

Craters of the Moon National Monument and Preserve
P.O. Box 29
Arco, ID 83213
208-527-1300

05/30/2018

RE: Completed study CRMO-0092 under permit CRMO-2018-SCI-0001,
Resurvey and map revision of Great Cavern and it's connection to Crystal Ice Cave

This report will reference numerous files that are not embedded in the document. This format is chosen due to the future referencing of the files without issues of software compatibility. The referenced files are included as attachments. It is suggested that when reviewing this document that you stop at each referenced document and open it.

ABSTRACT:

Great cavern was initially surveyed and mapped in the late 1960's by the concessionaire, Jim Papadakis. Idaho Cave Survey (ICS) surveyed and mapped much of the Great Rift in the King's Bowl area, including these caves, in 1990. Since then there have been notable changes in the caves. This project resurveyed Great Cavern through to Crystal Ice Cave, attempting to relocate original survey stations, and document the changes in the ice and rock slides/collapses. The extensive changes should continue to be studied.

HISTORY:

See file, an extract from the Idaho Down Under Newsletter

"Idaho Down Under fall 1995 pages 6-8.pdf"

After this report, the caves continued to change quite dramatically. In the early 2000's a large lake formed just to the left of the words *Great Cavern* on the map, filling the passages below. This lake continued to change volume until the mid 2010's when it drained completely, leaving the lower passages filled with ice. We had expected to see and map the lake in this project and were surprised to find it gone.

In 2014, Silver Sage Grotto members at my request and under direction of Chris Anderson resurveyed Great Cavern. I overlaid the survey lines on the old 1991 map and found several curious changes. This prompted the request to CRMO for a permit to resurvey again to determine the connection to Crystal Ice Cave and document the changes at both ends of the cave and document the lake.

Reference the File, *"3 combined surveys GC.pdf"*

The 2018 survey just completed and photos taken document several interesting changes, as noted below:

1. At the lower left of the map, note that the survey line now continues 25' further south through what was previously solid ice. See photo *"S end of GC.jpg"*
Sublimation (not melting) of the ice caused by airflow through the porous fractured lava rock, is opening this area and may soon reconnect this old passage to King's Bowl at a location where Jim Papadakis blasted an opening in the late 1960's and took guided tours through Great Cavern. This opening filled with water and froze soon after he created it.
2. Note that the lake is gone. When last reported it was about the level of the dashed line on the map.

3. The tubes below the lake are filled with ice and rock. They opened previously through sublimation of the ice below during a dry period. This cyclic event of filling with water during high water years followed by sublimation of the ice during dryer periods (caused by airflow through the porous lava rock below) can be observed throughout the Great Rift cave system. It cannot be directly related to global warming since it continues to cycle between more and less ice and is typically sublimated rather than melted.
4. The chambers at the lower center of the map initially were surveyed to -302' below the surface, and have now filled with rock as if falls during sublimation from the surface of the "Snickers Wall" and from cave walls and ceiling of Great Cavern.
5. Note the survey line next to "Chambers found in 2014 too dangerous to enter" There is no evidence of these now or they were missed by the 2018 survey team.
6. Where Great Cavern connects to Crystal Ice cave, the opening has enlarged and is now called the Snickers Ice Wall (See photos "*Snickers Ice Wall.jpg*" and "*Chocolate Banding.jpg*")
7. Between the New Lip and the north observation room, marked on the map, are attached 3 pictures of that area over time. "*1991 Ice in Crystal Ice Cave.jpg*" "*2018 Bldg facing S.jpg*" and "*2018 Building facing N.jpg*" see also the pictures of the same area taken in 1995 as referenced above in the newsletter "*Idaho Down Under fall 1995 pages 6-8.pdf*"
8. Note near the right side of the map that the discovery hole, which was initially formed through solid ice by sublimation, opened up in 2016 but now has collapsed and is completely filled with rock.

