THE GEOLOGICAL SOCIETY OF AMERICA
HYDROGEOLOGY DIVISION

The Hydrogeologist

Newsletter of the
GSA Hydrogeology Division

September 2010
Issue No. 71

The 2010 Annual Meeting is Fast Approaching

Photo by: Steve Crecelius
Courtesy of Denver Metro Convention & Visitors Bureau

By Bill Cunningham

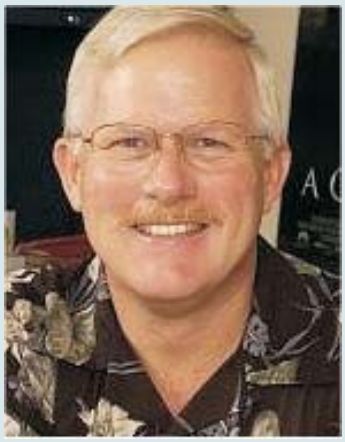
See old friends and make new ones in Denver 2010! The schedule is set for the 2010 GSA Annual Meeting and our Hydrogeology Division has another jam-packed schedule of oral presentations, poster sessions, and other activities. Don't miss the Darcy (Monday) and Birdsall-Dreiss (Tuesday) distinguished lectures, the always popular Hydrogeology Division luncheon (get your tickets early!) and the fun-filled student reception following the Birdsall-Dreiss lecture (more details on page 5). The Hydrogeology Division is a sponsor or co-sponsor of 29 oral and 9 poster sessions. Don't miss the sessions on carbon sequestration, enhanced geothermal systems, ground-water sustainability and availability, and urban ground water. Highlights also include sessions on ongoing research in karst, arsenic, and mountain hydrogeology, and many other topics. With so many attractive sessions, you won't be able to see them all. Use the handy session summary on page 7 to help plan your week.

"Reaching New Peaks in Geoscience"

2010 GSA Annual Meeting
31 October - 3 November 2010
Denver, CO USA
Colorado Convention Center

In This Issue:

Chair's Corner...



Scott Bair, Chair
GSA Hydrogeology Division

Each August before the semester begins, I consider adding one or two new topics to my autumn undergrad/grad hydrogeology course. This also makes me consider what topics to drop. This month I extended my internal discussion to consider what new topics might appear in future hydrogeology textbooks. (Not that I don't thoroughly enjoy the book I currently use, Frank.) My thoughts herein are influenced by two cover stories in general science magazines I read on recent plane flights: "Water: Our Thirsty World" (National Geographic, April 2010) and "Running Out of Water" (Scientific American, August 2008). Both articles describe the global water crisis in terms of geographic supplies and demands, the differences between different society's water "wants" versus their water "needs," the necessity for technological advances in desalination to lower its cost to viable levels, and the occurrence of regional and local conflicts over water rights and water usage. These articles reminded me how sage Mark Twain was back in the late 1800's when he said, "Whiskey is for drinking; water is for fighting over."

What I found interesting in both articles is a topic of global importance that I do not teach, one that is not presented in detail in any hydrogeology textbook, and one that has a variety of definitions depending on your view within the hydrologic cycle: droughts. Here in Ohio, local weather reporters tell us when we are in a drought based on daily rainfall data. In our agrarian region we also hear media outlets describe droughts based on crop needs and soil-water deficiencies. As groundwater scientists, however, we view droughts from a longer time frame, one that records a downward trend in annual groundwater-level fluctuations over a period of years to decades. Although I could not find many examples in the literature, groundwater-level data then can be analyzed much like streamflow data in terms of the computing the duration and recurrence interval of droughts. Unfortunately, long-term records of groundwater levels are far more scarce than those for stream discharge. Knowing that we are in a drought with a 20-year recurrence interval doesn't satisfy my mind, nor is it likely to satisfy the needs of planners, engineers, and government officials that are evaluating infrastructure costs and options.

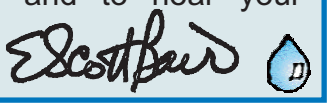
This dissatisfaction raises the other new topic in my hydrogeology class: climate surrogates. Scientists studying climate change have revealed and analyzed several types of long-term records from which they interpret changes dating back hundreds, thousands, to hundreds of thousands of years in parts of Earth's climate system. Of these surrogates, records from tree rings offer hydrogeologists the opportunity to approximate long-term groundwater-level changes and to compute larger drought recurrence intervals and severity indicies than can be computed using groundwater-level records.

Always looking for a way to combine business with pleasure, this summer I took several 3/8-inch cores in four types of trees (oak, pine, holly, and dogwood) in the maritime forest at the Outer Banks of North Carolina for my students to analyze in lab this autumn. (No, Don, I do not plan to deduct the trip expenses, but I thought about it.) The trees are all more than 100 years old. I hope to compare the results of drought recurrence intervals based on the tree rings with those based on nearby groundwater levels measured by the U.S. Geological Survey, although I'm not sure how this will work out as a student assignment. If you're interested, see me at GSA in Denver.

The articles in Scientific American and National Geographic mention the severe consequences of a prolonged, severe drought on crops, livestock, industry, and public supplies. The dynamic nature of the hydrologic cycle and the transient character of groundwater flow have always fascinated me and no doubt will continue to offer grand challenges for past, present, and future students of hydrogeology.

Before I sign off, let me pose this compound question to you. What topics do you think we will find in the next generation of hydrogeology textbooks and what topics do you think are now outmoded?

