U.S. Geological Survey Karst Interest Group Proceedings, Shepherdstown, West Virginia, August 20-22, 2002

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INTRODUCTION AND ACKNOWLEDGMENTS

Karst aquifer systems occur throughout the United States and it's territories. The complex depositional environments that form carbonate rocks combined with post-depositional tectonic events and the varied climate in which these rocks are found, result in unique systems. The dissolution of calcium carbonate and the subsequent development of distinct and beautiful landscapes, caverns, and springs have resulted in some karst areas of the United States being designated as national or state parks and commercial caverns. Karst aquifers and landscapes that form in tropical areas, such as the north coast of Puerto Rico differ greatly from karst areas in more arid climates, such as central Texas or South Dakota. Many of these public and private lands contain unique flora and fauna associated with the water. Thus, multiple Federal, state, and local agencies have an interest in the study of karst areas.

Carbonate sediments and rocks are composed of greater than 50 percent carbonate, CO_3, and the predominant carbonate mineral is calcium carbonate or limestone, $CaCO_3$. Unlike terrigenous clastic sedimentation, the depositional processes that produce carbonate rocks are complex, involving both biological and physical processes. These depositional processes impact greatly the development of permeability of the sediments. Carbonate minerals readily dissolve and precipitate depending on the chemistry of the water flowing through the rock, thus the study of both marine and meteoric diagenesis of carbonate sediments is multidisciplinary. Once the depositional environment and the subsequent diagenesis is understood, the dual porosity nature of karst aquifers presents challenges to scientists attempting to study ground-water flow and contaminant transport.

Many of the major springs and aquifers in the United States occur in carbonate rocks and karst areas. These aquifers and springs serve as major water supply sources and as unique biological habitats. Commonly, there is competition for the water resources of karst aquifers, and urban development in karst areas can impact the ecosystem and water quality of these aquifers.

The idea for developing a Karst Interest Group evolved during the November 1999, National Ground-Water Meeting of the U.S. Geological Survey, Water Resources Division. As a result, the Karst Interest Group was formed in 2000. The Karst Interest Group is a loose-knit organization of U.S. Geological Survey employees devoted to fostering better communication among scientists working on, or interested in, karst hydrology studies.

The mission of the Karst Interest Group is to encourage and support interdisciplinary collaboration and technology transfer among U.S. Geological Survey scientists working in karst areas. Additionally, the Karst Interest Group encourages cooperative studies between the different disciplines of the U.S. Geological Survey and other Department of Interior agencies, and university researchers.

The first Karst Interest Group Workshop was held in St. Petersburg, Florida, February, 13-16, 2001. That meeting was sponsored by Bonnie A. McGregor, Eastern Regional Director of the U.S. Geological Survey and co-hosted by Wanda C. Meeks, Regional Hydrologist, Eastern Region South and Lisa L. Robbins, Director of the Center for Coastal Geology, both of the U.S. Geological Survey. The U.S. Geological Survey, Office of Ground Water, provides support for the Karst Interest Group website. The first proceeding, Water-Resources Investigations Report 01-4011 is available online at: http://water.usgs.gov/ogw/karst/index.htm

As agreed by participants at the first Karst Interest Group Workshop in St. Petersburg, Florida, a second workshop was planned in a different geographic location, with a similar workshop format. The Shepherdstown, West Virginia, location is in close proximity to the carbonate aquifers of the northern Shenandoah Valley. Randall Orndorff and George Harlow, U.S. Geological Survey, agreed to develop the workshop field trip and field trip guide. The field trip is designed to help members of the Karst Interest Group understand the hydrogeologic framework of the carbonate aquifers of the northern Shenandoah Valley.

The second workshop and proceedings are sponsored by Zelda C. Bailey, National Park Service Interim Director of the Cave and Karst Research Institute and Norman Grannemann, U.S. Geological Survey, Ground-Water Resources Program Coordinator. This proceedings, Water-Resources Investigations Report 02-4174, will be made available online through the website listed above shortly after the workshop.

This second proceedings results from the efforts of the planning committee to bring together U.S. Geological Survey scientists with other Department of Interior scientists and land managers and University researchers interested in karst hydrology. Additionally, members of the private sector and State agencies involved in karst studies or land management are participating. The presentations cover: integrating science, the use of tracers in karst studies, state and national karst programs, the structure and genesis of karst areas, borehole flow measurements in limestone, and a field trip.