SUMMARY:

The ice in the King's Bowl Area specifically, and throughout the Great Rift (personally observed more recently in South Grotto, King's Bowl South, and Snow Cone) is undergoing rapid changes, but not in a predictable manner. While there is seasonal melting and freezing, which is easily observable in all caves on The Monument, the large changes we are documenting here are influenced by Wet and Dry cycles and Airflow. Heavy snowfall in winter, especially when drifting causes the snow to fall into the rift, followed by a wet Spring causes a lot of water to enter the caves, bringing with it raised temperatures (just above freezing) which enters the lower cold air traps and freezes making new ice. During summer, warm air travels through the caves that have openings at more than one place so that it can circulate, and causes some melting. More ice, however, is removed during the process of Sublimation. The rock deep in the rift is highly fractured and allows airflow through the floor of the caves and past the ice, evaporating the contact surface. The airflow is normal in caves and is caused by changes in atmospheric pressure. When a high-pressure front comes through the area, the caves *breath in* in order to equalize atmospheric pressure with the air in the fractured rock below. The inverse occurs and the caves *breath out* when a low-pressure cell moves through the area. The changes in the caves provide the opportunity for much more study and documentation in order to better understand these processes.

ICE CHANGES IN CRYSTAL ICE CAVE

Where's the Ice?

By Scott Earl

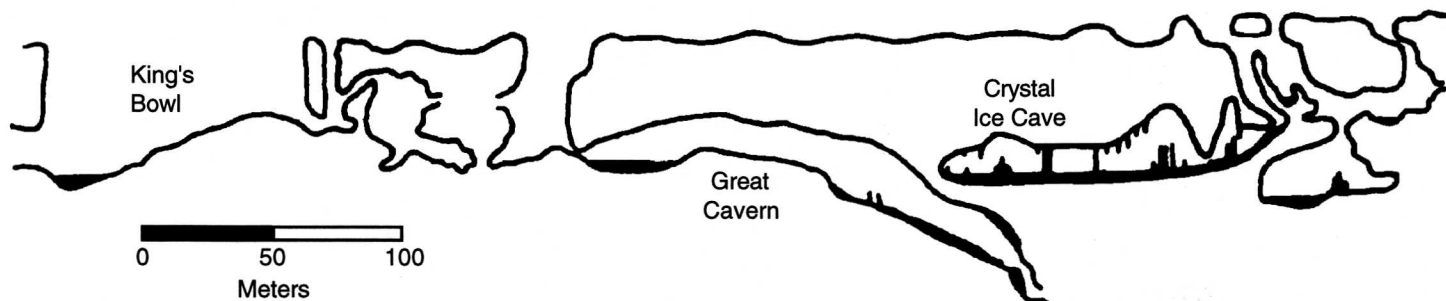
Crystal Ice Cave is still changing, and in ways we never guessed just a short time ago. Most unexpected was the 1992 opening of a hole in the floor at the farthest point south in Crystal that drops right into Great Cavern. This hole keep getting bigger and the resultant air flow has removed most of the ice in that area (see photos). This is the spot where Jim Papadakis (the developer of the cave) took his pictures of marvelous ice crystals. The maps below show how Great Cavern and Crystal Ice Cave looked back in the late 60's (from a sketch Jim gave Ron Greely), how the caves looked when we mapped them in 1990, and how they look now. It appears to me that the floor of Crystal Ice Cave is solid ice for at least 50-100 feet and possibly much more, as everything in the lower room below Crystal is ice with mixed-in loose rocks. The ice wall that used to be the north end of Great Cavern is actually the floor of Crystal Ice Cave.

Note that the floor of Great Cavern is much different than in the 60's. The floor has dropped down into a funnel shaped area and careful observation of the scary passage through the ice below this funnel shows that sublimation is the cause. Air flows from loose rock passages well below the current floor up through the floor and eats away the ice, causing passages and rooms, which eventually weaken the ceiling of the ice rooms until the collapse of the rock floor above. This is also occurring in King's Bowl

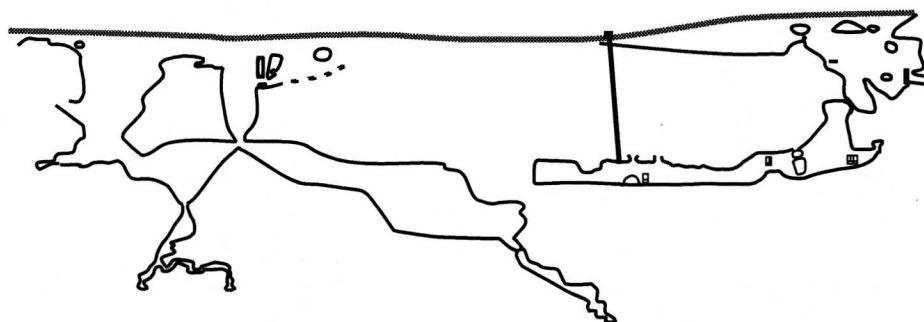
South Cave, the lower end of Great Cavern, a point in the Great Rift just north of where the Papadakis Tunnel makes a U turn, in a spatter cone at Craters of the Moon, and in the Ice Cave Entrance at Fossil Mountain Wind Cave/Ice Cave. There is inherent danger in that the floor you are walking on could easily be the roof of one of these sublimating chambers!

