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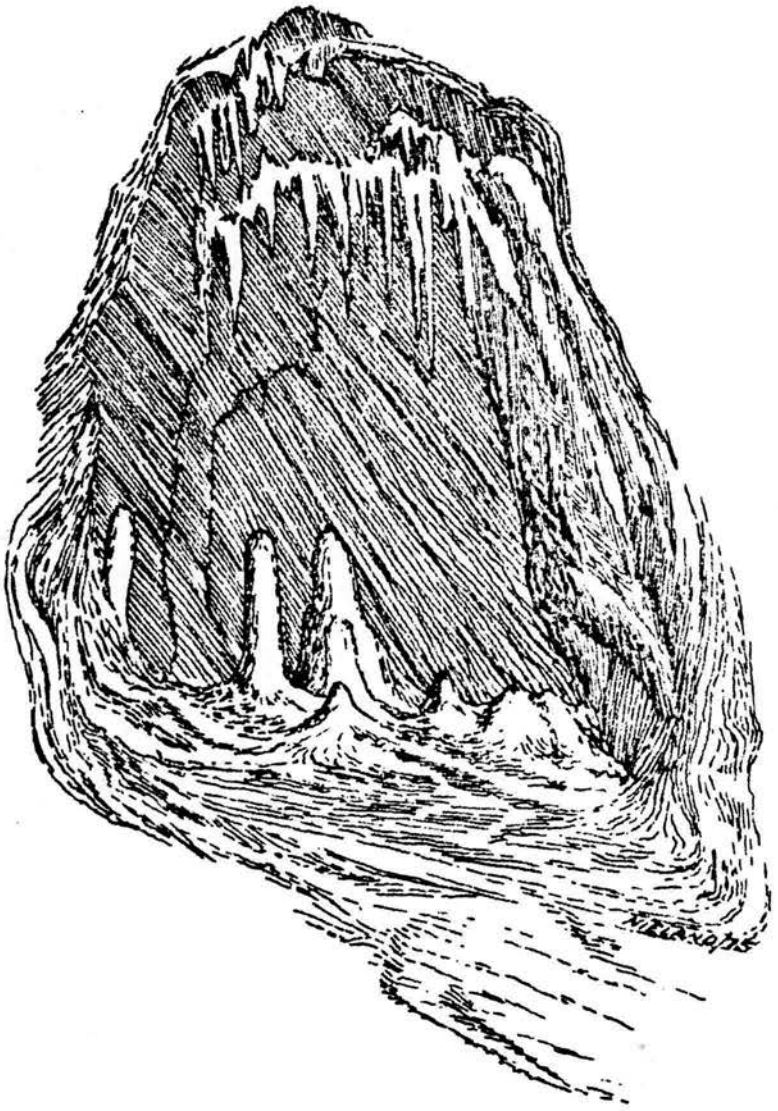

