The Cascade Caver

Official Publication of the
CASCADE GROTTO N. S. S.

Volume 13, no. 1 Editor: Dr. William R. Halliday Jan. 1974

1974 GROTTO OFFICERS

Chairman: Curt Black
Vice-chairman: Alex Sproul
Secretary-treasurer: Charley Anderson

COMING EVENTS

December 17. NO REGULAR GROTTO MEETING THIS MONTH.

December 20. 6 day Mexico trip to Bustamente area. Call Richardson, 584-5317.

December 27-31. Oroville area scouting. Call Crawford through 543-1668.

December 31 til GOKW. New Year's Eve Party at Larsons in Vancouver, Wash. 13402 NE Clark Road; 573-1782. Take climbing and caving gear. Take 134th St. offramp from Interstate 5 and drive west 1/4 mile into their driveway.

January 12 or 13. Big Four Ice Caves. Call Anderson, daytimes 622-3848., Snowshoes may be needed.

January 21. Regular grotto meeting; Hallidays, 1117 36th Avenue east at East Madison St. 8 PM. Movie of old Grand Canyon cave trip.

January 26-27. Photo trip to Trout Lake area; snowshoes probably needed. Call Anderson.

January 28 or 31. Kenya-Tanzania trip. Call Halliday.

February 2-3. Paradise Ice Cave. Call Anderson.

February 15-16. Trout Lake area. Call Anderson.

February 18. Regular grotto meeting; new place, to be announced in January.

March. Papoose Cave. Call Sproul, 964-2505.

May 25-27. Mt. St. Helens Steam Cave. Call Halliday.

July 4-7. Cave Ridge ice cream feed and helicopter lottery. Call Black, 564-0988.

Labor Day weekend: NW Regional Convention, Craters of the Moon. A 2-week trip en route also. Call Black.

Field trip report: Yucatan, tourist-style. February 1973.
William R. Halliday

On the way to the Belize field trip reported earlier this year in the Caver, Len and I had a look at caves, cenotes and karst of Yucatan as encountered along the main tourist routes.

With only a single exception, everyone was most anxious to assist, everywhere we went. The exception was a tour guide at Uxmal, with whom I discussed visiting the Gruta de Xtacumbilxunan near Bolonchen; he led me to believe it was far from habitation in hopeless jungle, which I later found was false (too late then to go). Especially after picturing this cave on the cover of a recent Journal of Spelean History, this was unfortunate.

The remainder of our reconnaissance was mostly close to the Merida-Valladolid road, highway 180. This includes the Chichen Itza area, with the famous Cenote Sagrado and the pleasanter, little-visited Cenote Xtoloc virtually across the highway from the Hotel Mayaland. A small square hole atop the Ossuary or High Priest's Tomb in Chichen Itza leads down to a small vertical cave beneath the ruin; we resisted that particular temptation.

About three miles west of Chichen Itza is the famous cave of Balankanche where a tour of a Mayan shrine is available at a reasonable price. Photography is forbidden to visitors, and the Mayan custodians speak almost as bad Spanish as I, so I never found out why, or whom to contact for permission.

In Valladolid, Cenote Zaci proved to be one of the prettiest and most cavernous cenotes we encountered. Located in the northeastern part of town, a small admission charge was well worthwhile.

Around Chichen, the karstlands distinctly resembled the recharge area for the Mammoth Cave karst - with a scrub jungle superimposed - but we were unable to learn of other caves in the limited time available. Farther west, however, the tourist can hardly avoid the large signs announcing: Cenote's Bar - right in the middle of the town of Libre Union. The bar is beside a deep, beautiful narrow-necked cenote which bells out beneath highway 180. At dusk, we could see bats circling below, but the bartender assured us that explorers had been unable to find more than the single chamber.

A sign at this cenote invites tourists (in English) to swim in the underground river of Cenote Xtojil; at first we thought that this was the name of the one by the bar. It turned out, however, that Cenote Xtojil is about a mile east of the Yaxcaba road, two or three miles south of Libre Union. Partially developed as a tourist attraction (like Cenote Zaci), it is pretty but lacks a feeling of cavernousness - and a current. If the cenote by the bar has a name, we were unable to learn it and currently list it as Cenote's Bar Cenote or Libre Union Cenote. A rather similar cenote is located about 1 km west of Libre Union, about 100 yards N of highway 180, behind a low cement wall. It, too, seems to be temporarily nameless.

