



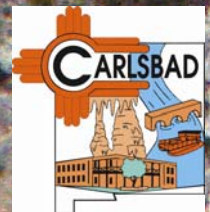
NATIONAL CAVE AND KARST RESEARCH INSTITUTE 2004-2005 BIENNIAL REPORT

Science

Information Management

Education

Resource Management



Legislative Purposes

The National Cave and Karst Research Institute Act of 1998

When Congress established the National Cave and Karst Research Institute (the Institute) in January 1998, it provided the cave and karst community with an unprecedented opportunity to further research, education, information transfer, and resource management revolving around these important, but fragile landscapes. The Institute's legislation offers the opportunity to develop a unique style of national effort with a broad base of both federal and non-federal support extending from collaborative projects to shared administrative responsibilities to matching funds.

Congress passed the National Cave and Karst Research Institute Act of 1998, linking the operation and management of the Institute to the recommendations of a 1994 Report to Congress. In the Act, Congress stated that the purposes of the Institute are:

1. to further the science of speleology;
2. to centralize and standardize speleological information;
3. to foster interdisciplinary cooperation in cave and karst research programs;
4. to promote public education;
5. to promote national and international cooperation in protecting the environment for the benefit of cave and karst landforms; and
6. to promote and develop environmentally sound and sustainable resource management practices.

TABLE OF CONTENTS

Inside cover	Legislative Purposes	
Table of Contents		
Overview by the Institute Director – Hose		1
Primary Partners		
	National Park Service	3
	City of Carlsbad	5
	New Mexico Tech	6
	NCKRI, Inc.	7
Institute Building Activities – Moving towards NCKRI, Inc.		9
	Preliminary meetings and activities	9
	NCKRI, Inc.	10
	Planning for the future	10
Facility Partners		
	New Mexico State Univ./Carlsbad Environmental Monitoring & Research Center	11
	Carlsbad Department of Development/AMITC	11
NCKRI Building Project		12
Visiting Scholar Program		13
Volunteers Program		15
NCKRI projects		
	NCKRI Lecture Series	16
	Karst Information Portal	17
	NCKRI library	18
	NCKRI program review	18
Sponsored projects		
	Mississippi State University – Digital map of karst in Mississippi	19
	U.S. Geological Survey - National KARST Map	19
	U.S. Geological Survey - Karst Interest Group	20
	Western Kentucky University- Microbial film study	20
	Western Kentucky University- Land managers graduate program	21
	Mammoth International Center for Research and Learning – Monitoring chapter	21
	National Cave and Karst Management Symposium	21
	National Speleological Society – Cave conservation book	22
	Boston Museum – Bat book	22

Institute Activities	
a. Refereed papers	23
b. Articles in edited guidebooks and proceedings	24
c. Contributions to edited books	24
d. Books	24
e. Publications edited	24
f. Reports and miscellaneous publications	24
g. Abstracts	25
h. Book reviews	26
i. Grants proposal, refereed journal, and other review panels	26
j. Professional journal editorial board	27
k. Grants and contracts	27
l. Conference and field trip leadership	27
m. Professional presentations	27
n. Community presentations/education	29
o. Major media projects and publicity	30
p. Cave research, assessments, and advisory efforts	31
q. Professional meetings attended	31
r. Project reports	31
s. Other contributions	32
New Mexico Tech Cave and Karst Studies Program	33
Appendices	
A - Articles of Incorporation	34
B - Bylaws	40
C - Capitan Aquifer study	55
D - Exit report by Scott Rice-Snow	57
E - NCKRI External Program Review	61
F - Annual progress report from Western Kentucky University's Center for Water Resources Studies	77
Back Cover - Institute legislation	



NATIONAL CAVE AND KARST
RESEARCH INSTITUTE

OVERVIEW BY THE INSTITUTE DIRECTOR

The close of 2005 finds the National Cave and Karst Research Institute on the verge of major institutional changes and a paradigm shift in how we will do business. Three years ago, the Institute comprised one full-time NPS employee, a Working Group/Advisory Board composed of representatives from six federal agencies, and two non-federal Cooperators (project partner). By the end of January 2006, representatives from twenty-five non-federal organizations joined the six federal agencies in program development efforts. NCKRI's pilot programs have thrived through the efforts of a diverse group of scientists, organizations, and government agencies, including twelve non-federal organizations that joined NCKRI programs during 2004-2005.

NCKRI formally expanded into the international karst world when we collaborated with the Northeastern Cave Conservancy to sponsor noted karst stewardship expert Elery Hamilton-Smith from Charles Sturt University (Australia) on a cross-country lecture tour of karst programs. In Spring 2006, the Institute will have the privilege of hosting our first international Visiting Distinguished Scientist Alexander Klimchouk, Director of the Ukrainian Institute of Speleology and Karstology and Vice-President of the International Union of Speleology. Dr. Klimchouk will be based at the Institute in Carlsbad, work with students in New Mexico Tech's Cave and Karst Studies Program, and visit karst programs across the country during his one-year appointment.

We have initiated several pilot programs over the past two years. The National Cave and Karst Research Institute Lecture Series began as irregular, free public presentations in Carlsbad by leading cave and karst experts. The effort expanded to a national tour by Dr. Hamilton-Smith last fall and will continue with Dr. Klimchouk's visit. We hope that NCKRI will continue to bring leading karst scholars to the United States and share their visits with programs across the country. The Karst Information Portal also promises to be a wonderful collaborative effort with international impact. The Institute has joined the University of New Mexico and the University of South Florida in initiating and seeking significant funding for the effort. We will bring together a diverse panel in January 2006, including foreign representatives of the International Union of Speleology and the Karst Research Institute of Slovenia.

**ORGANIZATIONS
FORMALLY REPRESENTED
IN NCKRI PROGRAM
DEVELOPMENT EFFORTS
DURING 2004-2005
(INCLUDING KIP MEETING
REGISTRANTS)**

American Cave Conservation Association
Australian Speleological Federation
Bureau of Land Management
Cave Research Foundation
CHRONOS
City of Carlsbad, New Mexico
Edwards Aquifer Authority (Texas)
Environmental Protection Agency
ESRI
Geological Society of America
GEON
International Union of Speleology
Karst Waters Institute
Los Alamos National Laboratory
Mammoth Cave Center for Learning & Research
Missouri State Parks
National Speleological Society
National Park Service
New Mexico Institute of Mining & Technology
Phil LaMoreaux and Associates
Pomona College (California)
Slovenian Karst Institute
State University of New York – Plattsburgh
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey
University of Florida
University of South Florida
Virginia State Karst Education Program
Western Illinois University
Western Kentucky University
Wittenburg University (Ohio)

Our partners have also been busy moving forward their contributions to the Institute. New Mexico Tech now has a full-fledged, PhD-granting Cave and Karst Program with several candidates working towards graduate degrees. Dr. Penny Boston continues to bring distinction to the program with her highly visible efforts focused on using earth-based cave microbiology and remote sensing to explore further the field of astrobiology. She and Dr. Lewis Land have worked hard to organize a landmark karst conference in the Guadalupe Mountains of southeast New Mexico for Fall 2007. The City of Carlsbad continues to lend strong support to NCKRI and, despite several unfortunate set-backs, remains committed to start building the Institute's headquarter in town in 2006. The karst community owes a great debt of gratitude to the citizens of Carlsbad for their vision and belief in the importance of a national cave and karst center.

The last two years have brought many challenges and we have experienced our share of setbacks and delays. But, progress has been made, the Institute has a growing vitality, and the vision remains strong. The stage is set for the National Park Service to transfer day-to-day authority to New Mexico Tech and a non-profit, corporate board of directors. This important change will allow many planned advances and an expansion in the vision for NCKRI's future. We encourage you to carefully review this report and think about how you or your organization might join NCKRI in crafting the strongest and most effective coalition possible to support cave and karst education and research worldwide.

**PRIMARY AFFILIATION OF
INDIVIDUALS WHO HAVE
PARTICIPATED IN
CURRENT NCKRI
PROGRAMS**

- Arizona State Parks
- Ball State University (Indiana)
- Carlsbad Department of Development
- Carlsbad Env. Monitoring & Research Center
- Carlsbad Tomorrow!
- Charles Sturt University (Australia)
- Los Alamos National Laboratory - Carlsbad
- Mammoth Cave Center for Learning & Research
- Northeast Cave Management Association (NY)
- State University of New York – Oneonta
- State University of New York – Plattsburgh
- University of New Mexico
- University of South Florida



Louise D. Hose, PhD
NCKRI Director
National Park Service

Photo by Larry Pardue



Bats exiting Carlsbad Cavern.
Photo by Rick Wiedenmann

PRIMARY PARTNERS

NATIONAL PARK SERVICE

SHARED STEWARDSHIP We share a commitment to resource stewardship with the global preservation community;
EXCELLENCE We strive continually to learn and improve so that we may achieve the highest ideals of public service;
INTEGRITY We deal honestly and fairly with the public and one another;
TRADITION We are proud of it; we learn from it; we are not bound by it;
RESPECT We embrace each other's differences so that we may enrich the well-being of everyone.

Leading the effort to implement the National Cave and Karst Research Institute Act has given the National Park Service an opportunity to hark back to and display our Core Values. Acting on the Congressional charge to establish the Institute and to retain “joint” administrative responsibility, we began a novel endeavor that demanded a creative organizational structure with a broad coalition of partners. At the close of 2005, as we shift day-to-day management over to New Mexico Tech, we sit on the brink of putting the Institute fully into action.

Through research and education programs directed toward sustainable resource management, the Institute will expand the Park Service's commitment to *SHARED STEWARDSHIP*. The recent formalization of a broad-based Board of Directors and the inclusion of representatives from European, Australian, and Middle Eastern karst programs in the Institute's projects strengthens NCKRI's and the NPS's ties with the global resource stewardship community. We look forward to the Institute's continuing growth at the national and international levels.

NCKRI partners and planning panels have demonstrated a strong commitment to *EXCELLENCE* and identified the Institute's Core Purpose as “Promoting science-based understanding and sustainable stewardship of cave and karst systems.” We have seen a high bar set for the quality of lectures in the NCKRI Lecture Series and the level of expertise invited to the Karst Information Portal Workshop. This level of excellence will undoubtedly be maintained by the caring attention and involvement of our Board of Directors and growing coalition of partners.

The National Park Service and our NCKRI partners have strived hard to earn the trust and respect of the cave and karst community by demonstrating the highest levels of *INTEGRITY*. When diverse groups come together to forge a new partnership, various competing interests, misunderstandings, and perceived slights often complicate the path to success. By dealing honestly and fairly with each other and with potential future partners, NCKRI is moving forward and has gathered an impressively diverse group of participants.

The National Park Service is proud of our *TRADITION* and our record of stewardship in caring for many of the nation's most cherished natural, cultural, and historic sites. But, NCKRI has been a novel and challenging endeavor. We have reevaluated and expanded our notion of organizational models to ensure the Institute's success as an international leader in promoting science-based understanding and sustainable stewardship of caves and karst lands.

The National Park Service has a deep *RESPECT* for the diverse karst community and recognizes that each organization and person can bring value to our efforts. We look forward to continued involvement as NCKRI continues to build a broad coalition of partners and add to its growing list of participants from organizations with a variety of interests, resources, and ideas. We encourage all participants to embrace the diversity that comes with a coalition and hold to the principle that these differences may enrich the well-being of everyone and, perhaps most importantly, help in our mission of promoting environmentally sound cave and karst resource management practices.



**Dave Shaver, Chief of Geologic Resources Division
National Park Service**



CURRENT NPS GEOLOGIC RESOURCES DIVISION STAFF WORKING DIRECTLY WITH THE INSTITUTE:

<u>TITLE</u>	<u>NAME</u>
Director, National Cave and Karst Institute	Louise Hose
Administrative Support (through contract)	Lynn Johnson
Policy/Regulation Specialist, GRD	Edward Kassman



Photo by John Woods

THE CITY OF CARLSBAD, NEW MEXICO

The City of Carlsbad helped lead the efforts to pass the National Cave and Karst Research Institute Act of 1998 and to also establish funding for the project. We have been involved with the Institute since its beginning and remain committed to help move NCKRI ahead as the leader in cave and karst research and education. We recognize from our experiences with several other national research centers sited in Carlsbad (i.e., Los Alamos National Laboratory, Sandia National Laboratory, Carlsbad Environmental Monitoring and Research Center) the positive benefits to our community that will come from engaging as full partners in NCKRI.

Carlsbad has a long and proud tradition of working with the National Park Service (NPS) in promoting and protecting our two nearby national parks (Carlsbad Caverns and Guadalupe Mountains). In 1990, I, as mayor, appointed Chuck Wiggins as the first Chairman of the National Cave and Karst Research Institute Committee. Our partnership with the NPS towards establishing NCKRI began in 2000 when representatives of the City's Department of Development met with Interim Director Zelda Bailey and other NPS representatives. Carlsbad's mayor at the time, Gary Perkowski, and New Mexico State Representative John Heaton carried that interest further with a request for state funding. Subsequent efforts by Senator Jeff Bingaman's and the late Congressman Joe Skeen's offices, representatives of New Mexico Institute of Mining and Technology (New Mexico Tech) and New Mexico State University (NMSU) focused on office space, a proposed building site, funding and partnerships.

Over the next several years the dedicated efforts of all the leaders of Carlsbad and the State of New Mexico paid off and the Institute became a reality. Temporarily housed on the campus of NMSU's Carlsbad Environmental Monitoring and Research Center, NCKRI began receiving funding from the State of New Mexico that included annual operational appropriations of \$350,000 as well as \$1M for the construction of a building. The City of Carlsbad also pledged \$300,000 of in-kind services toward the building.

The City of Carlsbad has been very much involved with the funding, design, and construction of the NCKRI headquarters building and has focused on the Institute as another attraction to bring visitors and jobs to the area. The Institute's headquarters will anchor the City's major riverfront redevelopment project, The Cascades. The initial phase of The Cascades is under construction and the City is currently working to finalize design plans for the NCKRI building. As we start the new year of 2006, the City is working closely with the Institute Director and New Mexico Tech staff to review designs and subsequent revisions. The architects are focusing on Construction Documents, which should be completed by mid-2006.



**Bob Forrest, Mayor
City of Carlsbad**

The City of Carlsbad takes pride in its important role in establishing the National Cave and Karst Research Institute and we look forward to helping it grow into an internationally recognized center attracting researchers, educators, and visitors from around the world. We have provided major support towards legislatively establishing and funding the Institute and deeply care about its future.

Current City of Carlsbad Staff Working Directly with the Institute:

<u>TITLE</u>	<u>NAME</u>
Mayor	Bob Forrest
City Administrator	Harry Burgess

NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

On behalf of New Mexico Tech, I would like to publicly thank our Institute partners for allowing this research university to become actively involved with this truly unique research venture based in Carlsbad, New Mexico.

Through our association with the National Cave & Karst Research Institute, we here at New Mexico Tech greatly appreciate the unprecedented opportunity to expand on our own mission and research goals by furthering the science of speleology, encouraging and providing public education in cave and karst topics, and promoting environmentally sound management of our public lands and natural resources.

I am also proud—as well as pleased—that New Mexico Tech, along with the National Park Service and the City of Carlsbad, will be able to continue to participate in the development, operation, and continued management of a world-class research institute dedicated to promoting a better understanding and responsible stewardship of our nation's—and, indeed, our world's—cave and karst resources. We owe a large measure of our success over the past few years to our Institute partners, and others like you—our staunchest supporters and advocates.

In an effort to keep you abreast of our recent triumphs and accomplishments, please take time to look over the pages of this institutional report. I hope it will allow you to share with us our collective sense of success, in looking back at what we have accomplished, and as we look forward to what the future has to offer.



Sincerely,

**Daniel H. López, President
New Mexico Institute of
Mining and Technology**



CURRENT NEW MEXICO TECH STAFF WORKING DIRECTLY WITH THE INSTITUTE:

<u>TITLE</u>	<u>NAME</u>
Director – Cave & Karst Program	Penelope Boston/Socorro
Karst Hydrologist	Lewis Land/Carlsbad
Associate V.P. – Research & Econ. Dev.	Richard Cervantes/Socorro

NATIONAL CAVE AND KARST RESEARCH INSTITUTE, INC.

The past year (2004-2005) was a time of transition for the National Cave and Karst Research Institute (NCKRI). For the first few years of its existence, the Institute functioned as part of the National Park Service, within the U.S. Department of the Interior. Because NCKRI was a government entity, it was not able to solicit funding from private sources, a fact that severely restricted its ability to grow and function. A

meeting was held in May 2005 where an Ad Hoc Committee consisting of key individuals from various federal, academic and private organizations were invited to discuss the feasibility of privatizing NCKRI as a non-profit (401-C-3) corporation. This corporation would be managed by New Mexico Tech in Socorro, New Mexico, and the National Park Service would retain supervisory control. The decision of the Committee was to move forward with privatization. The Committee elected its members to an interim Board of Directors for the new Corporation, and a framework was established for drafting Articles of Incorporation and Bylaws.

At a meeting of the Interim Board of Directors (October 2005), the Articles of Incorporation for NCKRI were accepted and representatives of New Mexico Tech were directed to file incorporation papers with the State of New Mexico. Bylaws were distributed to the members of the Board for approval in March, 2006. The Bylaws were accepted, placing the documentation needed for NCRKI to move forward into effect.



May 2005 meeting of the new National Cave and Karst Research Institute Board of Directors in Socorro, New Mexico. Left to right around table, board members Richard Cervantes, Dave Shaver, Geary Schindel, Hazel Medville, Len Vacher, Donald Macfarlane, Harvey DuChene, Carol Wicks, and Jack Hess. Background, left to right, Eddie Kassman (standing), Lewis Land, Gerry O’Nan, Louise Hose, and Penny Boston.
Photo by Ron Kerbo.

While a great deal of progress has been made in the last year, significant projects are still in progress. A significant consequence of the privatization of NCKRI is that the Executive Director, who is now an employee of the National Park Service, will become an employee of New Mexico Tech. This required that the position be filled in compliance with the hiring practices of New Mexico Tech. The position has been advertised and the qualifications of the applicants are currently being examined by a review board comprised of National Park Service, New Mexico Tech and NCKRI Board members.

Due to rising costs, the construction of the Headquarters Building in Carlsbad has been delayed. The City of Carlsbad received bids on the construction of the original design early this year, but the costs far exceeded the available funds and the bids were declined. The City is re-negotiating their design contract with the re-organized architectural firm of Durham, Kilmer, and Associates. A new building design is expected to be ready for bids by early summer 2006.

Although a great amount of time and effort is being expended on administrative details and projects, there has also been progress in other areas. For example, the Institute hosted a two-and-a-half-day Karst Information Portal (KIP) Planning Workshop in Carlsbad in January, 2006 that brought together 30 researchers, educators, information technology specialists, and land managers. The group enthusiastically endorsed the concept of a web-based portal that will create an open access system to karst, cave, and aquifer information. Establishing the digital Karst Portal will increase communication among karst scientists and policy makers around the globe. The KIP Steering Committee (NCKRI/New Mexico Tech, University of South Florida-USF, and University of New Mexico-UNM) prepared a grant proposal to the National Science Foundation for the first substantial financial support of the Portal.

I believe that the future for NCKRI under its new, non-profit, private corporation status is bright. The corporation is now able to seek outside funding to support exhibits, education and research. The Institute will continue to seek its niche in the karst community and within the broader scientific community. I envision an organization that complements existing karst programs and organizations and becomes a resource for them. The Karst Portal, where karst information in digital format is readily available, is a prime example of a resource that will be of world-wide value. With time, money, and creative thinking, the NCKRI facility in Carlsbad can become a magnet for the general public and scientists alike. For this to occur, NCKRI must reach out and embrace karst scientists across the country, providing support for existing programs as well as assisting younger scientists in the establishment of new programs. Many of the most prominent karst scientists in the United States have reached retirement age, and the future of karst education programs now rests in the hands of younger scientists and educators. This group is the future of karst education and research, and NCKRI should do everything it can to nurture and support these programs.

Sincerely,



Harvey R. DuChene
Board Chairman
National Cave and
Karst Research
Institute, Inc.



