ON LAVA CAVES IN JAPAN AND VICINITY

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INTRODUCTION

Among approximately 830 active volcanoes in the world, 67 are in Japan. Most of them have had phreatic explosions. The volcanoes around Japan exist along the Japan trench which is formed between the Pacific Plate and the Philippine Plate.

Nearly all of these volcanoes are of andesite, similar to that in the Cascade Mountains in America, and in New Zealand.

But the volcanoes on the islands in the inner Pacific Ocean are chiefly of basalt, which is similar to that of eastern Africa and the Mediterranean volcanoes, and contain much K_2O. The boundary line between the volcano area, whose main component is andesite, and the area of basalt, is called the Andesite Line. It bisects Hokkaido and Northern Honshu, running south into the sea just west of Tokyo Bay; on the Pacific side of this line, volcanoes contain no olivine, but a small amount of tholeiitic basalt or calcalkali basalt. The Izu Islands, Miyake Island and Hachijo Island are among these.

On the continental side of the Andesite Line are alkali basalt volcanoes, which contain much Na_2O and K_2O, without any pyroxene or olivine, but with a small amount of SiO_2. The volcanoes in the western part of Japan — Daikon Island and Fukue Island —and Cheju Island in Korea, and Chin Puo in China belong in this category.

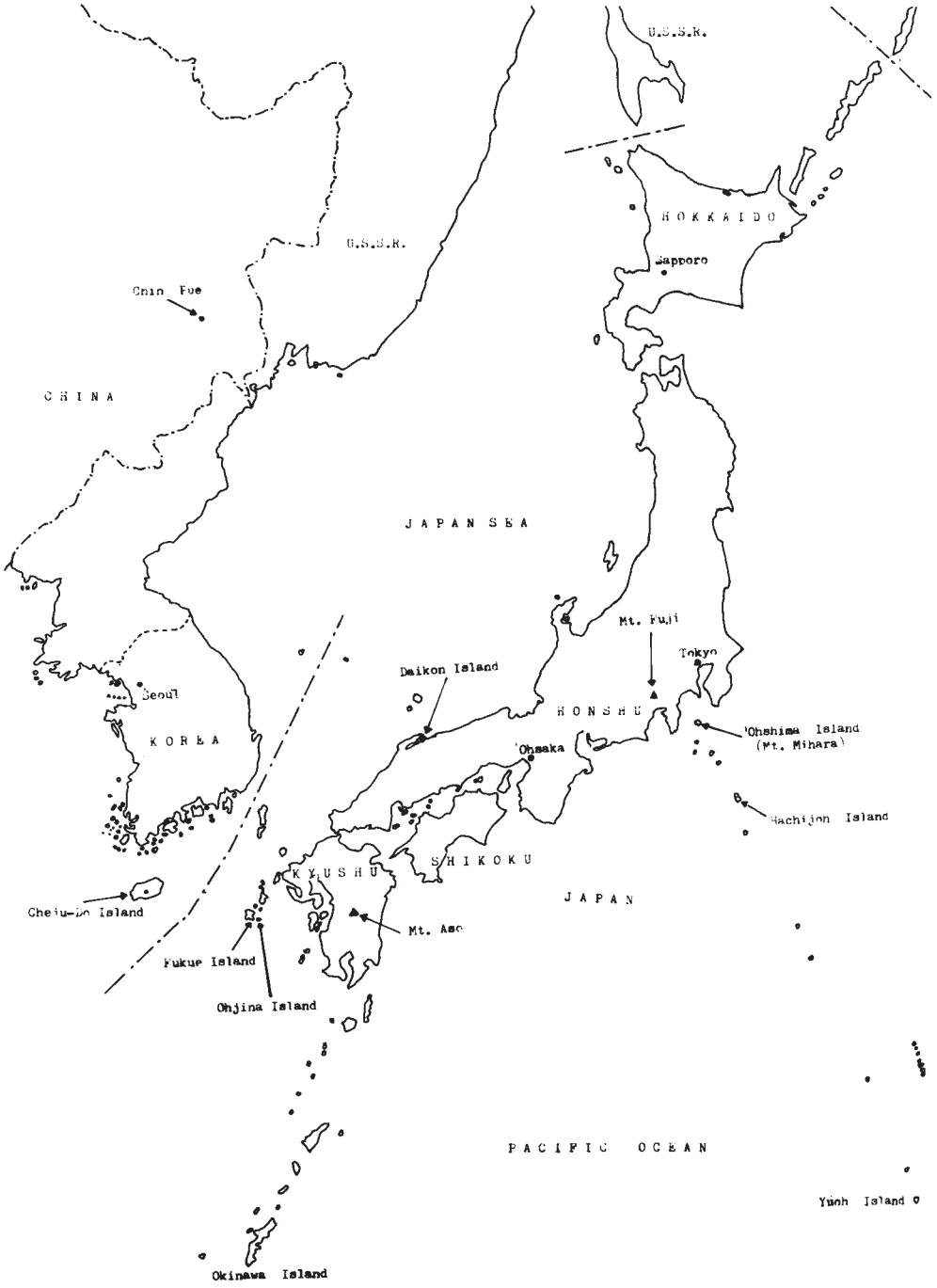
Between these is an intermediate type which contains much Al_2O, and high-alumina basalt volcanoes. In Japan, Mt. Fuji and Mt. Aso are this type.

JAPANESE LAVA CAVES, ESPECIALLY THOSE OF MT. FUJI

There are over 150 lava flows on Mt. Fuji, but only ten have lava caves; unless the lava flow is thick enough, there are no caves. At present, 95 caves are known which are over 30 meters in length, and two or three more are discovered every year. The longest is Mitsuike Ana, which is 2,139.75 meters long. Eight caves are more than 500 meters long.

The caves formed on level ground and have a complicated plan and profile. Those formed on slopes are mostly of tube-type and are of simple construction.

Mt. Fuji is a stratovolcano consisting of lava flows which contain only basalt and volcanic ash. It began to erupt 13,000

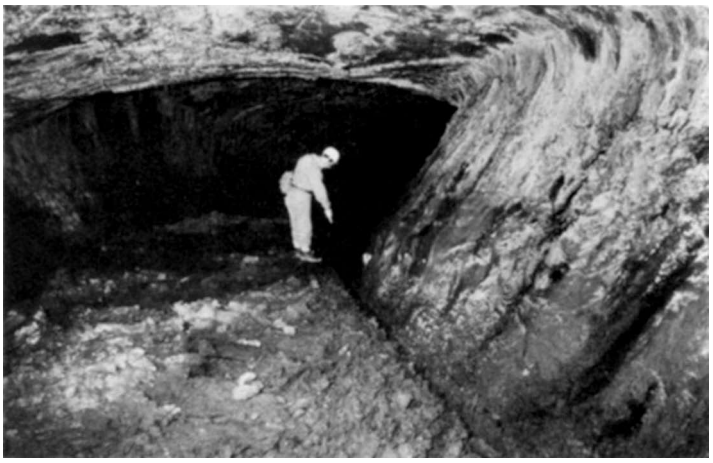


Location of lava caves in Japan, Korea and China.

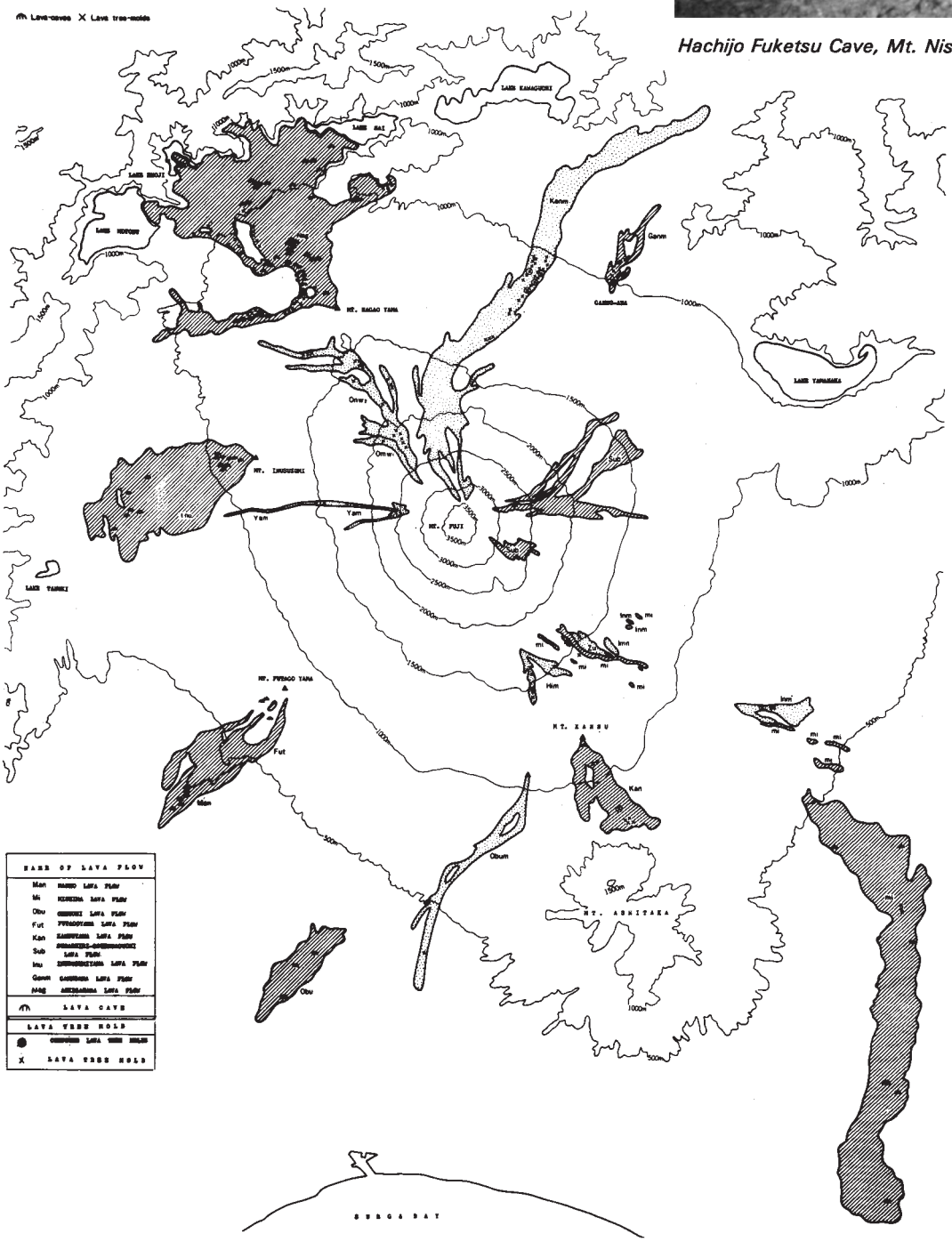
years ago. Its last eruption was in 1707 A.D.

Among the lava flows which contain lava caves, those whose date is clear are the Mishima lava flow and the Manno lava flow (13,000 B.C.), the Inusuzumi-yama lava flow (approximately 2650, more or less, 30 B.P.), the Kansu-yama lava flow (1250, more or less, 20 B.P.), and the Aokigahara lava flow (864 A.D.).

Besides Mt. Fuji, there are caves in lava belonging to the Fuji Volcanic Zone such as Mt. Mihara of Izu Oshima Island (in a flow formed by the eruption in 1962 A.D.), and a flow associated with Mt. Nishi of Hachijo Island which appeared after the eruption in 1606 A.D.



Hachijo Fuketsu Cave, Mt. Nishi, Hachijo Island, Japan.



Distribution map of lava caves and lava tree molds of Mount Fuji.

The cave of Mt. Mihara is small and was formed at the volcanic edge. A lava ledge of A-type can be seen there. Mt. Nishi has six lava caves, the longest one being the Hachijo Fuketsu lava cave, its length being 1,403.8 meters.

