along the continental margin followed by foreland-directed thrusting of terranes over Grenville basement

along a major detachment fault (Fig. 4A). The presence of African rocks north of the Brunswick magnetic anomaly is interpreted to result from thin-skinned thrusting of the Suwannee terrane across the trace of the deep crustal suture in the final stage of the Alleghanian orogeny (Fig. 4A) (e.g., Hall, 1990).

The models require that Mesozoic extension and magmatism did not overprint the magnetic signature inherited from convergence. The development of the South Georgia rift basin in the upper crust without extensive lower crustal modification along the suture is consistent with simple shear extension along the Atlantic margin (Fig. 4B) (Lister et al., 1991). In this model, focused magmatism is laterally offset toward the main Atlantic rift, and basin formation in the upper crust is accommodated by extension above a mid-crustal detachment. Lower crustal stretching is interpreted to be minimal.

If the suture zone beneath the South Georgia basin was not completely overprinted by extension and magmatism, then structure related to Alleghanian transpression and collision may be preserved along the inboard section of the suture. The truncation of crustal-scale dipping reflectors by relatively flat Moho reflectors on COCORP line 13 may be indicative of under-thrusting of crustal material beneath the Laurentian margin during collision (Figs. 2 and 4). Though speculative, the sub-Moho reflector on Line 14 (Fig. 2) may be related to tectonic wedging or transpression along the suture. This feature appears similar to Moho structure imaged on high-resolution seismic reflection profiles from the ALCUDIA transect in Spain (Martínez Poyatos et al., 2012). The preservation of convergent structures would provide insight into the nature of continental collision during the accretion of Gondwanan basement.

CONCLUSIONS

The new magnetic models presented here suggest that the source of the BMA resides in lower crustal metamorphic rocks outboard of the Laurentian margin. The acquisition of reversed-polarity remanent magnetization along the suture and within Gondwanan lower crustal blocks is consistent with transpression along the North American margin during the Kiaman Superchron. The preservation of this signature at depths of 16–24 km is consistent with simple shear extension involving limited lower crustal stretching and a lack of focused magmatism beneath the South Georgia basin.

The main implications of the magnetic modeling are as follows: (1) relatively weak reversed-polarity remanence (0.21–0.47 A/m) in lower crustal rocks outboard of the Laurentian margin provides a simple explanation for the BMA; (2) CAMP intrusions in the lower crust were not highly concentrated along the Suwannee-Wiggins suture zone; and (3) evidence for Alleghanian convergent structure at the crust-mantle boundary or within the mantle lithosphere may be preserved along the suture, rather than overprinted by Mesozoic extension.

The analysis provides an alternative to rift-related models assuming induced magnetization of mafic intrusions concentrated along the Suwannee-Wiggins suture zone. Additional geophysical constraints on crustal structure from the EarthScope Southeastern Suture of the Appalachian Margin Experiment (SESAME) broadband array (Fischer et al., 2012) and the Suwannee Suture and Georgia Rift basin (SUGAR) active-source seismic experiment (Shillington et al., 2013) targeting the suture

and CAMP will help differentiate between tectonic models. Integration of seismic data with new perspectives on crustal magnetism will provide a better understanding of terrane accretion, rifting processes, and passive margin formation in the southeastern United States.

ACKNOWLEDGMENTS

I would like to thank Rob Hawman for his encouragement, advice, and assistance with magnetic modeling. Reviews by Paul Mueller and an anonymous reviewer greatly improved the manuscript. Alberto Patiño-Douce, Mike Roden, Alex Brown, and Jacqui Maleski also provided helpful comments on an earlier version of this manuscript. This work was supported by U.S. National Science Foundation Grant EAR-0844154 and the University of Georgia Department of Geology.

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Manuscript received 4 June 2013; accepted 5 Sept. 2013. ▲

GSA 2014

19-22 October | Vancouver, BC, Canada



As preparations for GSA's 2014 Annual Meeting in Vancouver, British Columbia, Canada, go into full swing, we invite your participation—whether as a presenter, exhibitor, or just as an attendee taking in the full spectrum of geoscience research and the amazing surroundings of Vancouver, we don't think you will be disappointed.

Over the next several months, we will be providing you with vital information for attending the meeting in Canada. Our June *GSA Today* issue will have information on registration, housing, and the many activities, courses, and field trips you will be able to participate in during the conference. We will also be bringing you information on the city of Vancouver and things you should look to do while there. But we also invite you to look at our meeting website throughout the next few months to plan your trip (and perhaps an extended stay after GSA), as well as to interact with attendees on our Connected Community. For this issue of *GSA Today*, we have pulled together some travel details for you to review, including essential information and actions to take—sooner rather than later—in order to gain entry into Canada.

We look forward to welcoming you to Vancouver this October for another great meeting! — **The GSA Meetings Team**

A Special Thank You to Our ORGANIZING COMMITTEE

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2014 GSA Annual Meeting & Exposition

TRAVEL AND VISA INFORMATION

Meeting Dates

19–22 October 2014

Technical sessions run Sun.–Wed., 19–22 October. Some events and meetings, including field trips and short courses, will occur before and after these dates. **Time zone:** Pacific (PST UTC-08:00).

Meeting Location & Currency Information

The meeting will take place at the beautiful Vancouver Convention Centre, 1055 Canada Place, Vancouver, British Columbia, V6C 0C3, Canada; +1-604-689-8232; www.vancouverconventioncentre.com/thecity/getting-here/. Vancouver weather ranges from 52°F to 61°F in October, with light to moderate precipitation. **Currency:** Canadian dollar. **Please note:** GSA will only be accepting U.S. currency at the meeting. Credit cards will be charged in U.S. dollars. Checks will not be accepted. **Exchange rates:** www.bankofcanada.ca/rates/exchange/daily-converter. Tips for using currency in Canada: <http://travel.gc.ca/travelling/air/travelling-money/planning-finances>.

Travel Arrangements

If you are not a Canadian passport holder, please be prepared with the proper credentials. Learn more at www.cbsa-asfc.gc.ca/media/facts-faits/109-eng.html. **To apply for a temporary resident visa**, go to www.cic.gc.ca/english/information/applications/visa.asp. If you have more questions, check out this video: www.cic.gc.ca/english/department/media/multimedia/video/complete-application/complete-application.asp.

Airport

Due to heightened airport security and bag screening measures, you will need to arrive at your local airport approximately two hours prior to your scheduled flight time. **Traveling with a disability:** <http://travel.gc.ca/travelling/health-safety/disabilities>. **Boarding procedures:** Vancouver's airport (YVR), www.yvr.ca/en/default.aspx, does accept electronic boarding passes. **To read more about security procedures**, go to www.catsa.gc.ca/breezethrough.

Border Crossing

Determining eligibility to enter Canada: www.cic.gc.ca/english/visit/apply-who.asp.
Travel checklist: www.cbsa-asfc.gc.ca/travel-voyage/checklist-aide-memoire-eng.html
Prohibited goods: www.cbsa-asfc.gc.ca/publications/pub/bsf5056-eng.html#s5
Declaring food: www.cbsa-asfc.gc.ca/fpa-apa/regs-eng.html

Please see the GSA website for a link to a list of countries from which a visa is required to enter Canada.



Action Dates

▶ Abstract submissions:	Open Now!
▶ Registration opens:	Early June
▶ Housing opens:	Early May
▶ Student travel grants open:	Early June
▶ Student volunteer system opens:	Early June
▶ Space request deadline:	5 June
▶ Abstracts deadline:	29 July
▶ Speaker notification:	Late August
▶ Early registration deadline:	Mon., 15 Sept.
▶ Housing deadline:	Mon., 22 Sept.
▶ Registration cancellation deadline:	Mon., 22 Sept.

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Call for Papers

► Abstracts deadline: 29 July

2014 Joint Technical Program Co-Chairs

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SUBMITTING AN ABSTRACT

- **Submission deadline:** Tuesday, 29 July;
- **Go to www.geosociety.org/meetings/2014/sessions/** to begin your submission;
- **An abstract submission fee** of US\$45 for professionals; US\$25 for students; and US\$80 for digital posters will be charged; and
- **You may present two volunteered abstracts** during the meeting, *as long as one is a poster (including digital poster) presentation.*

THREE WAYS TO PRESENT

1. **Oral:** The normal length of a talk is 12 min., plus three min. for Q&A. You *must* visit the Speaker Ready Room at least 24 hours before your scheduled presentation. All technical session rooms are equipped with a PC using MS Office 2010.
2. **Posters:** You will be provided with one horizontal, free-standing 8-ft-wide by 4-ft-high display board and Velcro for hanging your poster. Each poster booth will share a 6-ft-long by 30-inch-wide table. Electricity will be NOT available this year; please plan your presentation accordingly.
3. **Digital Posters:** You will be provided with one horizontal, freestanding 8-ft-wide by 4-ft-high display board and Velcro for hanging your display. You will also have a 40–46-inch monitor on a 6-ft-long by 30-inch-wide table; electricity for your laptop (bring your own laptop); and a VGA cable along with sound. Mac users: Bring your own white dongle.

Hours for poster and digital poster presentations:

9 a.m.–5 p.m. on Sunday, with authors present 3–5 p.m.; and
9 a.m.–6:30 p.m. Mon.–Wed., with authors present during the
afternoon beer reception, 5–6:30 p.m. Presenters will also be
at their posters for two hours in the morning or afternoon,
as assigned.



www.geosociety.org/meetings/2014/

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Okanagan Highlands outcrop. Photo by Bruce Archibald.

TOPICAL SESSIONS

These sessions are topically focused, with a mix of invited and volunteered papers. They are sorted by **primary discipline**, but most sessions are designed to be interdisciplinary. Related disciplines are listed with each session; further details are online at www.geosociety.org/meetings/2014/.

Structural Geology

T1. The Structure of Faults from Top to Bottom: Implication for Fluid Flow, Ore Deposits, and Seismic Hazard

Disciplines: Structural Geology; Tectonics/Tectonophysics; Economic Geology

Advocates: W. Ashley Griffith; Christie D. Rowe; Joseph Clancy White

We encourage contributions from diverse fields exploring the range of fault slip behaviors and the long and short term effects of active and ancient faults from the top to the bottom of the crust.

T2. Emplacement of Upper Crustal Magmatic Intrusions: Field Studies of Laccoliths, Sills, and Subvolcanic Plugs

Disciplines: Structural Geology; Petrology, Igneous; Geophysics/Geodynamics

Advocates: Paul Wetmore; Eric Horsman; Charles Connor; Scott D. Giorgis

This session is focused on the emplacement and melt-host rock interactions of shallow crustal intrusions including sills, laccoliths, and subvolcanic conduits.

T3. Ridge to Trench Evolution of Oceanic Lithosphere and Its Accretion Tectonics in the Pacific Rim (Past and Present)

Disciplines: Structural Geology; Tectonics/Tectonophysics; Petrology, Metamorphic

Advocates: Yildirim Dilek; Yujiro Ogawa

Marine/ophiolitic rocks in subduction-accretion systems record the travel history of oceanic lithosphere from ridge to trench and their evolution in/across different tectonic settings. This session explores case studies from the Pacific Rim and beyond.

Tectonics/Tectonophysics

T4. Circum-Arctic Lithosphere-Basin Evolution

Disciplines: Tectonics/Tectonophysics; Geophysics/Geodynamics; Stratigraphy

Advocates: Larry S. Lane; Keith Dewing; Victoria Pease; Gordon Oakey; John Shimeld; Randell A. Stephenson

This session highlights new results relevant to the geological evolution of the Circum-Arctic region over the past 700 Myr, with particular emphasis on linkages (e.g., inter-regional, temporal, onshore-offshore, interdisciplinary, lithosphere-basin, magmatism-tectonism, etc.).

T5. Tectonic and Magmatic Evolution of the Aleutian Arc in Space and Time

Disciplines: Tectonics/Tectonophysics; Volcanology

Advocates: Brian R. Jicha; Suzanne Mahlburg Kay

The Aleutian arc is arguably the best place on Earth to investigate several fundamental questions about arc magmatism and tectonism. We seek contributions that highlight the geochemical, geophysical, and temporal evolution of this dynamic setting.

T6. Birth and Death of Supercontinents

Disciplines: Tectonics/Tectonophysics; Geophysics/Geodynamics; Geochemistry

Advocates: Daniel Pastor-Galán; J. Brendan Murphy; William J. Collins

Earth's landmasses amalgamate altogether into supercontinents following a quasi-periodic cycle since the origin of tectonics. This session will review the tectonic evolution of supercontinents from amalgamation to break up at every level of Earth's structure.

T7. Great Earthquakes, the Cascadia Subduction Zone, and Society (Posters)

Disciplines: Tectonics/Tectonophysics; Geophysics/Geodynamics; Marine/Coastal Science

Advocates: Andrew Meigs; Chris Goldfinger

The Cascadia subduction zone is arguably one of the biggest seismic hazards in North America. This session explores new advances in subduction zone dynamics, earthquake recurrence, tsunami hazards, and societal exposure.

T8. Cordilleran Ophiolites: Tectonic Significance and Comparisons with Other Orogenic Belts

Disciplines: Tectonics/Tectonophysics; Petrology, Igneous; Structural Geology

Advocates: Alexandre Zagorevski; John Wakabayashi

This session will focus on recent advances in the understanding of ophiolites through multidisciplinary studies of Cordilleran ophiolites and their analogues in modern and ancient settings.

T9. Reconstruction of East Asian Blocks in Pangea

Disciplines: Tectonics/Tectonophysics; Structural Geology; Geophysics/Geodynamics

Advocates: Wenjiao Xiao; Guochun Zhao; Baochun Huang

This session encourages contributions that highlight recent geological, paleogeographic, paleontological, and paleomagnetic advancements in understanding where, when, and how East Asian blocks were assembled and whether they had become part of Pangea.

T10. Development and Destruction of Accretionary Complexes in Time and Space: Evolving Evidence from Modern Techniques and Structural Analysis of the Rock Record

Disciplines: Tectonics/Tectonophysics; Structural Geology; Petrology, Metamorphic

Advocates: Sarah M. Roeske; Terry L. Pavlis; John I. Garver

Developments in detrital, metamorphic, and cooling ages, combined with petrology and field studies, are providing new insight into how accretionary complexes are assembled and destroyed through improved understanding of their material pathways and thermal evolution.

T11. Pan-Pacific Subduction Zone Hazards: Tectonic and Gravitational Effects

Disciplines: Tectonics/Tectonophysics; Marine/Coastal Science; Geophysics/Geodynamics

Advocates: Peter Bobrowsky; Yujiro Ogawa

We will summarize recent work on tectonic and gravitational effects for natural hazards and disasters in subduction zones of Pan-Pacific and other regions, particularly on earthquakes, active faults, landslides, tsunamis, and related socio-economic implications.

T12. Contrasting Styles of Phanerozoic Intracontinental Tectonics: North America versus Asia

Disciplines: Tectonics/Tectonophysics; Structural Geology; Geophysics/Geodynamics

Advocates: Dickson Cunningham; Stephen Marshak

This session will explore Phanerozoic tectonism, at all scales, in the continental interiors of North America and Asia, to characterize similarities and differences in the way continents respond to distant orogenic stress and/or mantle dynamics.

T13. Tectonics of the Northwest Cordillera: A Session in Honor of the Career Contributions of Ned Brown, Jim Monger, and Glenn Woodsworth

Disciplines: Tectonics/Tectonophysics; Structural Geology; Petrology, Igneous

Advocates: Robert Miller; G.E. Gehrels; Margaret E. Rusmore; Elizabeth R. Schermer

This session honors fundamental contributions by Ned Brown, Jim Monger, and Glenn Woodsworth on the tectonics of the Coast Mountains and North Cascades. We seek submissions providing new insights and syntheses of this orogen.

T14. Feedbacks among Tectonics and Surface Process during Cenozoic Growth of Topography in Asia

Disciplines: Tectonics/Tectonophysics; Geomorphology; Paleoclimatology/Paleoceanography

Advocates: Eric Kirby; Peter D. Clift

This session will highlight research on the spatio-temporal evolution of topography throughout the Indo-Asian collision zone and illustrate the linkages among erosion, exhumation, and transport of detritus. We welcome both observational and theoretical contributions.

T15. Continental Arcs #1: Tectonopetrologic Processes Controlling Arc Tempos and Evolution

Disciplines: Tectonics/Tectonophysics; Petrology, Igneous; Petrology, Metamorphic

Advocates: Alan D. Chapman; David Pearson; Robert B. Miller; Mark Behn

This session seeks a range of contributions aimed at understanding the influence of mantle and crustal melt interactions on the composition and productivity of batholiths and the tectonic processes that introduce mantle and supracrustal components.

T16. Continental Arcs #2: Processes at Arc to Magma Reservoir-Scale and Connections from Magma Source to Volcano

Disciplines: Tectonics/Tectonophysics; Petrology, Igneous; Volcanology

Advocates: Vali Memeti; Calvin G. Barnes; Scott R. Paterson

This session seeks contributions on chemical and physical magmatic processes and their time and length scales within specific parts of the vertical extent of continental arcs and the nature of vertical interconnectivity in these arcs.

T17. Continental Arcs #3: Mapping the Temporal and Compositional Evolution of Subvolcanic Magmatic Systems

Disciplines: Petrology, Igneous; Volcanology; Geochemistry

Advocates: Erik W. Klemetti; Lily Lowery Claiborne; Kathryn E. Watts

This session will highlight methods that illuminate the time-composition-thermobarometric evolution of subvolcanic magmatic systems. We encourage contributions that focus on crystal-scale petrologic, geochemical, and geochronologic characterization of volcanic and plutonic rock records.

T18. Landscape Records of Earthquake Deformation

Disciplines: Tectonics/Tectonophysics; Structural Geology

Advocates: Colin Amos; Andrew Meigs

High-resolution topographic data provide an unparalleled means for characterizing deformation along active faults. We seek contributions capitalizing on geomorphic, paleoseismic, stratigraphic, or other high-quality archives and methodologies for characterizing earthquake slip in active tectonic landscapes.

T19. The Geodynamics of Flat-Slab Subduction and Its Influence on Upper Plate Deformation, Magmatism, and Basin Evolution

Disciplines: Tectonics/Tectonophysics; Geophysics/Geodynamics; Stratigraphy

Advocates: Jeff A. Benowitz; Brian K. Horton; Meghan S. Miller

We seek to stimulate discussion of the causes and consequences of flat-slab subduction, a fundamental tectonic process influencing deformation, magmatism, lithospheric dynamics, thermal structure, surface uplift, exhumation, and basin subsidence along convergent margins.

T20. Magmatism, Tectonics, and Metallogeny of the Central Asian Orogenic Belt

Disciplines: Tectonics/Tectonophysics; Geochemistry; Economic Geology

Advocates: Wenjiao Xiao; Bo Wan

This session will provide an international forum for interdisciplinary discussions on accretionary orogenic belts, specifically on the Central Asian Orogenic Belt (CAOB).

T21. Phanerozoic Geology of the Southeastern Tibetan Plateau Region: Setting the Stage for Plateau Rise

Disciplines: Tectonics/Tectonophysics; Structural Geology; Stratigraphy

Advocates: Amy L. Weislogel; Delores Robinson

Geoscientists from diverse disciplines will assess the complicated geologic record produced by successive Phanerozoic tectonic systems of the southeastern Tibet region, aiming to piece together the geologic history that culminated in the modern Tibetan plateau.

T23. Exploring the Development of the Himalayan-Karakorum-Tibet Orogenic System from the Mantle to Mountain Peaks

Disciplines: Tectonics/Tectonophysics; Structural Geology; Petrology, Metamorphic

Advocates: Delores M. Robinson; Soumyajit Mukherjee; Barun Kumar Mukherjee

This session will unite geoscientists from diverse disciplines working on the Himalayan-Karakorum-Tibet (HKT) orogenic system. We will focus on controversies and evolution of the HKT using tectonics, geomorphology, geophysics, geodesy, geochemistry, sedimentology, petrology, and modeling.

T24. Forearc Basin Tectonics and Sedimentation

Disciplines: Tectonics/Tectonophysics; Stratigraphy; Geophysics/Geodynamics

Advocates: Marwan A. Wartes; Robert J. Gillis; Jeffrey M. Trop

The structural and stratigraphic evolution of the forearc region reflects dynamic processes along convergent margins. This multidisciplinary session will explore datasets that improve our understanding of tectonic processes recorded in modern and ancient forearc basins.

T25. Megathrusts: 50 Years after the 1964 Great Alaska Earthquake—In Honor of George Plafker

Disciplines: Tectonics/Tectonophysics; Geophysics/Geodynamics; Marine/Coastal Science

Advocates: Ray Wells; Peter J. Haeussler; Kelin Wang

On the 50th anniversary of the M9.2 Great Alaska Earthquake, we will examine advances in coastal geology, paleoseismology, geodetic monitoring, seismology, and geophysical surveys that illuminate processes and source structure of great subduction earthquakes.

T26. Deformation Localization throughout the Crust

Disciplines: Tectonics/Tectonophysics; Structural Geology

Advocates: Nicholas Perez; Graham Lederer

This session will explore the rheological implications of preexisting structures, partial melting, and lithology on localizing strain within the crust of orogenic systems, emphasizing the potential links or decoupling between lower and upper crustal deformation.

T27. Triassic-Jurassic Tectonics and Tectonic-Structural Controls on Porphyry and Related Mineralization in the Northern Cordillera

Disciplines: Tectonics/Tectonophysics; Economic Geology; Structural Geology

Advocates: JoAnne Nelson; James J. Ryan

This session aims to integrate tectonic models with district- and deposit-scale studies to enhance understanding of the rich metallogenetic episode immediately preceding initial accretion of offshore island-arc terranes to the North American continental margin.

