Recent Discovery of Secondary Mineral Deposits in an Idaho Lava Tube

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Abstract

Secondary mineral deposits of gypsum, mirabilite, thenardite, and cristobalite have long been known and, in fact, are quite common in the lava tubes of southwestern Idaho. Until recently, calcium carbonate deposits were only found in a few tubes in very small amounts and were thought to be quite rare. The recent "rediscovery" of Helens Hidden Hide-Away lava tube has significantly changed this thinking. The deposits in this lava tube are not only quite extensive but extremely varied in structure. As this is a very recent discovery, only basic preliminary work will be presented in this paper. It is hoped this will stimulate interest for further and more intensive study of the lava tubes of southwestern Idaho.

Introduction

A large number of lava tubes in southwestern Idaho contain some extremely impressive secondary mineral deposits. Gypsum and mirabilite can be found coating entire lava formations and in some cases entire rooms. Thenardite and cristobalite can also be found throughout Idaho's lava tubes, although in smaller individual concentrations. To a lesser degree, iron- and copper-based deposits have been found. On rare occasions, and in very small quantities, calcium carbonate deposits have been found.

The recent exploration of Helens Hidden Hide-Away has uncovered an extensive deposit of calcium carbonate, never before thought possible in an Idaho lava tube. Not only is there an impressive amount of deposition, but the individual structural variations could rival some limestone caves.

Since the study of Helens Hidden Hide-Away began, several other lava tubes have been discovered that may also contain large calcium carbonate deposits. As the work on Helens Hidden Hide-Away has not been completed and the work on the other tubes has not yet begun, this paper will deal with Helens Hidden Hide-Away as a truly unique find.

Only very preliminary work has been completed on Helens Hidden Hide-Away as there is not a large, knowledgeable, interested scientific base to draw upon. It is hoped that this paper will stir interest in the truly unique lava tubes of southwestern Idaho.

Background

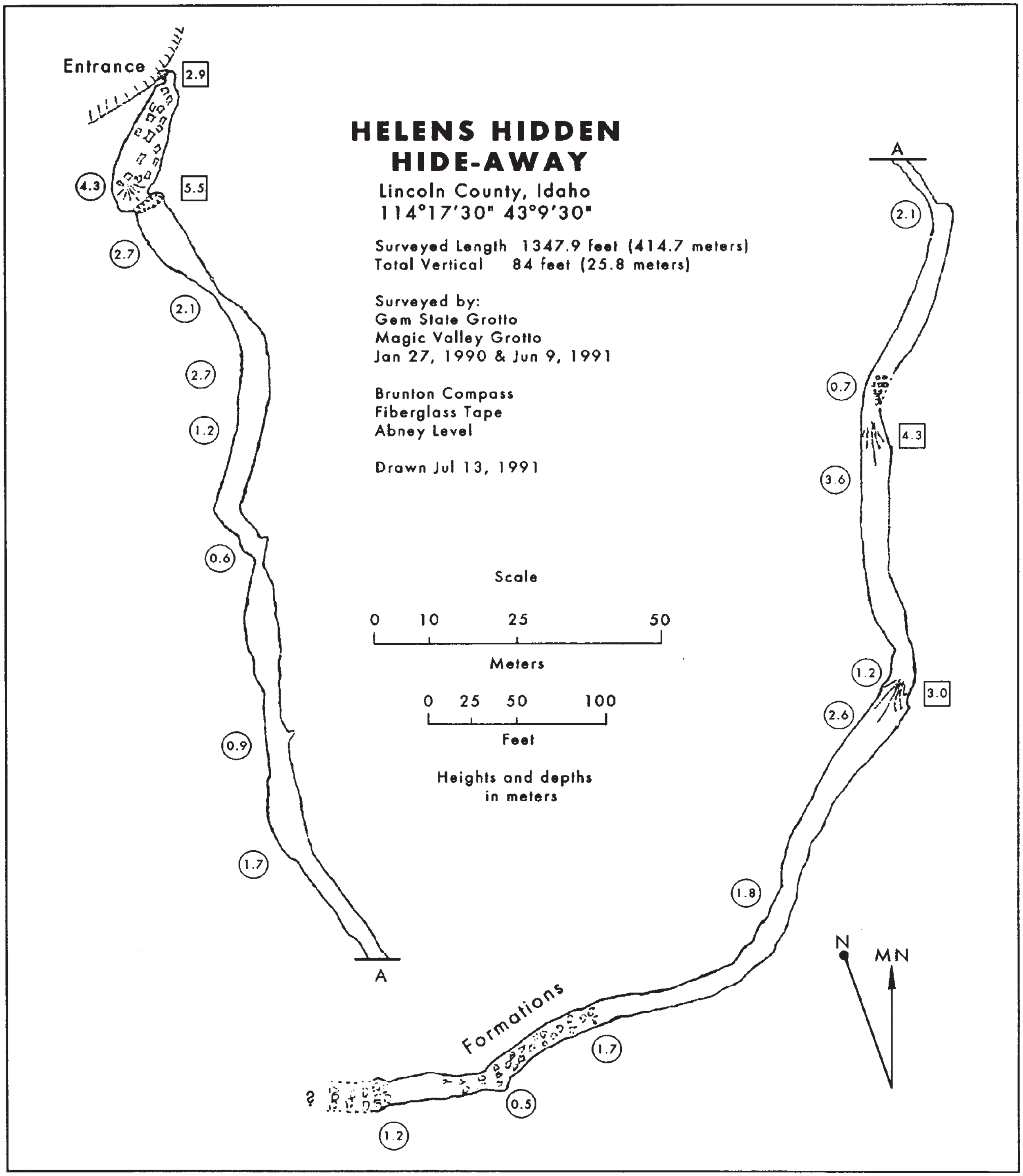
The background of Helens Hidden Hide-Away has been hard to uncover and is based mostly on verbal information gathered from locals. The first known account of the cave's exploration came in the early 1930s when Helen Lee's, (for whom the cave is named), future husband took her to this cave on their first date. While they were in the cave they found some bones and alerted the university in Pocatello, Idaho. They sent the bones to the museum there where they were identified as prehistoric bear. A team was sent down for preliminary studies. (Confirmation has not been made and further information is pending.)

