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Vol. 15 #10

THE CASCADE CAVER

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

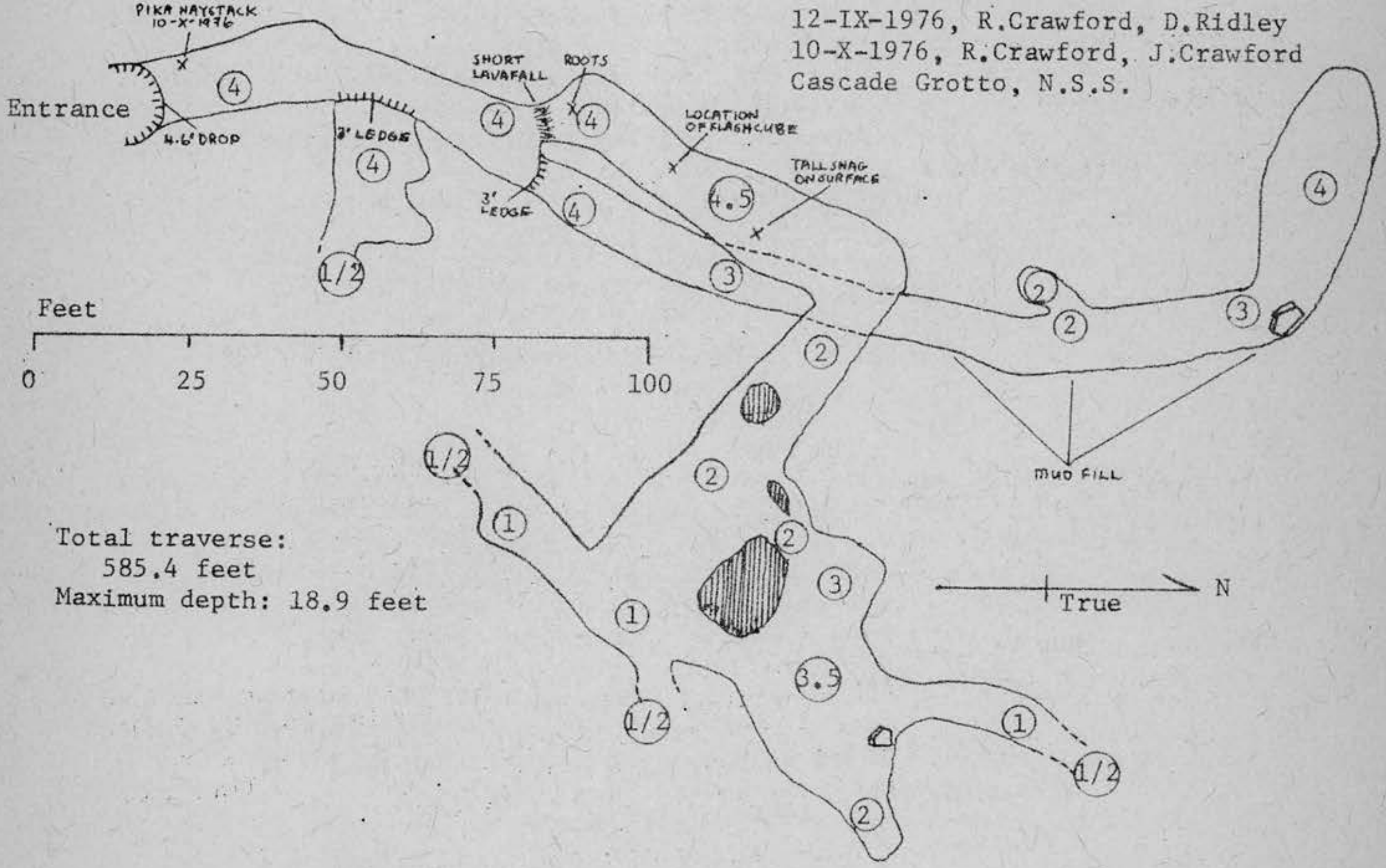
SEATTLE'S ONLY GENUINE UNDERGROUND NEWSPAPER

Vol. 15 No. 10 October, 1976
Editor: Rod Crawford

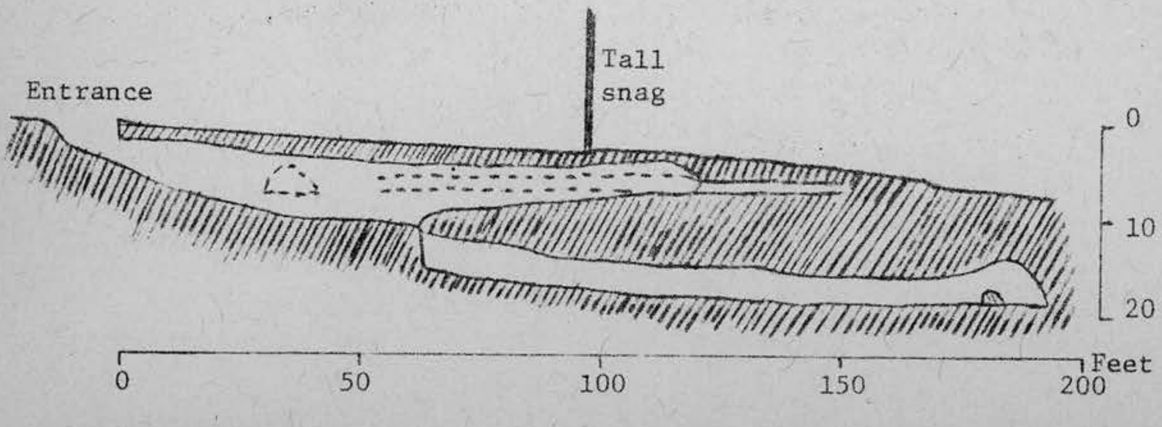
FLASHCUBE CAVE

Skamania County, Washington

Brunton Compass and Steel Tape Survey
C. R. G. Grade 5
25-VII-1976, R.Crawford, J.Thompson, L. Nelson
12-IX-1976, R.Crawford, D.Ridley
10-X-1976, R.Crawford, J.Crawford
Cascade Grotto, N.S.S.



Total traverse:
585.4 feet
Maximum depth: 18.9 feet



PROFILE

Along N-S axis (not extended).

Vertical exaggeration 2 X

THE CASCADE CAVER is published ten times a year by the Cascade Grotto of the National Speleological Society. Subscription rate is $4.00 per year. Full grotto dues of $6.00 includes a subscription to the quarterly *Northwest Caving*. All payments should be made to the grotto treasurer, Chuck Coughlin, 6433 S. 128th Pl., Seattle Washington 98178.

COMING EVENTS

October 16-17. GREAT POTLUCK AND FUNDRAISING EVENT AT EATONVILLE. See notice elsewhere in this issue.
October 18, Monday. Regular meeting at the Hallidays', 1117 36th Av. E. (the large house), 8:00 P.M.
October 23-25, Veterans' Day Weekend. Joint trip to Papoose Cave with Gem State Grotto. Call Bob Brown, (206)569-2724.
Mt. Adams cave area bat band checking (tentative). Call Clyde Senger, (206) 734-1360.
Last half of October. Southeastern U.S. caving. Call Russ Turner, 284-1125.
October 30-31. Some people are talking about a possible trip to Cave Ridge (Snoqualmie Pass). Ask at the meeting or call around.
Late October or Early November. Big Four Glacier Cave. Call Hank Ramsey, TA4-1807, or Rod Crawford, 543-4486 late evenings.
November 15, Monday. Regular monthly meeting, same time, same place. NOMINATIONS FOR NEXT YEAR'S OFFICERS.
November 26-28, Thanksgiving Weekend. Mt. St. Helens cave area for bat band checking. Call Senger.
December 1. DEADLINE for November-December *Cascade Caver*.