Lack of time caused us to miss Loltun Cave, which was unfortunate as new roads are about to make it a tourist center.

On the island of Cozumel, which hardly gets eight feet above high tide level, we were mildly surprised to find the famous Chancanab Lagoon to be a tidal cenote. At least one small bay along the Cozumel coast is clearly a breached cenote, and there is said to be another on the mainland coast near Tulum.

Jack Grant of the Oregon Grotto merits credit for being the first Northwestern caver to followup on the obvious potential of this magnificent area. Barb MacLeod tells me that the archeological museum at Merida especially treasures some material he found far back in a crawlway in Loltun Cave during a trip he led there in the early days of Northwest caving. The Association for Mexican Cave Studies is just beginning intensive work in Yucatan, especially biological. At Balancanche, I learned that recent French biospeleological work there had turned up a number of notable finds, including what sounded like a blind cave eel.

The number of caves known in the Chichen area is disproportionately small for a karst of this type, and the chance of discovery of other caves walled off and preserved since classical Mayan times appears high. With much of the peninsula now accessible by good roads, it appears likely to become a major caving area of the future.

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Vulcanospeleological Abstract

Silliman, Benjamin. 1854. A visit to Europe in 1851. NY, G.P. Putnam & Co., Vol. 2, pp. 39-30.

CAVERNS IN THE LAVA.- Near the base of Monte Rossi (near Mt. Etna in Sicily) we looked into another crater, of more limited dimensions, with rocky sides, at whose base opens a volcanic cavern, which has been explored a mile into the earth, but is so irregular that it cannot be penetrated without both difficulty and danger."

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Glaciospeleological Abstract

ibid, p. 237. (Glacier du Bois cave; source of the Arveiron River in the Alps.)

"..an elegant crystal arch, which, when we saw it, was about twenty feet high; but in August, this vault will be thirty or forty feet, or more, above the stream. It can then be entered, but not without serious danger, as the long and huge icicles and other masses frequently fall. Some years since, two young Englishmen who had entered the cavern had the extreme temerity to fire a pistol there. The concussion, as might have been expected, brought down so much ice that one of them was killed, and the other severely wounded. The Arveiron, even at its exit from under the glacier, is a large and vigorous stream, turbid with the pulverized granite from the bed of the glacier. It rushes onward with great power."

VULCANOSPELEOLOGICAL ABSTRACT

Dutton, C.E. Hawaiian Volcanoes. Report of the Director of the U.S. Geological Survey, Vol. III of Report of the Secretary of the Interior, 1883, Washington, GPO., pp. 135-136.

..."Nearly every stream (of pahoehoe on Mauna Loa), and perhaps literally all of them, show in some parts of their courses long tunnels, and in numerous places the arch above the hollow pipe has fallen in, leaving a deep pit in the ground and revealing the continuation of the gallery both upwards and downwards. Some of these galleries are, no doubt, miles in length, and I have been informed by credible persons that they have followed old galleries for three or four miles without finding any opening or termination. Their dimensions vary considerably, being sometimes sixty to eighty feet in diameter, and frequently constricted to eight or ten feet. The number of these tunnels in the mass of Mauna Loa must be vast indeed. As a general rule, they are not disclosed, and we become aware of their presence only where we find a spot where the arch has fallen in. Undoubtedly these tunnels are the agency by which the lavas are able to flow to such immense distances as forty or fifty miles from the vent and yet preserve to the end a high degree of liquidity."

ibid, p. 101. (en route from Kapapala Ranch to Kilauea). "Half a mile from the ranch the trail passes a deep cavity in the ground, and the rocks ring hollow beneath the feet...we have passed many such already on our route. It is an old lava pipe. A lava stream which has been flowing for several days gradually forms an outer covering by the superficial cooling of the lava, making a regular tunnel. Probably no great eruption takes place without the formation of several such tunnels, perhaps many of them. They are often of great extent and even as much as three or four miles in length. Here and there the roof of the tunnel falls in. Sometimes a single slab drops in, forming a skylight for the cavern below. More frequently the tunnel preserves its arch. There are literally thousands of these tunnels throughout the mass of Mauna Loa. Their transverse dimensions are highly variable, sometimes expanding into a great chamber 60 or 80 feet in height and of corresponding width, again contracting to an aperture of a few square yards. So numerous are these caverns that it seems as if they must form some appreciable part of the entire volume of the mountain."

ibid, p. 155 (on the great flow of 1855). "..large holes where the arch over some great lava pipe has fallen in."

ibid, p. 159-60 (on "half-concealed lava beds around the base of Mauna Kea). "I occupied the time...in exploring three or four long caverns or ancient lava pipes, which are quite as common here as they are upon Mauna Loa."

