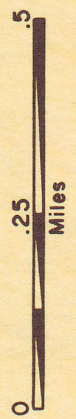


- 1. Cyprus Bend Park
(camping, registration)
- 2. V.F.W. Hall
- 3. County Fairgrounds
(RV hookups)
- 4. Civic Center
- 5. Presb. Church Aux. Hall
- 6. Hotel Faust
- 7. Krause's Cafe
- 8. River Restaurant
- 9. Wursthalle



Wilkommen !

WELCOME TO NEW BRAUNFELS !

Cavers from all over Texas, on behalf of the Texas Speleological Association, welcome you to New Braunfels and to the karst of Texas.

The underlying theme of this year's National Speleological Society Convention is diversity. The schedule of the week's activities is as varied as it is full. Field trips, sessions, workshops, special programs, contests, and parties provide something of interest for everyone. This year traditional convention activities are supplemented by several special events which emphasize the character of Texas caving. Among these are a full-day session on Cave Exploration, an afternoon program on caving in Mexico, a symposium on Texas and Mexico karst, an evening bat-flight watch, and several evenings of rip-roaring social functions in true Texas style!

Most of you have come a long way to be with us. We want you to experience our caves and our way of caving, but perhaps most of all, we hope that each of you will have the opportunity to see old friends and make many new ones. With this in mind, we invite you to indulge in as much of our program as you possibly can. We guarantee that you'll be glad you did.

The 1978 NSS Convention staff has spent a great deal of time over the last year and a half putting together this program. Our investment can only be rewarded by seeing each of you have the best NSS Convention experience ever. Seek us out if you have any problems, needs, or desires. It's your convention, so have at it!

Ernst H. Kastning, Program Chairman,
on behalf of the 1978 NSS Convention
Committee and Staff

"Conventions are something a lot of people leave behind when they attend one."

-Quotable Quotes, *Reader's Digest*,
January, 1976, p. 144.

Convention Staff

STEERING COMMITTEE

Co-chairmen	Ronald G. Fieseler, J. Michael Walsh
Secretary-Treasurer	Pamela Lynn
Program, Sessions, Scheduling	Ernst H. Kastning
Registration	Karen Kastning
Campground	Blake Harrison
Construction	Peter Strickland
Entertainment and Contests	Andy Grubbs, Pamela Lynn

STAFF

Publicity	Karen Kastning, Ernst H. Kastning
Public Relations	Ronald G. Fieseler, J. Michael Walsh, Ernst H. Kastning, Karen Kastning
Publications	
Convention Guidebook	Ronald G. Fieseler, James Jasek, Mimi Jasek
Editors	
Program Editors	Ernst H. Kastning, Karen Kastning
Geology Excursion Guidebook Editor	Ernst H. Kastning
Printing and Production	
Conventiongram	Terry Raines, Jean Jancewicz, James Reddell, Ronald G. Fieseler, Gil Ediger
Embroidered Patches	Margaret Hart, Bill Steele
Session Chairman	Ernst H. Kastning
Workshop Moderators	see Schedule of Events
Photo Salon	see Schedule of Events
Map Salon	Ed Herel
Local Caving Trips	Jan Knox
Mexico Caving Trips	Scott Harden
Geology Excursion Leaders	Craig Bittinger
Biology Fieldtrip Leaders	Ernst H. Kastning, Jan Knox, Thomas M. Byrd
Cave Diving Trips	William R. Elliott, Robert W. Mitchell
Events	Wayne Russell
Natural Bridge Caverns	Ernst H. Kastning, Jan Knox, Orion Knox
Speleolympics	Maureen Cavanaugh
Vertical Contests	Bill Cuddington, Pete Strickland
Four-wheel Drive Contest	Dwight Deal
Cave Ballad Contest	Bill Zarwell
Congress of Grottoes Chairman	Mike Dyas
Hotel and Restaurants	Margaret Wright
Child Care and Babysitting	Maggie Allison
Book Sales	Jimmy Clements
Vendor Liason	Jack Ralph
Campground Vendor Services	Kathy Walker
Security	Paul Self
Chili Cookoff	Doug Symanck, Sherri Symanck
Howdy Party	Ruth Darilek, Donna Klier, Alicia Gale
Banquet	
Chefs	Jon Everage, Fred Paschal
Arrangements	Alicia Gale, Donna Klier
Beverages	Bob Oakley
Firewood	Peter Strickland
Campground Maintenance	Frank Sodek
Campground Facilities	John Gale
Campground Cleanup	Dave Persha
Troubleshooter	Greg Passmore

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1978 NSS Convention Program edited and layed out by
Ernst H. Kastning and Karen Kastning, June 1978.

Summary Schedule of Events

	9	10	11	12	1	2	3	4	5	6	7	8
	Morning				Lunch	Afternoon	Afternoon	Afternoon	Dinner	Dinner	Evening	Evening
JUNE 17	CAVING TRIPS											
Saturday	CAVING TRIPS											
18	SUNDAY											
19	MONDAY											
20	TUESDAY											
21	WEDNESDAY											
22	THURSDAY											
23	FRIDAY											

Schedule of Events

INTRODUCTION

The following schedule may be used to keep up with the week's activity at a glance. Sessions and all events are listed chronologically, giving the times and location. Some events run concurrently with others and some care must be taken to select those events you wish to attend. The large number of sessions and events has made some conflicts unavoidable; however, the Convention Committee has attempted to minimize these.

The schedule summary for the entire week on page 6 should be used in conjunction with the itemized schedule below. Individual paper titles and authors are listed under each session. The time for each paper is noted. The number in parentheses following the title and author is a unique number keyed to the corresponding summary in the Abstracts section of the program. Workshops, Luncheons, Special Exhibits, and Fieldtrips are described in detail elsewhere in the Program.

The following abbreviations are used to designate locations of events. The city map on page 2 shows how to find these convention facilities.

CC	Civic Center	FG	Fairground
AH	Presbyterian Church Auxiliary Hall	WH	Wursthalle
AHG	Presbyterian Church Auxiliary Hall Gymnasium	CG	Campground
VFW	VFW Hall	RR	River Restaurant

SATURDAY, JUNE 17

All day PRECONVENTION FIELDTRIPS TO WILD CAVES - see bulletin board at Registration Pavilion

SUNDAY, JUNE 18

6:30 am - GEOLOGY FIELD EXCURSION TO CAVES AND KARST OF THE SOUTH-EASTERN EDWARDS PLATEAU - reservations required, meet at Registration Pavilion at 6:30 am *sharp!*
11:00 pm

All day PRECONVENTION FIELDTRIPS TO WILD CAVES - continued

4:00 pm - ? CAMPGROUND FESTIVITIES - see Special Events section of Program for details.

MONDAY MORNING, JUNE 19

- 8:00 - 11:00 BOARD OF GOVERNORS OPENING SESSION (Open Session), VFW
- 8:30 - 12:00 BIOLOGY SESSION I, CC. Chairman: *William R. Elliott*
- 8:30 coffee
- 8:45 Greetings and introduction, *William R. Elliott*
- 9:00 Subterranean aquatic fauna of the Edwards Aquifer in Texas as indicated by samples from wells and springs. *Glenn Longley* (1).
- 9:30 A remarkable amphipod crustacean fauna from the artesian well in San Marcos, Texas. *John R. Holsinger* (2).
- 10:00 Status of the troglobitic blind catfishes, *Trogloglanis pattersoni* and *Satan eurystomus* in Bexar County, Texas. *Henry Karnei* (3).
- 10:30 coffee
- 10:45 The development of diversity in Texas cave salamanders. *Samuel S. Sweet* (4).
- 11:15 The fauna of Hawaiian lava tubes. *Francis G. Howarth* (5).
- 11:45 lunch - see Biology Section Luncheon below.
- 11:00 - 12:00 BOARD OF DIRECTORS MEETING (Open to NSS Directors only), VFW

MONDAY AFTERNOON, JUNE 19

- 12:00 - 2:00 CAVE BALLAD LISTENING, AH, Chairman: *William Zarwell*
- 12:00 - 2:00 BIOLOGY SECTION LUNCHEON, RR
- 2:00 - 5:00 BIOLOGY SESSION II, CC, Chairman: *William R. Elliott*
- 2:00 A photographic survey of the Mexican cave fauna. *Robert W. Mitchell* (6).
- 2:30 Zoogeography of the cave fauna of the Yucatan Peninsula. *James R. Reddell* (7).
- 3:00 How food type determines community organization in caves. *Thomas L. Poulson* (8).
- 3:30 coffee

- 3:45 Competition as an organizing factor in a community of cave associated salamanders. *D. Craig Rudolph* (9).
- 4:15 Bat management in the United States: a survey of legislative actions, court decisions, and agency interpretations. *Thomas Lera* (10).
- 4:45 The New Melones Cave harvestman transplant. *William R. Elliott* (11).
- 2:00 - 5:00 SPELEOLYMPICS, CG, Chairman: *Maureen Cavanaugh*
- 2:00 - 3:30 CAVE RESCUE WORKSHOP, VFW, Chairmen: *Rick Rigg* and *Dan Smith*
- 3:30 - 5:00 EXPLOSIVES APPLICATIONS WORKSHOP, VFW, Chairmen: *Doug Medville*, *Chuck Hempel*, *Barry Baumgardner*, *Robert Thrun*, and *Dick Sanford*

MONDAY EVENING, JUNE 19

- 5:00 - ? HOWDY PARTY AND FEED, FG
- Mexican-style meal. Food and drink included in registration fee.
- Band: The People's Choice, from Austin Texas.

TUESDAY MORNING, JUNE 20

- 8:00 - 12:00 GEOLOGY SESSION, CC, Chairman: *A. Richard Smith*
- 8:00 Glaciation and karst geomorphology in Schoharie County, New York. *John E. Mylroie* (12).
- 8:30 North Carolina Coastal Plain caves. *Lindsey V. Maness* and *Cato O. Holler* (13).
- 9:00 A statistical comparison of joint, straight cave segment, and photo-lineament orientations. *Charles Barlow* and *Albert E. Ogden* (14).
- 9:30 Water balance, mass balance, and time scales for cave system development. *William B. White* (15).
- 10:00 break
- 10:15 Cavern development via H₂S dissolved in hot spring and natural gas field waters. *R. Mark Maslyn* (16).
- 10:45 Hydrogeology of the Spring Mountains, Nevada. *John W. Hess* (17).

11:15 Alpine karst of the Marble Mountains Wilderness. *Mike Sims* (18).

11:45 Speleogenesis in the Bermuda Islands. *John E. Mylroie* (19).

12:15 lunch - see Geology and Geography Section Luncheon below.

8:15 - 12:00 CAVE CONSERVATION SESSION, AH, Chairman: *Tom Strong*

8:15 Introduction. *Tom Strong*.

8:30 Cave conservation in the United States. *George Huppert* (20).

9:00 Repairing broken cave formations. *Martin Wiggins* (21).

9:30 Restoration of a speleothem - a case history. *John Tinsley* (22).

10:00 break

10:15 The Virginia Commission on Cave Conservation and Use of Caves. *John Wilson* (23).

10:45 Cave resources and the archaeological record: some additional conservation analogues. *Mark Grady* (24).

11:15 Discussion; other reports, if any.

9:00 - 10:30 CAVE PACKS WORKSHOP, VFW, Chairman: *Bill Steele*

10:30 - 12:00 ACUPRESSURE MASSAGE WORKSHOP, VFW, Chairman: *Elaine Hackerman*

TUESDAY AFTERNOON, JUNE 20

12:00 - 2:00 CAVE GEOLOGY AND GEOGRAPHY SECTION LUNCHEON, RR

12:00 - 2:00 WOMEN IN CAVING SECTION LUNCHEON, RR

2:00 - 5:00 CONGRESS OF GROTTOS, CC, Chairman: *Mike Dyas*

2:00 - 5:00 WOMEN IN CAVING SESSION, AH, Chairman: *Doris Haarr*

2:00 Introduction and comments. *Doris Haarr*

2:15 Clothing designs. *Sue Sundstedt* (25).

2:45 Discussion.

2:00 - 3:30 COMPUTER APPLICATIONS WORKSHOP, VFW, Chairman: *Robert Thrun*

3:30 - 5:00 STEREO PHOTOGRAPHY WORKSHOP, VFW, Chairman: *Keith Heuss*

TUESDAY EVENING, JUNE 20

6:00 - 10:00 NATURAL BRIDGE CAVERNS SPECIAL TOURS* (Geology and History of Exploration) Leaders: *Ernst H. Kastning, Jan Knox, and Orion Knox*. - See Special Events section of Program for details and directions to the cave.

6:00 - 10:00 BRACKEN CAVE BAT FLIGHT WATCH* Leader: *Robert W. Mitchell*. - see Special Events section of Program for details and directions to the cave.

*These two trips can be combined since they are within walking distance of one another.

WEDNESDAY MORNING, JUNE 21

8:00 - 12:00 TEXAS AND MEXICO KARST SYMPOSIUM, CC, Chairman: *Ernst H. Kastning*

8:00 The Edwards Story (film). *The Edwards Underground Water District* (26).

8:30 Cavern development, stream piracy, and aquifer evolution in the Edwards Limestone, south-central Texas. *C.M. Woodruff and Patrick L. Abbott* (27).

9:00 Natural Bridge Caverns. *Jan Knox* (28).

9:30 $^{230}\text{Th}/^{234}\text{U}$ dates on Texas speleothems - implications regarding ^{14}C ages of Late Pleistocene bone deposits. *Russell S. Harmon* (29).

10:00 Solution scarp and related fissure system, Yeso Hills, Culberson County, Texas and Eddy County, New Mexico. *A. Richard Smith* (30).

10:30 Development of gypsum karst features of La Hoya Alardín area, Zaragoza, Nuevo León, México. *Thomas M. Byrd and Walter R. Helmick* (31).

11:00 Late Pleistocene deer tracks in Cueva de las Pájaros, Oaxaca, México. *Roy Jameson* (32).

11:30 Some paleo-biological implications for speleochronology. *Merydith D. Turner* (33).

8:00 - 12:00 CAVE MANAGEMENT SESSION AND SECTION MEETING, AH, Chairman:
Ron Zuber

- 8:00 Introduction. *Ron Zuber*.
- 8:15 Cave management at Buffalo National River: Phase II. *Milford R. Fletcher, L. Lorraine Mintzmyer, and Keith A. Whisenant (34)*.
- 8:45 Cave management - the Virginia experience. *John Wilson (35)*.
- 9:15 Natural Bridge Caverns. *Clara Wuest Heidemann (36)*.
- 9:45 Status report on the 1978 National Cave Management Symposium. *Milford R. Fletcher (37)*.
- 10:00 coffee
- 10:30 Cave Management Section business meeting. *Ron Zuber (presiding)*.

8:00 - 12:00 VERTICAL CAVING SESSION AND SECTION MEETING, AHG, Chairman:
Kyle Isenhardt

- 8:00 Introduction. *Kyle Isenhardt*.
- 8:15 Choosing between rope and ladder when minimizing weight is important. *Kirk MacGregor (38)*.
- 8:40 Logistical considerations in deep multi-drop cave systems. *Bill Steele (39)*.
- 9:00 Sawed-off Gibbs ascenders. *Kirk MacGregor (40)*.
- 9:15 Flaring pin holes in Gibbs cams. *Kirk MacGregor (41)*.
- 9:30 Update on P.M.I. rope products. *Richard Schreiber, Steve Hudson, and Larry Caldwell (42)*.
- 9:50 papers to be arranged
- 11:00 break
- 11:15 Vertical Section business meeting.

WEDNESDAY AFTERNOON, JUNE 21

1:00 - 6:30 MEXICO PROGRAM, CC, Chairman: *Bill Stone*

- 1:00 Opening statement. *Bill Stone*.
- 1:05 Introduction to the Association for Mexican Cave Studies. *William H. Russell* (43).
- 1:20 Early exploration in Mexico. *T.R. Evans* (44).
- 1:40 The exploration of Sotano de Joya de Salas. *Orion Knox* (45).
- 2:00 Black holes. *Jeff Horowitz* (46).
- 2:20 The caves of Acatlan. *Andy Grubbs* (47).
- 2:40 A new area - San Joaquin. *Roy Jameson* (48).
- 3:00 High elevation caving - the Xilitla Plateau. *Patty Mothes* (49).
- 3:20 The caves of Yucatan. *James Reddell* (50).
- 3:40 Mexican caving groups. *Jorge Ibarra* (51).
- 4:00 intermission

Part II - The Big Projects

- 4:20 Caving in Chiapas. *Bill Steele* (52).
- 4:40 The river caves of Zoquitlan. *Jerry Atkinson* (53).
- 5:00 Purificacion area. *Peter Sprouse* (54).
- 5:20 Cueva de Diamante. *Mark Minton* (55).
- 5:40 La sistema de Chichicasapan-Atischalla. *Peter Lord* (56).
- 6:00 The Huautla Project. *Bill Stone* (57).

