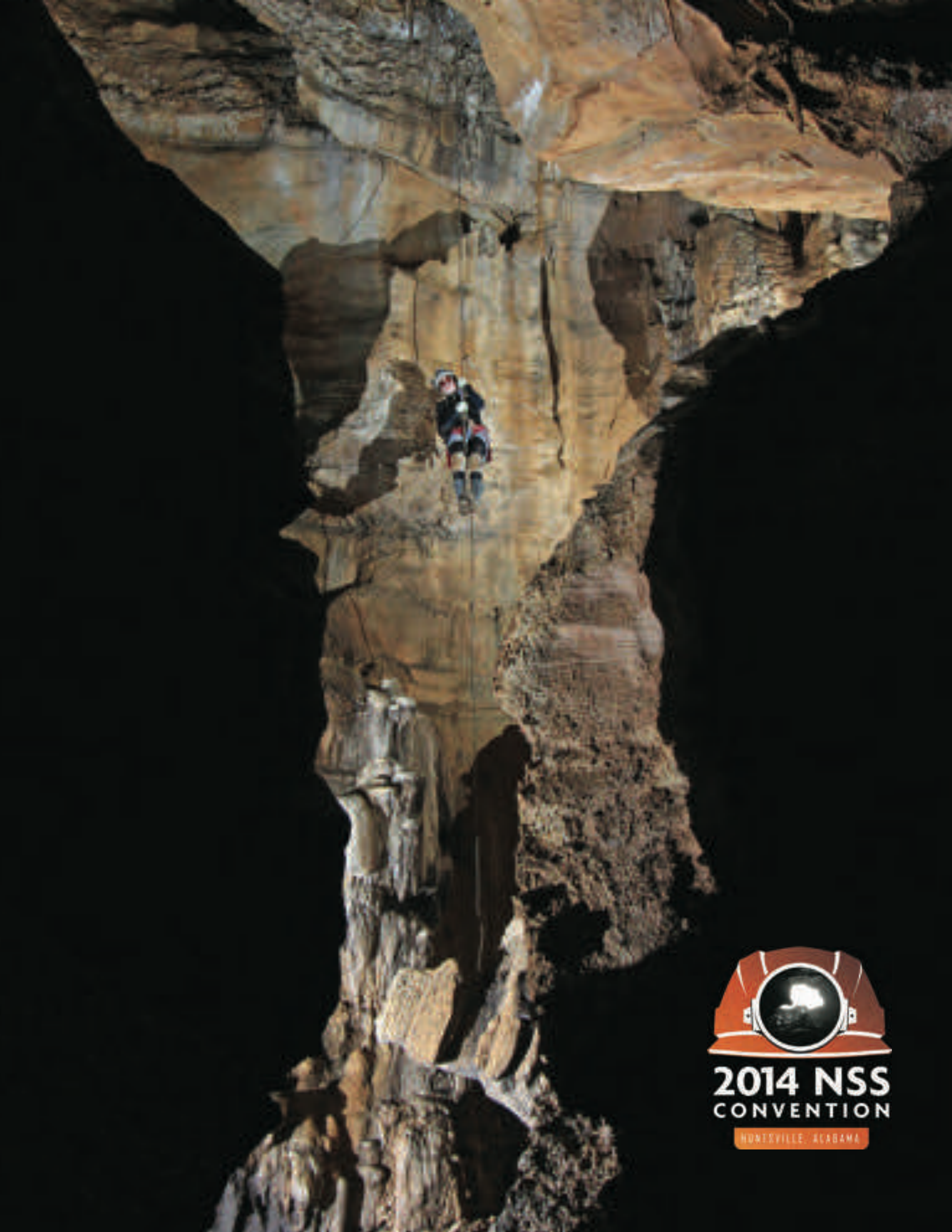
2014 NSS
CONVENTION
HUNTSVILLE, ALABAMA

2014 NSS CONVENTION

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July 14-18, 2014

Editor

Julie Schenck Brown, NSS 30493 RL, FE

Co-Editor

Louis Towles, NSS 44043

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2813 Cave Avenue
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USA
(256) 852-1300
nss@caves.org
www.caves.org

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2014 NSS CONVENTION

Huntsville, Alabama

Contents

Chapter 3: Cave Sciences

Chapter 4: History

Chapter 5: SCCi

Chapter 6: SERA Karst Task Force

Chapter 7: Cave Descriptions

Editor's Note

Julie Schenck Brown at The Fool's Progress the day they finished digging it open and first bottomed the main shaft. This is one of the many caves located within the city limits of Huntsville and less than 15 minutes from the site of the 2014 NSS Convention. Photo: Julie Uselton

After I served as the Editor for the *2005 NSS Convention Guidebook*, I thought that was the last Convention Guidebook that I would edit. However, after a series of unfortunate events, the 2014 NSS Convention was left without a Guidebook Editor. Louis Towles graciously agreed to prepare the layout and design of the *2014 NSS Convention Guidebook* if I were prepared to assume full editorial duties; this was in addition to serving as Chair of the 2014 NSS Convention and Louis working as the Webmaster of the 2014 NSS Convention. I also coaxed Meredith Hall Weberg to help out with proofreading, a major asset to the publications staff of the 2014 NSS Convention, as she was a tremendous help with the *2005 NSS Convention Guidebook*. With our key staff in place, I turned to some of the most talented cavers in the country and asked them to write about the elements that define our region.

While the region known as TAG has a profound history ingrained in survey and exploration, the foundation of this history is set upon an understanding of the geology of our region. The chapters on geology and survey complement each other and demonstrate this relationship. Another critical element of understanding the TAG region is integrated in the chapters on cave sciences and history. These chapters discuss the unique cave biota of TAG, as well as the prehistoric and modern cave usage by humans. A historical account of the Alabama Cave Survey is also included. An entire chapter is dedicated to the Southeastern Cave Conservancy Inc. (SCCi), and its ongoing acquisition of caves in the TAG region and throughout the southeast; the SCCi is now the largest cave conservancy in the country and continues to protect and preserve caves. In addition, the dedicated volunteers of the SERA Karst Task Force

(SKTF) continue to protect caves and karst features through remediation that includes trash and graffiti removal. A history of the SKTF, as well as a day in the life of a clean-up project is chronicled in an entire chapter. The final chapter includes cave descriptions for horizontal and vertical caves, many that have never been featured in previous publications.

The *2014 NSS Convention Guidebook* would not have been possible without the contributions of cavers who have helped define the Southeast Region, and more specifically the region known as TAG. Cavers have dedicated countless hours to discover, explore, survey, photograph, document, and conserve our caves. And it has been an absolute privilege to work with some of the most gifted cavers, cartographers, and photographers in the country in preparing the *2014 NSS Convention Guidebook*.

The cumulative effort of these cavers has made this publication a reality and I will be forever grateful for their contributions to caving.

Special thanks must also be given to the landowners who generously open their land to allow us access to some of the finest caves in the country. Without the unselfish efforts of landowners, we would not be able to explore and enjoy the hidden realms of earth.

Finally, I would like to thank my husband, Jon Brown, for his unwavering support as I worked on the 2014 NSS Convention these past years. This publication would have never been possible without his patience and understanding.

Welcome Home!

Julie Schenck Brown, NSS 30493 RL, FE

Julie Schenck Brown surveying virgin passage in Horseshoe Bend Cave, TN. Photo: Mark Ostrander

Acknowledgements

We would like to personally thank the following individuals for their contributions.

Contributors

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Jeff Bartlett
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Julie Schenck Brown
Warren Campbell
Alan Cressler
Joe Douglas
Clinton Elmore
Dante B. Fenolio
Mike Green
Alan Grosse
Lin Guy
Maureen Handler
Jason Hardy
Cory Holliday
Pat Kambesis
Peter Michaud
Matthew Niemiller
Steve Pitts
SCCi
Nick Schaer
Dr. Jan Simek
Kelly Smallwood
Elliot Stahl
Bill Varnedoe
Bill Walter
Tom Whitehurst
Andy Zellner
Kirk Zigler

Photographers

Ron Adams
Prescott Atkinson, M.D
Kristen Bobo
Benji Von Crammon
Alan Cressler
Tim Curtis
Joe Douglas
Clinton Elmore
Danté B. Fenolio
Jack Fischer
Mike Green
Alan Grosse
Chris Higgins
Amy Hinkle
Willie Hunt
Mark Ostrander
Matt Ketron
Nick Schaer
Kelly Smallwood
Ken Storey
Chuck Sutherland
J.V. Van Swearingen IV
Julie Uselton
Bill Varnedoe
Louise Varnedoe
Jerry Wallace
Tom Whitehurst
Nathan Williams
Andy Zellner

Cartographers

Marion Akers
Jeff Bartlett
Alan Grosse
Gary Griner
Patricia Kambesis
Steve Pitts
Jason Richards
Jim Smith
Bill Torode

Proofreaders

Meredith Hall Weberg
Andy Zellner

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Mark Dickinson
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Lin Guy
Chris Hacker
Meredith Hall Weberg
Maureen Handler
Dave Haun
Dave Howell
Valerie Howell
Patricia Kambesis
Dave Luckins
Jeff Martin
Nina Martin
Liv McKinsey
Michael McKinsey
Peter "Mudpuppy" Michaud
Glenn Mills
Martha Mills
Doug Moore
Mike Moser
Alicia Nelson
Stephanie Rubio
Geary Schindel
Patricia Seiser
Carolina Shrewsbury
Wm Shrewsbury
Sabrina Simon
Tricia Spiliotis
Alex Sproul
John "Rocco" Stembel
Carol Tiderman
Bill Torode
Julie Uselton
Bill Varnedoe
Michelle Vaughn
Bill Walter
Tom Whitehurst
Dean Wiseman
Woody Woods
Ed Yarbrough
Andy Zellner
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Chapter 1: Manuel Beers in Jess Elliot Cave, Alabama. Photo: Alan Cressler

Chapter 2: Jeff Bartlett and Alan Grosse on Traverse line over top of the tall canyon river passage. Photo: Chris Higgins

Chapter 3: Cave Cricket on a Stalactite. Photo: Tim Curtis

Chapter 4: Barefoot human tracks, ancient streamway. Photo: Alan Cressler

Chapter 5: Valhalla, Southeastern Cave Conservancy Preserve, Alabama. Photo: Jack Fischer

Chapter 6: Photo: SKTF volunteer

Chapter 7: Joy Palmer in Guys Cave. Photo: Alan Grosse

In Memoriam

It is appropriate that we remember those departed cavers who have contributed to southeastern caving, for their passion, fellowship, and discoveries!

Name	NSS Number	Dates		State
Earnest Ackerley	258	1924	1963	Georgia
Larry S. Adams	14224	1946	1993	Tennessee
Louis Adams	31584	1930	2004	Alabama
Clem William Akins	35242	1962	2012	Alabama/ Tennessee
Jack Henry Allen	3734	1923	1992	Alabama
W. C. Austin	48789			North Carolina
Everett N. Bagby	25291	1955	2011	Alabama
F. Clayton Baker	41434	1956	1997	Alabama
Carol V. Balog	14646	1998		Alabama
Robert G. Bennett	32327	1961	2007	Alabama
Thomas Calhoun Barr, Jr.	892	1931	2011	Tennessee
Barry Frederic Beck	11737	1944	2011	Tennessee
Fred Benington	3684	1916	1997	Alabama
Steve Berman	27704	1961	2001	Florida
Donald A. Black	34964	1953	1998	Florida
Donald Forsyth Black	116	1922	2003	Tennessee
Karen J. Blackburn	34339	1962	2013	Kentucky
Arthur David Bosnak	14216	1947	1985	Tennessee
Bruce Bosshart	56398		2009	Florida
Paul Rice Boyer	8422	1940	1980	Florida
Bruce Brewer	37185	1970	2003	Florida
Jack H. Brightwell	20980	1933	2003	Alabama
Ellsworth Brown	1878		c.1963	Tennessee
Kenneth Wayne Brown	16519	1952	2005	Alabama
Ted Burke	38061	1963	2014	Kentucky
Richard Byrd	6738	1944	1977	Alabama
Robert A. Caldwell	57293	1956	2013	Florida
James (Jay) Carpenter	34529	1958	2013	Alabama
Edward L. Carter, Jr.	14703	1932	2005	Alabama
Will Chamberlin	16402	1953	2010	Tennessee
Thomas Champion	46245	1949	2005	Alabama
John B. Chappell	59366	1956	2009	North Carolina
Joseph Roy Chapman	346	1898	1957	Georgia
Robert D. Clark	5262	1929	1970	Alabama
Terry Gale Clark	36369	1944	2013	Kentucky
Wallace Colly	5976	1923	2009	Georgia
Sara Foster Corrie	5002	1915	1988	West Virginia
Gary Alan Cotney	46974	1961	2006	Alabama
Sam J. Couch	10350	1945	1974	Georgia
George H. Cowden	24901	1956	2003	Georgia
William K. Cronin	26107	1901	1988	Florida
John W. Curtis	3255		1977	Tennessee
Joseph Dabbs	19454	1935	2014	Alabama
Gary Wayne Daugherty	13291	1954	1987	Tennessee
William Donald Davison, Jr.	12239	1947	1995	Virginia

Name	NSS Number	Dates		State
Charles Winn Dear	20899	1956	1997	Florida
Bert H. Denton, Jr.	1728		1975	Tennessee
Richard E. Dickson	23355	1935	1999	Alabama
Ronald R. Dilamarter	17653	1931	1987	Kentucky
Herb Dobson	4748		c. 1980	Tennessee
Dan O. Dougherty	12402	1914	1989	Georgia
Philip C. Duncan	13202		1997	Alabama
Thomas A. Engle	3599	1929	1984	Florida
Irby Sheck Exley, Jr.	13146	1949	1994	Florida
Marc W. Eyring	29742	1922	2013	Florida
John Fels	63261	1948	2014	North Carolina
Jack Fischer	51781	1948	2010	Alabama
Erick E. (Rick) Foote	9165	1942	1997	Georgia
Hubert Fraker	3394		c. 1960	Tennessee
John Andrew French	7846	1926	2011	Alabama
William Wayne Garrett	15192		1991	Alabama
Billy Alton Garrison	4699	1941	2009	Alabama
Arthur Goller	28803	1956	2014	Georgia
Lester V. Good	16532	1945	2002	Georgia
Standiford Rogers (Tank) Gorin	478	1922	2007	Tennessee
Richard Carter Graham	9694	1944	2003	North Carolina
Debra Green	48211	1965	2013	Florida
Daniel Payne Hale	3524	1926	2005	Alabama
Christopher M. Hammock	54890	1979	2012	Georgia
Alexia Stanley Hampton	39576	1962	1997	Tennessee
Charlie Hansen	4234		c. 1960	Tennessee
Alexis Karen Gottlieb Harris	24980	1957	1999	Georgia
Jimmy Leonard Harrison	10993	1949	2007	Alabama
Karen Hartsgrove Hellums	42119	1955	2013	Alabama
Steve Edward Henning	20876		1993	Georgia
Chuck Henson	26144	1946	2013	Georgia
Mical Holland	48962	1946	2006	Tennessee
Lewis S. Holtzendorf	14831	1945	1975	Florida
Marshall Goode Homes III	8183	1949	2003	Georgia
Steve Hudson	11444	1950	2013	Georgia
Mark Evans Hughes	28261	1964	2009	Alabama
Frank L. Hutchison	16660	1948	1993	Florida
Cecile James	27171	1935	2014	Virginia
James Hardy Johnston, Jr.	1718	1933	1992	Alabama
Mary Elizabeth Johnston	14606	1959	2005	Alabama
Hazel Phelps Jones	117	1900	1999	Alabama
Keith Jones	48280	1961	2004	Georgia
Walter Bryan Jones	108	1895	1977	Alabama
Marson Ashley Kay	63570		2012	Florida
Harmen Kelley	3619	1931	2013	Alabama
Kenneth Paul Kifer	9992	1945	2003	Alabama
Henry Tompkins Kirby-Smith	140	1907	1974	Tennessee
Steve Lalonde	64027	1980	2013	Florida
L. Mark Leach	8905		1975	Tennessee
John Brett Lewis	31335	1957	1992	Tennessee
Cord H. Link, Jr.	3089	1923	1978	Tennessee
Steve Lugannani	39621	1954	2001	Tennessee
John A. Masterson	47666	1930	2000	Alabama

Name	NSS Number	Dates		State
Edward McCrady, Jr.	320	1906	1981	Tennessee
William (Bill) McFaden	29043	1956	1988	Florida
Anthony H. McGee	18125	1948	2012	Tennessee
Francis Eugene McKinney	4247	1940	1975	Tennessee
Larry Ray McLennan	7197	1934	1985	Alabama
Staley Lee McPeak	10831	1938	2008	Tennessee
Tad Joseph Mattel	53895	1990	2009	Alabama
Johnny Rusty Mills	8014	1947	1966	Georgia
Agnes Milowka	59200	1981	2011	Florida
James Eddie Montgomery	17948	1947	1980	Tennessee
Mark Franklin Moore	40121	1953	2002	Tennessee
Fred J. Morrison, Jr.	8818		c.1972	Tennessee
Paul Homer Moser	34422	1931	1994	Alabama
Lyle R. Moss	16233	1950	2011	Kentucky
Barbara Cross Munson	2935	1920	2008	Tennessee
Leonard J. Munson	2934	1915	1979	Tennessee
Ronnie Lee Nixon	23000	1948	2012	Alabama
Rick O'Hara	28221	1963	1993	Alabama
William H. Oldacre	10998	1954	2013	Florida
Tim Owens	59082	1973	2011	Florida
William L. Petrie	126	1923	2005	North Carolina
Louis H. Pfau	4964	1923	2001	Alabama
Lary W. Pinkley	22544	1941	2004	Alabama
Carl E. Ponder	39272	1939	2007	Georgia
James Spence Pope	6642		2012	Tennessee
Karen L. Prowett	39562	1956	1997	Georgia
James Frances Quinlan, Jr.	3021	1936	1995	Tennessee
Vern H. Reckmeyer	3558	1909	2006	Alabama
Frederick R. Redwine	3392	1919	1985	Tennessee
John W. Reid	13089	1943	2009	Georgia
Rob Robbins	39109	1941	2013	Tennessee
John Robinson, Jr.	51075	1968	2004	Florida
Lloyd W. Root	3834	1933	2003	Alabama
Nancy M. Rueff	37916	1953	2009	Florida
Gary Wayne Sander	36791	1953	1996	Alabama
Thomas T. Sawyer	4587	1934	1976	Alabama
Richard Walter Schreiber	6782	1943	1990	TAG
Franklin Walter Shires	10945	1920	2003	Tennessee
William Siler	17299	1920	2011	Alabama
Ron Simmons	16894	1955	2007	Virginia
Wesley C. Skiles	20850	1958	2010	Florida
Harrison Ross Steeves, Jr.	4339	1911	1994	Alabama
James Boyd Stevenson, Jr.	4645	1936	2012	Georgia
Gary Robert Stewart	38127	1956	2011	Alabama
Barbara Miller Storey	7484	1940	1992	Georgia
James Welborn Storey	5309	1935	1992	Georgia
William Lee Suggs	24140		1992	Georgia
Archer Dee Swank	10392	1933	2008	Alabama
Edward V. Tapp	4713	1938	2008	Alabama
Terry Warren Tarkington	533	1925	2003	Alabama
J. Lawrence Temple	7547		1971	Alabama
Lavine K. Thrailkill	2380	1928	2006	Florida
Michael James Thurber	33669	1963	2004	Alabama

Name	NSS Number	Dates		State
George E. Titcomb	6012	1927	1991	Tennessee
Parker A. Turner	27953		1991	Florida
John Van Swearingen, III	12038	1916	2010	Alabama
John “JV” Van Swearingen, IV	12729	1945	2001	Alabama
John M. Wallace, Jr	6786	1924	1994	Georgia
Robert V. Welch	3318	1917	2011	Georgia
John Blue Weldon, Jr.	15066	1942	2010	Alabama
Melvin E. Whaley	15119	1953	2013	Tennessee
Paul Whistler			c. 1950	Tennessee
Harry E. White	8336	1942	2006	Florida
Robert L. Whorton	20052	1956	2012	Alabama
Robert Louis Williams	37186	1967	1995	Kentucky
Ross Wilson	36188	1948	2013	Alabama
William Lytle Wilson	12231	1953	2002	Florida
Steven Michael Wixson	46507	1966	1999	Alabama

Non NSS Cavers

Don Ball		1933	1950	Tennessee
Don Black			c. 1960	Florida
Sam Crawford		1963	1984	Georgia
Mike Hanebaum		1964	1984	Georgia
Labaron Pahlmeyer			c. 1960	Tennessee
Byon Reese		1947	1975	Georgia
Ronnie Reese		1948	1972	Georgia
Charlie Smith		1933	2009	Tennessee
Tom Shriver		1931	1997	Tennessee
Gene Wiggins			1973	Georgia
Billy Wooten		1951	1974	Georgia

Chris Bell climbing out of O'Shaughnessy Pit, Huntsville, AL. Photo: Elliot Stahl

Chapter 1 Geology

The Geology of the Caves and Karst of "Classic TAG" and Surrounding Areas

Patricia Kambesis, NSS 17304, LB, FE

Figure 1 - Location map of TAG.

Introduction

The place name "TAG" is well known to cavers from all over the United States as a region with a great abundance of deep shafts and multi-drop caves as well as horizontal cave systems that drain the many deeply incised coves characteristic of the area. The "classic" geographic definition of the TAG region (Figure 1) encompassed the areas surrounding the triple junction of state borders that included south-central Tennessee, northeast Alabama, and northwest Georgia (Smith, 1989).

The name TAG was informally coined by a group of cave explorers who, in the late 1960s, discovered, explored, and mapped caves in that triple junction of states. TAG became a hot spot for advances in single rope techniques and equipment that in turn sparked regional cave exploration (Palmer, 2009). These days the boundaries of TAG are also considered to include most of central Tennessee. TAG has become more than just a geographic region. It is synonymous with American vertical caving and embodies a caving mindset and culture that is unique to its geography.

For this report, the geographic areas described will encompass the lower Tennessee River Basin (Figure 2) that includes classic TAG and the karst areas due south and southeast of Nashville, Tennessee. The lower Tennessee River drains 32,000 km^2, centered in Tennessee, and also includes in its watershed the cave-rich portions of north-central Alabama and northeastern Georgia. In Tennessee, the lower part of the river flows west as it leaves the Valley and Ridge province and to the southwest through the Sequatchie Anticline. It crosses into Alabama at Walden Ridge near Guntersville, and takes a westerly course across the state. At the

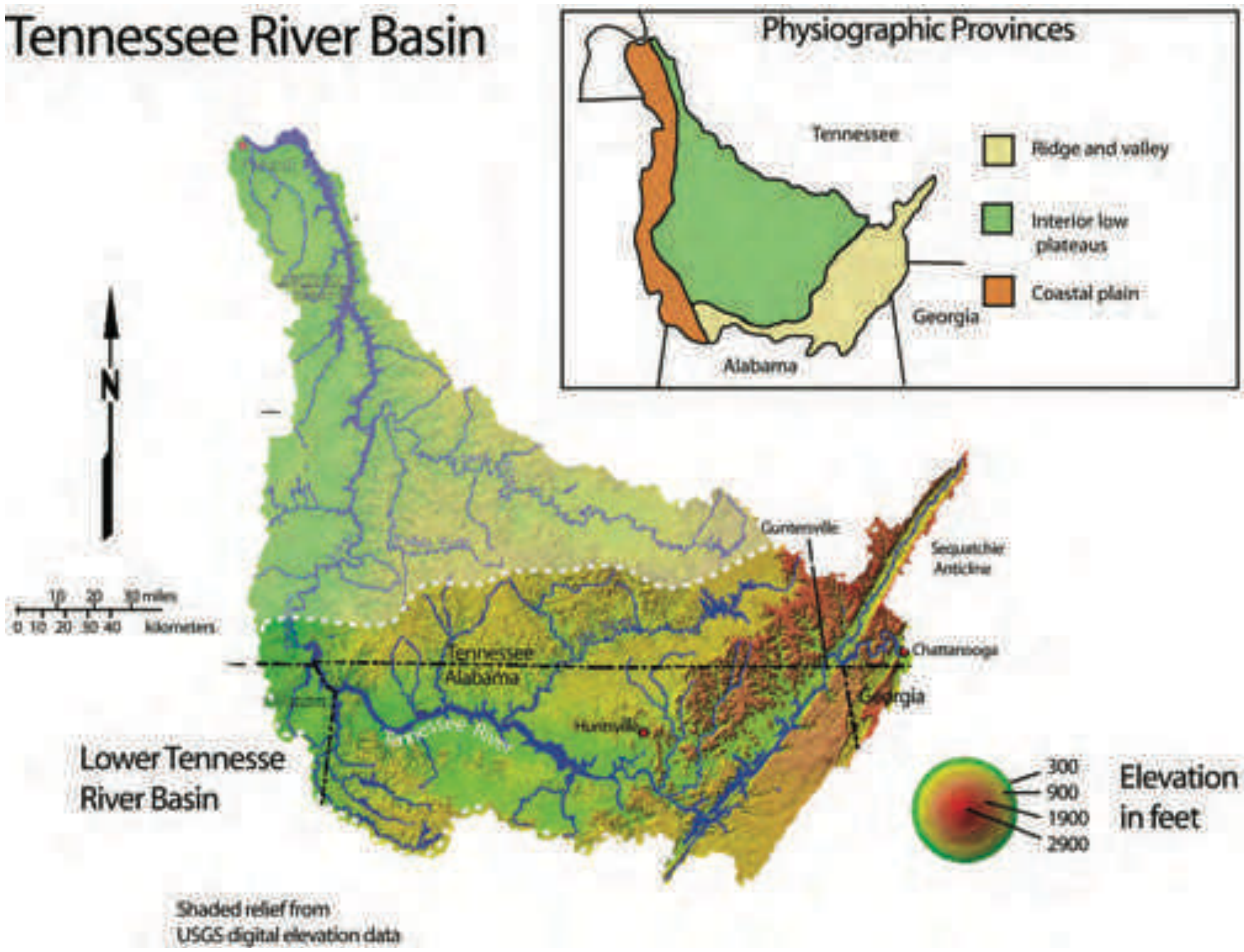

Figure 2 - Lower Tennessee River Basin.

borders of Alabama and Tennessee, the river heads due north and flows across Tennessee until its confluence with the Ohio River.

The caves of the lower Tennessee River basin are formed in Silurian, Ordovician, and Mississippian-age carbonates and are distributed in three major physiographic provinces, including the southern portions of the Eastern Highland Rim, the Outer Central Basin, and the Cumberland Plateau (Figure 3). The majority of caves in this region have formed at the base of the Highland Rim, at the contact between the Highland Rim and Outer Basin, and in the coves that indent the Cumberland Plateau. Most of the cave streams in the region function as underground tributaries of the valley streams. (Barr, 1954).

The variety of caves in the lower Tennessee River Basin include multi-drop cave systems, open-air vertical shafts, horizontal stream caves of various sizes and complexities, and enigmatic network mazes.

Geologic Controls on Cave Development

The diversity of caves in the lower Tennessee River Basin reflects the geologic and hydrologic controls prevalent in the area. Cave development in the Cumberland Plateau is influenced by mode of recharge, stratigraphy, and lithologic composition and thickness.

Most areas display impermeable clastic cap rocks that overlie erosionally weak limestones. Within those limestones are discontinuous and impermeable strata that control the vertical development of caves. This is displayed in the Pennington Formation which overlies the Bangor Limestone – an important geologic contact when ridge walking, especially for deep multi-drop caves. The Bangor often contains small perching layers that make for the familiar stair-step series of short shafts common in TAG vertical caves. The Hartselle Formation is next in the sequence and is known for making many a low, miserable crawlway and is the hallmark of horror hole caving at its best. When the Hartselle Formation is

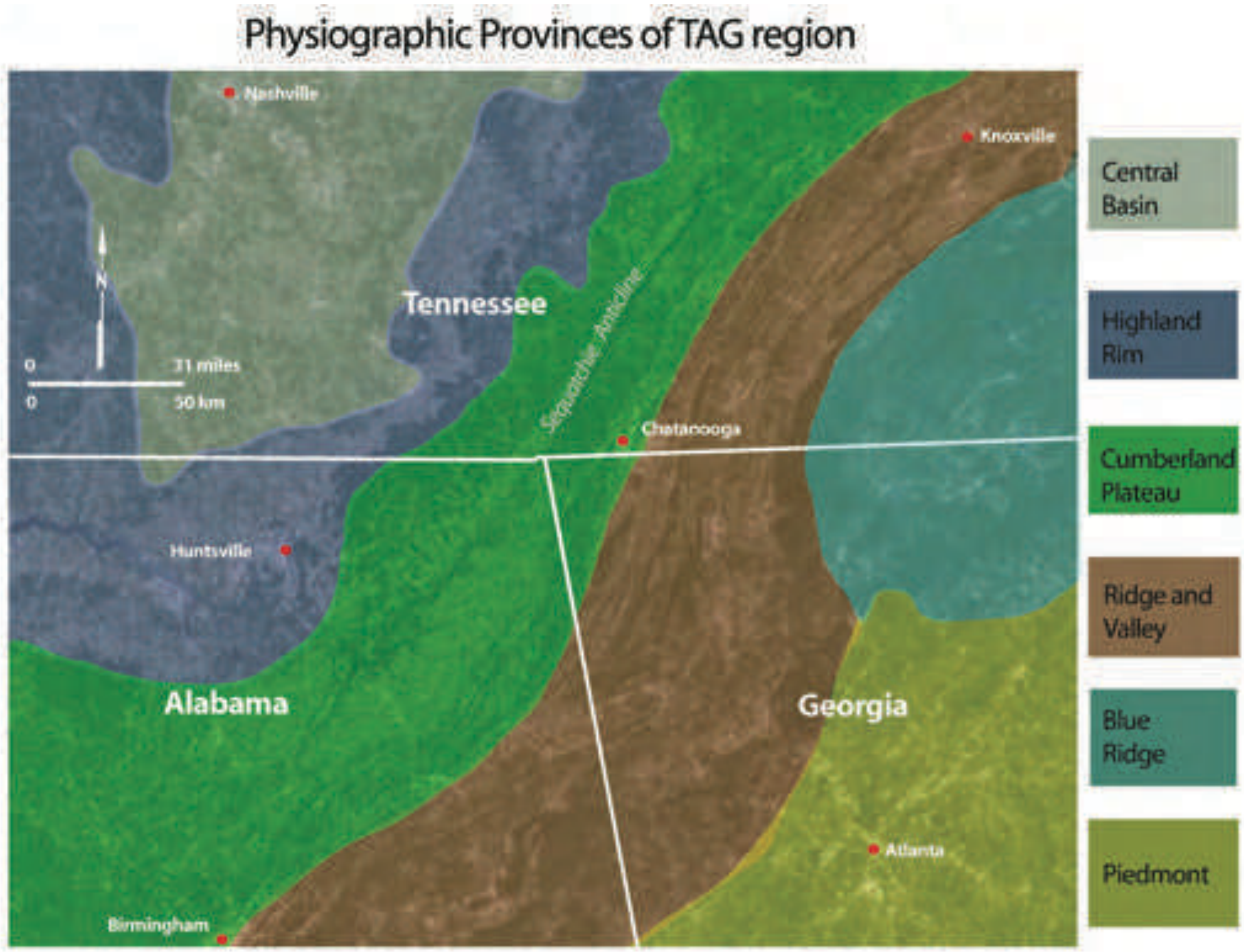

Figure 3 - Physiographic Provinces of TAG Region.

fortuitously breached it allows access via vertical shafts, into the Monteagle Limestone – a layer that holds some of TAG's most glorious segments of cave. At the bottom contact of the Monteagle is the St. Louis limestone and caves that reach that level degrade to very low, claustrophobic crawlways. The Warsaw Limestone is often times base level and cave streams breach the surface making a spring. Should the spring be enterable (or exit-able) the result is a through-trip; one of the most fun and challenging types of cave trip in TAG. A generalized stratigraphic section of the cave forming strata of TAG is shown in Figure 4.

Structural controls are an important factor in cave development in the TAG area (Figure 5). The eastern edge of the Cumberland Plateau abuts the structurally complex Ridge and Valley province. The Cumberland Plateau is the footwall block of the Eastern Overthrust of the Ridge and Valley province (Smith, 1989). When the plateau footwall block was deformed, a series of broad folds caused flexure in the carbonate units. The result was an anisotropic framework of joints that was imprinted in the interior of the Cumberland Plateau (Smith, 1989). Faults also play a role in cave development especially in areas adjacent to the Ridge and Valley province.

In the Highland Rim, the events that caused uplift of the Nashville Dome also affected the carbonate units, but to a much lesser degree than those of the Ridge and Valley province. The joints and fissures that resulted from tectonic flexure along with bedding planes and partings, caused by variations in depositional environments, provided pathways for the movement of groundwater.

The Tennessee River, which is a tributary of the Ohio River, is the regional base level of the southern Cumberland Plateau, the southern Central Basin, and southern Eastern Highland Rim. Variations in river base level affected the development of all caves and those changes were brought about by the evolution of the Ohio River. One of the most significant factors in this evolution was hydrologic rearrangement of ancestral rivers

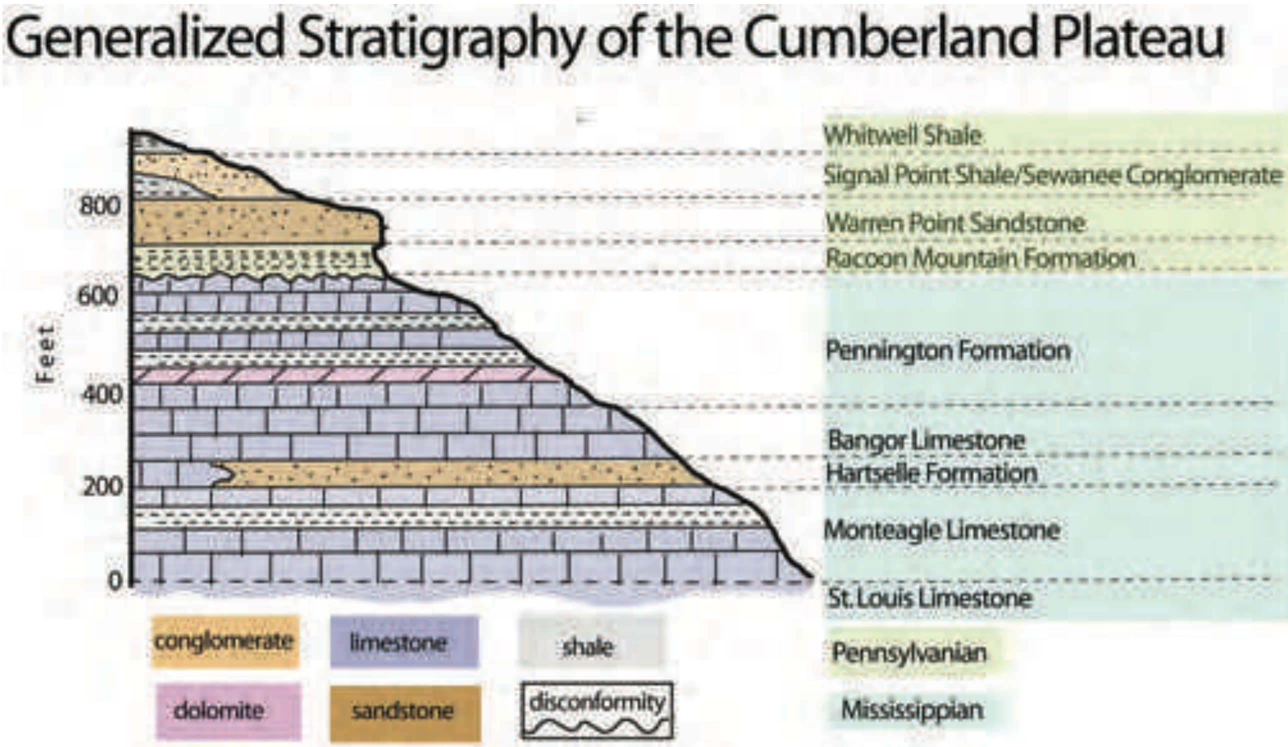

Figure 4 - A generalized stratigraphic section of the cave forming strata of TAG.

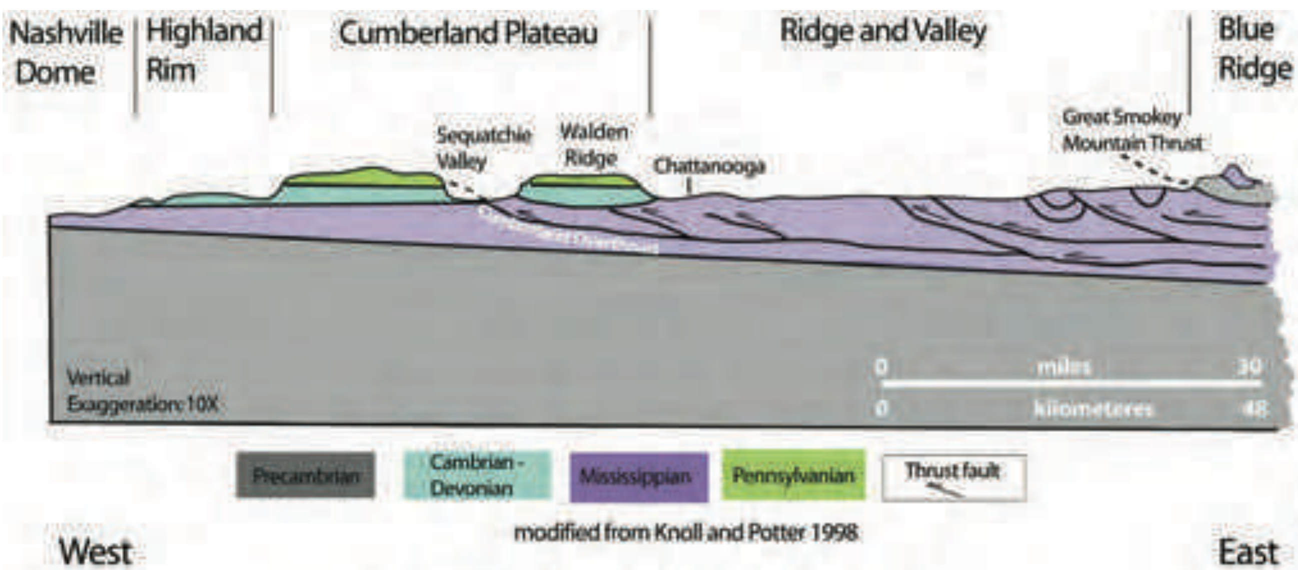

Figure 5 - Cross section from Nashville Dome to Blue Ridge showing generalized structure.

brought on by Pleistocene glaciations. Though glaciers never extended into Tennessee, their far-reaching effects on the development of the Ohio River are evident in all of its associated sub drainage basins including the Tennessee River and its tributaries. This evidence takes the form of gravel deposits, meander scars, broad straths incised beneath the plateau surfaces, and from the layout and morphology of the caves. All of these features are indicative of low gradient standstills and periods of incision (Miotke and Palmer, 1972; Anthony and Granger, 2004).

Caves and Karst of the Cumberland Plateau

The Cumberland Plateau is a karstified erosional remnant of a more extensive upland area that reaches elevations of more than 1,000 feet (300 meters) above the Tennessee River Valley. The southernmost reach of the Cumberland Plateau begins near Birmingham, Alabama, and trends northeast, crossing the extreme northwest corner of Georgia before entering Tennessee just to the west of the city of Chattanooga. The plateau continues northward into Kentucky. Prominent

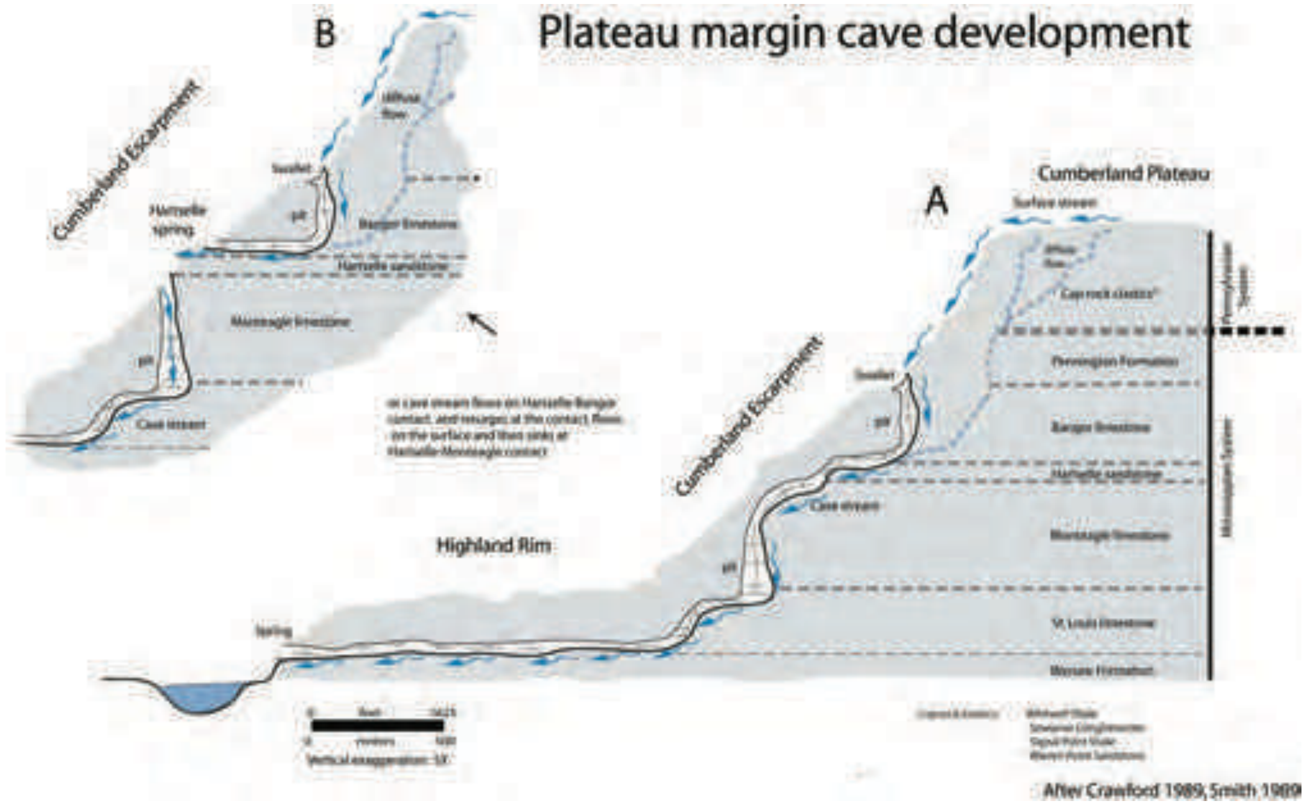

Figure 6 - Plateau margin type cave development. A. Cave development when the Hartselle breaches before sinking underground. B. Cave development when the Hartselle is very thin. (After Crawford, 1989 and Smith, 1989).

escarpments define the margins of the Cumberland Plateau and are characterized by deeply incised blind head ward valleys called coves.

The strata of the far southeastern side of the Cumberland Plateau are structurally more complex than those of the rest of the Cumberland Plateau and have been affected by the processes that formed the Valley and Ridge Province to the east.

The Devonian-age Chattanooga Shale occurs at the base of Mississippian-Pennsylvania sequence. The shale is less than 30 feet (10 meters) thick but forms a distinctive marker for geologic mapping. Because of its weakness relative to the overlying limestones, low-angle thrust faults produced during folding flattened out and propagated through the Chattanooga Shale. As a consequence, throughout the Cumberland Plateau in southeast Tennessee, northeast Alabama, and northwest Georgia, Mississippian and Pennsylvanian strata are detached from older strata by a major sub horizontal thrust fault. This has resulted in a series of valleys and mountains that are the flattened bottoms of anticlines and synclines. These structures influence the location and development of caves in this part of the Cumberland Plateau.

Surface streams that drain the impermeable top of the plateau sink into underlying carbonates and have formed a fluvio-karst landscape with an abundance of karst windows, sinking and losing streams, springs, waterfalls, and caves. In addition to active fluvio-karst are large, fossil caves containing passages on multiple levels. The Cumberland Plateau has an abundance of multi-drop caves, open-air and deep shafts, and horizontal cave systems both large and small that drain the many deeply incised coves that are characteristic of the region. Many of deepest caves and shafts in the entire TAG region can be found here.

Caves are the physiographic expression of subterranean conduits that convey water in karst aquifers and are an important part of the local and regional hydrology. There are many caves in the Cumberland Plateau area and they are predominantly of two styles: plateau margin, and master conduit. The latter has also been referred to as Cumberland-style caves for the large, fossil, multi-level trunk passage caves described from the Cumberland River Basin in middle Tennessee.

Plateau-margin caves, which include open-air pits and multi-drop caves, have passage morphologies that are dominantly narrow, sinuous canyons that follow local dip and profiles that are predominantly vertical in nature

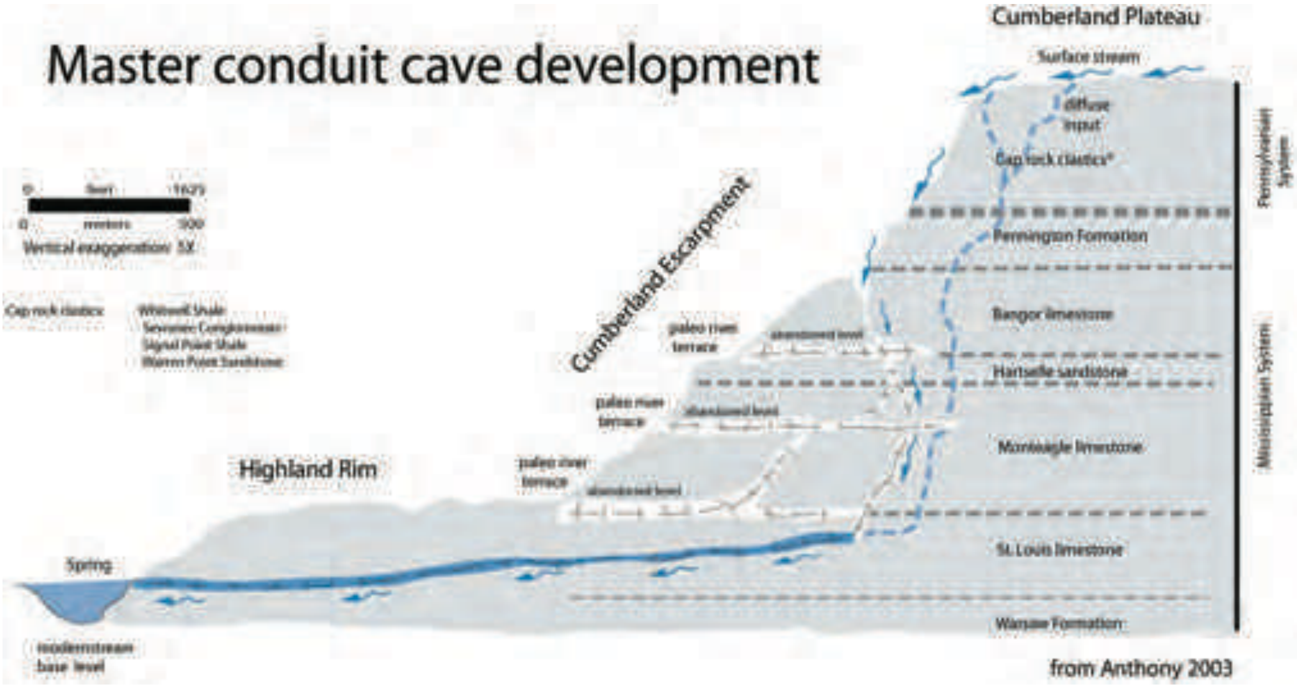

Figure 7 - Master conduit-type caves.

(Crawford, 1989). They form when surface streams sink at or near the contact between the Pennington Formation/ Bangor Limestone or at the Hartselle Formation contact. Cave passages form along joints and bedding planes between the Bangor Limestone and the Hartselle Formation and springs resurge on the surface at the contact between these two units to form surface streams again (Figure 6A). The streams sink when they encounter the Monteagle Limestone and cave passages develop along joints and bedding planes. Springs resurge at the local water table that can be the base of the Monteagle Limestone, the St. Louis Limestone, or the Warsaw Formation.

If the Hartselle Formation is very thin, highly jointed, or absent (Figure 6B), the cave stream will not resurge at the surface but will remain underground dissolving shafts and cave passages in the Monteagle Limestone and sometimes down to the St. Louis Limestone. When the Hartselle is absent, deep shafts may form. The subterranean stream will continue its course underground to resurge at the local water table.

Occurring in the same hydrogeologic setting as the plateau-margin caves are master conduit-style caves (Figure 7). However, these caves did not form in the current hydrologic setting in response to plateau margin retreat. Rather their development is most likely related to stable base levels of the Tennessee River during the Late Tertiary. The paleo levels associated with these types of caves may reflect episodic incision of the Tennessee River during Plio-Pleistocene time. These events have been quantified in studies of Cumberland-style caves of the Cumberland River basin (Anthony and Grainger, 2004). Master conduit-style caves, which occur in the Monteagle Limestone, have passage morphologies that reflect a phreatic origin, abandoned trunk passages sometimes connected by narrow floor canyons, and lower-level phreatic passages. Cave profiles for specific elevations are predominantly horizontal and passages are of much larger dimensions than plateau margin caves. This trend of cave passage commonly parallels the topographic contours of surface valleys and paleoflow features indicate flow in a down-valley direction (Sasowsky and White, 1994). However, cave passages can trend at oblique angles through the Cumberland Plateau and its outliers.

Northeast Alabama

The Cumberland Plateau in northeast Alabama is more highly dissected than the rest of the plateau. In some places the Hartselle Formation is either very thin or absent. As a result the plateau-margin caves may not have a surface component as described by Crawford's model (Crawford, 1989), but rather the vertical drainage system is entirely underground. In northeast Alabama, plateau-margin caves, that is, multi-drop cave and open-air shafts are common cave types as are horizontal caves.

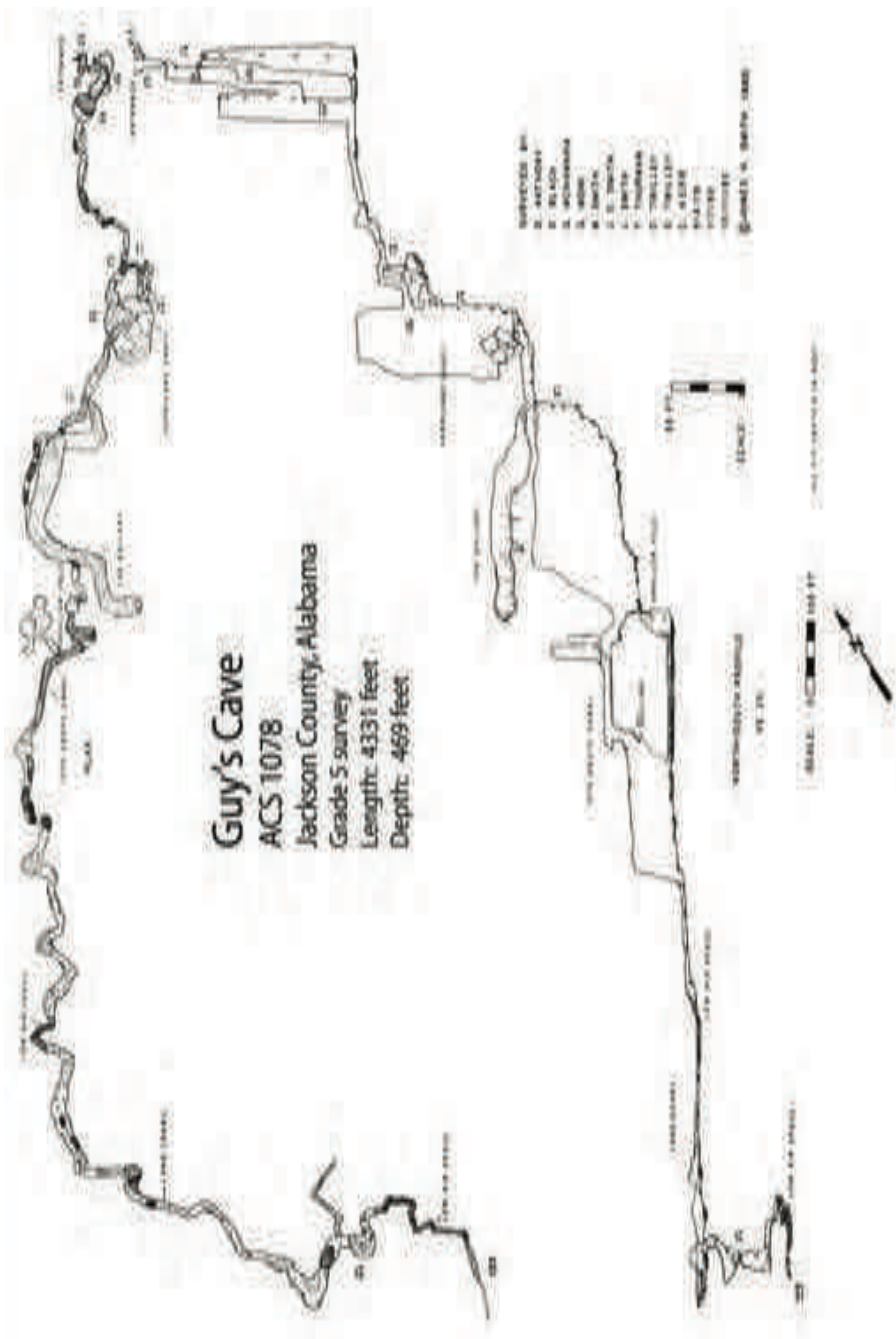

Figure 8 - Guys Cave – Example of a plateau-margin cave, also known as a multi-drop cave. Cartography: James H. Smith

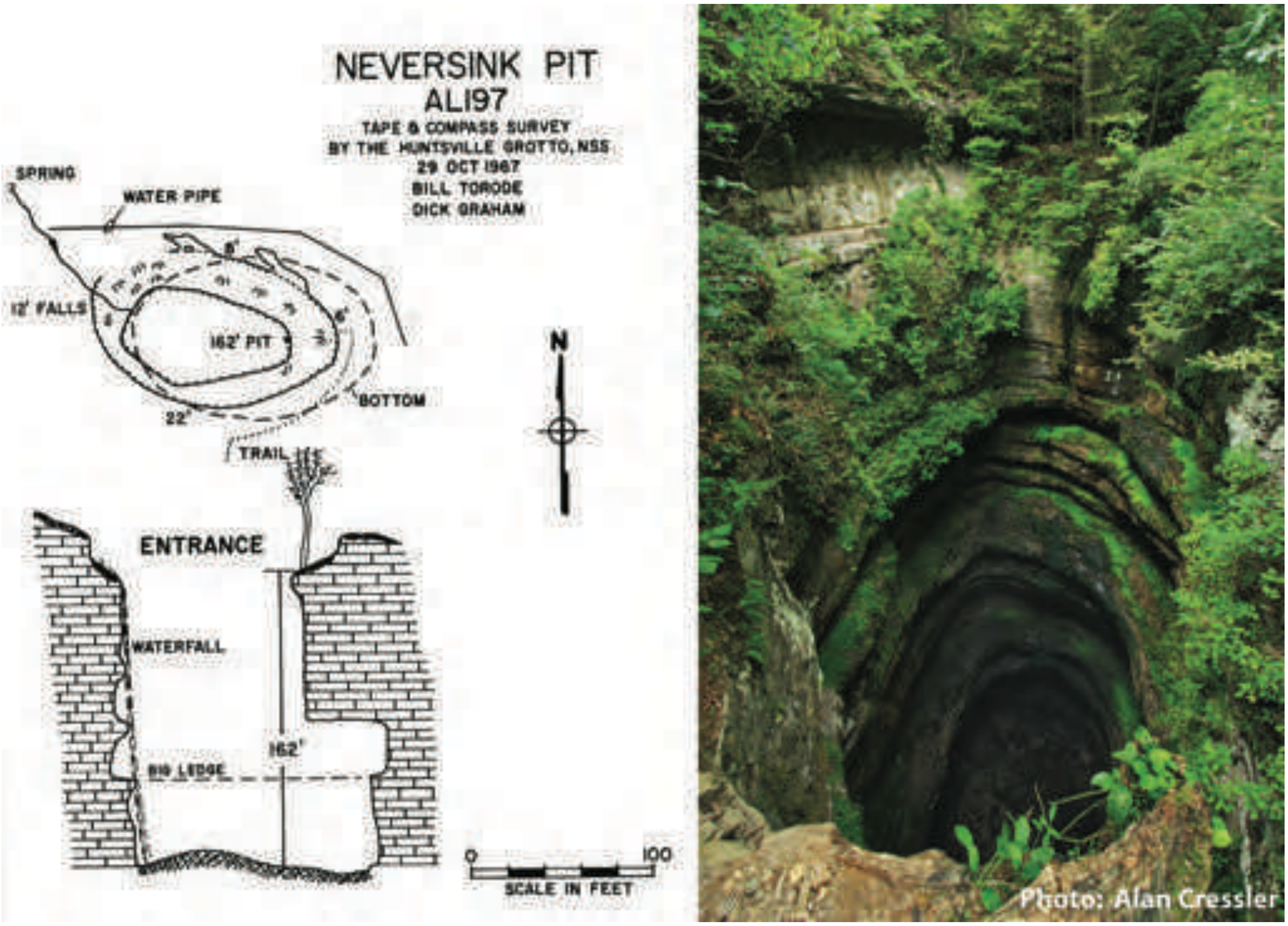

Figure 9 - Neversink is an open air plateau margin cave with no passage development at its base.
Cartography: Bill Torode, Photo: Alan Cressler

Multi-Drop (Plateau Margin) Cave Systems

Guys Cave in Jackson County, Alabama (Figure 8) is a multi-drop cave that exemplifies the effects of a thin section of Hartselle Formation on the development of a vertical system. Guys Cave has a surveyed length of 4,331 feet (1.3 kilometers) and a vertical extent of 469 feet (145 meters). The cave has an active stream with a total of seven vertical pitches. The cave entrance is located at the Pennington/Bangor contact. The upper sections of the cave are in the Bangor Limestone. At the base of the second pitch, the cave stream flows on the Hartselle Formation. At the third pitch the stream breaks through the Hartselle and into the Monteagle Limestone. The stream flows through several large galleries and shafts formed in the massive, light grey limestone. The large passages slam down to low-air crawlway dimensions at the contact of the Monteagle and St. Louis Limestones and keep these uncomfortable and low dimensions for almost 400 feet (120 meters) to the top of a 26-foot pitch (8-meters). The passage at the base of the last pitch is formed at the contact between the St. Louis Limestone and Warsaw Formation and the passage sumps after 115 feet (35 meters).

Some of the multi-drop caves of the region have lower entrances that are the spring resurgences for those systems. Traversing from the upper entrance to the lower entrance with only a couple of appropriate lengths of rope (lengths depend on pitch depths and rigging necessities) is called a pull-down trip. One of TAG's most spectacular pull-down trips is Bloodstone-Scott's Barn Cave, in Jackson County, Alabama. The cave has a surveyed length of 1.3 miles (2.1 kilometers) and a vertical extent of 560 feet (171 meters). The traverse consists of an entrance down-climb through a very tight, wet, mazy section of cave, to a 20-foot pitch (7 meter). Shortly beyond that is "Protected Well," the deepest shaft in the cave at 241 feet (78 meters). The Hartselle Formation is either very thin or missing, which explains the deep shaft within the cave. Beyond the big pitch there are four additional smaller ones followed by 984 feet (300 meters) of crawlway on the St. Louis Limestone leading to the lower entrance of the cave.

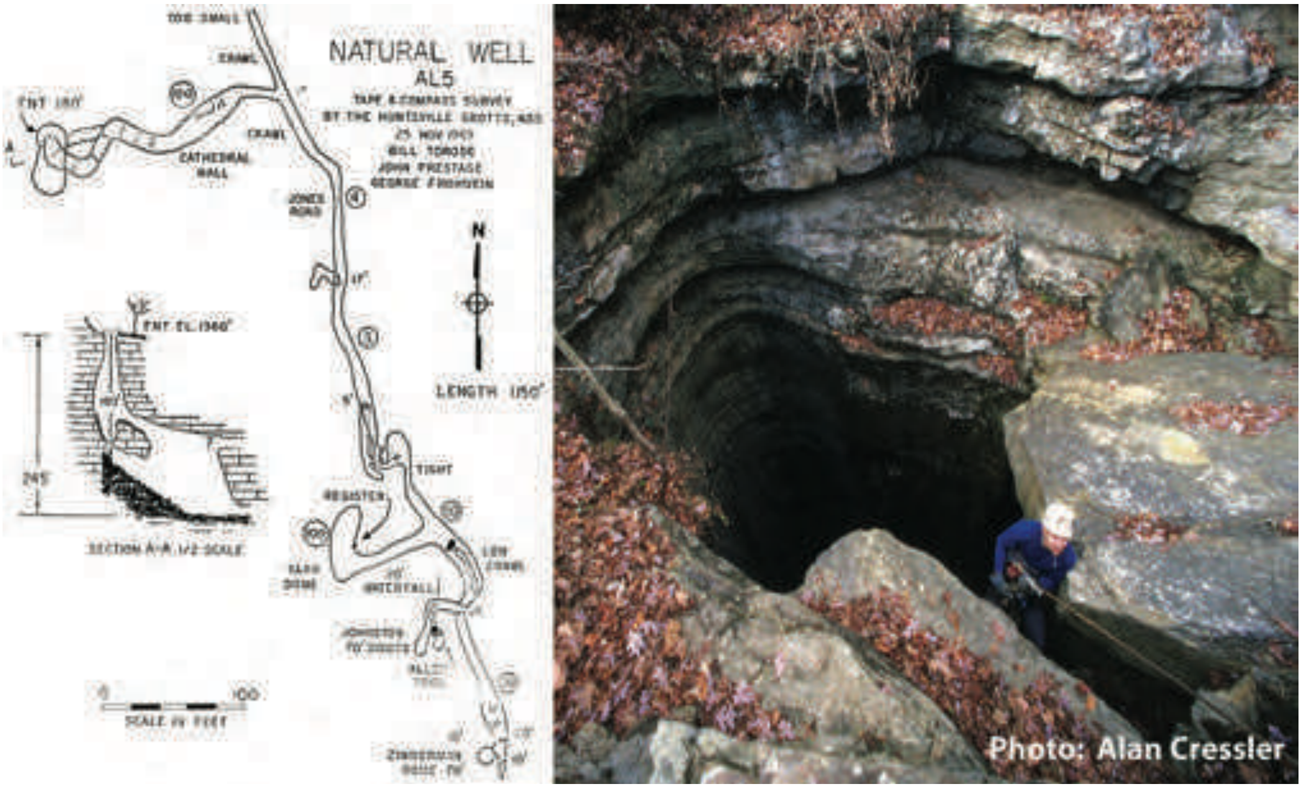

Figure 10 - Natural Well is a plateau margin cave with an open air pit entrance and passage development at its base. Cartography: Bill Torode, Photo: Alan Cressler

Open-Air Shafts

Northeast Alabama is known for its beautiful, open-air shafts ranging in depth from tens of feet to close to 300 feet (100 meters). The development of these features, or vadose shafts as they are also called, is the result of surface streams that sink at the contact between impermeable and permeable rocks either at the Pennington-Bangor contact or Hartselle-Monteagle contact. The limiting factor of depth is structure rather than lithology, specifically truncation of joints in bedding planes (Smith 1989). Two examples of open-air shafts are Neversink, which does not have any horizontal passage development, and Natural Well, which does; both are located in Alabama.

Neversink (Jackson County, Alabama) is one of TAG's classic open air shafts formed in the Bangor Limestone and terminating in the Hartselle Formation (Figure 9). The cave is noted for its scenic beauty, especially the series of small waterfalls that cascade from the margins of the shaft during wet weather. The mouth of the shaft has dimensions of 100 feet (30 meters) by 45 feet (13 meters) and a depth of 162 feet (49 meters). The drop is freefall all the way down to a large chamber at the bottom. Delicate ferns (Asplenium monanthes) that are listed as endangered grow on some of the upper ledges of the shaft. During summer months, glow worms light up the peripheries of the shaft.

Many of the open-air shafts do have cave passage at the bottom (Figure 10). Natural Well (Madison County, Alabama) has an entrance that is 72 feet (12 meters) long by 26 feet (8 meters) wide in dimensions. The depth of the entrance shaft is 184 feet (56 meters) and drops into a 98-foot (30-meter) tall canyon passage. At a north-south junction, passage dimensions average 3 to 5 feet (1 to 1.5 meters) for 328 feet (100 meters). The last 656 feet (200 meters) of cave consists of a series of domes that range from 82 to 98 feet (25 to 30 meters) in height. Survey length of the cave is 1,150 feet (350 meters) with a vertical extent of 278 feet (85 meters). The entrance shaft is developed in the Bangor Formation and lower passage formed on the Bangor-Hartselle contact.

Master conduit-style caves are characterized by trunk passage development in valley walls that are in concordance with topographic profiles or under the plateau proper and through plateau outliers. Distinct cave levels are associated with paleo-river levels. Passage dimensions are considerably larger than the

Figure 11 - **A**. Location map of Tumbling Rock Cave, Jackson County, Alabama.
B. Topless Dome with a height of 394 feet (120 meters). Photo: Nathan Williams
C. Mountain Olympus borehole, one of the oldest passages in the cave. Photo: Alan Cressler
D. The Asphalt Ooze of Tumbling Rock Cave (black material on the walls and breakdown in the photo) is one of only six cave locations in the world where hydrocarbon seeps have been documented. Photo: Alan Cressler

vadose canyons of plateau-margin caves. Two examples of this type of cave are Tumbling Rock Cave and the Fern Cave System both in Jackson County, Alabama.

Tumbling Rock Cave is one of Alabama's finest and is the showpiece of the Southeastern Cave Conservancy's (SCCi) Tumbling Rock Cave Preserve. The SCCi started leasing the cave in January 2008 and purchased it in July 2011. The cave is managed by Tumbling Rock Inc., an Alabama non-profit corporation. Tumbling Rock Cave is located in Round Cove (Jackson County, Alabama) and the entrance is located at the base of Crow Mountain (Figure 11A). A spring that resurges down slope from the main entrance is the headwaters of Mud Creek.

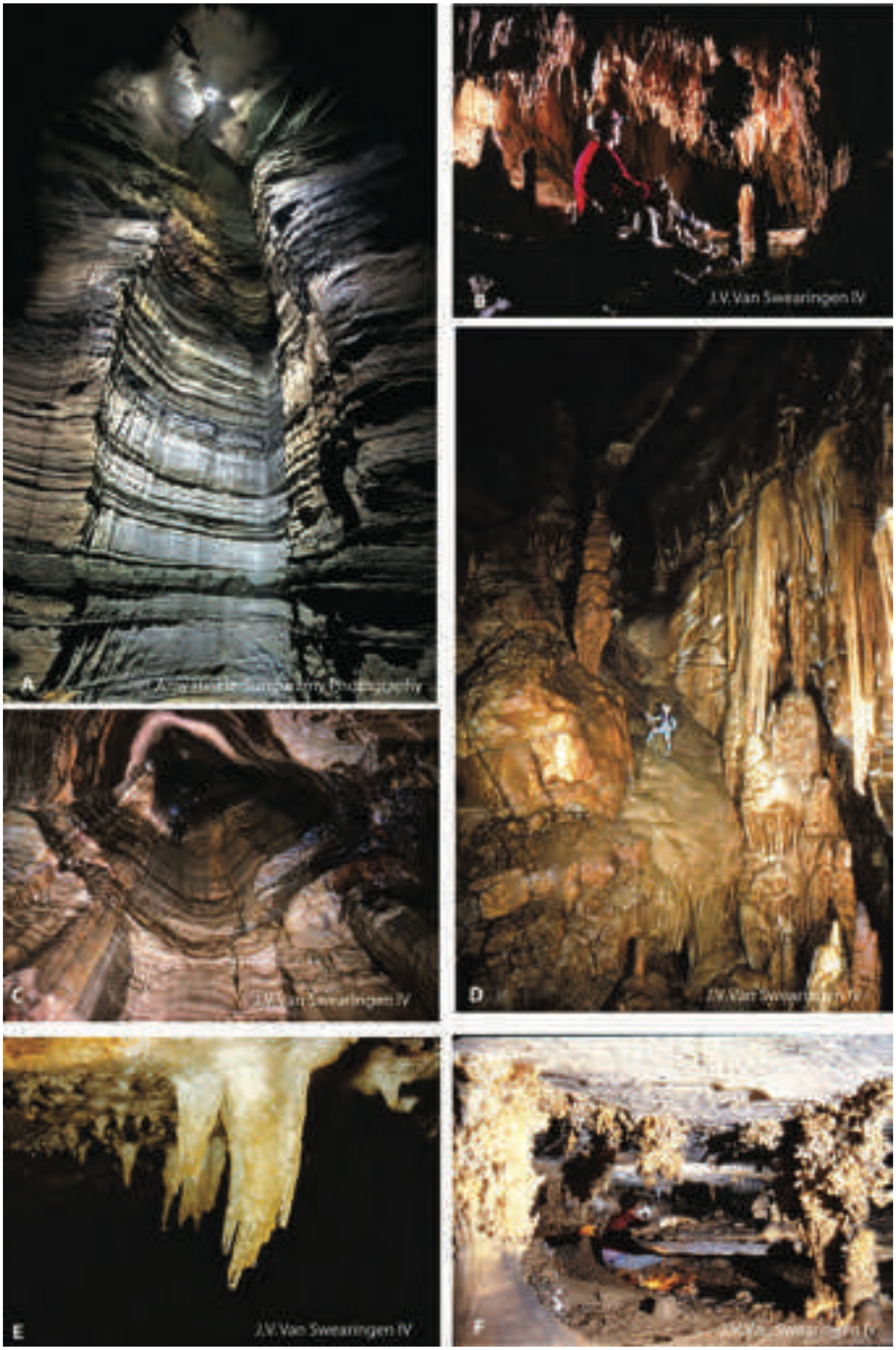

Figure 12 - Photos of Fern Cave:
A. Surprise Pit, (437 feet deep; 133 meters) cuts through the entire Mississippian stratigraphic section of cave forming units (Bangor through St. Monteagle). The Hartselle Formation may be extremely thin or absent. Photo: ©Amy Hinkle, Sunguramy Photography
B. Calcite speleothems in Upper Cave section. Photo: JV Van Swearingen IV
C. Pit in West Passage - one of the many smaller vadose shafts within the Fern Cave System. Photo: JV Van Swearingen IV
D. Torode Hall, one of the largest chambers in the cave, Photo: JV Van Swearingen IV
E. Mirabolite, an evaporite mineral deposit that occurs in the dry sections of the cave. Photo: JV Van Swearingen IV
F. Helictite Heaven passage with spectacular speleothem display. Photo: JV Van Swearingen IV

The cave was originally explored and surveyed in the late 1950s and early 1960s by members of the Huntsville Grotto. A resurvey was conducted in the early 1990s in order to produce a more detailed map. The cave has been surveyed to a length of 6 miles (10 kilometers) and has a vertical extent of 446 feet (136 meters). The main trunk of Tumbling Rock Cave has formed in the Monteagle Limestone. The highest waterfall dome in the cave is "Topless Dome," with a measured height of 394 feet (120 meters) (Figure 11B). The waterfall has cut through the entire section of Mississippian carbonates from the Pennington/Bangor contact all the way down to the Monteagle Limestone. The Hartselle Formation is absent in the dome, which explains the vertical extent of the dome.

An active stream flows through the entire length of Tumbling Rock Cave and exits at the lower spring entrance. However, this stream did not form the large trunk passages of Tumbling Rock Cave (Figure 11C). Paleomagnetic dating of sediments taken from a brown clay deposit about 30 feet (10 meters) above present stream level, were magnetically reversed. This indicates a minimum age of 780,000 years old for the age of this cave.

An unusual feature of the cave is the native asphalt that has dripped from the ceiling in several places in the cave and has become incorporated into the flowstone in one area (Figure 11D). Tumbling Rock is one of only six caves in the world where hydrocarbon seeps have been documented.

The longest cave in Alabama is the Fern Cave System, located in the Wheeler Wildlife Preserve in the Paint Rock River Valley of Jackson County, Alabama. The cave was discovered in 1961 by caver explorers of the Huntsville Grotto of the NSS and the original map was drafted by Bill Torode. The current survey effort continues under the leadership of Steve Pitts. The system has a surveyed length of 15 miles (25 km) and has a vertical extent of 535 feet (163 meters). The cave contains many pits including 437-foot (133-meter) "Surprise Pit" (Figure 12A), large chambers, and decorated rooms and passages (Figure 12B).

The Fern Cave system has three distinctive areas: New Fern is the most extensive part of the system and surrounds Surprise Pit on three sides. It can be divided into the Upper, Middle and Lower Cave. The Upper Cave has three sections referred to as the "East Passage," West Passage, and "North Passage." The various levels of the Fern Cave System represented distinct episodes of base level stability. The canyons and pitches that join the levels are vadose passages and features formed during river incision (Figure 12C). The Morgue section of the cave consists of passages that are directly accessible from the Morgue sink entrance. The Fern Cave section includes all passages leading from the Fern Sink entrance to Surprise Pit, passage at the top of Surprise Pit, the "Hall of Giants," "Torode Hall" (Figure 12D) and 437-foot Surprise Pit; New Fern is that part of the cave accessed by the Johnson Entrance and includes the "Bottom Cave" and sections of the "West Passage" (Myrick 1972). The upper levels of the cave contain evaporite minerals such as mirabilite (Figure 12E) and gypsum. Some of the most spectacular displays of helictites occur in the cave system (Figure 12F).

Fern Cave System contains the largest wintering colony of gray bats in the United States with over one million bats hibernating there in the winter. Bat researchers estimate that as many as one million Indiana bats may also be using the cave. The endangered American Hart's-tongue fern grows near the entrances to the Fern Cave System.

Caves and Karst of Doran Cove

The deeply incised coves of the southern Cumberland Plateau can contain both plateau margin and master conduit style caves. It's not uncommon for the hydrogeology of plateau margin caves to be superimposed on segments of master conduit style caves. A good example of this can be found in Doran Cove (Figure 13), a karst valley that straddles the Tennessee-Alabama border, near Bridgeport, Alabama. The head of Doran Cove is bounded by Orme Mountain to the north, Montague Mountain to the west, and Summerhouse and Little Mountains to the east. Russell Cave National Monument, a significant archeological site, is located within the cove. Doran Cove is drained by a series of vertical drainage systems that have surface and subsurface components.

The cap rock in the Doran Cove area consists of the deltaic complex of conglomerates, sandstones, shales, and coal that are the Whitwell Shale, Sewanee Conglomerate, Signal Point Shale, Warren Point Sandstone, and the Raccoon Mountain Formation. The latter contains discontinuously exposed coal seams as evidenced by a large number of mine adits located in the

Figure 13 - Location map of Doran Cove, Alabama-Tennessee.

northern reaches of Doran Cove in Old Shoppe Hollow and in Payne Cove. Bedding plain seeps and springs from the Pennington Formation are common in the cove and contribute recharge at the head of Doran Cove in all of its sub-drainages (Payne Cove, Cluck Cove, and Old Shoppe Hollow). Pennington springs flow for a short distance on the Bangor Limestone before sinking into fractures and bedding planes, and forming conduits within the limestone unit. When the subsurface streams reach the impermeable Hartselle Formation, they resurge at the surface. There are many Bangor/Hartselle contact springs within Doran Cove. One of the most notable flows for a short distance on the surface and then cascades over a limestone scarp forming a spectacular waterfall that sinks at the mouth of a plateau margin cave named Waterworks Cave. The stream continues down a 13-foot (4-meter) drop for just under 100 feet (30 meters) to the top of another shaft (39 feet; 12 meters). From there a crawlway leads to a terminal breakdown chamber. Dye traces have shown that the stream in Waterworks Cave is hydrologically connected to Ridley Karst Window and Russell Cave Spring located 2.5 miles (4 kilometers) in Russell Cave National Monument, and to Widows Spring located an additional mile (2 kilometers) down cove (Kambesis, 2008).

Russell Cave which is a master conduit-type cave is one of Alabama's longest with nearly 7 miles (12 kilometers) of mapped passages and 6 entrances. The cave is composed of base level stream passages, and upper level passages and domes giving it a vertical extent of 400 feet (122 meters). There are many other karst features associated with the cave including sinkholes, karst windows, springs and other related caves. Montague Cave, another master conduit-type cave is hydrologically the downstream extension of Russell Cave and has a surveyed length of 2.2 miles (3.8 kilometers). The downstream section of the cave terminates in a sump. A sump dive conducted by Jim Smith in the early 1990s documented a completely submerged cave passage that resurged at Widows Spring located a half mile (1 kilometer) to the southeast. A series of dome climbs located upstream of the sump gives Montague Cave a vertical extent of 403 feet (123 meters). Both caves were mapped by members of the Huntsville Grotto of the NSS in the 1970s and 1980s.

Archeological investigations have been conducted at Russell Cave and one of the first was at the main entrance of the cave in the early 1950s by the Tennessee Archeological Society. More extensive excavations were jointly conducted by Smithsonian Institute and National Geographic Society who determined that the cave had been occupied by humans from 6200BC to 1650AD. Russell Cave was declared a National Monument in 1961 when National Geographic Society donated 125 hectares of land surrounding the main entrance to the National Park Service (Matthews 2007).

Doran Cove, like many of the valleys of the Cumberland Plateau contains quaternary alluvium and colluvium that cover a sinkhole plain forming as a function of, and at the base of, the retreating escarpment (Crawford, 1989). The sediments were deposited from cap rock retreat. Small alluvial fans are deposited by ephemeral streams and remains of rockslides are also evident on slopes and in the valleys. The cap rock detritus from slope retreat weathers into a terra rosa. As the Monteagle and St. Louis Limestones are chemically eroded, the terra rosa

Figure 14 - Map with generalized geology the Sequatchie Valley which is the surface expression of the erosionally breached Sequatchie Anticline. Grassy Cove, located northeast on the same linear trend is the largest karst depression in the USA.

is lowered onto the Warsaw Formation and results in the formation of surface drainage that replaces the subsurface drainage of the sinkhole plain. Widows Creek is a surface drainage whose headwaters are at Widows Spring; this surface stream eventually joins the Tennessee River that is 6 miles (10 kilometers) away.

Southeastern Tennessee
(By Pat Kambesis and Clinton Elmore)

Sequatchie Valley

One of the most spectacular features of the Cumberland Plateau is the Sequatchie Valley, which is among the largest anticlinal valleys in the world (Ogden 1989) (Figure 14). Its dimensions are 60 miles (100 kilometers) in length, 3 to 5 miles in width (6 to 8 kilometers), and at its lowest elevations can be 1300 to 1600+ feet (400 to 500 meters) below the Cumberland Plateau. The Sequatchie Valley follows the trend of an anticlinal fold that extends through Tennessee and Alabama. The structure plunges toward the northeast and is capped by the Pennsylvanian sandstones of the Crab Orchard Mountains which rise 3,000 feet (1000 meters) to the average elevation of the Cumberland Plateau at 1,500-1,800+ feet (500 to 550 meters).

The walls of the valley form a linear incision that cuts into the Plateau from the south for 65 miles (108 kilometers). The valley is formed along a thrust-faulted anticlinal structure that dips to the east and upper Ordovician limestones are thrust over the Monteagle Limestone (Figure 15). The fault is eroded in the western half of the valley and reappears as the Cumberland Overthrust in Pennsylvanian-age rocks high on the western side of the valley. The eastern side of the valley is called Walden's Ridge, bounded on its eastern side by the Ridge and Valley Province.

Southwest of the Crab Orchard Mountains the anticline is breached forming Grassy Cove, the biggest sinkhole in the USA. The southern end of the cove is cut by a fault perpendicular to the main anticlinal axis that separates it from the Sequatchie Valley and is eroded down to the resistant Warsaw Limestone. The areal extent of the flat-floored cove is 7 miles by 3 miles (13 by 5 kilometers) and wall relief of 1,300 feet (400 meters) (Crawford 1989). Grassy Cove is surrounded by mountains that include Black Mountain on the northeast, Flat Mountain on the northwest, Brady Mountain on the west and southwest and Bear Den Mountain on the east and southeast (Figure 15).

