

11. The Volcanic Cave Mineralogy

1) Mineralogy of Miyake A-3 Rift Cave

The aspect of mineralization in Miyake A-3 Rift Cave which is coated on many walls as a frostwork(Fig.11-1).

X-ray powder diffraction and energy-dispersive analyses indicated the presence of carbonate(magnesite)and sulfate(gypsum) minerals.

Magnesite($MgCO_3$); In the general calcareous caves,magnesite is the final evaporative product of a magnesium-rich mineral sequence.

Although, the presence of magnesite speleothems is very rare(HILL, et al., 1986). The magnesite stability field is in needed of more higher temperature condition than the general caves.

Gypsum($CaSO_4 \cdot 2H_2O$)This mineral occurs both in calcareous and volcanic caves. The origin of volcanogenic gypsum was reported as a direct precipitation from volcanic gasses just after the eruption(OBA, et al., 1984).

These two minerals in Miyake A-3 Rift Cave probably were produced in sublimates from volcanic gasses.

References

- C. A. HILL. and FORTI P. (1986) Cave minerals of the world. With a historical introduction by SHAW. T. R.. National Speleological Society. Huntsvill. 238pp.
- OBA, N. , TOMITA. K. , YAMAMOTO. M. , INOUE. K. , NAKAMURA. T. , ISHII. T. and KIYOSAKI. S. (1984) Mechanism of the formation of volcanic ashes from Sakurajima Volcano, Japan and its influences to the environ-ments. Rept. Fac. Sci. Kagoshima Univ. , 17, 1-22.

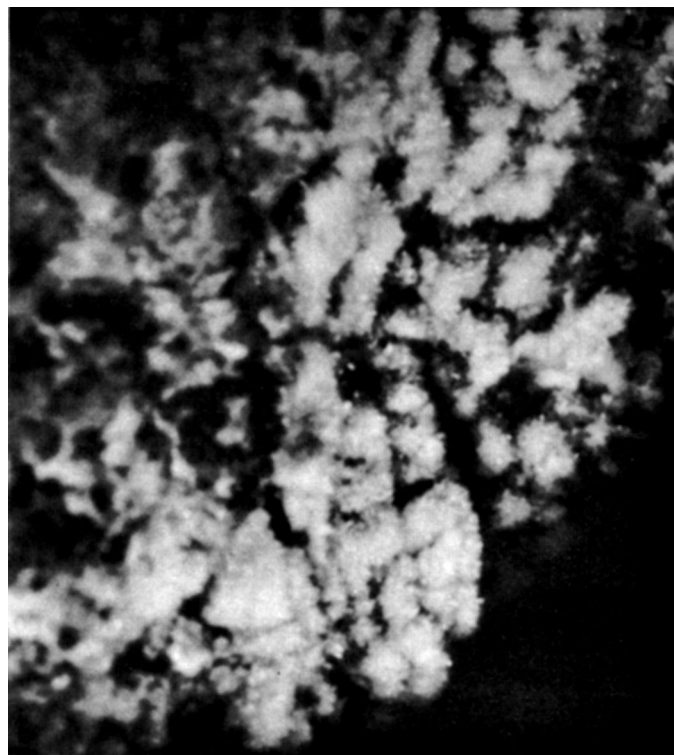


Fig. 11 - 1. The Crystal of gypsum and Magnesite in the Miyake A - 3 Rift Cave.

2) Mineralogy of the Lava Caves at Mt. Fuji

Siliceous and calcareous sublimates and deposits have been previously reported from many lava tube caves at Mt. Fuji area.

TSUYA(1971) reported the occurrence of siliceous and calcareous sublimates and deposits as thin coatings, stalactites and cave corals on lava walls. NOGUCHI(1973) shows a result of chemical analysis for two samples(Ouno Fuketsu and Komakado Fuketsu Caves) of white sublimates(Table 11-1).

Recently, X-ray powder diffraction analysis revealed that only two carbonate minerals (calcite and vaterite) account for the 7 samples.

On the other 11 samples, a mineralogical determination were not made by X-ray powder diffraction analysis, which did not occur as crystalline minerals.

TSUYA(1971) pointed out that the calcareous sublimates and deposits has been particularly distributed in lava tube caves of Aokigahara-marubi(864A.D.) lava flow (augite-hyperthene-olivine basalt).

Calcite(CaCO_3) and Vaterite(CaCO_3) Calcite is most common secondary cave mineral. Vaterite is the highest temperature polymorph of the calcium carbonate (more than the necessary 35 °C).

