We will be back in State College again! The first Field Conference of Pennsylvania Geologists, whose participants are seen here in 1931, was headquartered in State College and featured 5 different trips, which included rocks from the Devonian to the Ordovician, and everything from aggregates to thrust faults. The 82nd Field Conference will have 5 new trips, some of which will highlight new technologies and initiatives in hydrogeology, and which will cover the Devonian to Ordovician stratigraphy that makes the Nittany Valley famous (see announcement on page 8).
EDITORIAL

It’s All About the People
Gale C. Blackmer, State Geologist
Pennsylvania Geological Survey

May 6, 2017, was State Employee Recognition Day in Pennsylvania. I would like to take this opportunity to recognize the fine staff of the Pennsylvania Geological Survey. These dedicated people work hard every day to bring you the geological information that helps keep Pennsylvania’s economy humming and its citizens safe. Their feet beat mud, pavement, forest floors, and carpets. They work outside in heat, cold, rain, hot sun, and on lovely soft spring days. They work inside when they would rather be outside. They joust with uncooperative computer networks, recalcitrant software applications, and bureaucracy. They give their own time on evenings and weekends for outreach events and to do what it takes to get the job done. They experience the pleasures of geologic puzzles solved, projects successfully completed, and satisfied customers. They love their work. Some days they marvel that we get paid to do this; other days make up for that, and then some. Every day, they earn their keep. You will find their names listed on page 16. Our newest addition, Sim Suter, is also introduced in this issue.

Some of our employees love their work so much that they continue to volunteer after they retire. Former State Geologist Don Hoskins comes back to mentor younger geologists, partnering with our staff on mapping projects and teaching interns and other volunteers valuable field skills. They benefit from his vast experience, and he has helped to complete maps of several quadrangles. John Barnes, our most recent retiree, had his last paid workday on a Friday and was back in the lab on the following Tuesday. Of course, he now works on his own schedule and primarily on projects that he finds particularly interesting. John Harper, who retired as the manager of the Pittsburgh office, continues to lend his expertise on a variety of projects related to Devonian shales. He tracks unconventional wells, and pursues his interest in historical oil and gas drilling in Pennsylvania. You are reading this magazine because of the efforts of Anne Lutz, retired paleontologist and geological editor. She compiles and edits every issue. We couldn’t do it without her. Amy Randolph, retired from the Bureau of Forestry’s Minerals Division, is helping to organize and consolidate our files of water-well records. It is not unusual to see Jay Parrish, Bob Smith, Vik Skema, Jon Inners, or Bill Bragonier in the building, pursuing some line of interest that there wasn’t time to follow when they were actively employed. We also have volunteers who have never been employed by the Bureau. Some are geologists who come here to keep their hand in the work they love as they pursue other opportunities; others are nongeologist friends who lend their considerable organizational skills to our collections and library. The contributions made by all of these volunteers to the agency, the Commonwealth, and to us as individuals are invaluable.

(continued on page 9)
A Probable Protosuchian (Crocodilian) Footprint from the Late Triassic in South-Central Pennsylvania

Jeri L. Jones¹, Roger J. Cuffey², and Kathy Gordon³

Triassic Footprints in Pennsylvania

The Triassic rift basins along the east coast of North America (Weishampel and Young, 1996, p. 35) have long been famous for their fossil dinosaur and related footprints and trackways, first published on in the early nineteenth century as paleontology was becoming a modern science. By far most of the study of these has been carried out in the Connecticut River valley of western Connecticut and Massachusetts, but some prints have also been recorded in the Gettysburg basin in south-central Pennsylvania (Cuffey, 2008, p. 130–132; Cuffey and others, 2006, p. 13–14; Jones, 2000; Weems and others, 2014; Weishampel and Young, 1996, p. 41, 62–64, 66–67, 77, 90, 92–94, 97–98, 181–183, 228–229, 236–237).

Discovery and Significance

A partial fossil footprint was found by Kathy Gordon in East Manchester Township, west of Manchester north-northeast of York, all in York County, south-central Pennsylvania. This happened as a trench was being dug on the Gordon property as part of an electrical upgrade near the junction of Conewago and Little Conewago Creeks (Figure 1). The footprint’s finder is a citizen collector who regularly looks for curious or suspicious markings on local rocks.