Note also that the ceiling of Great Cavern also fell in at one point opening a vertical passage clear to the surface and making a huge cone of rock and dirt on the floor of the cave. This overhead passage is continually getting larger at the top, probably from freeze/thaw cycles, dropping more rock and soil into the cave. This cave is unstable and dangerous except in the winter when cold air freezes much of the loose stuff.

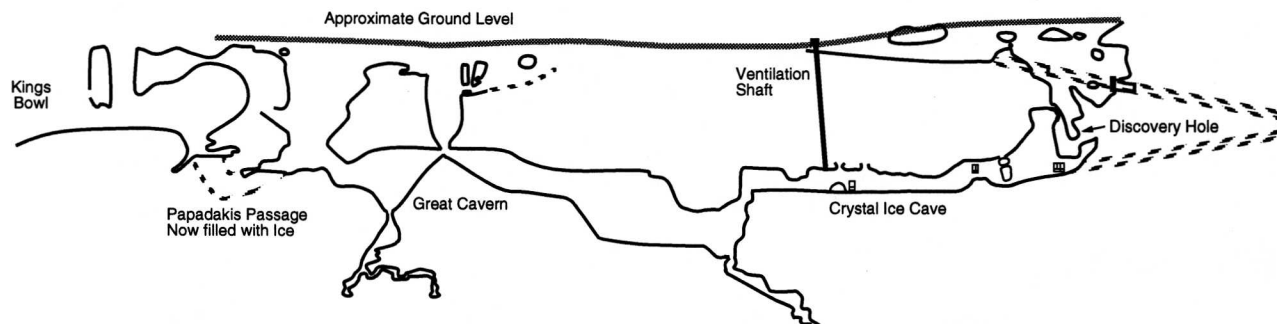
The discovery hole for Crystal Ice Cave has been frozen over now for at least 10 years, has been thinning every year since 1988, and is about to break open again barring a really heavy-snow winter which would slow the reopening a bit more. I was in the top of the discovery hole this September and also looked up at it from below. The survey shows the two points to be very close, although no light is coming through. Now that so much more has opened up in this area, I am amazed at how thick the ice and snow were at that point in 1988. I thought the connection was close back then when actually there was at least a 30 foot plug of ice and snow. The freezing of this hole coupled with the vandalized glass doors in the Papadakis Tunnel in 1989 is what I believe caused much of the reduction of ice in Crystal Ice Cave (see photos).