I hope to see you at GSA in Denver and to hear your answers.



Baedecker 2010 O.E. Meinzer Award Recipient

By Andrea Brookfield

Dr. Mary Jo Baedecker

The 2010 O.E. Meinzer Award will be presented to Dr. Mary Jo Baedecker of the USGS at the Hydrogeology Division luncheon at the Denver GSA meeting. Dr. Baedecker has spent over 30 years at the USGS in Reston Virginia where her research has focused on organic-inorganic processes that occur in aquifers impacted by the presence of contaminants. She is currently a scientist emeritus at the USGS and continues to conduct research on the degradation of organic material in near-surface environments.

In support of Dr. Baedecker's Meinzer Award, three papers were cited (see inset). These papers highlight Dr. Baedecker's work related to the generation and migration of organic plumes. The first paper describes her original work with Dr. William Back related to the chemical and isotopic signatures of leachate in groundwater. In this paper, Dr. Baedecker uses geochemical tools to understand the chemical reactions that occur in a highly reducing environment, and to understand their effect on groundwater chemistry. Within the paper, Dr. Baedecker outlines how to use geochemical tools for locating leachate plumes in groundwater, including the importance of isotopes as indicators of pollution.

The second paper, which is also a collaboration with Dr. Back, describes the characterization of redox zones in reducing plumes downgradient of a landfill. This work demonstrates how the chemical reactions that occur in a landfill are analogous to those that occur in marine sediments based primarily upon the types of oxidation-reduction reactions that occur within the redox zones as organic compounds decompose. The characterization of redox zones downgradient of the landfill by CH_4, NH_4^+, Fe^{2+}, Mn^{2+}, HCO_3^- and NO_3 is outlined, and is a major scientific contribution of this work.

The third paper is part of a classic and highly cited collection of papers determining the fate of crude oil in an aquifer. This work documents the changes in aqueous chemical species distribution in a contaminant plume originating from an oil body, over time. In addition, methods to determine the mass transfer of gases, solutes and solid phases along a flowpath in the anoxic zone are also given. This paper indicates several processes that result in small zones of distinctive water chemistry when crude oil is in contact with groundwater. It also concludes that biodegradation is the major process that attenuates the soluble organic compounds in groundwater, leading to considerable ongoing research into degradation methods for contaminant mitigation.

These cited works have served as the basis for many subsequent plume characterization and geochemical studies and have become standard reading in the organic geochemistry community and in water chemistry courses. Given these vital contributions to hydrogeology Dr. Baedecker is this year's recipient of the GSA Hydrogeology Division's O.E. Meinzer Award.

Papers Cited For The Meinzer Award:

Baedecker, M.J. and Back, W., 1979, Hydrogeological processes and chemical reactions at a landfill. Ground Water, v. 17, No. 5, 429-437.

Baedecker, M.J., and Back, W., 1979, Modern marine sediments as a natural analog to the chemically stressed environment of a landfill. Jour. Hydrology, v. 43, 393-414.

Baedecker, M.J., Cozzarelli, I.M., Eganhouse, R.P., Siegel, D.I., and Bennett, P.C., 1993, Crude oil in a shallow sand and gravel aquifer—III. Biogeochemical reactions and mass balance modeling in anoxic groundwater. Appl. Geochem., v. 8, 569-586.

Brahana and Tyler Receive the 2010 Distinguished Service Award

The 2010 Award for Distinguished Service is presented to Dr. Van Brahana and Dr. Scott W. Tyler in recognition of their exceptional service to the profession of hydrogeology. The articles below highlight each of their research careers, in addition to their service to the hydrogeology profession.

Dr. Van Brahana
Dept. of Geosciences
University of Arkansas

Dr. Van Brahana considers himself remarkably fortunate to have discovered his passion for geology early in life, and for the opportunity to work at this profession for almost 50 years. His fourth-grade teacher ignited the initial geologic spark, and a succession of outstanding mentors fueled his passion for understanding processes and controls of ground water flow and transport in fractured-carbonate rocks. Stanley N. Davis served as his advisor for both his Masters and Ph.D. at the University of Missouri, and Bill Back provided insight and encouragement as a USGS mentor; both were excellent role models by which Van guided his own career.

Please see **Brahana** on Page 13

Dr. Scott W. Tyler
Dept. of Geological Sciences and Engineering
University of Nevada, Reno

Dr. Scott Tyler received his B.S. in Mechanical Engineering from the University of Connecticut, M.S. in Hydrogeology from the New Mexico Institute of Mining and Technology and doctorate in Hydrogeology from the University of Nevada, Reno.

Scott's areas of research span a wide range in arid region hydrology, with particular interest in bridging the gap between hydrogeology and soil physics in the discipline of vadose zone hydrology. He is currently involved in a variety of studies of soil moisture flux, groundwater recharge and energy balances in the vadose zone.

Please see **Tyler** on Page 13

Denver 2010: Hydrogeology Division Events

By Andrea Brookfield with Brian Katz

The Hydrogeology Division always has several events that occur during the GSA Annual meeting, and this year will be no exception. This article highlights some of the most popular Hydrogeology Division events.

