



Prize Winner

Science Writing Year 5-6

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Living on the Moon

An Information Report

Introduction

For many years, people have dreamed about living on the moon. In 1638, John Wilkins, a founder of the Royal Society, wrote a book called “*Discovery of a World on the Moone*”. Since then twenty-four humans have travelled to the moon and twelve have walked on the moon’s surface. Today, NASA is preparing to establish a permanent sustainable human presence on the moon through the Artemis program¹. But is it really possible for humans to live on the moon?

Why the moon?

Out of all the planets, stars and moons in our solar system, the earth’s moon is a good option to support a permanent human settlement. The moon is located 384,400km away from earth at its closest, taking 3 days to travel there.² The moon has some surface gravity which makes a moon settlement more possible than on other planets. The moon also has some resources that we can use to harvest the necessary items that humans need for survival including oxygen, water, food, energy and shelter.

Oxygen

There is no atmosphere on the moon so there is no air for humans to breathe. NASA has discovered that lunar soil called lunar regolith consists of 42% oxygen. NASA has developed a robot that is capable of harvesting oxygen from lunar soil using heat and electricity.³ NASA has recently extracted oxygen from simulated lunar soil in a vacuum environment which proves that astronauts could harvest oxygen from the moons resources.⁴

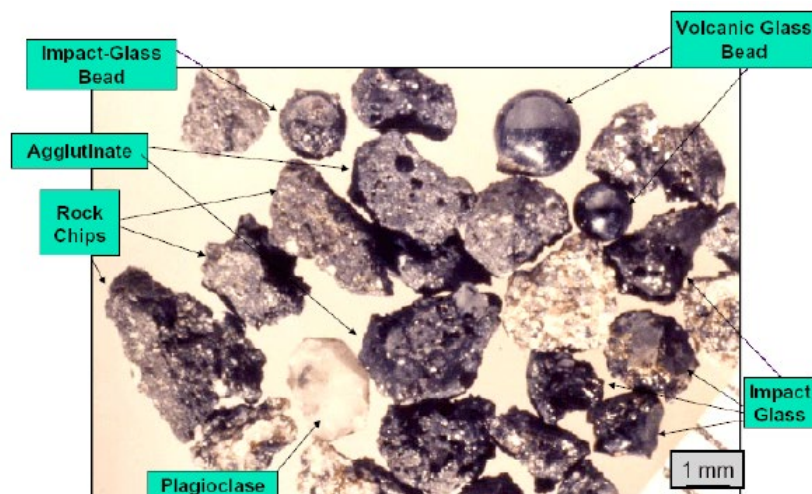


Fig.1 – Photograph of lunar regolith showing the different components⁵

¹ www.solarsystem.nasa.gov

² NASA Space Place www.spaceplace.nasa.gov

³ The Lunar regolith https://www.nasa.gov/sites/default/files/atoms/files/05_1_snoble_thelunarregolith.pdf

⁴ Twitter @NASA_Johnson #ICYMI Extracting oxygen from lunar regolith

⁵ The Lunar regolith https://www.nasa.gov/sites/default/files/atoms/files/05_1_snoble_thelunarregolith.pdf

Water

Water is made of hydrogen and oxygen. Oxygen can be harvested from lunar regolith, but hydrogen is more difficult to obtain. It would need to be transported from earth as a liquid. However, lunar ice was discovered in craters near the lunar poles in 2008 by Chandrayaan-1 (ISRO).⁶ In 2018 NASA confirmed that rovers could drill and collect ice from these craters.⁷ In 2020, NASA discovered water on the sunlit surface of the moon in the Cavius crater, proving that water could be found across the moon's surface.⁸

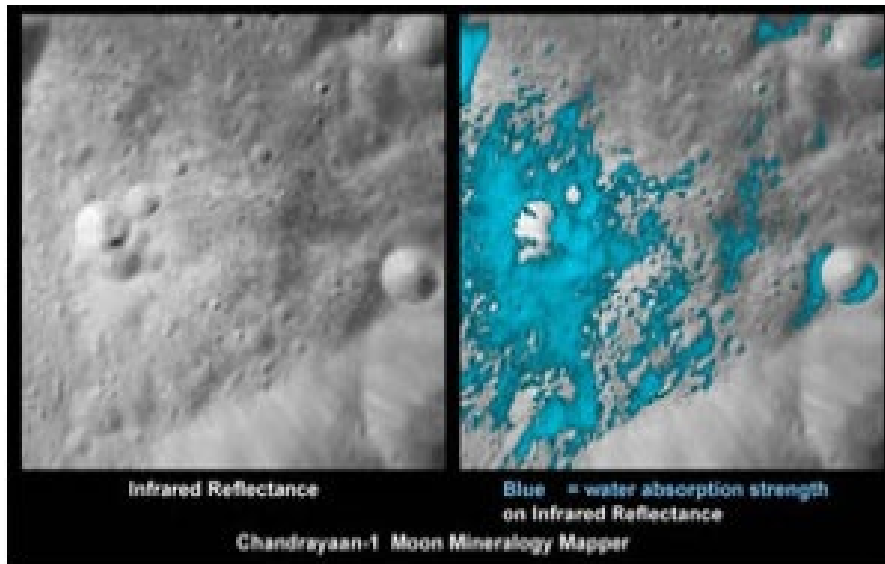


Fig. 2 Water molecules in a young crater on the side of the moon as viewed by NASA's Moon Mineralogy Mapper on the Chandrayaan-1 spacecraft.⁹

Food

Lunar regolith samples collected by Apollo astronauts have been used to successfully grow plants, such as the *Arabidopsis thaliana*.¹⁰ Research showed that the plants grew with different success depending on where the soil samples were collected from the moon.¹¹ Lunar regolith contains toxic matter but research has shown that by adding human manure to lunar soil adds nutrients and water to the soil and binds toxic materials, helping plants to grow.¹² Seeds and earthworms would need to be transported from earth for growing plants.