T28. Reconciling Geodetic/Seismological Estimates and Geological Observations of Permanent Deformation at Subduction Plate Boundaries

Disciplines: Tectonics/Tectonophysics; Structural Geology; Geophysics/Geodynamics

Advocates: Rob Govers; Kevin P. Furlong

This session seeks papers on the correlation between strain acquired during the seismic cycle and long-term geological strain near convergent plate boundaries.

T29. Geologic Processes That Influence the Tectonic Development and Economic Resources of the Northern North American Cordillera

Disciplines: Tectonics/Tectonophysics; Structural Geology; Stratigraphy

Advocates: James V. Jones III; Emily S. Finzel; Brian A. Hampton; Jeffrey M. Trop

This cross-disciplinary session will bring together diverse geoscientists studying processes that shaped the northern Cordillera, including deformation, exhumation, glaciology, magmatism, seismicity, and sedimentation. Studies from Alaska, western Canada, the Pacific Northwest, and California are encouraged.

Quaternary Geology & Geomorphology**T30. Sea-Level Changes from Minutes to Millennia**

Disciplines: Quaternary Geology; Geomorphology; Marine/Coastal Science

Advocates: Simon E. Engelhart; Benjamin P. Horton; Adam D. Switzer

Reconstructions of relative sea level, coastal evolution, and extreme events (storms and tsunamis) are of local to global interest. Devastating extreme events have placed significant socio-economic relevance on understanding human-land-ocean interaction and coastal dynamics.

T31. The Cordilleran Ice Sheet: A Glacial Legacy in the Pacific Northwest (Posters)

Disciplines: Quaternary Geology; Paleoclimatology/Paleoceanography; Archaeological Geology

Advocates: Andrew J. Stumpf; John J. Clague; Kathy Goetz Troost

This session explores major advances in understanding how the Cordilleran Ice Sheet played an important role in shaping the present landscape of westernmost Canada and adjacent parts of the United States.

T32. Younger Dryas and Other Dansgaard-Oeschger Events in the Northern and Southern Hemisphere

Disciplines: Quaternary Geology; Geomorphology; Paleoclimatology/Paleoceanography

Advocate: Ed Evenson

This session focuses on new data from North America, Europe, New Zealand, and South America to address the question of contemporaneity of Younger Dryas and other Dansgaard-Oeschger events in both hemispheres.

T33. Instrumental, Historical, and Geological Records of Earthquake-Related Deformation along Tectonically Active Coasts

Disciplines: Quaternary Geology; Geomorphology; Tectonics/Tectonophysics

Advocates: Simon E. Engelhart; Robert C. Witter; Richard W. Briggs

Recent great earthquakes in Sumatra, Chile, and Japan highlight the need for accurate assessment of coastal hazards over the periods of hundreds to thousands of years.

T34. Modern and Ancient Continental Depositional Environments: Linking Landscape Evolution with Fluvial Systems and Lacustrine Basins through the Cenozoic

Disciplines: Quaternary Geology; Geomorphology; Limnogeology

Advocates: Eric C. Carson; Jeffrey T. Pietras

The natural evolution of a landscape involves both gradual and catastrophic events. Both can be recorded within fluvial depositional environments, lacustrine basins, and geoarchaeological records, providing the opportunity to bring together researchers from multiple disciplines.



Landscape around the Ajax alkalic porphyry Cu-Au pit, Iron Mask batholith (peak in background is Sugar Loaf composed of Sugar Loaf diorite, part of the Iron Mask batholith). Photo by Thomas Bissig.

T35. Exploring Spatial and Temporal Variability of Latest Pleistocene and Holocene Alpine Glacier Fluctuations

Disciplines: Quaternary Geology; Geomorphology

Advocates: P. Thompson Davis; Douglas H. Clark; Johannes Koch

We solicit contributions that discuss evidence of glacier activity from new sites, reveal refined methods to develop chronologies, or consider climatic events or forcings that were responsible for latest Pleistocene through Holocene alpine glacier fluctuations.

T36. Quaternary History of the Pacific Northwest Using Integrated Geomorphic and Stratigraphic Records

Disciplines: Quaternary Geology; Geomorphology; Sediments, Clastic

Advocates: Mark R. Sweeney; Eric V. McDonald; David R. Gaylord

This session highlights the Quaternary geomorphic and paleoclimatic history of the Pacific Northwest using integrated stratigraphic and geomorphic records from glacial, lacustrine, fluvial, and aeolian environments, along with findings from paleopedological, geochronological, or paleontological studies.

T37. Late Pleistocene Circum-Arctic Ice Sheets: Extent, Chronology, and Dynamic Controls

Disciplines: Quaternary Geology; Geomorphology; Stratigraphy

Advocates: Brent C. Ward; Eiliv Larsen

The extent, timing, and environments of Late Pleistocene Arctic ice sheets remain controversial. This multidisciplinary session will bring together researchers examining ice sheets and their associated environments to summarize the current state of knowledge.

T38. Geology of Earthquakes, Faults, and Fault Systems

Disciplines: Quaternary Geology; Tectonics/Tectonophysics

Advocates: Kathleen M. Haller; Ryan D. Gold; Anke Friedrich

Large earthquakes disrupt society in many ways. The past behavior of faults is key to forecasting future behavior. We encourage papers that describe the results of identifying and characterizing potential sources of future seismicity.

T39. Aeolian Processes and Landscapes: From Dust to Dunes

Disciplines: Geomorphology; Quaternary Geology; Sediments, Clastic

Advocates: Ian J. Walker; Derek W.T. Jackson; Nicholas Lancaster; Alan F. Halfen; Karen E. Kohfeld

Examination of Earth's aeolian (windblown) processes and landscapes is approached from empirical, theoretical, and applied perspectives. Research from controlled simulations (e.g., CFD, wind tunnels), modeling approaches, and all landscapes (coastal, desert, glacial/periglacial, human-modified) is welcome.

T40. Records of Past Watershed Dynamics Archived in Lowland Wetlands and Lakes

Disciplines: Geomorphology; Geochemistry; Paleontology, Paleoecology/Taphonomy

Advocates: Jonathan F. Hughes; Lisa L. Ely

We encourage abstract submissions related to lowland environments that archive information about past watershed sediment supply, biogeochemical flux, and paleoecological response to Holocene climate change and human activity.

T41. Advances in Tsunami and Storm Research

Disciplines: Geomorphology; Marine/Coastal Science; Sediments, Clastic

Advocates: Breanyn MacInnes; Andrew Moore

Recent geological studies of tsunamis and storms have significantly advanced our understanding of these hazards. This session welcomes abstracts relevant to modern tsunami or storm studies or advances in paleo-tsunami, coastal paleoseismology, or paleo-tempestology research.

T42. Landscape Evolution through the Lens of Cosmogenic Nuclides

Disciplines: Geomorphology; Quaternary Geology; Geochemistry

Advocates: Matthew Cross Jungers; Rónadh Cox

This session investigates the rates of landscape evolution in response to climatic and tectonic forcing as recorded by cosmogenic nuclide abundances in rock and sediment. All applications of TCN systematics and all isotopes are welcome.

T43. Automated Approaches to Mapping Geological Materials and Landforms

Disciplines: Geomorphology; Quaternary Geology; Planetary Geology

Advocates: Jerome-Etienne Lesemann; Steven Pawley; Hazen A.J. Russell

This session addresses the need for increased adoption of automated mapping approaches (machine-based routines, conceptual approaches) in terrestrial, marine, and extra-terrestrial settings. Topical issues include theory/case studies examining dataset quality, classification approaches, and workflow development.

T44. Progress and Challenges in Developing Tools and Approaches Used in Sediment Budgets

Disciplines: Geomorphology; Environmental Geoscience; Geochemistry

Advocates: Allen C. Gellis; Philip N. Owens

Identification of fluvial sediment sources is a rapidly developing area of research worldwide. Interest in sediment-source identification is related to landscape evolution as well as to understanding environmental problems related to sediment as a pollutant.

T45. Tracking Sediment Movement across Earth's Surface

Disciplines: Geomorphology; Quaternary Geology; Geochemistry

Advocates: Lee B. Corbett; Eric W. Portenga; Paul R. Bierman

This session focuses on tracking sediment fluxes across Earth's surface to learn about soil formation, nutrient cycling, landform evolution, and geologic history.

T46. Geomorphic Dynamics in Glacial and Periglacial Mountain Landscapes

Disciplines: Geomorphology; Quaternary Geology

Advocates: Francesco Brardinoni; Olav Slaymaker

We welcome contributions on the geomorphic dynamics characterizing mountain drainage basins from a variety of formerly glaciated and currently glacierized settings. Contributions combining techniques of data collection/analysis across a range of temporal scales are encouraged.

Soils

T47. Soil as a Controller and Integrator of Geological Processes

Disciplines: Soils; Geomorphology; Environmental Geoscience

Advocates: Michael H. Young; Steven G. Driese; Todd G. Caldwell; David A. Stonestrom

This session focuses on the soil and soil processes that control and integrate biospheric responses to geologic and atmospheric forces, including biogeochemical evolution of rock, groundwater recharge, evapotranspiration, and regional atmospheric circulation patterns.

T48. Soil: Stress, Exploitation, and Erosion

Disciplines: Soils; Environmental Geoscience; Geomorphology

Advocate: Phillip P. Allen

Through presentations of varied research undertaken on soil records from the late Holocene and the Anthropocene, this session aims to raise awareness of the current plight of global soil communities due to unsustainable anthropogenic activity.

T49. Soil Development and Pedogenesis in Geosciences

Disciplines: Soils; Hydrogeology; Environmental Geoscience

Advocates: Todd G. Caldwell; Henry Lin; Daniel D. Richter Jr.

Soils result from a coupling of biotic and abiotic factors. Soil development, structure, and mineralogy are intrinsically bound to time. This session welcomes research on pedogenesis, its quantification, and implications to geologic processes.



The Middle Fork Nooksack lahar (MFL) is well exposed in a high bank studded with buried logs. The 5900 BP lahar (6800 calendar years) is the largest lahar in Mount Baker's geologic record, and may have traveled 100 km to the Fraser River via Abbotsford, British Columbia, Canada. At this site, MFL is directly overlain by the smaller Ridley Creek lahar. Photo by D. Tucker.

T50. Urban Soil Characteristics and Surface Environmental Quality

Disciplines: Soils; Geology and Health; Environmental Geoscience

Advocates: Nurdan S. Duzgoren-Aydin; Michael H. Young; Gurpal S. Toor

This session focuses on physical/chemical, mineralogical, and ecological characteristics of urban soils. We solicit presentations that review current research trends involving urban soils and that identify new collaborations between soil and environmental scientists.

Geoscience Education

T51. Geology and Hydrology of the National Parks: Research, Mapping, and Resource Management

Disciplines: Geoscience Education; Geoscience Information/Communication; Hydrogeology

Advocates: Bruce A. Heise; Jason P. Kenworthy; F. Edwin Harvey

This session addresses the role of geoscience in the national parks. Presentations are encouraged on geologic research, hydrology, and resource management in units of the U.S. National Park system, as well as comparable studies in Parks Canada.

T52. Preparing Our Workforce (POW): Increasing Students' Employability by Developing Practical Skills and Competencies

Discipline: Geoscience Education

Advocates: Heather R. Houlton; Richard Spruill; Ann Johnson

Retirement of professionals is causing an increased demand for trained geoscientists in the private sector. To meet this demand, we need to effectively prepare students to enter the workforce by developing practical skills and competencies.

T53. Place-Based Approaches to Geoscience Education

Disciplines: Geoscience Education; Geoscience Information/Communication; History and Philosophy of Geology

Advocate: Sadredin C. Moosavi

Place-Based Approaches to Geoscience Education brings together the community of scholars using this approach in a variety of educational settings with a diversity of student populations to share insights. K-16 and informal educators welcome!

T54. On-Ramp to the Research Highway: Case Studies in Undergraduate Geoscience Courses

Discipline: Geoscience Education

Advocates: Suzanne M. Smaglik; Dan K. Moore; Katrien J. van der Hoeven Kraft; Laura A. Lukes

This session will focus on how case studies can introduce undergraduate students to geoscience research. We seek presentations that share best-practices, example case studies, or research on the benefits of this approach.

T55. Models of Undergraduate Research in the Marine Sciences

Disciplines: Geoscience Education; Marine/Coastal Science

Advocates: Laura A. Guertin; Patricia Manley

This session will highlight undergraduate research opportunities, programs, and successes focused in the marine sciences. Submissions may range from field-based projects to utilization of online databases for independent or group investigations.

T56. Ushering in a New Era in K-16 Geoscience Education

Discipline: Geoscience Education

Advocates: Michael J. Passow; Glenn R. Dolphin

What are effective strategies to implement Next Generation Science Standards in U.S. schools, address critical issues such as climate change, and incorporate data-driven authentic inquiry?

T57. Digital Geology Sandpit

Disciplines: Geoscience Education; Geoinformatics; Geoscience Information/Communication

Advocates: Declan G. De Paor; Steven J. Whitmeyer; Callan Bentley

Get hands-on experience with the latest greatest digital technologies—hardware and software. Present on flat screens, sit at tables, and share your favorite mobile apps for geoscience education and research.

T58. Global Geoscience Education Research: Fostering Collaboration across Geographic and Cultural Borders

Disciplines: Geoscience Education; Geoscience and Public Policy; History and Philosophy of Geology

Advocates: Jacqueline Dohaney; Alison Jolley

This session aims to highlight geoscience education research themes and challenges across cultural, national, and geographic borders to unite a globally relevant but disjointed research community.

T59. A Grand Tour of the World's Most Important Geological Sites on Google Earth

Disciplines: Geoscience Education; Geoinformatics; Geoscience Information/Communication

Advocates: Declan G. De Paor; Steven J. Whitmeyer; Callan Bentley

The question we will pose in this session is this: given limited class time, what are the most important places that a literate student of the geosciences should visit on the Google Earth virtual globe?

T60. Improving Learning Outcomes by Transforming the Geoscience Classroom

Discipline: Geoscience Education

Advocates: Kelsey S. Bitting; Alan F. Halfen

Initiatives to redesign geoscience classrooms to be more active and learner-centered now abound. This session will highlight perspectives on the K–16 course transformation process (from individual lessons to whole curricula) and evidence for its impact.

T61. Spatial Thinking in Geoscience Teaching, Learning, and Professional Practice

Disciplines: Geoscience Education; Structural Geology; Geophysics/Geodynamics

Advocates: Heather L. Petcovic; Carol J. Ormand; Robert W. Krantz

Skills in spatial thinking and visualization are considered integral to geoscience learning and practice. This session considers research across educational settings and professional practice, as well as teaching aimed at enhancing spatial-visual skills.

T62. Supporting Student Success in Colleges and Universities

Discipline: Geoscience Education

Advocates: Robert H. Blodgett; Norlene R. Emerson; Bruce E. Herbert

Presentations can address working with underserved subpopulations (e.g., first generation students, students with disabilities), promoting self-reflection and metacognition, motivating students, improving study skills, reducing math/science/nature anxiety and stereotype threat, and other topics.

T63. International Field Experiences in the Geological Sciences

Disciplines: Geoscience Education; Geoscience Information/Communication; History and Philosophy of Geology

Advocates: Miriam Barquero-Molina; Robert L. Bauer

We seek presentations on international programs promoting student field study experiences completed outside the United States. In addition to description of the geological activities, presentations will include descriptions of associated logistical, administrative, and financial issues.

T64. Transdisciplinary Thinking in Geoscience Education at Two-Year and Four-Year Colleges: Innovations in Curriculum, Pedagogy, and Assessment in Introductory Geoscience Courses

Discipline: Geoscience Education

Advocates: Benjamin Wolfe; Merry Wilson

Effective interdisciplinary and transdisciplinary curriculum practices are essential for student success in introductory geoscience courses. Submissions may include learning communities, service and field-based learning, writing across the curriculum, and learning outcomes assessment.

T65. Successful Models of Blended/Hybrid Learning Environments in the Geosciences

Disciplines: Geoscience Education; Geoscience Information/Communication; Geoscience and Public Policy

Advocates: David A. McConnell; Elizabeth Nagy-Shadman; Timothy J. Bralower

This session will describe examples of courses featuring blended or hybrid learning formats that combine aspects of online learning and face-to-face instruction. We encourage submissions that assess learning in comparison to more traditional class environments.

T66. Transformative Innovations in Undergraduate Geoscience Education Supported by NSF Funding Programs: Accomplishments and Future Directions

Disciplines: Geoscience Education; Geoinformatics

Advocates: Jeffrey Ryan; Jill Singer

This session highlights successful NSF-supported efforts to improve undergraduate geoscience education, the strategies of high-impact projects, and future needs in this area that are amenable to NSF support.

T67. Supporting Successful Student Transfer between Two-Year Colleges and Four-Year Colleges and Universities

Discipline: Geoscience Education

Advocates: Eric M.D. Baer; Benjamin A. Wolfe; Carolyn Wilson

Topics might include advising and support strategies, articulation agreements, curricular alignment, ongoing 2YC–4YC faculty interactions, cross-institutional student research projects and field trips, summer bridge programs, recruitment programs, and/or research on transfer patterns.

T68. Involving Pre-Service and In-Service Teachers in Geoscience Research: Innovations and Strategies for Evaluating Their Success

Discipline: Geoscience Education

Advocate: Mark Abolins

Scientists who are involving current and future pre-college teachers in geoscience research will explore goal-setting and show-case best-practices in research design, recruitment, retention, mentoring, and evaluation. The presentation of evaluation results is especially encouraged.

T69. Climate Literacy: Research and Evaluation Results from Informal and Formal Climate Education Efforts

Disciplines: Geoscience Education; Geoscience Information/Communication

Advocates: Anne Gold; Tamara Ledley; Mona Behl

Papers that focus on what education, social and cognitive research, and project evaluation can tell us about misconceptions and incorrect mental models that hinder the understanding of the climate system are welcome.

T70. Undertaking Environmental- and Geoscience-Related Research Investigation as Part of Experiential Learning, Comprehension, and Critical Thinking Aspects: Involvement of K12–16 Students (Posters)

Disciplines: Geoscience Education; Geoscience Information/Communication; Geoscience and Public Policy

Advocate: Nazrul I. Khandaker

This topical session is primarily aimed at opening doors to K12–16 students to share their basic geology and environmental research information with the participants as part of experiential learning, comprehension, and critical thinking aspects.

T71. Climate Literacy: Formal and Informal Education and Outreach Efforts to Increase Awareness and Enable Responsible Decisions

Disciplines: Geoscience Education; Geoscience Information/Communication; Geoscience and Public Policy

Advocates: Tamara Shapiro Ledley; Katherine K. Ellins; Frank Niepold; Susan B. Sullivan

Papers focusing on efforts for pre-college (students & teachers), higher education, informal education audiences, and outreach, including materials, activities, curriculum, capstone projects, service learning, professional development programs, community activities, and the arts, are encouraged.

T72. Geoscience Alliance: Building Collaborative Partnerships That Strengthen Earth-Science Research

Disciplines: Geoscience Education; Environmental Geoscience; Geology and Health

Advocates: Nievita Bueno Watts; Diana Dalbotten; Jon Harbor

Geoscience Alliance, a national movement dedicated to broadening the participation of Native Americans in the geosciences, will highlight collaborative programs that integrate traditional knowledge and western science to solve real-world problems.

T73. Pedagogical Use of Physical Models

Disciplines: Geoscience Education; Geomorphology; Sediments, Clastic

Advocates: Jeffrey Clark; Matt Kutchta

We will focus on exploration and discussion of physical models in the classroom and laboratory. Best practices and demonstrations of models of earth processes related to tectonics, geomorphology, sedimentology, atmosphere, hydrology, and oceanography are welcome.

T74. Geoscience Field Education: The Implications of Research and Practice for Workforce Development

Discipline: Geoscience Education

Advocates: Heather L. Petcovic; Alison Stokes; Joshua L. Caulkins

This session considers examples of both formal and informal educational field experiences, research on teaching and learning in the field, and the role of fieldwork in developing the future geoscience workforce.

T75. Teaching, Learning, and Communicating about Energy and Sustainability

Disciplines: Geoscience Education; Geoscience Information/Communication; Environmental Geoscience

Advocate: Leilani Arthurs

This session welcomes presentations about student difficulties in learning about energy and sustainability, strategies for assessing student learning of related concepts and skills, and instructional approaches that facilitate student learning about energy and sustainability issues.

T76. Mapping the World Geologically and Culturally

Discipline: Geoscience Education

Advocates: Daniel F. Kelley; Nuri Uzunlar

Through international field opportunities, we are exposed to the geology and the cultures of the world. This session explores interactions with international cultures while participating in field trips, field camps, and fieldwork abroad.

T77. Undergraduate Research Projects as a Way to Solve Water-Related Problems/Issues (Posters)

Disciplines: Geoscience Education; Environmental Geoscience; Hydrogeology

Advocate: Solomon A. Isiorho

Water-related issues and problems are pervasive in most parts of the world; however, there are not enough personnel or resources to examine all of the issues. Undergraduate research projects could be a solution.

T78. Engaging the Next Generation of Geoscientists: Effective Educational Strategies That Broaden Participation and Prepare Diverse Learners for Advanced Study and Careers in the Earth Sciences

Discipline: Geoscience Education

Advocates: Shondricka Burrell; LeAnne Teruya

This session focuses on effective educational practices, strategic course design, and methodologies that foster learning, demonstrate relevance, develop critical thinking/problem-solving skills, broaden participation, and engage communities historically underrepresented in STEM in the study of geology.

Geology & Health

T79. Global Challenges and Human Health

Disciplines: Geology and Health; Geoscience and Public Policy; Environmental Geoscience

Advocates: Nurdan S. Duzgoren-Aydin; Geoffrey S. Plumlee; Suzette A. Morman; Saugata Datta

This session focuses on how global challenges such as climate change, natural resources, and natural and anthropogenic disasters will influence public health and solicits presentations covering global environmental issues and their local consequences.

