

A study on Biological Environment of Ondal Cave

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I. Introduction

Ondal cave is the limestone and the cultural asset cave designated as Natural monument NO. 261

Originally after the caves included in cultural assets separately survey the academic, cultural value of the cave, the result must be the academic basis of the cave

A cave should be divided into natural monuments, local ones, and so on. It is needless to say that the caves else that is not assets of course are called natural caves. This academic research is done about all details of the cave to illuminate the academic and cultural value, to make the basic criteria data in the center of the basic items about the geomophology and land configuration, and the change of biological environmeat

It is natural that the cave environment does not be preserved forever but is actually changed by the air, the quantity water, and many environment factors in and out the cave. The loss and pollution of geographic land is predicted and these basic criterion data should be made. Nevertheless, the general data survey is not practiced lot now.

Therefore the academic survey is needed like this, the effect should be surely used as the basic data for working out the measure for the environment security

This cave survey is restricted to be searched only witnin the inside part of the cave because the academic survey about the outside part of the

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cave in Songsan area of Onalsong, was already done, so this survey was focused on the inside part of the cave.

II. The weather within the cave

1. The outline about biological environment

It is characteristic that the weather within the cave doesn't change much because it is common that the inside part is always dark and does not change so much.

Furthermore, in case of the limestone cave when the cave has more than two entrances the condition is not even by the movement of the air current but the Ondal cave which is the airtight closing cave becomes the good material of the academic study.

That is to say, the weather within the cave is sometimes one of the great important factors in growing and developing the second beings by the low and high humidity of the atmospheric condition, the low and high atmospheric temperature and the temperature change, etc., which form the inhabitation environment of the cave creatures

As the high moist inhabitation environment serves the beneficial condition which makes the cave creatures to live, this research about the high moist one is related to the creature ecosystem and be useful for the academic study.

2. The atmospheric condition of the Ondal cave.

The climate of the Ondal area as the continental one and the inland one with the high daily temperature gap but this phenomenon becomes somewhat relaxed.

The temperature within the Ondal cave read about 16°C in summer and

about 14°C in winter. The annual temperature of the underground water within the cave was measured about 12°C.

In summer, the temperature gap within the cave shows that the upper level place is higher than the low level one. When the outer temperature increase, the air stream, to the contrary, flow out from the end of the inside cave to the one of the outside one, restricts the sudden temperature increase, and keeps low temperature relatively.

At night, the air gets cold and the atmospheric flow in the cave after sunsetting and out the cave after sunrising.

The flow of the air current around the cave entrance appear deeply gaps.

The climate aspects of the outside and the inside part of the cave is very different.

It is generally characteristic that on the surface of the land, the outside part of the cave, the climate aspects often is differently shown at almost the places in the inside and the climate environment is kept similar and regularly.

1) The characteristics about the general weather condition of the cave

The cave is the closed space in the underground so that it has other characteristics different from the area around.

That is to say, the cave was intercepted from the light so that the heat exchange is made by the movement of air current only through the entrance or by the transmission through the ceiling and the wall.

Also, the cave was intercepted with the water rising phenomenon, so the inner moisture amount is mainly decided by the ceiling or the wall.

Therefore, the weather condition within the cave was influenced by the

main factors as follows; the latitude, the height, the season, and so of the area in which is situated on, and the depth from the surface, the scale, the form, the entrance's number, the land quality, and so on.

The cave weather condition of the temperate monsoon region like our country generally has characteristics of high temperature and a little annual temperature change.

The airstream within the cave, when the cave is a small one, is influenced by the airstream connected to the outside.

The flow of the airstream varies depending on the season. In winter the temperature of the outside air is lower than that of the inside and the air within the cave has a higher density than without the cave. Accordingly, the air flows from the outside to the inside in winter. The air flows at a higher velocity at the entrance, where there is a great difference in temperature between the inside and the outside, and the velocity gradually decreases as the air approaches the inner end of the cave. But swirls occur where the cave narrows. In a small cave which has double openings at both of its ends, the air flows very slowly, which renders the measurement of its velocity nearly impossible, and the velocity is highly variable.