A series of northeast trending karst valleys are located adjacent to the mountains and are the result of subterranean stream invasion (Crawford 1978, 1989). They include McClough Hollow, Bat Town Cove, and Little Cove. Another significant karst valley in the area is

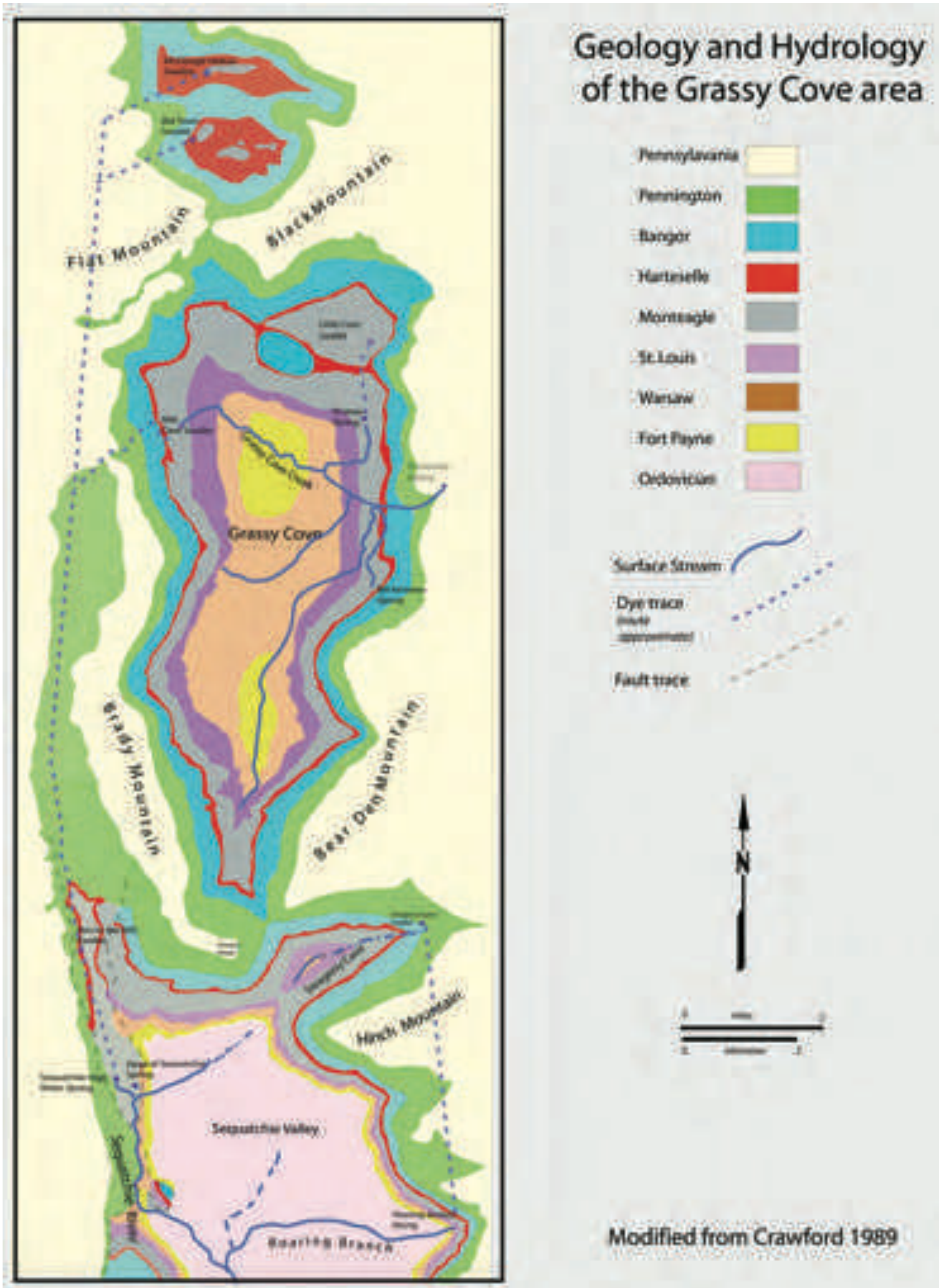

Figure 15 - Geology and hydrology of Grassy Cove. (From Crawford, 1989)

Swagerty Cove, which separates Bear Den Mountain from Hinch Mountain on the south end of Grassy Cove. The valleys formed when surface streams flowing down the anticlinal dip breached the Pennsylvanian cap rock and exposed the underlying Bangor Limestone. The streams flowed into enlarged joints and bedding planes, forming subsurface drainage conduits (caves) that eventually flowed on the Hartselle-Monteagle contact. Further development of Grassy Cove caves at or below the Hartselle Formation depends on where they are located on the anticlinal structure.

Grassy Cove displays a combination of plateau margin and master conduit-type caves. Master conduit-type development is displayed at Mill Cave which collects the surface drainage of Grassy Cove Creek and conveys it under Brady Mountain. The water of Little Cove that resurges on the eastern side of the Cove at Bristow Spring, as well as the resurgence of Bill Kemmer Spring, joins the Grassy Cove Creek surface stream. The stream flows west across the north end of Grassy Cove and sinks at Mill Cave. The coves north of Mill Cave including McClough Hollow and Bat Town Cove have been hydrologically connected to the Mill Cave drainage system (Crawford, 1989). Mill Cave is a sizeable 6,000-foot long (1,820 meter) borehole that ends with the cave stream flowing into a breakdown choke. The underground stream appears in large borehole of Run-to-the-Mill Cave located 5.5 miles (9 kilometers) south of Mill Cave, and finally resurges at the Head of Sequatchie Spring near the Monteagle-Warsaw stratigraphic contact. The breakdown at the southern terminus of Mill Cave and northern breakdown terminus of Run-to-the-Mill Cave indicate the existence of a very large and as yet undiscovered stream passage that connects the two caves.

Plateau margin caves are plentiful in the Grassy Cove area and their passage configuration depends on location with respect to stratigraphic contact and structural location within the anticline. Powder House Sinks Cave with a horizontal length of 300+ feet (100 meters), and a vertical extent of 250 feet (75 meters) located on the west side of the anticline on Brady Mountain is formed on a joint that parallels the axis of the regional anticline. A surface stream sinks at the Hartselle Formation-Monteagle Limestone contact and follows a series of short pitches through the Monteagle Limestone. The cave eventually resurgences at the base of Brady Mountain.

Dorton Knob Smokehole Cave (DKSH), located on the west side of the anticline under Brady Mountain, is one of TAG's deepest at 660 feet (201 m). The overall trend of the cave parallels the axis of the anticline (northeast-southwest). Sections of the cave have been reported to have formed along the traces of a major thrust fault that has been documented in the area. DKSH starts as a series of stair-stepping pits in the Bangor. Once the Hartselle contact is encountered, the cave continues horizontally for over 600 feet (180+ meters). The passage breaches the Hartselle and follows a multi-drop series in the Monteagle Limestone to a large terminal room. Hidden Well, a significant 293-foot (89 meters) pit also drops into the terminal room and may be the expression of intersection of the cave with the local thrust fault.

Jewett Cave I (length: 9440 feet ; 2870m), and Jewett Cave II (17684 feet; 5391m) located under Hinch Mountain near Swagerty Cove, are on the southeastern side of the Grassy Cove anticline. The caves are among the deepest in TAG with vertical extents of 615 feet (187 m) and 636 feet (193 m) respectively. Jewett I formed in the Bangor Limestone and its passages follow the strike of that stratigraphic unit. Passage development in Jewett II parallels Jewett I but is at a lower elevation and formed along the strike of the Monteagle Limestone with passages extending under Swagerty Cove. The relationship of the Hartselle Formation to these caves is uncertain and geological relationships are complicated due to faulting in the area. Dye trace tests conducted by Crawford (1978, 1989) in Swagerty Cove reported a hydrological connection to Roaring Branch Rising, a spring located a little more than a mile (2 km) due south of Swagerty Cove. The spring resurges at the Warsaw contact indicating considerable more depth potential for the caves in Swagerty Cove. New discoveries and continued explorations in existing caves could extend the vertical extent of the caves to the 900-foot depth level.

Lookout Mountain District—Chattanooga, Tennessee

Lookout Mountain is one of several folded structures located near the city of Chattanooga in Hamilton County, Tennessee. It is home to the Civil War Chickamauga and Chattanooga National Military Park of the National Park Service and also the location of several important caves. Lookout Mountain is a structural syncline that plunges gently to the southwest. The Cranmore Cove Thrust Fault flanks the west side of Lookout Mountain. The Fort Payne Chert sits on the hanging wall overlying the

Warsaw Limestone. Extending north and south is the Chattanooga Fault, a high angle reverse fault, which extends parallel to the Cranmore Cove Fault to the north. This fault terminates on the northeastern extent of Lookout Mountain. Pennsylvanian and Mississippian-age strata typical of the Cumberland Plateau are exposed on the slopes of Lookout Mountain, Raccoon Mountain, and Walden Ridge.

Lookout Mountain is drained internally by cave conduits to karst springs and externally on its east and west sides by surface creeks. The two major surface creeks are Lookout Creek on the western side and Chattanooga Creek on the eastern border of the mountain. Both streams discharge into the Tennessee River at Chattanooga, Tennessee. Internal drainage is through a series of cave systems and spring resurgences at the nose of the syncline at the Tennessee River and off of the perimeters of the mountain.

Dye tracing conducted by the Center for Cave and Karst Studies (Kambesis, 2008) on the northwestern side of the Lookout Mountain syncline showed that dyes injected into the various swallets and sinkholes sank through the Pennington Formantion and the Bangor Limestone until encountering the Hartselle Formation, which acted as a confining layer. The dye continued to flow downdip toward the trough of the syncline and after encountering it, flowed along strike. Dye was detected in various caves located on this route including Mystery Falls and Ruby Falls and at the various resurgences located along the structure indicating that the Hartselle Formation is heavily breached.

The dye trace results indicated that cave development was influenced by the synclinal structure and stratigraphy of Lookout Mountain. Master conduits have formed parallel to the synclinal strike along the western side of Lookout Mountain. The Hartselle Formation, which acts as a perching unit, directs subsurface streams down dip toward the Lookout Mountain syncline. The perched water table then causes groundwater to flow along the strike until it drops through vertical shafts in the Hartselle, resulting in underground waterfalls, such as, Ruby Falls and Mystery Falls. The many vertical shafts and waterfall domes characteristic of Lookout Mountain caves may be the result of stress release fractures due either to structural unloading at the edge of the plateau or in association with thrust faulting.

Lookout Mountain Cave is one of the longest known caves in Hamilton County (Barr, 1961) and contains over a mile (2 kilometers) of passage. The cave is intersected by a railroad tunnel that was excavated through the mountain in 1928. During the excavation process another cave was discovered at the 262-foot level (80-meter). The cave, named Ruby Falls was developed as a show cave and is still shown today. The main attraction in the cave is a migrating shaft waterfall that is currently artificially maintained. Both Lookout Mountain Cave and Ruby Falls are formed in the Monteagle Limestone.

Another important cave on Lookout Mountain is Mystery Falls. It contains one of the deeper shafts in Tennessee, a 270-foot waterfall dome (84-meter). The cave is formed in the lower part of the Bangor Limestone and the source of the water for the falls is a stream that flows at the contact between the Bangor Limestone and Hartselle Formation. The stream breaches the Hartselle and cuts the deep shaft through the full section of the Monteagle Limestone. At the base of the falls, water flows in a stream passage formed in the St. Louis Limestone and sumps after 300 feet (100 meters). Mystery Falls has two man-made entrances and a spring entrance. However, the spring is no longer accessible because of the Hales Bard Dam that was completed in 1913. Dam construction raised the water level of the Tennessee River and submerged many cave entrances along the river. The man-made entrances were constructed in 1885 by Robert Cravens, a local business man who planned to exploit the waterfall as a water source for the city of Chattanooga (Matthews, 2007).

Lookout Mountain District—Northwest Georgia

The Sequatchie Anticline continues into Georgia and forms the Lookout Mountain District, composed of Lookout-Pigeon Mountain and Sand Mountain. Lookout Valley is a breached syncline separating the two mountains. Stratigraphically, the mountains are capped by the Rockcastle Sandstone of Pennsylvanian age, and the valley is underlain by Chickamauga Limestone of Ordovician age. The upland slopes gently to the southwest from a maximum elevation of 1,900 feet (670 meters) near Durham, Georgia, to an elevation of 1,968 feet (600 meters) near the Alabama-Georgia border. The northwestern margin of Lookout Mountain and the southeastern margin of Sand Mountain are marked by a continuous escarpment that drops abruptly 984 to 1,180 feet (300 to 360 meters) to Lookout Valley. The escarpment on the southeastern side of Lookout-

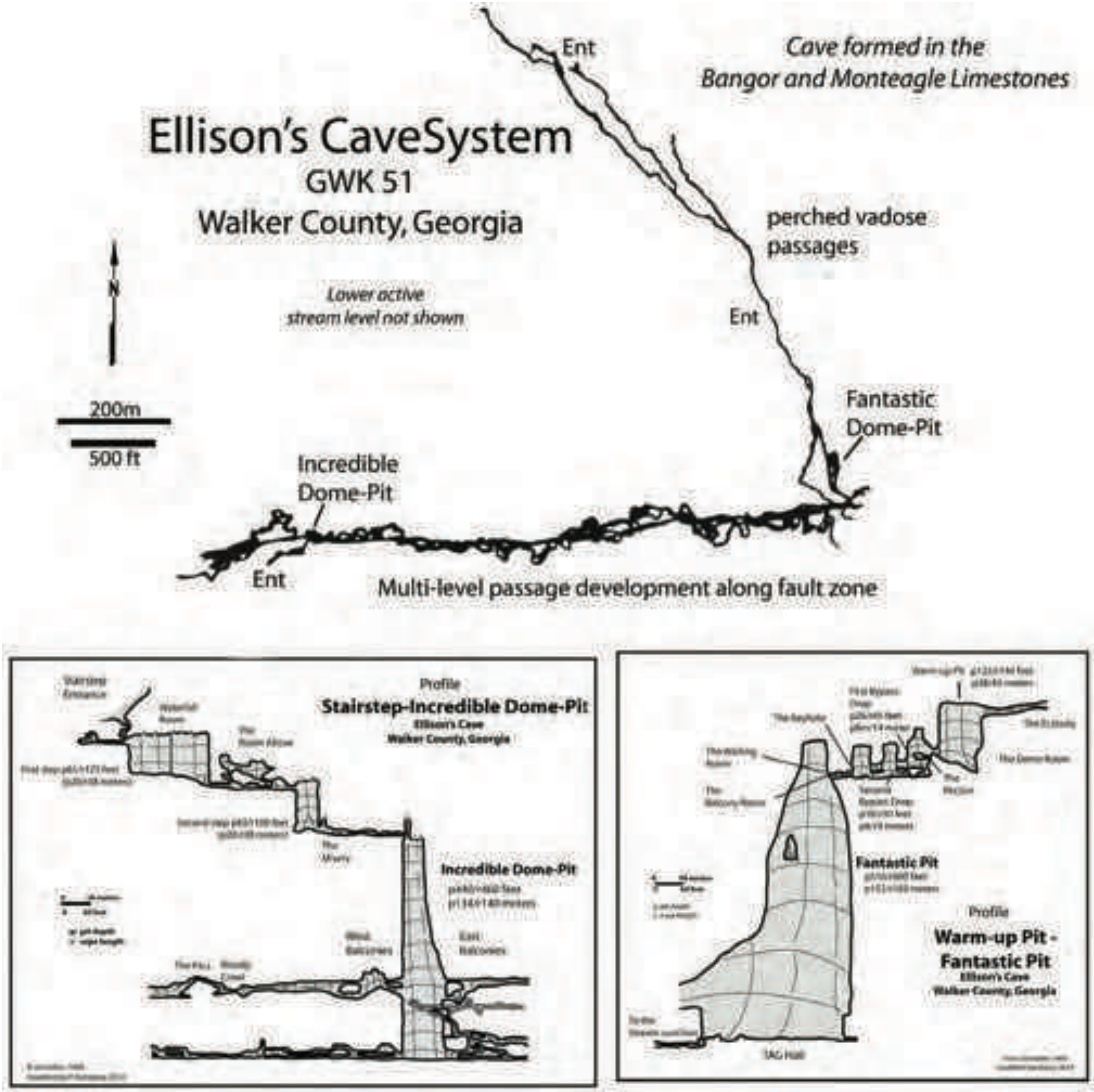

Figure 16 - Map of Ellison's Cave showing Incredible Pit and Fantastic Pit in profile. Cartography: Pat Kambesis

Pigeon Mountain also drops over 1,150 feet (350 meters) to the Chickamauga Valley. Both escarpments are breached by numerous small streams that have their source on top of the upland and have resulted in the formation of many caves. Two of the most significant in the area, Pettijohns Cave and Ellison's Cave System, are on land managed by the state of Georgia Department of Natural Resources, Wildlife Resources Division.

Pettijohns Cave, located in Walker County, Georgia, at Pigeon Mountain is one of the state's longer caves at 5.9 miles (9.6 kilometers) in length with a vertical extent of 236 feet (72 meters). The cave is joint-controlled and developed in the Monteagle Limestone. A small corkscrew entrance opens into a large cave passage that is 430 feet (132 meters) long by 39 feet (12 meters) wide with ceiling heights of 30 feet (10 meters). The large passage terminates in breakdown, but there are many routes through the breakdown to other areas of the cave, including the active stream level. Pettijohns Cave is a very popular beginner cave and on any weekend there are scores of visitors exploring its many passages.

Figure 17 - Fantastic Pit. Photo: Benji Von Crammon and Willie Hunt

Ellison's Cave System (Figure 16) located in Pigeon Mountain, is the deepest cave in TAG and the longest cave in Georgia at 12 miles (19.5 kilometers) of surveyed passages and a vertical extent of 1,063 feet (324 meters) (Gulden, 2008) and with five entrances (Historic, Dug, Stairstep, New, and Gross). The Stairstep entrance was originally a small sink leading to a short crawl followed by an 80-foot pit (24 meters). Over the years, erosion has considerably enlarged the entrance so it is now a large sinkhole with an open-air pit.

The sections of the cave located before the Warm-up Pit had been known to local residents at least since the late 1890s (Schreiber 1969). Discoveries beyond the Warm-up pit were made in 1968 by a team of cave explorers led by Richard Schreiber.

The cave contains two of the deepest free-fall drops in the United States and it is possible to do a through-trip traverse. "Fantastic Pit" is a 586-foot shaft (180-meter) with a continuous free-fall waterfall starting at the 508-foot level (155 meters) (Figure 17). Dimensions of the shaft are 39 by 68 feet (12 meters by 21 meters) at the top of the shaft and 69 by 112 feet (21 meters by 34 meters) at its base (Schreiber 1969). "Incredible Pit" is a 440-foot (134 meter) free-fall drop. The dimensions of the shaft are 39 feet (12 meters) in diameter at the top and 69 by 89 feet (21 meters by 27 meters) at its base (Schreiber, 1969). Passages intersect the shaft at 115, 138, and 148 feet (34, 42, and 45 meters) above the floor of the shaft.

Ellison's Cave contains a variety of mineral deposits such as epsomite and gypsum that make crusts, coatings and crystals on the cave walls; moonmilk deposits are extensive. Typical speleothems such as stalactites, stalagmites and flowstone also occur in the cave system.

The upper sections of Ellison's Cave follow the typical configuration of a plateau-margin cave with low, dip-oriented stream passages in the Bangor and Monteagle Limestones partly perched on shale beds (Palmer, 2009). Just beyond the Warm-Up pit the cave dramatically changes character when it encounters a major fault system (Schreiber, 1969). Cave passage development is controlled by the joint and fault trends and passage morphology is predominantly canyon-like. The passages on the east side of Pigeon Mountain follow an NW-SE trend.

The bottom section of the cave from the sump to the Hall of Giants follows an E-W fault zone which has been determined to be a lateral fault with mainly horizontal movement. The bedrock at the fault surfaces has been recrystallized to thick sheets of calcite or dolomite (Palmer, 2009). The fault is active and the relative movement between the passage walls has pulverized the bedrock forming shattered piles of breakdown and rock flour cover coat the canyon floors.

The lowest levels of the cave system contain an active stream which is recharged by the water from Fantastic and Incredible Pits, and from a sump on the far western edge of the cave. The cave stream resurges in the Blue Hole located approximately 2,348 feet (716) meters southeast from the farthest eastern extent of the cave. Several attempts have been made at diving the Blue Hole and a connection was established with known cave.

Eastern Highland Rim of the Tennessee River Basin

The Highland Rim is a broad shelf that averages 25 miles (42 kilometers) in width that surrounds the Central Basin in Tennessee. It is set apart from the Central Basin by an escarpment that forms a bench with an average elevation of about 1,000 feet (300 meters). The Highland Rim Escarpment was formed as a result of the erosional breach of the Fort Payne formation during the Tertiary and Quaternary periods (Crawford, 1989).

The stratigraphy of the southern edge of this region is primarily composed of flat-lying strata of Mississippian age (Hartselle Sandstone, Monteagle-Gaspar Limestone, St. Louis Limestone, Warsaw Limestone, and Fort Payne Chert) underlain by the Chattanooga Shale that forms a large part of the escarpment. The topography of the southern Highland Rim is relatively flat and is characterized by extensive sinkhole plains and predominantly horizontal caves.

There are many caves in the southern Highland Rim, but they are not extensive in length or depth. The majority of caves form in a similar fashion to those of the Cumberland Plateau, that is, surface streams flow from a protective cap-rock and sink when a limestone unit is encountered. They resurge as springs at the base of the escarpment. The caves are abandoned and destroyed as the escarpment retreats.

The southern portion of the Eastern Highland Rim does not contain significant deep or long caves. Many of the cave entrances have formed at or near the contact of

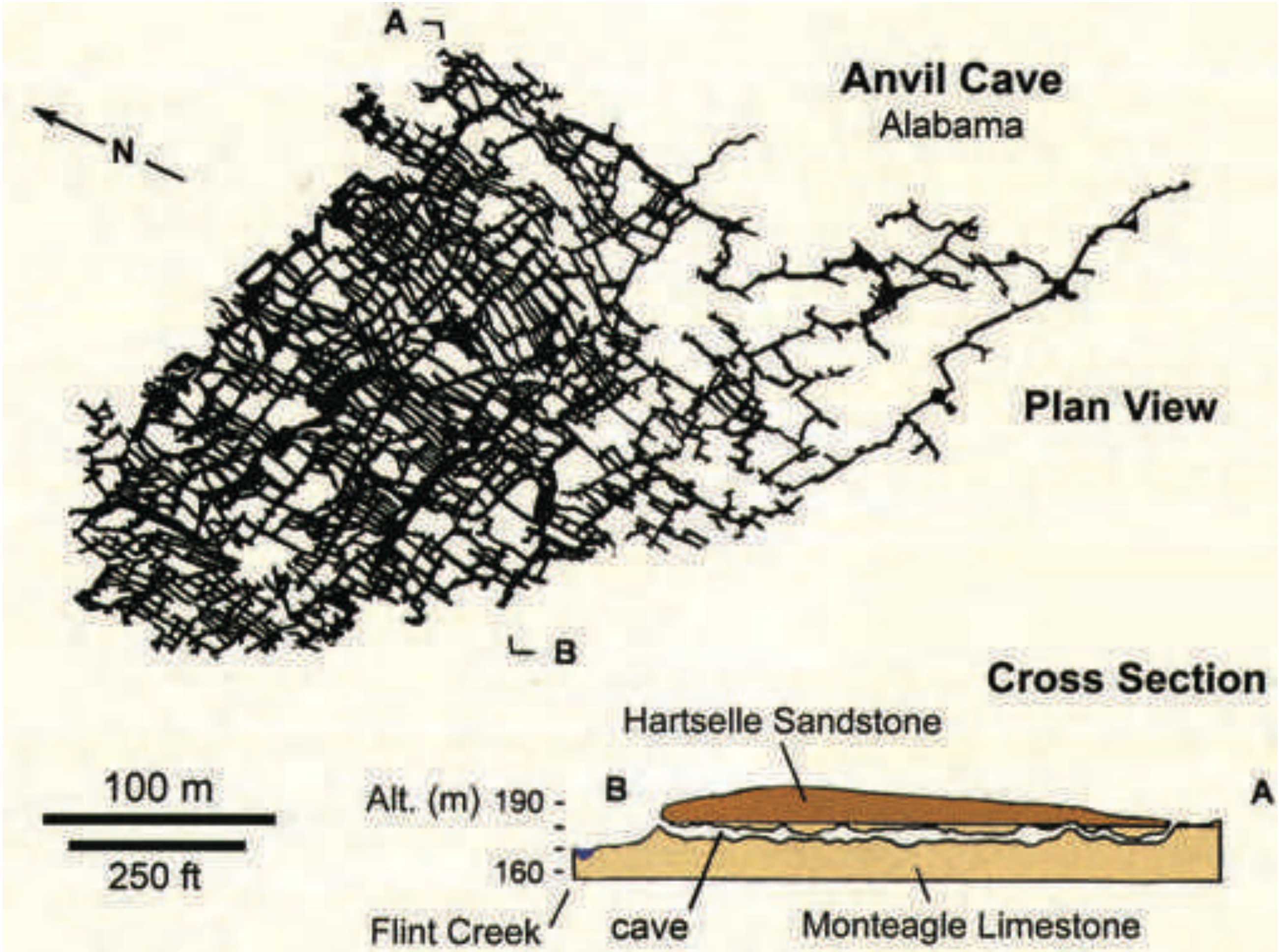

Figure 18 - Anvil Cave is an example of a network maze formed from a combination of diffuse recharge through an overlying sandstone layer coupled with enlargement that resulted from flooding of nearby creek. Cartography: Varnedoe, 1964 and Palmer, 2009

the lower Bangor Limestone or at the Hartselle Formation. Horizontal stream caves are common, but multi-drop caves of any kind and vertical shafts are rare. However, network mazes are very common. These types of cave tend to form at the perimeter of ridges where the Hartselle Formation, which acts as cap rock, tends to be thinnest. Water that infiltrates impermeable cap rock flows into the highly fractured Monteagle Limestone forming complex network mazes (Palmer, 2000). Anvil Cave, located in northeast Alabama is an example of such cave development (Figure 18). The cave is developed in the Monteagle Limestone that is capped by a thin layer of Hartselle Sandstone. The cave was formed by a combination of diffuse recharge through the sandstone coupled with enlargement that resulted from flooding of nearby Flint Creek (Varnedoe, 1964) at its contact with the Hartselle Formation.

Shelta Cave is located directly underneath the former National Speleological Society office on Cave Avenue in Huntsville, Alabama. At one time the cave was known for its great biodiversity and contained several species that were endangered or protected. Orconectes sheltate, was a crayfish found only in Shelta Cave and was notable for its long lifespan and extremely slow growth rate. The cave was also home to the endangered gray bat, Myotis grisescens. Urbanization and vandalism had a negative impact on the cave. In 1967 the NSS bought the cave and in 1968 gated it.

Summary

The geologic diversity of “classic” TAG has provided a spectacular variety of caves including horizontal boreholes nestled within the coves of the Cumberland Plateau and beautiful open-air pits located at the plateau margins. Plateau hydrology has resulted in a selection of multi-drop caves that range from pleasantly challenging to horror-hole caving at its best. A little bit of geologic knowledge about these caves can enhance one’s appreciation of the great caves of TAG and also provide some insight into finding more!

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2014 NSS Hydrology Field Trip: In Karst, Groundwater can hurt you.

Warren Campbell NSS 9513

The 2014 NSS Hydrology field trip will visit the following sites.

Stop 1: Lee High School

The convention headquarters are at Lee High School which sits at the foot of Chapman Mountain. Chapman Mountain has numerous sinkholes, small caves, and pits and will figure prominently in the early part of the field trip.

Stops 2 through 4: Chapman Mountain Saga or How To Create Public Panic and Get Yourself Sued

Chapman Mountain, west of I-565 and near the NSS Convention headquarters at Lee High School (Figure 1), has numerous sinkholes and small caves developed in the Monteagle Limestone. The top of the mountain west of I-565 is Hartselle Sandstone. Most of the mountain surface bedrock is Monteagle Limestone, while at the base of the mountain the formation is Tuscumbia Limestone. Big Spring issues from the Tuscumbia Limestone. Many small caves, pits, and sinkholes have formed in the Monteagle Limestone. You will see some of the sinkholes in profile (Figure 1) in rock cuts made for I-565.

The mountain is located 1.1 miles (1.8 kilometers) from two wells that supply water to 40,000 people in Huntsville and 2.2 miles (3.5 kilometers) from Big Spring in downtown Huntsville. Lincoln and Dallas Wells were originally hand dug in the early 1900s as fire suppression wells for textile mills. In the 1950s, they were acquired by the City of Huntsville, deepened, and have been used ever since as water supply wells. If the wells are pumped at full capacity, the water level drops in Big Spring 1.2 miles (1.9 kilometers) away.

In 2002, Chapman Mountain landowners sought a zoning change that would allow them to more easily develop the mountain. Chapman Mountain has many sinkholes and caves. You can see sinkholes in profile on the I-565 cut on Chapman Mountain (Figure 2 and Stop 1). Realizing that development on Chapman

Figure 1 - RWT dye trace from Chapman Mountain to Lincoln Well.

Mountain could possibly endanger Lincoln and Dallas Wells, I took three actions: 1) informed Huntsville Utilities of the proposed change and the karstic nature of Chapman Mountain, 2) enlisted local cavers to map sinkholes and caves on the mountain with hand-held GPS units, and 3) presented these maps with a discussion of the potential dangers to the City of Huntsville Planning Commission. One landowner in particular was not pleased. He threatened lawsuits directed at the City and me. In spite of my efforts, the Planning Commission granted the changes. Subsequently, Huntsville Utilities sent a letter to the owner that said if he wanted water connected to any of the new development, he would have to allow dye traces to see if the mountain was hydraulically connected to the wells. Being assured by his geotechnical engineer that the chances were 1,000,000 to one against a connection, he reluctantly agreed.

Bob Baker of the Geological Survey of Alabama and his colleagues injected Rhodamine WT in a sinkhole and fluorescein into a pond (Figure 3) at two sites on

Figure 2 - Chapman Mountain Sinkhole in profile.

Figure 3 - Chapman Mountain Dye Trace.

Chapman Mountain (Baker and Campbell, 2003). I had suggested that we might inform some of the residents of the trace, but the officials of the Water Department did not want people worrying about low concentrations of dyes in their water supply.

Within 24 hours, the Fluorescein dye began appearing in springs in neighborhoods below the injection points. This was one year after September 11, 2001 and the people were very concerned. HAZMAT crews were called to test the water. Eventually someone called the Water

Figure 4 - Big Spring is hydraulically connected to Lincoln and Dallas Wells and to both injection sites on Chapman Mountain.

Department who made contact with the HAZMAT captain and explained what was happening.

From the tests, we found that Chapman Mountain was hydraulically connected to both Lincoln and Dallas Wells and Big Spring (Figure 4). The result of these efforts is as follows. Neither I nor the City was sued. The family of one of the landowners donated a large section of the mountain to the Land Trust to be preserved in perpetuity. And the Land Trust is seeking funding to buy another large plot on the mountain. Lincoln and Dallas Wells are still supplying water to people in northeast Huntsville.

Big Spring provided the first water supply to Huntsville and was one of the first public water systems west of the Appalachians. The first system used cedar logs (Figure 5) and a crude positive displacement pump patented by Benjamin Franklin. The pump consisted of a log with one end hollowed to accept a piston driven by a water wheel. The other end had a flapper attached to the log by a leather strap. As the piston moved in, the flapper opened allowing water to be pushed through connecting pipes. As the piston withdrew, the flapper closed, reducing the back flow of water. Water was pumped up the hill to the courthouse square and held in a reservoir there. The bronze Madison County Courthouse in Figure 4 sits on the courthouse square. Buried cedar logs carried water to businesses for supply and fire suppression. Cedar logs had a hole drilled in them for fire suppression as shown in Figure 6. This hole was normally closed with a piece of wood called a fire plug, thus the birth of the term that currently has a broader meaning. The location of the holes was marked on the surface. In the event of a fire, the log was dug up creating a trench. The wooden plug was pulled from the hole allowing water to fill the trench and supply a bucket brigade (Figure 6).

Figure 5 - Cedar logs and pump patented by Benjamin Franklin.

Figure 6 - Hole for fire plug.

Figure 7 -Tony Waltham and caisson supporting low section of the Madison County Courthouse.

Figure 8 - Dye traces in McKay and Hale Hollows.

While the cedar log system showed much ingenuity, it apparently was ineffective and the water system became viable only when iron pumps became available.

Big Spring issues from Big Spring Cave which passes under the north part of the Courthouse Square. When the current courthouse was being designed, borings indicated that the south half of the square could support the Empire State Building, but the north half would only support three stories. Consequently, the architect designed the building as shown in Figure 4. The 11-story tower is over solid rock, and the 3-story section on the left in the picture is over the cave and is supported by caissons placed in holes drilled through the cave (Figure 7 and Campbell and Waltham, 2005).

Stop 5: Blue Spring and Big Cove

At Stop 5, you will view Hale and McKay Hollows. The watershed draining to McKay Hollow is about twice the size of the Hale Hollow watershed. Surprisingly, the stream in McKay Hollow goes dry in the summer, while Big Cove Creek in Hale Hollow creek always has flow. Dye traces conducted by Smart and Campbell (2003) indicated that the McKay Hollow stream sinks and resurges at Blue Spring (Figure 8). The straight line distance from injection point in McKay Hollow to Blue Spring in Hale Hollow was 1.7 miles (2.7 kilometers) and the time of first arrival was approximately 24 hours.

Another peculiarity in this area is illustrated by the dye trace from Ben's Den to Sycamore Spring. Ben's Den is a small cave with a year-round stream, while Sycamore Spring is approximately 0.5 miles (0.8 kilometers) and only 200 feet (60 meters) below Bens Den. In the Cumberland Plateau area of north Alabama, most caves on mountain ridges are parallel or sub-parallel to the ridge. This flow seems to follow that trend. On the northwest side of Hale Hollow, Smart and Campbell (2003) observed several blowouts that probably are connected to a solution conduit or conduits below the surface and these are springs during wet weather. Similarly, they also observed several springs along the break in topography.

The surrounding mountains have steep slopes that give way to very flat floodplains at the base. Clearly, the steep bedrock slope continues below valley sediments. These observations led Smart to hypothesize that the sub parallel caves may have formed during a different climatological regime when sediments filled the valleys to a greater depth. The presence of the sediments holds the water table at a higher level, allowing caves to form at or near the elevated water table just below the surface of the valley fill. This hypothesis is consistent with observations of cave formation here.

Stop 6: Peevey Creek and Springs

In the 1990s, local developer John Hayes conceived the idea of a large, upscale subdivision in Huntsville. The nicest neighborhoods in Huntsville at the time were in southeast Huntsville, but most of the developable land there was already developed, so Mr. Hayes began to look elsewhere. He settled on land across Monte Sano Mountain from downtown Huntsville. To develop this land, he needed a water supply well that could generate 1,000 gallons per minute (gpm). While several large wells in this range existed across Monte Sano Mountain, the largest on the side of the development was in the 150 to 200 gpm range. To solve the dilemma, Mr. Hayes hired a well known karst geologist from Kentucky who studied the geology of the area, walked the land, and chose several sites for test wells. These delivered a maximum of 150 gpm. Then Mr. Hayes hired a company famous for its karst work that suggested several sites for test wells. These delivered a maximum of 200 gpm. In desperation, he hired a local water witcher who said dig here. They did and got 1,200 gpm. Science indicates that water witchers do no better than digging randomly, but this experience might make you wonder.

The Arbor Woods development is the part of Hampton Cove built in the Peevey Creek Hollow. This large development of several hundred homes has been susceptible to flooding. The developer added fill to the valley so that the area of these homes was raised to at least one foot above the 100-year flood level, or the flood that has a percent chance of happening in any given year. One home in this subdivision flooded four times in five years. This would be a highly unlikely event (4.5x10-8) if the 100-year flood was known accurately. Subsequent investigations proved that the methods of calculating the 100-year stream discharge based on USGS regression equations were flawed. These equations give accurate results for the rolling hills west of Huntsville but seriously under predict flood discharges in the hollows of the Cumberland Plateau.

Another problem involves the extremely large wet weather springs that occur here. They are dry in the summer, but may discharge up to 3 m^3/s (100 ft^3/s) during wet weather. Another problem is the inaccuracy of the USGS topographic maps for the area that seem to show a dry wash discharging directly to Peevey Creek. Field study shows that at least one dry wash turns down valley and discharges into the creek near the homes of this subdivision.

Another interesting feature of this valley is very old sediments that have begun to consolidate into rock formations. These can be observed just upstream of the bridge on Little Cove Road. Younger, unconsolidated sediments overlay sediments that are as hard as concrete. Groundwater seeps from the new sediments and discharge at the top of the older sediments. The groundwater drains through the unconsolidated soils to the top of the impervious old sediments and move along them to the creek. Here is an opportunity to directly observe base flow that sustains stream flow during the dry season.

Stops 7 through 9: Hering, Vinson, and Saturday Caves

Hering Cave is home to the endangered Alabama cave shrimp. For this reason, a series of dye traces in the area were done by the Geological Survey of Alabama (Rheams, et al., 1994) and others. Most of Horse Cove appears to be drained by Herring Cave and the surface stream, Goose Creek. During the dry season, most of the drainage is subsurface. Every dye injection in Horse Cove resulted in a positive detection at Hering Cave. The traces included injections at Equinox Pit and Vinson Caves in Pelletier Hollow, as well as an injection in a cave more than 100 meters (328 feet) above Hering Cave.

Vinson Cave is the lower entrance of a blowing cave. The suspected upper entrances are Saturday Cave, Equinox Pit, and/or Vernal Well. In the back of the known cave is a pool known as the Wave Pool. In the summer, the wind is strong enough to create small waves on this pool. Dye

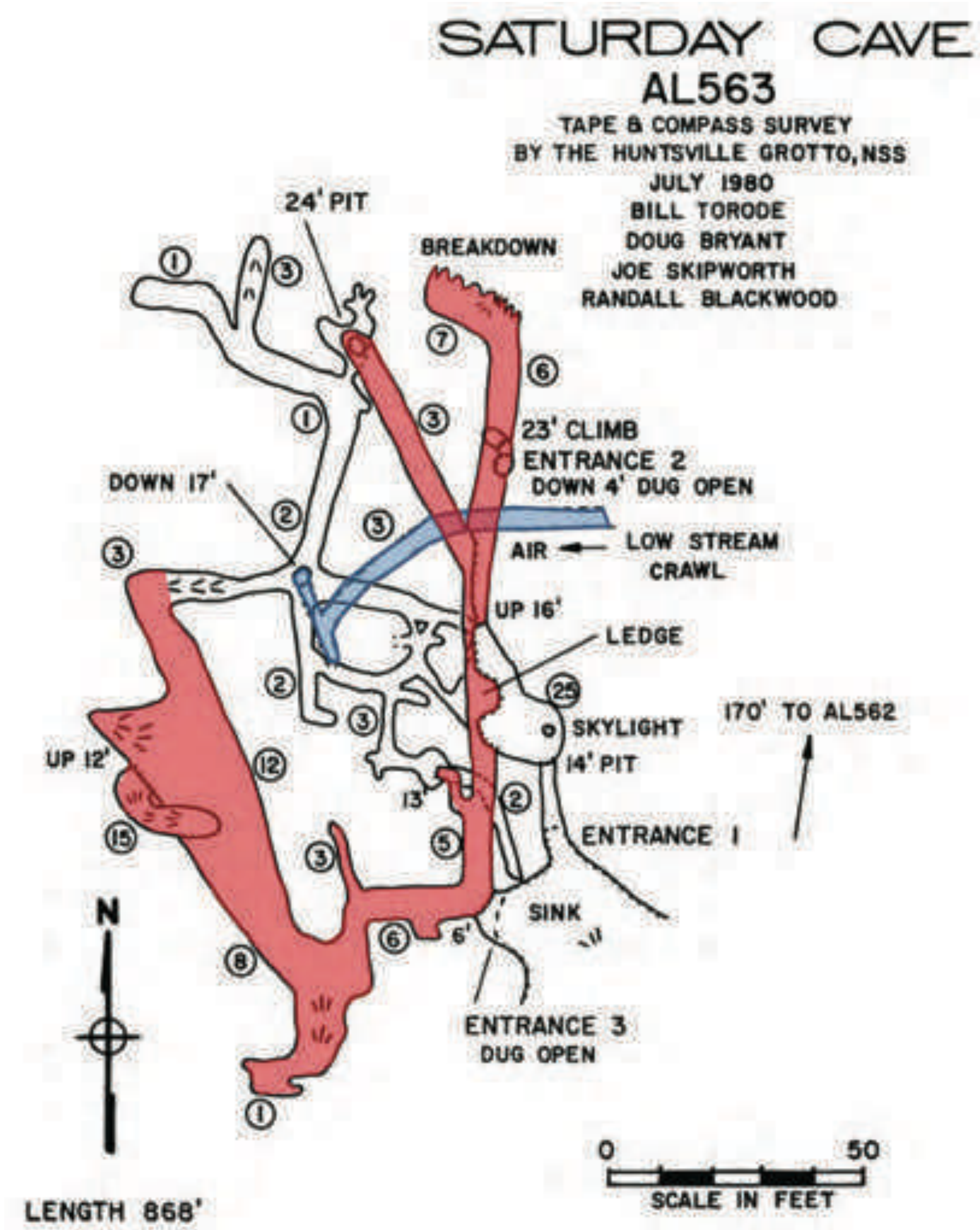

Figure 9 - Saturday Cave. Upper level is dark gray, middle level white, and lower level, light gray.

traces show that Vinson Cave is hydraulically connected to Hering Cave.

Up a normally dry stream bed from Vinson Cave is Saturday Cave. This cave is interesting because of the observed changes in surface and underground flow (Figure 9). The cave is formed on three levels indicated by the grayscale colors in the figure. In an effort to reach a stream for dye trace work, we attempted to reach the 17-foot pit that became known to our group as Mystic Pit because after several trips, we had failed to locate it. Further, the midlevel of the cave was nothing like shown on the map. Bill Torode, who made the map agreed to go to the cave with us to try to locate Mystic Pit. He also observed that the midlevel of the cave looked nothing like the map. Eventually, he led us to a sandy crawl about 1-meter high. There was no sign of the pit, but Bill looked at some logs that were sticking out of the solid sand and jammed between the floor and the ceiling. He indicated that might be Mystic Pit. The logs were jammed solidly between floor and ceiling and could not be moved. We returned later with a saw, and were able to remove the logs. Gravel poured into Mystic Pit. Sometime between 1980 and our trips to the cave in the mid-1990s, the pit had been sealed completely. We excavated the pit fill in layers and found coarser material on the bottom, and finer material on the top. From this, we were able to reconstruct the sediment history of the cave.

In 1980, the pit was open with some clearing of debris. It was apparent to the mapping team. Sometime between 1980 and the early 1990s, the logs washed into the pit partially choking off the flow. With the reduction in flow, the size of bed material that could be washed into the pit also decreased. As more material washed into the pit, the flow was choked further, reducing the size of the bed material that could be carried by the flow into the cave. Eventually, a solid sandy floor covered the passage to a depth of 60 centimeters (2 feet).

In 1995, we cleared the pit and observed several changes in the character of the midlevel of the cave. It began to look more like the map. Previously, some of the passages had been clogged with sand. The floor of the skylight room was lowered by about 1 meter. In a trip to the cave during a thunderstorm, we were able to enter the cave. The Skylight Room was completely filled with water which flowed down the upper level of the passage and into the first right-hand passage and on to Mystic Pit. By following the passage to the big western room, we were able to negotiate the climb down to Mystic Pit. We estimated the flow entering the pit as approximately 1 m^3/s. This would be orders of magnitude greater than the flow that could pass through 60 centimeters of sand. When Mystic Pit is clear, most of the surface drainage in a storm would end up as subterranean flow, but when 24 inches (60 centimeters) of sand covered the pit, flow would be on the order of a liter a second. Consequently, the cave would fill up within five minutes and most of the flow would continue on the surface downstream.

Had we left the pit as we initially found it, we could extrapolate the drainage future of the cave. Eventually, the blocking logs would rot and during a heavy storm, the support for logs, rock, and sand would give way, flushing out the pit. Most drainage would pass through the cave until the next log washed into the cave and started the process over again. These observations have ramifications for many karst areas. Changes in drainage have been inferred from dye traces in the Mammoth Cave area in Kentucky and in the Lost River system in Bowling Green, Kentucky. The sudden appearance of high levels of fecal coliform in a well near New Market in Madison County, Alabama, was recorded after a year of heavy rainfall. Several measurements exceeding EPA standards were observed in the Cress Well when none had occurred before. The flushing of a clogged solution cavity was the suspected cause.

Stops 10 and 11: Matthews Cave and the Bridge Street Saga

As we drive along I-565, most of the road will be asphalt. However, at one point we will pass a short section of concrete. This is effectively a concrete bridge across Matthews Cave. Initially, the Alabama Department of Transportation (ALDOT) planned to simply fill in the cave. However, local cavers led a few ALDOT engineers into the cave during the wet season. When they observed the torrent in the cave, the engineers decided an alternate plan would be prudent. Subsequently, the cave was bridged using a concrete deck with large steel girders for support.

Huntsville is home to one of the largest Research Parks in the U.S. In 2002, the City purchased the McDonald farm adjacent to the Research Park. Much of this farm was located in a large sinkhole and the owners had created a stormwater injection well to drain the sinkhole. This well is a large one with a 2.5 foot diameter corrugated metal stand pipe (Figure 11) that drains to a

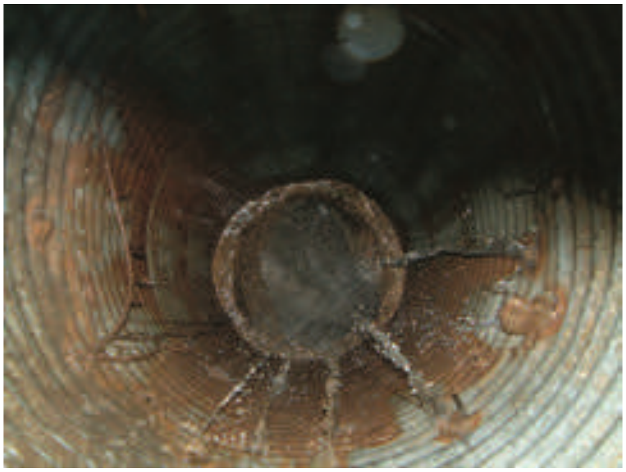

Figure 11 - Bridge Street Injection Well operating.

Figure 12 - Filling in the Bridge Street Lake.

bedrock cavity 15 feet (5 meters) below the ground surface. Previously, the Geological Survey of Alabama had injected dye in this well and recovered some of it in a spring 5 miles to the south on Redstone Arsenal.

Knowing that the City needed a permit for a stormwater injection well and suspecting that the previous owner had not bothered with it, I contacted the Alabama Department of Environmental Management (ADEM) with three questions. 1) How do we go about getting a permit? 2) How much does it cost? 3) How long will it take? The answer was, "Yes, we needed a permit, but we couldn't get one." ADEM wanted to close down all of the injection wells in Alabama, and they wanted us to close down this one as well. My estimate of the cost to do this was about $10,000,000 and since most of the water draining to the injection well comes from a state highway, when could we expect a check? As far as I know, the City still does not have a permit for the injection well and it is still there (Figure 11).

In late 2003, the City began negotiations with a developer in California who wanted to build a shopping center/office complex on the site. The original plans involved filling in much of the sinkhole and digging out land to create a small lake where shoppers could purchase a gondola ride. Because each of the five ponds in the Research Park had leakage problems, we strongly suggested that the developers hire a geotechnical engineer familiar with the karst in this area. Those suggestions were largely ignored and the developer proceeded with construction.

Bridge Street is a very nice shopping center, and now the developers have decided, after purchasing millions of gallons of water to keep water in the lake, to fill it in (Figure 12).

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Warren Campbell is an Associate Professor of Civil Engineering and can be reached at:

Western Kentucky University,
1 Big Red Way,
Bowling Green, KY 42101,
warren.campbell@wku.edu

Caves of the Huntsville Area

Lin Guy, NSS 10235 FE and Tom Whitehurst, NSS 12919

How Huntsville Cave Exploration Came About

Huntsville was named for settler John Hunts, who moved to the area around Big Spring in 1805 after Native Americans had been forced out of the area a few years earlier. In 1811, the town was the first to be incorporated in what would become the state of Alabama in 1819. The organizational convention for statehood was held there, making Huntsville the first state capitol of Alabama, although for only a year. The small farming community grew to a population of 13,050 by 1940.

During World War II, three military facilities were built in Madison County. Several years after the war, they were scheduled to be shut down and their properties sold. At the eleventh hour Redstone Arsenal was given a new task: to research and develop rocket propellants. Had this not happened, Huntsville might have remained a small farming community. In 1950, The US military brought 130 German scientists and engineers to Huntsville to work on the rocket program, joined by civil service employees and military personnel, including Dr. Wernher von Braun, Germany's top rocket scientist during World War II.

After the Russians beat the US into space by launching the first man-made satellite in October 1957, German and American workers under Dr. von Braun's technical guidance successfully put a satellite into orbit at the end of January 1958. Six months later the National Aeronautics and Space Administration (NASA) was created to operate the non-military arm of space exploration. These events during the 1950s led to a population explosion, during which Huntsville grew from 16,437 to 72,365 residents. The 2010 U.S. Census counted 180,105 residents in Huntsville and 334,811 countywide.

Individuals seeking a better life flocked to Huntsville to participate in the space program. This seed, in a roundabout way, led to Huntsville becoming an important location for cave activities and innovation. Bill Varnedoe, a 29-year old graduate engineer from Georgia Tech, was among the early arrivals in 1952. During his off-work hours, he traveled outside town and discovered North Alabama was a cave-rich area. After corresponding with Dr. Walter B. Jones (Alabama's State Geologist from 1927 to 1961, Madison County native, NSS member, and founder of the Alabama Cave Survey in the 1930s) about the need for an organized cave club in the area, Bill announced an organizational meeting to be held Monday, March 21, 1955. It was decided that the club would be chartered under the umbrella of the National Speleological Society as the Huntsville Grotto. The only other NSS Grotto in the state at the time was the Auburn Student Grotto at the Alabama Polytechnic Institute in Central Alabama, which was formed in October 1954.

The 1955 NSS membership roster listed 16 Alabama members; nine of these NSS members were charter members of the Huntsville Grotto. Most of the grotto's members in the early days were employees in the space industry or military personnel attached to Redstone Arsenal. For the first few years the club had no newsletter; then in February 1960, Tom Sawyer published a one-page *Huntsville Grotto Bulletin*. Usually published monthly, it was renamed the *Huntsville Grotto Newsletter* in November 1960, and is still published today. Hundreds of reports on the exploration of caves and development of equipment and techniques are chronicled in its pages.

Bill Varnedoe led the Alabama Cave Survey (ACS) from 1962, when it was transferred from the Geological Survey of Alabama where it began, to 1979. Besides their name, caves are uniquely identified by "AL" followed by a sequential number. Mapping caves has always been an important part of the ACS members' activities, and today around 2,380 of the 4,276 caves (over 55%) have a sketch or surveyed map. According to ACS records, 547 caves (over 12% of the state total) lie within Madison County.

Huntsville Grotto members were also pioneers in developing vertical caving equipment. Bill Cuddington, who moved to Alabama in 1964, was a pioneer of single rope techniques; John Cole developed today's popular rappel rack for safely descending pits and cliffs; and Dick Mitchell devised a system for safely climbing back out of them. Today's caver benefits from safe equipment and techniques passed down after years of research.

Geologic and Physiographic Framework

New caves are still being found within and near Huntsville's city limits and added to the Alabama Cave Survey, even after almost 60 years of organized caving in Huntsville. For example, the authors participated in three trips earlier this year that added four new Huntsville caves, one of which is on the new property of the NSS Headquarters & Conference Center.

Some of the information presented here can be used when ridge walking (looking for new caves); however, increased urbanization of formerly remote areas of the city requires caution to respect property owners' rights. Do not trespass—please ask permission before entering private property to ridge walk or visit known caves.

The goal of the geology portion of this paper is to provide cavers with practical information to help understand the occurrence and distribution of caves in the Huntsville area. The intent is not to be too academic; however, references are cited for those wanting to follow up in greater detail than what will be provided here. A more regional treatment of the geology of the TAG area can be found in the article by Patricia Kambesis that is located in Chapter 1 of this guidebook.

Physiographic Setting

Huntsville falls in a transition zone between two physiographic sections: the Highland Rim section of the Interior Low Plateau province and the Cumberland Plateau section of the Appalachian Highlands province. The area is characterized by flat-topped mountains of the Cumberland Plateau that are capped by resistant Pottsville Sandstone including Monte Sano, Huntsville, Green, and Keel Mountains and lower outliers of the Plateau typified by Weatherly, Chapman, Wade, and Drake Mountains, wholly or partially capped by Hartselle Sandstone (Sapp and Emplaincourt, 1975). The outliers are surrounded by low-lying limestone-floored valleys of the Highland Rim.

Geology of the Huntsville Area

Cavers in Huntsville are fortunate to have an exposed section of Middle and Late Mississippian carbonate strata greater than 700 feet (200 meters) thick (Sanford, Malmberg, and West, 1961; Raymond, 1999). The exposed carbonate section is continuous, except for up to 60 feet (18 meters) of Hartselle Sandstone (locally much thinner or absent) between two of the most cavernous formations—Monteagle Limestone and Bangor Limestone.

Figure 1 (Baker, 2005) is a generalized stratigraphic section for the Madison County area which includes Huntsville. Geologic mapping in Huntsville indicates that the thickness of individual formations is noticeably variable (Sanford, Malmberg, and West, 1961; Raymond, 1999). Other than Quaternary alluvium, the Early to Middle Mississippian Fort Payne Chert and Early Pennsylvanian Pottsville Formation are the oldest and youngest units exposed on the surface in Huntsville proper (Sanford, Malmberg, and West, 1961; Raymond, 1999). The most prolific cave-forming units are, in ascending order: Tuscumbia Limestone, Monteagle Limestone, Bangor Limestone, and Pennington Formation.

While there are some differences between the thickest carbonate units (Tuscumbia Limestone, Monteagle Limestone and Bangor Limestone), all three can be generally characterized as gray to brownish gray, bioclastic, crystalline, oolitic, fossiliferous limestone with varying amounts of chert, dolomite, shale, and cross-bedding (Sanford, Malmberg, and West, 1961; Raymond, 1999). Since the lower Pennington Formation represents, in part, a more clastic facies of the upper Bangor Limestone (Thomas, 1972), the carbonate strata in both units are very similar (Raymond, 2013).

Joints in carbonate strata play an important part in cavern development in Huntsville. These joint systems provide preferential pathways for migration of water (fracture permeability) and subsequent dissolution of the rock. Baker (2005) reports many cave passages in the Hampton Cove area of Huntsville are aligned N35°W and N50°E, reflecting orientation of the dominant joint systems. Many cave passages in other parts of the city have a similar orientation—generally northeast-southwest and southeast-northwest.

Structurally, Huntsville is located on the southern flank of the Nashville Dome. Regional dip from north to south across the Huntsville quadrangle is about 30 feet per mile (5.7 meters per kilometer) to the south (using Hartselle Sandstone as a marker). Locally, dip is not obvious; however, at 30 feet per mile (5.7 meters per kilometer), formation contact elevations will change about 300 feet in 10 miles (57 meters in 10 kilometers).

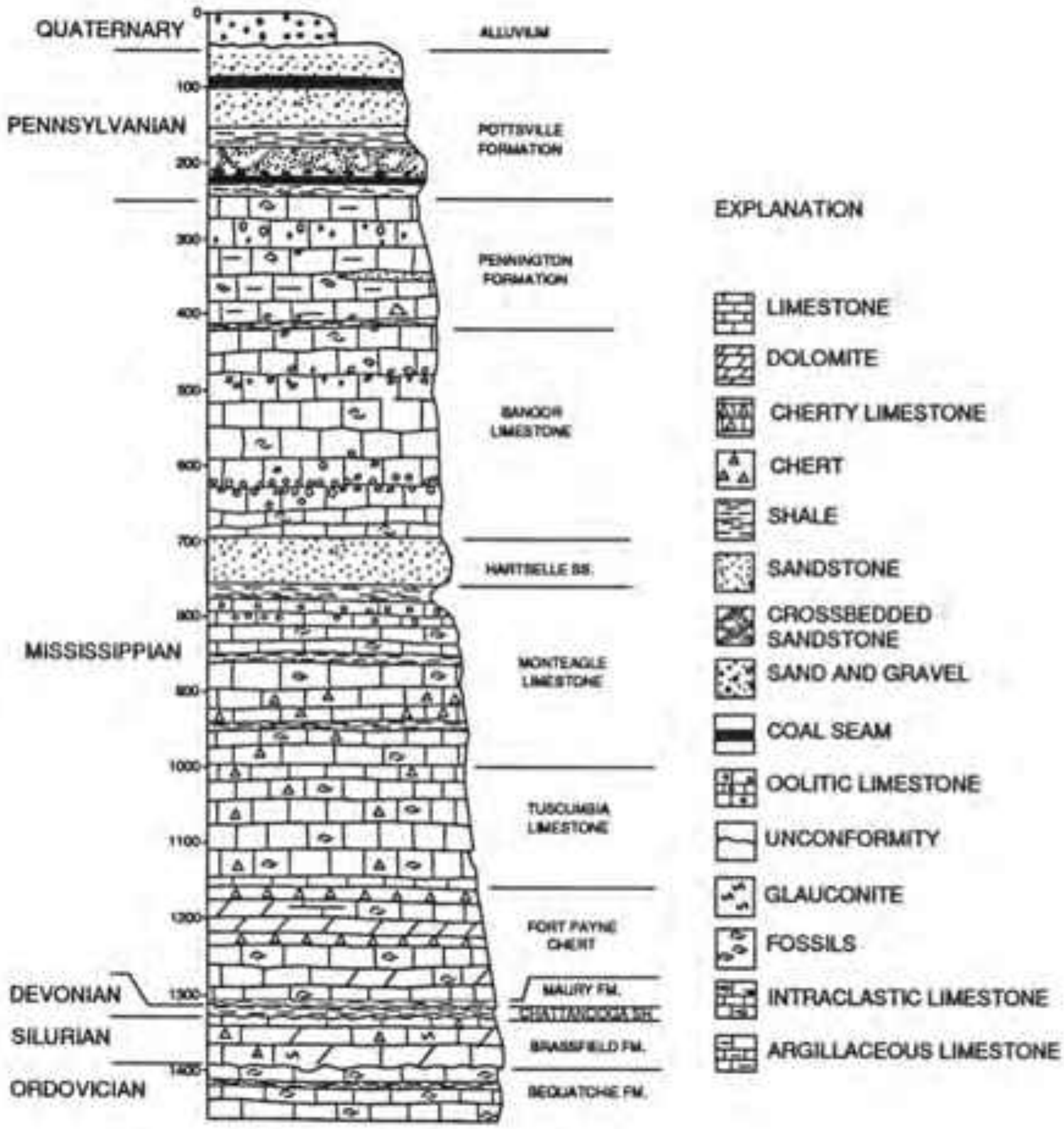

Figure 1 - Generalized stratigraphic section of Madison County, Alabama (Baker, 2005)

Geologic Contacts of Interest

Geologic contacts of interest to cavers, in ascending order, include the Monteagle-Hartselle contact (and Monteagle-Bangor contact where the Hartselle is absent), the Bangor-Pennington contact, and the Pennington-Pottsville contact. The Tuscumbia-Monteagle contact isn't included as it doesn't appear to significantly influence cavern development and, in this area, the contact is mapped on the basis of changes in chert and ooid content of two otherwise similar limestone units (Thomas, 1972).

The Monteagle Limestone-Hartselle Sandstone contact is of significant interest to cavers as Hartselle-capped erosional remnants of the Cumberland Plateau, such as Drake Mountain above the new NSS Headquarters & Conference Center, contain a significant number of caves with entrances immediately above or below the contact (Figure 2). Many of these caves have a distinctive look—highly-weathered limestone with sharp ridges and pinnacles in passages, and ceilings of weathered Hartselle Sandstone. In at least one case such as Blue Balloon Cave on the property of the NSS Headquarters & Conference Center, the Hartselle has apparently collapsed into voids in the Monteagle, giving the appearance of the cave being in sandstone. Care should be exercised in these caves as their entrances, ceilings, handholds, and footholds may be unstable.

Figure 2 - Lin Guy standing on Hartselle Sandstone outcrop above entrance to Blue Balloon Cave (AL 4345), Drake Mountain.
Photo: Tom Whitehurst

The Hartselle Sandstone represents a thin, fairly synchronous, stratigraphic marker in the region (Osborne, 2007). In the Huntsville city limits, it is a distinctive medium-to-coarse grained, cross-bedded, brownish-gray to tan, well-cemented sandstone in the middle of a thick succession of carbonates. It is locally thin or absent in the eastern portions of Huntsville and Green Mountains (Sanford, Malmberg, and West, 1961). In the Grant Quadrangle just southeast of Huntsville, it can be absent between two nearby exposures (Osborne, 2007). Where it is not present or thin and not exposed, differentiation between Monteagle Limestone and Bangor Limestone is difficult (Sanford, Malmberg, and West, 1961; Osborne, 2007).

The Hartselle Sandstone reportedly reaches a maximum thickness of 60 feet (18 meters) on the northwest side of Green Mountain, thins to about 8 feet (2.4 meters) along US Highway 431 (Figure 3) on the western slope of Monte Sano at an elevation of 1,040 feet (317 meters) and is 16 feet (4.8 meters) thick on Bankhead Parkway on the north slope of Monte Sano at the 1,080 foot (330 meter) contour. Raymond (1999) reports 50 feet (15.2 meters) of Hartselle Sandstone in the Jeff Quadrangle on the northwest side of the city. Vertical development of caves in the Huntsville area appears to be limited by the Hartselle Sandstone where it is more than a few feet (a meter) thick, thus the importance placed on being able to determine where it is present.

The Bangor Limestone-Pennington Formation contact presents some challenges as well. In this case it is important to know where you are in the stratigraphic section when ridge walking as caves formed in the Pennington in Huntsville are usually small and have limited vertical development while Bangor caves can be long and deep. Identifying this contact in the field can

Figure 3 - Cross-bedded Hartselle Sandstone exposure along U.S. Highway 431 on west slope of Monte Sano; hammer is 13 inches (33 centimeters) tall. Photo: Tom Whitehurst

be difficult because sandstone talus from the overlying Pottsville Formation often obscures the contact, and, where it is exposed in the Huntsville area, Sanford, Malmberg, and West (1961) place the contact at the base of a 33-foot (10-meter) interval of interbedded shale and limestone above a thin-to-thick bedded dolomitic limestone of the Bangor Limestone. However, they also describe the upper 70 feet (21 meters) of the Bangor Limestone as interbedded shale and thin beds of dolomite and limestone.

Sub-regionally, the bottom of the Pennington Formation can be mapped at the base of a distinctive conchoidally fractured, very finely crystalline dolomite that weathers to a yellowish-gray color where it is present (Thomas, 1972; Osborne, 2007; Osborne, 2013; W. E. Osborne, personal communication, February 2014). It is unclear if the dolomitic limestone described at the contact in the Huntsville Quadrangle by Sanford, Malmberg, and West (1961) is equivalent to the dolomite described by Osborne and Thomas. If so, the difference in placement of the contact is not significant in the context of this paper. Since the upper Bangor Limestone and lower Pennington Formation interfinger, and dolomitizaton is a diagenetic process, lithologic changes can be significant over short distances, making the contact difficult to identify where one of the stratigraphic markers is absent or cannot be found.

From a practical perspective, but not very accurate in an academic sense, the Pennington Formation can be approximately identified in the field as the strata between distinctive, resistant sandstone cliffs of the overlying Pottsville Formation and the more continuous carbonate column below the top of the Bangor Limestone. These criteria will undoubtedly include some of the upper Bangor Limestone and lower Pottsville Formation (as formally defined) in a “Pennington facies” designation that might be useful in the context of cave occurrence and ridge walking in Huntsville. This interval of interbedded limestone, shale, dolomite, and sandstone can contain small horizontal caves and pits and does contain numerous springs, swallets, and sinkholes in Huntsville. Unlike the Monteagle-Hartselle contact on Drake Mountain, many cave entrances in the Bangor Limestone, such as Natural Well on Monte Sano, tend to be slightly below the mapped contact, possibly due to shale content in the uppermost portion of the Bangor.

The unconformable contact between the Pennington and the Pottsville Formations is generally considered to be the boundary between the Mississippian and Pennsylvanian Periods in the area. However, Rich (1980) reported foraminifera in the upper Pennington Formation that indicate its uppermost strata may span the boundary between the two periods. This contact is important to cavers in that, other than sandstone rock shelters such as Alum Cave (see below), no caves occur above this horizon in the Huntsville area. Although in Huntsville the basal 25 feet (7.6 meters) of the formation is tan, brown and red, sandy shale with interbedded sandstones and a 1.5 foot (0.46 meter) thick coal bed, the remainder of the Pottsville Formation is distinctive cliff-forming, thin to massively bedded, cross-bedded, conglomeratic quartzose sandstone. Up to 60 feet (18 meters) of the lower Pottsville Formation is preserved in the Huntsville area (Sanford, Malmberg, and West, 1961).

A Sample of Huntsville Area Caves

Alum Cave (AL K6)

Alum Cave, marked on the Farley topographic map, is a sandstone rock shelter at the top of Green Mountain above Green Grotto that is 15 feet (4.6 meters) deep. So what's the big deal? It is over 100 feet (30 meters) wide. There are dozens of ant lion (sometimes called doodlebugs) traps in the dry sand that are protected from rain. By Alabama Cave Survey (ACS) standards Alum Cave is not a qualifying cave, but it does qualify as a "karst feature" (even though, strictly speaking, it isn't related to karst) and is now identified by a number in the ACS data files.

Alum Cave is a representative of rock shelters formed in Pottsville Formation sandstone bluffs in the area. Another rock shelter can be found along the trail from Panorama Drive to Natural Well (see below) just below the top of Monte Sano.

Big Spring Cave (AL 57)

Situated a bit west of the center of Madison County, Alabama, downtown Huntsville developed around the large karst water source known to the Cherokee and Chickasaw people as "Big Spring." Big Spring Cave extends over 1,100 feet (335 meters) northeast from the spring, passing under the northwest side of the Madison County Court House before ending at a pool under Eustis Street. The original spring entrance has long been blocked, as well as a pit entrance above it; nowadays the only access to the cave is through a street manhole. Dr. Walter B. Jones visited Big Spring Cave in the 1930s and logged it as the 57th cave (AL 57) listed in the state.

Big Spring Cave is formed along a joint in upper Tuscumbia Limestone (Sanford, Malmberg, and West, 1961). Topographic relief in the area is limited, thus the dry portions of the cave are always fairly close to the surface and the ceiling is reportedly weathered and unstable (Jones and Varnedoe, 1968). The spring itself is an example of how prolific amounts of water produce joint-controlled, enlarged solution cavities in the Fort Payne-Tuscumbia regional aquifer. Discharge from the spring ranged from 0.31 ft^3/sec to 30.7 ft^3/sec (0.009 m^3/sec to 0.87 m^3/sec) between September 1957 and May 1986 with an average flow rate of 19.6 ft^3/sec (0.56 m^3/sec) between April 1957 and June 1959 (Chandler and Moore, 1987). In units more easily grasped, the average flow rate corresponds to approximately 4.5 million gallons (17 million liters) per day.

Burwell Cave (AL 64)

Burwell Cave is another example of a cave altered by the forward march of progress. In February 1940, Dr. Jones visited Burwell Cave on the south tip of Burwell Mountain and reported several entrances and a thousand feet of cave passage. He also noted a limestone quarry that cuts off part of the cave. The part Dr. Jones described is now known as the "old cave" and ran from the quarry area west under the face of a short bluff. The final nail in the old cave's coffin occurred in 1957 when Alabama Highway 53 was constructed. Rumor has it that Madison County's Herman L. Nelson, Alabama Department of Transportation Director, under Governor "Big Jim" Folsom from 1955 to 1959, was so dismayed at the time it took to travel from Huntsville to Ardmore along Pulaski Pike that he obtained approval to build a straight line highway between the two towns. Maps show the 20-mile (32-kilometer) plus stretch between University Drive and the state line has only an imperceptible bend near the middle. The route shot straight through Burwell Cave, cutting off the east end of it by a talus slope between the pavement and the quarry. The quarry itself destroyed part of the cave and may have been expanded to provide fill stone for the new highway. This road would have spared the remaining parts of the cave if it had been

Figure 4 - Entrance of Natural Well (AL 5) in Monte Sano State Park. Photo: Tom Whitehurst

routed at least 800 feet (245 meters) farther southwest of Burwell Mountain, but this was not to be.

In November 1961, Bill Varnedoe and Chuck Lundquist discovered the old cave section no longer passable, but a north extension of the cave consisting of a large passage was discovered (Varnedoe, 1961). Bill Torode and John Minor mapped 926 feet (382 meters) in the new cave in November 1969, as well as a 153-foot (47-meter) section that may be a remnant of the old cave (Torode, 1969). In November 2011 a second set of lanes was constructed west of the original lanes of Alabama Highway 53. Dynamite was used to blast the roadbed through the toe of the hill. Dave Hughes and Lin Guy entered the four entrances that remain and found signs of new fracturing. Remnants of a water pump were found below Entrances 1 and 2. Bill's 153-foot (47-meter) cave, which is no longer connected to any other sections, is now known as Burwell Annex Cave (AL 4426). It is unknown if blasting has affected any other parts of the cave.

The Burwell Cave complex is in Tuscumbia Limestone at the base of Burwell Mountain, an erosional remnant of the Cumberland Plateau not unlike Drake Mountain some 3 miles (5 kilometers) to the southeast. The difference between Drake and Burwell Mountains is that the Hartselle Sandstone has only recently been completely eroded off the latter. The only indication of the Hartselle's recent presence is preservation of a large sinkhole at the very summit of the hill (Raymond, 1999).

Dug Hill Sink (AL 141); O'Shaughnessy Pit (AL 903)

Dug Hill Sink and O'Shaughnessy Pit are two pits, 163 and 120 feet (50 and 37 meters) deep, respectively, located less than 800 feet (245 meters) apart on O'Shaughnessy Point in Monte Sano State Park. Neither has any appreciable horizontal passage at the bottom. There are numerous other shorter drops along the spine of the ridge.

Both pits are in Bangor Limestone. The deeper of the two (Dug Hill) bottoms not too far above the Hartselle Sandstone.

Glove Pit (AL 228)

Glove Pit was discovered by cavers in October 1957 just off Green Mountain Road on the west side of the mountain. It was sketched by Rich Breisch of Pennsylvania in December 1965, who descended the

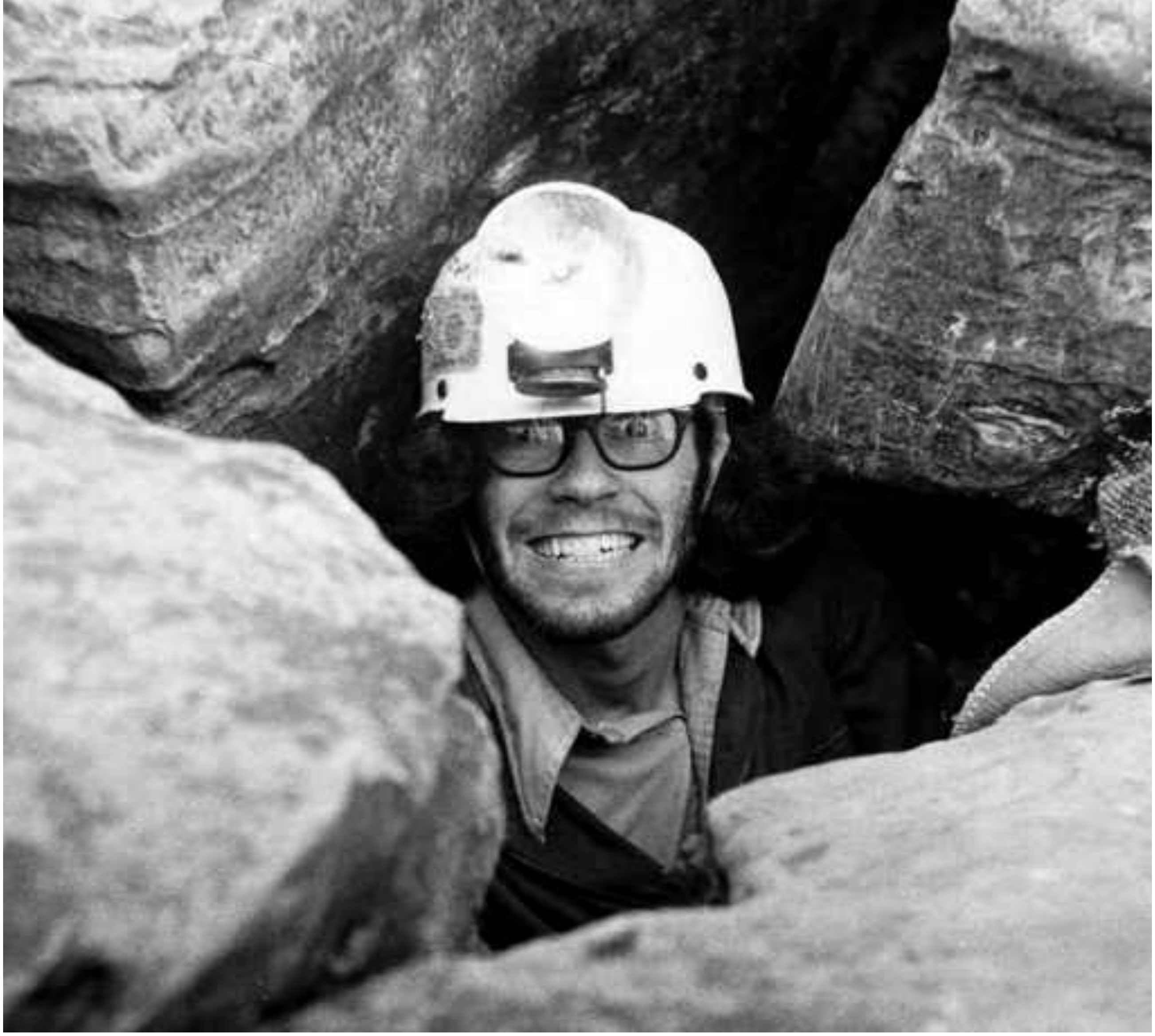

Figure 5 - Skip Whitehurst hanging in Hooper's Well (AL 181) on Monte Sano, c 1974. Photo:Tom Whitehurst

first drop of 109 feet (33 meters), climbed up the wall 34 feet (10 meters) and descended the second pit of 64 feet (20 meters), climbed up a second wall of 38 feet (12 meters), and descended a third drop of 45 feet (14 meters), placing him 118 feet (36 meters) below the lip of the entrance pit. In October 1967 a Huntsville group mapped 165 feet (50 meters) of horizontal cave.

In early 1985, a land developer discovered that the pit lay in the middle of one of his subdivision lots and inquired among local cavers of how best to fill it in. Bill Varnedoe, one of the cavers approached, suggested this would not be a practical solution, so the developer suggested giving it to cavers. The NSS and Huntsville Grotto did not want the responsibility, as they were then the defendants in a lawsuit over an accidental death at Natural Well, so Bill and other cavers formed a membership organization called Cavers Incorporated and accepted the pit offer (Varnedoe, 1985). They managed the pit for 10 years and then transferred it to the Southeastern Cave Conservancy, Inc., in 1995.

Glove Pit is another joint-controlled pit and dome complex in the Bangor Limestone. Some caves in Green Mountain seem to be oriented more north-south than those located elsewhere in the city, possibly indicating a slight change in direction of the dominant joint system.

Green Grotto (AL 229)

Green Grotto was explored by Huntsville cavers in November 1957 and mapped a year later. Additions were made to the map in February 1970, and in September 1977 it was completely resurveyed. A second resurvey in September 2010 shows 1,012 feet (309 meters) of passage. The cave swallows a creek in a gorge that drains over a square mile (2.6 square kilometer) area on top of Green Mountain. Although fairly short, going to the end of it involves doing a couple of climbs: 11 feet (3.4 meters) over a large rock at the main entrance and a 13-foot (4-meter) climb about 25 feet (8 meters) away. The second climb, which periodically becomes choked by washed-in stones, can be avoided by rigging a 21-foot (6.4-meter) sheer drop. Following the route, floodwaters from the outside creek take leads to the Big Room, which has two small debris-filled crawls and sand piles deposited when the water backs up to a depth of 25 feet (8 meters). Where all the water comes out is unknown, but it could be the valley floor 300 feet (90 meters) lower, which suggests an interesting cave no one has yet found or seen.

The cave's entrances are near the top of the Bangor Limestone that contains significant amounts of interbedded shale. It is possible that vertical development of Green Grotto may be limited by these relatively impermeable zones, or, in other words, it may behave more like caves in the Pennington Formation.

Haddox Pit (AL 799)

Haddox Pit was named for Robby Haddox, a non-caver who stumbled upon the hole on Drake Mountain while hiking and told Huntsville Grotto members about it. Robby's friend Warren Campbell and Eric Steenburn descended the first drop of 78 feet (24 meters) on July 29, 1967, returning a week later with Bill Torode to descend a second drop of 120 feet (37 meters) and survey the cave. Sloping passage between the two drops totals 84 feet (26 meters). Most of the Drake Mountain caves are found at the top under the sandstone cap. This one and a small number of others lie partway down the slope in limestone strata.

This pit's entrance, like Kelly Natural Well's entrance (see below), is in Monteagle Limestone significantly down slope from the Monteagle-Hartselle contact where most of the other cave entrances on the mountain are found. It is by far the deepest cave on Drake Mountain at 250 feet (76 meters). This places the bottom of the pit at local groundwater base level, and also puts it approximately 100 feet (30 meters) into the Tuscumbia Limestone.

Hooper's Well (AL 183)

Located on Monte Sano, Hooper's Well is noted for being a very nice "beginner's pit" for those wanting to take up vertical caving (Figure 5). Lin Guy rappelled into Hooper's Well, around 11 a.m. on November 9, 1968, about the same time a strong earthquake rattled North Alabama! None of the three participants on that trip noticed the magnitude 5.5 quake, which was centered 120 miles (190 kilometers) east of St. Louis near Mount Carmel, Illinois. The pit, named for a charter member of the Huntsville Grotto, is noted for a long stalactite which the caver brushes against on his or her way down.

The geologic setting of Hooper's Well is similar to Natural Well (see below) in that its entrance is in upper Bangor Limestone; however, its horizontal and vertical extent are both limited compared to Natural Well. Interestingly, the entrance elevation of Hooper's Well is about 90 feet (27 meters) lower than Natural Well, making the bottom of Hooper's Well about the same elevation as the bottom of the entrance drop in Natural Well.

Kelly Natural Well (AL 49)

Kelly Natural Well on the northwest side of Drake Mountain was the subject of a 1939 Montgomery Advertiser article, "State Geologist Finds Bottom of Bottomless Pit at 180 Feet." It was described as a dark, gaping hole on King Mountain, now known as Drake Mountain, and reputed to be "bottomless." Dr. Jones described the trip to the bottom to the press at his Montgomery office. He and his assistants first lowered 120 feet (37 meters) of rope ladder into the pit on Tuesday, January 24, 1939. The entrance was blocked by a huge boulder, with the exception of a space some 4 or 6 feet below the lip. The pit was dark enough that an electric torch was needed. Reaching the end of the ladder and seeing only blackness below, Dr. Jones got off on a ledge and shouted topside for another 60 feet (18 meters) of ladder to be added to the end. Continuing on down, he saw the ladder still lacked several inches of touching the floor. He described the room at the bottom as 12-feet wide by 60-feet long, with a 20-foot long bridge connecting two shallow holes at either end. The bottom was perfectly dry. From this day to the present, no one has been certain they have ever found the pit that Dr. Jones described, but everybody has a theory about where it is.

Dr. Jones filled out a report form for Kelly Natural Well after his initial descent. He gave a location on the west side of King Mountain within a 40-acre (16-hectare) square area. The pit was described as "A deep fissure on joint plane…straight down…on slope of mountain, Gasper formation…a few stalactites and stalagmites, wet in the bottom, rocky floor, length 57 feet, average ceiling height 160 feet, and a rather remarkable place – raining –not totally dark in the middle of the day. That is unusual." This area was scouted several years ago and no pit was found. The redraft of a profile sketch drawn by Dr. Jones shows a rock trap door lid covering part of the rim, which agrees with the newspaper article description. Various theories as to the "lost" location have been put forward over the years: that it is still lurking on the mountainside, that the quarry on the south end of Drake Mountain destroyed it, or that it is the same pit found in 1966 and named Lemon Drop (AL 690) (that pit was covered over by the quarry in 1996). There is yet a fourth theory, discussed below.

Drake Mountain Dome (AL 1589) was reported in March 1974, and mapped in August 1974 (Figure 6). It is located about halfway up the northwest side of Drake Mountain and 3,600 feet (1.1 kilometers) south of Kelly Cemetery. The map profile shows an uncanny resemblance to Dr. Jones' drawing of Kelly Natural Well, with the exception that the trap door lid over the top of Kelly is missing and the estimate for the earlier pit's depth is 20 feet (6 meters) deeper. There is a large slab of rock lying on the slope near the top of Drake's north end that conceivably could have once covered the north end of the drop.