The footprint is preserved in a light-gray sandstone. Stose and Jonas (1939) and Berg and others (1980) show the bedrock there to be low in the Upper Triassic sequence in the middle of the New Oxford Formation, of mid-Carnian age or early in Late Triassic time.

We have tentatively identified this new footprint as most likely that of a protosuchian, a primitive crocodile, which is significant inasmuch as this represents the first record of such an animal in the Gettysburg basin Triassic rocks that we are aware of. Protosuchian remains have also been found in the Connecticut Valley and in Arizona.

It is interesting to note that reptilian bones and Triassic flora have been previously identified from near the junction of the Little Conewago and Conewago Creeks (Wanner and Fontaine, 1900). Also, petrified wood has been collected by one of the authors (Jones) in the immediate area.

Morphology and Identification

Showing the exact appearance of the new footprint is best done photographically (Figure 2) rather than verbally, except for noting that it is likely of a rear foot and shows a probable heel print and the bases of four toes, an inference based on comparison with the figures used in identifying the footprint taxonomically (see below).

¹Jones Geological Services, 2223 Stoverstown Road, Spring Grove, PA 17362; jonesgeo@comcast.net.
²Department of Geosciences, 412 Deike Building, The Pennsylvania State University, University Park, PA 16802; rcuffey@psu.edu.
³Manchester, Pa.
Fossil footprints are commonly published as line drawings having the overall outline and depressions or rises within them crisply indicated. However, many fossils are not as clearly delineated as those drawings suggest, and thus identification of a particular specimen may be quite difficult. Morphologic features of the animal’s foot and its stance at the time interact with the texture, moisture content, and firmness of the sediment to produce considerable variation among the prints preserved even along a single clear trackway, let alone off in isolation. Lucas (2007, p. 169–176) discussed the formation and preservation of dinosaur-era footprints.

Taxonomic identification of fossil footprints is done the same way as for any fossil organism. One compares one’s specimen with published illustrations and descriptions of all previously known materials, paying particular attention to overall shape, dimensions, subtle similarities and differences in proportions, curvatures, angles, and lengths. Such inspection of the footprint literature reveals many combinations of these characteristics, so that numerous species and genera can be differentiated and the most appropriate one thereby recognized.

Comparison with the available literature on all the Early Mesozoic footprint fossils so far described and illustrated results in two possibilities independently, which turn out to belong to the same taxonomic group, encouraging more confidence in these being reliable identifications and assignment.
The new footprint appears to be either *Cheiroletheroides pilulatus* Hitchcock or *Batrachopus deweyi* Hitchcock, both of which represent protosuchian crocodiles. The *Cheiroletheroides* species was figured by Lull (1953; p. 240, Figure 110; p. 241, Figure 111), Haubold (1971; p. 61, Figure 37–4), and Haubold (1984; p. 158, Figure 105–3). The *Batrachopus* one was illustrated by Olsen and Padian (1986; p. 265, Figure 20.6C; p. 267, Figure 20.9) and Haubold (1986; p. 197, Figure 15.7H). None of the other identification possibilities (phytosaurs, *Brachycheirotherium*, and dinosaurs) matches the comparative characteristics as well as these two.

**Protosuchian Classification and Relationships**

In recent years, the higher-level classification of fossil reptiles has undergone significant changes, some quite controversial and not universally accepted. Since the present paper does not directly bear on such developments, the more stable traditional classification is followed below, in line with the references cited in the following paragraphs.

The class Reptilia includes several subclasses, one of which is the Archosauria or “ruling reptiles.” Protosuchians are down near the base or beginning of the great archosaur radiation that went on to dominate the Mesozoic Era (Benton, 2000, p. 231–232; Carroll, 1988, p. 278, 281, 620; Romer, 1966, p. 142, 368).

All the archosaurs evolved from an order (taxonomic group) of small- to medium-sized reptiles known as the Thecodontia, named for having their teeth set into sockets in the jaw bones (Carroll, 1988, p. 268–269; Romer, 1966, p. 137), a trait also seen in some other reptile groups. Early in the Mesozoic, thecodonts evolved into several other successful orders (dinosaurs, pterosaurs, and so on) including the Crocodilia (sometimes spelled Crocodylia), which are the only archosaurs surviving to the present. Interestingly, before the crocodilians, one group of thecodonts, the phytosaurs, also took on a crocodile-like body form, and some of the Connecticut Valley footprints (shaped differently from the new footprint here) have been attributed to them.