T80. Urban Pollutants and Their Effects on Environmental and Human Health

Disciplines: Geology and Health; Geochemistry; Environmental Geoscience

Advocates: Dibyendu Sarkar; Nurdan S. Duzgoren-Aydin; Saugata Datta

This session focuses on urban pollutants, including chemicals, physical, and microbiological constituents, such as metals, oils, nutrients, bacteria, and soil/sediments, and solicits presentations covering their fate, transport, remediation, risk assessment, ecological, and human health impacts.

T81. Geology of Metals and Human Health Impacts

Disciplines: Geology and Health; Environmental Geoscience; Hydrogeology

Advocates: Saugata Datta; Nurdan S. Duzgoren-Aydin; Karen Johannesson; Catherine Skinner

Inhaled and ingested metals have been causing a major human health impact recently. Contributions are welcome from medical practitioners, public health disciplines, and medical geologists, among others.

Karst

T82. Enhancing the Toolkit for Karst Investigations

Disciplines: Karst; Hydrogeology; Geophysics/Geodynamics

Advocates: Douglas Gouzie; Matthew D. Covington; Joseph Myre

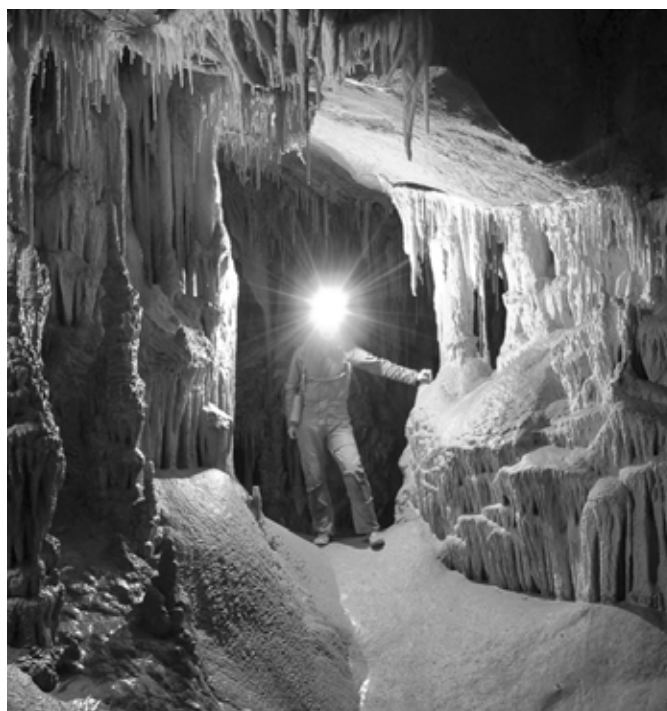
We will cover applications of novel, emerging, cost-effective tools used in karst investigations, emphasizing recent advances in instrumentation and remote sensing, isotopic and geophysical methods, computational models of karst processes and systems, or similar methods.

T83. Karst Systems and Processes in Mountainous and Alpine Terrain

Disciplines: Karst; Quaternary Geology; Hydrogeology

Advocates: Lewis A. Land; Tim R. Stokes; Chas Yonge

Karst in alpine and mountainous settings is an under-investigated field of research. We seek presentations on karst-related topics, including geomorphology, hydrology, paleoclimatology, glaciation, and resource development, in alpine settings within the Pacific Northwest and internationally.



Archaeological Geology

T84. Archaeological Geology Applications of LiDAR and Terrestrial Laser Scanning

Disciplines: Archaeological Geology; Geoinformatics; Geomorphology

Advocate: Stephanie S. Day

Aerial LiDAR and terrestrial laser scanning (TLS) are valuable tools throughout earth science. This session will highlight how they are used in archaeological geology and how they improve our understanding of anthropogenic landscapes.

T85. The Archaeological Record as a Paleoclimatic and Paleoenvironmental Archive

Disciplines: Archaeological Geology; Paleoclimatology/Paleoceanography; Geomorphology

Advocates: Alice R. Kelley; Daniel H. Sandweiss

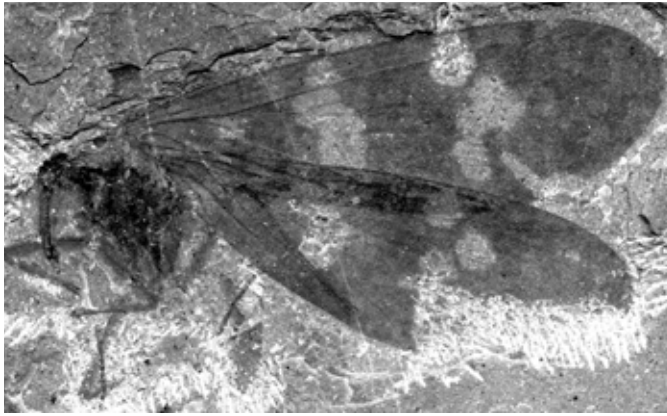
Much published research in earth sciences and archaeology concentrates on the potential causal role of climate and environment in culture change. This session highlights the unique proxy record of climate and environment recovered from geoarchaeological studies.

T86. Coastal Geoarchaeology

Disciplines: Archaeological Geology; Marine/Coastal Science; Geomorphology

Advocate: Joseph I. Boyce

Interest in human interactions with the landscape has led to innovative applications of earth-science techniques to archaeological contexts. This session will highlight the interdisciplinary breadth of recent developments in coastal geoarchaeology.



Eorpa ypsipeda, a scorpionfly of the extinct family Eorpidae, from McAbee, British Columbia, Canada. Photo by S. Bruce Archibald.

T87. Past Human-Environment Interactions

Disciplines: Archaeological Geology; Quaternary Geology; Geomorphology

Advocates: Catherine H. Yansa; Albert E. Fulton II

The session focuses on reconstructing human-landscape interactions during the Quaternary. We seek papers that inform our understanding of prehistoric cultural activities and their impacts on past landscapes.

Coal Geology

T88. North American Coal and Source Rock Geology

Disciplines: Coal Geology; Oil/Gas/Alternative Energy; Stratigraphy

Advocates: Jen O'Keefe; Brett J. Valentine

This is the general session for GSA's Coal Geology Division and highlights North American coal and source rock geology. All topics pertaining to coal or source rock geology are welcome.

Economic Geology

T89. Structural and Tectonic Controls on Gold Mineralization from the Roots of Mountain Belts to Hot Springs

Disciplines: Economic Geology; Structural Geology; Tectonics/Tectonophysics

Advocates: Julie V. Rowland; David Rhys

We solicit submissions that advance our ability to vector to mineralized structures within alteration halos or increase understanding of structural traps at regional or deposit scale and at any crustal level. Cross-disciplinary submissions particularly welcome.

T90. Honoring the Diverse Career of Eric S. Cheney: From Ore Deposits and Sequence Stratigraphy to Pacific Northwest Geology and Citizen Responsibility

Disciplines: Economic Geology; Tectonics/Tectonophysics; Precambrian Geology

Advocates: Andrew M. Buddington; George H. Shaw; K. Brock Riedell

The session will present on the geology of ore deposits; siting of major energy or industrial facilities; stratigraphy, structure, and

tectonics of the Pacific Northwest; stratigraphy and geology of South Africa; and geology's societal relevance.

T91. New Insights on Porphyry Cu-Mo-Au Deposit Genesis, Fertility, and Exploration

Disciplines: Economic Geology; Geochemistry; Petrology, Igneous

Advocates: Stephen Michael Rowins; Craig J.R. Hart; Ross Sherlock

This session will investigate variations on magma chemistry, metal sources, tectonic setting, redox states, and metal transport as fertility indicators and highlight geophysical and geochemical footprints that play a key role in porphyry discovery.

T92. Innovative Across-Scale Integration in Economic Geology: In the Giant Footprint of Rob Kerrich

Disciplines: Economic Geology; Tectonics/Tectonophysics; Geochemistry

Advocate: Richard J. Goldfarb

Broad-scale presentations will show how mineral resources are defined by interrelationships between evolving earth processes, changes in global heat flow, the supercontinent cycle, development of the subcontinental lithospheric mantle, and patterns of crustal preservation.

T93. Undergraduate Research in Economic Geology (Posters)

Disciplines: Economic Geology; Mineralogy/Crystallography; Geoscience Education

Advocate: Andrew H. Wulff

This session is designed to encourage undergraduate students engaged in research on all aspects of economic geology to present ongoing or recently completed work. Field-, lab-, and computer-based work are all welcome.

T94. Advances in Geologic Applications of Infrared Spectroscopy

Disciplines: Economic Geology; Oil/Gas/Alternative Energy; Mineralogy/Crystallography

Advocates: Wendy Calvin; Brigitte Martini; William H. Farrand

We will cover emerging techniques in geologic applications of infrared spectroscopy for mineral mapping in energy and minerals exploration. Recent developments include autonomous systems, portable field instrumentation, microscopic techniques, and rapid core logging tools.

Engineering Geology

T95. Frontiers in Environmental and Engineering Geology

Disciplines: Engineering Geology; Environmental Geoscience; Quaternary Geology

Advocates: Dennis M. Staley; William H. Schulz

Society faces numerous challenges as a direct result of geological hazards, population growth, and a changing climate. This session provides an overview of how environmental and engineering geologists are attempting to address these challenges.

T96. Slope Stability and Permafrost

Disciplines: Engineering Geology; Geomorphology; Environmental Geoscience

Advocates: Stephan Gruber; Marten Geertsema

Permafrost thaw can be an insidious contributor to landslides. Identifying its presence and understanding its influence on (often long-runout) landslides is crucial for hazard and risk analysis.

T97. Landslides in Sensitive Glaciomarine Clay

Disciplines: Engineering Geology; Geomorphology; Environmental Geoscience

Advocates: Marten Geertsema; Gregory R. Brooks

Landslides in sensitive glaciomarine clay are an important natural hazard in regions of Canada, Alaska, and Scandinavia. We welcome papers summarizing sensitive clay and landslide mapping, case studies of landslides, landslide modeling, and hazard assessment.

T98. Environmental and Engineering Geology Student Research Competition

Disciplines: Engineering Geology; Environmental Geoscience; Geoscience Education

Advocates: Dennis M. Staley; Scott F. Burns; Terry R. West; Jerry Higgins

We encourage students to submit abstracts for poster or oral presentations on topics related to any research in environmental and engineering geology. Monetary awards will be given to the top presenters.

T99. Urban Geology: An Emerging Discipline in a Changing World

Disciplines: Engineering Geology; Environmental Geoscience; Geoscience and Public Policy

Advocates: Michael C. Wilson; Lionel E. Jackson

Over 50% of humanity is now urban, yet geology remains a hinterland science. Urban centers abound in biosphere-geosphere interactions, from resource exploitation through natural hazards to geological heritage, affording opportunities for education and informed planning.

T100. Secondary Processes of Landslides

Disciplines: Engineering Geology; Geomorphology; Environmental Geoscience

Advocates: Nicholas J. Roberts; John J. Clague

Secondary processes can greatly extend and amplify landslide impacts. Topics include case histories, theoretical advances, and social and economic impacts of processes, including displacement waves, dam impoundment and outburst, and extreme run-out through debris fluidization.

T101. Landslide Hazard Analysis: Maps, Monitoring, Models, and the Future

Disciplines: Engineering Geology; Geomorphology;



Sitting atop a "Whale-back" feature demonstrates the effects of glaciation on the geology of the Sea to Sky. Photo by Melanie Kelman.

Environmental Geoscience

Advocates: Matthew M. Crawford; William J. Burns; Lynn M. Highland

This session will highlight research methods that address landslide hazards, providing the framework for (or) advancing the future of landslide hazard research. Global, regional, and local hazard analysis of different landslide types will be presented.

Environmental Geology

T102. Asbestos, Fibrous Zeolites, and Other Elongate Mineral Particles (EMP) of Environmental Concern: Where Mineralogy and Geology Meet Epidemiology, Industrial Hygiene, and Public Policy

Disciplines: Environmental Geoscience; Geology and Health; Geoscience and Public Policy

Advocate: Sean M. Fitzgerald

We will cover the latest science regarding asbestos and elongate minerals of environmental concern—where geology meets epidemiology, industrial hygiene, and public policy at the nanoscale. Presenters from industry, laboratory, and regulatory agencies are encouraged.

T103. Mining and the Environment: Addressing Common Challenges Faced across the Mining Industry

Disciplines: Environmental Geoscience; Geochemistry; Hydrogeology

Advocates: Matthew B.J. Lindsay; Joyce M. McBeth; K. Ulrich Mayer; Roger D. Beckie

This session will profile research on physical, chemical, and biological processes occurring in a variety of mining environments and explore innovative techniques for mitigating the environmental impacts of mining activities on sediments, soils, and water.

T104. GeoCorps™ America—A Successful Partnership Promoting Individual Professional Development and Application of Geoscience to Management of America's Public Lands

Disciplines: Environmental Geoscience; Geoscience Education; Geoscience and Public Policy

Advocates: Lisa Norby; Melody Holm; Matthew Dawson

GSA's GeoCorps™ America partnership program provides professional development opportunities for geoscientists while applying specialized skills to projects on public lands. This session highlights program accomplishments in national parks, national forests, and BLM lands.

T105. Deconstructing Terroir: Geologic Influences on the Sensory Components of Foods and Beverages

Disciplines: Environmental Geoscience; Geomicrobiology; Soils

Advocates: Kevin R. Pogue; Barry I. Cameron

This session encourages submissions that investigate the links between unique site-specific characteristics of bedrock, soil, geomorphology, and climate and corresponding site-specific sensory components of agricultural products.

T106. The Landslide Multi-Hazard Conundrum: What Primary Hazards Trigger Landslides, and How Do Landslides in Turn Cause Secondary Hazards?

Disciplines: Environmental Geoscience; Engineering Geology; Geomorphology

Advocates: Andrée Blais-Stevens; Lynn Highland; Marten Geertsema

The potential for secondary landslide effects from primary hazards varies greatly due to regional geologic and geomorphic conditions. A multi-hazard analysis of these combined primary and secondary effects is crucial for creating appropriate mitigation strategies against catastrophic damage.

T107. Undergraduate Research Talks: The Next Step in Student Research Projects

Disciplines: Environmental Geoscience; Structural Geology; Geomorphology

Advocates: Jacqueline A. Smith; Bradley G. Johnson; Edward C. Hansen

This session provides a venue for undergraduate students and recent graduates to present talks on completed research projects. Students may submit abstracts for research projects in any sub-discipline of geology or earth science.

T108. Palynology in Geoarchaeological and Environmental Studies

Disciplines: Environmental Geoscience; Archaeological Geology; Paleontology, Paleoecology/Taphonomy

Advocate: Francine M.G. McCarthy

This session will examine the application of pollen and non-pollen palynomorph analysis to archaeological and environmental issues—the latter including topics as varied as natural hazard prediction through anthropogenic impact assessment.

T109. New Research on the Taku and Llewellyn Glaciers, Juneau Icefield, Alaska and British Columbia: Extending a 68 Year Climate Science Legacy

Disciplines: Environmental Geoscience; Hydrogeology; Geophysics/Geodynamics

Advocate: C.L. Connor

We'll cover extending Taku Glacier's mass balance record (1946–2013) using traditional and modern techniques, including basal sediment excavation and Taku Glacier terminus dynamics, real-time high-elevation meteorological data streaming, and Llewellyn Glacier meltwater contributions to the Yukon River.

T110. GIS and Remote Sensing Applications in Environmental and Engineering Geology

Disciplines: Environmental Geoscience; Engineering Geology; Geomorphology

Advocates: Norman S. Levine; John Chadwick; Khalid A. Ali

GIS and remote sensing technologies are essential tools across a wide spectrum of geological disciplines. This session will highlight case studies, cutting-edge applications, and new research for visualization, interpretation, and applications in the geospatial sciences.

T111. Impacts of Anthropogenic Climate Change: Ethics and Liabilities

Disciplines: Environmental Geoscience; Geology and Health; Geoscience and Public Policy

Advocates: George T. Stone; Michael E. Mann; John J. Clague; Saugata Datta

Impacts of anthropogenic climate change already stress most of our planet's ecosystems, including the habitats of hundreds of millions of people. A new paradigm for solutions is essential. Ethics must be enforced and liabilities levied.

T112. Shale Gas and the Environment

Disciplines: Environmental Geoscience; Oil/Gas/Alternative Energy; Geoscience and Public Policy

Advocates: Roger D. Beckie; K. Ulrich Mayer

This session covers all dimensions of shale gas and the environment: geology, geochemistry, geomicrobiology, geophysics, hydrogeology, and meteorology; evaluation of impact on minerals, groundwater, surface water and the atmosphere; monitoring approaches; and case studies.

T113. Geologic Maps and Their Derivatives (Posters)

Discipline: Environmental Geoscience

Advocates: Richard C. Berg; Ralph F. Crawford; Michael W. Higgins; Holger Kessler; Peter T. Lyttle; Hazen A.J. Russell; David R. Soller; Harvey Thorleifson

This poster session will highlight new geologic maps, mapping programs, and innovations in geological mapping, including data management, Web accessibility, 3-D, and applications in water and land management.

T114. The Fate of Passive Acid Mine Drainage Treatment Systems: Results, Solutions, and Advances for Continued Improvement of Impaired Waters**Disciplines:** Environmental Geoscience; Coal Geology; Hydrogeology**Advocates:** Carrie Davis Todd; Kyle C. Fredrick

As passive acid mine drainage treatment systems reach the end of their expected effectiveness, we seek submissions examining their efficacy, long-term water quality prospects, innovative solutions for extended effectiveness, or low-cost monitoring and maintenance partnerships.

T115. Impact of De-Icing and Agricultural Chemicals on Water Quality and the Environment**Disciplines:** Environmental Geoscience; Geology and Health; Hydrogeology**Advocates:** Rudi Hon; Walton R. Kelly; James Besancon

De-icing chemicals and agricultural runoff are responsible for the increasing levels of Cl and Na plus biota nutrients in water systems. This session seeks new studies of the present state and projections for the future.

T116. Water Contamination and Treatment in Developing Countries**Disciplines:** Environmental Geoscience; Geology and Health; Hydrogeology**Advocates:** Peter J. Wampler; Peter S.K. Knappett; Michael E. Campana

This session focuses on natural or anthropogenic water contamination in developing countries, including contamination pathways and transmission; water treatment, sanitation, and land-use interventions; monitoring and evaluation; education and outreach; capacity-building; experiential learning; and community initiatives.

Geochemistry**T117. Magmas and Their Sources: A Tribute to the Distinguished Career of Fred Frey****Disciplines:** Geochemistry; Petrology, Igneous**Advocates:** Michael O. Garcia; J. Michael Rhodes; Rosemary Hickey

Fred Frey, 2014 MGPV Distinguished Career Award recipient, has devoted his career to studying magmas, their sources, and formation. We encourage research by those who are inspired by or have worked with this distinguished geoscientist.

T118. Frontiers in Non-Traditional Stable Isotopes: In Honor of Fang-Zhen Teng, Recipient of the 2014 MSA Award**Disciplines:** Geochemistry; Mineralogy/Crystallography; Planetary Geology**Advocates:** William F. McDonough; Nicholas Dauphas

This session explores recent advances in non-traditional isotopes (e.g., Li, Mg, Si, Ca, Cr, Fe), which provide insights into

topics as diverse as the composition of the core to tracing weathering and climate change.

T119. Organic Carbon Proxies in Terrestrial Paleocology**Disciplines:** Geochemistry; Sediments, Clastic; Soils**Advocates:** James M. Fulton; William C. Hockaday; Todd L. Longbottom; Lauren A. Michel

This session seeks to include work covering molecular and isotopic information in organic molecules. Proxy development and/or applications to terrestrial records (in soils, sediments, tree rings, and speleothems) are of interest.

T120. Proxies for Paleoprecipitation**Disciplines:** Geochemistry; Paleoclimatology/Paleoceanography; Soils**Advocates:** Neil J. Tabor; Greg A. Ludvigson

This session will feature new research related to the distribution, amount, seasonality, and stable isotopic composition of rainfall in ancient terrestrial environments.

T121. Apatites I Have Known: From Man to Mars (Posters)**Disciplines:** Geochemistry; Paleontology, Paleocology/Taphonomy; Planetary Geology**Advocates:** Sarah W. Keenan; Lawrence A. Taylor

This session will serve as a transdisciplinary overview of past, current, and future research on apatite, P biogeochemical cycling, and P as a limiting resource in terrestrial, lunar, and martian systems.

T122. Magmatism and Geodynamics within the Cascadia Subduction Zone**Disciplines:** Geochemistry; Geophysics/Geodynamics; Tectonics/Tectonophysics**Advocates:** S.M. DeBari; Patricia A. McCrory; A.J. Calvert; Nathalie Vigouroux

This session promotes an interdisciplinary approach to understanding the links between lithospheric plate dynamics, slab metamorphism and dehydration, melt generation, and magmatism within the Cascadia subduction margin since its inception about 40 million years ago.

T123. Advances in Nuclear Forensics**Disciplines:** Geochemistry; Geoscience and Public Policy; Mineralogy/Crystallography**Advocates:** Sara Mana; Patrick Donohue; Antonio Simonetti

This session focuses on advances made in nuclear forensics, with an emphasis on analytical techniques, database development, and implications for our ability to identify and possibly prevent nuclear attacks and trafficking of illicit nuclear materials.

T124. Sources, Transport, Fate, and Toxicology of Trace Elements and Organics in the Environment

Disciplines: Geochemistry; Environmental Geoscience; Geology and Health

Advocates: David T. Long; LeeAnn Munk; W. Berry Lyons

Basic and applied research on trace elements and organics in the environment are encouraged. Topics include those that relate to understanding and modeling sources, transport, and fate; human and ecosystem health; and environmental assessment and remediation.