The Hydrogeology Division Luncheon is always a popular event. (Photo by Ed Harvey)

Luncheon, Awards and Business Meeting

Tuesday November 2 will be a busy day, starting with the Hydrogeology Division Luncheon and Awards Ceremony beginning at 11:30 am in the Colorado Convention Center, Four Seasons Ballroom 1. The Business meeting will follow the lunch and awards in the same location. Tickets for the luncheon can be purchased when you register for the conference for $42.00. Student members of the Hydrogeology Division that have registered for the conference before September 27th should receive an e-mail on September 28th regarding the John Mann Mentors program. This program will provide a free ticket to this luncheon to the first 25 students that respond to the e-mail. The luncheon is an excellent opportunity to meet and network with many of the leading hydrogeologists at GSA.

Birdsall-Dreiss Lecture

Later on Tuesday afternoon is the Birdsall-Dreiss Lecture, given by Susan Hubbard, from 4:30 pm - 5:30 pm, the room TBD.

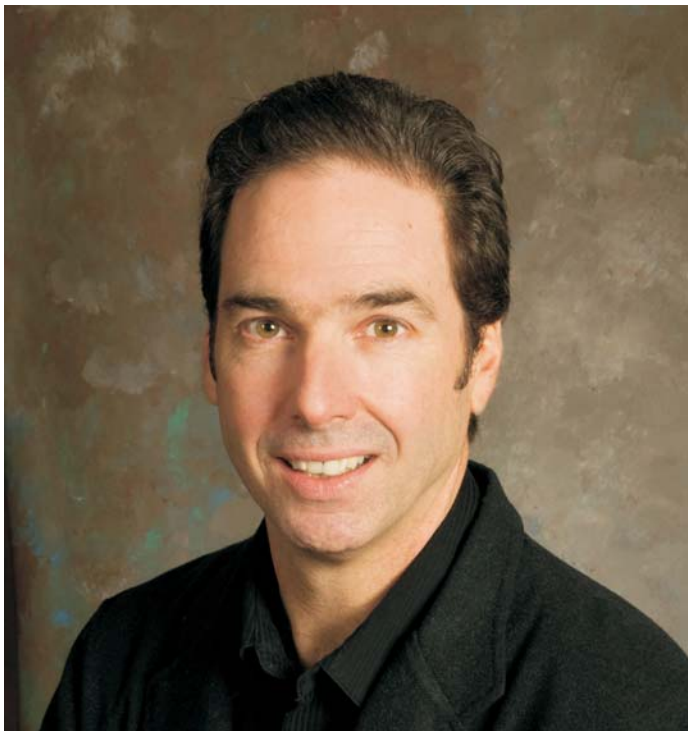
Everyone mixes and mingles during the Hydrogeology Division Student Reception. (Photo by Ed Harvey)

Student Reception

Following the Birdsall-Dreiss lecture is another chance for students to get together with many members of the Hydrogeology Division to enjoy appetizers, a free drink (for students only!) and get a chance to win a prize (again, students only!) at the annual Hydrogeology Student Reception. The reception will be held from 5:45 pm - 7:30 pm at the Hyatt CCC hotel in the Granite room.

McDonnell to Tour As 2010 Birdsall-Dreiss Lecturer

By Jeffrey McDonnell



Jeffrey J. McDonnell has been selected as the 2011 Birdsall-Dreiss Distinguished Lecturer. The lectureship is given to one person annually by the GSA Hydrogeology Division; McDonnell is the 33rd GSA Birdsall-Dreiss Lecturer and the first from the field of watershed science. Jeff holds the Richardson Chair in Watershed Science at Oregon State University and is OSU Distinguished Professor of Hydrology. He is also 6th Century Chair in Hydrology at University of Aberdeen (UK) and Visiting Professor at the Nanjing Hydraulic Research Institute and Hohai University in China. Jeff is a Fellow of the American Geophysical Union and the International Water Academy. He is recipient of the Dalton Medal from the European Geophysical Union, the Gordon Warwick Award from the British Geomorphological Research Group, the Nystrom Award from the Association of American Geographers and a D.Sc. from the University of Canterbury. Jeff has co-authored ~150 journal articles on watershed hydrology and co-edited the Elsevier textbook "Isotope Tracers in Catchment Hydrology". He has served as the Senior Advisory Editor of the "Encyclopedia of Hydrological Sciences", published by John Wiley and Sons and is currently Editor-in-Chief of the IAHS Book Series "Benchmark Papers in Hydrology". At the request of interested institutions, Jeff will present one of the two lectures summarized below. More information and a lecture request form are available at:
http://www.cof.orst.edu/cof/fe/watershd/

LECTURE TITLES AND ABSTRACTS

Where does water go when it rains? Conceptualizing runoff processes in headwater catchments.

Streamflow generation concepts have remained largely unchanged since the First International Hydrological Decade (1965-1974) despite numerous case studies from an ever-widening array of catchments. Two broad classes of streamflow generation behavior have been described and conceptualized into widely used model structures: infiltration excess overland flow and saturation excess overland flow. These concepts rely on the description of spatial patterns of soil surface infiltration rates and "variable source areas" of saturation (from rising near-stream water tables) with known boundary conditions. While subsurface flow during storm events occurs (and in steep wet areas may greatly exceed overland flow contributions), its location and behavior are poorly conceptualized and predicted. The mechanisms of subsurface flow delivery to the stream are seemingly endless and range from lateral preferential flow, to flow along impeding layers, to flow in highly conductive soil and sub-soil layers—all largely unpredictable from conditions at the soil surface. So how can we conceptualize subsurface flow and its many manifestations and such poorly known boundary conditions? Can we simplify the myriad