NEW MEMBER

Joyce Thompson 4009 15th Ave. NE, Apt. 824, Seattle WA 98105

NEWS AND NOTES

THE SEPTEMBER MEETING was fairly normal. Much trip planning took place. We finally got to see Charlie Anderson's latest slides of Caverns of Sonora (wow!). Bob Brown announced that, in view of this year's grizzly fiasco, next year's regional meet is being planned for Northern Vancouver Island, June 30- July 5, 1977. Phil Whitfield and Bob Brown would coordinate the meet. The grotto resolved to participate in the event that such a meet does occur.

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Clyde Senger says he has been up to Sumas Mountain Cave recently and has done some digging in the big sinkhole nearby. This digging was inspired by finding a small blowing hole in a cliff halfway up the mountain. He got to where the wall was sloping back from the sink before stopping. He is willing and able to lead future trips there for either digging or caving.

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Please remember that the November and December issues are combined, and don't come asking me where your November issue is.

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Our Cover: map of Flashcube Cave, drafted by the editor.

F E A T U R E   A R T I C L E

Solution Caves of the Metaline District Mines

Editor's note; The Metaline District, in northern Pend Oreille County, Washington, is the site of large outcrops of Cambrian limestone of the Metaline formation. The area is extensively mined for lead and zinc, and the Grotto has known for many years that caves have been intersected in the mines. Two comprehensive geological studies on the area have appeared: that of Park and Cannon (1943), and that of Dings and Whitebread (1965). Park and Cannon's report was briefly summarized in the *Cascade Caver* in 1962, v. 1 no. 2 p. 4, but no report of Dings and Whitebread's findings has ever appeared in these pages. Therefore, their very interesting account of the caves of the Metaline district is completely transcribed herewith:

CAVES

Caves are widely distributed in the Metaline district, where they range in size from a few feet or less to a hundred feet or more in depth and length. All the cavities in the Metaline district that are large enough to be classed as caves occur in the Metaline Limestone, and most of these are in the upper part of the limestone, where they are commonly found along fractures, faults, or in brecciated zones; a few are along bedding planes. Many caves, some of considerable geologic interest, are exposed in the workings of the principal mines, where they are commonly associated with the ore bodies and altered rocks. These caves occur both above and below the level of the Pend Oreille River; those in the Pend Oreille Mine range in altitude from about 2,500 feet in the old western workings, or more than 500 feet above the river, to 900 feet in the eastern workings, about 1,100 feet below the river.

The best known cave in the district is Gardner Cave, in the low hills between the Pend Oreille River and Russian Creek. This cave, which is a State park, is entered through an opening about 10 feet across. The cave extends to a depth of more than a hundred feet along steeply dipping fractures in marbleized gray limestone. Insofar as the writers are aware, no published record concerning the total depth and extent and sizes of the caverns in this cave [sic] is available, although local residents report having reached greater depths than the approximately 100 feet readily reached by the senior author in 1945.

The few caves that are present in the stratigraphically lower bedded dolomite unit of the Metaline Limestone are chiefly along the steep slopes of the valley of the Pend Oreille River and in the strata cut in the first part of the main adit of the Metaline mine. Those in the adit were filled with partly stratified clay, silt, and sand. They are located below the 2,575-foot lake terrace, and for this reason were probably formed before the last ice invasion, possibly during the Tertiary Epoch. Many years ago the Lehigh Portland Cement Co. mined brown clayey iron oxide from a similar cave on the southwest side of Washington Rock and used it in the manufacture of a certain type of cement. A few caves, probably not more than 10-20 feet deep, are scattered on the limestone hills east of Hoage and Beatty Lakes in the northwestern part of the district. The cave openings are generally elongated in northerly or northeasterly directions along bedding or fracture planes; the largest seen was about 1 foot in width and 10 feet in length. These caves are probably relatively recent features that developed by the dissolving action of surface waters along readily accessible channels.

Most of the caves in the mines are markedly different in appearance and in origin from those seen on the bare limestone hills and in the river gorge or in dolomite a short distance below the surface. The caves in the mines are almost everywhere in mineralized ground, commonly along fractures in compact dolomite breccia irregularly replaced by jasperoid; at many places the country rock is entirely silicified. The walls of most caves are in part smooth and in part corroded into jagged forms. In some caves sphalerite and galena occur in fragments of country rock lying on the floor or as corroded grains projecting into parts of the cavities; well-developed crystals of galena or spalerite are rare. Coarse cleavable calcite is commonly present, in places largely filling cavities and elsewhere as partially corroded masses. Small crystals of light-brown barite are perched on cleavage surfaces of calcite in one cave seen in the eastern workings of the Pend Oreille Mine along the 2200-level stopes at an altitude of about 2,100 feet. Fragments and slabs of country rock, some as much as 10 feet or more in length, are on the floor of some caves. A cave off the 800 level in the western workings of the Pend Oreille Mine contained many slabs and fragments which were firmly bound together by thin coatings of gray quartz. Pyrite crystals occurred between some of the fragments, and small crystals of calcite were scattered over some of the pyrite crystals and on much of the silicified surface of the fragments. This cave, now obliterated by subsequent mining--as so often happens--was a beautiful feature when seen by lamplight reflected from the thin coating of silica on the walls and huge pile of slabs.

Paligorskite, a hydrous magnesium-aluminum silicate, is commonly present in many of the caves where it fills fractures and hangs from the roofs and sides in dangling bodies resembling soiled and frayed rags or a wet and torn newspaper. Locally, fragments of ore, quartz, calcite, and country rock hang haphazardly and loosely suspended on some sheets of paligorskite. indicating that they formed before the paligorskite. Some paligorskite, on the other hand, was deposited before sphalerite, quartz, and calcite, for these minerals are present locally as crystalline coatings.

By far the greatest number of caves are aligned along fractures or faults. Many are bounded on one side by a smooth and, in places, slickensided surface. In one area in the eastern workings of the Pend Oreille Mine, 7 caves have been recognized over a distance of about 650 feet along a northward-trending fault, or fault zone, that extends from the 1900 level to the 1700 level. Probably the largest cave found in any of the mine workings is off the 1900 level in the eastern workings of the Pend Oreille Mine. This cave has been traced in length for at least 280 feet, and it averages 30 feet in width and 20 feet in height; at one place it rises to an estimated height of about 60 feet. In 1957 the lowest known caves in the district were found on the recently driven 900-level (alt. about 900 feet) workings of the Pend Oreille Mine, about 1,000 feet below the Pend Oreille River. Some caves with high roofs, or those with very narrow openings, have not been followed to their limits, and the extent and pattern of possible connections between openings is little known.

