

VULCANOKARST ON CHEJU ISLAND IN SOUTH KOREA

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Introduction

Geographically Cheju Island is located in the southmost part of Korea. Cheju Province, the largest island in Korea, consists of one major island, Cheju, and other minor islands including Chuja Island. The province is located in around 140 km from Mokpo on the north, about 272 km from Pusan. Tsushima Island of Japan on the northeast, and Shanhai of the China across the East China Sea to the west.

Volcanic landmass has abundant caves (60 recorded caves) which formations(Figure 1) are very

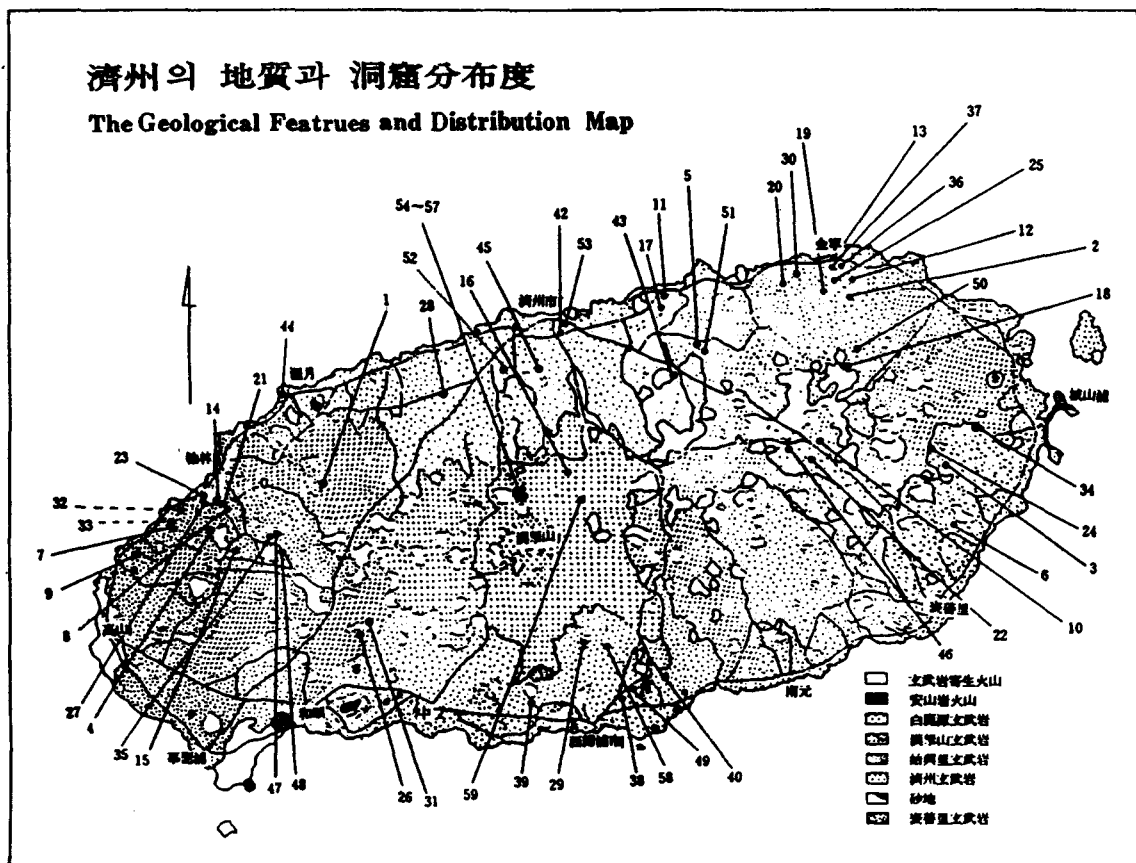


Figure 1. Distribution of the Lava caves in Cheju Island, Korea (Volcanic Caves in Cheju, 1987).

Table 1) Lists of the Volcanic Caves in Cheju Island (Volcanic Caves in Cheju, 1987).

