
EPISODE THREE
MOON GIRL

1
00:00:00,100 --> 00:00:06,360
NATALIE: There are still so many questions locked up in these rocks. It's exciting times just to be studying ther

2
00:00:06,360 --> 00:00:13,700
BARBARA: So we have a big window (a big gap) in our understanding of the early Earth, and the moon preser

3
00:00:13,700 --> 00:00:21,090
Where did all of this stuff come from? How did it form? What was the process? Does it happen all the time acro

4
00:00:21,090 --> 00:00:25,900
Or, are we somehow unique or at least a usual? What does all mean?

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00:00:25,900 --> 00:00:28,982
NARRATOR: I'm Katie Atkinson and this is NASA explorers Apollo

6
00:00:28,982 --> 00:00:33,200
where we tell stories about our moon and the people who explore it.

7
00:00:33,200 --> 00:00:40,000
[ARCHIVAL AUDIO FOOTAGE]

8
00:00:40,000 --> 00:00:43,200
[MUSIC]

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00:00:43,200 --> 00:00:48,000
NARRATOR: When astronauts travelled to the Moon, they explored its mysterious surface.

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00:00:48,000 --> 00:00:59,860
[ARCHIVAL AUDIO FOOTAGE: Look at this soil! It’s all cake-looking, isn’t it? Yeah it is! Okay, let me get the s

11
00:00:59,860 --> 00:01:03,800
They collected bits of soil, rock and dust to bring back to Earth.

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00:01:03,800 --> 00:01:06,500
And they were pretty excited about it.

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00:01:06,500 --> 00:01:18,900

[ARCHIVAL AUDIO FOOTAGE: Oh! Hey! There is orange soil! Well, don't move until I see it. It's all over! Oran

14
00:01:18,900 --> 00:01:25,080
NARRATOR: Each sample was carefully harvested and preserved so that scientists of the future could learn m

15
00:01:25,080 --> 00:01:31,560
Inside of those samples? Rich stories about the age of our moon and clues about its history.

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00:01:31,560 --> 00:01:36,000
Natalie Curran is one of the keepers of these tiny precious artifacts.

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00:01:36,200 --> 00:01:40,900
She's been thinking about Apollo since she was a kid.

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00:01:40,900 --> 00:01:42,640
[Music]

19
00:01:42,640 --> 00:01:48,180
NATALIE: I think it was my uncle that brought me back (he went to Kennedy Space Center)

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00:01:48,180 --> 00:01:51,860
and he brought me a pack of post cards, with all images from Apollo 11.

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00:01:51,860 --> 00:01:55,720
They went all up around my wall when I was a child.

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00:01:55,720 --> 00:01:58,120
Ever since I've always wanted to do something with space.

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00:01:58,120 --> 00:02:00,680
[MUSIC]

24
00:02:00,680 --> 00:02:04,160
NARRATOR: These days Natalie calls herself a lazy astronaut.

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00:02:04,160 --> 00:02:07,460
The moon rocks come to her instead of the other way around.

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00:02:07,460 --> 00:02:13,840
Natalie is a NASA postdoctoral fellow and a planetary scientist who spends her days with Apollo samples.

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00:02:13,840 --> 00:02:23,140
NATALIE: I'm currently working in our MNGRL lab which stands for Mid-Atlantic noble-gas research lab, which

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00:02:23,140 --> 00:02:27,740
NARRATOR: Natalie focuses specifically on samples from Apollo 16,

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00:02:27,740 --> 00:02:31,980
which she looks at to learn more about the formation of the surface of our moon.

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00:02:31,980 --> 00:02:39,757
NATALIE: So, a lot of the samples that we have are quite old. So they're some of the older rocks that you'll get

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00:02:39,757 --> 00:02:43,580
We're looking at rocks that are older than four billion years old.

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00:02:43,580 --> 00:02:50,080
Every time you look at something or think of something like that, what you just analyzed is older

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00:02:50,080 --> 00:02:55,900
than anybody that we know, anything that we know as living, and that, again,

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00:02:55,900 --> 00:03:03,480
is quite an amazing kind of achievement just in its own way to be holding and analyzing these ancient rocks.