NCKRI executive committee meeting in May 2006.
Photo by Ron Kerbo

INSTITUTE BUILDING ACTIVITIES

MOVING TOWARDS NCKRI, INC.

Two meetings set up framework for establishing the Institute as a 501.c.3 corporation

The National Cave and Karst Research Institute (NCKRI) made major strides during May 2005 towards moving from a government entity to a partnership coalition, as mandated by Congress through the National Cave and Karst Research Act of 1998. The Act charged the National Park Service (NPS) with establishing NCKRI and the effort has been carried out by NPS's Geologic Resources Division under Chief Dave Shaver's leadership. In developing NCKRI, Interim NCKRI Director Zelda Chapman Bailey and current Director Louise Hose worked to meet the mandate. Two formal partners, the City of Carlsbad and New Mexico Institute of Mining and Technology (New Mexico Tech), joined the effort during the last two year through a Memorandum of Understanding and two Cooperative Agreements. The October 2003 *NCKRI Vision Workshop* scoping session in Shepherdstown, WV, brought together representatives of diverse cave and karst programs nationwide. Following their recommendations, the partners commenced the current process moving towards the formation of a 501.c.3, non-profit, educational corporation.

NATIONAL PARK REPRESENTATIVES MEET

Representatives (Superintendents, Resource Management Chiefs, and Cave Specialists) from eight National Parks with cave and karst programs met in Denver for two-days during May 2005 to review the Institute's progress and plans. The meeting also provided an opportunity for the Parks to express their needs and how NCKRI might help address them. Park representatives left the meeting with a fresh and better understanding of the Institute's mission and plans while NCKRI staff discovered new ideas on how to best serve Park interests.



Park representatives listen to Mark Depoy describe cave and karst initiatives at Mammoth Cave National Park.
Photo by Ron Kerbo.

INTERIM BOARD OF DIRECTORS FORMED

Two weeks later, New Mexico Tech brought together representatives from thirteen governmental, academic, and private cave and karst programs on their Socorro, New Mexico, campus for a two-day Steering Committee meeting. New Mexico Tech and the NPS also had all pertinent staff members, including their respective legal counsel, present. The group discussed a proposal to establish NCKRI as a 501.c.3 with a governing board. By the end of the meeting, they had established an Interim Executive Committee, Interim Board of Directors, and Board committees charged with formally establishing NCKRI, Inc.

THE NATIONAL CAVE AND KARST RESEARCH INSTITUTE, INC. ESTABLISHED

The Interim Board of Directors approved Articles of Incorporation (Appendix A) in fall 2005, which were then submitted to the State of New Mexico by New Mexico Tech. The National Cave and Karst Research Institute was incorporated as a 501.c.3, non-profit corporation in December 2005. Corporation by-laws (Appendix B) were also drafted in 2005.

EXECUTIVE COMMITTEE

Harvey DuChene, Chair
Dr. Nicholas Crawford, Vice-Chair
Richard Cervantes, Treasurer
Dave Shaver, NPS representative
Harry Burgess, City of Carlsbad
representative
Dr. Louise Hose, NCKRI Director (non-voting)
Dr. John W. Hess, Member-at-Large
Dr. Penelope J. Boston, Recording Sec.
(non-voting)



DIRECTORS

Jim Goodbar
Dr. Donald McFarlane
Hazel Medville
Geary Schindel
Jerry Trout
Dr. Len Vacher
Dr. Carol Wicks

COMMITTEES

By-Law Committee Chair
Hazel Medville
Education and Research Chair
Vacant
Karst Stewardship Chair
Geary Schindel
Library Collections and Data Access Chair
Dr. Len Vacher

PLANNING FOR THE FUTURE

While the partners have worked on developing the administrative structure for the National Cave and Karst Research Institute, staff members and contractors have been developing plans for NCKRI's future. In 2004, Frank Binney and Associates wrote a planning document for the public use area of the planned NCKRI building, *National Cave and Karst Museum Preliminary Exhibit Plan*. The plans call for over 4576 square feet of public exhibit space in the NCKRI building's two-story, central atrium space. In late 2005, they began a project to further develop elements of the proposed exhibits in preparation for fundraising efforts by NCKRI, Inc.

In recognition of the Institute's need to diversify its funding base and aggressively pursue fundraising efforts once leadership is transferred from the National Park Service, the Institute commissioned a study by fundraiser Erin Noojibail to identify opportunity and propose strategies that might be pursued by NCKRI, Inc.

FACILITY PARTNER

NEW MEXICO STATE UNIVERSITY - CARLSBAD CARLSBAD ENVIRONMENTAL MONITORING AND RESEARCH CENTER

A formal agreement signed with New Mexico State University (NMSU) in October 2000 made temporary office space and administrative support at its Carlsbad campus available to the Institute. NCKRI's office was located in the university's Carlsbad Environmental Monitoring and Research Center (CEMRC), through an arrangement designed to facilitate collaboration between the two groups. The agreement, the first to be signed on behalf of the Institute provided important support towards establishing the Institute in Carlsbad. CEMRC provided up to four offices and support to NCKRI staff until July 2005, when the space was needed for research projects related to the Waste Isolation Pilot Plant. We remain appreciative to CEMRC and NMSU for their help in establishing the physical presence of NCKRI in the Carlsbad community.



CARLSBAD DEPARTMENT OF DEVELOPMENT ADVANCED MANUFACTURING AND INNOVATION TRAINING CENTER

NCKRI moved to the Advanced Manufacturing and Innovation Technology (AMITC) building in the Airport Industrial Park in July 2005. The Carlsbad Department of Development (CDOD) offered excellent office facilities in their business incubator building, the AMITC, just north of the Cavern City Airport. The move included a change in our Internet domain name to nckri.org as well as a new snail mail address and phone numbers. A Cooperative Agreement between the CDOD and the National Park Service ensured a minimum of 1,200 square feet of secure office space, conference rooms, local and long-distance telecommunications service, high-speed Internet access and e-mail accounts, and related computer support. An additional benefit included re-uniting hydrologist Lewis Land, who had been displaced from the crowded CEMRC facility, with the rest of the NCKRI operations in Carlsbad. The current agreement is renewable for three years.

The CDOD and NCKRI also share an Administrative Assistant, Lynn Johnson. Ms. Johnson works one-quarter time for NCKRI and has proven a very valuable asset to the Institute. A native Carlsbadian, Johnson has an Associate degree in computer science from New Mexico State University – Carlsbad.



Advanced Manufacturing and Innovation Training Center in Carlsbad.



Lynn Johnson

NCKRI BUILDING PROJECT

Representatives from the National Park Service (NPS) and New Mexico Institute of Mining and Technology met in early February 2006 with the City of Carlsbad and their contracted architectural firm of Durham, Kilmer, and Associates to discuss the future of the National Cave and Karst Research Institute headquarters building in Carlsbad, New Mexico. The City, which will build and own the building, received bids on the construction of the original design early this year but the costs far exceeded the available funds and the bid was declined.

The group came to agreement on the essential aspect in the original design and identified areas and features that could be eliminated without impacting the Institute's mission. The meeting also provided an opportunity for all key players to meet each other after recent changes in the lead people at both the architectural firm (Randall Kilmer replace the late Beryl Durham as the licensed architect on the project) and the City (Harry Burgess replaced the recently retired Jon Tully as City Administrator). The NPS has also offered to provide a full-week of design service by their award-winning architect, James Crockett, to help jump-start the re-design process.

At the end of February 2006, the City was re-negotiating their design contract with the re-organized architectural firm of Durham, Kilmer, and Associates. Once completed, Crockett will travel to Carlsbad with Nancy Cocroft of the NPS Construction Program to work with Kilmer and his group of architects in Carlsbad. The group hopes to have a new design ready to go out for bids by early summer 2006.

Meanwhile, the City and their contractors have been preparing the building site and constructing The Cascades, a brownfield renovation project near Lake Carlsbad. The NCKRI headquarters is anticipated to be the first building at The Cascades and the anchor for the project.



Architects Dean Cruse (Durham/Kilmer), James Crockett (NPS), and Nancy Cocroft (NPS) inspect the NCKRI building site.

Aerial photo of the NCKRI building site taken on February 17, 2006. Arrow points to the specific building site. The adjacent excavation is preparation for the water canal that will highlight the urban renovation site. Carlsbad Lake, at the top of the photo, was drained at the time for property maintenance and has since been refilled.

Photo by George West.

VISITING SCHOLAR PROGRAM



The National Cave and Karst Research Institute began a Visiting Scholar Program in spring 2004 with the hiring of **Thomas R. Strong** through a contract with New Mexico Tech. Strong worked with NCKRI for 14 months and focused much of his research attention on a study of vertebrate species usage of local Chihuahuan Desert caves. He also surveyed current monitoring efforts in National Park Service caves as part of the Institute's effort to promote sound monitoring practice among cave stewards. In May 2005, he returned to his home in Tucson, Arizona, where he resumed his career at an environmental consulting firm.

Tom Strong in the field assisting Scott Rice-Snow with his investigation.
Photo by Scott Rice-Snow.

Dr. **Scott Rice-Snow** joined the NCKRI staff in Carlsbad as a Visiting Scholar through the National Park Service's Sabbatical-in-the-Park program. Scott, a physical geographer from Ball State University (Indiana), spent spring semester of 2005 studying the geomorphology of the Guadalupe Escarpment area between the City of Carlsbad and White City as part of a Bureau of Land Management (BLM) effort to protect the Capitan Aquifer, the principle water supply for the City of Carlsbad. Scott presented his results to BLM and NCKRI staff. The study (Appendix C) provides important insight into the areas most likely to provide recharge to the aquifer, a particularly critical issue as petroleum exploration is rapidly extending into the area.

Rice-Snow also provided an exit report (Appendix D) on his experiences, which may prove useful for other scholars considering spending time in residence at the Institute in Carlsbad

Scott Rice-Snow makes presentation to BLM and NCKRI staff
Photo by Pat Seiser



Penny Boston (lt) and Ebery Hamilton-Smith (rt) discuss cave and karst issue during his visit to New Mexico Tech.

The tour stopped in Arizona, New Mexico, Texas, Missouri, Kentucky, and Virginia before finally ending up at the National Cave and Karst Management Symposium in Albany, New York. Presentations and

In a cooperative venture with the Northeastern Cave Conservancy, Inc., NCKRI sent Visiting Scholar **Ebery Hamilton-Smith**, on a three-week, nationwide lecture tour. Hamilton-Smith is a professor in cave and karst management at Charles Sturt University, Albury, New South Wales and has the parallel responsibility of serving as the chair of the International Union for Conservation of Nature and Natural Resources (IUCN, also known as the World Conservation Union) World Commission on Protected Areas Task Force on Caves and Karst.



meetings occurred with representatives from the United States Forest Service, the National Park Service, the Bureau of Land Management, and the Virginia Department of Natural Heritage, University of Arizona, New Mexico Institute of Mining and Technology, the Carlsbad Caverns National Park, the City of Carlsbad, NCKRI, the Edwards Aquifer, the University of Texas-Austin, Western Kentucky University, and Virginia Polytechnic Institute and State University.

List of Presentations

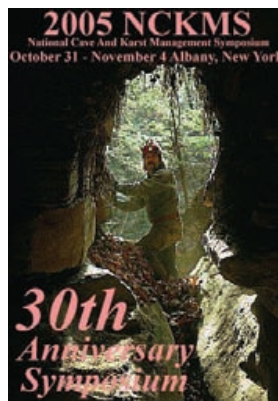
- * Australia Down Under: A Spelean Travelogue
- * Caves and Karst of Australia
- * Reviewing Changes in Nature Conservation
- * Protected Areas Changes in Philosophy and Management
- * Thinking about Karst and World Heritage
- * Karst Regions as World Heritage Sites



Hamilton-Smith met with students at Western Kentucky University.
Photo by Pat Seiser.



Hamilton-Smith concluded his tour with a banquet address closing out the 30th Anniversary National Cave and Karst Management Symposium in Albany, NY.



VOLUNTEERS PROGRAM

The National Cave and Karst Research Institute has partially met the challenge of addressing the Institute's mission during this developmental stage through the National Park Service's Volunteers-in-the-Parks and Geoscientists-in-the-Parks programs. We have been very fortunate to have several outstanding volunteers represent NCKRI on a variety of projects and at many events. Their credentials are outstanding and they have provided hundreds of hours of service towards fulfilling the Institute's mission. Particular recognition is due to Dr. Patricia Seiser, a Carlsbad, NM, resident who has volunteered hundreds of hours on behalf of NCKRI projects. Among her many contributions during the past two years have been helping to organize the NCKRI's workshop on developing cave management plans at the National Cave and Karst Management Symposium in October 2005, hosting Dr. Elery Hamilton-Smith's national tour, and providing karst and cave related programs to many organizations in Carlsbad.



Pat Seiser (rt) works with a young student during NCKRI's presentation on cave and karst sciences during the National Environmental Education Week program. The program, organized by the Guadalupe District of the U.S. Forest Service and hosted at the Living Desert State Park in Carlsbad, NM, taught attentive audiences of 5th and 6th graders about the natural environment in southeastern New Mexico.

Pat Seiser leads a group discussion during the NCKRI workshop at the National Cave and Karst Management Symposium in October 2005.



NCKRI VOLUNTEERS

- Harvey DuChene – Public presentations in Colorado
- Dr. Lynn Kleina - Public presentations in Pennsylvania
- Dr. Patricia Seiser – Public presentation, liaison with Venture Scout Program, and much more
- Doug Soroka – Public presentations in Pennsylvania
- Dr. Thomas Strong – Representing NCKRI at federal and state agency meetings in Arizona
- Dr. H. Len Vacher – Planning the incorporation of mathematics in karst education programs
- Dr. Dachang Zhang – Developing plans for further investigations of Capitan Aquifer

NATIONAL CAVE AND KARST RESEARCH INSTITUTE PROJECTS

NCKRI LECTURE SERIES

The National Cave and Karst Research Institute Lecture Series in Carlsbad, NM, began when an enthusiastic, overflowing crowd of over 95 local residents listened to NCKRI scientist Dr. Penelope J. Boston speak on March 2004 about the potential for subterranean life on Mars. Since that first lecture, the Institute has presented free, public lectures by highly distinguished karst scientists about every three months. The Institute arranged for some of the speakers to also give presentations at Carlsbad Caverns National Park to accommodate Park staff members who were unable to attend the evening lectures in town. The lecture audiences have averaged about 40-50 people.

3/15/04 – Dr. Penelope J. Boston (New Mexico Tech), *The Planet Within: Caves from New Mexico to Mars*

6/28/04 – Dr. Arthur N. Palmer (State University of New York – Oneonta), *America's Greatest Caves: Exploration, Geology, and Origin of Caves in the Guadalupe Mountains (NM), the Black Hills (SD), and Mammoth Cave Region (KY)*

8/9/04 – Dr. Kathleen Lavoie (State University of New York – Plattsburgh), *Cave Crickets; Little "Cave Cows"*

9/27/04 - Dr. Nickolay Hristov (Boston University), *The Bat-Moth Arms Race*

2/3/05 – Dr. Lewis Land (New Mexico Tech), *Karst Hydrology of Southeastern New Mexico: The Capitan Reef and Roswell Artesian Aquifer*

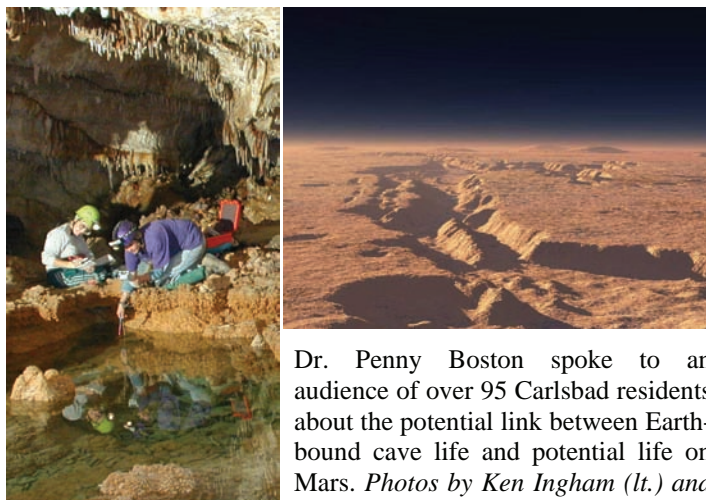
4/18/05 - Dr. Scott Rice-Snow (Ball State University, Indiana) *Geometries of cave room development and other investigations on Isla de Mona, Puerto Rico*

5/23/05 – Dr. Rickard Toomey (Arizona State Parks), *Conservation and Tourism at Kartchner Caverns: How are we doing?*

10/17/05 – Dr. Elery Hamilton-Smith (Charles Sturt University, Albury, New South Wales, Australia), *Thinking about Karst and World Heritage Sites*



Dr. Rick Toomey during his visit to Carlsbad, NM.
Photo by Pat Seiser.



Dr. Penny Boston spoke to an audience of over 95 Carlsbad residents about the potential link between Earth-bound cave life and potential life on Mars. *Photos by Ken Ingham (lt.) and NASA (rt.)*

Karst Information Portal

The National Cave and Karst Research Institute (NCKRI) teamed up with the University of South Florida and the University of New Mexico to develop a web-based Karst Information Portal (KIP). The goal of the project is to transform global understanding of karst terrains through an innovative, global on-line linkage among karst researchers, educators, and land managers who desire a wide variety of electronic information on karst topics by:

- 1) facilitating access to and preservation of karst information both published and unpublished;
- 2) developing linkages and communication amongst the international karst community;
- 3) promoting knowledge-discovery to help develop solutions to problems in karst;
- 4) developing interactive databases for ongoing karst research in different disciplines;
- 5) enriching fundamental multidisciplinary and interdisciplinary science; and
- 6) facilitating collection and dissemination of new data about karst.

Achieving the purposes enumerated above will increase communication among karst scientists, land managers, and policy makers around the globe. In addition to traditional print publications (monograph and journal references), sources will include difficult to locate materials, such as technical reports, conference proceedings, newsletters, and other items referred to as “grey literature.” Maps, databases, images, video, satellite imagery, geospatial data, and other formats are likewise sought, as are collections that document the development of karst research (e.g., researcher correspondence, journals, field notes etc.). The proposed site would both contain its own digital resources and provide convenient links into karst materials located on websites throughout the world.

NCKRI hosted a two-and-a-half-day Karst Information Portal Planning Workshop in Carlsbad in January that brought together 30 karst researchers, educators, information technology specialists, and land managers. The group enthusiastically endorsed the concept of a web-based, karst portal that will create an open access system to karst, cave, and aquifer information. Several participants offered to work closely with the project to make their organizations’ websites and resources compatible with the portal. The KIP team would like to hear from more karst research managers and scientists about how they and their programs might contribute and use the Portal.



KIP Workshop at the AMITC (1/20/06)
Photo by Pat Seiser

More information on the KIP project may be found at: <http://www.lib.usf.edu/KIP/>



NCKRI LIBRARY

Generous contributions have helped to build a substantial book and journal collection for the National Cave and Karst Research Institute. The appraised value of the collection is currently over \$21,000. Substantial donations have come from Warren Lewis, Jerry Vineyard, Tim George, and Diane Wilson (widow of Bill Wilson). Their valued contributions are greatly appreciated.



“Doc” Warren Lewis generously donated most of his extensive cave library to NCKRI shortly before his death in 2005. *Photo by John Ganter.*

NCKRI PROGRAM REVIEW

The National Cave and Karst Research Institute commissioned Dr. Kathleen Lavoie, Dean of Arts and Science at the State University of New York in Plattsburgh to perform an external review of the Institute’s progress through summer 2004 and to develop recommendations for both further program development and future program reviews. Her report is attached as Appendix E.



Dr. Kathleen Lavoie (foreground) works on her NCKRI Program Review report after spending a month actively reviewing the Institute-related programs in both Carlsbad and Socorro. She also interviewed partners and other members of the karst community nationwide regarding the Institute’s progress to date.