T125. Sigma Gamma Epsilon Undergraduate Research (Posters)

Disciplines: Geochemistry; Environmental Geoscience; Tectonics/Tectonophysics

Advocate: Erika R. Elswick

The goal of this session is to highlight recent and ongoing undergraduate research in a student-friendly forum. The session is open to students and faculty co-authors working in any area of the geosciences.

T126. Stable and Clumped Isotope Record of Topography, Climate, and Environments: Challenges and Recent Advances

Disciplines: Geochemistry; Tectonics/Tectonophysics; Sediments, Clastic

Advocates: Majie Fan; Andrew Leier; Joel E. Saylor

Stable and clumped isotopes in sedimentary records provide critical insights into orogenic evolution, paleoclimate, and paleoenvironments. We encourage presentations that discuss the challenges and uncertainties in these systems as well as novel applications.

T127. Urban Geochemistry

Disciplines: Geochemistry; Environmental Geoscience; Geology and Health

Advocates: W. Berry Lyons; David T. Long

This session encourages presentations that qualify and quantify the geochemical and biogeochemical impacts (temporal and spatial) of urbanization and urban activities on soil, water, and air resources as well as on human and ecosystem health.

Geoinformatics

T128. Geological and Geomorphological Applications of Digital Terrain Analysis

Disciplines: Geoinformatics; Geomorphology

Advocates: Carlos Henrique Grohmann; Christopher J. Crosby; Edwin Nissen

Digital terrain data provide vital insights into Earth's topography and the processes that shape it. We welcome contributions highlighting advances in methods, algorithms, and applications of digital terrain analysis to geology and geomorphology.

Geomicrobiology

T129. Methane Seepage, Chemosynthetic Life Oases, and Carbonate Deposits

Disciplines: Geomicrobiology; Sediments, Carbonates; Paleontology, Paleoecology/Taphonomy

Advocates: Benoit Beauchamp; Stephen E. Grasby

This session focuses on advances in the study of modern and ancient carbonates associated with unique ecosystems fed by microbes utilizing methane bubbling out of Earth's interior onto a variety of marine environments.

T130. A Shifting Balance: Microbial versus Metazoan Influences on Ecology and Sedimentation in Space and Time

Disciplines: Geomicrobiology; Paleontology, Paleoecology/Taphonomy; Sediments, Carbonates

Advocates: Kathleen A. Ritterbush; Katherine N. Marenco; Rowan C. Martindale

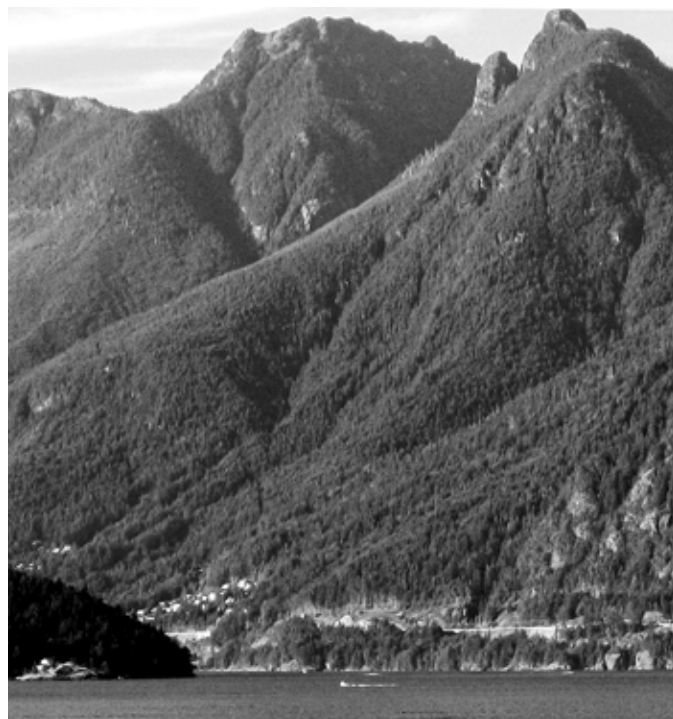
This session will address the interplay between microbial and metazoan communities at different spatiotemporal scales and, in particular, their differing influences on sediment production, taphonomy, ecosystem engineering, and geochemical cycling in marine environments through time.

T131. Critical Earth-Life Transitions: The Marine Perspective

Disciplines: Geomicrobiology; Paleontology, Diversity, Extinction, Origination; Paleoclimatology/Paleoceanography

Advocates: Christopher T. Reinhard; Noah Planavsky; Timothy W. Lyons; Gordon D. Love

This session will seek to both highlight recent advances and provide broad context for the road forward in our understanding of major transitions in the coupling between ocean-atmosphere chemistry and an emerging/evolving marine biosphere.



Bowen Island. East side of Howe Island Fiord, Lions Bay. Photo by Lionel Jackson.

T132. Harnessing “Omics” to Advance the Geosciences: New Paradigms and Platforms for Observing Earth Systems

Disciplines: Geomicrobiology; Environmental Geoscience; Geochemistry

Advocates: CarriAyne Jones; Sean Crowe; Steven Hallam

Microbial ecology and evolution intersect with biogeochemical cycling, climate change, biogeography, medical geology, bioremediation, etc. This session welcomes submissions that span disciplinary boundaries and use “omics” to address issues relevant to the earth sciences.

T133. Critical Earth-Life Transitions: The Terrestrial Perspective

Disciplines: Geomicrobiology; Paleoclimatology/Paleoceanography; Soils

Advocates: Nathan D. Sheldon; Noah Planavsky; Christopher T. Reinhard

This session will highlight recent advances in our understanding of major transitions in the coupling between Earth-surface environments and an emerging/evolving terrestrial biosphere.

T134. Geomicrobiology: Microbe-Mineral Interactions

Disciplines: Geomicrobiology; Geochemistry; Environmental Geoscience

Advocates: Nathan Yee; Sean A. Crowe

This session will feature recent advances in geomicrobiology focusing on microbe-mineral interactions and the complex interplay between microbial and geochemical processes.

T135. New Developments in Microbialites

Disciplines: Geomicrobiology; Sediments, Carbonates; Paleontology, Diversity, Extinction, Origination

Advocates: Frank A. Corsetti; Victoria A. Petryshyn; Yadira Ibarra

Microbialite research is moving forward at a rapid pace, with the advent of new techniques and localities. We welcome submissions regarding any advances in the study of stromatolites, thrombolites, or other microbial structures.

Geophysics/Geodynamics

T136. Geophysical Solutions to Geological Problems: Current Research Results and the Annual George P. Woollard Award Presentation

Disciplines: Geophysics/Geodynamics; Tectonics/Tectonophysics; Structural Geology

Advocates: Samantha E. Hansen; Anna M. Courtier

Contributions that employ geophysics to solve geologic problems are emphasized. This session also honors the recipient of the George P. Woollard Award for his or her outstanding geophysics contributions that advance our understanding of geology.

T137. Characterization and Modeling of Explosive Sources

Disciplines: Geophysics/Geodynamics; Tectonics/Tectonophysics

Advocates: Catherine M. Snelson; Aviva Sussman; Robert Mellors; Scott Broome

Integration of geologic and geophysical characterization and modeling efforts for understanding explosive sources is key in treaty monitoring and verification. We seek contributions from all research focus areas and technologies that meld these efforts.

T138. Geoscience Investigations of the Polar Regions

Disciplines: Geophysics/Geodynamics; Tectonics/Tectonophysics; Structural Geology

Advocates: Samantha E. Hansen; Kevin L. Mickus; Audrey D. Huerta

This session will bring together an international and interdisciplinary group of scientists focused on geophysical and geological investigations of the Arctic and Antarctic. Presentations will focus on lithospheric structure, geologic evolution, and ice sheet dynamics.

T139. Paleogeography of Supercontinents and Mobile Belts

Disciplines: Geophysics/Geodynamics; Precambrian Geology; Tectonics/Tectonophysics

Advocates: David A.D. Evans; Randolph J. Enkin; Dennis V. Kent

What were continental configurations before, during, and after Pangea? How can we restore displacement across sutures and terrane boundaries? How reliable are the assumptions of our paleogeographic methods? Multiple techniques can be brought to bear on these questions.

T140. Magnetic Surveys for Imaging the Geology of Earth and Other Planetary Bodies: A Session Honoring the Legacy of Isidore Zietz

Disciplines: Geophysics/Geodynamics; Tectonics/Tectonophysics; Planetary Geology

Advocates: Michael Purucker; J. Wright Horton Jr.; Anjana K. Shah

This session explores applications of airborne and satellite magnetic methods for imaging surface and subsurface geology of Earth and other planetary bodies. The session honors and builds on the legacy of Isidore Zietz.

T141. Measuring and Modeling Aseismic Transient Slip along Plate Boundaries (Posters)

Disciplines: Geophysics/Geodynamics; Tectonics/Tectonophysics

Advocates: Kathleen Hodgkinson; Evelyn Roeloffs; David Schmidt

This session focuses on identifying and modeling aseismic transients along plate boundaries using strainmeter, GPS, tilt, and seafloor pressure gauge data. Presentations on operation of subduction zone and other plate boundary geophysical networks are welcome.

Geoscience & Public Policy

T142. Warnings Heeded, Problems Fixed, Disasters Averted: Stories about How Geology and Geologists Have Succeeded in Helping Society

Disciplines: Geoscience and Public Policy; Environmental Geoscience; Engineering Geology

Advocates: R. Laurence Davis; Suzanne B. O'Connell

Case histories of geology and society interactions that worked; lessons learned from projects with positive outcomes; successful community planning and cooperation; hazard avoidance; and environmental controversies that turned out well.

T143. Geoscience for the Public Good: Toward a Sustainable Future

Disciplines: Geoscience and Public Policy; Environmental Geoscience; Engineering Geology

Advocates: Gregory R. Wessel; Jeffrey Greenberg

This session focuses on the primacy of geology to sustainable development and the parameters that influence such work. Examples of development, hazard mitigation, and environmental restoration in various settings will be presented.

Geoscience Information/Communication

T144. Regional and National Geological Mapping: Multidisciplinary 3-D Data Integration and Modeling

Disciplines: Geoscience Information/Communication; Geoscience and Public Policy; Hydrogeology

Advocates: Richard Berg; Kelsey E. MacCormack; Hazen A.J. Russell; Harvey Thorleifson

This session will bring together multidisciplinary research pertinent to 3-D geological mapping. The focus of the session is on data collection, analysis, data standardization and storage, and model development at regional to jurisdictional scales.

T145. Where in the World? Access and Availability to Geoscience Data

Disciplines: Geoscience Information/Communication; Geoinformatics; Geoscience Education

Advocate: Hannah Winkler

Identifying, accessing, analyzing, and preserving geoscience data sets can be daunting. This session will examine how researchers, information professionals, and librarians are supporting data-intensive scientific discovery in the geosciences.

T146. Where's the Data? Finding and Using Geoscience Data (Posters)

Disciplines: Geoscience Information/Communication; Geoinformatics; Geoscience Education

Advocate: Hannah Winkler

This poster session empowers and celebrates those who have taken steps to find, reuse, and preserve geoscience data—with a focus on programs, discovery tools, and research.

T147. Enhanced Understanding of Geologic Processes with Social Media: Eyewitness Videos and Geotagged Texts

Disciplines: Geoscience Information/Communication; Engineering Geology; Environmental Geoscience

Advocates: Jeffrey R. Keaton; Scott A. Anderson; Suzanne O'Connell; Dennis M. Staley

Smartphone texts, photos, and videos by nontechnical people uploaded in near real-time document the location and details of extreme processes and allow geologists to know about them and plan field visits.

T148. Increasing Diversity in Geological Survey Workforce

Disciplines: Geoscience Information/Communication; Geoscience and Public Policy

Advocates: Harvey Thorleifson; Vicki S. McConnell; Jonathan G. Price; Marilyn J. Suiter

Diversity in leadership and workforce in (state) geologic surveys is important in establishing a talented worker pool and embracing diverse scientific ideas. This session shares strategies for innovative and successful programs.

History & Philosophy of Geology

T149. The Great Ideas in Geology

Disciplines: History and Philosophy of Geology; Stratigraphy; Paleontology, Paleocology/Taphonomy

Advocates: Renee M. Clary; Michele L. Aldrich; Alan E. Leviton

Presentations explore great geological ideas, from sixteenth century through recent, that have become geological cornerstones. Interesting “bad ideas” that have been corrected and ideas from other sciences and/or prior to 1500 will also be considered.

T150. Foundations of Geology: Outcrops and Locations that Shaped Geologic Thought

Disciplines: History and Philosophy of Geology; Geoscience Education

Advocates: Nathalie Nicole Brandes; Paul T. Brandes

We encourage discussions of iconic localities, their place in the history of geology, the people who interpreted their importance, their use in teaching new generations of geologists, and what can still be learned from them.

Hydrogeology

T151. Energy Resource Development and Groundwater: Looking Broader and Deeper (Posters)

Disciplines: Hydrogeology; Oil/Gas/Alternative Energy

Advocates: Grant Ferguson; Andrew H. Manning

Energy resource development is perturbing groundwater systems at an increasing rate. Installation of deep wells, hydrofracking, and wastewater injection have the potential to alter groundwater quality and flow at a range of depth and scales.

T152. Transport of Micropollutants in Groundwater

Disciplines: Hydrogeology; Geochemistry; Environmental Geoscience

Advocates: Traugott J. Scheytt; Carol J. Ptacek; William W. Woessner

Micropollutants include pharmaceuticals, personal care products, biocides, and nanomaterials. Their presence in groundwater presents numerous technical and institutional challenges. This session aims at the latest developments in detection, transport behavior, treatment, and regulation.

T153. Characterization and Remediation of Fractured Rock

Discipline: Hydrogeology

Advocates: Kent Novakowski; Bernie Kueper

Abstracts on fundamental transport processes related to remediation in fractured rock, the application of modeling to the design of remedial programs, novel characterization methods, or unique case studies (laboratory or field) are solicited.

T154. Groundwater and Surface-Water Arsenic: From Source to Sink

Disciplines: Hydrogeology; Environmental Geoscience; Geomicrobiology

Advocates: Prosun Bhattacharya; Abhijit Mukherjee; Karen Johannesson; Saugata Datta

This session will focus on studies of geological, hydrological, chemical, biogeochemical, and microbiological processes controlling the fate of dissolved arsenic in natural water systems. Effects on public health and water management are also of interest.

T155. The Role of Groundwater in the Eutrophication of Surface Waters

Disciplines: Hydrogeology; Environmental Geoscience; Geochemistry

Advocates: James W. Roy; Kerry T.B. MacQuarrie Sr.; Clare E. Robinson

We seek contributions that focus on phosphorus inputs to fresh-water systems and nitrogen inputs to marine systems with groundwater. Oxygen and nutrient dynamics with groundwater-surface-water interaction, and related methodology and ecohydrology studies are welcome.

T156. Agricultural Impacts on Water Quality: Are We Making Progress?

Disciplines: Hydrogeology; Environmental Geoscience; Geology and Health

Advocates: M. Cathy Ryan; Edwin E. Cey

This session is targeted at the complex relationships between agricultural production and water quality and examining whether agricultural and water management practices aimed at achieving water quality protection are indeed producing societal benefits.



Garibaldi Park. In the foreground: Rubble Creek. The name Rubble Creek is taken from the andesitic cobbles and boulders which dominate the valley and stream. The origin of these boulders is the unstable face of the Barrier, a steep cliff and natural dam caused by ice-contact volcanism (visible in the distance) which periodically releases enormous landslides into the valley below. Photo by Brett Gilley.

T157. Joint Sustainability of Water Resources and Petroleum Energy Production

Disciplines: Hydrogeology; Oil/Gas/Alternative Energy; Geoscience and Public Policy

Advocates: John E. McCray; Terri S. Hogue; Newsha Ajami

Joint sustainability of water resources and petroleum-based energy production is required for a secure, sustainable energy future. This session seeks presentations on engineering, science, and social-policy research related to this important topic.

T158. Assessing Vulnerability of Water Supply Wells from Wastewater: Sources, Contaminants, Tracers, and Pathways

Disciplines: Hydrogeology; Geology and Health; Environmental Geoscience

Advocates: Christopher A. Gellasch; Kenneth R. Bradbury; Madeline B. Gotkowitz

This session will focus on wastewater contamination of water supply wells in urban and rural settings. Presentations covering source identification, contaminant fate and transport, pathway characterization, novel tracers, computer modeling, and related topics are welcome.

T159. Groundwater in Cold Environments: Current Understanding and Challenges**Disciplines:** Hydrogeology; Engineering Geology**Advocates:** Rene Therrien; Jean-Michel Lemieux

This session encourages contributions on field, laboratory, or modeling research projects that report on physical, chemical, and atmospheric processes controlling groundwater flow dynamics in northern regions and that identify the most pressing research need.

T160. Environmental Effects of Oil and Gas Development on Water Quality: Toward Sustainability and Stewardship**Disciplines:** Hydrogeology; Environmental Geoscience; Oil/Gas/Alternative Energy**Advocates:** Stephen G. Osborn; Joseph Ryan

This session provides a forum for current research related to potential environmental impacts on water resources from the growth of oil and gas development and exploration of routes to sustainability and stewardship.

T161. Application of Isotopes of Water to Characterize Hydrogeological Processes in Mine Environments**Disciplines:** Hydrogeology; Environmental Geoscience; Geochemistry**Advocates:** Jim Hendry; Lee Barbour

This session addresses the application of isotopes of water to define hydrogeological processes in mine environments, including saturated and unsaturated waste rock piles and tailings deposits and catchment hydrology.

T162. Hydrogeology of Arid Region Endorheic Basins: Groundwater Flow, Geochemical Evolution, and Hydrostratigraphy**Disciplines:** Hydrogeology; Geochemistry; Environmental Geoscience**Advocate:** Gregory T. Carling

This session focuses on field- and laboratory-based hydrogeological and hydrogeochemical studies of closed desert basins in the Great Basin and other systems around the world.

T163. Satellite Remote Sensing Applications in Hydrology and Geology**Disciplines:** Hydrogeology; Geoinformatics**Advocates:** Adam Milewski; Richard Becker

Understanding hydrology and geology on regional scales depends upon large data networks. We seek research presentations on applications integrating remote sensing observations with traditional methods in hydrology and geology, especially in data-sparse regions.

T164. Dynamics of Groundwater Temperature: From Recharge to Discharge Zones**Disciplines:** Hydrogeology; Geochemistry; Oil/Gas/Alternative Energy**Advocates:** David Boutt; Laura Lautz; Jeffrey McKenzie

Characterization of groundwater temperature allows quantification of groundwater-surface-water fluxes, assessment of climatic changes, and characterization of groundwater systems. We solicit contributions that use groundwater temperature measurements or modeling to improve understanding of hydrogeologic processes.

T165. Spatial and Temporal Variability in Water Requirements for Hydraulic Fracturing of Shale Oil and Gas Plays**Disciplines:** Hydrogeology; Environmental Geoscience; Oil/Gas/Alternative Energy**Advocates:** Jean-Philippe Nicot; Bridget Scanlon

This session will evaluate water requirements for hydraulic fracturing, including data availability from various databases, spatial variability within and between plays, trends over time, water sources, and volumes, reuse, and disposal of flowback/produced water.

T166. Gas-Water Interactions in the Subsurface**Disciplines:** Hydrogeology; Environmental Geoscience; Geochemistry**Advocates:** Richard T. Amos; Kevin G. Mumford

This session seeks contributions focused on processes that control fate and transport of dissolved gases and gas bubbles in the subsurface, including interactions at the gas-water interface, as well as data collection and analysis methods.

T167. Oil Sands and Groundwater: Steam-Assisted In-Situ Production, Open-Pit Mining, and Reclamation**Disciplines:** Hydrogeology; Environmental Geoscience**Advocates:** Carl A. Mendoza; Brent Mooder

This session will address the hydrogeologic impacts of steam-assisted in-situ production and open-pit mining of oil sands, and hydrogeologic approaches for reclaiming landforms and mitigating impacts.

T168. The Interaction of Geophysics, Geochemistry, and Hydrogeology with Ground-Source and Other Geothermal Systems**Disciplines:** Hydrogeology; Engineering Geology**Advocates:** Carolyn B. Dowling; Lee J. Florea; Klaus Neumann

This session welcomes all aspects of research on low- and high-temperature geothermal energy, such as the interactions between geophysical, geochemical, and hydrogeological considerations and ground-source and other geothermal energy systems.

T169. It's a Cold, Cold World: Permafrost and Glacial Hydrogeology**Disciplines:** Hydrogeology; Geochemistry; Environmental Geoscience**Advocates:** Randy L. Stotler; Stephen E. Grasby; Mark A. Person

This session welcomes presentations relating to recent research on the implications of physical or geochemical processes on hydrogeology in permafrost or glacial regions.

T170. Physical and Biogeochemical Measurements That Characterize Groundwater–Surface Water Interactions: Where to Go from Here?**Disciplines:** Hydrogeology; Engineering Geology; Geomicrobiology**Advocates:** Andrea E. Brookfield; Michelle M. Lorah

This session encourages the submission of abstracts discussing future directions of groundwater–surface water interaction research, with an emphasis on innovative physical and biogeochemical field- and modeling-based techniques and the results of unique case studies.

T171. Leading Edge of Produced Water Research: Impacts, Fingerprinting, and Science of Brines Associated with Hydrocarbon Production**Disciplines:** Hydrogeology; Geochemistry; Oil/Gas/Alternative Energy**Advocates:** Madalyn S. Blondes; Mark A. Engle

This session explores the study of waters associated with hydrocarbon production, including hydraulic fracturing and CO₂ storage. Topics include novel geochemical modeling and brine fingerprinting methods, hydraulic fracturing simulation experiments, and environmental impacts of use/disposal.