The mystery around the identity and location of Kelly Natural Well extends to the geological realm. As noted above, the pit at the location of Drake Mountain Dome (possibly Kelly Natural Well) is a bit unusual in that its entrance is well below the elevation of the Hartselle Sandstone-Monteagle Limestone contact where many of the caves on Drake Mountain are located. Consistent with that, the original ACS report form prepared by Dr. Jones in 1939 indicates the pit is in Gasper (upper Monteagle) Limestone. However, 29 years later, Kelly Natural Well is described in *Caves of Madison County, Alabama* (Jones and Varnedoe, 1968) as being near the top of the west slope of Drake Mountain (not halfway up) with its entrance in Bangor Limestone. According to Raymond (1999), Bangor only crops out on the top of Drake Mountain at one location on the east side above an elevation of approximately 1,170 feet (357 meters). Raymond did not map any other Bangor outcrops on the mountaintop although the west side reaches elevations above 1,200 feet (366 meters) in several places. One would presume that Dr. Jones, the Alabama State Geologist, Madison County native, and first author of *Caves of Madison County*, Alabama, would not mistake the very distinctive sandstone and overlying limestone for anything but Hartselle and Bangor almost literally in his back yard. And so, the mystery continues.

Matthews Cave (AL 23)

Matthews Cave, named for a former owner, was on farmland that was purchased by the government in 1941 to become part of the war's munitions arsenal. The field on the east side of the cave was used for troop training and a trench was dug from the field to one of the entrances to drain off water. The main passage runs about 550 feet (170 meters) south and 750 feet (230 meters) north of the main entrance. When US 72A was rebuilt as I-565 in 1990, the highway was relocated to the south and built over the top of part of Matthews Cave. The highway department constructed a bridge over the passages, but several steel beams pierced the cave, with one deflected by the cave floor horizontally and driven into the cave passage for a distance of 60 feet (18 meters). Since September 11, 2001, access to military property has been tightened and it's become much more difficult to enter the base to visit Matthews Cave.

Much of the cave is a single, linear joint controlled passage in a north-south-trending ridge about 40 feet (12 meters) above the adjoining field. Jones and Varnedoe (1968) report the entrance is in Warsaw (lower Tuscumbia) Limestone.

Natural Well (AL 5)

Located on Monte Sano within the state park boundary of the same name is a vertical shaft 191 feet (58 meters) deep (Figure 4). Natural Well was known to area residents just prior to the Civil War. The first descent was made in a bucket lowered by steel cable and winch by Jackson Lines—this after Joseph R. Scrimshaw, architect for the Monte Sano Hotel and whose idea it was to descend, got cold feet! Scrimshaw did descend after Lines made two descents. Dr. Jones and two others descended the well in 1927 on several sections of rope ladder attached together. High canyons and crawl passages run east and then south totaling 1,150 feet (350 meters), connected to three major domes. A persistent rumor that refuses to die is that ducks tossed in the pit came floating out Big Spring over 3 miles (5 kilometers) to the west. This story, although impossible, traces its lineage back to a diary entry written in 1895 (Varnedoe and Lundquist, 2005).

Natural Well has been a popular destination of vertically minded cavers since the late 1960s when single rope techniques were perfected. When the Huntsville Grotto announced in January 1967 it was providing patches for

Figure 6 - Lin Guy peering into Drake Mountain Dome (AL 1589). Photo: Tom Whitehurst

cavers who successfully descend and ascend eight of 10 specified pits, Natural Well was the first one on the list (Mitchell, 1967). Unfortunately, it has been the site of several accidents involving people not proficient enough to tackle pits of this depth. In 1984 a weekend visitor, who was not a caver, fell to her death while throwing rocks down the well.

The entrance of Natural Well is in the upper portion of the Bangor Limestone and is one of TAG's classic open-air pits in appearance and origin—the cave contains a series of tall domes, one of which has breached the ground surface. The stratigraphy within the cave as reported by early investigators presents a conundrum: Jones and Varnedoe (1968) indicate that the cave penetrates the Hartselle Sandstone significantly above its maximum depth; however, with the entrance elevation at 1,350 feet (411 meters) and a total depth of 279 feet (85 meters) (corresponding to a bottom elevation of 1,071 feet [326 meters]), this puts the bottom of the cave well above the Hartselle horizon projected to be present at an elevation of 1,040 feet (317 meters) based on surface mapping. Hartselle Sandstone outcrop elevations shown on Sanford, Malmberg, and West's 1961 map in the area near Natural Well were field checked and confirmed by the authors in March 2014.

Shelta Cave (AL 4)

Shelta Cave is located 2.25 miles northwest of Big Spring Cave. It consists of a series of large rooms, some several hundred feet (more than a hundred meters) wide, interconnected by smaller passages. Rooms or passages extend beneath several streets and homes 800 feet (244 meters) east and 1,360 feet (415 meters) northwest of the entrances. During wet periods, lakes cover lower areas; dye traces have shown a connection with Brahan Spring in a city park over 3 miles (5 kilometers) to the south. These ponds and other areas are an important habitat for blind fish, blind crayfish, cave shrimp, a neotenic salamander, beetles, and bats. Two nearby residents drilled wells, no longer in use that pierced the cave and continued down into the cave floor rock strata.

Two pit-like entrances are located next to each other about 300 feet (90 meters) from the Cave Avenue NSS Office building. The cave was named by Henry M. Fuller for his daughter, Shelta. He developed the cave as a tourist attraction in 1888, installing electric lights—perhaps the first in the town—and building a dance floor in the largest room, now known as Walter B. Jones Hall. In 1968 the NSS, with help from The Nature Conservancy, bought the property that includes the entrances and established it as a nature preserve. A gate constructed from an old jail door was built at the entrance but has been replaced by a fence to encourage bats to return. This has proven successful (Varnedoe and Lundquist, 2005).

Shelta Cave is projected from Raymond's (1999) and Sanford, Malmberg, and West's (1961) geologic maps of the Jeff and Huntsville quadrangles, respectively, to be in the uppermost portion of the Tuscumbia Limestone. A typo in Caves of Madison County, Alabama (Jones and Varnedoe, 1968) erroneously refers to the entrance drops as being 200 feet (60 meters) deep—the depths are actually 20 feet (6 meters). The cave is developed in a small ridge of Tuscumbia Limestone that provides some separation between the ground surface and the water table; however, according to Jones and Varnedoe (1968), water levels in the cave can vary seasonally up to 30 feet (9 meters).

Varnedoe Cave (AL 660)

Located on the east side of Green Mountain, Varnedoe Cave was first descended on November 28, 1965, by Bill Varnedoe, Bill Cuddington, and a third caver (Varnedoe, 1966). It is a four-drop cave, 290 feet (88 meters) deep and 2,716 feet (828 meters) long, with a number of climb downs that don't require rigging. The pits are now listed as 73, 20, 41, and 70 feet (22, 6, 12, and 21 meters) deep following a Grade 5 survey of the entire cave in 2007; original reports listed the pits as 90, 20, 60, and 110 feet (27, 6, 18, and 34 meters) after a pace and compass survey was conducted in 1966. The second drop can be bypassed by crawling around Nut Loop, so named for the debris left behind by some critter that somehow made it up and down the first drop. Although there are few side leads, many are very tall dome complexes, with one side lead in particular taking the water from the surface sink that is located adjacent to the original entrance. There is also a second entrance drop of 115 feet (35 meters) that in recent years was dug open. Both entrances can be rigged all the way to the Fox Skeleton Room.

Varnedoe Cave is fairly unique in the Huntsville area as its entrance, in Bangor Limestone, is low enough on the mountain and the cave is deep enough (290 feet [88 meters]) that it may penetrate Hartselle Sandstone. That said, the Hartselle may be very thin or absent on the east side of Green Mountain (Sanford, Malmberg, and West, 1961). A glance at the cave map strongly suggests joint control of passages in the familiar north-south orientation common to caves on Green Mountain. Prior to discovery of the new extension in Walter B. Jones Cave, Varnedoe Cave was the longest in the city; however, it is still the deepest.

Walter B. Jones Cave (AL 121)

Walter B. Jones Cave was originally named simply "The Sinks" by Dr. Jones who went there in 1946. He described the entrance as almost straight down, in crevices, and noted that it swallows all the water that falls into the area. He indicated that the passages were 2.5 feet (75 centimeters) high and 335 feet

(102 meters) in length. In 1967 the cave name was changed to honor Dr. Jones, who founded the Alabama Cave Survey in the 1930s. The 1986 map shows a 19-foot (5.8-meter) climb down entrance leading to several hundred feet (more than a hundred meters) of 1 to 2 foot (30 to 60 centimeter) high crawls. After a stream enters from the right the ceiling abruptly shoots up to 15 to 40 feet (4.6 to 12.2 meters) high for a couple hundred feet (about 60 meters) before dropping into another low passage over a 10-foot (3-meter) waterfall. Next to a 30-foot (9-meter) dome, the stream enters a miserable low spot that wasn't pushed any further at the time. In 1986, the total mapped length was 1,524 feet (465 meters); however, recent exploration extended its length to over 4,000 feet (1.2 kilometers). If this number is confirmed by mapping, this will make Walter B. Jones Cave the longest in Huntsville.

The cave entrance is in Bangor Limestone. Jones and Varnedoe (1968) indicate that the mapped part of the cave is narrow, vadose-cut canyon passage. A brief description of the newly discovered portion of the cave indicates that it is alternating tall canyon passage and crawls.

One could write a lengthy book about the caves in or near the city limits of Huntsville. This has been only a sampler of some of the better-known ones.

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The Amazing Fossils of the Union Chapel Mine

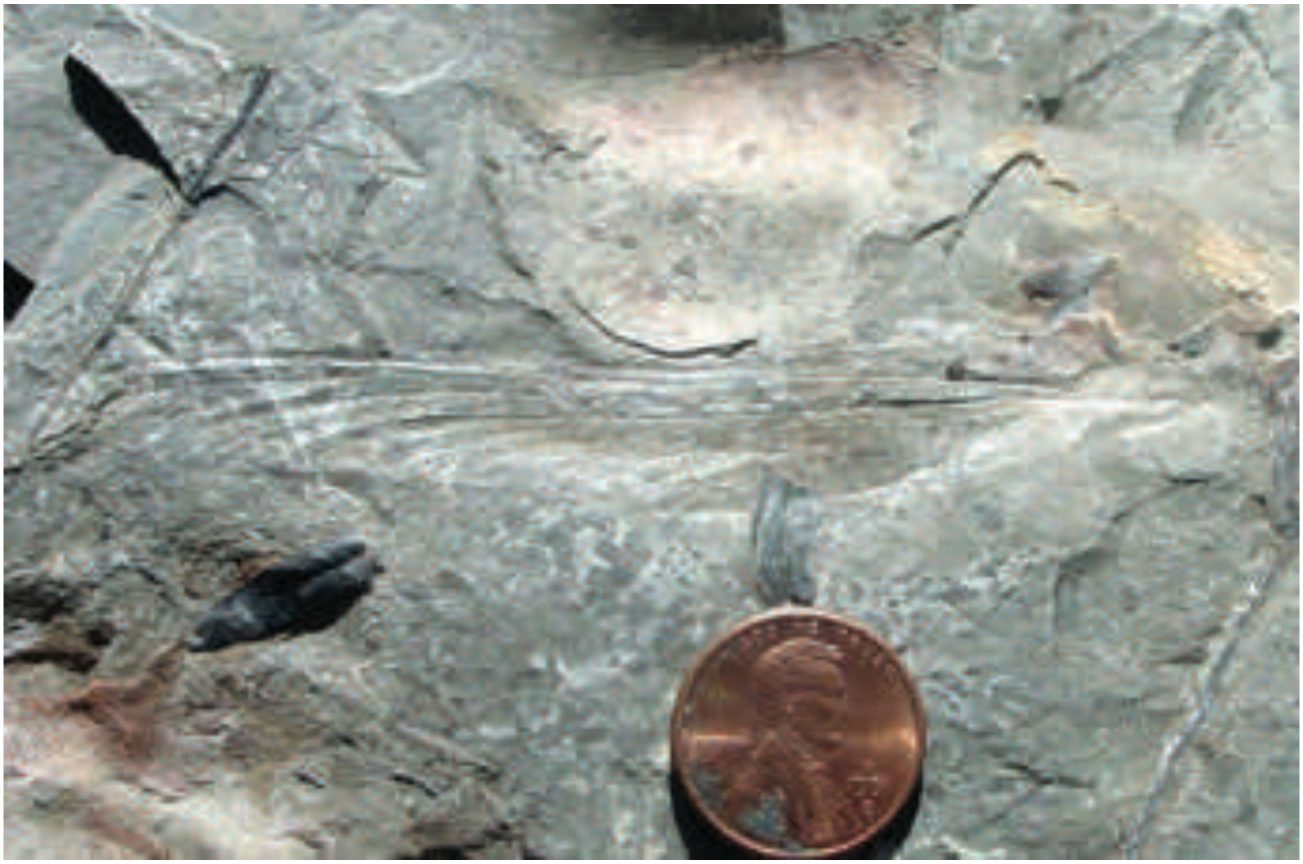
Nick Schaer, NSS 37648 FE

Small amphibian track way with central tail drag. Photo: Prescott Atkinson, M.D.

Nick Schaer is a Program Development Geologist, with the West Virginia Division of Environmental Protection.

Amazing fossils are being found at a recently active coal mine in Walker County, Alabama. The Union Chapel Mine in the northwest corner of Alabama, just east of Jasper, has turned into one of the most important fossil discoveries in North America. In the overburden above the Mary Lee coal seam, thousands of footprints and other delicate trace fossils have been collected, photographed, and cataloged. This mine is in the Mary Lee seam, the most heavily mined coal seam in Alabama. The Mary Lee is roughly equivalent to the Sewell coal seam in West Virginia, which was deposited in the early Pennsylvanian about 310 million years ago. The Union Chapel Mine is a small contour mine in Walker County. This coal mine was operated and owned by New Acton Coal Company.

Fossils can often be found near coal mines; it is typical to find plant fossils and occasional hard-bodied marine fossils. What makes the Union Chapel Mine so special is the quality and quantity of soft-body preservation and delicate trace fossils preserved at this location. By their ephemeral nature, these fossils must have been preserved immediately after they were created 310 million years ago. In the fine-grained shale above the Mary Lee coal seam, thousands of amphibian and/or



Insect wing from the mine collection of Dr. Prescott Atkinson. Photo: Nick Schaer

reptile footprints and tail drags were found. Along with the footprints, many other delicate structures have been preserved including plants, horseshoe crab prints, fishtail traces, spiders, and various insect wings. The footprints range from just a few millimeters to ones larger than a human hand. The biggest ones discovered may be from an ancient amphibian the size of a crocodile. These large prints have been nicknamed "Frogzilla" by local fossil collectors.

No other Pennsylvanian fossil footprint site of this magnitude has ever been found anywhere in the world. Scientist call such globally unique fossil beds "Lagerstätten" or fossil ore beds. Other famous Lagerstätten found in North America include the Burgess Shale in British Columbia and the Mazon Creek Formation in Illinois. Such unique beds are often discovered in mines and quarries. The famous fossil concretions of Mazon Creek also came from a coal mine, but it was abandoned prior to 1977. This was before coal mines were required to be reclaimed by the law and regulations. This is the first time any such fossil site has been discovered on a regulated modern surface mine.

I first visited the Union Chapel mine in 2003. I visited the site with members of the Alabama Surface Mine Commission and then a day later with the Alabama Paleontological Society. My wife and I spent about three hours looking through the spoil at the site. In that short time period we both found several fossil footprints in the loose shale at the site. We also found many finely preserved leaves, seedpods, horseshoe crab traces, and what appears to be an insect wing. I have looked for fossils in hundreds of coal mines across West Virginia

The Union Chapel Mine, New Acton Coal Company, Inc., SMA # P-3778, Walker County, Alabama. Photo: Nick Schaer and have never seen any such fossils. From an avid fossil hunter's point of view, it was simply an amazing day. One 12-year-old girl found her very first fossil ever, a beautiful set of amphibian footprints, the find of a lifetime.

Unlike historical sites, wetlands, and endangered species, there are unfortunately no laws written to protect unique natural resources like fossils. No active coal mine with such spectacular fossil preservation has ever been found in the United States. If this site were to be reclaimed by standard practices, a world-class fossil site would be lost. Thanks to a lot of hard work, this site is being preserved. We returned in March 2005 to attend the official dedication ceremony for the site. More than 200 people, along with several TV stations and the local and national press, were there. Speakers included representatives from New Acton Coal Company, the state parks, the Alabama Surface Mining Commission, and a congressional representative. Now the Steven C. Minkin Paleozoic Footprint Site, this recently active surface mine site is owned by the Alabama State Lands and the Department of Conservation and Natural Resources.

After the ceremony, the mine site was opened for fossil hunting. In less than two hours of searching, my wife and I found half a dozen fossil tracks. I also found a fossil shell of an insect never seen before at the site. I left this fossil with the local specialist, so a fossil insect specialist could study it.

Thanks to the hard work of many people, a world-class fossil site will be preserved for generations to come.

A geologic report and more complete information with pictures of the fossils and fossil tracks, is available at http://bama.ua.edu/~rbuta/monograph/.

Lycopod bark impression. Photo: Prescott Atkinson, M.D.

Civil War Lead Mining in Northern Alabama

Dan Brown, NSS 31306

I first became interested in lead deposits in the region when we decided to use the water in Vinsons Cave for our household water supply. Water testing, using both do-it-yourself test kits and laboratory testing by National Testing Laboratories in Cleveland, Ohio, showed the presence of lead in the water. The lead concentrations were variable, but seemed to be worse during dry spells. These tests indicated the need for lead-removal filters on my water system. The cave water system proved to be a maintenance nightmare. The heavy fine silts and biofilms in the cave water constantly plugged up my lead-removal filters, even with the addition of a back-washable filter ahead of the lead-removal filters. The foot valve also washed out of the cave pool during heavy rainfall, in spite of being buried under piles of rocks, requiring frequent trips into the cave to reset the foot valve and re-prime the pump. The low-flow high-pressure diaphragm pump required to suck the water from the cave pool and push it 230 vertical feet uphill to the house had to be replaced often. The 600 feet of signal wire to the cave pool float switches proved to be an effective antenna for lightning that fried my digital pump control circuit during thunderstorms. The system was eventually abandoned and replaced with a modern potable rainwater harvesting system having far less maintenance and orders of magnitude cleaner water. But my fascination with lead in the water remained and I began to inquire about it.

Doyle Myers, a bluegrass pickin' buddy of mine and old-timer who has lived in the area all his life, told me a story that he heard as a kid from a man who was about 100 years old at the time. Everyone called this 100-year-old man, "Professor Hill," due to his lifetime career as a school teacher. Professor Hill was a boy about 7 or 8 years of age during the Civil War and lived in the same house near where the Flint River Lodge hunting club now exists. He told the young boy, Doyle, that a highly productive lead mine was once run by the Confederates in Opossum Hollow on the southern end of Green Mountain, just west of Potato Hill. Practically every day wagon loads of lead mine balls and other lead munitions left the mine, forded a shallow area of the Flint River at the Swift Ford, and passed near his house. When the Yankees moved in to occupy Huntsville, the C.S.A. miners moved all their equipment into the mine, detonated a charge of black powder, and collapsed the entrance shut to prevent it from falling into Yankee hands. Doyle and his young buddies went up into Opossum Hollow looking for the old mine but never found it. What they did find, at around 700 to 800 feet in elevation, was large limestone boulders with lead veins so pure that he could carve it out with a pocket knife. This wasn't galena or lead sulfide, as was mined further south in Alabama, but pure lead. Doyle's grandfather also told him that there was pure lead all in these mountains and that Doyle's great grandfather used to chop lead out of the rocks on Keel Mountain with a hatchet in order to make rifle balls for his muzzle loader.

I told the story to another pickin' buddy, also an old-timer, Tommy Lemley of New Hope, Alabama. Lemley Mountain is named after his grandfather who settled in the area southwest of New Hope. Tommy had also heard of an old abandoned lead mine on Haymer Mountain, near Lemley Mountain, but its location has since been lost. Haymer is also in the limestone layer at about the right elevation for finding lead. In the late 1940s, the known presence of lead and radon in northern Alabama prompted the Atomic Energy Commission to declare the area as being highly likely for finding uranium deposits. A public craze to find uranium erupted with local hardware stores selling Geiger counters. No uranium was ever found and the hunt eventually died off. But this also corroborates, although circumstantially, early lead mining in northern Alabama. There are also stories of Native Americans mining lead in the area, probably for their own muzzle loaders or for bartering with the white man.

Other than local legend among long-time residents, attempts to find written documentation of lead mining in northern Alabama have so far been unfruitful. Given the horrors of Reconstruction and the carpet baggers after the Civil War, maybe this should not be surprising. The locals probably were not all that interested in sharing their secrets with the Yankees. The closest I've come to written documentation about lead mining in northern Alabama is on page 213 of a Department of the Interior United States Geological Survey, Bulletin 606, entitled

Origin of the Zinc and Lead Deposits of the Joplin Region, by C. E. Siebenthal, published by the Government Printing Office in 1915. The author writes:

> The Nashville uplift, the southern continuation of the Cincinnati anticline, is characterized by the same structural relations and practically the same stratigraphic relations as the Cincinnati uplift. Numerous deposits of lead are known in the central region of Tennessee, and some of them have been mined, as is noted by Nelson. Deposits of zinc occur in the area, but information is not at hand as to their location. The Nashville uplift extends into the northern part of Alabama, where lead has been mined near Guntersville, in Marshall County, and near New Market, in Madison County.

Since Opossum Hollow and Haymer Mountain are fairly close to Guntersville, at least as a crow flies, this may possibly be a reference to these two lead mines. Anyway, if you go caving in northern Alabama, don't be surprised if you find veins of pure lead in the limestone. You might even find one of the long-forgotten and highly secret lead mines of the C.S.A.

Chapter 2 Exploration & Survey in TAG

Arctic Rift

Clinton Elmore, NSS 49706

Alfred Crabtree and Clinton Elmore sketching. Photo: Chris Higgins

"This thing is ridiculous!" I turn and say to Katie while starting the 500-foot descent, hiking down into Icy Cove. "I can't believe how huge this thing is!" I say again while continuing to walk down the narrow, untraveled, and barely visible trail. Katie Ingram and I have embarked on another one of my numerous, crazy ideas earlier that morning. I call the activity that we are doing "ridge walking" just like other cavers out there who are looking for new caves. The big difference between my ridge walks and others are that my ridge walks also tend to involve areas that just generally spark my geological curiosity. I was out to find new undiscovered caves for sure, but that was only one of many my motives while hiking, running, crawling, climbing, and scrambling through the often very harsh woods of Middle Tennessee.

As we reach roughly 1,700 foot elevation, down from the starting elevation of 1,900 feet, a number of sizable hillside springs start to appear. To anybody else, these springs hold no significance, but these springs tell me what rock layer we are currently in. At this point I mention to Katie, "We have reached the bottom of our first limestone layer; a 70-foot thick isolated layer up at the top of the Pennington Formation." Katie is unusual, in a good way, as she is enthusiastic concerning rocks, elevations, geology, caves, water, and other topics that usually are considered boring by any normal person. She is also unusual in the fact that she is going along with and is actually enthusiastic about the idea of hiking down into a massive, 500-foot deep plateau sinkhole for one of our first dates together. "It's going to be a beautiful day; much too pretty to be underground; and these plateau sinkholes do have a bizarre natural beauty to them too," I had told her earlier that day.


ARCTIC RIFT
SURVEYED PASSAGES
NOVEMBER, 2013
Terminal Breakdown
Icy River
Entrance
Icy River
N
0
100
200 ft

Three hundred feet goes by and we finally reach the bottom of the massive sink and things instantly start getting very weird. We have been following these streams down into the sink ever since we passed by the isolated layer of carbonate rock from which they emerged. But, once we reached the bottom one stream disappears into a rock shelter 30 feet to our right, and the other stream flows into a huge dirt funnel to our left, then disappears. "Huh, that's weird!" Katie comments. "These massive sinks are very weird places," I respond. I then go check out the obvious rock shelter next to the trail; it ends after only 43 feet. "Doesn't qualify, it would need seven more feet of passage to be able to turn it in as a cave" I say to Katie. "I want to start walking to our left while staying somewhat on contour and start looking for anything obvious." We walk a couple thousand feed before we reach another sinking stream. This stream has some interesting sinks, one requiring rope to explore.

Clinton Bolting. Photo: Chris Higgins

I tie the rope around a nearby tree and throw it down into the pit-like sink. Katie states, "I'm going to look around this area for anything else while you go down into that little hole." She starts looking around in the general area while I check it out. After five minutes, I climb back out dirty and defeated, "Nada", I said to Katie. "How 'bout you, did you find anything?" I ask her. "There's some interesting looking little holes over here but they would require digging; it's probably nothing though." She didn't sound super enthusiastic about her new holes, so we shifted our focus to the sinking stream itself. We both gravitate to where the stream disappears. I look at a partially hidden, mud-and-rock, walled hole in the stream bank, directly above where the stream sinks. I first stick my hand up to the hole to feel for airflow; it feels like a leaf blower blowing cold, moist air. "This might be something interesting!" I excitedly told Katie. I look down into the hole and feel a very strong breeze of the cold, moist air hit my face. I start looking around. I see what looks like a 15-foot deep, clean-washed, canyon passage. "Sweet!" I think to myself; then I look beyond the canyon and all I see is a wall of white water "Well, at least I know where the stream goes now," I state with less enthusiasm, due to the cold temperature that day. The prospects of getting an impromptu shower courtesy of this freezing cold mountain water didn't sound favorable to me. "All I see is one tight crack, and freezing cold water everywhere that I'd very much like to avoid," I yell back to Katie, "Wimp! Ha, Ha!" she responds.

I start digging out this tight dirt and rock hole until I can finally squeeze into it. I rig the rope and go for it. "This has got to be one of the more awkward things I have done while on rope," I mumble to myself. I have to crawl backwards uphill into the hole and then belly crawl over the lip of the 15-foot deep canyon pit, all while avoiding the large waterfall that covers the entire right wall of the 5-foot wide canyon pit. I squeeze through, first with my feet, then my stomach, and then my chest, "Well, so far so good," I thought. When I finally reach my helmet, though, it gets wedged. I can't really reach the clip of my now stuck helmet without a fight so I try to move it around in the hopes of finding a way to fit it into this miserably tight hole. "Well, this is stupid," I say trenchantly; which, after a few minutes of being stuck, progresses to,

Alfred Crabtree in the downstream walking passage. Photo: Chris Higgins

"If I do die someone better name this damn thing after me and it better qualify as a cave!"

Finally as I start feeling like I was getting choked by a very weak person, I finagle my hands up to unclip my wedged helmet. While doing this a massive amount of dirt goes down my shirt and into my hair; this is the exact thing I wanted to avoid in the first place. I finally rappel down into the canyon below with my now unstuck cave helmet in one hand and rope in the other. At the bottom I put my helmet back on and finally look around. Straight in front of me is a 12-foot tall, washed canyon passage that I choose to venture down first. This 1-foot wide canyon passage leads me into a small room with a 3-inch wide, joint crack directly in front of me. "Well that's 20 feet," I mumbled to myself, "only 30 more to go." I go back to the bottom of the 15-foot entrance pit. By now I'm starting to realize that this room is a swirling mess of cold saturated air. I look to my left and there is a tiny passage half full of dirt directly above the opaque waterfall wall. "This passage looks pretty bad; I'll come back in dryer times to dig it out and see where all this air comes from," I think to myself, "Until then, though, I have the rest of a massive sinkhole to explore." I climb out of the very tight entrance, which isn't actually too bad on the way out, and then proceed to mark the details of this new lead on my GPS and continue walking the sink with Katie, enjoying our weekend date. On the long drive home I thought about the exciting findings that day. This motivates me to walk the rest of the 2-mile long and 1.5-mile wide sinkhole looking for the ever elusive "Big One" or the big, undiscovered cave system that has to be under this massive sink. Later on, the small cave I attempted to explore that day would be qualified, pushed, surveyed, and explored well beyond the spot that I turned around at by one of my best friends Jason Lavender; the way on actually ended up being a small low passage that was concealed by the large waterfall. Jason named it "Polar Bear Plunge" in keeping with the Icy Cove naming theme.

Within a week I'm back out in Icy Cove walking again. This time it is just me and nature on my own personal time rather than a date (which really doesn't change too much though). I want to venture the other way around the sink this time since I figured that if that other thing I crawled into has remained undiscovered than something bigger could have been missed as well. This is a large and a fairly inhospitable area to go hiking and looking for caves. I walk a couple thousand feet without much

MOS being stubborn and looking for dry passage to survey.
Photo: Chris Higgins

luck until I reach a massive, sinking river flowing right into the hillside. I sensed that there has to be a big cave here, so I start combing the area looking for anything obvious. After 30 minutes or so of walking, I mark the location on my GPS as a good lead and continue on. I then proceed to walk around a thousand feet before reaching another large sinking river. I first climb up on to the hill behind the river since this is usually where cave entrances, if they exist, can be found. As I crest the hill, I see a line of large sinkholes directly behind the sinking river, so I follow the trend of these sinks, assuming that they were on a large joint fracture and that there may be an open pit in one. I follow the line of sinks for only 250-feet before finding myself staring off into a huge, rift-shaped pit. The rift that lies before me is around 5-feet wide and 25-feet long; I pull out my GPS. "This has to be a known cave; this can't be new, it's too obvious," I say to myself as I look all through the Tennessee Cave Survey data files, scanning for any known cave located in Icy Cove.

Nothing comes up, so I look again. "I must have missed something; this is a huge pit and someone has to have turned it in to the TCS," but nothing comes up again. The next order of business, after a large amount of cussing in disbelief, is to throw a large amount of rocks down into the pit to gauge its depth. As I throw one, it hits what sounds like a ledge part of the way down and then I hear it fall even deeper and then down a slope of rocks. I throw another and another, and I finally start getting a feel for how deep the pit is. Some of the rocks go down even further than the slope so I figure that there must be a second drop. At this point I'm getting very excited but have to leave it for now and come back with others to bottom it. I walk another thousand feet past the pit not finding anything else of interest but I am not complaining; it was a good day!

Despite the good-looking pit that I had found in Icy Cove, I get sidetracked for a few months with other really good leads. Finally I manage to get a trip planned for pushing this new Icy Cove pit. I enlist Marion O. Smith, Jason Lavender, and Anne Elmore (my Mom) to come on my exploration trip of the rift-shaped pit. We reach the sink and do the mile of hiking to reach the pit. I throw the rope around a tree and proceed to hammer loose rock at the lip of the pit. I then rappel down the pit. I go down 30 feet, passing by the ledge that the rocks where hitting, and then rappel down 30 more feet before reaching a large room that looks like it will lead to the main part of the cave. I get off rope, even though the shaft continues down with much smaller dimensions for what looked like 30 more feet. I then move the extra rope out of the fall zone, untie the knot, and then yell, "Off Rope!" only after getting out of the fall zone myself.

The rest of the group follows me down the pit, one by one. I mention to Marion, "This may be it...this may be the way to finally reach the big cave that drains Icy Cove." He returns with, "Don't count your chickens before they hatch." Marion is of the belief that you find whatever you are unprepared to find. He often refuses to bring extra rope to push a cave because as he puts it, "The more rope you bring the fewer pits you will find." And in the same vein, Marion believes that, "If you pretend to ex-

Brian Killingbeck being surprised by virgin borehole. Photo: Chris Higgins

pect the cave to end right around the corner then it should keep going just to spite you." This is Marion's theory when it comes to finding virgin cave.

I instantly start checking out the most obvious way to go, while Marion races to check out the driest passage he can find. I crawl through drippy breakdown in a funnel shape opening that leads to a nice, dry, walking-size, canyon passage that's 3-feet wide and 12-feet tall. Three hundred feet of walking passage later, I turn around in going passage to go back and see what Marion found. When I climb back up through the cold and drippy breakdown funnel, I find out that Marion managed to find a few pits (that we didn't have rope for) and then he climbed into a maze of terrifying breakdown. I carefully crawl in this scary breakdown after him, all the while thinking about how much nicer my going passage was. It's not hard finding Marion since comments like "Why did I wear my doodads, dammit it stuck again!" and "Oh, the horror!" spew from the depths of the loose breakdown maze he is exploring.

While all this excitement was going on in the breakdown maze of terror, Jason and Mom choose the smart option of eating lunch and avoid the ongoing exploration of Marion's scary breakdown passages. I finally convince Marion to come down to the passage I had visited earlier; the same passage that he resisted due to the potential of getting wet in the drippy, breakdown funnel at the beginning. We all finally start down the passage I had turned around in, and shortly beyond where I turned around earlier, we reach a 34-foot deep pit in the middle of the floor. Marion and I try to decide how to cross when all a sudden we hear someone say "I'm already across." We look up to see Jason, who had seemingly floated across with no problem, looking at us and wondering what we were doing over there. I take a short piece of rope out of my pack and toss Jason the end. He ties it securely to a large bolder while I finally find out that the only thing I can do to secure it on my side is to tie a large stopper knot and shove it into a crack in the wall to my side.

While crossing the pit traverse, I hear the sound of what sounds like a large river below, so I look down the pit. I can see that the pit bells out to large dimensions half way down and that the floor of the pit does look faintly like a large river. It's looking more and more like my guess at the beginning of the day is true and that this may lead to the large cave draining Icy Cove. I get very excited to see what is going to happen next, as I venture around every corner of that narrow and dry canyon passage. After a few hundred feet of canyon passage, I pop out on a ledge 10 feet above the floor level of 60-feet tall and 20-foot wide river passage taking off in two directions. I manage to free climb off of the 10-foot ledge and wait for the rest of the group to reach me while studying the passage. Mom soon shows up and takes some pictures. Jason and Marion soon arrive and I decide that I want to see where downstream goes first. I jump into the freezing cold, knee deep, water and instantly get hit with the feeling of needles all over the submerged parts of my feet and legs, due to the cold water. I then start down the passage for around 100 feet before I have to stop and wait for the rest of the group to catch up. "What is taking them so long?" I think to myself after a few minutes; I soon have my answer. Marion, who seems more concerned with keeping his feet dry, rather than exploring the large river passage, is untying and tak-

Clinton, Jeff, and Brian taking a break from a long survey of virgin walking passage. Photo: Chris Higgins

ing his shoes and socks off to cross the river at any place that is deeper than a few inches and then putting his socks and shoes back on after reaching the other side of a deep spot. Marion repeats this process every 30 feet down the river passage. I finally give up on waiting for him and I justify my decision by thinking "Well, he got to explore all the monstrously huge, borehole passage in Rumbling Falls Cave and now is my chance to run down some much smaller but still nice borehole." At this point I could also hear the loud roar of what sounds like a big waterfall in front of me, and hearing this sound helped with my decision.

I start down the passage again and Marion finally gives up on keeping his feet dry and follows, along with Jason and Mom, at normal caving pace down the passage. After 200 feet of borehole, I reach the source of the loud noise; it was a cascade that was a few feet tall over a large, dolomitic clay layer that is most likely the top of the Hartselle Formation. I get very excited, since caves in TAG usually become massive if, or when, they break through the sandstone of the Hartselle Formation. After we venture down 300 additional feet of borehole, the cave runs into a massive breakdown collapse. Jason, Marion, and I start pushing anything along the sides of the breakdown, trying to find a way around the large pile of rock. It starts looking hopeless, so I head back and look at every side passage anywhere near that breakdown pile, hoping for another way around. No success! I then go back to pushing the breakdown again and Jason decides to climb up into what could best be described as "scary." He tries to reach the top of the breakdown pile. No success again! By this time, I'm determined to get through that breakdown, but it's time to call it a day. We leave Icy Cove hiking out through some newly fallen snow back to the cars; we are freezing, but happy and eager to return and explore what will later be the much more extensive upstream portion of the cave. This is also about the time I come up with a name for the cave, "Arctic Rift," and I decide to start a survey, since I understand the cave's geological significance. What makes it very significant is the fact that it is currently the only one of three large rivers sinking into Icy Cove that we can reach underground; thus, Jason Lavender and I both know that Icy Cove will be our main area for cave exploration and that we will be spending a whole lot of time down in that massive sinkhole.

"This seems like a terrible idea; we have to reach Arctic before dark!" I turn and say to Chris as we pick up all of our camping gear, bolting gear, digging gear, and micro-shaving equipment, and head towards the cave for the weekend. Due to access issues, we had to resort to a long hike into Icy Cove and then camping in the cave. Chris Higgins is a Knoxville caver whom I caved with five years ago in The Gouffre, located in Grassy Cove, Tennessee. We had not caved together for five years and then all a sudden we ran into each other at a SERA event and randomly planned a trip to Blue Spring Cave. Chris, along with Jason Lavender, quickly became my core group of caving buddies when it comes to doing any crazy, caving trip ideas we come up with.

"You know we are carrying the same amount of gear that eight normal cavers would carry! We've got to have more than 70 pounds for each of us!" Chris said while laughing. Sometimes I personally find that the only good response to certain ridiculous situations is laughter, and this was one of those situations. Both of us had stuffed an entire, massive army duffel bag full of gear to wear on our backs and a large, expedition size caving pack full of gear to wear on our chests. We hike down to the cave, as the sun fell behind the horizon and the cold crisp air of the winter night hit us. "Do you know if it's supposed to snow this weekend? I forgot to check," I said to Chris. "Yep," he responded. "Figures," I respond back.

We get to the cave, after carrying all this gear down into Icy Cove, right as the full darkness of nighttime hit us. We rappel and pass all the gear down to the room at the 60-foot level of the 89-foot deep entrance pit. Then we attempt to pass all the gear through the breakdown funnel without success. "It won't fit!" Chris said. "Well I guess we could enlarge it since we have all that gear, too," I say while laughing at the absurdity of carrying so much gear that we have to enlarge a squeeze to get into the cave. "Well I guess that squeeze needed enlarging anyways," I said and it does. I bring out the drill and micro-shaving gear and set a few shots, enlarging the opening to allow passage of our army duffel bags.

We go through the funnel passage and continue down the nice, dry, canyon passage to the traverse around the pit. We rig into the newly bolted traverse line and pass the giant packs across; and 700 feet later, we have arrived at our home for the next three days. "This is actually a great place to camp compared to most places in caves," I mention. "Yea, we could dig out bunk beds in this dirt bank near the river," Chris responds. We work on our camping area for a few hours and then eat supper and still have some time to kill. "How about we start bolt climbing those nearby domes?" Chris asks. "Sounds like a plan to me," I respond. I get out all my gear and Chris gets ready to belay me. We go to a nearby dome that may have upper passage and I start climbing. About half way up, we look at our watches and it is bedtime, so we leave a rope rigged to finish the climb another day and go to bed.

The next day both Chris and I sleep in due to the lack of a working alarm clock and are awakened by caver's lights in the distance. Alfred Crabtree, Jeff Bartlett, and Brian Killingbeck were here to start the survey of the upstream passage. We were supposed to meet them at the entrance pit but didn't due to our alarm clock malfunctioning. "Well, lucky they were able to find the right way to go," I say. We surveyed walking borehole passage the entire day and the next day. We gain over 2,500 feet of walking, borehole passage from this weekend alone. This weekend is also the start of our Spring Break, and while most students are more concerned with partying, we are out for virgin cave this spring break. In only a two-week time span, we survey over a mile of cave; and most of it is nice, walking, river passage.

Jeff Bartlett sketching. Photo: Chris Higgins

The cave, after this, seems to be getting more and more difficult to do, but this is mostly due to the extremely difficult access since the neighborhood above Icy Cove wants all people out by dusk; we are politely informed of this after we spend our entire spring break caving and camping down in Arctic Rift. We are taking a slight break from the exploration and survey of Arctic Rift since it is very cold and hard to access in the winter. But, we will most likely start back up soon. The data is held online

Brian Killingbeck rappeling down the 89 foot entrance pit.
Photo: Chris Higgins

in a digital database that everyone who has helped with the project can access; this is done to prevent the data hording that has happened to so many other cave projects.

The core group of cavers working on the exploration of Arctic Rift is: Alfred Crabtree, Chrissy Richards, Jason Lavender, Chris Higgins, Jeff Bartlett, and Clinton Elmore. What's been neat about this project is that it is one of the few major projects in Tennessee discovered and started by cavers of my generation; though, we have gladly included big-name caving legends from past generations of cavers such as Bill Walter, Marion O. Smith, Hal Love, and Joel Buckner to help us survey and explore Arctic Rift.

Rather than secrecy, I have welcomed anybody wanting to help and I've even personally planned out logistics for survey/exploration trips that I was unable to attend. Throughout this project, my only goal is to explore and map Arctic Rift, the nicest cave I've discovered so far, and I'm not picky who gets virgin "booty" or even who is on the survey trips. I just want to see what the cave does and where it goes out of my own never-ending quest to satisfy my speleological curiosity.

Arctic Rift is currently surveyed to a length of 9,740 feet (or 1.84 miles long) and a depth of 152.7 feet. I want to personally thank everyone who has helped out on the exploration and survey of Arctic Rift; everyone's effort has been greatly appreciated.

Clinton Elmore and Alfred Crabtree with virgin cave smiles. Photo: Chris Higgins

Blue Spring Cave Revisited

Bill Walter NSS 2944, LB, FE

35 Miles Surveyed-December 11, 2009 -Robert Oakes, Mike Rogers, Anne Elmore, Bill Walter. Photo: Ken Storey

I am writing this article as a tribute to all the explorers, surveyors, cartographers, photographers, journalists, authors, and landowners who helped Blue Spring Cave become one of the South's most outstanding caves to visit.

We are now celebrating the 25th Anniversary of the year of the discovery of "the rest of the cave." By "the rest of the cave," I mean the 38 miles of cave previously unknown. The original cave is situated only 100 feet from a gravel road, and was well known to locals and their sheep. Dr. Tom Barr visited the cave in 1953 and 1961. In his book, *Caves of Tennessee*, he describes the cave as being a single chamber, 60 feet wide, 6 feet high, and 500 feet long.

In 1988, after a Tennessee Cave Survey meeting, Gerald Moni led a survey trip and mapped 760 feet. They found a blowing crawl that appeared to be too small to negotiate. This lead went unchecked for about a year as Gerald kept trying to recruit the "little people." Finally on June 17, 1989, Gerald led a trip with Joel Buckner, Gary Chambers, and Tamra Kelly, reaching a small area above a crack in the floor. Tamra succeeded in pushing the tight tube to a point where she could see bigger passage ahead and below. On the next trip, Joel asked me to go and confirm what Tamra had seen. We were able to determine that where Joel was waiting was the right spot to begin mining our way straight down into the large passage. This process took three weekends; however, by the evening of Saturday, July 15, the hole was large enough for all to descend. The next day, Tamra Kelly, Joel Buckner, Greg Johns, Trey Caplenor, Patrick Turner, and I descended the 12-foot drop and explored 1.5 miles of

Gypsum curls-Blue Spring Cave. Photo: Chuck Sutherland

impressive trunk cave with numerous breakdown rooms. This happened about the time of the 1989 NSS Convention, and was kept secret.

Mapping of the cave began in earnest July 22, 1989. Three teams managed over a mile of nice trunk interspersed with breakdown, later named Johnson Avenue after one of the landowners. Eleven more survey trips added another 13,500 feet bringing the total length of the cave to 3.755 miles. The big question was "Who was going to draw the map?" Jeff Sims had mapped Xanadu, and he offered to take it on as a project. Hopes were dashed when Jeff moved to Oregon in 1990.

I continued to grab whoever was willing to continue the survey. Our going leads were heading upstream to a large sinking cove called Pass Cove. As expected, the cave ended in breakdown at the edge of the cove. The only lead left was the FC survey, a small sinuous passage with a wall to wall pit at FC77. James Wells led a rather precarious traverse, and we had run our survey out to FC 122. On February 18, 1990, John Smyre, Joel Buckner, and I tried to finish the FC survey.

However, the traverse at FC77 almost claimed Joel; he was lucky to hang on to a rope I had placed across the pit, as I grabbed his collar and helped him back on the ledge. Any further plans were aborted at the time in an area that is now called "Fear Chasm."

This folly proved to be the turning point as we retreated from Fear Chasm and went to survey a crawl heading back towards the entrance. The 4-foot by 4-foot crawl soon deteriorated into a low belly crawl and appeared to end in fill. I dejectedly squirmed to put the final station on the ceiling at the furthest distance and prepared mentally for the trip out of the cave. The flame on my carbide light was so feeble, I couldn't mark the ceiling, so I shook it hard, to get that last squirt of flame to finish the job. For a brief second I thought I saw darkness above where I was trying to put the station. Then my light went out. "Hey guys, I think I saw blackness above me," I exclaimed. The only part of blackness they would accept was the fact that I was in front with no light. I managed to get my light going and stood up, shining the lamp directly on my feet. Now all they could see were my boots. Seeing is believing and they came through. Joel scouted ahead and came back with somewhat disappointing

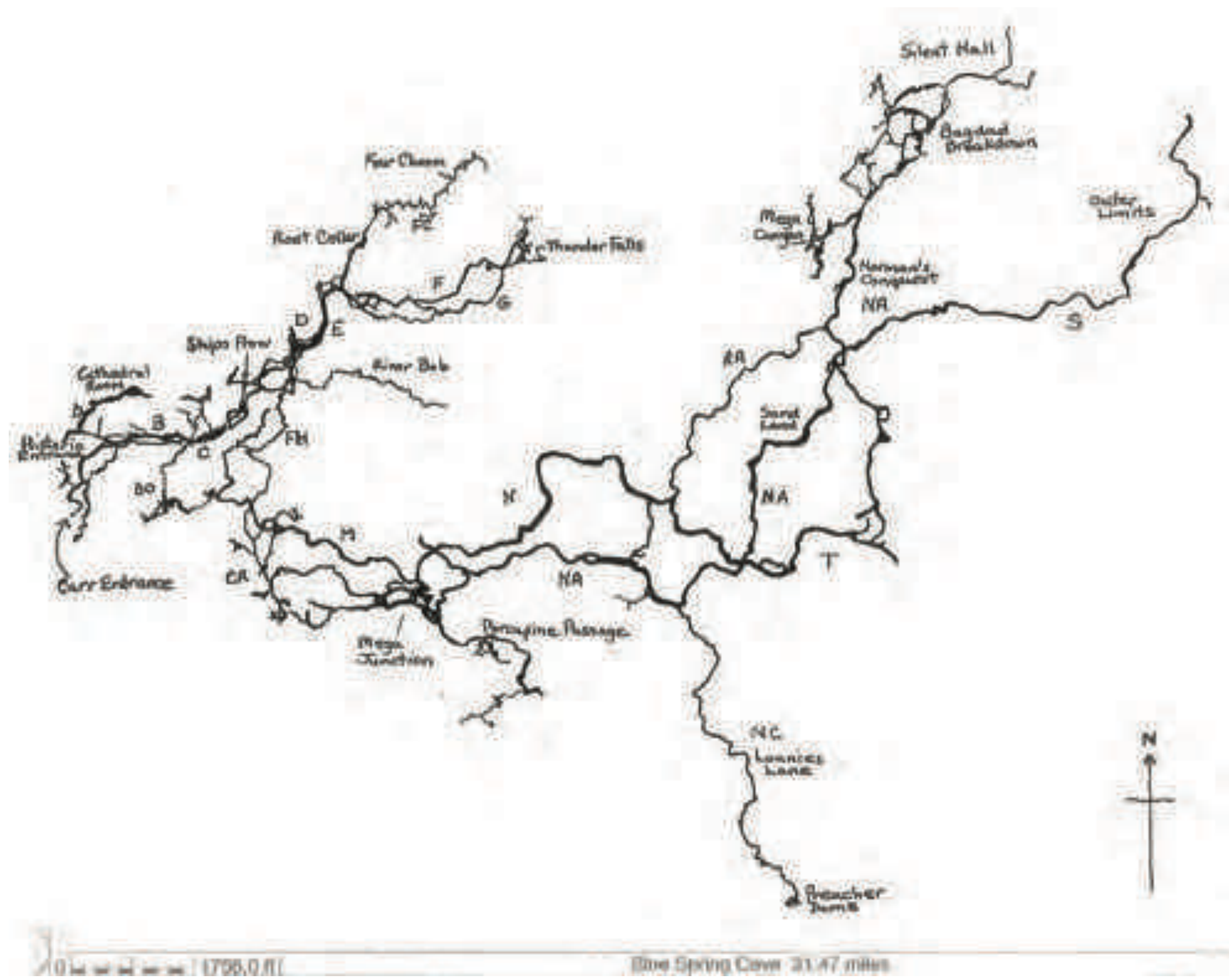
The Monnscape-Raft Cones in Blue Spring. Photo: Chuck Sutherland

news of lots of breakdown, but still-going passage. We figured we were somewhere under Buckner's Borehole, and trending south almost 180 degrees of the direction from FC. The next survey trip yielded 1,440 feet and got us through the breakdown into 4-foot high by 12-foot wide damp tube.

March 18, 1990, was a significant trip for some of us. After surveying 714 feet of pleasant alternating walking and crawling passage, I informed the crew I would have to leave to check on a cow due to calve. They were to continue the survey. Problems arose over compass agreement, so the survey was aborted and exploration began. After about 700 feet, the FH survey popped out into a large trunk passage now known as the M survey. Joel Buckner, Paul Alexander, and Jeff Noffsinger had found the way. They strolled down this splendid borehole for almost a mile, admiring scattered gypsum deposits and noting many leads. A survey trip followed on April 7, and netted 4,666.6 feet of explored cave from the previous trip. Pushing through about 50 feet of low crawl led the cavers to a large room known as "Mega Junction," with even larger passage going in several directions, including a stream trunk that we assumed would lead to the Blue Spring resurgence.

On April 28, 1990, it was obvious the word was out. The number of cars lined along the road near the cave entrance was bound to attract attention. We had 12 people wanting to survey, and when we arrived at Mega Junction, each group of four people had a nice virgin borehole to survey. The totals for the day were 143 stations yielding 10,412.2 feet. As we say in the vernacular, "It doesn't get any better than this."

In May of 1990 one of the landowners, Lonnie Carr, had seen the activity and wondered what was going on. I received Lonnie's phone call and was expecting the worst, but he was both curious and positive about our actions. Lonnie had visited the cave as a young boy and having been in the blowing crawl had wondered where the air came from. Needless to say, I invited him to see more. Because it would be Lonnie's first trip, I planned a short trip. I remembered a crawl that we had not pushed in July of 1989. My idea was to let him experience virgin cave. Gary Chambers and a friend just happened to be at the entrance and joined us. The crawl got low, but hit some breakdown. Gary said he would check it out. To



our good fortune it led into a large trunk segment. The gravel floor was devoid of footprints. Lonnie was very hesitant to go forward and make those first tracks. But make them he did! One area at the end of this passage was called the "Moonscape," having a strange lunar look to it. The other end was blocked by a massive flowstone choke.

With over 20 miles of cave surveyed, 1990 was a memorable year in Blue Spring Cave exploration. Twenty-plus-hour trips were becoming the norm. Walking through miles of trunk to get to those remote surveys was becoming tedious, rather than exhilarating when experienced for the first time. The long crawls and sand were even worse. I think Lonnie wondered what he had gotten himself into. But, he was game and endured many long trips.

The late Mike Yocum had taken over the data and kept us up to date with line plots. The most obvious way was the NA survey. The NA was the abandoned, dry, upper level above the main river trunk. There are three river crossings; otherwise it is mostly its own entity. The part of the NA survey known as "Sandland" is a half-mile walk through deep sand that torments the leg muscles. The NA finally gets low ("Norman's Conquest") leading into breakdown. Expecting the end, the survey team of Mike Yocum, James Wells, and Bill Walter were very surprised when they crawled up into Mega Canyon, a 60-foot high by 20-foot wide passage. The south end of Mega Canyon ended in breakdown, and the northern portion had a lot of dry, silty sand that caused us to wonder about the source.

In November 1990, Dick Market and I pushed a low belly crawl that soon led to walking passage. This opened up the paleo drainage that formed Mega Canyon. Surveyors were rewarded with several miles of new cave including "Bagdad Breakdown," "Silent Hall," and "Kuwaiti Canyon." Silent Hall is one of my favorite places in the cave. It stretches 360 feet, is roughly 40 feet high and 25 feet wide, and is covered in a fine sand that muffles the sound of movement; a place of wonder and contemplation.

Another nice discovery occurred in October of 1990 when Jim Smith bolted a traverse 90 feet above the river at P11, part of Mega Junction. Rigging a rope for the 90-foot climb, he was joined by Frank and Lorie Bogle,

Claire Murphy in the Cathedral Room of Blue Spring Cave. Photo: Chuck Sutherland

as well as Bill Howcroft. Nice borehole passage was surveyed including “Porcupine Passage” and “Tombstone Borehole” as another mile-plus was surveyed. Although the main passage appears to end in breakdown, we think that it might continue.

By March of 1991 almost 25 miles had been mapped in Blue Spring. Cumberland Caverns was listed at 26.7 miles, the longest surveyed cave in Tennessee, and our goal became to surpass that length. This was accomplished by the end of 1991, with a total of 26.98 miles.

In 1992 two major finds were surveyed. Pat Kambesis, John Smyre, and I surveyed the somewhat nasty crawl to the base of “Preacher Dome” at the end of the NC survey. The discoverer, Bob McCormack, was a Presbyterian minister, whom Lonnie Carr referred to as “Preacher Bob,” hence the name of the dome. We estimated the dome to be 65 feet high. I remember a trip where Jack Thomison free climbed part of it and made us all very nervous.

Marion O. Smith took an interest in Preacher Dome a few years ago. On February 4, 2012, Aaron Moses bolted the dome allowing Marion and Elliot Stahl to prusik up the rope. I guess Marion realized the 65 foot height estimate was an underestimated guess with carbide light. In March he came back with Jason Hardy and Kelly Smallwood and surveyed the dome and arrived at a minimum height of 122.421 feet. Good work, folks!

By the summer of 1992, we had pushed the NA all the way to Mega Canyon and had crossed the river three times. What was upstream at the Third River Crossing? In June, Joel Buckner and crew did a 30-station survey of nearly 2,700 feet and the passage continued. Jim Smith, Bill Steele, Laura Campbell, and Frank Bogle pushed the passage adding 71 more stations and another 5,879 feet. Mostly crawling or stooping, it was one of the more difficult surveys in the cave. Named “Outer Limits,” it is definitely not on the “have to see” list.

In December 1992, Joel Buckner and crew enlarged a hole, later called the “Cussing Hole.” This gave them access to “Cascade Hall” and the “Cathedral Room.” Thinking they were the first to enter this passage, they were somewhat disgruntled to find footprints beyond the hole. Unbeknown to them, a thin caver by the name of Mike Stegall had already been there.

Located only 40 minutes from the entrance, the Cathedral Room has become the most popular trip in the cave. Climbing up the steep flowstone slope to access the Cussing Hole is always a source of entertainment. The Cussing Hole does live up to its name—a steep, annoying slope with no handholds or footholds and often lubricated with water from the pool in the next room. But the challenge is worth the effort, as one emerges into beautiful Cascade Hall, with its large pool embedded in rimstone dams and accented by some unusual stalactites. As one looks across the pool, large mounds of flowstone

Jaguar Tracks in Blue Spring Cave. Photo: Chuck Sutherland

rise up towards the ceiling. One can traverse around the pool and get wet up to their knees. But, there is one hole that seems to claim a victim or two on every trip—they end up waist deep in the pool.

The Cathedral Room is a large breakdown room containing some outstanding draperies and veils. There are several pure white stalagmites close to the trail, and above is a colorful, twisting drapery. Further into the room on the left is a 40-foot high wall of multicolored flowstone. Beyond that there are some lovely, delicate curtain draperies. It's a majestic place and a haven for photographers. Well worth the visit!

In 1993 the "River Bob" was discovered by Bob Carver through a small hole in the FH survey. The clear blue water comes up from a crack that appears to be over 10 feet deep and flows down a scalloped passage of walking dimension. The passage eventually becomes a sump after about 1,850 feet, but it has not been determined as to where the water comes from—or where it goes. As it flows to the east and into the plateau, it contradicts the general east/west flow pattern of the main drainage. By the end of 1993 our survey had reached over 29 miles.

In 1994 the first radio location was conducted by Frank Reid; it was successful and helped to support the survey data. In addition, Lamar Hires and Woody Jasper made the first dives into the Blue Spring resurgence during the same year and explored over 1,800 feet.

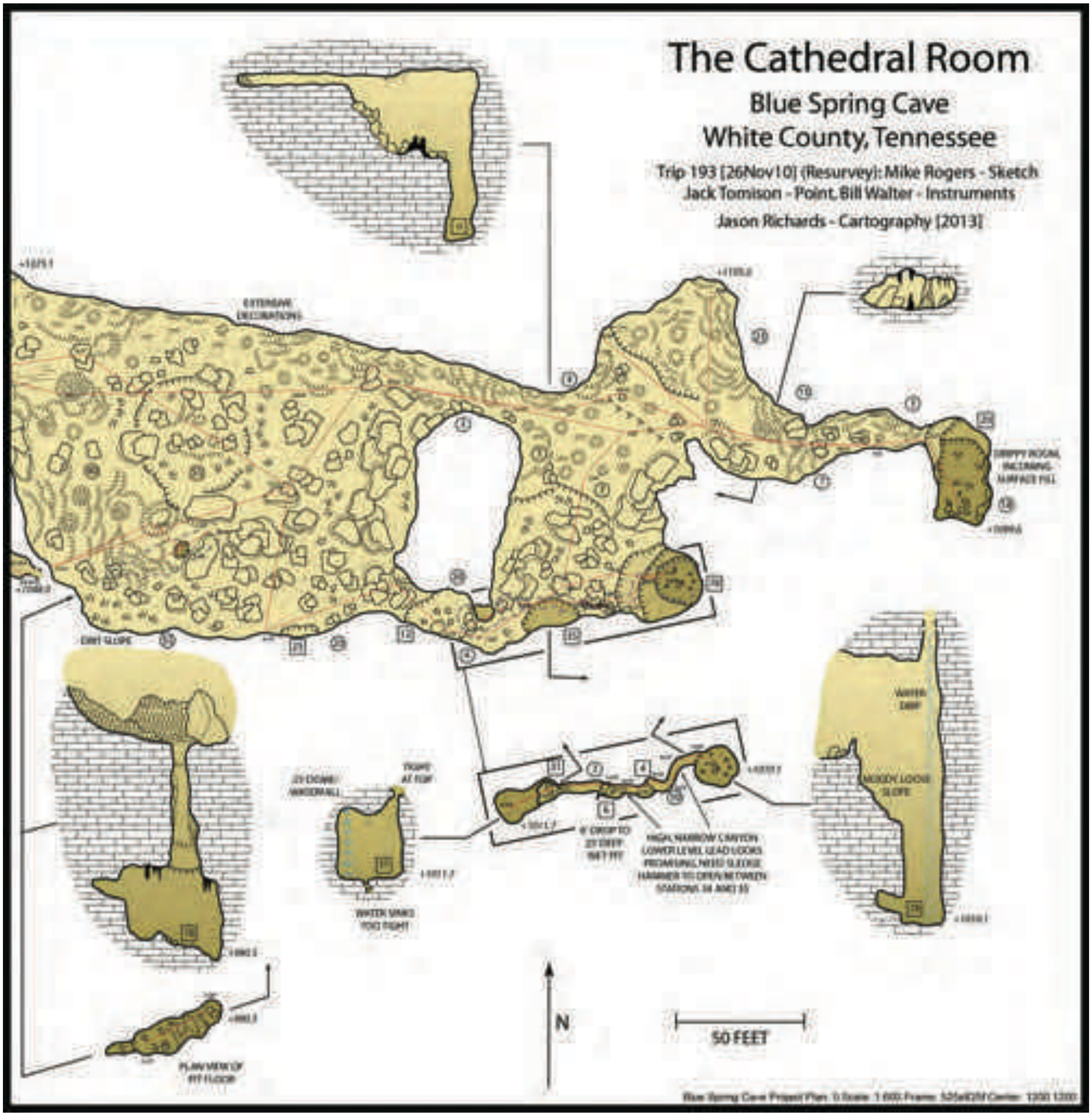
In 1995 Marion O. Smith joined our survey group beyond Mega Canyon. While we labored with the survey, he explored and found "Crashing Spire Pit." Trust him to find a pit 5.5 miles from the entrance! The following trip found the pit to be the deepest in the cave at 150 feet. The survey for 1995 only totaled 0.84 of a mile and we seemed to be running out of cave.

1996 was also a slow year, with only nine survey trips netting about 1,650 feet.

The renowned cave biologist, Dr. Tom Barr, visited Blue Spring Cave in 1997. He came to conduct an inventory of trilobites in Blue Spring Cave, and he gave a short lesson on the collection of cave fauna to an interested group of cavers. Unfortunately, Tom's back problems prevented him from going through the crawl and touring some of the 30 mile extension.

During the period from 1998 through 2000, only six survey trips occurred, mostly mopping up side leads and gaining only 3,500 feet.

In April 2001, a major event occurred when Bob Richards dislocated his shoulder while doing a climb-up on the way to the Cathedral Room. Because the patient was in so much pain, a full-scale rescue was called out. After morphine was administered by an EMT, Bob's shoulder was reset. And even though Bob thought he could exit on his own, he was assisted out by the Chattanooga/Hamilton County Rescue Squad and five other rescue teams. The members of the teams put Bob in a safety harness and secured him onto a horizontal traverse line across the pit. He was then tethered to a safety line as he climbed up the 12-foot ladder and proceeded out the original entrance crawl under his own power. Again, many thanks to all who helped with the rescue. This was the first major accident, and although the rescue was successful, Lonnie realized the difficulty of negotiating the tight crawl between the entrance room and the rest of the cave; consequently he decided to close the cave until another entrance route could be located.


The Cathedral Room
Blue Spring Cave
White County, Tennessee
Trip 193 [26Nov10] (Resurvey): Mike Rogers - Sketch
Jack Tomison - Point, Bill Walter - Instruments
Jason Richards - Cartography [2013]
N
50 FEET

Hansons Crossing. Photo: Tim Curtis

Finding a new entrance was not difficult. The passage below the crawl ending in the 12-foot drop went in two directions: one way to 30 miles of cave and the other to the side of the hill. Under Hal Love's guidance with his radio locater, a promising dig was started, and after 10 feet of excavation, a new entrance was opened. A door from a bank vault was installed in a concrete frame, and the "Carr Entrance" came into existence. However, there was another problem. Several hundred feet of the passage was covered with thick deep mud. The original plan was to go in the old entrance and out the new entrance, with the idea of tracking the mud out of the cave. Of course that did not work, due to human nature, so the mud was going into the cave by way of the new entrance. This problem was solved when Lonnie had gravel delivered, and several volunteers helped to carry and spread it on a newly built trail leading from the Carr Entrance towards the ladder climb below the old entrance.

With the new entrance one would think that the survey would pick up, but not in this case. There were no survey trips in 2001, one trip in 2002, and four trips in 2003; the only significant trip occurred in 2003 when leads at the end of the BO were surveyed by Mike Rogers and me, and added another 800-plus-feet, bringing the length of Blue Spring Cave to 33.35 miles.

Another improvement was added to the cave in the form of a suspension bridge next to "Trey's Traverse." This eliminated the exposure around the 20-foot pit. A joint effort by Lonnie Carr, Jerell Killian, John Osteen, and Steve MacDonnell produced the bridge, and it is now called "Hanson's Crossing" in honor of the late Mr. Hanson Carr.

In the November 2003 two important events occurred. The first was the discovery of jaguar tracks in the MOB survey, where Hal Love put his light close to the floor revealing numerous prints on a hardened mud floor situated off the trail. They had escaped being affected by the many cavers who had travelled past them and had never seen them, because they were under a slightly overhung wall. Secondly, after surveying over 33 miles with only line plots produced by Mike Yocum and Hal Love for guidance, Mike Rogers drafted a working map. Mike took on the challenge with only a few months to complete the task. The deadline became the 50th Anniversary of the Nashville Grotto in November 2013. How Mike was able to decipher 150 survey trips, and draw a great map in so short a time, is one heck of an accomplishment.

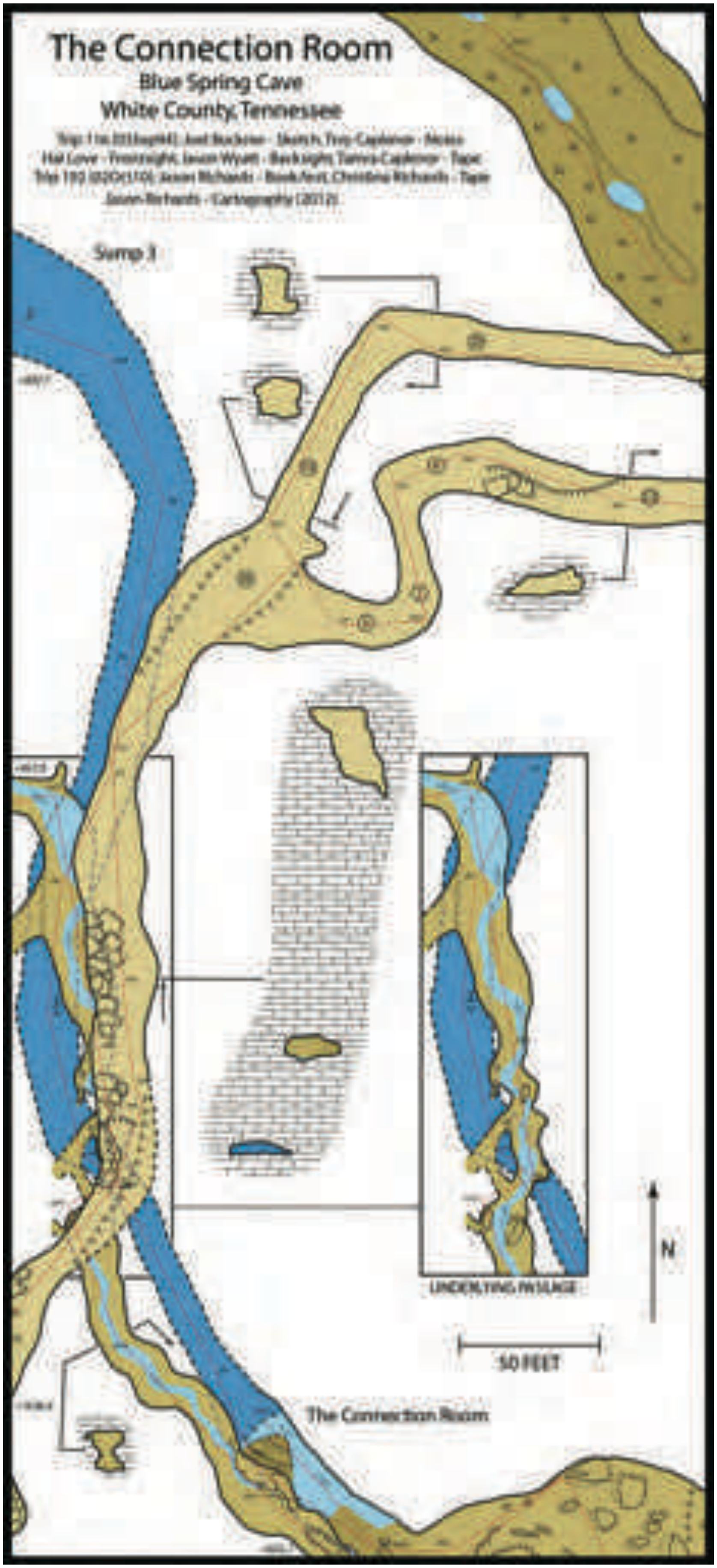
Cascade Hall-Blue Spring Cave. Photo: Tim Curtis

In 2005, Mark Joop, Clinton Elmore, and others started a dig about 10 minutes from the entrance. They dug through 60 feet of dirt that had filled up small side leads. Clinton encouraged his brother, Matthew, to dig a side lead that was still open. Matthew dug through and found the way on! It was a 600-plus-foot belly crawl with numerous tight spots. On the second trip, Clinton found a 30-foot drop where the crawl intersected a tall dome, estimated at 90 feet, and named the “Gamma Dome.” On the other side, a gnarly popcorn crawl leads to two side domes, and eventually to “Clinton’s Hall,” a nice recessional canyon ending at a waterfall. In a shallow pit Clinton opened a small hole, and through a short crawl connected into the BO survey. The total survey, including side passages, was nearly 2,200 feet. The “Joop Loop” may be the shortest route to Mega Junction, but my advice would be to take the standard BO route.

With the help of Cheryl Pratt, Anne Elmore, and her son Clinton, we finally made the 34 mile mark on November 11, 2007. The big question in my mind at that time was, “Are there any major additions to be found?”

Jason and Chrissy Richards were already on the way to answering my question. Recall that in 1994, Lamar Hires and Woody Jasper surveyed 1,500 feet in the Blue Spring resurgence before they were stopped by low visibility and could not find a way on. In 2007, Jason and Chrissy, aided by Marbry Hardin, took on the challenge of trying to connect the Blue Spring resurgence with the dry cave. The first few dives involved repairing the old dive line, and familiarizing themselves with the underwater passage obscured by poor visibility. Eventually they reached the end of the Hires and Jasper dive line. Although the passage appeared to end, closer inspection revealed a 3-foot by 3-foot hole leading into a new passage 60 feet wide by 20 feet high. On subsequent trips Jason, Chrissy, and Marbry surveyed the original line plus another 1,000 feet making the underwater survey at 0.5 miles.

The Richards renewed their diving in the Blue Spring in 2008. Their previous dives in 2007 had approached marginal safety on their available breathing gas, so they initiated stage diving with extra tanks. Jason also took


The Connection Room
Blue Spring Cave
White County, Tennessee
Sump 3
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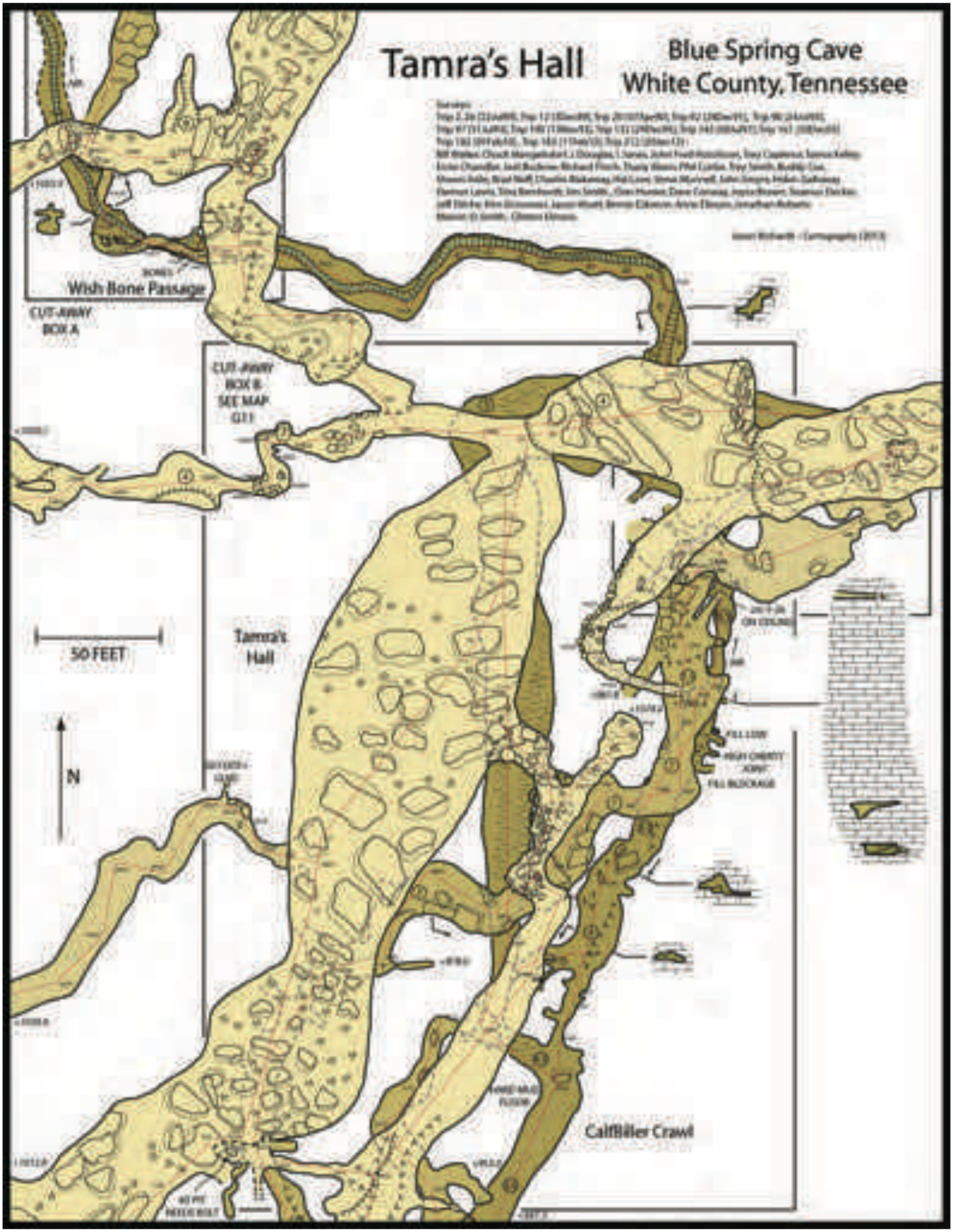
The Connection Room


Tamra's Hall
Blue Spring Cave
White County, Tennessee
Wish Bone Passage
CUT-AWAY
BOX A
CUT-AWAY
BOX B
SEE MAP
G11
50 FEET
Tamra's
Hall
N
CalfBiter Crawl

his homebuilt re-breather as an extension for longer dive time. Unfortunately, they had to turn around 50 feet short of the end of the dive line as both of their primary lights were gone, and they encountered very poor visibility. Jason made a wise decision and they headed out.

One of the main problems in diving the spring was continued poor visibility. Human activity on the surface of the upstream drainage to the spring was causing cloudy conditions in the outflow. Lonnie was in charge of letting Jason know when it was clear and in September of 2010 Lonnie gave the "all clear."

This time everything went smoothly and with better visibility Jason and Chrissy progressed much faster. They passed the end of their previous survey and continued on where they surfaced at a dry borehole passage 8 feet high by 30 feet wide. At first they thought they had connected, but there was no sign of survey. Instead, they had discovered 1,200 feet of impressive passage, which most of us will never see. Later, on the surface, after scrutinizing Mike Roger's map, they confirmed the discovery of new passage.

On October 2, 2010, Jason and Chrissy returned to push and survey the "New Dry Passage." After finishing the survey, Jason suited up to push a small sump. It was a shallow sump and after 200 feet of passage that gradually became smaller, he broke the surface. Jason was "elated" and certain he had connected. He found a blurred survey station that looked like CR, but he did not recognize the passage. Lonnie Carr, Anne Elmore, Clinton Elmore, and I were waiting when Jason and Chrissy resurfaced and the announcement of the connection, as well as their return produced a lot of excitement and relief. I was pleased everything had gone according to plan until Jason said he did not recognize the connection point. Let me explain. Earlier in the year, February 14th to be exact, I led a survey trip with Jason, Anne, and Clinton to survey a lead close to the probable connection area. We took Jason down to the water's edge to show him the passage he would most likely emerge from. We showed him our "welcome to CR" message scratched in mud about 10 feet from the pool. Anne took pictures of Jason looking into the pool and towards the passage. How could he not recognize it? Then I realized if I had been able to do what he had accomplished, I would probably not have recognized it either.

The next weekend I was most anxious to prove a point. Only one other passage was nearby, so Chrissy Richards, Anne Elmore, Clinton Elmore, Doug Strait, and I hurried to check that out. It was not the connection site as it was going upstream. Chrissy and Clinton moved quickly to the suspected connection site. By the time I got there they had found the end of the dive line and a note from Jason. It was now confirmed, and the survey had gained another mile, increasing it to 36 miles.

Somewhere in this time frame, Jason Richards decided to draw a detailed map of Blue Spring Cave with panels. Mike Rogers gave his approval, following up with a very nice resurvey of the Cathedral Room. Sketching to scale was not practiced in some of the previous surveys, so for the sake of accuracy many of the more recent surveys have, in fact, been resurveys. A rough estimate of the number of people participating in the 25 years of survey is 200. To name but a few of the sketchers: Pat Kambesis, Mike Yocum, James Wells, Bill Howcroft, Mike Rogers, Jim Smith, Susanne DeBlois, John Smyre, Jeff Sims, David Parr, Joel Buckner, Hal Love, Don Coons, Robert Hamm, Bob Sergesketter, Jim Borden, Jason Richards, Julie Schenck Brown, Derek Bristol, Mark Joop, Hazel Barton, Johanna Kovarik, Jason Hardy, Marion O.Smith, Keith Filson, Trey Caplenor, Harold Kalnitz, and of course there were a hundred plus on the support teams.

Since the end of 2010 the survey has been predominantly resurvey and mop-up. These 47 trips have added about 2 miles of new survey. Some of the trips were frustrating as far as the time factor goes. As little as 16 to 18 feet of new cave for eight hours of travel was almost pointless.

Mark Joop started a dig at the beginning of the FH and M junction. Here was a passage 30 feet wide and 8 feet high, completely filled with damp clay. Where did it come from? Certainly looked like a dig. After off-and-on overnight trips and 50 feet, the dig was abandoned. I mentioned it to a new friend, Tim Bratcher, and his son, Caleb. They recruited Tim Beach, Mark Ferguson, and Chance Ferguson. By the time the dig reached 70 feet, the logistics of removing the dirt was overwhelming as a curve in the passage was preventing a straight line pull. I went to see if I could help and their operation had gone from pulling a dirt-filled tray by manpower, to a winch pulling hundreds of pounds of dirt, placed on a tarp. After several runs of dirt extraction, the dig was starting to trend up at a 30 degree angle. I asked if I could dig at the front. After approximately 15 minutes of digging, it sounded like there might be a space above. Mark took over and punched into open space. Caleb and I squeezed through into a small room with possible leads in two directions. Visions of a nice walking passage soon evaporated, as soon as we realized we were in a ceiling channel interspersed with joint-controlled pockets. Tim and crew are now working on Dig #6 and we have surveyed over 250 feet in addition to the original 50 feet that were dug by Mark Joop, Clinton Elmore, and others. Tim's log shows 14 trips between April 2012 and the breakthrough in November 2013. Caleb estimated that over 45 tons of dirt had been removed by both teams.

The question remains: "Will Blue Spring Cave reach 40 miles?" On March 1, 2014, Julie Schenck Brown, Mark Ostrander, and I were improving on a survey I had done in 1989. My mind flashed back to that original survey and the question at that time, "Will Blue Spring Cave reach 2 miles?" With effort and support of so many willing people, we have reached over 38 miles.

A few special thanks to the people who have helped and encouraged me personally the past few years. Jason Richards with his amazing map. Julie Schenck Brown, Mike Rogers, and Dave Parr for their skillfully drawn sketches. Marion O. Smith for helping me survey under breakdown that most people would never enter. Anne Elmore who urged us on from the outside of the tight spots. Clinton Elmore who has demonstrated that he can now bear the responsibility of finding and surveying the rest of the cave. And for having allowed so many of us to explore this fine cave, Lonnie Carr will always deserve our thanks. Lonnie, thanks for being a great friend, host, caver, and steward for Blue Spring. A special hug to my wife, Christine, my typist and best friend, for sharing me with a cave.

Additional Information:

The book, *Blue Spring Cave*, was published in 2010 and written by Larry Matthews and Bill Walter. The 340-page book gives an account of the 20-year history of Blue Spring Cave along with maps and many, many photos. The entire proceeds from the sale of the book go to your NSS. Check with the NSS Bookstore and get yours before they sell out.

Silent Hall. Photo: Clinton Elmore

The Exploration of Chan Chasm, Tennessee

Andy Zellner, NSS 35397, FE

Ashley at drop #3

In the winter of 2007, Ashley Chan and I spent some time ridge walking around the Sherwood, Tennessee area. This part of TAG has potential for some of the deepest caves in the whole Cumberland Plateau. Rawhide Horror Hole at 630 feet deep is right around the corner, as well as 560-foot deep Youngs Creek Blowhole and several other challenging multi-drop caves. While the area has been extensively ridge walked, there are certainly some surprises left to be found. The following is a day-by-day account of how we discovered and explored one of these surprises.

February 10, 2007

Because it was my birthday, Ashley and I decided to take a walk along the north side of No Business Hollow, just above the tiny town of Sherwood. We parked at the spring resurgence of Sherwood Spring Cave, in a little field that belongs to Wayne Prince's family. There were several pits along the mountainside that we had never visited before. We were particularly interested in Good to the Last Drop, a 122-foot pit that had been badly mislocated for a long time.

We started up the hill following an ancient, rusty water pipe, which runs along the surface for over a mile and winds its way up to Barnes Spring. This large Pennington spring is right above Wayne Did Well, another 200-foot-deep cave. It apparently has some water flowing out of it in even the driest times, so it has been an important water source for the town for nearly a hundred years. Barnes Spring (and the pits nearby) is over 600 feet above the valley floor, creating good potential for more deep caves.

Marion O. Smith displays his most trustworthy light source.

We eventually found Good to the Last Drop, as well as nearby Three Beau Pit, a fairly nice 77-foot pit. We noted a number of trickling streams and tiny holes along the ridge that blew out warm air on such a cold day, but nothing that really seemed like it would amount to much. So on the way back across the ridge we decided to walk a little bit lower than usual, hoping to find Nowhere Cave, a 50-foot-long cave that Marion O. Smith had reported 30 years earlier.