Most caves are dry, but it is reported that all three of the principal mines cut into some caves containing water, or mud and water. At places the discharge of water was reportedly large. Some caves cut in the eastern workings of the Grandview mine were partly filled with a mass of wet mud and silt, probably derived from the overlying lake silts which rest on the eroded surface of the Metaline Limestone.

Park and Cannon (1943, p. 39) suggested the following four possible modes of origin of the caves in the mineralized parts of the mine workings.

1. They are caves formed by downward-percolating waters above the water level,

2. They were formed by meteoric water circulating below ground-water level, as suggested by Davis (1930, p. 480),

3. They are related to a possible erosion surface at the top of the Metaline Limestone and below the Ledbetter Slate,

4. They resulted from solution by hydrothermal fluids that deposited jasperoid and ore.

For ease of reference, the authors of the present report quote the discussion of these theories by Park and Cannon.

"The caves were not formed in recent time by downward-percolating water, because: (1) no indication of surficial infiltration or deposition of weathered debris has been found except in the upper caves that are clearly connected with the surface; (2) paligorskite is unstable in the zone of downward percolation, and it is also unlikely that sphalerite and crystalline quartz would form under these conditions; (3) no evidence is available to show that the ground-water surface was ever appreciably lower than it is today, and considerable physiographic evidence indicates that it was probably higher near the end of Pleistocene time.

"The second explanation, that the caves were formed by circulation below ground-water level, cannot be so summarily dismissed and has several points to commend it. The principal criticism is that the formation of paligorskite in pure calcite would necessitate the transportation of magnesium, silica, and aluminum in cold meteoric waters. The crystalline lining in the cavities, however, is not a convincing argument either for or against a meteoric origin, as crystalline sphalerite is very common between jasperoid and calcite, and if the calcite were leached crystalline sphalerite would project into the cavities. The small sphalerite and quartz crystals that are abundant on much of the paligorskite would under this theory be supergene. The principal points in favor of this explanation are the location of the caves where circulation of water is probably vigorous and the decrease in size and number of the caves in depth. The writers favor this explanation.

"The third possibility--that the caves are related to an old erosion surface that separates the Cambrian and Ordovician strata--is unlikely, mainly because of the lack of other evidence for the existence of such an unconformity. Also caves formed before the Ordovician period would be earlier than the ore and would necessitate an explanation for the ore breccia found on their floors. Deeper exploration should furnish additional data concerning this hypothesis. The decrease in size of the caves down the dip makes it more reasonable to relate the openings to some other feature than an unconformity at the contact with the two strata. It is also a possibility that Ordovician caves would have been filled with redistributed carbonate during regional disturbance.

"The fourth suggestion--that the caves result from dissolving action of the hydrothermal fluids that deposited the jasperoid and ore--answers many of the queries raised so far but does not explain why the caves decrease in size and number in depth, whereas jasperoid and ore, similar to those above, continue downward. The mineralizing solutions were capable of dissolving carbonates, as indicated by the fact that calcite and dolomite were removed from large masses now occupied by jasperoid and ore. As explained in the section on brecciation, the conspicuous shattering near the ore bodies may in part have been accentuated by the corrosive activity of the mineralizing solutions. Under this theory the paligorskite and the sphalerite and quartz on the paligorskite would be hypogene rather than supergene minerals."

The authors of the present report reject the first and third mode of origin of the caves for almost the same reasons that Park and Cannon have given. However, the authors of the present report favor the last, or fourth, suggestion (dissolving action) over the second (circulation below ground-water level), which Park and Cannon favor, although these authors state that the fourth suggestion has much in its favor. The mine workings are now far more extensive and far deeper than when Park and Cannon studied the region, and these workings show that the caves neither decrease in size nor in abundance with depth, which removes their principal objection to this theory. The theory that the caves resulted primarily from the dissolving action of the hydrothermal fluids is favored by the fact that the caves are so widely distributed in, and closely associated with, mineralized ground. The mine workings are, of course, largely confined to mineralized and altered ground, but insofar as the authors of the present report know, caves are not present in the hundreds of feet of unaltered gray limestone cut in the mines, except where this rock is adjacent to altered ground, or is near the surface or the overlying lake silts. Also under this theory the sphalerite, galena, pyrite, barite, paligorskite, calcite, and jasperoid found in the caves are of hypogene rather than supergene origin, which is more in accord with the usual mode of formation of most of these minerals, especially when there is little suggestion of supergene deposition elsewhere in the mines. It is further known that the dissolving action of hydrothermal solutions has resulted in the removal of calcite and dolomite from large areas of rock now occupied by the jasperoid and ore, as noted previously and explained in more detail in the section on origin and interrelations of calcite, dolomite, and silica. Considerable corrosive action is likewise indicated along the walls of some caves. The settling of the graben during ore deposition is also probably a factor favoring the formation of caves, because these repeated movements formed fractures and faults, or reopened older ones, which served as channels along which the hydrothermal solutions periodically migrated. At certain times the fluids actively dissolved the bordering rock, whereas a renewed stage of hydrothermal action filled or partly filled some of these caves that had previously formed. The pulses of movement, corrosion, and deposition that occurred would account for the cave breccias, the common, but not restricted, occurrence of caves along fractures and faults, and the variety and form of the minerals in the caves.

Both Dings and Whitebread's and Park and Cannon's papers contain photographs of cave interiors and minerals. A few of the caves are shown on the mine maps. The older account by Jenkins (1924) has the following to add about caves encountered in the early days of the Grandview Mine workings:

"Prospecting has been done by open cuts and in natural caves and by a 125-foot tunnel into the bluff...in one natural cave it was noticed that breccia was much in evidence. Broken off pieces of brecciated rock containing galena, partly filled the cave." Jenkins' map shows the location of one small 50' cave.

References:

Dings, McClelland G., and Donald H. Whitebread, 1965. Geology and ore deposits of the Metaline Zinc-lead district in Pend Oreille County, Washington. U.S. Geological Survey Professional Paper 489: 1-109.

Jenkins, Olaf P., 1924. Lead deposits of Pend Oreille and Stevens Counties, Washington. Washington Division of Mines and Geology *Bulletin*, 31.

Park, C.F., Jr., and R.S. Cannon, Jr., 1943. Geology and Ore deposits of the Metaline [30'] Quadrangle, Washington. U.S. Geological Survey *Professional Paper*, 202.