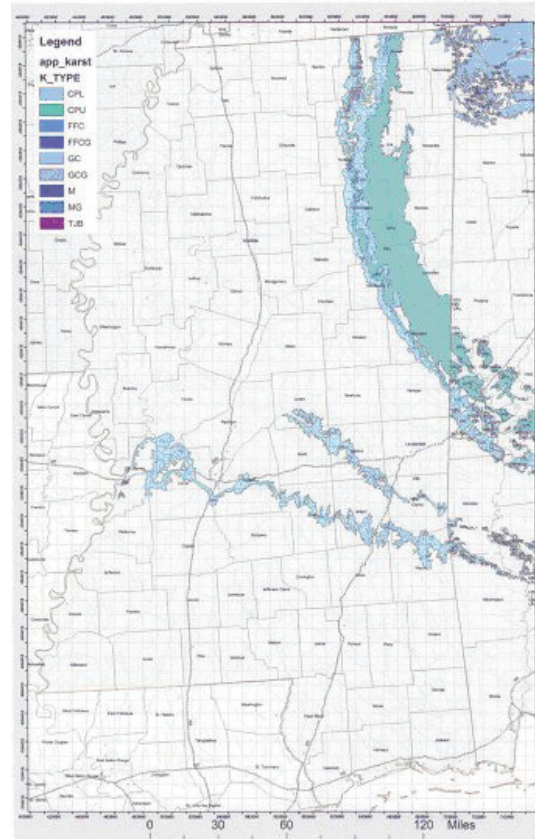


Guadalupe karst (China). Photo by Thomas R. Strong.

SPONSORED PROJECTS

MISSISSIPPI STATE UNIVERSITY - DIGITAL MAP OF KARST IN MISSISSIPPI

Christopher Moore, a graduate student in the Department of Geosciences at Mississippi State University, and his advisor Dr. John E. Mylroie have produced a digital map of the State of Mississippi with karst features and karst drainage basins following the guidelines and procedures of the U.S. Geological Survey KARST Map Project. The digital data is annotated with descriptions of the karst features and interpretations and land use implications of those features. Field and literature search data have been inventoried and placed in a Geographic Information System (GIS) to establish the relationship of cave and karst features with topography, geology, and cultural features. Their report was submitted to NCKRI, a financial sponsor of the project, and U.S. Geological Survey for inclusion in their national KARST map.



KARST map of Mississippi.

U.S. GEOLOGICAL SURVEY KARST MAP PROJECT

In the years 2004 and 2005, the U.S. Geological Survey KARST Project made progress towards producing a new national karst map. Efforts included completion of a draft map of carbonate karst areas in the southern Appalachian region along with further accretion of data from states to the west and north. Karst coverage for the states of Indiana, Arkansas, Rhode Island, and Connecticut were added to the database. A GIS version of the previous national atlas karst map was published online so that there would be a map available for use until the new product is complete (Tobin and Weary, 2004). Work is continuing on developing criteria for classification of the various karst area types found in the diverse geologic and hydrologic settings around the nation. In August 2005, the U.S.G.S. cosponsored a 2-day workshop and field trip at the Kansas Geological Survey, Lawrence, KS, on karst mapping, state karst maps, and the National Karst Map. Participants included representatives from 7 midwestern state geological surveys including: Arkansas, Illinois, Iowa, Kansas, Minnesota, Missouri, and Wisconsin. Progress on the national karst map was presented to the U.S. Geological Survey, Karst Interest Group meeting in Rapid City South Dakota in September 2005 (Weary, 2005).

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U.S. GEOLOGICAL SURVEY'S KARST INTEREST GROUP

U.S. Geological Survey scientists involved in karst research (Karst Interest Group) meet every two to four years at various karst sites and the 2005 event was in the Black Hills of South Dakota on September 12-15, 2005. NCKRI provided financial support for the event, which also included several National Park Service employees and others as participants. The event, organized by Eve L. Kuniansky, resulted in a proceedings volume that is available as a hard copy and online (<http://water.usgs.gov/ogw/karst/>).



Field Trip Stop at Mammoth Site (Larry Agenbroad and Kristine Thompson provided lectures on karst sinkholes as animal traps). *Photo submitted by Eve Kuniansky, USGS.*

WESTERN KENTUCKY UNIVERSITY - CENTER FOR WATER RESOURCES STUDIES - QUANTITATIVE MONITORING OF METABOLIC ACTIVITIES INFERRED FROM THE ACTIVITIES OF SPECIFIC SUBSET COMPONENTS OF MICROBIAL BIOFILMS FORMING ON CAVE-LIKE SUBSTRATA

Western Kentucky University's Center for Water Resources Studies is collaborating with Mammoth Cave National Park and other scientists to investigate the microbial ecology of biofilms on cave substrata in the world's longest known cave, the Flint-Mammoth System. They are leaving dozens of BioSep beads in the cave for months then analyzing and measuring lipid, DNA biomarkers, ¹³C enrichment, and other parameters. The team provided a detailed report on the project's status through December 2005 (Appendix E).



Researchers collect sediments at Charon Cascade. *Photo submitted by Rick Fowler.*

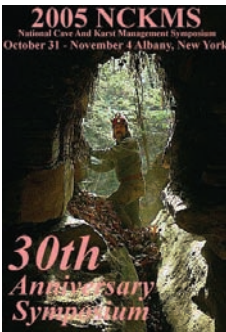
WESTERN KENTUCKY UNIVERSITY- LAND MANAGERS PROGRAM

Western Kentucky University has developed a graduate program tailored to the needs and schedules of National Park Service cave and karst resource management specialists who wish to further their educational background. Under the cooperative agreement with WKU, the Institute supports this program to allow more students access to the benefits of advanced education. No report was received from the program in 2005.

WESTERN KENTUCKY UNIVERSITY - MAMMOTH CAVE CENTER FOR SCIENCE AND LEARNING AND NPS'S GEOLOGIC RESOURCES DIVISION

The National Park Service's Geologic Resource Division, in cooperation with the Geological Society of America, initiated producing a manual on geologic resource monitoring for National Park Service resource managers. NCKRI joined the effort by offering financial support for the cave and karst chapter. Dr. Rickard Toomey, Director of the newly formed Mammoth Cave International Center for Science and Learning at Western Kentucky University, was selected for the task and began work on the chapter in fall 2005. Toomey is considered a leading authority on commercial cave monitoring techniques. He had recently left a position with the Arizona State Parks where he developed and oversaw several innovative monitoring techniques at Kartchner Caverns State Park.

NATIONAL CAVE AND KARST MANAGEMENT SYMPOSIUM



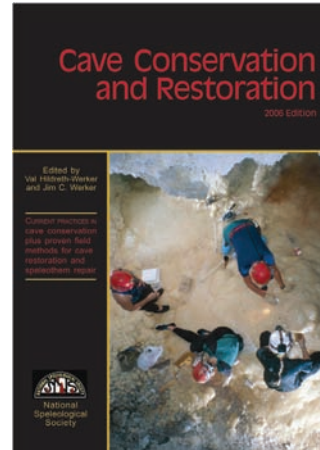
The National Cave and Karst Research Institute (NCKRI) played a prominent role in the National Cave and Karst Management Symposium in Albany, New York in November 2005. The Northeastern Cave Conservancy (NCC) did a magnificent job of organizing the biennial event with a full program of papers, posters, workshops, and a field trip. The NCKRI, a co-sponsor of the event, gave a workshop on developing and evaluating cave management plans. NCKRI volunteer Pat Seiser, Wind Cave National Park Cave Specialist Rod Horrick, and Mammoth Cave Science and Learning Center Director Rick Toomey led the break-out sessions during the workshop. The Institute also partnered with the NCC in bringing Elery Hamilton-Smith to the symposium as the banquet speaker.



Group discussion led by Rick Toomey during the NCKRI workshop at the National Cave and Karst Management Symposium in Albany, NY.

NATIONAL SPELEOLOGICAL SOCIETY

The National Cave and Karst Research Institute provided partial funding to publish a book compiled by the National Speleological Society (NSS) titled *On Caves Conservation and Restoration*, which features conservation and restoration topics by researchers from a variety of disciplines and chapters dedicated to specific conservation measures and restoration techniques. NSS Executive Vice President Gordon Birkhimer reports that the book is in the last stages of editing and will be available in July 2006.



BOSTON MUSEUM – BAT BOOK

The Institute provided partial funding to the Center for Ecology and Conservation Biology at Boston University for artwork and figures to be included in *A Guide to Bats of North America*. The book features information on the life-history, ecology, and behavior of 45 species of bats known from North America, half of which depend on or utilize caves. The book will be published by Oxford University Press, probably in 2007.



Townsend's big-eared bats (*Corynorhinus townsendii*). Photo by R. Scott Altenbach, submitted by Thomas Kunz, Boston College.

INSTITUTE ACTIVITIES

Bold letters indicate NCKRI-affiliated scholars

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- Centeno-Garcia, E., **Rosales-Lagarde, L.**, and Soreghan, G.S., 2005, Evidence for late Paleozoic magmatism in western Pangea (Mexico): Geological Society of America, Rocky Mountain Section, 57th annual meeting, Abstracts with Programs - Geological Society of America v. 37, n. 6, p. 43.
- Curry, M.C.**, and **Boston, P.J.**, 2006, A geomicrobiological investigation of moonmilk using scanning electron microscopy: Thursday Morning Cave, CO, and Dos Ojos Cave, NM [abst.]: Rio Grande Branch, American Society for Microbiologist (ASM) Abstracts with Programs, p. 3.
- Hose, L.D.**, 2004, Assessing cave and karst tourism in the Sultanate of Oman [abst.]: Journal of Cave and Karst Studies, v. 66, n. 3, p. 115.
- Hose, L.D.**, and **Boston, P.J.**, 2004, Implementing the National Cave and Karst Research Institute vision [abst.]: Journal of Cave and Karst Studies, v. 66, n. 3, p. 115.
- Hose, L.D.**, **Boston, P.J.**, Curry, M., and **Rosales-Lagarde, L.**, 2005. El nuevo Instituto Nacional de Investigación de Cuevas y Karst: Su papel en la comunidad internacional de Cuevas y karst: VII Congreso Nacional de Espeleología, Resumen y Programa, Monterrey, Mexico.
- Hose, L.D.**, and Northup, D.E., 2004, Biovermiculations: Living, vermiculation-like deposits in Cueva de Villa Luz [abst.]: Journal of Cave and Karst Studies, v. 66, n. 3, p. 112.
- Land, L.**, 2004, Seasonal vs. long-term variations in hydraulic head in a regional karst aquifer: Roswell Artesian Basin, NM: GSA Abstracts with Programs, v.36, no. 5, p. 131.
- Northup, D.E., Connolly, C.A., **Boston, P.J.**, Trent, A., Peck, V., Spilde, M.N., and Natvig, D.O., 2004, On the nature of bacterial communities: Four Windows Cave, El Malpais National Monument [abst.]: National Speleological Society National Convention, Marquette, MI.
- Northup, D.E., Turner, A.L., Spilde, M.N., **Boston, P.J.**, Alvarado, A., and **Hose, L.D.**, 2005, Sulfur-based microbial communities from Cueva de Villa Luz, an extreme sulfide-rich cave [abst.]: Abstracts of the General Meeting of the American Society for Microbiology, v. 105, N-065.
- Pfaffenhuemer, M.**, Spilde, M.N., **Boston, P.J.** and Stan-Lotter, H., 2004, Haloarchaeal occurrence in ancient Austrian rock salt - Electron microscopic characterization studies: Abstr. P12, Halophiles 2004, Sept. 4-9, Ljubljana, Slovenia.

Rosales-Lagarde, L., and Boston, P.J., 2005, Fuente e importancia del ácido sulfhídrico en la Cueva de Villa Luz, Tabasco, México: Resumen VII Congreso Nacional de Espeleología. Resúmenes y Programa.

Strong, T. and Boston, P.J., 2004, The National Cave and Karst Research Institute: Early history, evolution, and current progress [abst.]: National Speleological Society National Convention, Marquette, MI.

h. BOOK REVIEW

Strong, T.R., 2004, Book review: Monitoring trends in bat populations of the United States and territories: Problems and prospects: *Journal of Cave and Karst Studies*, v. 66, n. 3, p. 119-120.

i. GRANT PROPOSAL, REFEREED JOURNAL, AND OTHER REVIEW PANELS

- AIAA – Science and Technical Committee for Human Exploration of Moon and Mars 2003-Present - (Boston-panel)
- Biohazard/Planetary Protection Focus Team - Johnson Space Center - (Boston-panel)
- NASA Astrobiology Institute Review of Genomics and NAI – Genomics of the Subsurface Extremophile Population - (Boston-panel)
- National Academy of Science –NASA Mars Mission Architecture 2007-2016 - (Boston-panel)
- National Geographic Society Expedition Council - (Hose-1)
- National Research Council/DOE Panel - (Boston-panel)
- National Science Foundation Biogeosciences Grant Program - (Hose-1)
- *Journal of Environmental Management* - (Hose-1)
- *Geomorphology* - (Hose-1)
- *Hydrogeology Journal* (Land – 1)
- *Journal of Geoscience Education* (Rice-Snow-1)
- *Mathematical Geology* (Rice-Snow-1)
- *Journal of Cave and Karst Studies*- (Hose-1)
- GSA Special Publication - (Land - 2)
- University of New Mexico Press - (Hose-1)

j. PROFESSIONAL JOURNAL EDITORIAL BOARD MEMBER

- Senior Editor, *Astrobiology Journal* – (Boston)
- Editorial Board –*New Mexico Geology*, the journal of the Bureau (NMBGMR) – (Boston)

k. GRANT AND CONTRACTS

- Allen, L.D., & **Hose, L.D.** – Clean Energy Grant (New Mexico Energy, Minerals, and Natural Resources Department. Amount awarded: \$144,000 to City of Carlsbad for NCKRI building.
- **Boston, P.J.** - 18 other proposals submitted, 4 awarded, 1 awarded but no funds, 9 rejected, 5 pending
- **Land, L.** - Water level variations in the Artesian and Surficial aquifers, Roswell Artesian Basin. Contract with Pecos Valley Artesian Conservancy District (PVACD). Amount awarded: \$57,000
- **Land, L.** - Investigation of groundwater residence time in the San Andres Artesian Aquifer near Bitter Lakes National Wildlife Refuge. Contract with U.S. Fish and Wildlife Service (USFWS). Amount awarded: \$25,000

- **Land, L.** - Water level variations in the Artesian and surficial aquifers, Roswell Artesian Basin. Contract with Pecos Valley Artesian Conservancy District (PVACD). Extension of previous year's contract. Amount awarded: \$25,000

I. CONFERENCE AND FIELD TRIP LEADERSHIP

- National Cave and Karst Research Institute, Inc., Board organizational meeting to formulate the plan for future direction of the institute (Boston)
- National Cave and Karst Management Symposium *Biological Aspects of Cave Management* Session (Boston)
- National Cave and Karst Management Symposium *Assessing Karst Management Workshop*, (Hose, Seiser).
- Vice-President and Science Committee Chair for the 15th International Congress of Speleology to be held in Kerrville, TX, in July 2009 (Hose)
- Led a group of petroleum geologists from Occidental Petroleum on a tour of Carlsbad Caverns. (Land)
- Chaired session on cave and karst resources for George Wright Society Convention in Philadelphia, Pennsylvania (Strong)

m. PROFESSIONAL PRESENTATIONS

Angeles-Serrano, G., **Rosales-Lagarde, L.**, Ramos-Leal, J. A., 2004. Características de flujos regionales, y su manifestación, tres casos en México. Topic 1: Environmental issues of groundwater-flow scaling/ Aspectos ambientales asociados con la escala del flujo de agua subterránea. XXXIII IAH Congress, VII ALHSUD Congress.

Boston, P.J., 2004, Tiny stars on the planet Mars: Where geomicrobiology is leading the search for extraterrestrial life: Oral presentation at the cave geomicrobiology session at Geological Society of America Meeting, Denver, CO.

Boston, P.J., 2004, A hot and sour soup: Sulfur caves from toasty to downright chilly: Oral presentation at the hydrothermal spring communities session at Geological Society of America Meeting, Denver, CO.

Boston, P.J., 2004, NASA Director's Panel on Exploration Science – Cave Exploration As A Model for Extraterrestrial Missions, Naval Postgraduate School, Monterey, CA.

Boston, P.J., 2004, Microorganism Effects On Cave Formation, Enlargement, & Mineral Precipitation: Oral presentation at the 32nd International Geological Congress, Florence, Italy.

Boston, P.J., 2004, Extraterrestrial cave science exploration strategies: STAIF 2004.

Boston, P.J., 2004, Gaia: Still dancing in the dark: Whole Earth Systems Symposium – Stanford University, CA.

Boston, P.J., 2004, Ecological community development in a lunar ecopoiesis testbed facility: A Phase I and II NIAC Study: STAIF (Space Tech. Applic. Internat. Forum) – Albuquerque, NM.

Boston, P.J., 2004, Subsurface access via drilling into natural conduit: AME (Association of Mars Explorers) & CSA (Canadian Space Agency) – Meridiani Base Symposium, Vancouver, BC.

Boston, P.J., 2004, Toward a concept of habitability: Applications to Experimental Ecopoiesis: ASGSB (Amer. Soc. Gravity Space Biol.), Reno, NV.

Boston, P.J., 2004, Cave geomicrobes: Mineral microchemists of earth's subsurface: Amer. Chem. Soc., - Ft. Lauderdale, FL.

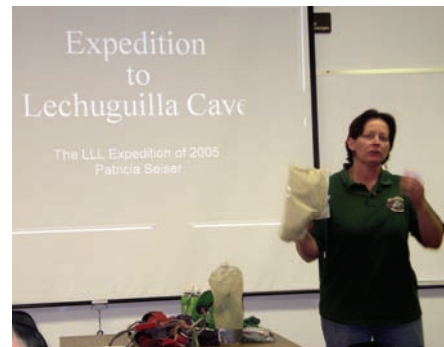
Boston, P.J., 2004, Caves as mesocosms of planetary systems: Ecosynthesis II Conference, Synergia Ranch, Santa Fe, NM.

- Boston, P.J.**, 2004, Microbial realms In the subsurface: The biological richness of caves: Washington Univ. Seattle, WA. NASA Astrobiology Institute Webcast Seminars.
- Boston, P.J.**, 2004, The REAL Mars underground: Learning to use extraterrestrial caves for science, habitat, and resources: Mars Society keynote address, Boulder, CO.
- Boston, P.J.**, 2004, Bayesian statistics in the interpretation of multi-dimensional niche space: Svante Arrhenius Symposium, Karolinska Institute, Stockholm, Sweden..
- Boston, P.J.**, 2004, The Planet Within: Astrobiology Beneath Your Feet: Swedish Museum of Natural History, Stockholm, Sweden.
- Boston, P.J.**, Spilde, M.N., Northup, **D.E.**, **Mullen**, K.E., Barger, J., Carey, R., Van de Kamp, J.L., Snider, J.R., and Pham, D., 2004, AGU, San Francisco, CA. Dec. 2004.
- Hose, L.D.**, 2004, Assessing cave and karst tourism assets in the Sultanate of Oman: Oral presentation at National Speleological Society National Convention, Marquette, MI.
- Hose, L.D.**, and **Boston, P.J.**, 2005, National Cave and Karst Research Institute update: Poster presentation at the 2005 National Cave and Karst Management Symposium, Albany, NY.
- Hose, L.D.**, **Boston, P.J.**, **Strong, T.R.** (Presenter) and **Seiser, P.E.**. 2005. The World Above, the World Below: The 3-Dimensional, Interdisciplinary Nature of Cave and Karst Stewardship. Paper presented at the George Wright Society Conference, Philadelphia, Pennsylvania, March 14-18, 2005.
- Hose, L.D.**, Brinkmann, R., and Northup, D.E., 2005, The global karst digital portal: An emerging collaboratorium will enhance information exchange among cave and karst managers: Oral presentation at the 2005 National Cave and Karst Management Symposium, Albany, NY.
- Hose, L.D.**, and Northup, D.E., 2004, Biovermiculations: Living, vermiculation-like deposits in Cueva de Villa Luz, México: Oral presentation at National Speleological Society National Convention, Marquette, MI.
- Hose, L.D.**, and **Boston, P.J.**, 2004, Implementing the National Cave and Karst Research Institute Vision: Oral presentation at National Speleological Society National Convention, Marquette, MI.
- Hose, L.D.**, **Boston, P.J.**, Frederick, G., and Zokaites, C., 2004, Using caves to inspire the next generation of Earth explorers: Poster presentation at the NASA Earth Science Education Community Meeting, Asilomar, CA.
- Johnston, J.G.**, **Boston, P.J.**, and **Stafford, K.W.**, 2006, Assessment of karst landform potential on Mars: Johnson Space Center, Houston, TX.
- Land, L.**, Guest speaker, Albuquerque Geological Society: *Karst Hydrology and Geomorphology of the Lower Pecos Valley, Southeastern New Mexico*
- Land, L.**, Guest speaker, New Mexico Brackish Groundwater Assessment Program Workshop, Albuquerque, New Mexico: *Geophysical Mapping of Freshwater-Saltwater Interfaces: Examples from the Coastal Plain Aquifer System of North Carolina*
- Land, L.**, Guest speaker, West Texas Geological Society: *Regional Hydrologic Framework of Karstic Aquifers in Southeastern New Mexico*
- Shindo, S.**, **Boston, P.J.** Wilson, J.L., and Burger, P., 2005, Micrometeorological modeling of an idealized cave and application to Carlsbad Cavern: NM. European Geophysical Union Conference.
- Stafford, K.W.**, and **Boston, P.J.**, 2005, Theoretical evaporite karst development on Mars: Lunar and Planetary Science Conference, Johnson Space Center, Houston, TX.
- Strong, T. R.**, and **Boston, P.J.**, 2004, The National Cave and Karst Research Institute: Early History, Evolution, and Current Progress. Paper presented at the National Speleological Society Convention, Marquette, Michigan, July 12-16, 2004. Abstract published in Journal of Cave and Karst Studies 66(3):111.