Maybe a quarter mile away from the big spring, we came upon a large sinkhole, perhaps 40 feet across with a small stream pouring in one end. There were at least three separate holes in the bottom of the sink, one of which took most of the dripping water. I chimneyed into this hole first, stopping at a slippery 10-foot climb down. The other two larger holes in the sink seemed to lead to about a 15-foot pit. Though we had vertical gear with us, the day was getting short and we decided to leave the pit for another drier and warmer day. It sure looked interesting though. I later asked several TAG cavers about the good-looking lead we saw, though no one seemed to recall anything about it.

March 31, 2007

Our original plan this morning was to meet up with Mike Green and Chad Dubuisson to visit Fort-Peebles Cave, another deep multi-drop cave near Sewanee. Unfortunately, access had changed since the last time Ashley and I were there, and it would now be a 3 or 4 mile hike just to get to the entrance. We decided to save it for another time and looked for something else to do nearby. Mike and Chad had never been to Wayne Did Well, so we offered to guide them up there if they didn't mind taking a second look at our lead along the way.

All this was done in short order, and soon we were back in the mystery sink. Mike decided to chimney down the 10-foot climb while Ashley and I rigged a rope to check out the other two 15-foot pits. I went down first, followed by Ashley. Mike's hole came to an abrupt end about 50 feet in, but our lead looked much more interesting. The pits led to about 40 feet of nice, tall canyon passage that ended at a completely blank wall. Since the sink was right in a blue-line ravine, and judging by the big piles of sticks and debris lodged at the end, a LOT of water comes through here in the rainy season. I wasn't expecting much, but I moved a few rocks and leaves away from the wall anyway, just to be sure.

After a short bit of excavation, I chunked a pebble back into the farthest corner I could reach. The rock rattled around, and then kept falling with a whoosh and an echoey thunk about a second later. Another rock tossed in made the same strange noise. So I stuck my head into the hole, and much to my surprise found myself peeking down another 30-foot pit! With Ashley's help, we managed to enlarge this hole in just a few minutes, as all the rocks seemed to funnel themselves right down the drop. Even better, there was noticeable airflow being sucked down the pit. Rigging a rope, we rappelled in and quickly found a third drop of about 15 feet, with clean-washed walls. This really looked good!

But of course at the bottom of the drop was a serious obstacle. The cave continued as a tight crack with a low water tube at floor level, though we could hear a larger dome area and a waterfall just ahead. But centuries of storms and floods had filled the entire passage with logs and sticks and dead turtles. With nothing better to do, Mike joined us and we started excavating this stick pile, finding that the pool of water was shaped like a plumber's trap with something major blocking the other side. Mike sleezed his way in the farthest, trying to see around the low-airspace corner. "Dude," he said, "there's bones floating around in here!" It was quite an icky spot. We would be forced to lie in the water up to our eyeballs to continue digging, which was just not something we were prepared to do this day. So we planned to work on it another time.

April 21, 2007

Mike, Ashley and I decided to return to our little cave with a better selection of digging tools, thinking maybe we could scoop all the debris out of the "Icky Spot" with a long hoe or something. We headed up the mountain armed to the teeth with various rakes, shovels, and plastic buckets. Marion Smith, Doug Strait, and Sharon Jones tagged along, just to see what we were up to.

Unfortunately, I made a crucial mistake before we even got to the cave. For reasons I have forgotten, we neglected to stop and get a pizza on our way out of town the night before. Anyone who has been caving with me over the last 10 years should know that Bad Things Happen when I don't bring my pizza. For example, the legendary McBride's rescue occurred on a pizza-less day. The time we got someone stuck in Bear Hollow Rift and had to hammer him back out, no pizza. Or the time Marion knocked a 200-pound rock down Rumbling Thunder Pit while I was on the rope, no pizza. Or the time we rappelled into the Chickamauga Quarry and that one guy passed out on a ledge part-way down the 500-foot-deep blasted quarry face...well never mind, that's another story.

So we hiked up the hill in a pizza-free environment, and sure enough came to the sinkhole only to find a sizeable torrent of water flowing in the cave entrance. Digging prospects did not look good for the day, but Mike and Ashley and I headed in anyway, determined to at least clear what we could out of the Icky Spot. Mike made another valiant effort to submarine his way through the tube, but it was not to be that day. We needed drier weather.

However, as a consolation prize, we did manage to find another tiny new cave just a hundred yards away on the surface. A slippery, body-sized slot curved down underneath a massive sandstone boulder for maybe 30 vertical feet. At the bottom we explored just over 50 feet of nooks and crannies, and Marion pushed a jaggedy crawlway filled with rat poop just to make sure it qualified. We named it "No Pizza Cave." Marion also confirmed that the other small cave in the sink was indeed Nowhere Cave. He thinks he probably rappelled into our cave way back in 1977, but it didn't appear long enough to qualify at the time. Thanks for saving the lead for the next generation, Marion!

Doug Strait preparing for the 13 foot entrance pit.

June 17, 2007

Ashley and I had a Sunday's worth of time to kill, so the two of us trudged back up the hill on a much warmer and drier summer day to see if we could make any progress on the dig. To minimize the possible amount of trouble we could get ourselves into, we only brought two short 50-foot push ropes with us. Oh yes, and some pizza.

Happily, the water level in the dig had receded by almost a foot. I suited up to do battle with the Icky Spot once again. Fortunately, it only took five minutes of raking and shoveling before a body-sized hole appeared through the debris. Moments later, we were through and standing in a nice walking passage on the other side. A small waterfall trickled out of a 30-foot dome in the ceiling, probably coming from Nowhere Cave, and this all disappeared

Paul Aughey with formations in the Hartselle borehole.

into a nice clean-washed hand and knees crawlway. A short recon down the crawl led to yet another pit in the 15-foot range, with good airflow. Finally the cave was going somewhere.

We found a natural flake in one wall to rig our rope to, though it didn't look like it was going to stay in place. Ashley finally jammed a rock hammer into the crack as well, hoping it would hold the rope in there long enough for us to get down and up the drop. This seemed to work. Soon we found ourselves in yet another nice dome room with yet another crawlway leading off. At least it was dry today. About 80 feet later the passage started getting larger. I was in front and I put my knee down on a pile of leaves and sticks, only to have it collapse under me and into a 12-foot deep hole. The passage ahead looked much better, but all the airflow was going down this body-sized hole. So we rigged our final push rope here to a natural jug handle, and I shimmied down while Ashley waited above.

This led to a tight crack and a series of down-cutting plunge pools for a few feet, and then the passage slammed down to a 1-foot-high crawlway right at floor level. It's one of those spots where you have to get your head where your feet are, but your backbone doesn't bend enough to get you all the way there. I finally managed to get flipped upside down and squeezed into the crawlway. This intersected a larger stream crawl, maybe 18 inches tall and a few feet wider. I followed this for about 150 feet until it slowly cut down through a layer of shale. Looked like a great place to find ... another 15-foot pit! Sure enough, I found myself at the top of one, looking down without any rope. Good airflow and good water. Since we were now down six drops and it appeared that the cave might actually do something cool, I decided to name the cave Chan Chasm. It was a cute name I had been saving for a long time.

July 28, 2007

Our exploration was put on hold for a while, as Ashley and I spent some time caving in Peru and other interesting places. But that undone pit was always dancing in the back of my mind. Finally we managed to return, convincing Doug Strait to come back with us and carry some extra rope. Most everyone else was a few states north at the NSS Convention in Indiana.

This time the cave was even drier than before, though we still all got slimed going through the Icky Spot. Soon we reached the forefront of exploration. I quickly rigged a rope and sent Ashley down the drop. She reported a 20-foot pit, followed by another 13-foot drop that could barely be free climbed. Beyond that the cave was nice and tall for 100 feet or so before it got up to its old tricks and turned back into a low stream crawl. Ashley went in first, moving logs and sticks as she went. At one point she made it sound horrible and we thought it was about to crap out completely, so Doug and I decided to ditch most of our push ropes and crawl in to help her look.

But slowly the cave got a little bigger, went down a few more climbs and a few more squeezes, ending at a tall dome room. Ahead the water went into a tube and around a 90-degree bend. Ashley blazed the way in, coming to what she thought was a deep black pool of water in front of her. It turned out to be a 20-foot pit into a large room, I'm glad she didn't take that final step! Somehow she managed to get turned all the way around in the tiny crawl without falling down the pit and back to our little chamber. We rigged a short rope and sent her right back in.

This pit had probably one of the most difficult lips I have ever encountered. You have to back into the tube on your belly, and then somehow get your rack over the lip which is undercut by at least 10 feet. There is simply no easy way to do it. We named it the "UCMF," for "UnderCut

Ashley pushes the final water crawl at the bottom.

MoFo." We also considered calling it the Rack Bender for obvious reasons. Finally the three of us were standing at the bottom of the drop, which was formed almost completely in a thick layer of shale. This was likely the Hartselle layer, which often prevents deep caves from forming (or at least from making them big enough for humans to fit through). Another passage larger than the one we were in came in from the right, doubling the amount of water in the cave.

But what we were most happy to see was yet another 12-foot pit right around the next corner, dropping into smooth, clean limestone. Doug managed to free climb down it, but we felt safer with a short rope. The floor was really pretty with big blue potholes and cascades. We covered another 500 feet of mostly walking passage before getting stopped at, yes, another 15-foot pit. This one had a good natural flowstone rig, and beyond that was about 100 feet of nice walking passage to the next drop, which we thought might actually be more than 20 feet! The water went down a tight crack, but Doug managed to rig our last push rope and swing over a flowstone mound for a much nicer 24-foot rappel.

Less than 100 feet later the cave seemed to die off in a flat chert crawlway. Not to be deterred, I squeezed in and started hammering away. This resulted in a BIG echo from just ahead—very exciting sounding! Drums, drums in the deep. Moments later I backed through the hole I made and down a 6-foot climb down, stopping at the edge of a pit that looked at least 50 feet deep. We had come down a total of ten drops, running out of rope at drop number 11. We figured we had reached the 300-foot-deep level. I set a bolt at the top of this pit to save some time on the next trip, and we vowed to return again soon.

August 11, 2007

This is where we ran into a dilemma. Finding new deep caves in TAG is getting to be a rare occurrence these days, and this one had the potential to be one of the deepest around. I still couldn't believe this one had been unnoticed for all these years. We wanted to share the experience with as many friends as we could. But a push trip is simply not well-served by a huge herd of cavers. I think some feelings got hurt because of this, which was never our intention, but we managed to whittle the group down to six people–myself, Ashley, Doug, Marion, Manuel Beers, and Brian Killingbeck. We brought enough rope to rig all the way to hell if necessary; perhaps we were being a little too optimistic.

Back to the front of ongoing exploration! Doug found a creative backup for the single bolt I had set, and down I went. The pit ended up being only 44 feet, but it seemed huge compared to all the previous drops. While the others were coming down, I went 50 feet ahead in a stooping size passage and came to drop number 12. This was a 30-foot pit with super-sharp jaggedy teeth around the edge. I set one bolt and hammered off the sharpest of the edges, though we still ended up with some rope damage here. Ashley took the honors and descended first. This landed her in a tall dome room with a huge flowstone mound filling most of it. The top of the mound was a dead end, so we had to enter a low chert-filled crawlway underneath the flowstone instead. This was one of those 102-degree days we had that summer, and the wind was howling through the crawlway with an audible roar. It was strange to be freezing our tails off on such a hot day.

Doug slid in first and soon came to a too-tight hole in the chert, no way around it. To make matters worse, the tight spot was half immersed in a pool of water. Since I had the hammer, we switched places and I beat the snot out of the restriction until I could barely squeeze through. One more tight spot beyond that, and I was out of the bathtub and standing up again! Just ahead of me, the water flowed through a 6-inch-wide crack in the floor and went down maybe a 40-foot pit. No way could we fit. But at least I managed to move a rock that sort of uncorked the dam, and suddenly all the water in the low crawlway drained out down the pit, much to everyone's relief.

The others followed me through and we set about trying to enlarge the way on. We ended up hammering open a hole underneath a strange-looking, saucer-shaped formation on the floor, just big enough to fit through. This ended up being a parallel drop to the water route that we measured at 38 feet. Beyond was a tall, spacious canyon passage with a lot of chert in the walls. After everyone came down, we trudged on down the canyon about a hundred feet before coming to a split. All the water and air went down to a lower level, so Ashley and I checked that out while the others took a muddy overflow route.

Our passage remained a narrow walking tunnel for another 100 feet before it got lower and lower, tighter and tighter, and oh so windy. Ashley went the farthest, squeezing into a low airspace with a rock ceiling and a massive chert floor. It remained maybe 5 feet wide and 5 inches high for as far as we could see. So this was finally the end of the cave. We crawled back out and caught up to the others, who reported finding a few hundred feet of really muddy passage that ended in a small chamber with a 15-foot-deep hole in the floor. Doug thought it could be entered with a lot of digging, but as there was no airflow and nobody seemed much interested in it.

We slowly dragged our butts back to the surface, disappointed that the cave didn't go all the way to the valley floor, but still quite thankful for a great exploration trip. We figured we had traveled 2,000 feet from the entrance and were 450 vertical feet deep—quite a nice find. The water and air probably drains into nearby No Business Blowing Cave somehow. However, the map of that cave does not show any major incoming side streams, so maybe it follows a different route to emerge at the final spring, over 100 vertical feet lower than the spot we reached.

September 1, 2007

We felt somewhat obligated to survey the great cave we had scooped, so on the next trip we got started. Ashley and I formed one team to survey all the long, low crawlways in the middle of the cave, while Brent Aulenbach, Mike Green, and Emese Dunai started at the entrance and worked their way in. It was the first real survey project for Mike and Emese, and Brent said they did very well. We finally tied the two surveys together around the fifth drop for about 900 feet of total passage.

Doug was also in the cave that day, working on the Icky Spot. We had always worried about a major flood filling it back up and trapping us while we were in the cave, so he moved well over a ton of rock and sand as he dug a drainage trench that will hopefully last a long time. It was very obvious when he finally released the dammed-up pool of water - it came shooting down the passage a few minutes later. We had an 8-hour trip.

September 15, 2007

Our second survey trip starred Branden Johnson, Ashley, and me. Our plan was to start at the very bottom end of the cave and work our way out. Eric Jacobson and Manuel also came along to work on the muddy dig at the end, hopefully extending the depth of the cave. They were successful in doing so, and Eric managed to down climb the last 15 feet on a piece of webbing. He reported another 50 feet of passage before it got way too tight, no airflow or water. This ended up being the deepest point in the cave, and drop number 14. On the way out, Eric somehow got his frog foot loop stuck in the mud and had to abandon it. Meanwhile Ashley, Branden, and I surveyed upstream to the top of the "Drums in the Deep Drop," figuring one more team could tie the two surveys together on the next trip. Total footage for the day was around 650 feet in about a 10-hour trip.

October 13, 2007

More survey work. This time Jim Smith and Paul Aughey came to help. After our customary hike up along the water pipe, we were chagrined to see that a logging operation had started all around the cave entrance. What was once a bunch of beautiful 100-foot tall oak trees was now just a pile of branches and tree tops. We all know that timber harvesting is an important and renewable resource. But it was still sad to see how much this changed the surface of the earth itself. There had only been a single rainstorm since they cut the trees out, and we could already see a large amount of muddy silt being washed into the cave entrance.

Ashley led Jim and Paul down to the tenth pit and they started working backwards, while Doug and I checked out the big infeeding passage just below the UCMF. This quickly led to some of the largest borehole passage in the cave, perhaps 30 feet in diameter. We actually managed to free climb back up above the Hartselle shale and got into a whole network of domes and passages and crawls and formations, which was by no means completely explored. We terminated the survey in a narrow hands-and-knees canyon, going upstream into virgin territory. Marion later gave me a hard time about this, remarking that I'm not a very thorough explorer. But Doug and I both felt there was no harm in leaving something for others to explore. We soon met the other three folks back in the UCMF room, perfect timing. We surveyed 1,400 feet in maybe a 9-hour trip.

November 3, 2007

The final survey and de-rig trip, whew. Ashley and I checked out another big side passage noted on the last trip, while a small herd of cavers from Georgia Tech bottomed the cave and started pulling ropes out for us. That group consisted of Mark Whitmer, Cody Planteen, David Linder, and Chris Goodman. They did manage to extract Eric's footloop, which he was reunited with at the next grotto meeting.

The survey crew found yet another large borehole passage that seemed to parallel the other one. Some of the largest and nicest decorations in the cave were in this section, too bad we never got around to photographing them. Once again we got back up into the Bangor limestone, and we finally turned around in a fairly nice going passage. It remains unexplored to this day. Our survey total was 560 feet for the trip, bringing the grand total to 3,515 feet long and 472 feet deep. A few weeks later, Chuck Constable and friends toured the cave and pulled out the remaining ropes for us, ending the exploration efforts for the year.

We believe the 14-drop route to the bottom of Chan Chasm to be the most number of sequential drops in any Cumberland Plateau cave, and perhaps in all of TAG. Even if the longest drop is only 44 feet, that's still a lot of ropes. And while the cave did not quite reach its full depth potential, there was a tremendous amount of airflow at the very end. Someday a caver will return and find a way on.

Chan Chasm seems to be a parallel drainage to the Wayne Did Well/No Business Blowing Cave System, which is just a thousand feet or so to the east. We thought for sure we would tie the two caves together, but so far they seem to be completely separate systems. It's possible that the water in Chan Chasm somehow emerges in the bottom level of No Business Blowing Cave, or perhaps it passes underneath the valley floor

Andy proves that you can stand up at least once in the cave.

and emerges in Lost Contact Cave, which is in the lowest levels of the St. Louis Chert formation. If that's the case, then there is certainly a lot of missing cave passage still to be found. Jim Smith and Dr. Nicholas Crawford performed some extensive dye traces of the No Business Blowing system, and a finely detailed copy of their report can be found in the *1989 NSS Convention Guidebook*.

Future explorers should be aware that Chan Chasm appears to flood to the ceiling in many places, and the UCMF could be a very dangerous place in high water conditions. While it's not the hardest cave in TAG, a trip to the bottom and back out is fairly challenging in my opinion. We sure had a blast exploring it. Thanks to all who helped along the way!

Tennessee's Hidden Mystery

Mike Green[1] NSS 55015

Mike Green negotiates one of Dorton's many crawls. Photo: Matt Ketron

I once again found myself staring blankly at the mud-covered ceiling. A trickle of water had somehow found its way to the back of my neck and generously began pouring its cold gratitude along my spine. I let out a long sigh. For some reason, I was apathetic to the cold, apathetic to the mile or so of crawling I had yet to contend with. The wall began to move and contort to wild shapes and patterns. "I swear that one looks like a horse," I thought aloud as my mind unconsciously searched for familiar images much like that of a child gazing up at a sky monopolized by marshmallow clouds.

"Any plans on moving?" Stephen Adcock asked from the direction of my feet.

"I…I guess so…" My glace went back to the sound of his voice but my pack blocked any chance of our making eye contact. I stared momentarily at the peanut butter mud as it fell to the ground with a somewhat humorous "plop!" I started to speak to my excessive luggage with the same conviction that Tom Hanks probably had while conversing with a volleyball in the movie Cast Away. I'm not sure if I actually had expected my manifested "Wilson" to continue to speak for Stephen, or if I was simply entertaining myself in a place that is otherwise barren of such stimuli. Surely my mind was far more tired than I had previously led myself to believe. I looked back to my prized mare but unfortunately the ceiling had resumed its boring veneer completely devoid of pattern and form. How long had we been here? And better yet, why did we continue to come back to this horror?

"Oh, the things we do for fun."—Andy Zellner

Matt Schohl and Drew Cole using the tyrolean to cross Hidden Well. Photo: Mike Green

The Dorton Knob Breakdown

The Dorton Knob Smoke Hole was once described to me by Marion O. Smith as a cave that only permitted one to stand upright only while on rope. Looking back, this was a fairly good assessment.

The terminus of Dorton Knob Smoke Hole is 660 feet below its highest entrance securing its place amongst TAG's deepest caves (third in the state of Tennessee and fourth in region that includes Tennessee, Alabama, and Georgia). The cave is not only deep but also long when compared with neighboring caves. The running survey totals over 1 mile of passage, but it is estimated that 2 miles will be overtaken before the project is completed. There are two known entrances, the "Gnat Hole" and the more frequently used "Yuppie Boating Entrance," that are comprised primarily of sporty, slot canyons that have the unique ability to consume possessions from the careless. The sandy floors of these rifts are littered with a historic agglomeration of relics that were abandoned due to the difficulty or the impossibility of their retrieval. The combined lengths of both infeeding canyons are approximately half a mile (without the inclusion of side passages that are yet to be surveyed). Each route contains four to five pits that are generally in the 50-foot range. The two canyons are eventually conjoined at a depth over 200 feet, where an impermeable layer known as the Hartselle Sandstone exists. The water that was completely hidden in the upper canyons is now visible and flows freely over the Hartselle for approximately 1,200 feet before reaching the beginning of the next major pit series. This stream is characterized by crawls, stooping, and the occasional (but short lived) walking passage. This area is exceptionally cold due to an ever-present breeze that never seems to wane despite seasonal changes on the surface. After several bathtubs, the passage ends abruptly in a small room known as the "Hartselle Pot." From here the entire contents of the stream cascades down the first of three pits (57 feet, 88 feet, and 136 feet), and into a large breakdown room known as "Hidden Well." This pit series served as the primary route to the cave's end during its original exploration. It was later discovered that a balcony providing an alternate drop of 259 feet could be reached by traversing the

Clinton Elmore trudges forward through a section of the Hartselle crawl known as Jail Break. Photo: Chris Higgins

Hartselle Pot. This discovery, made by Andy Porter, helped to propel Hidden Well to the top of Tennessee's deep pit list and second only to the long-standing reign of Mystery Falls (270-feet deep) that has held the title since it was first descended during the 1950s by modern vertical standards.

Hidden Well is without question the crown jewel of the Dorton Knob Smoke Hole due to its sheer enormity (and of course because the cave does not offer much else in the form of aesthetic beauty). This colossal massif is well over 300-feet tall and up to 200-feet across. Several streams converge to help create one of the most majestic breakdown chambers in TAG. All previous exertion is certainly rewarded here simply by being a part of Hidden Well's beauty if only but for a few brief moments. The pit's magnetic pull has attracted prudent minds to endure less than sensible conditions for decades.

Although seldom visited, the cave resumes its torturous nature as a route through the breakdown. The bottom is finally reached after two short drops, several hundred feet of walking passage, and a chert-filled stream crawl. It is here that Dorton's creator and lifeblood flows into a hole that is too small to permit human intrusion. The water is all but lost from the minds and imaginations of those driven enough to reach this point.

Geology of the Dorton Knob Smokehole (By Clinton Elmore, NSS 49706)

When discussing the geological characteristics of the Dorton Knob Smoke Hole, one must throw out all of the preconceived notions about anything related to TAG caving. Upon Brady Mountain, there is no flat, level rock; there are not really any "pit bouncer friendly" pits; and there's definitely no easy way to bottom or explore most of the 25 or so caves there. This is the wild, unpredictable land of long, deep, wet, tight, and difficult caves. If you are after depth, this is the place to be; if you are after horror, this is TAG's mecca. Brady Mountain takes the classic Mississippian carbonates, famous for the nice, easy, big open-air pits found in TAG, and distorts, folds, bends, and deforms them into a wild combination of geology that forms equally wild, unpredictable, and untamable caves. These caves start as small narrow canyons but as they gather water, they form progressively larger passage as you descend throughout the cave.

The Sequatchie Valley is a large anticlinal valley running from north Alabama all the way up through middle Tennessee that cuts up through the middle of the Cumberland Plateau. The Alleghanian Orogeny is the event responsible for the compressional forces that led to the creation of the Sequatchie Anticline and eventually to the creation of the Sequatchie Valley Fault as well, or what local cave explorer's often refer to as the "Mill Cave Fault." An anticline is a ridge created via compressional forces applied to the rock strata in the area. These forces push inward, compressing the land and causing it to push upward in a ripple effect in an attempt to dissipate the overbearing compressional forces applied to it. A similar process can be witnessed by taking a sheet of paper on a table and pushing two of its sides together. The center of the sheet then rises upwards in a ripple shaped bend. The additional effect that this upwards bending has to more brittle rock, and not on the paper, is that when the rock is warped into that ripple shape, the crest to the upside down "U" fractures as the top layers of rock are pulled apart in the process. These fractures greatly increase the surface area of the rock and therefore increase effects of weathering and erosion. This process of anticlinal erosion leads to the formation of a valley and ridge sequenced landscape much like what exists in East Tennessee. The upside down U-shaped mountains, a.k.a. the anticlines, erode away thanks to this fracturing at their crest, while the synclines, being more resistant to weathering thanks to the lack of upward facing fracturing, actually become the mountains.

At the head of this anticlinal valley is "Grassy Cove," a great example of a massive anticlinal karst window. Grassy Cove is considered one of the largest sinkholes in the United States, far dwarfing other large scale sinkholes, or "Coves" as the locals call them in Tennessee. Grassy Cove is rimmed by Pennsylvanian clastics (sandstones and shales) while the center of Grassy Cove is formed in the mostly carbonate, underlying Mississippian rock layers. The Mississippian sequence of rock starts with the Pennington Formation, which is around 400 to 700-feet thick and has little to no carbonate or cave-forming rock present in the Cumberland County area. The Pennington Formation, along with the overlying clastic cap rock, often funnels water into streams before these streams sink into the carbonate cave-forming rock found below. This funnel effect accounts for why many places in TAG have unusually large rivers sinking underground despite lacking the larger amount of rainfall found in other karst areas around the world. Next in the sequence is the thick-bedded Bangor Limestone that is close to 250-feet thick in the area. The entrance to Dorton Knob Smoke Hole is near the contact between these first two Mississippian rock units, and the cave mostly follows small faults and joints developed in the Bangor Limestone. These fault- and joint-controlled passages in the Bangor Limestone carry rapidly down-cutting streams that form tall, wet, and snaky canyon passages with numerous pits splitting up long stretches of stream crawling. This vadose origin often creates tight, sinuous, and spiky canyon passage in contrast to the often large, nice, and easy "fossil passage" of phreatic origin that we see developed in many of the classic long caves found on the Western Plateau Escarpment.

Finally, after around a mile of cave, the stream in the Dorton Knob Smoke Hole runs into the Hartselle Formation, the next layer in the cave. The Hartselle Formation contains roughly 5 feet of sandstone and around 10 to 20 feet of calcareous clays with occasional interbedded limestones. Though the clays and limestones in the Hartselle are often ignored and thought to be just a continuation of the Bangor Limestone, the more obvious sandstone is one of the defining features of middle Tennessee. This sandstone creates a semi-impermeable confining layer that the cave's stream remains perched on. While perched on this thin layer of sandstone, the stream spreads out forming a very wide and low crawl known as a "Hartselle Crawl." The Dorton Knob Smoke Hole has a fairly long Hartselle Crawl that contains a low, wet section of belly crawl before a medium-sized fault is intersected by the cave. This fault is related to the Sequatchie Valley, and thanks to this fault the Hartselle Sandstone is fractured at this location. What normally happens is that having a fractured Hartselle Formation allows water to seep through the formally impermeable layer and dissolve the underlying limestone creating a large void below. This undermining of the Hartselle Formation finally causes large scale collapse and creates a back-cutting waterfall effect with the cave's stream slowly migrating away from the center of the main collapse.

A similar process probably occurred during the solutional development of the Dorton Knob Smoke Hole, but something else more interesting happens here. The main break in the Hartselle in Dorton Knob occurs in the massive dome room named Hidden Well. This penetration of the Hartselle is only half the story in Dorton Knob Smoke Hole since Hidden Well doesn't just begin at the Hartselle, but rather begins mid-level somewhere in the Bangor Limestone. This is possibly due to the intersection of the main fault by a large paleo stream in the Bangor Limestone. This is an interesting development, since very few known pits penetrate the Hartselle Formation at mid level. Below the Hartselle Formation, Hidden Well

Matt Schohl braves the flood waters of the Hartselle Crawl in the name of the survey. Photo: Mike Green

continues dropping through almost the entire classic cave-forming Monteagle Limestone as a huge 100-foot diameter dome pit landing on top of a large rubble pile that fills up the pit below. The way on through the breakdown leads down into the underlying, cherty St. Louis Limestone to another sloped pit before encountering nice sized passage also in the St. Louis Limestone. This passage remains large only while the bedding is relatively level, but quickly shrinks down in size as the bedding starts to dip to the west after only a few hundred feet. The passage once again becomes tall, snaky, canyon passage as the rock becomes more and more tilted and the water gets more and more turbulent. Finally, a 9-foot pit is reached that drops down into the sandy limestone found at the top of the next rock unit called the Warsaw Limestone. This is where a massive terminal breakdown choke is reached, signifying the current end of the cave. This collapse is possibly where the cave intersects the main Sequatchie Valley Fault or another smaller secondary fault; whichever it ends up being, it must be crossed in order to further push the cave downward into the valley below. If this is the main fault and if it is crossed, the other side should be once again developed in the Bangor Limestone due to the displacement of the fault. This would start the whole sequence of geology over again, albeit with more water concentrated into a single stream now.

The Dorton Knob Smoke Hole currently ends in the top of the Warsaw Limestone at -660 feet. If this terminal breakdown were ever to be penetrated, the cave's stream should continue dropping an additional -580 feet to the head of Sequatchie Spring, where it has been dye traced. This would put Dorton Knob Smoke Hole at around -1,240 feet deep though this is only part of the story. There are multiple caves on Dorton Knob that are believed to have streams feeding into the Dorton Knob Smoke Hole drainage system, with the highest one being at 2,640 feet elevation. The cave at 2,640 feet, named "Dorton Knob High Hole", could be connected into the Dorton Knob Smoke Hole someday. This interesting prospect puts the total depth potential of any cave found within the Dorton Knob drainage system at around -1,560 feet.

Jim Fox ascends Hidden Well in all its splendor and glory. Photo:Clinton Elmore

Surveying the Hartselle Crawl. Photo: Chris Higgins

History of the most Recent Variety

“You have brains in your head. You have feet in your shoes. You can steer yourself in any direction you choose. You’re on your own, and you know what you know. And you are the guy who’ll decide where to go.”—Dr. Seuss

The Dorton Knob Smoke Hole has always been a source of excitement, mystery, and challenge for my friends and me, who are collectively known as the Active Cave Explorers Society or ACES. We grew as individuals and as a team on our many trips within the cold recesses of Dorton Knob. Its physical and mental challenges molded us into the group of cavers that we ultimately became. Countless days were spent exploring the misery within the mountain, and it was as though we knew of nothing else in the vast, cave-rich world of TAG. The depth and difficulty brought us back time and time again. Our minds and hearts grew so very intertwined with Dorton Knob. One might even venture to say that our connection ran as deep as the cave itself.

12-02-06: Traversing the Temple of Doom

Our group quickly grew tired of simple sport trips into Dorton Knob and we soon graduated to pushing every lead we could find. One such lead was a passage looming on the far side of Hidden Well across from “Porter’s Ledge.” It had had an inescapable draw on our group since we had first observed its existence on some of our first trips to the remote pit. After years of conjecture and an unrelenting desire to know, Chad Dubuisson decided to carry out an ambitious plan that will surely be recounted in Dorton Knob’s chronicles for years to come. He planned to aid-climb across the vast depths of Hidden Well via the “Balcony.” The proposal was quite simple in design, yet insanely complicated in reality (primarily that of the logistics). This bold strategy required a myriad of climbing gear all of which challenged the Smoke Hole’s passages for space; however, after dozens of man hours, six bolts, and a mild concussion (a completely different story entirely), Chad had accomplished his incredible feat, and we were left with a 30-foot Tyrolean stretching from the balcony’s precipice to the opposite corner of Hidden Well.

To our dismay, the virgin passage we had so eagerly awaited continued for only a short distance before running its course into a dead end. We were somewhat heartbroken but not completely deterred. The search for purpose, to our labors, continued for several more trips

Wrong Way Pit. Photo: Chris Higgins

until a climb, hidden by its obviousness on the edge of Hidden Well, began to give us revived hope that not all had been in vain. The passage doubled back towards the entrance as a multileveled hodgepodge. In all its jumbled complexity, the passage passed over several gaping holes that plummet into the heart of darkness. It was not until Drew Cole had wormed his way back to the top of the Hartselle Pot did we realize exactly what this upper level was going to provide for us: a complete bypass of the Tyrolean. We had to artificially persuade the ceiling to allow access resulting in a pit that was later dubbed the "Elevator." Our focus shifted back to the visual survey of the high, tortuous canyons in Hidden Well. We once again returned to the series of trapdoor-like windows that we had noted earlier in our unmethodical examination. These portals had an obvious lifting to our spirits; after all, we had climbed above the previous rig point for Hidden Well. Had we inadvertently found the deepest pit in Tennessee? In search of an appropriate rig point, we precariously stemmed over the windows by stuffing our bodies into the upper canyon before reaching a constriction that yielded only oblivion on the other side. The floor vanished and all that existed ahead was a void. The left wall continued for a short distance until turning completely out of sight. The desolate, space-like setting was impossibly difficult to gauge due to a mist that filled most of the upper portions of the chamber. All that could be heard were the siren calls personified by the distant subterranean showers. Bart Bledsoe, Chad Dubuisson, and I later returned to bolt the "Attic" as it was called in our group.

"I still vividly recall climbing along the wall's edge to our bolted plunder, as I prepared for one of my deepest descents to date. Despite my inexperience, I remember

One of many filters that dominate the Yuppie Boating Entrance. Photo: Chris Higgins

being unusually calm as I weighted my harness. There was no excitement, no bliss. I was without fear or hesitation. There was only the order of operations vocalized only by my internal monolog. Clip here, unclip there. Lock screwgate, thread rack.... Steam bellowed out of confines of my PVC suit, as my all-but-soaked polypropylenes vented their saturated anguish directly into my face. It was becoming a bit of a nuisance but I continued with my ritual. Finally, I was moving downward. Much like that of an old barn door, my rack began to squeak and squeal over the grit-veiled sheath of our 350-foot PMI pit rope. I left my burgeoning cumulous cloud behind, but the steam continued to permeate the darkness around me. I undoubtedly looked like an inflamed stuntman calmly rappelling in outer space. I passed Porter's Ledge on my descent but did not make a mental note of its distance from our new rig. The showerheads grew in audible intensity as I began passing the once-distant in feeders. Still, much like the pit itself, I remained devoid from all emotion." (Green, Personal Journal, May 5, 2007). We all touched bottom that day, but without the means to measure drop, we were left to guess the length of our drop. The next trip was the first attempt (more or less) to survey the pit.

"It was somewhat of an unsuccessful attempt [to survey Hidden Well] as our new 300-foot tape measure failed to arrive in time for the exploit. Refusing to be deterred, Jon Finley and I tied a series of strings together with the mindset that we could simply measure the string in a more pleasant surface setting. Eureka! Success! We managed to perform this foolish stunt without killing ourselves in the process. A true miracle. It's not that this was a particularly dangerous method, but rather that anyone performing such a boneheaded survey would be apt enough to get to a remote pit without any sort of incident along the way. Well, we were, in fact, able to reach Hidden Well without any sort of life and death struggle, and I anxiously rappelled into the dark void with a rack in one hand and a ball of string in the other. After touching bottom, I began the long climb back to the top as a very tangled buffoon extraordinaire. Hours later, in the comforts of a bar complete with frosted mugs, we measured Hidden Well at 289-feet deep. This was more than enough to make it the deepest pit in Tennessee, although our methodology would be more than scrutinized. We decided to keep our statistics to ourselves. The next day, the 300 -foot tape measure arrived via UPS." (Green, Personal Journal, August 18, 2007).

Now, no self-respecting, so-called intrepid explorer of the underground would call it done after such a poor excuse for a survey. Who could we possibly convince of our achievement with such a primitive approach in such a modern era? It was important to get a more accurate reading lest we abandon our dignities with the tangled mess of string that still resides as a mud ball in the corner of my gear closet. The inevitable catalyst for action came as a promise I had made to the Dogwood City Grotto (DCG) in Atlanta. The DCG had been extremely supportive (in the financial sense) and encouraging of our endeavors in Dorton Knob. As a reimbursement, I had volunteered my time to present our findings (up until this time, the new rig point was neither widely accepted nor widely discussed as a result of misinformation, lack of a proper survey, and the overall resistance to the dethroning of Mystery Falls, a TAG Classic as it were, to that of an abyss located a half mile through knee-grinding cave). My uncanny ability to procrastinate left me without a depth for Hidden Well just days before we were to unveil it as the deepest in Tennessee. It was essential that we get the measurement before such a bold pronouncement.

"Matt Schohl and I once again returned to the depths of Dorton to procure a more accurate or at least a more acceptable measurement of Hidden Well. We did not expect a 10-hour trip but that is what it turned out to be. After descending the Yuppie pits, we stopped momentarily to don more clothing for the Hartselle stream crawl. Before we departed, I began to hear a distant, yet very clear rumbling. It was that of a low flying jet engine; however, we were certainly far enough into the cave to eliminate that as a theory. Matt and I stood in silence while straining to hear and make sense of the noise, but it was to no avail. Just as I turned to Matt's questioning shoulder shrug, water began dripping feverously on my helmet where, moments before, there had been nothing. The upstream passage immediately began belching out a putrid sludge of brown organics that was being propelled forward by a preceding wall of murky water. The cave was flooding! We quickly picked up all our belongings mere seconds before losing them to the surging hydrant." (Green, Personal Journal, September 26, 2007)

Matt and I talked out risks involved with continuing our trip as planned and we decided that we would turn around should the passage look as though it had sump potential. Fortunately for us, there was no real call for concern. A pit like Hidden Well, in all of its size and splendor, facilitates the mountain's drainage with relative ease. Even the lowest parts of the Hartselle Crawl did not pose any real danger. This was clearly evident when we arrived to see that the stream level looked as it always had, even with the water's hurried pace.

"We continued to crawl through the worst of it with the brown water blasting past our bodies. Normally dry infeeders were now raging beasts of warm, surface runoff. I was shocked to see this much water, but even more shocked that the lowest passages were not sumped shut. Quite counterintuitive from what I would have predicted, the water simply flowed faster towards its ultimate destination. All the better for us I suppose. Matt and I continued our journey to Hidden Well without any further incident. The pit was mistier than ever, but we were blessed with the driest drop in the house. We unpacked the unused tape measure and Matt was first to rappel to the bottom. A barely audible, "on station" signified that he was ready. I pulled the tape tight while balancing precariously on the edge of nothingness to observe our long awaited figure." (Green, Personal Journal, September 26, 2007). It did not come much of a surprise to find that our original measurement was incorrect....

The Dorton Knob Smoke Hole project became somewhat dormant for the years that followed. Some members of our group moved on with their lives, others pursued different hobbies and life ventures. Overall interest waned and declined in the face of the mind-crippling prospect that remained: the cave needed a proper survey. Dorton Knob was reported to have been surveyed years before most of the current members were even born, much less active cavers. Resurveying the cave was a frequent topic between the remaining members, but obtaining commitment was scarce even amongst us; however, the idea finally gained traction and the official resurvey effort began on October 1, 2011.

Surveyed footage in the Smoke Hole started to add up rather quickly in the months that preceded our 4-year hiatus, and it was not long before both the Gnat Hole and Yuppie Boating Entrance were joined together by ink and paper. Survey trips rolled out on a bimonthly schedule to avoid burning out the project's momentum, a strategy that kept the team strong and enthusiastic. It finally looked as though the long-anticipated map, over 40 years in the making, would soon be drafted into existence.

It was an indescribable joy to watch the survey grow and flourish after so many years. Finally, the Dorton Knob

One of the few places to stand in Dorton Knob. Photo: Chris Higgins

Smoke Hole as a whole was slowly being drafted into an observable form. Nature's previously unseen art and secret beauty could now be seen in part on man's canvas. I grew more excited with the project than I ever had before; however, the euphoric fire would inevitably be doused by a bucket of cold reality. The survey was soon to reach Hidden Well and Dorton's crown jewel was to be the crux as much as it was to be its focal point. With a plethora of vertical routes, mazy upper level canyons, and its voluminous bulk, surveying Hidden Well would not be surmounted as easily as the mile of crawling that came before it.

It wasn't until January 2013 that I finally addressed the daunting prospect of surveying Hidden Well. Such a massive undertaking would surely take multiple trips with a group of strong cavers with experience surveying deep pits (much less those located within a horror hole). I began to feel out the caving community for such a group that could aid us in our quest without any sort of method or expectations. I had tried several avenues but it wasn't until I cast out a message on a local caving page maintained by the SPADES did I get a bite. Ben Miller, a Missouri caver transplanted to Western Kentucky University for a Master's degree in hydrology and geomorphology, responded to my call for help with a resounding, "YES."

It wasn't until I had done a little research did I find that Ben and his friends (collectively known as DPAS or Deep Pit Assassin Squad) had been systematically surveying all of the deepest pits in Tennessee without maps (incidentally, this was more or less ALL of the deep pits of Tennessee). Hidden Well was undoubtedly as high of a priority to DPAS as it was to me. What better union to tackle such a daunting challenge? It was not difficult for either party to convince the other of their respective need and importance to the overall project. Thus, "Team Hidden Well" was created.

Mapping Hidden Well (By Ben Miller, NSS 48893)

In preparing to survey Hidden Well, I had to rely somewhat on the descriptions from other cavers as I had never been in the cave. We would now be going nearly to the end of the cave and mapping the biggest drop. Having surveyed other large pits in the region by this point, we had an idea of how to possibly tackle the monster drop and huge room at the bottom. But, one never truly knows until they are at the pit with survey gear in hand. Our technique of mapping big pits always involves a 200- to 300-foot long tape and a Distometer, as well as normal survey gear such as sketch books, instruments, etc. In order to avoid hauling a large tape on a reel through the Smokehole, we had taken a 300-foot tape off the reel for the drop, carefully stuffing it into a stuff sack so that it would not tangle as it was lowered down the pit.

Upon arriving at the Hartselle Pot Room, we decided to head to the top rig point for the pit and leave the Historic Drops for later, eventually returning on September 21 to survey the 57-, 88-, and 136-foot drops. After Mike and I descended the pit, Stephen Adcock attached a carabiner to the end of the tape and began lowering the end slowly down the pit. The total drop in Hidden Well, from the bolt to the main floor, was 293.5 feet. This made Hidden Well a full 23 feet deeper than Mystery Falls and had finally confirmed that the pit was the deepest in Tennessee! Once the tape was at the bottom, we built a small cairn for the station and found that if we had wanted to "cheat" the length a bit, we could have ran the tape even further down the pit into a tight awkward breakdown pit which continued 12 feet further. However, no one would ever willingly squeeze themselves into the breakdown pit so we decided not to as well. Stephen tied off the tape to the bolt and rappelled down, since we were going to survey as much of the gigantic room as possible before heading out.

The room at the base of Hidden Well is over 200-feet long and 130-feet wide with a floor composed of car-to house-sized breakdown. The survey was slow since I had decided to sketch the room at 20 feet to the inch, a scale I would later regret. We managed to survey about 30 % of the room before it was time to get on rope and sketch the main pit. The room would have to be continued on at least two more survey trips before the beast was done.

When surveying pits, we leave the tape hanging in the pit in order to provide us with a scale when ascending and stopping to sketch. Then at various intervals, depending on a pit's complexity, the sketcher stops and shoots the laser distance meter to the four walls being sketched on the profile views. Since this was going to be a rather large pit, it would be necessary to stop frequently and thus I would probably be on rope for 1-1.5 hours. This may seem like a long time but this is roughly equivalent to the amount of time required to sketch an equal amount of easy horizontal passage. In the case of Hidden Well, I stopped about every 40 feet or so to shoot to the walls and sketch. Often this was more difficult than might be imagined, since the walls at times could be as much as 150- to 170-feet away from the rope and Hidden Well can have large clouds of mist that obscure the walls. The laser distance meter and the high beam on my headlamp were necessary tools for accurately depicting the detail of the pit, given the conditions. As I made my way up the rope, I was able to make notes of the various leads and passages on the sides of the pit walls, one known like Porter's Ledge, others yet to be explored. Multiple domes extended upwards from some of these ledges, possibly to even higher upper levels in the cave. In fact, the main dome that comprises the pit continues further upwards beyond the rig point we used.

It was certainly awesome to make Hidden Well the deepest single drop in Tennessee and was by far the largest volume pit we had ever attempted to survey. The survey of the pit was a challenge, though not surprising when considering the legendary difficulty of the Smoke Hole.

Looking Forward

(If but only for a few feet at a time)

The Dorton Knob Smoke Hole continues to intrigue and draw cavers into its depths, even after its discovery more than 40 years ago. Interest in this most difficult and demanding cave is embodied by the ambitious explorers,

Jim Fox descends the last drop in the Yuppie Boating Entrance (Wrong Way) before the Hartselle Crawl. Photo: Clinton Elmore

past and present, whose fiery passions have blazed through the unknown in search of challenge and conquest. Time has tested and worn the current project's constitution many times over, but the survey still rages on, albeit at a similar pace that one practices while inside the cave: slowly. The cave has already exceeded 1 mile in length and another mile is not out of the realm of possibility. The surveying of Hidden Well has subsequently stomped out any and all fiery challenges to its depth. As a result, it has finally laid claim to its rightful place at the top of Tennessee's deep pit list. This honor is unlikely to be relinquished any time soon considering how long Mystery Falls held the title. A slew of new recruits have eagerly joined the roster and it is hoped that, with current participation levels, the survey will be completed within the year. Certainly this is a most ambitious goal, but one that is reflected in the very people who have pledged their time, their bodies, and their sanity to the project's closure that has spanned over two generations of thrill seekers. Despite having such a harsh reputation of one that is synonymous with suffering, Dorton Knob has sparked a multitude of cavers to question, "What could lie beyond?"

[1] *mikegreen027@gmail.com*

The Many Depths of Mystery Falls

Jeff Bartlett, NSS 59325

Kyle Gochenour sets the Distometer at the lip of Mystery Falls

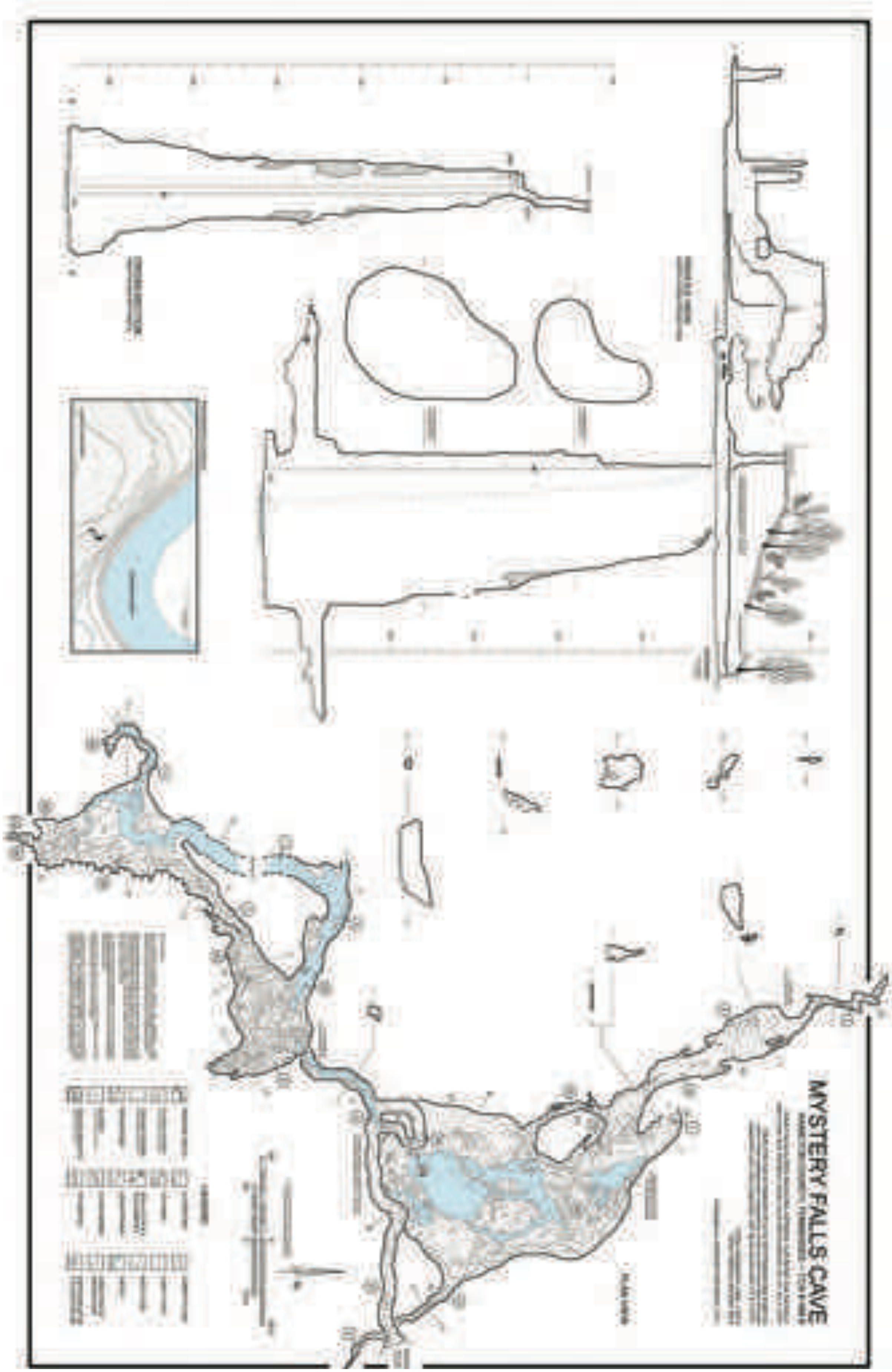
In the summer of 2009, concluding a weekend of caving in TAG and dreading my long drive home to Arkansas, I had the pleasure of accompanying Jonny Prouty, Mae Kile, and Brian Killingbeck to Mystery Falls Cave. At the time, it was the deepest pit I'd ever done, and surely the most spectacular; peeking over the lip at the tiny figures below, my heart was in my throat as I threaded my rack. I won't dare to admit how long it took me to climb out of the pit that day, but before I was off rope I knew two things: I wanted to move to TAG, and Mystery Falls was my favorite pit.

In September of 2010, I moved into a house in Chattanooga, and I received a few e-mails suggesting that I make a new map of Mystery Falls. I didn't need any convincing whatsoever. I was too shy to approach Buddy Lane about it, so I had a friend ask on my behalf, and it was settled. I hadn't even managed to unpack all of the boxes in my new place, but I'd made some phone calls and set aside a few dates to start mapping. Being new to the area, I was pretty excited to work on a cave so close by. Who knew you could cave on weekdays?

On October 19—a Tuesday!—after dinner, my wife Leah and I drove over to the cave and began the survey. In three hours or so, we managed 17 stations and 450 feet of survey in the entrance and upper area of the cave, terminating the survey line in the larger-than-expected room atop a short waterfall.

The following Saturday, we'd been able to arrange for two teams to be in the cave. Jason Hardy, Kelly Smallwood, and Buddy Lane would have the unenviable task of surveying the massive pit and landing area, while Marty Abercrombie and I would run a line through the passages


Mystery Falls. Photo: Amy Hinkle, Sunguramy Photography


MYSTERY FALLS CAVE

below the drop. After several hours of surveying in toasty-warm, dry passage while the other crew froze half to death in the waterfall spray, I met up again with Jason and Kelly. It was my turn to learn the big news of the day:

"269.8 feet. Buddy taped it twice to be absolutely sure."

Whoa. It was around this time that I realized that maybe choosing one of the deepest pits in TAG as my first mapping project might not have been the best idea; I had visions of an angry, pitchfork-wielding mob chasing me back to Arkansas for "shortening" one of the classics. That day, after the survey, I started doing some reading. Just how deep was this thing *supposed* to be, anyway? 281 feet… right?

Researching the answer did not provide as clear a picture as I had hoped:

1884: Anderson Gillespie uses a balloon filled with hot air and a line to measure the height of the dome. According to Larry E. Matthews (2007), the *Chattanooga Times* (December 5, 1885) wrote that the pit was "nearly 275 feet in height," but Mark Wolinsky (1985) reported 204 feet as the height recorded during this experiment.

1938: W.L. Dodds and R.E. Blalock performed a survey of Mystery Falls in May of 1938 as part of a commercialization plan. They recorded a measurement of 265 feet to the falls on the low-side lip; adding in the 8-foot height difference between the two lips would provide for a measurement of 272 feet on the high side. This measurement appears to be based upon USGS elevation markers on Lookout Mountain.

1951: According to Matthews (2007), it was 1951 when Bill Cuddington and Roy Davis were first told of Mystery Falls. This discussion is described in the November, 1953 issue of the Nashville Speleonews: "Two years ago two men from Ruby Falls were lowered into this drop by electric winch … (he) said that the Mystery Hole had a 41-foot drop to the first ledge, then a 302-foot free fall drop by a waterfall which falls the same distance."

1954: On June 12, 1954, Bill Cuddington famously performed the first modern descent of Mystery Falls on cable ladders. In closing his description of this historic event, Wolinsky (1985) wrote: "By 1959, many other cavers had rappelled and prusiked Tennessee's greatest pit. During this time the official depth of Mystery was established as 281 feet freefall from the first ledge, with a total depth of 316 feet."

Jeff Bartlett sketching in Mysterey Falls. Photo: Kelly Smallwood

Distometer set at the lip of Mystery Falls.

1967: Richard Schreiber, on a trip with the Rockeater Grotto soon after the horizontal passage was breached by "unknown individuals," taped the low side of the pit at 274 feet. This would equate to a figure of 282 feet for the high side (Wolinksy, 1985).

1973: In 1973, Buddy Lane published the first modern map of Mystery Falls, noting a depth of 281 feet for the pit. It is not clear which rig point the pit was measured from, or the technique (Wolinksy, 1985).

2007: As part of an attempt to resurvey Mystery Falls, Brian Sakofsky and crew used a fiberglass tape to measure the pit. No map was ever produced from these surveys, but the following comment was posted to a cavechat.org forum: "From the high rig side, and from just above floor level (the beginning of the drop) the pit was measured to 273 feet with a 300 foot tape and a person holding the end to the bottom of the puddle beneath the drop."

All told, then, the high rig point of the Mystery Falls pit had been previously recorded as 275, 204, 272, 302, 281, 282, 281, and 273 feet...not to mention the kiosk outside the cave entrance that claims "286 feet." Of course, the techniques used for some of these measurements were not certain. What was certain, however, was that if we intended to publish a new map showing a depth of 270 for the big pit, we needed to be absolutely sure we were right.

Later that week, I came back on separate trips with Marty Abercrombie, Leah Bartlett, and Brian Killingbeck to finish up the last of the survey work. In the end, this cave was mapped with a series of short surveys on weeknights, which I highly recommend if you ever have the opportunity to adopt a backyard project. It was not until November 5, however, that we would have our answer on the pit depth.

During our initial survey, Buddy had attempted to use a Disto D3 laser rangefinder, along with two other types of laser rangefinders, to measure the depth of the pit. This proved impossible, due to some combination of the misty air and the lack of a suitable target on the bottom. Hoping to find a way to confirm our original measurements, Buddy purchased a "target plate" directly from Leica, and I returned to the cave with Marty Abercrombie and Kyle Gochenour. Kyle brought another pair of D3 rangefinders, a "gorillapod" flexible tripod, Buddy's target plate, and a wild-eyed plan to affix the lasers to a handled ascender for sake of stabilization.

Friends in tow—after all, who says "no" to bouncing Mystery Falls on a beautiful Friday evening?—we sent the target plate down to the bottom of the pit, and Kyle assembled his laser rig. It was an immediate success. Using the ropes as a guide to place the target in the appropriate spot, we measured one side and then the other, three times each:

LOW SIDE: 262.27 feet, 262.29 feet, 262.31 feet

HIGH SIDE: 269.79 feet, 269.77feet, 269.75 feet

Success! With laser measurements that mirrored the taped measurements almost exactly, we could now be confident in the numbers on the new map. Pleased, I enjoyed another rappel into my favorite deep pit, did a bit of mop-up survey work on rope, and called it a night. The survey was complete.

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The Exploration and Survey of Rusty's Resounding Rock Drop, Franklin County Tennessee

Elliot Stahl, NSS 56422 and Danny Dible, NSS 18923

Ron Adams descending into the entrance pit, January 2008.

Trip #1: January 1, 1995

The story of Rusty's Resounding Rock Drop begins on New Year's Day, 1995. Danny Dible, Jonathan Schwer, Drew and Sandy Packman, and Rusty Riley, all "Indianians," went ridge walking on the south side of Youngs Creek, just outside of Sherwood, Tennessee. High on the ridge, Rusty found a small hole that was blowing good air underneath a sandstone boulder next to a shallow sink. Rocks tossed into the hole could be heard bouncing off the walls, then after a couple of seconds would "re-sound" with a loud thud indicating a fairly deep pit (hence the name). The entrance was dug open and had an extremely tight spot a few feet below the opening. This squeeze later became known as the "Shoulder Block" (also Dig #1). It was much harder to get your shoulders out than to get them in. Danny descended the pit first and it was taped at 112-feet deep. Drew Packman descended part way down the upper part of the shaft that has numerous wedged sandstone boulders, and decided it was too dangerous and climbed out.

Nobody else wanted to descend, so Danny explored the cave at the bottom. After dropping into the large dome pit, Danny made his way down a steep breakdown slope to a 6-foot climb-down and into a tall canyon passage. About 25 feet ahead he came to a constriction a few inches wide where he could peer through and see that the passage was larger on the other side. This was Dig #2. Danny dug out the floor of the passage to make it wide enough to squeeze through into 25 feet of larger canyon passage. This led to a small window which dropped down about 5 feet into a tall canyon about 8 feet wide that had a sculpted dome with a pool of water at one end. Downstream the canyon immediately narrowed at the floor level and was much too small to get through. By climbing up about 7 feet, Danny was able to squeeze sideways through a tight twisting canyon about 10 feet long. On the other side it opened into a small, dry, dome room about 10 feet in diameter. At the other end, the passage sloped down into an adjacent dome room about the same size as the previous one. This dome had a small pool of water and a very muddy floor. There was a crevice that was too small leading from the room with strong airflow. The only other lead was a small softball-sized hole in the floor down which rocks dropped 10 feet. Danny noted that the hole also had good airflow. He then climbed back out of the cave and the group continued ridge walking.

Trip #2: October 28, 1995

The second group to visit the cave was Jim Smith and John "Rocco" Stembel. They visited Rusty's after being turned around by an extremely tight spot about 250 feet down in nearby Youngs Creek Blowhole. (There was a joint Indiana/TAG caver push trip to Youngs Creek Blowhole that day). Jim descended the pit and set two re-belays to keep the rope off of the massive sandstone boulders that are wedged overhead that form the Shoulder Block. Rocco was not able to negotiate the squeeze and did not descend the pit.

Trip #3: December 25, 1995

Marion Smith, Maury Benamy, and Teresa Williams visited the cave on a tourist trip to yo-yo the entrance pit. It was so tight Marion had to back down the Shoulder Block with his jumars on because he could not rappel through. Marion descended the pit and rigged the two rebelays on his way down. When Marion tried to climb back out of the Shoulder Block, he had an even greater amount of difficulty trying to fit back up through the squeeze. He handed Maury his helmet and his chest harness (including his top ascender that is the most important part of his climbing system) so he could fit. It was not until after dark that Marion extracted himself. After seeing how much Marion struggled, Maury and Teresa decided not to do the pit, leaving Marion's carabiners and Maury's 200-foot rope abandoned in the cave.

Trip #4: October 18, 1996

Danny Dible and Jonathan Schwer visited the cave to begin the survey and found Maury's rope and Marion's carabiners still rigged and intact in the entrance pit. They rigged their own rope and used Maury's rope as well. This allowed both to be on rope at once to survey as they descended the entrance drop. They were glad Maury's rope was still rigged and usable. They surveyed to the known end of the cave. In the muddy dome room, they did some digging to enlarge the hole in the floor. However, they were not able to enlarge it enough to fit through (Dig #3). Two days later they returned Maury's rope to him at his and Teresa's wedding in Buford, Georgia.

Trip #5: November 2, 1996

Danny Dible and Kent Wilson descended to the muddy dome room and worked on Dig #3. After a short time they were able to open the hole up enough to fit through. It was a 12-foot pit which they descended and arrived immediately at Dig #4. They pushed this tight passage moving what they could for approximately 25 horizontal feet and 15 feet vertically. This passage led to a small room in a shale passage. Just beyond this they came to Dig #5. They set three survey stations and left.

Trip #6: August 2, 2003

Tony Akers, Marion Akers, Chuck Runkle, and Danny Dible returned to the cave and worked on Dig #5. Using a "wonder bar" and a hammer, they dug 25 feet through a low crawl. Beyond the dig they explored an additional

40 feet of small passage to a dome room 15 feet in diameter. The only lead exiting the room was a grim, wet crawl that Tony pushed followed by Danny. After about 25 feet the crawl enlarged slightly, 20 more feet of low wet crawl led to the edge of a 9-foot climb down that required them to enter head first. At the bottom they found another 20 feet of passage that led to Dig #6, which had strong airflow. On the way out the duo discovered a small hole that led up into the shale passage that would bypass the grim wet crawl if it was enlarged. On the ascent out of the cave the Shoulder Block proved to be very difficult with the large amount of digging and exploration gear they were carrying. Danny had to try four times before the right combination was found to squeeze out. After fighting his way out of the tight entrance, Danny realized he had forgotten his survey instruments at the bottom and had to re-rig the pit to obtain his instruments.

Trip #7: November 3, 2007

Danny Dible, Marion Smith, and Rusty Riley returned to the cave to enlarge the dreaded Shoulder Block in the entrance pit. The obstacle had not only given Marion and Danny much grief but also had prevented the discoverer of the cave (Rusty) from descending previously. They were very successful and were able to enlarge the tight squeeze to “more comfortable” dimensions, though it remained rather “snug.” The group then headed into the cave and worked on enlarging the crawl in the shale passage and the by-pass to the sleazy crawl.

Trip #8: November 17, 2007

Rusty Riley, Tony Akers, Marion Smith, Greg McNamara, Danny Dible, and Jonathan Dible descended into the cave and worked on Dig #6. They were once again able to break through the dig and explore another 40 feet of horizontal passage to Dig #7.

Trip #9: January 19, 2008

Danny Dible, Ron Adams, Doug Hanka, and Chuck Perkins went to the cave to dig. Chuck ended up spending the night outside the entrance, in freezing temperatures, because he was not comfortable descending the drop due to the wedged boulders and technical rigging (rebelays). The other three cavers worked on enlarging Dig #4 and enlarging the bypass to the wet crawl. The heavy packs full of digging equipment made descending the awkward entrance pit and crossing the rebelays extra challenging for the group.

Trip #10: March 8, 2008

Danny Dible and his son, Daniel Dible, worked on Dig #7 at the end of the cave and discovered about 70 feet of passage that included two nice dome rooms 15 feet in diameter and 30 feet tall. On the side of the second dome room they encountered yet another dig. The cave was very wet on this trip due to the large amount of snowmelt, making conditions damp as they traveled to the dig site.

Trip #11: May 24–25, 2008

Tony Akers, Marion Akers, Greg McNamara, Ron Adams, and Danny Dible completed an 18-hour trip to work on Dig #7. They broke through to a 15-foot pit after a 15-foot dig. Below the pit they explored several hundred feet of walking shale passage that led to a climb-down through boulders and into a lower stream passage. This began as a crawlway and then enlarged to a wide walkway. Just after the passage got big, they encountered a too-tight hole in the floor in which water dropped through breakdown and shale and into an approximately 70-foot pit. Just beyond, they climbed up a flowstone slope and found a large room about 80 feet across and 40 feet tall. It contained a large sloping flowstone mass that divided a larger, shallower pit to the left and a narrow and seemingly deeper shaft on the right. They stopped exploring and began traveling through the long, grungy obstacle course between themselves and the entrance.

Trip #12: June 7–8, 2008

Ron Adams, Greg McNamara, Tony Akers, Marion Akers, Doug Hanka, Danny Dible, and Chuck Perkins descended to the top of the fourth drop, which was virgin, and Tony rigged both sides of the pit. The shallow side of the drop was about 25-feet deep. The waterfall issuing from the virgin stream passage above rained down on the far side of the pit and flowed into a too tight canyon. The deepest side of the drop had a lip made of eroded blades of flowstone that coined the name “Hot Knife in Butter Pit” because that’s what the lip of the pit looked like it might do to a rope. A bolt for a redirect was placed to keep the rope away from the sharp edges. The entire group then descended the virgin 58-foot pit. At the bottom a steep flowstone slope led down to a narrow canyon way that Tony pushed, followed by Danny and Chuck. It led into the bottom of a tall dome, presumed to be the base of the 70-foot pit they crossed over in the stream passage above. On the other side of the dome, a very

Danny at the beginning of the tight canyon past Dig #2, January 2008. Photo: Ron Adams

tight canyon passage continued about 200 feet until it got too small. At some point "about face" was called and they exited the canyon passage. Back at the bottom of the Hot Knife in Butter Pit, Ron Adams rappelled into another 20-foot pit that led to a canyon which was too tight. The group then exited the next day after a long and exhausting trip.

Trip #13: May 23–24, 2009

Tony Akers, Marion Akers, Ron Adams, Greg McNamara, Brian Grubb, Danny Dible, and Elliot Stahl returned to the cave to continue pushing leads below the Hot Knife in Butter Pit. After rigging and descending to the bottom of the fourth drop, the group ignored the tight lower canyon leads and did a steep climb-up on flowstone that led to a 10-foot pit. Traversing around the side of the pit, they found a well-decorated dome room and an overflow pit series.

The group rigged and descended a 19-foot pit that landed on a bridge between two more pits. Bolts were set and the group descended the furthest and deepest-looking pit. It was 25 feet and dropped into a sizable dome room containing two canyon passages that immediately narrowed. At the bottom, Danny squeezed through the tighter side canyon that connected into the parallel pit.

Everyone made their way into the other lead, a narrow, floorless canyon passage. The canyon floor could not be seen but was estimated to be 50 feet below and too small to fit down, but large enough to fall into and get hopelessly wedged. The ceiling of the canyon rose up

Marion Akers above the Hot Butter in Knife Pit during the exploration, May 2008. Photo: Ron Adams

into a narrow crevice as well. The cavers traversed the canyon using mainly friction between the walls and occasional small ledges for hands and feet. This tricky canyon traverse continued for nearly 200 feet until the canyon became too tight. The only way on was to drop into the floor, which had finally widened enough to go down.

Encouraged by the group to continue exploration, Danny was able to free-climb 50 feet down to a stream passage below; after going around a few tight bends, he emerged in a large sculpted walking passage that led 60 feet to the edge of a 12-foot pit. Danny free-climbed the drop and explored another 150 feet of meandering stream canyon until he came to a low, wet spot, with what looked like a passage on the other side with good airflow.

The excitement of the large passage below the canyon traverse was once again met by yet another narrow obstacle. This led Danny to name the nice walking passage the "Boulevard of Broken Dreams" (quoting the song by Green Day). After Danny returned to the group, it was decided the canyon needed rigging for safety to continue exploration below. The cave now had the new challenge of what looked to be a low, watery crawl. The group had gotten a late start to the day and trip times ranged from 12 to 14 hours in length. Ascending from the depths the weary explorers were met with a hot and humid Tennessee night. One by one the cavers exited and fell asleep on the ground waiting for the others to climb out. It was slow going carrying heavy packs with dig gear and all of the ropes.

Trip #14: August 7, 2009

A large group consisting of Tony Akers, Marion Akers (a.k.a. "pretty Marion"), Marion O. Smith (a.k.a. "ugly Marion"), Greg McNamara, Ron Adams, Ty Spatta, Dave Stahl, Elliot Stahl, and Danny Dible returned with plans to rig, push, and survey the lower cave. Armed with rigging gear, digging equipment, and all the ropes needed to rig along with push ropes, the cavers slowly made their way down to the beginning of the canyon traverse. Tony placed bolts and rigged a traverse line down 150 feet of

Marion Akers descending the third drop during the push trip, May 2008. Photo: Ron Adams

the 200-plus feet of canyon passage making it safer to traverse.

Meanwhile, Marion Akers surveyed to the beginning of the canyon. At the end of the canyon, where Danny had climbed down, more digging was done in order to allow for the other larger cavers to descend. Ron and Ty still could not make it down the narrow canyon pit. So they, along with Dave (who had enough sense to want to get out of this horror hole) began exiting the cave. Meanwhile, Danny, pretty Marion, ugly Marion, Tony, Greg, and Elliot descended the tight canyon, this time using a rope either to rappel on or as a handline. It was necessary at one point halfway down the pit to take all vertical gear off the rope and do a downward squeeze and then get back on rope to keep descending. The group then made its way to the low, wet lead. They crawled through and the passage opened up into another low room with an even lower water crawl continuing.

Elliot, being the youngest and smallest, continued ahead traversing about 50 feet of low crawl. The crawl became so low that his body was scraping the floor and the ceiling as he crawled over ledges of chert in the water. After another 50 feet this opened only slightly to a place where he could turn around. The low wet chert crawl continued and Elliot went another 50 feet to where it became very low and the water pooled up. Hearing a waterfall ahead and feeling the rush of air, Elliot continued. Going through the low airspace he crawled up to the edge of a small hole, just barely able to turn his head in order to look down into a wet 30-foot pit. Once Elliot was able to look down the pit he realized he was lying on an overhanging chert ledge only 3 inches thick, which stuck out into the pit at least 4 feet. Had it broken he would have fallen in head first. After realizing this, Elliot backed up quickly to the other side of the pool and then had to crawl backwards another 50 feet out of the lowest part to where he could turn around. Seeing no possible way to descend such a tight awkward pit, Elliot returned and the group began the long trip out. Trip times ranged from 20 to 24 hours in length and everyone exited the cave Saturday afternoon.

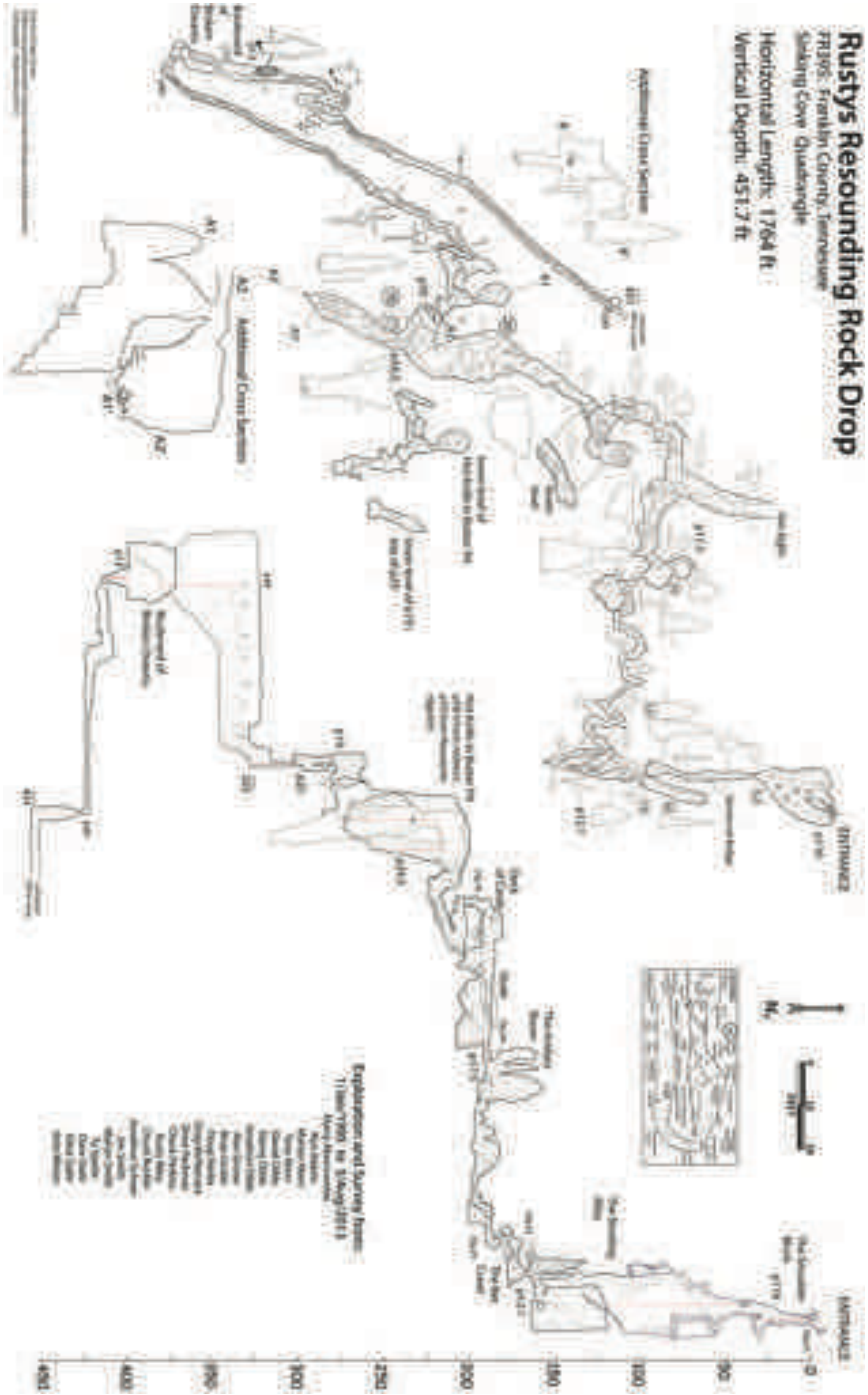
Trip #15: November 17, 2012

Years went by and the memory of that undescended pit with strong air and lots of water occasionally crept into Elliot's head. He decided to return to the cave with the idea of attempting to descend the pit. The original explorers would not fit past the tight chert squeeze to reach the pit, nor be able to descend it. With their graces, Elliot put together a team of strong, skinny cavers to rig and push the cave. Elliot led Brian Killingbeck, Andy Zellner, and Tony Voudy to the cave. They had to carry 900 feet of rope to rig eight pits, the canyon traverse, and the virgin pit. After reaching the Hot Knife in Butter Pit, Tony decided he had seen enough of the cave and made his way back to the entrance. Continuing, Elliot, Brian, and Andy re-rigged the canyon traverse and made their way to the low room before the wet stream crawl. Here Andy waited for a report. Meanwhile Brian and Elliot crawled ahead to the next low room. Since Elliot was not sure how far it was to the edge of the virgin pit and knowing at one point he could not turn around, he came up with a plan. Brian fed Elliot rope as he crawled forward until he found a rig point. Elliot crawled forward to a place where he could almost sit up. Sadly it was determined that the pit was still further down this low crawl than Elliot remembered. Brian came forward once more and fed Elliot rope as he made his way to the last rigging option, a small chert bridge in the water crawl. Elliot tied two 75-foot ropes together (the last ropes they had) and crawled toward the edge of the pit stringing the rope down the crawl as he went. Upon arriving at the lip of the pit he lowered the rope into the larger of the two small holes at the top.

At this point Elliot was lying in a stream in a passage maybe 10 inches tall, with several inches of pooled water. Elliot then turned around and backed down into the pit using one ascender as he could not fit with a rappel rack on. Once below the lip, he used the long tail of the knot that tied the ropes together to clip into with his other ascender while stepping between two chert ledges. The pit belled out below him, but he did not want to descend with the rope coming over the 4-foot under cut and very sharp chert ledge. So Elliot pulled the rope back up through the hole he came down and fed it through a hole adjacent in the chert ledge he could not fit down.

This hole held the rope away from the undercut chert ledge and actually had a lip that was composed of limestone. Switching ropes again he descended the 31-foot pit encountering the strong waterfall 10 feet down and hardly any extra rope on bottom. Brian crawled up to within 10 feet of the edge of the pit and decided he did not want to attempt the challenging move. At the bottom Elliot explored several hundred feet of narrow, down-cutting walking passage. This canyon led to a small pool of water; there the passage made a 90 degree bend and into a very low wet crawlway. Eventually it became too tight and Elliot dug through gravel for 15 feet to where the passage enlarged to a hands-and-knees crawlway that opened up into walking passage. Here he encountered a tight in-feeder. Elliot explored it for only 40 feet before it became too narrow.

Going downstream into another water crawl, the passage slowly enlarged again to become 20 feet wide and 15 feet tall, retaining these dimensions for 50 feet before ending in a massive flowstone plug. Elliot found a way to crawl under the flowstone plug and pushed another 50 feet into a low airspace crawlway. Chert ledges on the ceiling knocked his sten light off into the water. Elliot turned on his only spare light and found it was dead, so he carefully fetched his one working light from below the water (which was luckily still on) and fixed it back to his helmet. The passage became lower and


Rustys Resounding Rock Drop
FR305 Franklin County, Tennessee
Sinking Cove Quadrangle
Horizontal Length: 1764 ft
Vertical Depth: 451.7 ft
ENTRANCE

Greg McNamara at the top of the fifth drop lowering a tape during the push trip, May 2009. Photo: Ron Adams lower until finally Elliot could look ahead and see what appeared to be a sump. There was no airflow felt and the only way to be sure it sumped would be to suck the ceiling. Deciding he had pushed his luck enough, Elliot routed. Back at the pit he struggled a great deal to get back up and out of the ninth and final drop in the cave. The group then exited, leaving the cave rigged except for the entrance pit.

Trip #16: August 3, 2013

It took a long time to forget the horrors of the cave. Thus it was almost a year before Elliot returned with a new set of victims. Alan Grosse and Marty Abercrombie agreed to help survey the lower cave down to the top of the last drop. It was apparent that the last pit was impossible to descend for anyone not scrawny like Elliot. Below the Hot Knife in Butter Pit, Elliot rechecked the 20-foot pit and was able to squeeze through a tight canyon and look down into the Boulevard of Broken Dreams (bypassing the entire canyon traverse). However, the route needed to be bolted and enlarged to be usable. So they picked up the survey at the bottom of the sixth drop and made their way down the infamous canyon passage. They surveyed to the edge of the ninth drop and plumbed the pit, which was as good as it was going to get as far as survey. On the way back up the narrow canyon pit, the newcomers to the cave struggled much to get out, not already being familiar with the tight contortions needed to ascend. They pulled all the lower ropes to the top of the canyon drop and left the rest rigged, exiting the cave after a 9 hour trip.

Trip #17: September 1, 2013

Elliot Stahl and Charlie Emerson descended to the top of the canyon pit (seventh drop). Then they pulled out all of the rigging and ropes from the cave below the Hot Knife in Butter Pit during a 4 hour de-rigging trip.

Trip #18: February 22, 2014
(A mere six days before this article was due).

The final lead left in the cave was the stream passage that could be seen across the top of the Hot Knife in Butter Pit, forming the waterfall on the far side. Elliot Stahl, Marion Smith, and Lauren Satterfield descended to the top of the fourth drop. Elliot, belayed by Lauren, set a bolt on the left wall and cut steps in a sloping shale layer above the pit, traversing 20 feet to a bridge of rock spanning the pit. From here Elliot set 15 more bolts doing an aid traverse across the top of the pit to reach the passage on the far side. Once on the far side he climbed up into a tight canyon above the stream that opened up for 50 feet of nicely decorated walking passage ending at a flowstone plug. Squeezing over the top of the flowstone, he went another 30 feet in a low passage that eventually became a wet belly crawl and pinched out. Elliot cleaned the hardware from the traverse and the group exited the cave de-rigging the cave entirely during a 6.5 hour trip.

Thus the long and sometimes epic story of Rusty's Resounding Rock Drop is now over. This cave for obvious reasons will not be a popular destination for tourist cavers. Those inclined to "collect" hundred footers might visit the entrance pit. However, for one small group of Indiana and TAG cavers who spent many long weary hours exploring the depths, Rusty's Resounding Rock Drop is a cave none of them will soon forget.