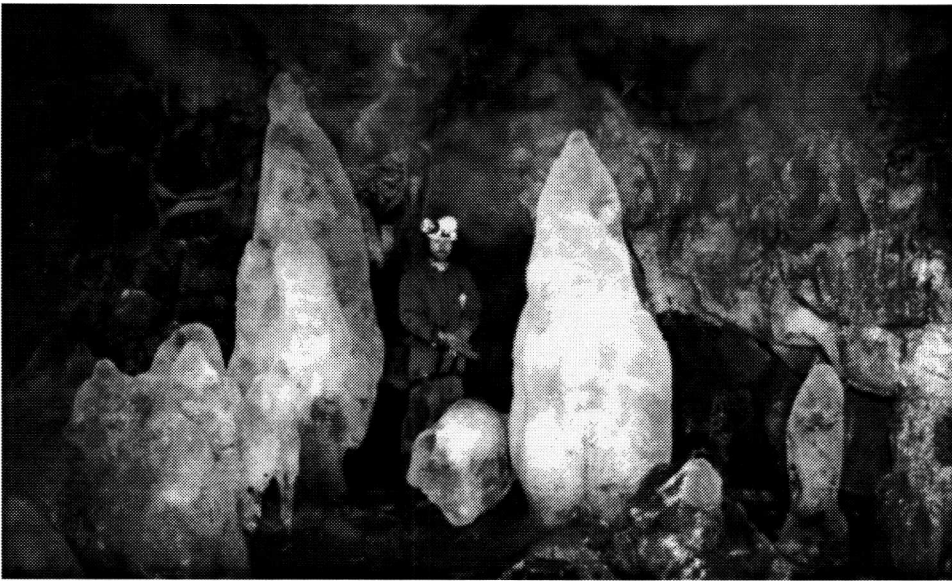
1990



1995

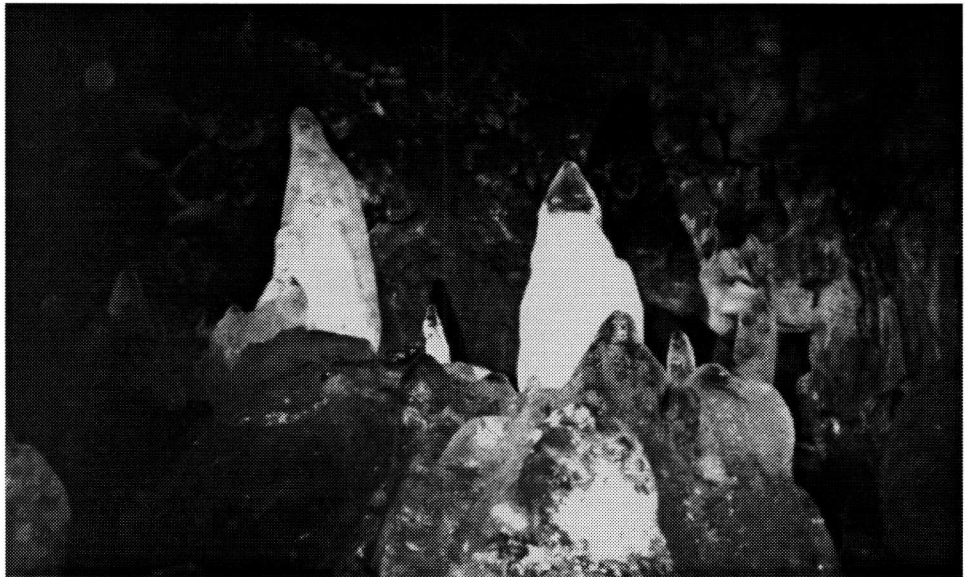


ICE CHANGES IN CRYSTAL ICE CAVE



This is the far south end of Crystal Ice Cave in 1989. This area always had substantial ice crystals on the wall and had the most stable ice in the cave until a hole opened in the floor in January 1992 allowing air to flow back and forth between Crystal Ice Cave and Great Cavern.

The January 1992 opening was right against the back wall and went vertical 6 feet to an ice/rock floor which sloped 20 feet south to a 40 foot drop into Great Cavern. Ice sublimation in Crystal Ice Cave began immediately, with accompanying melting or freezing depending on whether temperatures were warm or cold in Great Cavern.



Currently most of the ice is gone in this end of the cave. The hole in the floor is 8 feet in diameter and drops straight down into Great Cavern some 50 feet below. The right ice column, now 3-4 feet high, is the same one seen in the photos above at over 8 feet high. The other columns have fallen and mostly sublimated.

ICE CHANGES IN CRYSTAL ICE CAVE

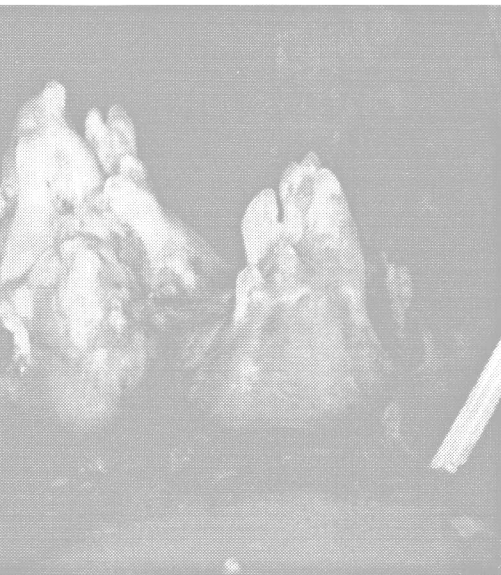
This is a 1989 view of the "north observation room" facing south. You are in Crystal Ice Cave whereas the observation room is connected to the