WEDNESDAY EVENING, JUNE 21

- 7:00 - 8:30 CLASSIC CAVING CARRIAGE CONCOURSE, CG, - see Exhibits section of Program for details.
- 7:00 - ? CAMPGROUND PARTY AND FESTIVITIES, CG - see Special Events section of Program for details.

THURSDAY MORNING, JUNE 22

- 8:00 - 12:00 BIOLOGY FIELDTRIP TO ARTESIAN SPRING, Leaders: *William R. Elliott and Glenn Longley* - meet at Registration Pavilion, see Fieldtrips section of Program for details.
- 8:00 - 12:00 EXPLORATION SESSION I, CC, Chairman: *Bill Steele*
- 8:00 Introduction. *Bill Steele*.
- 8:15 Spring Cave, Colorado. *Jim Pisarowicz* (58).
- 8:45 Bigfoot Cave, Marble Mountain Wilderness, California - a new United States depth record. *Steve Krutson and Mike Sims* (59).
- 9:15 Exploration of the Friars Hole System, West Virginia. *Doug Medville* (60).
- 10:15 break
- 10:30 Explorations in the Silvertip Cave System, Montana. *Mike McEachern* (61).
- 11:00 Explorations in the Janus Pit System, Stone County, Arkansas. *Mike Warshauer* (62).
- 11:30 TAG Area multi-drop caves. *Marion Smith* (63).

THURSDAY AFTERNOON, JUNE 22

- 1:00 - 5:00 EXPLORATION SESSION II, CC, Chairman: *Bill Steele*
- 1:00 The world's longest glacier cave: a decade of exploration in the Paradise Ice Cave, Mount Rainier, Washington. *William R. Halliday, Charley Anderson, and Mark Vining* (64).
- 1:30 The exploration of the Scapegoat Mountain Karst, Scapegoat Wilderness, Montana. *Jim Chester* (65).
- 2:00 Caves of White Ridges, Vancouver Island, B.C., Canada. *Paul Griffiths* (66).
- 2:30 break
- 3:00 Flint-Mammoth Cave System, Kentucky - progress since the connection of 1972. *Cave Research Foundation personnel* (67).

- 3:30 The 1978 NSS Expedition to the Astraka Plateau, Greece. *Wil Howie* (68).
- 4:00 The world's longest underwater cave. *Sheck Exley* and *Ned DeLoach* (69).

THURSDAY EVENING, JUNE 22

- 7:00 - ? PHOTO SALON NIGHT, CC
- Vertical Sessions Awards. *Bill Cuddington*.
- 1978 Map Salon Awards. *Jan Knox*.
- 1979 NSS Convention Preview, Pittsfield Massachusetts. *Robert Addis* and *Kevin Downey*.
- Photo Salon Slide Presentation. *Ed Herel*.
- Special Movie: The Mystery of the Mococho Abyss. *Karel B. Absolon*, narrator (70).

FRIDAY MORNING, JUNE 23

- 8:00 - 12:00 BOARD OF GOVERNORS CLOSING SESSION (Open to all), VFW, - continues into afternoon.
- 8:00 - 12:00 CAVE DIVING SESSION AND SECTION MEETING, VFW and CG, Chairman: *Tom Cook*
- 8:00 Lucayan Caverns: cave dive extraordinaire. *Gene Melton* (71).
- 8:30 Construction of cave diving equipment. *Tom Cook* (72).
- 9:15 Cave diving demonstrations, equipment display, and discussion at the Guadalupe River in campground.
- 9:00 - 12:00 SOCIAL SCIENCES SESSION AND SECTION MEETING, CC, Chairman: *Bruce Sloane*
- 9:00 Introduction. *Bruce Sloane*.
- 9:10 Black cavers. *John M. Wilson* (73).
- 9:30 Minorities in caving. *Janet L. Fitzsimmons* (74).
- 9:50 Discussion, questions on first two papers.
- 10:10 break

10:20 The great solo caving myth. *John M. Wilson* (75).

10:50 break

11:00 Social Sciences Section business meeting.

FRIDAY AFTERNOON, JUNE 23

12:00 - 2:00 AMERICAN SPELEAN HISTORY ASSOCIATION BUSINESS MEETING AND LUNCHEON, RR

12:00 - 2:00 REGIONS LUNCHEON, RR

2:00 - 5:00 BOARD OF GOVERNORS' CLOSING SESSION (Open to all), VFW, - continued from morning.

2:00 - 5:00 HISTORY SESSION, CC, Chairman: *Jeanne Gurnee*

2:00 Physicians as cave explorers. *Karel B. Absolon* (76).

2:15 The Olmec cave paintings of Juxtlahuaca Cave and their history. *William R. Halliday* (77).

2:30 Dr. Call at Mammoth Cave. *Harold Meloy* (78).

2:45 The skeleton of Luray Caverns, Virginia. *Russell Gurnee* (79).

3:00 A discussion of graphic techniques as related to spelean history. *Emily Davis Mobley* and *William F. Mobley* (80).

3:15 Caves of fantasy revisited. *Ernst H. Kastning* (81).

3:30 Speleothem growth rate measured from a stalagmite in Admiral's Cave, Bermuda. *Thomas M. Iliffe* (82).

3:45 Scientific, popular, romantic, and enterprising interests in Ball's and Howe's Caves, Schoharie County, New York, 1831-1900. *Ernst H. Kastning* (83).

4:00 George Washington Cave, Jefferson County, West Virginia. *Jack H. Speece* (84).

2:00 - 5:00 SAFETY AND TECHNIQUES SEMINAR, AH, Chairman: *Don Davison, Jr.*

2:00 Review of basic caving techniques.*

3:00 Review of intermediate caving techniques.*

4:00 Review of advanced caving techniques.*

*see summary of seminar in Abstracts section of Program (85).

5:00 - 6:00 SNAKEBITE TREATMENT, CC, Special Program

First aid for snakebite. *Dr. Thomas G. Glass (86).*

FRIDAY EVENING, JUNE 23

7:00 - ? BANQUET, WH, Emcee: *Gil Ediger*

Serving begins at 7:00 pm. Food and drink included in registration fee.

Program follows dessert:

Presentation of National Speleological Society Awards

Banquet Speakers:

The breccia-filled caverns of the Transvaal, South Africa:
insights on the ecology of early hominids.

Dr. C. Garth Samson, Professor of Anthropology,
Southern Methodist University, Dallas, Texas.

The long, lonely leap. *Colonel Joseph W. Kittinger, Jr.*,
Headquarters Twelfth Air Force, Bergstrom Air Force
Base, Austin, Texas

THE 1978 NSS CONVENTION STAFF WISHES YOU A SAFE AND ENJOYABLE
TRIP HOME. WE WILL SEE YOU NEXT YEAR IN PITTSFIELD,
MASSACHUSETTS !

Workshops

The purpose of the workshop at the NSS Convention is to provide a means of communication among cavers interested in a particular aspect of caving or speleology. The workshop has a moderator who leads discussion and in certain cases organizes an agenda of topics. Workshops are generally informal, with participants providing input from their experiences and deriving information from others. Several workshops have been scheduled this year and are listed here. These will be held at the VFW Hall. Persons wishing to hold additional workshops may use the small meeting rooms alongside the auditorium of the Presbyterian Church Auxiliary Hall and should announce new workshops in the *Conventiongram* and on the bulletin boards at the Registration Pavilion. This years scheduled workshops are:

CAVE RESCUE

Problems of cave rescue within the caving community will be discussed. Cavers may meet with representatives of the National Cave Rescue Commission to work toward solving these problems. Rick Rigg and Dan Smith are moderators.

EXPLOSIVES APPLICATIONS

Explosives are commonly used in the search for new caves and in exploration. New entrances can be opened in this manner and constrictions in passageways may be effectively enlarged with proper blasting techniques. Topics to be covered in this workshop include:

Descriptions of basic explosives - dynamite, gel-based explosives, Tovex, etc.

Detonation methods - electric caps, det cord, etc.

Basic fundamentals of blasting - handling of explosives, wires, batteries, storage of same.

Applied cave blasting: topics will include mud capping, opening of bedrock joints and bedding planes, removing boulders.

Advanced blasting topics: underwater demolitions, multiple charge shots, use of time delay caps, trenching.

Sinkhole enlargement/cave entrance opening - large blasts, the use of Ammonium Nitrate/Fuel Oil (ANFO) to enhance basic explosives and move large quantities of earth.

Cave blasting and the law: Obtaining explosives, federal forms to be filled out, day use vs. overnight use.

Doug Medville, Chuck Hempel, Barry Baumgardner, Bob Thrun, and Dick Sanford are moderators and speakers.

CAVE PACKS

The contents and organization of packs taken into caves are discussed. Of particular interest are packs used in extended underground stays, such as where climbing and camping equipment is ferried into deep systems for trips lasting several days. Bill Steele, moderator.

ACUPRESSURE MASSAGE

This is an introduction to acupuncture called acupressure massage. If time and interest permit, a second part on oil massage will be held as well. Elaine Hackerman is moderator.

COMPUTER APPLICATIONS

Computers and calculators are widely used in speleological studies. Survey data and other information can be efficiently manipulated and calculation errors are minimized in this manner. New programs and techniques are discussed. Robert Thrun is moderator.

STEREO PHOTOGRAPHY

The common camera can be used to take good quality stereo photographs of caves and surface features. Stereo 35mm slides can be projected by using two projectors and polarized lenses. These techniques and others will be discussed. Keith Heuss is moderator.

Luncheons

Five buffet luncheons are scheduled during the week. These will take place at the River Restaurant (see city map, page 2) from 12:00 noon to 2:00 pm. Luncheons encompass business meetings of NSS Sections. The Biology Section luncheon is on Monday, June 19; the Cave Geology and Geography and Women in Caving Sections luncheons are on Tuesday, June 20; and the American Spelean History Association and Regions luncheons are on Friday, June 23.

In order to provide the River Restaurant with the correct attendance figures, it will be necessary to sign up for the luncheons twenty four hours in advance at the bulletin boards at the Registration Pavilion.

Special Events

This year's Convention schedule includes many special events in addition to scientific, educational and business meetings. Some of these, such as the Howdy Party, Photo Salon, and Banquet are traditional. However, each year the Convention generally has events that are in keeping with the geographic flavor of the Convention site or are provided as new and fresh ideas to enliven the program. This year is no exception. The 1978 program has *many* new additions. Some of these are outlined below and others may be found elsewhere in this Program.

SUNDAY CAMPGROUND FESTIVITIES

Impromptu campground festivities begin on Sunday, June 18, at 4:00 pm at Cypress Bend Park. Various events may be watched and entered, including the Chili Cookoff, jalapena eating contest, armadillo races, and cowchip tossing contests. The Lone Star sound truck will provide music.

HOWDY PARTY AND FEED

The traditional Howdy Party and Feed will be held Monday night, June 18, beginning at 6:00 pm at the Comal County Fairgrounds (see city map, page 2). The Howdy Party meal will feature Mexican cooking, some of it prepared by Texas cavers. Ample beer and soft drinks will be provided free to all Convention registrants during the meal and party.

The Howdy Party will feature the People's Choice, one of the best country and western bands from Austin, Texas (Austin is known as "Nashville West" in country music circles). The People's Choice regularly play at Austin's most popular country and western nightclubs. Music begins at 8:00 pm. We anticipate this to be one of the finest Howdy Parties ever.

NATURAL BRIDGE CAVERNS SPECIAL TOURS AND BRACKEN CAVE BAT FLIGHT

Tuesday evening, June 19, is cave night. Convention attendees will have the opportunity to visit two superlative caves located approximately 17 miles west of New Braunfels.

Special guided tours of Natural Bridge Caverns will begin at 6:00 pm at the visitor center. These will be without charge to registrants. Attendees may choose from (1) a special tour on the history of discovery and exploration led by Orion Knox, one of the original discoverers, or (2) a geology tour led by Jan Knox and Ernst Kastning. Natural Bridge Caverns, with about 7,000 feet of survey, ranks eleventh on Texas' long cave list and contains some of the largest and best decorated passages found in Texas. Discovered in 1960, the cave was developed and opened to the public in 1964. Descriptions of the cave, its geology, and maps may be found in the 1978 NSS Convention Guidebook and the Geology Excursion Guidebook (available at the Registration Pavilion).

The nightly bat flight from Bracken Bat Cave will be observed during this same evening. Special arrangements have been made with Natural Bridge Caverns, the owners of Bracken Bat Cave, and the landowner of the intervening land to allow walking on a single trail between the two caves. Please stay on the trail!

The Bracken Bat Cave bat flight is one of the largest in the United States, surpassing that of Carlsbad Caverns. At times over 40 million bats are estimated to reside in Bracken Bat Cave, despite its short extent (see map in 1978 NSS Convention Guidebook). During the flight Dr. Robert Mitchell of Texas Tech University will talk about the bats and their behavior. Bats begin leaving the cave around dusk and the flight remains strong until 11:00 pm or so.

It is suggested attendees go to either cave and then switch off to alleviate the congestion a large group would impose at one location.

To reach the parking area for this event please follow these directions. It is imperative that carpools be used, so invite your friends or campsite neighbors to join you. From the traffic circle in the city center of New Braunfels, travel west on Route 46. Signs to Natural Bridge Caverns are easily followed. About 3.7 miles from the traffic circle, turn left onto Route 1863. Go 8.6 miles and turn left onto Natural Bridge Caverns Road. Go an additional 2.3 miles to the Natural Bridge Caverns gate. Signs and Convention personnel will direct you to the parking area and to the caves.

TEXAS AND MEXICO KARST SYMPOSIUM

A special geology symposium on Texas and Mexico Karst and caves will be held on Wednesday morning, June 21, from 8:00 am to 12:00 noon in the Civic Center Auditorium. Seven papers will be presented on a variety of topics following a movie on the cavernous Edwards Aquifer. See papers 26 through 33 in the Abstracts section of the program.

MEXICO PROGRAM

Two exciting programs will share the spotlight in this year's sessions: the Mexico Program and the Exploration Session. The Mexico Program will be held from 1:00 to 6:30 pm on Wednesday, June 21, in the Civic Center Auditorium. Fourteen slide presentations on exploration in one of the world's most exciting and spectacular caving areas will be presented by cavers who have worked these caves. The first part of this program is an historic overview and travelog of Mexican caving. The second part reviews the big projects presently in progress. Depth and length records are continually being set in this dynamic area. Previews of these talks can be found in papers 43 through 57 in the Abstract section of this program.

WEDNESDAY EVENING CAMPGROUND FESTIVITIES

A campground party is scheduled for Wednesday evening. It begins with the Classic Caving Carriage Concourse (see Exhibits). Late events include a midnight movie, *Chao*, and the baptism of Oztotl. Other happenings are bound to materialize as well.

EXPLORATION SESSION

A full-day program on significant recent cave exploration will begin at 8:00 am, Thursday morning, June 22, in the Civic Center Auditorium. Invited papers from across the United States and Canada will be presented. Included in the session will be the longest and deepest caves in the United States, the world's longest underwater cave, the world's longest glacier cave, and several recent major and spectacular discoveries (see papers 58 through 69 in the Abstracts section of the program).

This session should be one of the most popular events of the Convention. Exploration is an integral part of the American caving scene. We hope that this exciting program is the first of a series to be continued at future NSS Conventions.

PHOTO SALON NIGHT

Thursday evening, June 22, is devoted to the slide (transparency) portion of the Thirty-first International Salon of Speleological Photographic Art. The evening program will begin at 7:00 pm in the Civic Center Auditorium.

Awards will be presented to the winners of the vertical contests and the 1978 Map Salon. This will be followed by a slide preview of the 1979 NSS Convention to be held in Pittsfield, Massachusetts. The photo salon is next, with a showing of all accepted color transparencies and speleological movies. Awards in these categories will be announced at this time.

The final highlight of the evening will be a showing of the film "The Mystery of the Macocha Abyss". This historic movie, produced in Czechoslovakia by Karel Absolon, is one of the earliest examples of speleocinematography. Only one copy of this nitrate-base 35mm film now exists. It was shown at the Seventh International Speleological Congress in Sheffield, England in 1977, where it received wide acclaim. Karel Absolon's son, Dr. Karel B. Absolon, will provide narration. A summary of the film is given in paper 70 in the Abstracts section of this program.

POISONOUS SNAKE BITES

The threat of being bitten by a poisonous snake, particularly a rattlesnake, is very real to cavers in Texas and the southwest. Nearly every Texas caver has at one time or another encountered a rattlesnake while caving. The physical damage to human tissue resulting from a bite or its mistreatment is

grossly underestimated by most people. Dr. Thomas G. Glass, Jr. M.D., a renowned specialist on snakebites, gave this lecture at a recent Texas Speleological Association Convention. Several cavers suggested the talk be given at the 1978 NSS Convention. Dr. Glass' lecture, which is accompanied by slides and movie, will astound anyone not familiar with rattlesnake bites. It begins at 5:00 pm Friday, June 23, in the Civic Center Auditorium.

Caution: This program contains surgically explicit material. If you are offended by the sight of an opened body you should not attend.