The siliceous and calcareous sublimates form by high temperature volcanic gasses. On the other hand, siliceous and calcareous deposits mean the formation which were once in solution. It is the same mechanism by which carbonate and silicate minerals form the speleothems in the general caves.

In the following list of all minerals reported from lava tube caves at Mt. Fuji area (Table 11-2).

References

- NOGUCHI, K. (1973) On the spring water and sublimates in lava caves on the foot of Mt. Fuji. Report of Mt. Fuji Lava Cave Research Group, 6, 1-13.
- TSUYA, H. (1971) Topography and Geology of Volcano Mt. Fuji. Fuji-san. Result of the Co-operative Scientific of Mt. Fuji. 1-149. Fuji Kyuko Co., Ltd. Tokyo.

Table 11-2: A list of cave minerals in lava caves at Mt. Fuji

Caves	Minerals	
	This work	References
Ouno Fuketsu No. 2 Cave	calcite	silieous sublimates (NOGUCHI, 1973)
Komakado Fuketsu Cave	silieous	sublimates (NOGUCHI, 1973)
Susono Fuketsu No. 2 Cave	amorphous	silieous deposits (TSUYA, 1971)
Mishima Fuketsu Cave	Halloysite	
Hachiman Ana Cave	amorphous	silieous sublimates (TSUYA, 1971)
Atsuhara Fuketsu Cave	amorphous	
Banba Ana Cave	amorphous	silieous sublimates (TSUYA, 1971)
Yashiki Ana Cave	amorphous	silieous sublimates (TSUYA, 1971)
Koubou Ana Cave	amorphous	
Mado Ana Cave	amorphous	
Inusuzumi Fuketsu Cave No. 1	amorphous	silieous sublimates (TSUYA, 1971)
Inusuzumi Fuketsu Cave No. 5	calcite	
Zinza Fuketsu No. 1 Cave	calcite vaterite	
Zinza Fuketsu No. 2 Cave	calcite	calcareous sublimates (TSUYA, 1971)
Megane Ana Cave	silieous	sublimates (TSUYA, 1971)
Shoiko Fuketsu No. 2 Cave	calcite	
Motosu Fuketsu No. 1 Cave	calcite	
Fuji Fuketsu No. 1 Cave	calcite	
Heijibara Fuketsu Cave	amorphous	

3) Mineralogy of Cheju Island Lava Caves

The occurrence of secondary cave minerals in lava tube caves at Cheju Island is poorly known.

Pseudo-calcareous Hypoche Gul lava cave system, a variety of carbonate speleothems which have been derived from overlying calcareous microcoquina sands. The carbonate-bearing groundwaters percolated into cave and deposited carbonate mineral (calcite), which cover bare lava walls and coexist with lava speleothems (PETERSON, 1972; KASHIMA, et al., 1984).

Taranakite ($(K, NH_4)Al_3(PO_4)_3(OH) \cdot 9H_2O$) was reported in Kulin Gul lava cave by KASHIMA (1973). This mineral must have been formed by the interaction of the water that leached by bat guano and the clay minerals of cave deposits.

Recently, X-ray powder diffraction analysis of two samples from Man Jang Gul Cave and Oksan Gul Cave revealed that the xenocryst of quartz (SiO_2) and cristobalite (SiO_2), and calcite ($CaCO_3$), respectively.

References

- KASHIMA, N. (1973) Taranakite: A supplement of general remarks on the cave phosphate minerals in Japan. Mem. Ehime Univ., [D], 7, 73-77.
- KASHIMA, N. and M. S. SUH (1984) Hyeobjae cave system, a pseudo-calcareous cave on Jeju Island, South Korea. J. Speleol. Soc. Japan, 9, 23-30.
- PETERSON, L. (1972) Caving on Cheju-do, Korea. Cascade Caver, 11, 61.
- SUH, M. S. (1983) A study on the binary appearance in pseudo limestone cavern. J. Geography, 10, 291-304.

Table 11-1 Chemical composition of white sublimates in lava caves

	Komakado	Fuketsu	Ouno	Fuketsu
H ₂ O	16.43		15.22	
LOI	11.87		13.77	
SiO ₂	36.81		37.54	
Al ₂ O ₃	27.07		30.20	
Fe ₂ O ₃	1.78		0.28	
CaO	1.47		1.23	
MgO	2.11		0.28	
Na ₂ O	1.07		0.87	
K ₂ O	0.29		0.19	
Total	98.90		99.58	