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T R I P   R E P O R T   S E C T I O N

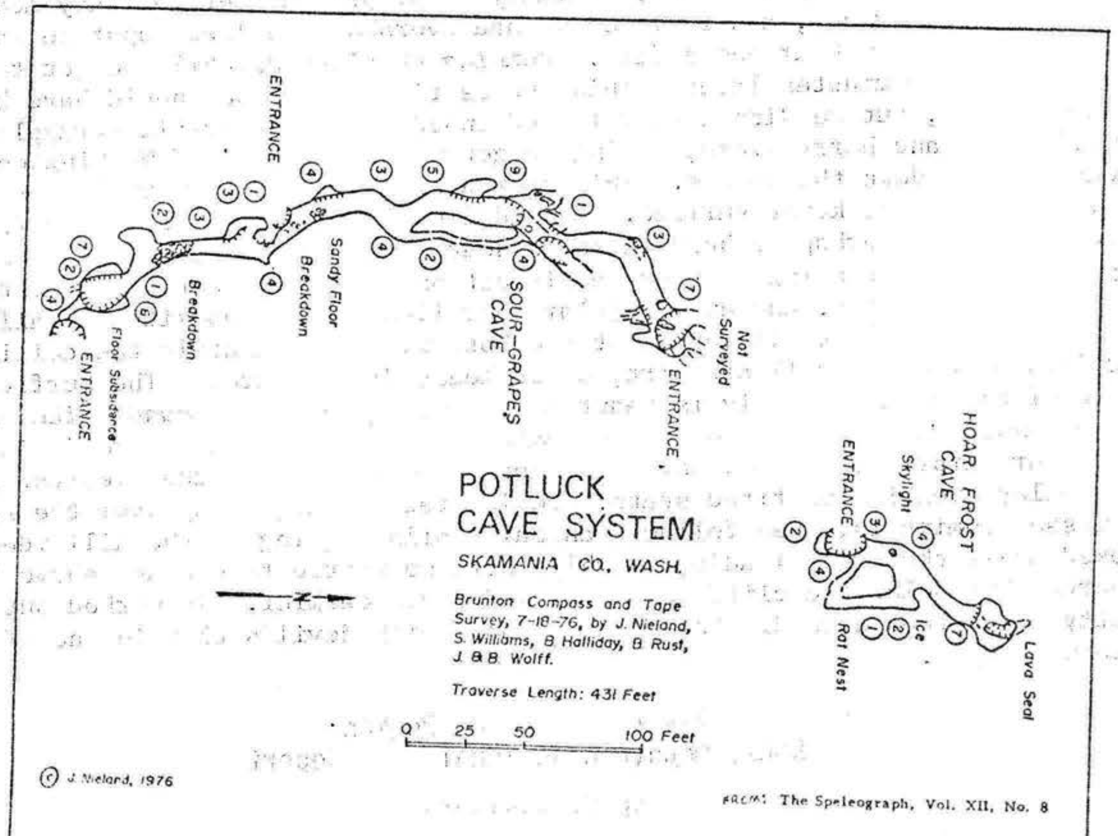
Hoarfrost and Sour Grapes Caves, Washington

by Bill Halliday

On July 17, from the air, Charley Larson and John Slabic spotted a new system sub-parallel to Slime Cave and about a mile further northeast. They checked it out briefly on the ground the next day, and after the Slabics' party (or was it an Oregon Grotto party at the Slabics'?), a bunch of us headed out with compass and tape: Jim and Beth Wolff, Ben Rust, Steve Williams and Jim Nieland. Luurt went to Big Cave instead, which may be one reason for the name of the second cave. Neither cave turned out to be large, but both were interesting.

Hoarfrost Cave is the lowermost in the chain of sinks (or the northernmost chain of sinks--there may be more in another chain nearby). It is a braided tube superposed on a shallow throughway. It ends at a lavaball plug at the lower end of a subsidence chamber containing a natural bridge. Total length is perhaps 150 feet. The name was derived from a localized harfrost deposit on the ceiling about halfway in. Some oupholitic ice was present on the floor. Quite a few ice stalagmites were present but melting actively. Only the terminal chamber is high enough to stand up in.

Sour Grapes Cave is even more braided. It is 120 feet upslope from Hoarfrost Cave, and includes the next three sinks uptube. The bottom end is low, like its neighbor, then gets very tight. I took the tape through, and suddenly found myself in walking passage with fascinating intercommunicating crawlways leading off. There are three levels here. I popped out of the next



sink uptube and had about decided that the one beyond didn't go when the mapping crew crawled out of it; a tight crawl to the left of the middle entrance went for them, into a 30-foot entrance room at the pit I was skeptical about.

These caves are 3/4 mile east of N604, and are best reached by a dirt road 1/2 mile north of 123. Collectively they are called the Potluck System.

More Windy Creeking

by Bill Halliday

On August 22, Alan Brandeberry and I had another look at the approach to Windy Creek Cave from the clearcut on the NW corner of Dock Butte. This time, the end of the road was at a fallen log which could easily be cut with a chain saw, but the road is not passable all the way to the clearcut anyway. It took 30-45 minutes to get to the upper end of the clearcut, then we ascended the NW spur of Dock Butte for 3-400 feet; a bit higher than I had originally planned, but there was a cliff in the wrong place. Then we cut straight south along the slope, following animal trails for the most part, and taking the path of least resistance up and down. Finally we popped out into a boggy meadow, skirted its lower end, and realized we had overshot the lower spur we wanted. This took about an hour and a half. Bombing straight downhill we got to the valley about 15 minutes later. This put us right where we should have been in the valley, but we didn't know it and ended up in a terrible struggle with devil's club and berry vines, trying to get up to the base of Washington Monument too far down the valley. This took a lot of time and wore us out so we only looked at the karst surface. We did find a little cave about 50 feet into the trees, perhaps a hundred yards south of the north end of the Washington Monument clearing. It has a pit entrance along a vertical limestone face in a small sink, and an irregular room 15-20 feet deep with a small vadose drain in pretty limestone at the bottom. Unfortunately the ceiling and much of the far wall are dirt, or at least dirt-covered. The surficial karst of the area certainly is beautiful. *Ed. note: this sounds like one of the small caves discovered by Jan Roberts and Dave Walker there in July '75.*

To our surprise, it took only 90 minutes to get back to the clearcut from the valley even in our tired state. We located and angled up over the spur we missed coming in, then followed animal trails angling up the hillside that looked as if they were leading roughly where we wanted to end up; above the clearcut but below the cliff we had passed above earlier. It worked out pretty well, though we did have some trouble with devil's club in one of the stream gullies.

A Visit to Another Region: Rocky Mountain Regional Trip Report

by Ed Crawford

About one week before the past Labor Day Weekend, I left Seattle, with the rest of the Crawford family along, for a vacation trip East. Our ultimate destination, and excuse, was to be the Rocky Mountain Regional conference, held near Lovell, Wyoming, on Sept. 4, 5, and 6th. Other incentives existed, of course, such as the desire to see different scenery, to get out of the rain, and to just be where significant amounts of limestone (and caves) did exist.

We travelled through Eastern Washington and Idaho rather quickly, then slowed down in Montana to more carefully inspect the scenery, and the cave possibilities. We spent a bit over a day in the area of the Scapegoat Wilderness looking over the amazing expanse of limestone, much of which has been checked, but much more hasn't. Then, later drove through another extensive limestone area which I had never heard of, the Little Belt Mountains. This area, which we drove through mostly on forest roads of the minimum visible on the highway map kind, has a lot of exposed Madison limestone, and, we later found out, some caves. We saw enough entrances to stop every few miles to look at something within a few hundred yards of the road, but none were more than shelters. I might add that in this part of the country, navigating these forest roads takes either a forest service map or a lot of luck, and they do have cattle gates, etc., on them to convince you that you have gone the wrong way even if you haven't.

Friday night, before the Conference was to begin, we arrived at the campground, actually about 60 miles and 1 1/2 hours east of Lovell. We were actually rather early arrivals, early enough to make some modifications in the rather tight cave trip schedule that had been set up according to preregistrations. It was a very well organized conference, but I will leave most of the discussion of the politics of such things to the other (regional) publication.