BANQUET

The 1978 NSS Convention comes to an official close with the annual Banquet beginning at 7:00 pm, Friday, June 23, at the Wursthalle (see location map on page 2). The Banquet is included in the price of registration. Texas cavers and chefs Jon Everage and Fred Paschal will prepare a Texas-style barbeque. The Banquet program begins with presentation of the National Speleological Society Annual awards and culminates with the banquet speakers.

This year we have two guest speakers. Leading off will be Dr. C. Garth Samson, Professor of Anthropology at Southern Methodist University, who will speak on the significance of hominid remains in breccia-filled caverns in the Transvaal dolomites of South Africa. Dr. Samson's talk is summarized in paper 87 in the Abstracts section of this program.

To close our Banquet we shift our emphasis from speleology to the broader realm of exploration. Our final speaker is Col. Joseph W. Kittinger, Jr. of the United States Air Force, who will talk about his record high-altitude parachute jump from a stratosphere balloon at 102,800 feet. This record, set in 1960, still stands today. A summary of this talk is given in paper 88 in the Abstracts section of this program.

Biographies of Dr. Samson and Col. Kittinger follow their abstracts.

Exhibits

THIRTY-FIRST INTERNATIONAL SALON OF SPELEOLOGICAL PHOTOGRAPHIC ART

Monochrome and color prints accepted for competition in the 1978 Photo Salon will be on display in the foyer of the Civic Center from Monday through Friday. Those entries receiving the blue-ribbon Merit Award and green ribbon Honorable Mention will be so marked, as will be the Best Color Print and Best Black and White Print. Color transparencies will be projected in the Civic Center main auditorium Thursday evening, June 22 (see schedule). This is traditionally the best attended Convention event.

1978 CAVE MAP SALON

Speleo-cartography has long been considered a form of art as well as a method of accurately presenting the graphic form of a cave or cavern. The 1978 Cave Map Salon is being conducted to foster interest in speleo-cartography, allow an exchange of methods, ideas and techniques between draftsmen, and promote an overall improvement of cave maps.

Map entries may be submitted at the Convention Registration desk no later than 12:00 noon Tuesday, June 20, 1978. The entry fee is fifty cents per map with a limit of two (2) map entries per person. Both entries and fees should be submitted at the Convention Registration desk.

All maps will be on display during the Convention at the Civic Center, Monday through 12:00 noon Friday. Judging will be Tuesday with the awards presentation prior to the Photo Salon Thursday evening. Ribbons for first place and honorable mention will be designated in each category in addition to a best of salon prize, and other special awards.

Maps can be picked up at the Civic Center Friday from 12:00 noon to 2:00 pm, or Saturday morning at the Convention Registration desk.

GENERAL MAP EXHIBIT

Exploration is a major aspect of speleology, one which we all share. It is also one of the underlying themes of the 1978 NSS Convention. Cave maps are a tangible result of exploring and charting new caves. Yet, few maps are published in a timely manner, when the excitement of discovery is still fresh. For this reason, we have solicited maps for general display, in addition to those entered in the 1978 Map Salon. Any interesting cave map will suffice and those wishing to display them may simply hang them on available wallspace in the Civic Center. The best locations are (1) along walls in the foyer, (2) entry way to the main auditorium, and (3) along the walls of the main auditorium. Maps may be attached to walls with masking tape. Tape will be available at the counter in the foyer. *Do not hang maps with pins or tacks* as this is not allowed by the Civic Center management. Maps should be displayed early in the week and taken down around Friday to provide maximum time for viewing. Speakers in the Mexico Program and Exploration Session are encouraged to display maps to supplement their talks.

SPELEOLOGY ON POSTAGE STAMPS - A PHILATELIC EXHIBIT

Wayne W. Russell, Jr. of Austin, Texas will be displaying his international collection of postage stamps depicting caves and cave-related subjects such as karst, cave rock art, bats, and the like. This collection is one of the most complete of its kind in the United States.

NSS SAFETY AND TECHNIQUES COMMITTEE EXHIBIT

The NSS Safety and Techniques Committee will sponsor a display showing safety aspects of caving equipment. Examples of failed equipment are included. The exhibit may be viewed at the Civic Center.

CLASSIC CAVING CARRIAGES CONCOURSE

Vintage and contemporary caving vehicles of unusual design or merit will be on exhibit at the campground beginning at 7:00 pm on Wednesday, June 21. Vehicles possessing eccentric or elaborate equipment, decorative embellishments, and profuse scars of service are desired for display. We particularly need Macho Trucks. Anyone having any such vehicle at New Braunfels is urged to drive it to the entrance area of the campground around 7:00 pm and park it neatly along side another, forming a row. These may then be photographed and viewed by the less fortunate who do not own a classic caving carriage.

Fieldtrips

WILD CAVE TRIPS

Pre-convention trips may be made Saturday and Sunday, June 17-18, to designated caves in the Edwards Plateau area. Consult the Convention Guidebook for descriptions.

Local cave trips will be going out during the Convention week. Information and sign-up sheets can be found on the bulletin board at the Registration Pavilion. Scott Harden is coordinator for local trips.

Cavers interested in Mexico caving trips are asked to see Craig Bittinger for arrangements, information, and advice. He will be in Bustamante Canyon, Mexico as liaison for pre-convention trips and will advise cavers who desire to make post-convention trips to Mexico. Anyone planning to go to Mexico *must* bring proof of U.S. citizenship (birth certificate or passport). If you plan to take your vehicle across the border, you *must* bring your title and registration papers.

GEOLOGY EXCURSION

The geology excursion to the caves and karst of the southeastern Edwards Plateau will board buses promptly at 6:30 am Sunday, June 18, at the Registration Pavilion. Only those who have pre-registered and reserved seats will be able to go. Consult the Geology Excursion Guidebook for details about the route and places to be seen of the trip. The excursion will return to the campground around 11:00 pm. Ernst H. Kastning, Jan Knox, and Thomas M. Byrd are leaders. See also the Tuesday night geology tours of Natural Bridge Caverns in the Special Events section of this program.

BIOLOGY FIELDTRIPS

William R. Elliott and Glenn Longley will lead and coordinate several biology fieldtrips in the Convention area throughout the week. A trip to artesian springs is scheduled for Thursday morning, June 22. Check the Registration Pavilion bulletin board and *Conventiongram* for further details on this and other biology trips. See also the notes on the Bracken Bat Cave bat flight watch Tuesday night in the Special Events section of this program.

CAVE DIVING TRIPS

There will be a cave diving trip to Jacob's Well in Hays County on Wednesday, June 21. Diving trips to other caves may also be arranged. Interested and qualified cave divers may obtain additional information and arrange trips by contacting Wayne Russell, Tom Cook, or Gene Melton. Check the Registration Pavilion bulletin boards and *Conventiongram* for further details.

Contests

Traditional NSS Convention contests will be held throughout the week.

VERTICAL CONTESTS

The vertical (rope climbing) events will begin on Monday at the Presbyterian Church Auxiliary Hall. Check there and at the Registration Pavilion for details on entering. Bill Cuddington, Pete Strickland, and other members of the NSS Vertical Section will be in charge.

SPELEOLYMPICS

The 1978 Speleolympics will take place on Monday afternoon, June 19, beginning at 2:00 pm at the campground. Maureen Cavanaugh will direct this event.

FOUR-WHEEL DRIVE CONTEST

The four-wheel drive contest will be held on Tuesday afternoon, June 20. Check the *Conventiongram* and bulletin boards at the Registration Pavilion for location. Dwight Deal will direct this event.

CAVE BALLAD COMPETITION

The 1978 Cave Ballad Competition will hold Ballad Listening Sessions on Monday, June 19, and Thursday, June 22, from 12:00 noon to 2:00 pm in the Presbyterian Church Auxiliary Hall meeting room (downstairs).

Abstracts

Biology

1 SUBTERRANEAN AQUATIC FAUNA OF THE EDWARDS AQUIFER IN TEXAS AS INDICATED BY SAMPLES FROM WELLS AND SPRINGS

Glenn LONGLEY, Box 46, Aquatic Station, Southwest Texas State University, San Marcos, Texas

An extensive sampling program was initiated in 1973 and has continued to the present on wells and springs along the Balcones Escarpment in Central Texas. This sampling program has produced much new information about aquatic species inhabiting the Edwards Aquifer. Nets have been placed on wells and springs that are supplied with water from the Aquifer. Where it has been possible, flow has been determined and related to numbers of organisms. Estimates of populations have been made where the hydrology is known. Numerous new species have been discovered in the amphipods, isopods, and gastropods. Several other taxa will probably produce new material when examined more closely.

New insight has been gained into the food chain relationships and feeding habits of vertebrates in the Aquifer. Extensive work has been done with the Texas Blind Salamander, *Eurycea rathbuni* and two species of blind cavefish from Bexar County. The blind-cats, *Satan eurystomus* (widemouth), are in the family Ictaluridae. Prior to my studies, few specimens of many of the species had been collected and studied. With the methods I employ numerous specimens of most forms are now available for various studies.

A discussion of the ecological relationships of various forms will be given. (Supported in part by contracts with the U.S.F.W.S.)

2 A REMARKABLE AMPHIPOD CRUSTACEAN FAUNA FROM THE ARTESIAN WELL IN SAN MARCOS, TEXAS

John R. HOLSINGER, Dept. of Biological Sciences, Old Dominion University, Norfolk, Virginia 23508

Since 1973 continuous sampling of the Artesian Well in San Marcos, Hays Co., Texas, has revealed an extraordinary assemblage of subterranean amphipods. At present this fauna consists of nine species representing six genera and five families. In overall taxonomic diversity this amphipod fauna is probably the richest in the world, and in number of species it is rivaled only by those of certain groundwater biotopes in southern Europe.

Among the amphipods recorded from the well are: *Stygobromus flagellatus* (family Crangonyctidae) which was first described from the well in 1896; two new genera and four species (three new) of the family Hadziidae that are members of the weckeliid generic complex of the greater Caribbean region; a new genus closely allied with *Bogidiella* (family Bogidiellidae) that is composed of two new species; a new family composed of a monotypic new genus and species; and a new species of the heretofore, monotypic, brackish-water genus *Seborgia* (family Sebidae).

Four distinct phylogenetic lineages are represented in the Artesian Well amphipod fauna: (1) superfamily Crangonyctoidea which is an old freshwater group of mostly groundwater-related species without contemporary marine relatives; (2) superfamily Hadzioidea which is composed of epigean and hypogean species living in shallow marine, brackish and fresh water habitats; (3) superfamily Bogidielloidea which is composed of subterranean species living in habitats that include mesopsammic marine, littoral interstitial, freshwater hyporheic and freshwater caves; and (4) family Sebidae which is predominately marine benthic.

The zoogeographic and ecological ramifications of the diversified amphipod fauna of the subterranean Edwards Aquifer are tremendous. More than 50 percent of the species have obvious affinities with marine and brackish-water relatives and are presumably derivatives of marine ancestors that colonized newly opened freshwater habitats during the recession of epeiric seas in the Late Cretaceous. Although little is yet known about the population and community ecology of amphipods in the Edwards Aquifer, it is apparent from the large number of species and their relative abundance and also the high degree of differentiation in mouthpart and appendage morphology that these species are well adapted for fine resource partitioning and coexistence. (Supported in part by grants from the National Science Foundation [GB-42332] and the Penrose Fund of the American Philosophical Society).

3 STATUS OF THE TROGLOBITIC BLIND CATFISHES, *TROGLOGLANIS PATTERSONI* AND *SATAN EURYSTOMUS*, IN BEXAR COUNTY, TEXAS

Henry KARNEI, Jr., Aquatic Station, Southwest Texas State University, San Marcos, Texas 78666

Prior to this study only three specimens of *Trogloglanis pattersoni* Eigenmann and three specimens of *Satan eurystomus* Hubbs and Bailey had been collected. A program for sampling the Central Pool of the Edwards Aquifer in San Antonio, Bexar County, Texas, was initiated in 1976 yielding approximately 25 specimens of *T. pattersoni* and 15 specimens of *S. eurystomus*. Ecological factors such as evolutionary background, distinguishing characteristics, distribution, habitat, feeding habits, population dynamics and predation of these fishes are presented.

4 THE DEVELOPMENT OF DIVERSITY IN TEXAS CAVE SALAMANDERS

Samuel S. SWEET, Department of Biological Sciences, University of California, Santa Barbara, California 93106

The Edwards Plateau is the site of the most extensive radiation of troglobitic salamanders in the world. About 35 populations representing 5-7 species are known, distributed along the Balcones Fault Zone from Austin to Del Rio and inland to the undissected Plateau surface. These troglobites range in morphology from populations indistinguishable from the widespread epigeal *Eurycea neotenes* through numerous intermediate forms to the advanced *E. tridentifera* and beyond to the uniquely specialized *Typhlomolge rathbuni*. Troglobitic populations of *Eurycea* originate when drying springs force resident epigeal populations underground. The local, repetitive nature of this process results in many independent colonization events, followed by extensive parallel evolution of troglobitic adaptations. Similar forms now occupy widely separated caves, and it is clear that morphological resemblance need not imply relatedness. Reproductive isolation is weak or nonexistent; hybridization occurs wherever cave and surface populations come into contact. Allopatry, evolutionary parallelism and convergence, and hybridization combine to make the systematics of these salamanders difficult. Of the four species currently recognized two (*Eurycea latitans* and *E. troglodytes*) appear to hybrid swarms involving *E. neotenes* and *E. tridentifera*; these taxa are thus invalid. With the addition of an undescribed intermediate troglobite from Travis County, the Texas cave *Eurycea* comprise about 20 populations of *E. neotenes* and six of *E. tridentifera*. Some biologists believe *Typhlomolge rathbuni* to be a specialized species of *Eurycea*. There is now strong evidence that *T. rathbuni* and the advanced troglobitic *Eurycea* are evolutionarily convergent rather than closely related. Analysis of a new, highly advanced troglobitic species from the San Marcos region supports this interpretation.

5 THE FAUNA OF HAWAIIAN LAVA TUBES

Francis G. HOWARTH, Bernice P. Bishop Museum, P.O. Box 6037, Honolulu, Hawaii 69818

Hawaii is a string of young oceanic volcanic islands stretching more than 2400 km across the mid-Pacific. The native fauna and flora are composed of those groups which dispersed across upwards of 4000 km of open ocean and became successfully established. Less than 300 introductions gave rise to our entire native insect fauna of 7000+ species. Lava tubes, the major cave type in Hawaii, form almost exclusively in pahoehoe basalt by the crusting over of lava rivers. The resultant caves can be complex. In the past these were considered too ephemeral, too often polluted with volcanic gasses, and too inorganic (lacking the main energy sources of continental caves) to support troglobites. Further, representatives of the continental cave fauna are absent, and very few terrestrial troglobites were known from the tropics.

Many of Hawaii's troglobites are representatives of the speciating native groups and have close surface relatives still extant. They have invaded caves through a process of adaptive shifts characteristic of island faunas and are not relictual. The two favorite biomes of evolutionary biologists are oceanic islands and caves. Now for the first time these have been combined.

Of the four life zones in caves, the dark zone, where the troglobites live, is of most interest. The main energy source in Hawaiian lava tubes is tree roots. Other energy sources are slimes and accidentals. At the base of the food web are several rhizophagous troglobites, including cixiid planthoppers, millipedes, and moths. The troglobitic scavengers include several species of crickets, a terrestrial water treader, and a terrestrial amphipod. A threadlegged bug and two blind wolf spiders are troglobitic predators.

Continental cave ecosystems are often likened to islands in their fragility to perturbations. A cave ecosystem on an oceanic island is in double jeopardy. Two troglobites, *Adelocosa anops* and *Spelaeorchestia koloana* have been proposed for the U.S. endangered species list.

6 A PHOTOGRAPHIC SURVEY OF THE MEXICAN CAVE FAUNA

Robert W. MITCHELL, Department of Biological Sciences and The Museum, Texas Tech University, Lubbock, Texas 79409

Some of the more spectacular and interesting cave animals of México will be illustrated by color transparency and briefly discussed. The animals seen will range from the planarians through the fishes, and cave areas will range from Nuevo León through Chiapas and Yucatán.

7 ZOOGEOGRAPHY OF THE CAVE FAUNA OF THE YUCATAN PENINSULA

James R. REDDELL, Department of Biological Sciences, Texas Tech University, Lubbock, Texas 79409

A total of 565 species of animal have been found in the caves and cenotes of the Yucatan Peninsula of Mexico. Of these 34 species are probable troglobites; this includes 23 terrestrial and 11 aquatic species. The terrestrial fauna consists almost entirely of species with tropical affinities; the aquatic fauna includes elements both of marine and fresh water origin. The distribution of the Yucatan cave fauna is discussed with respect to geologic and physiographic features of the Peninsula. The Yucatan fauna, a semi-arid tropical region, is compared to the fauna of a highland tropical region (the Sierra de Guatemala of Tamaulipas), a lowland semi-arid tropical region (the Sierra de El Abra of San Luis Potosí and Tamaulipas), a heavily-dissected temperate region (the Edwards Plateau of

Texas), and a homogeneous temperate region (the Mammoth Cave area of Kentucky). These diverse areas are discussed with respect to their comparative number of species present and the species composition of the troglolite fauna.