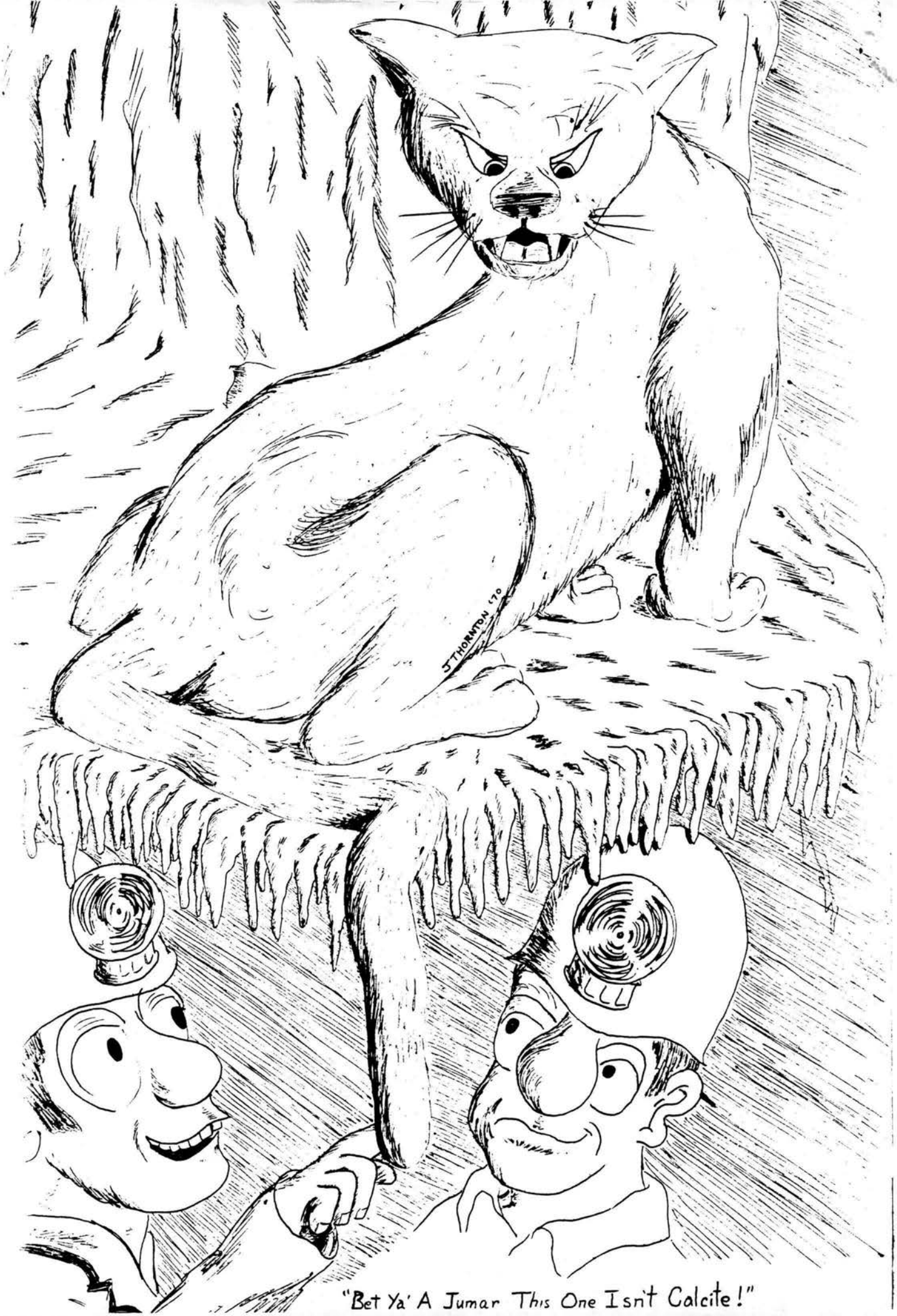

"Bet Ya' A Jumar This One Isn't Calcite!"

COMING EVENTS

June 11-13	Mt. Adams area, probably Dynamite and Falls Creek caves. Contact Dr. Halliday at 324-7474.
June 15	Grotto Meeting at 8:00, 1117 36th Avenue East.
June 26	Mt. St. Helens caves. Call Dr. Halliday.
June 26-July 2	NSS Convention, Bend Oregon.
July 3-5	Post Convention Grotto gathering at Deadhorse Cave. Beef, baked beans, beer and pop provided, $5.00 for adults and $3.00 for those under 14. Dinner starts at 7:00 on July 3. Contact Bob Brown at 569-2724 or Andrew Foord 523-6727 (at least one week in advance please).
Sept. 3-6	Northwestern Regional Meeting, Gordon River, B.C.

NEW MEMBERS

Matthew D. Carson
472 Haggett Hall
University of Washington
Seattle, WA 98195
543-6472

Tad Rogers
Tim Rogers
26415 SE 160th
Issaquah, WA 98027
392-1864

GROTTO NOTES

At this years NSS Convention in Bend, there will be an auction. If anyone has amusing or historic caving supplies or any sporting equipment, call Bob Brown at 569-2724 or bring it to the next Grotto meeting.

So Cheon Gul
A Major Korean Lava Tube Cave System
with Notes on the Geology of Cheju Do

by Rod Crawford

At least three of the lava tube caves on Cheju Do, a volcanic island off the coast of South Korea, have more than 2 km of passage, and are among the 25 or so caves that qualify for the List of the World's Longest Lava Tubes. One of these, Man Jan Gul, was discussed in a previous paper in this series (Crawford 1980). So Cheon Gul, the subject of the present report, is considerably nearer the bottom of the list, but still internationally significant. I summarize here the published information about the cave, and also give some more detailed geologic information about the island than was available for the previous report.

So Cheon Gul is located near the west end of the island (Fig. 1). So far as I can tell the name means something like "thousand cow cave", but surely that can't be right. I must have mistranslated.

Description of Cheju Do

Cheju Do is about 70 km long. It is known in Korea as the island of "three many's and three naughts": many winds, many stones, and many women; no thieves. no beggars, and no water. The highest elevation on the island is Mt. Halla, a symmetrical shield volcano, which at 1950 m is often snow-capped during the winter.

The island's climate is warm temperate and the vegetation, in favored spots, resembles that of Okinawa and southern Japan. The mean annual surface temperature is 15.1°C. Annual precipitation on the north side of the island is 130-200 cm (similar to that of, for example, North Bend or Concrete in Washington). However, much of this is confined to the annual monsoon season; and the basalt of which the island is mostly composed is so well-drained that there is little surface water during most of the year. This accounts for the "no water" statement about the island. There is, though, a vast body of groundwater, accessible via wells and springs. (Young 1969, Eckstein 1969, Davis et al. 1970). Population of the island was 318,358 by the 1964 census; most lived near the coast, where spring water is available.

Geology of Cheju Do

The island is almost entirely volcanic in nature and is about 1,000,000 years old. The most recent recorded volcanic activity was in 1002, 1455, and 1570 AD. The volcanoes are now considered extinct, or at least dormant.

The oldest known volcanic rock exposed on the island is trachyite of Pliocene age. Overlying this are andesite and trachyandesite, alternating with older basalt flows, of Pleistocene age. Younger basalts were erupted during historic times. Sedimentary deposits are very limited in extent, and consist mainly of cemented pyroclastics and ancient beach sand.

At least 20 different basalt flows (or groups of near-contemporary flows) have been identified. The most widely distributed is the Pyoseonri basalt, which is found along much of the coasts. This and later extensive basalt flows probably erupted from the crater of Mt. Halla.