Saturday, the whole family went on a "clean up" trip to Tongue River Cave near Sheridan, and, although our party didn't get to the river passage, we had a good time, and actually did remove a lot of junk. This particular cave has a lot in common with Ape Cave, in that it is well known by the youth of a nearby semi-urban area as a party-place, with similar results. It is, though, a rather extensive limestone cave, with a very interesting hydrology, as we found out later in the conference.

Sunday, Jim and I went on a trip to Horsethief Cave, which turned out to be an outrageously long drive toward Lovell from the camping area. We finally got there, although late enough that our guide's plans for a mapping trip were pretty well shot. After a rather fast trip through a small part of this extensive cave, which for some reason reminds me of Wind (South Dakota), we headed back to camp, and after some delay (running out of gas), got back in time for the tail end of the banquet. Yes, they even had one of those, complete with a speaker, Nick Noe of the NSS Conservation Committee. His talk was concerned with a very general view of future cave conservation policy and specifically with an evaluation of the impact of recent "Caves of" publications, with special reference to "Caves of Wyoming", which had been published through the state dept. of resources. He seemed to regard this as a relatively "good" publication.

Monday was the last day of the conference, and for most people, was spent packing. There was a session for formal papers, of which there were three or four, including one on the hydrology of the Tongue River Cave. This work had been done under state auspices in order to find out more about the regional hydrology, to better understand the impact of possible strip mining activities. The Rocky Mountain States are giving very serious consideration to these questions.

About noon, we left for the Yellowstone area and the next day, spent some time around Craters of the Moon National Monument. Yes, there are lava tubes there, and more in the surrounding area.

Mt. Adams Area Trip
September 11-13

by Rod Crawford

After the usual last-minute cancellations it was a party of two--Dave Ridley and I--who drove down to the Deadhorse Cave campsite via the Randle road on

Saturday the 11th. We met an Oregon Grotto party--the trio of Jones, White, and Silver with some others--coming out of the cave, and after various delays we went in. The first order of business was for me to place a plankton net in the spring of the cave river. For the results of this netting, see last month's Biologist's Chamber. We spent a good deal of time exploring the complex at the bottom of the River Passage. This is a fascinating part of the cave, little visited for some reason. Then, having retrieved the net, we made our way out. It was not only dark, but also drizzling. Fortunately, it stopped long enough for us to have dinner and fasten a waterproof tarp between four trees to sleep under. By early morning there was so much water in the tarp that it vibrated like a drum with every additional drop. Fortunately, rain doesn't make things especially wet in that area, and it rained no more during our visit.

Sunday, we spent the morning mapping the upper crawlway complex in Flashcube Cave. This part of the cave is interesting in retrospect, but it was no fun to map. All the crawling did wonders for Dave's old knee injury, so I had to promise him a really *large* cave. Thus, in late afternoon we descended into Cheese Cave. Having toured this gigantic tube--30 to 60 foot high ceilings--we drove to and camped at Goose Lake to give Dave a chance to do some kayaking.

Monday morning we made a brief visit to Poachers' Cave. However, Dave's knee proved not to have recovered yet. So, we started for home.

Near Elbe, the engine in Dave's car burned up [!]. So we were towed the rest of the way into Tacoma.

Two Caves Found in Boulder Glacier Snout

by Bill Halliday

The July 4 weekend trip had found the Boulder Glacier snout still snowed in, and every subsequent attempt had either seen the troops mutinying because of storm conditions or giving up in advance because of the weather this miserable summer. Finally, though, on Sept. 25, Russ Turner and I made it (with Pakawon Duvall and Joyce Hawkes in support). For the first time ever on a caving trip, snow was almost entirely gone from the snout.

Unlike the Paradise Glacier, the drainage from the Boulder Glacier does not emerge at one or two major creeks or rivers, with associated cave passages. None of the resurgences could be penetrated, and none looked penetrable unless the streams dried up so completely that the low orifices could be crawled. We did find two small caves with features quite unlike any I have previously seen, however. The first was immediately south of the resurgence of the north fork of Boulder Creek and was separated from the stream chennel by a thin wedge of large cobbles and till through which the stream was audible. The entrance was about two feet high and while several feet wide, the south part was occupied by another of the branches of Boulder Creek, cascading down a slope just inside the glacier-neve junction. Flake-fall and subsequent removal by the stream had left an irregular room perhaps 15 feet in diameter. The northern part of the stream channel of the north fork of Boulder Creek was a stoopway perhaps 50 feet long and three to four feet wide and high; along its north margin was a lower extension. Dramatic in its ceiling were deep abrasion grooves similar to but deeper and more localized than those illustrated in Post and La Chapelle (1971, p. 25). Some small till curls were also present.

A few hundred feet southwest around the snout, I found some concentric flakefall that permitted entry into a chamber approximately 25 by 30 feet, and up to 6 feet high. Most of it was demarcated by flakefall, but at the lower end, back toward the snout, were some till curls of approximately the same magnitude as in Post and La Chapelle (1971, p. 26).

Crawling through flakes at the upper end of the room allowed me to slide into a larger inner room, perhaps 50 by 40 feet in size but lower than the other. Along each margin, small streams cascaded noisily. Flakefall was much less prominent than in the outer room and seemed limited to the section between two short sections of grooved throughway much like that at the other cave. More large till curls were present at the lower end, and one small one was hanging from the ceiling.

Where not floored with flakes, most of the floor of both these caves consisted of till in a marked state of fluidity, locally approaching quicksand. Evacuation by till flowage appeared to be a major factor in their enlargement to passability. I have not seen this suggested as a major factor in glaciospeleogenesis, and suggest that it be given serious scrutiny in future studies, especially in active glaciers like this one.

We also checked the dramatic waterfall pit at the extreme north end of the snout, against a rock wall. Since July 4, it is grown into a large gulf, with an accumulation of fallen flakes that block access to any glacier-front cave which may be present. Running water in the depths can be heard there and at several crevasses en route to the resurgence of the north fork.

Several hundred feet farther southwest from the second cave, we found another flake-fall chamber with two openings. At first it looked good although very drippy and muddy. When I finally succeeded in crawling up the flake pile, however, it turned out to be only an ablation space where the glacier was receding back behind (above) a low rock face and cracking apart; the equivalent of a talus cave but so transitory that I don't think we should even count it as a cave. We left unchecked the big hole at the extreme upper end of the south margin of the snout--it looks like it will be safer and more accessible with a good thickness of snow. And all resurgences in the upper basin remain unchecked, even from a distance.

It looks to me like a thin apron of glacier snout recently has melted back quite rapidly. A remnant of glacial ice was present amid residual snow more than 100 feet downstream along the north fork. Also more than one hundred feet from the present glacier edge, a few hundred feet further southwest, the imprint of glacier sole abrasion grooves on a till surface showed no signs of weathering despite this summer's raininess. Whether this has anything to do with the geothermal activity up in the crater, more than a mile away, I would not care to speculate. I see no reason to believe that the two caves have any relationship to the thermal activity. On the other hand, further investigations of these and related phenomena may well shed more light on torrential glacier outbursts--see page 360 in the new edition of *Depths of the Earth*.