(Editor's note: a short recent written communication from Frank Howarth in Honolulu indicates that the mapped length of Kazumura Cave on Hawaii is now such that it may be longer than Ape Cave even if continuing excavation reveals the postulated length in the present gap between the present end and Lake Cave.) W.R.H.

GLACIOSPELEOLOGICAL ABSTRACT

Russell, Israel C. Glaciers of Mount Rainier. 18th Annual Report of the U.S. Geological Survey, 1898, Washington, G.P.O., Part II. pp. 371-2.

"My companions soon joined me, and we began the exploration of the crater, our aim being to find the least uncomfortable place in which to take refuge from the freezing blast rather than to make scientific discoveries.

"...The steam and heat from the rocks have melted out many caverns beneath the snow. In one of these we found shelter."

"The cavern we chose in which to pass the night, although irregular, was about 60 feet long by 40 wide, and had an arched ceiling some 20 feet high. The snow had been melted out from beneath, leaving a roof so thin that a diffused blue light penetrated the chamber. The floor sloped steeply, and on the side toward the center of the crater there was a narrow space between the rocks and the descending roof which led to unexplored depths. As a slide into this forbidding gulf would have been exceedingly uncomfortable, if not serious, our life line was stretched from crag to crag so as to furnish a support and allow us to walk back and forth during the night without danger of slipping. Three arched openings or doorways communicated with other chambers, and through these drafts of cold air were continually blowing. The icy air chilled the vapor rising from the warm rocks and filled the chamber with steam which took on grotesque forms in the uncertain, fading light. In the central part of the icy chamber was a pinnacle of rock, from the crevices of which steam was issuing with a low hissing sound. Some of the steam jets were too hot to be comfortable to the ungloved hand. In this uninviting chamber we passed the night. The muffled roar of the gale as it swept over the mountain could be heard in our retreat and made us thankful for the shelter the cavern afforded.

"The floor of our cell was too uneven and too steeply inclined to admit of lying down. Throughout the night we leaned against the hot rocks or tramped wearily up and down holding the life line. Cold blasts from the branching ice chambers swept over us. Our clothes were saturatedd with condensed steam. While one side of the body resting against the rocks would be hot, the strong drafts of air with a freezing temperature chilled the other side. After long hours of intense darkness the dome of snow above us became faintly illuminated, telling that the sun was again shining. After a light breakfast and a cup of tea, prepared over our alcohol lamp, we resumed our exploration, none the worse for the exposures of the night."

ibid, p. 390. Russell barely mentions the Carbon Glacier cave, and on page 399, gives even less attention to the Nisqually Glacier cave. The latter is snown on plate LXXX opposite page 406. In sections on the Paradise Glacier, he doesn't even mention caves. Could it be that he was feeling a bit overcaved after his night topside? --W.R.H.

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QUOTABLE QUOTE - from the Division of Mines and Geology newsletter

"In science the credit goes to the man who convinces the world, not to the man to whom the idea first occurs." - attributed to Sir William Osler.

FRUITCAKE DEPARTMENT
courtesy of Vern Frese

"Cave destroyed by an earthquake" - W.R. Braden

"Dear Editor: Between May 16, 1965 and September 15, 1968 I spent a lot of time in a cave in Madison County (presumably Arkansas - WRH). I made a study of the ancient records on the floor, the walls and the ceiling of the cavern.

"The ceiling was dome-shaped showing the creation of the sun, the stars and planets and the moon and earth.

"The floor was the map of the earth millions of years ago showing the exact locations of 13 Gardens of Eden - the original garden and 12 other gardens, one for each tribe sent out from the original Garden of Eden which was in Arizona.

"In the cavern was a miniature space ship - one-man size. It was an exact copy of larger ones. The largest size spaceship spoke of was 482 feet in diameter.

"The 12 tribes of the original Garden of Eden were brought to this earth in spaceships from another planet. I wrote to the news media many times trying to get them to come to Muddy Gap to see the cavern. No one ever came.