The most recent volcanic activity is represented by more than 200 parasitic cones. Lava flows associated with these cones are restricted to specific

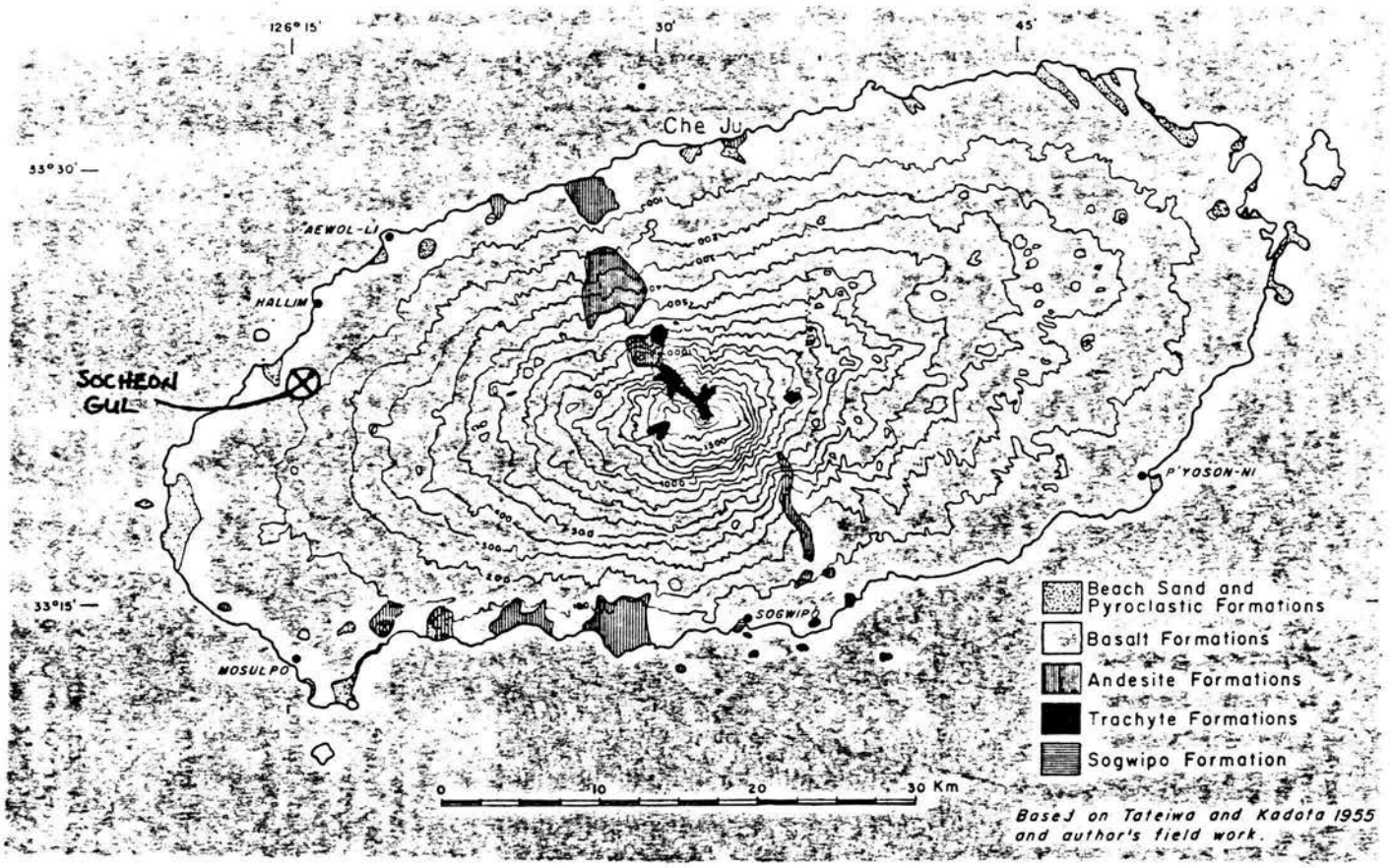

Figure 1. Simplified geologic map of Cheju Do, showing location of So Cheon Gul. Basalt shown in **gray**. After Eckstein (1969).

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areas of the island, unlike the widely distributed Mt. Halla flows. Lava cones, driblet cones, cinder cones, and tuff cones are present; they are composed of basalt, andesite, and trachyite. The trachyite cones are the steepest, with slopes of up to 50°.

As can be seen from the geologic map (Fig. 1), the vast majority of the island's surface is covered by basaltic lava (shown in gray). Several types of basalt are present. The common types are chemically similar to Hawaiian basalts, except for having a much higher iron content, a little more sodium and potassium, and a little less magnesium and calcium. The basalts are vesicular, cut by numerous joints and fissures, and contain many lava tubes.

Speleogenesis

As far as I can determine, the lava tubes of Cheju Do originated in the conventional manner as often described for Hawaiian caves. However, Eckstein (1969) proposed a mechanism for formation of these caves which is, well, a bit unusual. He claimed that "the main beach sand deposits...appear as long and narrow (maximum 6 km) tongues extending inland within the lava flows...At their narrowmost extensions, the tongues were covered by younger lava and later flushed out by ground water, leaving long spacious tunnel-like caves...On the older basaltic cave walls are well preserved ancient sea level marks"!! This theory gets high marks for originality; in all my experience of crackpot notions about lava tube genesis, I've never encountered this one before. Eckstein, an Isreali geologist, clearly had never seen or heard of a lava tube before.

Geology of So Cheon Gul

The location of So Cheon Gul is shown on Fig. 1. It is in an area mapped as Pyoseonri Basalt, the most widespread of the Mt. Halla lavas, perhaps late Pleistocene in age. However, the cave is just downslope from one of the basalt parasitic cones, and may actually be in a small, unmapped younger flow.

A few re-entrant side passages are present (see map at end of article), as well as some small tributary feeder passages. There are two collapse sink entrances. The lower end of the cave is blocked with sand (probably such occurrences suggested Eckstein's odd theory. I wonder what he would think of Ape Cave, similarly blocked with sand but a long way from the beach!)