Please see **McDonnell** on Page 12

2010 GSA Annual Meeting Program Schedule
Hydrogeology Division

Session title	Day	Time	Room (CCC=Colorado Convention Center)
T2. Impacts of Land Use and Climate Change on Water Resources Sustainability	Sunday	8:00 AM-12:00 PM	CCC Room 107/109
T4. Advances in Understanding Aquifer Heterogeneity and Multi-Scale Flow and Transport in Porous and Fractured Media	Sunday	8:00 AM-12:00 PM	CCC Room 103/105
T13. CO2 Sequestration in Deep Saline Aquifers: Leakage Pathways, Risk Assessment, and Impact on Overlying Aquifers	Sunday	8:00 AM-12:00 PM	CCC Room 104/106
T34. Vapors, Brines, Sulfides, and Mines: Understanding Metal Mobility in Magma-Hydrothermal Systems and Their Supergene Successors	Sunday	8:00 AM-12:00 PM	CCC Room 601
T5. Mountain Hydrogeology, Faults, Fractures, Fluid Flow, and Sustainability of Natural Resources: In Memory of the Contributions of Craig Burton Forster (Poster)	Sunday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
T2. Impacts of Land Use and Climate Change on Water Resources Sustainability	Sunday	1:30 PM-5:30 PM	CCC Room 107/109
T5. Mountain Hydrogeology, Faults, Fractures, Fluid Flow, and Sustainability of Natural Resources: In Memory of the Contributions of Craig Burton Forster	Sunday	1:30 PM-5:30 PM	CCC Room 103/105
T7. Contaminant Hydrogeology of Karst — Characterization, Modeling, and Remediation	Sunday	1:30 PM-5:30 PM	CCC Room 104/106
T135. Hydrogeomorphic Processes in Hillslopes, Rivers, and Landscapes	Sunday	1:30 PM-5:30 PM	CCC Room 702
T4. Advances in Understanding Aquifer Heterogeneity and Multi-Scale Flow and Transport in Porous and Fractured Media (Poster)	Sunday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
T13. CO2 Sequestration in Deep Saline Aquifers: Leakage Pathways, Risk Assessment, and Impact on Overlying Aquifers (Poster)	Sunday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
T1. Assessing Groundwater Availability and Sustainability	Monday	8:00 AM-12:00 PM	CCC Room 103/105
T9. Sources of Acid Rock Drainage to Draining Mine Tunnels and in Complex Geologic Systems	Monday	8:00 AM-12:00 PM	CCC Room 104/106
T64. Geochemistry of Geologic Sequestration of CO2: Understanding Gas-Water-Mineral Interactions over Wide Temporal and Spatial Ranges	Monday	8:00 AM-12:00 PM	CCC Room 205
T74. Integrated Approaches to Modeling Geochemical, Hydrological, and Ecological Processes in Watersheds	Monday	8:00 AM-12:00 PM	CCC Room 207
T118. Filling the Hole: Sedimentary Geology and Paleontology of Caves and Karst	Monday	8:00 AM-12:00 PM	CCC Room 603

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2010 Annual Meeting Hydro Div. Program Schedule (Cont'd)

Session title	Day	Time	Room (CCC=Colorado Convention Center)
T156. Controls and Consequences of Continental Rifting: From Heat Flow, Stress, and Strain to Magmatism, Landscape-Basin Evolution, and Development of Natural Resources	Monday	8:00 AM-12:00 PM	CCC Room 704/706
T2. Impacts of Land Use and Climate Change on Water Resources Sustainability (Poster)	Monday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
T1. Assessing Groundwater Availability and Sustainability	Monday	1:30 PM-5:30 PM	CCC Room 103/105
T3. The Hydrogeological Effects of Urbanization	Monday	1:30 PM-5:30 PM	CCC Room 104/106
T8. Flow in Fractured and Karstic Aquifers: Models and Methods	Monday	1:30 PM-5:30 PM	CCC Room 107/109
T82. Geology in the National Forests and Grasslands — Stewardship, Education, and Research	Monday	1:30 PM-5:30 PM	CCC Room 710/712
T3. The Hydrogeological Effects of Urbanization	Tuesday	8:00 AM-12:00 PM	CCC Room 104/106
T14. Enhanced Geothermal Systems (EGS): Sustainable, Carbon-Free Energy	Tuesday	8:00 AM-12:00 PM	CCC Room 103/105
T1. Assessing Groundwater Availability and Sustainability (Poster)	Tuesday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
T8. Flow in Fractured and Karstic Aquifers: Models and Methods (poster)	Tuesday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
T16. Geochemical and Isotopic Evolution of Sedimentary and Crystalline Formation Brines	Tuesday	1:30 PM-5:30 PM	CCC Room 104/106
T18. Reaching New Peaks in Geoscience: Geoscience in the Service of a Sustainable Future	Tuesday	1:30 PM-5:30 PM	CCC Room 107/109
T51. Neutral Mine Drainage: Release, Transport, and Attenuation of Metals and Trace Elements in Circumneutral Mining Environments	Tuesday	1:30 PM-5:30 PM	CCC Room 601
T12. Arsenic in Geologic Systems (Poster)	Tuesday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
T10. The Hydrogeologic and Regulatory Environments of Phosphate Mining and Processing	Wednesday	8:00 AM-12:00 PM	CCC Room 104/106
T12. Arsenic in Geologic Systems	Wednesday	8:00 AM-12:00 PM	CCC Room 103/105
T72. Noble and Trace Gas Geochemistry: Practical Applications and Current Research	Wednesday	8:00 AM-12:00 PM	CCC Room 207
T3. The Hydrogeological Effects of Urbanization (poster)	Wednesday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
General Hydrogeology (poster)	Wednesday	9 to 11 AM, and 4:30 to 5:30 PM	CCC Hall B
T12. Arsenic in Geologic Systems	Wednesday	1:30 PM-5:30 PM	CCC Room 103/105
Hydrogeology I: Physical Hydrogeology	Wednesday	1:30 PM-5:30 PM	CCC Room 104/106
Hydrogeology II: Chemical Hydrogeology	Wednesday	1:30 PM-5:30 PM	CCC Room 107/109

Hope to see you in Denver!