The weather was so magnificent that it must have been a mistake. And unlike the July 4 trip, we could see occasional puffs of steam from the crater --perhaps not quite as much as last year, but still impressive.

Reference:

Post, Austin, and Edward R. LaChapelle, 1971. Glacier Ice. University of Toronto Press, Toronto. 113 pages. [An American edition also exists].

Still More Windy Creeking

by Rod Crawford

On Saturday, October 2, Chuck Coughlin, Tuffy, Bill Capron and I left

Seattle at 4:00 A.M. with Tom Sheehan, a former Iowa caver now living in Wenatchee. By 6:30 we were at the washout on the Bear Creek Road. It was also raining. After turning Tom's van around, we sat and tried to talk ourselves out of hiking to the cave in the rain. This took until about 7:00, by which time it had stopped raining and was beginning to get light. So, we loaded up with gear and hiked on up the road. Fortunately we all had rain gear, for it sprinkled a bit more on the way.

When we reached the spot where one leaves the road, Chuck recognized it by the ribbon he had left on a tree this July. There was still snow on the ground then. This may explain why the ribbon was now ten feet above Chuck's head!

We hiked on down the valley and climbed up to the base of the cliff only a little too soon, necessitating only one difficult traverse before reaching Windy Creek Cave. It was now noon, and we gave ourselves two hours before starting out of the cave. Tuffy was wrapped in wool and deposited in the entrance, and this time had sense enough to stay there.

While Chuck and Bill hurried on to start surveying, I gave Tom a tour of the Flatworm Passage, finding no flatworms. We then squeezed through the completely dry Ex-Pool and continued down the cave at a leisurely pace. This was the first time I had been past the Ex-Pool (when I was there before, it was still a pool), and I noted with horror that this part of the cave now contains some six or ten broken stalactites. Please, people, be more careful. There are few enough of the things in Washington as it is.

The day was not lost biologically, for I gathered in a couple of flatworms in the main cave stream and preserved them properly. Perhaps a specialist's opinion on them will be recieved in time for the next issue. When we reached Chuck and Bill, they had surveyed almost as far as the breakdown room. We passed them and did a little exploring. We returned to the mappers as they did their last station, to the cairn in the room. Chuck was standing in a hole in the floor reading the compass when a large rock on a shelf above him began to slide. As we warned him, it slid a little more, making our hair stand on end. Fortunately, he got out unscathed and we pushed the rock the rest of the way off the shelf. It fell through the hole with a great noise.

By the time we got out to the entrance, I was completely exhausted from all the chimneying one has to do in this cave. Nonetheless, the hike out was still necessary, and I managed it somehow. Of course it was now raining harder. We reached the car at 7 P.M., just as it was getting dark. All in all, an excellent (though damp) trip to an excellent cave.

Total surveyed passage is now 950'. There are at least a couple of hundred more feet of explored, and some more unexplored, leads.

We left a register just inside the ExPool as part of Dave Jones' cave register program. According to Dave, the idea of these registers is to calculate the impact of visitation on the cave, so <u>all</u> visitors, including cavers, should sign them.

All-Grotto Lava Tube Trip
October 9-10

by Rod Crawford

I arrived at the Deadhorse Cave campsite early Saturday afternoon with Ed Crawford and his family to find that the personnel already present consisted of: Les Nelson, Bob Brown, Marlene Schneider, and Curt Black. Later, Stan and a number of other Pughs arrived. This was the total turnout for the so-called All-Grotto Trip.

I immediately placed my plankton net in the lower spring of Deadhorse Cave in order to have a full 24-hour sample. This was duly picked up the next day; its rather interesting contents have not been fully examined at this writing. Bob, Curt, and Les had some vertical practice at Little Goose Creek Canyon, then went through Deadhorse while I and Ed's kids admired a bat *(Plecotus townsendi)* in the upper entrance chamber. Later, I went spider collecting.

That night, those of us who had elected to sleep out under the stars got rained on. Luckily I woke up before my sleeping bag was very wet, and so was able to continue my slumber uninterrupted in Ed's van.

Sunday morning, I, Stan, and Jim Crawford headed for Flashcube Cave and (glory be!) finished the map. It may be viewed in all its glory on the cover of this issue. The length of 585 feet was less than I had hoped, but the cave is interesting nonetheless. There seem to be three separate levels, separated by 3' ledges and drops. The top level is very near the surface and has a perfectly flat floor--virtually no slope. It is almost all crawlway but one section, containing three pillars, is amazingly wide. There are some very nice hanging roots, which, on our visit, had overwintering harvestmen clinging to them. There were hundreds more on the ceilings--I collected twenty while sitting in one spot. The middle level, that of the entrance, slopes downward normally, as does the lowest level except where its end is modified by a mud fill.

The cave is plainly part of the same system as Squeaking Pika Cave, and deserves this name equally well--a pika had made its winter "haystack" just inside. A study of its speleogenesis might be enlightening.

After lunch, Brown, Black, and Schneider headed for Curt and Annie's house in Eatonville, where we were to meet them later. Ed and family drove off presumably to our rendezvous at Dynamited Cave, but were never seen again.

When Les and I arrived at Dynamited, Stan was engaged in an abortive attempt to take his family to the bottom of the entrance chamber. After this failed, Stan, Les and I continued on and went down the first ledge on one of Stan's ladders, and spent some time photographing in the sand castles area. I was prepared to admire the castles, but no one had told me that the sand was white--like beach sand. Amazing.

Les and I returned over the Randle-Trout Lake road (in reasonably good condition) to Eatonville and thence on an uneventful trip home.

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ADDENDUM TO A PREVIOUS REPORT: On Sunday, September 12, Dave Ridley became the first (and, so far, the only) person to explore Clearcut Cave in the Flashcube Cave area. He reported that it consisted mainly of one 100 foot crawlway. Oh, well.

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THE PRACTICAL CAVER SAYS: The top to something like a Prestone Antifreeze gallon jug also works as a top for a carbide lamp bottom, for those who are cheap and have spare bottoms lying around.---L.G.N.

[Cribbed from *The Speleograph,* Vol. 8 No. 10 p. 114.]

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THE BIOLOGIST'S CHAMBER: AMPHIPODS

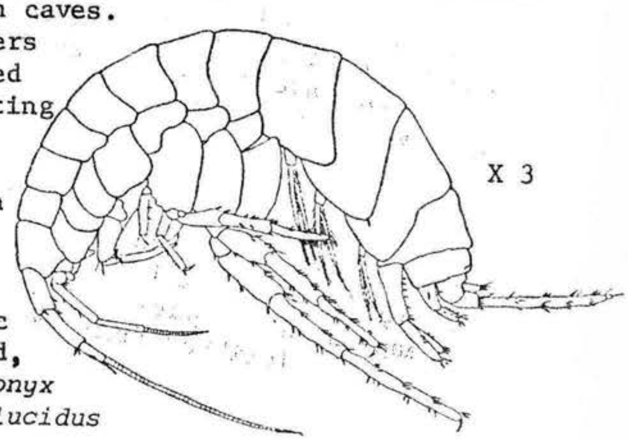
by Rod Crawford

Amphipods (or "scuds"), like their close relatives the isopods [see last month's column], are an Order of the class Crustacea. Though less conspicuous than the well-known crab-and-lobster type of crustaceans (the decapods), amphipods are nonetheless numerous and widespread. They are the "sandfleas" that hop about on the beach, and most species--some of great size--are oceanic. The freshwater branch of the amphipods is one of the best-represented groups in subterranean waters. 65-75% of North American freshwater species are exclusively subterranean.