- Strong, T.R., and Boston, P.J., 2004.** The National Cave and Karst Research Institute: The New Mexico Connection. Paper presented at the National Speleological Society Convention, Marquette, Michigan, July 12-16, 2004.
- Strong, T.R., and Goodbar, J., 2005.** Vertebrate Species Use of Cave Resources in the Chihuahuan Desert. Paper presented (by J. Goodbar) at the International Congress of Speleology, Athens, Greece, August 21-28, 2005.
- Strong, T.R., 2005,** Vertebrate Species Use of Caves in the Chihuahuan Desert. Paper presented at the George Wright Society Conference, Philadelphia, Pennsylvania, March 14-18, 2005.

n. COMMUNITY PRESENTATIONS/EDUCATION

- Carlsbad Leadership Council (Hose)
- Carlsbad Lions Club (Hose)
- National Environmental Education Week presentations at Living Desert State Park (Hose, Seiser)
- Caves and karst of China for Pecos Valley Grotto of NSS (Strong)
- Biology efforts of NCKRI for Carlsbad Caverns interpreter training program (Strong)
- NCKRI Lecture Series, *Geometries of Cave Room Development and Other Investigations on Isla de Mona, Puerto Rico* (Rice-Snow)
- Carlsbad Rotary Club: *Karst Hydrology of Southeastern New Mexico: The Capitan Reef and San Andres Artesian Aquifers* (Land)
- Pecos Valley Grotto (National Speleological Society): *Geology and Hydrology of Fort Stanton Cave, Sacramento Mountains, New Mexico* (Land)
- *Geophysical methods in cave and karst investigations*, for Frontiers of Cave and Karst Science, NMT Earth Science Dept, spring semester, 2004 (Land)
- Pomona College Environmental Analysis Program field trip: *Karst Hydrology of Southeastern New Mexico: The Capitan Reef and Roswell Artesian aquifers* (Land)
- Carlsbad Leadership Council (Land)
- Bottomless Lakes State Park Enchanted Evenings presentation: *A Tale of Two Aquifers: The Capitan Reef and San Andres Limestone Formations of Southeastern New Mexico* (Land)
- National Cave and Karst Research Institute: *Karst Hydrology of Southeastern New Mexico: The Capitan Reef and San Andres Artesian Aquifers* (Land)
- Rockin' Round New Mexico, 2005, a field trip organized by the New Mexico Bureau of Geology for secondary school science teachers working on their MST (Master of Science Teaching). (Land)
- Presentation on NCKRI for Carlsbad Interfaith Ministers Council (Strong)
- Presentation on NCKRI for Eddy County Commissioners (Strong)
- China Karst for Carlsbad Rotary (Strong)
- Pecos Valley Grotto of NSS (Seiser, Strong) Vertebrates in Chihuahuan Desert caves for Carlsbad Caverns interpreter training program (Strong)
- Vertebrates in Chihuahuan Desert caves for Arizona Regional Association of NSS Meeting (Strong)



Seiser giving a talk to the Pecos Valley Grotto, Carlsbad.

- Vertebrates in Chihuahuan Desert caves for Western National Parks Association, Tucson, AZ (Strong)
- Exploration Science Advisory Panel – Museum of Science and Industry, Chicago, IL. (Boston)
- Lecturers in a Cave and Karst Science Workshop for K-12 teachers held at the NMSU-Carlsbad campus (Boston, Hose)
- Tapijulapa High School, Tabasco, MX (Boston, Hose, Rosales-Lagarde)
- Space Foundation, Inc., Colorado Springs. Graduate Astrobiology for Teachers (Boston)
- TAAS (The Albuquerque Astronomical Society) (Boston)
- OASIS Adult Education Program, Albuquerque, NM (Boston)
- AAUW Socorro Chapter (Boston)
- Science Day at Roundhouse, NM State Capitol, Santa Fe (Boston)
- Socorro Public Library (Boston)
- OASIS Adult Education Program, Albuquerque, NM (Boston)
- REU Program – 2005 – 2007 (Boston)
- Summer Science Program (Cal Tech sponsored program at NMT and Ojai, CA) (Boston)

o. MAJOR MEDIA PROJECTS AND PUBLICITY

- MIT Forbes Forum PBS live broadcast (Boston)
- *NOVA*. Origins (Boston)
- *NHK* (Japan) TV Documentary on cave exploration and our research in Spider Cave, NM. (Boston)
- *Paladin Productions* – The Case for Mars (Boston)
- *Discover Channel* – Science in the National Parks special (Boston)
- *BBC Pioneer – Earth* (Boston and Hose)
- Cueva de Villa Luz: The Acid Cave, Japanese Broadcasting Corporation (NHK) (Boston, Hose)
- Numerous interviews concerning Fort Stanton Cave (FSC) and Senator Pete Domenici introduction of special legislation designed to protect the Snowy River pool deposits (Boston and Land)



Boston investigating microbial participation in speleothem development.

Photo by Ken Ingham.

p. CAVE RESEARCH, ASSESSMENT, AND ADVISORY EFFORTS

- Began research on vertebrate species using caves of Chihuahuan Desert (Strong)
- Cueva de Luna Azufre preliminary scientific assessment, Tabasco, Mexico (Hose, Lagarde, volunteers)
- Fort Stanton Cave, surface geophysical surveys and continuing investigations of Snowy River Passage. (Land)
- Concluded research on vertebrate species using caves of Chihuahuan Desert (Strong)
- Advising Coronado National Memorial, Arizona, on cave management issues (Strong)
- Reconnaissance investigation of active, sulfidic caves in Italy (Hose)

q. PROFESSIONAL MEETINGS ATTENDED

- 2004 Geological Society of America, Denver, Colorado (Boston, Hose, Land, Seiser)
- 2005 Geological Society of America, Salt Lake City, Utah (Boston, Hose)
- 14th International Congress of Speleology, Kalamos, Greece (Hose)
- Consortium of Universities for the Advancement of Hydrological Sciences Institute (CUAHSI), Logan, Utah (Strong)
- National Speleological Society Convention, Marquette, Michigan (Strong)
- National Cave and Karst Management Symposium, Albany, NY (Boston, Hose)
- New Mexico Geological Society, Fall Field Conference, Taos region, New Mexico (Land)
- New Mexico Water Resources Research Institute Fall Meeting, Ruidoso, NM (Land)
- Southwest Section, American Association of Petroleum Geologists (AAPG), El Paso, TX (Land)
- State Map Advisory Committee (SMAC) Meeting (Land)
- American Society of Civil Engineers, Conference on Sinkholes and the Engineering and Environmental Impacts of Karst, San Antonio, TX (Land)
- New Mexico Geological Society, Fall Field Conference, Chama Basin, New Mexico (Land)
- NSS-Southwest Region Spring Meeting, McKittrick Hill, Eddy Co., NM (Land)
- NSS-Southwest Region Winter Technical Meeting, Carlsbad, NM (Land, Hose, Seiser)
- George Wright Society Convention, Philadelphia, Pennsylvania (Strong)



Hose visiting Frasassi Cave, Italy, during a pre-14th International Congress of Speleology field trip. Photo by Art & Peggy Palmer.

r. PROJECT REPORTS

- Two final reports on geoarchaeology projects, to Tibes Indigenous Ceremonial Center, Puerto Rico (Rice-Snow)
- Final report, "Landscape and Aquifer Interactions on the Guadalupe Escarpment, Whites City to McKittrick Draw, Eddy County, New Mexico", to BLM Carlsbad Office (Rice-Snow)

s. OTHER CONTRIBUTIONS

- Contributed to a web-based Science Journey on caves aimed at middle school age kids in New Mexico and beyond in collaboration with UNM and the Natural History and Science Museum, Albuquerque. 2004 (Boston)
- NM Science Fair judging – NMT, Socorro, NM (Boston)
- Mentoring 5 science fair student projects by email (Boston)
- Testimony before the Senate Subcommittee on Energy and the Environment on behalf of legislation to create a new protected class for subsurface resources (i.e. caves) within the Bureau of Land Management (Boston)

NEW MEXICO TECH CAVE AND KARST STUDIES PROGRAM

DIRECTOR/ADVISOR: Penelope J. Boston

PhD students and their dissertation topics:

Kevin Stafford – Variable Controls on Calcium Sulfate Speleogenesis in the Castile Formation of the Gypsum Plain: Eddy County, New Mexico, and Culberson County, Texas.



Laura Rosales-Lagarde – Investigation of the geological controls of the spring water chemistry in the Sierra de Chiapas Foothills, Southern Tabasco and Northern Chiapas, Mexico.



Katrina Koski – To be decided.

MS students and their theses topics:

Setsuko Shindo – Graduated August 2005. Thesis: “Micrometeorological Modeling of an Idealized Cave and Applications to Carlsbad Cavern, NM.”

Megan Curry – A Geomicrobiological and Hydrogeochemical Approach to the Biogenicity of Moonmilk Formation [Tongass National Forest, Alaska; White River National Forest, Colorado; Carlsbad Caverns and El Mal Pais National Parks, New Mexico]

Erin Kay – Impact generated speleogenesis on Mars.

Senior thesis students and their topics:

JoAnna Johnson - Periglacial karst landforms.

Penny Bencomo – Graduated, Dec. 2005. Surface Interactions Between Microbes and Mineral Surfaces: A Look at Moonmilk

Stefani Bennett – Graduated, May, 2005. Cave and Karst Science in the High School and Junior College Classroom.

Kristin Mullen – Graduated, May 2004. Fe/Mn Deposits in Caves.

Visiting summer/semester students and their home institutes:

Carrie Haglock – Ashland University, OH. Summer 2005.

Sarah Stachura – Trinity University, TX. Summer, 2005.

Amy Turner - College of William and Mary, VA. Summer, 2004.

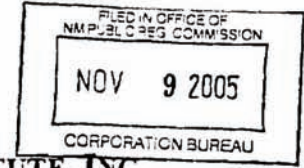
Marian Pfaffenhuemer – Inst. Genetics Gen. Biol., Salzburg, Austria. Fall, 2004.

COPY

ARTICLES OF INCORPORATION

of

NATIONAL CAVE AND KARST RESEARCH INSTITUTE, INC.



I, the undersigned Incorporator, desiring to form a corporation pursuant to the New Mexico Nonprofit Corporation Act, hereby adopt the following Articles of Incorporation for such Corporation:

ARTICLE I

Corporate Name

The name of the Corporation is National Cave and Karst Research Institute, Inc.

ARTICLE II

Nonprofit Corporation

The Corporation is a non-profit corporation.

ARTICLE III

Perpetual Duration

The period of the Corporation's duration is perpetual.

ARTICLE IV

Members; Governance

The Corporation shall have various classes of members, the qualifications and rights of which shall be set forth in the bylaws. The Corporation shall be governed by its Board of Directors.

ARTICLE V

Purposes

The Corporation is organized exclusively for charitable or educational purposes within the meaning of § 501(c)(3) of the Internal Revenue Code. More specifically, the Corporation is organized to receive and maintain a fund or funds of real or personal property, or both, and,

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APPENDIX A

subject to the restrictions and limitations hereinafter set forth, to use and apply the whole or any part of the income therefrom and the principal thereof:

- (1) to further the science of speleology;
- (2) to centralize and standardize speleological information;
- (3) to foster interdisciplinary cooperation in cave and karst research programs;
- (4) to promote public education;
- (5) to promote national and international cooperation in protecting the environment for the benefit of cave and karst landforms; and
- (6) to promote and develop environmentally sound and sustainable resource management practices,

all in accordance with the provisions of the National Cave and Karst Research Institute Act of 1998, 16 U.S.C. §4310 note, either directly or by contributions to organizations that advance one or more of these purposes and that qualify as exempt organizations under Section 501(c)(3) of the Internal Revenue Code of 1986 and the Regulations promulgated thereunder, as they now exist or as they may hereafter be amended.

ARTICLE VI *Corporate Powers*

The Corporation shall have all powers necessary or convenient to effect any or all of the purposes for which the Corporation is organized, including the authorities and limitations as described in the National Cave and Karst Research Institute Act of 1998, 16 U.S.C. §4310 note.

ARTICLE VII *Registered Office, Agent*

The street address of the registered office of the Corporation is 801 Leroy Place, Socorro, NM 87801-4796 and the name of the registered agent at such address is Daniel H. López.

ARTICLE VIII *Initial Board of Directors*

The initial Board of Directors of the Corporation consists of the following twelve persons who have consented to serve as the initial directors:

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APPENDIX A

NAME	ADDRESS
1. Harvey DuChene, Chairman	Consulting Geologist 7216 E. Bentley Circle Englewood, CO 80112-1197
2. James Goodbar	Bureau of Land Management 620 East Greene Street Carlsbad, NM 88220
3. Jerry Trout	Coronado National Forest Federal Building 300 W. Congress Tucson, AZ 85701
4. Nicholas Crawford	Center of Cave and Karst Studies Applied Research and Technology Program of Distinction Dept. of Geography and Geology Western Kentucky University Bowling Green, KY 42101
5. H. L. Vacher	Department of Geology University of South Florida 4202 E. Fowler Ave. Tampa, FL 33620
6. David Shaver	National Park Service-Geologic Resources Division P.O. Box 25287 Denver, CO. 80225
7. Hazel Medville	National Speleological Society 11762 Indian Ridge Rd. Reston, VA 20191-3525
8. Geary Schindel	Edwards Aquifer Authority 1615 N. St. Mary's Street San Antonio, TX 78215
9. Robert Forrest	Mayor, City of Carlsbad P.O. Box 1569 Carlsbad, NM 88221-1569

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10. Donald McFarlane
WM Keck Science Center
The Claremont Colleges
925 N. Mills Ave.
Claremont, CA 91711
11. John W. Hess
Geological Society of America-Executive Director
3300 Penrose PL.
PO Box 9140
Boulder, CO. 80301
12. Richard Cervantes
New Mexico Institute of Mining and Technology
Associate Vice President, Research & Economic
Development
801 Leroy Place
Socorro, NM 87801

ARTICLE IX

Regular Board of Directors

The term, number, qualification, and selection of the directors shall be fixed by the Bylaws, provided, however, that regardless of any other provision in the Bylaws regarding the directors, the National Park Service of the United States Department of the Interior, the New Mexico Institute of Mining and Technology, and the City of Carlsbad shall each appoint one director. Each such appointed director and his or her successors shall serve at the discretion of the appointing entity, and may be removed and replaced only at the appointing entity's discretion.

ARTICLE X

Restrictions on Corporate Activities

Notwithstanding anything herein to the contrary, the Corporation shall not carry on any other activities not permitted to be carried on by an organization exempt from federal income tax as an organization described in § 501(c)(3) of the Internal Revenue Code (or corresponding section of any future federal tax code). No substantial part of the activities of the Corporation shall be the carrying on of propaganda, or otherwise attempting to influence legislation, and the Corporation shall not participate in, or intervene in (including the publishing or distribution of statements) any political campaign on behalf of any candidate for public office. Notwithstanding any other provision of these articles, the Corporation shall not carry on any other activities not permitted to be carried on (a) by a corporation exempt from federal income tax under Section 501(c)(3) of the Internal Revenue Code of 1986, as amended; or (b) by a corporation, contributions to which are deductible under Section 170(c)(2) of the Internal Revenue Code of 1986, as amended.

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ARTICLE XI

*Corporate Distributions, Retentions,
Investments, and Expenditures*

No part of the net earnings of the Corporation shall inure to the benefit of, or be distributable to, its directors, officers, or other private persons, except that the Corporation shall be authorized and empowered to pay reasonable compensation for services rendered and to make payments and distributions in furtherance of the purposes set forth in Article V hereof. The Corporation shall make distributions at such time and in such manner as not to subject it to tax under Section 4942 of the Internal Revenue Code of 1986, as amended; the Corporation shall not engage in any act of self-dealing which would be subject to tax under Section 4941 of the Internal Revenue Code of 1986, as amended; the Corporation shall not retain any excess business holdings which would subject it to tax under Section 4943 of the Internal Revenue Code of 1986, as amended; the Corporation shall not make any investments which would subject it to tax under Section 4944 of the Internal Revenue Code of 1986, as amended; and the Corporation shall not make any taxable expenditures which would subject it to tax under Section 4945 of the Internal Revenue Code of 1986, as amended.

ARTICLE XII

Dissolution

Upon the dissolution and winding up of the Corporation, the Board of Directors shall, after paying or adequately providing for the debts and obligations of the Corporation, distribute all of the remaining assets of the Corporation to one or more nonprofit fund, foundation, or corporation. Any such distributee shall have a purpose or purposes consistent with those specified in Article V and shall be organized and operated exclusively for the purposes of Section 501(c)(3) of the Internal Revenue Code of 1986, as amended, which has established its tax-exempt status under that section. Also, the Board shall comply with all applicable state and federal regulations with regard to the disposition of assets acquired by the use of state or federal funds.

ARTICLE XIII

Director Liability, Indemnification

In accordance with the New Mexico Nonprofit Corporation Act, no director of the Corporation shall be liable to the Corporation for monetary damages for an act or omission in the director's capacity as a director except as provided in that statute. The Corporation shall indemnify any director or officer, or former director or officer of the Corporation, to the extent he or she is not indemnified by insurance, against expenses actually and necessarily incurred by such director in connection with the defense of any civil or criminal action, suit, or proceeding in which such director is made a party by reason of being or having been a director or officer of this Corporation, except in relation to matters for which indemnification is not permitted by law. Such indemnification and reimbursement shall not be deemed exclusive of any rights to which one indemnified may be entitled under any statute, agreement, vote of directors, or otherwise.

RECEIVED

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NM PUBLIC REG. COMM.
CORPORATION BUREAU

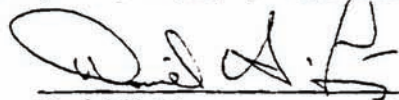
APPENDIX A

ARTICLE XIV
Incorporator

The name and address of the incorporator is:

NAME	ADDRESS
Daniel H. López	801 Leroy Place Socorro, NM 87801-4796

IN WITNESS WHEREOF, I have hereunto set my hand, this 3rd day of November, 2005.



Daniel H. López

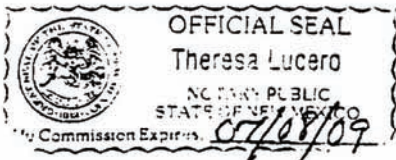
This instrument was acknowledged before me on November 3rd, 2005 by Daniel H. López.