The earliest, most primitive, or “basal” crocodiles are the Protosuchia, which can be understood best as the transitional group between the thecodonts and the later crocodilians, which further evolved into several different suborders or different types of crocodiles (Figure 3).
Protosuchians in Life

The best way to visualize what a protosuchian looked like during life (Figure 4) is to imagine a small crocodile, slimmer than modern ones, and walking around on short legs held vertically upright underneath the body (rather than splaying out to the sides in a sprawling manner). It probably spent its time mostly on land instead of in swamps or water.

Later crocodiles became larger, their limbs were sprawled out to the sides (because they could not hold up the weight of the larger body), and they usually lived in swamps or along riverbanks (where the water could help carry their increased weight).
Conclusion

A newly discovered fossil footprint near Manchester (York County, Pa.) in the early Late Triassic New Oxford Formation appears to be the first known find in the Gettysburg basin of a protosuchian or primitive crocodile, probably a species of either *Cheirotheroides* or *Batrachopus*. A find like this should encourage people to keep looking for more fossil footprints in the area and to call on professional geologists or paleontologists for assistance if any are encountered.

References

ANNOUNCEMENT

The 82nd Annual Field Conference of Pennsylvania Geologists

The 82nd Annual Field Conference of Pennsylvania Geologists, Recent Geologic Studies and Initiatives in Central Pennsylvania, will be held on October 5–7, 2017, and will be headquartered in the Ramada Inn, State College, Pa. (see page 1 for a photograph of participants at the very first Field Conference, which was also headquartered here). We will have four buses this year and will split the attendees into two groups, two buses each. On day 1 (Friday morning), both groups will travel to the first stop for a brief orientation on the geology (emphasizing the stratigraphy, structure, and geomorphology) of Nittany Valley from the Joe Hayes lookout on Tussey Mountain. Thereafter, Group 1 will proceed on to the Shale Hills Critical Zone Observatory for the rest of the morning and relocate at the pavilion for lunch at nearby Lake Perez. Group 2 will travel on to Huntingdon to examine outcrops of the Marcellus Shale, plumose joints in the Brallier Sandstone, and thin-skinned deformation in the shoaling-upward tidalite cycles of the Wills Creek Formation. After lunch, Group 1 will go to Huntingdon and Group 2 will visit the Shale Hills Critical Zone Observatory. On day 2 (Saturday), the groups will be segregated into disciplinary preference themes of (a) an environmental/hydrogeology all-day excursion on the hydrogeology of the Nittany Valley and the Penn State Sustainability Initiative, or (b) stratigraphy/engineering geology in the Loysburg Formation; the evolution of Nittany Mountain; and Skytop—a confrontation between civil engineering and geology.
Pre-conference field trips (and their leaders) may include:

- Pb-Zn deposits in Sinking Valley (George Pedlow)
- The Middle Ordovician carbonate section exposed in the Pa. Route 453 roadcut at Union Furnace (Chris Laughrey and John Harper)
- Sinkholes and drone development for mapping (Doug Miller)
- Artifacts and the source materials in Centre County (Barry Scheetz)
- The Arboretum at Penn State (staff plus Duff Gold)
- Kayaking (Albert Mabus and Warren Fox)
- Mountain biking on Tussey Mountain (Mike Canich)
- Horseshoe Curve and the Hughes borehole (Steve Lindberg)

Call for Posters or Vendors for Thursday Night: If you are interested in presenting a poster, becoming a sponsor, or having a vendor table during the Thursday night reception, please contact Kristen Hand at khand@pa.gov, 717–702–2046.

Registration for this Field Conference will open August 1, 2017, at 8:00 a.m. More information about this and previous conferences can be accessed through our website at http://fcopg.org/, or you can ask to be added to our email list by contacting Stephen Shank at stshank@pa.gov.

Contacts: Katherine Schmid, Chair, 412–442–4232, kschmid@pa.gov; Kristen Hand, Vice Chair, 717–702–2046, khand@pa.gov; Stephen Shank, Secretary, 717–702–2021, stshank@pa.gov; Connie Cross, Treasurer, 717–702–2054, ccross@pa.gov.

