

Three Sources of Light Episode #4: Rocky Worlds to Explore

[Introduction Music]

ANTHONY MAZZUCCO: Hello everyone! Thank you for listening to another recording of Three Sources of Light presented by Carlsbad Caverns National Park. Park Guide Anthony Mazzucco here to introduce today's astronomical topic of discussion.

In addition to being one of over sixty-two designated National Parks in the United States, Carlsbad Caverns is also recognized on a global scale as a World Heritage Site.¹ The United Nations Educational, Scientific, and Cultural Organization (UNESCO) describes the park the park as quote, "one of the few places in the world where on-going geologic processes are most apparent and rare speleothems continue to form enabling scientists to study geological processes in a virtually undisturbed environment." The deep solitude of our underground cave network has inspired the curiosity of both visitors and scientists alike.

However, in this episode, we are going to stay well above the Earth's surface. The exploration of rocky worlds need not always be underground. Not everyone can put in the advanced planning and preparation needed to deeply explore a cave. But everyone listening to this podcast can more than likely relate to the following topic of conversation. Have you ever found yourself standing in your own backyard, examining the night sky, transfixed while staring at the stars and the moon?

In a moment, you will hear a brief dialogue I had with Park Guide Ross Studlar about the importance of the night sky, and how astronomy is naturally connected to our interpretation of caves. Afterwards, the episode will directly transition into a short story told by Ross which is an adaptation of his full moon interpretive hike. Enjoy!

[Transition Music]

AM: I am thrilled to be joined in studio by my fellow Park Guide, Ross Studlar, a member of the Astronomy Team here at Carlsbad Caverns National Park.

ROSS STUDLAR: Good to be here Anthony.

AM: Thanks for taking some time this afternoon to chat with our listeners about the night sky. So, let's start with the Astronomy Team. How long have you been a member, and what role does the team play here at Carlsbad Caverns National Park?

RS: I joined the Astronomy Team in the summer of 2018. We do a variety of night sky educational programs for visitors here. We do moon hikes, and star walks, and we also do star parties. In the star parties, we use a telescope to see distant celestial objects. The star walks and moon hikes focus on what we can see with our naked eyes, or perhaps binoculars. Every night sky program we do, we use a meter to determine how dark our sky is. We have the future goal of Carlsbad Caverns National Park becoming an International Dark Sky Park. We are working step-by-step on the application for that.

¹ In January of 2021, New River Gorge National Park and Preserve located in West Virginia became the 63rd National Park in the National Park Service System. This episode was recorded in the year 2020.

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AM: Could you describe for us what becoming a dark sky park would mean for Carlsbad Caverns National Park in the future?

RS: Well, it's a designation determined by the International Dark Sky Association. That association began in 2001 in response to how light pollution can light up the night sky and obscure our views of the stars. Luckily, of all the forms of pollution that humans make, light pollution is the easiest type to control. Effective measures include turning off lights when they are not needed and shielding lights, so they direct their light to the ground instead of up to the sky. So, to be an International Dark Sky Park, we have to show a high level of dedication to the preservation of the night sky through having quality lighting codes and also having dark sky education and citizen support.

Carlsbad Caverns is already recognized world-wide for its subterranean wonders as a UNSECO World Heritage Site. If we could become an International Dark Sky Park, then we'd also have international recognition for our night sky. There are International Dark Sky Parks in many parts of the world. South Korea has one. Hungary has one. Some other National Parks have the International Dark Sky Park designation. Those include Great Basin, Black Canyon of the Gunnison, and Chaco Culture. Notably, in Utah, Antelope Island State Park is an International Dark Sky Park, and that one is right by Salt Lake City.

AM: It is amazing how close dark sky parks are to urban civilizations. It shows how much effort really has been put into combating light pollution in the 21st Century.

RS: Yes, indeed. And to gain the designation of International Dark Sky Park, well even at a park like this it's a lot of work to inventory and document all our various lights, assess how we can reduce our levels of light pollution, and yes, we are taking on-going bortle ratings of our night sky, seeing if we can get a sky dark enough to qualify. So yes, it is a work in progress.

AM: It fascinates me, growing up in the northeast, working for the National Park Service all along the east coast, I've never really experienced a true night sky before coming here to New Mexico and working at Carlsbad Caverns National Park. Seeing the stars from the park at night, it is a breath-taking experience.

RS: I too found it astounding, the grand dark sky full of stars that one can view out here in the wild west. Especially in remote locations. But once again, it doesn't have to be remote locations. If we take more measures to get light pollution under control, we can get some extraordinary night skies in urban environments as well.

AM: Yeah, some exciting news to look forward to in the future here at the park and within your own community. Ross, you touched on it a moment before that Carlsbad Caverns is world renowned for its underground scenery. So, I am curious, how are caves, the moon, this idea of the night sky, how are they all inherently linked?