JAPANESE CAVES OUTSIDE THE MT. FUJI AREA

Outside the Mt. Fuji area, there are 23 lava caves in Japan, although some are smaller than 30 meters in length.

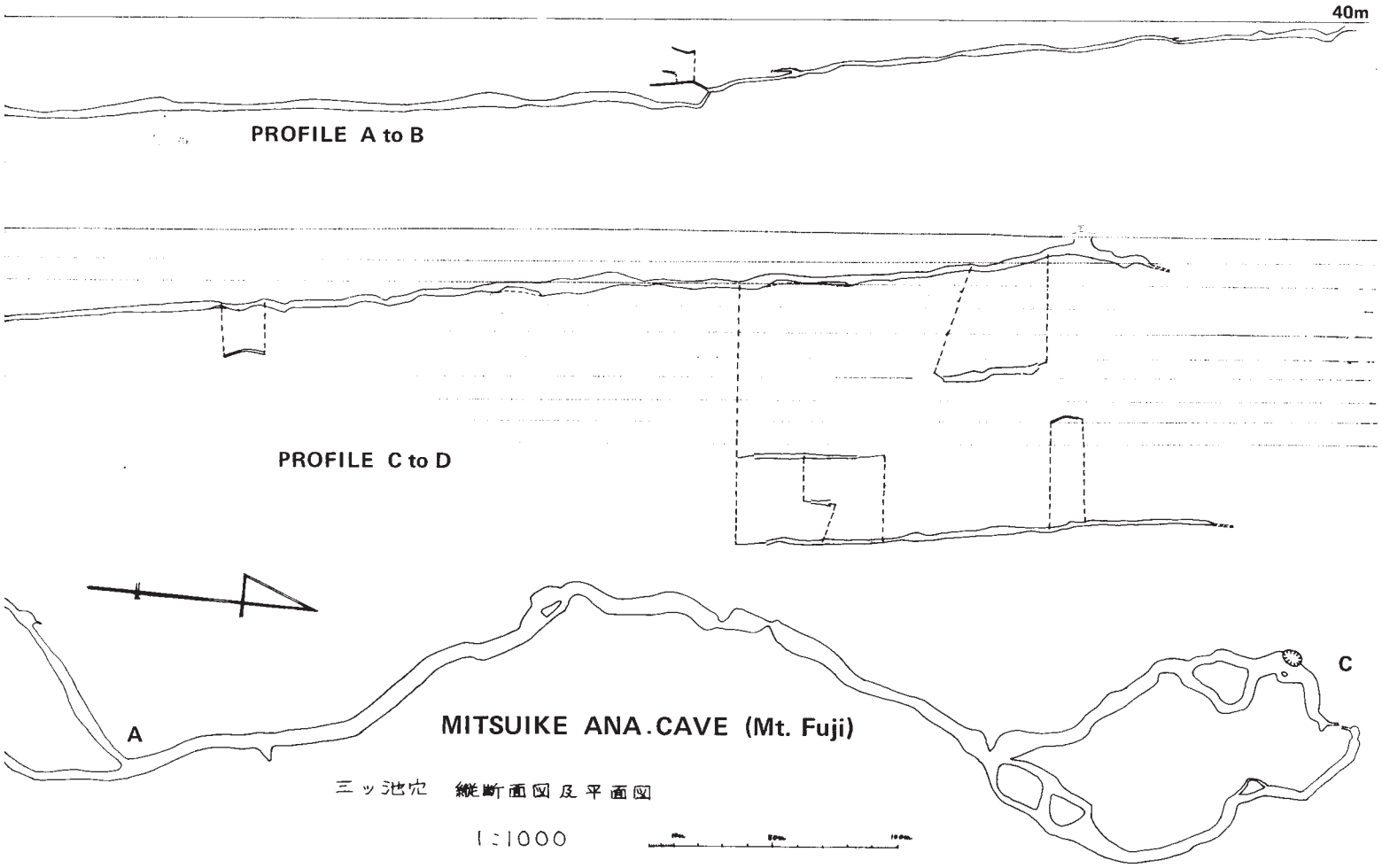
Daikon Island in the western part of Japan has two lava caves over 30 meters in length, but they do not have any noteworthy features. In Yukido Cave, the B-type lava ledge can be found. There is some water inside these two caves. The eruption date is considered to be the oldest of all the lava caves in Japan.

On Fukue Island, in the westernmost part of Japan, are two caves over 30 meters long and 11 of lesser length.

At Mt. Aso are nine lava caves, but only three are more than 30 meters long. This lava flow is, among the Japanese lava flows, the closest in quality to andesite, and most of these caves are featureless.

LAVA CAVES IN JAPAN

	Lava flow and cave name	Length (m)	Elev. (m)	Place
	*** Mishima lava flows**			
1	Ohno Fuketsu No.1 (Buried)	/	480	Mt. Fuji
2	Ohno Fuketsu No.2	375	480	" "
3	Komakado Fuketsu	625	355	" "
4	Iwanami Fuketsu	220	260	" "
5	Susono Fuketsu No.1	116	115	" "
6	Susono Fuketsu No.2	121	125	" "
7	Mishima Fuketsu	*250	45	" "
	*** Ohbuchi lava flows, Mount Fuji**			
8	Fudo Ana	124	200	" "
9	Hachiman Ana	187	150	" "
10	Atsuhara Fuketsu	89	110	" "
	*** Futagoyama lava flows, Mount Fuji**			
11	Banba Ana	621	675	" "
12	Futagoyama Komori Ana No.1	*60	695	" "
13	Futagoyama Komori Ana No.2	127	690	" "
	*** Manno lava flows, Mount Fuji**			
14	Yashiki Ana	239	310	" "
15	Kobo Ana	*40	270	" "
16	Mado Ana	510	265	" "
17	Dainichi Ana	908	250	" "
18	Ginga Fuketsu	* 40	250	" "
19	Chikusho Ana (Buried)	/	230	" "
	*** Inusuzumiyama lava flows, Mount Fuji**			
20	Inusuzumiyama Fuketsu No.1	192	1140	" "
21	Muzina Ana	118	1095	" "
22	Inusuzumiyama Fuketsu No.2	*130	1060	" "
23	Inusuzumiyama Fuketsu No.3	*50	1015	" "
24	Inusuzumiyama Fuketsu No.4	*120	1000	" "
25	Inusuzumiyama Fuketsu No.5	*800	975	" "
26	Inusuzumiyama Fuketsu No.6	*250	975	" "
27	Inusuzumiyama Fuketsu No.7	95	980	" "
28	Inusuzumiyama Fuketsu No.8	76	985	" "
29	Inusuzumiyama Fuketsu No.9	49	990	" "
30	Inusuzumiyama Fuketsu No.10	/	1200	" "
31	Teppo Ana	/	1020	" "
32	Mitsuike Ana	2140	820	" "
33	Ubu Ana	123	760	" "
34	Uzura Ana	820	735	" "
35	Shin Ana	150	720	" "
36	Hito Ana	83	690	" "
37	Mamashita Ana (Buried)	/	820	" "
	*** Kansuyama lava flows**			
38	Kaminari Ana	35	1210	" "
	*** Zunazawa lava flows**			
39	Suyama Tainai	40	1490	" "
	*** Subashiri-Gotemba lava flows**			
40	Subashiri Tainai	*20	263	" "
	*** Aokigahara lava flows**			
41	Karumizu Fuketsu	433	1265	" "
42	Zinza Fuketsu & Kamaboko	443	1260	" "
43	Zinza Fuketsu No.2	51	1255	" "
44	Zinza Fuketsu No.3	170	1190	" "
45	Zinza Fuketsu No.4	*100	1220	" "
46	Zinza Fuketsu No.5	*100	1230	" "
47	Zinza Fuketsu No.6	*85	1240	" "
48	Megane Ana	154	1220	" "
49	Ohmuro Fuketsu No.1 (Buried)	95	1165	" "
50	Ohmuro Fuketsu No.2	40	1150	" "
51	Shyoiko Fuketsu No.1	230	1150	" "
52	Shyoiko Fuketsu No.2	56	1140	" "
53	Shyoiko Fuketsu No.3	35	1135	" "
54	Shyoiko Fuketsu No.4	32	1130	" "
55	Motosu Fuketsu No.1	494	1155	" "
56	Motosu Fuketsu No.2	238	1165	" "
57	Motosu Fuketsu No.3	61	1145	" "
58	Motosu Fuketsu No.4	32	1140	" "
59	Motosu Fuketsu No.5	*40	1150	" "
60	Motosu Hyoketsu	68	1150	" "
61	Fuji Fuketsu No.1	511	1110	" "
62	Fuji Fuketsu No.2	57	1120	" "
63	Fuji Fuketsu No.3	52	1120	" "



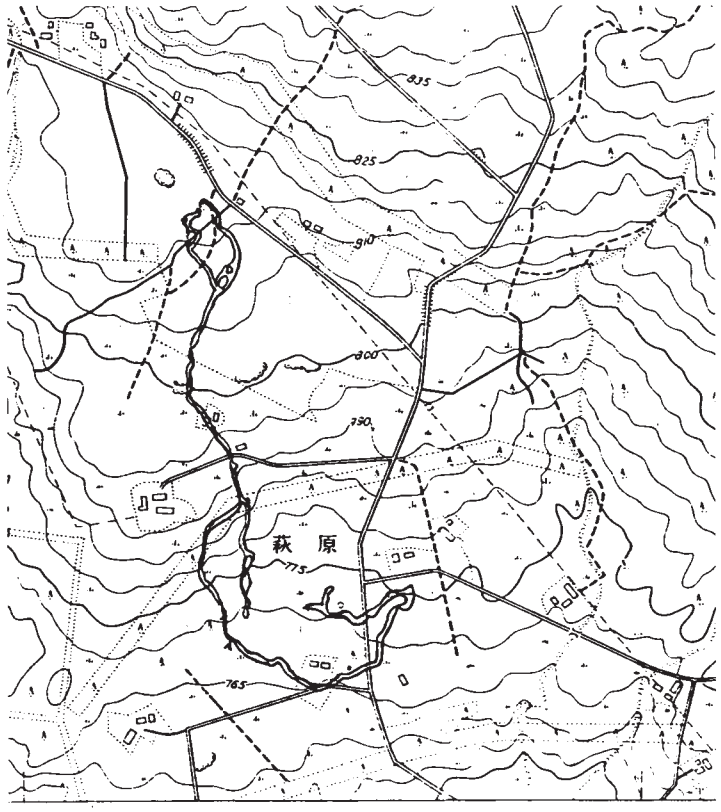
64	Fuji Fuketsu No.4	118	1120	" "
65	Fuji Fuketsu No.5	143	1120	" "
66	Fuji Fuketsu No.6	60	1120	" "
67	Fuji Fuketsu No.7	130	1120	" "
68	Katabuta Ana	*30	1190	" "
69	Gyoja Ana	93	1190	" "
70	Kazuhito Ana No.1	254	1180	" "
71	Kazuhito Ana No.2	44	1180	" "
72	Kazuhito Ana No.3	*30	1175	" "
73	Kazuhito Ana No.4	102	1170	" "
74	Kazuhito Ana No.5	*60	1160	" "

*** Aokigahara lava flows**

75	Shyoji Oana, Nichi Do	161	985	" "
76	Shyoji Oana, Gats Do	247	980	" "
77	Shyoji Fuketsu No.1	*40	970	" "
78	Shyoji Fuketsu No.2	*50	970	" "
79	Shyoji Fuketsu No.3	*30	970	" "
80	Shyoji Fuketsu No.4	130	960	" "
81	Shyoji Fuketsu No.5	32	960	" "
82	Shyonin Ana	77	970	" "
83	Aokigahara Fuketsu	*40	1060	" "
84	Narusawa Hyoketsu	156	1025	" "
85	Fugaku Fuketsu	258	1005	" "
86	Ryugu	96	955	" "
87	Saiko Komori Ana	386	920	" "
88	Saiko Fuketsu No.1	72	950	" "
89	Saiko Fuketsu No.2	317	945	" "
90	Saiko Fuketsu No.3	41	945	" "
91	Narusawa Komori Ana No.1	69	1005	" "
92	Narusawa Komori Ana No.2	71	1005	" "
93	Narusawa Komori Ana No.3	40	1005	" "
94	Narusawa Komori Ana No.4	48	1005	" "