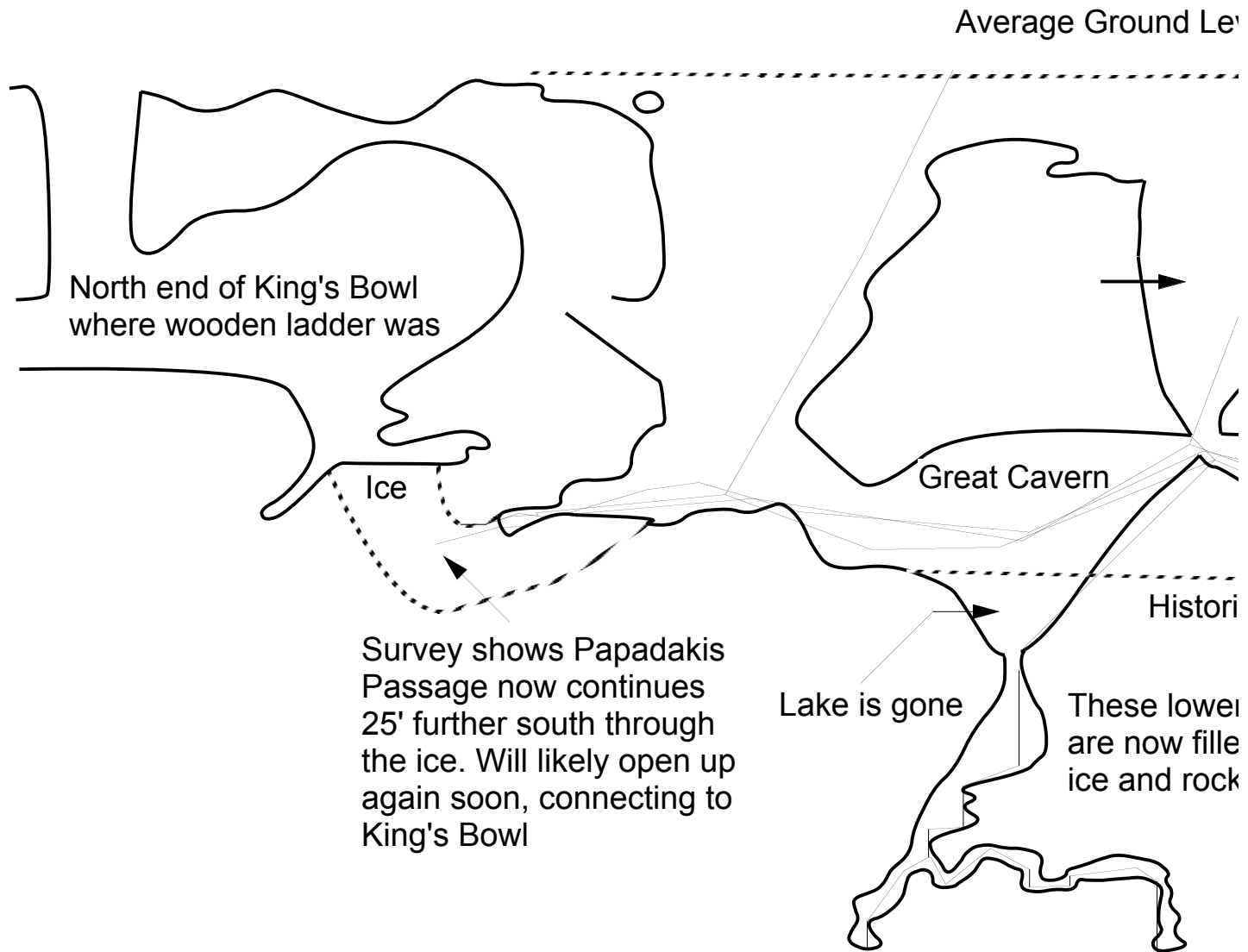


In the early winter of 1992 cold air coming from Great Cavern allowed the formation of the most new ice seen in Crystal Ice Cave in 10 years. The growth of new ice was totally unexpected. It is now hard to say what will happen when the discovery hole re-opens since air will be able to go clear through the cave.



Currently the ice in this area is fairly stable. Strangely, however, there is almost a foot of ice in the observation room and beyond in the lower portion of the Papadakis tunnel where there has never been ice before. Lots of water is dripping in the tunnel and flowing and freezing on the floor.





North End of Kings Bowl through Great Cavern and Crystal Ice Cave

April 28, 2018 Great Cavern resurvey by Dean Killian, Jeb Blakeley, Jody Burnham, and Craig Poteet
3 Survey lines are shown, 1991, 2014, & 2018

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