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EDITORS:

Daniel H. Doctor
United States Geological Survey
Reston, Virginia, USA

Lewis Land
National Cave and Karst Research Institute
Carlsbad, New Mexico, USA

J. Brad Stephenson
CB&I Federal Services
Knoxville, Tennessee, USA

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Dr. George Veni, Executive Director

400-1 Cascades Ave.
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ASSOCIATE EDITORS:

Cover Photo:

A first look inside the National Corvette Museum sinkhole, which consumed eight rare Corvettes upon its collapse. The museum Skydome was built over a large cave passage which suffered a catastrophic roof collapsed on the morning of February 12, 2015, causing more than $3 million in damage (see paper by Polk et al., p. 477-482). Photos provided courtesy of Jason Polk and Western Kentucky University.

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- Justin Camp, Barton Springs/Edwards Aquifer conservation District, Austin, Texas

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FOREWORD

Welcome to the Fourteenth Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst in lovely Rochester, Minnesota! This venue is the farthest north that the Sinkhole Conference—as it is better known—has met since its inception in 1984. The setting will provide conference participants with a unique opportunity to view karst phenomena within the glaciated and driftless terrains of southeastern Minnesota, and a significant number of papers presented in this volume address the hydrological and geological characteristics of karst within the upper Mississippi Valley region.

The National Cave and Karst Research Institute (NCKRI) is a non-profit organization dedicated to pure and applied research on caves, karst phenomena, and karst hydrology. In 2011, NCKRI assumed a leadership role in organizing and hosting the Sinkhole Conference, and the 2013 Sinkhole Conference that was held at NCKRI headquarters in Carlsbad, New Mexico was an unqualified success.

This year, NCKRI is pleased to partner with the Minnesota Ground Water Association (MGWA) for hosting the Sinkhole Conference. The MGWA is a non-profit, volunteer organization dedicated to the following primary objectives: 1) promotion and encouragement of the scientific and public policy aspects of ground water; 2) establishing a common forum for scientists, engineers, planners, educators, attorneys, and other persons concerned with ground water; 3) education of the general public regarding ground water resources; 4) dissemination of information on ground water through meetings of the membership. I can think of no better way to meet these objectives than through the excellent research and information presented at the conference and published within these Proceedings.

I am exceptionally pleased that the papers and abstracts within this volume aptly represent the current state of the science, as well as cover notable recent occurrences of sinkholes and other karst phenomena. At the time of this writing (August 19, 2015), news reports are circulating about yet another sinkhole in Florida, but not just any sinkhole: this particular sinkhole opened up in the town of Seffner, in the very same place where Jeffrey Bush tragically lost his life on the 28th of February, 2013 when the ground beneath the room where he lay caved in and swallowed him. That event captured the attention of the nation and was reported across the world, quickly elevating karst geohazards within the public eye. Once again, all sinkholes had become newsworthy, no matter how small, or whether they occurred in actual karst areas.

A number of truly spectacular sinkhole collapses followed the 2013 tragedy in Seffner, Florida, including the event at the National Corvette Museum in Bowling Green, Kentucky on the 12th of February, 2014 that destroyed a number of vintage automobiles (see the paper by Polk et al., p. 479-484), as well as the continued saga of salt dome collapse threatening an entire community within Bayou Corne, Louisiana (see the paper by Jones and Blom, p.415-422).

Sinkholes have also generated news outside of the United States in recent years. For example, periods of unusually heavy rainfall in the winter of 2013-2014 triggered numerous sinkholes in the United Kingdom, sparking a similar media frenzy of sinkhole coverage (see the paper by Banks et al., p. 223-230). Such events, and the public interest they have generated, demonstrate the current relevance of the study of karst and karst geohazards. I am confident that the information contained within these Proceedings will serve as a reference for many future studies.