Editorial (continued from page 2)

State employees get a bad rap in some quarters. I can attest that the staff of our Bureau and of the Department of Conservation and Natural Resources in general are not stereotypical “state employees.” They are skilled, hard-working people, dedicated to the land and citizens they serve. I thank my lucky stars for the privilege of coming to work every day with the great group of people in our Bureau. I salute them.
BUREAU NOTES

Staff Updates

NEW SUPERVISOR. Simeon B. Suter, P.G., comes to the Bureau with more than 35 years of diverse experiences. After attaining a Bachelor’s degree in geology, he entered the U.S. Marine Corps as a commissioned officer. Sim served for 20 continuous years on both active and reserve duty and retired as a Lieutenant Colonel in December 2002. Among others, his duties included being the Intelligence Officer for a Combat Engineering Battalion, and serving as the only geologist within the Marine Corps Intelligence Activity. Prior to state government service, he completed many geological and environmental investigations as a consultant to industry. This enabled Sim to do some traveling while expanding his capabilities in that several projects were out-of-state. He also served for a few years as the Professional Geologist for the Pennsylvania Department of Environmental Protection (DEP) Storage Tank Advisory Committee.

More recently, Sim has served in the DEP Office of Oil and Gas Management in the Abandoned and Orphaned Well Plugging Program, and he followed this as Chief of the Remediation Contracts Management Section. In this latter capacity, he provided oversight of procurement and management of statewide remediation contracts for investigations and cleanups of contaminated sites. He directed and supervised a staff of contract managers performing administration of contract service expenditures of approximately $17 million per year.

Sim has accepted the assignment to lead the Groundwater and Environmental Geology Section and will be attempting to fill the shoes of Stuart Reese, who recently became the manager of the Geologic Mapping Division (see Pennsylvania Geology, v. 46, no. 4, p. 14). Sim and his bride of almost 34 years reside in Lancaster County; they have two adult children, one granddaughter, and two cats. He is also a life member of the Harrisburg Area Geological Society and has contributed elsewhere in the capacity of science fair judge on many occasions. He has also given presentations on business ethics and has helped to train the next generation of environmental professionals.
NEW RETIREE. After 46½ years with the Pennsylvania Geological Survey, John Barnes retired in early February. John earned degrees in geology from the State University of New York College at Fredonia and the State University of New York at Buffalo and began his career at the bureau straight out of graduate school. From Day One, the main focus of his work at the Survey was in the mineralogy laboratory, where he cared for and operated the bureau’s X-ray diffraction equipment and, after the bureau acquired its first scanning electron microscope in 2002, that, as well. His work in the laboratory provided support for many bureau projects. John also was the author or coauthor of several of the bureau’s popular Educational Series booklets as well as several editions of the *Directory of Nonfuel Mineral Producers in Pennsylvania* and many technical publications. He also spent two years as an editor in the Publications Services group. For the past eight years, he served as chief of the Mineral Resource Analysis Section.

As is true of many of the bureau’s retirees, John’s retirement does not mark the end of his association with us. He has joined the growing corps of Survey retirees who stay on part time as volunteers. His primary focus as a volunteer remains the mineralogy lab, but he plans to help out in other ways as well. Beyond that, he is looking forward to having more time to pursue his other interests, including photography, music, amateur astronomy, and visiting interesting places near and far.

From the Stacks . . .

Jody Smale, Librarian
Pennsylvania Geological Survey

Did you know that the bureau’s library houses thousands of geologic texts and journals? Not only can you find the bureau’s publications dating back to 1858, but you can also find the latest publications from professional geologic organizations such as the American Association of Petroleum Geologists (AAPG), the American Geosciences Institute (AGI), the Geological Society of America (GSA), and the Society for Sedimentary Geology (SEPM).

The library also maintains current subscriptions to professional journals such as AAPG Bulletin, American Journal of Science, American Mineralogist, Groundwater, GSA Bulletin, and The Journal of Geology.
Below are some of the more recent additions to the library’s collection:


A Look Back in Time

Former State Geologist (from 1919 to 1946) George Ashley and others taking in a bird’s-eye view of a quarry during the Association of State Geologists field trip in Berlinsville, Northampton County, Pa. This photograph was taken in October 1925 by former staff geologist Ralph W. Stone. Photograph provided by Jody Smale, librarian, Pennsylvania Geological Survey.