Fig. 2 shows the formation of various features of the wall-floor junction of the cave.

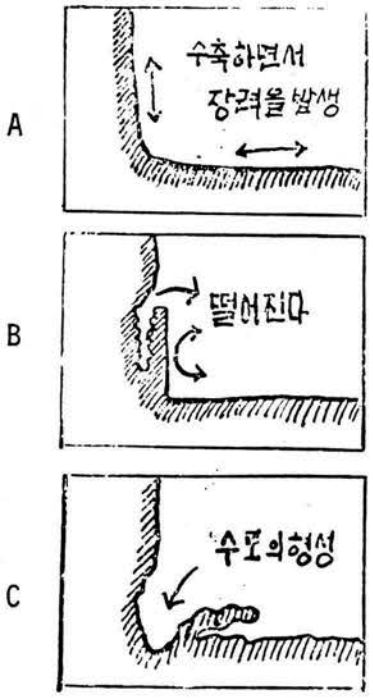

Figure 2. Wall-floor junction structures in So Cheon Gul.
A. Curved junction formed by contraction
B. Wall lining slumped while still soft.
C. Lateral gutter and incipient tube-in-tube formed by floor flow.

Length of So Cheon Gul

As is usual for Korean lava tubes, different length figures are given in different publications. The Korean Speleological Society (1970) gives 2389 m; Lee (1974) gives 2500 m; Ogawa (1978) gives 3074 m. The accompanying K.S.S. map shows that the second entrance segments the system into two caves. I calculate from the map that the caves' lengths are 2186 and 404 m, for a system total of 2590 m. Ogawa's figure is said to include "new branches". The only unmapped side passage shown on the old map is in the longer cave, so perhaps its length is actually 2670 m. As discussed previously (Crawford 1980), only the length of the individual caves counts in determining length statistics. Thus, for the purposes of a long cave list, So Cheon Gul is 2186 or, possibly, 2670 m long.

Microclimate

Microclimate data for So Cheon Gul is given in Table 1, on the next page. This data is taken from the Korean Speleological Society 1970 book; measurements were made on December 4, 1968.

Evidently the station numbering starts at the upper entrance and proceeds downtube. The three air temperatures taken in the main cave are significantly above the mean annual surface temperature (MAST) of 15.1°C; whereas the temperatures of most caves in the area, such as Man Jang Gul, are significantly below the MAST. This is supposed to be the case with most caves whose entrance is higher than the rest of the cave, as is the case with So Cheon Gul. The temperatures given in the table are, therefore, anomalous. Perhaps there is some geothermal heat flow here?

The water pH given is nearly neutral. Most caves in the area have slightly alkaline water; one, Ke Os Sae Gul, has markedly acid water, with pH from 3.5-5.2.

As is usual, the water temperatures are slighly lower than the air temperatures.

A more extensive microclimate survey of this cave would be of interest.

Table 1. So Cheon Gul Microclimate Data

Station	Air Temp., °C	Water Temp., °C	pH	Remarks
Surface	16.0	---	---	Time 1515
1	14.0	12.0	7.2	Near entr. 1
2	13.5	12.0	7.2	
3	15.0	---	7.2	Near 2nd cave (?)
4	17.0	16.0	7.0	Main entr.
5	17.0	16.0	7.0	
6	17.0	16.5	7.0	
7	16.5	15.5	7.0	

Botany

As with Man Jang Gul, the entrance flora of So Cheon Gul has been studied carefully. However, in this case study seems to have been limited to vascular plants; no mosses or algae are listed. By far the most diverse plant group in the list is ferns, of which 27 species are listed, as opposed to 20 in Man Jang Gul. The 27 species include all 20 of those reported for Man Jang. 22 species of flowering plants are listed, as follows. The names have been updated according to Walker (1976).

Piper kadura. Windvine. A woody climber on trees and rocks.
Quercus acuta. Asian Oak, a cultivated tree.
Quercus glauca. Rough Oak, a large evergreen tree to 20 m high.
Quercus salicina. White-beneath Oak, a medium-sized tree.
Castanopsis cuspidata. A large evergreen tree.
Ficus nipponica, Ficus pumila. Climbing figs.
Stauntonia hexaphylla. An evergreen vine.
Cinnamomum japonicum. Brush Cassia-bark. A scrubby tree.
Machilus japonica. Narrow-leaved Tabu. Evergreen tree 6-7 m high.
Rubus hongnoensis. A berry bush.
Pueraria hirsuta. Kudzu. A climbing vine.
Ilex integra. Bird-lime Tree. Small tree or dense shrub to 15 m high.
Eurya japonica. Erect dense shrub or tree to 4 m high.
Eleognus glabra, Trachelospermium asiaticum. Climbing shrubs.
Hedera tobleri. Woody vine.
Ardisia japonica, Ardisia pusilla. Creeping undershrubs.
Ardisia crenata. Erect shrub to 1.5 m high.
Ligustrum japonicum. Shrub 1-4 m high.
Gardneria insularis. Climbing or prostrate shrub.

As can be seen, there are no fewer than eight species of tree in these two relatively small sinkhole entrances. Miniature forests indeed! A photograph shows that the sinkholes are relatively much more heavily vegetated than the surrounding surface, no doubt because groundwater is much more accessible there. Again, the lack of surface water on the large basalt flows makes itself felt.