Where in the World?

This new section of the newsletter was inspired by the comments of Dr. Darryll Pederson in response to my picture in the "From the Editor" portion of the June 2010 newsletter. From that picture he was able to identify where I was, and provided some additional information regarding the significance of these and other waterfalls to the overall hydrogeologic system in Hawaii (see article below).
This section will include a picture provided by a division member along with a hint (if necessary) as to the location. If you think you can identify the location, send me an e-mail (andrea@kgs.ku.edu). I will identify the first few to guess the location (if any!) in addition to a short article identifying the location and hydrogeologic interest of the site in the following newsletter.
Pictures can be submitted to andrea@kgs.ku.edu. Please include the location and the basis for a short article regarding it's hydrogeoloic significance. Thanks!

This edition's photo:

Where in the World was Ed Harvey?

GSA Hydrogeology Division's 1st Vice Chair Ed Harvey shared this picture that he took on a recent trip.

Hint: Those little black shapes are some of the largest trout (rainbow and brook) in the world.

Think you know where Ed was? Send your guess to andrea@kgs.ku.edu

Previous edition's photo:

Location: Opaeka'a Falls, Kauai, Hawaii, USA

The Waterfalls of Kauai, Hawaii

By Darryll Pederson

Everyone enjoys the sounds and sights of a tropical waterfall. They are the setting for romantic and action packed movies. Fantasy Island used Wailua Falls on Kauai to open their weekly TV series. From a different viewpoint waterfall origin and evolution has been attributed to a wide range of geologic processes. The Hawaiian Island's waterfalls and amphitheater-headed valleys have been cited by many as equivalent to similar features seen on Mars. After a number of years of studying these features on Kauai I offer the following thoughts and observations about Kauai's waterfalls and amphitheater-headed valleys.

Kauai is a shield volcano built from the ocean depths as the Pacific oceanic plate passed over a hot spot in the mantle. The other islands in the Hawaiian chain were formed in a similar manner. The main development of Kauai occurred on the order of

Please see **Waterfalls** on Page 10

Waterfalls from Page 9

5 million years ago. The Kauai volcano is composed of innumerable layers of rock formed from repeated eruptions of low- viscosity lava flowing down the 12-14 degree flanks. This lava, on cooling, formed basaltic rocks that with continued cooling resulted in fractures and joints. At times large cross-cutting fractures formed in the volcano were filled with rising magma. The magma cooled slowly in the fractures forming a dense and strong rock (dike). During periods of minimal or no lava flows the exposed basalts weathered rapidly to red clays in the tropic heat and moisture.

In aquifer terms the joints and fractures in the basalts represent major secondary-permeability routes for groundwater flow. The red soils represent low permeability as do the dikes. Because dikes cut across the multiple basalt flow layers and have different orientations they can be thought of as low permeability walls of an irregular box that leaks. An additional consideration is that the height of the shield volcano coupled with the trade winds has resulted in copious amounts of rainfall at the summit. The summit has been called by some "the wettest spot on Earth." In spite of the high precipitation most rainfall infiltrates into the basaltic aquifer with discharge through innumerable springs on the island and springs in the submerged flanks of the volcano. Groundwater flow is radial from the top of the volcano. There is little direct surface runoff in the high areas of the island except where high weathering rates and low erosion rates has produced thick low- permeability soils. Because of the very active groundwater flow system groundwater is a major player in the development of drainage features on Kauai.

There are numerous waterfalls and a number of large amphitheater-headed valleys on Kauai. Many waterfalls are notable for protruding downstream under the mainstream of water flowing over the waterfall. Examples are Wiapo'o Falls (Figure 1) on the dry side of Kauai and Opaeka'a Falls (Figure 2) on the wet side of Kauai. Because the greatest headward development of the overall knickpoint morphology occurs where the water does not actively fall it begs the question of why is the greatest erosion not where the energy of the falls is concentrated, especially where rock juts out in the impact stream of Waipo'o Falls (Figure 1)? The wall of the upper and lower amphitheater of Waipo'o Falls is heavily vegetated to the right of the falls (Figure 3). In this area there is considerable groundwater discharge from groundwater recharged in the Alakai Swamp located on the high points of the shield volcano. Because of the radial groundwater flow, reflecting the sloping flank of the volcano, there is minimal groundwater discharge in canyon walls beyond points of intersection of the groundwater system and they appear dry.