濟州의 火山洞窟 一覽表 The List of Volcanic Caves

No	洞窟名	길이	높이	緯度	經度	所在地	岩石層
1	밀에못窟	11,749m	255m	33°24'01" N	126°21'08" E	北濟州郡 遂月邑 於晉里	表善里層 玄武岩
2	萬丈窟	8,928 m	125m	33°31'26" N	126°46'18" E	北濟州郡 舊左邑 東金寧里	'
3	水山窟	4,674m	140m	33°25'30" N	126°50'37" E	南濟州郡 城山邑 水山里	'
4	昭天窟	2,980m	130m	33°21'53" N	126°15'38" E	北濟州郡 翰林邑 挾才里	'
5	臥蛇窟	2,066m	130m	33°30'10" N	126°38'10" E	北濟州郡 朝天邑 臥蛇里	'
6	美千窟	1,695m	100m	33°23'03" N	126°50'27" E	南濟州郡 城山邑 三達里	'
7	한돌窟	1,400m	30m	33°22'28" N	126°13'56" E	北濟州郡 翰林邑 金陵里	'
8	초기화窟	1,289m	50m	33°22'56" N	126°14'50" E	北濟州郡 翰京面 月令里	'
9	新昌窟	850m	20m	33°20'48" N	126°11'20" E	北濟州郡 翰京面 新昌里	'
10	松堂窟	850m	265m	33°26'22" N	126°45'31" E	北濟州郡 舊左邑 松堂里	表善里層 玄武岩
11	육티기窟	800m	70m	33°31'36" N	126°37'27" E	北濟州郡 朝天邑 新村里	'
12	金寧蛇窟	705m	60m	33°32'26" N	126°46'38" E	北濟州郡 舊左邑 金寧里	'
13	개우섯窟	88.5m	10m	33°33'09" N	126°45'22" E	北濟州郡 舊左邑 東金寧里	表善里層 玄武岩
14	雙龍窟	392.3m	30m	33°23'00" N	126°14'38" E	北濟州郡 翰林邑 挾才里	'
15	玉山窟	391m	140m	33°21'58" N	126°16'34" E	北濟州郡 翰林邑 月林里	'
16	구연窟	380m	760m	33°24'19" N	126°32'45" E	濟州市 梧登洞	漢拿山 玄武岩
17	이모루窟	350m	70m	33°31'25" N	126°37'26" E	北濟州郡 朝天邑 新村里	始興里層 玄武岩
18	龍泉窟	232m	155m	33°29'52" N	126°45'30" E	北濟州郡 舊左邑 松堂里	表善里層 玄武岩
19	케네기窟	200m	30m	33°32'18" N	126°44'58" E	北濟州郡 舊左邑 東金寧里	'
20	게이빙窟	170m	10m	33°32'38" N	126°42'57" E	北濟州郡 舊左邑 東福里	'
21	黃金窟	140m	35m	33°22'59" N	126°14'39" E	北濟州郡 翰林邑 挾才里	'
22	松堂窟 2	138m	255m	33°26'39" N	126°45'58" E	北濟州郡 舊左邑 松堂里	'
23	財岩泉窟	114m	10m	33°23'18" N	126°50'21" E	北濟州郡 翰林邑 挾才里	'
24	水山窟 2	100m	150m	33°25'57" N	126°50'21" E	南濟州郡 城山邑 水山里	'
25	복나루입窟	100m	150m	33°32'24" N	126°45'09" E	北濟州郡 舊左邑 東金寧里	'
26	당오름窟	90.6m	434m	33°19'48" N	126°20'19" E	南濟州郡 安德面 東廣里	始興里層 玄武岩
27	挾才窟	98.84m	20m	33°22'59" N	126°14'38" E	北濟州郡 翰林邑 挾才里	表善里層 玄武岩
28	松林窟	367.4m	30m	33°22'58" N	126°14'44" E	北濟州郡 翰林邑 金陵里	濟州 玄武岩
29	觀音窟	80m	280m	33°17'32" N	126°34'43" E	西歸浦市 吐坪洞	'
30	돛내륙단窟	80m	30m	33°32'45" N	126°43'36" E	北濟州郡 舊左邑 東金寧里	表善里層 玄武岩
31	당오름窟 2	57.7m	370m	33°19'57" N	126°20'24" E	南濟州郡 安德面 東廣里	始興里層 玄武岩
32	초롱窟	50m	30m	33°22'39" N	126°13'39" E	北濟州郡 翰林邑 金陵里	表善里層 玄武岩

* 높이는 굴입구의 해발고도임.

characteristics in shapes and sizes (Table 1), even they have unique calcite speloscapes in some caves due to the penetration of surface lime shells' dissolution.

Geology and distribution of caves

1. Volcanic cave geology:

Cheju island is a volcanic genesis island formed at the end of the tertiary period. The geology layers of the island are constituted with the Pleistocene layer of the end of the Cenozoic era, the sedimentary rock of Seongsan layer, Whasoon layer and Shinyangri layer formed at the Quaternary period, basalt, trachyte, volcanic rock and volcanic debris. Most of the layers are basalt, especially Pioseonri, mountain Hanla, Cheju, Hahyeri, Shiheungri areas which have low viscosity and are basic. Therefore the basalt is closely related to the distribution of lava caves.

The lava caves in Cheju have low viscosity, and developed within the basalt layer. Now about 60 lava caves are found and distributed as follows.

2. Distribution of Caves:

The numbers of volcanic caves found in Cheju Island are about 100, about 60 of them have been investigated. Most caves were located near villages and have been related with the life of the local dwellers. By the investigations of the height above sea level and length of the cave, the higher size of caves are bigger; Hyopjae cave and Manjang cave are connected each other, so that they formed larger system of caves. It is assumed that because the basal slopes of mountain are lower, and the sizes of caves are bigger.

