



Arizona Geological Society Newsletter

SEPTEMBER 2017

September 5, 2017 DINNER MEETING *and ANNUAL BUSINESS MEETING*

Who: Victor R. Baker is the featured speaker. See abstract below.

Where: Sheraton Tucson Hotel and Suites, 5151 East Grant Road, (at the intersection of Grant and Rosemont on the North side of Grant in the **SABINO BALLROOM** (enter at northwest corner of the building) and go upstairs to the meeting room.

When: Cash Bar at 6 p.m.—Dinner at 7 p.m.—Talk at 8 p.m.

Cost: Members \$30, Guests \$33, Students Members free with on-line reservation (\$10 without).

RESERVATIONS ARE REQUIRED: Reserve on the AGS website (<http://www.arizonageologicalsoc.org/events>) by **11 a.m. Friday, September 1**. Please indicate Regular (Petit Filet of Beef with a Classic Demi-Glace, Roasted Potatoes, Seasonal Vegetables), Vegetarian (Polenta) or Machaca Chicken Salad meal preference. Please cancel by **Friday, September 1 at 11 a.m.** if you are unable to attend - no shows and late cancellations will be invoiced. (Please call or text David Briggs at 520-784-3954 if you must cancel after the deadline. We may be able to sell your meal and you won't be billed).

ABSTRACT

The Influence of the 18th Century Enlightenment on the Natural Sciences, Especially the Earth Sciences and Evolution

Victor R. Baker, Regents' Professor, Departments of Hydrology and Atmospheric Sciences, Geosciences, and Planetary Sciences, The University of Arizona, Tucson, AZ, 85721-0011

In a famous 1784 essay (Beantwortung der Frage: Was ist Aufklärung?) the great philosopher Immanuel Kant (1724-1804) asked, then answered the question: "What is enlightenment?" Enlightenment, for Kant, is the courageous use of one's own intellect, that is, to think for one's self, thereby to overcome the paternalism of both church and state. Thus, for Kant enlightenment requires freedom of thought and the maturity to exercise that freedom. Of course, these are sentiments that contributed to the American Revolution, and both Kant's essay and the great political revolutions of the 18th century, American and French, are commonly thought to mark the culmination of the formal Age of Enlightenment, also known as the Age of Reason, a period lasting from about 1715 to 1789. This was also the time of extraordinary growth in philosophy, the natural component of which subsequently became known as science.

Much academic history and philosophy of science has focused on the methods of experimental physics, and Enlightenment scholars like Voltaire (1694-1778) emphasized the immense influence of Sir Isaac Newton (1642-1726). Indeed, the Scientific Revolution is thought to have immediately preceded The Enlightenment, encompassing the 17th century, and marked by the works of both Newton and Galileo

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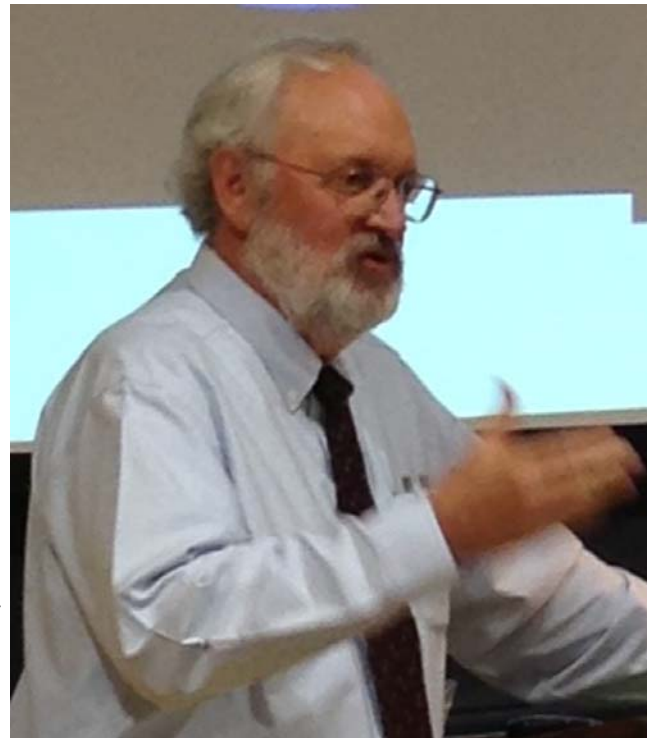
(1564-1642). While The Enlightenment itself is not heralded as a great period for advancements in physics, I will argue that it most definitely was a great formative period for the Earth sciences. Indeed it was the spirit and the ideas of The Enlightenment that led to the most important historical era for geology, 1780-1820, the developments of which are masterfully described in Martin J.S. Rudwick's volumes *Bursting the Limits of Time* and *Ages Before Adam*. It was the Earth science of this period and the exploratory spirit exemplified in the works of Prussian geographer, naturalist, and Romantic philosopher of science Alexander von Humboldt (1769-1859) that arguably inspired the discoveries that brought fame to the only scientist to equal (or surpass) Newton: the evolutionary biologist-cum-geologist Charles Darwin (1809-1882).