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00:03:03,480 --> 00:03:08,660
NARRATOR: As it turns out, the moon can teach us a lot about the history of our solar system.

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00:03:08,660 --> 00:03:13,700
Scientists like Natalie study lunar rocks, soil, dust and sand.

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00:03:13,700 --> 00:03:19,360
She and her fellow scientists weigh, measure and scrutinize samples to find answers

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00:03:19,360 --> 00:03:22,440

and sometimes, even more questions.

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00:03:22,440 --> 00:03:26,880
The process teaches scientists about the makeup and evolution of our moon,

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00:03:26,880 --> 00:03:29,680
but it also reveals plenty about our home planet.

41
00:03:29,680 --> 00:03:36,220
NATALIE: Unlike the Earth, which, we've had quite a complex history of plate tectonics,

42
00:03:36,220 --> 00:03:39,130
where it's erased some of the surface,

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00:03:39,130 --> 00:03:43,000
the moon hasn't had any plate tectonics like that. So the actual surface of the Moon

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00:03:43,000 --> 00:03:48,900
provides the perfect archive of both lunar history and solar history

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00:03:48,900 --> 00:03:55,020
that we can go collect some different age samples tell us a lot about how

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00:03:55,020 --> 00:03:57,120
the moon and the solar system has evolved.

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00:03:57,120 --> 00:04:02,720
[MUSIC]

48
00:04:02,720 --> 00:04:08,180
BARBARA: The moon goes farther back in our past than we can on the Earth.

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00:04:08,180 --> 00:04:11,000
The Earth and the moon formed together at about the same time

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00:04:11,000 --> 00:04:16,344
four and a half billion years ago. It's a really long time ago. But because we have water

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00:04:16,344 --> 00:04:23,440
on the Earth and plate tectonics and a whole bunch of things that erase our surface and renew our surface,

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00:04:23,440 --> 00:04:27,200
the rocks on the earth don't go back further than about three billion years.

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00:04:27,200 --> 00:04:38,743
So we have a big window (a big gap) in our understanding of the early Earth and the moon preserves that histo

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00:04:38,743 --> 00:04:41,920
NARRATOR: That's Barbara Cohen. She started and leads the MNGRL lab.

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00:04:41,920 --> 00:04:47,800
Her team studies noble gases to learn more about the age of the lunar samples.

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00:04:47,800 --> 00:04:55,000
BARBARA: And those gases are interesting to us because they help us tell when that rock was made and how

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00:04:55,000 --> 00:05:01,080
and what process is it underwent. So we are trying to understand the geology of another planet through its rock

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00:05:01,080 --> 00:05:06,140
And we use those gases to trace the processes that it went through on another planet.

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00:05:06,140 --> 00:05:11,760
The element Potassium decays overtime to the element Argon which is a noble gas.

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00:05:11,760 --> 00:05:19,302
And so we look at the ratio of potassium to argon in the rock and we say how much potassium was there to be

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00:05:19,302 --> 00:05:25,240
and how much has decayed to the element Argon overtime? That's a little clock inside the Rock.

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00:05:25,240 --> 00:05:30,380
NARRATOR: While scientists like Natalie and Barbara are interested in lunar and solar history,

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00:05:30,380 --> 00:05:33,780

NASA's astrochemists, like Jaime El Cielo,

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00:05:33,780 --> 00:05:37,860
want to know what the samples can tell them about the origins of life

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00:05:37,860 --> 00:05:44,180
A lot of times what I'm doing is working in a lab with meteorites or other extraterrestrial samples,

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00:05:44,180 --> 00:05:50,548
including the lunar soil samples that we've worked with. I will take these samples, grind them up into a powder,

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00:05:50,548 --> 00:05:56,516
seal them up in a vial with water and heat them and basically make meteorite tea or lunar tea out of them.

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00:05:56,516 --> 00:06:02,700
I'm pulling out the soluble compounds and I try to understand how these chemical compounds formed

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00:06:02,700 --> 00:06:06,360
and evolved and were distributed in the early solar system.

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00:06:06,360 --> 00:06:09,360
[ARCHIVAL AUDIO FOOTAGE: Okay, let me get to the soil before you start whacking okay?]

