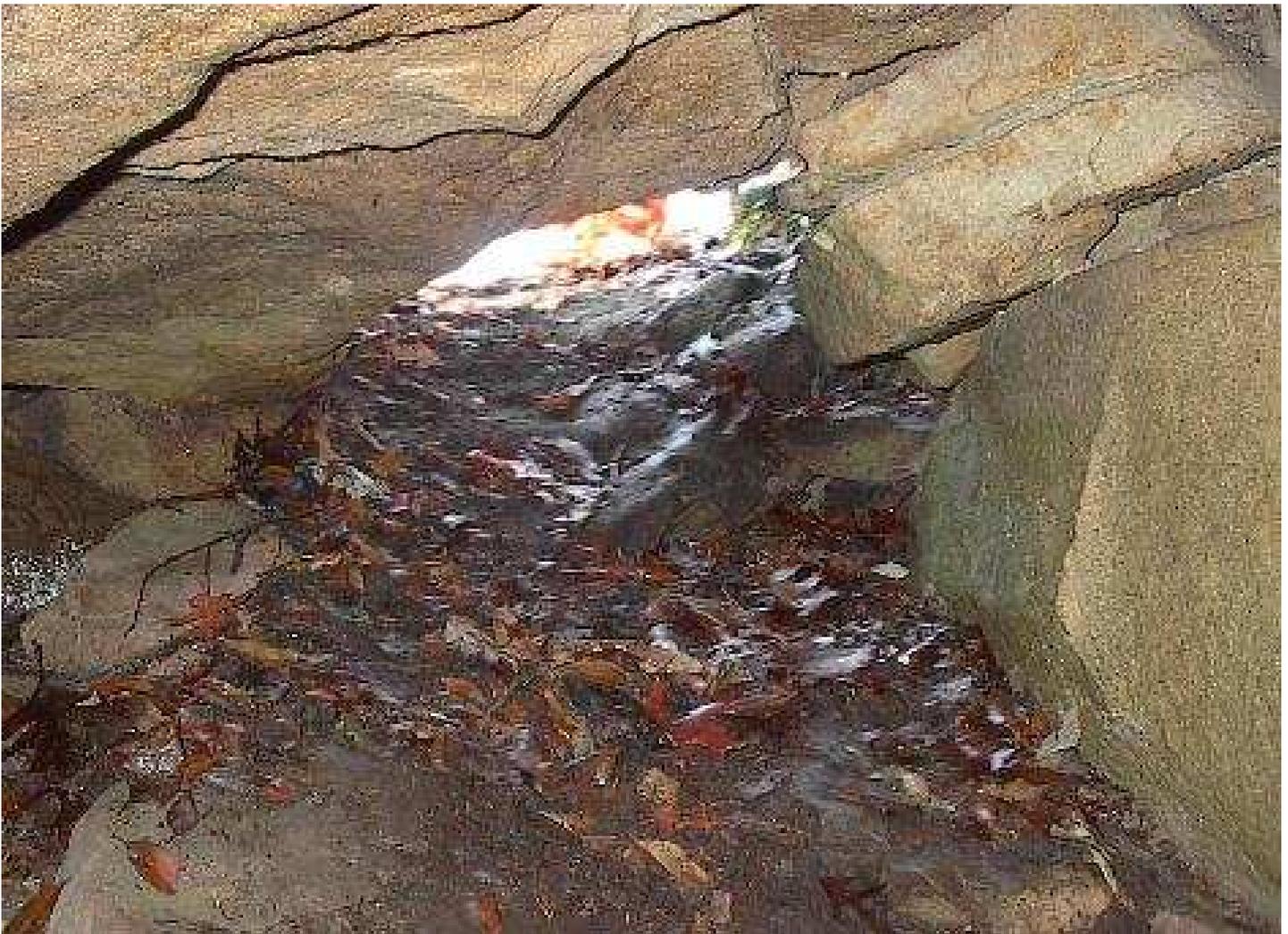


The Carbide Courier



The
Dayton Underground Grotto
of
The National Speleological Society



In this issue: “The Pine Mountain Get-Away”, Cancellation of 2009 Crawlathon, Cop of the Year, Ohio Karst Areas, and more!

Volume 18, Issue 2

February 2009

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GROTTO MEETINGS

Grotto meetings are held the 2nd Sunday of each month (except for September, December and month of Wormfest) at 7:00 pm at Roger and Lynn Brucker's house, 1635 Grange Hall Rd., Beavercreek, OH. For directions, see the map on the back cover, or go to the DUG web page:

www.dugcaves.com

MEMBERSHIP INFO

Annual membership is \$15 per individual, or \$20 per family. Membership includes the monthly publication of *The Carbide Courier* in paper or electronic format. Memberships are renewable on October 1st. Dues can be mailed to:

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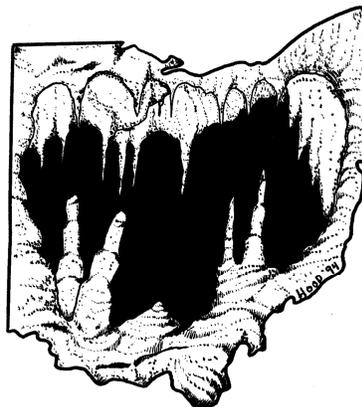
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What?? You haven't attended a DUG meeting since when???

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Front Cover: Steam Cave entrance. Photo © by Ron Fulcher	

From the Editor...

Hello DUGsters,

By now, I'm sure you all know about the cancellation of Crawlathon due to the concern of cavers spreading White-Nosed Syndrome to the park's bat population.

As disappointing as this is, we must keep the welfare of our little furry friends in our best interest, as WNS is fatal to the bats.. It's unfortunate the government agencies involved waited until 72 hours before the event to cancel it. I was pleased to see all the supporting comments Coy Ainsley received from "staph" members and others letting him know they did not blame him or the staff at Carter Caves State Resort Park. Unfortunately, Coy was caught in the middle of a "no-win" situation.

I understand many "staphers" were still going down the weekend of Crawlathon, so hopefully I'll have some articles about it for the March edition.

You can read the press release, and find out more about this, beginning on page 11 of this newsletter.

Until next time!

Mike Hood
Editor

Volume 18, Issue 2

February 2009

The Carbide Courier is sent electronically the last week of the preceding month and also sent to the printer at the same time. Submissions must be sent to the editor by the Friday preceding the last week of the month at carbidecourier (at) yahoo (dot) com.