State of New Mexico
County of Socorro

My Commission Expires: 07/08/09



Notary Public



BYLAWS

of

NATIONAL CAVE AND KARST
RESEARCH INSTITUTE, INC.

A New Mexico Nonprofit Corporation

**BYLAWS OF
NATIONAL CAVE AND KARST RESEARCH INSTITUTE, INC.**
A New Mexico Nonprofit Corporation

ARTICLE I
Name and Location

Section 1.1 Name. The name of this Corporation is NATIONAL CAVE AND KARST RESEARCH INSTITUTE, INC.

Section 1.2 Principal Office. The principal office of the Corporation shall be located in Carlsbad, Eddy County, New Mexico.

Section 1.3 Other Offices. Other offices and other facilities for carrying out the purposes of the Corporation shall be located at such places as the directors may determine from time to time.

ARTICLE II
Purpose

Section 2.1 Purpose. The primary purposes for which the Corporation is organized are to receive and maintain a fund or funds of real or personal property, or both, and, subject to the restrictions and limitations contained in the Articles of Incorporation of the Corporation or in these Bylaws, to use and apply the whole or any part of the income therefrom and the principal thereof:

- (a) to further cave and karst science;
- (b) to centralize and standardize information about cave and karst science;
- (c) to foster interdisciplinary cooperation in cave and karst research programs;
- (d) to promote public education;
- (e) to promote national and international cooperation in protecting the environment for the benefit of cave and karst landforms;

(f) to promote and develop environmentally sound and sustainable resource management practices; and

(g) to comply with and advance the purposes of the National Cave and Karst Research Institute Act of 1998, 16 U.S.C. §4310 note,

either directly or by contributions to organizations that advance one or more of these purposes and that qualify as exempt organizations under Section 501(c)(3) of the Internal Revenue Code of 1986, the regulations promulgated thereunder, as they now exist or as they may be amended hereafter.

Section 2.2 Restrictions on Activities. Notwithstanding any other provisions of these Bylaws, the Corporation shall not conduct or carry on any activity not permitted to be conducted or carried on

(a) by an organization under Section 501(c)(3) of the Internal Revenue Code of 1986, as amended, and the Regulations promulgated thereunder as they now exist or as they may hereafter be amended, including, but not limited to, carrying on propaganda, or otherwise attempting to influence legislation, participating in, or intervening in (including the publishing or distributing of statements), any political campaign on behalf of or in opposition to any candidate for public office or

(b) under the National Cave and Karst Research Institute Act of 1998, 16 U.S.C. §4310 note.

Section 2.3 No Private Inurement. No part of the net earnings of the Corporation shall inure to the benefit of any Director or officer of the Corporation, or any private individual (except that reasonable compensation may be paid for services rendered to or for the Corporation effecting one or more of its purposes), and no Director or officer of the Corporation or any private individual shall be entitled to share in the distribution of any of the corporate assets on dissolution of the Corporation.

Section 2.4 Distributions upon Dissolution. Upon the dissolution and winding up of the Corporation, the Board of Directors shall, after paying or adequately providing for the debts and obligations of the Corporation, distribute all of the remaining assets of the Corporation to

one or more nonprofit fund, foundation, or corporation. The fund, foundation, or corporation shall have a purpose or purposes consistent with those specified in Article V and shall be organized and operated exclusively for the purposes of Section 501(c)(3) of the Internal Revenue Code of 1986, as amended, and shall have established its tax-exempt status under that section. Also, the Board shall comply with all applicable state and federal regulations with regard to the disposition of assets acquired by the use of state or federal funds.

ARTICLE III

Members

Section 3.1 Admission. Persons, including individuals, corporations, and institutions, may be admitted to membership at any time. To be admitted as a member, a person must:

- (a) Meet the qualifications for a specific class of member, as set forth in this Article III;
- (b) Agree to be bound by the Articles of Incorporation, Bylaws, and policies of the Corporation, as amended and adopted from time to time, and execute a copy of the Bylaws; and
- (c) Be approved by a majority of the Board of Directors.

Section 3.2 Only members in good standing of the Corporation shall be eligible to participate in any regular or special meeting of the Members and to recommend candidates for Director.

Section 3.3 Classes. The Corporation shall have three (3) classes of Members, to be known as Institutional Members, Corporate Members and Individual Members.

Section 3.4 Membership Qualifications. The qualifications for each membership class shall be determined by the Board of Directors.

Section 3.5 Membership Dues. Membership dues shall be determined by the Board of Directors, and may vary from class to class.

Section 3.6 Membership meetings. Meetings of the Members or of any class of Members may be held at such times as may be fixed from time to time by resolution of the Board of Directors. The Chairman of the Corporation shall give notice of the time and place of these meetings not less than fourteen (14) before the meeting, either personally or by mailing such notice to each Member, or each Member of the relevant class, as the case may be, at the address that appears in the records of the Corporation. Unless otherwise required by these Bylaws or by statute, the notice need not set forth the business to be addressed at the meeting.

ARTICLE IV

Directors

Section 4.1 Initial Board of Directors. The directors named in the Articles of Incorporation shall constitute the Board until the first annual meeting of the Board, and until their successors are elected and qualify.

Section 4.2 First Regular Board of Directors; Number and Categories of Directors. At the first annual meeting of the Board, the initial board of directors shall be replaced by the election of the first regular Board, which shall consist of three (3) Appointed Directors and not less than five (5) nor more than twelve (12) Elected Directors, as fixed by the initial Board prior to the first annual meeting, who shall be selected as follows:

(a) *Appointed Directors.* The National Park Service of the United States Department of the Interior (“**National Park Service**”), the New Mexico Institute of Mining and Technology (“**NM Tech**”), and the City of Carlsbad (“**Carlsbad**”) shall each appoint one director. Such Appointed Directors and his or her successors shall serve at the discretion of the appointing entity, and may be removed and replaced only at the appointing entity’s discretion.

(b) *Elected Directors.* The Members may nominate one or more individuals to serve in each position of Elected Director. The initial Board shall elect the Elected Directors of the first regular Board from these nominated individuals at the first annual meeting of the Board.

Section 4.3 Staggered Terms. The Elected Directors of the first regular Board shall be organized into three groups of approximately equal number. The members of the first group shall serve terms of one year; the members of the second group shall serve terms of two years; the members of the third group shall serve terms of three years.

Section 4.4 Subsequent Boards of Directors. The number of Elected Directors to serve on the Board of Directors may be increased or decreased from time to time by an amendment to Section 4.2 adopted by two-thirds (2/3) of the whole Board of Directors. In all other instances, Directors and their successors shall each serve a term of three years. Directors shall hold office until their successors are elected and qualified. Directors may be elected to succeed themselves.

Section 4.5 Vacancy in Elected Director Position.

(a) *Expiration of Term*. When a vacancy on the Board of Directors is occasioned by the expiration of an Elected Director's term, the Members may nominate one or more individuals to fill the anticipated vacancy. At the Annual Meeting of the Directors, a majority of the Directors attending the meeting and voting shall elect the successor Director from those so nominated.

(b) *Other Vacancies*. Any vacancy in an Elected Director position, except for a vacancy occasioned by the expiration of an Elected Director's term, shall be filled by the Directors at the next regular meeting or at a special meeting called for that purpose, with the successor director elected by a majority of the Directors attending the meeting and voting. A Director thus elected to fill any vacancy shall hold office for the unexpired term of his or her predecessor, and until his or her successor is elected and qualifies.

Section 4.6 Resignation. Each Director shall have the right to resign at any time upon written notice thereof to the chairman of the Corporation. Unless otherwise specified in the notice, the resignation shall take effect upon receipt thereof, and the acceptance of such resignation shall not be necessary to make it effective.

Section 4.7 Removal. The Board may remove at any time any Elected Director from the Board when such removal is determined by the Board to be in the best interest of the

Corporation. Such determination shall be made at any meeting of the Board by an affirmative vote of two-thirds (2/3) of the whole Board, excluding the Director being voted upon.

Section 4.8 Compensation of Directors. No Director shall be entitled to receive any salary or other compensation for fulfilling his or her or her duties as Director of the Corporation, provided, however, that this provision shall not apply to the reimbursement of expenses incurred by Directors in the performance of their duties, and nothing herein shall be construed to preclude any Director from serving the Corporation in any other capacity and receiving compensation therefor.

Section 4.9 Annual Meeting. There shall be an annual meeting of the Board of Directors held at a time and date in the month of May each year as shall be established by the Board of Directors or a committee so authorized. The Chairman shall give to each director of the Corporation not less than fourteen days prior written notice of the time, place, and agenda for the annual meeting.

Section 4.10 Regular Meetings. Regular meetings of the Board of Directors shall be held at such times as may be fixed from time to time by resolution of the Board of Directors.

Section 4.11 Special Meetings. Special meetings of the Board of Directors may be called by the Chairman or by any two directors.

Section 4.12 Notices of Special Meetings. The Chairman of the Corporation shall give the directors notice of the time, place, and agenda for the special meetings before the meeting either personally or by mailing such notice to each director at his or her address as the same appears on the records of the Corporation. Such notice may be waived by any director, in writing, either before or after such meeting, and will be deemed waived by any director who attends the meeting in person.

Section 4.13 Quorum. A quorum for the transaction of business by the Board of Directors shall be the presence of a majority of the whole Board. The act of the majority of the directors present at a meeting at which a quorum is present shall be the act of the Board of Directors, except as otherwise specifically provided by law, by the Articles of Incorporation, or by these Bylaws. The directors present at any meeting, whether or not sufficient to form a quorum, by a majority vote may adjourn the meeting from time to time and a meeting may be held as adjourned without further notice, at which, if a quorum shall be present, any business may be transacted which might have been transacted at the meeting as originally noticed.

Section 4.14 Budget Committee. The Appointed Directors and the Secretary/Treasurer shall constitute the Budget Committee. The director appointed by the National Park Service shall be designated as Chairman and shall preside at all meetings of such Committee. The Budget Committee shall keep regular minutes of its proceedings and report the same to the Board of Directors when required.

Section 4.15 Executive Committee. Officers of the Corporation and one Director elected by the Board of Directors constitute the Executive Committee. The Appointed Directors may participate in Executive Committee meetings. The Executive Committee sets the date, time, place, and agenda for meetings of the Board of Directors. The Executive Committee also appoints members of other committees whose membership is not defined by the By-Laws. Other functions of the Corporation may be assigned to the Executive Committee by the Board of Directors. The Executive Committee shall keep regular minutes of their proceedings and report the same to the Board of Directors when required.

Section 4.16 Other Committees. The Board of Directors may, by resolution passed by a majority of the whole Board, designate committees, each committee to consist of two or more

persons. Each such committee shall have such power and authority and shall perform such functions as may be provided in such resolution, including the power to have and exercise the authority of the Board of Directors if so provided in such resolution. Such committee or committees shall have such name or names as may be designated by the Board of Directors and shall keep regular minutes of their proceedings and report the same to the Board of Directors when required.

Section 4.17 Action by Written Consent. Any action required or permitted to be taken at any meeting of the Board of Directors may be taken without a meeting if a written consent, setting forth the action so taken, is signed by all the members of the Board of Directors, and such consent shall have the same force and effect as a unanimous vote at a meeting. Any action required or permitted to be taken at any meeting of any committee designated by the Board of Directors may be taken without a meeting if a written consent, setting forth the action so taken, is signed by all the members of such committee, and such consent shall have the same force and effect as a unanimous vote at a meeting.

Section 4.18 Meetings by Electronic Conference. Members of the Board of Directors or members of any committee designated by the Board of Directors may participate in and hold a meeting of such Board or committee by means of electronic conference or similar communications equipment by means of which all persons participating in the meeting can interactively communicate with each other, and participation in such a meeting shall constitute presence in person at such meeting, except where a person participates in the meeting for the express purpose of objecting to the transaction of any business on the ground that the meeting is not lawfully called or convened.

Section 4.19 Honorary Members. The Board of Directors from time to time may designate, by title and duty, honorary members of the Board of Directors, each of whom shall serve in an advisory and consultative capacity. Honorary directors shall serve for one year. The honorary directors may attend meetings of the Board of directors and may participate in committee assignments, but shall have no vote.

ARTICLE V

Management of the Corporation; Administrator

Section 5.1 Board of Directors. The affairs of the Corporation shall be managed by the Board of Directors and such other persons as they shall appoint to assist them.

Section 5.2 Administrator. NM Tech shall be the Administrator of the Corporation. The Administrator shall have and may exercise all of the authority of the Board of Directors to plan, coordinate, and administer the Corporation and its programs, except where action of the Board of Directors is required by statute, the Bylaws, or the Articles of Incorporation, and shall have the authority to sign all checks, drafts, or orders for the payment of money, note, or other evidences of indebtedness issued in the name of the Corporation and the power to authorize the seal of the Corporation to be affixed to all papers which may require it; provided, however, that the Administrator shall not have the authority to commit the Corporation to any indebtedness, other than in the normal course of the Corporation's business, without the prior express approval of the Board of Directors. Such delegation shall not relieve the Board of its responsibilities under the New Mexico Nonprofit Corporations Act for the management of the Corporation. The Administrator shall assist the officers in the performance of their duties under these Bylaws, but such assistance will not relieve the officers from the responsibility for the proper exercise of their duties.

Section 5.3 Annual Statement. The Administrator shall present at each annual meeting of the Board of Directors a full and clear statement of the business and condition of the Corporation.

Section 5.4 Budget. The Administrator shall prepare a preliminary budget each year. Seventy-five (75) days before each annual meeting of the Board of Directors, the Administrator shall provide a copy of the preliminary budget to each director. No later than forty-five (45) days before the annual meeting, each director shall submit any comments he or she may have to the Budget Committee. Thirty (30) days prior to each annual meeting, the Budget Committee shall meet with the Administrator to review the preliminary budget and the directors' comments, and to make such changes to the preliminary budget as the committee, by the affirmative vote of a majority of committee members present and voting, deems appropriate. Fourteen days before the annual meeting of the Board of Directors, the proposed budget, as revised by the Budget Committee, shall be distributed to the directors. At the Annual Meeting of the Board of Directors, the chairman of the Budget Committee shall lead a discussion of the budget. At the conclusion of the discussion, the chairman of the Budget Committee and the Administrator shall, at their sole discretion, make such additional changes to their respective (federal and state) portion of the proposed budget as they deem appropriate and approve the budget.

ARTICLE VI *Officers*

Section 6.1 In General. At each annual meeting of the Board of Directors, the directors shall elect a Chairman, a Vice Chairman, and a Secretary/Treasurer. Any two of such offices may be held by the same person; except that the same person shall not hold the two offices of Chairman and Secretary/Treasurer. The directors may elect such additional Vice Chairmen as they deem appropriate.

Section 6.2 Chairman. The Chairman shall be elected from the Board of Directors. The Chairman shall preside at all meetings of the Board of Directors and appoint a recording secretary for each meeting. The Chairman may execute, in the name of the Corporation, deeds, mortgages, bonds, contracts, or other instruments authorized by the Board of Directors, except where otherwise provided by statute or by the Bylaws; in general, the Chairman shall perform all such other duties as from time to time may be assigned to the Chairman by the Board of Directors; and the Chairman may from time to time delegate such of the Chairman's powers to the Vice Chairman as the Chairman may deem appropriate.

Section 6.3 Vice Chairman. The Vice Chairman shall be elected from the Board of Directors. The Vice Chairman shall perform the duties of the Chairman in the absence or incapacity of the Chairman and assume such other duties and responsibilities as may be assigned to the Vice Chairman by the Chairman.

Section 6.4 Secretary/Treasurer. The Secretary/Treasurer shall be elected from the Board of Directors. The Secretary/Treasurer shall have the duty to record the proceedings of the meetings of the members and directors in a book to be kept for that purpose and to safeguard the books and records of the Corporation.

Section 6.5 Term of Office. All officers shall hold office at the pleasure of the Board of Directors or until their respective successors have been elected and have qualified.

Section 6.6 Compensation of Officers. Stipends for officers are determined by the Board of Directors. In addition, the officers shall receive reimbursement of expenses incurred in the performance of their duties. Nothing herein shall be construed to preclude any officer from serving the Corporation in any other capacity and receiving compensation therefor.

ARTICLE VII

Executive Director

Section 7.1 Duties. The Executive Director shall comply with and advance the purposes of the National Cave and Karst Research Institute Act of 1998, 16 U.S.C. §4310, note, the Articles of Incorporation of the Corporation, and these Bylaws, and have such duties as may be delegated by the Administrator.

Section 7.2 Qualifications. The qualifications for the Executive Director shall be determined by the Administrator upon consultation with the Board of Directors.

Section 7.3 Selection. The Executive Director shall be selected by the President of NM Tech or the President's designee from a group of candidates selected by a committee (the "Search Committee") composed of the Appointed Directors and at least two Elected members of the Board of Directors. The Director appointed by the NPS shall be a member of the selection committee.

Section 7.4 Employee of NM Tech. The Executive Director shall be an employee of NM Tech, whose services shall be devoted entirely to the Corporation. The Corporation will reimburse NM Tech for all costs incurred by NM Tech in the employment of the Executive Director, including wages and benefits.

Section 7.5 Term. The Executive Director shall serve for a term of one year, which term may be renewed by the Administrator without limit.

Section 7.6 Review. The Executive Director's performance shall be reviewed annually by a committee (the "Evaluation Committee") composed by a representative of NM Tech, a

representative of the NPS, a representative of the City of Carlsbad, and two members of the Board of Directors.

Section 7.7 Ex Officio Member of Board. The Executive Director shall be a nonvoting, *ex officio* member of the Board of Directors.

ARTICLE VIII
General Provisions

Section 8.1 Fiscal Year. The fiscal year of the Corporation shall be from July 1 through June 30.

Section 8.2 Seal. In the discretion of the Board of Directors, the Corporation may have a seal and said seal may be used by causing it or a facsimile thereof to be impressed or affixed or in any manner reproduced. Any officer of the Corporation shall have authority to affix the seal to any document requiring it.

Section 8.3 Special Authorization. The Board of Directors may authorize any officer or officers, agent or agents of the Corporation, including the Administrator, in addition to the officers so authorized by these Bylaws, to enter into any contract or execute and deliver any instrument in the name of and on behalf of the Corporation. Such authority may be general or may be confined to specific instances.

Section 8.4 Depositories. All funds of the Corporation shall be deposited from time to time to the credit of the Corporation in such banks, trust companies, or other depositories as the Administrator may select.

Section 8.5 Acceptance of Donations. The Board of Directors may accept on behalf of the Corporation any grant, contribution, gift, bequest, or devise that may be used to advance the purposes of the Corporation. The Board of Directors may also decline any grant,

contribution, gift, bequest, or devise if, in the determination of the Board, such action would be in the best interest of the Corporation.

Section 8.6 Resignations. Any director or officer may resign at any time by giving written notice to the Chairman or a member of the Executive Committee. Such resignation shall take effect at the time specified therein or, if no date be specified, on the date of its receipt.

Section 8.7 Directors' and Officers' Liability. The Officers and Directors of the Corporation shall be entitled to the full extent of protection from liability afforded under Sections 53-8-25.2 and -25.3 of the New Mexico Nonprofit Corporations Act. The Corporation shall not directly indemnify Officers and Directors, but shall maintain errors and omissions coverage for those persons, in an amount to be determined by the Board of Directors.

ARTICLE IX

Bylaws

Section 9.1 Amendments. These Bylaws may be altered, amended, or repealed and new Bylaws may be adopted by the Board of Directors at any regular meeting or at any special meeting called for that purpose by a vote of at least two-thirds of the whole Board of Directors.

Section 9.2 When Bylaws Silent. It is expressly recognized that when the Bylaws are silent as to the manner of performing any corporate function, the provisions of the New Mexico Nonprofit Corporation Act shall control.

CERTIFICATE OF CHAIRMAN AND SECRETARY/TREASURER

We certify that we are the duly elected and acting Chairman and Secretary/Treasurer of National Cave and Karst Research Institute, Inc., and that the foregoing Bylaws constitute the Bylaws of the Corporation. These Bylaws were duly adopted at a meeting of the Board of Directors held on _____.