Limnogeology**T172. Terminal Lakes****Disciplines:** Limnogeology; Paleoclimatology/Paleoceanography; Quaternary Geology**Advocates:** Michael R. Rosen; Scott W. Starratt

Paleoclimatology and limnology of terminal lakes are under threat from climate change. This session seeks abstracts about all aspects of terminal lakes and how climate change and hydrology have affected the function of these lakes.

T173. From Peak to Playa, Saline to Fresh—The Great Diversity of Lakes in Western North America**Disciplines:** Limnogeology; Paleoclimatology/Paleoceanography; Stratigraphy**Advocates:** Scott W. Starratt; Katrina A. Moser

Lacustrine records from western North America represent large, deep, and fresh to small and saline lakes, providing a rich record of paleoenvironmental variability across the Cenozoic. This session welcomes presentations utilizing all proxies.

T174. Non–Steady-State Element Dynamics in Lakes**Disciplines:** Limnogeology; Geochemistry; Hydrogeology**Advocate:** Johan C. Varekamp

Human perturbations of element cycles in lakes can be simulated with non–steady-state mathematical models. We encourage theoretical and empirical approaches to the dynamics of nutrients and contaminants, and their isotopes in lakes.

T175. Time Critical: Age-Depth Modeling in Quaternary Continental Sedimentary Records**Disciplines:** Limnogeology; Paleoclimatology/Paleoceanography; Quaternary Geology**Advocates:** Amy Myrbo; Susan H. Zimmerman; Dylan Blumentritt

Your age model can alter what your dataset says. Discussions include all radiometric, biostratigraphic, relative methods, and more; calibration, a-d modeling software, tuning, knob-turning, pre-radiocarbon, post-bomb; databases; methods; and what to do and not do.

Marine/Coastal Science**T176. Microfossils in the Coastal Zone: Indicators of Coastal Change over Short- and Long-Term Timescales****Disciplines:** Marine/Coastal Science; Quaternary Geology; Paleoclimatology/Paleoceanography**Advocates:** Andrea D. Hawkes; Jessica Pilarczyk; Tina Dura

We'll explore recent advances in microfossil research/applications to the coastal zone with studies employing microfossils as indicators of coastal change over various spatial and temporal scales, such as punctuated extreme events to long-term environmental change.

T177. Antarctic Fjords, Interaction of Biotic, Oceanographic, and Cryospheric Systems under Changing Climate**Disciplines:** Marine/Coastal Science; Paleoclimatology/Paleoceanography; Quaternary Geology**Advocates:** Eugene Domack; Julia Wellner; Charles Nittrouer

Fjords of the Antarctic Peninsula represent a rich natural laboratory wherein processes influenced by climate change can be studied, and this session will provide a venue by which relevant new results can be presented.

T178. Relative Sea-Level Changes since the Last Glacial Maximum**Disciplines:** Marine/Coastal Science; Geomorphology; Quaternary Geology**Advocates:** Dan H. Shugar; Ian J. Walker; Olav B. Lian; Jordan B.R. Eamer; Christina Neudorf

Relative sea-level histories since the Last Glacial Maximum are spatially and temporally heterogeneous due to interplay between eustasy, isostasy, and neotectonics. We welcome geomorphologists, geochronologists, and modelers interested in relative sea-level changes and landscape responses.

T179. Back-Barrier Systems in Times of Change

Disciplines: Marine/Coastal Science; Geomorphology; Quaternary Geology

Advocates: Kristin R. Wilson; Joseph T. Kelley

Back-barrier systems (dunes, marshes, sub-tidal) are dynamic. Understanding their geomorphologic transformations in response to natural and man-made disturbances is critical to our knowledge of coastal environments. Contributions from different habitats and settings are encouraged.

T180. Anthropocene Estuaries: The Geological Record and Geological Responses of Estuaries to Human-Induced Alterations during the Anthropocene

Disciplines: Marine/Coastal Science; Sediments, Clastic; Geomorphology

Advocates: Timothy M. Dellapenna; Guan-hong Lee; Carlos Augusto Franca Schettini; Joseph Carlin

We will examine the sedimentological record and geological responses to human-induced changes to estuaries, including physical changes and changes in fluxes of sediment, nutrients, organic matter, or contaminants from the drainage basins or other sources.

T181. Sea-Level Rise and Salt-Marsh Response: A Paleo Perspective

Disciplines: Marine/Coastal Science; Quaternary Geology

Advocates: Andrew C. Kemp; B.P. Horton; James T. Morris

Paleo-sea-level data provide a background against which to compare recent trends and characterize patterns of natural variability. Salt marsh reconstructions deliver a paleo-perspective for predicting ecological effects of future sea-level rise.

T182. Evaluating Coastal Models and Transgressive Coastal Systems

Disciplines: Marine/Coastal Science; Sediments, Clastic; Stratigraphy

Advocate: Duncan M. FitzGerald

This session presents the results of recently introduced coastal modeling efforts, new modeling directions, and insights into the impact of climate change (external forcings) on the transgression and resilience of coastal systems.

Mineralogy/Crystallography**T183. Theory and Experiment in Petrology and Geochemistry: A Session in Honor of Bernard J. Wood, 2014 Roebling Medalist**

Disciplines: Mineralogy/Crystallography; Petrology, Metamorphic; Petrology, Igneous

Advocates: Jon Blundy; Andrew Matzen

This session will focus on recent applications of theory and experiments to broad understanding of the composition and structure of Earth, the processes of terrestrial accretion and core segregation, and mantle melting and differentiation.

T184. Gemological Research in the 21st Century: Exploration, Geology, and Characterization of Diamonds and Other Gem Minerals

Disciplines: Mineralogy/Crystallography; Economic Geology; Geoscience Information/Communication

Advocates: James E. Shigley; Dona Dirlam; Frank C. Hawthorne; Lee A. Groat; Thomas Stachel; Barbara Dutrow

Gemstones are the most recognized, sought after, and highly valued of all minerals. This session will focus on gem exploration, documenting conditions of formation, characterizing properties of gems, and improving the means of their identification.

T185. Pegmatites I Have Known and Loved

Disciplines: Mineralogy/Crystallography; Petrology, Igneous; Economic Geology

Advocate: David London

This session provides an opportunity for individuals to share their detailed knowledge of a particular pegmatite body and thereby inform those new to the field of the features and study of pegmatites.

Oil/Gas/Alternative Energy**T186. Natural Carbon Dioxide Accumulations as Analogs for Geologic Storage**

Disciplines: Oil/Gas/Alternative Energy; Stratigraphy; Geochemistry

Advocates: Marc L. Buursink; Matthew D. Merrill; Martin Cassidy

Investigating natural accumulations of CO₂ is essential to improving our understanding of geologic CO₂ storage. Areas of investigation include accumulation extent, geochemistry, sedimentary environment, migration pathways, and confining history.

T187. Recent Advances in the Exploration, Characterization, and Development of Geothermal Resources in the Pacific Northwest (Posters)

Disciplines: Oil/Gas/Alternative Energy; Hydrogeology; Geoscience and Public Policy

Advocates: Owen A. Callahan; Trenton T. Cladouhos; Pete Stelling

This session is focused on sharing new insights into historically underutilized geothermal resources between Oregon and Alaska. Topics may range from site-specific characterization to techniques for overcoming development hurdles impacting the region as a whole.

T188. Organic-Rich Mud Rocks: Geochemistry, Physical Properties, and Paleo-Environments

Disciplines: Oil/Gas/Alternative Energy; Paleoclimatology/Paleoceanography; Geochemistry

Advocates: Greg Ravizza; Chrsiton Achong; Timothy Lyons

Organic-rich facies are key archives of Earth's redox history and targets for energy production. This session integrates resource

geology, geochemistry, and paleoceanography to extract paleo-environmental information from these important deposits and unlock their resource potential.

T189. Geothermal Energy, Geothermics, and Tectonics of Western Canada

Disciplines: Oil/Gas/Alternative Energy; Geophysics/Geodynamics; Tectonics/Tectonophysics

Advocates: Martyn Unsworth; Catherine Hickson

This session will review crustal structure using geology and geophysical data, including magnetotellurics and seismics, to develop an updated geodynamic structure and foundation to understand the geothermal energy potential in western Canada.

T190. Applications of Structural Geology and Geomechanics in the Petroleum Industry

Disciplines: Oil/Gas/Alternative Energy; Structural Geology; Tectonics/Tectonophysics

Advocates: Peter Hennings; J. Steve Davis; S.E. Laubach

This session highlights structural geology and geomechanics research with strong petroleum industry applicability. Topics include regional structural analysis, computational and kinematic deformation modeling, fracture and fault characterization, and interaction of buoyant fluids with geologic structures.

T191. What Do We Know about Fluids Produced from Unconventional Reservoirs?

Disciplines: Oil/Gas/Alternative Energy; Geochemistry; Economic Geology

Advocates: Robert C. Burruss; Leslie F. Ruppert

This session examines oil and gas from shale and coal and water produced in unconventional reservoirs. Topics include thermal history, maturity, fluid composition and physical properties, fluid-rock interactions, environmental consequences of production, and resource abundance.

Paleoclimatology/Paleoceanography

T192. High-Resolution Geochemical Proxies of Global Change: Progress, Problems, and Utility (Posters)

Disciplines: Paleoclimatology/Paleoceanography; Paleontology, Paleoecology/Taphonomy; Geochemistry

Advocates: David P. Gillikin; David H. Goodwin; Alan D. Wanamaker Jr.

We seek papers presenting geochemical records of global change, including calibration/validation studies, in biologic or inorganic carbonates (e.g., mollusks, corals, speleothems) and highly resolved sediments. Geochemical studies highlighting recent progress, problems, or utility are welcome.



McAbbee siricid wasp. Photo by S. Bruce Archibald.

T193. Speleothem Records of Climate Change in North America

Disciplines: Paleoclimatology/Paleoceanography; Geochemistry; Karst

Advocates: Jessica L. Oster; Isabel P. Montañez

This session focuses on speleothem records of North American climate. We encourage presentation of records utilizing multi-proxy approaches to investigate multiple facets of paleoenvironmental change and those aimed at refining analytical tools applicable to speleothems.

T194. Exploring Ocean Redox Chemistry with Modern and Ancient Records

Disciplines: Paleoclimatology/Paleoceanography; Geochemistry; Marine/Coastal Science

Advocates: Allyson Tessin; Meghan Taylor

This session will highlight research utilizing geochemical methods to address ocean redox chemistry in modern environments and in deep time.

T195. Extreme Environmental Conditions and Biotic Responses during the Permian-Triassic Boundary Crisis and Early Triassic Recovery

Disciplines: Paleoclimatology/Paleoceanography; Paleontology, Biogeography/Biostratigraphy; Paleontology, Diversity, Extinction, Origination

Advocates: Thomas J. Algeo; Hugo Bucher; Peter Roopnarine; Arne M.E. Winguth

This session will feature new research related to the globally disturbed conditions associated with the end-Permian mass extinction and its aftermath during the early Triassic.

T196. Climate Change in the Geological Record: What Can We Learn from Data and Models?

Disciplines: Paleoclimatology/Paleoceanography; Geochemistry; Paleontology, Biogeography/Biostratigraphy

Advocates: Yannick Donnadieu; Christopher J. Poulsen; Dana L. Royer; Isabel Montanez; Emmanuelle Puc  at

The aim of this session is to share progress in our understanding of global climate changes occurring during the pre-Quaternary based on the integration of geochemical-paleobotanical-sedimentary techniques and numerical models.

T197. Deep-Time Paleosols and Sediments from the Boundary Events (Flood Basalt Eruptions and Bolide Impacts): Their Applications and Limitations as Geological Proxies in Understanding the Paleo-Environmental Conditions during the Mass Extinctions

Disciplines: Paleoclimatology/Paleoceanography; Geochemistry

Advocates: M.R.G. Sayyed; Kunio Kaiho

A variety of approaches to obtain paleo-environmental information from boundary sediments and paleosols are welcome. This session encourages future work in reconstructing climatic extremes during the periods of mass extinctions through critical and constructive discussions.

T198. The Ordovician Revolution: Co-Evolution of Climate and the Biosphere

Disciplines: Paleoclimatology/Paleoceanography; Paleontology, Biogeography/Biostratigraphy; Paleontology, Diversity, Extinction, Origination

Advocates: Thomas J. Algeo; Pedro J. Marengo; Matthew R. Saltzman

This session will feature new research related to changes in global climate, oceanographic conditions, and marine biotas during the Ordovician period.

Paleontology

T199. Conodonts as Stratigraphic and Paleoclimatic Tools

Disciplines: Paleontology, Biogeography/Biostratigraphy; Paleoclimatology/Paleoceanography; Geochemistry

Advocates: Charles M. Henderson; Michael J. Orchard

This session will focus on the increasing use of conodonts as stratigraphic and paleoclimatic tools and welcomes contributions involving conodont biostratigraphy and isotope geochemistry of conodonts.

T200. Advancing the Digitization of Paleontology and Geoscience Collections: Projects, Programs, and Practices

Disciplines: Paleontology, Biogeography/Biostratigraphy; Geoinformatics; Geoscience Education

Advocates: Talia S. Karim; Gil Nelson; Russell D. White

Digitization programs in paleontology and geoscience collections have become widespread, and researchers and educators now expect that these data will be discoverable online. This session will present new developments in digitization and data discovery.

T201. Eocene Northern North America: Biotic Change and Environmental Context

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy

Advocates: S. Bruce Archibald; Kathleen B. Pigg; David R. Greenwood; Melanie L. DeVore

This session will examine progress in understanding Eocene communities and their plant and animal lineages in the context of climate and geography in the rich northern North America and Arctic terrestrial fossil record.

T202. The Tonian-Cryogenian World

Disciplines: Paleontology, Diversity, Extinction, Origination; Geochemistry; Precambrian Geology

Advocates: Leigh Anne Riedman; Erik A. Sperling; Phoebe Cohen; Susannah M. Porter

This session seeks to explore a wide range of topics related to the Tonian and Cryogenian periods. We welcome papers investigating all aspects of this time interval, including paleontology, geochemistry, tectonic evolution, and more.

T203. Timing, Tempo, and Mode of Evolutionary and Paleoenvironmental Changes across Boundary Events and Transitions: The Protistan Evidence

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleontology, Phylogenetic/Morphological Patterns; Paleontology, Paleoecology/Taphonomy

Advocates: Eduardo A.M. Koutsoukos; Brian T. Huber; R. Mark Leckie

This session focuses on protistan studies characterizing the timing, tempo, and mode of evolutionary and paleoenvironmental changes across boundary events and transitions. These include the search for extinction/recovery patterns, paleoclimate/paleoceanographic changes, and oceanic carbon cycles.

T204. Fossil Mammalian Communities across Periods of Pronounced Climate Change

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Paleoclimatology/Paleoceanography

Advocates: Anne Weil; Jessica Theodor; Craig Scott

How have mammalian faunas responded to changes in global and regional climate conditions in the past? We encourage abstracts examining correlated faunal changes, including those in taxonomic composition, morphological disparity, diet, range, and relative abundance.

T205. Major Evolutionary Events of the Early Mesozoic—Paleontology and Paleoecology from the Middle Triassic to the Late Jurassic

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Sediments, Carbonates

Advocates: Lydia S. Tackett; Rowan C. Martindale; David Bottjer

The early Mesozoic represents one of the most evolutionarily chaotic intervals of the Phanerozoic. This session encourages paleontological and paleoecological studies from the middle Triassic through the Jurassic (e.g., Mesozoic Marine Revolution, Triassic-Jurassic, Toarcian OAE).

T206. Mass Extinctions: Volcanism, Impacts, and Catastrophic Environmental Change

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleoclimatology/Paleoceanography; Volcanology

Advocates: David P.G. Bond; Gerta Keller; Thierry Adatte

This session explores recent advances in the stratigraphic and geochemical records of mass extinctions and impacts that have seen the impact-kill scenario recede in favor of terrestrial causes that may ultimately derive from massive volcanism.

T207. Dynamic Landscapes and the Diversification of North American Rodents

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Geomorphology

Advocates: Rebecca C. Terry; Samantha S.B. Hopkins

Using fossils, genes, isotopes, and landscapes, we will address how 25 million years of tectonic and climatic change has influenced the evolutionary history, community assembly, and diversification of functional ecological traits in North American rodents.

T208. Ecosystem Paleobiology and Geobiology: Energy, Nutrients, and Food Webs in Deep Time

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination; Geomicrobiology

Advocates: Andrew M. Bush; Sara B. Pruss; Jonathan L. Payne

Ecosystems represent the interface between the biological and earth systems. This session will explore how changes in the structure and function of ecosystems controlled the history of life and environments (marine, freshwater, and terrestrial).

T209. Understanding the Flammability of Our Planet: The Present Day to the Ancient Past

Disciplines: Paleontology, Paleoecology/Taphonomy; Quaternary Geology; Soils

Advocates: Victoria Hudspeth; Claire M. Belcher

This session aims to promote discussion in wildfire research, bringing together knowledge from interdisciplinary research areas to answer key wildfire questions. Topics will cover a spectrum of ecosystems, vegetation types, fire histories, and methodological approaches.

T210. Topics in Paleoecology: Modern Analogues and Ancient Systems

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination; Paleontology, Phylogenetic/Morphological Patterns

Advocates: Amelinda E. Webb; Darrin J. Molinaro; Ben M.J. Collins; Austin J.W. Hendy; Gary J. Motz; Michael E. Burns

This session highlights the diversity of paleoecological research, organized within a framework of biotic interactions/predation, community/organismal ecology, and fidelity/conservation paleobiology.

T211. Paleoecology and Taphonomy of Late Paleozoic Lagerstätten

Disciplines: Paleontology, Paleoecology/Taphonomy; Geomicrobiology; Paleontology, Diversity, Extinction, Origination

Advocates: Emma Rose Locatelli; Victoria E. McCoy; Simon A.F. Darroch; James D. Schiffbauer; Marc Laflamme

Late Paleozoic Lagerstätten are rare. We will investigate mid- to late Paleozoic Lagerstätten (Rhynie Chert, Mazon Creek, Bear Gulch, Hunsrück Slate, Joggins) for insight into the paleoecology of marine, mixed marine, freshwater, and terrestrial ecosystems.

T212. Co-Evolution on Earth's Surface: Terrestrial Ecosystem and Environmental Interactions

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination; Paleoclimatology/Paleoceanography

Advocates: Jonathan P. Wilson; Ellen D. Currano

New fossil discoveries, analytical advances, and improved proxies are reshaping our picture of the evolution of Phanerozoic terrestrial environments. We encourage abstracts on any aspect of plant-animal-environmental interactions, from models to mass extinctions.

T213. Echinoderm Paleobiology: Phylogenetics, Morphology, and Evolutionary Paleoecology

Disciplines: Paleontology, Phylogenetic/Morphological Patterns; Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy

Advocates: Jeffrey R. Thompson; David F. Wright; Selina R. Cole

This session will address recent advances in the understanding of echinoderm evolution and paleontology. This complex topic will include trends in phylogeny, morphology, paleoecology, macroevolution, taphonomy, and systematics.

T214. Unearthing the History of Life: The Application of Phylogenetic Methods to the Fossil Record

Disciplines: Paleontology, Phylogenetic/Morphological Patterns; Paleontology, Diversity, Extinction, Origination; Paleontology, Biogeography/Biostratigraphy

Advocates: James C. Lamsdell; Curtis R. Congreve

This symposium focuses on the many different ways both phylogenetic methods and phylogenetic theory can be applied to fossil data to help better understand big questions in the history of life.

Petrology, Igneous/Metamorphic**T215. Chikyu Meets Lithoprobe: Can We Connect Modern Arcs and Ancient Continental Crust?**

Disciplines: Petrology, Igneous; Geochemistry; Tectonics/Tectonophysics

Advocates: Paul A. Mueller; M.E. Bickford; Robert Stern; Sally Pehrsson; Ronald Clowes

The session will focus on the extent to which the geochemical, geophysical, and tectonic characteristics of modern arc systems are pertinent to understanding the formation of Hadean and Archean crust.

T216. Cenozoic Magmatism and Volcanism in the North American Cordillera

Disciplines: Petrology, Igneous; Volcanology; Tectonics/Tectonophysics

Advocates: Ben Edwards; J. Kelly Russell; Graham D.M. Andrews

This session will highlight recent advances in our understanding of connections between tectonics, lithospheric structure, and magma generation from studies of Cenozoic volcanism in the North American Cordillera.

T217. Mechanisms, Rates, and Timescales of Texture Formation in Metamorphic Rocks

Disciplines: Petrology, Metamorphic; Petrology, Igneous; Mineralogy/Crystallography

Advocates: Thomas Mueller; John M. Ferry

This session explores all aspects of mass and heat transport leading to the formation of metamorphic textures, as well as their application in the earth sciences (e.g., geospeedometry, geothermometry, and diffusive fractionation of isotopes).

T218. Subduction Zone HP-UHP Metamorphism and Its Relation to the Coeval Magmatism

Disciplines: Petrology, Metamorphic; Petrology, Igneous; Tectonics/Tectonophysics

Advocates: Lifei Zhang; Yaoling Niu; Yilin Xiao; Jinghui Guo; Shuguang Song

This session focuses on current work on HP-UHP metamorphism and its relationship to the coeval magmatism. We seek contributions from petrology, geochemistry, and tectonics that expand our understanding of subduction-related metamorphism and magmatism.

Planetary Geology**T22. Dynamic Planetary Geology Revealed by Long-Term Observations**

Discipline: Planetary Geology

Advocates: Colin M. Dundas; Alexander G. Hayes; James J. Wray

Our focus is time-variable geology observed on a range of worlds beyond Earth. We welcome abstracts on processes ranging from impact, aeolian, mass-wasting, and lacustrine to phase changes and volatile transport over various time scales.