Waterworks Cave: The Survey and Continued Exploration

Alan Grosse, NSS 58114

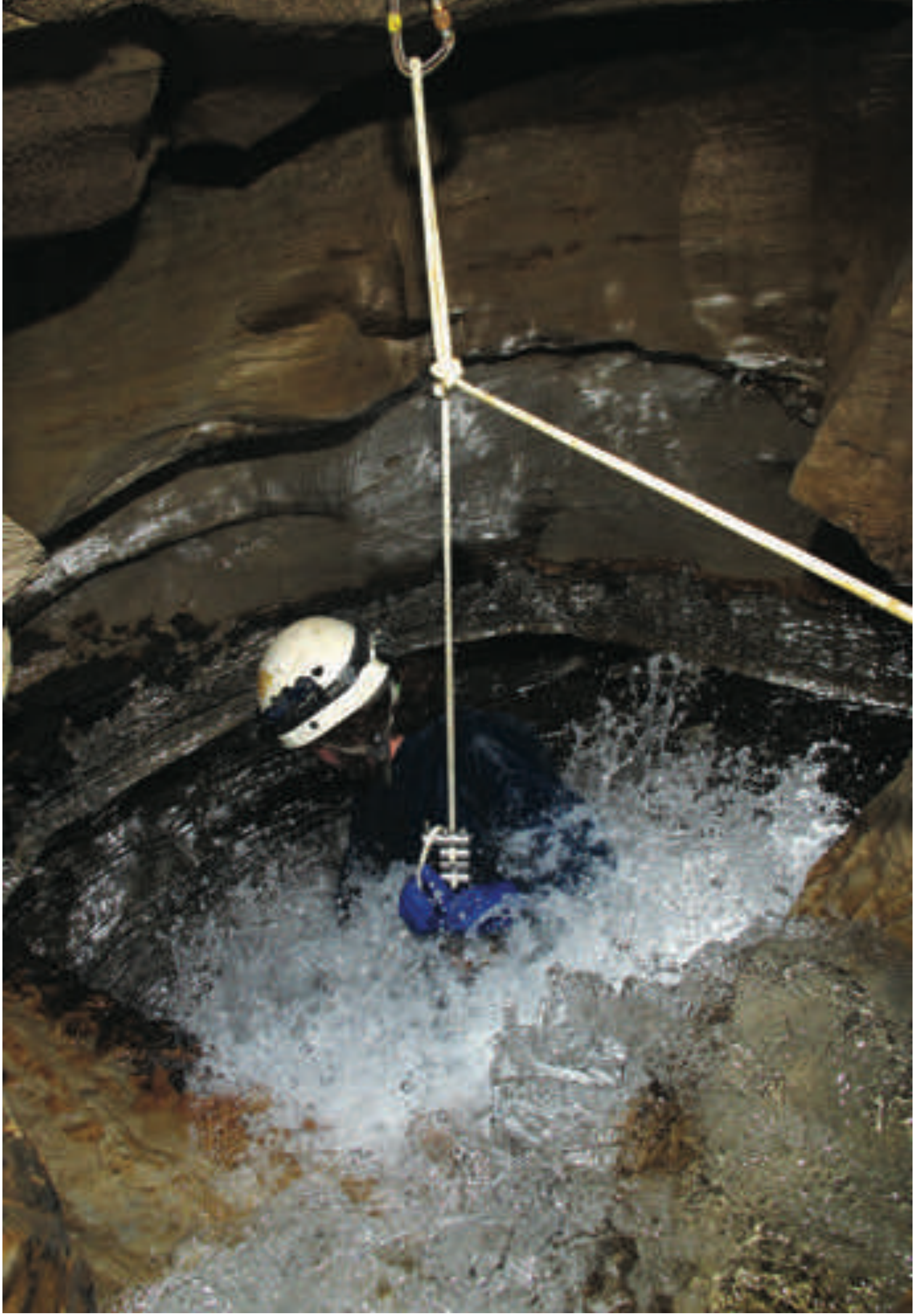
Alan Grosse at the entrance of Waterworks Entrance. Photo: Alan Grosse

Andy Zellner suggested Waterworks as an easy first cave to map. That's how it started.

As a first-time surveyor and cartographer, it seemed like a good idea. With only 1,000 feet of horizontal extent listed in the Tennessee Cave Survey (TCS), we guessed we could survey the cave in a weekend; maybe two if we found anything new. The latter seemed unlikely for such a well-visited cave. Andy observed that someone had attempted to map the cave before, as he pointed out some survey stations, but it appeared that they'd never finished.

The cave is located in Orme, Tennessee. The parking area is next to the town's old waterworks, hence the name, no longer used after a past drought forced the residents to connect to the municipal water grid. A short walk to the sink reveals a spectacular waterfall. Depending on the time of year, this water can run into the cave and down the first pit, but most of the time it just disappears into the ground.

To the left of the falls is the primary entrance to Waterworks. And 50 feet to its right, slightly up the breakdown slope, is the Indian Trace entrance to Waterworks Cave. This was believed to be a separate cave, the name provided by the current landowner after discovery of artifacts near the entrance.



Elliot Stahl at Waterboarded Well. Photo: Alan Grosse

Elliots Totem Room. Photo: Alan Grosse

The first survey trip into Waterworks consisted of Jeff Bartlett, Grace Baumann, Joy Palmer, Brian Killingbeck, and Alan Grosse. I wanted to break in my brand new Suunto Tandem and as I handed it to Jeff, he lost his grip. In an effort to regain control he spiked the instrument into the ground. Luckily, it survived.

We had intentionally brought a few extra people on this trip, so Jeff could teach me the various jobs of a survey team and let me sketch behind him. After we did a quick survey of the sinkhole and set a tie-in station for Indian Trace, we headed into the entrance and rappelled down the 12-foot pit. At the bottom we headed down the canyon to the next drop, which we measured at 47 feet deep.

The bottom of this drop features large, round cobbles on the floor of an old trunk passage that is partly filled with breakdown. We set stations for various leads in the room and headed up the breakdown. We concluded the survey by mapping one side passage, which ended up doubling back and reconnecting to the main trunk.

Alan, Joy, Grace, Andy Zellner, and Kyle Gochenour returned on March 24. We split into two groups. Andy and Grace followed the lead under the 47-foot drop, while the rest of the crew surveyed toward the known bottom of the cave.

The first lead starts out as a hands-and-knees crawl that splits. To the left, the passage goes a few hundred feet and opens up to a room that has a waterfall running over breakdown into the floor. To the right, more hands-and-knees stream passage turns into a tall canyon room that has water coming down from the ceiling. I met Andy at this point, and it was so wet we just set a station near the water to finish this area in drier times.

The other team went to a lead off of the loop from the first trip. This passage starts as a hands-and-knees crawl as well, soon opening to a stoop walk before dropping into a canyon at a brilliant white flowstone formation. After a short distance, the floor of the canyon drops about five feet into a deep pool. We traversed over the pool to a small, decorated room, continuing the survey up and into a well-decorated dome room.

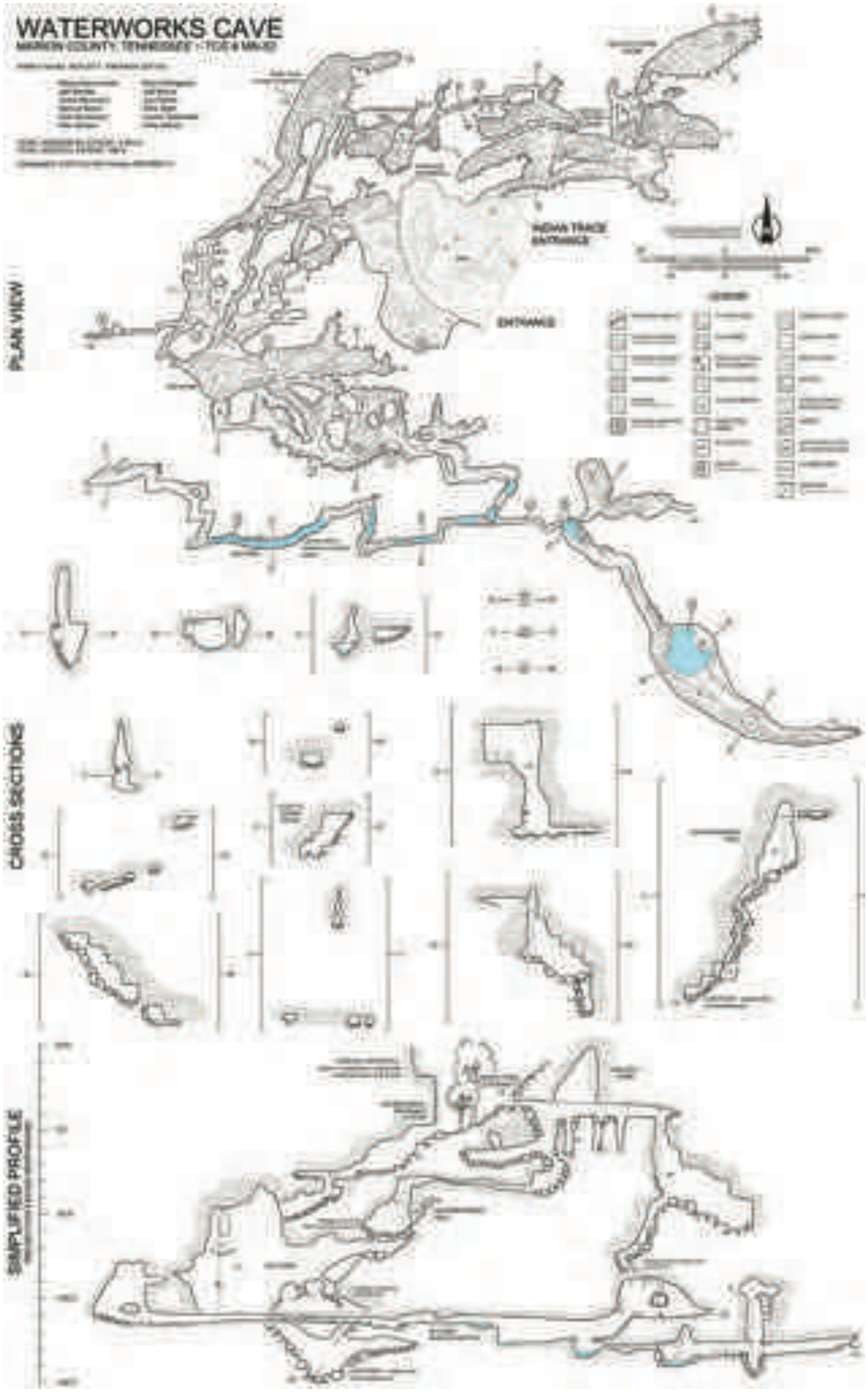
Elliots Totem Room. Photo: Alan Grosse

On March 31, after a long night at Andy's and a late start, Alan, Joy, and Jeff returned to the cave and started with a lead above the nice white flowstone in the bottom of the cave. We didn't want to track anything on this very pristine formation, so we ditched our boots for aqua socks before proceeding into the high lead. It led over a large rimstone dam, filled with water and curved back into a passage that transitioned from a stoop-walk to a belly crawl on a series of rimstone dams filled with water.

The air was blowing through this passage and the awkward instrument reading, the lack of real shoes, the unexpected immersion and the impact of the previous night's events began to catch up with Joy as she exclaimed: "I feel like I'm going to throw up." Jeff immediately sent her out of the cave, and the two of us continued the survey. Jokes ensued about the possibility of having to crawl out through pools of Joy's vomit, thus coining this crawl the "Bile Mile."

At the end of the rimstone series, the passage took a hard right into passage that got bigger and bigger. The realization that we had found something very new overwhelmed us as we scurried through the passage, but it ended abruptly at a 20-foot dome. We called the survey and headed back to check on Joy's condition; luckily, we didn't have to crawl through vomit, and she was comfortably hanging out at the bottom of the second drop. On the way out of the cave, we mopped up a small loop at the top of the 12-foot pit.

Alan, Joy, and Kyle started the survey on the nearby Indian Trace Cave on May 2, 2013. It was suspected that this cave must connect to Waterworks somehow, but as far as anyone knew, no one had made a physical connection. Indian Trace proceeds horizontally for a few feet then drops down a breakdown slope into a small room with many leads. After setting tie-in points, we completed a 6-foot climb up to an area with four pits. The first three pits can be down-climbed and interconnect at the bottom. The last, a very wet pit, was left for a drier day. We surveyed out a passage that looped around to the entrance, skirted around the climb-down and closed the loop.


WATERWORKS CAVE
INDIAN TRACE
ENTRANCE
ENTRANCE
PLAN VIEW
CROSS SECTIONS
SIMPLIFIED PROFILE

Elliot Stahl in Indian Trace Crawl. Photo: Alan Grosse

Elliots Totem Room. Photo: Alan Grosse

Elliot Stahl setting bolts for the Dome Climb. Photo: Alan Grosse

Elliot Stahl at the Dome Climb. Photo: Alan Grosse

The next morning, Elliot Stahl and I returned to Waterworks with a handful of mop-up survey objectives. We decided that the best order of operations would be to survey the area past the pool in the canyon before getting wet and cold in the Bile Mile to check the lead at the top of the dome.

We climbed down and traversed over the pool into a decorated area. After a short crawl, we popped out into a section of borehole that gradually pinched off in a pile of breakdown. This section had a lot of nice formations, as well as a pit and dome bisecting it. The dome had a small amount of water coming down, so we marked it for later exploration and headed to the Bile Mile, where we picked up the survey and headed to the dome.

Elliot free-climbed this dome to a high lead, which was a rift passage that went about 40 feet before becoming too tight to proceed. It had no airflow. The air, we discovered, was coming from the end of the rimstone crawl, out of a tiny crack almost completely plugged by formations.

On July 28, Alan, Elliot, and Manual Beers headed to Indian Trace to push leads and look for a connection to Waterworks. I proceeded down a tight crawl at the bottom of the slope and started to hear water. Hoping I was getting close to the area behind the waterfall, I called Elliot down. At the end of the crawl, a lead to the right yielded a small, wet dome with a wet lead that pinched off quickly.

Elliot pushed the lead to the front, moving some cobbles, and then disappearing for a few minutes. He then popped back into earshot, and said he was on a tiny ledge at the top of a very wet pit! Next, he dug at a lead on our left, which popped out into a room with lots of water flowing through it. We were behind the waterfall!

August 8, 2013, Elliot and I brought Marty Abercrombie along for a late-evening trip to investigate the wet pit. It was almost dark when we entered the cave. Marty proved to be a valuable addition, as he took time to dig the squeeze and make it much more comfortable for all of us. We rigged the pit and Elliot was the first to descend, the water flowing over a large lip and going horizontally right into Elliot's face. From that point forward it

Joy Palmer in Water Works Cave. Photo: Alan Grosse

was referred to as “Water-Boarded Well” and was taped at 31 feet.

I was the second to descend, followed by Marty. Elliot had disappeared by the time I got to the bottom, so Marty and I began to survey the room at the bottom along with a lead off to the right that connected to the tight lead off the wet dome at the top. As we finished, Elliot popped out of the water and asked if we were coming.

We continued down a very wet breakdown passage, further and further until we reached a point where the water went through the breakdown. Elliot, on point, took some time to move rocks and eventually proceeded. Out of excitement, he disappeared again, and upon return, exclaimed he had broken through to the breakdown waterfall in the bottom of Waterworks. We had made the connection!

September 9, 2013, I returned with Joy and Elliot to survey a handful of loose ends in Waterworks. We started with a short side lead that ended in a small dome off of the area Andy had surveyed. Early in the survey, we had an issue with flags disappearing from our tie-in areas, I attributed it to cavers as Waterworks is a popular cave, but, as I reached the end of this side passage, the room was completely full of sticks and debris… and, on the top, a fat pack rat sitting on a pile of my station flagging!

We then proceeded to the end of the right fork of Andy’s survey. This area was previously very wet, but now was completely dry. I expected one or two survey shots but upon inspection it was obvious there was way more cave here that was previously hidden by the water. Two leads were now obvious. One went to a small room; the other, a few feet from the end, proceeded down a canyon but became low and tight quickly. Joy attempted to push it, got stuck and backed herself out. Elliot jumped in and

WaterWorks Entrance. Photo: Alan Grosse

started breaking rocks off the walls to fit through, connecting the passage to the other side of Andy's survey at the room with the breakdown waterfall.

Our last lead was the wet pit in Indian Trace. We were hoping it was dry, since the main Waterworks waterfall was a mere trickle compared to earlier in the year, but it wasn't. Elliot proceeded down the pit first. By the time I got to the bottom, Elliot had disappeared again, which was a bad sign. I was hoping this was the day we called "End of Survey." Joy decided it was too wet for her liking and kept watch up top. The room at the bottom was big and I started to set stations. Elliot still wasn't back, so I started poking around the breakdown where I heard rocks being moved. I found a path through the breakdown and it kept going and going, all the while calling Elliot.

Finally Elliot called back, there was an echo, and he replied, "I found a big room." I've never been excited and downright pissed off all at the same time. I was ready for this cave to be over, but the room was a pretty cool find and it was obvious it was virgin. Knowing we wouldn't have time to survey it, we routed out of the cave. We took a few survey shots at the bottom of the pit to get the tie in station out of the water. I pretended to have trouble getting a reading so that Elliot would have to stand in the water longer.

On November 3, Elliot and I convinced Lauren Satterfield to come help us survey the area at the bottom of the pit. The passage to the room is basically a void filled with big pieces of breakdown, so there are many possible ways to get through. It was a real challenge to sketch, but this time around our path was much easier and more direct. We checked the rooms for leads, and took a few photos as I knew I would probably never make my way down there again. On the way out, we stopped by a dome lead at the bottom of the breakdown slope at the Indian Trace entrance. Elliot checked it out but it didn't go far.

November 10, 2013, I headed into the cave with Elliot, Joy, Dan Calhoun, and two friends of mine who were just learning vertical caving: Patrick and Jen Kemper. The goal of the day was to check out a dome lead in the decorated borehole area. Elliot started climbing the dome with Dan Calhoun on belay. I took Pat, Jen, and Joy to tour the cave while Elliot did the climb. Upon our return, Elliot had reached the top, so I started up with survey gear. The dome measured 48 feet to the ceiling; Elliot climbed 35 feet of it to a ledge that went over to a 19-foot parallel pit that connected over to the dome. End of Survey, finally!

February 9, 2014, Alan, Joy, Elliot, Jeff, Kyle, and Tabby Cavendish did the first Waterworks crossover trip. Alan, Elliot, and Jeff went in the Indian Trace entrance while the remainder of the crew started at the dry side.

As a first-time cartographer, I was in way over my head, but it proved to be a great cave as it had a little bit of everything. Due to the nature of Waterworks being mostly breakdown, it made for some really interesting sketching and a lot of short shots. I was lucky to have a great cartography mentor who, at times was the only thing keeping me sane as I drew in countless pieces of breakdown. In the end, we took a total of 222 survey shots and the total horizontal extent of the cave is 3,843 feet … a far cry from the estimated 1,000 feet!

Fern Cave Survey

Steve Pitts, NSS 31111 FE

Dan Lengini Middle Cave-December 23, 1993. Photo: Steve Pitts

The discussion of the new map will benefit from a little background about the original map. Members of the Huntsville Grotto of the NSS discovered Fern Cave and the 437-foot deep "Surprise Pit" in 1961. In the mid-1960s, Bill Torode started to survey the cave, including ledges and the passage complex at the top of Surprise Pit. In 1968, the Morgue Entrance to Fern was discovered, and in 1969 the Johnston and Little Morgue Entrances were found. A massive exploration and the original mapping project started in January, 1969 when 50 mapping trips were conducted, adding 65,452 feet of passage to the survey.

Within a few years, the survey encompassed 15.6 miles of passage and five entrances. The cave became the largest known in Alabama, number 172 on the world's longest cave list, and for a time had the deepest pit in the US. The cave also contains the largest gray bat hibernaculum in the US and many spectacular formation areas including the famous "Helictite Heaven."

Mapping Fern Cave was, and probably will remain, the largest contribution to Alabama speleology ever made by the Huntsville Grotto. There are countless pits and interconnections in the cave all linked by canyons, trunk passages, and crawlways. The cave is so intricate and complex that it is difficult to fully grasp. With this in mind, it is impressive that a small group of cavers mapped the entire cave in a very short period of time (about two years). It is also interesting to note that the techniques used for the original survey were primitive and quite different from modern cave survey methods. There was no sketching to scale and no in-cave sketching. Clinometers were not used and there were no distos or tripod-mounted Brunton compasses used. All the drafting was done by hand after the cave trips based on notes made

Surprise Pit - View from Land Bridge. Photo: Amy Hinkle, Sunguramy Photography during the trips. The end result is a very large map that needs to be projected on an 8 foot by 3 foot sheet for anyone to see meaningful detail about the passages. The original map contains 20 distinct levels, distinguished by color added to the map. The detail depicted on the original map is very rudimentary. It shows passage walls, but little else. There is very little depicted inside the passages, unlike modern cave maps. The map consists of a plan only and there is no profile view or vertical information depicted on the original map.

In spite of its shortcomings, the survey and the map are both amazing accomplishments. The entire cave was surveyed in only a small number of trips by a few enthusiastic, dedicated individuals using, by modern standards, fairly crude methods. Despite the crude methods, we have discovered that this map is actually very accurate. Our new map, when overlaid over the old map, is a surprisingly close match. New connections that completed very large loops have been dug through in places where the old map indicated the existence of separate passages only a few feet apart. The original map was very accurate, and the mapping project was efficient. Thus, the map itself is a very impressive thing to see. However, the only glimpse most people have ever had of the original map is from the cover page of Don Myrick's excellent book about Fern Cave.

In 1991, a small group from the Huntsville Grotto proposed to resurvey Fern Cave. We were motivated by two factors. First, the original map was kept in Bill Torode's private collection and never published. The original surveyors, the grotto, and the entire caving community were denied access to the map. Only a hand-drawn rendition of the map was submitted to the Alabama Cave Survey with outlines of some of the major passages. So, we wanted to be able to provide the caving and scientific community with a first-class map of this premier cave. Also, Fern Cave is an extremely complex, horizontal, and vertical maze, and we wanted to take advantage of modern cartography to depict its true nature. The labyrinthine vertical nature of the cave is too important for any meaningful map to omit. The project was also considered a good way to promote cave survey skills and help cavers learn about this wonderful cave. With these things in mind, we launched the survey project.

We organized what became known as the Fern Cave Project. The resurvey of the cave was expected to be a huge undertaking. One estimate was that it would take 10 years to survey the entire cave. A management plan was created for the project that specified the general goals and methods that were to be used for the survey and how they could be accomplished within the confines of the access policy of the time. Survey standards were established to ensure a high-quality accurate map. Equipment was purchased, some with grants from the Dogwood City Grotto, and other donations. Our equipment inventory included multiple sets of Suunto instruments, various length tapes, custom survey paper, and dozens of survey books. We purchased PMI ropes to leave many of the drops on major routes permanently rigged. We also made special instrument and station illuminators using LEDS and electro-luminescent panels that were very effective survey aids. A permanent compass calibration course was setup on the trail to the entrances with three stations. The stations were metal posts epoxied into large rocks, each about 20 feet apart. Before each survey trip, the team would shoot the three stations and record the measurements as well as the instrument set used.

At the beginning of the survey, some of the larger, easier passages such as the "West Passage" and the "Middle Cave" were mapped with a tripod-mounted Brunton compass to create a precision "backbone" survey. The precision survey also ran the length of the "Upper Formation Area" to the "Blowing Hole," and then through the "Vertical Maze" into the Middle Cave trunk passage. The "Upper North Cave," some sections of the "Bottom Cave," and the upper level of the "Gold Level Canyon" were surveyed in the early 1990s.

The "Morgue" section of the cave has always had strict access restrictions in order to protect hibernating bats during winter. We were only able to survey here from April through August, so progress in that area has been limited. The "Short Cut Route" to the Bottom Cave was surveyed as well as a portion of the "Morgue Middle Cave," but the majority of the "Morgue Area" remains un-surveyed. It is worth noting that, in many ways, the Morgue Area that includes the gray bat hibernaculum is one of the most important parts of the survey because there is no other way to record accurate, reliable, historical information as to the whereabouts of the major segments of the bat population. This information is critical to the understanding and conservation of the bat habitat and conducting gray bat inventories. Currently, the only historical record of the bat hibernaculum is contained in handwritten notes that are cryptic, vague, and of limited value. The Morgue section is also the least well-known area of the cave and few individuals are familiar with it.

Some sections of the Morgue are visited only once a decade or less, and many areas have been visited only once or twice since the original exploration.

Survey Standards

Each station required a front and back-sight expected to match within one degree. Sketching was done to scale with "left/right/up/down" measured at each station. A running vertical profile and leads list were maintained. Initially, the decision was made to use flagging tape for marking stations. Some felt that this was the best method to minimize impact in the cave environment. Blue flagging tape was used for stations, and red and black-striped flagging tape was used to mark leads. Permanent stations were set at major junctions using aluminum markers and small pins set into the rock.

At the beginning of the project, we solicited help from many grottos. Fern Cave is well known nationally and soon, much of the work was being done by cavers visiting from out-of-state and many from outside the TAG region. The project initially went very well. There was a lot of enthusiasm about the survey and learning about the cave. We published a newsletter, provided training, and did over 120 survey trips resulting in almost 10 miles of survey. In the late 1990s the momentum waned and the project began to slow. During this time, several problems became clear. We had more novices than experts, and inexperienced sketchers got bogged down with the detailed sketching requirements. Few knew the cave very well, and we were heavily dependent on the small number of skilled team leaders. This could have been solved by dedicating certain teams to specific passage areas, but this was never done. We had a lot of novice cavers, and they were slow to move through the cave to get to their survey areas. In many tight canyons and crawlways, the front and backsight requirement slowed progress since hard shots are never easy to match up. Because of the emphasis on minimal impact station marking, and use of flagging tape, station markers got displaced or were knocked off the stations during subsequent trips, and not enough recoverable stations were set. Some surveyors just did not understand the importance of leaving stations at leads and junctions. As well, it proved to be more difficult to keep the large group organized and focused than anyone expected. Progress slowed and soon, a couple of years had gone by with little progress.

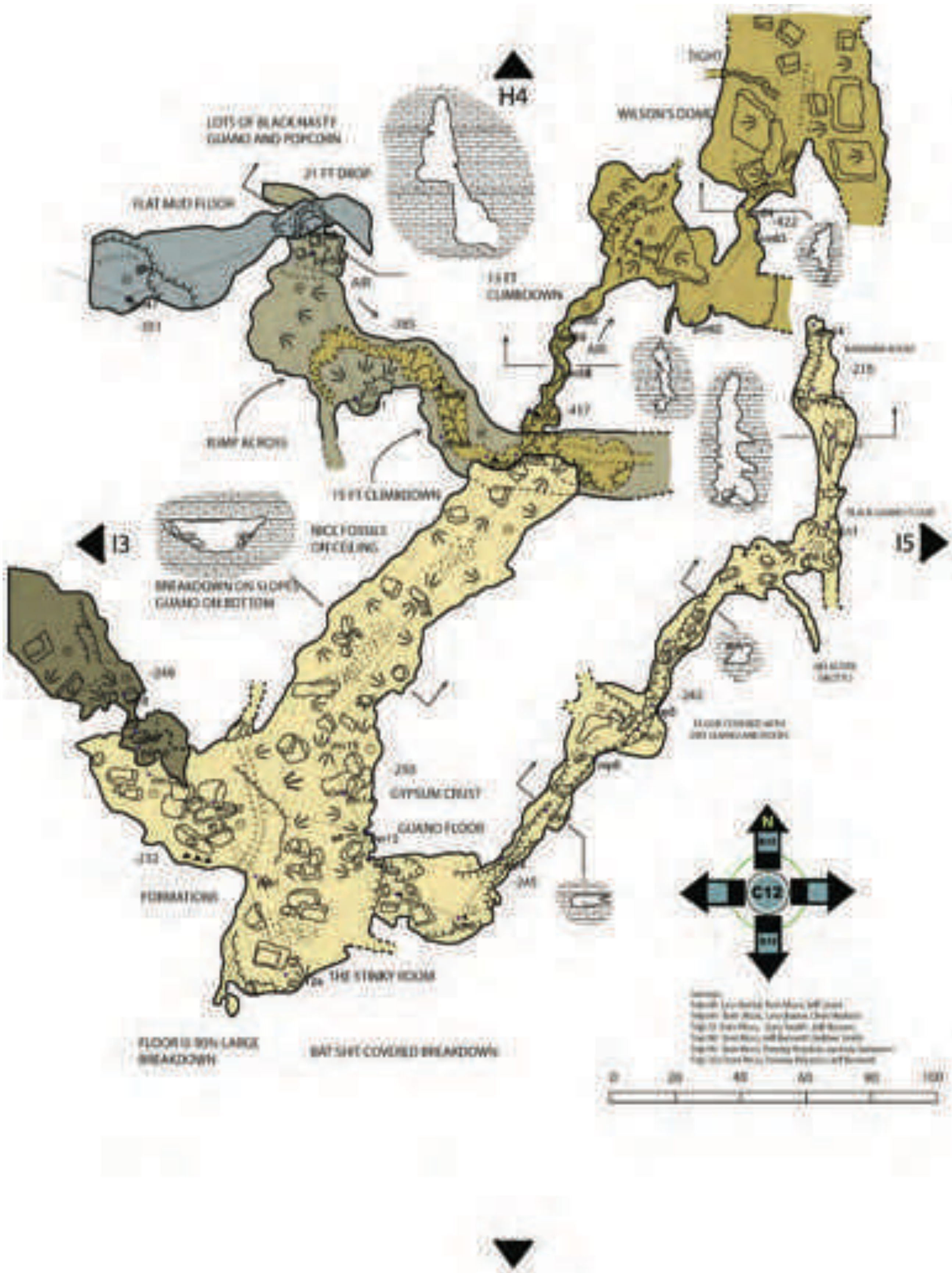
In the early 2000s, interest was revived, and a small team began surveying again. The focus of our first effort was "Level 7" of the "North Cave" and we were able to push the survey all the way to the northern most segment of the cave system. We also surveyed the "West Room," the "Hall of Giants," and started on the "East Canyon." Some sections of the "Waterfall Dome Route" were surveyed, and the "Pendulum Pit" in the "West Passage" was connected to the West Room. Also during this time, sections of the Bottom Cave were added to the survey, and the Sump Entrance was tied into the Bottom Cave by cave divers. A small team of surveyors continued work on the project until 2009. At this time, the entire cave was abruptly closed as white-nose syndrome (WNS) appeared to threaten bat populations all over the southeastern US.

Drafting

During the years when the Fern Cave Survey Project was active, we collected data from 200 trips, but no one drafted an interim map. Line plots were generated, but there was no drafting of a real cave map to show tangible results of the massive amount of work that had been done. The focus was on data management: checking for errors, scrutinizing loop closures, keeping track of the leads list, and generating line plots. Originally, Mike Churchill's program was used to manage data and then we later transitioned to Compass. The ability to create 3D images of the cave map using the CaveX Viewer was especially appealing, and this served the purpose of an interim map. In recent years, the data has been migrated into Walls, and drafting of the map has begun. The project has over 2,000 pages of sketches so far. All have been scanned and exist in digital format. These sketches are imported into Adobe Illustrator, which was chosen for drafting the final map. The current format for the map is organized into 32 sections that measure 11 inches by 17 inches each. Several of the more complicated sections have been started and many more are currently in progress. This work has shown the best glimpse of the high quality map we had envisioned in the beginning of the project.

Challenges

Mapping Fern Cave presents a lot of challenges. The cave is extremely complicated, there are over a dozen distinct horizontal levels in the cave that mingle in very confusing ways, and there are numerous loop closures that are very large and subsequently test our accuracy. There are a lot of passages that are difficult to access as they require exposed climbing and special rigging.


H4
LOTS OF BLACK NASTY
GUANO AND POPCORN
21 FT DROP
FLAT MUD FLOOR
AIR
WILSON'S DOME
15 FT
CLIMBDOWN
JUMP ACROSS
15 FT CLIMBDOWN
I3
NICE FOSSILS
ON CEILING
BREAKDOWN ON SLOPE
GUANO ON BOTTOM
I5
GYPSUM CRUST
GUANO FLOOR
FORMATIONS
THE STINKY ROOM
FLOOR IS 90% LARGE
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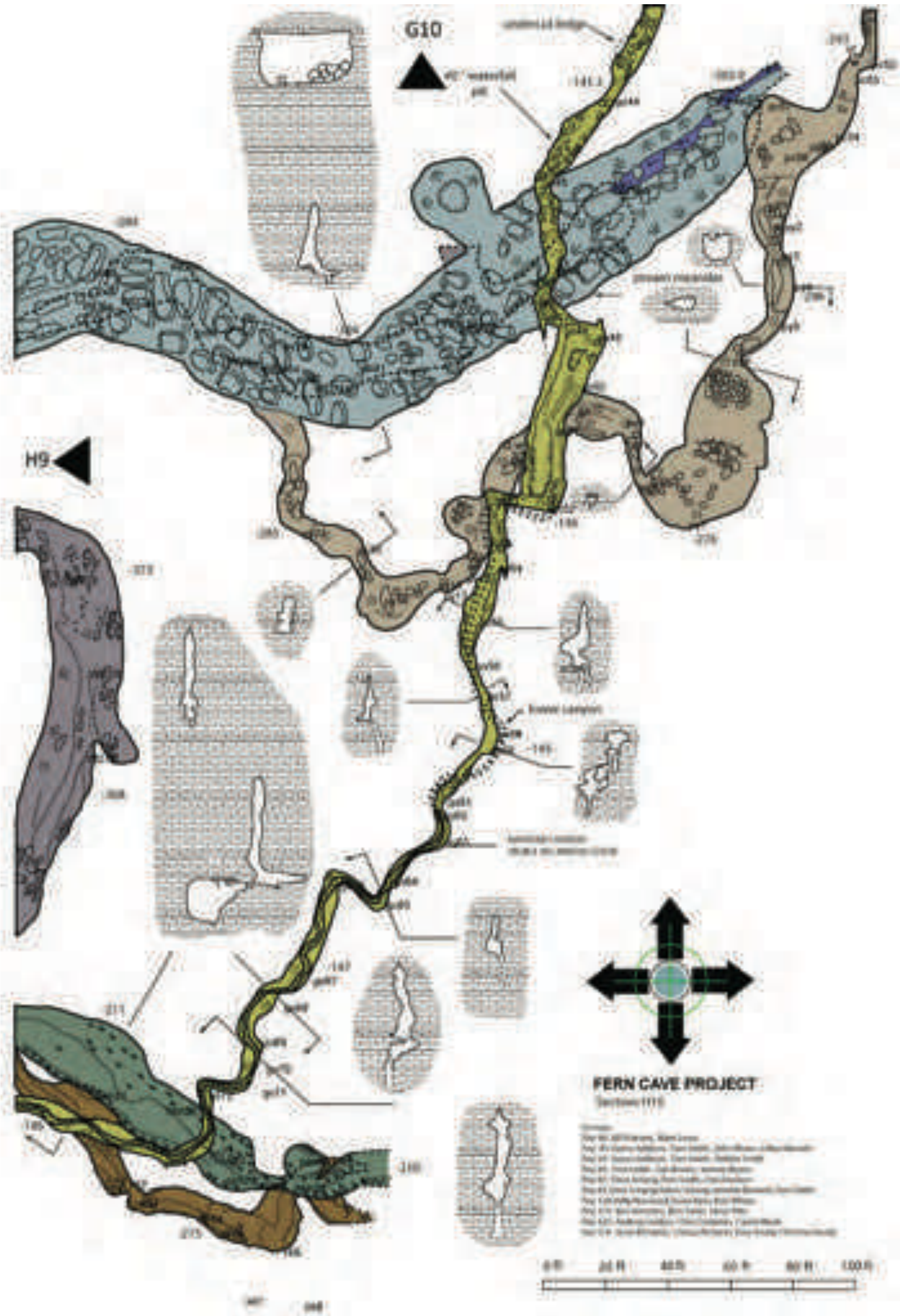

G10
H9
FERN CAVE PROJECT

There are also areas that have limited access because of the bat hibernation season limitations. And especially in recent years, there has been a shortage of skilled team leaders and sketchers. All of the work has to be done in a way that causes minimal impact both to the fragile ecosystem and delicate formation areas. Certainly, conducting a resurvey cannot be as appealing as mapping in a new, going cave of unknown extent with the promise of virgin cave to be discovered.

The Future of the Project

In 2009, Fern Cave was closed to all access in accordance with US Fish and Wildlife Service White Nose Syndrome policy. Naturally, the survey project was put on hold indefinitely. In the meanwhile, progress is being made on the drafting effort, and in survey data management. However, since the cave is still closed, we are not able to continue to conduct in-cave survey. For now, we have a nice survey of about half of the cave system, but there is a huge amount left to be done, and much of the remaining survey is in remote and difficult areas of the cave. The "Surprise Pit" area and "Torode's Hall" have not been surveyed. The lower level of the Gold Level Canyon, the East Canyon, the "Four Letter Passage," and the maze around Helictite Heaven remains un-surveyed. An especially interesting remaining piece is the Surprise Pit connection and much of the bat hibernaculum in the Morgue area that remains un-surveyed. An estimated 50 to 100 more trips will be required to finish the survey work.

A Summary of Our Goals

Upon resumption of the survey project, here are some goals we have to move forward with the project:

Complete the East Canyon Survey and link the survey to the West Room. This will establish an important loop closure of about 3 to 4 miles of passage.

Complete the Surprise Pit/Torode's Hall Survey. This is by far the most significant feature on the map and the largest passage area in the cave.

Finish the Waterfall Dome Route Survey and tie it into Bottom Cave. This is another very large loop closure.

Extend the Bottom Cave Survey towards the Surprise Pit connection, and tie in to the Surprise Pit Survey. In many ways, this will be the crowning achievement of the survey project, and probably the most difficult of all. Only two people in history have ever been through this connection when it was discovered during the original survey and only the vaguest clues exist about where it actually is located.

Expand the survey in the Morgue area of the cave. This area has had the least amount of survey work done so far, but is one of the very most significant areas in the cave as it contains the gray bat hibernaculum. In addition, the leads list has well over 100 entries still waiting to be surveyed.

To get this work done, we need to expand our survey personnel to include more team leaders who can learn complicated routes and conduct long survey trips into remote areas of the cave. The flagging tape that was used to mark stations is decaying and many station markers have been displaced or otherwise lost. Efforts are underway now to systematically restore and re-mark stations throughout the cave. Currently the project is on hold until we are able to negotiate an arrangement with the US Fish and Wildlife Service to conduct the remaining survey. At present, the outcome is unknown, but progress is being made. Many people in a decision-making capacity understand not only the scientific value of the Fern Cave Survey, but also the fact that this work can be done in accordance with all conservation goals for endangered species in the cave as it is in many other large federally owned caves.

Here is what is at stake: thousands of hours of hard work have been invested in the cave and at home in front of a computer by very dedicated and highly skilled individuals in order to produce a modern, high-quality map of this very special cave. If we cannot continue, in many ways this effort will be a total loss. In this case, some years in the future, someone will decide to make an entirely new map of the cave in which case, all of the traffic necessary to do so will be repeated which, of course, will have a negative effect on the cave that could be avoided.

Fern Cave is a very significant cave from several perspectives, primarily as an ecosystem for endangered species of bats and other cave-adapted species, and as a paleontological and archaeological resource containing huge amounts of information about prehistoric species, and early cave explorers. The cave is also an amazing showcase of three-dimensional speleology that the partially completed new map conveys in a way never seen before. Discovered by the original explorers, and all but forgotten, there is a new interest in the bat hibernaculum. Any detailed scientific discussion of these areas of interest requires a detailed and accurate map.

The Hell Sucker, Jackson County, Alabama (AJK3291)

Kelly Smallwood, NSS 58745 and Jason Hardy, NSS 56383 LF

Jason Hardy & Anne Grindle starting the Survey. Photo: Kelly Smallwood

On July 9, 1994, Mike Thomas, along with Lin Guy and Glenda Fleming found themselves making their way down a steep logging road into Long Island Cove in Jackson County, Alabama. They were heading to check out some leads that hunters had informed Mike about. Eager to take a look, they decided to drive Lin's 1985 Jeep CJ-7 down the old logging road. They parked at a spot near the junction with Long Island Creek and unknowingly unleashed a nest of yellow jackets in the road. They then walked south heading towards Newby Gulf and came upon a tree with the word "cave" carved in its trunk. Uphill from the tree they found a rock shelter-like entrance blowing air, which they named Hurricane Gussie (AJK3292) after a bawdy joke. They began mapping the cave and after surveying 1,190 feet, they came to a slimy belly crawl blowing a hellish amount of air. Not interested in pushing any further, they decided to head back over to Mike's next lead. Upon going in the next lead, they squeezed into the small entrance and found a wooden ladder that was at a 14-foot drop. They carefully climbed down the ladder and found a large spool of twine at the base of it along with several hundred feet unraveled and strewn about. They made their way down the passageway about 500 feet until it opened up into a wide, gloomy, gooey canyon with slimy sloping walls. Wearing wheat lamps, it looked too hazardous to push without a safety line, so they decided to turn back. They named the cave The Hell Sucker, turned it in to the Alabama Cave Survey as 500 feet long, and never returned.

Later, in 2010, after Steve T. Davis moved back to Alabama, he began exploring the caves near his home on Sand Mountain, including caves in Long Island Cove. Upon entering The Hell Sucker, he realized the cave was much longer than what was listed in the Alabama Cave Survey. A bit timid about pushing the cave himself, he reached out to Lin Guy who was not interested in ever going back. Steve then reached out to Jim Smith. Jim was also not interested. Steve then reached out to Jason Hardy and Kelly Smallwood after seeing their presentation on the Doodlebug survey at the 2011 Alabama Cave Survey meeting. Jason and Kelly agreed to check out the cave, but told Steve if they were going to push it then they were also going to start a survey and survey as they went. Kelly and Steve arranged a date for the first trip following the 2012 NSS Convention and Steve arranged access with the landowners and hunting clubs in the area.

On July 8, 2012, nearly 18 years to the day that Mike Thomas, Lin Guy, and Glenda Fleming turned around in The Hell Sucker, Jason Hardy, Kelly Smallwood, Anne Grindle, Kim B. Smith, and Keith Sutphin met Steve Davis at his home in Bryant, Alabama, to go see what the scare was all about. Steve and his neighbor, Ken Williams, led us down the 4x4 road in Jason's Toyota Tacoma to the valley floor and then to the entrance of the cave. The cave was blowing a lot of air and an equally impressive and huge Buckeye Tree was right next to the bluff at the entrance; the tree was later measured at just over 15 feet in diameter. Upon each visit Kelly hugged the tree and always tried to encourage Jason and others to hug it as well. After squeezing into the small entrance we found that the ladder had been moved, so we rigged the 14-foot drop to a natural anchor and began our survey. We were able to survey nearly 1,000 feet on this day but it wasn't easy. There is a lot of mud and slippery slopes along with a canyon running right down the middle that you have to traverse. The last passage we surveyed for the day was a canyon passage that had sharp protruding rocks at neck level so in keeping with the theme of the cave name, we decided to call it "The Highway to Hell." Standing there at our stopping point for the day, we realized we were in a big cave system that was going much farther. And despite the dangers that lay ahead, the cave called us to continue. We also knew on the following trips we would have to do something to make the going passage safer and more effective for traverse by the survey team. We were facing a canyon with deep walls that we knew we were going to have to climb out to access the muddy, slippery slopes above. Over the next week we prioritized our goals to survey the cave safely while also producing photo documentation of the cave. For the next trip we decided we would need to bring back not only a crew to survey but a push team with shovels to dig foot holds for us to traverse through the tricky canyon passage.

On July 21, 2012, two weeks since our initial trip, Jason and Kelly woke up and started getting ready for the day. Jim and Rachel Campbell had come up the night before, so we cooked breakfast while we waited on the others to arrive. In the meantime, it had started pouring rain outside. Concerned about the weather and the condition of the road to the cave, Jason checked the weather radar. After determining that it was just a pop up shower, we were all very eager to get on the road and back into the cave. This time we came armed with enough cavers to not only survey, but to have a team of diggers leading the way for the survey team. Joining Jason and Kelly on this trip were Blaine Grindle, Jim and Rachel Campbell,

Virgin Borehole. Photo: Kelly Smallwood

Danja Mewes, Scott Ehardt, Kim B. Smith, and Keith Sutphin. We knew this was a lot, but we also knew that we needed all the help to progress the survey team safely and effectively ahead. Blaine, Jim and Keith led the way with their shovels and we later dubbed them the "Fraggles." They dug safe passages with shovels through the mud-slopped walls. Following behind was Jason sketching and leading the survey team. We taught Rachel how to read the laser disto while Danja read the compass and taught Scott how to set stations. Along the way, the passage became much wider and so did the crack, thus we decided to name the passage "Hell's Half Acre."

After a few hundred feet and past the last known footsteps in the cave, we all sat down for a break and admired the amazing view before us. For the majority, this was the first time virgin borehole was witnessed. The best way I can describe it is like fresh snow. The passage was huge and the mud was so perfect with no footsteps in it at all. No human had ever stepped foot in it before. This is what caver's dream of! We all felt very blessed to be a part of this project, admired it for a few minutes, took some pictures, and finished up our snacks. The digging team then eagerly continued shortly ahead of the survey team. We eventually began to hear the rumbling sounds of water. We had finally reached a canyon too wide and unsafe to traverse so we named it "Come Hell or High Water." There were a few small side leads here so we checked them as we looked for a way down. Jason knew at this point we had reached a major junction in the cave and we would have to return to set bolts to continue on. We had already had a good day of surveying nearly 1,000 feet so we called it a day and started discussing our plans to return. Everyone was excited with the thoughts of what could lie ahead, so we determined that the very next day would be optimal and we all started carefully routing out. Since Steve Davis didn't join us on this trip, we stopped by his house once we were back on top of the mountain and informed him of the progress we had made. He was very excited to hear that the cave continued on and was also very interested in returning with us the next morning.

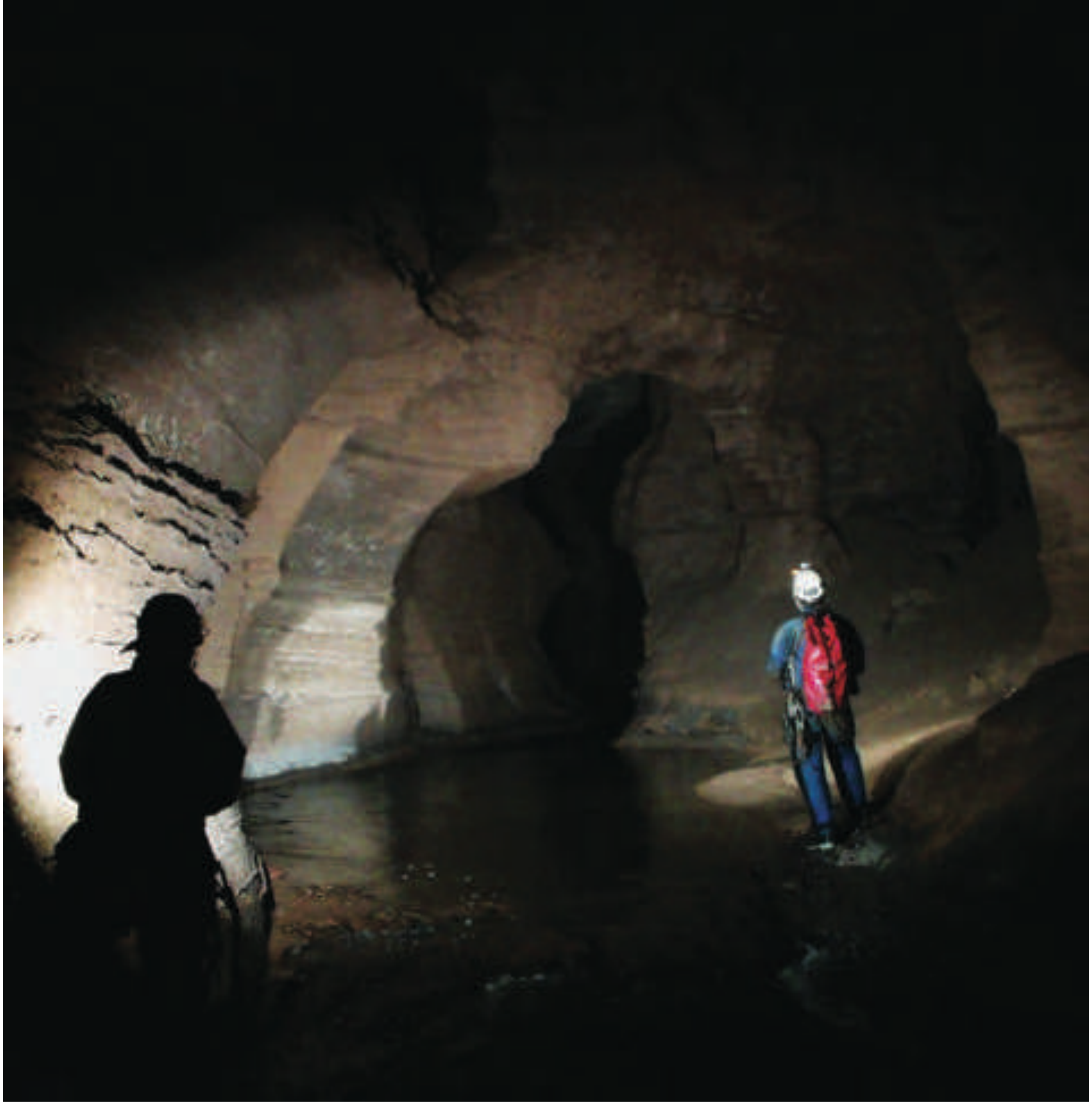
On the way home, Jason was excited about what we had found and decided to call Marion O. Smith. After informing Marion of our find, Jason was able to talk him into dropping all plans and coming down to help us the next morning. At this point we also began to feel the fears of being scooped. Not many people knew what we had found and the anticipation of knowing what lay ahead was starting to tease us. We knew we had a big cave system but just didn't know how big yet. It was at this point we had to maintain self-control and trust those around us who were helping.

Once back at the house, Jason and Jim had a wild hair to brew a batch of homebrew. While the guys were brewing, Rachel, Kelly and Danja were outside washing all of the mud off their cave gear in preparation for the next day's return. As they were cleaning gear in the front of the house it began raining. Rachel was in a hurry to get a rain coat so Kelly sprayed her with the water hose and reminded her of the mud they had been in just a few hours earlier. What's a little rain going to hurt at this point? So they finished up cleaning the gear in the pouring rain, rung everything out they could, and hung everything in the house to dry.

Jim, Rachel, Danja and Scott all spent the evening with Kelly and Jason. The next morning they got up and cooked breakfast before meeting Marion at Big Daddy's Fireworks near Lake Nickajack. Kim and Keith called and informed us that they were running late, so we told them

Jason Hardy setting bolts at Come Hell or High Water.
Photo: Kelly Smallwood

to just meet us at Steve's house. Once at Steve's house, we condensed vehicles and started our way back down Gilliam Gap on the 4x4 road to the parking area for the cave. Just about the time we had geared up and started towards the cave, Keith and Kim finally showed up. One by one we all made our way in, past the 14-foot nuisance drop and through the scary borehole with the crack of doom in the middle. Jim was the lucky one and carried the heaviest pack with the drill. Once we were at the stopping point from the previous day, Jason got all his gear ready to set bolts. He made his way out onto the ledge and began setting three bolts, rigging the rope for a traverse as he went. He then left it up to the digging team to move us forward. After about 10 minutes of Jim trying to safely make his way across, it was determined that we would have to rappel down into the canyon into the swift-running stream passage instead of traversing. Jason re-rigged and reset the rope for a rappel instead of a traverse and rappelled down into the water passage. After spending a few minutes and determining this would be the way on, he called for the survey team to continue. Kim was still fairly new to caving and didn't feel comfortable to continue down the muddy drop so she, along with Keith, Danja, and Scott, decided to route. On their way out Scott removed all of the old twine that was strung



Rachel Campbell & Jason Hardy. Photo: Kelly Smallwood

throughout the first several hundred feet of the cave and the huge pile at the entrance.

With the others gone, this left Jason, Marion, Jim, Rachel, Steve, and Kelly. Marion wanted to pull tape and did not want to use a disto. Since we were in water and Rachel was still fairly new to surveying, Kelly read instruments. We continued the survey upstream through a small slot canyon and out of the water into muddy passage. Here we took off our vertical gear and continued surveying a few hundred more feet continuing in a canyon. It wasn't very long before we could hear the rumbling sounds of water again and we soon found ourselves in a much wider stream passage. Continuing with the theme of the cave name, we decided to call this area "The River Styx." After surveying a few hundred more feet and nearly 1,000 feet for the day, we began looking for a good stopping point. While it's hard and takes a lot of self-control, it is also extremely rewarding to survey as you go. It keeps the momentum going and your team coming back. None of us wanted to leave not knowing what was around the next corner, but we knew it would continue the excitement for the next trip and for the survey. Kelly set up a few flashes and snapped a picture of what lay ahead. Little did we know at the time, but this picture would taunt us for the next two weeks and would also add more paranoia about being scooped.

After two long weeks since our last trip we were ready to get back into The Hell Sucker to see what was beyond that next turn. On Friday night, August 3, 2012, Jim and Rachel Campell, along with Shari Lydy drove up from the

Marty Abercrombie helping with the survey. Photo: Kelly Smallwood

Atlanta area to meet up with Jason and Kelly. Saturday morning they all got up and as usual cooked breakfast before heading out to meet the rest of the crew for a long day of surveying. Once at Steve's house, already waiting on us were Steve, Marion, and Keith and Marty Abercrombie. The plan for the day was to have two teams. Team 1 was Jason, Marion, Jim, and Steve. They would pick up where we left off in the borehole stream passage beyond the drop last time. Team 2 was Marty, Shari, and Keith. They would survey the leads near the entrance while Kelly and Rachel took photos. On the way down to the cave, we also decided that Rachel, Shari and Kelly would pick up the aluminum cans that littered the entire 4x4 road. This would also allow enough time for Jason and Marty's team to get geared up and in the cave so we would not have a bottle neck of cavers waiting at the entrance. Jason was also going to set more bolts for a traverse line in the slippery canyon to make it safer for the crews to pass.

Shortly after starting our descent down Gilliam Gap on the 4x4 road into Long Island Cove, Rachel and Kelly began picking up the cans while Shari drove alongside us. A few minutes later, Kelly heard Rachel shouting and as she looked back she quickly realized that Shari had accidentally nearly driven over Rachel's foot. As Rachel was yelling to move the vehicle, Kelly quickly shouted to Shari to go in reverse. Rachel was a little shaken but fortunately was able to continue on so we forged ahead picking up cans. Once at the parking area at the bottom of the cove, Teams 1 and 2 were nearly ready to head off into the cave. Shari, Rachel, and Kelly then geared up and started to the entrance, where they made their way in with Marty and Keith. By this time, Jason and his team were long gone on their way to set the traverse line. Kelly showed Marty where the first side lead was and he began surveying with Shari setting point and Keith reading instruments. Rachel and Kelly followed along behind taking photos.

As our team made its way into one room, we noticed there were a lot of tiny roots growing all over out of the mud. Kelly said we should come up with a name for the room, keeping with the theme of the cave's name. Shari

The Breakdown Collapse. Photo: Kelly Smallwood

quickly shouted out, “the Root of All Evil” and we all liked it. As Rachel and Kelly were waiting on the team to catch up, Kelly noticed a small side lead behind a pretty formation. She told Rachel she should go check it out and see if it goes anywhere for the team to survey. As she proceeded cautiously past the formation, she shouted back that she was able to go at least 40 feet. When Marty caught up to his survey team, they showed him the lead. As the team started off to survey this lead, Rachel and Kelly knew it was too small for everyone to survey, so they decided to wait in the Root of All Evil room, where they made a mud formation for cavers to find in the future.

Once the survey team was finished with the lead, we continued on and eventually made our way back out into the main passage creating a loop. After tying back in to the main survey, we decided it was time for a break. We had spent nearly four hours surveying the side passage and since it had taken longer than expected, we decided to go ahead and make our way down to the rest of the cave and catch up to Jason’s team. Just as we were entering the first canyon area, out of nowhere Rachel took a big fall. Clearly this wasn’t Rachel’s day. As she was falling, to prevent herself from going into the canyon, she flung her body onto the ledge. It was very scary to look back and see Rachel grabbing onto the slippery, muddy ledge while her legs were dangling below. Keith and Marty were both very quick to assist Rachel and pull her up. Once Rachel was safe and we realized she was okay, we continued on.

At the traverse line, Kelly was very impressed with what they had done. This part of the cave had been a very scary part for those of us who had passed it many times with no safety line. It is a slippery slope above a canyon that is about 30 to 40 feet deep in some spots and has a 2-inch ledge to put your feet on and slide across. One slip and you could be seriously injured, so it was very nice to now have a safety line. One by one we made our way across and finally to the drop at Come Hell or High Water. As we headed down the stream passage, we did notice there were several big side leads that Jason had left for Marty. Shortly after, we finally came upon Jason’s team as they were heading back towards us. Unfortunately, they had found a big breakdown collapse and were unable to continue forward. But there was still more work to do. Still very eager to survey, Marty told Jason he was willing to continue on, so Jason showed him the first side lead. Kelly wanted to take more pictures, so Jim, Rachel, Jason, and Kelly headed towards the end while Keith, Shari, Steve, and Marion assisted Marty surveying one of the remaining side leads. As Jim and Jason showed Rachel and Kelly the rest of the cave, they took pictures along the way using three Vivitar 283 flashes. Once they were finally at the end, they were greeted by a huge breakdown collapse that literally blocked the entire borehole passage, a typical ending to a TAG cave. There was water flowing from underneath so there was hope with some more pushing on the next trip we could find a way around this. We took a few more pictures and then headed back to meet up with Marty's team.

Once back with Marty's team we found them still surveying. Due to time, Jason decided that the four of us should go ahead and start making our way out of the cave. Jason, Jim, and Rachel made it up the climb and as Kelly was climbing she could hear the voices of others close by, so we decided to wait on them at the top of the drop. As we were waiting, Marion was the first from the second team to come up. Rachel, Marion, and Kelly decided to proceed ahead and finish making their way out of the cave while Jason and Jim waited on the others. When we reached the traverse line Marion said to Kelly, "Do you want to carry this drill out?" She jokingly replied to Marion, "There are some things I feel are a man's job and one of those things is carrying the drill out of the cave!" As Kelly neared the other side where Rachel was waiting, she shouted back to Marion to let him know she was off the traverse line. As he was making his way across, he was mumbling something about the drill. Rachel and Kelly then realized he was carrying it across the traverse line. Kelly shouted to Marion, "When I said it was a man's job, I didn't intend for you to carry it. I expected one of the younger guys that were behind us to get it." Once Marion was off the traverse line Rachel decided she would then carry it out.

Just as the three of us were finally back at the entrance, Marion started looking for the bottle of water he stashed at the entrance. If you've ever caved with Marion, you know he doesn't carry a lot of water with him and he typically stashes it in the cave. He wasn't able to find it and Kelly asked him what kind of bottle it was. He said it was

Shari Lydy's stuck vehicle. Photo: Kelly Smallwood

a small bottle and just as he was saying that, Kelly realized, uh oh. Keith had gone off during our survey earlier in the day because he had to pee. He said he was going to pee in one of the bottles near the entrance. So looking around, Kelly pointed out to Marion the bottle that Keith apparently had peed in. Marion picked it up and gave it a good glare and said, "He peed in my bottle. What did he do with the water that was in it? I can't believe he peed in my bottle." Rachel and Kelly started laughing hysterically, they just couldn't help it. Marion was in such disbelief that someone disposed of his perfectly good water to fill his bottle with their pee. About this time, Jason and Jim showed up giving thanks for us taking the drill out and we shared with them what Marion had just discovered. After we all had a good laugh, we then one by one made our way up the 14-foot drop and out the entrance. Once all five of us were out, we headed back the short distance to change into dry clothes and wait for the others. Finally everyone was out, all changed and ready to head back up the 4x4 road in the dark.

We had three vehicles in the cove and since Shari's vehicle was at the back of the line she was heading up the mountain first, followed by Jim and then Jason. Kelly was sitting in the front seat of Shari's vehicle and Rachel and Marty were in the back. As we were heading up the road,

Jason Hardy & Nancy Aulenbach. Photo: Kelly Smallwood

Kelly mentioned to Shari that she was driving a little fast. She assured us that it was okay. Kelly then asked her if she had ever driven up a road like this before and Shari began telling us she used to have a Ford Bronco that she used for four wheeling. Just then, Kelly looked ahead and said, "Shari, go high here." Instead Shari went low and realizing she was in trouble, gunned the gas. Kaboom, POW. We hit and all of a sudden we were stuck. The tires were spinning and we were slanted at an angle. Kelly got out of the Jeep and yep, it looked pretty bad. Jim was behind us so he got out of his truck to come see what was wrong. Kelly then walked back to Jason's truck to let him know of the situation. By this time, everyone was out of the vehicles standing around Shari's jeep, scratching our heads. Bewildered by what had happened, the guys quickly starting making a plan on how to get her out. After a few unsuccessful attempts and knowing that food was waiting on us on top of the mountain, we decided it would be best to return with new energy the next morning. Luckily for us, Shari was stuck in such a way that the two trucks behind her could still get by and up the mountain.

We arrived back at Steve's house around midnight. Thankfully, his wife Karen had cooked us two big pots of chili for dinner. We all ate at least one bowl and some had two. Knowing we would need to return the next morning to help Shari free her vehicle, Jason, Kelly, Jim, Rachel, Shari, Keith, and Marty left very exhausted. Since it was so late, Marion decided to stay at Steve's house. Once back at our house, we drank a few beers and made it to bed around 4:00 a.m.

After a bit of sleep, we woke around 10:00 a.m. Shari had already been up making phone calls to figure out how to get her jeep out. Jim and Rachel cooked breakfast and we all got ready to leave. We headed back up to Steve's house where Marty and Blaine also met us. Once back down at Shari's vehicle, Steve made quick work getting some of the big rocks out from underneath the vehicle. Blaine brought some 6x6 pieces of wood that were strategically placed under the tires with more rocks. Jim got in the drivers seat and after a few hard pushes on the gas was able to free the vehicle. We all cheered once it was clear.

It had been three weeks since our last visit to the cave and we knew it was time to get back in there and finish up those side leads. Hunting season was fast approaching and we knew we wouldn't be able to get in the cave during winter due to high water levels. So on August 25, 2012, Jason and Kelly met Nancy Aulenbach at the Big Daddy's Fireworks Store next to Lake Nickajack. The plan was to leave her car there and ride up to Steve's house. However, as soon as we got to Big Daddy's, Jason realized that he left his caving boots on the front porch. Good thing we live close. Nancy got in with us and we drove back by the house and picked up Jason's boots. We got to Steve's house around 9:15 a.m. and Jason asked if he would be willing to cut 100 feet off the 300-foot rope that he had mentioned we could use in the cave for a permanent traverse line. After spending a few minutes measuring out the rope, we were once more on our way down Gilliam Gap on the 4x4 road to the cave.

The plan was to start surveying the side lead near the entrance off of station A6. This would give Jim Campbell enough time to catch up to us in the cave before the traverse. Jim was driving up from the Atlanta area, but had a late start. We had only been in the cave about 30 minutes when we could hear Jim, who quickly joined us as the survey began. We surveyed about 100 feet of passage in this side lead before we headed to the next one that was before the drop at Come Hell or High Water. We surveyed about another 50 feet here. It was a slimy, muddy passage so Steve and Kelly waited at the drop while Jim, Nancy, and Jason surveyed it. We then made our way down the drop into the water passage and decided we would check out a few side leads further upstream before going downstream. We knew downstream was a potential sump and we could get completely soaked, so we decided to save it for last.

As we approached the first side passage upstream, we realized the previous station was not ideal for a tie-in station. We ended up having to set a new station and getting the shortest shot of the entire survey, a whopping 6 inches! After a few laughs, we continued on to discover that this side passage made a loop to the main passage. Once at the next side lead we felt it was a good time to take a break. As we were getting our snacks out, Jim pointed out a catfish that was swimming in the passage. On a previous trip they had also seen a fish in this passage. We all watched it swim around for a few minutes while we enjoyed our snacks and speculated on how the fish made it this far into the cave. After our break, Jim went into the water first. We carefully watched knowing the potential depth of this passage. He was followed by Nancy and then Jason. Steve and Kelly spent a few minutes contemplating if they should go in or not. It looked pretty deep on everyone; being the shortest in the group, Kelly knew it could potentially be chest deep. However, Kelly decided it was important to continue on with the crew since she was there to take photos. Steve decided he would go further upstream to see if the passage was going to do another loop around and come back out. Kelly was very happy she followed the survey crew as it turned out to be a really neat passage. However, because the water was so deep she was only able to take a few pictures. After surveying the passage, it did in fact loop around and pop back out into the main passage.

Since we were at the big breakdown collapse that had been discovered on the last trip, we decided to go ahead and take Nancy. We spent some time poking around to see if there was any way through. Unfortunately, there wasn't so we decided to go check one more lead that Marty's crew had surveyed past on their last trip. At that time it was only blowing a small amount of air. However, today it was blasting air. Jason and Jim both tried to push it but were unable to break through. They came out of the passage covered in icky mud and we appropriately named it "Satan's Rectum." Next it was Nancy's turn. She jumped right in and we could hear her pushing and trying to dig through the nasty mud. Nancy finally emerged unsuccessful but then decided to try the higher route. After moving a few rocks out of the way she was able to break through and made it big enough for Jason to come up and take a look as well. A few minutes later they returned to report that it looked like it could have possibly been a collapsed entrance, but unfortunately was not significant passage.

Jason Hardy & Jim Campbell after pushing Satan's Rectum.
Photo: Kelly Smallwood

By this time it was getting late and we were tired, but we still had one more lead, the downstream. Because of the difficulty just getting to the cave and to this point we decided it was in our best interest to go ahead and survey the downstream. Once back at the rope, Steve decided he was going to climb up and wait for us. Nancy decided it was time to blow up her floatie, while Kelly decided not to blow hers up. Kelly followed the survey crew as they moved ahead through water that was chest deep at some points. Eventually, the mud below the water became really deep; with every step we would sink to our knees in the mud and debris, while the water would rise higher on our bodies. It was very interesting and it made it a little difficult to walk. We eventually reached a point where the cave sumped completely. All very excited that we had finished the day's work, we started to head back out. We de-rigged the drop but left 100 foot of rope at the traverse line. Back at Steve's house, his wife Karen had made spaghetti for dinner. We ate like there was no tomorrow and after a while headed home for the night. Nancy and Jim spent the night and the next morning Jason, Jim, and Kelly went to Maureen's to help with the Cave Fest work weekend.

We had pushed every lead and surveyed everything we could in the cave, except Satan's Rectum. The thought

Nancy Aulenbach with her floatie. Photo: Kelly Smallwood

of that last blowing lead kept weighing on Jason's mind and he felt the need to push it before he started on the map. So on October 2, 2012, Jason, Anne Grindle, and Paul Lundberg made another trip to The Hell Sucker, which at the time we were still calling, "Project Yeti Hole." We went armed with shovels and trowels to dig through the lower blowing lead that no one was able to penetrate in August. However, when they got to the drop at Come Hell or High Water, Jason could hear the raging water below. He rigged the rope and went over the edge. He saw the water was at least 6 feet deep and knew it would be impossible to make it to the lead that day. We had to wait until after hunting season and the water levels to go back down before we could get back in there.

On February 9, 2013, with the water levels still too high to enter the cave, Jason wanted to take the opportunity to ridge walk Newby Gulf during the winter. He, along with Jim Campbell and his son Tao, met up with Steve Davis and his son Kyle at Steve's house. They drove one truck down the 4x4 road into Gilliam Gap and left it on a major bench. They then all drove over to High Falls, on top of Sand Mountain, to begin their hike. Once they began, they crossed over tornado damage to get to the falls and then encountered huge boulders the size of vehicles. Their hike was grueling the first mile and half until they eventually reached limestone. Along the way they found at least one known cave and dug open another small one. After spending a lot of time and energy ridge walking it was getting late and they were tired. Their focus then turned towards getting back to the truck and out of the cove. Overall, the kids did great on the hike but it did not yield any potential leads into The Hell Sucker.

Eight long months later, Jason Hardy, Kelly Smallwood, and Jim Campbell headed back to The Hell Sucker once more to push the last blowing lead—the one that had been weighing on our minds all winter and spring, Satan's Rectum. In 2013 there was an unusually high amount of rainfall, so we were unable to get into the cave again until now. On June 9, 2013, we made our way in the cave and down the drop into the stream with no problems. We quickly made our way to the lead and spent several hours working on it without much progress. The lead is extremely muddy but blows a lot of air. It is a small opening that leads into a tight area with a lot of breakdown above. After a lot of work, no progress, and safety concerns with the lead, we decided to call End of Survey.

The Hell Sucker has been surveyed to a length of 6,239.9 feet with a depth of 62.1 feet. This makes it one of the longest projects for the Sewanee Mountain Grotto and we did it all within two months! It is also the largest cave by volume that we have surveyed. All but the first 1,000 feet of the cave was virgin territory when we began the survey and the average passage was about 30 feet wide by 25 feet high. We surveyed as we went and we also taught five cavers how to survey on this project. Way to go Sewanee Mountain Grotto as Alabama now has another mile-plus-long cave!

Jason and Kelly would like to extend their sincere appreciation to everyone who was involved in the survey and exploration of The Hell Sucker including: Steve T. Davis, Jim and Rachel Campbell, Anne and Blaine Grindle, Marion O. Smith, Shari Lydy, Marty Abercrombie, Kim B. Smith, Danja Mewes, Scott Ehardt, Keith Sutphin, and Ken Williams. We also extend a big thank to Lin Guy, for leaving something for the next generation, even though we tried multiple times to encourage his return to the cave. We are also happy to report that even though during our survey there were rumors buzzing around TAG about another mile-plus-long cave system in Alabama, we were never scooped!

Tumbling Rock Cave Stories

Bill Varnedoe, NSS 3160 OS, FE, CM

Brad Barker at the Kings Shower. Photo: Alan Cressler

Tumbling Rock Cave is a long, interesting cave. It offers challenges to cavers, but nothing that is extremely difficult. It has all sorts of items of interest: nice formations, a history of saltpeter mining, odd mineral deposits, and so on. But these sites are scattered throughout the cave, not all in one place. Time-constrained visitors can enjoy this cave by turning back at any point—some things of interest are near the front. However, it takes a full trip all the way to the end to fully appreciate the cave's diversity.

Tumbling Rock Pile

How did Tumbling Rock Cave get this name? It was a very apt name invented in the early 1950s by Phil Zettler-Seidel. Phil was one of the Von Braun missile team engineers who came to Huntsville in 1950. But Phil was also a die-hard cave explorer and joined the newly formed Huntsville Grotto of the National Speleological Society (NSS). A group, including Phil, was trying to see how far they could go in a cave a few miles north of Scottsboro,

Brad Barker, Katie Clay, Peter Clay, and Michelle Clay in the Elephants Feet Room. Photo: by Alan Cressler

Alabama. It was locally called Blowing Cave, but that was more of a description than a name, as a strong wind blew out of its small entrance in hot weather. The cave proved to have a long passage with an intermittently visible stream flowing toward the entrance. During their visit, the cavers had come, after a mile of vigorous caving, to what seemed the end of the cave. By “end” they meant that they could go no further. They had reached a rubble pile of rocks and boulders choking a small passage. This rock pile turned out to be extremely unstable, moving and shifting with the slightest touch. This inspired Phil Zettler-Seidel to call it the “Tumbling Rock Pile,” a name that stuck and was applied to the entire cave.

I can personally testify that these rocks were precarious. Once I was there with the Huntsville Grotto cavers trying to find a way past this choke. We dared not try to worm our way into spaces between the boulders, which seemed to move with every breath. So we were working our way up, trying to find a way over, between the rocks and the ceiling or a solid limestone wall. One caver, Uwe Hueter, was up ahead of me in the rock pile. Suddenly he came flying down and back toward the low passage leading to the bottom. As I looked up I saw a big boulder following Uwe, rumbling down on his heels. It was bouncing along very fast, but Uwe was faster! He beat it down and out. Later, we did venture into the rock pile. I was standing between two big rocks with my feet on another rock, holding one end of a survey tape, then whop!! The rock I was standing on dropped away, leaving me suspended by my elbows on the two rocks by my side. Such was the Tumbling Rock Pile. It was just too dangerous to push into, and this was the "end of the cave" for years. Eventually, having found another completely different way beyond, we were able to work back into this area and stabilize it from the other side. This is now the "standard" route through "Suicide Passage," as it came to be called, to the further wonders of Tumbling Rock Cave. But that's another story in the future.

Ghost Crawl

On another early trip, I was leaving the Tumbling Rock Pile in a low, hands-and-knees crawl back toward the "Great Hall of Mysteries." Other cavers from the Huntsville Grotto were following me and I thought that Phil's caving dog, Electra, was behind me, too. Electra used to go caving with us on every trip that Phil was on. She carried no light, or had any gear at all, just plain dog. However, she seemed to navigate all of the twists, turns, climbs, and scrambles that we all did on her own and she caved very well. Electra was a friendly dog so as I was crawling along, I was not surprised to feel her jumping on my back. I yelled at her, "Stop!" to no avail. She continued to pound on my back, not viciously, but very definitely. I was in such a position that I couldn't reach back and push her off. Thus, I kept on crawling and shouting at her to quit. The caver behind me couldn't figure out what I was calling about. Because as I emerged from the crawl, there was Electra ahead of me! Absolutely nothing was on my back or touching me, as verified by the caver behind me. Many cavers and I have passed through the "Ghost Crawl" since then, and the spook has never returned. This was before we opened up Suicide Passage so I guess he gave up trying to stop us, since cavers now routinely go beyond that area. This Ghost Crawl is located at the very bottom of the Great Hall of Mysteries leading to the Suicide Passage.

The Elephant Feet

In those early days, cavers from Washington D.C. often came to Alabama for a caving trip. Among them was William J. Stephenson, the founder of the NSS who was NSS 2 (His wife, Merle, was NSS 1). One of the caves I took him and his colleagues into was Tumbling Rock Cave. As we ambled along, Bill, looked at some formations and asked, "What do you call these?" I told him we had not named them. He said, "They look like elephant feet to me." They do indeed resemble huge elephant feet. That name, "Elephant Feet," stuck. Therefore, the columns that we still call The Elephant Feet were named by none other than the very founder of the NSS, William J. Stephenson, himself.

Vujade Extension

The cavers who surveyed and named the "Vujade Extension" claimed to be the discoverers of that piece of Tumbling Rock Cave. Alas, I hate to disappoint them, but our early explorers claim that honor. Although these first discoverers did find it, they did not explore or map it. The Kambesis mappers most surely can justly claim that piece of the pie. Our early cavers discovered a crawl above one of the Elephant Feet on the way out of the cave, after another futile attempt to push beyond the "end" of the cave. This party entered this crawl but only did a short reconnaissance. They were very tired after a day of hard caving, so they planned to return in the future. Among them was our friend Phil Zettler-Seidel. Phil spoke English with a thick German accent and he also had a speech impediment, which, if he got excited, caused him to stutter. On exiting this crawl Phil got stuck. Understanding what he was sputtering and hollering about became utterly impossible. We tried to advise and reassure him that in a few days without food, he'd shrink enough to slide out easily. However, this did nothing to calm him down. Of course, he obviously did manage to escape. But with so much big cave still to explore and map, they never did go back to that tight crawl. Its very existence was relegated to a story that morphed, with time, into just a rumor. It wasn't rediscovered again until many years later when the Kambesis mappers found the Vujade Extension. And this time, they explored, named and fully surveyed it.

Early Cave Mapping Techniques

Returning to the very early days, we knew of no standard or body of knowledge on how to map a cave. We could not afford nor did we have access to a theodolite, the normal surveying instrument used by land surveyors. And even if we had one, it would have been too clumsy to use in a cave. Therefore, we learned how to map in a cave as we went. We made measurements of angle and distance from station to station. Our "instruments" were a boy scout compass and a fishing reel with string. It had a knot tied in the string every yard. We could count the knots as we let out the string; this was our tape. We kept the readings in a small pocket book and make sketches of the cave passages as we went along. (With better instruments, this is still a basic technique most cave surveyors use).

To compensate for some readings made at a steep up or down angle, we simply estimated the angle and recorded the cosine of the estimated angle to the number of knots counted. That is for a 45 degree slope record 7/10 of the measurement, for 30 degrees use 3/10 and for 60 degrees it would be half of the measurement. This sounds crude and it was. But the resulting map looks almost exactly like the finished, detailed, accurate map generated later with sophisticated means and instruments by the Kambesis cavers. The main difference between these maps is the scale. There is a small crack in the floor of a passage in the cave. People have wondered why in the world that insignificant crack was named Fish Reel Canyon. It is because on a surveying trip one day, one of us dropped the surveying fish reel down in that "canyon." The opening is so small, deep, convoluted and tight, that that is where that fish reel is today.

Cave Rescue—Or Not

The group of Huntsville Grotto cavers who participated in the early exploration were: Jack Allen, Jim Johnston, Chuck Lundquist, Will Lynch, Phillip Zettler Seidel, Slim Taylor, Bill Varnedoe, and several others. One of our members [I will not give his name] got a call from a radio station that someone was lost in Tumbling Rock Cave. According to this member's story, two cavers from Nashville had come down to go caving. They became separated, and the one who came out could not find the other guy, named Ray Smith. Our group assembled at the cave and thoroughly searched the cave, all the way back to the Great Hall of Mysteries that was the end of the cave at that time. No luck or any sign of him.

We were about to give up when one of our group who was very unsatisfied with quitting went back in solo, without telling anyone. We counted noses and missed him. After a while he emerged and told us that he'd found a note. He showed us a scrap of paper with, "Lost. One light left, R.S.," scrawled on it. Now we had no choice but to try once more. Again, we diligently searched the entire known cave, but to no avail. By this time, we were exhausted. All available members of our group had been rounded up and had come and participated in the searches. As the Grotto Chairman, I called the Chattanooga Grotto for fresh help. But before they arrived, a Nashville newspaper reporter who knew Ray Smith as a caver heard of the incident. He called Ray's house and there was Ray, home, fast asleep, nowhere near Alabama! The fellow who spawned this tale vanished, and hasn't caved since. It was just a terrible hoax!

But we learned lessons about rescues. We would not send everybody in on a first effort, but keep a reserve. From now on, we would keep a sign-in-log of people going in and out. It also taught us to form an organized rescue team with formal training, one of the first cave rescue teams in the NSS.

Hidden Door

We used to have a lot of fun with the "Hidden Door." There's a place where one passage lies above another. Going in, a caver moves up through an opening into an upper one to keep heading into the cave. The way up is rather obvious and thus new visitors seldom pay much attention to this maneuver. On returning, however, there are several openings that go down and they all look alike. Only one leads to the passage that is the proper way out. The other openings lead nowhere or dead end. If one does not go down to the lower level, the upper passage he is in pinches off. Clearly, he's missed the proper door. It was a joke to rush ahead, go down, turn off your light, be quiet, and listen to the "goat" go by the "hidden door," then he'd shortly return in frustration, hunting for it! Alas, some humorless carbide-using soul clearly labeled The Hidden Door.

Spilled Milk

Somewhere along this same "hidden door" passage is a climb up through the ceiling to still another third level passage. This passage is rather short, but well decorated. One spectacular formation is the "Spilled Milk" stalagmite. The stalagmite and the level floor around it is jet black travertine. But there is a streak of pure white flowstone on the stalagmite, as the mineral forming it went suddenly from black to white. It looked as if someone had spilled milk on it. Unfortunately, unless it's been cleaned up, careless people have tracked mud all over the shinny black floor and onto the stalagmite itself!

Topless Dome

Cavers cannot but notice the "King's Shower." It is a stream falling into the middle of a good walking passage just before reaching the Great Hall of Mysteries. The water comes down from a neat hole in the ceiling. Climb-

Dan Calhoun at the The Christmas Tree, Tumbling Rock Cave. Photo: Alan Cressler ing up into this hole puts the caver in a small complex and room. This room, off to one side, is literally topless. This "Topless Dome" is the source of the King's Shower water.

The Topless Dome has been climbed only once, by Don Davis and Cheryl Jones, who set bolts to reach the top. Don climbed 400 feet up to just under the actual top of the dome before a sloping mud bank, with no way to make a purchase, stopped him. During their descent, a chock in a crack slipped out, and Cheryl fell about 10 or 20 feet, knocking off her helmet and hitting her head. She was belayed, and fell no further. However, Cheryl was about 40 feet off the floor and hung up on her safety belay. Don exited the cave and called the Huntsville Cave Rescue Unit. With a little effort and 15 or so Huntsville cavers, Cheryl was lowered and placed in a stretcher, where she was properly packaged, in case her back had been injured. It took most of the night to get her down and out of the cave. Minor climbs and slight obstacles for traversing became major hurdles in maneuvering a stretcher. Then on to a hospital emergency room where an examination showed no serious injury, just scrapes and bumps. The Topless Dome has been visited many times, but never climbed again.

King's Shower

But the story of the King's Shower had an earlier beginning. In the early days of exploration, there was no hole in the ceiling where the shower is today. Off to the west side of the passage at that area is an opening and canyon. Water was pouring down into the canyon, and this was dubbed the King's Shower. Cavers leaned out over the canyon and looked up to see where the water was coming from, and found it was coming out of a stream directly over the passage. With a bit of tricky climbing they got out over the canyon and into the stream passage that came from the bottom of the Topless Dome. Jim Johnston, one of the early cavers exploring the cave, said the floor of the stream passage sounded hollow. To emphasize that, he stomped on the floor. CRACK! The floor fell open! The King's Shower moved to the middle of the passage, where it is found today.

Emperor's Room

Meanwhile back at the Great Hall of Mysteries efforts were continuing to force a way on. Someone noticed that high on the wall, opposite the passage entering the Great Hall, there seemed to be a passage. It appeared to be up an un-traversable wall, but the explorers found a way. They cut and hauled in with a great deal of effort and ingenuity a 20-foot tree! They leaned it against that wall and prusiked up the tree and on into the crack at the ceiling. It quickly opened into the "Emperor's Room." It was easy to rappel into this large room, but it was just a room. We named it the Emperor's Room. While poking about this room the cavers inside heard the others outside at the base of that wall. There MUST be a way through at the bottom. Digging and rock moving opened up Johnston's Junction. Jim was the first one through. This is an awkward tight crawl. It involves two vertical right-angle turns. To go in on your stomach makes the first turn abruptly difficult. But to go in on your back to ease through that turn makes the next turn back to a horizontal crawl, back-breaking. The way most cavers do it is by making a corkscrew turn of the body between the two turns.