To see more photographs from the bureau’s archives, please visit the library’s Historical Photographs Collection (http://digitalcollections.powerlibrary.org/cdm/search/collection/spgsl-photo) page.
Science Fair Judging

Two of the bureau’s staff geologists, Victoria Neboga and Toni Markowski, ably assisted in category judging of Environmental and Energy–Transportation projects at the 60th Capital Area Science and Engineering Fair (CASEF). The fair was held in Harrisburg on March 22–25, 2017. It is expanding its service, so this year 342 aspiring young scientists from 38 counties, grades 7 through 12, exhibited their projects at the Whitaker Center for Science and the Arts and neighboring Harrisburg University.

Neboga judged seven junior projects, where students showcased their creativity and knowledge in areas such as nanotechnology, air content, chemical weathering, and renewable sources of electricity. Neboga recommended one junior project, “Go with the Flow,” for the Dr. George Hayward Love, Sr., Judges’ Award. Two students studied the water-flow rate through a Kelvin electrostatic generator, which they built by themselves. Another project, where a student studied the health of the Chesapeake Bay’s tributaries, was nominated for the regional award from the Association for Women Geoscientists.

Markowski judged ten senior projects, including three Energy–Transportation and seven Environmental projects. “Predictions of Drought Severity in the Continental U.S.” was nominated for Grand Champion, the Dr. George Hayward Love, Sr., Judges’ Award, and the NOAA (National Oceanic and Atmospheric Administration) and NASA (National Aeronautics and Space Administration) Earth regional awards based on outstanding communication skills and display presentation. Five other candidates worthy of the Dr. Love Judges’ Award included one on the topic of the effect of temperature on electromagnet strength as well as the following four projects. These four were also recommended by Markowski for regional awards, as follows: “How Does Humidity Affect Particulate Matter” (American Meteorological Society award); “Going ‘Green’ When You Clean: How Environmentally Friendly Are Various Household Detergents” (Arizona State University Walton Sustainability Solutions Initiatives award); “Cooling Influences: The Association of Battery Longevity to Temperature” (I-SWEEEP [International Sustainable World Energy, Engineering, and Environment Project] award); and “How Does UV Lighting Affect the Viability of Lithobates (Rana) pipiens Egg Masses” (Society for In Vitro Biology award).

Special awards judge Michelle Bell Curry (Pennsylvania Department of Environmental Protection retiree and Pennsylvania Department of Conservation and Natural Resources conservation volunteer) nominated senior environmental project “It’s All Creek to Me: A Study of Hampden Township Creek Water Quality” for the Harrisburg Area Geological Society Award.

Anyone interested in judging the 2018 CASEF should contact Valerie Knowles (CASEF Director) at 717–724–3892 or casef@whitakercenter.org. For further information about CASEF, see www.casef.org. The projects become more exciting each year!
NEW MINERAL RESOURCE REPORT

In March, the Pennsylvania Geological Survey released **Mineral Resource Report 102, Source Rock Evaluation of the Upper Devonian Genesee, Harrell, and West Falls Formations in Pennsylvania**, by Katherine W. Schmid and Antonette K. Markowski. The report consists of 45 pages of text and eight figures, four tables, four map plates, and an appendix. The appendix is a spreadsheet of total organic carbon (TOC) data and thermal maturity ($R_o$), hydrogen index, and production index results (where available) from 119 Pennsylvania wells.

As of 2017, more than 80 wells have been completed in Upper Devonian organic-rich shales in Pennsylvania. The authors of this report examined three of these units: the Geneseo Shale Member of the Genesee Formation, the Burket Shale Member of the Harrell Formation, and the Rhinestreet Shale Member of the West Falls Formation. Drill cuttings provided by the Pennsylvania Geological Survey were analyzed by external entities for TOC, $R_o$, and mineralogy. The authors compiled the data and created scatter plots comparing TOC to gamma-ray values, TOC to quartz content, and $R_o$ to depth. Relationships of thermal maturity (as evidenced by $R_o$) and TOC to basement structures (cross-strike discontinuities and the Rome trough) are noted, and maps of TOC and $R_o$ show areas of hydrocarbon potential that can be targeted for future production.

**Mineral Resource Report 102** is now available to download from the bureau’s website at [www.dcnr.state.pa.us/topogeoh/publications/pgspub/template/index.htm?id=959](http://www.dcnr.state.pa.us/topogeoh/publications/pgspub/template/index.htm?id=959).