T219. Subsurface Tectonics of Crust, Mantle, Core and Sedimentary Basins with Hydrocarbons As a Single Dynamic (Posters)

Disciplines: Planetary Geology; Tectonics/Tectonophysics; Structural Geology

Advocates: Allen Lowrie; Rhett Hamiter

Comprehension of multi-layered crust, mantle, and core with sedimentary basins with hydrocarbons increases. Qualitative and quantitative descriptions of intricate relationships, known and unknown, within a "single dynamic" facilitate visualization.

T220. Planetary Hydrology

Disciplines: Planetary Geology; Hydrogeology; Karst

Advocate: Devon M. Burr

We seek studies of planetary hydrogeology and hydrology from both theoretical and observational standpoints, including remote sensing analyses, modeling, and experimental studies; laboratory and theoretical investigations of hydrologically mediated chemical reactions; and Earth analog studies.

T221. Advances in Planetary Geophysical Exploration

Disciplines: Planetary Geology; Geophysics/Geodynamics

Advocates: Richard Saltus; Devon M. Burr

This session will explore challenges and advances in geophysical methods related to inversion and interpretation of planetary datasets, acquisition in planetary environments, and results of recent geophysical exploration campaigns.

T222. *Curiosity* on Mars—Inspiring the Young Generation

Disciplines: Planetary Geology; Geochemistry; Paleontology, Paleocology/Taphonomy

Advocates: Radu H. Iacob; Cristina E. Iacob

In the midst of the mobile apps and social media culture, *Curiosity*'s mission at Gale Crater brings the younger generation new reasons to embrace the scientific adventure on Mars, inspiring creativity and desire for discovery.

T223. Experimental Investigations of Planetary Geologic Processes

Disciplines: Planetary Geology; Geochemistry; Geomorphology

Advocates: Danielle Y. Wyrick; Paul K. Byrne

This session solicits abstracts regarding experimental and laboratory analyses of geologic processes and materials under the range of dynamic, kinematic, temperature, pressure, and chemical parameters found throughout the solar system.

T224. When Water Meets Rock: Aqueous Alteration in the Solar System

Disciplines: Planetary Geology; Geochemistry; Mineralogy/Crystallography

Advocate: John F. Mustard

Water-rock chemical interactions are ubiquitous on surfaces and in shallow crusts of planetary bodies and in chondritic materials. This session seeks contributions examining processes and products of aqueous alteration including terrestrial analog studies.

T225. Micro-Mars to Mega-Mars: Integration of Surface and Orbital Data

Disciplines: Planetary Geology; Geomorphology; Stratigraphy

Advocate: Nathan Bridges

The goal of this session is the integration of surface and orbital studies of Mars geology.

T226. Geophysics across the Outer Solar System: The G.K. Gilbert Award Session

Disciplines: Planetary Geology; Geophysics/Geodynamics; Tectonics/Tectonophysics

Advocates: Devon M. Burr; Debra L. Buczkowski

This session will explore the origin, structure, evolution, and bombardment history of the outer solar system. Geophysical and geological research on the satellite systems of the outer planets and on Kuiper Belt objects is welcome.

GSA Partners with Our Associated Societies for the Vancouver Meeting

GSA has a long tradition of collaborating with like-minded organizations in pursuit of mutual goals to advance the geosciences. As the Society looks to the future, it aims to build strong, meaningful partnerships with other societies and organizations across the country and around the world in service to members and the global geoscience community. National and international societies with consistent aims and missions of advancing the geosciences and/or science in general are invited to affiliate with GSA as an Associated Society.

GSA currently works with its 68 Associated Societies and 17 specialty science Divisions to build a dynamic Annual Meeting technical program and exciting events during the meeting. We invite our Associated Societies to present their representative science and hold customized events during the Vancouver, British Columbia, Canada, meeting this October. GSA is looking forward to hosting our valued partners and organizations to present their science, hold meetings, and to exhibit at a booth during the meeting. Members of Associated Society organizations also receive the GSA member registration rate to the Annual Meeting.

For more information about the GSA Associated Society program and a full list of current Associated Societies, go to www.geosociety.org/divisions/.



T227. From the Inside Out: Ceres to Pluto and Satellites in Between

Disciplines: Planetary Geology; Structural Geology; Geomorphology

Advocates: D. Alex Patthoff; Emily S. Martin

We encourage abstracts relating to surface, structural, and tectonic processes; interior and thermal evolution of icy bodies; and planetary analogs. This includes observational and theoretical approaches.

T228. Detection, Tracking, and Managing Hazardous**Asteroids: Critical Early Steps in Solar System Management and Development**

Disciplines: Planetary Geology; Paleontology, Diversity, Extinction, Origination; Paleontology, Phylogenetic/Morphological Patterns

Advocates: John C. Smith; Kevin Mickus

This session will cover challenges in detection, tracking, and systematic management; paleogeology; paleobiology; species die-offs related to large asteroid impact; and hazardous asteroid periodicity. Proposals for international cooperation are encouraged.

T229. The Holey Solar System

Disciplines: Planetary Geology; Structural Geology; Petrology, Igneous

Advocates: Jeffrey Plescia; Christian Koeberl; Gordon R. Osinski; Angela Stickle

This session focuses on impact processes. Terrestrial craters provide ground-truth for remote sensing of planetary craters. We solicit contributions regarding shock processes, materials, modeling, structure, and airburst. Comparisons of craters among different bodies are encouraged.

T230. Topics in Planetary Geology (Posters)

Disciplines: Planetary Geology; Structural Geology; Geomorphology

Advocates: Devon M. Burr; Robert Anderson

The wide diversity of solar system bodies encompasses a broad range of geological processes and histories. We seek presentations on topics of current interest in the field of planetary geology (posters only).

T231. Ice throughout the Solar System

Disciplines: Planetary Geology; Geomicrobiology; Geophysics/Geodynamics

Advocate: Louise M. Prockter

This interdisciplinary session celebrates research into ice in any form, in any part of the solar system, using laboratory analyses, terrestrial fieldwork, and planetary and telescopic data analysis.

T232. Remote Sensing of Volcanoes in the Solar System

Disciplines: Planetary Geology; Volcanology

Advocates: William Farrand; John C. Mars

Advances in our understanding of volcanoes on Earth and other planets have been enabled by advances in remote sensing

technology. This session addresses the use of new remote sensing technology to study volcanoes.

T233. Tectonics and Volcanism in the Solar System

Disciplines: Planetary Geology; Structural Geology; Volcanology

Advocates: Debra L. Buczkowski; Danielle Y. Wyrick

We encourage abstract submissions related to the description, mapping, modeling, and subsequent analysis of tectonic and volcanic structures on rocky bodies, including planets, moons, and asteroids.

Precambrian Geology**T234. Precambrian Geology of the North American Cordillera: An Exploration of New Developments in Laurentia's Ancient History**

Disciplines: Precambrian Geology; Tectonics/Tectonophysics; Stratigraphy

Advocates: Justin V. Strauss; Marcus Kunzmann; Galen P. Halverson; Rob Rainbird

The North American Cordillera is host to an exceptional record of Precambrian tectonism, sedimentation, and historical geobiology. This session provides a forum to share progress in our understanding of western Laurentia's ancient history.

T235. Some New Gloss on Old Lips: Implications for Continental Reconstructions and Metallogeny

Disciplines: Precambrian Geology; Petrology, Igneous; Tectonics/Tectonophysics

Advocates: Richard E. Ernst; Wouter Bleeker; Kevin R. Chamberlain

A flood of new data (mainly U-Pb ages) on the plumbing system of Large Igneous Provinces (dikes, sills, and layered intrusions) is providing an improved framework for resource exploration and for reconstructing supercontinents.

T236. The Ediacaran-Cambrian Ecosphere (R)evolution: Emerging Records from Central and East Asia

Disciplines: Precambrian Geology; Paleontology, Diversity, Extinction, Origination; Geochemistry

Advocates: Christoph E. Heubeck; Francis A. Macdonald

Late Proterozoic terranes from central Asia hold a mostly low-latitude marine record of the Cryogenian and the Ediacaran-Cambrian ecosphere turnover that has received little attention to date. We encourage contributions on all aspects.

Sediments, Carbonates/Clastic**T237. Carbonate Reservoirs—Characterization, Geochemical Modeling, and Case Studies**

Disciplines: Sediments, Carbonates; Geochemistry; Hydrogeology

Advocates: Tina L. Roberts-Ashby; Lester Williams

This session includes reservoir characterization, geochemical modeling, and case studies for carbonate rocks utilized in the oil and gas industry, the CO₂ capture and storage industry, and

hydrogeologic evaluations related to fresh and brackish groundwater resources.

T238. Sedimentary Geology: The Now and the Next Generations of Scientists (Posters)

Disciplines: Sediments, Carbonates; Sediments, Clastic; Stratigraphy

Advocates: Katherine A. Giles; Marjorie Chan

This session welcomes student scientific contributions on sedimentary geology. Topics can range broadly from studies of ancient to modern sediments, sedimentary processes, and their products in the geologic record.

T239. Precambrian Sedimentology: From the Field to the Laboratory

Disciplines: Sediments, Clastic; Sediments, Carbonates; Precambrian Geology

Advocates: Christopher M. Fedo; John Grotzinger; Edward L. Simpson

This session is dedicated to honoring the retirement of Professor Kenneth A. Eriksson of Virginia Tech and will highlight advances in the field and the current state of Precambrian sedimentology.

T240. Bedforms: Genesis and Development Processes, Morphology, Stratigraphy, and Insights into Planetary Environment

Disciplines: Sediments, Clastic; Geomorphology; Stratigraphy

Advocates: Jeffrey A. Nittrouer; Mauricio M. Perillo; Ryan Ewing

Bedforms occur over a range of Earth and planetary surfaces. Session contributions are encouraged from geoscientists investigating bedform processes, morphology, and stratigraphy over a range of settings, using laboratory, field (modern/ancient), and theoretical research approaches.

T241. Paleoenvironmental Reconstruction of Hominin Sites: Techniques—From the Unique and New to the Tried and True

Disciplines: Sediments, Clastic; Quaternary Geology; Paleoclimatology/Paleoceanography

Advocates: Cynthia M. Liutkus-Pierce; Gail M. Ashley

This session will highlight research that reconstructs hominin paleoenvironments using sedimentological and geochemical techniques, including those that are popular and well known, while also encouraging submissions from groups that are developing unique, new methods/applications.

T242. Mud Deposition

Disciplines: Sediments, Clastic; Marine/Coastal Science; Oil/Gas/Alternative Energy

Advocates: Juergen Schieber; S. George Pemberton; M.K. Gingras

The session is to be devoted to the intricacies of mud deposition in coastal and riverine environments with a focus on the processes of mud deposition and sedimentary structures formed.

Stratigraphy

T243. Road-Testing the Placement of the GSSP Golden Spikes

Disciplines: Stratigraphy; Paleontology, Biogeography/Biostratigraphy; History and Philosophy of Geology

Advocates: Lucy E. Edwards; Stanley C. Finney; Brian R. Pratt

This session is devoted to discussing the utility of GSSP boundary placement from the end-user perspective of geoscientists doing regional mapping and correlations and utilizing outcrop and subsurface data.

T244. New Advances and Applications in Sequence Stratigraphy

Disciplines: Stratigraphy; Sediments, Clastic; Sediments, Carbonates

Advocates: G. Michael Grammer; Christopher Fielding

This session will focus on the integration of multiple data sets (e.g., geochemical, geophysical, and petrophysical data) into the increasingly refined development of sequence stratigraphic models for both carbonate and siliciclastic depositional systems.

Volcanology

T245. Ancient and Modern Cultural Responses to Volcanic Disasters—Messages for the Future

Disciplines: Volcanology; Archaeological Geology; Geology and Health

Advocate: Grant Heiken

What have we learned from past interactions between volcanic eruptions and diverse cultures that can be used to mitigate future disasters? With Earth's rapidly growing population, more people are at risk from volcanic eruptions.

T246. Glaciovolcanism at Snow- and Ice-Clad Volcanoes

Disciplines: Volcanology; Quaternary Geology; Geomorphology

Advocates: Christopher F. Waythomas; Ben Edwards; J. Kelly Russell

Glaciovolcanism concerns volcano interactions with ice in all its forms and any meltwater created by volcanic heating of that ice. This session will focus on recent contributions to glaciovolcanic processes at ice-clad volcanoes.



Mount Baker is a streaming volcano visible from all over the Fraser Lowland, Vancouver to Bellingham. Photo by Don Easterbrook.

Discipline Categories

Can't find a topical session that fits your abstract? No problem! In addition to topical sessions, we offer the following discipline categories. Discipline sessions are equally vital to our technical program and are an essential addition to the fulfillment of the overall meeting. Encourage your friends to submit a discipline abstract too.

REVIEW GROUP	DISCIPLINES	CONTACT(S)
GSA Archaeological Geology Division	archaeological geology	Cynthia M. Fadem, fademcy@eartham.edu; Katherine A. Adelsberger, kadelsbe@knox.edu
Association of Earth Science Editors	geoscience information/ communication	Monica Easton, monica.easton@ontario.ca
Coal Geology Division	coal geology	Jennifer O'Keeffe, j.okeefe@moreheadstate.edu; Brett J. Valentine, bvalentine@usgs.gov
GSA Environmental and Engineering Geology Division	engineering geology	Bill Burns, bill.burns@dogami.state.or.us; Matt Crawford, mcrawford@uky.edu
GSA Geobiology & Geomicrobiology Division	geomicrobiology	Jocelyn Sessa, SessaJ@si.edu
Geochemical Society	geochemistry, geochemistry, other	Bill Hart, hartwk@muohio.edu; Brandy M. Toner, toner@umn.edu
GSA Geoinformatics Division	geoinformatics	Kerstin Lehnert, lehnert@ldeo.columbia.edu; M. Lee Allison, Lee.allison@azgs.az.gov
GSA Geology and Health Division	geology and health	Saugata Datta, sdatta@ksu.edu
GSA Geology and Society Division	geoscience and public policy	R. Laurence Davis, rldavis@newhaven.edu; Suzanne O'Connell, soconnell@wesleyan.edu
GSA Geophysics Division	geophysics/tectonophysics/ seismology	Samantha E. Hansen, shansen@geo.ua.edu; Anna M. Courtier, courtiam@jmu.edu
GSA Geoscience Education Division	geoscience education	Julie C. Libarkin, libarkin@msu.edu; Christopher L. Atchison, catchison@gsu.edu
Geoscience Information Society	geoscience information/ communication	Hannah Winkler, hannah.winkler@stanford.edu
GSA History and Philosophy of Geology Division	history of geology	Renee M. Clary, rclary@geosci.msstate.edu; Jane P. Davidson, jdhexen@unr.edu
GSA Hydrogeology Division	hydrogeology	Ben Rostron, ben.rostron@ualberta.ca; Christopher Gellash, Christopher.gellash@usuhs.edu
Karst	karst	Cory Black Eagle, cblackeagle@uky.edu; George Veni, gveni@nckri.org
GSA Limnogeology Division	limnogeology	Amy Myrbo, amyrbo@umn.edu
Marine/Coastal Geology	marine/coastal science	Mike Lewis, Michael.Lewis@NRCan-RNCan.gc.ca
Mineralogical Society of America	mineralogy/crystallography; petrology, experimental; petrology, igneous; petrology, metamorphic; volcanology	James S. Beard, jim.beard@vmnh.virginia.gov; Philip Brown, pbrown@geology.wisc.edu
GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division	mineralogy/crystallography; geochemistry; petrology, volcanology	Diane R. Smith, dsmith@trinity.edu; Yildirim Dilek, dileky@muohio.edu
National Association of Geoscience Teachers	geoscience education	Randy Richardson, rmr@u.arizona.edu; Aida Awad, aawad@maine207.org

REVIEW GROUP	DISCIPLINES	CONTACT(S)
Paleoceanography and Paleoclimatology	paleoclimatology/ paleoceanography	Claude Hillaire-Marcel, chm@uqam.ca
Paleontological Society	paleontology, biogeography/ biostratigraphy; paleontology, diversity, extinction, origination; paleontology, paleoecology/ taphonomy; paleontology, phylogenetic/morphological patterns	Phoebe Cohen, phoebe.a.cohen@williams.edu; Christy Visaggi, cvisaggi@gsu.edu; Thomas D. Olszewski, tomo@geo.tamu.edu
Petroleum/Energy	petroleum	Marc L. Buursink, mbuursink@usgs.gov
GSA Planetary Geology Division	planetary geology	Devon M. Burr, dburr1@utk.edu; Debra Buczkowski, Debra.buczkowski@jhuapl.edu; Danielle Wyrick, dwyrick@swri.org
Precambrian Geology	Precambrian geology	Kent Condie, kcondie@nmt.edu
GSA Quaternary Geology and Geomorphology Division	geomorphology; Quaternary geology	Alan R. Nelson, anelson@usgs.gov; David Dethier, David.p.dethier@williams.edu
Sedimentary Geology Division	sediments, carbonates; sedi- ments, clastic; stratigraphy	Greg Ludvigson, gludvigson@kgs.ku.edu; Ed Simpson, simpson@kutztown.edu
Society for Sedimentary Geology (SEPM)	sediments, carbonates	Neil Tabor, ntabor@mail.smu.edu
Society of Economic Geologists	economic geology	Nigel M. Kelly, nkelly@mines.edu
Soils and Soil Processes (Interdisciplinary Interest Group)	soils	Michael Grammer, michael.grammer@okstate.edu
Structural Geology and Tectonics Division	neotectonics/ paleoseismology; structural geology; tectonics	Dan Gibson, hdgibson@sfu.ca; Chris Bailey, cmbail@wm.edu

Let us help you arrange space for your event

2014 Annual Meeting Space Requests



Deadline: 5 June

Please let us know about your non-technical events by submitting them through our online space request system. Space is reserved on a first-come, first-served basis; in order to avoid increased fees, you must submit your request for meeting rooms before the 5 June deadline. All fees and space request guidelines are online.

WHY THE SPACE REQUEST SYSTEM:

- To arrange for meeting rooms to hold events (i.e., business meetings, luncheons, receptions, etc.) at the Vancouver Convention Centre, Hyatt Regency Vancouver or Fairmont Hotel Vancouver—with NO food/beverage minimum or room rental from the facility/hotel;
- To make sure your event is listed in the meeting program book, in the personal scheduler, and on the GSA website; and
- For off-site events (events that are NOT being held at the Vancouver Convention Centre, the Hyatt Regency Vancouver or the Fairmont Hotel Vancouver)—your event can still be included in the program book, personal scheduler, and GSA website.

www.geosociety.org/meetings/2014/

Housing

NEW
for 2014

Housing reservations will open in early May!

GSA has selected a range of hotels in terms of proximity, rate, and style to meet your needs and preferences. Please check the GSA website in early May for the housing map and room reservation procedures. Below is the list of hotels and group rates for our block. All rates listed are in Canadian dollars (CAD) and are based on single or double occupancy and do not include the current applicable tax of 16.5%.

The official GSA housing bureau is MCI Vancouver. To receive the GSA group rate at each hotel, reservations must be made through MCI Vancouver and not directly with the hotels. The MCI/GSA Housing Bureau DOES NOT contact attendees directly to solicit new reservations. If you are contacted by a vendor who claims to represent GSA, please notify GSA Meetings Department at meetings@geosociety.org or +1-303 375-1000.

▶ Best Western Plus Downtown Vancouver	\$129
▶ Days Inn Vancouver Downtown	\$139
▶ Fairmont Hotel Vancouver (<i>Co-Headquarter Hotel</i>)	\$239
▶ Fairmont Waterfront Hotel	\$239
▶ Four Seasons Hotel Vancouver	\$199
▶ Hampton Inn & Suites by Hilton Vancouver-Downtown	\$159
▶ Hyatt Regency Vancouver (<i>Headquarter Hotel</i>)	\$249
▶ Pan Pacific Vancouver	\$249
▶ Renaissance Vancouver Hotel Harbourside	\$249
▶ Sheraton Vancouver Wall Centre Hotel	\$159
▶ Sutton Place Hotel	\$175
▶ Vancouver Marriott Pinnacle Downtown	\$249



Tourism Vancouver/ Clayton Perry

www.geosociety.org/meetings/2014/

GSA Grants & Awards

■ HISTORY AND PHILOSOPHY OF GEOLOGY STUDENT AWARD

Application deadline: 1 May

GSA's History and Philosophy of Geology Division is offering a US\$1000 award for the best proposal for a student paper to be presented at an upcoming GSA Annual Meeting. The topic of the proposed paper may be (1) the history and philosophy of geology; or (2) a literature review of ideas for a technical work. If you have questions about the award, contact David W. Goldsmith, dgoldsmith@westminstercollege.edu. For more information, go to www.gсахist.org/hapg_award/student_award.htm.

■ STEPHEN E. LAUBACH STRUCTURAL DIAGENESIS RESEARCH AWARD FUND

Proposal deadline: 1 June

The Stephen E. Laubach Structural Diagenesis Research Award Fund promotes research that combines structural geology and diagenesis as well as curriculum development in structural diagenesis. The donors believe multidisciplinary approaches often reveal new insights into long-standing problems and expose productive avenues for enquiry. To help promote the cross disciplinary emphasis of this annual award, the Sedimentary Geology and Structural Geology and Tectonics Divisions have been designated to jointly select the recipient. Graduate students, postdocs, and faculty-level researchers are eligible. For more information, go to <http://rock.geosociety.org/sgt/Laubach.htm>.