Blue Crawl

Now that the early explorers were in the Emperor's Room, they wondered, "What next?" There was a narrow vertical crack up on the far wall, the only way on. The opening was high but extremely tight. In an attempt to widen the crack, Jim took a blowtorch and heated the walls. He hoped the rock would expand and crack off in small slabs, maybe widening this crawl. "Crawl" is a misnomer, since the void is vertical and one simply cannot crawl in a tall vertical slot. I don't believe the wall spalled off much, if any, with Jim's efforts. But Jim tried, and as he moved on, he found himself wedged against the very spot he had heated. His language turned the air blue, and this has been called the "Blue Crawl" ever since.

Allen's Alley and the Asphalt Ooze

The Blue Crawl deposits the caver in a room dubbed the "Inner Sanctum." This then opens into a huge borehole passage, named "Allen's Alley" after Jack Allen, the first to enter the passage and who was very much a part of this extension-finding crew. There is one short, wide but low spot in this otherwise high passage.

Just beyond the low spot, there is a rare and unique phenomenon for the inside of a cave, the "Asphalt Ooze." The passage has intercepted a small deposit of asphalt in a layer of the limestone high on a wall. The tar-like substance had dribbled out in a slim line depositing on the breakdown floor, where the trickle had formed a stream down the slope. A close look in this rivulet found an unfortunate cave cricket firmly stuck in the black goo. Samples have confirmed this shinny black stuff is a bituminous hydrocarbon material. Sadly today, muddy footprints have all but hidden this stream on the breakdown.

Mount Olympus

Beyond Allen's Alley, the passage turns into a steep slope pinching off high against the ceiling. Up at the top of what we named "Mount Olympus," there are some very pretty flowstone formations. A large stalagmite is bright red and deservedly is named the "Pillar of Fire." It is the subject of many photographs, as well as several smaller, crimson ones nearby called the "Flamingoes."

Off to the east of Mount Olympus the breakdown allows the explorer to crawl through and against the east wall to such minor voids as "Grant's Tomb," after Peter Grant who surveyed this area, and to "Terry's Terrible Tiger Teeth," named for protruding slabs of rock named by Terry Tarkington. This path is also somewhat unstable, with changes having occurred in living cavers' memory. As of this writing, this is the furthest anyone has been able to penetrate.

Round Cove

The stream that flows intermittently throughout the cave is also seen in Grant's Tomb. There are no waterfalls or noisy cascades in Tumbling Rock Cave; therefore, this "end" is very near the same elevation as the entrance to the cave. An accurate survey by Patricia Kambesis confirms this. However, Round Cove, where the cave water goes underground, is much higher. We speculate that somewhere between Round Cove Sink and Terry's Terrible Tiger Teeth, there has to be a long cave with a substantial pit. If some intrepid cavers are willing to brave the very real potential of flooding in Round Cove, a push in one of its caves might well lead to a long cave and pit connecting to the Tiger Teeth in Tumbling Rock Cave.

Future Exploration

Another elusive "back door" could be the source of the water that flows into the Topless Dome. The main cave stream exits as a spring just yards from the cave entrance. However, studying the cave map and the location of a small cave in the valley to the west of Tumbling Rock Cave, leads to the conclusion that this small cave was once the spring of the cave's stream. It no longer connects to Tumbling Rock Cave and is blocked from tying into an extension west of and lower in elevation than the Wildcat Rock Pile.

There are other areas in Tumbling Rock Cave that could still lead to new discoveries. For instance, "Virgin Passage" runs from "Little Chuck's Music Box" in "Totem Gallery," at a slightly higher level than the main passage, back toward the entrance. Surveys show it ending above, but overlapping an area above the Wildcat Rock Pile. They must be close, but no connection has yet been made.

Byers Cave

Marty Abercrombie, NSS 51557

Mark Ostrander in the Big Room. Photo: Nathan Williams

Byers Cave was discovered by Ken Pennington who named the cave after his longtime friend and ridge walking partner, Freddy Byers. Freddy and Ken were members of the Rockeaters, an early TAG grotto responsible for the discovery and initial exploration of many caves in the North Georgia and Northeast Alabama area. The Rockeaters explored much of the lower section of the cave while keeping it a secret. In 1961 fellow Rockeater, Ronnie Reece, fell down a 26-foot pit he had been ascending (hand over hand) on a manila rope and required rescue. Other than his pride, he was unhurt but the resulting rescue efforts made the world aware of the cave. Shortly after the rescue, James Storey produced the first map of Byers Cave. This map shows the cave from the entrance to the large formation hall. During this initial survey, the survey team lost its compass in some breakdown. Rather than quitting the trip, they continued surveying the cave without a compass. The resulting map has remarkable detail for maps of the time, but it is more or less a sketch map.

The Cave Received Regular Visitation and Exploration

In 1964 Dogwood City Grotto (DCG) members found a second entrance connecting to the big room. This group also climbed the waterfall at the end of the “old cave” and the new section of the cave was discovered, doubling the known extent of the cave at that time. In 1966, another survey project was begun by DCG members, led by Elizabeth “Foxy” Ferguson (Elizabeth Stafford). This project mapped more than 6 miles of passage, including a third entrance leading to the far reaches of the new section of cave; this entrance has since collapsed. In 1969 the survey was concluded. Foxy never produced a map, or released her notes, stating that a map would cause increased visitation to the cave and she did not want responsibility of the cave being negatively impacted. Not long after this Dion Bradford, the property owner, closed the cave and restricted access to cavers.

Ronnie's Chicken Pit. Photo: Kelly Smallwood

Big Formation Room. Photo: Jerry Wallace

Fast Forward to 2004

The Southeastern Cave Conservancy (SCCi) has purchased a large part of Fox Mountain including the tract of land adjacent to the Byers property. The property line ended on a cliff face directly above the entrance. Mr. Bradford sold his property to Steve Brock, a real-estate developer from Atlanta. Mr. Brock was approached and agreed to donate the property, directly around the entrance to SCCi, allowing the cave to be open to cavers again after more than two decades of being closed.

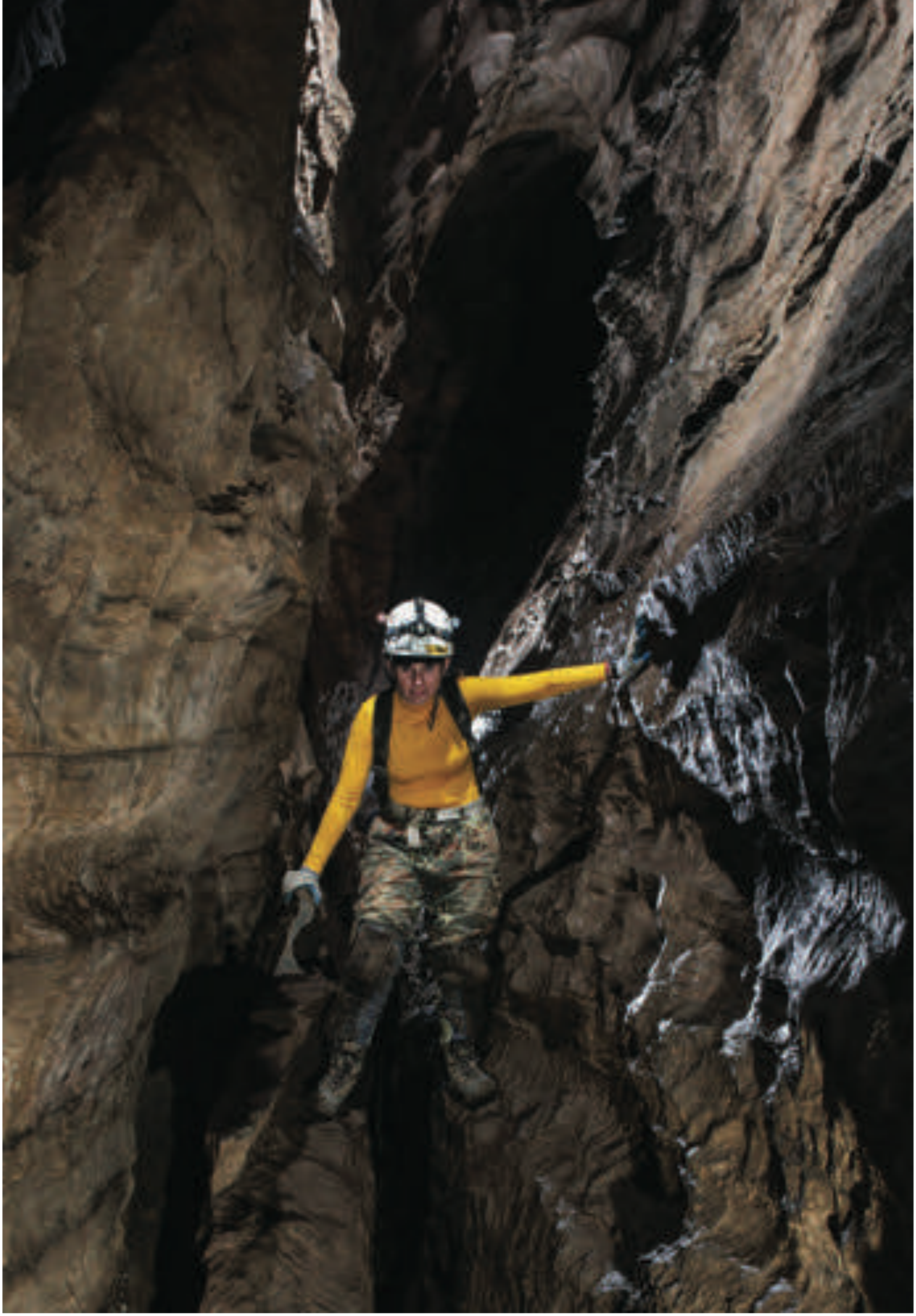
During the years the cave had been closed to cavers, Byers had been heavily visited and used as a party spot for locals. Trash was knee deep in many places and graffiti covered every easily (and not so easily) accessible surface. The next two years saw graffiti scrubbed from the reasonably accessible areas of the cave as well as thousands of pounds of trash carried out by volunteers. With the SCCi's acquisition of the cave, Brent Aulenbach was able to convince Foxy to allow him access to her notes and draft a map for the SCCi property managers for use in case of a rescue. Each of the property managers received a 2 foot by 5 foot copy of this map. While being better than the original map from the early 1960s, with no cross sections or vertical control, it still proved to be difficult to use for navigation.

Survey Revisited

In 2012, at the spring meeting of the Georgia Speleological Survey, the idea of re-mapping Byers Cave was introduced. Over the next month the prospect of re-mapping the cave kept resurfacing and gaining more steam. The SCCi was approached for feedback to see if it was willing to allow a re-survey of the cave and enthusiastically approved the proposal and drafted a Memorandum of Agreement (MOA). The MOA states that the primary goal of the project is to produce a completed Grade 5 map with cross sections and a vertical profile. The secondary objective of this project is to provide the opportunity for anybody who wants to learn surveying or gain experience a chance to do so.

The re-survey began with the first trip on May 5, 2012. Six cavers surveyed from the entrance into the first large room. From this room they surveyed into the cave stopping at a large climb down known as the "Glass Wall." From here they surveyed a parallel passage back into the large room to make a loop of 887 feet.

Survey trips were scheduled for the end of each month with some months being missed due to conflicting schedules. There were five trips in the first year from May to December 2012. These trips surveyed more than a mile of the lower passage as well as the notable side passages in the upper cave and "Ronnie's Chicken Pit,"



Sabrina at the bottom of Glass Wall. Photo: Nathan Williams

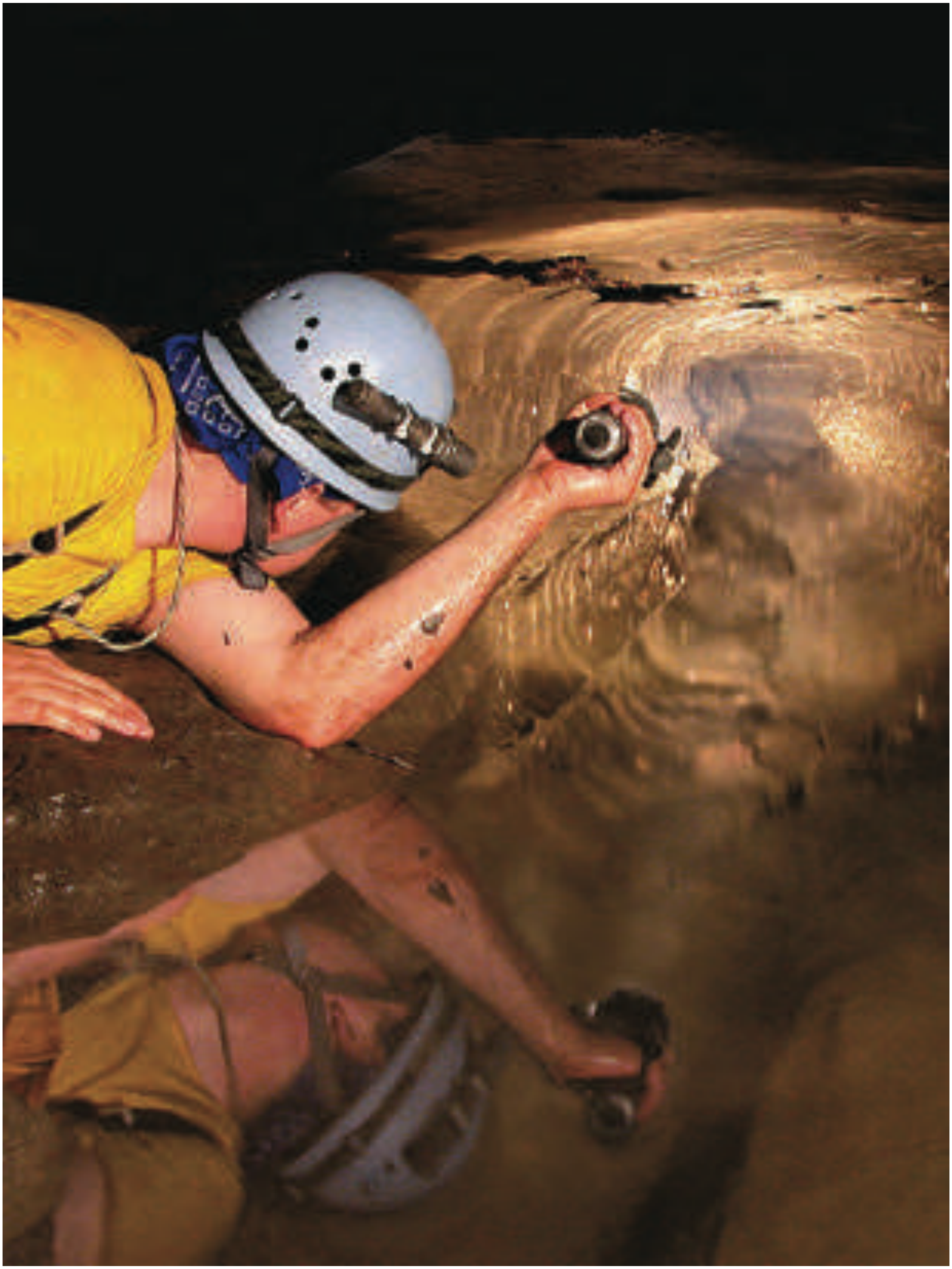
Johnny Prouty in Byers. Photo: Nathan Williams the 26-foot pit Ronnie Reece fell down and had to be rescued from in the 1960s.

Survey footage averaged a little more than 1,000 feet per survey with the largest amount surveyed in a day being 2,257.75 feet and the shortest amount being 500 feet. By January 2013, a total of 209 survey stations had been set with a total surveyed length of 1.00 mile, while a total of 26 people surveyed in the cave. Eighteen of those individuals were novice surveyors who learned to survey while helping on this project.

2013 was a slower year for the project. Due to conflicting schedules, inclement weather, and injuries, there were only four survey trips. With 3,600 feet surveyed, these trips did complete the easily accessible sections of the lower cave. This prepared the surveyors to continue into the new section of the cave above the waterfall.

In January 2014, we celebrated the New Year by beginning to survey above the waterfall into the new section of cave. A small survey team spent two days surveying the upper cave and staging gear to improve the efficiency of future survey trips, which will continue both upstream past the big room, as well as into the new section.

Survey trips are ongoing and generally scheduled for the next-to-last Saturday of each month. We hope to have the majority of the known cave re-surveyed by early next year and a completed map shortly afterwards. At the time of this writing (February 2014), there have been 38 people who have surveyed in the cave. Nineteen of the participants have never surveyed before. A total of 1.75 miles of passage has been mapped.



Is it worth the wet crawl? Photo: Tim Curtis

Chapter 3 Cave Sciences

Discover Life Underground in TAG

Cory Holliday, NSS 50057

Salamander - *Eurycea lucifuga*. Photo: Tim Curtis

Cory Holliday is the Cave and Karst Program Director for The Tennessee Chapter of The Nature Conservancy.

I'm often cited as or labeled an expert, but I must disclose that I still feel like a newcomer to TAG and to the field of cave ecology. I have been investigating life underground for 10 years and have discovered far more questions than answers. I suppose that is the most alluring part of cave science: exploration and the promise of discovery. The Nature Conservancy is a scientific conservation organization that prides itself on the highest quality conservation planning, especially at a large scale. For caves and karst regions, this proves especially difficult. No two caves are alike, and the suite of subterranean biota in TAG could not be more diverse. We often can't apply a "one size fits all" approach. However, the more I learn about our cave environments, the more enriching my underground experiences are. Luckily for me, many TAG cavers have shared knowledge with me from a variety of disciplines. I hope to return the favor by increasing your awareness of life underground in TAG and hopefully improving your caving experiences here as well.

TAG CAVE ECOLOGY

While no two caves are alike, TAG caves do share one thing in common: a dependence on external energy sources. (I should note that there are examples of chemoautotrophy in subterranean habitats, but they

Cave Cricket. Photo: Tim Curtis

don't drive cave ecology in TAG.) Scientists of course have to have a name for everything, and we call dependence on external energy sources being allochthonous. There are a lot of ways for energy to enter our TAG caves, and life underground is well adapted for handling these nutrient inputs. Compared with surface habitats, caves are very nutrient poor, and the organisms that live there seem well suited to this dark, cool, wet, and energy-poor ecosystem. I'll briefly discuss general cave ecology, and then we'll get deeper into bats and of course white-nose syndrome (WNS), which has been the major emphasis of my work in recent years.

Although caves are typified by complete darkness with no hope for photosynthesis, life in and around cave entrances can be extremely unique. Many calcium-loving plants make their home in or around cave entrances. One very notable TAG cave plant is the American Hart's Tongue Fern, which is common in Canada, but very rare in the United States. The fern is found in a handful of TAG pits, with a climate not dissimilar to a more northern growing season. This species, and many other cave inhabitants, may be relicts from colder climate regimes during a prehistoric glacial period. Many believe that as glaciers receded and temperatures warmed in North America, many organisms were driven to the cool, isolated subterranean environment of TAG caves.

In the entrance and twilight zones of TAG caves you can find an incredible variety of life. Many organisms thrive in the insulated habitat and use these cave areas for some part of their life cycle. This is where the surface and cave habitats collide. Look closely and you may notice unique algae, glow worms, hibernating invertebrates, nesting birds, amphibians cooling off on a hot day, etc. As we move deeper into our caves, we find organisms that are more and more adapted to these unique cave environments. These truly cave-adapted organisms are called troglobionts. These are what cave biologists live for. These organisms are specifically adapted to these cool, dark, low energy, allochthonous habitats. Outside nutrients drive these systems, so let's take a minute to explore those energy paths.

Water and TAG caves are inseparable. Water formed and is still forming these caves, and water helps feed these caves in multiple ways. As rainwater moves through surface and soil habitats, its chemical composition

Gyrinophilus palleucus palleucus, Bluff River Cave, Jackson County, Alabama. Photo: Alan Cressler changes quite a bit. It picks up organic carbon as well as dissolved organic matter. Both of these help feed our TAG caves. One of the most consistent and reliable sources of energy is ceiling drips. This water makes its way from the surface through the soil and epikarst, picking up physical and chemical hitchhikers along the way. By the time this water reaches a cave, it is generally rich in carbon, organic matter, and even small organisms like copepods and ostracods. This is one of the most consistent energy inputs our TAG caves have. From a conservation standpoint, everything we do above ground affects where this water moves, what it comes in contact with, and the duration of contact with organic matter.

More obvious waterborne energy inputs come from sinkholes and sinking streams. These carry everything you can imagine into our TAG caves - from the annual influx of deciduous leaves to full-sized trees. Not to mention anything else you might find in the waters of TAG: aquatic animals, runoff pollutants, and the occasional major appliance, to name a few.

Animals also provide critical energy inputs into TAG caves. Some are in the form of direct decaying organic matter as accidental deaths by animals that fall into a cave or wander in too far and become trapped. Many animals that use caves are still dependent on the surface environment for some part of their life. The cave cricket is a fantastic example of this. Practically ubiquitous in TAG caves are members of both the Ceuthopholis and Hadenoecus genera of crickets. Both forage outside of the cave and return energy to the cave in the form of guano deposits and eggs. A single cave cricket can lay hundreds of eggs per year, which can be very important food for predatory troglobionts like beetles. Guano from these surface foragers becomes the base for a biological mat on which microorganisms build the fundamental strands of the food web in cave ecosystems.

TAG CAVE BATS

Many other animals bring energy into caves in the same way as crickets: raccoons, woodrats, bats, etc. Bats are especially important in TAG as we have a variety of species with differing effects on the cave environment. Although bats are not considered troglobionts or cave-adapted animals, they are often associated with caves and are an internationally recognized symbol of the caver. Many bats depend on TAG caves for part of their life cycle and could not survive without their subterranean safe havens.

Bats use caves for hibernation, mating, and to rear their pups. About one-half of the bats found in the TAG region will use caves for hibernation. Bats are very unique animals. They buck the trend of most mammals by being both long-lived as well as small with high metabolisms. All of our TAG bats are insectivorous, so when the temperatures drop and the invertebrates disappear from the landscape, many bats hibernate in caves to survive the colder months of the year.

These bats are small to start with, between four and 14 grams on average. That's less than half an ounce. It is an incredible feat of nature for these animals to survive 5–7 months on 2–3 grams of fat storage. Most utilize especially cold caves using the thermal conditions to reduce their bodily functions to the absolute minimum required to survive in a state of torpor. During hibernation many of these bats are especially vulnerable to increased disturbances within the cave. Bats' vulnerability during hibernation is a major reason that many TAG area caves have been gated.

Possibly my favorite TAG bat is the gray bat, *Myotis grisescens*. These are our most cave dependent bats as they use caves both in summer and winter. As far as scientists know, over 95% of all gray bats hibernate in less than 10 caves. These bats form incredible winter colonies often numbering in the hundreds of thousands. Gray bat hibernation caves represent a fascinating ecological assemblage. These bats cluster at densities up to 275 per square foot and can cover huge wall surfaces in a handful of TAG caves. During the summer, these bats spread out to hundreds of warmer caves. The sexes segregate, and the females select the warmest TAG cave roosts to rear their young. Like most of our TAG bats, gray bat mothers give birth to just one pup per year. Gray bat pups are typically born between mid-May and early June, and by late June to mid-July they are flying on their own. This period when the pups are still unable to fly is critical, and again their vulnerability at this time has prompted the gating of certain caves.

Gray bats prefer to forage over waterways, and they tend to roost in large caves along our southeastern rivers. Some of these summer caves contain over 100,000 bats, and the emergence at dusk is an extraordinary ecological event. Nickajack Cave in Tennessee contains one of our largest gray bat maternity

Bat in flight. Photo: Chris Higgins

colonies and is a great place to be on a summer evening between June 1 and mid-July. There is a nearby viewing area for bat watching, or the more adventurous can boat out into the lake as thousands of bats swarm overhead.

Gray bats have profound effects on cave ecology in TAG. In their transitional and summer caves, gray bats contribute enormous amounts of energy in the form of guano. It remains unknown exactly how that energy is used by other cave organisms and if some organisms, other than guanophiles, may be dependent on this gray bat guano input. This mystery is relevant now more than ever. Many of our cave hibernating bats in TAG may be facing their greatest challenge ever, white-nose syndrome (WNS). If gray bats prove to be vulnerable to WNS, we could see drastic changes in cave ecology in many TAG caves over the next several years.

WNS IN TAG

Working its way down from New York, WNS officially entered Tennessee (in a recognizable manner) in 2010 and was in the heart of TAG by 2012. What we know about WNS has increased with time, but as far as effects on bats, everything we know is largely based on the observations from the Northeast, where WNS originated in North America. I'm holding out at least a bit of hope that our southeastern winters and greater diversity of caves may enable our bats to better cope with the causative agent, the fungus now known as: *Pseudogymnoascus destructans* (Pd).

My involvement with white-nose syndrome really started in 2009, when the disease expanded outside of the northeastern United States and made a big leap down the Appalachians. By March 2009, WNS was already within the summer range of gray bats. With gray bats hibernating in so few caves, a disease affecting cave hibernating bats compelled The Nature Conservancy (TNC) to act. In July 2010, TNC co-hosted a workshop with Bat Conservation International and the US Fish and Wildlife Service to explore specific strategies that may help mitigate the effects of WNS. Experts in varying disciplines from around the world were in attendance.

One strategy that was popular amongst experts was a short-term winter holding strategy in which large

Perimyotis subflavus, with Geomyces destructans, white-nose syndrome, Fricks Cave, Georgia. Photo: Alan Cressler

numbers of bats could roost in "clean" WNS-free artificial habitats. An artificial cave strategy was one that we had kicked around within TNC already, and this was just the impetus we needed to put the concept into practice. We began planning and fundraising for the project right away. Our goal was to design an artificial habitat that could be cleaned periodically when the bats are absent so that the bats are entering a Pd/WNS-free cave for hibernation. The hardest part is engineering a cave with optimal micro-climate regimes for our cave hibernating bats. Bats in TAG tend to hibernate in our coldest caves. Typical hibernation temperatures for TAG bats are between 35 and 48 degrees F, depending on the species of bat. Engineering an artificial cave to maintain these cold temperatures consistently would be a challenge in TAG.

We decided that rather than holding bats captive, we would first try to attract bats to our artificial, WNS-free cave. In order to shorten the colonization time, we located the cave next to an existing gray bat cave in an area of Tennessee with a high density and diversity of hibernating bats. After a tremendous amount of engineering and planning, we finally constructed the cave in 2012. The cave is approximately 16 feet by 80 feet by 11 feet (inside) and is concrete underground. There is a main bat entrance above ground and a ventilation shaft that runs upslope approximately 30 vertical feet. The cave is designed to function as a natural cave in many ways. We engineered a system for rainwater to run through the cave during rain events, and we have the ability to capture and release water in the cave at varying rates. Although the construction ended too late to expect bat use in winter 2012–2013, we were able to verify consistent temperatures between 41 and 48 degrees F between January 1 and April 1. This was an incredible first success, and we owe a lot to Rich Peine of Peine Engineering and to Merlin Tuttle for helping us engineer this cave correctly the first time.

Fast forward to summer 2013. We have to find a way to clean any potential Pd out of this cave. We did have some very limited bat use during the winter that we recorded with one thermal camera and an acoustic bat detector from Wildlife Acoustics. We considered the cave WNS positive that first year, and environmental swabs did confirm the presence of Pd in the artificial cave in year one. We wanted to keep it simple and try non-chemical, environmentally friendly treatments first. So we treated the entire artificial cave using a commercial high temperature steam/pressure washer. We did not detect any Pd during our post treatment environmental sampling, but given the low prevalence of Pd to start with, we need to do more research on this technique. One thing we did record during the first winter was relative humidity that was generally lower and more dynamic than in a natural cave. Some of that may have been due to the curing process of the concrete, but we modified the cave to capture and hold a higher volume of water in hopes of increasing and stabilizing the relative humidity to a more cave-like environment.

TNC has high hopes for our artificial cave, and with luck it will help save a subset of the population of hibernating bats at Bellamy Cave. If it does, we hope it can serve as a model and similar structures can be built and maintained throughout the WNS region. Also, artificial habitats like our artificial cave, and potentially converted underground bunkers, can serve as an important intermediate step in regards to WNS research. Science is finally beginning to make progress on developing WNS control agents that have real potential for controlling or inhibiting the effects of WNS on bats. Artificial habitats can serve as living laboratories where WNS control agents can be researched fully before ever being tested in a natural environment. This is a critical step if we ever hope to conserve or restore cave hibernating bats in meaningful numbers.

However, this is a novel disease, and we have no guidebook to follow as we attempt to battle WNS. Our best case scenario is to develop tools that inhibit the negative effects of WNS while allowing bats to maintain a natural, undisturbed lifestyle. These are the shared goals of many organizations and agencies working together to find solutions to WNS. I'm confident that in the next few years, the scientific community will develop tools to combat WNS.

Personally, I find the diversity of life in the caves of TAG greatly enriches my caving experience, and I hope it does yours too. We don't yet know how WNS will affect our cave bats in TAG, but for now we are hoping for the best but planning for the worst. I'm optimistic, but perhaps this is the year to finally go watch a major gray bat emergence while they are still on the landscape in large numbers. The worst thing that could happen is you have an inspiring experience causing you to have a connection with these amazing flying mammals that are the symbol of the caver.

Cave softly.

Cave Radioactivity

Bill Varnedoe, NSS 3160 OS, FE, CM

Bill Varnedoe and Chuck Lundquist conducting radioactivity studies in Tumbling Rock Cave. Photo: Louise Varnedoe

Vern Rechmeyer wrote several articles in the *Huntsville Grotto Newsletter* in the 1960s when he conducted extensive studies of radioactivity in Tumbling Rock Cave, Hughes Cave, Sauta Cave, and Hughes Junior Cave. My wife, Louise, and I assisted Vern several times with his studies. Unfortunately, much of what Vern did was written up in the *Huntsville Grotto Newsletter* in narrative form without explicit data. Nevertheless, he did give enough information to form some very positive scientific conclusions.

The studies conducted by Vern indicated that the radioactivity was largest when these caves were wet. The radioactivity also varied both seasonally and with precipitation cycles. In addition, the radioactivity was at the highest level when the air exchange in Tumbling Rock and Hughes Caves was greatest, while the highest levels were obtained at the windiest points in Tumbling Rock Cave. However, Vern also noted that wind alone was not required, since he found Sauta Cave had essentially no radioactivity even when vigorously blowing. At first he thought maybe that the activity came from dust particles in the cave air; nevertheless, it later became very clear that the principal radioactivity was from the air itself and some type of gas.

Vern was never able to find a "hot spot" in any cave as a likely source to generate this gas. However, the use of an ion chamber to measure the radiation of sands from both Tumbling Rock and Hughes Caves allowed the separation between gamma rays and beta plus alpha rays. Using this ratio, Louise Varnedoe was able to positively eliminate uranium and radon gas as the culprits. This leaves thorium and thoron as the very likely

Vern Rechmeyer measuring radioactivity in Tumbling Rock Cave in the 1960s. Photo: Bill Varnedoe

source of the radioactivity, as thoron is a gas decay product of thorium. Louise also did a decay study which matched thoron but not radon.

Monazite sand is a phosphate ore of thorium and other rare earth metals. Monazite sand has been discovered in North Alabama (Personal Communication between Dr. Walter B. Jones, Alabama State Geologist, and Louise Varnedoe). Vern and Louise speculated that the sand was spread throughout the cave and was of such a low level that it was undetectable. However the air moving over the fill throughout the cave accumulated enough gas to become "hot" at the blowing points, mainly the entrance. This is the sum of what is known before Vern retired from caving and moved away.

Later tests by Chuck Lundquist, Louise Varnedoe, and me also confirmed that the blowing entrance of these caves was quite hot, but we also failed to find an interior hot spot. Our sole Geiger counter died and has not been replaced.

Since then, another thought has occurred to me. Carbon dioxide gas outgases when water enters the cave, depositing flowstone. Perhaps thoron also outgases, that is, if thoron is soluble in water like carbon dioxide? This would fit the wet-dry cycle Vern observed for the radioactivity and would account for the negative results of finding no radioactive hot spots in the cave. During all radioactivity studies, we never checked the cave stream or the cave water. I wanted to pursue further studies on cave radioactivity, but age and the lack of proper sensitive enough instruments ended this pursuit.

Editor's Note: Louise (Thomas) Varnedoe worked at Oak Ridge National Laboratory as a Physicist before moving to Huntsville when she accepted a position as an engineer for the Army Missile Command. Bill met Louise when she came on a Huntsville Grotto caving trip as someone's date after she had joined the brand new grotto and the NSS. When Bill was working at Cape Canaveral in May 1955, as an engineer for a Redstone Rocket launch, he went into a restaurant for supper. Bill spotted a lady sitting alone, and recognized that it was Louise, whom he first met on the caving trip as she was there for the same launch. Bill went over and sat down and they started to date, while working at Cape Canaveral. Back home in Huntsville, Bill and Louise caved together frequently. In November 1955, Bill and Louise were married and still are after 59 years! Bill Varnedoe, Louise Varnedoe, and Chuck Lundquist are the only remaining Charter members of the Huntsville Grotto.

Cave Biodiversity of the Southern Cumberland Plateau

Kirk S. Zigler, NSS 62696; Matthew L. Niemiller, NSS 53235; and Danté B. Fenolio

The South Cumberland Region of Tennessee, Alabama, and Georgia (Figure 1) is known for its tremendous diversity of caves, including huge pits, massive stream passages, and tight crawls. Less well known is that the region also supports tremendous cave biodiversity (Niemiller, Zigler, and Fenolio, 2013). Here we discuss many of the species that inhabit caves of the region, focusing on the southern Cumberland Plateau.

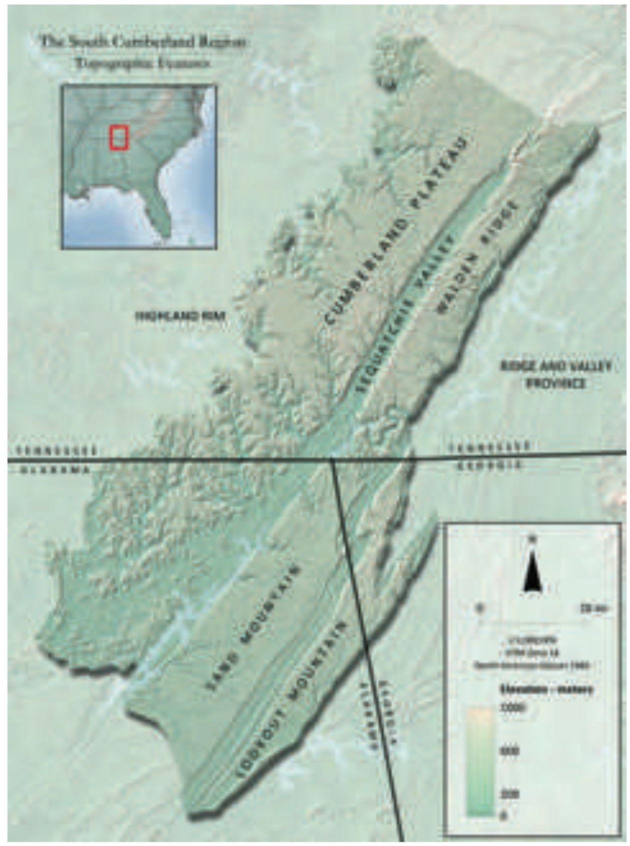


Figure 1 - The South Cumberland Region at the junction of Tennessee, Alabama, and Georgia. Figure courtesy of Nick Hollingshead.

Cave Biodiversity

Four ecological classes of organisms can be found in caves: trogloxenes, subtroglophiles, eutroglophiles, and troglobionts (Culver and Pipan, 2009). **Trogloxenes** are not typically found in caves and cannot persist there for long periods of time. They must either find their way back to the surface or ultimately perish. **Subtroglophiles** are commonly found in caves but are associated with surface habitats for at least part of their life cycle. Some are seasonal inhabitants of caves and others move back and forth from cave to surface habitats for feeding, such as cave-roosting bats, cave crickets, and Allegheny Woodrats (*Neotoma magister*). **Eutroglophiles** are commonly found underground but can be found in surface habitats. Unlike trogloxenes and subtroglophiles, eutroglophiles can complete their entire life cycle underground. Examples include the Cave Salamander (*Eurycea lucifuga*) and the Cave Orbweaver (*Meta ovalis*). **Troglobionts** are obligate, permanent residents of subterranean habitats. They spend their entire life underground and are not found in surface habitats. Troglobionts typically display morphological changes associated with subterranean living. These changes include the loss or reduction of pigment and eyes, increased appendage length and increased development of nonvisual sensory systems. Physiological and life history changes typically include decreased metabolic rates, longer lifespans and lower rates of reproduction.

This review focuses on troglobiont diversity, as trogloxenes and troglophiles are not strictly associated with cave habitats and often have large ranges. This review also does not consider other organisms associated with caves, including plants, fungi, or microbes. Little is known about the subterranean biodiversity of these organisms.

Distribution

It has been known for some time that northeastern Alabama is a hot spot for cave biodiversity (Peck, 1989, 1995). Jackson County, in particular, stands out as having more troglobionts than any other county in the United States, with Madison and Marshall Counties not

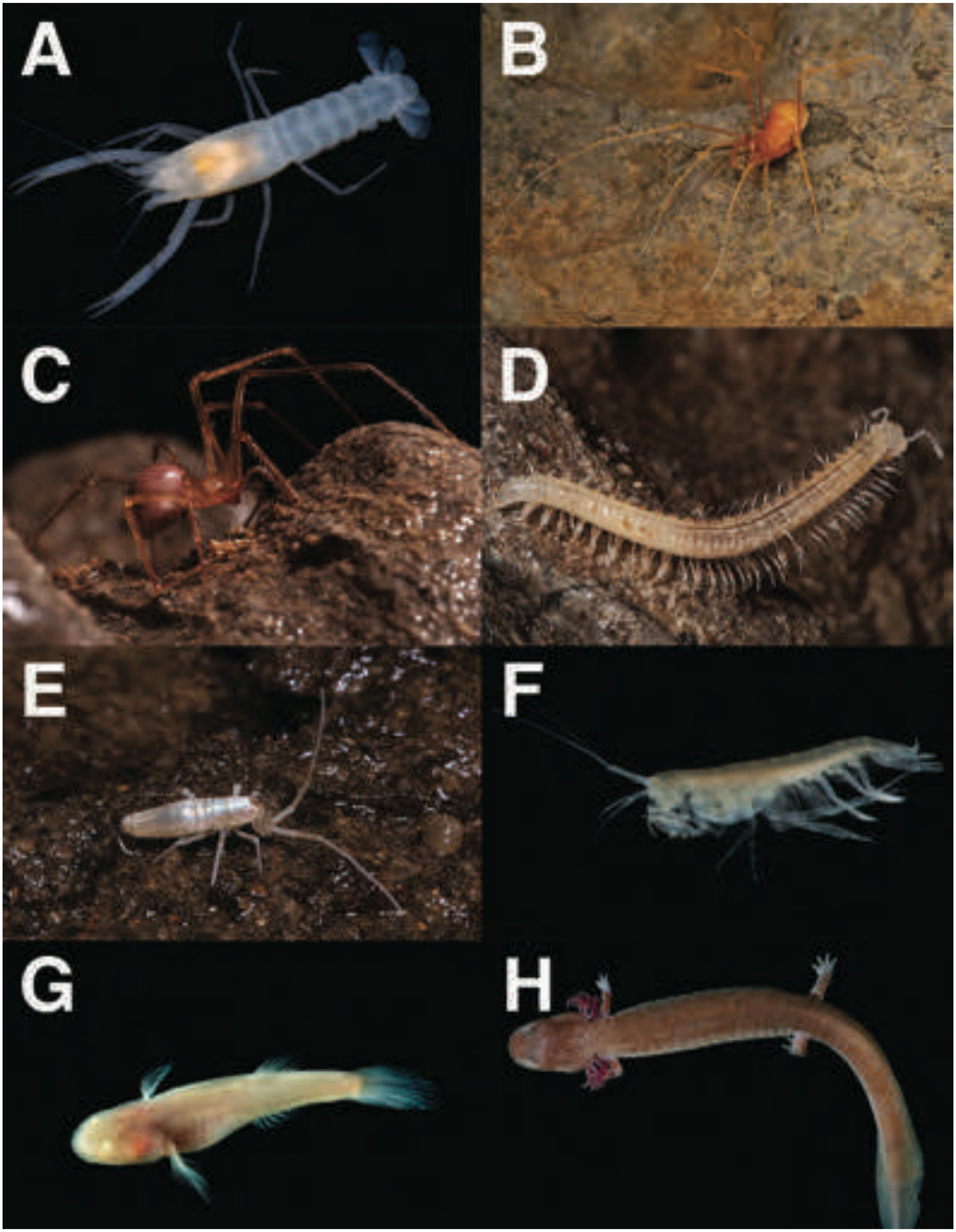


Figure 2 - Representative cave fauna of the southern Cumberland Plateau:
A) Southern Cave Crayfish (*Orconectes australis*); B) an undescribed cave harvestman (*Bishopella* n. sp.); C) Barr's Cave Spider (*Nesticus barri*); D) a cave millipede (*Scoterpes* sp.); E) a cave springtail (*Pseudosinella* sp.); F) a cave amphipod (*Crangonyx antennatus*); G) Southern Cavefish (*Typhlichthys subterraneus*); and H) Tennessee Cave Salamander (*Gyrinophilus palleucus*). Photos: Danté B. Fenolio

far behind (Culver, et al., 2000). The cave biodiversity of this region has been compared to that of other global hotspots of cave biodiversity including the French Pyrenees and the Dinaric karst of Slovenia (Culver, et al., 2006).

Recent work indicates that the hot spot of cave biodiversity in northeastern Alabama extends across the border into south-central Tennessee (Lewis, 2005; Niemiller and Zigler, 2013). The six-county region spanning the Tennessee-Alabama border on the southern Cumberland Plateau—Madison, Jackson, and Marshall Counties in Alabama and Franklin, Grundy, and Marion Counties in Tennessee—supports more than 150 described troglobionts (Table 1). These species represent nearly 15% of all troglobionts known from the United States, and is the greatest concentration of cave biodiversity in North America. The number of troglobionts known from this area will undoubtedly increase as more than 40 potentially new species have been mentioned in the literature but have not yet been described.

Why is the southern Cumberland Plateau such a biodiversity hot spot for troglobionts? High cave density (there are more than 4,400 caves in the six-county region) undoubtedly plays a role by providing a substantial amount of potential habitat. The region also has relatively high rainfall and surface productivity that indirectly support subterranean communities. In addition, the fragmented nature of the southern Cumberland Plateau (Figure 1) may increase the potential for cave populations to become isolated from one another, promoting the formation of new species over time. Last, three ecoregions come together in the vicinity of the southern Cumberland Plateau—the Southwestern Appalachians (including the Cumberland Plateau, Sand Mountain, and Lookout Mountain), the Ridge and Valley, and the Interior Plateau (including the Highland Rim) (Figure 1). Each of these ecoregions has significant karst and the troglobiont communities from these ecoregions have been able to intermingle in and around the southern Cumberland Plateau.

Looking at a finer scale, there are a number of particularly notable locations for cave biodiversity on the Cumberland Plateau. Hubbards Cave in Warren County, Tennessee, and Sauta Cave in Jackson County, Alabama, are two of the eight major Gray Bat (*Myotis grisescens*) hibernacula, with Hubbards Cave hosting more than 500,000 Gray Bats in recent winters. Although many caves in the region support diverse troglobiont communities, Shelta Cave in Huntsville, Alabama, and Crystal Cave in Grundy County, Tennessee, stand out as two of just seven caves in North America known to support more than 20 troglobionts (Culver and Pipan, 2009).

Taxonomic and Ecological Diversity

Troglobiont diversity on the southern Cumberland Plateau (Figure 2) is dominated by a variety of arthropods (93%, 142 of 152 species). Particularly diverse are beetles, pseudoscorpions, millipedes, and spiders (Table 1). Beyond the arthropods, four other animal phyla are represented, with flatworms (Phylum Platyhelminthes), segmented worms (Annelida), snails (Mollusca), and vertebrates (Chordata) comprising the other 10 known troglobionts. Particularly diverse genera are *Tyrannochthonius pseudoscorpions* (27 species) and *Pseudanophthalmus* and *Ptomaphagus* beetles (12 species each). The two vertebrates are the Southern Cavefish (*Typhlichthys subterraneus*) and the Tennessee Cave Salamander (*Gyrinophilus palleucus*).

There are many more terrestrial troglobionts than aquatic troglobionts, as only 16% of the troglobionts are aquatic (25 of 152 species). The aquatic troglobionts are the two vertebrate species, a variety of crustaceans (including five crayfish), a flatworm, and several segmented worms (Table 1).

Endemism

Limited by the challenge of migrating between caves, many troglobionts have extremely small ranges. Of the ca. 450 terrestrial troglobionts in the eastern United States, 45% are endemic to a single cave (Christman, et al., 2005). Within the six-county region discussed here, nearly a third (49 of 152 species) of troglobionts are known from a single cave (Table 1). The frequency of endemism varies across taxonomic groups. About 70% of pseudoscorpions are single-cave endemics, whereas less than 10% of millipedes are. The list of single-cave endemics is dominated by pseudoscorpions (29 species) and beetles (12 species), with a handful of other taxonomic groups represented (Table 1). Further study may identify new populations of some currently “endemic” species, removing them from the list of single-cave endemics. These changes will be balanced by the discovery and description of new species that are restricted to single caves.

Taxonomic Group	Species	Endemics
Arthropods		
Arachnids		
Pseudoscorpions	39	28
Spiders	8	1
Harvestmen	4	1
Mites	1	
Crustaceans		
Crayfish	5	1
Isopods	5	1
Amphipods	5	
Copepods	3	
Ostracods	2	
Shrimp	1	
Non-insect hexapods		
Springtails	10	1
Diplurans	3	
Insects		
Beetles	42	12
Flies	1	
Myriapods		
Millipedes	13	1
Flatworms	1	
Segmented worms	3	3
Snails	4	
Vertebrates		
Fishes	1	
Salamanders	1	
Total species:	**152**	**49**

Table 1 - The taxonomic diversity of troglobionts from the southern Cumberland Plateau (Jackson, Madison, and Marshall Counties in Alabama and Franklin, Marion, and Grundy Counties in Tennessee). The number of species from each taxonomic group and the number of single-cave endemic species are indicated.

In contrast to the numerous endemic species, a handful of troglobionts have ranges that span most or all of the Cumberland Plateau and beyond. These include the Southeastern Cave Pseudoscorpion (*Hesperochernes mirabilis*), the Subterranean Sheet-Web Spider (*Phanetta subterranea*), the Cave Dung Fly (*Spelobia tenebrarum*), and the Southern Cavefish. How these species achieved and maintain such large ranges are open questions. Some of these species may actually represent complexes of morphologically cryptic species. For example, recent molecular studies suggest that the Southern Cavefish is actually composed of several genetically distinct lineages, including four lineages found along the southern Cumberland Plateau (Niemiller, Near, and Fitzpatrick, 2012; Niemiller, et al., 2013).

Threats to Cave Biodiversity

As troglobiont populations are rarely quantified and troglobionts may be present at low densities, detecting changes in their populations over time is challenging. However, it is clear that populations of cave animals are vulnerable to a variety of threats, including groundwater pollution and the modification of habitats around cave entrances.

As an example of radical modification of habitat around a cave entrance, the construction of Nickajack Dam and the subsequent formation of Nickajack Reservoir in the 1960s flooded Nickajack Cave in Marion County, Tennessee. This may have led to the extinction of *Pseudanophthalmus nickajackensis*, a cave beetle known only from that site. Cave populations are also vulnerable to less radical habitat changes. An example of this is the extirpation of the Alabama Cave Shrimp (*Palaemonias alabamae*) from Shelta Cave. This federally endangered species was first collected from Shelta Cave in 1958 but has not been observed there since 1973. The loss of this population may have resulted from the abandonment of the cave by a Gray Bat maternity colony (and subsequent loss of nutrient input to the cave) in the 1970s, and/or increased runoff of pollutants into the cave (Cooper and Cooper, 2011). Fortunately, other populations of the Alabama Cave Shrimp are known, but the loss of this population from this well-studied and carefully managed cave highlights the vulnerability of troglobiont populations.

A handful of cave-dwelling species from the region are federally protected. Gray Bats and Indiana Bats (*Myotis sodalis*) are listed as endangered by the US Fish and Wildlife Service. Two troglobionts, the Alabama Cave Shrimp and the Alabama Cavefish (*Speoplatyrhinus poulsoni*, known only from Key Cave in Lauderdale County), are also listed as endangered. Seven troglobionts from Tennessee, including six cave beetles (all from the genus *Pseudanophthalmus*) and the Berry Cave Salamander (*Gyrinophilus gulolineatus*), are Candidate Species for the Endangered Species List, awaiting a final determination on their conservation status. However, these species are not found in the southern Cumberland Plateau.

An emerging threat to cave biodiversity in the region is white-nose syndrome (WNS). Now known from Tennessee, Alabama, and Georgia, it remains to be seen how great an impact WNS will have on cave-roosting bats in the region. Beyond being a tremendous threat to bats, other cave species are threatened by WNS as bats are a critical link between nutrient-poor caves and surface resources. Any decrease in the number of bats in caves will affect cave ecosystems. The consequences of WNS for cave ecosystems will only become clear over time.

Summary

The southern Cumberland Plateau in Tennessee and Alabama has more troglobiont diversity than any comparable area in North America and is a cave biodiversity hot spot of global importance. This diversity is dominated by terrestrial arthropods, in particular beetles and pseudoscorpions. Endemism is high, particularly for pseudoscorpions. A handful of species are federally protected as Endangered Species, but threats to most species are not well documented. An emerging threat to cave communities in the region is WNS. As new species are discovered and described, our understanding of these diverse communities will improve.

About the Authors

Kirk Zigler is an Associate Professor of Biology at the University of the South in Sewanee, Tennessee. Matthew Niemiller is a postdoctoral researcher at the University of Kentucky. Danté Fenolio is a biologist and head of the Department of Conservation and Research at the San Antonio Zoo.

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Sauta Bat Flight, AL. Photo: Kelly Smallwood

Chapter 4 History

Prehistoric Cave Art in the American Southeast—2014

Jan B. Simek[1], NSS 43467 and Alan Cressler, 24392 FE

Figure 1 - Petroglyph of birds from 12th Unnamed Cave, Tennessee.

Introduction

The caves of the southern Appalachian Plateau, the region called "TAG" by the caving community, contain some of the most impressive prehistoric records known in North America. Prehistoric people in the southern woodlands knew of and used caves from very early in their history (Watson, 1969; Watson, 1986), undertaking deep explorations, mining for minerals, burial, and perhaps most significantly, developing a rich and varied dark zone (beyond the reach of external light) cave art tradition that rivals those of ancient Europe, if not in age then in symbolic power. First identified by archeologists in 1980, this cave art represents a widespread, complex, and longstanding aspect of indigenous prehistoric culture in Southeastern North America, one with local origins and development and one closely tied to prehistoric religious beliefs and practices. Ironically, this important aspect of Eastern North American prehistory has only been known for three and a half decades, all the more curious in a region where archaeology has been practiced more or less continuously since Thomas Jefferson dug Indian mounds near Monticello sometime before 1783 (Jefferson, 1998).

Archaeological discovery is often a direct function of the intensity of effort, and in 1995 we formed the Cave Archaeology Research Team (CART) at the University of Tennessee, made up of professional archaeologists, students, and regional cavers interested in the historic

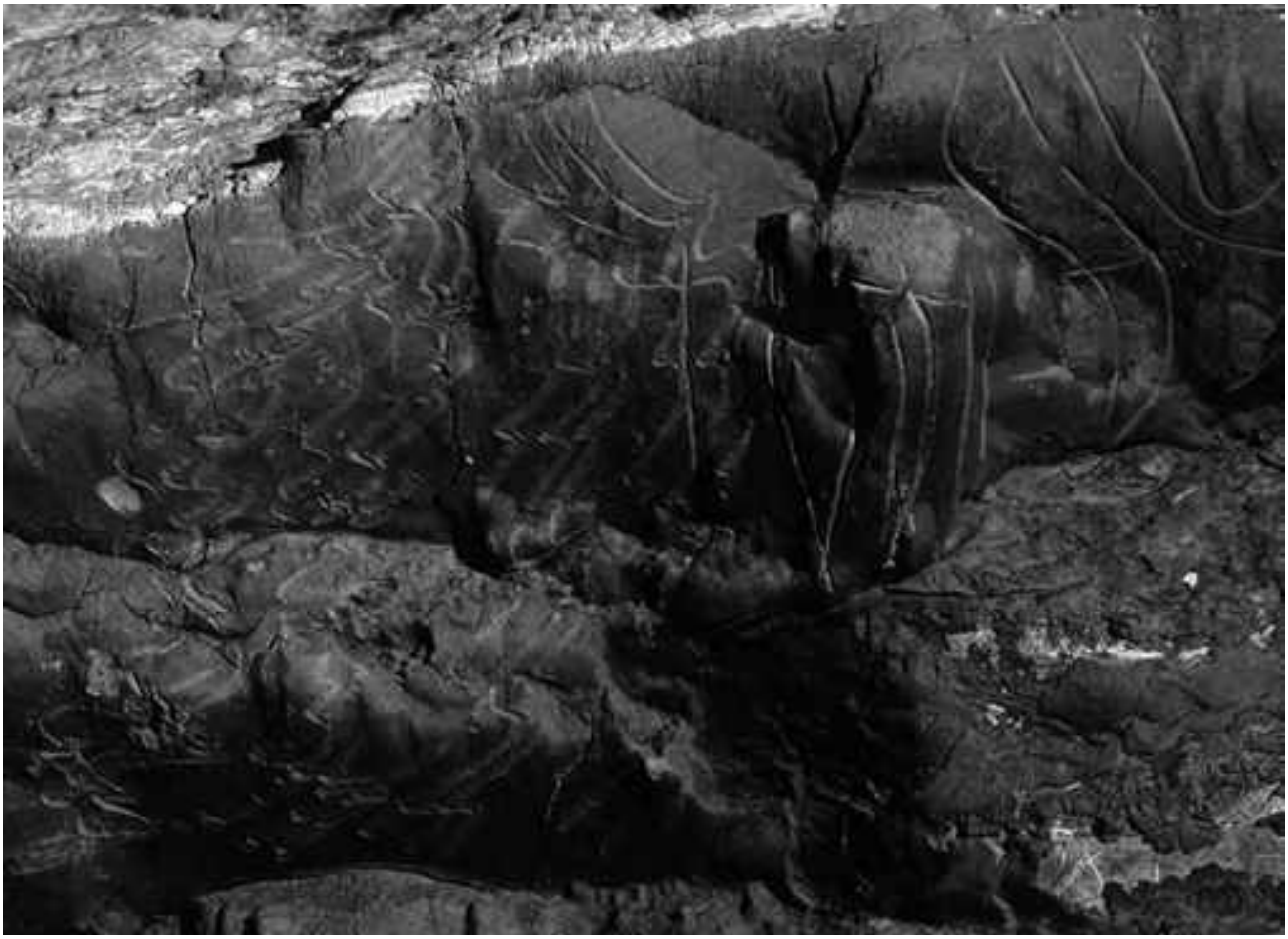

Figure 2 - Lines incised into wet clay banks (Mud Glyphs) from Mud Glyph Cave, Tennessee.

and prehistoric use of caves, in order to devote maximum effort to studying prehistoric cave use. CART began systematic survey of Southeastern caves and rock shelters, and as 2014 begins, there are nearly 70 cave art sites now recorded in TAG. A number of other sites are known in Kentucky, Florida, Illinois, Indiana, Virginia, and West Virginia, and along the western margin of the Eastern Woodlands in Arkansas, Missouri, and Wisconsin. Many of these sites were first discovered by vocational cavers, and since beginning this work, we have increasingly partnered with members of the TAG caving community, who have become indispensable in the discovery and recording of prehistoric art caves. CART and its associated cavers have now examined more than 1,500 Southeastern caves in hopes of finding prehistoric art, and our yield rate is something on the order of one cave art site discovered for every 25 caves visited (Simek, 2008). Thus, while Southeast cave art sites are rare, they are not as rare as all that. Remembering that the Tennessee Cave Survey contains records for more than 12,900 caves in Tennessee alone, with thousands more in Alabama, Georgia, and the Upper South, it is clear that we have only scratched the surface of prehistoric cave art in TAG. There is a great deal of survey work still before us, and there will certainly be many more caves discovered in the future. In 2013, for example, two new cave art sites were discovered by cavers in Tennessee and there are a number of possible new sites for CART to visit and verify.

Over the years, we have periodically published what is now a small series of overviews of this cave art (Faulkner, 1988; Faulkner, 1996; Simek and Cressler, 2001; Simek and Cressler, 2005; Simek and Cressler, 2009; Simek, Cressler, and Douglas, 2013). Our last overview, published in 2013 but actually written in 2008, was based on the 49 Southeastern cave art sites then recorded. This paper will consider a total of 67 cave art localities (a 36% increase in five years): 54 sites in Tennessee, 10 in Alabama, and 3 in Georgia. Our discussion here will follow quite closely our earlier overviews in format, employing our larger samples to expand on what we have presented already based on fewer sites. We will also say a few words on how these cave art sites relate to the larger world of prehistoric

Figure 3 - Engraved petroglyph of an upright bird with arms holding ceremonial weapons in its hands. Devilstep Hollow Cave, Tennessee.

Figure 4 - Charcoal pictographs of canids (dogs) from 60th Unnamed Cave, Tennessee.

Native American religions in the region.

The story of how this cave art tradition was discovered is a familiar one to most cavers. Dark zone cave art was actually known among a small group of cavers in the Southeast from the 1950s. Prehistoric engravings had first been identified at the mouth of 12th Unnamed Cave[2] in Middle Tennessee (Figure 1). That site remained a relative secret, known to only a few cavers and unknown to archaeologists, until Charles Faulkner of the University of Tennessee was taken there in the 1980s. Faulkner had begun the first archaeological study of a Tennessee cave art site, Mud Glyph Cave, in 1980, and he had made inquiries among the caving community about the possibility of other prehistoric cave art sites in the region (Faulkner, 1986). Mud Glyph Cave itself was discovered when several East Tennessee cavers explored a narrow subterranean stream passage and saw images incised into the wet clay lining the stream banks (Figure 2). The cavers, in turn, alerted an archaeologist friend who told Faulkner about these images. Upon seeing the site, Faulkner quickly recognized that the art was prehistoric, and he initiated a documentation project, culminating in the publication of *The Prehistoric Native American Art of Mud Glyph Cave* in 1986. The renderings in Mud Glyph Cave resembled pictures found on prehistoric Mississippian Period (c 500–1,000 years ago) ceremonial objects (Muller, 1986) and therefore linked the cave to the wider Mississippian religious iconography labeled as the “Southern Death Cult,” the “Southern Cult,” or the “Southeast Ceremonial Complex” (Waring and Holder, 1945). Other sites began to come quickly to light. By 1988, Faulkner could document seven cave art sites, including Mud Glyph and 12th Unnamed Caves (Faulkner, 1988). His was the first overview in the series that we continue in the present paper.

Since the discovery of Mud Glyph Cave, dark zone art has been recorded in 75 other caves in the karst regions of eastern North America. Of these, 67 are in TAG. Chronological data from these sites (Simek and Cressler, 2001; Simek, Franklin, and Sherwood, 1998; Simek, Cressler, and Douglas, 2013) demonstrate a long-term regional tradition of cave art. As Faulkner observed, some of the imagery can be understood in terms of other prehistoric iconography, that is, the Southeast Ceremonial Complex (Muller, 1989), but some has less

Figure 5 - Mud glyph of an insect from 19th Unnamed Cave, Alabama.

Figure 6 - Carved speleothem (?) statue of a human purportedly from an East Tennessee cave; drawing from Jones (1876).

obvious connection with that imagery. We continue to explore in order to find new examples from this tradition, but we must also try to understand this art, what it meant to those who made it, and its role in complex prehistoric Southeastern religious, symbolic, and ceremonial behavior.

The Nature and Context of Southeastern Cave Art

Cave art in the Southeast had at least three main production formats. One technique, an extractive one that removed material from the decorated surface, produced petroglyphs engraved into the limestone ceilings and walls (Figure 3). Another method, this one additive, involved pictographs produced by applying mineral pigments using dry crayons or liquid paints (Figure 4). A third art type, mud glyphs (like those discovered in Mud Glyph Cave) are extractive images worked into plastic clay veneers on cave walls and ceilings (deposits often produced and/or maintained by condensation corrosion) or in sedimentary clay deposits along cave passages (Figure 5). Finally, there is a fourth possible but rare cave art format: three dimensional speleothem sculptures. Sometime in the mid-19th century, a human effigy sculpture was discovered

Figure 7 - Bird-man effigies from Mississippian contexts.
a: Embossed copper plate from Etowah, Georgia; **b**: mud glyph from Mud Glyph Cave, Tennessee.

in a cave near Strawberry Plains east of Knoxville, Tennessee (Figure 6). Presented to the Smithsonian Institution by Captain Edward Grant of Nashville in 1868, this sculpture was reportedly made of "crystalline limestone" (Smith and Miller, 2009:131–133). The mineralogy of the stone warrants testing to see if this sculpture, indeed, was made from cave stone.

In cave art sites generally, petroglyphs are the most common art form, with pictographs and mud glyphs less frequent. Most often, only one kind of art is found in a given cave, although there are exceptions to this. Mud glyphs and petroglyphs are occasionally found in the same cave, but one or the other form is always numerically dominant. Pictographs are often found in association with other art types, but this is because they are quite the rarest form, anyway.

There is a great deal of variability in the archaeological contexts of Southeast cave art, and this, in part, reflects the complexity of prehistoric cave use more generally in the region (Simek, 1998). Patty Jo Watson (1986) defined four types of prehistoric cave use in the Eastern woodlands, including exploration (witnessed by torch remnants and footprints); mining of cave minerals, earths, and tool stones (witnessed by industrial extraction of some raw materials); burial and/or deposition of human remains (sometimes with grave goods); and ceremonial caves (witnessed by evidence for rites of passage and the presence of cave art). In fact, prehistoric cave art in our sample is associated with all of these uses. Nearly every cave art site has evidence showing that prehistoric explorers examined much of, if not the entire cave, often visiting many miles of passageways, not just where the art was produced (Franklin, 2002). A number of cave art sites were also burial caves (Simek, Cressler, and Pope, 2004), although it is difficult in many cases to determine if the burials and the art are contemporary. This is especially true as many caves were used for burial alone, and some of these go back into the Archaic Period (c. 3,000–11,000 years ago) in the Southeast (Simek and Cressler, 2010), so it is quite possible that art was produced in caves that had already seen use as mortuaries. A few caves contain cave art in association with clay, chert, or mineral

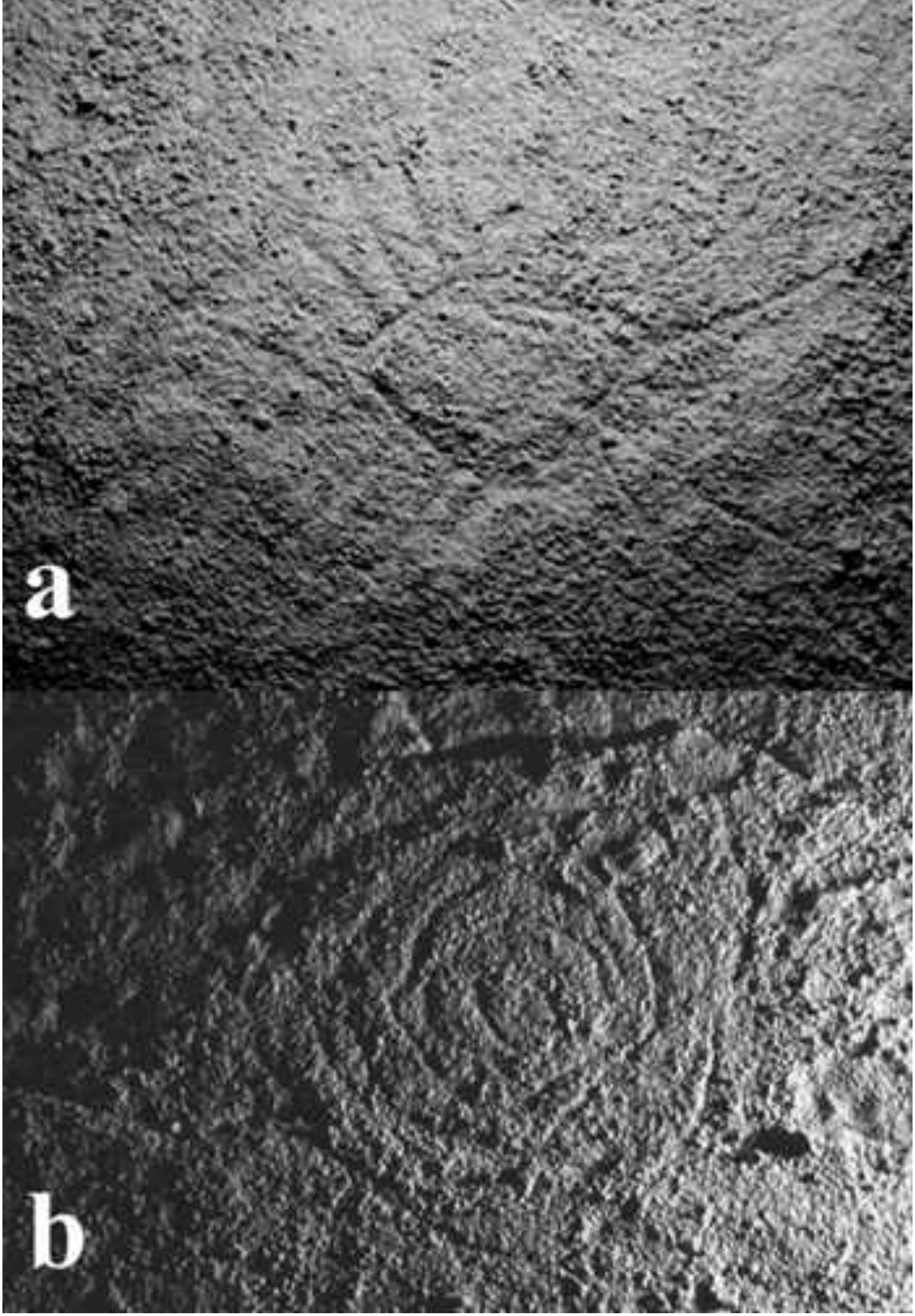

Figure 8 - Archaic period petroglyphs. a: rayed oval; b: concentric circles. 3rd Unnamed Cave, Tennessee.

Figure 9 - Anthropomorph and quadruped pictographs from 48th Unnamed Cave, Tennessee.

mining; these caves can be quite extensive, requiring long and arduous treks to where the mining and art are located (Simek, Franklin, and Sherwood, 1998). In at least one case, art, mining, and burial were all performed in the same cave (Simek et al., 2001). The nature and contexts of prehistoric cave art in the Southeast are thus quite variable.

Chronology

Part of the reason for variable cave records may relate to changes in how caves were seen and used over time. There is no necessary expectation, in fact, that cave use should be unitary or monolithic over the course of prehistory in the Southeast, especially since there were revolutionary changes in the human experience during that long time period. People in the region first practiced focused hunting-foraging as their primary lifeway (before c. 4,000 years ago), moving across the landscape following seasonal variations in resource availability. We call these people Paleo-Indian and Archaic peoples. Some 4,000 years ago, Archaic foragers begin to domesticate certain local plant species and become more sedentary in their settlement patterns; the Archaic Period gives way around 3,000 years ago to the Woodland Period. Maize and other highly productive food sources enter the farming regimes, human populations concentrate in river valleys, and they begin, around 1,000 years ago, to develop large communities that were interrelated in very complex social, economic, and political interactions that spanned very large geographic areas. These complex farming peoples are the Mississippian peoples who were the last prehistoric cultures in the Southeast before the 16th century Spanish entradas.

As has been noted, the subject matter of some prehistoric Southeast cave art seems related to the Mississippian Period Southeast Ceremonial Complex. But cave art has more ancient origins. Two kinds of

Figure 10 - Woodland Period anthropomorph petroglyph from 13th Unnamed Cave, Tennessee.

dating have been employed in trying to place cave art images into temporal context. The first is stylistic dating, where the images themselves are related to similar ones found in contexts with better chronological control. The second is chronometric age determination on artifacts associated with the creation of the images, like 14C decay assay of discarded torch charcoal fragments or even from "stoke marks" on the walls where ancient torches were struck to refresh the burning end. We will consider each of these methods in turn.

The association of sites or specific images with the Mississippian Period is usually founded on characteristic visual icons identified in other, firmly dated archaeological contexts. In particular, icons associated with the Mississippian Southeast Ceremonial Complex appear in both obvious and stylized forms in dark zone cave art sites. For example, bird/human images, often holding weapons or maces, are known from a variety of Mississippian open site contexts (Figure 7a) and have also been seen in caves as petroglyphs and as stylized mud glyph images (Figure 7b) (Muller, 1986:55; Simek et al., 2001). Based on the presence of these and other icons, cross-in-circle motifs, for example, some cave art can be given temporal parameters because of style and/or subject. Many images are reasonably ascribed to the Mississippian on these grounds. It should be noted that 14C age determinations associated with Mississippian icons confirm the stylistic attributions in every case.

Stylistic dating of cave art from before the Mississippian, and therefore before the Southeast Ceremonial Complex, is more difficult. Cave art from the Woodland and Archaic does exist (Cressler et al., 1999; Crothers et al., 2002). However, earlier art is less elaborate, less representational, and often includes images for which there are no interpretive referents (for example, Figure 8). More importantly, there is less of a corpus of artistic renderings from outside caves to facilitate stylistic correlation. Woodland period sites in the Southeast do contain elaborately decorated ceramics (Broyles, 1968; Williams and Elliott, 1998), some decorated stone, bone, and shell artifacts that seem to anticipate Mississippian religious paraphernalia, and evidence for connections with artistically rich cultures like the Ohio Valley Hopewell. Yet patterning of specific symbols, seen as a true iconography during Mississippian times (and therefore a source of stylistic data), simply is not recognized for the Woodland Southeast. Symbolic representations in the Archaic are even rarer. In essence, we cannot estimate cultural affiliation for pre-Mississippian works based on stylistic similarities with artifacts from well-dated contexts.

We now have over 100 absolute radiocarbon age determinations from Southeastern cave art sites (these are listed in [Simek, Cressler, and Douglas, 2013] so they won't be given here). Several of these are "direct dates" obtained on recovered organic material from the art image itself, either from the pigment used to make a pictograph or from tools used to make mud glyphs and left embedded in the actual image. Even with direct dates, there are potential sources of error in dating, including the possibility that "old charcoal" was recovered from the cave floor and mixed into pigments, yielding dates for the charcoal rather than for the paint. Our direct dates, however, tend to fit pretty well with the subject matter of the art itself. Most of our absolute age determinations are for associated artifacts found near or with the cave art. Examples of such materials include cane torch residues found on the cave floor and burnt

Figure 11 - Rayed circle pictographs from Dunbar Cave, Tennessee.

animal bones found in the cave; we try to take such association samples from as close to the artwork as we can, but there is always a possibility that the artifacts were discarded by people visiting the cave before or after the cave art itself was produced and/or used. We try to obtain as many dates as possible from every site in order to determine if a cave was used over a long time or at a short period that can help to date the art.

The oldest dated cave art in Tennessee (at nearly 6,000 years old) is a representational charcoal pictograph from 48th Unnamed Cave (Figure 9) with an AMS (accelerator mass spectrometer) radiocarbon age determination of 4,980 + 35 before present, which calibrates to 5,709 years ago (Creswell, 2007). This early date is a direct one, made on a sample of the charcoal pigment used to make the picture (Blankenship, 2007), and it places the pictograph within the Middle Archaic phase in Tennessee. The 48th Unnamed Cave pictograph is, to our knowledge, the oldest directly dated cave art in North America, and it may be one of the oldest directly dated rock art images on the continent. This is not to say that it is the oldest example of rock art known, but problematic dating techniques, especially for petroglyphs in the American West, make suspect many of the early absolute age determinations so far presented.

Overall, our absolute dates for Southeast cave art indicate two things. First, several determinations show that artwork in deep caves was first produced during the Late Archaic period (after c. 6,000 years ago). Second, the great majority of cave art dates cluster at the later end of the region's prehistoric sequence, in the Mississippian period (after 1,000 years ago). In between, there are a few dates that implicate Woodland period involvement in cave art production. Therefore, cave art in the Southeast clearly has a relatively great time depth and comprises a great deal of ecological and cultural variability. It seems to increase in utilization over time, slowly at first and then accelerating as agriculture and settled communities supplant the earlier highly mobile forager patterns. Moreover, cave art sites tend to occur in upland regions, where limestone is exposed, away from the river valleys where late prehistoric farming settlements are located (Simek et al., 2013). Cave art in later times may, therefore, reflect pilgrimages by some community members, perhaps priests or religious specialists, from valley towns to upland sacred places that included the subterranean world of caves.

Despite 100 dates and some stylistic information, we are still a long way from having good chronological control over the cave art works we are trying to age. Until now, proposed stylistic correlations seem reasonable, based

Figure 12 - Line and Groove Motifs from 51st Unnamed Cave, Tennessee.

as they are on complex images long identified as culturally and chronologically meaningful (that is, Southeast Ceremonial Complex iconography). No comparable corpus of representational iconography found outside caves has ever been recognized for the Archaic or Woodland periods in the Southeast. We have found cave art dating to the Archaic and Woodland, and it is quite different from what we see in the Mississippian. We chart new ground as we recognize the more ancient icons represented in caves.

Subject Matter

Our documentation of cave art sites has led to the definition of six recurring motifs, some of which the reader has seen in previous illustrations. Humans or human-like figures ("Anthropomorphs") are one of the most common elements seen in caves, and as we have seen (Figure 9), they first appear during the Archaic in Southeastern cave art. Woodland period sites also contain detailed human images, including the remarkable human face petroglyph from 13th Unnamed Cave, Tennessee, shown in Figure 10 that has associated 14C dates between 1,500–2,000 years ago. But without doubt, the human images from the Mississippian period are the most elaborate and detailed, exemplified by several mud glyphs from Mud Glyph Cave (see Figure 7b).

Circles, concentric circles, and circle in cross motifs are a second theme common in caves, for example at Dunbar Cave, where classic Mississippian icons painted in black (Figure 11) are found alongside concentric circle pictographs and petroglyphs.

Another common motif comprises various grooves and curving lines. Sometimes forming palimpsests of great density and complexity, lines and grooves are among the most frequent motifs in petroglyph and mud glyph caves (Figure 12).

Depictions of weapons, or images that might be reasonably interpreted as weapons, are very rare in Southeastern cave art (Figure 13). More telling, with one exception, all such images are late in the region's prehistoric sequence, that is, from the Early Mississippian to the end of the prehistoric sequence. A number of mace images are present in the Mississippian sites, Devilstep Hollow, and Mud Glyph caves in Tennessee (Faulkner, 1986; Simek, et al., 2001), including a bird effigy holding maces in its hands (see Figure 3).

Animal images of various types are common in Southeastern caves. Quadrupeds, especially dogs, are frequent characters (see Figure 4). Serpents are seen in at least nine art caves, including one cave dated to the Archaic Period and two others dated to the Woodland Period. Snakes occur as mud glyphs, petroglyphs, and pictographs and can be relatively small (15–20 cm) or very large (5 meters in length at 1st Unnamed Cave, Tennessee). Birds are among the most frequent depictions in dark zone cave art (Figure 14). In a few caves, such as 7th, 11th, and 12th Unnamed Caves, birds are the dominant subjects.

Finally, transformational motifs, often involving human and animal blends, are important elements in many cave art sites (see Figures 3 and 7). Some serpents in caves have head appendages or horns, including examples from 12th Unnamed Cave, 8th Unnamed Cave, 1st Unnamed Cave, and Mud Glyph Cave (Muller, 1986:50). In 18th Unnamed Cave, a turkey has the body and long legs of a bird and the head of a serpent, with an exaggerated rattle at the back of the bird body where the tail should be (Figure 15). There are also examples of fish transforming into birds. Shape-shifting is clearly an important theme in Southeastern cave art.

The Problem of Meaning

At least for now, the bulk of Southeastern cave art seems to have been produced during the Mississippian period, and Mississippian ceremonial iconography almost certainly had religious importance. We cannot yet speculate on its meaning in earlier time periods. As should be clear, however, it seems highly unlikely that this corpus of cave art represents a unitary, unchanging phenomenon, given the chronological, technological, and contextual variation that is present. This is quite important, because it implies that historical ethnographic records, especially oral religious tracts, may not be at all relevant to interpreting more ancient images.

The meaning of Southeast cave art is also certainly more complex than a simple “religious” interpretation might imply. In 1st Unnamed Cave, for example, some of the images resemble motifs used to decorate pottery in the region (Simek, et al., 1997; Faulkner and Simek, 1996a). This has also been observed at Crump’s Cave in Kentucky (Haskins, personal communication 1996) and 19th Unnamed Cave in Alabama (Figure 16) (Cressler, et al., 1999). It would not be surprising if cave art comprised both religious and social meanings, of course, since ethnicity and culture are linked.

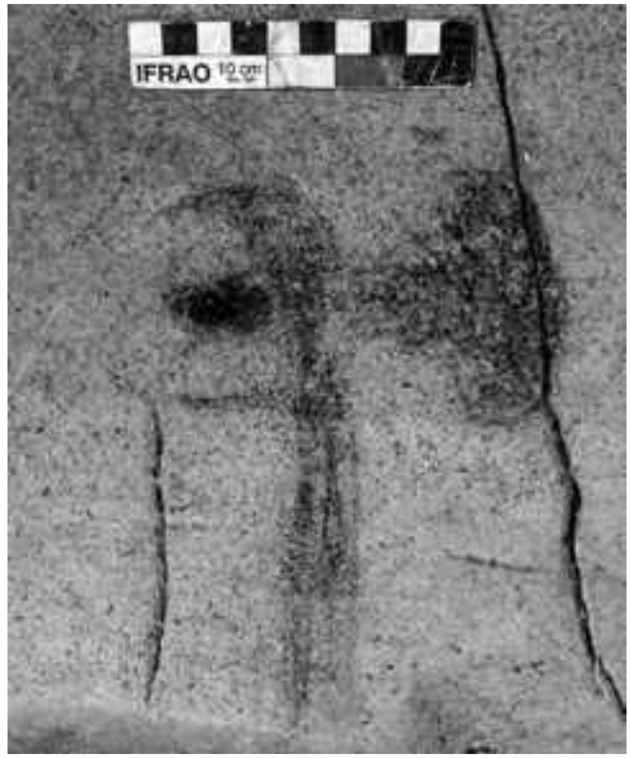

Figure 13 - Ceremonial monolithic axe pictograph from 65th Unnamed Cave, Tennessee.

Conclusions

In sum, Southeastern prehistoric cave art must now be viewed as a complex, evolving phenomenon with great time depth and variable sacred and profane expression. We are far, however, from understanding this phenomenon, or these phenomena, in clear cultural context. In particular, chronology and context must continue to be refined before we can begin to develop cultural and evolutionary explanations. Ongoing survey, and new discoveries treated to proper documentation, including chronological assessment, will only help in improving our interpretations.

Some tantalizing patterns may be emerging, however. A great number of our radiocarbon ages fall into periods of rapid and significant prehistoric culture change: the Late Archaic, Late Woodland, and Early Mississippian. This suggests that cave art production may be related to periods of culture stress and culture change. We know, for example, that a series of major droughts led to the abandonment of some large settlements in the Mississippi River Valley around 900 years ago and the

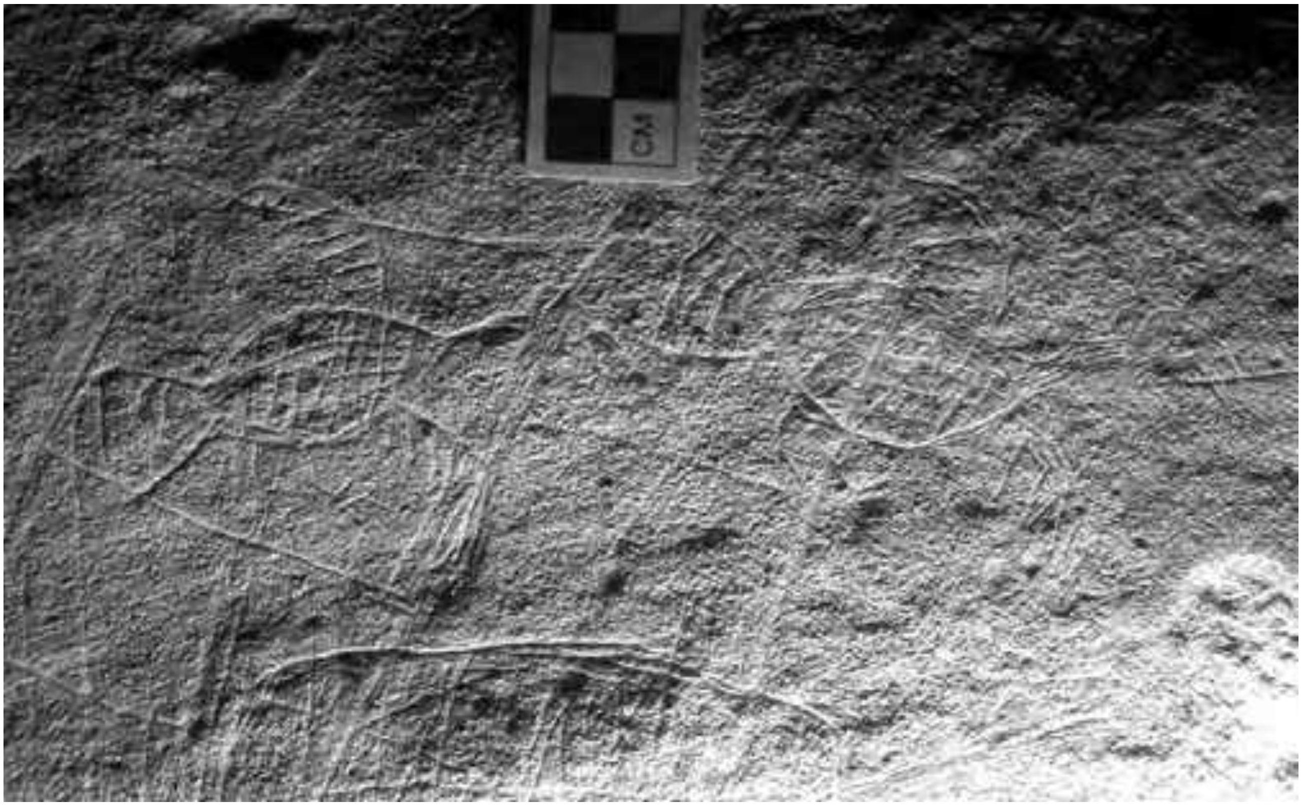

Figure 14 - Petroglyphs of birds, probably turkeys, from 7th Unnamed Cave, Tennessee.

subsequent dispersal of many Mississippian peoples into other regions (Meeks and Anderson, 2013). As for other aspects of religious behavior around the world, the ceremonial use of Southeastern caves may partly have been native responses to environmental and/or social changes. One implication of this is that Southeastern cave art has local origins. Another is that it represents a remarkable and important cultural resource preserved in the thousands of caves of the North American Southeast. And it is one that is only recently being brought to light through cooperation between the cavers and archaeologists of the TAG area.