Zoology

Bats are not recorded from So Cheon Gul, though they may occur in small numbers. Of the invertebrates, there are four species of spider: Leptoneta sp.; Nesticus quelpartensis, listed as common; Cicurina japonica; and Coelotes coreanus. All these spiders build small webs in dark, damp places. There is one milliped species, Oxidus sp. Oxidus are widespread, medium-sized greenish millipeds which are common in greenhouses. A springtail (tiny jumping insect), Sinella sp., also occurs.

A species of camel cricket ("cave cricket"), Tachycines sp., is found in

the cave. Tachycines is one of the camel cricket groups where the eyes are variable in size, which indicates that they are highly evolved for sheltering in caves, as opposed to other types of shelter. Nonetheless, like other camel crickets, they leave caves at night to forage for food.

One species of aquatic invertebrate is listed as common in So Cheon Gul. It must occur in pools, since these caves are said not to have permanent streams. It is a pigmented isopod, Asellus sp., possibly Asellus hilgendorfii.

Thus, as of 1970, eight invertebrate species had been recorded from So Cheon Gul.

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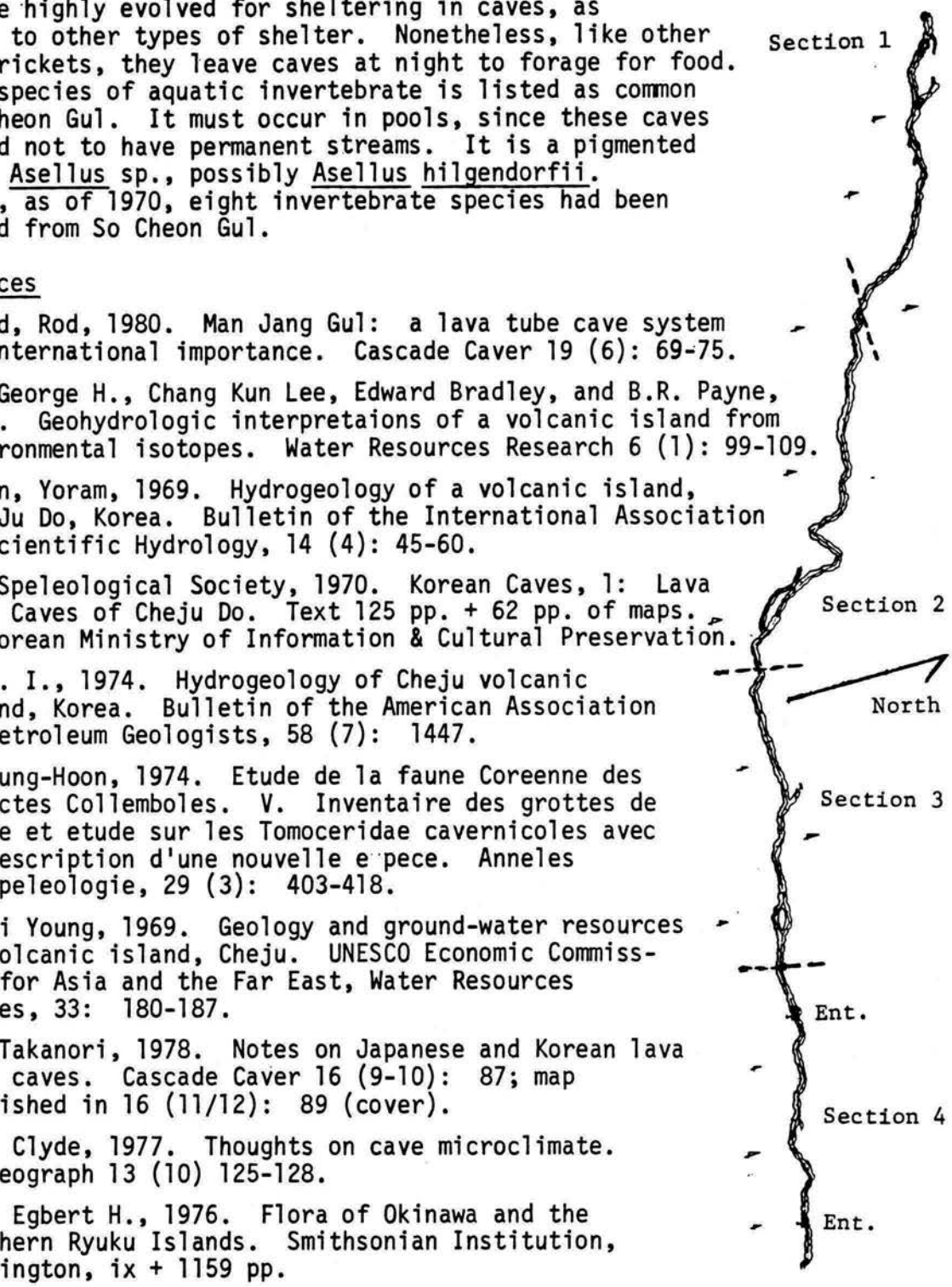


