

Our Marvelous Moon: fine-tuning becomes more and more clear

New studies identify more ways that the fine-tuned event that gave us the Moon, helped make life possible... a Lunar Magnetosphere

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November 13, 2020

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Science is fascinated with our nearest astronomical neighbor... the moon. This year has produced a number of discoveries that relate to the moon. Our interest in the moon is with good reason. For one thing, it provides important information about the formation of Earth and the rest of our solar system. More importantly, it turns out that advanced life as we know it needs the moon. It also turns out that not just any moon will do. Our moon is unique in important ways in our solar system and is probably extremely unusual in our universe. How is it unique? Consider these points:

- Our moon is relatively large compared to our planets size. Most moons are tiny, but ours is 1/4th the size of the Earth.
- The moon was formed 4.5 bya by a slow collision between Earth and a Mars-sized planet, sometimes called “Theia”. (At least this is the favored proposal and has held up for at least 20 years and seems to have a lot of support for it.) See Figure 1 (I love timelines.)
- This collision brought additional radioactive elements to our core that were important in giving us the long-lived plate tectonics that helped keep the planet from becoming a frozen ball of ice.
- The collision gave us the tilt that gives us seasons and again, helped keep the planet from being frozen.
- This relatively large moon is important in stabilizing the Earth’s tilt, increasing climate stability. ([Cain, 2015](#))
- The collision also brought water to us, a critical component for life. ([University of Münster, 2019](#))

- The Moon is responsible for the ocean's tides. Many "origin of life" hypotheses propose that the earliest life formed in tidal zones, making the moon critical in such theories.