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**DO YOU GET A PAPER COPY OF
THE COURIER? DO YOU HAVE
ACCESS TO THE INTERNET OR
E-MAIL?**

If so, why not consider switching to electronic means of getting the Courier? You'll get your Courier quicker (and in color!) and save the grotto some money to boot! Contact Alan Leach to change your status.

Calendar of Events

- February 11th 7pm - Grotto General Membership Meeting
Roger & Lynn Brucker's House (See back of Courier for map)
- February 20th-21st Miami Valley Adventure Summit at Wright State University
(www.theadventuresummit.com)
- March 8th 7pm - Grotto General Membership Meeting
Roger & Lynn Brucker's House (See back of Courier for map)
- April 12th 7pm - Grotto General Membership Meeting
Roger & Lynn Brucker's House (See back of Courier for map)
- May 10th 7pm - Grotto General Membership Meeting
Roger & Lynn Brucker's House (See back of Courier for map)
- May 22nd-25th Speleofest at the Lone Star Cave Preserve. Hosted by the Louisville Grotto
- June 14th 7pm - Grotto General Membership Meeting
Roger & Lynn Brucker's House (See back of Courier for map)
- June 25th-28th Karst-o-Rama at the Great Saltpetre Cave Preserve.
- June 26th-28th 56th Annual Indiana Cave Capers. Hosted by the Central Indiana Grotto
Camp Rivervale, Mitchell, IN (<http://cig.caves.org/pages/capers.html>)

February Birthdays!

Austin Hedges—3rd

Janine Brown—15th

Michael Lucas—16th

Jim Hembold—27th



New Members!

Trey & Wendy Ferris

Welcome!





From the Chairman:

I know it's hard to believe, but I don't have much to say. This month you are getting my random thoughts. Historically my 3am rant is written at 3am while under the influence of copious amounts of alcohol, and only sent to a select few. This ramble is written soberly at noon. That being said I'm sure it will not be as insightful as others.

Last night while handling a three car crash in a rural area I came to conclusion that -14 degree with wind means one thing...Dana don't pee outside, it just can't be done.

In 2002 crude oil was in the low \$40's per barrel, and we paid about \$1.25 per gallon for gas. Crude oil recently dropped to \$36 a barrel and gasoline still costs \$1.90ish. I'm not the brightest crayon in the box, but I think we are (p/c moment) "being taken advantage of." Now gas is under two bits we are all warm and fuzzy about it. Grrrrrr.

I know I am going to take a flogging for this one. However I can't help myself! As you all know, the Borehole pops its head up, spouts off at the mouth then crawls back under a rock. Again this year at the Christmas party the Borehole sent its own "certificates of merit." The Borehole felt the need to screw with Jim Pisarowicz (new member & on the Executive Committee). Jim's last name is not real common or an easy spell. The Borehole did spell his last name correct, but put the wrong first name on the certificate!!! My hat is off to you Borehole. Keep up the good work!

I think that's about all the random stuff I have to share with you for now.

Dana Sutherland,
Chairman

Sheriff's Deputy Named Cop of Year



LIMA -- Deputy Dana Sutherland was named the police officer of the year Tuesday by the Lima/Allen County Family Abuse Prevention Team.

Sutherland was chosen for his work against domestic violence that included risking his life in the line of duty. He was called to a home last year where a couple were fighting. The man, armed with a knife, eventually tossed the weapon but then fought Sutherland.

The man, who was bigger than Sutherland, tried to grab Sutherland's gun during the fight. Sutherland stopped him and was able to take control of the man. Sutherland suffered minor injuries in the struggle.

Sutherland, a five-year veteran of the Allen County Sheriff's Office, said domestic calls are tough to deal with because an officer never knows what he or she is getting into.

"There is a lot of emotion involved and it's a very volatile situation," he said.




Congratulations
Tom Cottrell
on
Receiving the NSS Fine Arts
Salon's Merit Award in the
Sketch Category
at the 2008 NSS Convention!


The Pine Mountain Get-Away Thanksgiving Weekend 2008

By: Ron Fulcher NSS 44706RL

Steve Greene invited me to tag along with him on a trip to Bell County Kentucky for Thanksgiving this year. For a dozen years or so he had been telling me about some caves on his family's place but somehow we just never made the trip. My loss for hidden among the trees there were caves to be seen but I am getting ahead of myself here. We spent the trip down searching for Kentucky's roadside historical markers and a good chilidog.

Engles Drive in had the chilidogs and more but we struck out on the marker of greatest importance, one about the Wilderness Road. Steve's Family lives near Pineville Kentucky on Pine Mountain and within a stones throw of the Cumberland Gap. The original settlers and the Indians before them were drawn to this area and left their mark on history. Steve's Great Grandfather bought their piece of the mountain in the early part of the last century.

Thanksgiving Morning we woke to a "country breakfast" and tales about a "steam cave" on their property near a gas well. We were also warned that an eastern black bear had been seen very near this same cave. COOL! Cave and bear hunt wrapped up into one. We found the cave in a matter of minutes and it did indeed have a strong gust of "steam" rushing forth.

Inside, the cave gave us one hundred feet of passages to explore but standing up was in short supply. The sandstone walls were moist and the wind rushed at us from an impassable crack at the rear. We had very shortly solved and documented the family's Steam Cave so Steve decided we should go look at some other caves higher on the hill and near the Huckleberry Rocks.

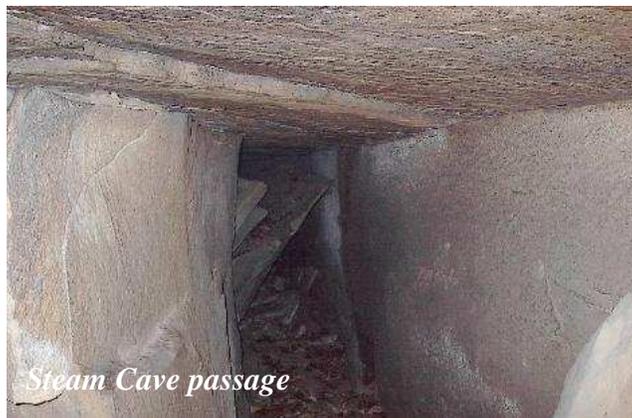
View, Words, Limited. How do you describe one of the most picturesque images that can be etched into your memory? Below us the gently rolling hills danced among the shadowy morning light with all the brilliance of late autumn on display. Here we stood on a cliff line with the bluish-green pines with orange and red oaks trees painting the landscape to the far reaches of another mountain range. I was easily reminded of hiking in the Smokey Mountains where the same golden vistas might also be found.