So Cheon Gul

Index to detail map

Scale 1:8,373

0 100 200 300

Meters

소 천 굴

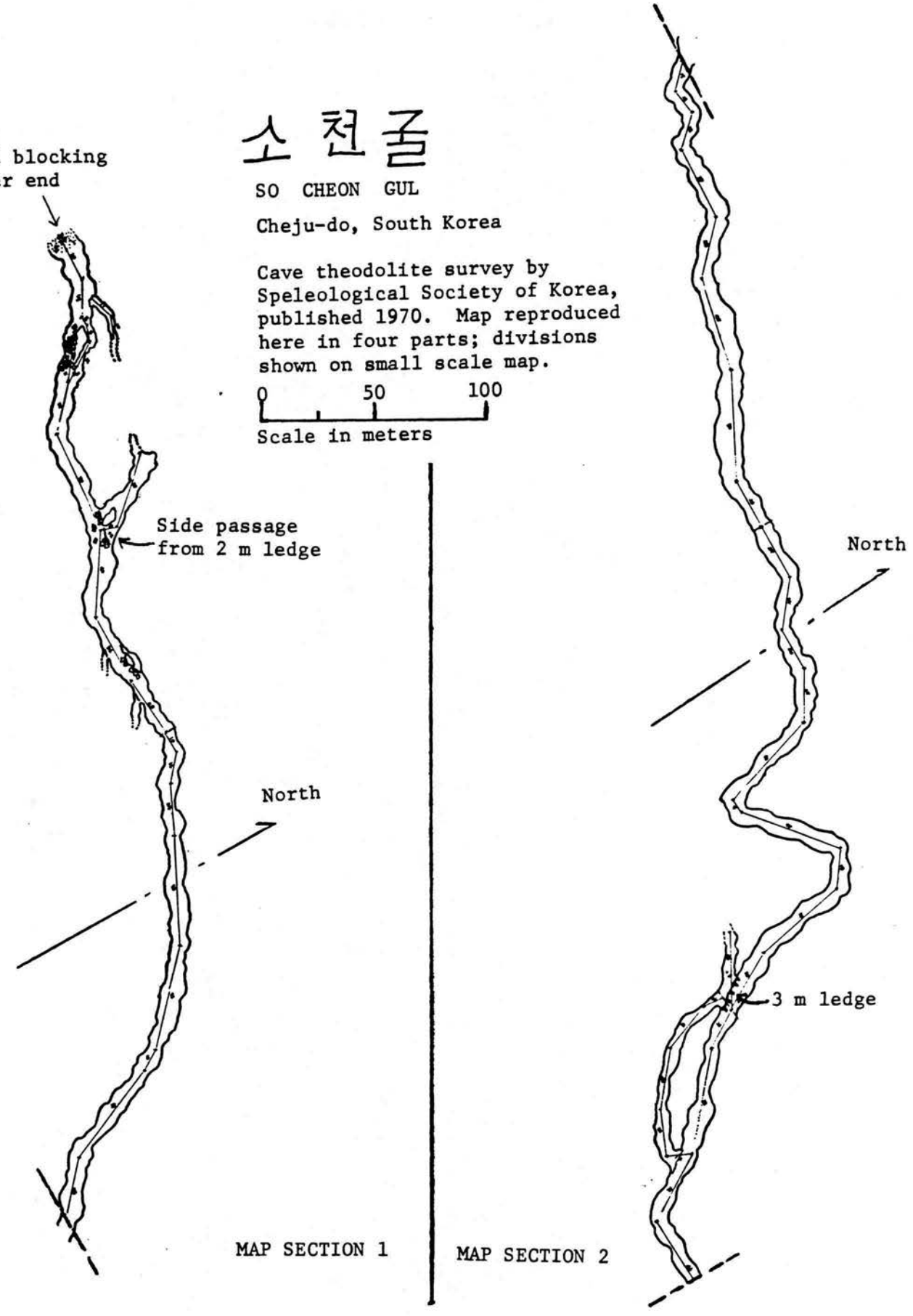
SO CHEON GUL

Cheju-do, South Korea

Cave theodolite survey by Speleological Society of Korea, published 1970. Map reproduced here in four parts; divisions shown on small scale map.

0 50 100

Scale in meters



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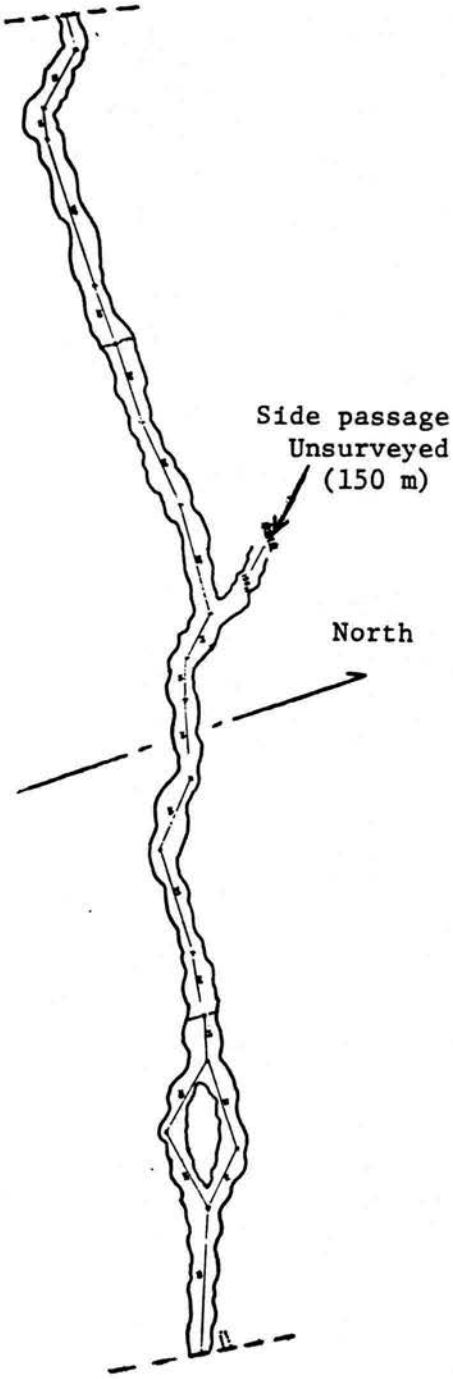