In discussing the spirit of reason, exemplified in general by the Age of Enlightenment and more specifically by geological thinking, I suggest that this special kind of thought may well serve as an antidote to the unreason that characterizes what is today being described as the Age of "Post-Truth."

ABOUT THE SPEAKER

Victor R. Baker is Regents' Professor of Hydrology and Atmospheric Sciences, Geosciences, and Planetary Sciences, University of Arizona. He received a B.S. in Geology from Rensselaer Polytechnic Institute in 1967 and a Ph.D. in Geology from the University of Colorado in 1971. After working as a hydrologist and geophysicist for the USGS in New York and Colorado, he was on the faculty of the University of Texas at Austin from 1971-1981, advancing to Full Professor. In 1981 he moved to the Department of Geosciences, University of Arizona, first a Full Professor, and then in 1988 as one of the first University of Arizona's Regents' Professors. From 1996-2004 he was the Department Head of the Department of Hydrology and Water Resources (now Hydrology and Atmospheric Sciences), University of Arizona.

Baker has authored or co-authored more than 1000 scientific contributions, including 18 books, 410 research articles and chapters, more than 520 abstracts and short research reports, 34 extended technical reports; 42 encyclopedia articles; 39 published book reviews; plus guidebook contributions and various other writings, including popular works in science. His research has concerned paleoflood hydrology (a field of study that he defined in the 1970s and 1980s); flood geomorphology; channels, valleys, and geomorphic features on Mars and Venus; catastrophic Pleistocene megaflooding in the northwestern U.S. and central Asia; history/philosophy of Earth and planetary sciences; and the interface of environmental science with public policy. He has served as President of the Geological Society of America (1998), Chair of the American Association for the Advancement of Science Section on Geology and Geography (1992-93 and 2008-2009), and President of the International Union for Quaternary Research Commission on Global Continental Paleohydrology (1995-99). Among his honors are Foreign Membership in the Polish Academy of Sciences (1994); Honorary Fellowship in the European Union of Geosciences (1999); the David Linton Award of the British Society for Geomorphology (1995); the Distinguished Scientist Award (2002) and Distinguished Career Award (2010), both from The Geological Society of America Quaternary Geology and Geomorphology Division; the Inaugural International Lectureship of the Geological Society of America (2012-2013), a Fulbright-Hays Senior Research Fellowship (1979-1980); an Indo-American Fellowship (1987-1988); and professional society Fellowships respectively in the American Geophysical Union, the American Association for the Advancement of Science, The Geological Society of America, and the British Society for Geomorphology. His work on megafloods has been featured in television documentaries for PBS, BBC, and the National Geographic, Discovery, and History Channels, including the 2005 NOVA production "Mystery of the Megaflood" and the upcoming NOVA production "Volatile Earth" (Fall, 2017).



2018 SLATE OF OFFICERS

Don't miss the September 5 meeting, when we will vote on the following slate of officers for 2018. Additional nominations will be accepted from the voting membership from the floor during the September meeting. If you are unable to attend the meeting, you may vote electronically using a link that will be sent to members' email addresses before September 2.

Please note that we have a number of vacant offices that, if not filled, will affect the way the Society is able to conduct business. Please let Don Applebee know if you are willing to fill one of these positions.

President - Marisa Lerew, ASARCO LLC

Vice President, Field Trips - Wolf Schuh, Freeport-McMoRan, Inc.

Vice President, Programs - VACANT

Vice President, Marketing - Don Applebee, ASARCO LLC

Secretary - VACANT

Vice Secretary - VACANT

Treasurer - Mike Conway, Arizona Geological Survey

Vice Treasurer - VACANT

Past President - David Briggs, Retired Consultant

Counselor 1 (18-20) - William Whitty, Freeport-McMoRan, Inc.