*** Gannoana lava flows**

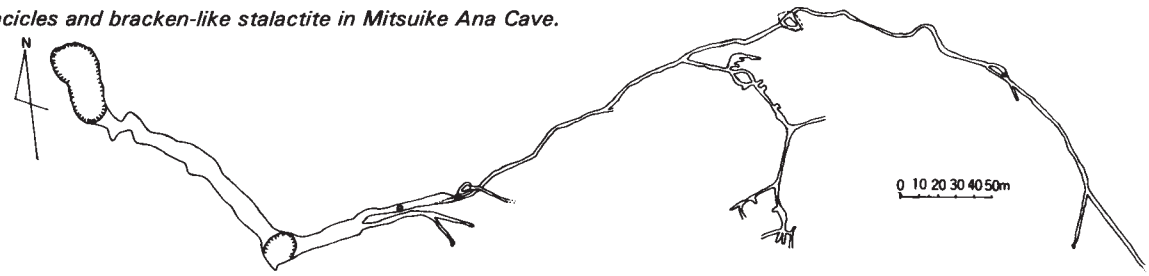
95	Kusure Ana	*130	1020	" "
96	Mihara Fuketsu	*20	673	Mt. Mihara
97	Hachijo Fuketsu No.1	1404	165	Mt. Nishi
98	Hachijo Fuketsu No.2	*100	140	" "
99	Gokuraku Ana	*200	10	" "
100	Shin Gokuraku Ana	*300	10	" "
101	No.20 Boku Fuketsu	*35	513	" "
102	No.21 Boku Fuketsu	*45	528	" "
103	Yuki Do	*200	5	Daikon Is.
104	Ryusei Do	*80	16	" "
105	Komezuka Fuketsu	*20	870	Mt. Aso
106	Ohgawara Fuketsu	/	645	" "
107	Nagaobane Fuketsu No.1	44	75	" "
108	Nagaobane Fuketsu No.2	*20	750	" "
109	Mizonokuchiue Fuketsu	*25	600	" "
110	Mizonokuchiue Komori Ana	*15	600	" "
111	Inuotoshi Fuketsu	*40	640	" "
112	Gannome Fuketsu	/	635	" "
113	Jao Fuketsu	/	522	" "
114	Unishiura Fuketsu	32	800	" "
115	Yurunkuchino Ana	41	26	Mt. Taoakari
116	Sakishirazunoi Ana	965	30	" "
117	Iyano Ana	*15		" "
118	Furutsutsumino Ana	*5		" "
119	Iankawano Ana	*15		" "
120	Kuroseno Ana	*20		" "
121	Kichiga Ana	/		" "
122	Ohiima Ana	/		Ohiima

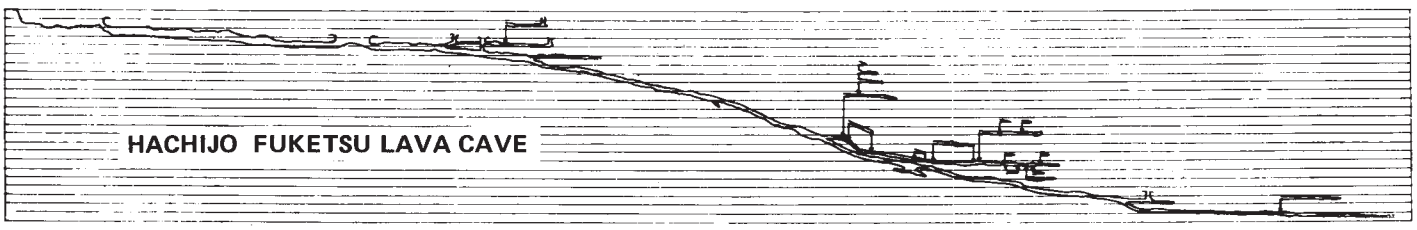


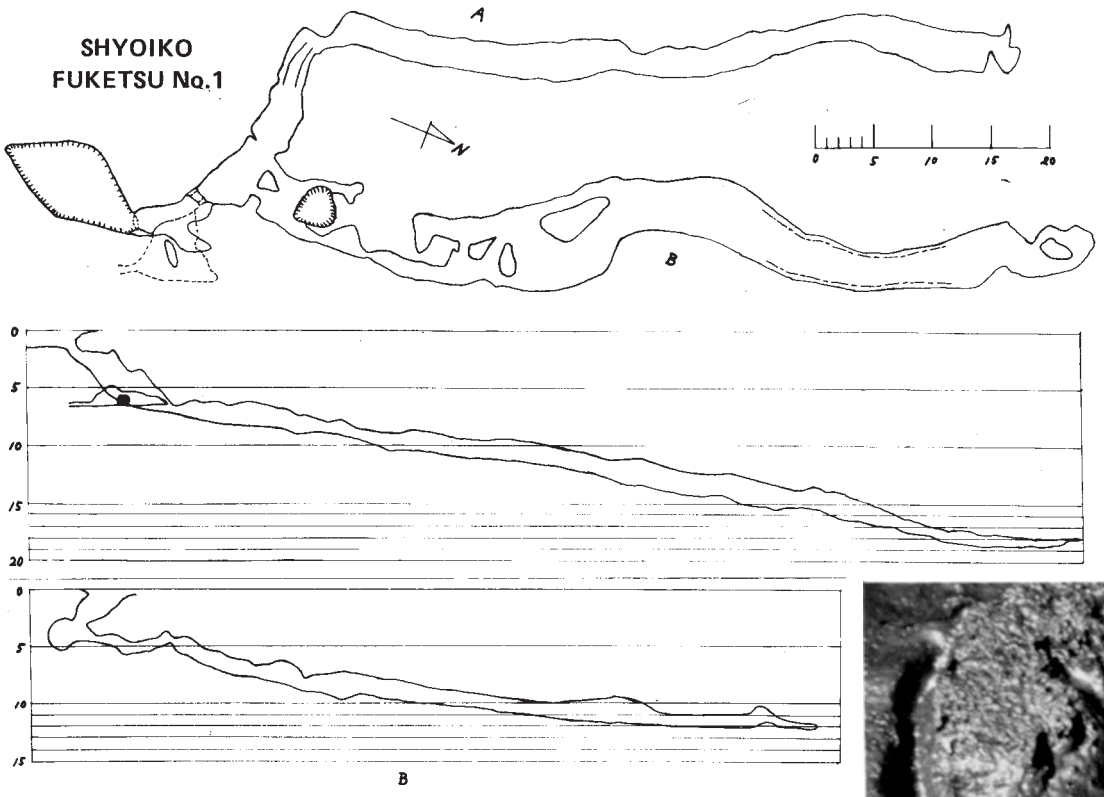
Laminae of the side wall in Mitsuike Ana Cave, Mount Fuji, Japan.

The outer crust of the cavity, Mitsuike Ana Cave, Mount Fuji.

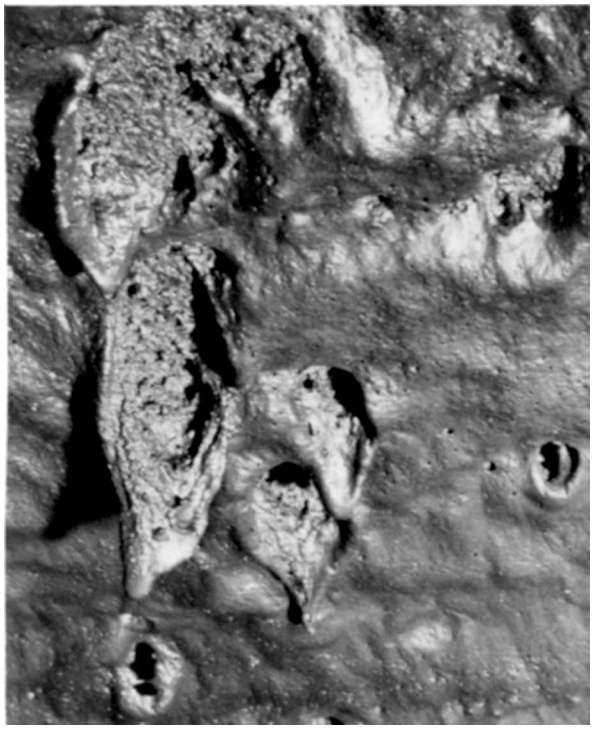
Lavacicles and bracken-like stalactite in Mitsuike Ana Cave.







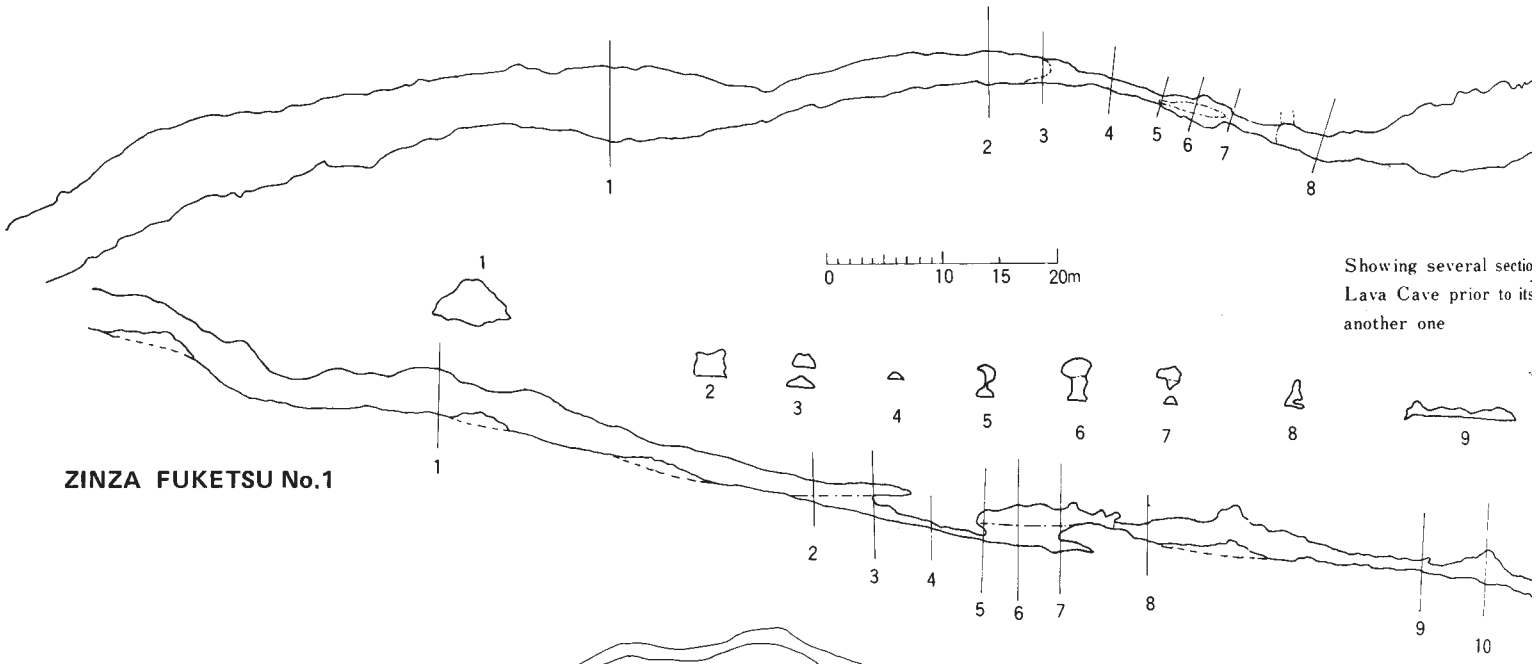
B-type lava shelves with subsided original lava bridge. Shoiko Fuketsu Cave No.2.