From the rocks we follow a natural cut through a jungle of laurel trees, Steve kept calling a logging road. We found many small shelter caves along the cliffs and banks of a now very defined wilderness stream. We were not where we were supposed to be. Visions of bears hiding in every crack kept us alert to our surroundings and soon enough we found Moonshiners Cave.

This cave still has a few remnants of its' namesake activity with the iron rings from metal barrels betraying the past. From there we move around the ridge to the largest cave. Huckleberry Rocks Cave is a great example of a karstic sandstone shelter complete with a spring! Here, just a few feet off the ground, a basin like formation pool is filled with cool, clear water. Early visitors may have found

this a welcome addition to the 70 plus feet of cave passage.

Steve and I were exploring the sandstone but it was now time to see some of that famous Pine Mountain limestone. Along the lower edges of their mountain, Steve's family has a cave overlooking the Cumberland River. At very nearly the edge of the railroad tracks we first visited the L&N Blowhole Cave; although this has some nice crawling it was not the



Steam Cave passage

cave we came to see. Up above this diversion is the cave he calls Icebox Cave and it is a great example of a Pine Mountain Cave.

Up a steep embankment and further still we went until a three-foot square entrance was found. You first enter a smaller room and passage with wide rushing from a crawlway at the far end. Twenty feet or more of crawling and you pop out in a nice bore-hole passage with stately columns and historic signatures lining the walls. The passage cuts right through the limestone beds that are tilted at around 45 degrees and at each extreme ends in breakdown fill. One dated name we found was from 1893.

After a full day of exploring, the hunger for a home cooked Thanksgiving meal drew us back to the family homestead. Turkey, ham, beans, corn, cranberries, biscuits, sweet potatoes, mashed potatoes, gourmet potatoes, pies and, cakes, oh my what a delightful spread! We ate heartily and later settled in for another night of movies with the Greene family.

Friday morning Steve and I went to an abandoned coal mine camp called Blackstar where his grandfather had worked. Steve worked at metal detecting the homesites while I was charged with keeping an eye out for piles of rust and unfriendly varmints. His luck with the machine was short so we headed over to Pathfork Mountain. Steve got me to explore a 2-foot high smallish coal mine and bring him a sample of the coal. It was good coal mined on just a local basis.

Saturday Morning we had plans to meet Tricia Forman at Jean's Restaurant back in Rockcastle County. We left from there to work on our mapping project in Middle Cave where David Lindsey owns the nearest home. We jumped in pretty quick and started surveying the passage that reduced to a low belly crawl. We are in the Upper Newman limestone with large crinoid fossils reaching out from the walls. The

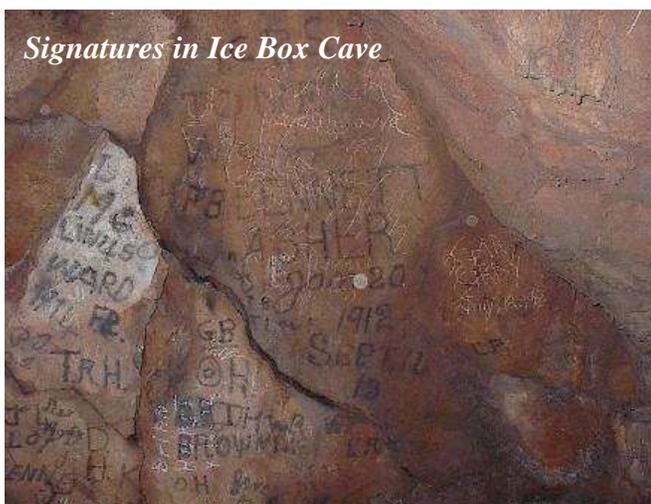
entrance is a wet weather insurgence streambed with large and small breakdown mixed with patches of gravel making up the floor.

Tricia handled the instruments while Steve took up point, leaving me to sketch and keep track of the data. At around station number twenty; the cave started to open up. The sometimes-wet floor started to drop away and soon we were standing upright in a ten-foot wide small recessional canyon. Our shot lengths grew and soon we were standing in passages with 30-foot ceilings.

The cave twists some but has followed a general southerly trend even in the more domed sections. Soon we are in a junction room where a small feeder intersects the main passage. Here the floor is made up of a pothole forming transition layer just above a larger blue-green shale unit where the stream continued on. We were able to chimney above the streambed but we wanted a good handline to continue on. We had now reached 34 stations and 595.5 feet surveyed in just a few short hours.

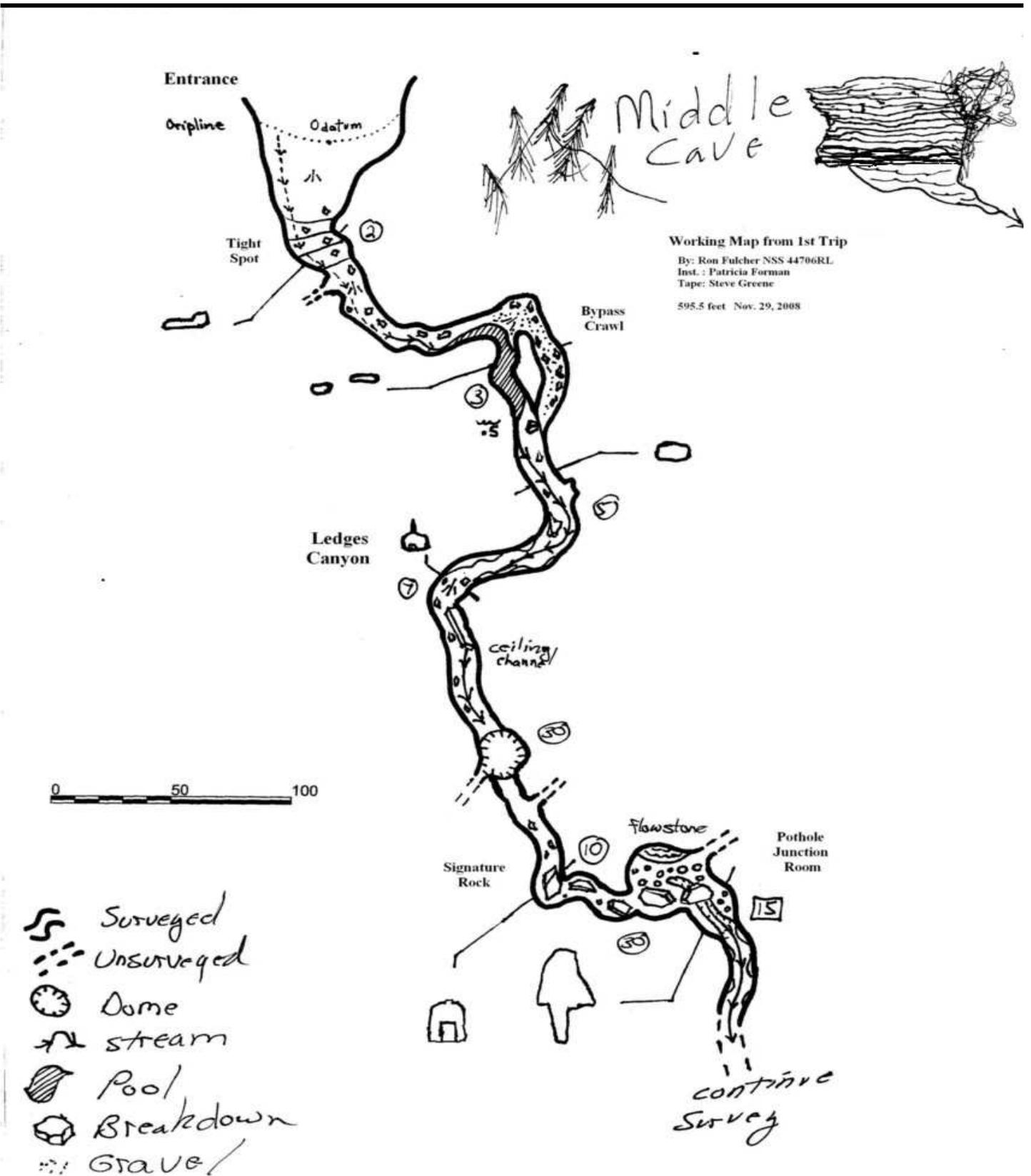
Back on the surface, we went to the Pizza Hut in Burr for a feast of meat and mozzarella cheese! Bring on the endless tumblers filled with sweetened goodness and the mountain of bread sticks dripping with marinara sauce. After our meal we all went over to meet Jim Landram at his new home. We beat him there but had only enough time to plant a new tree in in his yard before he arrived. For the next few hours we plotted our next big meeting there for Groundhog's Day in February.