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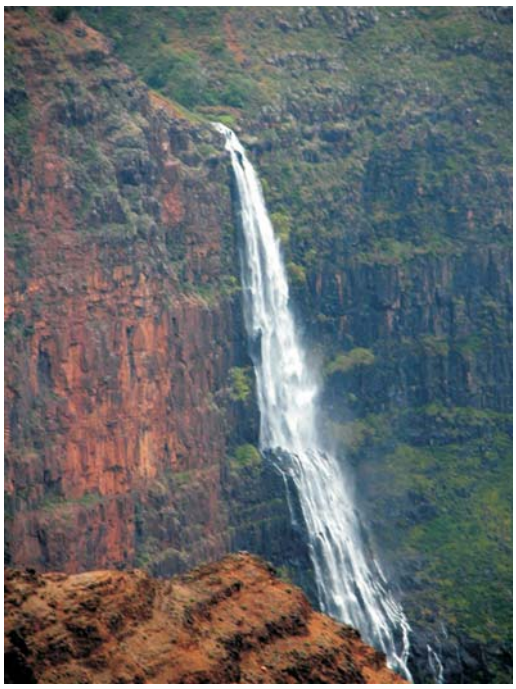

Figure 1 - Close view of Waipo'o Falls. Photo by Darryll Pederson

Do you have an interesting idea for a short scientific article? Perhaps an opinion on a new policy or technique? Any exciting news in your professional life? Upcoming conferece? An announcement of interest to the hydrological community? If so, why not publish it in The Hydrogeologist? Send your submission ideas to andrea@kgs.ku.edu

STUDENTS, WE WANT TO HEAR FROM YOU TOO!

Waterfalls from Page 10

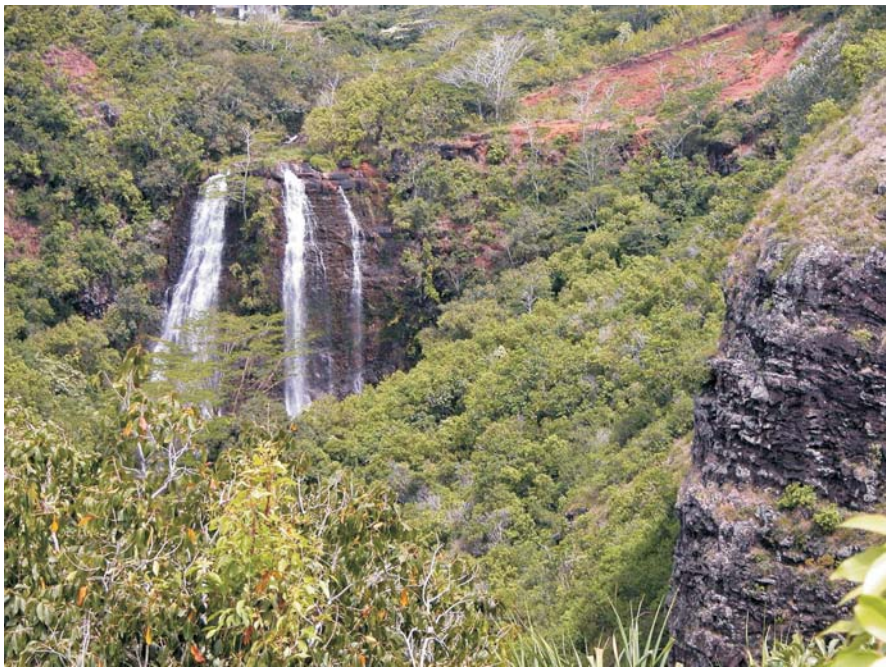

Figure 2 - Opaeka'a Falls. Photo by Darryll Pederson

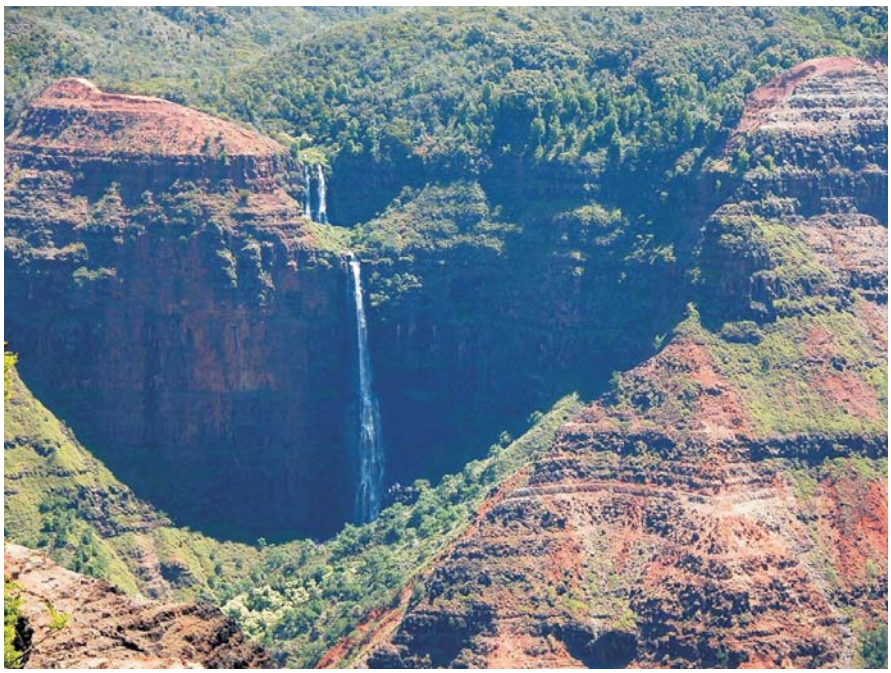

Figure 3 - Upper and Lower Waipo'o Falls. Photo by Darryll Pederson

The growth of vegetation is the main driver of landscape weathering on Kauai. The mechanical action of roots breaking up rocks is extremely fast and effective. Fragmenting yields greatly increased surface area available for other type of weathering processes. Micro-environments around root fibers also enhance weathering processes through chemical and microbial effects. Finally, the presence of discharging groundwater supports the rapid and dense growth of vegetation and through hydrolysis weathering to clays. Waipo'o Falls protrudes because there is no vegetation under the waterfall stream and erosion rates are low as opposed to the right side of the knickpoint where there is ample vegetation and weathering rates are high (note - it is easy to transport clay weathering products). The amphitheater form (upper and lower falls) is developing in the direction of radial groundwater flow. Opaeka'a Falls has identical morphology and weathering processes. The main lower protruding feature (Figure 1) impacted by water flowing over Waipo'o Falls represents rock in place, not a boulder pile.