Gas blowout from sidewall in Shyoiko Fuketsu Cave No.1.

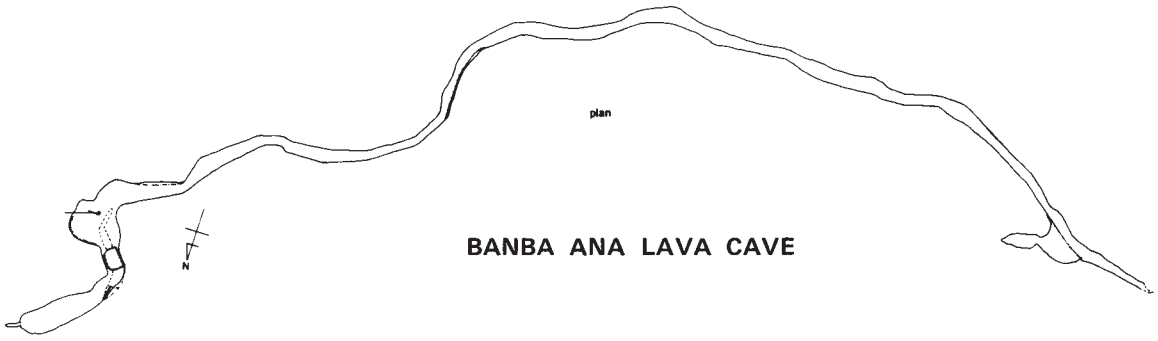
Mihara Fuketsu, Mount Mihara, Izu Oshima Island, Tokyo, Japan.

Yukido Cave, Daikon Island, Japan.

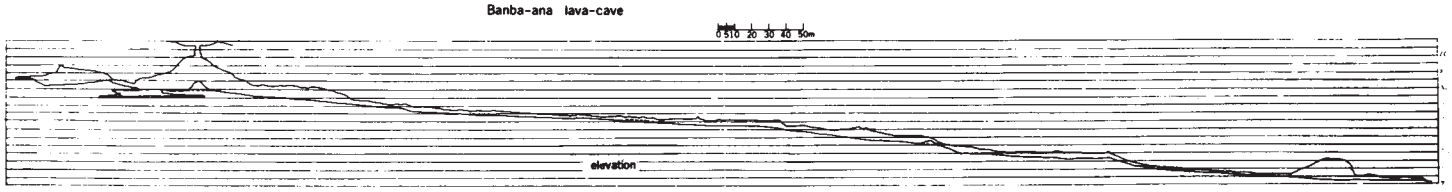


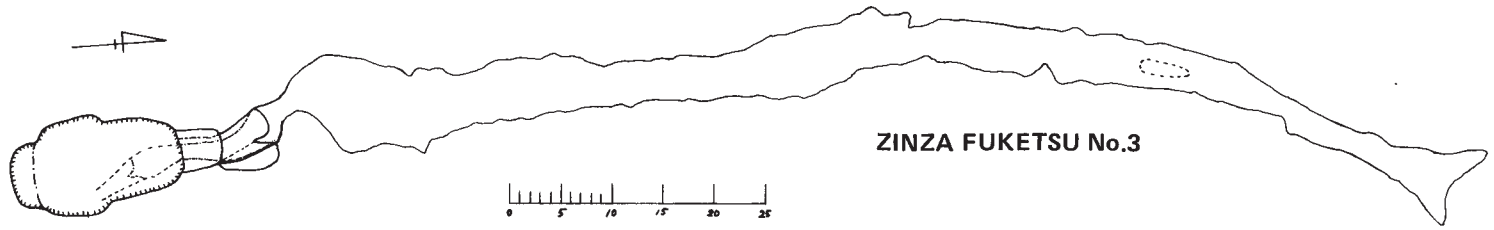
Showing several sectio
Lava Cave prior to its
another one

ZINZA FUKETSU No.1



BANBA ANA LAVA CAVE





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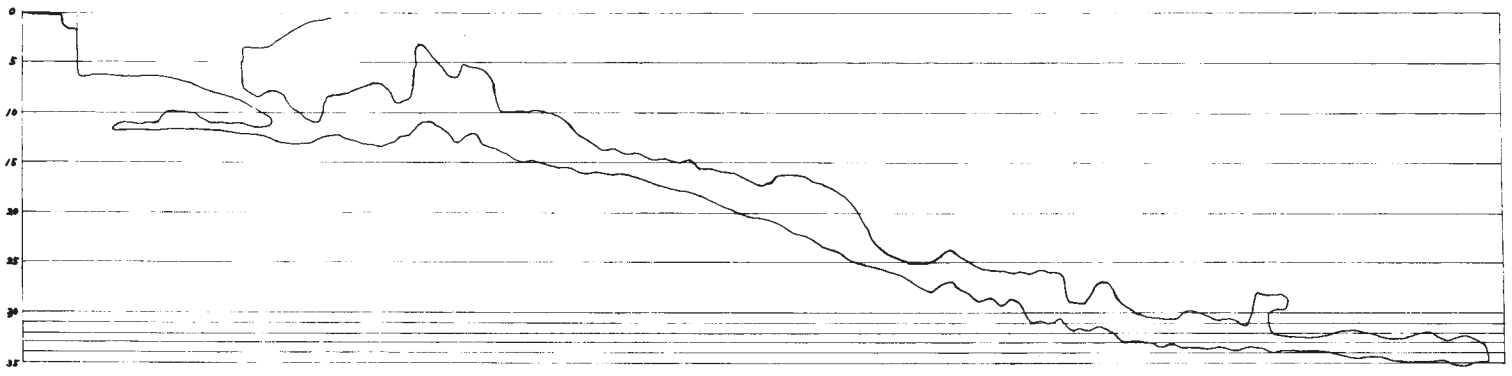
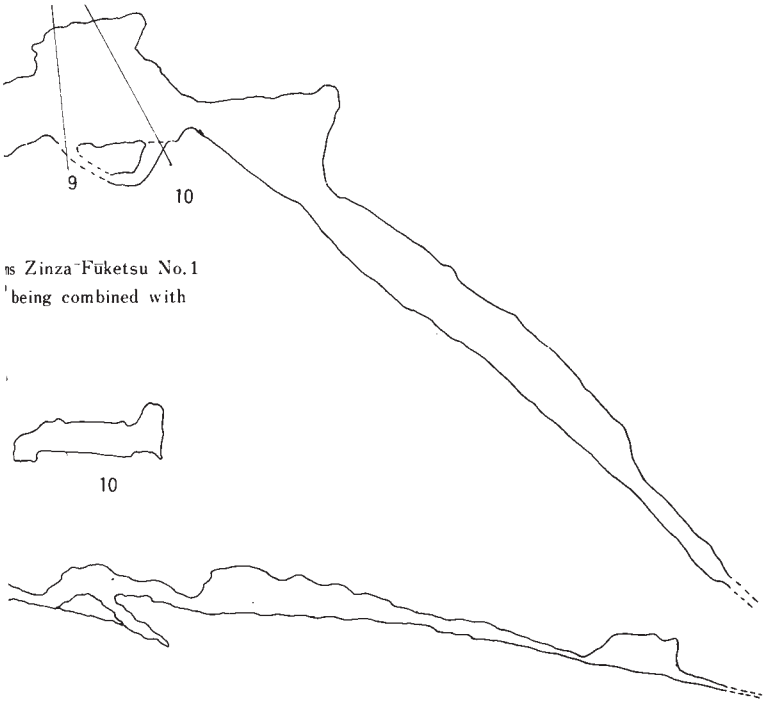
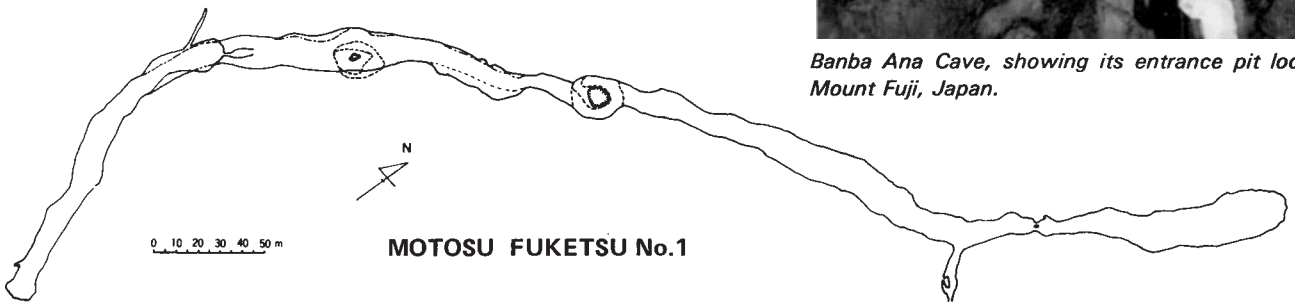
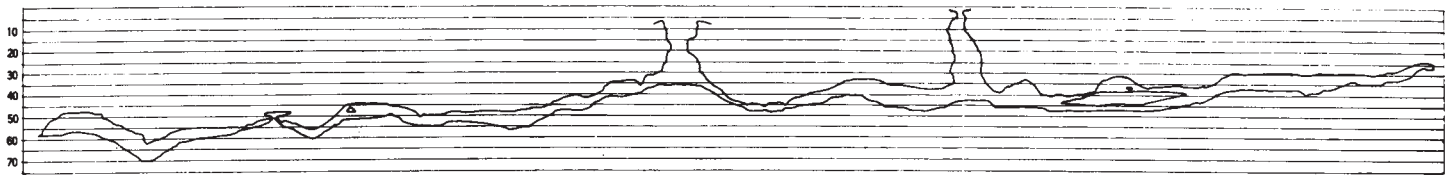
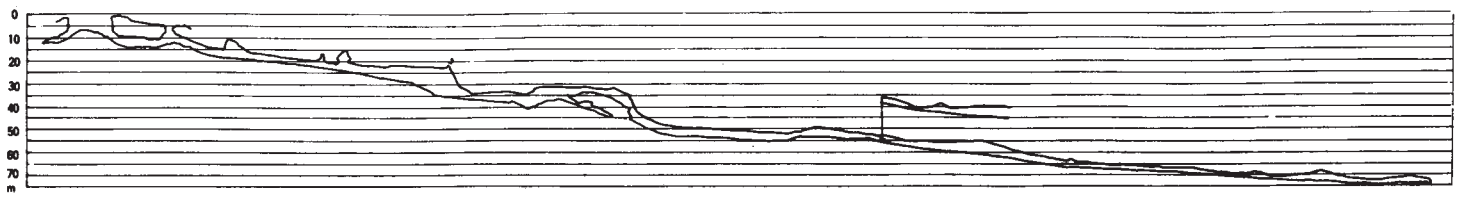