Energy

Lunar regolith contains the elements used to build solar panels that could provide sustainable energy. However the moon is in darkness for approximately 16 days during the lunar night so solar panels would not provide enough power. A European Space Agency (ESA) study showed lunar regolith could be used to store heat and provide electricity for lunar vehicles and landers. Apollo astronauts collected samples

⁶ Can we live on the moon? www.kids-tpi.ca

⁷ www.iop.org/explore-physics/moon/how-could-we-live-on-the-moon#gref

⁸ Water & Ices | Composition – Moon: NASA Science <https://moon.nasa.gov/inside-and-out/composition/water-and-ices/>

⁹ [NASA Instruments Reveal Water Molecules on Lunar Surface \(usra.edu\)](http://NASA.Instruments.Reveal.Water.Molecules.on.Lunar.Surface.usra.edu)

¹⁰ Scientists grow plants in lunar soil www.earthsky.org

¹¹ Scientists grow plants in lunar soil www.earthsky.org

¹² www.iop.org/explore-physics/moon/how-could-we-live-on-the-moon#gref

of lunar regolith that have been used to replicate lunar regolith on earth to experiment with. The fake regolith was able to be moulded into 3D bricks that could store heat and were connected to a heat engine to create electricity.¹³ Using lunar regolith to store heat and create electricity means that it wouldn't need to be transported from earth. The stored energy would power robots and machines used on the moon and help harvest lunar resources like food, water and oxygen.



Fig. 3 - Homemade regolith brick¹⁴



Fig. 4 - A 1.5 tonne building block of artificial lunar regolith, demonstrating 3D printing using lunar soil¹⁵

Shelter

For humans to survive on the moon, they would need protection from the lunar environment, the extreme temperatures and space radiation. In direct sunlight, the surface of the moon can reach over 100 degrees Celsius and drop as low as -173 degrees Celsius.¹⁶ Shelter could be provided using inflatable or expandable

¹³ Powering the moon -

https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Discovery_and_Preparation/Powering_the_future_with_lunar_soil#

¹⁴ Powering the moon -

https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Discovery_and_Preparation/Powering_the_future_with_lunar_soil#

¹⁵ Powering the moon -

https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Discovery_and_Preparation/Powering_the_future_with_lunar_soil#

¹⁶ Westlake, H (2018) "Journey to the Moon – 50th Anniversary of the moon landing 1969-2019" page 13

structures. To protect these structures from cosmic rays, lunar soil could be used to cover these structures in the form of lunar bricks.

Conclusion

While the moon is a good option for permanent human presence through the development of a lunar settlement, it is unlikely that humans will ever colonise the moon, relying only on the moons natural resources to sustain human existence. It is more likely that humans could establish a temporary lunar settlement utilising the moons natural resources, in addition to transporting valuable resources from earth in the preparation for greater space exploration. The long term effects on humans eating plant foods grown in lunar regolith and drinking water harvested from moon ice is not known. However the conversion of the moons resources to create oxygen, shelter and power are a great start for a lunar settlement. More research and testing are still needed to discover if a permanent sustainable human presence can be successfully established in the lunar environment.

Reference List

3 problems we need to solve before we can live on the moon

www.herox.com/blog/957-3-problems-we-need-to-solve-before-we-can-live-on-the-moon

About Artemis Project www.nasa.gov/specials/artemis

Apollo Missions – www.nasa.gov/mission_pages/apollo/missions/index.html

Goldsmith, Dr. Mike, Hynes, Margaret, Taylor, Barbara (2016) Earth and Space, London, UK

How can we live on the moon? Institute of Physics www.iop.org/explore-physics/moon/how-could-we-live-on-the-moon#gref

Hubbard, Ben (2020) The complete guide to space exploration – A journey of discovery across the universe, London, UK.

Ice on the Moon https://nssdc.gsfc.nasa.gov/planetary/ice/ice_moon.html

Living on the Moon: What it would be like (Infographic) www.space.com/27203-living-on-the-moon-explained-infographic.html

Lunar Regolith, Sarah Noble, NASA

https://www.nasa.gov/sites/default/files/atoms/files/05_1_snoble_thelunarregolith.pdf

NASA Instruments Reveal Water Molecules on Lunar Surface (2009)

<https://www.lpi.usra.edu/features/chandrayaan1/waterMolecules/>

NASA Space Place www.spaceplace.nasa.gov

Powering the future with lunar soil

https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Discovery_and_Preparation/Powering_the_future_with_lunar_soil#

Scientists grow plants in lunar soil <https://earthsky.org/space/scientists-grow-plants-in-lunar-soil/>

Twitter @NASA_Johnson #ICYMI Extracting oxygen from lunar regolith

Westlake, H (2018) “Journey to the Moon – 50th Anniversary of the moon landing 1969-2019” page 13

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Assistance was provided by my Mum, Rebecca O'Reilly, with some typing and editing/grammar due to my special needs – Autism spectrum disorder with speech and language disorder.

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