New Comments & Replies Posted Online

www.geosociety.org/gsatoday/comment-reply/

Comment

COMMENT on "The geological legacy of Hurricane Irene: Implications for the fidelity of the paleo-storm record" by Scott P. Hippensteel, Matthew D. Eastin, and William J. Garcia

Jeffrey P. Donnelly, John B. Anderson, Andrea D. Hawkes, Ervin G. Otvos, Michael R. Toomey, Peter J. van Hengstum, Davin J. Wallace, and Jonathan D Woodruff, doi: 10.1130/GSATG205C.1, p. e28–e29.

Reply

REPLY to comment on "The geological legacy of Hurricane Irene: Implications for the fidelity of the paleo-storm record" by Scott P. Hippensteel, Matthew D. Eastin, and William J. Garcia

Scott P. Hippensteel, Matthew D. Eastin, and William J. Garcia, doi: 10.113/GSATG209Y.1; page e30–e31.

Original Article

The geological legacy of Hurricane Irene: Implications for the fidelity of the paleo-storm record, *GSA Today*, v. 23, no. 12, p. 4–10, doi: 10.1130/GSATG184A.1, <http://www.geosociety.org/gsatoday/archive/23/12/article/i1052-5173-23-12-4.htm>.

Comment

Comment on "Late Oligocene–early Miocene Grand Canyon: A Canadian connection?"

Eric Clausen, doi: 10.1130/GSATG202C.1, p. e32,

Reply

Reply to comment on "Late Oligocene–early Miocene Grand Canyon: A Canadian connection?"

James W. Sears, doi: 10.1130/GSATG213Y.1.

Original Article

Late Oligocene–early Miocene Grand Canyon: A Canadian connection: *GSA Today*, v. 23, no. 11, p. 4–10, <http://www.geosociety.org/gsatoday/archive/23/11/article/i1052-5173-23-11-4.htm>.



Help Shape the Future of Geoscience— Serve on a GSA Committee!

Deadline: 15 July 2014

Terms begin 1 July 2015 (unless otherwise indicated)

If you are looking for the opportunity to work toward a common goal, give back to GSA, network, and make a difference, then we invite you to volunteer (or nominate a fellow GSA member) to serve on a Society committee or as a GSA representative to another organization.

Learn more and access the nomination form at www.geosociety.org/aboutus/committees/. Use the online form or download a hardcopy and mail it to Pamela Fistell, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA; fax: +1-303-357-1074; pfistell@geosociety.org.

ACADEMIC AND APPLIED GEOSCIENCE RELATIONS COMMITTEE

Two member-at-large vacancies (3-year term; 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 a 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

Two member-at-large vacancies (4-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 term; T/E)

This committee selects candidates for the Arthur L. Day Medal. **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."

DIVERSITY IN THE GEOSCIENCES COMMITTEE

Three member-at-large (3-year term; 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.

eGSA COMMITTEE

Two member-at-large vacancies: one Recent Graduate and one Councilor/Former Councilor (3-year term; 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, and/or other emerging technologies.

EDUCATION COMMITTEE

Three representative vacancies: one 4-year college faculty representative, one member-at-large (4-year term), and one graduate student (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.

GEOLOGY AND PUBLIC POLICY COMMITTEE

Two member-at-large vacancies (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 the 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 vacancies: one marine/coastal geology and one soils representative (2-year term runs 1 Dec. 2014–30 Nov. 2016; 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 COMMITTEE

One member-at-large vacancy (government) (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 COMMITTEE

Two members-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 COMMITTEE

Two member-at-large vacancies (3-year term; 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 Field Forum.

PENROSE MEDAL AWARD COMMITTEE

Two member-at-large vacancies (3-year term; 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 COMMITTEE

One member-at-large vacancy (3-year term; 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 COMMITTEE

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 COMMITTEE

Seven member-at-large vacancies (3-year term; B/E/C)

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. 2015.

YOUNG SCIENTIST AWARD (DONATH MEDAL) COMMITTEE

Two member-at-large vacancies (3-year term; 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.”

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Call for Committee Service

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GSA REPRESENTATIVES TO OTHER ORGANIZATIONS

GSA Rep. to the AAAS Consortium of Affiliates for International Programs (CAIP):

One vacancy (3-year term begins 1 Jan. 2015; B/E): CAIP encourages cooperation on projects with international aspects and facilitates networking in its member societies. **Qualifications:** Interest in the international area of his/her society but there are no specific qualifications.

GSA Rep. to the U.S. National Committee for Soil Science (USNC/SS):

One vacancy (3-year term begins 1 July 2015): The mission of the USNC/SS is to promote the advancement of soil science in the

United States and throughout the world in order to strengthen U.S. soil science as a contributor to the international scientific community and to inform the U.S. scientific community of soil science activities carried out elsewhere in the world. Learn more at <http://sites.nationalacademies.org/pga/biso/SS/>.

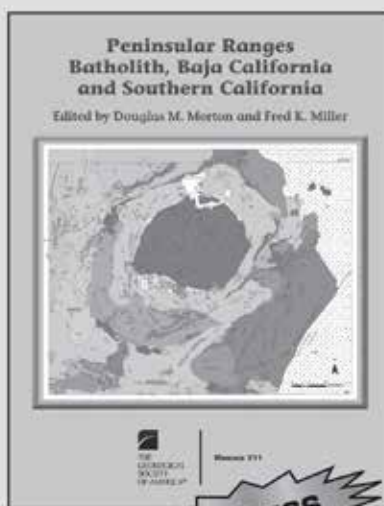
Committee, Section, and Division Volunteers:

Council Thanks You!

GSA Council acknowledges the many member-volunteers who, over the years, have contributed to the Society and to our science through involvement in the affairs of the GSA. Your time, talent, and expertise help build a solid and lasting Society.



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Edited by Douglas M. Morton and Fred K. Miller

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Sustainable Land-Use Management Requires Geoscience

GSA members are invited to submit comments and suggestions regarding the following Position Statement DRAFT by 15 May 2014. Go to www.geosociety.org/positions/ to learn more and submit comments.

Position Statement

To ensure that land management practices meet the present and future needs of people and the natural systems on which they depend, The Geological Society of America (GSA) strongly advocates incorporating comprehensive geoscience information into land-use management planning and decision making. The geosciences, or earth sciences, uniquely inform land-use issues because they address the origin, character, and interconnection of natural resources as well as the natural and human-induced processes that affect these resources. Geoscience information is critical to addressing natural and human-induced hazards, such as landslides, earthquakes, subsidence and sinkholes, floods, and droughts; to determining the availability of natural resources such as clean air, potable water, fertile soil, minerals, and energy; and to resolving environmental issues, such as soil erosion, surface water quantity and quality, groundwater supply and contamination, and wetland destruction.

Purpose

This position statement: (1) represents the consensus view of GSA regarding integration of geoscience into land-use management; (2) delineates the vital contributions geoscientists can make to effective policies for sustainable land use; and (3) encourages geoscientists to participate in land-use decision making at every level of government.

Rationale

Land-use practices include agriculture, ranching, logging, mining, river management (dams, reservoirs, canals, etc.), groundwater withdrawals and recharge, waste disposal, commercial and residential development, and land conservation. These practices affect hydrologic and biogeochemical cycles and processes and the structure of fundamental ecosystems, such as wetlands, streams, estuaries, bays, shorelines, and forests. Changes in these highly dynamic processes can affect the integrity and future availability of natural resources.

Earth's land, water, and air are indispensable natural resources that are closely linked through complex cycles and processes. Land generates most of humanity's food, provides the mineral and soil resources vital to society, and serves as a major carbon sink through photosynthesis and rock

weathering. The land surface also provides natural beauty and recreational value and affects the quality and amount of water delivered to streams and aquifers.

Groundwater, lakes, and rivers provide water for domestic, municipal, industrial, and agricultural uses. Lakes and rivers provide water for transportation, power generation, recreation, and natural habitats. Coastal waters provide important food resources and ecosystems for marine life, and coastal environments, such as dunes and marshes, protect communities from storm surges and tides. Many of these ecosystems are also home to endangered species.

Air quality is determined by interactions between natural and human activities on Earth's surface and the atmosphere; for example, some land uses, such as agriculture or construction, may generate large amounts of dust and smoke that travel great distances on global wind currents.

Land resources, and our ability to manage and protect them, also affect Earth's climate on various scales. For example, land-management decisions that promote urban sprawl will result in more paved surfaces generating urban heat islands, which influence precipitation patterns around cities. Hotter cities use more electricity for air conditioning, increasing fossil fuel use for power generation. Likewise, urban sprawl and highway construction require more fossil fuel consumption for transportation and increase greenhouse gas emissions. The impact of sprawl is amplified by the deforestation and land clearing that accompany it. As people continue to migrate to cities worldwide, large-scale urban land-use management will become increasingly important.

Land management decisions are inherently interdisciplinary because natural and anthropogenic changes to land resources are diverse. Geoscience provides a unique contribution to land-use issues because it addresses the origin, character, distribution, availability, vulnerability, and connectivity of natural resources. The geosciences provide an understanding of potential short- and long-term effects of past, present, and future land-use practices on other natural resources. Earth-science information must be integrated with land-use planning so that land-use management options are evaluated on the basis of conservation, protection of human and ecologic health and safety, and equitable economic growth.

Public Policy Aspects of Integrating Geoscience with Land-Use Decision Making

Land-use planning and management decisions should (1) reflect a comprehensive understanding of the potential impacts on natural resources that sustain communities; (2) include measures to avoid over-allocation, chronic depletion, and/or degradation of natural resources; (3) consider the needs of future populations to conserve natural resources and avoid damage to natural systems that may be difficult, expensive, or even impossible to restore; and (4) minimize the loss or destruction of natural ecosystems and unique physiographic features.

Geoscience, with its interdisciplinary, multi-geographic-, and multi-time-scale perspective, is a critical component of effective and sustainable management of land and natural resources. Geoscience information also helps decision makers optimize resource use while minimizing undesired or unacceptable environmental impacts. Finally, as human population grows, demand for land and associated

natural resources will increase, as will the need for more science to inform land management decisions and develop strategies for mitigating unacceptable and irreversible changes.

Recommendations

- Geoscience should be incorporated into all relevant land-use and natural-resources management planning and decisions, to enhance their integrity and sustainability.
- Government at all levels should integrate geoscience information into land-use planning to effectively address natural and human-induced hazards, natural resource availability, and environmental issues.
- Public investments in geoscience research should be maintained or increased in order to improve the scientific basis for land-use decisions.
- Geoscience information, such as the activity of fault zones, location of floodplains, vulnerability of eroding coastlines, and the susceptibility of groundwater resources to degradation, should be readily accessible and communicated clearly for a general audience. The public, policy makers, private developers, and land managers should all have the opportunity to understand the science needed for good decision making and to reduce potential risk and liability in areas of natural or anthropogenic hazards.

Opportunities for GSA and GSA Members to Help Implement Recommendations

To improve implementation of the goals of this position statement, GSA recommends the following:

- Communicate the value of integrating geoscience into natural resources management to government, developers, land-use planners, chambers of commerce, and other local decision makers. Failure to incorporate or apply geoscience information has often resulted in costly adverse land-use activities, worsened consequences of natural disasters, and allowed for needless human-induced disasters.
- Communicate the links among geoscience, land-use planning, and resource management to the general public through print, Internet, broadcast, and social media.
- Promote mapping programs, such as state soil surveys, NRCS soil mapping, and the USGS National Cooperative Geological

Mapping Program (NCGMP), which support the production of new geologic maps and student education programs that create the next generation of geologic mappers.

- Share experiences in land-use and associated natural resources planning at GSA meetings and with GSA's Director for Geoscience Policy and the Geology and Society Division. Local examples of geoscience contributions to land-use planning are essential to this effort.
- Identify legislation that affects land use and alert GSA's Director for Geoscience Policy, the Geology and Public Policy Committee, the Geology and Society Division, and GSA's Associated Societies so they can help improve the scientific basis for land-management decisions as well as bring this position statement to the attention of lawmakers.
- Encourage interaction among geoscientists at all levels who work with land and natural resources management issues or are interested in incorporating geoscience into land-use decision making. GSA should sponsor symposia or town-hall meetings, particularly at the GSA sectional or annual meetings, that bring together geoscientists from land management agencies, the U.S. Geological Survey, universities, and private industry to share ideas about how geoscience has been and can be successfully integrated into land use and natural resources policies.

About the Geological Society of America

The Geological Society of America, founded in 1888, is a scientific society with more than 26,000 members from academia, government, and industry in more than 100 countries. Through its meetings, publications, and programs, GSA enhances the professional growth of its members and promotes the geosciences in the service of humankind. Headquartered in Boulder, Colorado, USA, GSA encourages cooperative research among earth, life, planetary, and social scientists, fosters public dialogue on geoscience issues, and supports all levels of geoscience education. Please direct inquiries about the GSA or this position statement to Kasey White, GSA's Director for Geoscience Policy, at +1-202-669-0466.



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Soils and Soil Processes: A New Interdisciplinary Interest Group at GSA

Michael H. Young, *Bureau of Economic Geology, The University of Texas at Austin, USA*

Steven G. Driese, *Department of Geology, Baylor University, USA*

Patrick J. Drohan, *Department of Ecosystem Science and Management, Pennsylvania State University, USA*

Last November, GSA Council approved the first GSA Interdisciplinary Interest Group (IIG). The new IIG, *Soils and Soil Processes*, was created to better link multiple GSA Divisions, including Hydrogeology, Quaternary Geology and Geomorphology (QG&G), Sedimentary Geology, Environmental and Engineering Geology, Planetary Geology, and Geology and Health—quite a few Divisions relate to soils in some way, and this IIG will better connect them on an interdisciplinary platform.

Why was this effort taken? The growing recognition of soil as a mediator of many geological, hydrological, and biogeochemical processes in the biosphere is driven by global challenges that are the focus of GSA. These range from climate change to food security and from energy and water resources to geological hazards and ecosystems. The evolving soils community is expanding beyond traditional links with agriculture and pedogenic processes and (re-)connecting with geosciences. This natural partnership drove the soils IIG initiative. Strengthening ties across disciplines is critical for the relevance of most scientific communities, but particularly for the geologic and soils communities, where scientific and societal issues related to the biosphere are more challenging than ever. Some issues with particular interdisciplinary solutions include land stewardship, water quality and quantity, carbon cycling, and paleoclimate reconstruction. An IIG soils group at GSA offers numerous advantages and opportunities for the professional preparation of broadly trained current and future students focusing on biosphere processes.

Other scholarly organizations have recognized the importance of soil processes as well and have embraced the organization of like-minded members into committees. For example, the American Geophysical Union (AGU) recently approved a technical committee named “Soil Systems and Critical Zone Processes.” This Committee links AGU’s biogeosciences and hydrology sections, and was instrumental in highlighting soil processes through a recent Chapman Conference and AGU’s Fall 2013 meeting, in what AGU calls the “Global Soils SWIRL.” This SWIRL integrated the broader scientific concepts of soil across the AGU meeting. Efforts like this are making a significant difference in the visibility and appreciation of soils and soil processes and their value in solving the myriad of scientific issues related to the

biosphere. The creation of a soil-related interest group at GSA heightens the visibility of shallow earth processes and invites collaboration between the soils and geosciences communities.

IIG Goals and Structure

All Divisions or Interest Groups operate with specific goals. For the Soils IIG, our goals are to reach out and communicate the value of soils in Earth’s processes to current and future members of GSA; to support interdisciplinary activities within GSA and inter-organizational activities with other scholarly organizations, specifically the Soil Science Society of America; and to organize scholarly activities (symposia, special sessions, other event) and communications (publications) related to soil and geological sciences. Specifically related to the last goal, the IIG is sponsoring several soil-related special sessions at the upcoming 2014 GSA Annual Meeting in Vancouver that will match other sessions proposed within existing GSA specialty science Divisions.

Three people currently lead the group (which already has over 60 members, as of mid-January 2014): Chair Michael H. Young, Outreach Coordinator Steven G. Driese, and Community Administrator Patrick J. Drohan. All interested GSA members are encouraged to join the Soils and Soil Processes IIG and provide ideas and energy to ensure that the group continues to grow and benefit the Society. Log in to GSA’s Connected Community website at <http://community.geosociety.org/> and join our soils group to stay connected to our science and stay informed of meetings, sessions, and events!



2014 Section Meeting Calendar

www.geosociety.org/Sections/

SOUTHEASTERN SECTION



Blacksburg, Virginia, USA

10–11 April 2014

Skelton Conference Center at Virginia Tech

Local Committee chair: Robert Tracy

Blue Ridge Mountains, Shenandoah National Park, Virginia. Photo by Amrinder Arora; used with permission of Wikimedia Commons.

NORTH-CENTRAL SECTION



Lincoln, Nebraska, USA

24–25 April 2014

Cornhusker Marriott

Local Committee chair: Matt Joeckel

Chimney Rock National Historic Site, Morrill County, Nebraska. Photo by Allen Stutheit; used with permission of Wikimedia Commons.

ROCKY MOUNTAIN/ CORDILLERAN SECTIONS



Bozeman, Montana, USA

19–21 May 2014

Montana State University,

Strand Union Building

Local Committee chairs: Dave Lageson
and Jeff Vervoort

Early registration deadline: 14 Apr. 2014

Grinnell Glacier, Glacier National Park, Montana. Public domain.

2014 GSA Section Meeting Mentor Programs

Plan now to attend a Roy J. Shlemon Mentor Program in Applied Geoscience and/or a John Mann Mentors in Applied Hydrogeology Program at your 2014 Section Meeting to chat one-on-one with practicing geoscientists. These volunteers will answer your questions and share insights on how to get a job after graduation.

FREE lunches will be served at these mentor programs. Check the meeting website and program to confirm time and location. A reminder will be included on all student badges at the onsite registration desk.

The popularity of these programs means that space is limited, so plan to arrive early, because lunch is first-come, first-served. For further information, contact Jennifer Nocerino at jnocerino@geosociety.org.

► **NEW!**

GSA GEOSCIENCE CAREER PROGRAM WORKSHOP

Students: Are you about to embark on the search for a job? Or are you currently in the job market and want to increase your chances? Would you like some feedback on your résumé and some pointers on approaching your interview? The new GSA Geoscience Career Program will be running free workshops at each of the 2014 Section Meetings designed to help you begin this process. We will discuss cover letters, CVs/ résumés, job hunting skills, and job market statistics.

SOUTHEASTERN SECTION

Blacksburg, Virginia, USA

Shlemon luncheon: Thurs., 10 April

Mann luncheon: Fri., 11 April

NORTH-CENTRAL SECTION

Lincoln, Nebraska, USA

Shlemon luncheon: Thurs., 24 April

Mann luncheon: Fri., 25 April

JOINT MEETING: ROCKY MOUNTAIN AND CORDILLERAN SECTIONS

Bozeman, Montana, USA

Shlemon luncheon: Mon., 19 May

Mann luncheon: Tues., 20 May



www.geosociety.org/mentors/sectionSched.htm



2013 HIGHLIGHTS

Last year was a milestone year for the GeoCorps America program. Through its work on this program, and its sister program Mosaics in Science, GSA was included as a member organization of the 21st Century Conservation Service Corps and became an affiliate member of The Corps Network. In 2013, GeoCorps worked with ten BLM lands, 44 National Parks, and 12 National Forests on 118 geoscience projects on America's public lands. Participants took part in research, monitoring, conservation, and education projects in locations spanning the United States. They monitored the effects of climate change on rivers and glaciers, discovered new dinosaur tracks, assessed potential geological hazards, recorded unique and amazing geological features, and helped share all of this information with the general public. Every day that a GeoCorps participant volunteers on America's public lands, he or she contributes new insights in the geosciences, helps foster a diverse geoscience community, and inspires new advocates of Earth stewardship. Kelli Parsons, David Khambu, Justin Peinado, and Kelly Gray are four of the participants who contributed their time and passion through GeoCorps America in 2013.



Kelli Parsons, Hydrogeologist, U.S. Forest Service, Willamette National Forest, Blue River, Oregon, USA

Parsons surveyed springs in the Middle Fork Ranger District of Willamette National Forest. She collected information on the location of springs, spring types, water temperature, and surrounding vegetation. This springs survey created a baseline for evaluating any changes to the groundwater resources due to impact from visitor use or climate change. In addition, Parsons created a Gold Lake Bog monitoring action plan. Gold Lake Bog is the habitat of the Oregon spotted frog, which the U.S. Forest Service proposed be listed as a threatened species during summer of 2013. The survey and research activities Parsons suggests in this plan would generate information on what unique hydrological features create the frogs' habitat and are linked to the species' success. The information could also help monitor changes in the bog and therefore preserve the habitat of the Oregon spotted frog.



David Khambu, Interpretation Specialist, Bureau of Land Management, Upper Missouri River Breaks National Monument, Fort Benton, Montana, USA

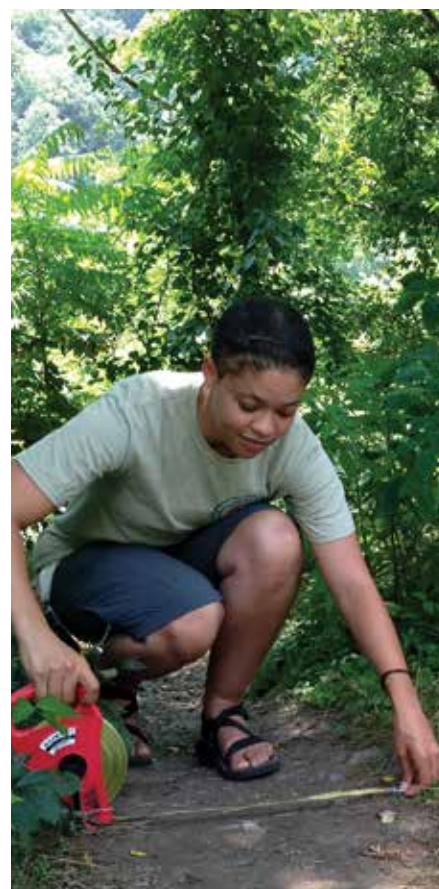
Khambu engaged in a creative way to provide geology education to visitors exploring distant areas of the monument using GSA's EarthCache program. His main project was to create two EarthCache trails for two different audiences. One trail highlighted unique geological features for tourists on a road loop through the Highwood Mountains. The

second trail was designed for fifth-graders taking a canoe trip along the Marias River. Both trails highlighted unique geological features along the route, identified their type, and encouraged visitors to look at the Earth around them in order to learn the story of the landscape's formation. Khambu also identified rocks for visitors when they brought them to the visitor center and explained how the specimens had formed. He helped to transport and catalogue a fossil collection from the local court house and also wrote articles on local geology for *The River Press* in Fort Benton.