"I removed everything that was possible from the cavern and took it to Arizona as I was directed to do by a holy messenger that showed me the cavern and was with me every time I was in the cavern...

"An earthquake in November 1969 completely destroyed the cavern. All underground passageways leading to the cavern have caved in. The earthquake shifted the rock and closed the passageways.

"Now why don't you print the foregoing anywhere you desire in your paper, giving my name and address."

W.R. Braden
117 Roosevelt Road
Jacksonville. (? Ark.)

From the Arkansas Democrat, April 18, 1973, found by Vern Frese in the May 1973 "Forteana" published by UFO Research Committee of Seattle.

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DYNAMITED CAVE RESCUE

No detailed report ever seems to have been received on the rescue of a boy from the Ballroom of Dynamited Cave. All that is on hand here is a note that on the evening of July 3, 1972, Oregon MORESCO had a call from the Hood River Alpinees that a boy was stranded at the bottom of a "30-foot pit" in the cave. Charley Larson was left a message, but when he called back, the boy was out, If anyone has additional information, please submit a more detailed report.

(From Georgia Underground, May/June 1973)

THE CARE AND FEEDING OF Nylon ROPE

-- by Kyle Isenhart

With the tremendous number of cavers doing vertical pitches these days, it is very important safety-wise to understand some things about the ropes to which we all entrust our lives.

What is Nylon?

Nylon is a generic term for a family of polyamides and is defined as: "Any long chain polymeric amide which has recurring amide groups as an integral part of the main polymer chain." Commercial nylon polymers vary not only in molecular structure but also by molecular weight within each particular structure. Some of the common nylons are types 6/6, 6/10 and 12. Within each of these types are high and low molecular weight grades. While the physical properties of these different nylon polymers vary widely, their chemical properties are very similar.

The name applied to nylon polymers in Europe is "Perlon". It is from the misunderstanding of the meaning of this term that people often refer to the dynamic ropes manufactured in Europe as Perlon ropes. While they are made from Perlon polymer they are of kernmantel construction. Different rope manufacturers use identical nylon filaments and produce ropes with different elasticity and strength. The selection of a proper type rope depends upon its intended use but for most caving activities ropes such as Blue Water II are best.

Care and Grooming of Nylon Rope

After purchasing a new rope and before its first field use it should be washed. This should be done for two reasons: to remove the oil and other lubricants that inadvertently remain on the rope filaments from manufacture and, more importantly, to "set" the rope. This pre-use treatment of the rope is very important as it can increase the usable life of the rope many times.

The first time a rope is washed it will shrink a considerable amount. This shrinkage is very important for several reasons: (1) it stabilizes the elasticity of the rope, (2) in laid ropes (e.g. Goldline) it tightens the strands, (3) on braid over braid ropes (e.g. Sampson, West 707) it closes the openings in the inner braid and tightens the outer braid somewhat, and (4) on ropes of kernmantel construction (e.g. Bluewater II, dynamic climbing ropes) it tightens the sheath over the inner core and closes the openings in the braided sheath enough to prevent almost all penetration by mud and dirt to the inner supporting filaments.

While the problem of abrasive particles penetrating the sheath and cutting the inner strands is not completely solved by pre-treatment and frequent laundering, it can be slowed sufficiently to make kernmantel ropes usable for the life of the outer sheath. Allowing nylon ropes to become extremely dirty and using them in that condition not only destroys the rope but causes severe damage to expensive descending and ascending equipment. A dirty rope is NOT a status symbol. It generally denotes improper care. While all ropes eventually become dull colored and fuzzy from use there is no excuse for a 5/8" diameter mud rod with a 7/16" nylon core. Due

A dirty rope is NOT a status symbol. It generally denotes improper care. While all ropes eventually become dull and fuzzy from use there is no excuse for a 5/8" diameter mud rod with a 7/16" nylon core. Due to the fact that internal damage cannot be inspected in braided ropes it is extremely important to protect this type of rope from unnecessary exposure to dirt.