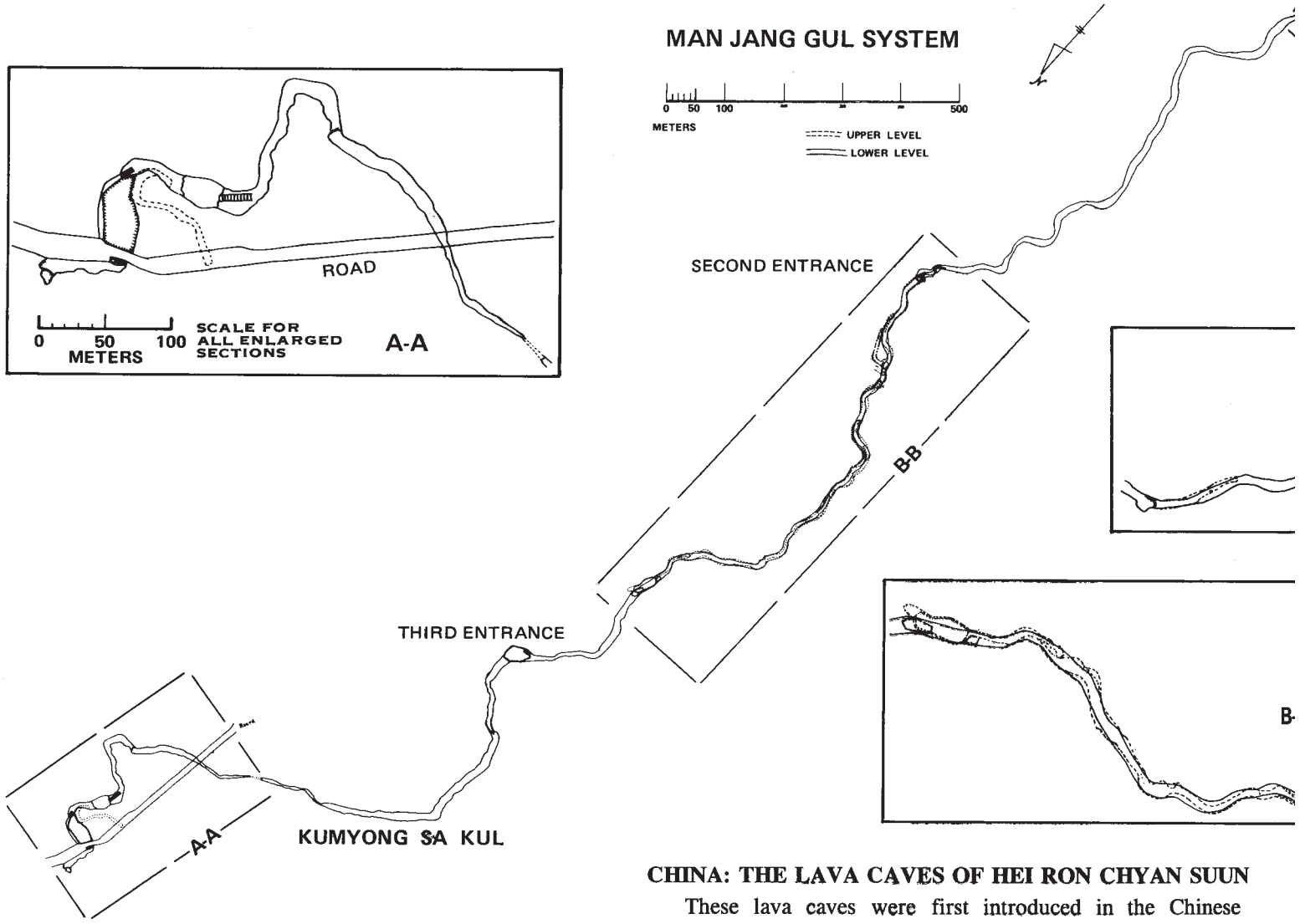


Banba Ana Cave, showing its entrance pit looking up from inside. Mount Fuji, Japan.









KOREA: LAVA CAVES ON CHEJU-DO (ISLAND)

Cheju-do (Island) consists largely of alkali basalt which erupted from Mt. Hanra. The latest eruptions took place in 1002 A.D. and 1007 A.D. In the southern part of this island, there formed a small "volcanic island" of andesite. Later, there occurred an upheaval, and now there are many "islands" in the southern district of the island surrounded by the basalt of Mt. Hanra.

In Korea, Mt. Hanra is said to have erupted in Pliocene or Pleistocene time. But judging from the erosion of the mountain and the weathering of the caves, we believe, from comparison with Japanese volcanoes, that it began to erupt about 20,000 years ago. If we think of the fact that Oahu Island came into existence about 3,000,000 years ago, Cheju Island is quite a recent one, and when we compare its caves with the weathering and ruined state of the oldest of Mt. Fuji caves (13,000 years old), it may be considered to be more recent. More precise geological mapping is needed.

CHINA: THE LAVA CAVES OF HEI RON CHYAN SUUN

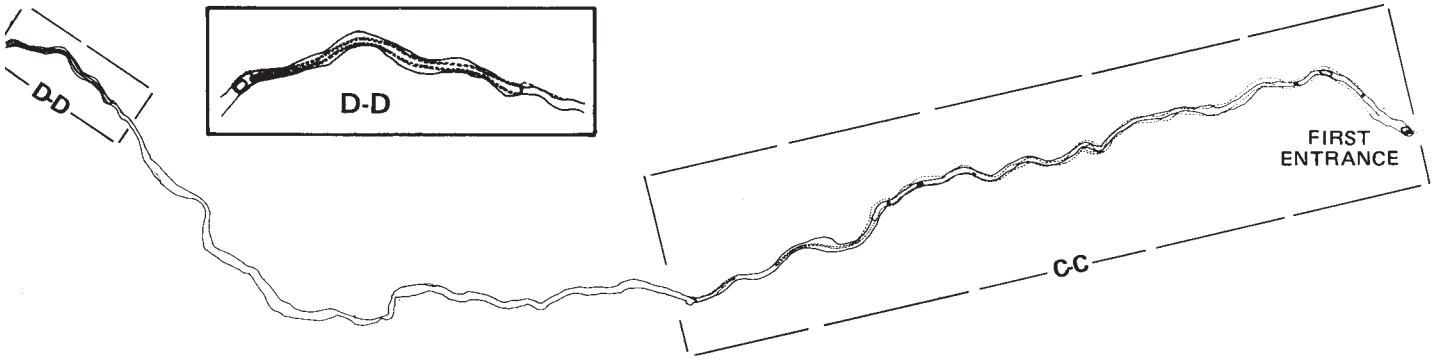
These lava caves were first introduced in the Chinese periodical *Geomorpholical Knowledge* in January 1981. They are at the upper fork of Mu Tan Chyan River; northeastern China, 110 kilometers southwest of Mu Tan Chyan Su (city) in Hei Ron Chyan Suun, and 13 kilometers southeast of Fuo Ko Sum Rin which is near Puo Fu (lake). Here are craters with basalt lava erupted 4,000 to 8,000 years ago. Lava caves of various sizes were discovered here in June 1980. They range from 10 meters long to 500 meters long. The width is 3 to 11 meters, and the height is 1 to 4 meters.

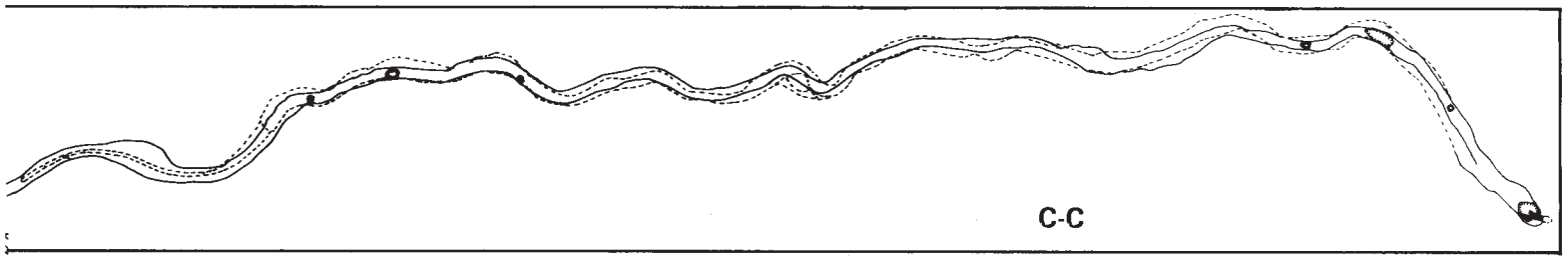
The lava ledges are B and D types, and besides ropy lava flows, lava stalagmites, and lava falls, there exists the same type of lava ball here that is found in Man Jang Kul (Cave) in Korea. Also found are those with lava hanging from the tips of stalactites. The number of caves was not mentioned.

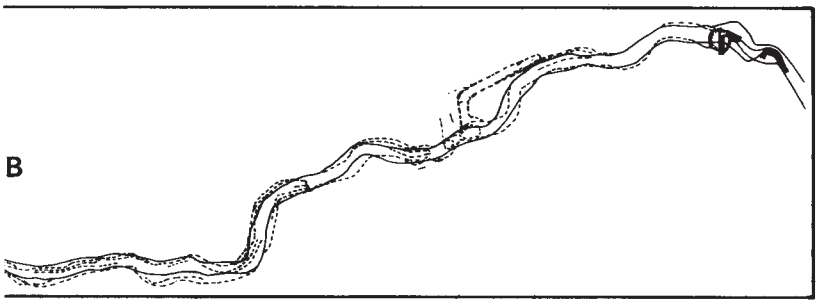
FEATURES SEEN IN THE LAVA CAVES IN EAST ASIA REGION

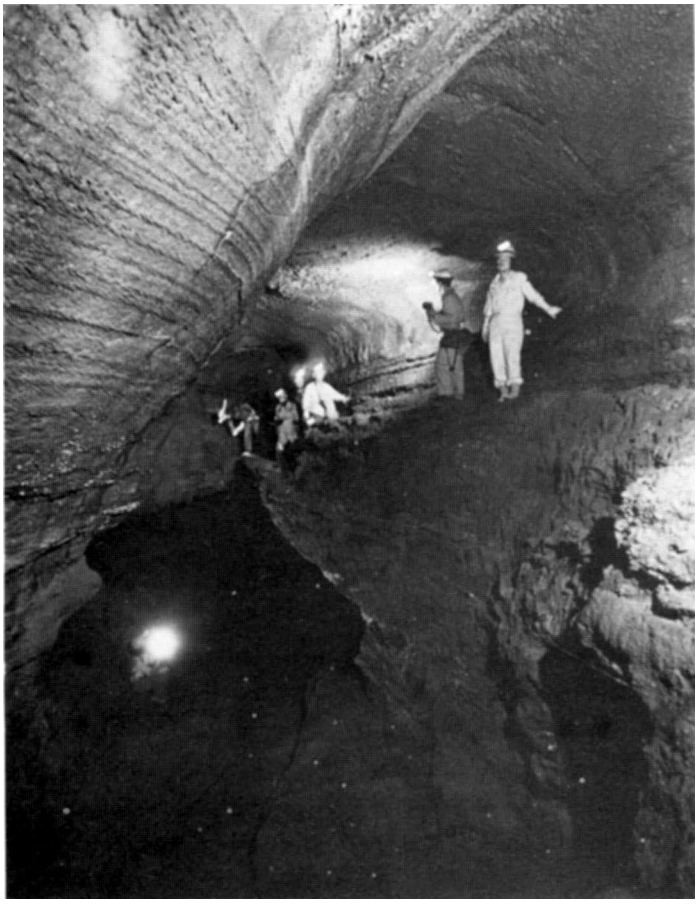
The lava in which caves are found in Japan is the aa type lava, but in Korea and China is the pahoehoe. In the Mt. Fuji area, the caves contain A-type lava ledges.

In Japan, these can be seen in seven of the caves, but in

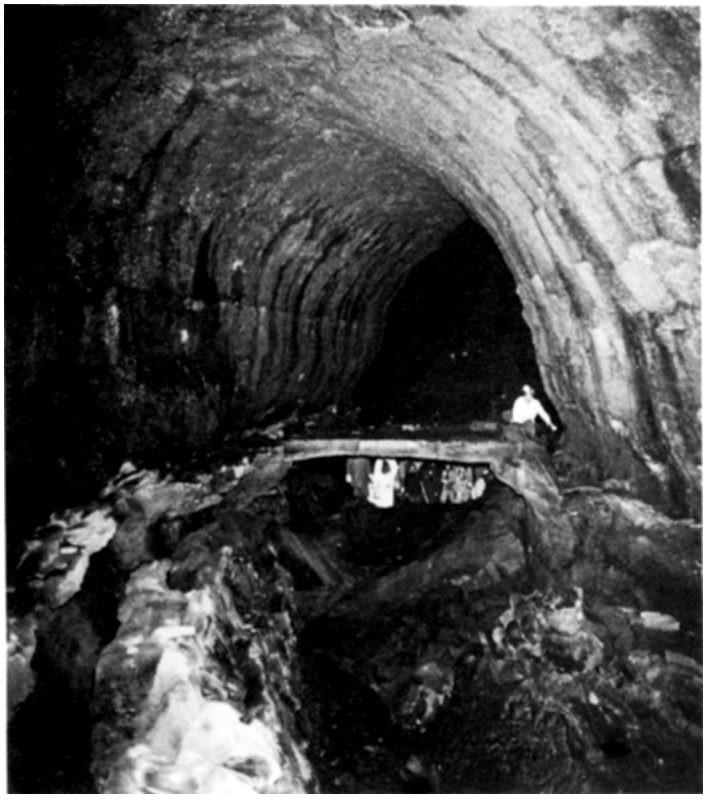








Bilemot Kul Cave, Cheju Island, Korea.