Justin Peinado, Cave Surveyor and Data Manager, National Park Service, El Malpais National Monument, Grants, New Mexico, USA

Peinado, a second-time GeoCorps participant, completed an extensive survey and resurvey of the geologically significant features on the lava flows at El Malpais, such as the large lava tube caves. His work required hiking on the lava flow on difficult and inhospitable terrain, sometimes for five miles per day. Peinado recorded the locations and characteristics of unique geologic features, both newly identified and previously recorded, with a hand held GPS. Completing the survey also included doing work to update and correct the information in the GIS Database, where the survey results are stored. When Peinado finished his work at the end of the summer, the database included some 400 unique geological features. In the course of his work, Peinado also came across new archaeological sites. His duties included recording the location of these sites, reporting the information back to archaeologists, and helping them to relocate the site so that it could be properly recorded. Peinado volunteered at the GeoCorps booth at GSA's most recent annual meeting, and presented his 2012 and 2013 GeoCorps work. He also participated in GSA's new "On To the Future" program.



Kelly Gray, GIS Technician, National Park Service, Delaware Water Gap National Recreation Area, Layton, New Jersey, USA

Gray's main project was a survey and assessment of the impact of unofficial, visitor-made trails at the Hialeah Picnic Area and Kittatinny Point Visitor Center. Visitors often forge their own path to the river to swim, creating new trails and potentially impacting local flora. Gray mapped these unofficial trails, recorded their features, and recorded any vegetation in the area that they were affecting. She then used this information to create a map and cross section to help guide the restoration of one of the most damaged areas. Gray also created a base map of the official trails in the park to be used as a starting point in creating an updated trail map for visitors. Her GIS skills were also put to good use bringing the park's database of historically significant buildings and structures up to modern standards, completing a viewshed analysis of land surrounding the park towards assessing the impact of potential development, and recording spatial information for a survey of ash and hemlock trees.

NEW GEOCORPS POSITIONS AVAILABLE FOR FALL/WINTER 2014-2015

Fall/Winter 2014–2015 positions will be posted online at the beginning of May, and applications will be accepted until the beginning of July. GeoCorps positions generally last for three months, offer an allowance for living costs, and in some cases an allowance for housing and/or travel.

For information on the program and how to apply, go to www.geosociety.org/geocorps. You can also visit us on Facebook (www.facebook.com/geocorps), follow us on Twitter (www.twitter.com/geocorps), and contact us at geocorps@geosociety.org.



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GSA FOUNDATION UPDATE

P. Geoffrey Feiss, GSA Foundation President

Student Support of GSA



Last year, 6,032 individual gifts—from nearly 20% of GSA's active members—were received by the GSA Foundation in support of the myriad activities of GSA. This is a tribute to both the high quality of GSA's programs, which inspire members to consider additional support beyond their dues, as well as to the deep sense of commitment GSA members have to furthering the work of the Society on behalf of all geoscientists.

As I expect many of these generous donors know, a significant portion of these gifts support the activities of GSA's student members. This may be through On To the Future, student research grants, career mentoring events, field camp

scholarships, or internships on public lands through GSA's GeoCorps™ America program. Other gifts underwrite student travel to the GSA Annual Meeting, to Section Meetings, and to international meetings.

What I suspect few GSA members realize is that included in these 6,032 gifts are 1,299 (21.5%) contributions from GSA's student members. While the actual dollar amount, predictably, may not be as proportionally large as the contributions from professional members—we all can recall how little spare cash we had as students—I believe this demonstration of confidence in GSA by our youngest and newest members and the future leaders of the profession is a graphic tribute to the impact of GSA's privately supported programs on all GSA members.

If you are one of our student supporters, thank you so much for your contribution. Your gift, no matter the size, gives me a sense that we are on the right path to meeting the needs and gaining the confidence of our profession's future practitioners.

To make a contribution to the GSA Foundation via our secure site, please go to gsafweb.org/makeadonation.html or contact GSA Foundation Director of Development Chris Tallackson at +1-303-357-1007, ctallackson@geosociety.org.



2014 GSA ANNUAL MEETING & EXPOSITION

Find Treasures at the GSA Foundation's Silent Auction

Thanks to everyone who supported the GSA Foundation's 2013 Silent Auction in Denver. We had an amazing event! Funds raised helped support *On To the Future*, GSA's Diversity in the Geosciences project to bring 125 students from underrepresented geosciences groups to their first annual meeting. The remarkable attendance at the anniversary event helped increase awareness of the Foundation's fundraising mission in support of Society-wide projects and programs.



Donate to the Foundation's Silent Auction

We're seeking items that broadly pertain to the geosciences:

- Geo-gifts, jewelry, and apparel donations are great for our pre-holiday meeting;
- Help us build our "well-equipped geoscientist" with tools, field gear, supplies, software;
- Donate geologic specimens, gems, and fossils;
- Contribute to our selection of wine and wine accessories;
- Give gift certificates (i.e., Amazon, special events, trips, restaurants); and
- Remember that GSA meeting attendees love books.

Proceeds from this year's Silent Auction will help support GSA's Diversity Committee's projects.

Visit us in Vancouver.

Browse! Bid! Buy!

Contact: GSA Foundation Silent Auction, Ann Crawford,
acrawford@geosociety.org, +1-800-472-1988 ext. 1053.

In Memoriam



GSA regrets to report the deaths of the following members. Notifications were received between 1 Nov. 2013 and 31 Jan. 2014.

Aureal T. Cross

East Lansing, Michigan, USA
Date of death: 1 Dec. 2013

Michael J. Kennedy

Blackrock, Ireland
Date of death: 24 July 2013

Randall J. Weege

Florence, Wisconsin, USA
Date of death: 25 Dec. 2013

John C. Dohrenwend

Moab, Utah, USA
Date of death: 21 April 2013
GSA notified 8 Nov. 2013

Jay C. Nania

Houston, Texas, USA
Date of death: 18 March 2013
GSA notified 3 Dec. 2013

Charles B. Wheeler

Miami, Florida, USA
GSA notified 2 Jan. 2014

Donald L. Everhart

Grand Junction, Colorado, USA
GSA notified 6 Jan. 2014

Boris Sergeevich Sokolov

Moscow, Russia
Date of death: 1 Sept. 2013

John G. Fuller

Tunbridge Wells, Kent, UK
GSA notified: 6 Jan. 2014

James D. Vine

Brawley, California, USA
GSA notified 7 Jan. 2014



To honor a friend or colleague with a GSA Memorial, please go to www.geosociety.org/pubs/memorials/mmlGuid.htm to learn how. Contact the GSA Foundation, www.gsafweb.org, if you would like to contribute to the Memorial Fund.

FIELD OPPORTUNITIES

GSA/ExxonMobil Field Awards

Deadline to apply: 18 April

The importance of field schools to practicing geologists is unquestionable; yet, the opportunities to experience field geology are dwindling. The Geological Society of America (GSA), in cooperation with ExxonMobil, is currently offering three programs to support and encourage field geology. This non-profit/industry collaboration has proven very successful, and each year more than 600 geology students and professors apply for these awards.

THE GSA/EXXONMOBIL BIGHORN BASIN FIELD AWARD

This is a one-week field seminar that offers 20 undergraduate and graduate students and five faculty members a chance to receive a high-quality educational experience in the spectacular Bighorn Basin of north central Wyoming, USA. The course is free to accepted participants, and all transportation, meals, and living expenses are covered. The seminar focuses on multidisciplinary integrated basin analysis and enables awardees to study exposures of individual hydrocarbon system play elements, such as source, seal, reservoir and structure, within a prolific hydrocarbon basin. For more than a century, the Bighorn Basin has been studied by academic, industry, and government geoscientists, who have focused on the exceptional outcrop exposures, as well as subsurface borehole and seismic data. Our current understanding of the basin derives from both industry and academic perspectives. This seminar is team taught by four ExxonMobil professionals, who represent more than 100 years of combined research in integrated basin analysis, with specific skills in tectonics, geochemistry, structure, sequence stratigraphy, sedimentology, paleontology, hydrocarbon systems analysis, and integrated play analysis. GSA will select the awardees and handle all logistics.

What people are saying:

"It was one of the most invaluable experiences of my lifetime."

*"That was a fantastic course.
I learned so much! It was an honor to go."*



THE GSA/EXXONMOBIL FIELD CAMP SCHOLAR AWARD

This award provides undergraduate students US\$2,000 each to attend the field camp of their choice, based on diversity, economic/financial need, and merit. Funds for this award have been provided by ExxonMobil; selections of awardees are completed by GSA.

What people are saying:

"The experience was unforgettable. The scholarship afforded me this great opportunity to strengthen my education, which I would otherwise have not been able to finance. I am truly grateful."

"For me, this was a once in a lifetime experience, and having spent an entire summer in this immersive program has laid a solid foundation as I move forward in my career as a glaciologist. Thank you for providing me the financial support in this vital step of my academic career."

THE GSA/EXXONMOBIL FIELD CAMP EXCELLENCE AWARD

This award provides one geologic field camp leader US\$10,000 to assist with his or her summer field camp based on safety awareness, diversity, and technical excellence.

Supported by

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<https://rock.geosociety.org/ExxonMobilAward/index.asp>

ON TO THE FUTURE Returns

The Geological Society of America will once again run the very successful On To the Future (OTF) diversity program at this year's annual meeting. OTF aims to provide partial financial assistance to 125 diverse geoscience students to help them attend their first GSA Annual Meeting—this year in Vancouver, British Columbia, Canada, 19–22 October. Please visit <http://community.geosociety.org/OTF/home/> for program information and eligibility requirements.

Questions?

Please contact Tahlia Bear at tbear@geosociety.org.



3rd International EarthCache™ Mega Event

Vancouver Island, British Columbia, Canada
11 October 2014

EarthCache gets people out in the field to learn about their planet first-hand. Participants in this annual event will learn all about EarthCaching, interact with EarthCachers from around the globe, meet EarthCache developers and reviewers, find local EarthCaches, and engage in many other exciting and educational activities. For details, go to www.earthcache.org or contact Gary Lewis at glewis@geosociety.org.

LET EARTH BE YOUR TEACHER!



GEOCORPS™ AMERICA

Fall/Winter 2014–2015

Application deadline: 1 July

The next GeoCorps America fall/winter season runs from September 2014 through May 2015. All fall/winter GeoCorps positions will appear on the GeoCorps website and open for application starting 1 May.

GeoCorps America provides paid, short-term geoscience opportunities on public lands managed by the National Park Service, the U.S. Forest Service, and the Bureau of Land Management. All levels of geoscientists—students, educators, professionals, retirees, and others—are encouraged to apply.



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www.geosociety.org/geocorps www.facebook.com/GeoCorps

Top and bottom: Cassi Knight, Grand Canyon National Park, 2013. Middle: Erin Smith, Mount Rainier National Park, 2013.

CALL FOR NOMINATIONS

2015 Officers and Councilors

Deadline: 15 July

The GSA Committee on Nominations requests your recommendations for GSA Officers (Vice President/President-Elect and Treasurer) and Councilors to serve beginning in 2015. Each nomination should be accompanied by basic data and a description of the individual's qualifications. You can access the online nomination form at www.geosociety.org/aboutus/officers.htm or you may send nomination materials to Pamela Fistell, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA, pfistell@geosociety.org.

► NOTICE ◀

Spring 2014 GSA Council Meeting

GSA Council will meet on
Saturday, 26 April, 9 a.m.–4:30 p.m. and
Sunday, 27 April, 7 10:30 a.m.

The GSA Corporate meeting will be
Saturday, 26 April, 4:30–5 p.m.

All meetings will be held at the GSA Headquarters located at 3300 Penrose Place, Boulder, Colorado, USA. Contact info: +1-303-357-1000, option 3; +1-888-443-4472; slofton@geosociety.org.

Meetings of the GSA Council are open to Fellows, members, and associates of the Society, who may attend as observers, except during executive sessions. Only councilors and officers may speak to agenda items, except by invitation of the chair.



GSA ELECTIONS

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

By now, you will have received a postcard with instructions for accessing your electronic ballot via our secure website, and

biographical information on the nominees will be online for you to review at that time. Paper versions of both the ballot and candidate information will also be available.

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

2014 OFFICER AND COUNCIL NOMINEES

PRESIDENT

We congratulate our incoming President (July 2014–June 2015), who was elected by GSA membership in 2013: **Harry (Hap) Y. McSweeney Jr.** of the University of Tennessee–Knoxville.

VICE PRESIDENT/PRESIDENT ELECT

(July 2014–June 2016)

Jonathan G. Price

Jonathan G. Price, LLC
Reno, Nevada, USA

TREASURER

(July 2014–June 2015)

Bruce R. Clark

The Leighton Group Inc.
Irvine, California, USA

COUNCILOR POSITION 1

(July 2014–June 2018)

Aaron Cavoie

University of Puerto Rico–Mayagüez
Mayagüez, Puerto Rico

Anke M. Friedrich

Universität München
Munich, Germany

COUNCILOR POSITION 2

(July 2014–June 2018)

Timothy Bralower

Pennsylvania State University
State College, Pennsylvania, USA

Shuhai Xiao

Virginia Polytechnic Inst. and State University
Blacksburg, Virginia, USA

COUNCILOR POSITION 3

(Section Representative to Council)

(July 2014–June 2018)

Stephen G. Pollock

University of Southern Maine
Gorham, Maine, USA

Alan E. Kehew

Western Michigan University
Portage, Michigan, USA

Ballots must be submitted electronically or postmarked by 6 April 2014.

www.geosociety.org/aboutus/officers.htm

Classified Rates—2014

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

Classification	Per Line for 1st month	Per line each add'l month (same ad)
Positions Open	\$9.10	\$8.85
Fellowship Opportunities	\$9.10	\$8.85
Opportunities for Students		
First 25 lines	\$0.00	\$5.00
Additional lines	\$5.00	\$5.00

Positions Open

FULL-TIME TEMPORARY (ONE ACADEMIC YEAR) NON-TENURE TRACK POSITION STRUCTURAL GEOLOGY MILLERSVILLE UNIVERSITY

Millersville University welcomes applications for a full-time temporary (one academic year) non-tenure-track faculty position in Structural Geology. Millersville University, highly regarded for its instructional quality and strong commitment to

diversity, is a student-centered institution and one of 14 institutions of the Pennsylvania State System of Higher Education. The campus is located in historic Lancaster County within a short drive of Baltimore, Philadelphia, Washington, New York, and the Atlantic Ocean. Millersville enrolls approximately 9,000 undergraduate and graduate students and has over 900 full-time employees, and is nationally ranked as one of the top regional public institutions of higher learning by *U.S. News & World Report*. The Department of Earth Sciences offers a traditional BS-Geology degree, plus a BA in Earth Sciences with an option in environmental geology. Additional information about the program can be found at www.millersville.edu/esci/. To see the full job description, the required and preferred qualifications, and to create a faculty application, go to <http://jobs.millersville.edu/postings/611>. Full consideration will be given to applications received by 14 April 2014. An EO/AA institution, www.millersville.edu.

Opportunities for Students

MS Research Assistantship. Georgia State University, Atlanta, Georgia, USA. We have an opening for a MS student to join an NSF-funded team investigating the mineralogy and geochemistry of authigenic clay minerals in East Africa. This project is part of a major international effort by dozens of scientists around the world to understand late Cenozoic environmental change and the evolution of homi-

nins and other vertebrates. The assistantship is in the Department of Geosciences, funded at \$10,000 per year, covering all tuition and fees, and research costs. The student will prepare and analyze samples using state-of-the-art X-ray diffraction and geochemical facilities, and assist with other field and lab work. Requirements are a BS in Geology or related field, experience or interest in clay mineralogy and low temperature geochemistry. For more information, please contact Dr. Dan Deocampo at deocampo@gsu.edu.

Note Cards

GSA publications have sported stunning cover images over the years, and we have chosen ten of them for these note cards. Blank inside for your personal message.

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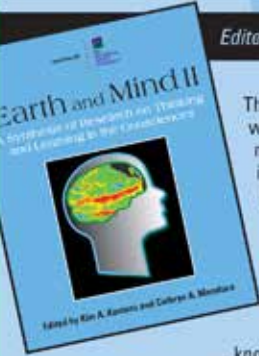
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SPECIAL PAPER 486

Earth and Mind II


A Synthesis of Research on Thinking and Learning in the Geosciences

Edited by Kim A. Kastens and Cathryn A. Manduca



This volume explores the distinctive ways in which geoscientists use the human senses and mind to perceive, analyze, and explain the workings of the Earth system, and then builds on those insights to suggest how to help students master the thought processes of the geosciences. Written by teams of geoscientists and cognitive scientists, the discussion includes spatial thinking, temporal thinking, systems thinking, field-based teaching and learning, the nature of expertise in geosciences, and knowledge integration in geoscience education.

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GSA Publications Highlights

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2014 GSA GeoVentures

Because the best geologists have seen the most rocks!



- **The Geology of Canyon Country, Moab, Utah:** 11–17 May (S, G, R)
- **Geology of Dinosaur National Monument, Yampa River Trip:** 5–11 June (S, G, R)
- **Survey of Colorado's Mining Geology, Colorado Springs, Colorado:** 22–28 June (S, G, R)
- **Explore Dynamic Iceland*:** 27 July–7 August (S, G, R)
- **Explore Hawaiian Volcanoes for College Students II:** 27 July–4 August (S)
- **Explore Hawaiian Volcanoes for K–12 Teachers:** 6–13 August (T)
- **Geocaching on an Active Volcano:** 8–15 November (EC)

CONTACT Gary Lewis, glewis@geosociety.org, for more information on these GeoVentures, or go to www.geoventures.org.

*Waitlist only; EC—EarthCache; G—geoscientists; R—rockhounds; S—students; T—teachers.



And you thought the Midwest didn't have amazing geology!

2014 Field Camps for K–12 Teachers

- **Illinois Basin:** 15–19 June
- **Rocky Mountain:** 21–26 June
- **Mammoth Cave:** 14–19 July



Mammoth Cave National Park. Image courtesy Wikimedia Commons.

CONTACT Davida Buehler, dbuehler@geosociety.org, to learn more about these field camps, or go to www.geoventures.org and click on “Teacher Trips.”

www.geoventures.org www.facebook.com/GSAGeoVentures

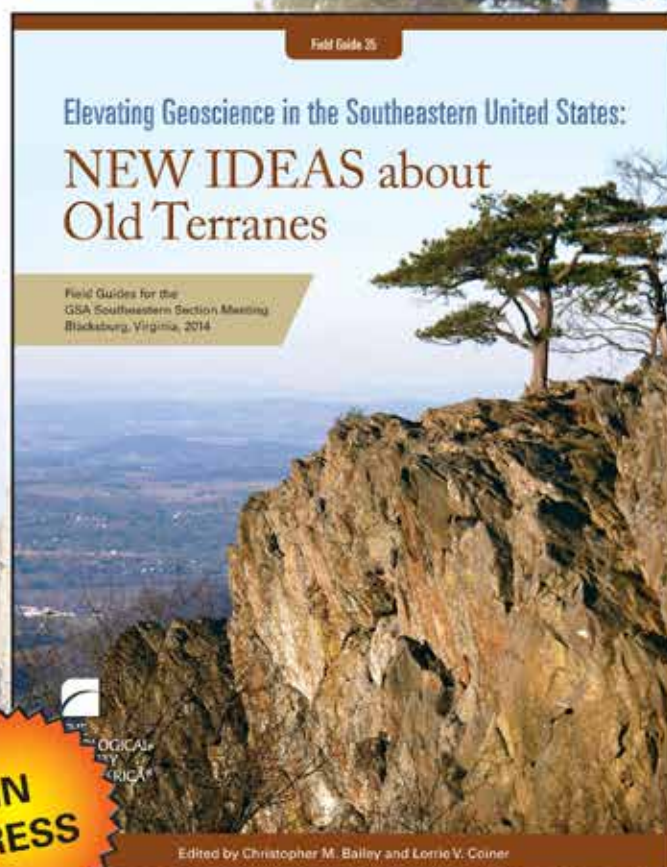
Elevating Geoscience in the Southeastern United States: NEW IDEAS about Old Terranes

Field Guides for the
GSA Southeastern Section Meeting
Blacksburg, Virginia, 2014

Edited by Christopher M. Bailey
and Lorrie V. Coiner

This volume includes 10 field guides that explore the diverse geology of the southern and central Appalachians. These guides examine both ancient rocks and modern landscape processes, highlighting new research ideas regarding these old terranes. Three guides focus on the geology of the Appalachian Plateau and Valley and Ridge, considering topics such as the enigmatic Eocene igneous rocks, the gas-rich Marcellus and Millboro Shales, and new models for karst formation. The 2011 M5.8 Mineral, Virginia, earthquake literally shook up our understanding of the Piedmont and two guides focus on new research in the epicentral region. Two guides take in the Paleozoic to Proterozoic geology of the Blue Ridge province. The volume is rounded out by three guides focused on Mesozoic geology, including the world-class Lagerstätte fauna in the Dan River basin, a unique uranium deposit at Coles Hill, Virginia, and the tectonics of the Scottsville Basin.

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