Chairman of National Cave and Karst Research Institute, Inc.

Secretary/Treasurer of the National Cave and Karst Research
Institute. Inc.

APPENDIX C

Landscape and Aquifer Interactions on the Guadalupe Escarpment, Whites City to McKittrick Draw, Eddy County, New Mexico

ABSTRACT

Scott Rice-Snow, Department of Geology, Ball State University, Muncie, Indiana

The Guadalupe Escarpment is a high-relief zone extending one to four miles westward from the Guadalupe Front in the area between Whites City and southwest Carlsbad. This area is under accelerating oil and gas development, and also comprises the most direct recharge area for the Capitan Aquifer. Local relief across any portion of the escarpment zone is 400-600 feet. The landscape within the zone divides well into the classic land surface elements of uplands (22% of surface area), slopes (61%), and canyon floors (17%). Fine-scale drainage development is generally dendritic, but there are escarpment front areas of rectangular drainage at southern and northern ends of the study area controlled by front-parallel fractures (and/or possibly minor synclines), and a distinctive area of parallel drainage development on the north side of Wood Canyon with significant headward extension into Guadalupe Ridge.

Infiltration on uplands and slopes must generally pass through soil-filled fracture openings and downdip on open bedding planes. Slope areas include many first- and second-order mapped stream channels in V-shaped valleys, with open fractures relatively rare on streambeds. Sandstone and siltstone exposures are commonly marked by seepage erosion alcoves. The floor of Dark Canyon, the most major drainage traversing the area, includes bedrock as well as boulder/cobble/gravel streambed sections. Infiltration in bedrock pavement sections may be aided by bedrock abrasion-formed basins along fracture lines, and by eastward-dipping strata with unusual levels of karst conduit development. Depth of boulder fill along some reaches exceeds ten meters, providing a large-volume medium for streamflow transfer to the subsurface during torrential rains.

It is likely that water moving slowly downdip through backreef units will only feed the reef aquifer if it does not again contact the surface. Water seeping out on slopes is lost by evapotranspiration. Two simplified models can be postulated for escarpment area recharge to the Capitan Aquifer. In Model 1, infiltrating water descends vertically through carbonate units and then runs downdip on the major sandstone beds. Model 2 treats the entire mass of the backreef as a material with strongly anisotropic permeability, much enhanced

along the dip direction, with infiltrating water proceeding in a downdip direction immediately on reaching bedrock. The likely real condition resides between these end members, but the two models agree in identifying the following portions of the escarpment landscape as recharge areas that should be given special attention in terms of water quality protection: (1) The floors and updip-facing side slopes of Dark Canyon and other major canyons, and (2) The escarpment front (outer Reef ridge and adjacent mile or so of area to the west). In the latter area, strong focus should be placed on the floors and updip-facing walls of shallow canyons, and zones of rectangular, fracture-associated drainage.

APPENDIX D

Report on Sabbatical Experience

National Cave and Karst Research Institute

Scott Rice-Snow

Professor, Dept. of Geology, Ball State University

January-May 2005

I am very satisfied with the sabbatical experience I've had at NCKRI. I've been able to accomplish significant work on a project with Jim Goodbar of BLM, germinated and did literature-based research for another study in cave morphometry, become acquainted with a number of issues being addressed by the Institute, expanded my professional network, and visited a number of significant geological sites for the first time. The support provided by NCKRI (office, housing stipend, local travel support) and BLM (field transport, GIS) has been crucial in getting the work accomplished. NCKRI staff have been welcoming and very ready to involve me in various Institute activities.

The Sabbatical in the Parks Program played the clearinghouse role to connect me with the Institute: without it, I would not have been here. Although NCKRI is somewhat atypical of the Parks Service sites hosting sabbatical volunteers, it is a good example of the breadth of work environments that can be accessed through the program. The main difficulty in working through sabbatical in the Parks was the initial phase of uncertainty extending through several months before getting a proposed assignment. I likely caused some of the drawing-out of the process by offering a vita and asking for a search of sites (friendly to winter field work) that might be interested in a visiting worker with my specialties and skills, rather than: 1) Following the prescribed procedure and coming up with a fairly specific type of project from my own research priorities, but which could be done at any of a number of different locations (bit of a trick for my discipline), or 2) previously developing a relationship with research personnel at a NPS park or other site, establishing with them that housing support could be provided, and then sending a geographically specific proposal to the national office.

Although NCKRI has a large network within the cave/karst community from which to draw visiting scientists in the future, I would recommend that the Institute stay in touch with the NPS Sabbatical in the Parks coordinator with expression of continuing interest, explicit list of the breadth of volunteer scholar disciplines/skills that would be welcome, and, if appropriate, titles of specific long-term priority projects. While NCKRI moves more under New Mexico Tech management, the NPS sabbatical program could continue serving to draw in the contributions of scholars, such as myself, with main specialty areas outside cave and karst science.

An active visiting scientist program will greatly benefit the Institute and greater research/education community. Integrating a pay level above housing/office/local travel reimbursement will of course be welcome. While we were in Carlsbad we were mainly trying not to deplete financial resources, keeping about the same balances as we would in Muncie. The NCKRI housing allowance was therefore crucial, while we continued to make mortgage payments in Indiana. I should note that in our search for a sabbatical home, replacement of housing costs or provision of family housing was the key necessary factor.

The delay in arrival of housing, etc., reimbursement checks during our first two months here did

cause some concern for us. Once the matter was addressed, we appreciated the subsequent promptness in processing of reimbursement claims and more reliable cash flow.

As I have mentioned before, I think that a Carlsbad semester-in-residence program with seminars and field experiences for cave/karst graduate students would be a worthy contribution of the Institute. This could become a standard expectation of the NMT program, especially as some NMT theses would presumably be directed by NKCRI staff based in Carlsbad. It would be a great student-exchange component of the nation's premier cave/karst programs, and a valuable transfer-credit opportunity for students working in departments with advisors more or less alone in cave/karst involvement.

On the premise, then, that professional and student visitors (weeks to months duration) will be a significant part of the Institute population into the foreseeable future, I will suggest some areas for long-term development of visitor support. These issues could be left to visitors' individual action and the market, etc., to decide, but I think they would benefit from some considered, systematic development by one of the Institute permanent staff members. This ought to be someone with responsibilities (and pay grade?) that allow some formal recognition of the contribution of dealing with nuts-and-bolts visitor issues. I am suggesting such an explicit approach with the idea that there will be a number of persons visiting simultaneously at times, and a limited number of permanent staff. Jenn, Wesley, and I have benefited from town orientation and many other kindnesses offered informally by colleagues while here. It may be a bit easier for a visitor or two to 'fall through the cracks' when there are several here, and other duties piling up at times for Institute staff. The following are areas for consideration:

- 1) Housing. The greatest benefit of our temporary apartment at Vista del Rio was proximity to work, allowing me to walk many days and leave the car for Jenn to use. I suspect this will be a consideration for other visitors bringing along family, as few are likely to bring multiple vehicles. It will certainly not hurt for single visitors as well to have easy access to the office and live near some other visitors. With NCKRI offices moving into the new building it will be helpful to survey apartment complexes and other rental properties close to the Cascades, visiting units to get some on-site feel before placing them on a list of housing suggestions. It might be possible to go a step further and develop a specific Institute relationship or two with specific rental providers.
- 2) Furniture. It will be a lot easier on a long string of visitors over the years (and on local people called on to help them move in/out) if they can occupy at least minimally furnished spaces. Furnished units provided by landlords are rare in the area by our pre-arrival search, but perhaps a NCKRI relationship with a provider could result in a strategic modification of some units. Or perhaps NCKRI could develop and dispense a stock of basic furniture, stored by a local volunteer supporter with a truck? We would have been ready to contribute a couple coffee tables purchased here, to such a stock.
- 3) Medical Care. Doctors and nurse practitioners are scarce in Carlsbad, and generally offered waits for first appointments are too long to be practical for visitors. Without a ready-med clinic, the remaining option is an expensive trip to the emergency room (\$400 for a three-patient, fairly routine visit in our experience). Again, this seems an area where an Institute special relationship with a medical provider (preferably one serving some of the permanent staff) would be a great help. It should not be a great add-on patient load for a physician to agree to a few appointments per year with NCKRI visitors, on the same playing field with established local patients.
- 4) Town Orientation. As a supplement to Chamber of Commerce Web offerings, it would be a service for the Institute to compile a list (or conversation thread?) and map of

useful/good stuff in the town, based on staff and visitor recommendations. This should probably be e-mailed to those inquiring about visiting, rather than placed on the Web site, to avoid offending non-listed business owners. We've made a start on a couple categories (attached, but could include more specific info.). The list should explicitly address the diverse individual/family situations and interests of diverse group of visitors you'll be having. For example, when suggesting a sabbatical visit to NCKRI to another geology colleague, I needed to consider what an urban-oriented spouse with grown children would find most interesting about Carlsbad.

Because I was a Parks and BLM volunteer during my stay, it was important for me to keep a record of hours spent on various activities. I split my activities into three categories: 1) BLM Work – the Capitan Escarpment geomorphology/hydrology study that was my negotiated primary research activity for the stay, 2) NCKRI Activities - Other karst-related research work, participation in NCKRI staff outreach activities, and NCKRI/CEMRC office tasks, and 3) Personal Professional Development - visits to non-research-related sites of geological interest, continuation of Ball State research projects, and continuation of Ball State faculty responsibilities. If doing it all again, I would split the third category between 3) Real local professional development field experiences, lectures, authoring, reviewing, and so on, and 4) Continuation of home university teaching and administrative tasks. Separating out category 4 allows a direct check on a category of work that, while unavoidable to some degree, should be kept at a minimum during a sabbatical period. It may be useful for assessment of sabbatical programs on both the university and NCKRI sides.

Some of the NPS and BLM documents I have completed as a sabbatical volunteer have included estimates of anticipated total hours to be worked. In retrospect, depending on whether erring toward maxima or minima is best for a specific document, I would suggest using a formula based on a 30- or 35- hour work week, rather than 40, or otherwise reducing total anticipated hours. This accounts for time spent settling in on arrival and preparing to depart, sick days, getting business done less efficiently in an unfamiliar location, and days off on a similar level to the home institution vacation schedule.

As noted at the outset, I have found this sabbatical experience very rewarding in both professional and personal terms. My family has also benefited from a great, lengthy adventure in the area. I am proud to be the National Cave and Karst Research Institute's first sabbatical visitor, and hope that there will be many more scholars able to take advantage of this opportunity in coming years.

Carlsbad Recommendations

Best for Kids:

- Playground on the Pecos
- Living Desert State Park
- Carlsbad Library/Museum complex
- High School Natatorium

You Have to See:

- Sitting Bull Falls
- Carlsbad Caverns (of course)
- Riverwalk on Pecos River
- The view from the top of Church Street or Living Desert State Park
- Ruidoso and San Patricio

Enrichment:

- Cooking classes with Kevin Zink (contact through Blue House)

Events:

- Full Moon Walks at Living Desert
- Mescal Roast at Living Desert
- Loving Bluegrass Festival
- Taste of Carlsbad

Things in Roswell

- Target
- Several thrift stores with furniture (some only open weekdays)
- Two art museums
- U.F.O. museum (hey, it's free)

APPENDIX E

Final Report: External Review of the National Cave and Karst Research Institute

Preliminary Report: 8/13/04

Final Report: 11/25/04

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Table of Contents

Introduction 3

Observations and Recommendations 4

1. Construction of the NCKRI Building in Carlsbad, NM 5
 2. Consistency in Message 5
 3. Communications Among Primary Partners 6
 4. Mammoth Cave International Center for Science and Learning 6
 5. Educational Programs 7
 6. Relationships and Identity 7
 7. Research Issues 8
 8. New Mexico Tech 9
 - a. Cave and Karst Program
 - i. Curriculum Development 9
 - ii. Web Visibility 9
 - iii. Administrative Support 9

b. Bureau of Geology and Mineral Resources	10
c. Dr. Lewis Land	10
9. Fundraising Issues	11
10. Speaker Series	11
11. Travel	11
12. Minor Recommendations	11
a. Small Grants Program	
b. National Cave Association	
c. Broaden Focus at National Meetings	
d. Develop Associates/Affiliates Program	

Conclusions	13
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Appendices

1. Speaker Series: Sigma Xi	14
2. Small Grants Program: Sigma Xi	17
3. Program Affiliates Model: Lake Champlain Research Institute	18

Introduction

This review of the National Cave and Karst Research Institute (NCKRI) was conducted on-site from 18 July-13 August, 2004, by consultant Dr. Kathleen Lavoie, State University of New York at Plattsburgh where she is the Dean of Arts and Sciences, a Professor of Biology, and a biospeleologist. Additional individuals were contacted by telephone for interviews in October 2004.

Evaluation Process: The review used a simplified modification of the external review process developed for NCKRI by reviewer Dr. Kathleen Lavoie. The review involved only one person instead of the two or three recommended in the formal process. Background materials, interviews in person and by telephone, and on-site visits were used by the Reviewer to gather information and opinions for this report.

Material reviewed for the Program Review

- 2003 Annual Report
- NCKRI Website (www2.nature.nps.gov/nckri)
- NCKRI Monthly Updates from July 2000 to June 2004.
- NCKRI business plan outline (7/20/04)
- NCKRI Self-Review 7/22/04
- Informal Science Education Planning Grant Proposal

Interviews and Meetings:

- NCKRI
 - Dr. Louise Hose, Director
 - Dr. Thomas Strong, Visiting Chief Scientist
 - Dr. Lewis Land, Karst Hydrologist

- NPS
 - Dave Shaver, GRD Division Chief
 - Ron Kerbo, GRD, Cave Specialist
 - Mike Adams, Mammoth Cave National Park, Interpretation
 - Dale Pate, Carlsbad Cavern National Park, Cave Specialist
- City of Carlsbad
 - John Heaton, State Representative
 - Jon Tully, City Administrator
- New Mexico Tech
 - Dr. Penny Boston
 - Dr. Richard Cervantes
 - Dr. Peter Scholle
- Others
 - Jerry Trout, USDA-USFS, Cave Specialist
 - Malcolm Field, EPA
 - Kevin Amos, Deputy Director, Program Analysis, NOAA

History (from NCKRI Website www2.nature.nps.gov/nckri)

The National Cave and Karst Research Institute Act of 1998 (Public Law 105-325) enabled the National Park Service to establish the Institute. The Act stipulated that the Institute would be located in the vicinity of Carlsbad Caverns National Park in New Mexico and that the Institute could not spend Federal funds without a match of non-Federal funds. The main purpose of the National Cave and Karst Research Institute is to further the science of speleology, to encourage and provide public education in the field, and to promote environmentally sound cave and karst management. The Institute is authorized to carry out its objectives internationally as well as nationally.

In July 2000, an interim director was named to help the National Cave and Karst Research Institute move forward with National Park Service to define the scope of operation, design an organizational structure, form partnerships, find funding sources and a physical facility, and define research needs. The Institute will evolve through several organizational phases before it fully reaches the capacity to sponsor a wide range of activities. The position of interim director phased out in early May 2003.

Dr. Louise Hose was named permanent director in December 2002 and is continuing to develop the Institute. She is leading the Institute through a Gearing Up phase, that is likely to last another year (2005), and will consist of staff recruitment, design of the headquarters building and initial operational setup.

A Memorandum of Understanding (MOU) to facilitate the development and management of the Institute was signed in January 2003, by the National Park Service, the City of Carlsbad and the New Mexico Institute of Mining and Technology, who constitute the three primary partners

involved in establishing the Institute. Funding has been secured for the building that will serve as visitor center, laboratory, library and offices for the Institute. Design work for the \$4.6 million facility is underway and groundbreaking, on land donated by the City of Carlsbad, is planned for early 2005.

The Basic Institute phase will take another one to two years (2004-05) while the experience of the staff and the capacity of the Institute gradually increase, and financial resources for full operation are accumulated. The building should be completed during this phase.

The Fully Operational phase should be attained by 2006, when the Institute becomes a significant and recognized resource in cave and karst research, education, and support of cave and karst management.

Observations and Recommendations:

The observations, opinions, and recommendations below are those garnered from interviews, readings, and the ideas and experiences of the reviewer. For the most part, comments have not been attributed to specific individuals. Many of the suggestions and recommendations can't be fully implemented at this time because of sequencing and timing, or because of limited staffing at the Institute. NCKRI is still fairly early in its development, has ambitious plans, and seems to be heading in the right directions.

1. Construction of the NCKRI Building in Carlsbad, NM:

Construction on the Institute building should commence no later than January 2005 with expected completion in about 18 months. Many individuals reviewed stress the need for NCKRI to have this physical presence as a necessary step to achieving national and international recognition. We need a real Institute, not a virtual one. Need to improve awareness of NCKRI and possible benefits to participants. NCKRI needs to have a good reason(s) to exist, and has been working on defining what makes it unique and useful. Several suggestions were made that the Institute should take a lesson from the USGS, which was at one time was threatened with elimination. The USGS was very assertive in taking action and are very good at maintaining a high profile and enhancing their real and perceived value.

2. Consistency in message:

A listing of various plans, goals, programs from documents I reviewed are listed below. While all are laudatory, and I expect them all to be achieved, there are simply too many of them. Many of these are actually specific projects designed to meet a particular goal, and they should be presented as such, rather than as stand alone goals. NCKRI needs to present a consistent mission to create a clear identity in the mind of both consumers and the public.

Recommend addition to list of services;
Authoritative national and international advocate and resource for cave and karst.

Mission:

"The National Cave and Karst Research Institute facilitates speleological research, enhances

public education, and promotes environmentally sound cave and karst management."

“Goals of the National Cave and Karst Research Institute:”

- Further the science of speleology through coordination and facilitation of research.
- Serve as a repository and provide analysis and synthesis of speleological information.
- Foster partnerships and cooperation in cave and karst research, education, and management programs.
- Promote and conduct cave and karst educational programs.
- Promote national and international cooperation in protecting the environment for the benefit of caves and karst landforms and systems.
- Develop and promote environmentally sound and sustainable cave and karst management practices, and provide information for applying these practices.

“Core Values”

- Objective, science-based research and education
- Science-based stewardship
- Shared decision-making and workload responsibilities lead to better science and implementation
- Improved understanding of caves and karst lead for better decision-making and benefits all segments of Society
- The Institute will provide world-wide leadership in the field

“When NCKRI is fully-functional, it will provide services to the cave and karst community in ways that are underserved or completely lacking, including:”

- Professional coordination of “Big Science and other large initiatives
- Providing a collaborative approach to purchasing and maintaining high-cost equipment, facilities, libraries, databases or other items.
- Providing a variety of support for qualified scholars needing a professional affiliation and/or setting while pursuing sabbatical, graduate, post-graduate, or independent research.
- Help expand currently successful local or regional programs to national programs.
- Help stabilize and strengthen currently successful volunteer or under-supported projects,
- Improve communication among varied disciplines and programs.

3. Communication Among Primary Partners

I found a significant need for enhanced, more direct communication among the primary partners. Several problems identified could be addressed quickly if all parties were involved at the table at the same time, rather than going through intermediate steps. The monthly updates are good, but more face to face, or shorter, focused emails, would be good. This work can be shared with other NCKRI associates. Perhaps Institute Associates can make a point of sending updates or informal messages to targeted individuals among the primary partners and associates, to keep visibility high and increase information opportunities?

4. Mammoth Cave International Center for Science and Learning

The proposed new Mammoth Cave International Center for Science and Learning is a problem for NCKRI on many levels. It seems to duplicate the mission of NCKRI, it will siphon off scarce funds, and I feel that the role of the NPS in sponsoring two centers is very strange. If this center does get established it should be as a branch facility reporting to NCKRI. I am really concerned about this end run by WKU and Mammoth Cave and its impact on the future of the Institute.

The new project at Mammoth Cave is very parallel to NCKRI, but without the advantage of federal funding. Local congressional support is of limited duration. On the other hand, they are not handicapped with the 1:1 federal:non-federal matching requirement that NCKRI has. The actions taken by MACA are seen by several individuals as a direct response to actions and attitudes of the Director. Several individuals expressed disappointment that there is currently no partnership between the two, with hopes that bridges can be built for the future.