The next account came less than a year ago when Jim Woods from the Herrit Museum in Twin Falls, Idaho, made a few trips into the cave, presumably to also look for archaeological or paleontological artifacts. (Again confirmation has not been made and further information is pending.)

These are the only known visitations to the cave. It can be assumed, though, that there have probably been many unrecorded visits by locals. This assumption is verified by the signs left behind of tin can kerosene lanterns and a barbed wire and wood ladder.

Geology and Hydrology

Helens Hidden Hide-Away is located in the Central Snake River Plain next to, but not in, the Shoshone Ice Cave Flow. This flow is one of the youngest and least altered flows in the area. It starts at Black Butte Crater and flows generally southeasterly, covering almost 210 square kilometers. It was originally thought that Helens Hidden Hide-Away was in this flow but subsequent research has shown it to be from a much older flow originating in a shield volcano just to the east. The age difference is quite obvious when comparing the bare lava of the Black Butte Crater



Flow to the soil covered area around Helens Hidden Hide-Away.

Less than sixty kilometers to the northeast is the Lost River Range. These mountains are predominantly dolomite and limestone and probably account for a percentage of the soil make-up in the area.

Less than 400 meters to the north of the cave runs the Richfield Canal. It is a raised earthen structure and prone to a fair amount of leakage. This canal takes its water from the Big Wood River and is the major source of irrigation water for the entire area. The Big Wood River originates in the Lost River Range and has apparently changed its course many times in the area around the cave. One of the presumed old courses, which is now an intermittent run-off, actually runs over the cave.

Cave Morphology

Helens Hidden Hide-Away is a lava tube that trends in a southwesterly direction for approximately 450 meters. Total vertical depth is 25.8 meters. The vertical depth is attained from a 2.9-meter vertical drop at the entrance, a 5.5-meter vertical drop 25 meters in, and a 4.3- and a 3.0-meter sloping drop about half way in. Passage widths average two to three meters and passage heights from 4.5 to less than 0.5 meters with the majority under 1.5 meters.

The first half of the cave is typical for the majority of Idaho lava tubes: dry and dusty with the floor covered in small "klinker" breakdown. A few short areas have sandy floors. About half to three-quarters of the way in the tube starts exhibiting cavernous weathering features not seen in other Idaho lava tubes. These sculpted features look a lot like heavy water erosion in limestone and sandstone.

At about 375 meters the cave the formations start appearing. At first they look old and dried and are scattered around the walls and ceiling. It is in the last 25 to 30 meters of the cave that the formations completely take over and cover the entire ceiling, walls, and most of the floor. Here the formations are actively growing with water constantly dripping everywhere. The majority of the formations are a coralloidal structure, but draperies, rimstone, flowstone, conulites, and drip cups can all be found.

The cave appears to end in breakdown in the formation room, but has not been fully explored due to the tight quarters and fragile nature of the formations.

Mineral Analysis

Methods

Field testing was done using dilute hydrochloric acid. Laboratory testing was done using energy dispersive x-ray spectroscopy, scanning electron microscopy, cross section analysis, and atomic absorption spectrophotometry.

Analysis

All analysis was done on formations found on the floor, assumed to be from natural breakage.

Field tests showed fizzing when dilute hydrochloric acid was applied to the formations. This led to the assumption that they were calcium carbonate.

Energy dispersive x-ray spectroscopy, (EDX), was done on three structurally different samples: a drapery, a coralloid, and a round knob. The drapery showed a makeup of 58.53% calcium, 38.35% silica, 1.78% magnesium, and 1.33% chlorine. The coralloid showed a make-up of 65.56% calcium and 34.44% silica. The round knob showed a make-up of 66.59% calcium, 28.95% silica, and 4.46% magnesium. These percentages are not the actual amount of each element present as EDX reports percentages based on total elements detected and EDX can only detect the elements sodium through uranium.

Cross section analysis was done to determine if the structures were helictites. The analysis showed concentric growth rings with no central capillary canal verifying they are coralloidal formations formed from seeping or splashing water.

Scanning electron microscopy was done to analyze crystal structure. This was not successful as the preparation required desiccating the sample which destroyed the surface structure.

A sample of water was taken from the Richfield Canal directly above the cave. Direct aspiration atomic absorption spectrophotometry was done for five elements. The results were calcium 36.0 ppm, magnesium 7.5 ppm, iron 0.01 ppm, sodium 5.7 ppm, and copper $<$0.01 ppm.

Conclusions

Preliminary analysis shows these formations to be at least partly calcium carbonate. It is not known if the silica content is bound with the calcium or is simply interdispersed. The data seems to indicate that elemental make-up may play some part in the different structural formations.

The source for calcium and magnesium is most likely from the dust deposited from the Lost River Range. As this dust is covering a vast majority of Idaho's southwest desert, and other lava tubes do not have these formations, the water source from the Big Wood River and the Richfield Canal must play a major role in dissolving and redepositing the minerals.

As research and testing progresses on Helens Hidden Hide-Away and exploration and testing begins on other Idaho lava tubes we hope that more accurate and conclusive theories can be made about Idaho's "limestone lava tubes."

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