Counselor 1 (18-20) - Matt Wetzel, Freeport-McMoRan, Inc.

Counselor 2 (17-19) - Dan Aiken, Retired, Freeport-McMoRan, Inc

Counselor 2 (17-19) - Leandra Marshall, Haley & Aldrich, Inc.

Counselor 3 (18-20) - Colin Campbell, Student, University of Arizona

Counselor 3 (18-20) - VACANT

Interested in an 8-day Grand Canyon Geology raft trip in 2018? Contact Alison Jones for more information. ajones@clearcreekassociates.com

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August Dinner Meeting

On August 22, we held a “meet and greet” at Borderlands Brewery downtown in lieu of our regular meeting. It was a successful and well-attended event. The ambiance was great, and the atmosphere convivial. National Well Drilling provided the food and footed the bar bill! *Thanks to National for their generosity!*

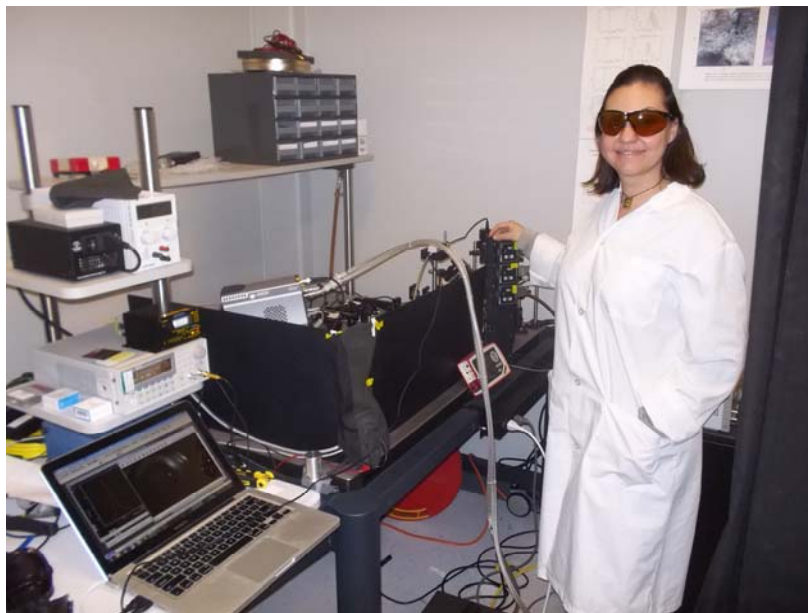
In 2018, most meetings will be at the Sheraton, but we are considering a few meetings at Borderlands. The venue is set up so that we can have a technical presentation in an informal atmosphere. This change is part of AGS's ongoing effort to draw additional members to the meetings.

AGS Executive Committee is seeking your input on the meeting format. Please let an Exec Comm member know your thoughts and ideas about the August meeting and ideas you may have for future meetings.

ARIZONA STUDENT SPOTLIGHT: Svetlana Shkolvar

AGS will periodically feature a student from an Arizona University in this newsletter.

Svetlana Shkolvar is a Carnegie Fellow working at the Geophysical Laboratory on biosignature studies on Mars. She received her Ph.D. from Arizona State University in Geosciences in December 2016.



Informing Mars Sample Selection Strategies: Identifying Fossil Biosignatures And Assessing Their Preservation Potential

Svetlana Shkolvar

NASA recently identified the search for life on Mars as a top priority. My dissertation research focused on strategies for in situ sample selection on Mars to inform biosignature searches performed with upcoming rover missions. Both NASA and ESA (European Space Agency) plan to launch rovers in 2020 that will be suited to identify potential biosignatures. One technique included on both rovers for in situ organic matter and mineral characterization will be Raman spectroscopy. This will be the first time Raman instruments are flown on a planetary mission. Given these rapidly approaching rover missions, my dissertation research was motivated by the need to inform rover-based Raman spectroscopy strategies using relevant analog samples.