In the damp area, the underground water is supplied through the surface of the earth or the cave walls and maintains the humidity of 90%. The annual difference of the humidity within the cave ranges within 10% despite the great difference of the humidity on the surface of the earth between the rainy and dry season. But the area around the entrance shows a low humidity because of the outside air. The survey data over the caves distributed in the inner mid-land area generally shows the humidity of 88~90% at the entrance and 95~98% at the point 500m

away from the entrance (Table 1).

Table 2 The distribution of temperature and humidity of limestone caves

(temperature : °C, humidity : %)

caves names	Ondal cave		Kossi cave		Songyu cave		Nodong cave		Kosu cave		Yongdam cave	
	T	H	T	H	T	H	T	H	T	H	T	H
100m	15.5	82	15.5	88	14.6	93	14.9	88	15.6	87	13.8	85
200m	15.1	85	15.0	85	14.2	89	14.5	89	15.2	85	13.5	92
300m	14.9	88	13.5	89	14.1	92	14.2	84	14.8	89	14.2	94
400m	15.2	94	12.8	92	13.8	95	14.5	87	14.5	90	14.1	94
500m			13.1	97	14.0	98	14.6	90	14.2	92		
600m			14.9	97			14.0	97	13.9	96		
700m			14.1	98								

Generally, the temperature within the cave shows small daily or annual differences. The caves located at the temperature zone are said to maintain the mean temperature 16°C in summer and 13°C in winter. According to Table 1, the limestone caves in Korea show the temperature 12~15°C (the mean between April and October, 1986) at the 300m point within from the entrance, and the lava caves 15~17°C (July and August, 1985).

In the area near the cave entrance, there are daily and annual variation of temperature, which are similar to those outside the cave. This is due to the constant exchange of heat between the inside and the outside. Accordingly, in the area near the entrance there is a great difference between the air temperature and the cave wall temperature. But as the air approach deep into the cave it shows little difference in temperature from

the wall.

As heat is exhausted through conduction rather than by airflow deep inside the cave, the temperature of the cave wall is a factor that determines the inside temperature.

The part below 1 m from the surface maintains a constant temperature since the horizontal heat exchange is almost zero. Likewise, inside the cave, the heat inflow by conduction is almost equal to the outflow, thus a small amount of daily changes of the air temperature.

Observation data shows that if the daily range of the outside air temperature is 10°C, then that of the inside air temperature is about 1°C. The inner temperature of the cave is influenced by the latitude and altitude of the cave site.

According to the survey of Chejudo caves, the Kurin cave (located at an altitude of 700m on a slope of Mt Halla) has an inner temperature which is lower by 2~3°C than those of the Hyopjae and Kumnyongsa caves located in the low-land area near the coast. This implies that the low-land caves have a higher temperature than those of the high-land ones.

The water temperature inside the cave is slightly variable depending on the region but generally ranges from 12°C to 16°C. In summer the temperature is 2~3°C higher than in winter. The farther from the entrance, the less seasonal fluctuations of the water temperature. The water temperature of a lava cave is 1~2°C lower than that of a limestone cave. This is due to the fact that the lava cave has a simple structure, which has less obstacles to block the air inflow, while the limestone cave has a labyrinth-shaped multi-layer structure, which blocks the air inflow from the outside.

The Ondal cave has a relatively small approach and leads to the blind end almost in a straight line. This may explain the variable water temperature.

The water erupts out of the approach and has a temperature 16.5°C inside the cave, and 18°C near the approach, which is about 2°C higher than in other regions. This implies that the water flowing within the cave erupts directly into the cave inside from the surface of the earth.

Figure 1 shows how the temperature varies according to the distance from the approach. The temperature continues to decrease up to the 100 m point from the approach, and ceases to change beyond that point. In summer the temperature continues to decrease up to the midway from the entrance or the exit, and then increases again, while in winter the temperature changes in the other way.