8 HOW FOOD TYPE DETERMINES COMMUNITY ORGANIZATION IN CAVES

Thomas L. POULSON, Department of Biological Sciences, University of Illinois at Chicago Circle, P.O. Box 4348, Chicago, Illinois, 60680

The Flint-Mammoth terrestrial fauna shows: 1. Groups of species specialized to different foods; 2. Specialization based on calories *available / area / time*; and, 3. Coevolved species interactions for the most stable foods.

1. *Component communities* are demonstrated by an index (IV) summing each species frequency + density + weight. Of 40 species, 28 have 95%+ of their total IV on one food, 6 on two, 4 on three, and 2 on four of the seven foods. Seasonal stress of flooding or cold-dry microclimate reduces number of species and increases dominance of some, but no new species are added. Addition of a natural food, litter, attracts only expected specialists, but an unnatural food, horse manure, repels normal specialists, attracts new species, and allows rare species to become highly dominant. More species occur and specialist IVs decrease when component foods are mixed in a compound community setting.

2. *Caloric availability* of each food favors different combinations of foraging, life history, and physiology. Calories available / area / time ranges from "hot" racoon feces to "cold" water-leached litter, with cave rat feces, fresh litter, cricket guano, cricket eggs, and mud-silt in between. Species occurring on multiple foods face the same caloric availability by picking different times in successional decomposition or different places along a gradient of food concentration. Comparing species pairs, hot food specialists are time efficient with highly flexible rates of growth, reproduction and development, whereas cold food specialists are inflexible and resource efficient with additional specializations of foraging, habitat selection and body size-shape. When alone and given no choice they grow poorly on hot foods, so ongoing competition does not explain their restriction to cold food.

3. *Coevolved community organization* is shown for cold foods which are most stable in space-time and so have the most predictable species composition. In sand-silt -- which covers large areas, has many replicates and has existed over long geological time -- there are multiple levels of prey-predator and competitor-competitor coevolution. High densities of individuals on hot foods makes high intensity interaction possible but food renewal, and thus interaction, is transitory in space-time.

Supported by NSF-BMS 11140 and Cave Research Foundation.

9 COMPETITION AS AN ORGANIZING FACTOR IN A COMMUNITY OF CAVE ASSOCIATED SALAMANDERS

D. Craig RUDOLPH, Dept. of Biology, Texas Tech University, Lubbock, Texas 79409

Field manipulation experiments indicate that competition is an important factor influencing the structure of a four species salamander community associated with caves of the western Ozarks. Available data supports the existence of competitive interactions in the larval portion of the life cycle. Predictions concerning community stability will be based on these data. The failure of predictions, based on larval ecology, to be confirmed by field observation is hypothesized to be a result of interactions among post-metamorphic salamanders. Available data supports this hypothesis.

10 BAT MANAGEMENT IN THE UNITED STATES: A SURVEY OF LEGISLATIVE ACTIONS, COURT DECISIONS AND AGENCY INTERPRETATIONS

Thomas LERA, U.S. Environmental Protection Agency, Region 5, 230 S. Dearborn, Chicago, Illinois 60604

In 1966, Congress enacted legislation which afforded native animals legal protection. Since that time, this legislation has been twice revised. The current Endangered Species Act of 1973 provides not only animals but also plants with what appears to be a reasonable degree of protection and survival. Recent court decisions support the concept and validity of the Endangered Species Act of 1973.

This paper is the result of a survey conducted throughout fourteen Federal departments and agencies in order to obtain their interpretation of this legislation, and more specifically, how bats are protected by this interpretation. The survey included four questions:

- 1) What Federal laws, regulations and guidelines govern your agency's actions regarding both the protection and/or eradication of bats?
- 2) How has your agency interpreted these laws, regulations and guidelines in the formation of its internal policies?
- 3) What do your protection policies include?
- 4) If eradication is necessary, what methods and recommendations are followed and what chemicals and in what dosages are allowed?

11 THE NEW MELONES CAVE HARVESTMAN TRANSPLANT

William R. ELLIOTT, Texas Tech University School of Medicine, Epidemiologic Studies Program, 152 East Stenger, San Benito, Texas 78586

The New Melones Lake project of the U.S. Army Corps of Engineers, Sacramento District, will inundate several caves on the Main and South Forks of the Stanislaus River in Calaveras and Tuolumne Counties, California. In 1975 the Corps sponsored a small transplant project of cave fauna from McLean's Cave, Tuolumne County, to the Von Trump Mine, an inactive gold prospect 2.5 km away. Uncertain as to the success of the first effort, the Corps sponsored a second transplant from December 1977 to March 1978. The primary concern of both projects was the cave-dwelling phalangid, *Banksula melones* Briggs, which is known only from two localities: McLean's Cave, which will be completely flooded, and McNamee's Cave, which is threatened by quarrying.

The second transplant resulted in the transfer of 27 of the 30 or more species which inhabit McLean's Cave, for a total of 1353 individuals. Despite a considerable collecting effort, only 26 adults of *B. melones* were transferred to the mine. Seven other local caves were studied to determine the range of *B. melones* and other cave fauna. Details are given on the techniques employed, theoretical and logistical problems encountered and the future management plans for the transplant.

Supported by the U.S. Army Corps of Engineers, Sacramento District, Contract # DACW05-78-C-0007.

Geology

12 GLACIATION AND KARST GEOMORPHOLOGY IN SCHOHARIE COUNTY, NEW YORK

John E. MYLROIE, Dept. of Chemistry and Geology, Murray State University,
Murray, Kentucky 42071

Schoharie County, New York, contains a well-developed karst formed on gently dipping (1-2 degrees SSW) Upper Silurian-Lower Devonian limestones. The karst has unique features which result from Pleistocene glaciation. The effects of the Wisconsinan glacial episode predominate. Most pre-glacial surficial karst landforms are either quarried, buried, or crushed, with derangement of surficial drainage by glacial deposits at insurgences and resurgences the dominant factor. Insurgences may be either covered, starved, or rejuvenated, depending on their location with respect to the present-day rearranged landscape. Many large, glacially constructed basins exist, which are preserved as topographic lows by solutional processes that remove water and sediment. Resurgences are either glacially occluded locally with immature passages that bypass the blockage, or glacially alluviated on a larger scale with regional base level rise both in the surface and subsurface.

Active master cave conduits are basically unchanged, but abandoned upper-level conduits are filled with sediment. High loads of glacial sediment are common. These form local hydraulic inefficiencies which result in floodwater overflow passages. Cave sediments deposited during ice cover are characteristically high in soluble components and low in organics. Postglacially deposited cave sediments are low in soluble components and high in organics. This reflects stagnant, sterile ice cover conditions and aggressive, floodwater-oriented post-glacial conditions. Schoharie County is a nonalpine, undeformed area, and as such is a simple presentation of the effects of glaciation on cave development.

13 NORTH CAROLINA COASTAL PLAIN CAVES

Lindsey V. MANESS and Cato O. HOLLER

Coastal Plain cave systems, when accessible (not underwater), are usually quite limited in extent. The two principal cave systems, Rock Houses Cave in Onslow County and Old Blacksmith Cave in Jones County, are rich in several ways. For generations both caves have been the source of "curios" (human bones), an archaeological heritage that needs to be preserved. Fauna include poisonous snakes, cave crickets, spiders, eyeless fish, bats, salamanders, etc. True cave flora appears limited to fungi.

The geology of the caves may be the source of much valuable data about joint sets, palaeontology, early stages in the evolution of caves, and, perhaps, possible causes for Carolina Bays. Joint sets are quite well developed in Coastal Plain caves. There appears to be a positive correlation

between marly (clay-rich) limestone and the presence of caves. Earlier assumptions by geologists that karst features in coastal North Carolina were negligible to non-existent were obviously not based on adequate field checking; consequently, earlier conclusions that Carolina Bays were not influenced by solution processes should be re-examined.

Data on Coastal Plain caves can lead to further research concerning the karst development in the Coastal Plain, the preservation and study of Indian burial sites in the caves, and an inventory of the associated flora and fauna in these little explored sites.

14 A STATISTICAL COMPARISON OF JOINT, STRAIGHT CAVE SEGMENT, AND PHOTO-LINEAMENT ORIENTATIONS

Charles BARLOW and Albert E. OGDEN, Dept. of Geology, University of Arkansas, Fayetteville, Arkansas 72701

A statistical comparison was made of the orientations of joints, straight cave-passage segments, low altitude photo-lineaments (1:20,000) and high altitude photo-lineaments ($\leq 1:120,000$) for Benton County, Arkansas. A modified version of the Kolmogorov-Smirnov (K-S) test, compensating for circular (0° - 360°) data, was used. The area is underlain by nearly flat-lying Mississippian carbonates (Boone and St. Joe Formations) on the southwest flank of the Ozark Dome.

Eight, two sample K-S tests were used to compare the orientation diagrams. The null hypothesis in each case is a statement of no significant difference in orientations of the two distributions or populations at the chosen alpha level ($\alpha = .10$). The results (Table 1) show that for low altitude photo-lineaments and straight cave passage segments (both 50' and 100'), the orientations are *not* dissimilar. This suggests that large-scale photo-lineaments may be either discrete fractures or zones of weakness that control cave passage development to a significant degree. The lack of similarity of orientation of lineaments and joints suggests that lineaments may be formed in part by larger scale processes than those forming the regional joint patterns.

Table 1 - Statistical Comparison of Orientation Diagrams*

	Joints	Low Altitude Lineaments	High Altitude Lineaments
50' Cave Segments	Dissimilar	Similar	Dissimilar
100' Cave Segments	Dissimilar	Similar	Dissimilar
Joints		Dissimilar	Dissimilar

* Similarity of orientations at $\alpha = .10$

Although not statistically significant, there are certain preferential orientations common to small-scale photo-lineaments and cave-passage segments. This further supports the hypothesis that caves have formed, and are still forming, along major fractures or orientations that are not represented by joint patterns alone.

15 WATER BALANCE, MASS BALANCE, AND TIME SCALES FOR CAVE SYSTEM DEVELOPMENT

William B. WHITE, Dept. of Geosciences and Materials Research Laboratory,
Pennsylvania State University, University Park, Pennsylvania 16802

It is reasonably well established that most cave systems, or at least individual passages in cave systems, are fragments of drainage conduits that have acted to transport water and clastic sediment from well defined catchment areas to specific discharge points where the underground drainage returns to surface routes. The evolution of such systems requires two thresholds: (i) a critical passage size at which the flow becomes localized along a single route and thus a transition from diffuse to conduit flow; (ii) a critical velocity in the system at which the clastic sediment load can be moved. Past these thresholds, the cave system will evolve on a time scale dictated by available recharge, CO_2 uptake, and clastic load. Constraints on the system can then be calculated from considerations of kinetics of solution, overall water balance in the catchment, mass balance of dissolved load, and mass balance of clastic load. Model calculations illustrate the time scale of these processes and the growth curve of the caves in relation to known climatic and probable tectonic events of the Pleistocene.

16 CAVERN DEVELOPMENT VIA H_2S DISSOLVED IN HOT SPRING AND NATURAL GAS FIELD WATERS

R. Mark MASLYN, P.O. Box 502, Golden, Colorado 80401

Several hot spring caves located in 4 areas of Colorado and Wyoming may be classified in three categories; 1) single main horizontal passage caves with little or no side passage development, 2) multiple, parallel main horizontal passage caves with smaller cross passages connecting the main passages, and 3) spongework-like caves with multiple interconnected passages. Cave development resulted from or was enhanced by the H_2S gas dissolved in the hot spring waters. There is in all three of these types naturally some mixing of the hot spring waters with variable amounts of ground water.

Caves of the first two types develop where hot spring waters flow horizontally through fissures in the carbonate rock toward a nearby surface stream. When the hot spring waters simultaneously flow through a number of closely spaced fissures, interconnecting side passages form. The Kane Caves near Lovell, Wyoming, are examples of the first type, whereas

Hubbard's Cave near Glenwood Springs, Colorado, is an example of the second type. Spongework-like caves form where the hot spring waters mix with large quantities of slowly moving groundwater. Fairy Cave near Glenwood Springs, Colorado, is an example of this type of cave.

The majority of the cave development in all three types proceeds a short distance below the top of the ground-water table. Therefore, a dropping water table often produces one or more vertical fissure passages connecting different cave levels.

H₂S is also commonly found with natural gas accumulations. There, the H₂S dissolved in the water, which either contains or underlies the natural gas, should function as it does in the hot spring waters, forming the same three types of caves. One area that may illustrate cave development at least partly enhanced by water containing dissolved H₂S is the Guadalupe Mountains of southern New Mexico. Further work may show that H₂S-related cave development is a much more widespread occurrence.

17 HYDROGEOLOGY OF THE SPRING MOUNTAINS, NEVADA

John W. HESS, Water Resources Center, Desert Research Institute, 4582 Maryland Parkway, Las Vegas, Nevada 89109

The Spring Mountains are located in southeastern Nevada 16 km west of Las Vegas. They are 72 km long and 29 km wide, rising to an elevation in excess of 3600 m. The range is composed primarily of dense Paleozoic carbonate rocks up to 4500 m thick. Structures are dominated by east-directed thrust faults. The Spring Mountains receive up to 65 cm precipitation per year as summer thunderstorms and winter snows. Water movement is primarily along solutionally enlarged fractures and brecciated zones. Part of the recharge emerges as local springs through out the range, and part becomes recharge to the regional carbonate flow systems. Approximately 60 springs issue from the mountains with discharges varying from a few liters per minute up to 1000 l/sec. Only eight springs are known to have discharges greater than 6 l/sec, and in general most are less than 1 l/sec. Springs tend to be localized by faults and joints, with several emerging from cave entrances. Six known caves in the range exceed 30 m in length. One of these, Trout Spring Cave, 1000 m long, has an active stream that emerges at Trout Spring with an observed minimum discharge of 14 l/sec and a maximum of 250 l/sec. Electrical conductivity averages 300 mhos at the spring.

18 ALPINE KARST OF THE MARBLE MOUNTAINS WILDERNESS

Mike SIMS, Klamath Mountains Conservation Task Force

A significant area of alpine karst occurs in the Marble Mountains Wilderness Area of California. The karst is in marble beds that lie at elevations of 5,000 to 7,000 feet. Major surface features were formed by glacial

action. The caves reveal two distinct stages of speleogenesis: an earlier phreatic development of cave passages in the upper members of the marble, and more recent subglacial cave development at the lower bedding contact. The latter phase resulted in caves of significant size and depth, including Bigfoot Cave System, deepest cave in the U.S.A. at -1205 feet.

19 SPELEOGENESIS IN THE BERMUDA ISLANDS

John E. MYLROIE, Dept. of Chemistry and Geology, Murray State University,
Murray, Kentucky 42071

The Bermuda Islands are located 650 miles east of North Carolina in the Gulf Stream of the Atlantic Ocean. The islands consist of marine and aeolian limestones overlying a submerged and inactive volcanic peak. The bulk of the island consists of aeolian calcarenite hills rising up to 257 feet above sea level. Solutional features are well developed, including small-scale solutional fretwork on outcrops, residual soils, paleosols, caves and dolines. A lack of impervious catchment material precludes the formation of surface streams, and meteoric waters sink directly into the porous limestones.

Most Bermuda caves have a similar morphology, leading downward from collapse dolines as passages formed between breakdown on the floor and a bedrock ceiling, both dipping around 45 degrees and leading to terminal chambers ending in collapse or sea level pools. The water is saline and fluctuates with the tides, which cause currents in submerged caves that agitate the fresh water lens, limiting lens development. True solutional conduits are rare, and most enterable caves represent the upward collapse of portions of solutional conduits formed at a lower sea level during continental glaciation episodes. Collapse prograding above present sea level, but below the landsurface, forms the typical Bermuda cave, and complete collapse to the surface produces structures analogous to "blue holes". A few small perched solutional conduits 20 feet above present sea level follow a horizontal datum across bedrock structures, indicating a possible earlier, higher interglacial sealevel.

Cave Conservation

20 CAVE CONSERVATION IN THE UNITED STATES

George HUPPERT

The conservation of caves has been practiced in the United States since Mammoth Cave and Grand Caverns first opened to admit tourists in the very early 1800s. Commercial caves continue to be very important in the protection of many caves in this country. However, the real story of American cave conservation does not begin until the middle of the 20th Century. This move to protect caves is consomitant with the advent of organized caving and the great proliferation of cavers, which by some estimates may number in the hundreds of thousands. Some of the problems caused by this increase are litter, vandalism, pollution, biotic disturbance, and the disruption of archeological, paleontological, and historical evidence. The most subtle of all damage is done by using the cave beyond its carrying capacity to absorb the impact. The story of modern cave conservation is largely that of small groups of concerned, dedicated individuals with the drive for hard work and the patience to wait for results.

