

Team Third - Ice Formations

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MCEN 5151-003



Original Photo



Edited Photo

As part of the third assignment in this flow visualization class, I wanted to find a way to relate a naturally occurring fluid phenomenon to something man-made. While climbing outside I was looking at a nearby river and recognized that the flow of the water resembled that of pipe flow. When out there, I discovered a rock with a very interesting ice formation beneath it. I decided to divert my attention towards this and try and investigate why it formed.

A good way to visualize what is happening here is to imagine you are playing a game of 3D Tetris and you are just playing very poorly which creates a structure, but is full of air pockets and holes. This is similar to what is happening in the photo. As water flows over the rock, it creates a small waterfall, but since the flow is thin enough passing over the rock, it becomes laminar and then breaks up into smaller particles as a demonstration of the Rayleigh Plateau (Prado and Kellay). These small particles then hit the water below which would have already frozen meaning that these small water particles are crashing down onto the ice. Water can spontaneously freeze depending on the conditions (Dorsey). This situation meets those conditions including a low outside temperature as low as 0 degrees Fahrenheit some nights and a very cold water which hasn't frozen due to the fact that it is moving quickly. The process of the water freezing still takes time so very little is created for each droplet that lands, but as all the droplets continually fall, it slowly builds the ice up in this super airy fashion.

This is one of those images that might be hard to create if you were trying, but by accidentally stumbling across it, it was simple to take. I used a large flood light on the maximum setting shown at a 10 degree downward angle directly towards the ice formation. Jacob Kelleghan helped me with attempting some different positioning of the light in relation to the camera to attempt to highlight the image and focus. I took a collection of photos from different angles and selected the best one. The goal was to investigate the phenomenon more and see if I could discover what was happening through research.

This photo was taken using a Canon EOS R100. Some specific specifications for the settings include: Shutter Speed (1/5), Aperture Value (F5.0), ISO speed (ISO1600), Exposure (0.6) and a Lens Focal Length (55mm). The shutter speed was relatively slow as I was trying to capture the depth of the image and wanted to have more time for light to come in.. Both the ISO speed and aperture value were selected to allow a good amount of light in so the ink was almost reflective. The photo was taken from about 10 feet away and has a small field of view around 3" x 2". In editing, the shadows, highlights, and contrast were increased to create the final image and show the gaps in the ice more.

This image revealed how in nature, unique circumstances can lead to beautiful things. I really appreciated this image and the process of taking it because it took me outside on a beautiful night. I would like to improve the clarity of the photo. I tried a bunch of things, but could not get any version where I could get the image into complete focus. I would try bringing multiple lights and setting them up in different places to try and see what was happening. Further development of this idea would come by searching for more naturally occurring instances of this. It could be possible to create using experimentation, but it would be difficult to get the temperatures needed for the amount of time needed.

Work Cited

Dorsey, N. Ernest. "Spontaneous Freezing of Water." *The Scientific Monthly*, vol. 78, no. 5, 1954, pp. 283–88. *JSTOR*, <http://www.jstor.org/stable/21479>. Accessed 9 Dec. 2024.

Prado, G., Y. Amarouchene, and H. Kellay. "Experimental Evidence of a Rayleigh-Plateau Instability in Free Falling Granular Jets." *Physical Review Letters*, vol. 106, 198001, 10 May 2011, doi:10.1103/PhysRevLett.106.198001.