Tall tales were shared with Shawn Pollock and Jim until the stars littered the heavens above. We woke Sunday to Aunt Bert and Steve's mom preparing another wonderful breakfast delight. I sure will miss their down-home hospitality but all good things have to end and so does our extended Thanksgiving vacation. Oh, but what a weekend we had though, with



Signatures in Ice Box Cave

several undocumented caves added to the survey list in Bell County and nearly 600 feet added to a Rockcastle County cave. I just can't wait to see what our intrepid band of explorers does next.





Indiana Karst Conservancy News

By Mike Hood, IKC Representative

There is an article in the December 2008 issue of the *IKC Update*, the newsletter of the Indiana Karst Conservancy, that tells about the Indiana Karst Conservancy, along with several Indiana grottos, taking on a project to clean up Houghton Hole (also known as Big Trashcan Pit). The pit is located in Harrison County, Indiana (close to where the 2008 Wormfest and 2007 NSS Convention were held).

Some DUG members helped clean part of the pit during the 2008 Wormfest and assisted in the removal of some of the trash. It will take many more cleanup weekends to get all of the trash removed. I'm proposing the grotto offer to help with some of the work weekends and am willing to act as the liaison between the grotto and the project coordinator.

Upcoming work dates are as follows:

March 28, 2009
 May 16, 2009
 July 11-12, 2009
 August 21-23 (actual date to haul out junk)

If the grotto decides to get involved, I will provide more information as I get it from the coordinator. Contact me if you are interested in helping.

Other upcoming IKC activities include the Indiana Cave Symposium, April 18, at a location to be announced, and a tree planting workday at the Buddha Cave property, also in April (date to be announced).

Visit the IKC's website for more information:

<http://ikc.caves.org>

MINUTES OF THE JANUARY 11, 2009 GENERAL MEMBERSHIP MEETING

25+ people were in attendance tonight! It was great to see this many come together for a meeting.

Vice Chair: Looking for Wormfest Sites. If you have ideas, please let Amy know.

Treasurer: No concrete numbers available tonight. Checking is at approximately \$1200.00, and savings is at approximately \$2000.00.

Courier: Due to potential size and costs, the electronic CC will be much larger than the printed version for February. Those receiving paper copies will get "edited" versions.

Secretary: DUG now has a small storage unit for Grotto-related items. Contact an EC Member if you have anything Grotto-related to store.

Chair: EC Meeting minutes were read (see separate EC Meeting report). Of specific interest:

Rockcastle Regional Grotto has been started. Steve Greene said a few words about the Grotto. Dana offered to include RRG in the Grotto-Chairman-Info-Share endeavor currently happening between many of the area grottos.

Present Committee Reports are as follows:

Membership: DUG has 163 members to date.

Conservation: Harry Goepel offered to lead a spring trip for cave-cleanup and is looking for ideas.

Landowner Relations: Nothing new.

GSP Committee: Chris Hacker is the newest DUG GSP Committee Representative (along with Tim Hale). 2009 waivers are needed for all members. 2009 camping passes are now available (\$30 for individuals, \$50 for families).

IKC: There is a current clean-up effort of Houghton Sink in Crawford County, and work weekends will be coming up. Vertical qualification is needed to get into the cave. Contact Mike Hood for more information.

Richard Blenz Nature Conservancy: 2008 projects are done. Property is being finalized to go to the NSS. 2009 projects are pending.

KSS: There will be a meeting on Sunday, January 25 at Crawlathon.

Old Business:

No old business.

New Business:

GSP Donation: The DUG EC voted to make an immediate \$500.00 donation to GSP in support of their new out-house project. \$500 additional dollars may be donated later in the current EC Term, depending on finances.

The DUSI: Roger Brucker introduced Sean D. who invented the new Digital Underground Survey Instrument (DUSI). Sean gave a brief overview and demonstration of this new instrument for laser/digital incline & azimuth measurements. He is currently trying to perfect the calibration (currently a .2 error for incline and .6 for azimuth). This tool should make surveying much easier.

Program:

Jim Pisarowicz gave a great talk on "Caving in Acid: Cave exploration in Tabasco, Mexico." Thanks Jim!

Traci Fearday
Secretary

MINUTES OF THE JANUARY 11, 2009 EXECUTIVE COMMITTEE MEETING

GSP Rep – Chris Hacker was verified as the new DUG GSP Representative, filling our one empty spot.

Meeting Streaming – Crawlathon did online video streaming of some of their meetings. This could be a possibility for future DUG Meetings to improve "attendance".