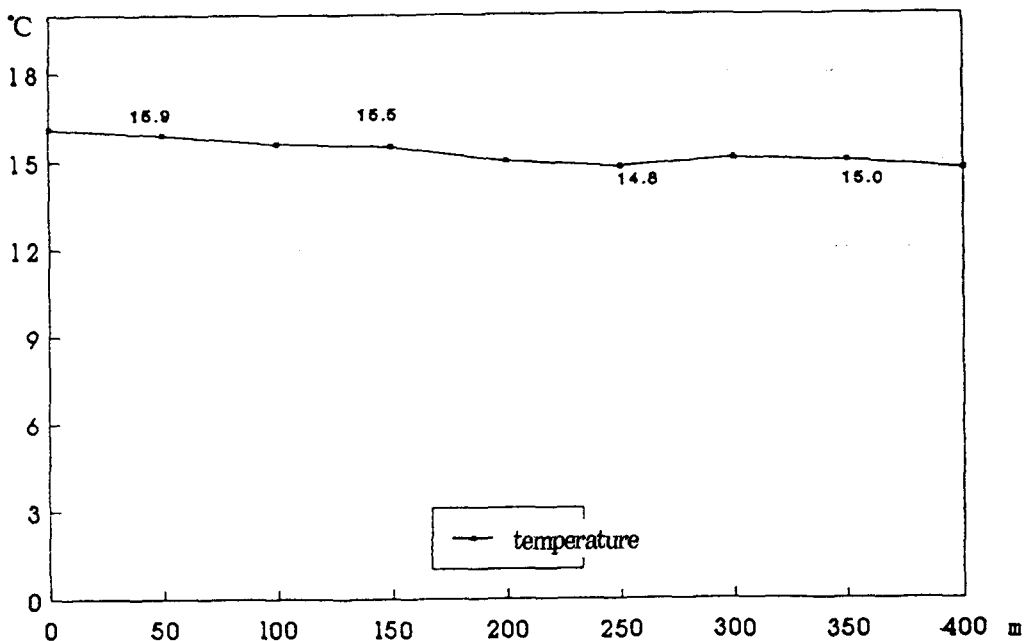


Figure 1 The temperature variation according to the distance in the Ondal cave

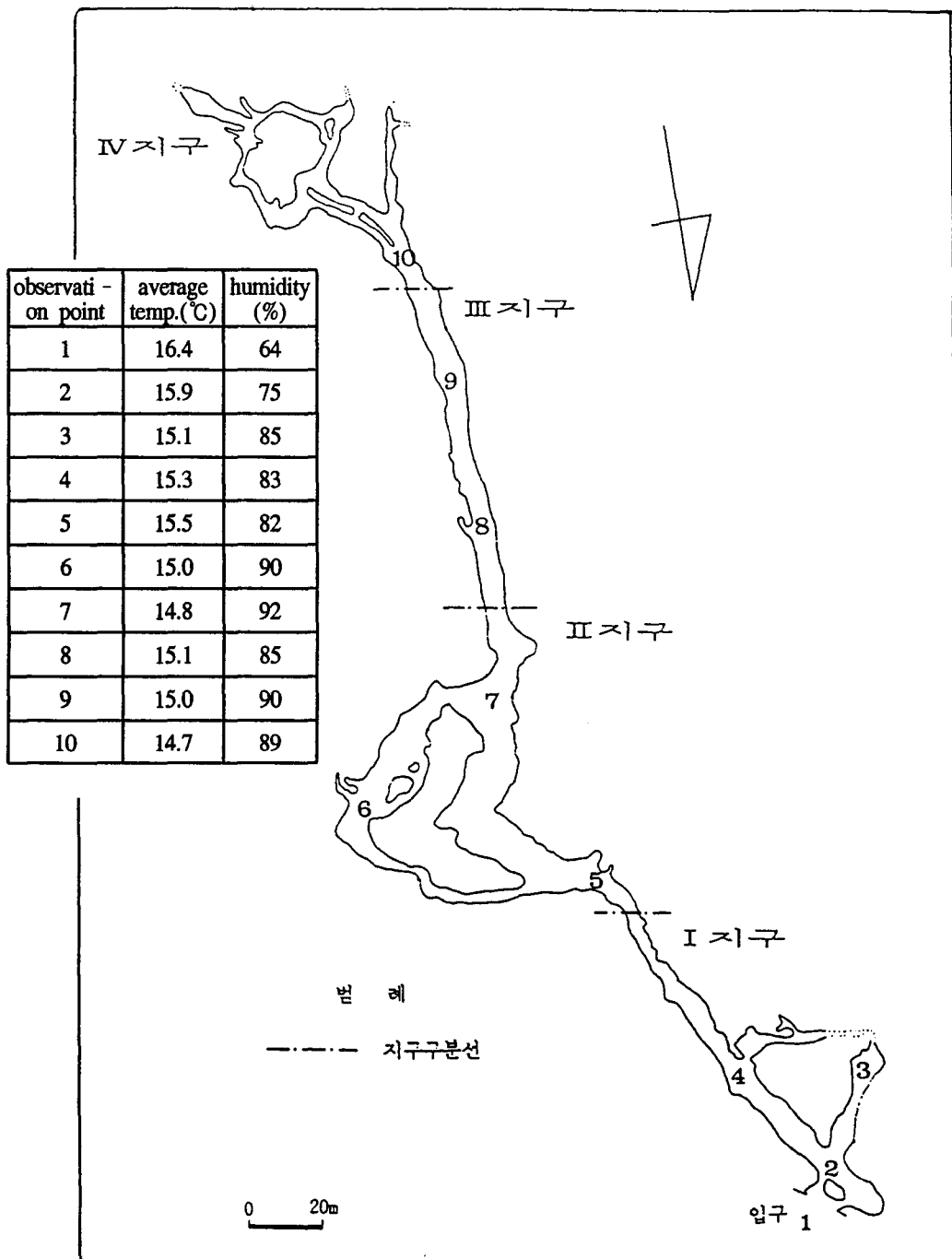


Figure 2 The temperature and humidity distribution map of Ondal cave

When the limestone cave develops according to joints or shifts or gets spacious because of rock downfalls, this space provides a channel thorough which the air can flow. The air convection is caused by the temperature difference between the cave inside and the surface of the earth. The water temperature of the Ondal cave is about 15°C and the seasonal variation is about 0.6°C.

The meteorological condition of the cave inside is an important factor that determines the secondary products of the cave and the biological distribution.

90% humidity is appropriate for the generation and development of the cave components. The overall variation range is about 10%, which shows the humidity is maintained almost constantly. In a cave which is open to the public, the lighting apparatus disturbs the constant humidity. The Ondal cave, since it is not yet open to the public, has no problem of that kind.

3. The quality of the cave water

The annual change of the water temperature inside the cave ranges from 3°C to 5°C. According to the survey, the water temperature of the Ondal cave is 15~16°C in summer and 12~13°C in winter.