**Outcrop of the Upper Devonian Burket Shale Member of the Harrell Formation in Clinton County, Pa. Photograph by Rose-Anna Behr.**

RECENT PUBLICATIONS

Open-File Miscellaneous Investigations **(February 2017)**

- Water depth of Yellow Creek Lake—Yellow Creek State Park, Indiana County, Pennsylvania


- Source rock evaluation of the Upper Devonian Genesee, Harrell, and West Falls Formations in Pennsylvania
Calling All Authors

Articles pertaining to the geology of Pennsylvania are enthusiastically invited. The following information concerning the content and submission of articles has been abstracted from “Guidelines for Authors,” which can be seen in full on our website at www.dcnr.state.pa.us/topogeo/publications/pageolonline/pageoolguide/index.htm.

*Pennsylvania Geology* is a journal intended for a wide audience, primarily within Pennsylvania, but including many out-of-state readers interested in Pennsylvania’s geology, topography, and associated earth science topics. Authors should keep this type of audience in mind when preparing articles.

**Feature Articles:** All feature articles should be timely, lively, interesting, and well illustrated. The length of a feature article is ideally 5 to 7 pages, including illustrations. Line drawings should be submitted as CorelDraw (v. 9 or above) or Adobe Illustrator (v. 8 or above) files.

**Earth Science Teachers’ Corner:** Articles pertaining to available educational materials, classroom exercises, book reviews, and other geologic topics of interest to earth science educators should be 1 to 2 pages in length and should include illustrations where possible.

**Announcements:** Announcements of major meetings and conferences pertaining to the geology of Pennsylvania, significant awards received by Pennsylvania geologists, and other pertinent news items may be published in each issue. These announcements should be as brief as possible.

**Photographs:** Photographs should be submitted as separate files and not embedded in the text of the article.

**Submittal:** Authors may send their article and illustrations as email attachments to RA-pageology@state.pa.us if the file sizes are less than 6 MB. For larger sizes, please submit the files on CD–ROM to the address given below. All submittals should include the author’s name, mailing address, telephone number, email address, and the date of submittal.

Director
Bureau of Topographic and Geologic Survey
3240 Schoolhouse Road
Middletown, PA 17057
Telephone: 717–702–2017
Department of Conservation and Natural Resources
Bureau of Topographic and Geologic Survey

Main Headquarters
3240 Schoolhouse Road
Middletown, PA 17057–3534
Phone: 717–702–2017 | Fax: 717–702–2065

Pittsburgh Office
400 Waterfront Drive
Pittsburgh, PA 15222–4745
Phone: 412–442–4235 | Fax: 412–442–4298

DIRECTOR’S OFFICE
Director and State Geologist
Gale C. Blackmer 717–702–2017

Administrative Services
Connie F. Cross 717–702–2054
Elizabeth C. Lyon 717–702–2063
Jody R. Zipperer 717–702–2073

GEOLOGIC AND GEOGRAPHIC INFORMATION SERVICES
Michael E. Moore, 717–702–2024

PAMAP and Public Outreach
Helen L. Delano 717–702–2031
GIS Services
Caron E. O’Neil 717–702–2042
Thomas G. Whitfield 717–702–2023

IT and Database Services
Sandipkumar P. Patel 717–702–4277
Mark A. Dornes 717–702–4278
David F. Fletcher 412–442–5826
Library Services
Jody L. Smale 717–702–2020

GEOLOGIC MAPPING
Stuart O. Reese, 717–702–2028

Stratigraphic Studies
Gary M. Fleeger 717–702–2045
Rose-Anna Behr 717–702–2035
Clifford H. Dodge 717–702–2036
Antonette K. Markowski 717–702–2038
James R. Shaulis 717–702–2037

Groundwater and Environmental Geology
Simeon B. Suter 717–702–2047
Aaron D. Bierly 717–702–2034
Kristen L. Hand 717–702–2046
William E. Kochanov 717–702–2033
Victoria V. Neboga 717–702–2026

ECONOMIC GEOLOGY
Kristin M. Carter, 412–442–4234

Mineral Resource Analysis
Leonard J. Lentz 717–702–2040
John C. Neubaum 717–702–2039
Stephen G. Shank 717–702–2021

Petroleum and Subsurface Geology
Brian J. Dunst 412–442–4230
Robin V. Anthony 412–442–4295
Lynn J. Levino 412–442–4299
Katherine W. Schmid 412–442–4232
Renee H. Speicher 412–442–4236