GSP Outhouses – The GSP Management Committee sent a letter requesting a donation of \$1000.00 from us to be put toward the new Outhouse Project. Since GCG has offered to match up to \$3500.00 of contributions received, so the GSP Committee is eager to meet this number. Mike Hood made a motion that the DUG EC donate \$500.00 now, with the possibility of donating another \$500.00 later in the 2008-09 EC Term, provided the Grotto has the funds. Jim Pisarowicz seconded the motion, and the EC passed the motion.

DUG Website – Dana received complaints about the DUG Website's lack of "completion". Information was not being updated and some information/documents were not

available. Much of the updating had been done since, and some of the missing content had not yet been passed to the new website administrator. So far, the new webmaster has been doing a pretty good job, and we need to just let him make it his own.

Rockcastle Regional Grotto (RRG) – as we all now know, our esteemed ex-chairman, Ron Fulcher, has started a new Grotto down in Rockcastle, KY. While informal discussions have been in support of this new endeavor, the DUG EC would like to officially commend this new organization and offer our support.

Membership Renewals – It was suggested that, to ease the "hassle-factor" on both members and the Membership Chair, that DUG offer a multi-year membership option. Currently, there is nothing preventing a member from sending multiple-year's payment, making a notation to extend membership past one year (on the DUG Membership page, there is even a column showing when your membership expires, whether it be in a year or more). The EC encourages any and all members to pre-pay for multiple years.

Membership Fees – During the past two years, the Grotto has been running on a budget which included a minimal number of Carbide Courier Printings. Since the Grotto has gotten used to working on such a budget, the production of 12 issues when almost 50% of the members want printed copies will make the DUG expenses skyrocket this year, between printing costs and mailing costs. It has been a long time since DUG Dues have gone up, and the EC does not like the idea of raising dues. Mike suggested adding \$5 to membership fees for those members wanting a paper copy of the newsletter to help offset expenses. The EC will consider this and make a decision later in the year.

RKC Access Committee - RKC has created a committee to solicit ideas/concerns regarding RKC Property access. Members of this committee were present for DUG EC feedback. Comments are as follows:

RKC can NOT turn potential members away (based on how it was set up), so anyone and everyone can join RKC. The concern there is that if people join RKC with the idea that they have free reign of any and all of the RKC properties, this could cause a "campground" mentality to arise.

If RKC properties are mainly **cave conservation** properties, the main concern should be the preservation of the caves and land, not membership admittance. Those who join RKC should NOT expect free and equal access to any and all properties owned. Access should be based on individual management plans for each of those properties (similar to SCCI or IKC).

If RKC members are looking for “tangible” benefits of membership, they should probably not join. While many RKC members would *enjoy* access to all properties, some properties may need to be regulated. RKC Membership offers the knowledge that you are preserving caves and cave land, and that’s it.

The consensus is that of most importance is the conservation aspect rather than open access. There is a management committee that has specified access requirements to GSP based on the cave, the land, and conservation/upkeep concerns. This would be expected for ANY RKC cave/land acquisitions. This has worked so far – why should this be changed?

If there are any additional comments/concerns/ideas on this topic, contact Tammy Otten, Mike Rzesutock, Mary Gratsch, or Matt Keller to share.

Grotto Membership Renewals – DUG will renew its organizational membership to both IKC and SCCI.

Traci Fearday
Secretary

Department of Parks

Crawlathon At Carter Caves State Resort Park Cancelled Due To Bat Disease Concerns

OLIVE HILL, Ky. – The Kentucky Department of Parks announced today that the annual Crawlathon at Carter Caves State Resort Park scheduled for Jan. 23-25 is being cancelled because of concerns about the spread of a disease that is fatal to bats.

The decision follows a recommendation by the U.S. Fish and Wildlife Service that the event could pose a threat to bat populations in caves at the park because of “White-nose Syndrome,” a disease that has killed thousands of hibernating bats in several Northeastern states. The name comes from a white fungus that appears around the noses of some affected bats.

The Crawlathon is an annual event that includes special cave tours, educational programs and seminars. Approximately 600 people had registered for the event.

The U.S. Fish and Wildlife Service is asking cavers to take precautions -- such as decontaminating clothing and cave gear -- to help prevent the spread of the disease, although the cause is not known. No cases have been reported in Kentucky.

Caves at the Northeastern Kentucky state park are home to two-thirds of the state’s hibernating population of Indiana bats, a federally endangered species.

“We’re obviously very disappointed about having to cancel this popular event,” said state park Commissioner Gerry van der Meer. “But after our discussions with fish and wildlife officials we decided it would be very difficult to take all of the precautions necessary to adequately protect these animals with the large numbers of guests we expected.”

The Department of Parks had been working with the Kentucky Department of Fish and Wildlife Resources on plans to limit the spread of the disease through decontamination steps for Crawlathon guests. However, in recent weeks, the disease was discovered in New Jersey and Pennsylvania, bringing the number of states where WNS is now confirmed to six since its discovery in February 2007. The other states are New York, Vermont, Connecticut and Massachusetts.

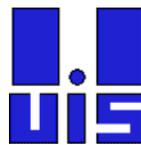
“I’ve been monitoring this situation through conversations with Fish and Wildlife officials from the start,” said state Rep. Robin Webb, who represents Carter County. “I hate that we have to cancel the event, but we have no choice but to follow the recommendation of the U.S. Fish and Wildlife Service and protect the resource.”

Those who made reservations for the event are being notified and having their payments refunded.

For more information, please visit www.crawlathon.com and www.caves.org/WNS/WNS%20Info.htm.



Bats displaying White-Nose Syndrome.



Karst Horizons
15th International
Congress of Speleology
Kerrville, Texas USA
www.ics2009.us

OHIO KARST AREAS

Karst is a landform that develops on or in limestone, dolomite, or gypsum by dissolution and that is characterized by the presence of characteristic features such as sinkholes, underground (or internal) drainage through solution-enlarged fractures (joints), and caves. While karst landforms and features are commonly striking in appearance and host to some of Ohio's rarest fauna, they also can be a significant geologic hazard. Sudden collapse of an underground cavern or opening of a sinkhole can cause surface subsidence that can severely damage or destroy any overlying structure such as a building, bridge, or highway. Improperly backfilled sinkholes are prone to both gradual and sudden subsidence, and similarly threaten overlying structures. Sewage, animal wastes, and agricultural, industrial, and ice-control chemicals entering sinkholes as surface drainage are conducted directly and quickly into the ground-water system, thereby posing a severe threat to potable water supplies. Because of such risks, many of the nation's state geological surveys, and the U.S. Geological Survey, are actively mapping and characterizing the nation's karst regions.