I have heard many types of rope cleaning recommended and most have some merit. I have seen ropes pulled up rivers behind power boats, and I once met a young couple washing their most prized posession - a new 350' Blue Water - in a creek with toothbrushes. It worked well but was a little slow. The most practical way to wash a nylon rope is in one of the big round front-opening commercial washers at a laundromat. They have a large round sight glass in the door. Make sure it is glass instead of plastic as it is possible with a plastic window that during the spin cycle the rope could be rubbed against the window enough to generate sufficient heat to fuse a portion of the outer surface. It is best to put the rope in the washer in a loose bundle instead of a tight coil because it cleans more efficiently. Another important point is to make sure all the rope is inside the drum of the washer and not hanging out around the edges. Lengths up to 600 feet can be easily washed in this manner. Upon removal from the washer the rope will be tangled but patience and a little help from your friends will usually prove superior to the snarls. Washers with central rotating agitators should be avoided as the rope tends to become very tightly entangled about the agitator.

The proper water temperature and cleaning agent for nylon rope always brings up great controversy especially among those who know very little about leaning agents and nylon chemical structure. Nylon polymers can withstand 180° immersion indefinitely with no degradation of the polymer. Immersion in liquids above 300°F for more than a few minutes should be avoided. Water boils considerably below this temperature so what all this means is that it is best to wash your rope in HOT water. At most commercial laundries hot water is about 140°F, which is sufficient to do an excellent cleaning job.

The next question is what kind of cleaning agent to use. Our research department (Marbon Chemical Division of Borg-Warner) decided not long ago that the company should enter the soap business so we did extensive investigations on commercially available cleaning agents. I am not pushing any products, just sharing some results of our research work.

Some purists recommend natural soaps like Ivory. Their fault is that the natural soaps lack the necessary additives to keep the removed dirt suspended in the water so it settles back on the surface of the article being washed. The result is that while they don't hurt anything they don't clean very well either. All detergents when dissolved in water are alkaline, and clean by the action of either phosphates or carbonates. Nylon is not affected by such alkaline conditions. All soaps and detergents at the grocery store for laundry use can be safely used on nylon. The best liquid cleaning agents for nylon are the detergents such as Wisk, and Liquid All - the best powder detergent seems to be Tide. The use of

special pre-soaks such as Axion and Bix before washing is of little value. If you have a white nylon rope and want to bleach it, that is all right also. Do NOT use chlorine bleach, but try one of the others available at the grocery store for nylon. There has been some question raised about borax. Borax will NOT harm nylon. You can even use a little Bo-Peep ammonia if it turns you on.

Since some ropes tend to become very stiff after extended use everyon sooner or later ponders whether to use fabric softener on their rope. Softeners work by the action of Quaternary ammonium salts. These salts adhere to the surface of the fibers of the material being washed and form a macro-thin coating. This coating is very slick and allows the fibers to slip past each other with very little friction. This lubricating effect increases the flexibility of the material which people interpret as being softer when in reality it is only more flexible. These ammonium salts have no harmful effect on nylon and the use of fabric softeners on ropes is quite advantageous.

The softener's coating on the outer surface of the rope causes it to feel waxy but it wears off very quickly. The first person to rappel on a rope treated with fabric softener will notice that it is quite slick but by the third rappel it will not be noticeable. Besides making the rope more flexible softeners have other advantages. That portion which penetrates to the core of kernmantel ropes lubricates the minute filaments and helps keep them from abrading on each other while the rope is flexing. The softener also forms a barrier between the rope's nylon fibers and dirt particles. All the good quality softeners (e.g. Downy) are effective on nylon. If you are afraid you will miss the final rinse cycle use a softener such as Johnson's Rain Barrel which can be added initially with soap. After washing, the rope should be dried before storage. While drying the rope in a dryer would be acceptible (if the drum doesn't get too hot), it is much better to hang the rope in the air to dry.

What Attacks Nylon Rope?

Nylon is an extremely inert polymer. It is resistant to most common solvents, alkalis and even weak acids. Nylon is attacked by strong mineral acids such as sulfuric (battery acid) and other strong oxidising agents. It is also degraded by sunlight over an extended period. The type nylon used in rope will slowly degrade at temperatures above 180° F and will degrade very fast at temperatures above 240°F if exposed to air. Do NOT store a nylon rope on the back window shelf of your car. While nylon melts only at high temperatures, its tensile strength decreases rapidly as its temperature increases. Nylon is dissolved by liquid phenol and formic acid, neither of which I have ever seen in a cave. Formic acid is in most insect stings and ant bites. Phenol (carbolic acid) is present in many wood preservatives. The nylon used for rope is not attacked by gasoline, anti-freeze, beer, urine, bat guano, whiskey, brake fluid or oil. It is inert to all foods that are edible by humans. It is difficult to find a substance that will attack a nylon rope around your home or while out caving. Specific chemical resistance data on many questions are available from the author if you have any further questions.