RS: One notable link between caves and the night sky is sacred darkness. Night is the time for stories. Around a campfire or at a movie theatre, night is the time for stories. It seems intrinsic to how humans are wired. Going back to ancient times, people have attributed great significance to darkness. Darkness is where your true self comes out, or it is where you connect to a higher

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power. That higher power could be whatever deity you might choose to believe in, or it could be a vast universe with trillions of stars. Either way there is magic to the darkness. Now, some of us in modern times have forgotten about our deep connection to darkness and cast bright lights everywhere we go. So, caves enable us to reconnect with darkness. When I am roving the self-guided tour routes of Carlsbad Caverns, I commonly meet visitors who last visited the cave thirty years ago or seventy years ago. And they tell me about when the ranger turned off the lights and you couldn't see your hand in front of your face. Out of all the grand features of Carlsbad Cavern, often that is the one thing that people remember above all else. In darkness, light has great value. Whether it is a candle that lights your way, or whether that is the light from the stars or the moon.

AM: It is really cool to make those parallels between these underground chambers and the night sky above us. But expanding our horizons beyond the boundaries of just Carlsbad Caverns National Park, a night sky, that's something available to all citizens of the world. In what ways does the night sky impact our daily lives?

RS: Biologically, we're connected to the cycles of night and dark, the sun and the moon. People who have gone on extended caving trips, such as ten-day trips into our famed backcountry cave Lechuguilla Cave, can tell you about how their circadian rhythms changed or are disrupted when they no longer have exposure to the daily cycles of light and dark. That background significance is always present. For most of the time that there were people on Earth, there were no movies, not even any books. The night sky was the movie as big as the universe that comes out every night, told stories about the constellations. But, in addition, it was also a calendar. People knew when it was time to plant, or when it was time to go out and gather certain crops based on the stars. Extreme darkness was a more common experience in ancient times. The moon, as the most luminous thing in the night sky, had great importance. Full moon nights enabled travel, or night hunting, or other activities. Whereas a cloudy night with a new moon, it's almost as dark as it is in the Queen's Chamber of Carlsbad Cavern when you turn off the lights. So, although we may not be thinking as much about the night sky and may not be looking to it for information as much on a day-to-day basis in the 21st Century world, our hearts harken back, and we find inspiration from the constellations and from the old stories. I'd also mention newer technologies don't have to disconnect us from the night sky. They can re-connect us too. There are various star gazing apps available for your phone and I have found they are very useful for helping you learn the constellations.

AM: That idea of darkness, and the light comparing against it, is prevalent in both cave science and astronomy. So, this discussion has me thinking, if cavers are required to bring three sources of light with them underground, how many sources of light does NASA require their astronauts to carry?

RS: Well NASA would have a better answer for that one Anthony. However, a space suit and a space capsule have a remarkable number of tools incorporated into them. A bit like a real-life version of Ironman's armor and Batman's batwing. Cavers and astronauts have in common that they both venture into territory where no one has been before. Astronauts face the special

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challenge of environments that are extreme cold and have extreme heat and no oxygen to breathe.

AM: Alright, and with that, now that we have digressed a little bit into mentioning Batman, I think it is a good time to shift gears. So, without further ado, I present to the audience Ranger Ross in action presenting Rocky Worlds to Explore: The Moon Above Carlsbad Caverns National Park.

[Transition Music]

RS: At Carlsbad Caverns National Park, we often tell stories about Jim White, a cowboy who explored Carlsbad Cavern in the early 1900's. He frequently went alone, with only the small flickering flame of a homemade lantern to guide him through the darkness. He journeyed in deep solitude. His light revealed an elegant wilderness of towering stalagmites under a great dome ceiling. White described an unforgettable awe on his first cavern adventure.

I will share a pair of stories, one fiction and the other fact, about exploring a different rocky world. "There is no one among you, my brave colleagues, who has not seen the moon, or at least heard of it," said Impey Barbicane, Jules Verne's character in *From the Earth to the Moon*. The Moon is a prominent feature of the night sky, of this park and your backyard. Do you remember, my listeners, what you thought of the Moon when you were a young child? Did the Moon bring you fear or peace or delight? Did you ever dream of traveling to the Moon?

In the 1860s, in Paris, France, a former stockbroker named Jules Verne found unexpected success in penning adventure novels based on science. These included *Five Weeks in a Balloon* (1863) and *Journey to the Center of the Earth* (1864). The latter features an epic caving adventure with the Earth's core as its destination. Next, this science fiction pioneer turned his attention to the Moon, writing the novels *From the Earth to the Moon* (1865) and its sequel *Around the Moon* (1870). Of all speculative stories about lunar voyages, Verne's stands out as a prophetic feat of scientific imagination.

Verne's story took place in a peaceful future. Members of the Baltimore Gun Club, devotees of shooting big guns, were frustrated that their favorite sport had lost practical application and become an anachronism. Everything changed when gun club president Impey Barbicane had an idea, that they become the "Columbuses of a new world," by turning their firepower towards the Moon. He asserted that a cannon of sufficient magnitude can fire a projectile to the Moon, and presented supporting calculations, verified by an astronomer at Cambridge. He led a mission to construct this cannon and its spacecraft projectile. A daring trio of men, including Mr. Barbicane, volunteered to be the crew. They named their ship *The Columbiad*.