In general structure, amphipods have much in common with isopods--the three body divisions, segmented thorax, and seven pairs of legs. However, the high and narrow or "pinched" body form, with the arched back, easily distinguish them. Unless eyes are present, telling one end of an amphipod from the other is not always so easy (see figure). The *pleopods*, appendages of the abdomen, are leglike. Respiratory organs, called *coxal gills*, are attached to the base of the legs. The male sex organs are located between the last (seventh) pair of legs.

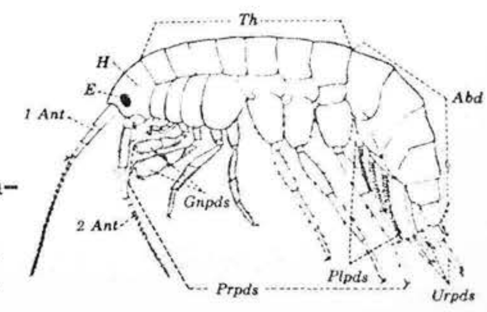
All subterranean amphipods in North America, and most worldwide, belong to the family Gammaridae. There about 120 known species in seven genera in U.S. cave and phreatic waters. Of these, only the genus *Stygobromus* has subterranean representatives in the Northwest.

Most species in these seven genera are both troglobites (specialized inhabitants of caves) and phreatobites (inhabiting underground water generally). In theory, each of these species evolved from a surface species that became isolated in a cave and evolved the usual blindness, white color, long appendages, etc. There would follow a period of dispersal through the surrounding area in the "interstitial medium" of groundwater, colonizing any other caves encountered. The underground dispersal could even cross drainage divides. Most species of the present day have geographic ranges with dimensions in the hundreds of miles. Not all occur in caves. The Eastern genus *Stygonectes* seems more abundant in the interstitial medium than in the caves themselves, and cave populations are present only sporadically, perhaps when individuals are flushed into caves by groundwater flooding. One expert, John R. Holsinger, believes that many species exist which are exclusively phreatobitic, not occurring in caves. Only a few of these are known and finding others presents obvious problems. There is no refined method for collecting from a well, and collecting at springs and groundwater seeps usually requires special conditions such as wet weather or spring flooding. Species of the midwestern genus *Allocragonyx* (see fig.) are thought to be exclusively troglobitic, being too large for the interstitial medium.



A troglobitic amphipod, *Allocragonyx pellucidus*

Known localities for *Stygobromus* in the Northwest



Diagnostic figure of a surface-living amphipod. *H*, head. *Th*, thorax. *Abd*, abdomen. *E*, eye. *1 Ant*, 1st antenna. *2 ant*, 2nd antenna. *Gnpds*, gnathopods (1st legs). *Prpds*, pereiopods (legs). *Plpds*, pleopods. *Urpds*, uropods.

Cave populations of *Stygobromus* are always associated with mud or silt bottoms. In Washington they have been found mainly in cave streams, but elsewhere they usually occur in pools fed by drips or seeps. Holsinger found that amphipods would appear in plastic trays fed only by cave ceiling drips. Their invasion of this purely vadose (percolated from the surface) water may have been via temporary saturated zones above the water table.

Cave amphipods are mainly confined to the bottom, where they move both with their legs and by flexing their whole body. They can, however, react to touching with a rapid, short swim (on their side) propelled by the pleopods. They are restricted to water which is shallow and well-oxygenated, though their respiratory rate is slow.

Amphipods feed voraciously and omnivorously. In caves, like the isopods, they serve as general scavengers and feed on dead vegetation and bacterial scums.

In common with the isopods, female amphipods have a pouch or *marsupium* under the thorax. Species of *Stygobromus* may sometimes reproduce parthenogenically (without fertilization by the rare males). When mating occurs, a male will sieze the female shortly before she molts to sexual maturity, and carry her on his back until that molt occurs. Then he releases sperm near her marsupium; she sweeps it in, then releases eggs into the marsupium where they are fertilized. The young, which soon hatch, are released from the mother's marsupium at her next molt. The cycle of molts, through which the young amphipods grow, is slow compared to that of surface species and cave amphipods may live more than one year. No complete life histories are known.

Three species are presently known from our area. *Stygobromus hubbsi* is well known from 105 specimens collected in Malheur Cave, Oregon, the famous lava-tube-with-lake, by Carl Hubbs in 1928. In recent years, Ellen Benedict and others have rediscovered it. *S. oregonensis*, a larger species--up to eleven millimeters long--is known only from two females collected in 1967, in a small fissure cave near Roseburg that sometimes contains phreatic water. The total ranges of these two Oregon species have not been investigated.

Stygobromus elliotti was first collected during the 1972 NSS convention by W.R. Elliott, Frank Howarth, Luurt Nieuwenhuis, and others, in three Washington lava tubes. These were Deadhorse, Three Sinks, and Little Red River caves, so that its distribution includes Washington's three major lava tube areas and crosses several drainage divides, including the Cascade Crest. It is fairly large, reaching 9.5 mm. It is the only troglobite known from the Mt. St. Helens cave area. Of the 23 specimens collected, only two were males.

Amphipods can often be collected under dead leaves or other objects in seeps and springs during groundwater flooding. As with isopods, they should be picked up with a wet brush and transferred to 70% alcohol. Specimens in open cave waters--which often swim away at the touch of a brush--can be captured with the aid of a small tea strainer.

The following publications by John R. Holsinger have been of great aid in preparing this column:

1969. Biogeography of the freshwater amphipod crustaceans (Gammaridae) of the Central and Southern Appalachians. *in:* Holt, Perry C., et al., eds., The distributional history of the biota of the Southern Appalachians. Part 1: invertebrates. Virginia Polytechnic Institute, *Research Division Monograph* 1. Pp. 19-30.

1972. The freshwater amphipod crustaceans (Gammaridae) of North America. U.S. Environmental Protection Agency, *Biota of Freshwater Ecosystems Identification Manual* No. 5. Pp. 1-89.

1974. Systematics of the subterranean amphipod genus *Stygobromus* (Gammaridae). Part 1: species of the Western United States. *Smithsonian Contributions to Zoology*, No. 160: 1-63.

DEPARTMENT OF CONFUSION AND OBFUSCATION

While doing research recently for a "Biologist's Chamber" column, yr editor happened upon a general paper on the subject of groundwater fauna in a German journal. Not being able to read German too well, it was necessary to depend on the English summary appended to the article. However, all attempts to understand this summary failed, as it consists of the most amazing gibberish. Most of it is here appended for your amusement and edification.

"The interstitial biotopes in layers of sands and gravels filled with underground water--'mesopsammal' and 'mesopsephal'--are marked as highly favored biotopes among the several ecozones, where the inhabitants of underground water are able to live in and that all in their whole are representing the ecoregnum 'stygon'.