The five most significant Ohio karst regions are described below.

BELLEVUE-CASTALIA KARST PLAIN

The Bellevue-Castalia Karst Plain occupies portions of northeastern Seneca County, northwestern Huron County, southeastern Sandusky County, and western Erie County. Adjacent karst terrain in portions of Ottawa County, including the Marblehead Peninsula, Catawba Island, and the Bass Islands, is related in geologic origin to the Bellevue-Castalia Karst Plain. The area is underlain by up to 175 feet of Devonian carbonates (Delaware Limestone, Columbus Limestone, Lucas Dolomite, and Amherstburg Dolomite) overlying Silurian dolomite, anhydrite, and gypsum of the Bass Islands Dolomite and Salina Group.

The Bellevue-Castalia Karst Plain is believed to contain more sinkholes than any of Ohio's other karst regions. Huge, irregularly shaped, closed depressions up to 270 acres in size and commonly enclosing smaller, circular-closed depressions 5 to 80 feet in diameter pockmark the land between the village of Flat Rock in northeastern Seneca County and Castalia in western Erie County. Surface drainage on the plain is very limited, and many of the streams which are present disappear into sinkholes called swallow holes.

Karst in the Bellevue-Castalia and Lake Erie islands region is due to collapse of overlying carbonate rocks into voids created by the dissolution and removal of underlying gypsum beds. According to Verber and Stansbery (1953, Ohio Journal of Science), ground water is introduced into Salina Group anhydrite (CaSO_4) through pores and fractures in the overlying carbonates. The anhydrite chemically reacts with the water to form gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), undergoing a 33 to 62 percent increase in volume in the process. This swelling lifts overlying strata, thereby opening fractures and creating massive passageways for conduction of greater volumes of ground water through the Silurian Bass Islands Dolomite and into underlying Salina Group strata. Gypsum, being readily soluble in water, is dissolved, creating huge voids. Overlying carbonates then collapse or break down, leaving surface depressions similar to those resulting from roof failure of an underground mine.

DISSECTED NIAGARA ESCARPMENT

The dissected Niagara Escarpment of southwestern Ohio includes the largest single area of karst terrain in the state and the greatest number of surveyed caves. It also is estimated to include the second-largest number of sinkholes in the state. The area is underlain by Silurian rocks of the Peebles Dolomite, Lilley Formation, Bisher Formation, Estill Shale, and Noland Formation in Adams, Highland, and Clinton Counties and the Cedarville Dolomite, Springfield Dolomite, Euphemia Dolomite, Massie Shale, Laurel Dolomite, Osgood Shale, and Dayton Formation in Greene, Clark, Miami, Montgomery, and Preble Counties. The Peebles-Lilley-Bisher sequence and the Cedarville-Springfield-Euphemia sequence constitute the Lockport Group.

Most karst features along the Niagara Escarpment in southwestern Ohio are developed in Lockport Group strata. More than 100 sinkholes and caves developed in the Lockport have been documented in the field, and more than 1,000 probable sinkholes in the Lockport have been identified on aerial photographs, soils maps, and topographic maps. As with most karst terrain, sinkholes developed on the Niagara Escarpment commonly show linear orientations aligned with prevailing joint trends in the area. The greatest concentration of sinkholes on the escarpment is south of the Wisconsin

glacial border in southern Highland and Adams Counties, where highly dissected ridges capped by Silurian carbonate rocks rise 150 to 200 feet above surrounding drainage. Illinoian till in these areas is thin to absent, and soils are completely leached with respect to calcium and calcium-magnesium carbonate. Such geologic settings are ideal for active karst processes, as downward-percolating, naturally acidic rain water is not buffered until it has dissolved some of the underlying carbonate bedrock. Other significant karst features of the Niagara Escarpment include small caves in escarpment re-entrants created by the valleys of the Great Miami and Stillwater Rivers in Miami County.

BELLEFONTAINE OUTLIER

The Bellefontaine Outlier in Logan and northern Champaign Counties is an erosionally resistant "island" of Devonian carbonates capped by Ohio Shale and surrounded by a "sea" of Silurian strata. Though completely glaciated, the outlier was such an impediment to Ice Age glaciers that it repeatedly separated advancing ice sheets into two glacial lobes—the Miami Lobe on the west and the Scioto Lobe on the east. Most Ohioans recognize the outlier as the location of Campbell Hill—the highest point in the state at an elevation of 1,549 feet above mean sea level.

Although it is not known for having an especially well-developed karst terrain, the outlier is the location of Ohio's largest known cave, Ohio Caverns. The greatest sinkhole concentrations are present in McArthur and Rushcreek Townships of Logan County, where the density of sinkholes in some areas approaches 30 per square mile. Sinkholes here typically occur in upland areas of Devonian Lucas Dolomite or Columbus Limestone that are 30 to 50 feet or more above surrounding drainage and are covered by less than 20 feet of glacial drift and/or Ohio Shale.

SCIOTO AND OLENTANGY RIVER GORGES

The uplands adjacent to the gorges of the Scioto and Olentangy Rivers in northern Franklin and southern Delaware Counties include areas of well-developed, active karst terrain. These uplands also are among the most rapidly developing areas of the state, which means karst should be a consideration in site assessments for commercial and residential construction projects.

The Scioto River in this area has been incised to a depth of 50 to 100 feet into underlying bedrock, creating a shallow gorge. The floor, walls, and adjacent uplands of the gorge consist of Devonian Delaware and Columbus Limestones mantled by up to 20 feet of Wisconsin till. Sinkhole concentrations up to 1 sinkhole per acre are not uncommon in Concord, Scioto, and Radnor Townships of Delaware County. The sinkholes range in diameter from about 10 to 100 feet and commonly are aligned linearly along major joint systems.

The Olentangy River is approximately 5 miles east of the Scioto River in northern Delaware County and occupies a gorge that is narrower and up to 50 feet deeper than the Scioto River gorge. The floor and the lower half of the walls along the Olentangy gorge are composed of Delaware and Columbus Limestones, the upper half of the walls is composed of Devonian Ohio and Olentangy Shales mantled by a thin veneer of glacial drift. Karst terrain has developed along portions of the gorge in a manner similar to karst terrain along the Scioto River.

ORDOVICIAN UPLANDS

The Ordovician uplands of southwestern Ohio are the location of surprisingly well-developed karst terrain despite the large component of shale in local bedrock. Numerous sinkholes are present in Ordovician rocks of Adams, Brown, Clermont, and Hamilton Counties.