The *Columbiad* and its crew launched from Florida, in an explosion of firepower. The astronauts experienced weightlessness in space. They reached the Moon in four days. As it turned out, Barbicane's calculations were not perfect; instead of landing on the Moon, they looped around it, pulled by its gravity. As they flew by the Moon's surface, they collected all the data they could, including observing rocky craters. The *Columbiad* returned to the Earth and splashed down in the Pacific Ocean.

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Verne envisioned all this during a time of steam engines and oil lamps. Originally written in French, Verne's lunar adventure was translated to many other languages, and adapted to stage, film, television, radio, and comics.

The real-world quest for the Moon happened in the mid-twentieth century, during the Cold War. In preparation for the Apollo 11 lunar mission, NASA constructed a five-stage Saturn rocket. NASA chose a daring trio of astronauts for the crew. Their names were Neil Armstrong, Buzz Aldrin, and Michael Collins. They named their space capsule the *Columbia* and their lunar lander the *Eagle*. They planned to take this lander to the Sea of Tranquility, an area of dark volcanic rock, which Moon watchers of past generations had mistaken for a body of water. Interestingly, the volcanic landscape of the Moon contains lava caves, which no human has yet explored.

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On July 20, 1969, from a stable orbit 60 miles (96 kilometers) above the Moon's surface, with Collins at the controls of the *Columbia*, Armstrong and Aldrin climbed into the *Eagle*. Armstrong piloted the *Eagle*'s descent, with guidance from Aldrin and an onboard computer. Today, even a simple digital watch has a more advanced computer. They flew past immense craters, towards a flat plain.

Armstrong said into his radio, "*Houston, Tranquility Base here. The Eagle has landed.*" He donned his spacesuit and stepped onto the Moon. He said, "*One small step for a man, one giant leap for mankind.*" Armstrong and Aldrin walked on the Moon for two and half hours among rocks impressively varied in size and type, under the brilliant light of the sun. They collected all the data they could, including 47 pounds (21 kilograms) of rock, and various photographs and films. Aldrin described the lunar surface as magnificent desolation.

Meanwhile, Collins orbited the Moon fourteen times in the *Columbia* and spent most of that time preparing for rendezvous with the *Eagle*. On the far side of the Moon, he had no radio contact with the Earth. He journeyed in deep solitude.

"And we have lost signal as the Apollo goes behind the Moon..."

En-route back to the Earth, with all three astronauts back onboard the *Columbia*, Armstrong thanked the men and women working at mission control and in research and development, who made the Moon landing possible. He also acknowledged Jules Verne, who had envisioned a lunar voyage very similar to the real one, 100 years before the fact. The *Columbia* returned to the Earth and splashed down in the Pacific Ocean.

Seeing the Earth from space deeply affected the Apollo astronauts. They felt a sense of unity with all of humanity and a need to preserve the only habitable planet we have. Collins later said, "*Oddly enough, the overriding sensation I got looking at the Earth was, my god that little thing is so fragile out there.*"

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Here at the National Park Service, we strive to preserve and protect America's great natural and cultural resources unimpaired for future generations. The places in our custody range from the depths of Carlsbad Cavern to the night sky, which stretches over all parks, providing unique views of the Moon and the constellations.

Carlsbad Cavern and the Moon are both rocky worlds to explore. Both contain colossal and awe-inspiring features, sculpted by millions of years of geologic history. Both are harsh places where the explorers' survival depends on careful planning and proper equipment. And yet both are delicate environments, where footprints from 50 years ago are still visible today.

Both cave explorers and lunar explorers represent not only their own curiosity but that of you and me. We all want to know what it's like on those other worlds, in the sky and underground. When Jim White explored the cave for the first time, could he have dreamed that millions of people would follow in his footsteps through the establishment of Carlsbad Caverns National Park? In contrast, the Apollo astronauts knew that hundreds of millions of people watched them on TV. While few others have physically followed them to the Moon, their voyage brought many forms of knowledge and inspiration back to the people of Earth—that small, fragile world out there in space.

Moreover, caves and the night sky share a rare and precious feature, darkness. Light pollution from artificial lights disrupts the dark sky.

What do you like about the night sky? What stories do you think of when you observe the night sky?

Curiosity begets exploration. By preserving night skies and caves, we preserve places that inspire curiosity.

What can you do to preserve the night sky?

[Conclusion Music]

GABE MONTEMAYOR: Hello listeners. Thank you for listening to Three Sources of Light. This podcast is produced by the Interpretation and Education Division at Carlsbad Caverns National Park. Episodes are researched, developed, and hosted by Park Guides Anthony Mazzucco and James Gunn. Today you also heard the voice of Ross Studlar. All audio engineering, music, and sound effects are made in house by Park Guide Gabe Montemayor. This episode was recorded in August 2020. For more information about Carlsbad Caverns National Park please visit our National Park Service website at www.nps.gov/cave. Thanks for listening.