The planning committee for this second workshop included: Zelda C. Bailey, National Park Service; and Alan W. Burns, Norman Grannemann, Eve L. Kuniansky, Randall C. Orndorff, and Albert T. Rutledge, U.S. Geological Survey. We sincerely hope that this workshop promotes future collaboration among scientists of varied educational backgrounds and improves of our understanding of karst systems in the United States and it's territories.

The extended abstracts of U.S. Geological Survey authors were reviewed and approved for publication by the U.S. Geological Survey. Articles submitted by university researchers and other Department of Interior agencies did not go through the U.S. Geological Survey review processes, and therefore may not adhere to our editorial standards or stratigraphic nomenclature. However, all articles were edited for consistency in appearance in the published proceedings. The use of trade names in any article does not constitute endorsement by the U.S. Geological Survey.

The cover illustration was designed by Ann Tihansky, U.S. Geological Survey, Tampa, Florida, Office for the first Karst Interest Group Workshop.

Eve L. Kuniansky
Karst Interest Group Coordinator

AGENDA, U.S. GEOLOGICAL SURVEY KARST INTEREST GROUP WORKSHOP

August 20 – 22, 2002
Shepherdstown, WV
USFWS Training Facility Auditorium

Tuesday, August 20

Time	Title
Integrating Science	
8:30 – 9:00	Opening Remarks-Eve Kuniansky, U.S. Geological Survey Integrated Science in the U. S. Geological Survey –Tom Armstrong
9:00 – 10:00	Invited Lecture-Overview of Research and Engineering in Karst by P.E. LaMoreaux and Associates –Barry Beck, P.E. LaMoreaux and Associates
10:00 – 10:30	BREAK
10:30—11:00	National Cave and Karst Research Institute–Progress in the First Two Years – Zelda Chapman Bailey. National Park Service
11:00--11:30	Considerations for Managing Karst in the National Park Service --Ronal C. Kerbo. National Park Service
11:30 – 1:00	LUNCH
Tracer session	
1:00 – 1:30	Demystification of ground-water flow and contaminant movement in karst systems using chemical and isotopic tracers –Brian G. Katz. U.S. Geological Survey
1:30 –2:00	Age Dating studies in Karst Systems of the Shenandoah Valley –Neil Plummer. U.S. Geological Survey
2:00 – 2:30	Development of Counterterrorsim Preparedness Tool for Evaluating Risks to Karstic Spring Water –Malcolm S. Field. U.S. Environmental Protection Agency
2:30 – 3:00	BREAK
3:00 – 3:30	Comparison of methods to source track bacteria in ground water in karst areas of Berkeley County, West Virginia –Melvin Mathes, Don Stoeckel, and Ken Hyer. U.S. Geological Survey
3:30 – 4:00	Karst Aquifers as Atmospheric Carbon Sinks: An Evolving Global Network of Research Sites –Chris Groves, Western Kentucky University and Joe Meiman. National Park Service
4:00 – 5:00	Panel discussion: Natural and Anthropogenic Tracers –Neil Plummer, Malcolm Field, and Brian Katz

Wednesday, August 21

Time	Title
State and National Program session	
8:00 – 8:30	Managing a hidden landscape. Stakeholders perceptions and concerns –Patricia E. Seiser. West Virginia University
8:30 – 9:00	Synopsis of ground-water investigations by the U.S. Geological Survey in karst areas of Jefferson and Berkeley Counties, West Virginia –Mark D. Kozar. U.S. Geological Survey
9:00 – 9:30	Recent Activities and Accomplishments of the Virginia Department of Conservation and Recreation, Division of Natural Heritage Karst Program –Joey Fagan and Will Orndorff. Virginia Department of Conservation and Recreation
9:30 – 10:00	National Karst Map Project, an Update –Jack Epstein, David Weary, and Randy Orndorff. U.S. Geological Survey, and Zelda Chapman Bailey. National Park Service
10:00 – 10:30	BREAK
10:30 – 11:00	Karst Initiative in the USGS Ground-Water Resources Program –Norman Granneman and Charles Taylor. U.S. Geological Survey
11:00 – 11:30	Panel Discussion: GWRP Karst Initiative –Norman Granneman and Charles Taylor. U.S. Geological Survey
11:30 – 1:00	LUNCH
Structure and genesis session	
1:00 – 1:30	Karstification along an active fault in eastern Cyprus –Richard W. Harrison, Wayne L. Newell, and Mehmet Necdet. U.S. Geological Survey
1:30 – 2:00	Structural and lithologic control of karst features in northwestern New Jersey – Donald Monteverde and Richard Dalton. New Jersey Geological Survey
2:00 –2:30	Three-Dimensional Geologic Framework Modeling for a Karst Region in the Buffalo National River, Arkansas – Kyle E. Murray and Mark R. Hudson. U.S. Geological Survey
2:30 – 3:00	BREAK
3:00 – 3:30	Preliminary findings of a karst-stratigraphy study of the Frederick Valley, Maryland –David Brezinski. and James Reger. Maryland Geological Survey
3:30 – 4:00	Geohydrologic framework of the Northern Shenandoah Valley carbonate aquifer System (Field Trip Overview and Logistics) –Randall Orndorff and George Harlow. U.S. Geological Survey
4:00 – 5:00	Poster session