"This ecoregnum 'stygon' is divided into ecological zones of own conditions. The interstitial biotope in layers of sands an gravels filled with subsoil water is proposed to be called 'eustygon' in those regions where biological influences from waters of the surface of earth do not exist and where only extreme 'stygophile' subsoil fresh water organisms (for example *Acanthocyclops venustus* and *Diacyclops languidoides*-relationship) make members of nearly ecological equivalence in biocenoses of otherwise stygobiont species.

"The mesopsammal and mesopsephal biotopes of the "eustygon'--'eustogopsammal' and 'eustogopsephal'--are characterized by giving a list of typical species as elements of the two biocenoses 'eustygopsammon' and 'eustygopsephon'.

"The underground water biotopes within sandy and gravy beds of rivulets, streams and rivers in the ecosystems of 'rhithron' and 'potamon'--'stygorhithron' and 'stygopotamon'--are confronted as ecoregions of own conditions with their mesopsammal and mesopsephal interstitial biotopes 'rhithrostygopsammal' and 'rhithrostygopsephal', as well as 'potamostygopsammal' and 'potamostygopsephal'." [There is more, but enough already!]

From: Husmann, Siegfried, 1966. Versuch einer okologischen Gliederung des interstitiellen Grundwassers in Lebensberichte eigener Pragung. *Archiv fur Hydrobiologie*, 62 (2): 231-268.

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VULCANOSPELEOLOGICAL ABSTRACT

Ford, Alexander Hume, 1911. Volcano days in Samoa. *Mid-Pacific Magazine*, 1 (5): 582-593, 1 (6): 635-641.

Narrative of a visit to the new volcano Hale Kakina (Fale Tateno), also called Matavanu, on the Samoan island of Savaii. This volcano had first appeared in August 1905, and at the time of visit had been erupting pahoehoe lava continuously for nearly six years. Mentions (p. 583) that: "One may even peer over the edge of the cone and watch the forces of nature at work, observing the flow of boiling rock as it pours itself into an engulfing tunnel; then turning around, he may watch the cloud of steam ascending from the sea eight miles away, where the tunnel ends and the molten stream falls into the ocean...".

P. 587: "We fell in with a German trader from across the little river and he guided us the next day to some remarkable caverns near the little village of Fagaee--tunnels in an old lava bed, in fact--tunnels through which molten lava once flowed to the sea from some long-forgotten crater. The natives now use these tunnels for cisterns and swimming pools. In the tunnels near the sea shore I noticed that there was a rise and fall of water within, although it was quite fresh. These tunnels are the refuge of the people now, for, while the rain water collected in tanks is so impregnated with sulfur

Map showing the location of the Savaii 1905-1911 lava flow.

From an old U.S. Hydrographic Office chart.

"...to be undrinkable. The water in the volcanic tunnels is always fresh and sweet."

Pp. 589-90: "I stood, or lay, at last upon the edge of the crater itself. The glare was blinding and the fumes of sulphur stifling... At either end great caverns seemed to engulf the terrific overflow of fire, the roar of the descending lava could be plainly heard above the seething and boiling in the greater chaldron. As I raised my head and turned it away from the ascending devastating cloud of sulphurous vapor, I could see the column of ruddy steam rising from the sea, eight miles away, at the other end of that great under-lava tunnel, into the two devouring mouths at which I once more gazed and was fascinated."

P. 591. Photograph of the gas vents along the line of the tube. Photo plainly shows "semitrench" ridge. "The surface of the lava flow has now cooled, but beneath the cold, black lava is a river of flowing fire, which still empties itself into the sea. Once or twice the tunnel has been clogged, and then the lava has forced itself through the soil near the cone, just beyond the last outburst, and, taking a course along the outer edge of the old lava field, has carried destruction over new areas from the mountain to the sea."

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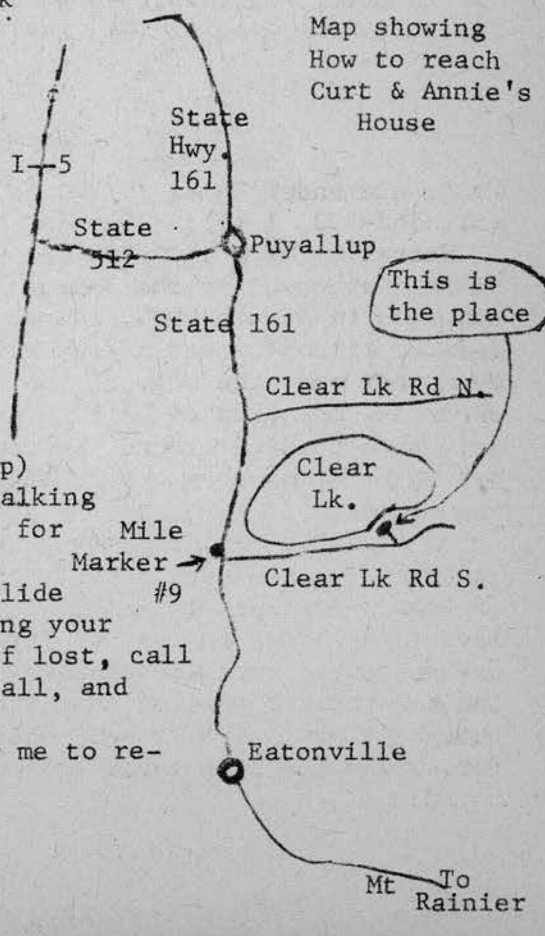
DETAILS ON THE GREAT POTLUCK AND CONEPICKING AND SLIDE SHOW MEET

All participants meet at the home of Curt Black and Annie Ruggles near Eatonville (see map) at 10:00 A.M. both Sat. and Sun. for a day of walking through the woods gathering cones (for much $$$ for the Grotto), mushrooms, etc. At 6:00 P.M. on Saturday there will be a a potluck dinner and slide show at Curt and Annie's house. Be sure to bring your slides in addition to your food for the pot. If lost, call (206) 832-6352. There will be a good time for all, and we hope that EVERYONE will attend!

(N.B. Many recreations--a list too long for me to remember--will be available at the house.).

Map showing How to reach Curt & Annie's House



CASCADE GROTTO STORE
Bill Capron, Keeper, Phone 784-8497
Price List September 1976

Cave Packs	$1.50
Carbide	*
Helmets	*
Chin Straps	.85
Premier Carbide Lamps	8.75
Lamp Brackets	*
Lamp felts	2/15¢
Lamp tips	.20
Lamp flints	3/25¢
Lamp gaskets	.10
MSA Nickel-Iron Headlamps	*
Gibbs Ascenders (spring)	8.50
Gibbs (quick release)	10.50
Bonaiti D carabiners	2.50
Bonaiti Locking D	2.50
Cascade Grotto Patches	1.50
Cascade Grotto Decals	.25
NSS Decals	.20

*Contact keeper for information

Quantities are limited in some cases. If you want any caving-related equipment not listed here, please ask for it. The store is here to serve you, so take advantage of it. ---B. C.

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POTLUCK

SLIDE SHOW

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FOR THE GROTTO

AT EATONVILLE

COME ONE COME ALL!

(This Weekend)

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SEE NOTICE WITHIN
FOR MORE DETAILS

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Take
Nothing
But
Pictures
Leave
Nothing
But
Footprints

THE OCTOBER GROTTO MEETING IS THIS MONDAY, THE 18th! REMEMBER?