The hydrogenion concentration(pH) of the water ranges between 7 and 8, which is not much deviated from neutrality.

This pH value is almost neutral as seen in most of limestone caves, which satisfies one of the requirements for the first class water.

The hardness shows 150~160mg/l inside the cave but a slightly lower value outside. Outside the cave, the hardness can be doubled if there is a large amount of water flowing out of the limestone area sodium exists

in 1~2ppm almost invariably over the area, and PO₄-P is less than 1ppm, which implies that there is little inflow of industrial or household waste water from the neighborhood. There is no great source of contamination nearby.

Table 4 Water analysis of the Ondal cave

point No.	water temp(°C)	pH	CaCO ₃ ppm	Na ppm	K ppm	Mg ppm	Ca ppm	Fe ppm	Alkali - nity	SO ₄ ppm	PO ₄ -P ppm	SiO ₄ ppm
1	15.0	7.9	157.6	1.8	0.18	0.35	48.7	ND	128	15.4	0.62	0.27
2	15.2	7.6	155.4	2.0	0.20	0.33	53.1	ND	133	15.0	0.48	0.30
3	16.0	7.0	153.2	2.3	0.18	0.38	50.6	ND	130	14.9	0.51	0.34
4	16.5	7.5	149.1	2.5	0.21	0.41	49.7	ND	132	14.2	0.58	0.39
5	18.0	7.3	158.7	2.1	0.18	0.39	49.6	ND	126	14.3	0.55	0.38

* ND : NO DETECT

Mg appears in less than 0.05ppm as in other caves;the alkali value is 120~130 ; SiO₄ less than 0.5ppm as in other caves, but a little higher in side the cave because of limestones.