21 REPAIRING BROKEN CAVE FORMATIONS

Martin WIGGINS

Commercially available adhesives were investigated to determine which would be most appropriate for use in the repair of broken cave formations. Certain epoxies and urethane glues were found to yield the most satisfactory results.

22 RESTORATION OF A SPELEOTHEM -- A CASE HISTORY

John TINSLEY

A stalagmitic speleothem 0.5 m tall, dubbed the "Ice Cream Cone" and suffering from the deleterious effects of two episodes of breakage, was reconstructed from three fragments and was reinstalled in Santa Claus Cave, California in March 1978, by members of the San Francisco Bay Chapter, NSS. Materials employed included a 3/8-inch diameter aluminum rod, a modest quantity of stucco-patching compound, epoxy glue, a soup can (#303), an immodest quantity of water, drop cloths, a pair of surgeon's gloves, a 3/8-inch drill, and a cordless electric drill. Two 3/8-inch diameter holes were bored and aligned parallel to the vertical axis of the speleothem. One hole extended 8 cm. into the 4 cm. diameter basal stalk, and the second hole was bored 9 cm. downward into the subjacent flowstone. Stucco-patching

compound was applied to the base of the speleothem to mask the aluminum rod and to restore the original appearance and taper to the pedestal. We are monitoring the repair to observe the durability and hence the suitability of the technique and materials employed.

23 THE VIRGINIA COMMISSION ON THE CONSERVATION AND USE OF CAVES

John WILSON

The Virginia Commission on the Conservation and Use of Caves was established in March 1978, by the Virginia General Assembly to make recommendations to the Governor and the General Assembly by 1 October 1978. This is the first commission ever established by any state government to study the use and conservation of caves in general. It should provide an overview of the problems of cave use and conservation in Virginia and it is hoped a more all-encompassing solution to the problems of cave use and conservation will be developed. This paper will (1) discuss the rationale for the commission and the limitations of other approaches to cave conservation, (2) present the methods by which the commission was established, the progress made so far, and the goals to be obtained, and (3) list a few needs of the commission for data in various cave related areas.

24 CAVE RESOURCES AND THE ARCHAEOLOGICAL RECORD: SOME ADDITIONAL CONSERVATION ANALOGUES

Mark GRADY

A number of presentations and papers in the recent past have emphasized the value of cave conservation approaches derived from those already demonstrated to be effective in conservation archaeology. In an effort to further this perspective, a series of more refined parallels is drawn between the preservation of archaeological manifestations and the conservation of cave resources. Some successes and failures on the part of conservation archaeologists in dealing with the general public, land managers, and the archaeological profession are considered, and recent conservation research in caves threatened by the New Melones Reservoir is used as an example of the specific application of aspects of this perspective. The NSS is singled out as the organization having the most potential to promote cave conservation in a broad-based and responsible fashion.

Women in Caving

25 CLOTHING DESIGNS

Sue SUNDSTEDT (no abstract submitted)

Texas and Mexico Karst Symposium

26 THE EDWARDS STORY (Film)

Edwards Underground Water District, 2603 Tower Life Building, San Antonio, Texas 78205

This twenty-four minute sound color film provides an overview of both the Edwards Underground Water District and the Edwards Aquifer -- the sole source of water for over one million persons in an area stretching 175 miles from Brackettville in Kinney County to Kyle in Hays County, Texas

The responsibilities and projects of the District since its creation by the Texas Legislature in 1969 are interwoven with the story of the limestone aquifer and its unique rechargeable ability to supply an average of 562,000 acre-feet of water annually for pumpage for agricultural, industrial, municipal and miscellaneous uses, and by springflow for major recreational uses at Comal Springs, New Braunfels, Texas and Aquarena Springs, San Marcos, Texas.

The unique process of artificial recharge, carried on by the District, is portrayed by word, film, and animation.

The film, during its year of release, was judged one of the four worldwide outstanding entries in the Hemisfilm Festival and received the Texas Water Quality Board's "Chairman's Award" for outstanding effort in explaining to the public the works of this unique regional water resource.

27 CAVERN DEVELOPMENT, STREAM PIRACY, AND AQUIFER EVOLUTION IN THE EDWARDS LIMESTONE, SOUTH-CENTRAL TEXAS

C. M. WOODRUFF, Jr. and Patrick L. ABBOTT

Geometry of stream nets and of drainage basins indicates that stream piracy occurred within the Guadalupe and San Antonio River systems near the Balcones fault zone. Further evidence includes relict fluvial features existing on drainage divides near presumed "elbows of capture"; all these relict fluvial features occur on upland karstic plains. At one time these karstic plains were probably lowlands adjacent to recharging streams, but they were left as relict landforms after the rapid downcutting by pirate streams that graded to a new, low base level. Because of this deep incision in the Guadalupe and San Antonio watersheds, the Edwards Limestone was breached at the lowest topographic levels in the entire region, thus providing loci for spring discharge from the aquifer. Farther west, in the Nueces watershed, the geometry of trunk streams suggests that no major piracy occurred there. Because of the absence of piracy and because of lesser fault displacement and less rainfall to effect erosion, the major streams of the Nueces system cross the Edwards Limestone at a higher topographic level and thus recharge the aquifer.

28 NATURAL BRIDGE CAVERNS, TEXAS

Jan KNOX, Texas Department of Water Resources, Austin, Texas

Natural Bridge Caverns is a commercial cave in Comal County located on the uplands above Cibolo Creek, adjacent to the Bat Cave Fault. The cave is a prominent feature of the Edwards Solution Zone of the upper Cibolo Creek study area. Cavern development is strongly guided both by variations in rock type and by joints and faults. The five levels of passages, generally trending northwest-southeast, have been joined in places by solution dome development in the vadose zone. The bedrock floors of the cave passages are commonly covered with mud, guano, and/or breakdown upon which speleothems have locally developed. Natural Bridge is still active, with solution enlargement and speleothem deposition occurring simultaneously. Current studies include detailed mapping of the cave with accompanying stratigraphic cross-sections, study of the distribution of joints and fractures, and documentation of intervals of flooding.

29 $^{230}\text{Th}/^{234}\text{U}$ DATES ON TEXAS SPELEOTHEMS - IMPLICATIONS REGARDING ^{14}C AGES OF LATE PLEISTOCENE BONE DEPOSITS

Russell S. HARMON, Scottish Universities Research and Reactor Centre, East Kilbride, Glasgow, G75 0QU, Scotland (no abstract submitted)

30 SOLUTION SCARP AND RELATED FISSURE SYSTEM, YESO HILLS, CULBERSON COUNTY, TEXAS, AND EDDY COUNTY, NEW MEXICO

A. Richard SMITH, 8310 Hazen, Houston Texas 77036

The Yeso Hills, lying across the southern border between Texas and New Mexico, are part of the Gypsum Plain. A pronounced west-facing scarp about 3 1/2 miles long and up to 140 feet high bounds the western Yeso Hills. Along the upper slope of the scarp and subparallel to its trend are fissures up to 60 feet deep of apparent tensional origin, modified by solution, collapse, and filling.

Bedrock of the Yeso Hills is the Castile Formation, predominantly gypsum at the surface and in the shallow subsurface. This laminae of brown calcite give the Castile a varved appearance. The lowland west of the scarp (Border Flats) is covered with gravel, cobbles, and boulders of Permian limestone and dolomite carried from the Guadalupe Mountains by flood flow of McKittrick Draw. Thickness of the gravel is at least 100 feet near the foot of the scarp.

The scarp was formed by relatively fresh (aggressive to gypsum) flood-water issuing from the Guadalupe Mountains. Once an initial low area existed, it filled with gravel which served to hold water against the gypsum,

further dissolving the toe. Tributaries of McKittrick Draw have moved back and forth in front of the scarp, contributing to its relative straightness. Sulfur and petroleum test wells show no evidence for faulting as a control for the scarp. The tensional fissures result from solution of the toe and slow rotational subsidence of the scarp front toward the gravel-filled basin.

A similar fissure system exists at Lake McMillan, north of Carlsbad, New Mexico.

31 DEVELOPMENT OF GYPSUM KARST FEATURES OF LA HOYA ALARDÍN AREA, ZARAGOZA, NUEVO LEÓN, MÉXICO

Thomas M. BYRD and Walter R. HELMICK

In the fall of 1976, a reconnaissance study was made of a gypsum karst in the semi-arid region between Zaragoza and Aramberri, N.L., México. The gypsum crops out in a north-south trending valley (elev. 1400 m) between the Sierra de San Francisco (2700 m) and the Sierra de Aramberri (2500 m). The gypsum is part of the Jurassic Olvido Formation, which is exposed along the axis of the valley. During the early part of the Laramide Orogeny imbricate thrusting carried Jurassic and Lower Cretaceous rocks eastward over Upper Cretaceous Méndez, San Felipe, and El Abra Formations. The gypsum formed the base of the thrust along which slippage occurred. Tensional faulting near the close of the Laramide Orogeny resulted in the formation of this graben valley. Pediments extend from the mountains into the 2.5-4 km wide valley, which is drained by the northward flowing Rio Blanco.

The gypsum is predominantly alabaster with a thin soil mantle of gypsite. Rainpits and Rillenkarrén are common on exposed surfaces. The center of the outcrop contains a small polje with caves arranged around the periphery. These caves are of two types: solution-widened joints and collapse sinkholes. Older sinkholes are filled with soil and appear to coalesce with the polje. Speleothems are scarce and composed of CaCO_3 . Rainfall in the mountains flows into the valley by sheetflow over, or seepage through, pediment gravels. Subsurface solution of the gypsum is directed along joints and weaknesses. Unlike limestone, these weaknesses result from plastic deformation caused by local tectonic activity and unloading.

32 LATE PLEISTOCENE DEER TRACKS IN CUEVA DE LOS PÁJAROS, OAXACA, MÉXICO

Roy JAMESON, Dept. of Geological Sciences, University of Texas at Austin, Austin, Texas 78712

Cueva de los Pájaros and Cueva San Agustín (Oaxaca, México) have yielded remains of *Navahoceros fricki*, a large Late Pleistocene deer. On the basis of adaptive morphological features, including thick-set bones and short

metapodials, and a mountainous habitat, Kurtén (1975) suggested an alpine or climbing mode of life. The occurrence of deer tracks in Cueva de los Pájaros offers unusual supporting evidence for Kurtén's interpretation. Cueva de los Pájaros was probably a shelter and certainly a natural death trap for *N. fricki*. Several individuals apparently fell down the entrance pitch of 13 m and survived. They then negotiated a 17 m breakdown slope and left their tracks on a mud floor en route to a 13 m flowstone drop and a final 19 m pitch into a room measuring 20 by 50 m. In this last chamber, floored by mud, popcorn, and flowstone, are perhaps a hundred tracks, all of a size commensurate with *N. fricki*. A steep mud bank contains "skid marks" terminating in tracks. One fully articulated and several partially articulated skeletons of *N. fricki* are present.

33 SOME PALEO-BIOLOGICAL IMPLICATIONS FOR SPELEOCHRONOLOGY

Merydith D. TURNER, Box 8536, U.T. Station, Austin, Texas 78712

Problem: A major cave containing a large chamber with deposits of a material (apparently ancient guano) has no natural entrance.

If the material is guano, what can be learned of the bats, and what might be implied of past speleological sequences? A multidiscipline study of the biology, paleontology, chemistry, and stratigraphy of such situations should yield substantial data of interest. A pilot project along these lines was undertaken in Natural Bridge Caverns, Comal County, Texas. Literature was searched for bat habits and habitat data, guano composition and decomposition. Modern and ancient samples were taken and physical and chemical observations made. The short duration of the study and lack of equipment limited the study. However, the author feels justified in concluding; that the "material" was guano from a large *Tadarida* nursery colony which existed for some time until the collapse of the 50 ft by 50 ft (conjectured) entrance which sealed the cave thousands of years ago; and that dates of paleo-speleological events could in fact be determined from such studies.

Cave Management

34 CAVE MANAGEMENT AT BUFFALO NATIONAL RIVER: PHASE II

Milford R. FLETCHER, Regional Biologist, National Park Service, Southwest Region; L. Lorraine MINTZMYER, Superintendent, Buffalo National River, Harrison, Arkansas 72601; Keith A. WHISENANT, Resources Management Specialist, Buffalo National River, Harrison, Arkansas 72601

The National Park Service (NPS) of the Department of the Interior has recently acquired lands on the Buffalo National River in Arkansas which contain some outstanding karst features including a number of caves. During the past year the NPS has contracted to have a number of these caves inventoried and classified according to the dual classification system evolved by the U.S. Forest Service, the Bureau of Land Management, and the National Park Service. Well over 40 caves and springs have been so classified to date and more than a dozen of these have been opened to general public use. Plans for the future include a continuation of the value and hazard evaluation of caves, the establishment of photo points and cave registers, and investigation of the karst and hydrological features of the park. Within the next year we plan to begin establishing critical habitat for several species of animals including three species of bats.

35 CAVE MANAGEMENT - THE VIRGINIA EXPERIENCE

John WILSON

The success of efforts in Virginia to manage or control caves for a given purpose, such as conservation, have been directly related to the degree of management skill, time and capital applied to accomplish those goals.

Several different approaches to cave management have been tried with four significant caves in Virginia: Butler, Perkins, Paxton's and Porter Caves. This paper examines the effectiveness of the efforts made to preserve these caves. Limited efforts to gate the back portion of Paxton's Cave were marginally effective; very little more was done to manage the cave. Porter Cave had a better gate installed but follow up was inadequate to effectively deter cave vandals, and thus gating only marginally achieved its goals. Butler Cave is controlled by the Butler Cave Conservation Society (BCCS) which not only seeks to preserve the cave, but has also given priority to exploration and mapping of the cave. The success of BCCS is impressive although there has been some unintentional deterioration of the cave in a few places. Based upon these experiences, the sensitive Perkins Cave is now controlled and managed by the Perking Cave Conservation and Management Society (PerCCAMS) under even more protective controls.

Moratoriums can be effective, but they have limitations. Color slides provide a vivid description of the results of cave management and control. Data from cave registers, historical sources, direct observations, cave management organization documents and interviews provided the information for this study.

36 NATURAL BRIDGE CAVERNS

Clara Wuest HEIDEMANN, President Natural Bridge Caverns, Natural Bridge Caverns, Texas

Natural Bridge Caverns was discovered on March 27, 1960, by four students from St. Mary's University in San Antonio. The spelunking students were Preston Knodell, Orion Knox, Jr., Al Brandt and Joe Cantu.

A closed cooperation was formed in 1962 and plans were begun for development of the caverns. Development began on March 25, 1963 by Jack Burch, Harry Heidemann, Reginald Wuest and Orion Knox, Jr. While excavating, spear-points dating back to 5,000 years were found near the entrance. Also the jaw bone of a grizzly bear that became extinct over 8,000 years ago. Below the bear bones were an Indian's leg bone and spear point.

Natural Bridge Caverns is the largest cave in the state abounding in cave formations such as soda straws, stalactites, helictites, stalagmites, columns, totem poles and the rare fried eggs.

Each room throughout the cavern seems to have a personality all its own, such as "Emerald Lake" with its multi-colored flowstone and emerald-green water, and the forbidding depths of "Purgatory Creek" and "Grendel's Canyon" the deepest point below the surface.

The caverns were opened July 3, 1964, and were officially dedicated by then Governor John Connally on August 5, 1964. In 1967 Lt. Governor Ben Barnes dedicated the caverns as a State Historical Site. In 1971 the Department of the Interior registered the cavern as a National Natural Landmark. In 1973 the Discover America Travel Organization (DATO) conferred the honor of Travel Attraction of the Year on Natural Bridge Caverns.

As for my philosophy towards tourism, recognition of the essentiality of the travel industry should be emphasized. Travel and tourism, which used to be a privilege of the well to do, is now within reach of most Americans. It is an important growing segment of the U.S. economy. It supports over 4 million jobs. Tourism is one of the three largest employers in at least 30 states. By the turn of the century tourism will be one of the largest industries in the world, if not the largest.

37 STATUS REPORT ON THE 1978 NATIONAL CAVE MANAGEMENT SYMPOSIUM

Milford FLETCHER, Regional Biologist, National Park Service, Southwest Region (no abstract submitted)

Vertical Caving

38 CHOOSING BETWEEN ROPE AND LADDER WHEN MINIMIZING WEIGHT IS IMPORTANT

Kirk MACGREGOR

On some caving trips it is important to minimize equipment weight, but it may not be obvious whether ropes or ladders will be lighter for the cave to be visited (for example, where a cave with a few short pitches is approached by a long hike). This can present a complicated problem, and it may be desirable to consider unconventional techniques and/or to do detailed calculations of relative weights.

However, when reasonably conventional techniques are used (11 mm nylon rope with one average-weight vertical rig per caver versus Pierre Allain ladders with sufficient 11 mm rope to belay all members of each party) an adequate decision can usually be made by comparing the total depth of pitches in the cave with $7.5n$ meters (or $25n$ feet), where n is the number of cavers on the trip. Deeper caves require less weight on rope. Shallower caves require less weight on ladders. These depths can be halved for lightweight vertical rigs or doubled for "overweight" rigs. Thus a trip consisting of three cavers with lightweight rigs would save weight by using rope in caves with over 11 meters (37 feet) of pitches, but a trip with 12 cavers with "overweight" rigs would need a cave with at least 180 meters (590 feet) of pitches before it would save weight by using rope.