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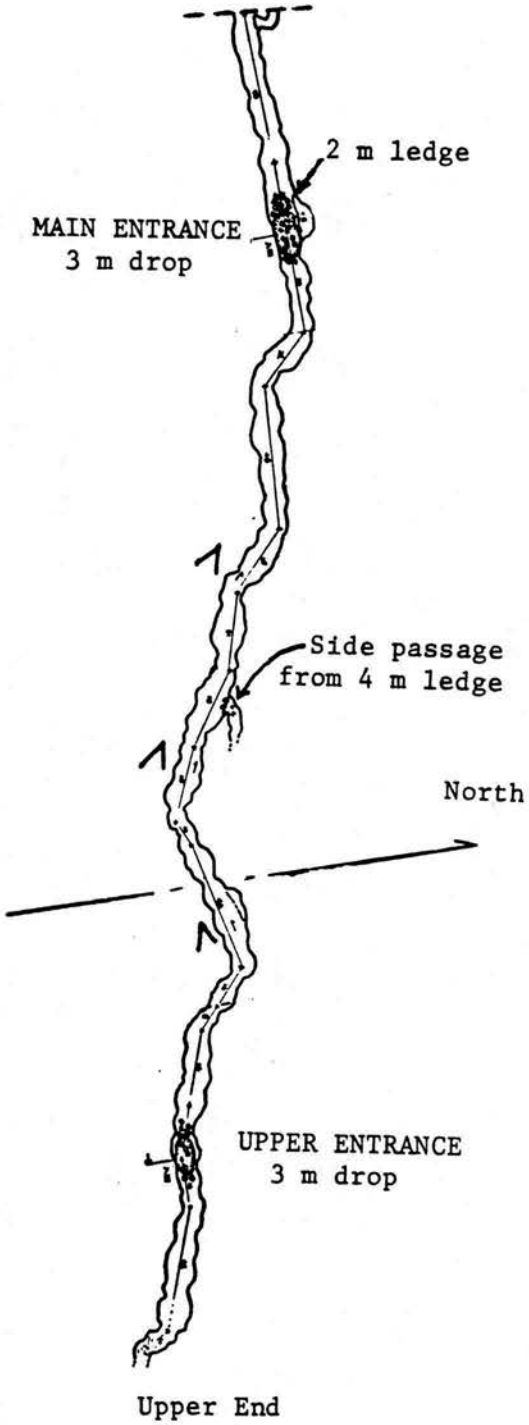

DECEMBER 1981 MOUNT ST. HELENS TRIP

By William R. Halliday, M.D.

The December Mount St. Helens trip was the 13th official one under the WSS permit, unless I've lost count, which would be in accord with other happenings on this glorious 13th. We started off with a good crew: Jim Nieland and Alice Purcell of the Forest Service, Rick Pope and Becky Taylor, Clyde Senger, Jim Harp (new Cascade Grotto member) and the Krehbiels. Weather conditions were reasonably good, with snow beginning to fall late Saturday afternoon and only an inch or two around the main entrance of Ape Cave. We could see most of Mount St. Helens most of the day. The riprap dam at the hairpin curve above the main entrance still was holding but was leaking near the west end. A muddy pond was present at the west end. Jim Nieland mentioned that he had seen water flowing around this end of the dam but not over it, in spite of the eroded channels we had found on top of it in November. Water was running in several channels on the Hopeless Cave mudflow, including the original one at what formerly was the west edge of the lava flow, now dammed by the riprap dam and flowing along the upper face of the dam toward the site of Hopeless Cave. In Ape Cave we remeasured all the stations and emerged through the Dug Entrance where the snow was a bit deeper but presented no problem. On the way back to the cars, Jim Nieland bestowed the name Easy Cave on the small unnamed cave below Leprechaun Cave, along the old logging road. We followed the trench rather than the road, and found another small surface tube worth naming: Knee Cave. It is a small complex, with moss and ferns inside. No visible impact of the eruptions, however. Later, Clyde, Jim Harp, and I traced out the route of the streams on the northern side of the Hopeless Cave Mudflow. To our surprise they do not rejoin those in the section near the road, but form a large pond in an area of lava ridges and extensive logging slash, it was not clear which was responsible for the ponding although we wallowed quite a while trying to find out.

Some further aggradation and erosion had occurred on the road west of the Lake Cave turnoff but we made no specific studies here.

Considerable snow fell Saturday night, but a reduced crew made it to the Lake Cave or Lava Cast turnoff with no problem. Jim Harp, Helen Krehbiel, and I checked the upper end of Lake Cave, finding nothing of interest except some mushrooms on the ceiling of the entrance to the Red Passage and on the rotting ladders (which hopefully will be replaced by the Forest Service now that they have exchanged for the land including the cave). Several types were noted: button mushrooms with little or no stem, on the ceiling, and tiny, graceful ones with bell-shaped caps, and others, on the ladders.

Snow conditions were not bad for driving but I forgot to warm up my car and it pooped out at about the upper entrance of Ape Cave. The other car made it through some 8 inches of snow to the usual N818A parking area and reported that water was flowing in one of the channels of the main N818 Mudflow. That was enough for the 13th!