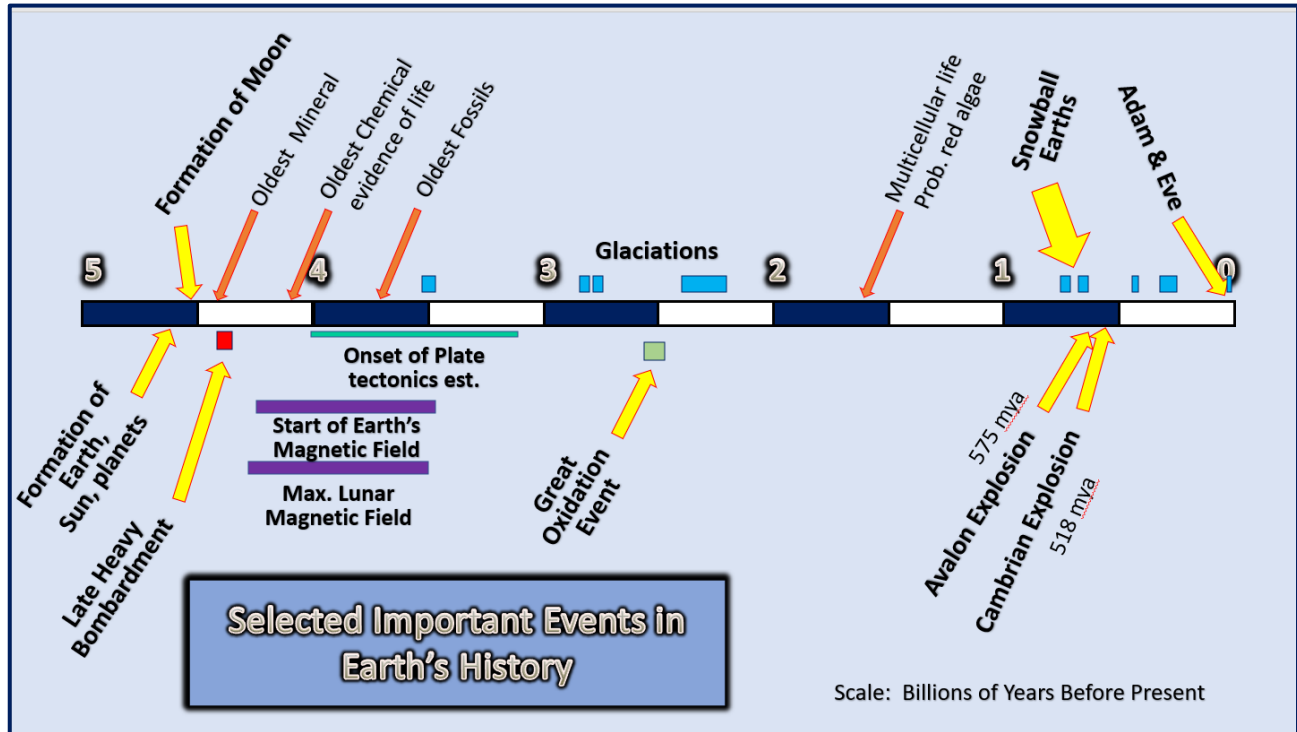


Figure 1. Timeline showing key events in Earth's history. It includes the ages of some of the oldest discovered evidences of life.

As you can see, our Moon's formation, location, and properties have obviously benefited our planet in making it hospitable for life and particularly for advanced life. Most scientists recognize that the moon has benefited our forms of life, though for each individual characteristic that we know affect life here, some challenge their absolute necessity for life. For instance, Dr Jason Barnes, assistant professor of physics at the University of Idaho, claimed in an interview, that even if the Earth had much higher variations in its spin, because of the lack of a moon, life would be different, but not impossible. ([Talk of the Nation, 2011](#)).

It is proposed that the core of "Theia" and the cores of the early Earth merged, with Earth getting most of the material. This would have increased the amount of radioactive material in the Earth available to heat the core and provide energy for plate tectonics. A very recent study points out **the amount of radioactive material in a planet's core "may be crucial to planet habitability"** ([Sci-News.com, 2020](#)). Too little material means tectonics will not last and life cannot be sustained. Too much and the dynamo that powers the tectonics shuts down. Goldilocks, at it again.

Scientists have long recognized that water is critical for life. We have bountiful water that is stable as liquid, gas and solid forms. It is now believed that "Theia" originated in the outer part of the solar system and this allowed it to bring water for us. It is true that water also may have been supplied by

other means. A recent report was produced that concludes that some water may be present on all rocky planets. ([University of Copenhagen, 2020](#)). We know that some water exists on the moon, even on the sunny side. ([NASA, 2020B](#)). The source of this water is debated, but clearly advanced life needs abundant water and that is likely to be rare, though again it can't be too much for a total water planet wouldn't do.

The first origin of life is interesting. We could say more about how rare it is if we had any scientific explanation for how it starts. Scientists really don't have any solid explanation for beginning life, particularly in a setting that realistically could have existed on the early earth, let alone by unguided processes. Regardless of whether it formed by unguided naturalistic processes, or was created more directly by an intelligent designer, early life lived and flourished on an Earth that was overall largely inhospitable to life. Tides result in many settings where life can flourish. Early life must have benefited from environments that were controlled by such tidal processes, and thus were influenced by the Moon. ([Dorminey, 2009](#)). The lunar cycles and seasons are utilized by many more advanced lifeforms to regulate their internal clocks. This again demonstrates the importance of the Moon for our existence.

New evidence of a magnetic field for the Moon

Terrestrial life brought specific demands for Earth's atmosphere and those changed over time. The demands involved both the air's composition and its pressure. It seems that our Moon also played a role in developing and keeping our atmosphere. The composition of the earliest atmosphere was determined by a competition between forces and processes that generated gases, and those forces that drove gases away from earth. Volcanoes generated large amounts of gases, even as they do today. Forces such as gravity and solar wind tended to cause the earth to lose gases. Hydrogen and helium were generated but were too light to be held by gravity, so they escaped. Evidence from the oldest rocks suggests that the early atmosphere was very different than ours today. It included far less nitrogen and no free oxygen. It was largely composed of hydrogen sulfide, methane, and up to 25% carbon dioxide (compared to 0.04% carbon dioxide today). ([Scalice, 2011](#); [Anderson, 2020](#), [Zahnle, 2010](#)) The first atmosphere was actually lost during a period of intense meteorite impacts known as the "Late heavy bombardment" (LHB) (Figure 1). As the next atmosphere built back up, protection from cosmic radiation in the form of solar wind would have been important. Most experts believe that today, the earth's magnetic field protects our modern atmosphere from the solar wind that would otherwise blow it away. The current magnetic field is generally believed to result from interaction between Earth's solid iron inner core and the liquid iron outer core. Evidence however, indicates that the Earth had a magnetic core long before this solid core developed. ([University of Liverpool, 2015](#); [Chu, 2020](#)) Apparently the early magnetic field was generated somehow differently.