Two hybrid techniques are also considered. One is using ladders on some pitches and ropes on others. Using the techniques described above, this is never the lightest approach. The other is rappelling in on a rope, and climbing out on a ladder using an autobelay. If the rappel/autobelay rigs used are light enough, this technique can save weight over a limited range of total depths, with the maximum saving being at $7.5n$ meters (25 n feet) and amounting to perhaps 10 or 20% (compared with pure rope or ladder).

39 LOGISTICAL CONSIDERATIONS IN DEEP MULTI-DROP CAVE SYSTEMS

Bill STEELE, 1506 Waller St., Austin, Texas 78702

This is a state-of-the-art presentation on how NSS members have been approaching their deepest cave systems. Unlike the Europeans, who have explored their deep caves with use of large parties, the Association of Mexican Cave Studies, which has taken on three caves in the Huautla, Oaxaca, Mexico area deeper than 2000 feet in the past year, has used small numbers of personnel. Basically, the procedure has been: (1) rigging ropes; in the case of the Sotano de San Agustin, forty-five in number; then exiting, (2) entering the cave with camp provisions; rappelling down, (3) establishing a camp and exploring from the camp for up to twelve days, (4) exiting with camp packs, and (5) re-entering to retrieve ropes.

There are logistical problems such as communications, timetable scheduling, equipment hauling, and other factors. Questions and discussion are encouraged.

40 SAWED-OFF GIBBS ASCENDERS

Kirk MACGREGOR

In a few applications, it is desirable to have a Gibbs ascender with a short shell. Three tensile tests of such "sawed-off" Gibbs show that loss of strength is not a problem.

However, other problems may arise. If the Gibbs must ride on top of a pulley or another ascender, enough metal must be left on the bottom of the shell to ensure that the cam does not protrude sufficiently to catch on the device below, hindering locking. The amount that can be cut off the bottom of a shell ranges from about 3 mm to 15 mm, depending on the use of the Gibbs. If the top of a Gibbs shell is made very short (for example, by cutting 45 mm off it), the breaking strength of the rope at the Gibbs is slightly reduced, and both the tendency of the Gibbs to slip and the "fallback" of the Gibbs are substantially increased. For practical use, up to about 32 mm can be cut off the top of a Gibbs shell with essentially no effect except increasing the fallback by about 1 cm.

Two benefits of the sawed-off Gibbs, besides its shorter length, are a reduction in weight by up to about 20 percent, and a tendency for these ascenders to catch sooner than regular Gibbs when they are dropped loosely down a rope.

41 FLARING PIN HOLES IN GIBBS CAMS

Kirk MACGREGOR

If the pin-entry end of the pin hole in a Gibbs cam (not the hole in the shell) is flared to 12 mm (1/2 inch) in diameter, using a countersink, the Gibbs becomes substantially easier to assemble on to a rope. Two Gibbs with this modification were tensile tested to over 1100 kg (2500 lbs.) with little damage except bent clevis pins. (In an ill-advised economy move, spring-wire Gibbs were used in this test. The clevis pins used in these typically bend around 900 kg. Had the much-stronger quick-release pins been used, both Gibbs would have been in working condition after the tests). Combining these results with information from Gibbs Products Company, it is clear that this modification has essentially no effect on the strength of Gibbs ascenders.

42 UPDATE ON P.M.I. ROPE PRODUCTS

Richard SCHREIBER, Steve HUDSON, and Larry CALDWELL (no abstract submitted)

Mexico Program

43 INTRODUCTION TO THE ASSOCIATION FOR MEXICAN CAVE STUDIES

William H. RUSSELL (no abstract submitted)

44 EARLY EXPLORATION IN MEXICO

T.R. EVANS

An enlightening insight to the first caving trips to Mexico by Texas cavers, and the organization of the Speleological Survey of Mexico... later to become the Association for Mexican Cave Studies. T.R. talks of early reconnaissance trips and a few of the deep pits they found - among them, the "Big G."

45 THE EXPLORATION OF SOTANO DE JOYA DE SALAS

Orion KNOX

In 1965 three caves were making headlines in Mexico: Ventana Jabali, with its 154-meter skylight drop, had just knocked down Fern Cave's record 123-meter Surprise Pit. A new cave near Xilitla, Sotano de Tlamaya, was starting to get deep. But the one everyone was watching was a great fissure which split the valley floor in a remote lumbering camp named Joya de Salas.

46 BLACK HOLES

Jeff HOROWITZ

Mexico has long been known for its spectacular deep open-air shafts. Jeff takes you on a whirlwind tour of the best: Hoya de las Guaguas, Sotano de la Cuesta, Sotano de las Golandrinas, Hoya de la Luz, Sotanita de Ahuacatlan, and El Sotano del Barro.

47 THE CAVES OF ACATLAN

Andy GRUBBS

Not everything is vertical in Mexico. Andy talks about the significant horizontal systems in the lowlands of Puebla.

48 A NEW AREA - SAN JOAQUIN

Roy JAMESON

Several long-distance hikes have netted an exciting new karst area high atop the San Joaquin Ridge. Large arroyos disappear into deep caves which also take air. Resurgences are 1200 meters lower.

49 HIGH ELEVATION CAVING - THE XILITLA PLATEAU

Patty MOTHEs

Cavers have for years visited the lush tropical area around the town of Xilitla, S.L.P., but few have bothered to hike up above the rain forest and into the alpine meadows...until now.

50 THE CAVES OF YUCATAN

James REDDELL

Amidst the land of Mayan ruins, sacrificial cenotes and thick jungle, James describes caving in the flatlands.

51 MEXICAN CAVING GROUPS

Jorge IBARRA

Many Americans caving in Mexico are unaware that there are two active national caving groups in Mexico. Jorge Ibarra, from Mexico City, D.F., talks about these groups and what they are up to.

52 CAVING IN CHIAPAS

Bill STEELE

Bill takes you into the heavy river caves for some fast flowing excitement. Some exceptional photography in Sumidero Yochib highlights this talk.

53 THE RIVER CAVES OF ZOQUITLAN

Jerry ATKINSON

In December 1976 cavers located two sinking rivers, 20 km to the north of Huautla, Oaxaca. Jerry tells of the return expedition in October 1977.

54 PURIFICACION AREA

Peter SPROUSE

Two large caves above Ciudad Victoria, Tamps. are heading for each other. Cueva del Brinco is 800 meters above Cueva de Infiernillo. During spring of 1978 AMCS cavers spent two and a half months working in the system. Peter tells about the results.

55 CUEVA DE DIAMANTE

Mark MINTON

Until quite recently everyone thought the Sierra de el Abra had a maximum elevation of 1500 feet. An AMCS team spent four years proving this to be incorrect in a most unusual manner. Mark tells the story.

56 LA SISTEMA DE CHICHICASAPAN-ATISCHALLA

Peter LORD

In early 1978 cavers spent three months working in the Cuetzalen, Puebla area, culminating in the big connection between Cueva de Chichicasapan and Sumidero Atischalla. The system is now Mexico's longest at 16 km.

57 THE HUAUTLA PROJECT

Bill STONE

During the past year and a half five major expeditions have been directed to this area in eastern Oaxaca, exploring the three deepest caves in the Western Hemisphere. The sixth expedition left Austin, Texas on May 13, 1978 to return to Sotano de Agua de Carrizo - 778 meters deep with thirty rigged drops.

Exploration

58 SPRING CAVE, COLORADO

Jim PISAROWICZ, Colorado Grotto of the NSS

Spring Cave, located in northwestern Colorado, has been the site of some significant exploration by the Colorado Grotto for the past few years. The dry entrance series of the cave has been known for many years but it was not until the early sixties, that exploration was pushed by a swim through 40° F water, into Spring's interior river gallery. Lead by Donald Davis, nearly a mile of serious gallery was traversed but exploration was stopped by a sump. In 1975, Colorado cavers Al Collier and Tom Taylor dove this sump (76 meters underwater) to reappear into more large stream gallery. Not carrying caving gear they noted that the large bore-hole passage continued further than their SCUBA lights could penetrate. In 1976 caver-divers Collier and Taylor were joined Norm Pace and the passage beyond the First Sump was traversed, but the passage again sumped. Nineteen-seventy-seven saw cave divers Collier, Taylor, Pace, and Jim Pisarowicz dive the First Sump and survey their way to the Second Sump (823 meters sump to sump). The Second Sump was then passed by Collier and Taylor into a swimming passage which sumped a third time 30 meters into more passage. Here the gradient of the cave changed somewhat as waterfalls were encountered. Climbing two waterfalls, Collier and Taylor encountered Sump Four where exploration now stands. Once logistics problems have been solved, this sump will also be dived.

59 BIGFOOT CAVE, MARBLE MOUNTAIN WILDERNESS, CALIFORNIA - A NEW UNITED STATES DEPTH RECORD

Steve KNUTSON and Mike SIMS, Klamath Mountains Conservation Task Force

In 1974 an alpine karst in the Marble Mountain Wilderness in extreme northern California was rediscovered. Subsequent explorations by personnel of the Klamath Mountains Conservation Task Force showed caves there to be of national significance. On 9 September 1977 Meatgrinder and Bigfoot Caves were linked giving a combined depth of 369 meters, a new United States record. (Editor's note: this connection was made five years to the day after the Flint-Mammoth connection - the *longest* cave in the United States).

60 EXPLORATION OF THE FRIARS HOLE SYSTEM, WEST VIRGINIA

Doug MEDVILLE, Reston, Virginia

The Friars Hole System in Pocahontas and Greenbrier Counties, West Virginia, is a large and complex cave currently undergoing active exploration and survey work by cavers from several eastern Grottos and from McMaster University in Canada. Until 1976, two sizeable but separate caves were known in the area; Friars Hole Cave with 7.2 km of passage and Snedegars Cave with about 4.8 km of passage. While several streams sink in the area between the two caves, none were traced into either. Digging in one of these sinking streams in early 1976 resulted in the discovery and exploration of a third substantial cave, Rubber Chicken Cave, which lay between the other two and which took some of the water sinking between them. Exploration of this cave soon resulted in 9.7 km of surveyed passage and then in connections, first to Friars Hole Cave and then to Snedegars Cave. Subsequent exploration and mapping resulted in over 25.7 km of surveyed passage by September 1977. At the same time, cavers from McMaster University were working in a separate cave just to the north of the system, Canadian Hole. In mid-1976, they made a major breakthrough at the known end of the cave and discovered over 6.4 km of large passage, including the largest underground chambers in West Virginia. Finally, in September 1977, the McMaster cavers, pushing a low but blowing lead in Canadian Hole, connected it to the northern end of Rubber Chicken, resulting in a single system having a surveyed length (as of April 1978) of over 35 km, a depth of 142 m and a linear extent of 5182 m. Considerable work remains to be done in the system. Only one of its four major streams has been followed to an apparent downstream end, the major springs in the area are 11.3 km to the south, and the stream in Canadian Hole apparently comes from streams sinking over 1.6 km (1 mile) to the north.

61 EXPLORATIONS IN THE SILVERTIP CAVE SYSTEM, MONTANA

Mike MCEACHERN

An exploratory reconnaissance of Silvertip Mountain, Montana during the summer of 1972 lead to the discovery of a major alpine karst cave system. Since that time exploration has continued every year during the late summer, following the snow-melt run-off. Most of the 2000 man-hours logged underground have been devoted to mapping and connecting together the numerous entrances which have been located on the mountain. To date, over 11 kilometers of cave passage in several different caves have been mapped and a number of entrances have been connected together. Entrances occur as much as 425 meters above the resurgence although attempts to break the U.S. depth record have been thwarted. At the present time the Getout, Easyout, Stairwell, and Bell sections of the cave comprise the largest interconnected portion of the system and reach over 300 m in depth.

Major obstacles to the exploration include the 27-kilometer hike over rugged trails to reach the system, ice cold cave temperatures at 1°C and

water temperatures requiring full wet suits, thermal fractured cave walls making hand and footholds unreliable in addition to creating a severe hazard of rock fall, extremely tight and jagged passageways which slow travel to a snails pace, numerous drops and traverses requiring rigging and finally, the limited time during the year in which the cave is accessible.

62 EXPLORATIONS IN THE JANUS PIT SYSTEM, STONE COUNTY, ARKANSAS

Mike WARSHAUER

Stone County, Arkansas is speleologically interesting because three cavernous physiographic provinces are juxtaposed within a few kilometers. These include the Boston Mountains in the south and the Springfield Plateau (elev. 122 to 244 meters ASL) in the north, draining northwards to the White River. A modest-sized cave system has, for the past three and a half years, been a focus of intermittent exploratory activity.

The Janus Pit System is developed principally in the gently dipping Plattin limestone of Ordovician age. Approximately 2.4 km of passage has been mapped out of an estimated 4 km of explored passage. Exploration has presented a number of physical difficulties, among which are the 45 m principal entrance pit, mud, cold water, and lengthy sumps separating the resurgence, Cave River Cave, from air filled passages in the Atlantic Avenue section and from Flitterin' Pit (44 m deep).

63 TAG AREA MULTI-DROP CAVES

Marion SMITH

Almost every weekend since 1974, vertical cave enthusiasts from the Tennessee, Alabama and Georgia (TAG) area have carried on exploration in ridge caves of Tennessee and Alabama. Systematic walking has located many new caves. Previously entered caves have been extended with determined pushing, and by the use of wetsuits and electric lamps where wet conditions persist. Many of the caves are among the deepest in the United States. Photographs are included of Run to the Mill Cave, Bicentennial Cave, Wilkerson Hollow Horror Hole, Fifth Entrance to Sinking Cove Cave, McBride Cave and ridgewalking techniques.

64 THE WORLD'S LONGEST GLACIER CAVE: A DECADE OF EXPLORATION IN THE PARADISE ICE CAVE, MOUNT RAINIER, WASHINGTON

William R. HALLIDAY, Charley ANDERSON and Mark VINING

Until 1966, neither the Paradise Ice Cave nor glacier caves as a whole, were considered to be of speleological importance. Approximately 26 km (16

miles) of spelean passage are now on the map of the Paradise Ice Cave, with much remaining unmapped. This is by far the longest mapped glacier cave in the world. The size, location, pattern, and features of the cave have changed extensively during the period of study, and numerous new concepts of glacioc speleology have resulted. Similar investigations have now been begun elsewhere in the world.

65 THE EXPLORATION OF THE SCAPEGOAT MOUNTAIN KARST, SCAPEGOAT WILDERNESS, MONTANA

Jim CHESTER, 410 East Aspen St., Bozeman, Montana 59715

"Until an exploring party is dispatched into this area, stories of deep shafts and chasms on the slopes of Scapegoat Mountain is the extent of information available concerning its mysteries."

In 1971, "an exploring party" was "dispatched" 26 km into the Scapegoat Wilderness of western Montana. This group found a vast alpine karst on the plateau encircling Scapegoat Peak 2806 meters (9206 feet). Literally hundreds of shafts, swallets, and resurgences riddle the area. Since 1971, the karst has been systematically investigated in summer and winter expeditions of up to two weeks duration. More than 6.7 km (22,000 feet) of passage have been mapped in Green Fork Falls Cave and other caves in the associated system. Exploration is progressing from the resurgence level up, with a potential system height of over 426 meters (1400 feet). Its remoteness, wilderness quality, large river galleries with 2°C (35°F) rivers, lakes requiring boats, and technical climbs all combine to make the Scapegoat System one of "the classics."

66 CAVES OF WHITE RIDGES, VANCOUVER ISLAND, B.C., CANADA

Paul GRIFFITHS

The White Ridges are the site of the deepest known caves on Vancouver Island in the Province of British Columbia, Canada. Recent exploration has been concentrated on a 1200m-high karst plateau which has regularly yielded vertical systems. One of these possesses the deepest free drop in Canada, at 80 m, and a unique subterranean glacier of considerable thickness. The deepest point reached presently stands at 220 m. Seven hundred meters below is an extensive resurgence cave ascending to a height of 140 m with a total passage length of 1050 m. Local cavers are hopeful that they will ultimately make the connection between the resurgence and plateau caves and evidence certainly points to a master system. Rigorous weather conditions, including 380 cm/year rainfall have led to experimentation in equipment and techniques for this particularly challenging alpine caving.

67 FLINT-MAMMOTH CAVE SYSTEM, KENTUCKY - PROGRESS SINCE THE CONNECTION OF 1972 CAVE RESEARCH FOUNDATION personnel

The Flint-Mammoth Cave system in the central Kentucky karst is by far the world's longest cave. When the connection between the Flint Ridge Cave System and Mammoth Cave was made on 9 September 1972, the total length was 232.4 km (144.4 miles). Today the system has over 314 km (195 miles) of surveyed passage. Eighty kilometers (50 miles) of passages have been added in less than six years. The potential for further discoveries remains great and the integration of the Joppa Ridge Cave System to the south is a future goal.