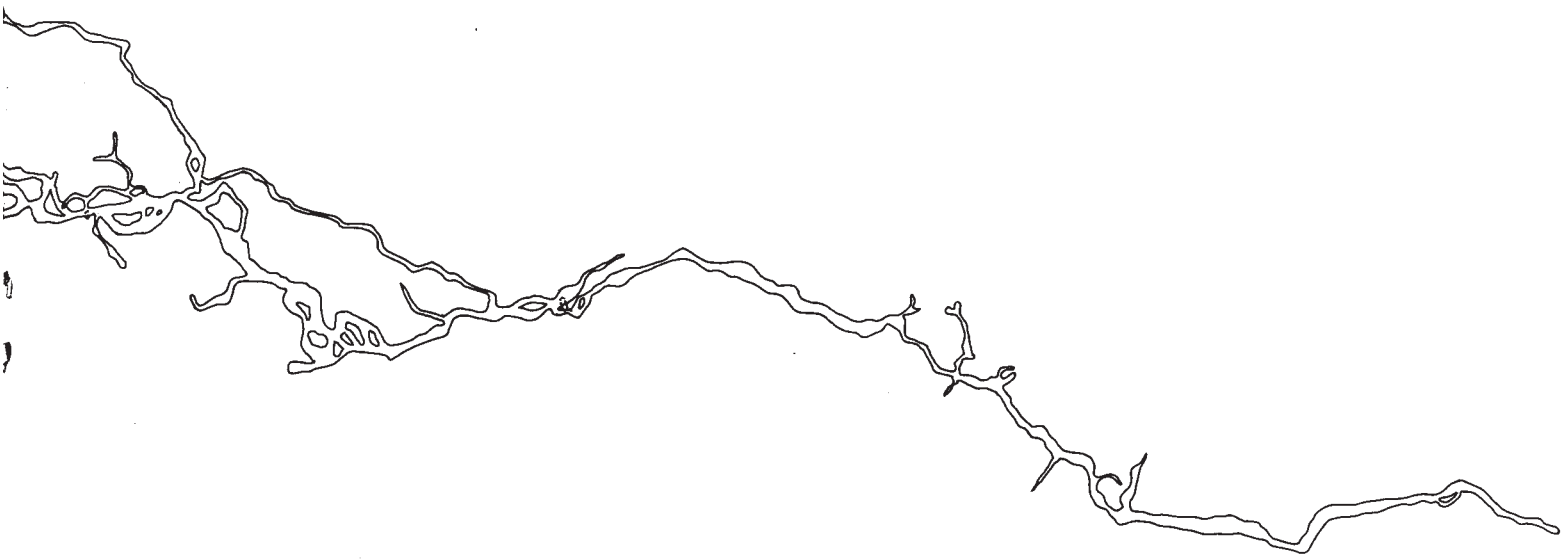


Lava bridge in Man Jang Kul, Cheju Island, Korea.

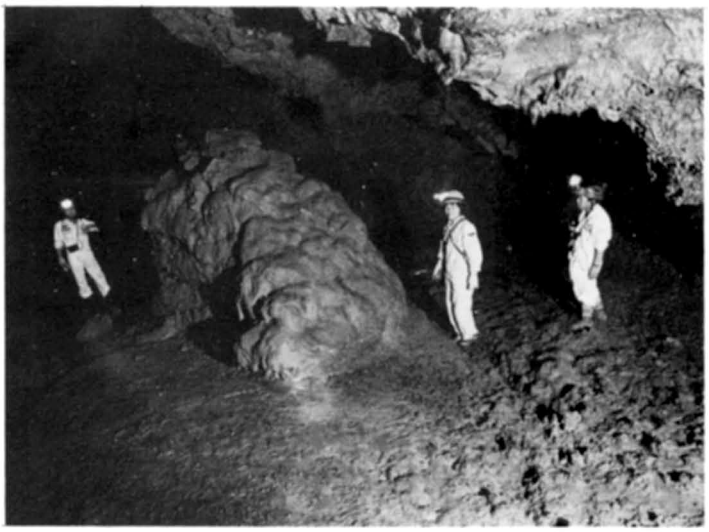
BILEMOT KUL (Cheju Island)

Man Jang Kul, Cheju Island, Korea.

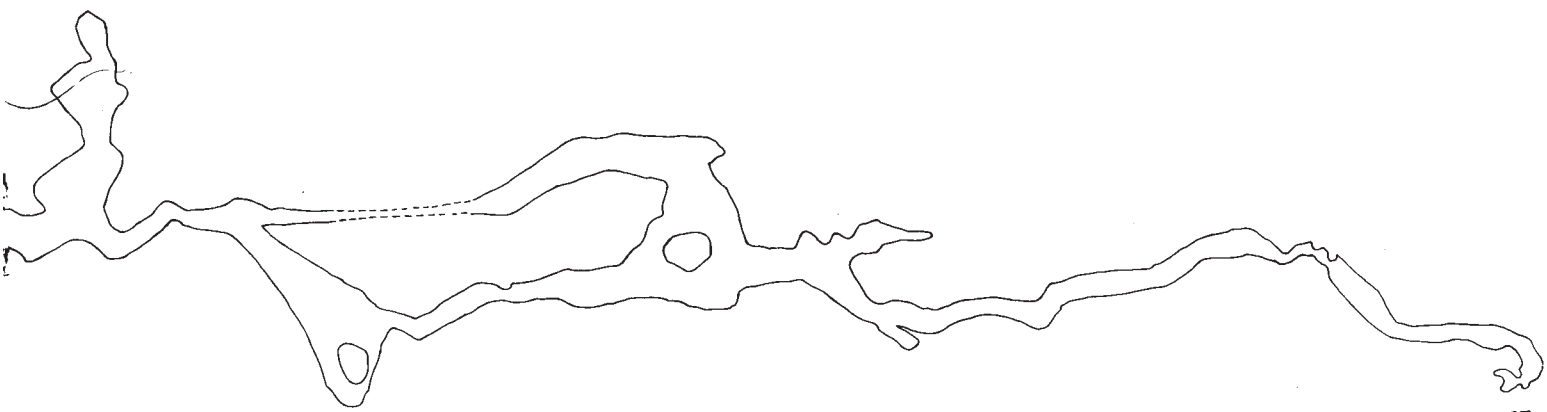
WAHUL KUL (Cheju Island)



Bilemot Kul, Cheju Island, Korea.



Lava ball in Bilemot Kul, Cheju Island, Korea.



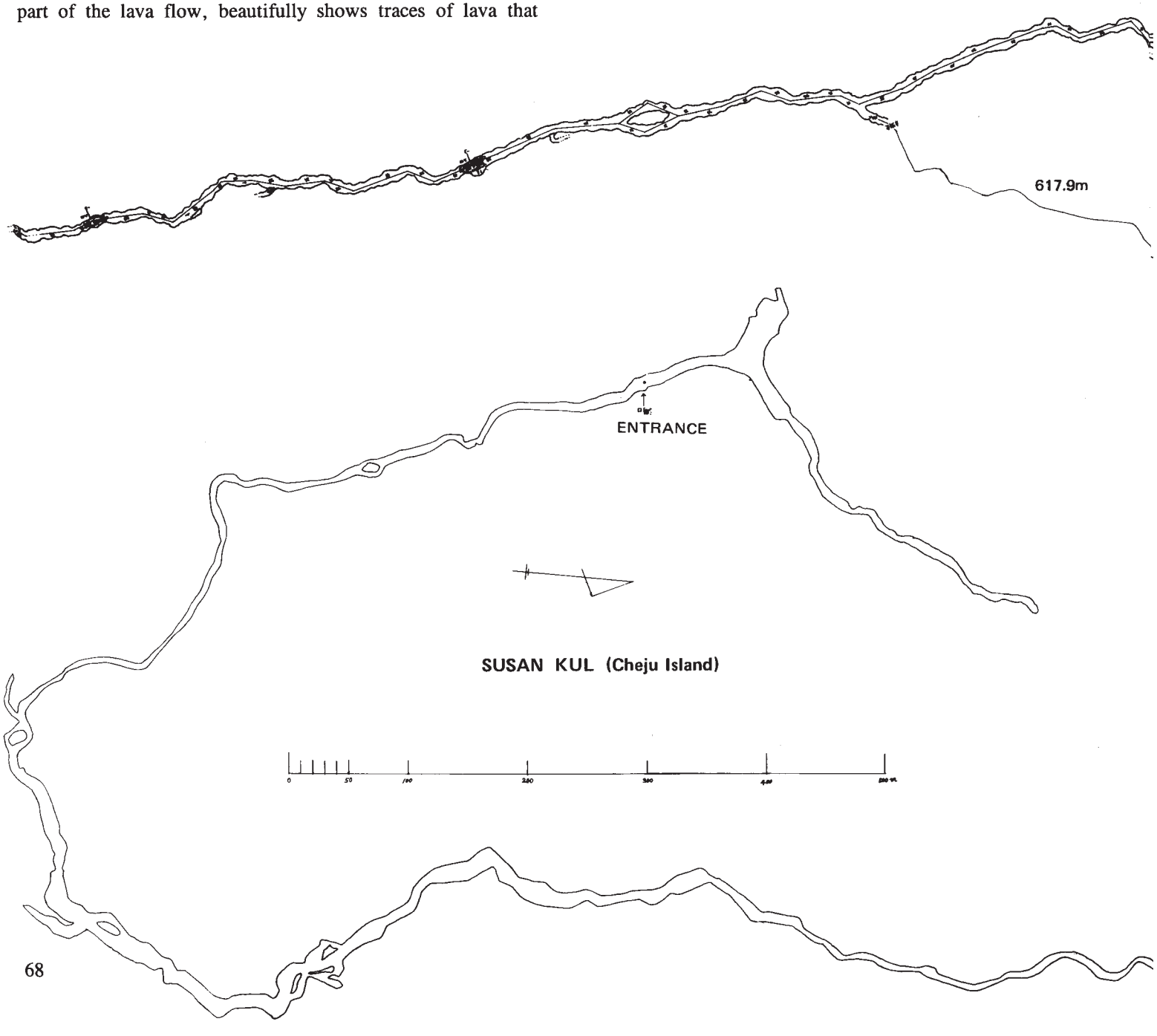
only one cave has an A type lava ledge. This type is caused by secondary flows of somewhat low temperature lava, which flowed into the caves, and after it flowed out, the lava which remained on both sides of the wall curled off and formed into a snake-shaped pipe. When the lava is very hot and soft, this does not occur, and a B-type lava ledge forms instead.

In Japan, three lava balls can be seen in Mitsuike ana (Cave) and two in Hachijo Fuketsu lava cave; in Korea, 21 are in Man Jang Kul (lava cave) and three in Bilemot Kul lava cave. The biggest of these is seven meters in the longest diameter, and 5.2 m in the shortest, and 2.5 m in height. There is also one in Susan Kul. The most notable ones are in Man Jang Kul.