Daniel Doctor
U.S. Geological Survey
Reston, Virginia

EDITED BY:

Daniel H. Doctor
U.S. Geological Survey
12201 Sunrise Valley Dr.
MS 926A, Reston, VA 20192 USA
Phone: 703-648-6027
E-mail: dhdoctor@usgs.gov

Lewis Land
New Mexico Bureau of Geology and Mineral Resources
and the National Cave and Karst Research Institute
400-1 Cascades Ave.
Carlsbad, NM 88220 USA
Phone: 575-887-5508
E-mail: lland@nckri.org

J. Brad Stephenson
CB&I Federal Services
312 Directors Drive
Knoxville, TN 37923
Phone: 865-694-7336
E-mail: brad.stephenson@cbifederalservices.com

National Cave and Karst Research Institute

Minnesota Ground Water Association
www.mgwa.org

INVITED SPEAKER

HALES BAR AND THE PITFALLS OF CONSTRUCTING DAMS ON KARST

J. David Rogers
Missouri University of Science and Technology
Department of Geological Sciences and Engineering
157 McNutt Hall, 1400 Bishop Ave. Rolla, Missouri, 65409

Hales Bar Dam was built on the Tennessee River 33 miles downstream of Chattanooga by a private company to generate power in 1905-1913. The dam site was selected because it was the narrowest reach in the downstream end of the Walden Ridge Gorge. The site is underlain by Mississippian Bangor Limestone on the southeast flank of the Sequatchie Anticline.

Three different contracts failed to complete the dam because of difficult foundation conditions. From 1910-1913 diamond drill core holes were used to explore the site and a series of reinforced concrete caissons 40x45 ft on upstream side and 30x32 ft on the downstream side were installed. Excessive leakage soon appeared near the eastern abutment, and gradually increased. Soundings were made in 1914 to ascertain the areas of gross leakage. Shortly thereafter, rags were placed over suction holes on the river bed and concrete pumped over these. Once a leak was stemmed, leakage would resume at other, adjacent locations. The owners tried to stem the leaks by inserting hay bales, old mattresses, chicken wire, and even corsets! In 1919 the owners began drilling grout holes from the inspection gallery within the dam and pumping hot asphalt into the voids. This was followed by the injection of 78,324 cubic feet of hot asphalt grout into the dam foundation, using 6,266 lineal feet of boreholes with average hole depth of 92 ft. By 1922 the problem appeared solved, but leakage gradually resumed between 1922-1929, rising to the same level as had been observed previously.

In 1930-1931 a new program of exploration was undertaken, using dyes and oils to identify conduits under the dam. Leakage was found to vary between 100 and 1200 cubic feet per second (cfs). When the dam was acquired by the Tennessee Valley Authority (TVA) in 1939 they employed fluorescein dyes to track the underseepage. Dye tests revealed that the leakage varied between 1720 and 1650 cfs; about 10% of the river's normal flow. They also noted seepage boils forming in the gravel bars, which increased each year. The TVA began constructing the most expensive cutoff wall ever built, drilling 750 18-inch diameter holes along the dam's centerline and backfilling this with concrete to a maximum depth of 163 feet, extending 25 to 103 feet below the river bed. In April 1963 the TVA announced it was abandoning Hales Bar Dam, due to increasing leakage.

Biography

Dr. J. David Rogers holds the Karl F. Hasselmann Chair in Geological Engineering at the Missouri University of Science & Technology in Rolla, Missouri. He is presently representing the geological and geotechnical engineering professions on the National Academies panel that has been charged with examining "Levees and the National Flood Insurance Program: Improving policies and practices," being funded by FEMA. Dr. Rogers has served as principal investigator for research funded by the NSF, U.S. Geological Survey, National Geospatial Intelligence Agency, Federal Highway Administration, Department of Defense, and several state departments of transportation. He has served on numerous panels, including the Mississippi Delta Science & Engineering Special Team, the Coastal Louisiana Recovery Panel, the NSF Independent Levee Investigation Team and USGS Investigation Teams evaluating the impacts of Hurricanes Katrina and Rita, the NSF team evaluating the 2008 and 2011 Mississippi River floods, and the Resilient and Sustainable Infrastructure Networks team funded by NSF to make a five year examination of the California Bay Delta flood protection systems.

Dr. Rogers received his B.S. degree in geology from California Polytechnic University at Pomona, his M.S. degree in civil engineering from the University of California, Berkeley, and his Ph.D. in geological and geotechnical engineering at the University of California, Berkeley. He served on the Berkeley faculty in civil engineering for seven years prior to accepting his current position in 2001.