A most appealing feature of nylon ropes to cavers is the fact that they do not rot or deteriorate from exposure to water. However, this is a very misunderstood phenomenon! There is an interaction between nylon and water and your nylon ropes' physical properties are highly dependent upon the amount of water entrapped within the polymer structure. This may seem confusing but the nylon filaments have small spaces between the molecular chains that form them. The amide structure has an affinity for water and small numbers of water molecules penetrate the nylon filaments to fill these open spaces. While many physical properties such as modulus of elasticity, [redacted] ural fatigue are also affected by the percent of absorbed water, we will dwell mainly on its effect on tensile strength. Nylon has such a high affinity for water that after manufacture it is never dry. The types of nylon used to manufacture rope come to equilibrium in a 50% relative humidity [redacted] when they contain about 2.5% absorbed moisture. This water is absorbed directly from the air and there is no way to prevent it. Most manufacturers' specifications for nylon ropes are based on ropes in which the nylon polymer has 2.5% absorbed moisture. This is about what your rope has if you store it around the house. The problem is that as the moisture content of nylon polymers increases, its tensile strength decreases rapidly. I had not given this much thought until I heard some people advocating soaking ropes in water before doing long rappels to help prevent the rappel devices from overheating. I have discussed this with technical representatives from several major nylon manufacturing firms and they all felt it was a bad idea. The water saturation point of nylon filaments the size used for rope manufacture is reached in minutes and the tensile strength of the polymer is drastically reduced. Because of this fact the use of standing ropes in wet drops should be discouraged as well as the practice of saturating ropes before use. It could be that cavers have been very lucky thus far that a water saturated rope hasn't broken. I hope our rope suppliers will test some saturated ropes in the near future and shed some more light on this subject.

Heat too is a potential enemy of nylon ropes. People are very concerned about overheating rappel devices on long pitches. The problem is that nylon, like most polymers, does not have a sharply defined range of temperature at which it is usable. Nylon filaments used for rope manufacture can withstand 180°F air exposure indefinitely without degradation. At 240°F they degrade in a matter of minutes. The real question is just how hot can a rappel device become while in contact with the rope. This depends on the pressure and time at the point of contact. A 180-pound caver applies almost 70 psi load on the rope in the areas contacted by the brakebars during rappel. At this loading nylon can withstand just over 300°F before softening to break under the load. The thermal conductivity of nylon rope is so low that if the sheath were in contact with a 300°F brakebar long enough and enough pressure were applied to melt the surface, the rope 1/8" away would still be near ambient temperature. While this in no way solves the heat problem it does show that if the rappel device overheats and fuses a section of the sheath while moving on Blue Water II it still retains nearly 92% of its initial strength - considerably more than a water-soaked rope with the same internal temperature.

BELIZE SPELEOLOGICAL SURVEY PROGRESS
--from a letter from B. MacLeod

We've mapped Blancaneaux Cave - took us three days. In the last large chamber, Bill Zarwell found assorted human teeth. Closer investigation turned up a flint spear point, a ground stone celt, a shell disc, two other marine shells, and a ceramic figurine head first mistaken for a vertebra. In the burial chamber itself we found two more bone needles, an obsidian blade, and about 150 more shell beads. (The surface burials here previously mentioned in the Caver had been excavated by the Department of Archaeology within a month of discovery, so the location can now be mentioned. WRH)

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VULCANOSPELEOLOGICAL ABSTRACT

Montoriol-Pous, J. & de Mier, J. 1971. Estudio vulcanoespeleologico del sistema Surtshellir-Stephanshellir, Hallmundahraun, Islandia. Speleon, V. 18, pp. 5-17.

The authors conducted a morphological study of two major lava tube caves in post-glacial basalt in Iceland: Surtshellir (1,810 meters long) and Stephanshellir (810 meters long). The two caves were found to be parts of a single sytem, separated by collapse. Also studied were mural features and ice speleothems --J.M, translated by W.R.H.

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Glaciospeleological note

On the Juneau B-1 USGS Quadrangle, the Norris Glacier is shown as having pseudokarstic features compatible with a major glacier cave system. WRH.

The Cascade Caver
1117 36th Avenue East
Seattle, Wash. 98112