The Kalalau Valley on the Na Pali coast is headed by a large amphitheater face. There are no streams flowing over the face of the amphitheater. There are waterfalls, fed by springs, in the amphitheater face. There is also diffuse groundwater flow and associated dense vegetation on the amphitheater face. The Kalalau Valley amphitheater face has advanced headward in the direction of radial groundwater flow from the high Alakai Swamp. There are very striking and extensive flute developments in the walls of the Kalalau Valley and other valleys in the immediate area. There is an interesting interruption in the gradient of vertical sections of the walls of the Kalalau Valley. This interruption has a gradient along the walls of about 14 degrees or about the same as the groundwater gradient. This is a likely a groundwater story in itself.

At first glance Wailua Falls (TV's Fantasy Island fame, Figure 4) would appear to fit the model of undercutting by waterfall action. However, the "undercutting feature" is well above the elevation of the plunge pool and the main undercutting is to the left side of the waterfall. Figure 4 shows a clear elongation of the overall morphological feature associated with the plunge pool. The long axis of the elongation is parallel to the expected (radial) direction of groundwater flow. The undercutting unit has significant groundwater discharge. If one goes just downstream, there is another morphologic feature (incipient amphitheater?) that appears to be cutting in the direction of groundwater flow and widening the valley in the process. This feature has considerable groundwater discharge, dense vegetation growth, and considerable weathering of rock. The main channel of

Please see **Waterfalls** on Page 12

McDonnell from page 6
subsurface response mechanisms to be consistent with infiltration excess and saturation excess overland flow concepts? This talk examines the future of runoff conceptualization and advances a simple concept of subsurface "storage excess". I offer evidence in support of storage excess using field data from catchments distributed across a wide array of climate, geology, vegetation and topographic conditions. These data show subsurface storage filling and then spilling is a simple concept that makes sense across many scales and may help explain runoff amount and timing, geographic and time source components, and residence time. I address how such measures might be used for "gauging" the ungauged catchment as part of the IAHS Decade on Prediction in Ungauged Basins (2003-2012) and informing questions of "what to measure, in what order and why"? This lecture is intended for those interested in water resources, landuse planning, hydrogeology and water quality.

Isotope tracers in catchment hydrology: How far can we go?

The use of stable isotopes as tracers of water has fundamentally changed the way that we view catchment hydrology. Most importantly, isotope tracers have shown that the mean transit time for water through catchments can be orders of magnitude longer than the timescale of hydrologic response. This recognition of prompt delivery of old water to the stream changes the way we consider catchment response to landuse and climate change. Findings from catchment isotope studies have now matured to the point where such information is informing rainfall-runoff model development and testing and new hydrological scaling theory. So how far can we go with isotope tracers in catchment hydrology? This talk explores future avenues of study made possible by the recent development of laser spectrometers—a technology poised to radically alter the field by facilitating increased sample frequencies in time and space and ultimately, routine and widespread field-based deployment. Examples with laser spectrometers are given that show the power of this approach for understanding ecohydrological interactions, rainfall and snowmelt mixing from the plot to hillslope to catchment scale and finally, for addressing transit time distributions and 'hydrological memory' of catchments. This lecture is intended for those interested in environmental science, ecohydrology, water resources and water quality.

Waterfalls from page 11
the Wailua River is very narrow along this reach with high rock walls.

Rapid headward incision of the Waimea Canyon occurred at an angle to the slope of the volcano flanks and has provided a local base-level change for the development of many knickpoint waterfalls such as Waipo'o Falls. The streams feeding these waterfalls have a large groundwater component representing recharge in the Alakai Swamp. In the lower elevations the Alakai Swamp sloping plateau has significant incision of streams fed by groundwater discharge..

All of the above features can be readily viewed, some from a distance. It is possible to get quite close to Wailua and Opaeka'a falls but the slopes are very steep. One should exercise extreme caution as the rock is brittle and should not be relied on for climbing support. The presence of water and clay also makes for very slippery conditions. The Kalalau Valley amphitheater and Waipo'o Falls can be reached from below by very long hikes. The Upper Waipo'o Falls can also be reached via a trail that starts just north of the second developed overlook of the Waimea Canyon. There are a number of trails through the lower parts of the Alakai Swamp.

Figure 4 - Air View of Wailua Falls. Photo by Douglas Peebles

Brahana from page 4

Van's professional career includes more than 28 years with the USGS as a research hydrologist (now emeritus), and currently, 20 years as a Professor at the University of Arkansas. In addition to these two major jobs, he has served as an Adjunct Professor at 3 universities, as a consultant and expert witness, and as a lab and field assistant for the Illinois Geological Survey. The focus of his professional research included regional hydrogeologic studies in the midcontinent utilizing flow tracing, aqueous geochemistry, and numerical simulation for hypothesis testing. He has contributed more than 70 peer-reviewed papers to the literature. With Tom Sauer, USDA-ARS, he established the Savoy Experimental Watershed for long-term karst research.