The carbonate-rich members of the Grant Lake Formation (Bellevue and Mount Auburn), Grant Lake Limestone (Bellevue and Straight Creek), and the upper portion of the Arnheim formation are the Ordovician units most prone to karstification; however, the shale-rich (70 percent shale, 30 percent limestone) Waynesville Formation also has been subjected to a surprising amount of karst development in southeastern Brown and southwestern Adams Counties, just north of the Ohio River.

ACKNOWLEDGMENT

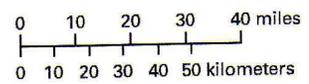
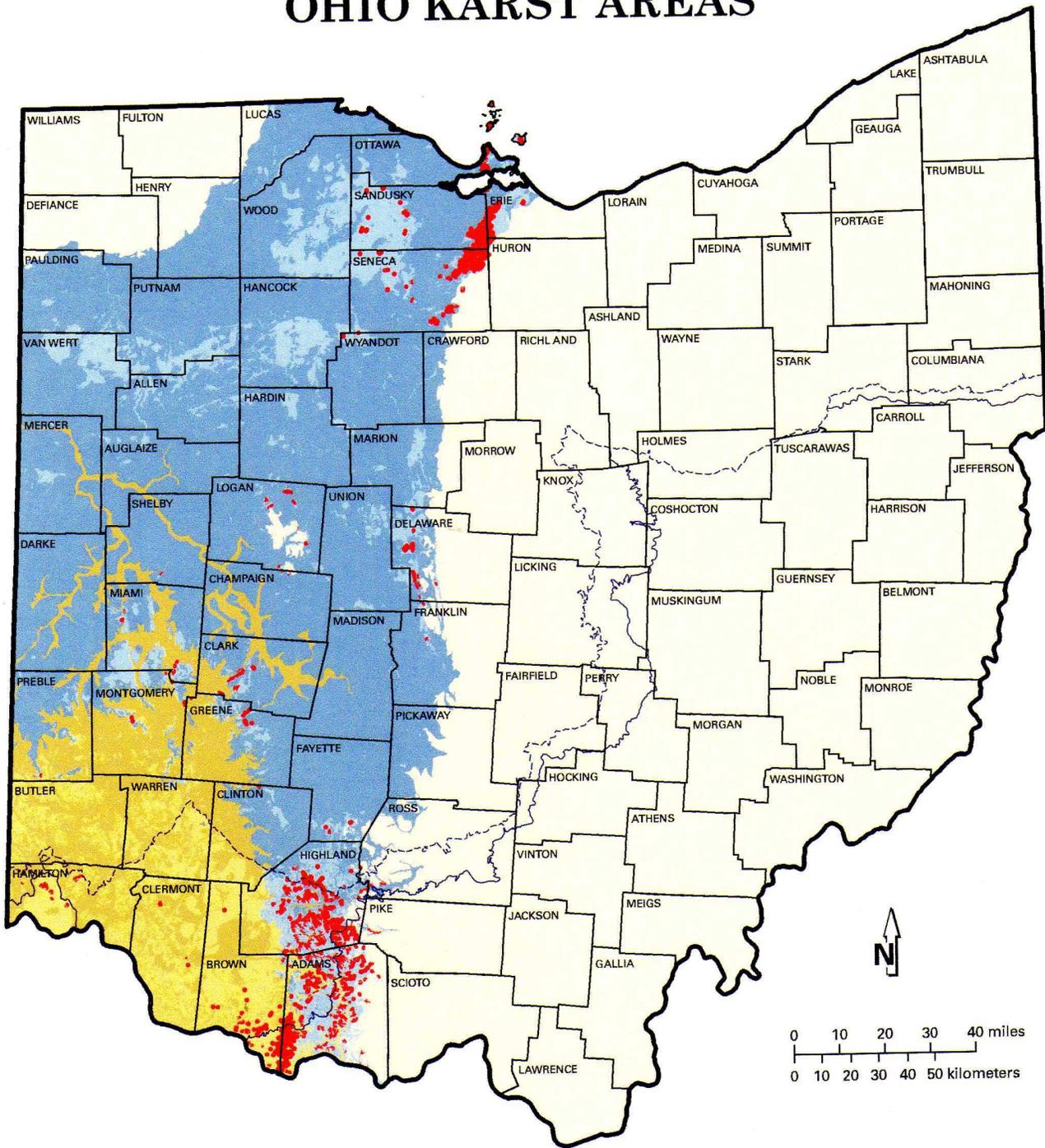
The Division of Geological Survey gratefully acknowledges the Ohio Low-Level Radioactive-Waste Facility Development Authority for its financial support for mapping Ohio karst terrain.

STATE OF OHIO
Ted Strickland, Governor

DEPARTMENT OF NATURAL RESOURCES
Sean D. Logan, Director

DIVISION OF GEOLOGICAL SURVEY
Larry Wickstrom, Chief

OHIO KARST AREAS



EXPLANATION

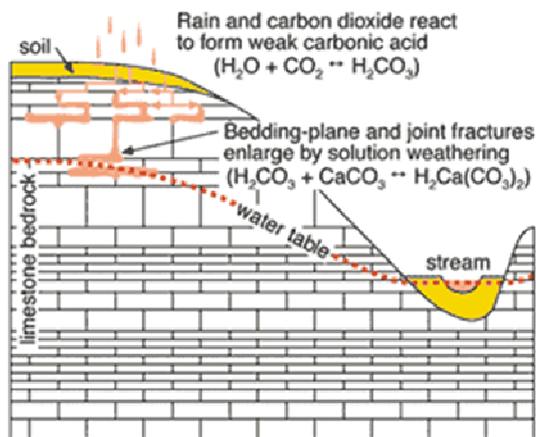
- | | | | |
|---|---|---|--|
|  | Silurian- and Devonian-age carbonate bedrock overlain by less than 20 feet of glacial drift and/or alluvium |  | Probable karst areas |
|  | Silurian- and Devonian-age carbonate bedrock overlain by more than 20 feet of glacial drift and/or alluvium |  | Area not known to contain karst features |
|  | Interbedded Ordovician-age limestone and shale overlain by less than 20 feet of glacial drift and/or alluvium |  | Wisconsinan Glacial Margin |
|  | Interbedded Ordovician-age limestone and shale overlain by more than 20 feet of glacial drift and/or alluvium |  | Illinoian Glacial Margin |



TYPICAL DEVELOPMENT OF KARST IN OHIO

Karst develops on or in water-soluble rock such as limestone, dolomite, and gypsum and is characterized by the presence of sinkholes, caves, and underground drainage. The term "karst" is derived from the Slovenian region of northwestern Yugoslavia along the Adriatic Sea, where karst is well developed and was first described scientifically. The particular style and rate of karst development is dependent on many factors, including physical and chemical properties of the rock, structural orientation of the rock, temperature, vegetation, and the amount of rainfall. Rainfall and water-soluble rock are the most critical factors in Ohio karst formation.