68 THE 1978 NSS EXPEDITION TO THE ASTRAKA PLATEAU, GREECE

Wil Howie

The 1978 NSS Expedition to Greece's Astraka Plateau was very successful. All major goals set for the expedition were met. In addition, further work was done in adjacent areas.

During the extended three-and-a-half-week trip, over 80 new caves were added to the survey. The first extensive and detailed surface survey was done as well as complete subsurface mapping. The first truly accurate survey of Provatina was made, several new significant caves were discovered, and much unfinished work by previous expeditions was completed.

A brief history of the area is given and slides from the 1973 NSS Field Trip as well as the 1978 NSS Expedition are shown.

69 THE WORLD'S LONGEST UNDERWATER CAVE

Sheck EXLEY and Ned DELOACH

The 22-year exploration of the Peacock Springs Cave System is unique not for length attained (5.85 km) or depth attained (67 m), but for the mode of exploration employed to survey the cave: cave diving. It is Florida's longest cave, but more impressive is the fact that it is the longest known underwater cave in the world - *by far*. No underwater cave outside of Florida has been explored or surveyed for more than a third of Peacock's surveyed length.

Peacock has also played a significant role in the development of cave diving equipment in the United States, having long been employed as a "proving ground" for new equipment and procedures. From the crude single tank, double hose regulator and flashlight in a plastic bag employed by Vasco Murray in 1956 to catch the first glimpse of the cave entrance, equipment has gradually evolved to enable NSS explorers to push silt-filled underwater

squeezeways almost 700 m from the nearest entrance and in up to 67 m of water depth. Double 100 cu. ft. tanks, dual valve manifolds, quartz halogen lights and stage diving procedures are now being employed by NSS divers to attain safe cave bottom times of over 2.5 hours and still retain a 100% safety margin. During the evolution of this equipment all of the seven passable entrances of the Peacock system were connected, all of the passage explored, and all but approximately 650 m of the passage surveyed.

Special Film

70 THE MYSTERY OF THE MACOCHA ABYSS

Karel B. ABSOLON, Professor and Chief of Surgical Training, University of Illinois Medical Center in Champaign-Urbana, Illinois

This historic movie on speleology presents the discovery of the central European Punkva caves in the environment of Macocha, one of the largest sink hole abysses in the world. The dramatic discovery of nature's secrets, geographic and paleontologic substance of this classical karst locality is united by the underlying musical theme of its people, the "Dear Moravia Theme". The motion picture was presented recently at the International Speleological Congress Meeting in Sheffield, England, held in honor of Professor Karel Absolon's 100th anniversary and given a special citation as the best documentary film on the subject.

Cave Diving

71 LUCAYAN CAVERNS: CAVE DIVE EXTRAORDINAIRE

Gene MELTON (no abstract submitted)

72 CONSTRUCTION OF CAVE DIVING EQUIPMENT

Tom COOK (no Abstract submitted)

Social Sciences

73 BLACK CAVERS

John M. WILSON

Speculation has long existed about why there are so few contemporary black cavers in the United States. There are black cavers, but the percentage is small; even the fact that blacks make up only 12 percent of the U.S. population cannot account for this phenomenon. Numerous factors are mentioned as possible contributors to the low percentage of black cavers, including (1) the generally racially separate social life in the U.S., (2) location of caves with respect to demographic distribution of blacks, and (3) economic and cultural factors of the black community. The nature of caving, both as a recreation and as a science, and the intrinsically conservative nature of organizations may be significant.

74 MINORITIES IN CAVING

Janet L. FITZSIMMONS

This study is a statistical analysis of the participation of minority races in United States caving. A survey was conducted during the Spring of 1978. Self-addressed survey cards were sent to all listed internal organizations of the National Speleological Society. These cards requested information concerning the proportion of minority race and women members of each grotto. The demographic presentation includes geographic considerations. The author hopes this survey will serve as groundwork for a future sociological study of Black participation in non-materialistically rewarding leisure-time activities.

75 THE GREAT SOLO CAVING MYTH

John M. WILSON

People often seek absolutes to simplify communication and understanding, and to help establish unity of belief. Possibly other reasons exist as well. One of the dominant themes in caving safety has been an absolute prohibition against caving alone. This paper will examine the prohibition against solo caving as an important concept for novice cavers and one of decreasing importance for experienced, skillful cavers who use good judgment.

Several solo caving situations are ranked according to possible inherent dangers. A system is proposed for evaluating trade offs between risk and cost of time, money and reduced goal achievement. A call is made for open discussion on this type of issue. The advantages of a more credible safety policy are identified.

Spelean History

76 PHYSICIANS AS CAVE EXPLORERS

Karel ABSOLON (deceased) and Karel B. ABSOLON

This study is based on unpublished material from the archives of the senior author, formerly Professor of Geography, Charles University (Prague, Czechoslovakia). It concerns the exploration of the Moravian Karst, north of Vienna, by the provincial capital of Brno.

Two physicians were instrumental in exploring caves in this classical Karst locality, the umbilicus of which is the Macocha abyss, one of the largest collapsed sinkholes in the world: Dr. J. Wankel (1821-1897) in the second half of the 19th century and J.F. Hertod v. Totenfeld (1648-1714) two hundred years before.

The motivations of the two physicians were different. J. Wankel, a practitioner to the miners in nearby Blansko, was a scientist, thus named "father of Central European Archeology". As speleologist, geographist and archeologist, he published a number of scientific books and articles which retain present day quality and flavour.

J. Hertod v. Totenfeld, aimed at the relationship of geography (spas and its beneficial waters) and health in Moravia, retaining Paracelsian arguments of the previous centuries. Thus, he argues good mother earth "ipse facto" makes remedies available to its inhabitants. Looking for a replacement for the imported "unicorn" powder, an "essential" ingredient of his remedies, he finds replacement in form of ground up fossilized mammoth tusk and bones from localities in and outside of caves. This aim lead him to explore new caves and finally visiting the awesome Macocha Abyss. He even measured its depth (137 m) by approximating the time it takes to say the "Pater Noster" and a stone to reach its bottom.

Due to his exploits, J. Hertod v. Totenfeld, the main subject of this presentation, reached fame and got involved in controversy. He became "Protophysicus" - first physician of Moravia, physician to the Austrian Emperor and King in Vienna, and even the "selector" of the bride for the future King Charles VI. In this capacity, he applied his medical and investigative knowledge to identify the physical and psychological qualities of the future queen.

The controversy he got involved in related to the efficiency of his questionable procedures and remedies, the underlying motivation of which was professional jealousy of his competitor. Professionally, he was certainly not innovative, but within the limits of the then medical science, a contributor to it. His suggestions regarding hygienic principles were progressive. He thus became a member of the prestigious "Academia Naturae Curiosorum" scientific society in Schweinfurt.

Even though Hertod v. Totenfeld's "Tartaromastix Moraviae" (1669) did not reach the scope of A. Kircher's (1602-1680) "Mundus Subterraneus" (1664), he reached fame as physician and became part of medical and speleo-history.

77 THE OLMEC CAVE PAINTINGS OF JUXTLAHUACA CAVE AND THEIR HISTORY

William R. HALLIDAY, 1117 36th Avenue East, Seattle, Washington 98112

The April 1967 issue of *Natural History* announced the "find" of "what are believed to be the oldest paintings discovered in the New World" in La Gruta de Juxtlahuaca in Guerrero, Mexico. They were and still are attributed to the Olmecs, the first high culture known in the Americas. The great discovery was widely reported at the time, with three color photos in *Life*.

Since these are the only cave paintings known in the western hemisphere which are comparable with those of Europe, it is important to clarify their history.

Actually, Juxtlahuaca has been a semi-commercial cave since its dedication in 1932. A 43-page booklet on the cave, published locally in 1961, described the three main paintings. The 1964 edition of "Mexico's Caves and Caverns," a 32-page booklet in English widely distributed by the Pemex Travel Club, devoted a half-page to them. NSS charter member, Charles Mohr, visited the cave and photographed the paintings even earlier.

78 DR. CALL AT MAMMOTH CAVE

Harold MELOY, P.O. Box 454, Shelbyville, Indiana 46176

One of the very top Mammoth Cave authors was Richard Ellsworth Call, M.D., Ph.D. (1856-1917). His writings flashed across the sky of Mammoth Cave literature during the 1890s with all the brilliance of an unexpected comet. His descriptions of the famous cave outshone all other accounts then in print, including the works of Horace C. Hovey. Hovey joined with Call in 1897; and, thereafter, Call's prose gave new life and refreshing luster to Hovey's books.

79 THE SKELETON OF LURAY CAVERNS, VIRGINIA

Russell H. GURNEE, 231 Irving Avenue, Closter, New Jersey 07624

On October 4, 1878, Andrew J. Campbell discovered a skeleton at the bottom of a chasm eight hundred feet from the entrance of Luray Caverns. The skeleton was partly covered with calcite; and only the skull, jaw, ribs and leg bones were visible.

Identified by local medical authorities as a "young person," it became a point of curiosity for visitors for several years. The loose bones were quickly taken by souvenir hunters; however, there were sufficient parts available for Professor Joseph Leidy to identify them in 1880 as a "young

human male." Later in 1887 he again saw them and said they were then almost unrecognizable.

In 1921 Col. T.C. Northcott, then owner of the cave, had the bones excavated by Smithsonian Institution archaeologists. The bones were taken to Washington and identified as a "sub-adult female." They are still there in the storage racks of the Institution, but may be transferred to Luray Caverns for the centennial exhibition at the cave in 1978.

Many tales were told of the skeleton. A book, published in 1887 titled *Legend of the Luray Caverns* by Pauline Carrington Rust, tells in poetry form a fanciful story of a young Indian brave who was sealed up in the cave. Other known references to the skeleton will also be discussed.

80 A DISCUSSION OF GRAPHIC TECHNIQUES AS RELATED TO SPELEAN HISTORY

Emily Davis MOBLEY and William F. MOBLEY, Box 333, Walbraham, Massachusetts

Throughout the years many techniques have been used to present visual images on paper. This report will be concerned with the application of these techniques within the spelean history field. Techniques, and how to recognize them, will be discussed so that spelean historians may be able to date and recognize prints which have been separated from books or those which were never bound.

The earlier prints were woodcuts related to the Bible. Although there may be early (15th century) Biblical cave prints, the authors have not found any. Man progressed through copper etchings and engravings, mezzotints, aquatints, lithographs, wood engravings and has completed the cycle with photography. The paper discusses each of these methods and gives examples of each when possible.

81 CAVES OF FANTASY REVISITED

Ernst H. KASTNING, Dept. of Geological Sciences and Texas Natural Areas Survey, University of Texas at Austin, Austin, Texas 78712

Countless writers have used caves as settings for novels and other works of fiction. Caves purvey a sense of darkness, eeriness, nystique, intrigue, and adventure. They are unfamiliar places to the typical reader of fiction. In many cases the cave is the villain, a natural enemy to be conquered. More commonly it is a physical setting around which hardship, quest, romance, and various other life struggles are played out. Caves may also serve symbolically in fiction; never really as tangible places, but rather as figurative images. In this context the mind may be an intricate cavern or the interplay of human experiences may be excursions through the labyrinth of life. Whether the cave is used realistically or figuratively,

the variety of fictional works in which it is found is suprisingly diverse. Fiction using caves includes classical works, historical novels, science fiction, fantasy, gothic romance, westerns, pure adventure, children's fiction, the occult, and others. The role of caves in fiction is indeed fascinating and ranges from the proverbially ridiculous to the sublime. As speleologists we derive something extra from these works, beyond what the authors had intended: many ways caves are used are downright amusing. This light-hearted overview of spelean fiction is in part a progress report on the compilation of an annotated English-language cave-fiction bibliography.

82 SPELEOTHEM GROWTH RATE MEASURED FROM A STALAGMITE IN ADMIRAL'S CAVE, BERMUDA

Thomas M. ILIFFE, Bermuda Biological Station for Research, St. George's West 1-15, Bermuda

In 1819 Admiral Sir David Milne removed a large stalagmite from Admiral's Cave, Bermuda, to be placed in the Museum of the University of Edinburgh, Scotland. Sir Alexander Milne, visiting the cave in 1863, determined that five cubic inches of stalagmitic material had been deposited on the stump during the 44 years since the original speleothem had been removed by his father. David Milne Home concluded from his brother's observations that, assuming a constant rate of deposition, it would have taken 600,000 years to form the original stalagmite. Sir C. Wyville Thompson, director of the H.M.S. "Challenger" oceanographic expedition, entered Admiral's Cave in 1873 to observe the stump. Under Thompson's direction, a slice was removed containing the material deposited in the last half century. Current measurements of drip rate and calcite deposition at the stump and at other locations in Admiral's Cave are reported.

83 SCIENTIFIC, POPULAR, ROMANTIC, AND ENTERPRISING INTERESTS IN BALL'S AND HOWE'S CAVES, SCHOHARIE COUNTY, NEW YORK, 1831-1900

Ernst H. KASTNING, Department of Geological Sciences and Texas Natural Areas Survey, The University of Texas at Austin, Austin, Texas 78712

Ball's and Howe's Caves received substantial early recognition in scientific, popular, and romantic literature of the mid-nineteenth century. Early accounts were authored by renowned and influential persons of that time and have significantly enriched spelean history of the period. Continuing historical research has unearthed several interrelationships among various visitors, authors, scientists, and cave owners and managers.

Local newspaper accounts of the discovery and first visits to Ball's Cave were communicated to editors of established scientific journals such as the *Monthly American Journal of Geology and Natural Science* (1832) and *The American Journal of Science and Arts* (1835). These writings may have inspired Charles Fenno Hoffman to create the Cavern of Waneonda in his romantic novel, *Greyslaer* (1840). So real was his description of this Schorharie Cave that it later inspired a young lady named Geraldine to see Ball's Cave and write about it in *The American Literary Journal*.

Meanwhile Howe's Cave was discovered (1842) and opened to the public by Lester Howe, creating a sensation in newspapers, geological reports, and in several American and English magazines. Simeon North's "Visit to Howe's Cave" first appeared in the *Knickerbocker* (1851). The account was pirated in the same year by *Sharpe's London Journal*, the *New York Evening Post*, *The North American Miscellany*, and *Littel's Living Age*. Two years later W.H. Knoepfel published his prospectus for developing nearby Ball's Cave for public view, claiming it was rivaled only by the great Mammoth Cave in Kentucky. Surely Knoepfel was influenced by the publicity given to Howe's Cave. These plans never came to fruition and what may have been America's first "cave war" was squelched.

The popularity of Howe's Cave continued to grow. The enigmatic "Pip Morgan" account appeared in the *Continental Monthly* (1863). The first guidebook to Howe's Cave was published in 1865 and contained the celebrated "Greatest Wonder of the World" map of Howe's Cave, later used by Horace Hovey in *Celebrated American Caverns* (1882). Howe's Cave was later subjected to financial vagaries of railroad reorganization and the cement industry. The first phase of its development came to an abrupt halt at the end of the nineteenth century.

84 GEORGE WASHINGTON CAVE, JEFFERSON COUNTY, WEST VIRGINIA

Jack H. SPEECE, 711 E. Atlantic Avenue, Altoona, Pennsylvania 16602

George Washington Cave near Charles Town, Jefferson County, West Virginia contains the signature of George Washington, dated 1748. Although this inscription appears to be authentic and similar to those in Madison's Cave and at Natural Bridge, it can not be verified by historical accounts. The cave is also reported to have been used by him for Masonic purposes. The commercialization of this landmark was short lived but still remains today in good condition.

Safety and Techniques Seminar

85 REVIEW OF SEMINAR

Don DAVISON, Jr., Moderator, 319 Kilbourne Avenue, Appalachia, Virginia 24216

Review of basic, intermediate, and advanced caving techniques, including the results of new research and the lessons of recent hits and near misses (safety incidents). The basic cave pack - useful multi-purpose equipment in a small space. How to keep your body warm before it gets cold. How to keep a body warm in survival or hypothermic situations. How to get the most lift for the least effort, with the least equipment, the fewest men, etc. in a hauling situation. The shortcomings and hazards of recently introduced equipment. See lots of failed gear and the STC Display Boards. Get the most up to date information. Ask probing questions which can inspire new research. Bring your pad and pencil.

Snakebite Treatment

86 FIRST AID FOR SNAKEBITE

Dr. Thomas G. GLASS, Jr., M.D., Clinical Associate Professor of Surgery, The University of Texas Medical School at San Antonio, San Antonio, Texas 78229

(no abstract was submitted; however, further information may be found in "Special Events" section of this Program)

Banquet Speakers

87 THE BRECCIA-FILLED CAVERNS OF THE TRANSVAAL, SOUTH AFRICA: INSIGHTS ON THE ECOLOGY OF EARLY HOMINIDS

Dr. C. Garth SAMSON, Professor of Anthropology, Southern Methodist University, Dallas Texas 75275

Research on five breccia-filled caverns in the Transvaal dolomites of South Africa continues. All of them are providing new insights into the origins of Man. Not only have new fossils come to light recently, but multidisciplinary studies on the stratigraphy, paleomagnetic-dating, pollen content, and mammalian fauna have all helped to place the earliest hominids in their ecological setting. These new facts have led to an improved understanding of the ecological pressures which brought about the origins and speciation of the early hominids. Intensive studies of the human fossils themselves have continued apace, revealing new evidence for demography, physical capacity and diet. Most fascinating are the new group of theoretical models for predator-prey relationships between the hominids and other large mammals, in the vicinity of the cavern entrances.

