

## Emma's letter to Ken Ham (founder of Answers in Genesis)

*I went to a NASA display of a moon rock and a lady said, "This Moon-rock is 3.75 billion years old!" Guess what I asked for the first time ever?*

*"Um, may I ask a question?"*

*And she said, "Of course."*

*I said, in my most polite voice, "Were you there?"*

*Love, Emma B*

## How PZ Myers would reply to Emma

Dear Emma;

I read your account of seeing a 3.75 billion year old moon rock, and how you asked the person displaying it "Were you there?", the question that Ken Ham taught you to ask scientists. I'm glad you were asking questions — that's what scientists are supposed to do — but I have to explain to you that that wasn't a very good question, and that Ken Ham is a poor teacher. There are better questions you could have asked.

One serious problem with the "Were you there?" question is that it is not very sincere. You knew the answer already! You knew that woman had not been to the moon, and you definitely knew that she had not been around to see the rock forming 3.75 billion years ago. You knew the only answer she could give was "no," which is not very informative.

Another problem is that if we can only trust what we have seen with our own two eyes in our short lives, then there's very little we can know at all. You probably know that there are penguins in Antarctica, and that the Civil War was fought in the 1860s, and that there are fish swimming deep in the ocean, and you also believe that Jesus was crucified two thousand years ago, but if I asked you "Were you there?" about each of those facts, you'd also have to answer "no" to each one. Does that mean they are all false?

Of course not. You know those things because you have other kinds of evidence. There are photographs and movies of penguins and fish, there are documents from the time of the Civil War, as well as the fact that in many places you can still find old bullets and cannon balls buried in the ground from the time of the war, and you have a book, the Bible, that tells stories about Jesus. You have evidence other than that you personally witnessed something.

This is important because we live in a big ol' beautiful world, far older than your 9 years, and there's so much to learn about it — far more than you'll ever be able to see for yourself. There's a gigantic universe beyond South Carolina, and while you probably won't ever visit a distant star or go inside a cell, there are instruments we can use to see farther and deeper than your eyes can go, and there are books that describe all kinds of wonders. Don't close yourself off to them simply because you weren't there.

I'd like to teach you a different easy question, one that is far, far more useful than Ken Ham's silly "Were you there?" The question you can always ask is, "How do you know that?"

Right away, you should be able to see the difference. You already knew the answer to the "Were you there?" question, but you don't know the answer to the "How do you know that?" question. That means the person answering it will tell you something you don't know, and you will learn something new. And that is the coolest thing ever.

You could have asked the lady at the exhibit, "How do you know that moon rock is 3.75 billion years old?", and she would have explained it to you. Maybe you would disagree with her; maybe you'd think there's a better answer; maybe you'd still want to believe Ken Ham, who is not a scientist; but the important thing is that you'd have learned why she thought the rock was that old, and why scientists have said that it is that old, and how they worked out the age, even if they weren't there. And you'd be a little bit more knowledgeable today.

I'll assume you're actually interested in knowing how they figured out the age of the rock, so I'll try to explain it to you.

The technique scientists use is called radiometric dating. It uses the fact that some radioactive elements slowly fall apart, turning into other elements. For instance, a radioactive isotope of potassium will decay over time into an isotope of another element, argon.

One way to think of it is that it's like an hourglass. You know how they work: you start with all the sand in the top half of the hourglass, and it slowly trickles into the bottom half. If you see an hourglass with all the sand at the top and none at the bottom, you know it was recently flipped over. If you see one with half the sand in the top, and half in the bottom, you know it's about halfway through the time it will run. And if you look at how quickly the sand moves through the neck of the hourglass, you could even figure out how long until it all runs out.

In radiometric dating, the scientists are looking at how far along all the radioactive potassium is in the process of turning into argon. The amount of potassium is like the amount of sand in the top half of the hourglass, while the amount of argon is like the amount in the bottom half. By measuring the relative amounts of the two elements, and by measuring how fast radioactive potassium turns into argon, we can figure out how long it's been since the rock solidified.

It takes a very long time for the decay to occur. It takes 1 and a quarter billion years for half the potassium to turn into argon. When they measured those elements in the moon rocks, they found that the radiometric hourglass had mostly run out, so they knew that it was very, very old.

Scientists double-check everything. They also looked at other elements, like how quickly uranium turns into lead, or rubidium into strontium, and they all agree on the date, even though these are decay processes that run at different rates. All the radiometric hourglasses they've used give the same answer: 3.75 billion years. None of them say 6,000 years.

I think you're off to a great start — being brave enough to ask older people to explain themselves is exactly what you need to do to learn more and more, and open up the whole new exciting world of science for yourself. But that means you have to ask good questions to get good answers so that you will learn more.

Don't use Ken Ham's bad question, and most importantly, don't pay attention to Ken Ham's bad answers. There's a wealth of wonderful truths that reveal so much more about our universe out there, and you do not want to close your eyes to them. Maybe someday you could be a woman who does go to the moon and sees the rocks there, or a geologist who sees how rocks erode and form here on earth, or the biologist who observes life in exotic parts of the world...but you won't achieve any of those things if you limit your mind to the dogma of Answers in Genesis.

Best wishes for future learning,

A handwritten signature in black ink, appearing to read "PZ Myers". The signature is stylized and cursive, with the first letters of the first and last names being capitalized and prominent.

## Dear Emma...