When we look at these lava balls, we understand that the condition for the formation of these balls is that when they fall from the ceiling, the flow of lava on the floor must be slow. The lines on the sides of lava balls in Man Jang Kul show that the lava balls had sunk into the floor and subsidence and flow made these lines on the lava balls. One lava ball, on the surface part of the lava flow, beautifully shows traces of lava that flowed in two different directions, one to the right and the other to the left.

On Mt. Fuji, in Motosu Fuketsu No. 1 Cave, Zinza Fuketsu No. 1, and Karumizu Fuketsu, the "grape-type" lava stalactites can be seen. This is caused by the action of gas which dispersed small pieces of lava into a state of spray, and these particles stuck together one after another in a cluster of stalactites.

In Japan, siliceous stalactites can be seen in 13 of the caves of Mt. Fuji. The longest stalactites are 30 centimeters in length, but most of them are about 5 centimeters long. They are not seen in other places in Japan. In Korea, they have been found only in Man Jang Kul, Handul Kul, and Bilemot Kul. In some



caves, siliceous stalagmites also are present.

Cross-sections show a concentric state. Formation of these stalactites and stalagmites is as follows: when gas is suddenly cooled, silicate which is contained in the gas forms particles. Later these are carried by water that has soaked through the lava, and they are deposited just like calcite stalactites.

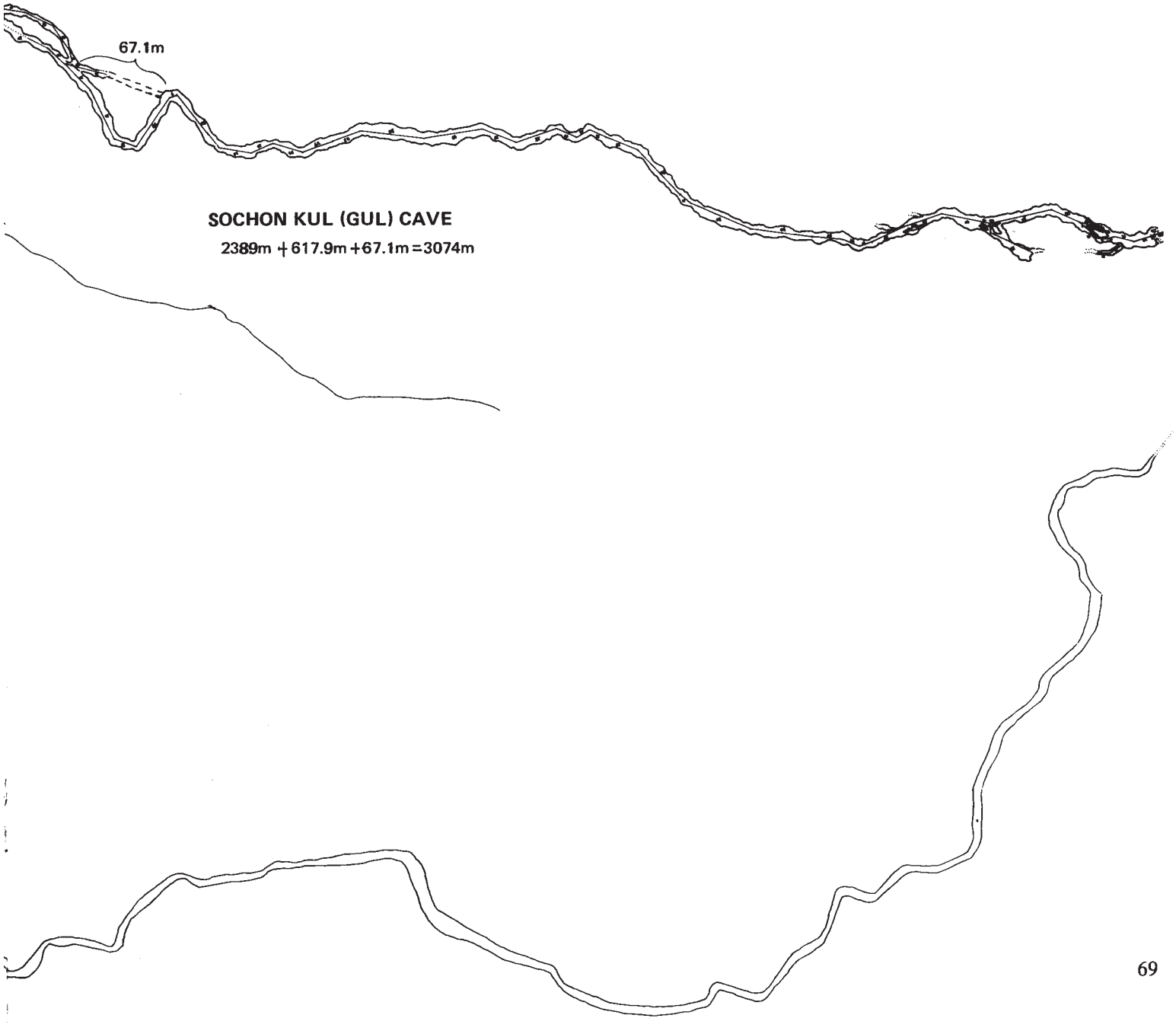
Other siliceous deposits are chemically similar to siliceous stalactites. In the USA, they have been reported by C. Larson as coralloid speleothems in Round Mountain Cave (Oregon). In Japan, they can be seen in nine of the lava caves of Mt. Fuji. In Korea, they are found mostly in Bilemot Kul (Cave). In Man Jang Kul (Cave), Handul Kul (Cave), and in Susan Kul (Cave), a few of them are present.

These are formed when the secondary lava flowing into the cave is suddenly cooled and the gas which gushes out from the lava hits against the side wall and the silicate contained in the gas sticks to the side wall.

Sometimes they are found in foam-like holes of lava, especially in Bilemot Kul Cave, on the walls and ceiling, where gas broke through into the cave. Generally, the color is white, but sometimes the surface is oxidized and is black. They vary in shape from mushroom-type to coral-type.

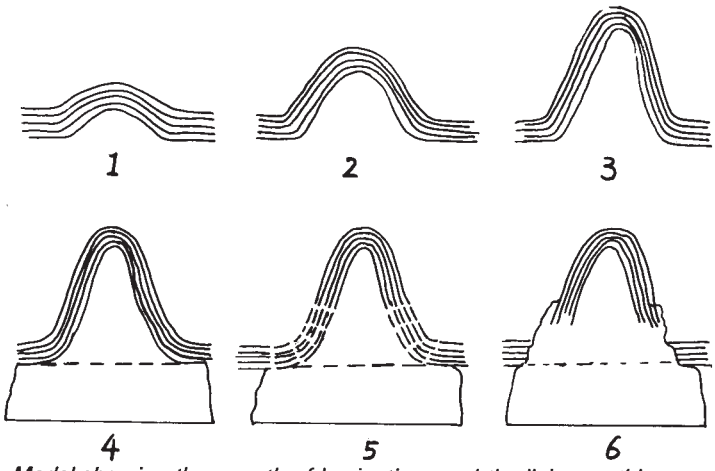
In Japan, calcareous sublimates can be observed in some of the lava caves in Aokigahara lava flow in Mt. Fuji; in these lava caves, a siliceous deposit does not exist at all. As this lava flow is a rather recent one which erupted in 864 A.D., there may be some lime still remaining in the country rock. In the case of Korea, calcareous sublimates cannot be seen at all.

In Japan, there are no tubes-in-tube in the caves of Mt. Fuji. A small one is found in Hachijo Fuketsu No. 1 in Hachijo Island.



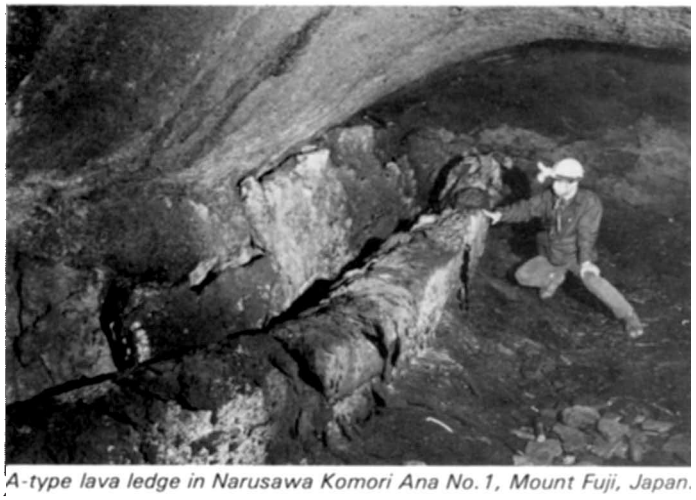
LAVA CAVES ON CHEJU ISLAND

	Lava flow and cave name	Length (meters)	Elev. (meters)
	*** Pyoseonri lava flows, Mount Hanla**		
1	Bilemot Kul	11749	245
2	Man Jan Kul	8927	120
3	Susan Kul	4674	110
4	Sochon Kul	3074	150
5	Michon Kul	1695	100
6	Wahul Kul	2066	200
7	Handul Kul	1400	80
8	Kunchokit Kul	910	80
9	Shinchang Kul	850	20
10	Yuktigi Kul	800	70
11	Kumyong Sa Kul	705	60
12	Kyeosae Kul	414	10
13	Sangyong Kul	380	15
14	Imemolu Kul	350	70
15	Kyeotsae Kul	250	10
16	Kaenegi Kul	200	30
17	Kyeyomul Kul	170	10
18	Hwangkukm Kul	140	20
19	Jaeamchun Kul	114	10
20	Hyupjae Kul	109	20
21	Pognamumit Kul	100	30
22	Kumyong Bat Kul	/	10
23	Kumyong Jeol Kul	/	10
24	Jagun Chogit Kul	/	/
25	Kum Rung Kul	/	/
26	Buzong Kul	/	230
27	Konaebong Kul	/	/
28	Han Dam Kul	/	/
	*** Ha Hyo Ri & Cheju lava flows, Mount Hanla**		
29	Mosimeol Kul	80	460
30	Kaeng Saengi Kul	45	280
31	Dotjae Pognamu Kul	80	30
32	Jolong Kul	50	30
33	Yeo Woo Kul	/	/
34	Nam Sogak Kul	/	/
35	Dot Lyanug	/	/
	*** Hanlasan lava flows, Mount Hanla**		
36	Kulin Kul	380	780
37	Yong Jin Kul	/	1450
38	Tong Kwae Kul	/	1530
39	Dung Tojin Kwa Kul	/	1750
40	Pyeong Kwae Kul	/	1600
41	Sang Kwae Kul	/	1450
42	Neol Bun Sang Kwae Kul	/	1700
	*** Sihungri lava flows, Mount Hanla**		
43	Songdang Kul	850	250
44	Dukchon Kul	190	180
45	Konaengie Sul Kul	/	/



Model showing the growth of laminations and the lining partition.

Laminations in Inusuzumiyama Fuketsu Cave No. 1, Mount Fuji, Japan



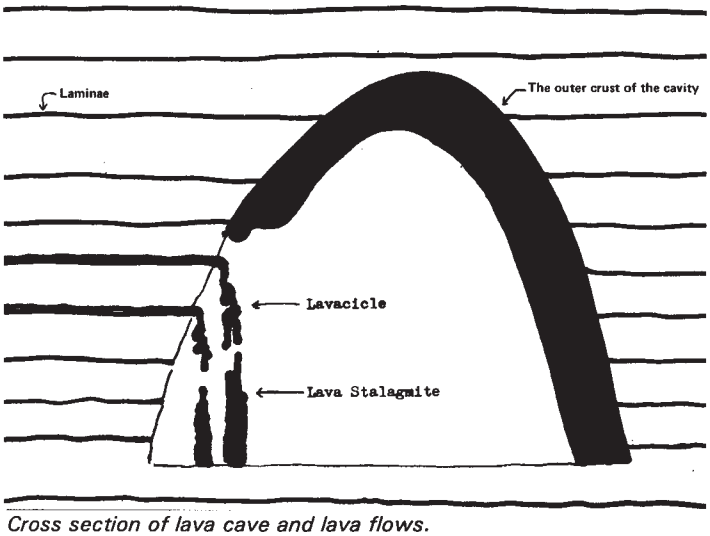
A-type lava ledge in Narusawa Komori Ana No. 1, Mount Fuji, Japan.