PILLAR BUTTE CAVE TRIP

By Maurice Magee

My wife and I visited my cousin in Aberdeen Idaho in June, 1981. His name is Norvin Brown. He and his son Scott took me out to visit a cave in the Pillar Butte lava field they had found. The cave entrance was at one end of a section of breakdown. We poked around at the other end and found a continuation of the cave. They had found an upper section of the cave and this was a lower section.

My brother, Warren Magee, and I went back on August 14, 1981 to map the cave and explore more of the area around Pillar Butte. We finished mapping the cave and then found two other caves we did not have time to explore. We called them Pillar Butte caves 1 and 2. At least one and maybe both of them had been found before and one, the upper one (number 2) had a stone monument built up by it.

Pillar Butte is a shield type volcano with gradually sloping sides. It is not steep except the last part, right at the top. The lava fields are extremely interesting. There are several craters on Pillar Butte. There are places that look like caves with the tops blown off. There are lava bombs and more than one distinct flow over the other. Some activity has grass on it and others are too new for grass to grow yet. The lava field is huge. It is relatively unexplored and looked to have many possibilities for other caves.

On the way in we crossed an area of cracks in the earth that are said to go from Pillar Butte to Crystal Ice Cave. We did not get to follow them to see if they do, but that is the way they were headed. Some are wide enough to get down into. There are some real interesting possibilities. We heard one story about a friend of my cousins who knew of a large crack in the ground that has old buffalo bones in it. There are definitely interesting possibilities there and not too many have been checked out.

OCTOBER 10TH TRIP TO SCHUSTER CAVE, WOODLAND IDAHO

By Maurice Magee

Maura Laverty, Bruce Aitken, Jean Davis, Margaret Magee, and Maurice Magee went to find this cave, reported by Jim Tuning and Edward Simler. It is located at the back of the Alexander farm (formerly owned by the Schusters, so we named it for them).

The cave mouth is a low horizontal opening about 5 feet up in an outcrop face. It is about 12 inches high and 3 feet wide. Inside it opens to a circular area approximately 20 feet in diameter. It looks like a gas bubble formed in the lava. There is a lead on the right side of the circular cave opposite the entrance that continues about 15 feet but pinches out as the ceiling meets the floor. Maximum height in the cave is approximately 2 feet.

The cave floor is composed of animal droppings of some medium size animal. There are circular depressions in the floor apprximately 2.5 feet across and 6 inches deep. They looked like places a coyote or some such animal used for a bed. There were grasses formed in a nest on the right about 8 feet inside the entrance. It was probably where some small mammal lived.

THE CLOSEST CAVE TO I-5 ?

By W.R. Halliday, M.D.

Prominent when driving through Dunsmuir, California on I-5 is the Cave Springs Motel, on the west side of the freeway, between the old road and the river. On Sunday June 28th Mary White (of the Oregon Grotto) and I made the long, arduous trek through the motel grounds to the riverbank grotto at the foot of low cliffs below the older section of the motel. Slightly deteriorated concrete steps and a pipe make it difficult to lose the way. When operating, mineral water from the spelean spring is piped up to the motel for the theoretical delectation of guests.

Cave Spring Cave is a spacious groto or rockshelter with a ceiling height of about 10 feet at the entrance and about 15 feet at the rear, which is about 30 feet back. Its width is about 20 feet at the entrance and about 30 feet just before the back wall. The entire grotto is in twilight. Brown and green algae add color along the trickle of mineral water. The geology is unclear; it must be in igneous rock but a surface coat of mud or mineralization or both obscures the lithology in the cave.

This little cave is of some interest as the closest cave to I-5, at least that I know about. It provides a nice view up-river and is about 15 feet above low water. The motel looks nice, with a clean pool and both modern and old, rustic units, right above the river. For reservations phone (916) 235-2721 and the address is 4727 Dunsmuir Ave.

LONGEST LITTORAL CAVE?

By Rod Crawford

In the January 1981 issue of Inner Mountain News (Salt Lake Grotto), Dale Green refers to Clinton's Cave, near the Great Salt Lake, as "the longest known sea cave in the continental U.S." at 325 feet. This brings up the question as to whether anyone has ever made an effort to compile length statistics on littoral caves. Many exist, but cavers seldom pay them any serious attention (unless, for some crazy reason, they are inland and formed by ancient seas, as in the case of Clinton's).

The longest littoral cave that I know of is Tunnel Island Cave on the Washington coast, which is about 500 feet long and unmapped. Is this in the "continental U.S."? Well, it can be reached on foot at low tide. You might say that Clinton's Cave holds the record only when the tide is up in Washington. I have personally been in two littoral cavities in Washington more than 100 feet long but have been littoral caving only those two times. Considering how much coast we have, I think that there are undoubtedly longer littoral caves that have not been found due to lack of interest.

GLACIOSPELEOLOGICAL ABSTRACT

By W.R. Halliday, M.D.

Ubach i Tarres, Monteerrat, 1980. Paradise Ice Cave; Campana espeleological "Cascade Range-79". Speleon, V. 25, pp. 99-105

This is a report on the events and conclusion of the expedition of three cavers from Barcelona to the far west in 1979 when they worked closely with the Cascade Grotto and Western Speleological Survey. Paradise Ice Cave is recognized as the longest glacier cave in the world. Included is a map by Charley Anderson and Mark Vining showing the system at a stage when it was truncated by ablation at about Edith Falls (the cave has ablated markedly since that stage). A section on speleogenesis gives more emphasis on cave enlargement by stream actions than do American glaciospeleologists. The article should encourage European interest in glacier caves as this is a widely read journal.

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GROTTO MEETING
TUESDAY JUNE 15
8:00 PM