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00:06:09,360 --> 00:06:14,740
BARBARA: I'm very grateful for the scientists who had the foresight to

72
00:06:14,740 --> 00:06:21,200
archive these examples and for the curators who kept them all this time in a state

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00:06:21,200 --> 00:06:24,640
that was ready for us to be able to look at

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00:06:24,640 --> 00:06:30,593
JAMIE: It didn't as a kid seemed like something spectacular to me. I was just part of history. But now when I ge

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00:06:30,593 --> 00:06:36,402
lunar samples in the lab and I stop and think about what it took to bring these back to Earth and where they've

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00:06:36,402 --> 00:06:41,450
what the history of the samples is, sometimes I'm working in the lab and I just stop

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00:06:41,450 --> 00:06:43,160
and I'm just overwhelmed by this amazement.

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00:06:43,160 --> 00:06:48,660
NARRATOR: Each sample, carefully cultivated by lunar explorers, reveals more about the moon

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00:06:48,660 --> 00:06:50,000
and planet Earth.

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00:06:50,000 --> 00:06:54,030
[MUSIC]

81
00:06:54,030 --> 00:07:00,960
There's still so many questions locked up in these rocks that it's exciting times just to be studying them.

82
00:07:00,960 --> 00:07:06,380
NARRATOR: Barbara, Natalie and Jamie will have the opportunity to keep learning about our moon very soon.

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00:07:06,380 --> 00:07:14,000
They were recently selected to open up and study never-before-seen Apollo samples.

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00:07:14,000 --> 00:07:16,940
Who knows what they'll uncover in the future.

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00:07:16,940 --> 00:07:22,040
[MUSIC]

86
00:07:22,040 --> 00:07:25,600
We asked you to help NASA tell the story of Apollo.

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00:07:25,600 --> 00:07:29,660
Hundreds of people answered from all over the world.

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00:07:29,660 --> 00:07:34,420

Here's what Sophie, a 13-year-old from Greece, had to say.

89
00:07:34,420 --> 00:07:39,980
SOPHIE: Hi, I am 13 years old. I am from Greece and I live in Athens.

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00:07:39,980 --> 00:07:46,780
I am very interested in space exploration and I would like to become an astrophysicist.

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00:07:46,780 --> 00:07:54,800
Even though I was not born when the first humans walked on the moon, the Apollo program means a lot to me

92
00:07:54,800 --> 00:08:02,000
The Apollo program and all of the people who worked in order to make the impossible possible

93
00:08:02,000 --> 00:08:05,920
inspired me in a way that changed my whole life.

94
00:08:05,920 --> 00:08:12,300
Now, after having learned all of these things about the Apollo Mission, whenever I look at the Moon,

95
00:08:12,300 --> 00:08:15,660
I dream about where the humankind is capable of going.

96
00:08:15,660 --> 00:08:22,206
When I think of the Moon I feel wonder and admiration because of the fact that humans have been there

97
00:08:22,260 --> 00:08:27,940
and because of the fact that this act has inspired hundreds of thousands of people, including myself.

98
00:08:27,940 --> 00:08:34,940
Furthermore, whenever I think of the Moon, I think that humans are now maybe,

99
00:08:34,940 --> 00:08:40,870
after so many years of space exploration, to make a step further of the Moon to Mars

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00:08:40,870 --> 00:08:44,760
and who knows, maybe in a few years, even further to the interstellar space.

101
00:08:44,760 --> 00:08:49,860
I believe that the Apollo program made it clear that the sky isn't the limit.

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00:08:49,860 --> 00:08:52,520
[MUSIC]

103
00:08:52,520 --> 00:08:55,060
What do you remember about Apollo?

104
00:08:55,060 --> 00:08:59,860
Or, what space exploration do you hope to see in your lifetime?

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00:08:59,860 --> 00:09:11,310
We want to hear your Apollo stories. Visit nasa.gov/apollostories to learn how to get involved.

106
00:09:11,404 --> 00:09:16,570
This is the only long-term information that we have from the surface of the Moon.

107
00:09:16,570 --> 00:09:18,665
I don't think the search for data is over with.

108
00:09:18,665 --> 00:09:23,480
Where did all of this stuff come from? How did it form? What was the process?