Volcano caves in Cheju Island are divided in two groups:

- (1) Manjang cave area in northeast slopes,
- (2) Socnon cave area in Hanlim.

In the Manjang cave area, there are Songdang Cave, Dockchon, Sagul Cave, Kaenaegi Cave, Pocknamoo Cave, Pocknamoo mit Cave, Boojong Cave, Waful Cave in Chocheon, Immemerru Cave, Gonaeisl Cave, Yooktigie Cave. In the Socheon Cave area there are Hyopjae Cave, Jorong Cave, Sanhyong Cave, large Chokit Cave, and Hwankeum Cave.

Formation and topography of caves

1. Formation of caves

Lava is formed by the extrusion of magma under the ground. The lava is cooled down when it flowed down to basal mountain, which is formed as lava platform areas. When the lava flows down, lava caves are formed. The temperature of the magma extruding from the ground is about 900 - 1,200 °C. The areas touching with air is cooling

down, but inner sides of lava are hot flows down from top to base of mountain, meanwhile, caves are formed. In Cheju Island, the lava flowed down from top to long basal mountain along, therefore many caves were formed.

In terms of cave meteorology, the temperature in the cave is almost constant around a year. The temperature of an entrance area is only different from the inner temperature. The average temperature of the cave is about 12-16 °C.

2. Topography of caves

The volcano found in Cheju Island has scientific values because properties of their size, distribution, density, topography, and natural feature of the earth. The length of caves are considerably longest in the world, their topography and actual feature are typical and distinguished, which is described in the following.

10

(1) Lava rod

Lava rod is formed by accumulated lava on the first cooled cave. The height of the rod at the point of 1,000m of the is about 7.6m and it is supposed to be the longest in the world.

(2) Lava Ball

Lava ball is formed by solidifying of lava aggregated and lava selves with the stream of lava.

(3) Lava Bridge

When lava is streaming, the bottom layer of the lava is rapidly solidified, on the solidified layer, a lava floure again, and then solidified with formation of bridge style.

(4) Lava Stalagmites

A cave is formed by lava flow, and flow and then from the ceiling droplets of the lava is drapped piled and solidified on the bottom layer

of cave. The piled and solidified drops become lava stalagmite.

(5) Lava Stalactites

When forming cave by lava, a part of hot lava flows down along walls or from ceiling slowly and the solidified like a icicle. This is called stalactites.

(6) Mini Cave in Cave (Tube in Tube)

After formation of a cave, another lava stream flows on the cave bottom, at the time a mini gaseous cave is formed. This is called a cave in cave or a tube in tube.

(7) Silica rod

Silica a stalactites is growing and connected to the bottom layer of cave. This connected rod is called a silica rod, and is a rare cave in the world.

(8) Silication

Silicic acid in liquid phase in gas is attached to the wall or ceiling of cave. This is called silication.

(9) Gas ball

When a lava flows, concentrated gases draplets are attached to the wall or ceiling. This is called a gas ball. The gas ball on the bottom layer is formed by imperfect extrusion of gas in the lava flow.

(10) Ropy Lava

When a lava stream is stopped and a cave is formed, temperature of the bottom layer is down and the density increased the wall lava is pressed by weight. Consequently, the wall lavas are waved down by gravity. These wave form is called Ropy lava.

(11) Lava ledge

Lava ledge is formed by solidifying of a

part of lava on the wall of cave when a lava flows.

Biota in Caves

By ecological classification of biota in their caves, 30 species live only in caves, 51 species came from outsides, and remain cave dweller was one species (*Epanerchodusclavisetosus*). Aquatic animals were only 3 species. In fact, this history of caves are short. 19 orders of the biota in Cheju Caves are as follows: Triciadida, Gordiacea, Gastropoda, Pseudoscrpionida, Opilionida, Acarina, Araneida, Isopoda, Anphipoda, Chilopoda, Diplopoda, Collembola, Thisanura, Orthoptera, Coleoptera, Hemiptera, Diptera, Chiroptera, and Anura

Conclusions

Vulcanokarst in Cheju Island exhibits significant sizes and shapes. Geologically the caves were formed from the end of the Cretaceous in the Tertiary to the Pleistocene. They are comparatively very young and fresh pseudokarstification. 60 recorded lava caves demonstrate volcanic formations in the cave interiors. In addition, there are unusual calcite formation in the lava tubes. Calcite cave landscapes are derived from the pieces of surface shells (Suh, 1980). Caves consist of almost all kinds of the limestone cave formations. Some present strew types of stragmites and bacon types of formations. Columns, limestone dams, and stagmites are also present.

Ecologically caves have limited numbers of the biotic remnants. They are isolated from the main land, peninsula, and limited number of the cave living species: 19 orders 97 species that indicate only 37% of the all biota in caves is

procave animals. This percentage is less than that of the limestone biota in the peninsula. These results indicate the shortage of the history of the caves in Cheju Island.

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