5. Education Programs:

While in residence at the Institute and while visiting NMT, the reviewer had many opportunities to discuss plans for informal educational programs currently planned and many seeking grant support. I found the ideas to be excellent, innovative, and likely to have strong, positive impacts regionally and nationally in the area of cave and karst education. The involvement of other agencies and individuals was also excellent.

6. Relationships and Identity:

Dave Shaver suggested that I ask some of the Federal people what it would take to get their agencies more involved with the Institute. The relationship with other federal agencies, and even to some extent the NPS, remains a key challenge for NCKRI. The NPS role is not featured in the NCKRI website, nor on some posters and grant applications submitted by NCKRI.

In talking to the federal employees, it is clear that many of the current problems with some individuals goes all the way back to the early working groups. All of the individuals on the original working group were from different federal agencies, and while the Nov. 2000 monthly update states "Each member also will represent the interests of a variety of non-federal and private organizations and groups." And reiterated in the December 2000 monthly update that "...each person in the group has responsibilities to represent and communicate with other non-federal constituent groups." It is not clear to this reviewer how often, if ever, the working group ventured very far outside the realm of federal interests and federal models for organization. The working group and Interim Director Bailey were all obviously working towards a shared vision of NCKRI, and several of the constituents were very upset when Director Hose came on board with some new and different ideas. But she had to take control at the Feb 03 transition meeting. NCKRI is now growing into something of its own. Interviewees recommended that the Institute needs to be a consensus builder and be more user-friendly. It needs to focus right now on building relationships with the primary partners, and move forward with additional partners. All partners, including the NPS, need to be included in the growth and evolution of NCKRI.

Although an evaluation of the Director was not a part of my review, most of the people I

interviewed find Louise Hose to be exactly the right person to do the job. Some find her abrasive and some find her wonderful. The consensus among the individuals I talked to is that she is the right person for the job, and is taking NCKRI in the right directions. Some of the work to bring folks back to NCKRI can be accomplished through working with others on the Institute team, particularly Tom Strong. It was stressed that it is important to hire the right people and then let them do their job. Louise Hose is dedicated and committed to developing NCKRI, and must have the necessary latitude to do her job.

Concerns were expressed by several individuals that the director has a disdain for federal employees and federal agencies. Whether it is true or not is irrelevant; the perception is there and it is widespread. I also feel there is a need to increase the visibility of the role of the National Park Service in NCKRI. The NPS should be listed as a partner organizations/sponsor/affiliate in everything NCKRI does, including grant applications and presentations at meetings. Institute personnel should be out schmoozing with superintendents of the many parks that have caves.

Other agencies are interested in advancing the development of the Institute and its goals, but not at the budget level. The Institute needs to work to expand governmental support beyond Carlsbad and New Mexico; other senators in other states need to advocate for NCKRI, and they will only do that when the Institute is doing something in their areas for them.

Several interviewees observed that the NPS may not be the best fit for NCKRI, and characterized the NPS as essentially a land management organization. Suggestions were made that the USGS might be a better federal partner with its emphasis on research.

All members of the original federal working group that I talked to are willing to work with NCKRI if asked. They want to work on meaningful projects, and not just busy work. All want the Institute to succeed, regardless of what direction it takes. The best approach seems to be to invite them to participate on specific projects with significant value. As it was put: “not dumb, nit-picky stuff.” One specific suggestion that I like very much was to help NCKRI decide on which projects should be supported, how can they be funded, what is the best way to support specific projects, and so on.

7. Research Issues

One area of concern the reviewer encountered among federal employees interviewed was the need for the Institute to address the balance between applied and basic research. In order to increase visibility and ensure steady funding, the research done by and supported by NCKRI should show some immediate value or application. Going down the applied research road to a large extent will benefit everyone. Applied research can also be used to fund basic research. NCKRI does need to do some of its own research. Scientists can be hired, they can be visitors, NCKRI can sponsor summer research camps for undergraduates, and it can sponsor Post-docs. But the Institute does need to be actively producing research. (A minor pet peeve of this reviewer; when accomplishments are listed in annual reports, it should not include work in progress or submitted or in review, only work actually completed (published or reported on) to avoid inflating accomplishments. That’s my pet peeve for the day.) A warning from one Federal employee was to let the scientists/ visiting researchers/post-docs/ staff, etc actually do their own research. If they turn into administrators or paper-pushers, you will have unhappy scientists and

high turnover.

8. New Mexico Tech.

I visited NMT for two days in August. Facilities and support are excellent. Several new students were there and seem quite pleased with their choice. According to Penny Boston, students are of uniformly high quality. NMT also has an excellent placement record for its graduates.

a) Cave and Karst Program. Dr. Penny Boston is overwhelmed with work, some of it her own, some for NCKRI, and other work is administrative. She has been working very hard on developing grant proposals, and is having some success. Penny made a significant error in not hiring an assistant immediately, then lost ground when an incompetent assistant was hired. She has since remedied the situation and is working on an alternative plan for getting the effective office support that the program, and Penny, desperately needs.

i. Curriculum Development. Despite these problems, I am concerned that in two years a formal cave and karst curriculum has not been developed. It is a complex task to develop a curriculum for a truly interdisciplinary program, and Boston has the right approach in mind with a core curriculum that offers different tracks to meet the varying needs of the students, but it has not happened yet. In addition to the curriculum, program objectives and an assessment plan for student academic achievement in the major must be developed.

ii. Web presence. Also of major concern to this reviewer is web visibility, which is absolutely essential now. NCKRI is the first thing that comes up when you google caves and karst. There is no mention of cave and karst on the academic programs home page for NMT. A Google search for cave and karst education turns up a lot of references to NCKRI, but nothing dedicated to the NMT program in the first 100 hits. NMT is there, but only through news articles related to NCKRI. Likewise, a google of cave and karst education and NMT turns up NCKRI-related articles, and information on Boston, but nothing on academics. WKU does not have caves and karst listed under academic degrees, but they do have a nice WKU Karst Center web site linked to their Centers and Institutes page. A search for cave and karst from the WKU home page immediately brings up the Center for Caves and Karst, complete with offers to sell tee shirts. The cave and karst program at NMT is housed in the department of Earth and Environmental Science, yet the NMT EES home page search has no mention of caves and karst, except as a part of Boston's title. Boston knows this is a critical need and has provided information to the webmaster at NMT, but has not had results. I hope her new arrangement with the program assistant will allow this to happen very soon. (Still no change in hits through Google as of late November 2004.)

iii. Administrative support. NMT has been and continues to be very supportive of NCKRI and the cave and karst education program. However, in order to grow the program faculty it will be necessary for the number of students to increase. NMT seems to be concerned about details of the lease for the building, and future funding for the lease. NMT officials believe that much of the success of the Institute is contingent on users of the facility in Carlsbad.

b) Bureau of Geology and Mineral Resources. A very interesting discussion with Peter Scholle centered around the balance between applied and basic research. New Mexico is a poor state, and the funding base for NCKRI must diversify. He highly recommends NCKRI seek state funding from areas such as FEMA and Department of Transportation funds that are dedicated to public safety issues at the state level. The money originally came from the feds, but is granted to each state to use as needed. Among issues that could be funded this way are studies of karst hazards, such as active sinkhole surveys, water quality issues, and issues involving sites for roads and facilities. He suggests that generous funding for applied research can be used to help sponsor basic research.

Currently the Bureau of Geology and Mineral Resources has no tie to the academic Cave and Karst program at NMT. Yet the Bureau does sponsor about 15-20 graduate students, to some degree, to work on issues important to the state of New Mexico. Relationship building between the Bureau and the Cave and Karst program in developing cooperative research with NCKRI could benefit everyone.

c. Dr. Lewis Land. I interviewed Dr. Lewis Land and also got to hear a very well-organized presentation he gave to the Rotary on the Capitan Aquifer that supplies water to Carlsbad. Although his affiliation with the Institute is given on his presentations and his business cards, Dr. Land seems to be of uncertain status with regard to his role with NCKRI. While it is clear from reading the monthly updates that he is busy and doing useful and appropriate work, his lack of reporting and evaluative responsibilities to the Institute allow him to function as a free agent, without regard to helping to build NCKRI. It is also clear from talking to Dr. Peter Scholle, his supervisor at NMT, that Land is doing what his boss expects him to do. Dr. Land has a tenure committee at NMT and is obviously, and appropriately, concerned about doing what needs to be done to secure continuing appointment. However, I recommend that he become more involved in furthering the work of the Institute. There is no reason that I can see why he could not work on a karst hydrology related grant proposal to the state of Florida, for example, that would pay part of his salary that would normally come from NM, and such a project would advance the work and visibility of NCKRI. Such a grant project would also benefit his tenure case at NMT. Alternatively, perhaps one day a week he could be reassigned to work specifically for the Institute. I feel that he is talented, and could make many important additional contributions to the development of the Institute, but he is currently an underutilized asset to the program.

9. Fundraising issues:

A current and growing problem facing the Institute is the limitation on fundraising that DOI or federal funds be matched from non-federal courses. Everyone I talked to about this issue agrees this needs to change. Representative Heaton believes the opportune time to push for such a change is during the grand opening festivities associated with the new building. If necessary, the match provision can remain in place, but what desperately needs to be changed is the limitation that prevents use of federal funds from non-NPS sources.

It is important to get other agencies to step forward with funding, and this applies to federal agencies and private organizations. In general and as discussed before, the Institute will have to show these organizations and individuals what NCKRI can do to help them. The first step would be to find out what they need from the Institute. NCKRI must be visible beyond Carlsbad.

A non-federal/non-governmental manager/administrator would be in a better position to solicit donations and grants. Once NCKRI is operational, Mew Mexico Tech can take the lead role in handling the overall administration through their offices. A NMT affiliation for the director opens up many opportunities that are limited under the federal agency model.

10. Speaker Series. Build on the success of the Distinguished Visiting Faculty Speaker series program at Carlsbad by taking it to a wider audience. The model I suggest is the Sigma Xi Distinguished Lectureship Series (Material from the Sigma Xi web site attached. Attachment 1.)

A simplified overview of the process would be to select a group of speakers willing to participate as a speaker. The speaker provides a brief abstract of their work, and a few lecture topics/titles that are identified by audience level from General to Specialized. NCKRI would be responsible for publicity and sending out lists of available speakers each year to member organizations and other appropriate venues, such as universities and caving organizations. In the case of Sigma Xi, they rely on the host institution to make all arrangements directly with the speaker, to pay the speaker a \$200 stipend and cover all local expenses. Sigma Xi provides subsidies upon application to defray costs of travel for the speaker. At least for the first few years, it would be most effective if NCKRI could defray all costs. Speakers may also decline the honorarium or contribute it to NCKRI.

11. Travel. The director is hindered in meeting the mission and goals of NCKRI because of NPS imposed restrictions on travel, particularly international travel. She could be more effective if it did not, literally, require an act of Congress for her to attend, for example, the International Union of Speleology meetings in summer 2005 in Greece. The benefits to NCKRI are potentially very large. This particular problem would be solved if the Director were out of the NPS, or a more formal part of NMT.

12. Minor recommendations:

a. A small grants program should be developed, but don't tie up staff with reviews and administrative details; this can be given to an advisory board or other volunteer group. Every grant given must include a significant assessment component to justify having spent the funds. (Suggestions, see Attachment 2 from the Lake Champlain Research Institute, and consult the Sigma Xi web page.)

b. One individual felt that the National Cave Association of show cave owners is at a good juncture to partner with NCKRI. There has been a lot of turnover in old owners, and the “young turks” coming in understand the value of education. Show caves see education as a way of increasing their business and are willing to contribute to such activities.

c. This recommendation comes from my bias as a biologist, but I feel that the Institute needs to expand its focus beyond geology. Perhaps it would help for the Institute to report to someone at NPS with broader divisional responsibilities, although by all accounts, Dave Shaver is doing an excellent job. Conferences and workshops so far organized by NCKRI seem nearly exclusively to be geology focused, yet the geomicrobiology aspects would certainly be appropriate to present at the American Society for Microbiology, or at the international microbiology meetings, at the Ecological Society of America annual meetings, or at multidisciplinary meetings like the American Association for the Advancement of Science annual meetings. In addition to sponsoring symposia and having NCKRI-affiliated scientists make presentations, these are good venues for raising awareness about the Institute among scientists and graduate students. Penny Boston and I discussed hosting such an interdisciplinary session at the next AAAS meeting, and it is something I will continue to work on after my return to New York. I know the Institute has developed associations with Karst Waters Institute, and that is a very positive step. Can NCKRI contribute or partner in some way with Bat Conservation International?

d. Develop a formal Associates/Affiliates (or some such name) program for individuals. Associates can serve as a significant resource for NCKRI by providing information, expert testimony, support, and networking. The Director is already doing this, but formalizing it would enhance NCKRI prestige and make folks more likely to associate formally with it; they can put it on their resume. Associates should have some benefit not available to the general public, such as free or reduced cost interlibrary loan and perhaps access to some small grant program “seed money”. The attached information from the Lake Champlain Research Consortium “Affiliates” might serve as a model for formation of a formal Associates program (Attachment 3). It is also important to recognize contributions by “qualified scholars” and by talented amateurs who may lack the academic credentials but be making important contributions in their area, or even just those with interest in furthering the mission and goals of NCKRI.

Conclusions

Overall, this review is happening at a very early stage in the development of NCKRI. Concerns were raised that NCKRI began as a project without a master plan, but now has plans that are ambitious but achievable with the passion and dedication of Director Louise Hose. Having a building will be a critical step in establishing NCKRI as a real entity and not just a virtual one. The principle partners are all pleased to be working with NCKRI, and look forward to the realization of what has been a long-time dream.

Please contact me if I can provide you with additional information or clarifications. It has been very enjoyable and interesting to work on this review of NCKRI.

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Preliminary Report 8/13/04
Final Report 11/25/04

Attachment 1. Information from SigmaXi.org website on Speaker Program

How to Host a Successful Lecture

Invitations should be extended directly to the individual lecturer. All arrangements about dates, travel and hospitality should be worked out between the sponsoring Sigma Xi chapter and the invited visitor. Chapters hosting lecturers are required to provide a stipend of \$200. In the distribution of subsidies to chapters, the Lectureship Committee will only consider a \$200 honorarium per visit as part of the subsidy, and lecturers may not request more than this. However, because chapters are encouraged to schedule multiple activities for a lecturer during his/her visit, it is appropriate for the chapter to consider increasing the honorarium based on the demands they are making of the speaker and the length of the visit. Any additional honorarium is to be decided between the chapter and the lecturer and lecturers may not refuse an invitation based on the amount of the honorarium.

Financial Support

- Consider asking the institutions affiliated with the chapter for support for the lecture. Other support may come from academic societies, businesses or industry that are particularly interested in the topic.
- Applications for a subsidy through the Sigma Xi Administrative Offices were due by March 1. If you have any questions, please e-mail lectureships@sigmaxi.org.

Make Arrangements

- Arrangements should be confirmed with the lecturer in writing through either U.S. mail or e-mail.
- Arrangements should be made as early in the fiscal year (July - June fiscal year) as possible. The Distinguished Lecturers frequently have busy travel schedules and early planning will optimize the chapter's chances of getting their first choice for lecturer.
- The Committee on Lectureships, through the Sigma Xi Administrative Offices, should be informed of the arrangements as soon as they are confirmed. Please contact the offices through mail, phone 800-243-6534 x 206 or chapters@sigmaxi.org.

Cosponsor Visits

- When making the initial arrangements for the lecturer's visit, contact nearby chapters about co-sponsoring the lecture or having the lecturer visit both chapters. Because airfare is typically the largest expense in hosting a Distinguished Lecturer, this can significantly lower the cost. Chapters that are able to be flexible on the dates of the lecture can save money.

Expectations for Lecture

- Review with the lecturer the expected length of the talk and question and answer period. Also what audio/visual equipment the lecturer will need.

Advertising

- Be sure to adequately advertise the lecture. This includes notifying the public affairs office of the institutions affiliated with the chapter. Copies of the Distinguished Lecturer's C.V. can be obtained from the lecturer. Announcements should be made to appropriate classes as well as on the institution's calendar. If it is a public lecture on a topic that could be understood by K-12 students, contact the local schools with information about the lecture. Contact lectureships@sigmaxi.org for a high-resolution photograph of the lecturer to use in advertising.

Maximize the Opportunity

- While the lecturer is at the chapter, consideration should be given to having the lecturer engage in additional activities such as speaking to a class, having a meal with students and/or faculty, meeting with the local press or visiting an area school. Many lecturers have commented that meeting students and faculty members and seeing campuses they might not otherwise see is the greatest reward of being a Distinguished Lecturer.
- Strong consideration should be given to having a public lecture. If the lecture is part of the chapter banquet, consider opening up the lecture to the public after the meal function. Consideration should be given as well to including populations that might not otherwise have access to high quality speakers.
- Each Sigma Xi member should invite a nonmember to the lecture. This is an EXCELLENT OPPORTUNITY to introduce colleagues to Sigma Xi.
- Don't forget to invite senior administrative staff to the lecture.

Logistics

- Every effort should be made to ensure that the lecture proceeds smoothly. This includes the standard checks of room readiness, projection equipment, etc.
- Assist the lecturers in confirming plane reservations and related travel arrangements. Inform the speaker whether a member of the chapter will provide transportation to and from the airport.
- Shortly after arrival at the institution, the lecturer should be shown the auditorium or room where the lecture will be held. At this time double-check audio-visual equipment.
- The lecturer should be given the honorarium and expense reimbursement as promptly as possible.
- Unless otherwise requested by the lecturer, the host is responsible for all local arrangements including transportation, lodging, meals, etc.

Checklist

Financial Support

- ___ Ask provost, chancellor, deans, heads of laboratories, or senior administration staff, other academic societies, businesses or industry for support.
- ___ Apply for subsidy for Distinguished Lecturer. Deadline is March 1.

Publicity

- ___ Announcements to classes.
- ___ Announcements to media.
- ___ Announcements to local schools.
- ___ Announcements on institutional calendar of events.
- ___ Announcements on chapter listservs.

- ___ Arrange media interviews for lecturer.

Sigma Xi Administrative Offices

- ___ Notify once date of lecture is set.
- ___ Send Lecture Report Form after lecture.

Nearby Chapters

- ___ Coordinate visit with nearby chapters if possible.
- ___ Invite nearby chapters to attend.

Arrangements with Lecturer

- ___ Confirm in writing all arrangements.
- ___ Agree ahead of time on the lecturer's activities (lecture, class discussion, media interview, etc.). Lecturers have agreed to accept a \$200 honorarium per visit. Chapters however can offer a larger honorarium.
- Show the lecturer the location of the talk as soon as possible after arrival.
- Check room and equipment directly prior to the featured talk.
- ___ Pay lecturer promptly.

<http://www.sigmaxi.org/programs/lectureships/host.shtml>

Attachment 2: Example of a Small Grants Program

Call for LCRI Research Seed Grants: 2001-02

LCRI Affiliates and their research students are eligible to submit **LCRI research seed grants**. These “seeds” are small awards (\$500-\$1500) designed to provide students with a research experience, foster collaborative research and promote the development of external proposals.

Applications are due on March 30

GUIDELINES:

Seed grant awards should involve use of LCRI facilities and equipment with preference given to projects that foster collaborative interdisciplinary interactions and address the Institute's goals and objectives. Eligible expenses include research supplies (including computer software if justified), travel for collaborative research proposal development, and research intern stipends (up to \$1000 of the total budget) to support student research. Proposals should include a short (2-page) narrative describing the nature of the proposed research, how the award will function as a “seed” for future research and grant development, a brief summary of the methods, and how the project will involve students. Students are eligible to serve as proposal authors or co-authors as long as an LCRI affiliate is also involved.

Please include a summary budget and a brief proposal cover letter stating how

NATIONAL CAVE AND KARST RESEARCH INSTITUTE 2004-2005 BIENNIAL REPORT, 74

the grant application meets the LCRI goals/objectives and how the award will foster collaborative interdisciplinary research and student research. Preference for awards will be given to collaborative interdisciplinary research involving junior faculty and projects involving undergraduate student research.