As a professor, he has supervised more than 20 M.S. and Ph.D. students in hydrogeology, 10 REUs and Honors students, and has served on more than 100 graduate research committees. In fact, one of Van's greatest contributions to the field has been his mentoring of hydrogeologists. Van encourages students to "Be the Aquifer" in order to conceptualize the processes and to better understand the physics and mechanics behind theory.

Van's service record has been exemplary, including numerous committee assignments and leadership positions in which he has directed or served as Chair of regional, national, and international meetings. He is a Fellow of GSA, Chair of Fulbright College Cabinet at the University of Arkansas and a member of Aquifer Science Advisory Panel of the Edwards Aquifer Authority. He typically provides about 10 reviews for hydro-journals each year.

There are few active hydrogeologists who have contributed as much or as broadly to the development of our discipline. The Hydrogeology Division takes pride in presenting John Van Brahana the GSA Hydrogeology Division Distinguished Service Award.

Tyler from page 4

His group is also a leader in the development of distributed fiber-optic temperature sensing and using this technology to study of soil moisture, aquatic stream and lake ecology, cave air circulation and snow hydrology. Scott is co-Director of the NSF-sponsored Centers for Transformative Environmental Monitoring Programs (CTEMPS) designed to develop and distribute environmental fiber-optic temperature sensing systems. He has published more than 80 refereed articles and books across a wide range of hydrologic fluid dynamics, including development of coupled solar energy/desalinization systems for water reclamation, modeling the limnology of complex aquatic ecosystems, the study of ground-water/brine interactions in terrestrial environments, the development of fundamental models of root water uptake and root physics, the reconstruction of paleoclimates from soil water chemistry, and stochastic reactive transport of contaminants in the subsurface.

Scott's service to hydrogeology pervades his career. Obvious contributions include leadership of the Division as President in 2007, during which he launched the 50th Anniversary Campaign and facilitated fruition of GSA's 2008 Joint Meeting with the Soil Science Society of America (SSSA) and allied societies. In addition, he currently serves on the editorial boards of GSA Bulletin and Advances in Water Resources, on the Board of Directors of CUASHI and on the National Academy of Sciences Panel on Challenges and Opportunities in the Hydrologic Sciences. Scott's service also includes indentifying, nurturing and challenging others to become leaders of hydrogeologic science and educating the broadest possible audiences about the interconnected worlds of water, geology and environment.

In consideration of manifold contributions to the science and application of hydrogeology, the Distinguished Service Award is a fitting acknowledgement of Professor Scott Tyler's many *pro bono publico* labors of love.

Want to know what's going on within the GSA Hydrogeology Division?

Then visit our website at <http://gsahydrogiv.liu.edu>

OR

Join the GSA Hydrogeology Division facebook group

BULLETIN BOARD

AGU Fall Meeting

The AGU Fall Meeting will be held December 13-17 in San Francisco in the Moscone Convention Center. Registration fees will increase after November 10, so register today.

NGWA Ground Water Expo

The NGWA Ground Water Expo will be held December 7 -10 in Las Vegas. Registration fees will increase after November 5, so register today!

GSA 2011 Minneapolis, MN

The 2011 GSA Annual Meeting will be held on October 9-12 in Minneapolis, MN.

Upcoming deadlines:
Field Trip Proposals - Dec. 1, 2010
Technical Session Proposals - Jan. 11, 2011
Short Course Proposals - February 1, 2011

GSA Section Meetings

Northeastern/North-Central: Pittsburgh, PA, March 20-22 2011
Southeastern: Wilmington, NC March 23-25, 2011
South-Central: New Orleans, LA, March 27-19 2011
Rocky Mountain/Cordilleran: Logan, UT, May 18-20 2011

PLACE YOUR ANNOUNCEMENT HERE

From the Editor....

That wraps up my second attempt at newsletter editor, I hope everyone enjoyed the issue. I want to thank everyone who contributed to this issue, the newsletter would not be possible without you. The next issue will be in early 2011 as we're moving to a 3/year format to better cover division events and activities. As per usual, if you have any comments, suggestions or an idea for a column or article please let me know at <andrea@kgs.ku.edu>.

I hope to see many of you in Denver next month!

Andrea Brookfield, Editor
The Hydrogeologist

Hydrogeology Division Contacts

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Newsletter Editor: Andrea Brookfield (andrea@kgs.ku.edu)

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The Hydrogeologist

The Hydrogeologist is a publication of the Hydrogeology Division of the Geological Society of America. It is issued twice a year, to communicate news of interest to members of the Hydrogeology Division. During 1998, the publication moved from paper-based to electronic media. The electronic version may be accessed at: <*http://gsahydrodiv.fiu.edu*>. Members of the Hydrogeology Division who have electronic mail will receive notification of all new issues. Other members will continue to receive paper copies.

Contributions are material are most welcome, and should be directed to the Editor. Submission as a Word or WordPerfect document is most expedient.

Andrea E. Brookfield, Editor
The Hydrogeologist
Kansas Geological Survey
1930 Constant Avenue, Moore 414
Lawrence, KS
66047-3726

Voice: (785) 864-2199
Fax: (785) 864-5317
Email: andrea@kgs.ku.edu

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