Notes

1 President Emeritus, Distinguished Professor of Science, Department of Anthropology, University of Tennessee, Knoxville, Tennessee

2 Looters and vandals are a constant problem in Southeastern caves, so we use a numerical designation system rather than a cave's common or registered names; see Simek et al. (1997) for a description of this system.

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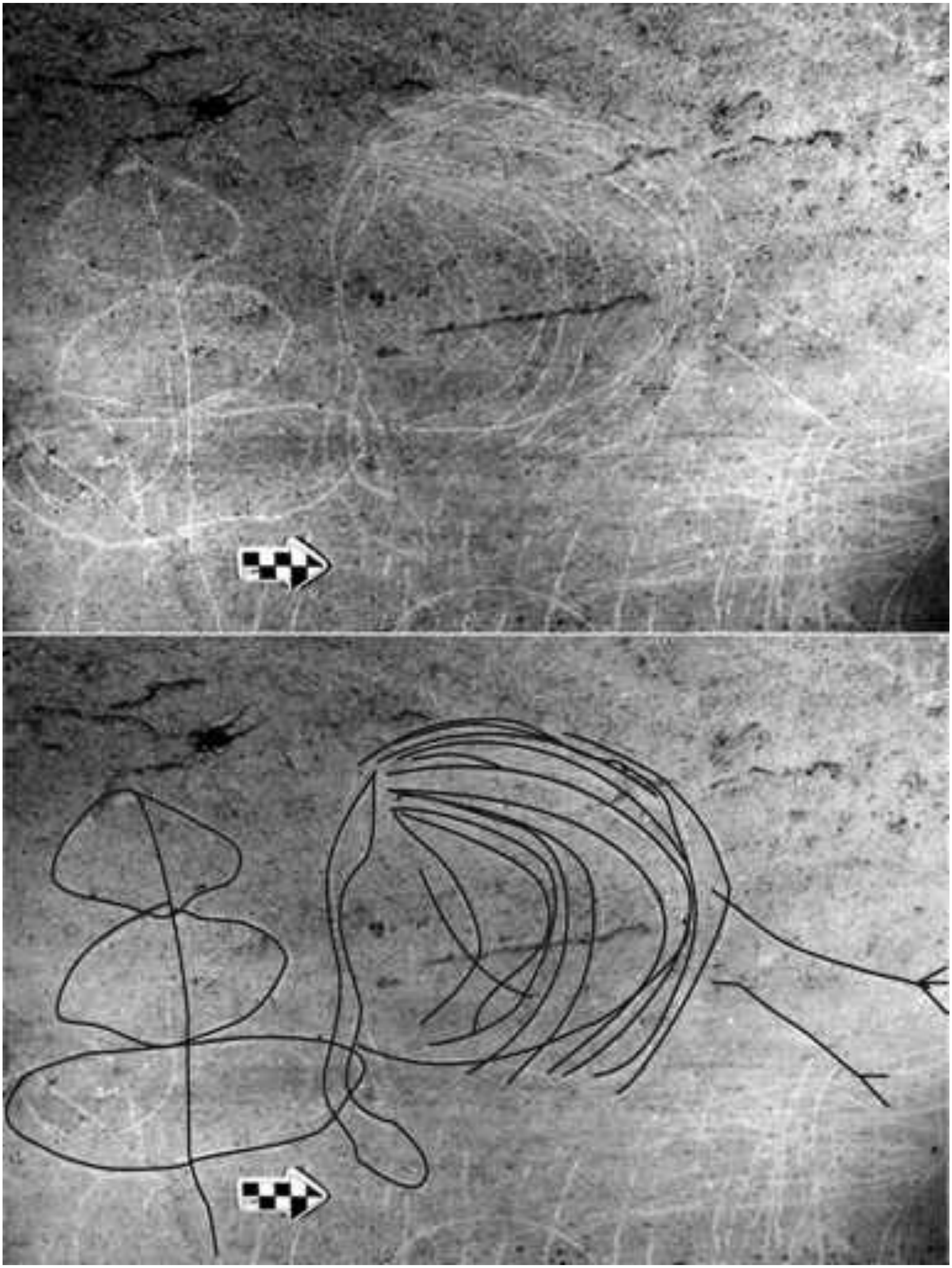

Figure 15 - Petroglyph of a serpent/bird transformation from 18th Unnamed Cave, Alabama.

Figure 16 - Mud Glyphs resembling complicated stamped pottery decorations from 19th Unnamed Cave, Alabama.

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Identifying and Preserving Caves as Historic Industrial Landscapes

Joseph C. Douglas, NSS 20059, PH, FE

Marion O. Smith examining saltpeter artifacts. Photo: Joe Douglas

Many American caves are unrecognized historic landscapes, utilized as industrial, hidden, and social spaces. This paper focuses on the past industrial use of caves with an emphasis on recognizing and preserving the unique underground landscapes, including the artifacts, environmental modifications, and other extant physical features. While there were many different types of industrial uses of the cave environment in the American past, two of the most common were as saltpeter mines in the 18th and 19th centuries and as moonshine production sites in the 19th and 20th centuries. The two activities were present in a large number of caves, many hundreds at a minimum, especially in the great central-eastern karst lands in the United States, and both resulted in unique and often well-preserved industrial landscapes. This paper examines saltpeter mining and associated landscapes, with tangential references to underground moonshine production sites, using Blue Ridge Saltpeter Cave in Tennessee as an example.

Environmental conditions in caves often lead to spectacular preservation of the industrial landscapes

Historic industrial landscape, Monteagle Saltpeter Cave. Photo: Joe Douglas

created by saltpeter miners in the past, especially in low-energy or "paleo" caves. However, even active stream caves can contain surprising physical remains, especially tucked away in drier or more stable micro-environments, such as particular rooms or upper levels. Thus a stream cave like Robinson Ridge Saltpeter Cave in Tennessee has a single saltpeter passage, elevated above the current water level, in an otherwise wet cave. Most sizable caves have a deep environmental zone away from the entrance and transition zones that includes comparatively stable temperature and humidity regimes, a lack of light (and UV which breaks down organic material), and that is sheltered from many of the events that frequently disrupt surface landscapes, such as changes in vegetation, erosion from wind or flooding, or other extreme weather events like tornadoes. Bioturbation, the mixing of archeological deposits by living creatures, occurs in caves but to a lesser extent than outside. A greater threat to surface historic landscapes, land development, is also a threat to cave landscapes, whether through ignorance or disregard of the historic and geologic resources. Industrial developments themselves that focus on removing the host rock often threaten, damage, or destroy underground landscapes. Ladd's Quarry in Georgia and the cave that was (mostly) destroyed there come to mind. Both surficial and underground landscapes suffer from vandalism as well as other threats. Nonetheless, caves, due to their environmental conditions, are some of the best preserved landscapes in America.

For cave landscapes that are pristine, every appropriate effort should be made to keep them so, as they represent remarkable geologic landscapes. But many caves have been modified by humans for industrial purposes, some in subtle and others in obvious ways. These landscapes should also be studied, appreciated, and when possible, preserved. In general, relatively few historic industrial landscapes of any type are preserved. In Tennessee, examples include Copper Hill, the Burra Burra mine in Polk County, and the Gager Lime Company at Sherwood. There are others as well, including old textile and gristmills, blast furnaces, coke ovens, and quarries, and the entrance to Hasson Cave in Hawkins County where "Tennessee Marble" was extracted. But large, deep cave historic sites such as Sauta Cave in

Mike Moser at the entrance of Pollard Saltpeter Cave, likely the smallest verified saltpeter cave in Tennessee. Photo: Joe Douglas

Alabama, Big Bone Cave in Tennessee, or Great Saltpeter Cave in Kentucky are at least as important as industrial landscapes. Fortunately, these three major caves have been preserved, and their significance as historic landscapes is recognized, if still not fully appreciated. But what of the hundreds of other, perhaps lesser, saltpeter or moonshine production sites? Cavers can help by identifying these sites, documenting them on maps, in photos, and in written trip reports and descriptions. Cavers can also help preserve these sites, first by highlighting them to land owners and managers, and then by dovetailing their protection as historic landscapes with efforts to protect other resources in caves. Occasionally, such as at Cagle Saltpeter Cave in Tennessee, the underground historic landscape is so compelling that it becomes the focus of preservation efforts. Even here though, biological and historic preservation worked in tandem.

What should a caver look for to help in identifying historical industrial use of a cave, like saltpeter mining? In a sense, evidence of saltpeter mining is often indirect because the desired material has been removed, but there are still plenty of clues to observe. Look carefully at the floors, walls, and ceilings for signs of disturbance, old sediment levels, tool marks, darkening from smoke, and unorganized piles of rocks. The latter, known as waste rocks, are diagnostically important features in identifying saltpeter caves. Any cave with small to medium rocks piled on ledges or along the edges of a path is likely a saltpeter cave. The presence of mined dirt deposits are also strong evidence for nitrate extraction. Inspect any remaining sediment deposits for signs of removal with a flat or curved edge metal tools like a mattock. The enlargement of passages, trail making, step building, historic torch fragments, torch marks, and several other features are suggestive if not definitive evidence. They all contribute to the landscapes associated with saltpeter mining.

Many caves also contain primary or direct evidence of mining in the form of extant tools, processing equipment such as leaching vats, water transport systems, shoring, and even counting systems (tally marks). These features are virtually unique to the cave environment and vary in terms of preservation among and within caves. Tools such as saltpeter paddles, used for scraping dirt from under ledges, are evidence of sediment removal and are sometimes found in fragmentary condition under waste rocks. Leaching vats are proof of saltpeter processing on site. Some leaching vats are now barely discernible piles of dirt, but one can

Large pile of waste rocks in a Tennessee saltpeter cave. Photo: Joe Douglas

look for cornerstones or any wood embedded within. Sometimes small fragments of wood are scattered nearby or in wood rat nests, especially from the clapboard sides of saltpeter vats. Other saltpeter vats are indicated by more organized piles of earth, some with the cast of wood still showing in the remaining feature. The best saltpeter caves still have intact elements of the wooden vats, allowing observations on the number, size, and construction techniques of the structures. Recent scholarship suggests that these are most often 200 years old, and at a minimum are 150 years old. They are some of the central features of some of the best preserved landscapes of any type from the War of 1812 and Civil War eras.

Saltpeter mining was a fragmented industry and the scale varied from very small sites to major industrial enterprises. Many of the most significant caves were worked episodically. We need many more studies of specific caves, some of which are still being identified in the field, to help understand the relationships between caves and local gunpowder mills, the chronology of mining, and how vat construction varied over time and across space. Cavers can mention in reports and place on maps such features as suspicious piles of earth, the presence of waste rocks, paths, and other modifications to the environment. These guide historical researchers and often lead to historical discoveries. At Reed Creek Cave in Tennessee, the caver-produced map showed a suspicious rounded pile of dirt, which upon closer inspection by Marion O. Smith and the author is undoubtedly a saltpeter vat, with elements of the wooden frame still intact, as well as fragments of the clapboards used for the sides. Some caves have so many historical features from saltpeter mining that they comprise a remarkably rich landscape.

An example of a lesser-known cave of moderate length that has a landscape value beyond its individual features is Blue Ridge Saltpeter Cave in northern Tennessee. There is no known documentary evidence regarding saltpeter mining or moonshine production there, so the information we have is from inside the cave and is irreplaceable. While not quite the exactly same as the day the miners or moonshiners left off work there, it is well-preserved and conveys a strong sense of what industrial work in a saltpeter or moonshine cave probably entailed. Incorrectly located for years in the Tennessee Cave Survey, we were taken to the site by a member of the landowning family in May 2011. About 100 feet inside the large entrance of the 500-foot-long cave is a moonshine site, indicated by a stone firebox. Nearby is a 13-foot-long section of a wooden gutter type of pipe, made from a single log. Above, in a high spot, is a second fragment of wooden gutter, about 6 feet long. These appear to be triangular in profile. These likely date from the saltpeter mining period and were originally used to bring water to the leaching vat[s], but they appear to also have been utilized by the later moonshine operators. (We have found another instance of adaptive

Kristen Bobo holding a saltpeter paddle found in a Tennessee cave. These paddles were used to scrape dirt from under rocks and ledges. Photo: Joe Douglas

reuse of saltpeter artifacts by moonshiners at Allred Saltpeter Cave where not only was the lengthy piping system adapted for moonshine production, but the still's firebox and associated stone platforms were placed directly on top of the remnant of a leaching vat, indicated by in situ timbers in the sediment below the still's foundation.

In the dark zone, there is a trail made by saltpeter miners, including several roughly stacked stone steps. This trail takes one past an area of discoloration on the right wall, indicating the former sediment level 2 feet above the current floor. A short distance beyond is the dirt cast of a single saltpeter leaching vats, with small fragments of side slat clapboards scattered about. There is a second possible vat site, but all that currently remains above ground is a low pile of sediment, making identification uncertain. On our site visit, Alfred Crabtree explored a 20-foot pit leading down to a lower area and there found evidence of an old ladder made with peg and hole construction techniques, which are common in 19th century wooden saltpeter artifacts.

Aside from these major artifacts, the Blue Ridge Saltpeter Cave has many minor features that help create the historic industrial landscape. There are metal tool marks on the walls, showing where sediment was removed. There are waste rocks piled on ledges and along the sides of the path through the cave. Individual blackened marks of carbon on the walls and ceilings are historic torch marks, showing where the miners set their pine torches as they illuminated their work. Near the back of the cave, the rock walls and ceilings are all covered in general black soot, as carbon was deposited there from what must have been a horribly smoky work environment. This suggests much of the mining occurred when the air was sucking into the cave, which gives us an indication of its seasonality. Present in the same area is primitive stone shoring of the mined passage, which probably did not enhance the miner's safety as much as provide them psychological assurance.

When viewed as a whole, caves such as Blue Ridge Saltpeter Cave represent historic industrial landscapes with intact cultural features from the saltpeter mining era and the moonshine production era. While not an especially large production site for either commodity, the cave conjures up images of miners toiling in a smoky atmosphere to extract, leach, refine, and collect the precious niter for the gunpowder trade. Like many other saltpeter caves, the signature record in the cave is sparse and difficult to link to the miners, though it does show multiple visits by members of the local Huff family in 1857 and 1861. Despite these Civil War era names, based on what is known about saltpeter mining in the various regions of Tennessee, the cave saltpeter mining probably dates from earlier in the 19th century, perhaps in the War of 1812 era. Caves like Blue Ridge Saltpeter Cave are important historic sites, as well as biological, geological, and recreational resources. Cavers should look for these historic resources, document them, and help preserve them. Nowhere else can one find an industrial landscape that is so intact, and so true to the past.

An Annotated History of the Alabama Cave Survey

Lin Guy[1], NSS 10235 FE; Bill Varnedoe[2], NSS 3160 OS, FE;
and Julie Schenck Brown[3], NSS 30493 FE

GSA at Big Spring Cave-Bo Daniel with cigar and Dr. Walter Bryan Jones with flashlight.

Origins of the Alabama Cave Survey: The Geological Survey of Alabama

The Alabama Cave Survey (ACS) had its unofficial start with the publication by the Geological Survey of Alabama (GSA) of the *Report on the Valley Regions of Alabama* by Henry McCalley, the Assistant State Geologist, in 1896. Part 1 was subtitled *The Tennessee Valley Region* (Special Report 8) and Part 2 was *The Coosa Valley Region* (Special Report 9). Past ACS Director Bill Varnedoe counted 26 caves that were described in these volumes, but with scant information given about them or their locations it was difficult to identify some of the caves with today's known counterparts.

Ground Water In the Paleozoic Rocks of Northern Alabama (Special Report 16) was published by the GSA in 1933, and included a 27-page chapter about 22 visited caves. The book was authored by William Drumm Johnston, Jr., but the section on caves was written by Dr. Walter Bryan Jones (February 25, 1895–May 3, 1977), who was State Geologist from 1927 to 1961. Descriptions, maps, and in some cases locations to within a square mile, were included. The 22 caves that Dr. Jones described became the basis of what would later be called the Alabama Cave Survey and are known today by their assigned numbers as AL 1 through AL 22. The end of the chapter mentions several rumored caves: two within Fort McClellan, one 6 miles west of Sylacauga, and "some smaller caves in the northeast corner of Morgan County." The chapter ended with Dr. Jones' prediction: "There are doubtless many other caves in northern Alabama, and it is to be hoped that descriptions of them will someday be available." That hope has been realized with the discovery today of over 4250 caves in the state as of the year 2014!

Dr. Jones was an active caver, joining the National Speleological Society in 1942 as its 108th member shortly after it was founded. Between 1936 and 1942 he revisited the first 22 listed caves and filled out a newly devised report form for each with the heading "Catalog of Alabama Caves and Caverns." They included descriptions and location information, commonly within 40 acres, and the form was exclusively used through 1962. Thus Dr. Jones became the first "director" of the ACS and visited, documented, and numbered caves until 1956. His last entry that year, at the age of 61, was Ridley Cave, the 170th cave added to the growing Alabama list.

After the first NSS grotto, Auburn Student Grotto, was chartered on October 21, 1954, the second grotto, the Huntsville Grotto held its first organizational meeting in Huntsville, Alabama, on March 21, 1955. The Huntsville Grotto, located in prime cave country, was barely a year old when Dr. Jones entered his 170th cave into the survey's list, and had already been collecting information on caves for the Alabama Geological Survey (AGS). Dr. Jones realized the new Huntsville Grotto members would be a great help in accumulating to the knowledge of the caves in northern Alabama, so he enlisted their help to add newly discovered caves to what had become known as the ACS. The first new cave was a Huntsville Grotto discovery, Tumbling Rock Cave (AL 171), known to early Jackson County residents and undoubtedly to Native Americans for perhaps thousands of years. As the Huntsville Grotto's secretary in 1957 and 1958, charter member Bill Varnedoe kept the grotto's cave records using Dr. Jones' original report form. Club secretaries elected after that didn't want the ACS part of the task, so it became Bill's permanent duty.

Dr. Jones passed the ACS duties at the GSA to Thomas W. "Bo" Daniel, Jr. and Earl Hastings in 1957. They, along with Dr. Jones, announced a meeting to be held on October 15, 1958, to form the Tuscaloosa Grotto for the purpose of encouraging others to cave and adding to the knowledge base for the ACS. Temporarily elected officers were Chairman Bo Daniel, Vice-Chairman Dr. Jones, and Secretary Earl Hastings. At a business meeting on October 29, 1958, the charter for the new grotto was adopted. To expedite each of the four state grottos to add caves to the survey and not to rely on the ACS in Tuscaloosa for the assignment of cave numbers, each club was given a block of unassigned numbers to fill out their part of the overall list as reports came in. The Huntsville Grotto was assigned numbers 171 through 229, 301 through 350, and 551 through 700; Tuscaloosa Grotto 230 through 260 and 351 through 400; Decatur area cavers, which had no formal organization, 261 through 300; Birmingham Grotto (which was chartered on May 7, 1958) was assigned numbers 401 through 500; and Auburn Grotto 501 through 550. The earliest known typed list dated November 1959 included only the caves collected by the GSA and the Tuscaloosa Grotto up through AL 367. The Decatur group and Auburn Grotto never made use of their assigned block of numbers, and other clubs failed to use all of their assigned numbers, therefore as late as 1963 there were still large gaps in the assigned numbers, which were subsequently no longer in consecutive chronological order.

When Dr. Jones retired as State Geologist in 1961, the ACS lost its main support in the GSA. By the second half of 1962 the succeeding State Geologist had pulled GSA support of cave research and investigation, effectively preventing Bo Daniel from spending any further GSA time on it. This sealed the doom of the Tuscaloosa Grotto, which suspended publication of its newsletter in August 1962. It struggled on as a caving organization for a couple more years but disappeared completely from the caving scene by 1966.

GSA at Big Spring Cave.

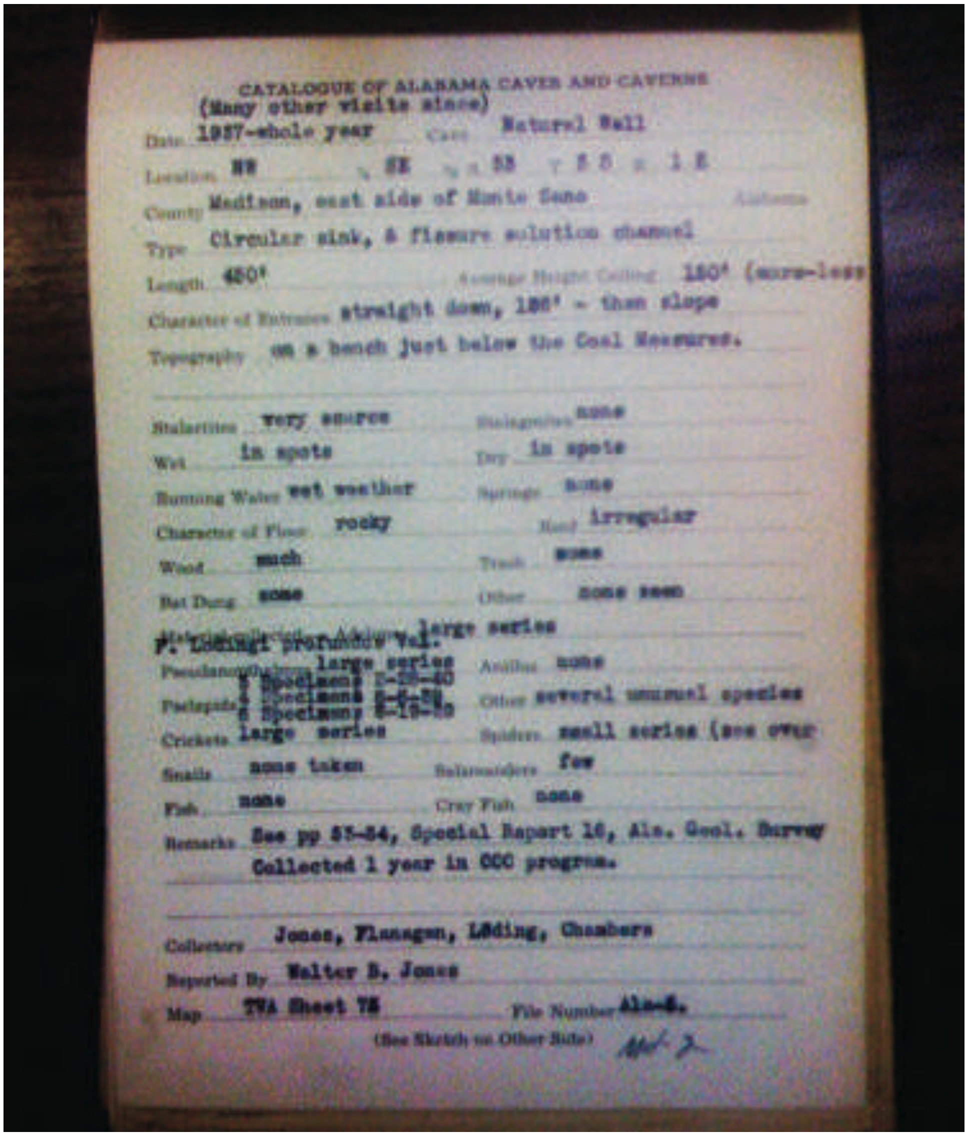
The ACS is Transferred from the GSA to Bill Varnedoe and is Computerized

By the summer of 1962 Bo Daniel had begun the process of converting the ACS to a county numbering system, but since the GSA had just backed out of supporting the ACS all duties were transferred to Bill Varnedoe in Huntsville, who became the third ACS Cave Files Director. Around this time the ACS became a Section of the NSS. Bill maintained the state numbering system and established some standards to encourage uniformity in submissions. He created a “50-foot rule” to qualify as a “cave”—it had to be either 50 feet long or 50 feet deep. He encouraged cavers to place at a minimum four things on each map: north arrow, scale, labeled entrances, and type of map reflecting their accuracy (sketch, pace and compass, or tape and compass). Bill reserved the right to modify submitted maps to make them conform to ACS standards and add details that were submitted later. Although this proved somewhat controversial, map submissions remained at an all-time high. Approximately 70% of the ACS caves had maps, a record percentage among the state surveys at the time!

In 1961, the National Cave Files Committee was a newly formed organization under Richard R. Anderson, Chairman. He published an article in the February 1961 *NSS News* discussing the purpose of the newly formed Committee. He listed 18 states that had contributed to the national list; however, Tennessee, Alabama, and Georgia were not among them.

Bill Varnedoe began working with Richard in 1961 after the publication of the article in the *NSS News*. Richard had written a computer program to record data for the known caves in the USA. It required punching up to 80 bits of data into IBM punch cards and running them through the program on an IBM mainframe computer. An early national run dated June 1, 1963, provides cave names and coded data for the quality of description, location, and map; ownership; rock type; length and depth range; equipment; number and type of entrances; reference; and county and state. With 46 states represented, the four exceptions were Rhode Island, which had no caves; Tennessee; West Virginia; and Virginia, for which minimal state references were given. An additional reference was cited for information. Exact locations were omitted from the national list.

The national program format was used by Bill Varnedoe to produce the Alabama Cave Survey data listing from 1961 through 1968, with some modifications over time. In January 1963 Bill created a new report form to



CATALOGUE OF ALABAMA CAVES AND CAVERNS
(Many other visits since)

Date 1937-whole year Cave Natural Well

Location NE ¼ SE ¼ S 33 T 5 S R 1 E

County Madison, east side of Monte Sano Alabama

Type Circular sink, & fissure solution channel

Length 450' Average Height Ceiling 180' (more-less

Character of Entrance straight down, 186' - then slope

Topography on a bench just below the Coal Measures.

Stalactites very scarce Stalagmites none

Wet in spots Dry in spots

Running Water wet weather Springs none

Character of Floor rocky Sand irregular

Wood much Trash none

Bat Dung none Other none seen

large series

Pseudoscorpions large series Annelids none

Pedipalps Other several unusual species

Crickets large series Spiders small series (see over

Snails none taken Salamanders few

Fish none Cray Fish none

Remarks See pp 53-54, Special Report 16, Ala. Geol. Survey
Collected 1 year in CCC program.

Collectors Jones, Flanagan, Löding, Chambers

Reported By Walter B. Jones

Map TVA Sheet 75 File Number Ala-6.

(See Sketch on Other Side)

Natural Well Report Form from 1937. Photo: Tom Whitehurst

replace Dr. Jones' original version that would match the submission information with the national format he was using. Computerizing the data enabled the files to be sorted in many ways—numerically, alphabetically, by county—and then compiled into statistics. Codes were used to squeeze the most information from the 80 bits. For instance, the lengths and depths were represented by a logarithmic scale of single digits that bracketed an averaged value.

The first collaborative computer run was dated August 21, 1961, and listed 398 caves by county, with a top number of 597 due to unassigned gaps in the numbers reserved for the various state groups. All caves had a prefix of "AH", which stood for Alabama and the Huntsville Grotto. Included in the list were rumored caves, with not enough information or actual field verification to include them previously in the numbered list. The second run, sorted numerically and dated February 26, 1962, (and identical to a numerical and alphabetical run dated April 20) listed 430 caves with a top number of 602. The third run dated June 5, 1962, listed 457 caves in numerical order with a top number of 602 and a new prefix, simply "A."

By the end of the summer of 1962, with the ACS fully in Huntsville, Bill's first priority was to fill up the empty gaps in the numbering system with new caves before assigning any numbers higher than 602. By August 21, 1963, the fourth computer run listed 555 caves, still with a top number of 602. Unassigned blocks remaining were AL 514 to 550 and AL 581 to 590. By the end of the ACS's second year under Bill, all the gaps had finally been closed and sequential numbers were once again being assigned above AL 602. The fifth run dated November 10, 1964, reflected this: no gaps remaining and 15 more caves added, with a new top number of 617. This became the cutoff point for publication of a long-awaited ACS book, over 30 years in the making!

On June 1, 1965, 250 copies were printed of the highly anticipated first ACS book: *Alabama Caves* (popularly known as "the red book") by Terry W. Tarkington, William W. Varnedoe, and John D. Veitch, the first book to appear with cave maps since *Special Report 16* in 1933. *Alabama Caves* contained 384 pages on 617 caves based on the fifth computer run: 84 pages of data and other information, as well as 300 pages of maps. Cave data was sorted numerically and by county; abridged lists that were sorted alphabetically and by Public Land Survey (PLS) locations were also included. Locations were given to the nearest 40-acre square, or 1340 feet, which had been established by Dr. Jones during the 1930s. The preface mentions that a quarter of the caves and their maps were added by Dr. Walter B. Jones!

Bill and Birmingham Grotto member Lou Pfau also discussed the desirability of devising a numbering system for the Alabama 7.5-minute topo maps. The idea of using existing TVA map numbers was discarded because these numbers do not exist outside the TVA watershed, which covers only the extreme north part of the state. The proposed system, as described by Bill in the November 1965 *Huntsville Grotto Newsletter*, was to letter the vertical columns and number the horizontal rows beginning with C-1 for Yellow Creek in the northwest corner of the state. Because topo coverage was very spotty in 1965, especially south of Birmingham, the system was planned to accommodate new maps as they are published. A method was described for accommodating 15-minute topos, of which there were numerous ones still in print. These codes first appeared in the November 15, 1967, computer run and are still in use today.

The sixth computer run, in numerical order, appeared on April 26, 1966, and topped out at 700 entries with an "A" prefix. Additionally there were 58 numbered "B" prefix topo features or rumored caves at the end.

Before he retired as State Geologist, Dr. Jones co-authored with Bill Varnedoe: *Caves of Madison County, Alabama: Circular 52*. Its last entry was Varnedoe Cave (AL 660), and included a map of the cave that was completed on May 15, 1966. The completion and printing of the book was delayed until 1968, by which time there were at least 200 more caves in the numerical list, including 26 more in Madison County alone. The publication delay of the book on Morgan County caves was much, much longer.

By the mid-1960s, new cave submissions began arriving at around 100 per year, so Bill enlisted help from Bob Clark and John Stokes to update the survey over the next 14 years. With multiple caves being commonly reported within one 40-acre area of land, Bill realized that a 40-acre location in the PLS was not accurate enough to distinguish one cave from another. To alleviate the problem, he invented a letter code system to increase accuracy of location without adding additional bits to the punched cards. The codes were included by the seventh computer run dated November 15, 1967, which listed 845 caves. Numerical and alphabetical lists including the same 845 caves were labeled *Edition of January 1968*. The 1/16th divisions of a square-mile section were changed to letter codes - each 1/16th division identified by a letter from "A" to "P." Up to three iterations of 1/16th divisions were allowed. The first iteration narrowed the location to 40 acres (1320 feet on a side), the second 1/16th division to 2.5 acres (a square 330 feet on a side), and the third to 0.15625 acres (a square 82.5 feet on a side). Several other major modifications to the computer list appeared: the elimination of the 21-charater comment bits, the addition of a topo map code, and a "knowledgeable source," either AGS (by default) or a contributor's NSS number. "AL," borrowed from the recent postal zip code abbreviation, was used as the ACS number prefix in anticipation of the generation of a list of TAG caves in the future, and the need to distinguish between caves in Tennessee, Alabama, and Georgia.

The NSS number credit disappeared by the time of the eighth run of 1033 entries in October 1969, which was in alphabetical order. Another set of major changes took place as well, the most notable of which was that the length and depth logarithmic codes were replaced by metric values—the length in scientific notation. Entrance elevations were included for the first time, also in meters. This, unfortunately, was incompatible with contour lines published on the USGS topo maps of Alabama. Prefixes for the ACS numbers were changed to "A" plus a two-letter code for the county. Three additional runs survive that employed the metric system: a personal run dated December 4, 1969, containing 1065 entries; January 1972, the *Interim Alabama Cave Survey Report Number 10*, published with 1281 entries

Bill Varnedoe & Lin Guy discussing cave locations on Green Mountain. Photo: Tom Whitehurst

and the “X” or “no cave” entries of topo features and non-qualifying small caves (these were included intermittently in later years); and June 13, 1972, a partial run of added caves from AL 1262 to AL 1324.

May 1, 1973, marked the publication of the second complete ACS book, *Alabama Caves and Caverns* (commonly known as “the blue book” by W. W. Varnedoe) and the twelfth surviving computer run. It contained well over twice as many caves as the 1965 “red book,” 1421 entries, and 1092 pages of maps in a book that is 2½ inches thick. The good news is the lengths, depths, and elevations were converted back to feet. The bad news is that the number used is a center value of the code spread. Unfortunately, this number looks exactly like accuracy to the foot, but is in fact still only + or - about 570 feet. In addition, ACS number prefixes did not appear.

The ACS Converts to a Membership Organization

Bill Varnedoe announced his decision to retire as ACS Director, “when the cave listing reaches number 2000 and after a third complete survey book of information and maps is published.” With this in mind he decided to convert the ACS to a paid membership organization staffed by a board that would lessen the work formerly done by one or two people. The first ACS organizational meeting was held in Birmingham on Sunday, September 23, 1979, to discuss the future of the ACS as well as the Constitution and Bylaws prepared by members of the Birmingham Grotto. It was decided to elect a five-person Executive Committee to oversee the future operation of the ACS, with one member to serve as the Cave Files Director. A second organizational meeting was held in Huntsville on Sunday, November 18, 1979. Executive Committee members Eric Batchelder and John French were elected for one year and Joe Domnanovich, Greg McGill, and David Howell for two years. Bill Varnedoe was elected interim Cave Files Director to oversee publication of the third book. A Constitution and Bylaws were adopted. At the Huntsville Grotto meeting on January 2, 1980, Bill announced that the current count of assigned caves was at 1959, and when 2000 is reached he would pass the completed manuscript to the ACS Executive Committee for publication.

The first annual ACS membership meeting was held on Sunday, March 30, 1980, in Birmingham, Alabama. Memberships were offered for $4/year. At the May 7, 1980, Huntsville Grotto meeting Bill Varnedoe announced a total of 1993 caves had been assigned numbers. By the meeting on June 4, 1980, Bill reported that the ACS cave count had gone over 2000 and the book was closed for new additions. A special ACS meeting was held in Huntsville on Sunday, June 8, 1980, to elect officers and format the new book. Bill Varnedoe retired as the ACS Cave Files Director after 25 years of service to the ACS, either in partnership with the GSA for 7 years or as the survey director for 18 years. In appreciation for over 25 years of support to Alabama speleology as well as his work in maintaining the ACS, Bill was elected unanimously as the first lifetime member of the ACS. The 14th computer run of 2020 entries dated July 29, 1980, was the cutoff for the new book: *Alabama Cave Survey – 1980*, edited by Bill Varnedoe. The Executive Committee met on Saturday, September 13, 1980, at the Guntersville State Park lodge to finalize printing the book.

February 15, 1981, was the official publication date of the first ACS book since it became a membership organization: *Alabama Caves, 1980*, with 2020 entries, including the “X” or “no cave” list. By the spring meeting the first 50 copies had been distributed to 69 members who had prepaid $25. The actual cost of the 900 pages was $27, with losses to be borne by the ACS. Printing of the second 50 copies was soon to begin. For the next six years the ACS distributed only updates to the 1980 publication. Minutes and details for many of the meetings, including election results and discussed topics, are no longer available, but capsulated summaries have been compiled by the first author for the ACS files.

In the meantime, the long overdue *Caves of Morgan County, Alabama; Geological Survey of Alabama Bulletin 112*, mentioned earlier and authored by the late Dr. Walter B. Jones and William W. Varnedoe, Jr. was published in 1980. It included the county’s caves through Zulu Pit (AL 1462), which was reported in 1973, plus five foldout maps. Between that year and the 1980 cutoff for the new ACS book, 34 new Morgan County caves were added to the survey but not included in the book. This was the last support the GSA gave to a cave-specific publication. The long delays in publishing books plus its complete disinterest under the new State Geologist, made its continued participation impractical.

Summary

The ACS has experienced a successful and supportive 81-year history serving the cavers and scientists who explore and study Alabama caves. Our goal is to keep the files updated and accurate, while making them accessible to members of the caving community who meet the few simple requirements for membership. Anyone who is interested in joining the Alabama Cave Survey is welcome to contact our membership chairperson found on our home page (alabamacavesurvey.org) under the tab marked “Join” for information. Thank-you to the cavers and scientists who have contributed to the study and exploration of Alabama’s cave and karst features as your contributions make the ACS a reality.

1 Alabama Cave Survey, Cave Files Director (2008–Present)

2 Alabama Cave Survey, Cave Files Director (1962–1980)

3 Alabama Cave Survey, Membership Director (2002–Present)

Chapter 5 SCCi

Southeastern Cave Conservancy, Incorporated: Buying (and Managing) Caves for Cavers

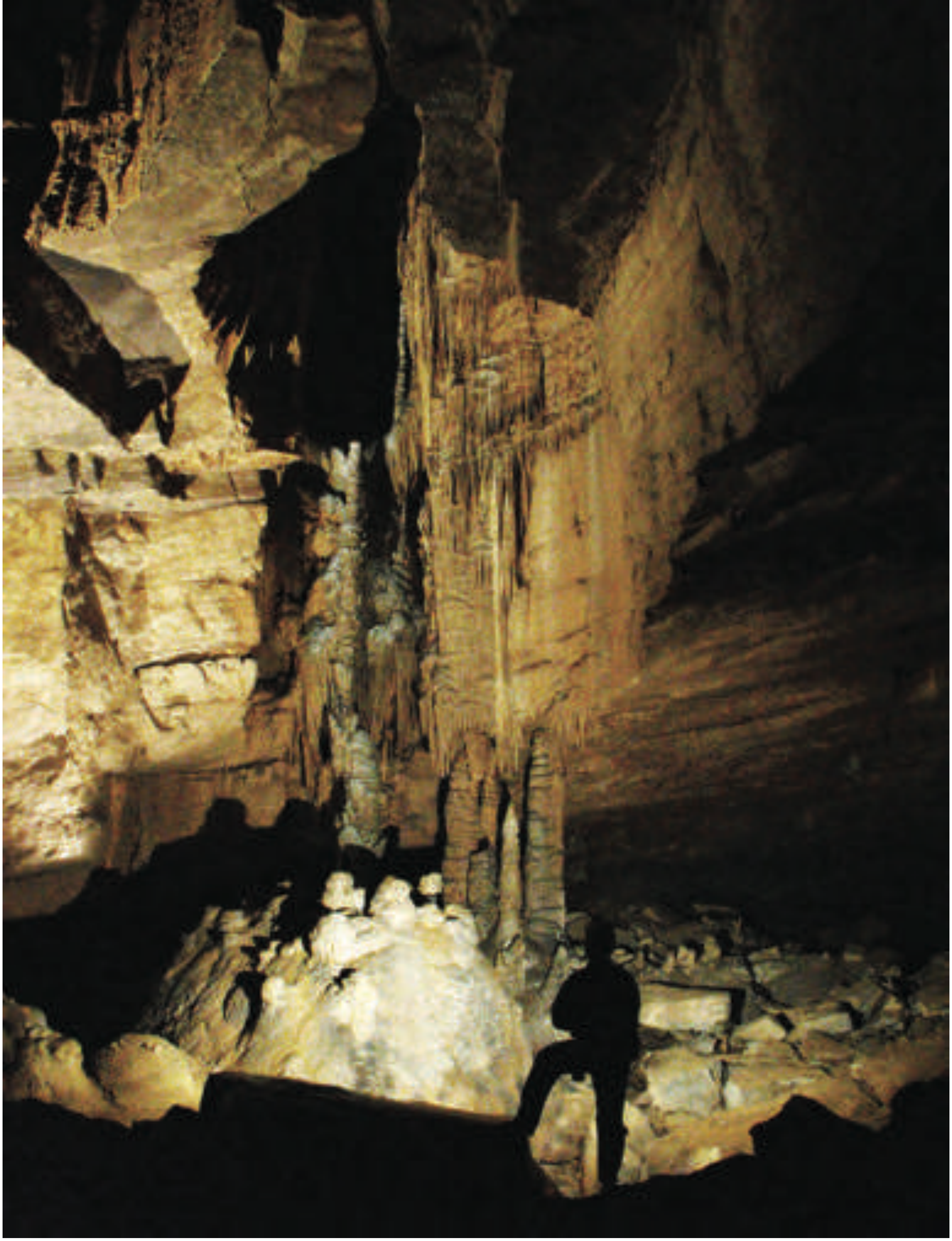
Dripping soda straw, Hurricane Cave, Southeastern Cave Conservancy Preserve, Georgia. Photo: Alan Cressler

It all started in 1990 with a small group of cavers who wanted to try something new: create a land conservancy dedicated to buying caves to preserve recreational access, to protect caves for future generations, and to support scientific research in caves. A small group of cavers met in Bill Putnam's living room in 1990 to talk about how to move their idea from concept to reality. They knew they had a great idea. But would other cavers agree? They decided to move forward, formed a nonprofit organization, and in May of 1991, the Southeastern Cave Conservancy, Inc. (SCCi) was born. The SCCi is now the largest and most successful land conservancy in the world devoted to buying, protecting, and managing caves. Our success has been achieved through the hard work of many individuals, good timing, patience, and the incredible support from the caving community.

The Early Years of the SCCi

In the late 1980s, cavers had seen the breakup of large tracts of land that had been open for recreational access and caving for generations. Some caving areas were also being closed because landowners started to worry about liability. As access changed, cavers started to realize that the best way to ensure access to caves they loved was to buy or lease caves.

The SCCi got off to a great start because of a donation



Byers Cave, Southeastern Cave Conservancy Preserve, Georgia. Photo: Kelly Smallwood

from Chuck Henson. Chuck had confidence in the new conservancy and donated Howard's Waterfall Cave in Dade County, Georgia, to the fledgling group. As one of Georgia's longest and most popular caves, acquiring this cave helped make cavers aware of the SCCi and the group's goals. The donation was the first step in getting cavers excited about a cave conservancy and gave the new group the confidence and experience to start planning how to buy or lease other caves.

Manuel Beers in the Upper Entrance Room, Fricks Cave, Southeastern Cave Conservancy Preserve, Georgia. Photo: Alan Cressler

The SCCi board recognized that the next acquisition would not be that easy and discussed its next project. Fox Mountain had been a popular area to visit for many years because many well-liked caves are on the property, including Hurricane Cave, Cemetery Pit, Rusty's Cave, and seven others. While the SCCi was trying to figure out how to somehow buy Fox Mountain, the board heard that another well-known cave, Neversink, was up for sale. This pit, located in Jackson County, Alabama, is considered one of the jewels of the caving world. At that time, the cave was closed, and the SCCi recognized the unique opportunity to raise money for this very popular cave. Buying Neversink took a very long time. The cave was twice sold to other people, but the SCCi persevered and in December 1995, closed on the purchase of 32 acres containing Neversink Pit. Cavers were thrilled. This purchase was what put the SCCi on the map and caused many cavers to realize the huge potential of the organization.

Fundraising to Buy Caves

To pay for the $50,000 purchase of Neversink, the SCCi came up with a unique fund raising idea. How about dividing up the property map into sections and "selling" honorary ownership of pieces of the property? They figured out that if they "sold" supporters on the purchase honorary pieces of this favorite cave, created certificates of honorary ownership, wrote each person or organization's name on a fundraising map, and then gave each donor a t-shirt, they could raise the money needed to pay off the bank loan. It worked. Cavers loved this concept and flocked to buy Pieces of the Pit. Since then, the "Buy a Piece of the Cave/Pit" program has successfully raised the money to pay for many other caves and is still popular today. The program also helps advertise the SCCi and all of the caves the organization has purchased over the years because so many cavers wear t-shirts with maps of their favorite caves.

Growth and Expansion

After buying Neversink, the SCCi turned its attention back to Fox Mountain. But again, the group got word that another popular Alabama cave, Kennamer Cave, located in Jackson County, Alabama, was up for sale. After finding out that the owner was ready to sell immediately, the board leapt into action and within three months had signed a purchase contract and secured external financing for the purchase of 100 acres containing

Jeff Moore in Sinking Cove Cave, Southeastern Cave Conservancy Preserve, Tennessee. Photo: Alan Cressler

entrances to Kennamer and Little Kennamer Caves. To raise money, the board once again set up a Buy a Piece of the Pit program. More than half of the money was raised before the purchase was completed, and the loan was repaid in full in only two years.

Soon after buying Kennamer, the SCCi signed leases for three significant caves: the Surprise Pit entrance to Fern Cave, Gourdneck Cave, and South Pittsburg Pit.

Surprise Pit, located in Jackson County, Alabama, was closed following two rescues. The Conservancy was able

Neversink, Southeastern Cave Conservancy Preserve, Alabama. Photo: Jack Fischer

to sign a lease with the owners to re-open access to Alabama's deepest pit. The 99-year lease was the Conservancy's first opportunity to sign a lease to maintain access for cavers.

The Fern Cave lease was adapted to lease Gourdneck Cave, located in Marion County, Tennessee, and Logsdon Cave, located in Hart County, Kentucky. A stipulation of the Gourdneck lease was that SCCi would assume responsibility for maintaining the owner's water line that runs through the cave. Logsdon Cave, owned by the Nashville Grotto, was seen as a possible entrance to Fisher Ridge Cave and is located on the border of Mammoth Cave National Park. This was the SCCi's first project outside the TAG region.

In early 1997, another significant cave became available. Fricks Cave, located in Walker County, Georgia, and home to 10,000 federally-listed endangered gray bats, was put up for sale by its owners, who were planning to sell their farm and retire. Two other organizations, the Georgia Department of Natural Resources and the Georgia Chapter of The Nature Conservancy (TNC), were also interested in buying the cave, but neither organization could come up with the funds fast enough for the upcoming auction. Being a young organization with little bureaucracy, the Conservancy was able to act quickly and purchased 34 acres containing all three entrances to the cave. The $105,000 price tag shocked a few members, but with financing through the Georgia TNC and donations provided by cavers, grottos, and sponsors such as Bat Conservation International and the NSS, the cave was paid for. The cave's populations of gray bats and Tennessee cave salamanders, along with other wildlife and important cultural and historic resources, are now protected and preserved forever.

After clearing its plate of any other possible acquisitions, the SCCi board turned its attention one more time back to Fox Mountain. Board member Mark Wolinsky was able to meet face-to-face with the property owners and negotiated purchase terms for the 300-acre tract of property, including owner financing. While it took several years to finally buy this caver favorite, the lessons

Brian Killingbeck in Kennamer Cave, Southeastern Cave Conservancy Preserve, AL. Photo: Alan Grosse

learned along the way made the acquisition of the Fox Mountain preserve a smooth transaction.

Handling Debt

With phenomenal growth came debt. The SCCi saw its debt load increase to over $200,000, a huge amount for a tiny nonprofit. Fortunately, the Conservancy had very few other expenses so almost all donations went directly to paying off loans. But the board also realized that they needed to expand their fundraising efforts to help keep the pace of buying more caves in the future.

One of the SCCi's board members suggested an idea of creating a sustaining membership. This type of membership allows a donor to make an automatic monthly donation by credit or debit card. The program was popular, many cavers signed up, and the program now provides the SCCi a fairly steady income each month. Today, nearly 500 of the SCCi's 1,000 current members are sustaining members, contributing over $90,000 a year. The SCCi really appreciates its sustaining members because they provide the financial backbone for the organization, providing a regular, predictable, and sustainable income stream to support monthly mortgage payments on cave purchases.

Because of the huge amount of support from the caving community, the SCCi continued to purchase many other significant southeastern caves, including Limrock Blowing, Valhalla, Snail Shell, Fern Cave's Surprise Pit entrance, Tumbling Rock Cave, and many, many more.

Leadership in Cave Conservation and Management

In 1999, the Southeastern Cave Conservancy hosted the National Cave and Karst Management Symposium. This event brought together cave and land managers from across the country to discuss issues and present new ideas on how to best manage cave and karst resources. The Conservancy was able to demonstrate that a group of cavers could come together to acquire and manage caves, not just on a small scale, but in an aggressive, free-market entrepreneurial style, working, and sometimes competing, on an equal footing with developers and other individuals or organizations pursuing land acquisition in the region. This was important because many of the symposium's participants were from government agencies, where priorities, policy issues, budget and funding constraints, and political considerations often impede efforts to protect cave and karst lands. The SCCi, and the other cave-oriented land trusts and groups that preceded it, showed that a new era in cave protection and management had begun.

Managing Caves

While the purchase and financing of property can be time-consuming, something that many people take for granted is the ongoing stewardship requirements inherent in owning property. The SCCi understands that with the purchase of a cave, there could be increased visitation. Taking care of the land and the cave is just as important as protecting it from development or destruction. The SCCi accomplishes this important goal by creating a comprehensive management plan for each cave preserve and recruiting volunteer property managers for each preserve. Through a network of SCCi property managers and management committees, SCCi volunteers monitor each cave, assist people interested in visiting our caves, review permit requests, and care for each cave property. It is the responsibility of each property manager or management team to ensure that the property is properly supervised and cared for, and that we maintain good relations with our neighbors. Over 40 cavers volunteer as property managers and they're a key part of responsibly managing our caves.

In the era of white-nose syndrome (WNS), the SCCi took the lead in balancing cave and bat conservation with recreational access. The SCCi closed several caves with seasonal bat populations in the early years of the WNS crisis, but after WNS reached the southeast, the organization re-opened those caves under permitting systems. The SCCi has also worked to educate its members about how to safely and effectively clean caving gear and clothing to kill not only the fungus that causes WNS, but also other microbial hitchhikers that cavers could inadvertently carry from one cave to another. The SCCi is currently working with other organizations to help implement permitting systems for caves that are currently closed.

Where are We Now?

The SCCi recently celebrated its 20th anniversary and has accomplished a huge amount over the years. We currently own 22 cave preserves with 52 caves and we lease 5 preserves with 80 caves. We own 1,390 acres of land and lease 15,050 acres. We own over $2 million in land assets, thanks almost entirely to support from cavers. We own some of TAG's most popular and beautiful caves in six southeastern states. Our most recent purchase, Run To The Mill Cave, has a deep pit, beautiful formation areas, miles of passage, and large borehole. The cave is over 15,000 feet long, 445 feet deep, with a 167-foot deep pit. It's a caver's cave. And thanks to SCCi's purchase, Run To The Mill Cave joins over 50 other caves that are permanently protected by an organization for which responsible recreational caving use is a critical component of its mission.

Our Future

The board of the Southeastern Cave Conservancy is certainly optimistic about the future. Last year we participated in an extensive Strategic Planning retreat to

Peter Clay at Small Falls in Tumbling Rock Cave, Southeastern Cave Conservancy Preserve, Alabama. Photo: Alan Cressler figure out where we want to go as an organization. Our goal is to reach the point where we can double, and eventually triple, our current rate of new preserve acquisition. That means we will need more member support, plus we plan to extend our fundraising reach to grants. We are also implementing a new membership database program, financial management programs, contracted administrative support, and new tools to help us better serve and respond to our members. We have had great success in our mission to acquire caves, and see ourselves as a very stable organization. There is always going to be a challenge in deciding which caves to acquire and how to fund the purchases, but we have faith that cavers will continue to recognize the benefits they receive from supporting the SCCi. Besides your financial support, we ask all cavers to respect the SCCi's property, as it is your property too. Please help us to grow in the future and to preserve what we have acquired, for the benefit of future generations of cavers and for the caves themselves.

How Can You Help?

The simplest way that you can help us buy more caves is to contribute financially to the SCCi, either by becoming a member, making a donation to help pay for a preserve, or both. If you're not yet an SCCi member, you can join as a regular member for as little as $25 per year, or as a sustaining member for as little as $10 per month. If you're already a member, consider becoming a sustaining member. If you're already a sustaining member, consider increasing your monthly or quarterly donation amount. If all of our sustaining members increased their donations by just $5 per month, the SCCi would receive almost $30,000 more each year to help buy caves! Stop by our booth to sign up or to increase your donation amount. Please also encourage your friends, fellow grotto members, and fellow cavers to join the SCCi. The more member support we have, the more caves we can buy. We hope that cavers will continue to show their support of the SCCi and encourage their friends to support us too. We have a long list of caves we would love to buy in the future, but we need your support to make those purchases a reality.

As the SCCi grows in size and complexity, we also are finding that we need even more volunteer help. In particular, we need the assistance from people who have nonprofit management skills and the ability to help us improve our policies and procedures to a level that foundations and other major funding organizations expect before they will consider us for significant grant funding. If you're interested in volunteering for the SCCi, please check out our website for current volunteer opportunities, or contact us by email at volunteer @scci.org.

To learn more about the SCCi, to review a list of all of the cave preserves we own or lease, and to read news, visit our webpage at www.scci.org. You may also connect with us on Facebook and Twitter.

SCCi Preserves

This is a list of the 27 preserves with 132 caves that the SCCi owns or leases. Support the SCCi to help us add to this list!

Anderson Cave, Alabama (leased)

Fern Cave, Surprise Pit Entrance, Alabama

Fox Mountain, Georgia

Frenchman Knob, Kentucky

Frick's Cave, Georgia

Glove Pit, Alabama

Gourdneck Cave, Tennessee (leased)

Hollow Ridge, Florida

Holly Creek Cave, Tennessee

Horse Skull and Jack's Hole, Alabama

Howard's Waterfall, Georgia

Jennings Cave, Florida

Kennamer Cave, Alabama

Limrock Blowing, Alabama

Lobelia Saltpeter Cave, West Virginia

Logsdon Cave, Kentucky (leased)

Lost Canyon Cave, Georgia

Neversink, Alabama

Rattling Cave, Tennessee (leased)

Run To the Mill, Tennessee

Sinking Cove, Tennessee (leased)

Snail Shell, Tennessee

South Pittsburg Pit, Tennessee

Steward Spring Cave, Alabama

Tumbling Rock Cave, Alabama

Valhalla, Alabama

Wolf River Cave, Tennessee

Chapter 6 SKTF

SERA Karst Task Force

Beginnings

Because of ignorance and perhaps laziness, sinkholes, caves, and karst have accumulated a fair amount of trash over the years in the southeastern region. Although it was not extremely widespread, sometimes it was heavy, especially where access was quite easy. Kind of a monkey see, monkey do type thing. Another generation would then come along and add spray paint and refuse from parties. However, there were two things they did not know or did not care about. One, if you dump it, you drink it. And two, they were severely impacting the fragile karst environment. Luckily for the caves, four individuals got together over 13 years ago and decided to get the ball rolling on this problem.

The night before the 2001 SERA Winter Business Meeting, Brian Roebuck, Lynn Roebuck, Rob Robbins, and Jim Wilbanks got together to discuss karst conservation and education about the fragility and sensitivity of karst regions. They traded ideas and began to plan out a course of action. The following day at the SERA Winter Business Meeting a motion was passed to create the SERA Karst Task Force (SKTF) as a standing committee of SERA. Many came forward to join the committee and help, which was tasked with studying ways in which SERA could contribute to conservation in karst areas.

Initially, the cleanups did not net a large number of volunteers. Thus, the committee decided to create "stand alone" events and soon cavers were coming out in droves to help. With experience, the SKTF became better organized and streamlined the process of identifying karst areas to clean up, with input from local grottos and individual cavers. The SKTF's expertise became recognized throughout the region and became a major component in the process of cave conservation and protection. In addition, donations started flowing, in

Before

After

A Saturday Somewhere in the Karst of TAG

both monetary amounts and gear from caving vendors, as cavers recognized something really good had been born in 2001.

The SKTF is now composed of a Chair, Vice Chair and Secretary/Treasurer. Each year, the Chair of SERA nominates six "at large" members for two-year terms to serve on the SKTF committee. At the first SKTF board meeting, which follows the spring SERA Winter Business Meeting, the SKTF elects its directors for that year and plans begin to take shape for the coming year's activities.

A Saturday Somewhere in the Karst of TAG

You arrive to find a number of volunteers milling about, some sleepy still, others perhaps a tad hung over from Friday night festivities. The rigging crew that arrived an hour before everyone else is putting the finishing touches on a "highline" system to take the strain out of getting all the "stuff" from point A into a dumpster or trailers situated nearby. Instructions are given on safety concerning the haul system and in moving around and dealing with the trash. Certain folks are eager to do jobs they have come to love. Several folks excel at making "large" trash into manageable pieces. Others begin the task of filling poly bags that can hook into the haul system and speed up trash removal. One caver runs the rack, which requires a certain amount of skill, to control the load as it is raised and moved about. Still others sort the trash and separate recyclables and tires.

The haul master speaks into his radio, "Ready to haul!" Along with the driver of the vehicle that adds the muscle, the rack person controls the load while the haul master makes sure all is going smoothly and safely. Those in any kind of fall zone have already moved to a place of safety. The load makes it to the "top" and work below quickly resumes on gathering more trash. The whole movement is like a ballet, only with sometimes a refrigerator doing a Peter Pan waltz. Empty bags are sent back down and the process repeats itself over and over the entire day.

Some cavers find toys or memorabilia that, once cleaned off, grace places of honor in their homes. A few of these discarded items find their way onto plaques given to the

Volunteer of the Year at the SERA Summer Cave Carnival each year. A few lucky cavers even earn a nickname because of their relentless hard work on difficult tasks. Locals drive by and get an instant education on conservation and see cavers in a positive light.

In this case, this is the last clean-up at this site. Leaves are spread to cover bald spots, gear is ferried up top. The haul system is taken down, ropes coiled, pictures taken. Some cavers seem to be wearing a lot of slime (as cavers enjoy). Later that night a campfire dwindles down and those who worked on that trash heap that day feel very, very good as they trade stories and swap cave lies.

Accomplishments

While a complete list of all clean-ups, both large and small, is not really feasible, some more noteworthy clean-ups should be mentioned. The authors apologize ahead of time for not having a complete list and not posting this list in chronological order.

Lost Creek, Tennessee: The second clean-up was a foreshadowing of key elements that would fall into place for future events. There was an excellent turnout with many grottos represented. The landowner participated along with local government and the SKTF received local news coverage.

Rocky River, Tennessee: The first time we set our eyes on it, "WOW! What a trash heap!" was all we could say. Besides being a difficult place to haul out trash, there was just so much of it. The county received a nice roadside pickup grant and even put up a guardrail to help stop illegal dumpers. The SKTF was given the NSS's Group Conservation Award in part for this clean-up.

The Russell Cave Watershed, Alabama: This project took even longer than Rocky River, but the amount of trash, tires, and hazardous stuff removed is staggering as evidenced by the "before and after" pictures of just one section of the watershed. The watershed is now monitored by the local grotto which has periodic clean-ups to maintain the now pristine setting of this area.

Horseshoe Bend, Tennessee: How can a karst/cave cleanup lead to over a mile of virgin cave? Well, this one did. Peeling away the trash led to a few climb-downs, a 34-foot deep drop, and then a short dig into more than a mile of highly decorated passage. Unfortunately the entrance sinkhole has received additional trash and planning is underway for another round of clean-ups.

Unsung Roadsides: There have been a number of cleanups with no "direct" cave nearby but numerous caves not too far away. These have been in karst terrain and sometimes are steep and difficult to access. Rigging has been problematic but sometimes even a blind nut finds a squirrel. Case in point—one time we were able to

rig the highline to dump directly into the dumpster. SWEET!

Decon Stations: When concerns about white nose syndrome (WNS) began to arise and the first decon protocols became known, the SKTF began supplying a WNS decon station at caving events. The committee has kept abreast of new developments and has continued to supply this service at caving events across the region.

Many other caves and karst areas have seen the work of the SKTF and local grottos. Among them are:

Tennessee: Big Room Cave Watershed, Blue Spring Watershed, Carson Campbell Cave, Conner Creek Cave, Copeland Cave, Grassy Cove Watershed, Tennessee River Gorge Sinkhole, The Sinkhole, Wet Cave Watershed, White River Cave.

Alabama: Manitou Cave, Newsome Gap Road, San Souci Cave, Stephen's Gap Cave, Talley Cave, Weaver and Lady Cave.

Georgia: Byers Cave Restoration, Pettijohns Cave.

Over 200 volunteers from 7 different states, many participating on countless clean-ups, have removed a massive amount of debris out of caves and karst in the southeast region. Over 100,000 pounds and counting! The number of tires is staggering and defies an accurate count. And numerous containers with harmful chemicals have been disposed of properly.

Benefits and the Future

While removing all that trash from karst areas is an obvious benefit, other ones come to mind. Local governments have been enlisted in helping, whether with waiving tipping fees at the nearest landfill or with supplying some needed help with local manpower. In turn, the local government can turn in the tonnage to aid in obtaining federal grants to assist them in ongoing roadside clean-up operations. The mayor of one small town even provided pizza to all the SKTF volunteers after clean-up operations had ended for the day.

Locals see cavers in a positive light. Some have donated money to help defray costs and some have even participated. They also get an education about karst. This in turn has opened up new contacts and renewed old ones, while allowing cavers access to caving areas that were previously closed or strengthening bonds with landowners who have a long-time history of being friendly to cavers.

The hard work of many volunteers has made a positive influence on the caving community as a whole. Many have realized that no longer can we just sit back and go caving every weekend. Giving up a weekend of caving to work a cleanup can change your life, introduce you to new caving friends, and give you a sense of satisfaction by making a difference in protecting the karst we live and play in.

Over 13 years ago, four cavers had a vision. That vision has become a reality with the hard work of many volunteers. The SKTF is currently working to remove invasive plants from the property of our new NSS Headquarters and Conference Center. And as of early March, the SKTF is looking to purchase a trailer to haul the myriad of supplies used in karst cleanup operations.

Volunteers have made this organization strong and helped it to continue to grow. Committee members past and present would like to give a heartfelt thank you to all who have participated over the years! Let's keep the ball rolling!

This article is respectfully submitted by Maureen Handler and Peter "Mudpuppy" Michaud in honor of all the volunteers who have dedicated their time and effort to the SKTF.

Chapter 7 Cave Descriptions

Caving Around the Rocket City and Beyond

Moses Tomb with Elliot Stahl and Brian Killingbeck. Photo: Alan Grosse

With more than 13,000 caves and karst features in the TAG region, you should have no difficulty finding a cave to visit this week. The *2014 NSS Convention Guidebook* features several caves that have never been discussed in a Guidebook, as well as TAG classics. We have offered a range of caves for families to cavers wanting a more challenging trip, such as a wet multi-drop. A few of the vertical caves are listed under a geographical heading to facilitate planning. Please recall that several descriptions for Huntsville area caves are included in Lin Guy and Tom Whitehurst's article, Caves of the Huntsville Area, located in Chapter One.

When you visit any TAG cave, please remember that most of them are privately owned. We are fortunate to have some of the best landowners in the country, but please be respectful of their rights as a land/cave owner. Please make an effort to stop by and let the landowner know your plans and respect their wishes. Most would welcome the opportunity to meet cavers from out-of-state who have traveled to TAG just to visit their cave.

The Southeastern Cave Conservancy, Inc. (SCCi) owns a few of the caves listed in the *2014 NSS Convention Guidebook*. This organization has made a tremendous effort to acquire or arrange access to some of TAG's finest caves. Many of the SCCi caves are extremely popular. If you arrive at an SCCi cave or any cave during the 2014 NSS Convention and find the parking area full, please go to another cave. In addition, the SCCi requests that you stop by its booth to obtain current information on access and any visitation issues.

Finally, landowners and access issues continually change and are subject to change before and after the 2014 NSS Convention. Please stop by the cave information desk to verify any changes. Current copies of the Closed Cave List will also be available.

Horizontal Cave Descriptions

Daphne Soares in Anderson Spring Cave, Putnam County. Photo: Chuck Sutherland

Bible Springs Cave (TMN 91)

Length: 3,948 feet
Depth: 85 Feet

The entrance is above Bible Spring and is a short climb down that leads to a pool 10 feet long and 3 feet deep. The first 500 feet of the cave is a joint-controlled stream passage, 3 to 4 feet wide and 6 to 10 feet high, with the water varying from 3 inches to 4 feet deep, depending on recent surface precipitation.

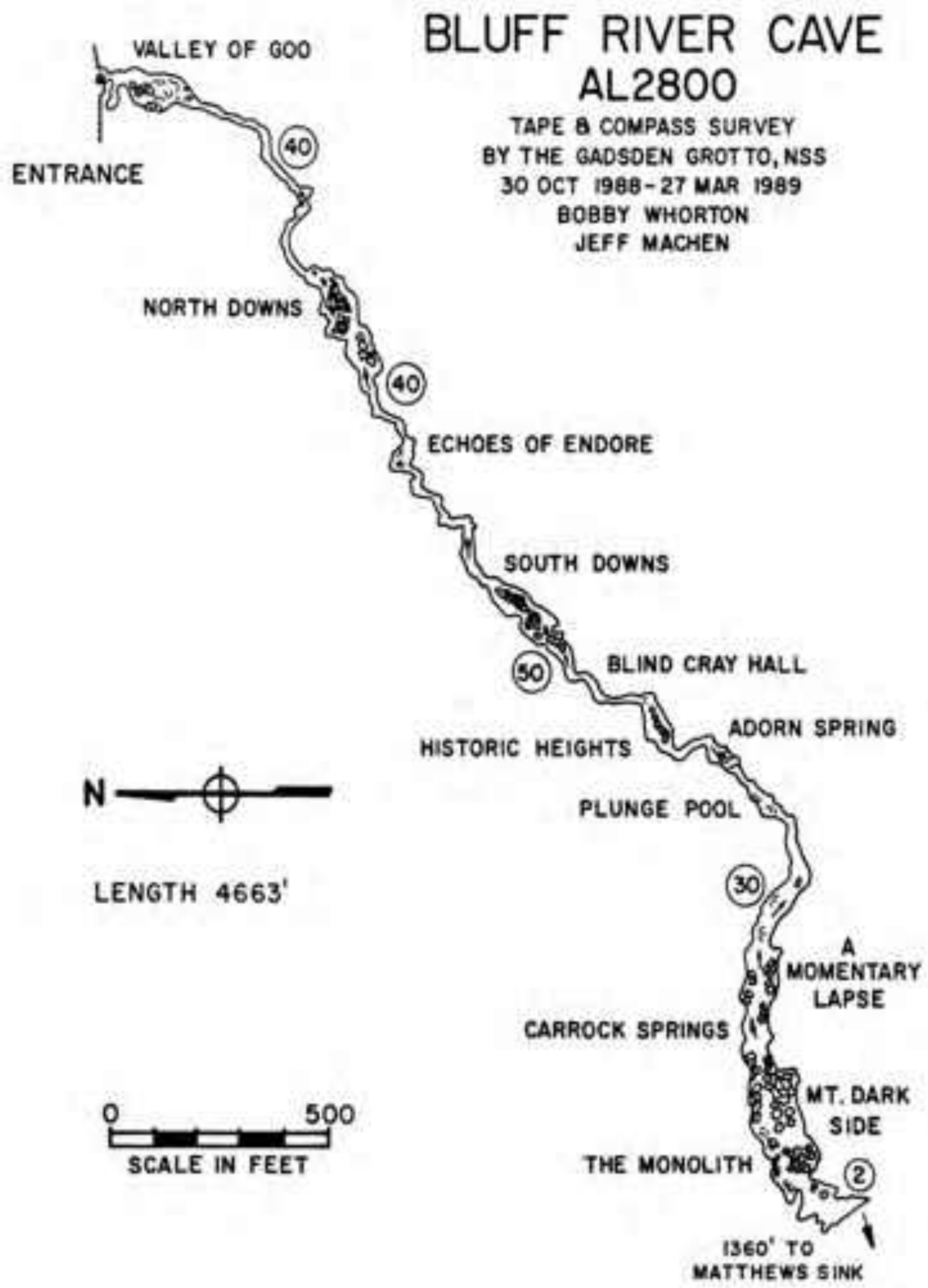
The cave leaves the joint-controlled trend and opens to a large walking passage 10 to 20 feet wide and 10 to 20 feet high. After 300 feet, a hands and knees crawlway through the stream is encountered. Several decorated rooms are developed in an upper level here.

Continuing upstream the ceiling rises after 100 feet and continues as walking passage for a short distance to another stream crawl. After the second crawlway the passage continues for another 200 feet as a stoop way and then opens to a large room 50 feet wide and 200 feet long. A climb down on the far wall leads to additional stream passage that eventually becomes a low air space. A wetsuit is recommended, but not required to visit this cave.

Bluff River Cave (AJK 2800)

Length: 4,663 feet
Depth: 50 Feet

This multi-level cave offers dry upper level passages, with lower level, stream borehole passage. The cave contains haystacks, pillars and a whole host of other formations and opportunities for cave photographers who are fond of big room photography. The large borehole passage averages 50-100 feet wide and 45-feet high for almost 3,000 feet.


BLUFF RIVER CAVE
AL2800
TAPE & COMPASS SURVEY
BY THE GADSDEN GROTTO, NSS
30 OCT 1988-27 MAR 1989
BOBBY WHORTON
JEFF MACHEN
VALLEY OF GOO
ENTRANCE
40
NORTH DOWNS
40
ECHOES OF ENDORE
SOUTH DOWNS
BLIND CRAY HALL
50
ADORN SPRING
HISTORIC HEIGHTS
PLUNGE POOL
N
LENGTH 4663'
30
A
MOMENTARY
LAPSE
CARROCK SPRINGS
MT. DARK
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0
500
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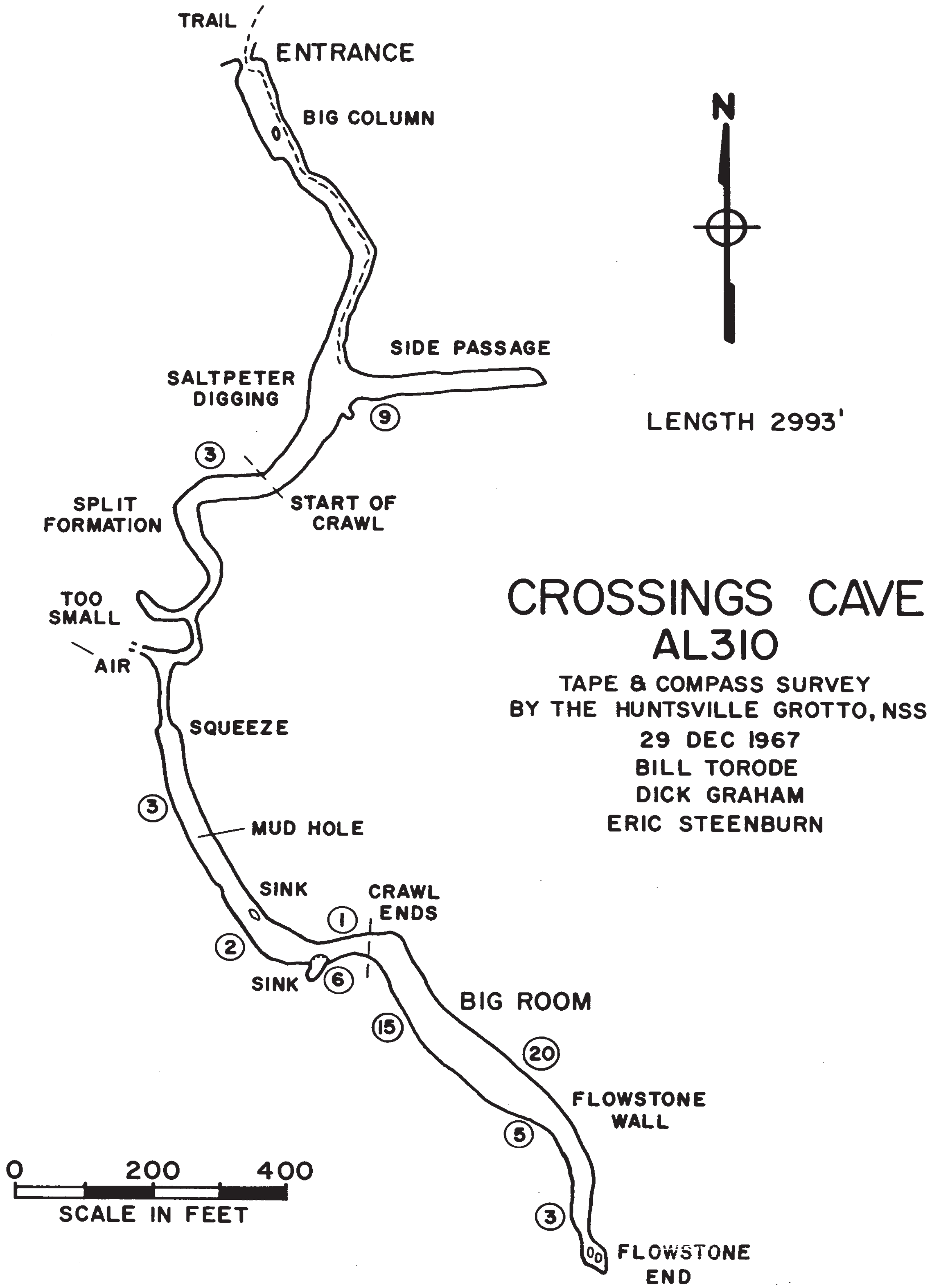
THE MONOLITH
2
1360' TO
MATTHEWS SINK

Bluff River Cave, Alabama. Photo: Alan Cressler


TRAIL
ENTRANCE
BIG COLUMN
N
SIDE PASSAGE
SALTPETER DIGGING
9
LENGTH 2993'
3
START OF CRAWL
SPLIT FORMATION
CROSSINGS CAVE
AL310
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
29 DEC 1967
BILL TORODE
DICK GRAHAM
ERIC STEENBURN
TOO SMALL
AIR
SQUEEZE
3
MUD HOLE
SINK
CRAWL ENDS
1
2
SINK
6
BIG ROOM
15
20
FLOWSTONE WALL
5
0 200 400
SCALE IN FEET
3
FLOWSTONE END

Candlestand Cave (AMD 123)

Length: 747 Feet

Named for a well known balanced rock formation outside the cave, Candlestand is formed in the Hartselle Sandstone along a bluff. The cave is a great cave for beginners and children.

Cave Mountain (AMS 346)

Length: 2,680 Feet
Depth: 27 Feet

Cave Mountain Natural Area is classified by TVA as a small, wild area of 34 acres. A one-mile loop trail leads to an overlook, and circles the base of the mountain past the cave entrance. The cave is located on a steep bluff overlooking a swampy area, just downstream of Guntersville Dam. Cave Mountain, oval in shape, is a small hill 800 feet by 2000 feet and 200 feet high, with 2,680 feet of cave. Cave Mountain Cave is the remnant of a very old and much larger cave and zig-zags inside the mountain. The passages in the back of the cave end in dirt fill and flowstone, just before exiting the hill. The majority of the cave has been filled in with dirt. In a few areas the dirt floor has been eroded away, revealing a deep canyon.

During the Civil War the cave was called Long Hollow Cave, and was mined for saltpeter. Dirt on the floor has been removed to a depth of four to five feet for the first 700 feet into the cave. There is no running water in the cave, but the back is muddy enough that you will look like a caver after visiting this cave.

Guntersville Dam, built between 1935 and 1939, is 3,979 feet long and 94 feet high. Visiting hours are 6 AM to 7 PM. Rest rooms and picnic facilities are available at the dam.

Cedar Ridge Crystal Cave (TMN 6)

Length: 684 Feet
Depth: 13 Feet

The entrance to Cedar Ridge Crystal Cave is 5 feet high and 7 feet wide, but the gate opening is 2-feet square. It opens into a room 30 feet in diameter and 10 feet high. A crawlway leads east into a passage which heads northeast for 150 feet and averages 10 feet wide and 5 feet high. Numerous formations decorate this passage. This passage leads into a room 75 feet long, 150 feet wide, and 25 feet high.

Northwest from the largest room, the cave continues for 75 feet through a maze of flowstone columns and stalagmites. It then narrows to a small dripstone grotto, beyond which a crawlway continues for an undetermined distance.

Please stop by the Cave Information Booth to obtain the entrance key.

Crossings Cave (AJK 310)

Length: 2,993 feet
Depth: 27 feet

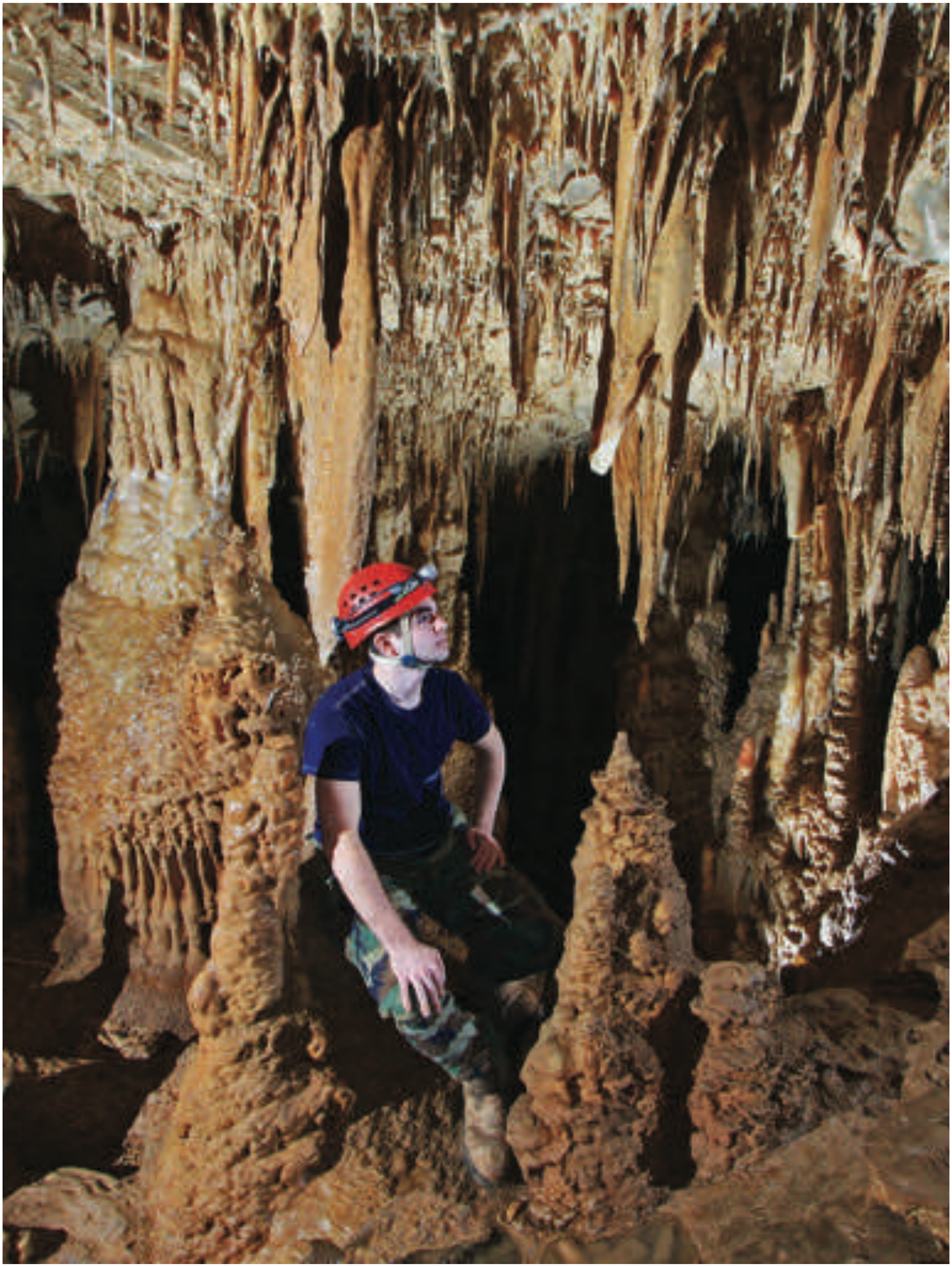
Crossings Cave is a great family-friendly cave with a very short walk to the entrance. Immediately upon entering the cave, you are greeted with some very nice columns and stalagmites with a large haystack column at the back of the entry room. For a short trip of an hour or two, you can visit the side passage which is off to the left, once you get to the "T" intersection where saltpeter was dug. Within that passage you will see a great deal of decoration, including helictites. Members of the Huntsville Grotto have conducted extensive repair work at the end of this passage over the past few years; this is an ongoing cave restoration project.