One study asked, given a rover sampling scenario in a Mars landing site, what samples should be targeted for having the highest biosignature preservation potential? This work involved assessing the impacts of depositional and diagenetic processes on kerogen (macro-molecular, fossilized organic matter) preservation in the Miocene-age evaporative playa lake outcrop, Old Indian Salt Mine, within Verde Valley, Arizona (see Fig. 1). This study, soon to be submitted to *Astrobiology Journal*, integrated outcrop-scale field-based observations with micro-scale laboratory analyses and is the first to recognize this site as a relevant and interesting Martian analog. Results revealed complex diagenetic pathways for each evaporite subfacies within the outcrop as well as a model of biosignature preservation through those pathways.

Another question I asked was, what are possible limitations of Raman spectroscopy as a rover-based analytical technique? For this work, I identified sample- and instrument-based issues that might limit the effectiveness of Raman as a tool for in situ sample identification on Mars. Samples were selected to represent a broad range of potential analog lithotypes for Mars that included evaporites, including some from the Verde Valley site, hydrothermal deposits, and lacustrine sediments. I identified issues with Raman spectroscopy that could reduce commonly interfering background (i.e., fluorescence) and allow the identification of kerogen as well as its host minerals. I focused on two types of Raman instruments: visible and UV excitation wavelength UV instruments (Fig. 2), both of which are similar to the ones that will be included on the upcoming rovers. This work revealed strategies for rover-based Raman studies to identify the samples with the highest potential to preserve biosignatures.

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The results obtained in my dissertation implemented NASA's recommendations to inform in situ approaches for upcoming Mars rover missions by:

- Refining models for kerogen preservation in realistic, challenging Mars analog field samples;
- Improving the ability to select and cache samples with the highest biosignature preservation potential, which could in turn increase the success of biogenicity studies; and
- Informing instrument protocols and sampling strategies for rover-based Raman spectroscopy instruments.

At Left: Svetlana in the Verde Valley of Arizona, collecting halite and gypsum samples for lab analysis.



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Dues Increase Under Consideration

The AGS Executive Committee is in discussions regarding raising membership dues for the Society, beginning in 2018. The last dues increase was over 10 years ago. Since then, our expenses have continued to go up. A dues increase is necessary to help balance our operating budget. We are also looking for ways to reduce costs. Annual dues of \$20/year are low compared to other professional organizations that offer similar benefits, and this dues increase is overdue. Your membership dues support the following AGS benefits:

- Field Trips to geologically significant locations
- Monthly Technical Presentations at dinner meetings
- Networking opportunities
- Online document repository with free downloads for members
- Monthly newsletter
- Scholarship awards
- Being a part of something important!

AGS's mission to promote and encourage interest in the science of geology and in the geology of the State of Arizona is a worthy one. With your continued membership, we can continue this mission into the future.



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Please contact the AGS Secretary if your firm is interested in advertising in this monthly newsletter.

FALL FIELD TRIP!

We are in the preliminary stages of working on a multi-day field trip to Jerome, AZ in the fall. Stay tuned!

The American Geosciences Institute recently updated their fact sheet for Geoscience and Arizona. You can see it here:

<https://www.americangeosciences.org/policy/factsheet/states/arizona>

This sheet includes information regarding workforce, water, energy and minerals production, natural hazards, USGS Geologic mapping, etc.

Welcome New Members

Daniel Collins

James Davis

Charles Devine

Jordan Fowler

Tejo Permadi

Maria Snyder

Arizona Geological Society is grateful to Freeport-McMoRan, Inc. for their generous support of our student members! Freeport-McMoRan sponsored student dinners for the 2017 AGS monthly meetings.



FREEPORT-McMoRAN

2017 AGS MEMBERSHIP APPLICATION OR RENEWAL FORM

YOU CAN RENEW OR SIGN UP as a new member and pay online. Please go to our website, arizonageologicalsociety.org. Or use the form below if you are more comfortable with the old school approach.

Please mail check with membership form to: Arizona Geological Society, PO Box 40952, Tucson, AZ 85717

Dues (check box) 1 year: \$20; 2 years, \$35; 3 years: \$50; full-time student (membership is free)

NEW MEMBER or RENEWAL? (circle one) Date of submittal _____

Name: _____ Position: _____

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All newsletters will be sent by email. If you do not have an email address, we will mail a hard copy to you, but we cannot guarantee timeliness.

If registered geologist/engineer, indicate registration number and State: _____

Enclosed is a _____ tax-deductible contribution to the J. Harold Courtright or the M. Lee Allison Scholarship Funds.