Seed Grant applications should be submitted by March 30 to the LCRI coordinator:

Dr. Timothy Mihuc, LCRI coordinator
101 Hudson Hall
Plattsburgh State University
Plattsburgh, NY 12901



Plattsburgh State University of New York

Attachment 3: Example of an Affiliates Program

Lake Champlain Research Institute: Affiliates

I. LCRI goals and objectives:

The primary objective of LCRI is to promote undergraduate student research. Current affiliate activities include regional interdisciplinary investigations of biological, physical, economic, historical and educational issues. The Institute is actively involved in research in the Lake Champlain Basin, providing reliable information to environmental policy makers, and improving our understanding of regional natural resources. Although now broader in scope, LCRI was originally established in 1996 to support basic and applied research relating to aquatic ecosystems in the Lake Champlain basin.

II. Research Affiliates:

LCRI affiliates conduct research in many areas including biological, physical, economic, historical and educational topics of concern for the Lake Champlain/Adirondack region. Affiliates are eligible for access to all LCRI facilities and equipment.

Applying to become an LCRI affiliate:

Affiliate applications are accepted at any time by submitting a letter of application and curriculum vitae to the LCRI coordinator (Dr. Timothy Mihuc, 101 Hudson Hall, Plattsburgh State University, Plattsburgh, NY 12901). The application letter should justify how the applicant will improve their individual research capabilities and foster collaborative research with others by becoming an LCRI research affiliate.

LCRI Research Committee: Current members: Drs. Buckley, Deutschman, Rice, and Romanowicz

Affiliates will nominate and elect representatives to serve on the LCRI research committee which will provide input on research activities in order to promote the goals and objectives of the Institute.

LCRI Research committee- Duties

- 1) Provide input on research directions/avenues for LCRI
- 2) Promote and provide ideas for collaborative research
- 3) Support development of funding opportunities
- 4) Interact with other organizations (i.e., Lake Champlain Research Consortium, etc...)
- 5) Suggest uses of LCRI facilities to promote the goals and objectives of the Institute
- 6) Provide recommendations to the Dean for LCRI award recipients and LCRI seed grant recipients

APPENDIX F

**NCKRI Project Summary Report
January 2005 through December 2005**

Quantitative Monitoring of Metabolic Activities Inferred from the Activities of Specific Subset Components of Microbial Biofilms Forming on Cave-Like Substrata

**Cooperative Agreement H2360020009
Task Order 02-01, Mod. 2**

Effective June 1, 2002 through May 31, 2007

Principal Investigator:

Rick Fowler
WATERS Laboratory
Center for Water Resource Studies
Western Kentucky University
Bowling Green, KY 42101

Other Administrative Personnel:

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WATERS Laboratory
Center for Water Resource Studies
Western Kentucky University
Bowling Green, KY 42101

TASK ORDER 02-01, Mod 2

Description of Work

Project objectives and strategy:

- The primary hypothesis is that many of the most important cave-based geochemical processes are basically microbiological so the key is understanding the microbial ecology and the locus of this ecology is in biofilms on the cave substrata;
- The secondary hypothesis is that the metabolic activity biomarkers of the cave biofilm microbial community (e.g., lipid activity biomarkers and activity of specific groups of bacteria that incorporate ^{13}C -substrates into lipids and rDNA/rRNA) will be better correlated with other field activity measurements (e.g., direct measures of specific processes under study for the particular research program) than with the conventional measures of biomass and community composition that are the usual measures of the ecology;
- BioSep beads (3 mm diameter Nomex coated particulate activated carbon beads) containing either powdered cave wall limestone or isotopically labeled $\text{Ca}^{13}\text{CO}_3$ will be incubated for two to four months in the Flint-Mammoth Cave System and compared to coupons of cave wall material and BioSep beads without the added cave material in a cave stream. Seventy percent of the beads (~70 each) will be retained by WKU for DNA analysis.
- Development of rapid and expanded quantitative lipid analysis will allow separation of neutral and polar lipids during the extraction process using an automated Accelerated Solvent Extractor (ASE). This separation technique combined with the sensitivity of the LC/MS/MS allows the analysis of respiratory quinines, diglycerides, sterols, intact phospholipids, poly- ω -hydroxyalkonates, archaeol, and caldarchaeols from Archaea;
- Coupling lipid analysis with ^{13}C enrichment experiments using solid phase samplers that will provide a readily recoverable, integrated microbial community that will be serially monitored;
- Lipid and DNA biomarkers which would be recovered after a few months and ^{13}C -determined in the PLFA by GC/IRMS;
- Triplicate samples of three surfaces with and without isotopically labeled carbonate will be set at each site.
- DNA will be extracted from bacterial cells adhering to the beads. The DNA fraction will be analyzed by Quantitative Real Time PCR (qRT-PCR) and fluorescent fragment analysis. QRT-PCR will give an estimate of the biomass adhering to the particles and fragment analysis is a quick indicator of biodiversity, sometimes allowing identification of certain bacteria by the use of biomarker fragments.
- Some DNA will be used for cloning and sequencing in order to establish genetic relationships among the environmental bacteria comprising the biofilms. DNA sequences will be posted online in the GenBank database (<http://ncbi.nih.nlm.gov>) for others to access for use in their research.

Deliverables

The proposed products include:

- 30 lipid analyses from 5 sites within Mammoth Cave, KY, derived from triplicates with limestone beads and triplicates with isotopic $\text{Ca}^{13}\text{CO}_3$ beads. (\$8,000 of the total funding).
- Complete DNA sequence data for 72 cloned bacterial genes derived from sediment at the same 5 sites within Mammoth Cave, KY (\$44,000 of the total funding). Also perform qRT-PCR and TRFLP were appropriate.
- Report to the National Cave and Karst Research Institute detailing the methodology, including both successful and unsuccessful procedures, used in this study. The report will also include recommendations for further application of the techniques to other caves nationwide.
- Storage of sample material for future analyses.
- Make cloned bacterial 16S rDNA sequences determined from the cave sediments publicly available on the internet. The genetic database will be fully compatible with GenBank, the Ribosomal Database Project, and other online tools for extensive genetic comparisons and identification of species. A research paper will be written and submitted for publishing this work.

1. Activities, Progress, and Status

1.1. Optimization of DNA extraction procedure and demonstration of reproducibility.

While waiting for the retrieval of artificial substrates until a full year of residence in cave aquifers, thorough optimization of our DNA extraction technique was carried out by examination of saturated clastic sediments from the well-studied Charon's Cascade site (Figure 1). Eight sediment samples were collected, quickly air dried at 65° C, and environmental DNA was extracted from triplicate 10 g masses of the samples according to our standard protocol using a modification of the MOBio Megaprep Soil DNA extraction kit. Triplicate quantitative Real-Time PCR reactions were performed to amplify eubacterial 16S SSU-DNA from each DNA extract, along with triplicate reactions on quantitative standards of *E. coli* high molecular weight genomic DNA (Sigma cat. # D-0421). Results were normalized by calculating the total yield of DNA per gram of sediment (Fig. 2). Bacterial DNA concentrations in the sediments ranged from 553 ± 10 ng/g to 3349 ± 138 ng/g among eight samples taken within a 1 m radius at depths of 5-10 cm in sediment covered by the permanent pool at the base of the waterfall. On average, Charon's Cascade sediment yielded 1261 ng/g with a standard error of $\pm 10.9\%$.



Figure 1. Charon's Cascade waterfall and pool. Rick Fowler and Hazel Barton (background) collecting sediments.

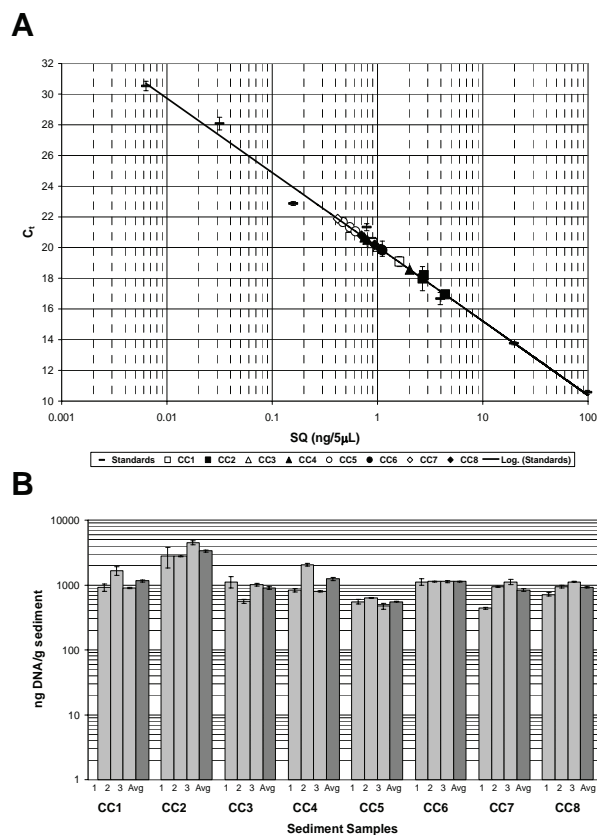


Figure 2. Demonstration of reproducibility among DNA extraction and qRT-PCR reaction techniques using Mammoth Cave sediment Samples.

A. Raw qRT-PCR data showing the log starting quantity (SQ) of environmental DNA as a function of the threshold cycle (C_t) among triplicates of eight sediment samples. B. Bar graph showing quantitative results normalized for comparison of yields of bacterial DNA per gram of sediment.

1.2. Extraction and quantification of DNA from biofilms on artificial substrates after one year residence at five cave aquifer study sites.

Dye trace bags containing Bio-Sep beads impregnated with either limestone or $\text{Ca}^{13}\text{CO}_3$ were retrieved (Fig. 3) and transported aseptically on ice to WATERS Laboratory. Isotopically labeled beads and one half of each sample of limestone beads were shipped to the Center for Biomarker analysis for membrane lipid profiling (Section 1.4). Masses of hydrated beads were measured and DNA was extracted from limestone beads followed by triplicate qRT-PCR reactions to determine the yields of bacterial DNA from each sample (Figure 4) as described in Section 1. Bio-Sep bead traps were rinsed with water *in situ* to remove accretions of mud and sediment, and transported in sterile containers on ice back to the laboratory. Bacterial DNA yields from the five study sites ranged from just 6.3 ng/g at Mystic River and 476.2 ng/g at Eyeless Fish Trail where inputs originate from limited forested land cover up to 3463.2 ng/g at Owl Cave and 5135.5 ng/g at the Hawkins/Logsdon River confluence where major aquifers drain the sinkhole plain outside park boundaries. Roaring River yielded an intermediate 1398.2 ng/g.

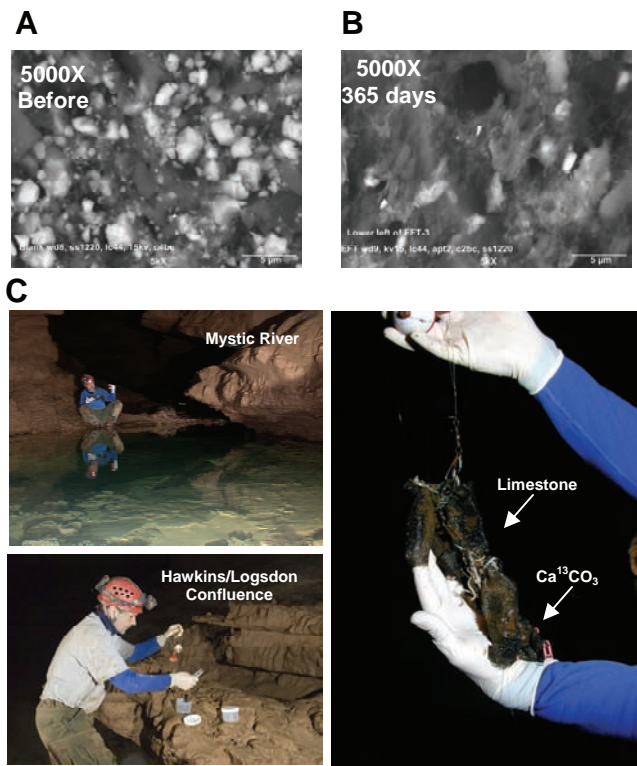


Figure 3. Recovery of dye trace bags containing Bio-Sep beads after one year in cave aquifers.

A. SEM of BioSep bead before deployment showing limestone particles. B. SEM of a bead recovered from Owl Cave after one year with biofilm secretions covering limestone particles. C. Clockwise, from upper left: Pool at Mystic River where influx of surface water originates from a forested watershed. Closeup of biofilm traps containing triplicates of limestone and $\text{Ca}^{13}\text{CO}_3$ impregnated Bio-Sep beads. Recovery of traps from Hawkins/Logsdon confluence where high currents washed away one of the triplicate limestone bags, leaving duplicates.

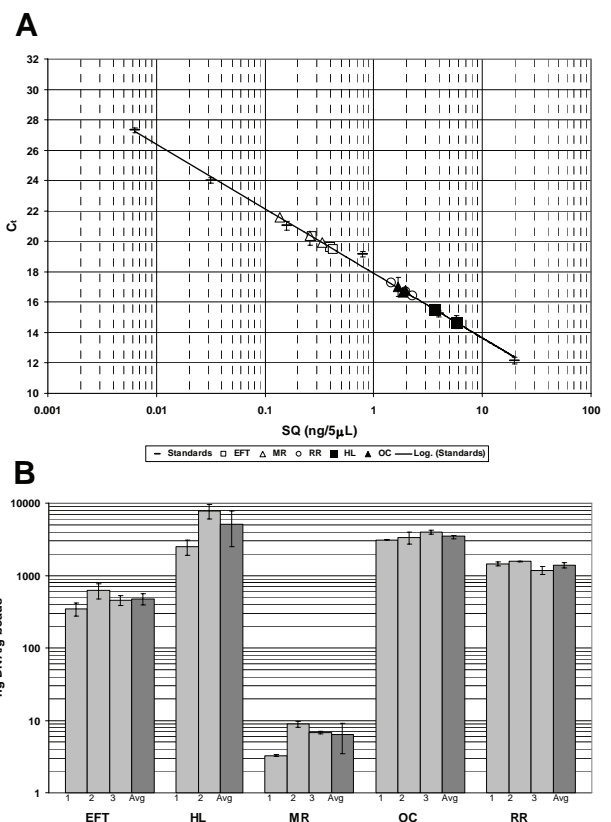


Figure 4. Data showing the concentration of bacterial DNA extracted from Bio-Sep beads.

A. Raw qRT-PCR data showing the log starting quantity (SQ) of environmental DNA as a function of the threshold cycle (C_t) among triplicates at five sites. B. Bar graph showing quantitative results for each site normalized in order to compare yields of bacterial DNA per gram of substrate.

1.3. Construction of clone libraries and DNA sequencing of eubacterial 16S SSU-DNA for identification of bacteria.

Amplified eubacterial 16 SSU-DNA was ligated into the plasmid vector pGEM-T EZ (Promega, Madison, WI) and transformed into *E.coli* JM109 for creation of a clone library segregating random copies of identifying bacterial sequences for each site. Individual eubacterial 16S SSU-DNA sequences from at least 48 clones have been obtained in both forward and reverse directions in duplicate for each site. The total number of DNA sequences now under scrutiny totals 240. Our work presently is engaged in assembling the DNA sequence information of overlapping fragments into full length DNA sequences of the cloned genes. Dr. Barton will create and interpret phylogenetic trees of the bacterial communities from the data we generate.

1.4. Biofilm Lipid Analysis.

Fatty acid methyl ester (FAME) analysis is a method characterizing membrane lipids to yield data on the biomass, community structure, and physiological status of bacterial communities comprising the cave aquifer biofilms developed on the beads. This data will augment the nucleic acid data. Dr. White's lab has reported successful results and a comprehensive interpretation of the data is currently in progress. For detailed information see the Center for Biomarker Analysis website at <http://cba.bio.utk.edu/>.

2. Problems encountered

Due to strong currents at Hawkins/Logsdon River one of the triplicate bags containing limestone Bio-Sep beads was lost and calculations were based on duplicates rather than triplicates. After recovery of artificial substrates from the five study sites, molecular biology procedures were quite successful and all techniques performed successfully as practiced and optimized.

3. Considerations for estimated completion of project

Substrates have been recovered and successfully yielded quantitative nucleic acid data as planned. Lipid analysis is nearing completion and interpretation is forthcoming. Nucleic acid sequences of over 200 clones have been generated and for the remainder of the project these and others will be generated, assembled, and interpreted. Dr. Barton will develop phylogenetic trees using nucleic acid sequences and lipid data will be incorporated into a comprehensive description of Mammoth Cave aquifer bacterial biogeochemistry by the expert panel assembled for this study.

We anticipate that obtaining 72 full-length clone sequences from each of the study sites may be overly ambitious and perhaps unrealistic, given that cloning artifacts will be apparent and some clones may have to be rejected as Dr. Barton scrutinizes them. We shall utilize our time and financial resources to make certain the sequences we do obtain are accurate by performing secondary rounds of sequencing to cover ambiguous regions if necessary. Nevertheless we will produce as many clone sequences as possible with the goal of obtaining a sufficient number of sequences to provide a statistically significant representation of the bacterial diversity.

National Cave and Karst Research Institute Act of 1998

S.231

One Hundred Fifth Congress of the United States of America at the second session begun and held at the City of Washington on Tuesday, the twenty-seventh day of January, one thousand nine hundred and ninety-eight. An Act To establish the National Cave and Karst Research Institute in the State of New Mexico, and for other purposes. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the 'National Cave and Karst Research Institute Act of 1998'.

SECTION 2. PURPOSES.

The purposes of this Act are—

- (1) to further the science of speleology;
- (2) to centralize and standardize speleological information;
- (3) to foster interdisciplinary cooperation in cave and karst research programs;
- (4) to promote public education;
- (5) to promote national and international cooperation in protecting the environment for the benefit of cave and karst landforms; and
- (6) to promote and develop environmentally sound and sustainable resource management practices.

SECTION 3. ESTABLISHMENT OF THE INSTITUTE.

- (a) GENERAL- The Secretary of the Interior (referred to in this Act as the 'Secretary'), acting through the Director of the National Park Service, shall establish the National Cave and Karst Research Institute (referred to in this Act as the 'Institute').
- (b) PURPOSES- The Institute shall, to the extent practicable, further the purposes of this Act.
- (c) LOCATION- The Institute shall be located in the vicinity of Carlsbad Caverns National Park, in the State of New Mexico. The Institute shall not be located inside the boundaries of Carlsbad Caverns National Park.

SECTION 4. ADMINISTRATION OF THE INSTITUTE.

- (a) MANAGEMENT- The Institute shall be jointly administered by the National Park Service and a public or private agency, organization, or institution, as determined by the Secretary.
- (b) GUIDELINES- The Institute shall be operated and managed in accordance with the study prepared by the National Park Service pursuant to section 203 of the Act entitled 'An Act to conduct certain studies in the State of New Mexico', approved November 15, 1990 (Public Law 101-578; 16 U.S.C. 4310 note).
- (c) CONTRACTS AND COOPERATIVE AGREEMENTS- The Secretary may enter into a contract or cooperative agreement with a public or private agency, organization, or institution to carry out this Act.
- (d) FACILITY-
 - (1) LEASING OR ACQUIRING A FACILITY- The Secretary may lease or acquire a facility for the Institute.
 - (2) CONSTRUCTION OF A FACILITY- If the Secretary determines that a suitable facility is not available for a lease or acquisition under paragraph (1), the Secretary may construct a facility for the Institute.
- (e) ACCEPTANCE OF GRANTS AND TRANSFERS- To carry out this Act, the Secretary may accept—
 - (1) a grant or donation from a private person; or
 - (2) a transfer of funds from another Federal agency.

SECTION 5. FUNDING.

- (a) MATCHING FUNDS- The Secretary may spend only such amount of Federal funds to carry out this Act as is matched by an equal amount of funds from non-Federal sources.
- (b) AUTHORIZATION OF APPROPRIATIONS- There are authorized to be appropriated such sums as may be necessary to carry out this Act.



1400 Commerce Drive, Carlsbad, NM 88220
www.nckri.org

Photo by R. Scott Altenbach