A recently released study indicates that the moon also had a magnetic field in the distant past, ~4.25 to ~2.5 BYA ([Green, 2020, *When the Moon had a magnetosphere*](#)). The combination of the early Earth and early Moon magnetic fields would have strengthened the deflection of solar winds and thus protected the early Earth atmosphere and the early oceans. It seems that once again, the Moon helped make life possible on earth. I will not be surprised for later studies to come out that show that this additional protection of the atmosphere early after the LHB was critical to life. The atmosphere partially protected the oceans where life began. The Earth's atmosphere has the optimal pressure for non-marine life. ([Ross, 2018](#))

It is worth recognizing that earth is amazing.

- It is in the right type of galaxy... A third generation, spiral armed galaxy ([Ross, 2016](#))
- It is in the right part of that galaxy... Between the spiral arms, away from both the core and the outer edges
- It has the right type of star... type and position to give abundant heavy elements
- It is in a finely tuned solar system... all planets in a plane where the outer gas giant planets also protected earth and influenced Earth's mass and distance from the Sun ([Ross, 2016](#); [Carnegie Institution for Science. 2020](#))
- It is the right distance from the star... not too hot, not too cold... just right
- It has a large moon that stabilizes the tilt of our planet and provides a means to regulate biologic systems
 - It formed from a collision that further enriched our planet in radiometric elements that have kept our plate tectonics active for 3-4 billion years
 - It brought additional water to our planet, helping to give us that just right amount we need
 - It helped shield our early atmosphere from solar wind that might have left us dry and with too little atmosphere like Mars.
- As soon as the earth was stable enough for life... it appeared
- And the list goes on and on

We don't have detailed data from hundreds of planets in similar settings. We have a sample size of one. There are inherent dangers in extrapolating based on a very small sample set. Our information on other planets in other solar systems is going to be very limited for a long, long time. NASA report that "About half of Sun-like stars could host rocky, potentially habitable planets". ([NASA, 2020A](#)). This works with a very limited number of requirements, but the more we recognize the more difficult this claim is to believe. Their funding is of course helped by the idea that life is likely to be abundant in the universe. Someday, more hard data will be available from Mars, but until then, this is what we have. Perhaps, all of the above features are coincidences, but in my view, the point to earth being a very finely tuned work by a designer who purposefully put life in this place. He designed Earth as a home for creatures who could know Him and appreciate His creation.

Genesis 1 records:

*And God said, "Let there be lights in the expanse of the heavens to separate the day from the night. And let them be for signs and for seasons, and for days and years, and let them be lights in the expanse of the heavens to give light upon the earth." And it was so. And God made the two great lights—the greater light to rule the day and **the lesser light to rule the night**—and the stars. And God set them in the expanse of the heavens to give light on the earth, **to rule over the day and over the night**, and to separate the light from the darkness. And God saw that it was good. And there was evening and there was morning, the fourth day. **Genesis 1:14-19 (ESV)***

The moon was given to "rule over the night". As I discussed in "[Creation: Days 1 to 4](#)", this verse speaks of when the early clouds and haze were removed from the sky so that the Moon was actually visible from the Earth's surface. Maybe we should appreciate this "ruler of the night" more now because we

can see how God used it to provide for us in many ways that we know of today, and we are likely to learn of even more ways in the future. Some societies have worshipped the Sun, Moon and stars. We should worship the One who made them.

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