

Secondary Chemical Deposits In Lava Tubes

by
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"Secondary" means deposits that are not related to the formation of the lava tube. "Chemical" means material which was once in solution (including soil colloids in some cases). Non-chemical secondary deposits include sand infillings, such as that in the lower end of Ape Cave. Table 1 lists occurrences of secondary chemical deposits, taken from a brief literature survey.

At Pisgah (in the Mojave Desert, Southern California), secondary chemical deposits in lava tubes are more abundant than in caves of the Northwestern states. This is primarily due to the low rainfall. Salts leached from the lava are not carried far in solution. No rigorous analyses of the Pisgah deposits have been done, but some simple tests have been made.

Thin, white, crusts are found adjacent to cracks in the walls and ceilings. These appear to be calcite. Cave coral in beads about 3/32" diameter is probably also calcite.

Deposits of white cotton-like salts are present on the floor of Salt Cave, Pisgah. Two beds each cover several square feet and are about two inches thick. Samples fizz with vinegar and give a bright yellow (sodium) flame. A small amount of insoluble contaminant is present; otherwise it is highly soluble in distilled water. A saturated solution has a pH of 8. The salt is essentially tasteless and is probably Na_2CO_3 , with some K_2CO_3 .

Cotton-like deposits found on the floor of Finis Cave (Pisgah) look similar to those in Salt Cave. However, the Finis salts taste extremely bitter (borax?). It is certainly not the same as that from Salt Cave.

In December 1965, a loose fragment of lava was removed from 015 Cave. This piece had been in a breakdown pile where water had never touched it. Rain water does not drip or flow into the area where the sample was found. This is shown by the presence of dry fluffy dust that has no drip-holes in it.

When the sample was taken outside, it happened to be raining. The lava was thoroughly soaked (and so were we) while hiking back to the car. The wet rock was put atop the load in the trunk. When we reached home several hours later, the piece of lava had dried and was encrusted with a white salt.

Further leaching, using distilled water, yielded about one level teaspoon of salt. The rock weighed about 4 pounds. This salt does not react with vinegar. It is neutral (pH of saturated solution is 7) and is highly soluble in water. It gives a bright yellow (sodium) flame and has a slightly salty taste (Na_2SO_4).

Leaching, as with the 015 sample, is the first stage of lava weathering. Considerable leaching probably occurs during the first rainstorm on fresh lava. In the desert, lava could be fairly thoroughly leached in a few years' time. In a tropical climate the same amount of leaching could occur in a few days.

The important implication is that, although the effect may be minor, nobody's lava analyses can actually be correct unless the sample has not been leached.

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TABLE 1. SECONDARY CHEMICAL DEPOSITS IN LAVA TUBES

Locality	Cave	Composition	Reference	Note
Calif.	20 mi. NE of Red Bluff	"Opal"	Anderson 1930	Stalactites and Stalagmites
Calif.	?	Opal	Swartzlow & Keller 1937	
Calif.	Fern (Lava Beds)	Sulfur(?)	Knox 1959	
Calif.	Golden Dome (Lava Beds)	CaCO ₃ , sulfur	Knox 1959	
Calif.	Crystal (Lava Beds)	Gypsum	Knox 1959	
Calif.	Labyrinth (Lava Beds)	Opal	Nieuwenhuis, 1973	
Hawaii	?	"Glauber salt" (Na ₂ SO ₄ ·10H ₂ O, alum (rare)		precipitated from fumeroles
Hawaii	?	"Sulphates"	Dana 1890	leached out while lava is still hot
Oahu	Makua	Calcareous, opal-like	Finch 1926	lava is still hot
Oahu	Makua	Magnesium silicate	Halliday 1958	sea cave in basalt
Idaho	Crystal Pit	Mirabilite	Halliday 1972	sea cave in basalt
Idaho	Crystal Pit	Gypsum, Jarosite	Moore 1961	dehydrates to thenardite
Idaho	Arco Tunnel	Probably Opal	Peck 1962	
Idaho	Indian Tunnel	Mirabilite or Thenardite	Peck 1962	
Idaho	Snow Cone	Mirabilite or Thenardite	Peck 1962	
Idaho	500' S. of Crystal Pit	Gypsum	Peck 1962	
Idaho	Spatter Cone #2	Gypsum	Peck 1962	
Idaho	Big Rift Area	Opal	Nieuwenhuis 1973	
Wash.	Mike's Cave	"Siliceous"	Larson 1972	
Wash.	Curly Creek	Silica (?)	Halliday 1965	
Wash.	Slime	Silica (?)	Halliday 1965	
Wash.	Red Cave	Goethite	Moore 1967	
Wash.	Dynamited	Mn & Clay	Moore 1967	
Wash.	Dry Falls	Siliceous (?)	Halliday 1971	
Wash.	Dynamited	Calcite	Tubbs 1972	X-ray diffraction analysis
Wash.	Dynamited	Labradorite, Illite, Vermiculite or Chlorite	Tubbs 1972	X-ray diffraction analysis
Wash.	Dynamited	Sodium Allophanes (?)	Tubbs 1972	Atomic absorption analysis
Tenerife, Canary Is.	Cueva del Viento	Opal, Clay	~~Moore~~ Fittett 1972	
Cheju-do Is., Korea	Stalactite Grotto	Calcite (?)	Peterson 1972	lime from seashells above cave
Etna, Sicily	1910 Flow	Na, K, Mg, Ca, Ba?, Chlorides and sulfides	Perret 1950	collected from roof
Galepagos Is.		Gypsum	Stoops 1970	X-ray diffraction analysis
Santa Cruz Is.				