On Cheju Island, a very long one (over 300 meters long) has been found in Sochon Kul (Cave). Man Jang (Kul) and Bilemot Kul (Cave) each has one tube-in-tube.

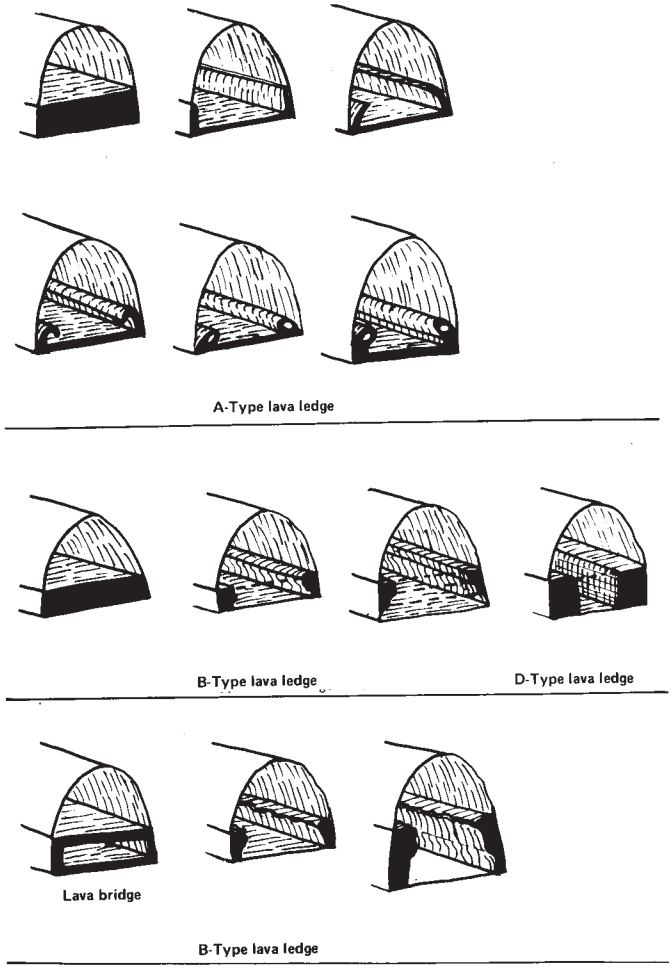
Laminae can be seen only in the following six lava caves on Mt. Fuji, namely, Inusuzumi-yama No. 1 Cave, Mujina-ana (Cave), Mitsuike-ana (Cave), Zinza Fuketsu No. 1 Cave,

A-type lava ledge in Shoji Ja Ana (cave), Mount Fuji, Japan.

C-type lava ledge, Uzura Ana (cave), Mount Fuji, Japan.



Cross section of lava cave and lava flows.



Push out lava stalactite, Bilemot Kul, Cheju Island, Korea.

Motosu-Fuketsu No. 1 Cave and Karumizu-Fuketsu Cave. There are none in the caves of Cheju Island.

In Japan, lava stalagmites exist only in Mitsuike-ana (Cave) in Mt. Fuji. The biggest is 191 centimeters in height, and there are 137 which are over 5 centimeters in height.

On Cheju Island, there are four in Bilemot Kul (Cave) and in Susan Kul (Cave) about ten can be found. Formerly, there were two in Sochon Kul Cave, but they were stolen. In Man Jang Kul (Cave), there were many, but at present there are none.

Japan has only two small lava bridges in the caves of Mt. Fuji. Cheju Island has beautiful lava bridges in Man Jang Kul (Cave). Susan Kul (Cave) has lava bridges extending as long as 20 meters, and Sochon Kul has 300 m.

A coffin in Sochon Kul (Cave) shows clearly the process of origin of this type of feature.

The coffin in Prince Albert Cave (Washington) was formed when the surface of the secondary lava flow hardened and later when the inside lava flowed out, it formed the coffin as a tube-in-tube.

But when the lava was flowing, the ceiling which had hardened, collapsed, and was carried away by the moving lava, then the walls of tube-in-tube were pushed outward and made wider, and in the Sochon Kul Cave, the part which is stuck and pushed upward can be seen.

In Japan, lava stalactites of various forms are found in Mitsuike-ana (Cave) of Mt. Fuji. In Hachijo Fuketsu Cave on Hachijo Island, there are five others. There are no other examples in Japan.

On Cheju Island, Bilemot Kul (Cave), Man Jang Kul (Cave) and Susan Kul (Cave) have some. The ones in Man Jang Kul are pipe stem types. One of them is about 90 centimeters long. It is not as narrow as the one in Pisgah Crater Cave (California).

These stalactites are laminated. Hot lava which infiltrated into the thin lava layer kept dripping and formed them. Columns formed by joining of stalactite with stalagmite can be seen in Mitsuike-ana (Cave) in Japan and Bilemot Kul (Cave) and Susan Kul (Cave) in Korea.

THE STUDY OF THE FORMATION OF THE CAVES

When we look at the vertical section of Zinza Fuketsu No. 1 Cave in Mt. Fuji, it can be understood that the cavities are connected to each other and become longer and longer.

As one cavity joins with another, gas moves from one cavity to another. The following caves contain evidence of this:

1. The grape-type lava stalactites (Motosu-Fuketsu No. 1 Cave, Karumizu-Fuketsu Cave, and Inusuzumi-yama Fuketsu No. 1 Cave on Mt. Fuji).

2. Speleothems resembling eolian ripple marks on lava ledges (Man Jang Kul in Korea).

3. Speleothems of lava drops which ran down against the wall impelled by gas (Man Jang Kul).

4. Stalactite bent by the movement of gas.

5. Stalactite on the ceiling that shows many straight parallel lines (Shyoiko Fuketsu No. 1 Cave, Japan).

When we examine the laminae in Mitsuike-ana (Cave), it is clear that the outer crust of the cavity hardened quickly into a crust; around the crust, there is a thin lava layer, which sometimes flows on as one thick plate.

When this outer crust breaks down and laminae are exposed, these laminae seem to have separated from each other as they flowed and traces of scratches can be observed between the upper and lower layers in Mujina-ana (Cave).

Also in Zinza Fuketsu No. 1 Cave, laminae are pushed up by gas, some parts are destroyed. They are identical with what is called the Plug in Kitty-Pooh Extension (Oregon), Ice Rink Cave (Washington) and Dynamited Cave (Washington).

In those lava caves which are near the surface, cavities exist under surface swellings where lava is pushed up by gas. There are four such caves on Mt. Fuji.

CHEMICAL QUANTITATIVE ANALYSIS OF SILICEOUS SPELEOTHEMS IN LAVA CAVES

Place	Mt. Hanra (Korea)		Mt. Fuji (Japan)	
Cave name	Man Jang Kul	Man Jang Kul	Komakado Fuketsu	Ohno Fuketsu No.2
Form	Powder	Lamella	Coralloid	Stalactite
SiO_2	33.07	49.39	36.81	37.54
Al_2O_3	0.04	0.19	27.07	30.20
Fe_2O_3	0.12	0.18	1.48	0.28
Mn O	0.00	0.01	0.00	0.00
Mg O	14.4	8.66	2.11	0.28
Ca O	0.89	11.6	1.47	1.23
Na_2O	0.26	0.22	1.07	0.87
K_2O	0.02	0.03	0.29	0.19
H_2O	44.41	5.80	16.42	15.22
Ignition loss	6.61	20.05	11.87	13.77
Total	99.8	96.1	98.9	99.58

Ripple marks on a lava ledge, Man Jang Kul, Cheju Island, Korea.

Lava ball in Mitsuike Ana (cave), Mount Fuji, Japan.

Considering these phenomena, we must say that gas has much to do with the making of caves. In Shyoiko Fuketsu No. 1, when we examine the place where gas explosively broke through the wall of the cave, we can see how rapidly the lava has hardened. Also, when we look at pipe-like stalactites, it can be understood that, when the drops of lava are dripping, it cannot be formed unless its surface quickly becomes hard.

When a lava cave is made, first of all successive flat cavities are formed by gas. At the bottom of the cavity, the floor moves on with the least resistance, so the floor itself sinks and the cavities are connected, and thus they may form an enormous cave. In this way, very long caves are formed.

Features of Three Kinds of Lava Caves

We have examined caves in the three kinds of basalt caves, and they do not show much difference. But in the lava caves of Cheju Island and those in China, caves in alkali basalt have some characteristics:

1. There was much flow of lava, and generally the caves having the above conditions are very long caves.

A. The lava on the walls of the cave has luster and is smooth, and many caves show that the floor moved down and sank rapidly, that is, the lava was of high temperature and had no coking property.

B.As the amount of lava eruption was great, the lava caves are generally very long, as in the case of Cheju Island, which is a volcanic island, and because gas from the sea water was added to the lava, in the case of Man Jang Kul (Cave) in Korea, 51 cavities were joined together producing a system 8,927 meters in length.

2. In these alkali basalt caves, laminae cannot be seen on the sides. We may consider that this depends on the nature and quality of lava.

3. A lava bridge is big and long, so the coking property has something to do with it. According to the chemical analysis table, SiO_2 here is less than in those in Hawaii, and it has much fluidity.

As in the case of high-alumina basalt in the lava in Mt. Fuji, each lava flow has different chemical components. Inusuzumi-yama lava flow has the softest basalt erupted from a shield volcano, which is called Mt. Inusuzumi, halfway up to Mt. Fuji. So here there are many very long caves and also caves with complicated planes.

Because there are caves in which the side walls have collapsed and laminae can be seen, it is probable that there was much fluidity of lava. Even if the lava flow is the same, the impression we get when we go into the caves can be completely different according to the condition of the movement of lava or the difference of time when the eruption occurred.

Generally speaking, the caves near the flat part of the summit are close to the surface, and they are complicated and small. But the cave which formed where the lava did not move but stayed, are simple, big and long.

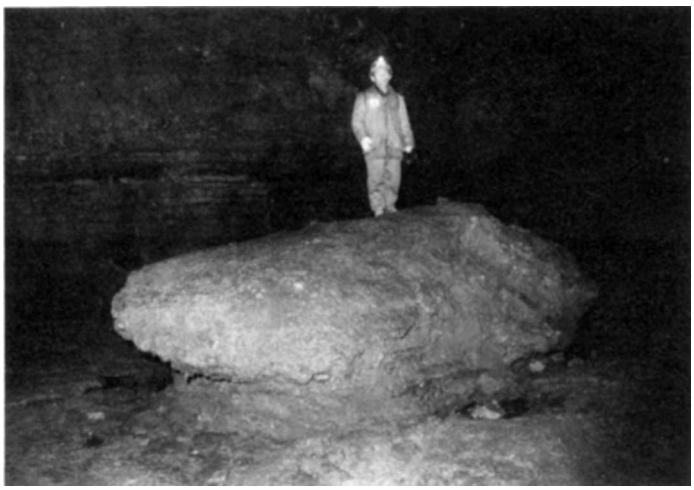
In Aokigahara, where the number of caves is the greatest, the lava flow is typical aa lava. So A type lava lege is found only in this lava flow and in that of Mt. Aso.

It is not certain whether it is due to high-alumina basalt, but in Pinwill's Cave (Australia, North Queensland) A type lava ledge is present. This A type lava ledge is formed in a snake-like shape under both the side walls of the cave. Some of them are hollow.

As I have mentioned above, a small difference in the chemical component of basalt gives every cave some different features.

ACKNOWLEDGEMENT

The report on the lava caves on Cheju Island is the result of joint investigation with Dr. Hong Shi Hwan, head of the Speleological Society of Korea.



Lava ball in Man Jang Kul, Cheju Island, Korea.