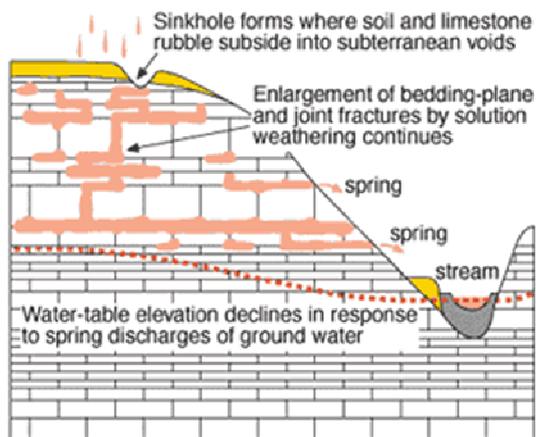
Rainwater falling through the air reacts with atmospheric carbon dioxide to form carbonic acid ($H_2O + CO_2 \rightarrow H_2CO_3$). Upon



entering the soil, rainwater reacts with carbon dioxide released from decaying vegetation to form additional carbonic acid. As part of the ground-water environment, carbonic-acid-charged water continues to move downward under the force of gravity into underlying limestone bedrock. The water moves laterally along horizontal fractures (bedding planes) and downward along vertical fractures (joints) until it reaches a depth where all fractures and pore spaces within the rock are filled with water (the water table). As the water moves along fractures, both above and below the water table, small amounts of limestone are dissolved by the carbonic acid ($H_2CO_3 + CaCO_3 \rightarrow H_2Ca(CO_3)_2$). Additional limestone is mechanically abraded and removed by the movement of the water.

rectly into the ground-water environment where fracture enlargement through mechanical abrasion.

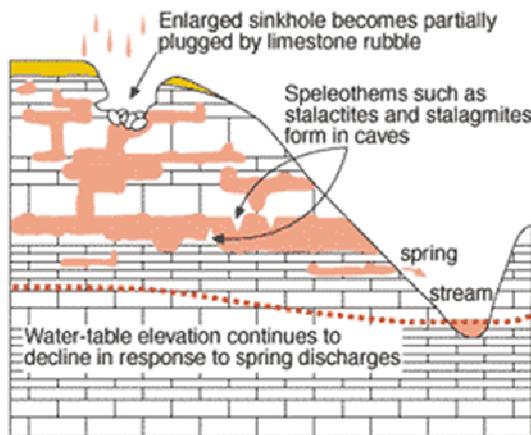
With the passing of time, bedrock fractures become greatly enlarged by the dissolution and abrasion process. Sinkholes (dolines) begin to form on the surface where enlarged vertical fractures allow soil and rock debris to collapse into the earth. Surface drainage is diverted directly into the ground-water environment where sinkholes intersect drainageways, thereby accelerating the rate of fracture enlargement through mechanical abrasion. The water table is lowered as ground water escapes to the surface through springs. The terrain created by the presence of numerous sinkholes and other solution features is called karst.

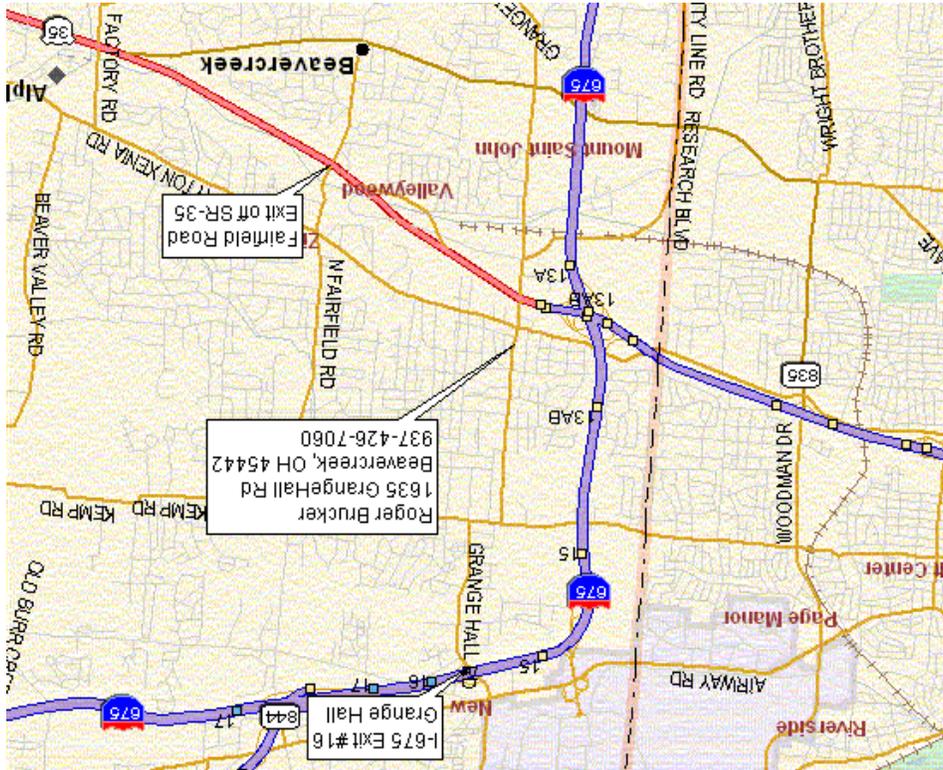


Over the course of many centuries, sinkholes continue to enlarge and coalesce with other sinkholes as underground voids collapse and ongoing abrasion and/or dissolution continue to remove bedrock. Horizontal and vertical fractures become enlarged to the extent that they can be classified as a cave (an underground passage large enough for a person to enter). The water table continues to drop in elevation as internal drainage networks within the cave system become more integrated and efficient in collecting and discharging ground water. Ground water saturated with calcium carbonate (calcite) and dripping from cave ceilings and walls or flowing along the

cave floor evaporates, causing calcite to be deposited as cave formations (speleothems) such as stalactites, stalagmites, flowstone, and travertine.

Article source: <http://csweb.winona.edu/semnwr/b/files/general/karstdev/karstdev.htm>





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