POSTERS

Evaluating travel times and transient mixing in karst aquifers using seasonal and climatic changes in stable isotopes. –Larry Putnam and Andy Long. U.S. Geological Survey

Use of dye tracing to verify delineation of source-protection zones around selected springs and wells, Bear River Range, Utah –Lawrence Spangler. U.S. Geological Survey

Changes in nitrate concentrations in spring waters due to mixing of surface and ground water in the Woodville Karst Plain, northern Florida –Brian G. Katz, U.S. Geological Survey

An evaluation of borehole flowmeters used to measure horizontal ground-water flow in limestones of Indiana, Kentucky, and Tennessee – John T. Wilson[1], Wayne A. Mandell[2], Frederick L. Paillet[1], E. Randall Bayless[1], Randall T. Hanson[1], Peter M. Kearl[3], William B. Kerfoot[4], Mark Newhouse[1], and William Pedler[5]. [1]U.S. Geological Survey; [2]U.S. Army Environmental Center, Aberdeen Proving Grounds, Maryland; [3]Aqua Vision Environmental LLC; [4]K-V Associates, Inc., Mashpee, Massachusetts; [5]RAS INC., Golden, Colorado

Karst ground-water basin delineation--Underlying concepts, needed data, and natural variation of evolving flow systems -- Van Brahana[1], R.K. Davis[1], P.D. Hays[2], Terri L. Phelan[3], Tim Kresse[4], T.J. Sauer[5], John Murdoch[1]. [1]University of Arkansas, Fayetteville; [2]U.S. Geological Survey; [3]U.S. Department of Agriculture; [4]Consultant, Fayetteville, Arkansas; [5]Arkansas Division of Environmental Quality

An hypothesis of endangered cavefish and cave crayfish occurrence and distribution in the mantled karst aquifers of the southern Ozarks -- Van Brahana[1], G.O. Graening[2], A.V. Brown[1], and Mike Slay[1]. [1] University of Arkansas, Fayetteville; [2] Nature Conservancy, Fayetteville, Arkansas

Recurring, multicomponent ground-water tracing experiments at a well-characterized basin in mantled karst--lessons from the Savoy Experimental Watershed --Van Brahana[1], R.K. Davis[1], Tiong Ee Ting[1], Said Al-Rashidy[2], Kelly Whitsett[1], Sherri Hamilton[1], and Mohammed Al-Qinna[1]. [1] University of Arkansas, Fayetteville; [2]Ministry of Water Supply, Sultanate of Oman, Sallalah, Oman

Thursday, August 22

8:00 – 5:00 Field Trip Geohydrologic Framework of the Northern Shenandoah Valley Carbonate Aquifer System

The carbonate aquifer system of the northern Shenandoah Valley of Virginia and West Virginia provides an important water supply to local communities and industry. This is an area with an expanding economy and a growing population, and this aquifer is likely to be further developed to meet future water needs. An improved understanding of this complex aquifer system is required to effectively develop and manage it as a sustainable water supply. Hydrogeologic information provided by a detailed aquifer appraisal will provide useful information to better address questions about (1) the quantity of water available for use, (2) the effects of increased pumpage on ground-water levels and instream flows, (3) the relation between karst features and the hydrology and geochemistry of the surface- and ground-water flow systems, and (4) the quality of the ground-water supply and its vulnerability to current and potential future sources of contamination. To answer these questions, a geohydrologic framework is necessary to look at the relationship of water resources to the geology.

Field trip stops will show karst hazards (stop 1), stratigraphic sections of karstic rock (stop 2), sinkholes related to high hydraulic gradient (stop 3), relationship of structural geology to conduit development (stop 3), real-time stream gauging (stop 4), and a karst spring (stop 5).