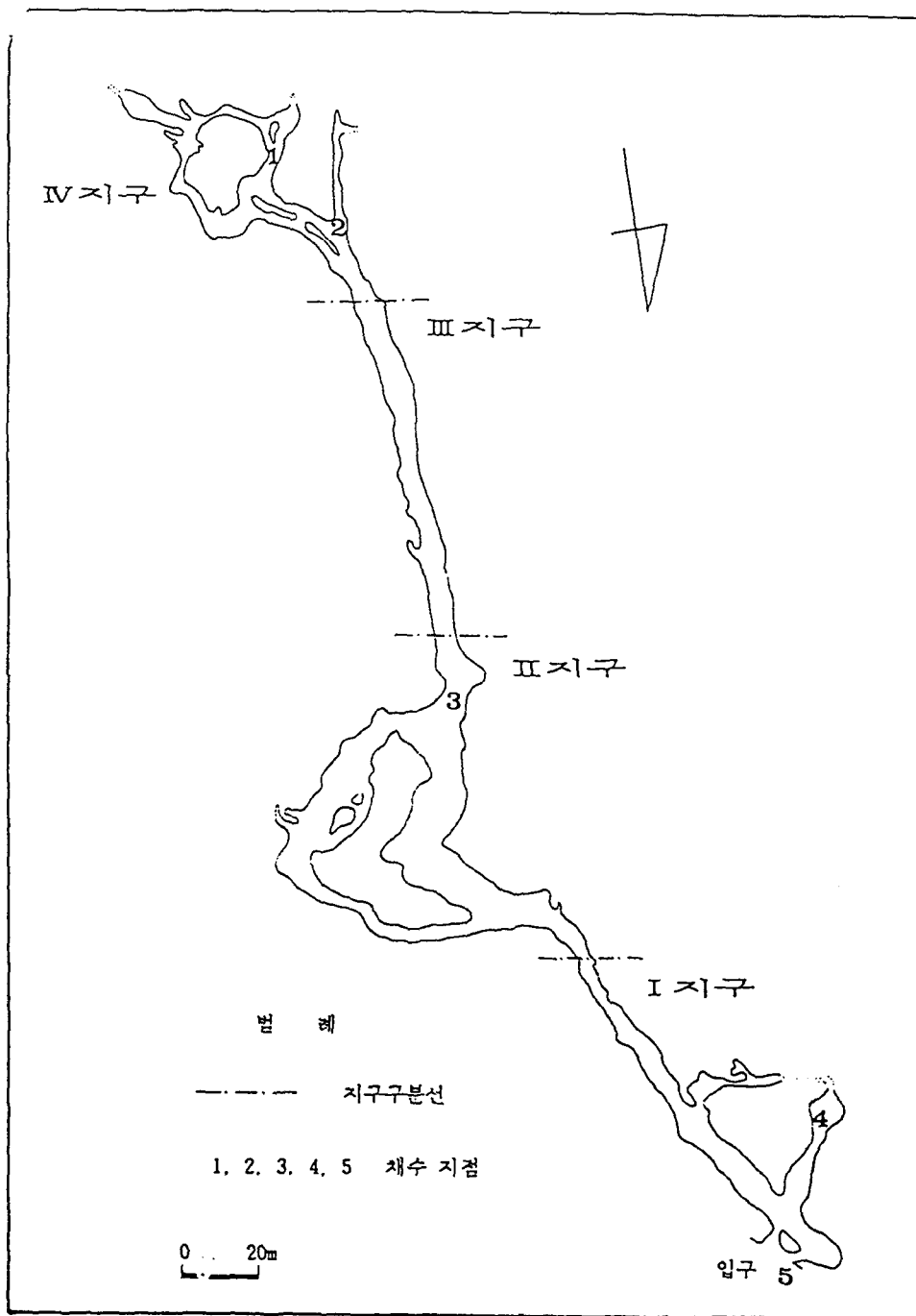


Fig 3. The observation point of water quantity of Ondal cave