Biography of Dr. C. Garth Samson:

Dr. C. Garth Samson was born in Cape Town, South Africa. He did his undergraduate work at the University of Cape Town and the University of Cambridge, England. His masters and doctoral work were performed at the University of Oxford. He has subsequently taught at the University of Cape Town, the University of California, the University of Oregon, and Southern Methodist University in Dallas where he is now Professor of Anthropology. Dr. Samson's research interests include paleolithic archaeology, (especially southern Africa), lithic technology, systematics of stone artifact classification, and Quaternary geology. He has authored several technical papers on these subjects. He is a member of the American Anthropological Association, the Prehistoric Society of Great Britain, the Rhodesian Prehistory Society, the Société Préhistorique Française, the Society for American Archaeology, and several South African scientific associations.

88 THE LONG, LONELY LEAP

Colonel Joseph W. KITTINGER, Jr., Headquarters Twelfth Air Force, Bergstrom Air Force Base, Austin, Texas

On August 16, 1960, Colonel Joseph W. Kittinger stepped from a gondola attached to a stratosphere balloon over New Mexico at an altitude of 102,800 feet (19-1/2 miles). Thus began a 13-minute, 45-second plunge to earth at speeds up to 614 miles an hour until his main chute opened at 17,500 feet. His fall lasted 4 minutes and 38 seconds. This feat was part of the U.S. Air Force's Project Excelsior, designed to investigate safe methods for bailing out of high-altitude aircraft in emergency situations and falling safely to earth. Colonel Kittinger's high-altitude parachute jump set a world record that still stands today. His exciting talk will include film taken aboard the gondola that shows him departing from the "highest step in the world."

Biography of Colonel Joseph W. Kittinger, Jr.:

Colonel Joseph W. Kittinger, Jr. is presently assigned to Headquarters Twelfth Air Force, Bergstrom Air Force Base, Austin, Texas. He is a native of Florida. He received his wings in 1950 at Las Vegas AFB, Nevada and has been stationed at various times in New Mexico, Ohio (during this assignment he participated in the high-altitude parachute jump project), Florida, Arizona, Alabama, Germany, South Vietnam, and Thailand. He was shot down over North Vietnam and became a prisoner of war in May 1972. He was held in the Fourth Allied POW wing at Hanoi, North Vietnam, until released through Operation Homecoming in 1973.

Colonel Kittinger has logged more than 7600 hours of flight time in 27 different types of Air Force aircraft, including 5300 hours in jets. He has accumulated 1000 hours of combat flying on 483 missions. He destroyed one MIG 21 in aerial combat over North Vietnam during March 1971.

Colonel Kittinger has made 101 parachute jumps including two emergency ejections. In addition to his five high-altitude balloon flights -- Man High I, 96,000 feet; Excelsior I, 76,000 feet; Excelsior II, 75,000 feet; Excelsior III, 102,800 feet; and Stargazer, 86,000 feet -- he also has extensive flight experience in low-altitude free-air and hot-air balloons.

Among his military awards and decorations, Colonel Kittinger holds the Silver Star with one oak leaf cluster, Legion of Merit, Distinguished Flying Cross with five oak leaf clusters, Bronze Star Medal with two oak leaf clusters, Air Medal with 23 clusters, Purple Heart with one cluster, Air Force Commendation Medal, Vietnam Service Medal with two service stars, and the Republic of Vietnam Campaign Medal. His 102,800-foot-altitude jump brought him the coveted Harmon International Trophy, which was presented to him in 1960 by President Eisenhower.

Colonel Kittinger is a member of the Society of Experimental Test Pilots and the Explorers Club. He coauthored the book, *The Long, Lonely Leap* and many articles about his historic jump, Excelsior III, including one in the December 1960 issue of the *National Geographic Magazine*.

General Information

EMERGENCY TELEPHONE NUMBERS

Fire Department	625-2424
Police Department	625-3467
Crime Stop	625-9411
Sheriff	625-9141
Ambulance	625-2331
Texas Cave Rescue	1-817-772-0110
McKenna Hospital	625-911 (162 E. Austin St.)
NSS Convention	call information 1411, ask for National Speleological Society

FIRST AID

First aid supplies are kept at the Registration Pavilion.

NEED ANY HELP?

The entire convention staff will be wearing green convention I.D. badges. These people are eager to be of assistance. If they can not meet your needs or solve your problems, they may be able to direct you to someone who can. Feel free to call on any staff member when you need help or information.

I.D. BADGES

The laminated circular personalized I.D. badge you received when you registered serves as your ticket for all regular convention activities as well as identifying you to your fellow caver.

This badge will be checked at the gate or door of most events, including the Howdy Party, Banquet, Natural Bridge Caverns, and sessions. So, please do not lose it or leave it behind.

CAVING COURTESY

Please observe proper courtesy when visiting wild or commercial caves in Texas. If you are not familiar with caving courtesy, please read a copy of a recent NSS brochure on the subject. These are available at the Registration Pavilion or at the NSS booksales.

In providing the convention with group rates, several commercial caves have expressed concern over misbehavior of cavers on guided tours. Please stay on the trails at all times. Do not take alcoholic beverages to or into the caves. Do not litter. Perhaps the most rude a caver can be at a cave is to hassle the guides. This is never tolerated by the cave operators, nor by the convention staff. We have asked that any cases of poor behavior be brought to our attention. Needless carelessness on your part may easily lead to revocation of special rates extended to us during convention week.

TEXAS CAVING MAY BE HAZARDOUS TO YOUR HEALTH

When traveling through brush or grazing land, be aware of your natural surroundings. Many plants, such as prickly-pear cactus and yucca plants have painful spines. Rattlesnakes abound in the Hill Country of central Texas. As you will see in Dr. Thomas Glass' eye-opening talk on snakebites and their treatment (see schedule), being bitten by a rattlesnake is something you will want to avoid at all cost. Also, check yourself for ticks after each cave trip as well. See your Convention Guidebook for more details.

COMMERCIAL CAVE GROUP RATES

Each of Texas' seven commercial caves has given attendees special group prices to visit the caves. A total saving of \$8.40 is possible if all caves are visited (Incidentally, this is over half of the pre-registration fee of \$15.00 that many of you paid. If you go to all the caves, you in effect get the rest of the convention for \$6.60!). The NSS Convention badge is required at the gate of each cave to qualify for these rates. It is not necessary that you take the tour with other convention attendees to qualify as a group. Please note that Inner Space Cavern also requires a valid NSS membership card.

A summary of the special group rates is as follows:

<u>Cave</u>	<u>Regular Rate</u>	<u>Reduced Rate</u>
Natural Bridge Caverns	\$3.50	no charge
Inner Space Cavern	4.00	\$3.00
Longhorn Caverns	3.00	2.00
Cascade Caverns	3.00	1.50
Cave Without a Name*	1.50	1.00
Caverns of Sonora	3.00	2.50
Wonder Cave	2.65	2.25

* Cave Without a Name is open Saturdays and Sundays only

Please refer to the brochures given to you in your registration packet for directions to the caves and their hours of operation.

BREAKFAST PLAN

Arrangements have been made with Hotel Faust to provide breakfast Monday through Friday, beginning at 6:30 am at the Hotel Faust restaurant (see map, page 2, for location). It will be necessary to purchase tickets in advance at the Registration Pavilion. Each ticket, costing \$2.00, will entitle the holder to one breakfast meal. For example, breakfast at the hotel for each of the five days will require five tickets costing a total of \$10.00. The hotel is only one block from the Civic Center where sessions generally begin at 8:00 am. The Presbyterian Church Auxiliary Hall is also only one block away. The breakfast menu will vary from day to day and should

be available for inspection at the Registration Pavilion.

CONVENTIONGRAM

The *Conventiongram* will be printed daily and placed for free distribution at the Registration Pavilion at the campground and in the lobby of the Civic Center. Updates on program activities, important announcements, and other pertinent and timely information will be included in each issue.

If you have material to go into the *Conventiongram*, please deposit this in the special box at the Registration Pavilion prior to 6:00 pm if it is to go into the next morning's edition.

OFFICIAL CONVENTION PUBLICATIONS

The Convention Committee has edited three official 1978 NSS Convention publications. These are (1) this Program, (2) the general Guidebook to Texas caves, and (3) the Guidebook for the Geology Field Excursion to the southeastern Edwards Plateau. Each adult registrant (age 13 or over) automatically receives the first two. The geology guidebook and extra copies of the others will be sold at the Registration Pavilion. Other pertinent literature on Texas caves will be available there as well.

PUBLICATIONS SALES

Publication sales will be located in the Civic Center in the two meeting rooms between the foyer and the main auditorium. The general sales room will handle material submitted by individuals and organizations for sale. A small surcharge may be charged to offset handling expenses and any pilferage. The other room will house publication sales operated privately by their proprietors. The NSS Bookstore can also be found in one of these rooms.

Booksales begin at noon on Monday, June 19, and continue until Friday morning. Persons wishing to bring material for sale may do so Monday morning. Unsold books and payment for sales may be claimed Friday morning at the Civic Center booksale rooms.

VENDOR SALES

Persons or retail outlets wishing to sell cave-related items other than publications should check with the vendor liaison director. Selling from vehicles in the campground is permitted, but space within buildings must be arranged through vendor liaison. The NSS Convention Committee reserves the right to disallow the sale of any merchandise which is offensive or contrary to NSS policies.

CAMPGROUND

Camping will be at Cypress Bend Park, a town park operated by the City of New Braunfels. We have been granted sole use of the park from Saturday, June 17 through Friday, June 23 inclusively. Please do not camp or park in areas so restricted by signs.

Firewood will be available at the campground. Inquire at the Registration Pavilion about its location.

R V CAMPING

R V Camping with hookups will be available at the Comal County Fairgrounds. Inquire at the Registration Pavilion.

CAMPGROUND SECURITY

We have taken measures to minimize theft and foul play at the campground by (1) obtaining sole use of the campground, and (2) providing a security detail to patrol the campground. Nevertheless, Cypress Bend Park is large and unfenced in many locations. To avoid any possibility of theft, please take your valuables with you or lock them securely in your vehicles when you leave the campground.

ANNOUNCEMENTS

All official convention announcements, sign-up sheets, and personal announcements will be found at the Registration Pavilion. Four bulletin boards and a chalkboard will be located there for this purpose.

C B CHANNEL

Monitor channel seven (7) to keep in touch with other campers and the convention during the week.

TRANSPORTATION

Connections with airports, train terminals, and bus terminals may be made by checking at the Registration Pavilion well in advance. The convention staff will try to arrange rides to these facilities.

LOCAL SIGHTSEEING AND INFORMATION

For a street map of New Braunfels and literature on sights to see and vacation activities while in the area, stop in at the New Braunfels Chamber of Commerce Office adjacent to the Civic Center. Information on historic places, walking tours, restaurants, canoe rental facilities, and many more activities are available here.

CANOE RENTALS

Canoeing is popular on the Guadalupe River, particularly upstream of New Braunfels. Several canoe rental operations exist along the river and elsewhere. Among them:

Gruene River Company
1495 Gruene Loop Road
New Braunfels

Camp Huaco Springs
2-1/2 miles north of Loop 337
on River Road

Whitewater Sports
Canyon Lake exit off IH 35

TUBING

Another popular pastime in this area is inner tubing on rivers and through chutes constructed adjacent to rivers. Among these are:

Camp Warnecke
370 W. Lincoln Street
New Braunfels

The Comal River Chute
E. San Antonio St. at Comal River
New Braunfels

CHILD CARE AND BABYSITTING SERVICE

Child care and babysitting will be available at the Presbyterian Church Auxiliary Hall during the weekdays from one half hour before the day's schedule begins to one half hour after it ends. This service *may* be in effect on Sunday, June 18 as well (check at the Registration Pavilion). Bring your child to the room at the back of the basement floor. Ample toys and cribs are available. The rates will be 25¢ per hour and 75¢ for the lunch meal and should be paid at this location.

LAUNDRIES

Here are two places you can wash those grubby cave clothes and other things:

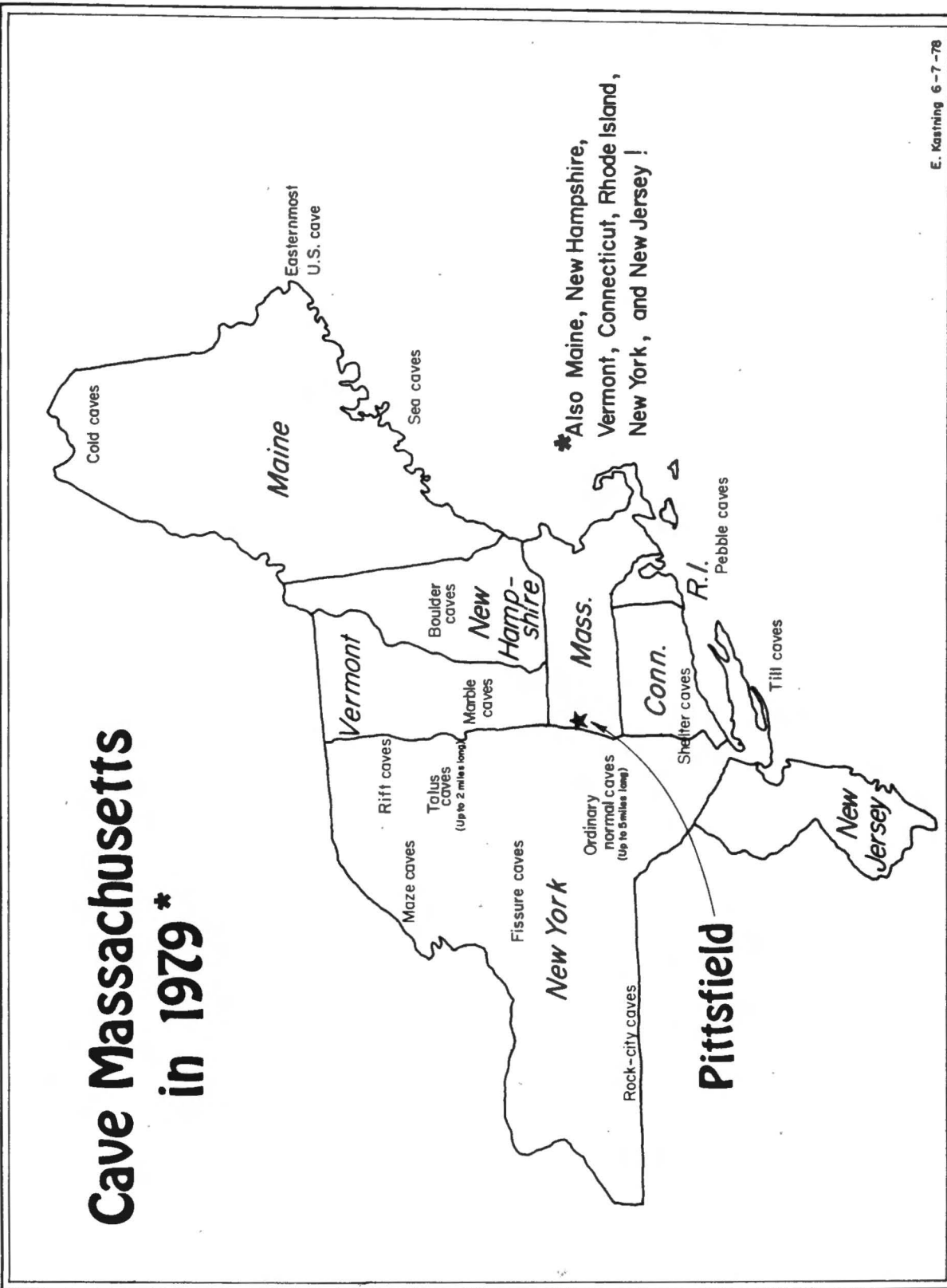
Holiday Wash
118 E. Common

Tip Top
219 E. San Antonio



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New Braunfels
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Das
Leben Schön

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Rope and Vertical Gear Pack

Racks

Hollow Steel Brake Bars

Carabiners

Many other climbing related items.

Come by the campground, pick up a catalog, and tell us what you think about our products or what you'd like to see next.

Yours Truly,

Richard Schreiber NSS 6782

Steve Hudson NSS 11444

Susan Schreiber NSS 11343

Pam Hudson NSS 16741

Larry (Smokey) Caldwell NSS 15403

Bill Cuddington NSS 2177

Carolyn Caldwell NSS 17305

Miriam Cuddington NSS 13078





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