For the more adventurous, you can get really muddy while doing the 1,300-foot long crawl. Along the way, you are rewarded with massive amounts of helictites and at the end of the crawl (stay toward the left wall side) you will enter a large room with numerous soda straws and white calcite formations. At the end of the cave you will find little mud sculptures, before you return back through that fun crawl again. A tour of the entire cave could last four or five hours. Don't forget to bring plenty of water to clean up. (Paul Meyer, NSS 34328)

Guffey Cave (AMS 317)

Length: 32,726 feet
Depth: 210 feet

Guffey Cave is a large, dry cave with nice formation galleries. Very few people make the entrance-to-entrance trip, which involves some crawling and getting wet in a few pools. There is enough big cave in the section accessible from the main entrance to spend all day without getting wet or doing any real crawling. A traverse on the right side of the entrance room, followed by a short climb-down, takes you into the main trunk passage.



Wesley Gibbs in Cedar Ridge Crystal Cave, Tennessee. Photo: Alan Cressler

The cave owner explicitly asks that he be contacted before visiting the cave. Check with the Cave Information Booth at the Convention before planning a trip.

Hans Kennamer Cave (AJK 3268)

Length: 17,452 feet
Depth: 20 feet

Hans Kennamer Cave is a maze cave on the valley floor that has five entrances. Diligent survey efforts by Bill Torode have nearly tripled the caves original estimated length. While the cave lacks large formation galleries, it offers a range of trips from easy to advanced level.

Herring Cave (AMD 6)

Length: 10,430 feet
Depth: 40 feet

Herring Cave is a master drain for Horse Cove and has a large walk-in entrance that is typically dry during the summer months, but requires a short swim in the winter months. The passage dimensions average 40-foot tall in many places, with a 350 foot stoop way approximately 1,500 feet past the entrance. This section of the cave can also be wet or muddy, depending on recent rainfall. A nice flowstone formation gallery is located near the end of the cave, where Pleistocene bear bones were also discovered.

Kennamer Cave (AJK 490)

Length: 12,283 feet
Depth: 200 feet

Kennamer Cave is over two miles in length, most of which is the main passage connecting the upper and lower entrances. The cave has six entrances: three upper entrances, two lower entrances, and the sixth entrance is a pit (Kenna Pit) that has a very small connection to the lower end of the cave. Of these entrances, three are useful – the main upper entrance (E1), the Dug Entrance (E5), and the lower Orgy Entrance (E2).

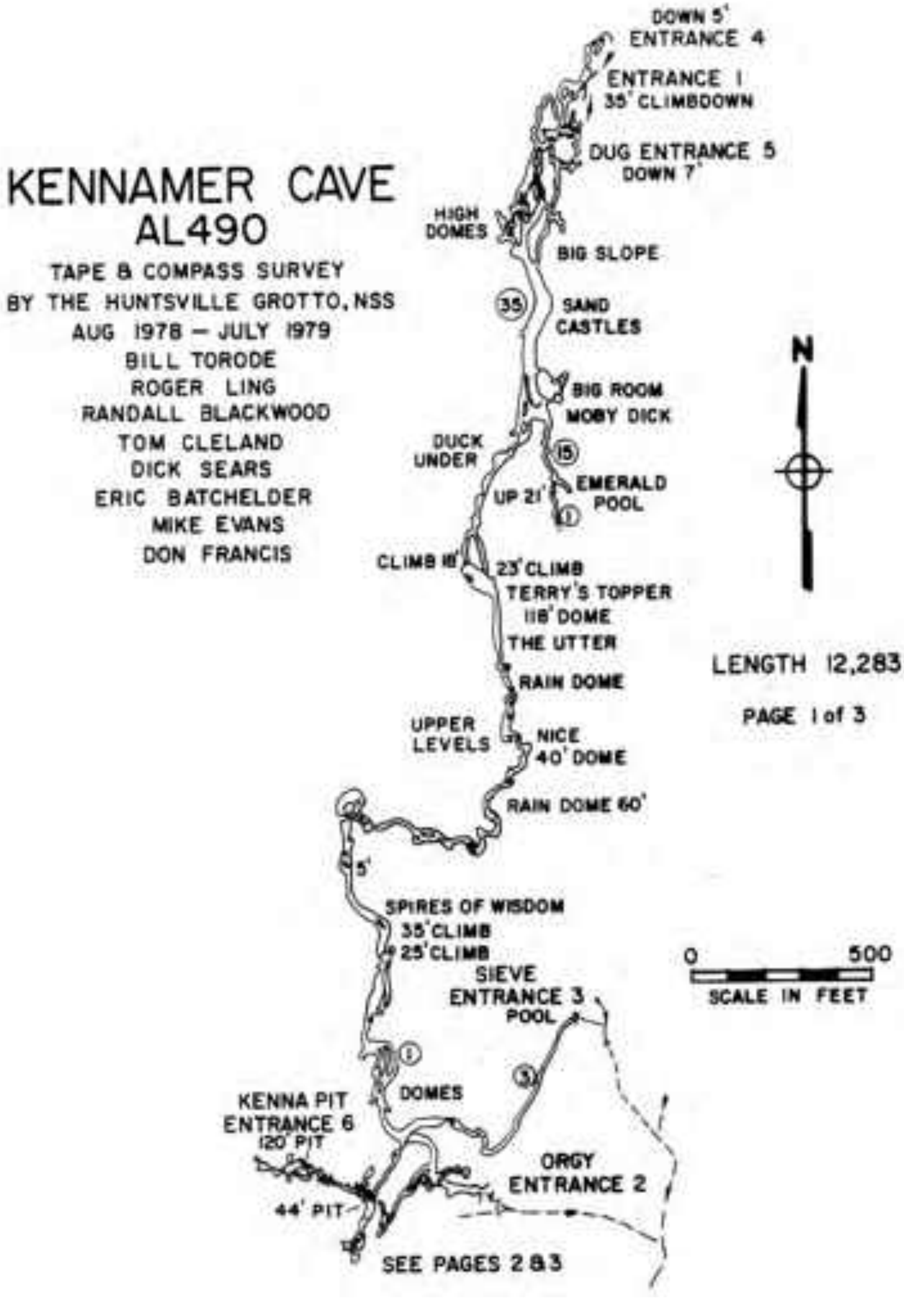
The cave has three nominal levels to it. The Upper level extends from the upper entrances through the giant canyon passage to the top of a fissure that is a 23-foot climb down. Except near the fissure, it is almost all walking passage. The Middle level extends from the room at the bottom of the fissure through much narrower canyon passage to the top of a canyon involving a 35-foot climb down or rappel. There are frequent blockages in this section that involve hands and knees crawling to connect to the next walking section. The Lower level is mostly hands and knees crawling with several lengths of belly crawling. There is some standing water along this route and a section of wet cobblestones.

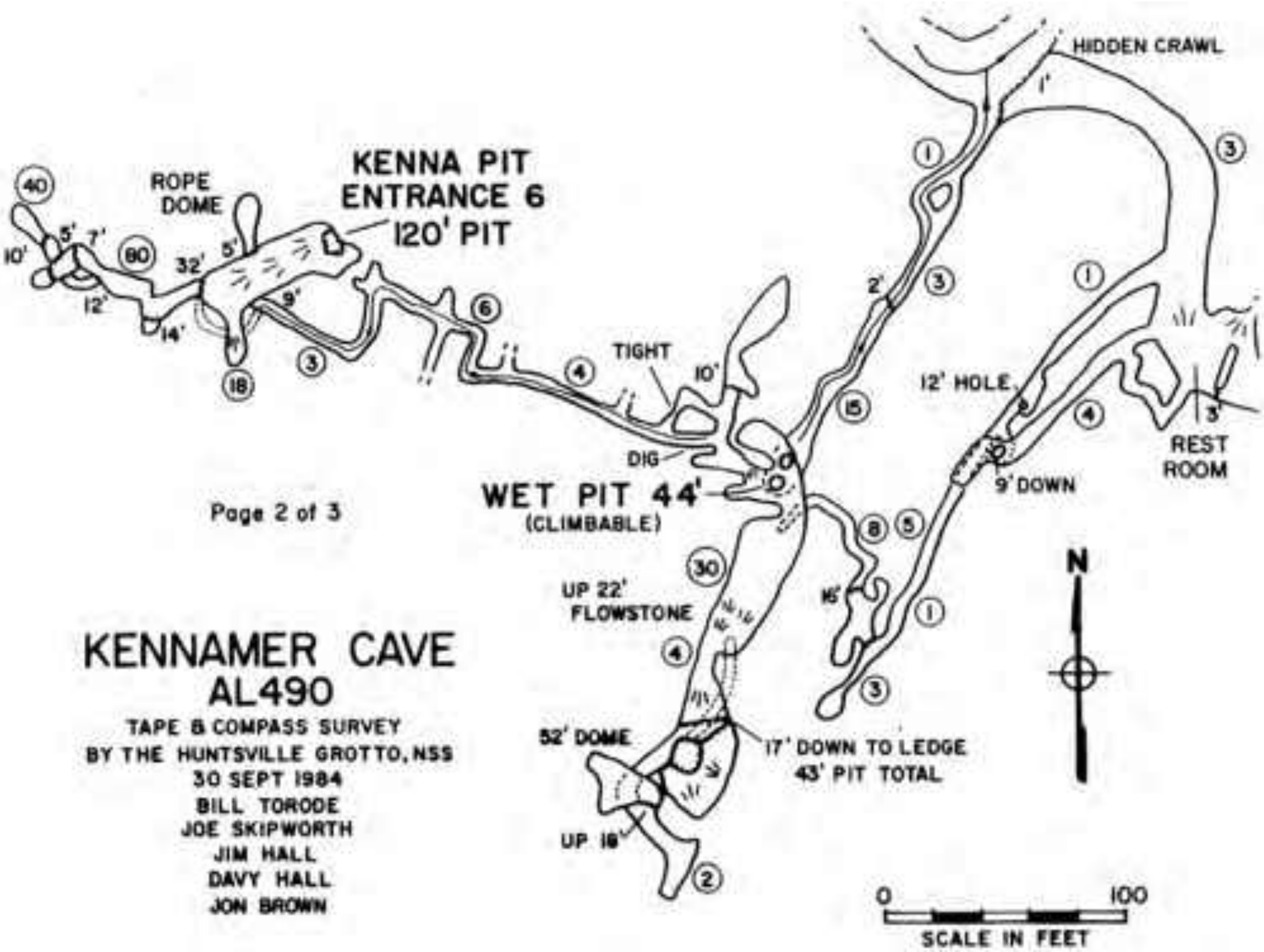
The main canyon passage in the upper level has over 500 feet of wide, extremely tall passage (100 feet in places); at the southern end is a huge breakdown block almost blocking the bottom of the passage, known as Moby Dick. A slippery climb along the side wall of the canyon will get you past Moby Dick. Beyond that, the canyon narrows but has the occasional very tall ceiling or dome along the way. A fork in the passage leads to two separate climb downs that meet up in the room below. Most people take the lower fork and arrive at the 23-foot fissure climb. It is narrow, and exposure is minimal.

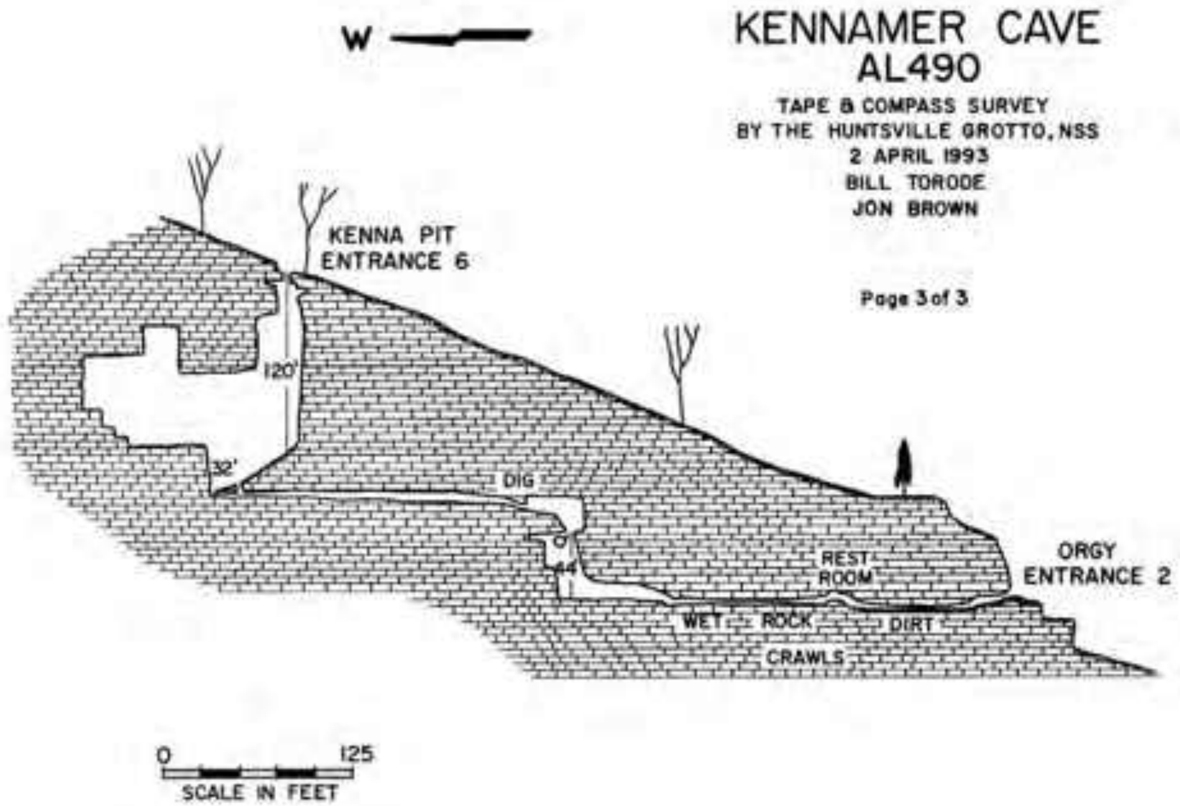
The Middle Level begins here and is the most decorated part of the cave. One dome has several very nice shield formations. Another has a beautiful set of draperies flowing down into a mini-rimstone terrace. A fantastic wall of bacon formations is nearby. There are areas of the middle level where the flowstone chokes off the walking passage and short crawls must be made to get to the next standing area. Some of the crawls have soft organic debris floors indicative of standing water. It is in these areas that one is most likely to see flooding during a heavy rain. Flotsam 15 feet up the walls has been observed after some rains.

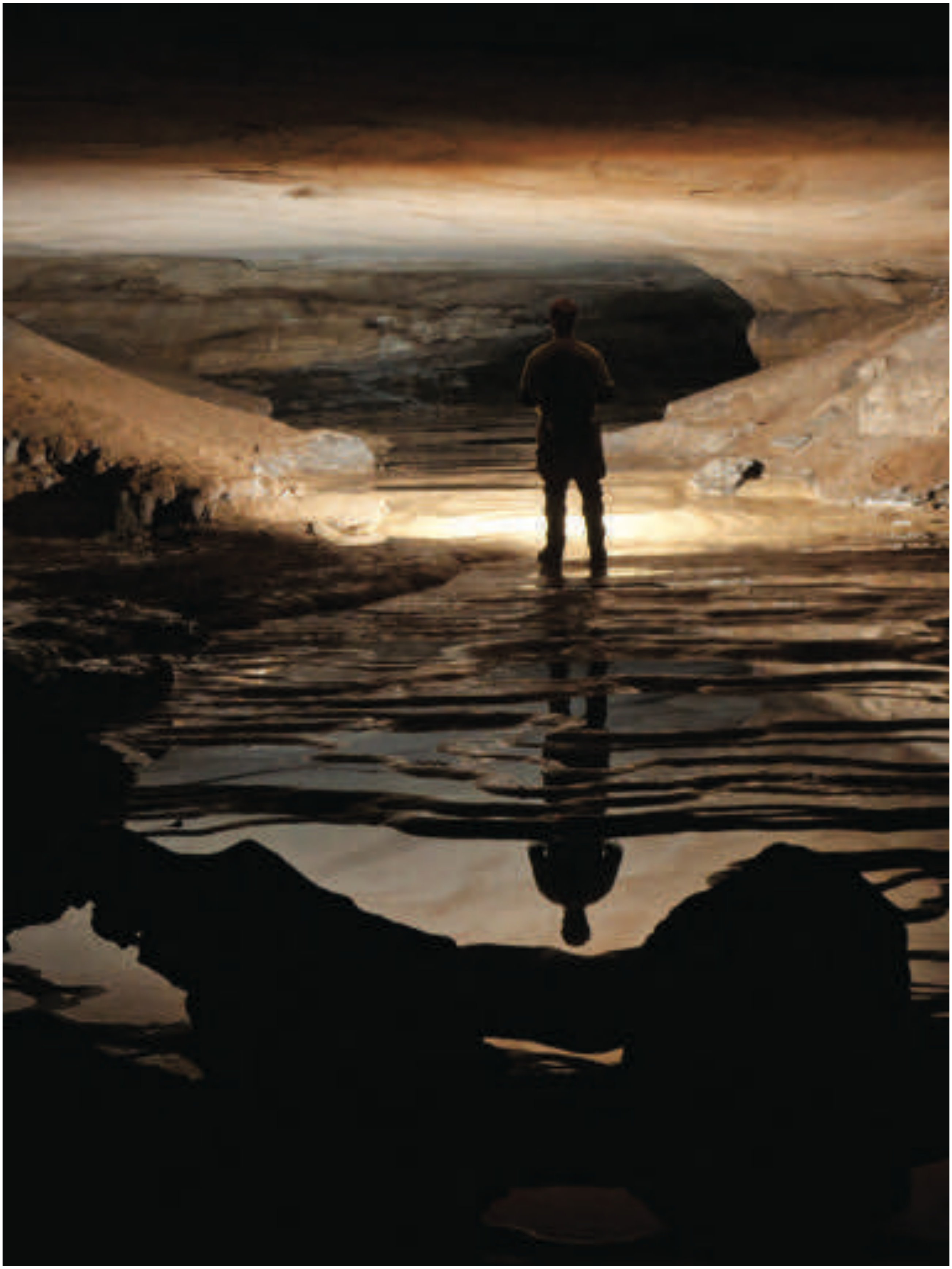
As one heads south from the wet formation areas, the passage becomes drier and taller, and more breakdown is encountered. This area is a multi-level maze, with climbs to upper loops and ledges. One encounters a dry formation area just to the north of the larger room that is the attic for the 35-foot canyon passage below. In this room is a strikingly-layered pillar next to a large hole in the floor. This hole can be rigged for rappelling down to the canyon below, or a rabbit hole 50 feet north of that pillar leads you to a part of the canyon that can be free-climbed. The rabbit hole can also be rigged.

The bottom of the 35 foot canyon begins the Lower level. Going south from the canyon, the route is generally straightforward for half the distance. It is a lot of hands and knees crawling, mostly dry but with several wet areas. A stagnant pond with occasional low air space requires getting wet up to about mid-thigh on one side. The general rule in the lower level for route-finding is to follow the air. In the summer, it will be blowing OUT the


KENNAMER CAVE
AL490
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
AUG 1978 — JULY 1979
BILL TORODE
ROGER LING
RANDALL BLACKWOOD
TOM CLELAND
DICK SEARS
ERIC BATCHELDER
MIKE EVANS
DON FRANCIS
DOWN 5'
ENTRANCE 4
ENTRANCE 1
35' CLIMBDOWN
DUG ENTRANCE 5
DOWN 7'
HIGH DOMES
BIG SLOPE
35
SAND CASTLES
BIG ROOM
MOBY DICK
DUCK UNDER
15
UP 21'
EMERALD POOL
N
CLIMB 18'
23' CLIMB
TERRY'S TOPPER
118' DOME
THE UTTER
RAIN DOME
LENGTH 12,283
PAGE 1 of 3
UPPER LEVELS
NICE 40' DOME
RAIN DOME 60'
5'
SPIRES OF WISDOM
35' CLIMB
25' CLIMB
0 500
SCALE IN FEET
SIEVE
ENTRANCE 3
POOL
DOMES
KENNA PIT
ENTRANCE 6
120' PIT
ORGY
ENTRANCE 2
44' PIT
SEE PAGES 2 & 3


HIDDEN CRAWL
KENNA PIT
ENTRANCE 6
120' PIT
ROPE
DOME
TIGHT
DIG
WET PIT 44'
(CLIMBABLE)
12' HOLE
9' DOWN
REST
ROOM
UP 22'
FLOWSTONE
52' DOME
17' DOWN TO LEDGE
43' PIT TOTAL
UP 18'
Page 2 of 3
KENNAMER CAVE
AL490
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
30 SEPT 1984
BILL TORODE
JOE SKIPWORTH
JIM HALL
DAVY HALL
JON BROWN
N
0
100
SCALE IN FEET


W
KENNAMER CAVE
AL490
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
2 APRIL 1993
BILL TORODE
JON BROWN
KENNA PIT
ENTRANCE 6
Page 3 of 3
120'
32'
DIG
44
REST
ROOM
ORGY
ENTRANCE 2
WET
ROCK
DIRT
CRAWLS
0
125
SCALE IN FEET



Limrock Blowing Cave. Photo: Amy Hinkle, Sunguramy Photography

Orgy entrance, and is an excellent guide. Where some people go wrong is a junction south of the stagnant pond where the water trickling in from the Kenna Pit entrance joins the stream crawl. The passage appears to curve left as a belly crawl, but the actual route one wants is straight ahead up the far bank. The ceiling blocks your view of this opening until you actually crawl over to it.

The big question in visiting Kennamer is whether to do it from the top-down or bottom-up. It is possible to do the cave as a purely horizontal one in going from the bottom upward. One will have to free-climb the 35-foot canyon between the lower and middle levels, and then go out the Dug Entrance at the top of the cave. The free climb is very difficult for people of small stature. Another benefit to going bottom-up is that one gets in the cave quicker, and the walk back to the car is all downhill. (Mark Ostrander, Kennamer Cave Preserve Manager)

This cave is owned by the Southeastern Cave Conservancy, Inc. Please stop by the Conservancy's booth for information on access.

Limrock Blowing (AJK 311)

Length: 14,694 feet
Depth: 27 feet

Limrock Blowing is one of the classic horizontal caves in Jackson County, Alabama and consists of a long, smooth stream tube with some formation areas and small rooms. The passages are usually dry, except during times of very heavy rainfall. During the winter, a good-sized stream can flow out of the entrance, making access impossible.

From the entrance, walk in 700 feet to where the passage tees into the main stream passage. Turn right and go upstream for 100 feet. A smaller passage branches off to the left here. You can stay drier by taking this side branch. Duck walking and crawling down this wide passage leads to a breakdown room and along the "sidewalk" back to a 70-foot dome and waterfall.

The next 1,000 feet of passage are through the Raceway, where you can really make time. This brings you to a large junction where the register is located. To the left is the Rimstone Dam Passage. Almost 600 feet back is a 50-foot dome with a small crawl, leading back another 300 feet to a breakdown area. A stiff breeze blowing out is from Pretty Well (AL 1937) which is 200 feet away. No connection has been found.

Back in the main passage at the register there is a drop of 10 feet into a deep, dark, very ominous pool of water. To the right side is an easy climb-down; cross the stream here and continue upstream into an increasingly large trunk passage. At one point the passage was measured at 120 feet wide. Pass the first breakdown mountain by walking on a ledge to the left of the stream. At the second breakdown mountain, one goes into a narrow passage to the right. Following the main stream to the end of the cave, you find water coming out of the small breakdown, with no apparent way to continue. The stream is believed to be coming from Walrus Pot (AL 2000), which is a closed cave.

This cave is owned by the Southeastern Cave Conservancy, Inc. Please stop by the Conservancy's booth for information on access.

Sauta Cave (AJK 50)

Length: 14,628 feet
Depth: 150 feet

If you are on the north side of Lake Guntersville at sunset, bring a lawn chair and camera to enjoy one of the largest bat flights in the United States, which peaks in the summer months.

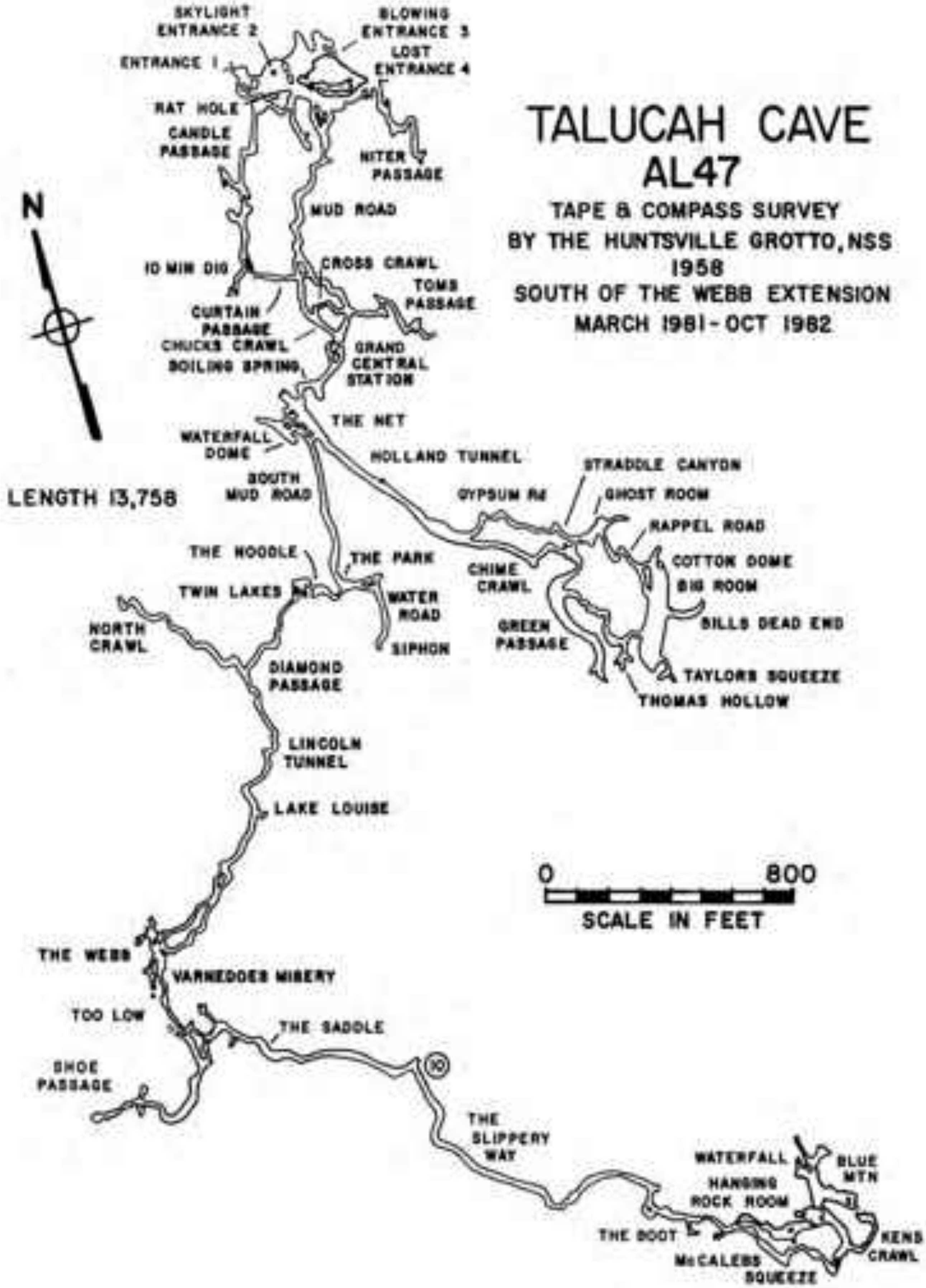
Talucah Cave (AMG 47)

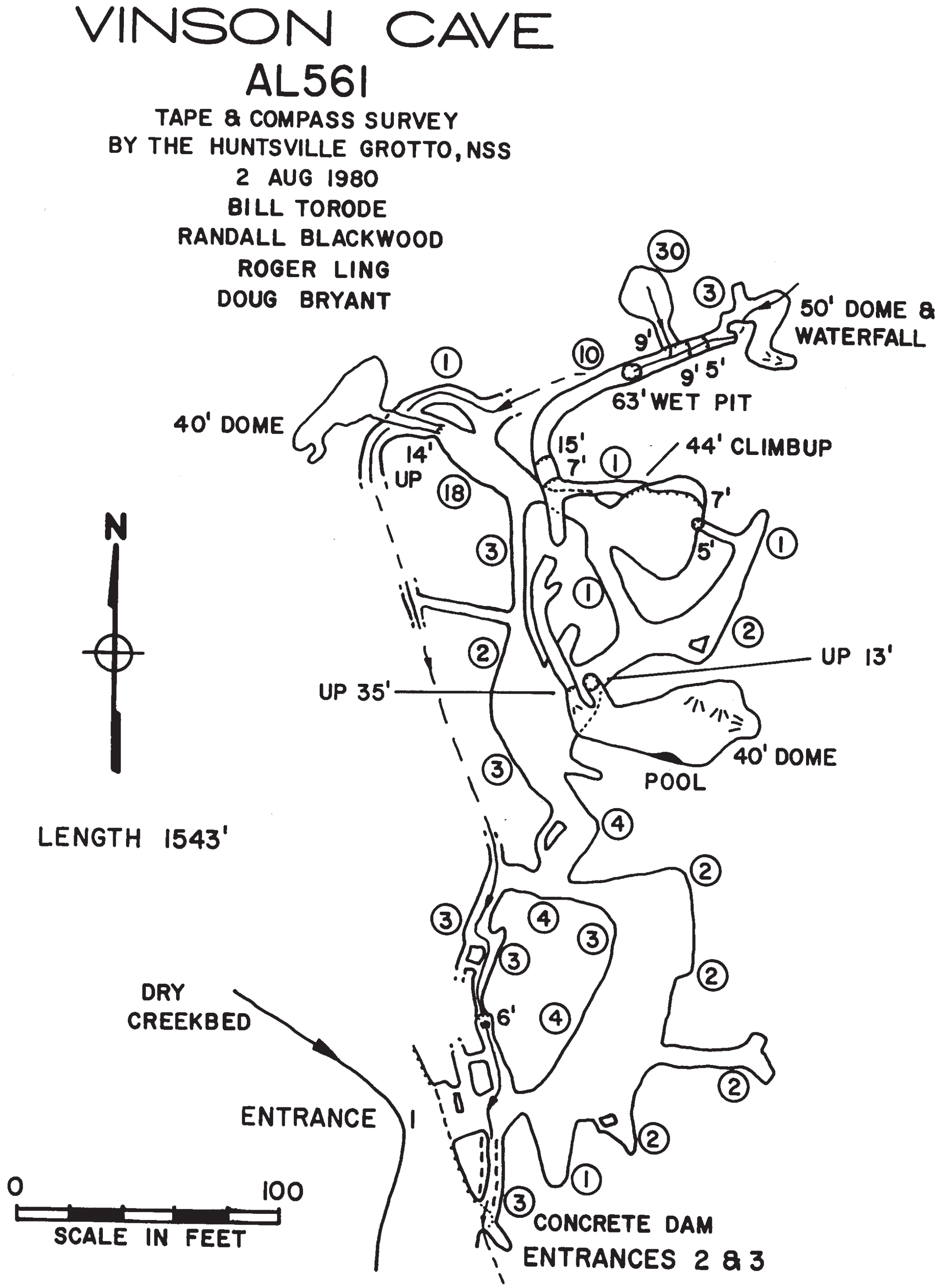
Length: 13,758 feet
Depth: 90 feet

There are several entrances to Talucah Cave, but you will want to enter through the entrance located off the pasture. The first feature you encounter is the Church Room located below the entrance pit (Entrance Two). Many years ago, this room was used to conduct church services; members entered via wooden stairs from Entrance Two, which had been blasted open to collect saltpeter.

The first part of the cave is good for beginners and families, but not necessarily so beyond Grand Central Station. Beyond Grand Central, the cave becomes a little more adventurous with crawls, more water, and the possible need to use hand lines in a few places.

Be forewarned that this can be an extremely slippery cave. The cave is not highly decorated, but if you keep your eyes open, you can see some nice fossils in the ceiling and walls. The Holland Tunnel is a popular area to take a break, as evidenced by the large amount of


TALUCAH CAVE
AL47
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
1958
SOUTH OF THE WEBB EXTENSION
MARCH 1981 - OCT 1982
LENGTH 13,758
0
800
SCALE IN FEET
N
SKYLIGHT ENTRANCE 2
BLOWING ENTRANCE 3
LOST ENTRANCE 4
ENTRANCE 1
RAT HOLE
CANDLE PASSAGE
NITER PASSAGE
MUD ROAD
10 MIN DIG
CROSS CRAWL
TOMS PASSAGE
CURTAIN PASSAGE
CHUCKS CRAWL
GRAND CENTRAL STATION
BOILING SPRING
THE NET
WATERFALL DOME
HOLLAND TUNNEL
STRADDLE CANYON
SOUTH MUD ROAD
GYPSUM Rd
GHOST ROOM
RAPPEL ROAD
THE NOODLE
THE PARK
CHIME CRAWL
COTTON DOME
BIG ROOM
TWIN LAKES
WATER ROAD
GREEN PASSAGE
BILLS DEAD END
NORTH CRAWL
SIPHON
DIAMOND PASSAGE
TAYLORS SQUEEZE
THOMAS HOLLOW
LINCOLN TUNNEL
LAKE LOUISE
THE WEBB
VARNEDOES MISERY
TOO LOW
THE SADDLE
SHOE PASSAGE
10
THE SLIPPERY WAY
WATERFALL
BLUE MTN
HANGING ROCK ROOM
THE BOOT
KENS CRAWL
McCALEBS SQUEEZE



spray paint graffiti. The Big Room is a popular destination, if it is not filled with water. It's best to allow an entire day to explore the cave.

Vinson Cave (AMD 561)

Length:	1,543 feet
Depth:	130 feet

Vinson Cave has a nice walk-in entrance and requires traversing a stream passage which is present throughout the cave. The solutional passage of the cave features flowstone, climb ups and three domes. For the adventurous, there is also a wet 63-foot pit less than 100 feet from the end of the cave. The cave has a tremendous amount of air and is hydrologically connected to Vernal Well, located northwest of Vinson Cave.

Vertical Cave Descriptions

The Sinkhole. Photo: Alan Grosse

Green Mountain:

Cooks Pit (AMD 3078)

Cooks Pit is an open-air, 135-foot pit that was discovered and first descended by Jamie Cook. A 70-foot dome is located in a passage parallel to the main shaft. However, there is no passage at the bottom of the cave.

Discovered and dug open on December 13, 1992 by Jamie Cook, Jon Brown and Bill Torode.

Green Tree Pit (AMD 3079)

The entrance is snug, but Gerald Moni would get through it. Once you clear the lip, the pit immediately bells out, and you descend a 53-foot freefall to a ledge. After crossing over the ledge, you rappel an additional 44 feet next to a wall, which is completely covered in flowstone.

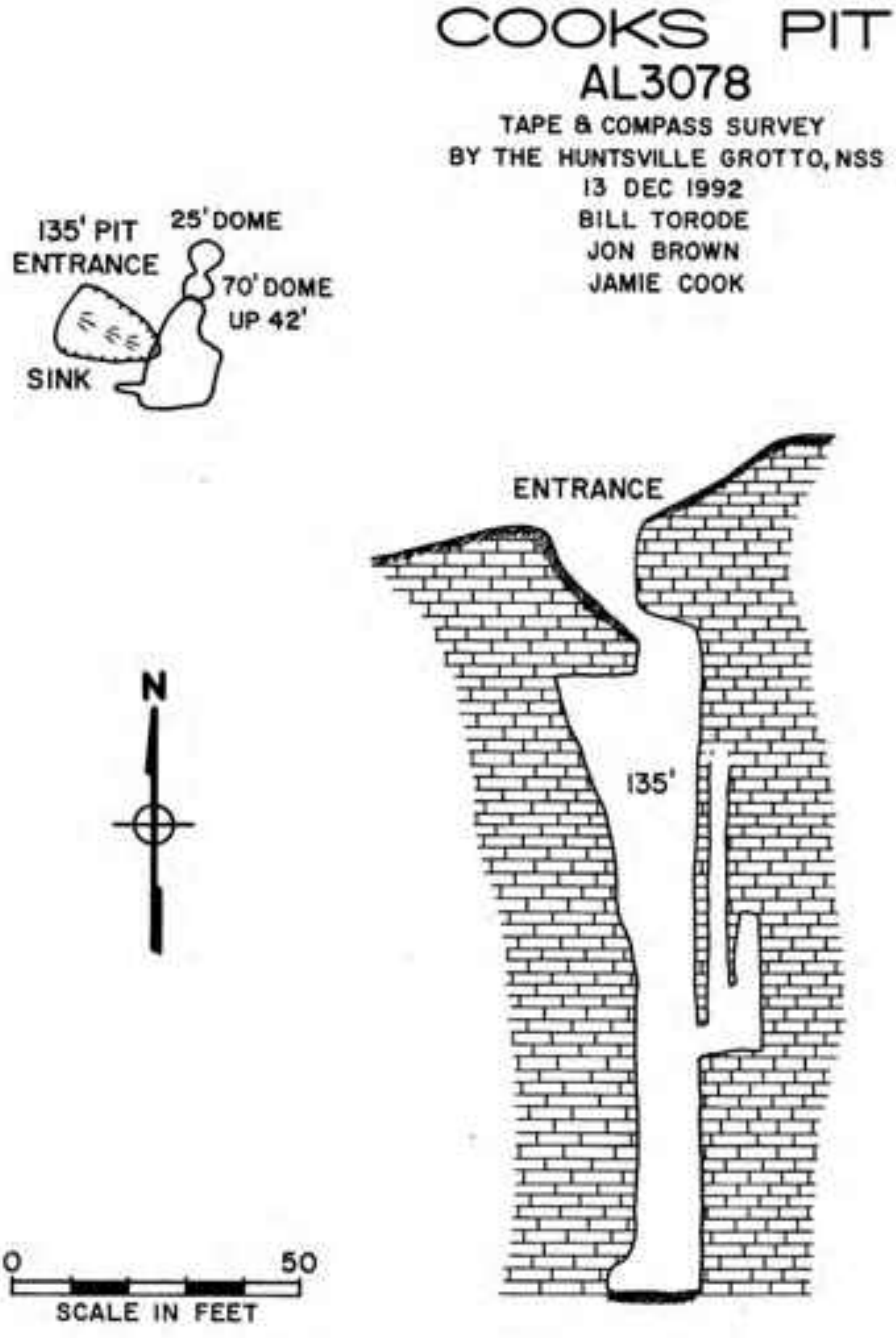
Drake Pit (AMD 3051)

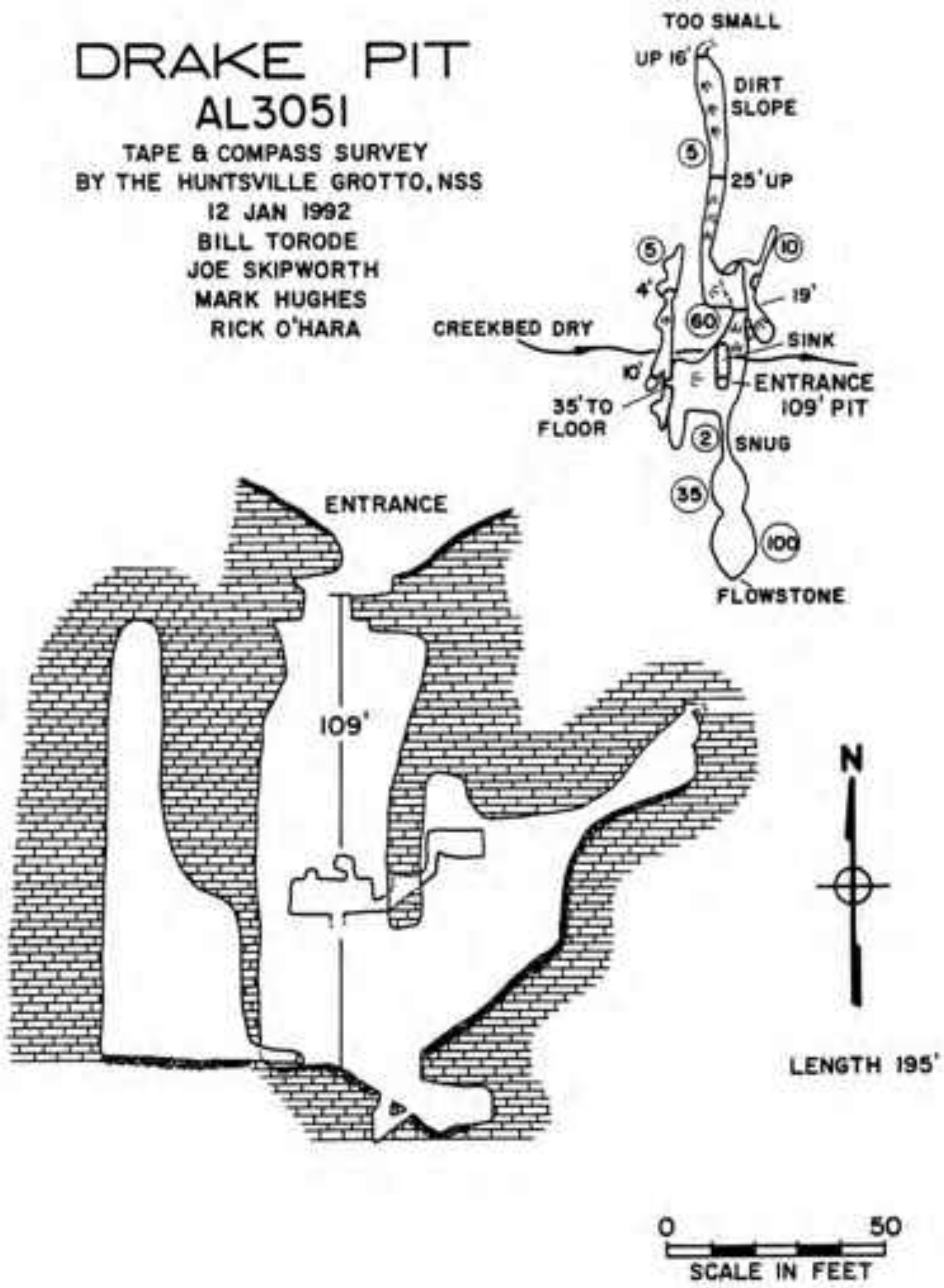
The open-air pit is located right next to an old logging road, so it's fairly easy to find, and is a nice 109-foot rappel to the immense chamber below.

Three Turkeys Plunge (AMD 3083)

A beautiful 164-foot entrance pit leads to a massive chamber with water flowing down the middle. Follow the 600 feet of passage to additional drops of 23 feet and 48 feet, as well as several nice domes.

Three Turkeys Plunge was discovered by Jon Brown, who returned with Marion O. Smith and Teresa Williams to explore the cave. As they approached the entrance sinkhole, they startled three wild turkeys and Marion joked they were three turkeys getting ready to plunge.


COOKS PIT
AL3078
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
13 DEC 1992
BILL TORODE
JON BROWN
JAMIE COOK
135' PIT
ENTRANCE
25' DOME
70' DOME
UP 42'
SINK
N
0
50
SCALE IN FEET
ENTRANCE
135'


DRAKE PIT
AL3051
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
12 JAN 1992
BILL TORODE
JOE SKIPWORTH
MARK HUGHES
RICK O'HARA
TOO SMALL
UP 16'
DIRT SLOPE
5
25' UP
5
10
4'
19'
60
CREEKBED DRY
SINK
10'
ENTRANCE 109' PIT
35' TO FLOOR
2
SNUG
35
100
FLOWSTONE
ENTRANCE
109'
N
LENGTH 195'
0
50
SCALE IN FEET

Scorpio Pit (AMD 1315)

The entrance to Scorpio Pit is located in an obvious sinkhole. A small opening leads to an 8 foot and then a 5-foot climb down before a 115-foot freefall pit is encountered (best to rig one rope for the climb downs and pit). At the bottom of the pit, a tight walking passage leads to a 100-foot dome.

The Fool's Progress: An Honest Cave (AMD 4396)

This cave is located 30 northeast of Scorpio Cave in an adjacent sinkhole and is shown on Bill Torode's map of Scorpio Cave as a lead that is too tight. The cave consists of a 7-foot climb down (hand line recommended) to a tight and awkward pit opening that is a 56-foot free drop; the vertical drop at the entrance should not be attempted by cavers who cannot descend or ascend past an 8 inch opening as a caver could easily become stuck. There are several large sandstone blocks in the ceiling that are notable after the tight squeeze, when the pit becomes a free drop. At the bottom of the entrance drop there is 75 feet of horizontal passage. Traveling in a southwest direction leads to a duck under and a 58-foot pit that is blind; a 36-foot dome is adjacent to the pit. To the northeast, a 15-foot exposed climb up leads to an 88-foot pit which is also blind. By using a 200-foot rope, the entrance pit, as well as the other pits can be rigged off the same rope. The cave is very drippy, regardless of surface conditions.

The cave entrance was a small surface hole that had to be enlarged and led to the discovery of two vertical holes that were fist sized and golf ball size.

Initial digging was begun by Mark Dickinson, Julie Schenck Brown and Julie Uselton in February 2011. Julie Schenck Brown, who primarily led the digging efforts, was joined by Mark Dickinson, Peter "Mudpuppy" Michaud and Julie Uselton on four different attempts at digging open an entrance that would allow human entry. On May 15, 2011, a final enlargement effort of the vertical entrance was accomplished and Peter Michaud, Julie Schenck Brown, Doug Moore and Julie Uselton proceeded to survey the cave.

The cave was named for Edward Abbey's *The Fool's Progress: An Honest Novel* as a reflection of the discoverers lives and pursuit to open a cave that probably would have been written off if not for the constant encouragement of each other during the four dig trips.

Youree Pit (AMD 2327)

The entrance to Youree Pit is located in an obvious sinkhole and has two small openings that lead to a broken pit that drops to depths of 84 feet, 157 feet, 184 feet and 202 feet. One 280-foot rope can rig the entire cave, although the passage below the initial 84 foot depth mark is tight. A 100+ foot dome is located at the bottom of the pit.

Monte Sano:

Skipworth Well (AMD 3330)

This is a nice 112-foot pit that has no passage at the bottom, but is worth a visit if making the hike to O'Shaughnessy Pit and Dug Hill Sink.

Lizard Hole

Lizard Hole is a 118-foot pit that leads to 60 feet of slightly muddy passage. A large amount of cave salamanders usually congregate near the entrance, which is a small, corkscrew into a ledgy chamber. The hiking trail to the cave passes through an exposed Hartselle Sandstone outcrop that is quite scenic. This cave is worth a visit if making the hike to O'Shaughnessy Pit and Dug Hill Sink.

High Point:

Askins Pit (AMD 1127)

Askins Pit is an open-air pit that is 91 feet, landing on a sloping, loose floor. The entrance drop has a narrow vertical chute along the rope line for most of the lower part of the drop. The floor goes down to a 15-foot drop-off to a lower room. Facing downhill, one can get out of the rock fall zone by going between the right wall and the lower pit, and traversing around the corner.

Blake's Hole (AMD 1128)

Located 300 feet from Askins Pit (AMD 1127) and 600 feet from High Point Pit (AMD 2500), this is a 92-foot open-air pit with no passage at the bottom.

Caswell (AMD 3237)

This cave was found by Doug Strait. The entrance is a small sink about 60-70 feet above the contact. A small hole at one end of the sink was enlarged at the top of the pit which begins as a narrow canyon. Approximately

15 feet down it bells into a large pit – there's a good place for a re-belay on the right wall which makes the drop mostly free, except for one ledge about 40 feet off the floor. The 153-foot pit is blind.

December Pit (AMD 1839)

December Pit is an open-air pit that descends 28 feet to a ledge, followed by a 76-foot drop to a narrow spot that then leads to 32-foot and 11-foot pits before terminating.

High Point Pit (AMD 2500)

The entrance, when found was no more than 4 by 8 inches, but has been dug out to dimensions of 3 feet by 3 feet. The initial 8 feet is snug, and then there is a 78-foot drop to a ledge, and below another 83-foot drop. All of this is done on one rope, so basically it is a 171-foot pit. The bottom is about 40 feet long, and up to 15 feet wide. There is a 6-foot climb up to the top of a 4-foot wide "partition." Then there is a 16-foot drop down the other side to a too narrow to fit through crack to a 20-foot pit.

Pat's Pit (AMD 2816)

The entrance was dug open and is about 1.5 by 2 feet and offsets about 3-4 feet to the top of a narrow, and twice offset, NARROW pit that is 165-feet deep. The last squeeze (40 feet off the floor) is very narrow and dips at a 45-degree angle for 4-5 feet and is below a nice flowstone area; some people would call this a second pit. At the minus 170-foot level there was about 20 feet of passage to the top of a too-tight-to-do pit of 15 feet, which, if it could be enlarged, would give a total depth of 185 feet.

The tiny hole was found January 1, 1989 by Patricia Anthony and dug open the same day by her, Paul Wojtkowski and Marion O. Smith.

Madison County:

Anniversary Pit (AMD 3300)

The entrance is located in a sinkhole and under a large slab of Bangor Limestone. A 92-foot pit leads to a small formation gallery.

Orton Cave (AMD 3301)

Located less than 500 feet from Anniversary Pit (AMD 3330), Orton Cave is a 102-foot pit with an interesting formation and a 60-foot parallel dome.

Esslinger Pit (AMD 757)

The pit has a small entrance, with a short dirt slope under a rock to the top of the pit. Looking down the pit, there is an opening on either side of a rock bridge. One side is wider than the other, but the narrow side is probably still wide enough to fit through. The pit is somewhat narrow and very irregular. The rope lands on a ledge about 30 feet up from the floor and then a canyon opens up either way below you. This passage leads to a beautiful flowstone chamber.

Located 150 feet higher in elevation than Esslinger Pit is Lost Sink, a spectacular sinkhole that is owned by The Nature Conservancy and has a well maintained hiking trail.

Equinox Pit

Equinox Pit, is a 72-foot pit inside a large sink. There aren't a lot of formations, but it's a pretty pit and a nice, free drop, once you clear the lip.

Vernal Well

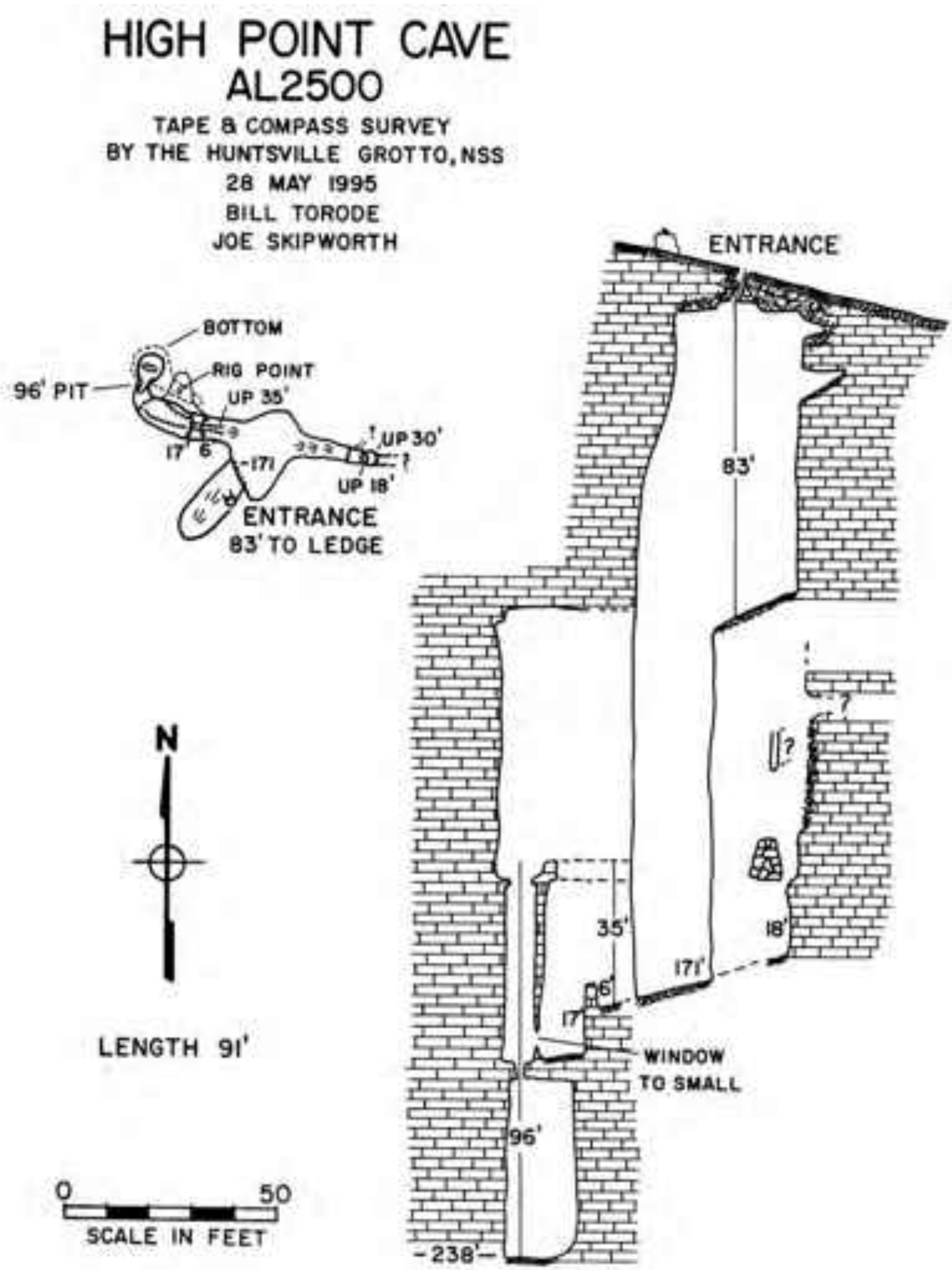
The main entrance to Vernal Well is located in a beautiful sinkhole, which if you rig to the high side, results in a 129-foot rappel. The cave, itself, has 2,800 feet of passage that leads to several in cave drops, waterfalls and domes. The cave has been dye traced to Vinson Cave (AMD 561) and Herring Cave (AMD 6), both of which are listed in the horizontal cave description section.

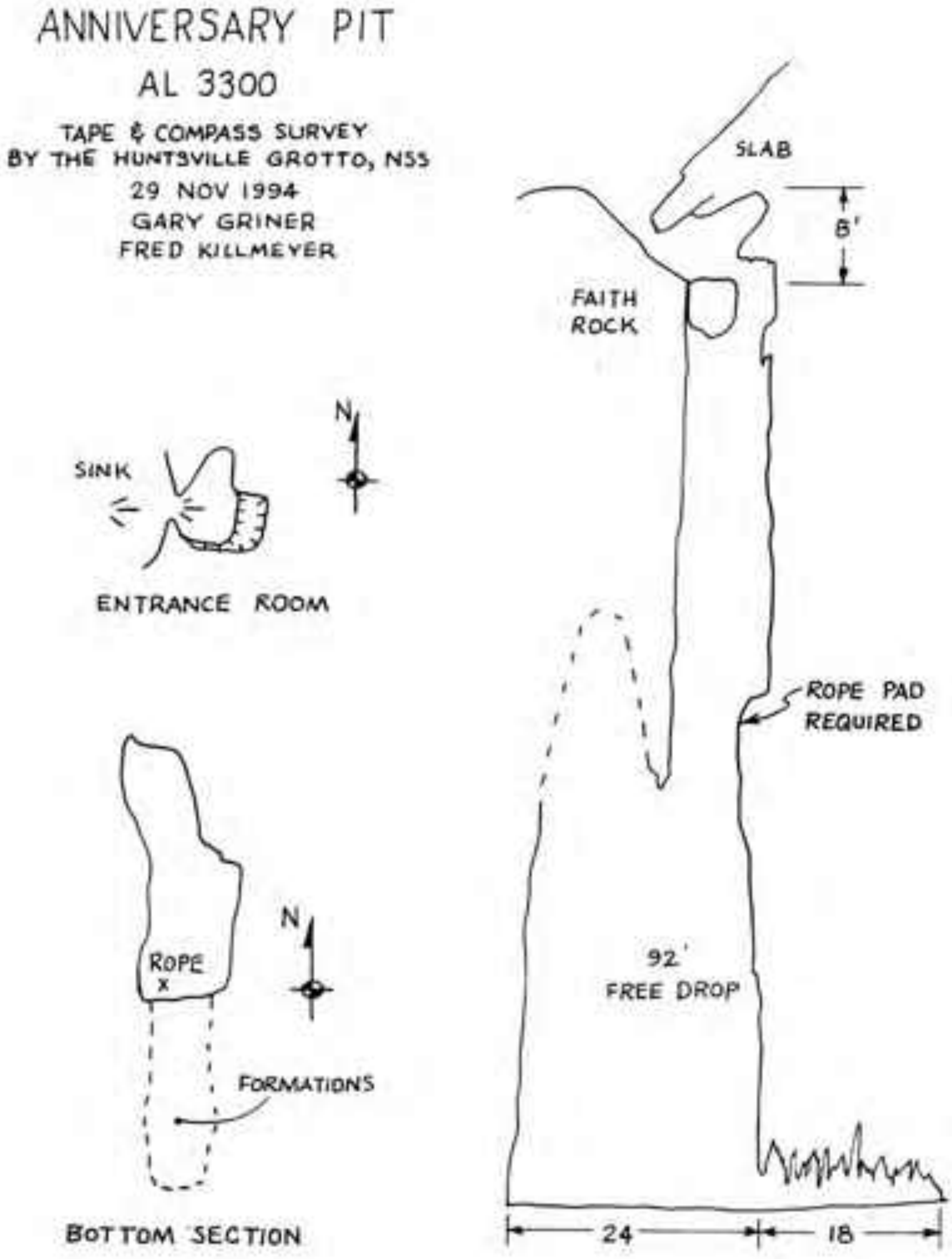
Jackson County, Alabama:

Blunder Hole (AJK 3333)

Length:	3,802 feet
Depth:	353 feet
Pits:	107, 34, 12, 14, 41, 24, 26, (13 Up, 9 Up), 25, & 17 feet

The entrance is an obscure hole below a low rock ledge on the contact bench. Downslope and through a narrow vertical spot is a small sit-up room, just beyond is a 107-foot pit, which is rigged from the surface. There are two small sharp ledges that need pads. It is a mostly free drop with a ledge about 30 feet from the floor. There is a formation pocket on this ledge. Water pours into the pit on the opposite wall, but the pit is dry.


HIGH POINT CAVE
AL2500
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
28 MAY 1995
BILL TORODE
JOE SKIPWORTH
BOTTOM
RIG POINT
96' PIT
UP 35'
UP 30'
17'
6
-171
UP 18'
ENTRANCE
83' TO LEDGE
N
LENGTH 91'
0
50
SCALE IN FEET
ENTRANCE
83'
35'
18'
171'
6'
17'
WINDOW
TO SMALL
96'
-238'-


ANNIVERSARY PIT
AL 3300
TAPE & COMPASS SURVEY
BY THE HUNTSVILLE GROTTO, NSS
29 NOV 1994
GARY GRINER
FRED KILLMEYER
SINK
N
ENTRANCE ROOM
ROPE
X
N
FORMATIONS
BOTTOM SECTION
SLAB
8'
FAITH
ROCK
ROPE PAD
REQUIRED
92'
FREE DROP
24
18

At the bottom is a short section of walking passage to a flowstone blockage (Scuba Squeeze). All the water and air goes under this very low spot (a body length), then the canyon opens to a mostly hands and knees crawl to a 4-foot climb-down followed by a 7-foot climb-down to the top of a 34-foot pit. There are two bolts on the right wall. This drop is wet and lands in a nice-sized dome complex. Left upstream leads to a 40- to 50-foot high waterfall dome.

Downstream is a stoop canyon which grades to a smaller passage with a natural bridge and some quicksand, this is followed by a 12-foot pit. Rig to a large block on the left before the pit. A stoop passage leads past several nice formations to a 7-foot sluiceway climb-down. At the bottom is a deep pool and a narrow meandering walking canyon. The passage gets narrow with some cascades and it lowers at a flowstone blockage. There is a breakdown block on the right before a hole and a crawl under the flowstone. There are several small cascades in a hands and knees tube to a large pool. On the left, up high, is a dry bypass with a V-bend in the middle. At pool level, there is a body-length crawl to a hands and knees to walking passage, then a lower passage up and over a low natural bridge. This continues under formations and flowstone in a tube, which gets larger with cascades.

The passage becomes a down-cutting, walking canyon with formations to a 14-foot pit. Rig to a large column on the left wall. This is followed by the Willies. The first is a 41-foot wet pit (one bolt on left wall over drop); at the bottom, a short hands and knees tube leads to a 24-foot wet pit (one bolt on left wall). This pit drops into a large hall with some very nice formations to the left. Down a short cascade is a wet 13-foot climb-down split by a partition. A narrow walking canyon continues to a 5-foot sluiceway climb-down with a natural bridge and pool. At the bottom, a walking canyon continues around a large vertical partition then up and over a narrow spot. This canyon ends at a flowstone infeeder.

On the left, down low, is a 20-foot long wet stream crawl (very low in places), it opens to a narrow walking canyon, which gets wider. The water disappears under a ledge along the right wall and a dry walking canyon continues but lowers just before a dry 26-foot pit. Rig to a formation breakdown block in the passage. (This is the main route to the bottom of the cave.)

By crossing over the top of this pit, a narrow canyon with some hands and knees crawls leads to 7-foot climb-down with a chert bridge at the top and pool at the bottom. The narrow canyon continues with several small climb-downs to the top of a 13-foot pit. At the bottom of the pit, a canyon continues to a 12-foot climb-down that is offset twice with very nice formations below. The walking canyon leads to a long narrow deep bathtub (waist-deep in places). This ends at an 8-foot flowstone climb up with nice formations. On the other side, a 12-foot climb-down on flowstone leads to a T-junction with a stream passage. Left (upstream) leads to several hundred feet of passage. Right (downstream) is a short crawl to a walking passage with lots of formations. There is an 8-foot flowstone climb-up on the right that leads to a very nice formation area. The stream that had disappeared enters again in a sizeable room with breakdown which is mostly cemented sandstone. The passage drops 4 feet and under a ledge on the left into a hands and knees crawl. It continues past a couple of dry cascades to a 9-foot pit with a large pool at the bottom. The rig is a marginal flake on the right wall.

A stoop canyon continues and water forms a 2.5-foot waterfall from a small tube on the right. A lower passage begins to meander as a lower water crawl leading to a low airspace. It gets a little bigger as a meandering canyon. Just beyond is a sit-up spot. There is a very tight spot beyond, which is 100 feet of low crawl with a thin film of water over flowstone. This is followed by a second, very tight spot, and the end of this route.

Back at the bottom of the 26-foot pit (having a huge water-filled pothole halfway down), a very narrow scalloped passage continues to a V-bend on the left. There is a small tube connection on the left to a point under the 7-foot climb-down. Another V-bend to the right, in a very narrow scalloped canyon, leads to a V-bend to the left. The very narrow canyon goes to a narrow 7-foot climb-down. At the bottom is a narrow spot for 15 feet to a 4-foot climb-down and very low dig. The dig is 8-feet long and low. A narrow muddy canyon continues on the other side to a low wet hog-waller. Past that, the passage becomes a slightly larger canyon. The stream re-enters the passage and the next 1,000 feet is a down gradient stream passage with a slick floor. At the point where it finally begins to get larger, beautiful formations are numerous. There is a side passage on the right with 3- to 4-foot long white soda straws and columns. This passage continues for about 200 feet to a point where digging is necessary.

The main stream passage continues to improve and there are nice formations. It ends at a 25-foot pit. The pit is narrow at the top and the rig point is a formation on the right. There is a sizeable dome room at the bottom. The water enters a too-tight crawl but there is a gravel crawl to the left that leads to a Y-junction with a small infeeder on the left. The infeeder on the left has been pushed for 200 feet and continues. To the right, at the Y and down a flowstone crawl, the passage intercepts the water and a low chert crawl continues for 25 feet to a 17-foot pit. The pit has a very tight entrance and the rig point is a massive chert ledge. The pit drops directly into the sump pool, 4-feet deep at its deepest point.

Please DO NOT park at the nearby Cave Springs Church and remember that even though the cave is on State land, you are extremely close to private landowners who will not appreciate hordes of cars or lots of noise at night.

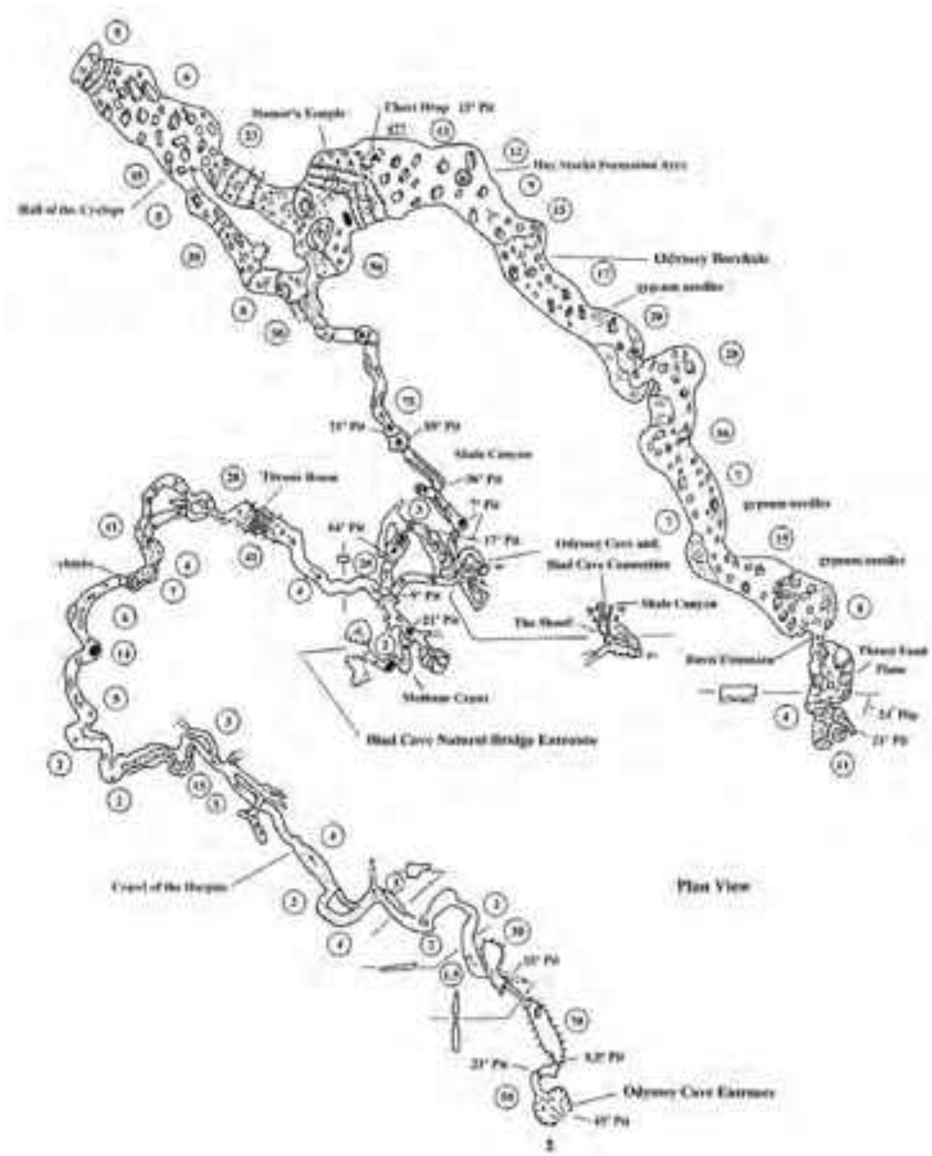
Greens Well (AJK 725)

First descended by Bill Cuddington, Green's Well is a beautiful, circular free drop of 227 feet which is very wet in winter and spring. There is 763 feet of solutional canyon passage with a 100-foot and 70-foot dome.

Neversink (AJK 197)

The classic TAG pit. Beautiful waterfalls cascade through the ferns in wet weather. Be sure to take plenty of film. The 100-foot by 40-foot hole is 162-foot deep and freefall all the way down to the large chamber at the bottom.

This cave is owned by the Southeastern Cave Conservancy, Inc. Please stop by the Conservancy's booth for information on access.



Odyssey Cave (AJK 1568)

[Alternate name: Iliad-Odyssey Cave]

Length: 9,786 feet
Depth: 477 feet

Rope lengths for the Odyssey entrance route: 120, 40, 25, 70, 70, 60 (pad this drop), 80, 40

Rope lengths for the Iliad entrance route: 50 (pad this drop), 80, 70 (pad this drop), 25, 70, 70, 60 (pad this drop), 80, 40

The entrance to the Odyssey route is a steep-walled, 40-foot-diameter sinkhole. Descend down a loose slope for about 50 vertical feet to a 20-foot pit. Rigging is scarce. Just around a corner is the next drop of 15 feet. Both pits could probably be rigged with a single 120-foot rope. Less than a hundred feet away and down a series of climbs is a third drop of 12 feet, needs a 40-foot rope. Beyond is a few hundred feet of fairly nice walking passage, then the cave drops down into a long, low stream crawl for several hundred feet. After that is a series of breakdown rooms and nozzle-like features, just keep following the water where you can, and traverse up and over a few breakdown piles where you can't. After 1500 feet or so, this route intersects the Iliad route in the complex area just below the third drop.

The Iliad entrance is located in a large ravine, and has a small natural bridge over the top of it. If water is flowing in this entrance, entering the cave would be ill-advised. Climb-down and commence crawling for about 200 feet of awkward, wet passage. The first pit you come to is about 25 feet and needs a 50-foot rope. You can use natural rigging at this drop. Continue through a narrow canyon for a few hundred feet to a 65-foot pit, with a few old rusty bolts at the top. Past drop two, follow the water around a few bends until it disappears into a leaf-filled crawl. Look to your right and climb up a mud hump into a ceiling channel. Crawl for 20 feet, and then

Jeff Moore at the pull down route in Stephens Gap, Alabama. Photo: Alan Cressler walk another 50 feet or so to a 15-foot pit. Rig a 50-foot rope to the breakdown.

Looking away from the rope, turn left and climb-down over some breakdown. Not IN the breakdown, but over the top. You will come to a parallel, muddy passage. The passage to the right leads back to the Odyssey entrance. Turn left and go 50 feet until you come to a 12-foot deep canyon in the floor, with a flowing stream at the bottom. If you traverse out across the canyon for 20-30 feet, you will find a place where you can climb down. Follow the water around a few bends until it all flows underneath a flowstone drapery. This is the Nozzle. You might want to take off your vertical gear before going through. It pops into a standing spot, and then goes through another nozzle; this one has a 5-foot drop on the other side. Hard to get back up if the water is really pounding. Go head first through the first one, then feet first through the second one.

At the bottom, continue 100 feet or so to a 7-foot pit, which needs a 25-foot rope. Past that, you will come to a spectacular white formation area and the top of a 35-foot pit. Carefully rig around a flowstone mound, but watch for the ceiling as it is very delicate! The water goes down a canyon; stay high and traverse across the canyon to a dry 50-foot pit with natural rigging and a single bolt (only accepts quick links/mallions) for a re-belay. At the bottom, the water goes down a hole. Look for a drier 25-foot drop just to the left, and rig around a large boulder back in an alcove with at least a 60-foot rope.

Then follow a nice canyon passage for a few hundred feet until the water goes down a 15-foot pit. Continue high here, traversing out over the canyon. You will come to a large ledge where an 80-foot rope can be rigged to a flowstone mound for about a 40-foot rappel to the floor. From here you can follow the water to one more pit past this, but it sucks getting to it and rigging is really scary. A 40-foot rope will rig it if you are determined. Its 300 feet down the crawl in front of you.

Before the start of the water crawl to the last pit a large flowstone slope and ledge can be seen on the left. Step up to the ledge and climb several flowstone slopes to a large mud/breakdown pile. Go right from the top of the flowstone up the slope into a large formation room. Be careful of the floor in the area as it is delicate.

Skirting around the left edge of the room and behind the large flowstone mound, one can climb/walk up the large flowstone wall on the left to the top of the room. From the top of the flowstone wall, at least 1000 feet of large borehole walking passage can be explored before ending in a breakdown pile. You can continue past the breakdown pile by climbing straight up the center of the mountain into the ceiling and turning left and climbing up near the white formations. This leads into another several hundred foot section of walking borehole before ending in a large breakdown pile.

Secret Pit (AJK 1486)

Secret Pit is a 140-foot open air pit located on the SCCI Kennamer Cave Preserve. After the initial 10 feet, it is a free-hanging drop to a relatively level and long linear chamber. There is some interesting fluting on the side walls where a seasonal waterfall splashes off a ledge.

This cave is owned by the Southeastern Cave Conservancy, Inc. Please stop by the Conservancy's booth for information on access.

Stephen's Gap (AJK 585) and Pipeside Pit (AJK 1107)

Length: 2,442 feet
Depth: 200 feet

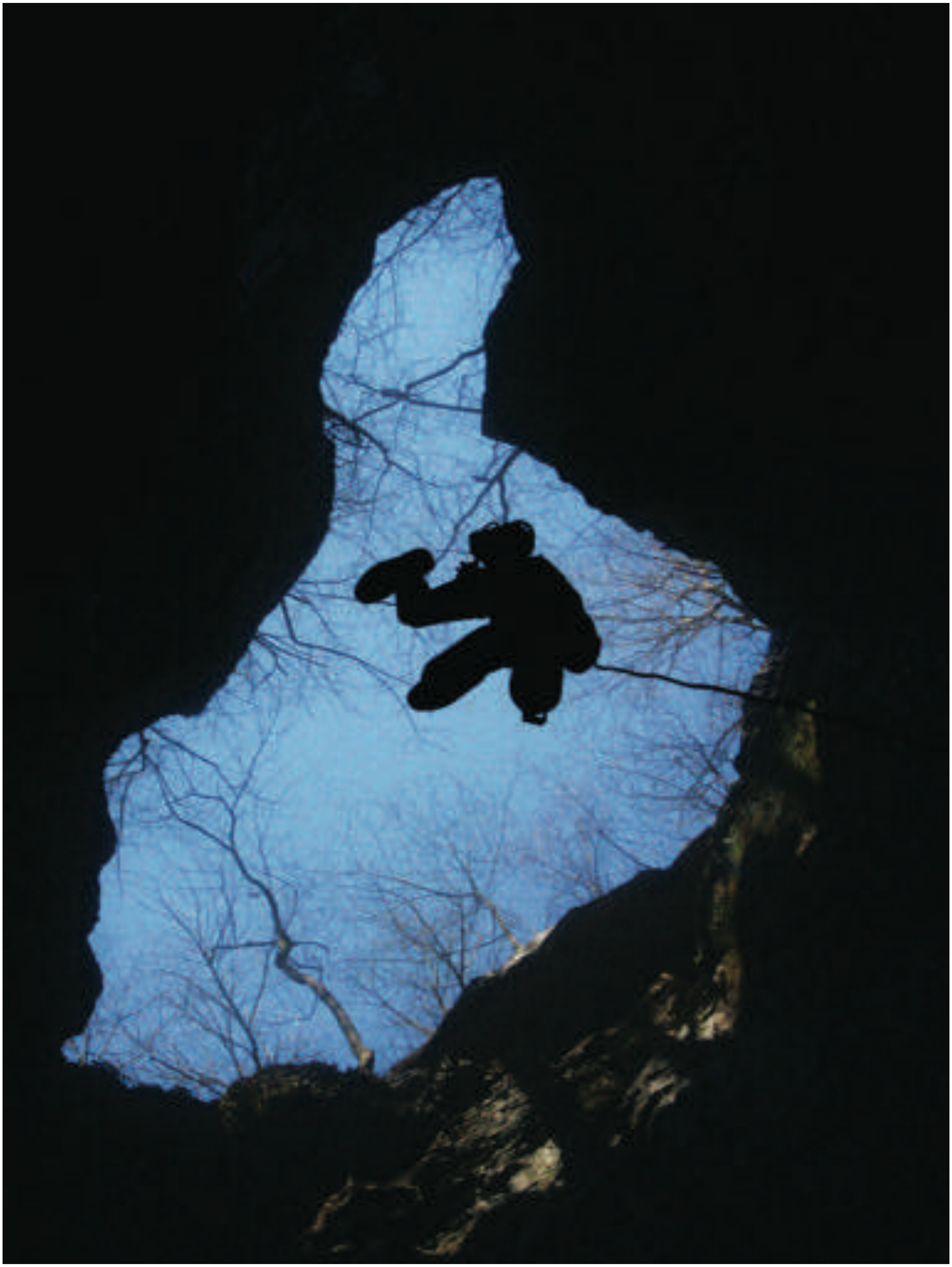
Stephen's Gap cave is a classic pit known for its beautiful 143-foot drop and walk-in entrance. This pit is great for both cavers and non-cavers—cavers can enjoy dropping the pit, while non-cavers can walk into the cave and enjoy the cool air and the view.

The entrance pit is 143 feet to the bottom of the pit, but cavers frequently swing over to a ledge and get off rope 30 feet above the floor. From this ledge, you can hike up and out Entrance One, without using a light. From the ledge, photographers can shoot across to cavers on rope, with sunlight streaming down through the waterfall behind the climbers.

Most cavers know about entrances one and two, but few have visited the other five entrances. Yes, Stephen's Gap actually has seven entrances.

Pipeside Pit is a 66-foot pit with a small formation chamber at the bottom. It is located alongside the trail to Stephen's Gap.

For information on visiting Stephen's Gap during the Convention, please stop by the Caving Information Booth.



Sean Lewis rappelling into Valhalla. Photo: Elliot Stahl

Thunder Hole (AJK 1435)

Gear:	Vertical, wetsuit; 100-, 40-, 60-, 120-, & 100-foot ropes
Length:	1,704 feet
Depth:	460 feet

Thunder Hole is a fine multi-drop cave with five pits which are known for being extremely wet during the rainy season. The 80-foot entrance pit leads to a series of climb downs to a 22-foot pit. Beyond this is a room with two crawlways leading off. Take the right-most crawl and corkscrew down a few short climbs until you rejoin the main stream. Follow the water through a few hundred feet of wet crawling passage to the third drop of 46 feet. The next pit of 95 feet is only a short distance away - this one can be a rope-eater, so bring an extra-long rope pad. At the bottom, 500 feet of walking passage leads to the final 66-foot pit and a sump pool. Each of the four in-cave drops has at least two bolts at the top for rigging. The entire cave can be dangerous in high-water conditions.

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Valhalla (AJK 691)

Length:	5,197 feet
Depth:	279 feet

Around 1960, one of Huntsville's old-time cavers, Tom Sawyer, checked out a sink called the Neverhole on the Mud Creek quad. Tom just missed finding Valhalla. Five years later, a farmer led a group of Huntsville and Nashville cavers down the side of Crow Mountain into Goshen Hollow, to the edge of a deep pit. Larry McLennan was given the honor of being the first to descend, because it was through his efforts that the pit was discovered. Richard Schreiber and Kirk Holland wrote an account of the discovery in the *Georgia Underground*. The pit was named Valhalla, after the warriors' heaven of Norse mythology.

In April of 1967, a trail was cleared to the pit in preparation for the NSS Convention. At this time, the pit was measured on the low side with a 300-foot steel tape. The pit measured 227 feet. Through the years, various out-of-state cavers would ask about parts of the cave, which didn't seem to be on the map, which was done in 1966 by Mitchell, Cole, and Wyman.

In April 1970, John Minor from Birmingham and Bill Torode from Huntsville headed for Valhalla to start a remap. On this trip the virgin Megadome was discovered in the very back of the cave. After three trips, the cave passages totaled 4814 feet.

Val Cave, AJK 973 is located 100 feet higher and 500 feet away from Valhalla. The air and the stream in Val Cave run into Valhalla, but after 335 feet the passage becomes too low to get through. All of Goshen Hollow drains underground and exits at Kyles Spring, 5 miles from Valhalla. Part of this underground system is the 3-mile long Carns Cave, AL 441.

In June 1984, Valhalla was the scene of a tragic accident. A large section of wall fell, killing two Georgia Tech cavers. A cenotaph to Samuel Crawford and Mike Hanebaum is located near the entrance. Despite this tragedy, Valhalla is truly a classic and one of the most scenic entrances in the world.

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Tabby Cavendish traversing a canyon passage in No Cave, AL. Photo: Elliot Stahl


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HUNTSVILLE, ALABAMA