AN IN-DEPTH STUDY OF THE THEORETICAL AND EMPIRICAL VERIFICATION FOR THE PRESENCE OF WATER AND CLIMATE ON MARS

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The solar system that is our home has a habitable zone that starts at 0.95 AU, very close to the Earth. But there is not only one planet in the habitable zone there is one more planet that is present in the habitable zone.

This planet does not have life and is smaller than Earth; it is our neighbor red planet Mars. This planet is red due to the presence of Iron oxide in the soil. Scientists have said that Mars was once not barren as it is today rather it has water and climate that disappeared.

In this paper, I am going to talk about the water, and the climate on Mars of both past and present and then If mars could have life or before it lost its atmosphere was it still habitable

Unlike Earth Mars has two moons Phobos and Deimos which are so small that rather than having a spherical shape, they are more like a weird potato-like shape. Comparing the moons to our moon, we see that our moon is 300 times bigger than the largest moon of Mars, Phobos, and 540 times bigger than the smaller moon of Mars Deimos. Moons of Mars orbit much closer to Mars than the moon does to the Earth. both of the planets moons were created by the same method, by the impact of another body, the difference here is that Earth was hit by an object named Theia, about the size of Mars, and Mars was hit by an object that was one-third of the mass of Mars

MARS GEOLOGY AND ATMOSPHERE

Mars is the second planet present in the habitable zone but is it barren like a desert Mars in the sky appears to be red due to the presence of iron oxide particles present in the soil of the Mars surface. Mars elevation, if we see how much of a difference is there from the north pole to the south pole and how the change happens on the equator, by the diagram we can conclude that the north pole was maybe an ocean and the south pole was land. Today we can see some evidence of water the most evident in the North and the South pole. By looking at the second picture, we can see that the poles of Mars have ice. Unlike Earth where the ice is made of mostly water, this ice is made of solidified canon dioxide and water. In the Martian atmosphere water and carbon dioxide exists in their gaseous form, when they

are taken to the poles, similar to the Earth the temperature dips, hence the water vapor and the carbon dioxide sublimates to their solid form, dry ice, and ice and that is what we see on the poles of Mars.

Martian atmosphere is very thin; it contains mostly carbon dioxide(95%). The atmospheric pressure is less than 1% of the Earth, and going there without a pressurized space suit the difference in the atmospheric pressure would kill us instantly. Looking from the sky, unlike Earth the atmosphere or the sky wouldn't look like blue or gray rather it would be bright, pinkish-color sky This is due to the fine, red dust carried by the Martian winds. Because of the thin atmosphere, these winds blow up to 100 km per hour, sometimes stirring up the thin, Martian dust and creating global dust storms.

Gravity on Mars is only about 38% of Earth's. So, if you weighed 100 kg on Earth, you would only weigh about 38 kg on Mars. And if you can jump one meter high on Earth, you would be able to jump 2.64 meters high on Mars. The lower gravity on Mars could be beneficial to future astronauts, as it would be easier to walk on the surface of Mars carrying Heavy backpacks and oxygen tanks.

Mars and Earth share a comparative point of axial tilt - Mars at its current 25 degrees, and Earth at a generally consistent 23.5 degrees. During the previous ten million years, Earth's pivotal tilt has just fluctuated between around 22 and 24.5 degrees, because our moderately huge Moon keeps up a steady tilt. Yet, Mars, which has two little moons, has encountered more outrageous changes in its pivotal tilt - somewhere in the range of 13 and 40 degrees over timescales of around 10 to 20 million years. Now and again when Mars' pivotal tilt is high, the late spring polar cap focuses legitimately towards the Sun, which permits the whole polar ice cap to sublimate. These variances in hub tilt lead numerous researchers to accept that extraordinary changes in atmosphere and seasons have happened since Mars' commencement.

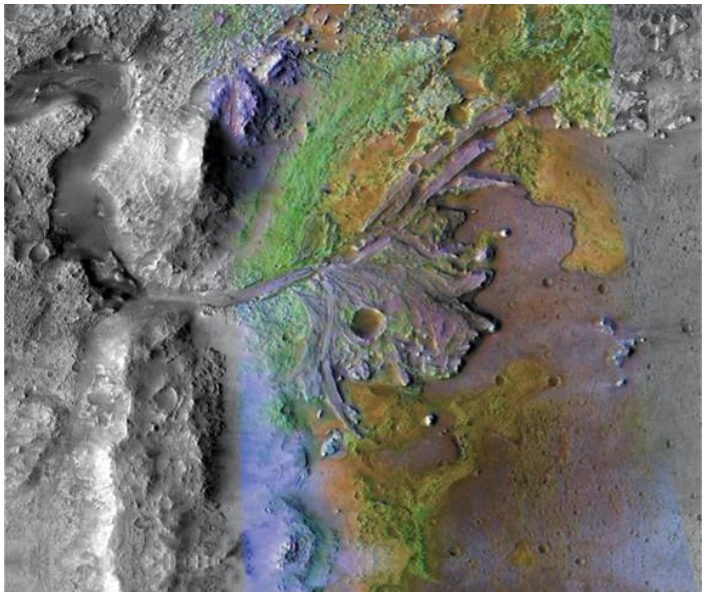
Mars is a cold planet with an extremely cold planet average temperature of -63°C and can get as low as -153°C and at the equator would be 20°C. The martian atmosphere is thin, so asteroid impacts from smaller can reach the surface. Geologist says that there may have been a massive ocean in the northern

part of Mars which is now frozen or the water vapor escaped into space.

Mars is a little planet. It is a large portion of the span of Earth. As the planet cooled, Mars, lost its attractive field at some point around 4.2 billion years prior, researchers state. During the following a few hundred million years, the Sun's amazing sun based breeze stripped particles from the unprotected Martian air at a rate 100 to multiple times more prominent than that of today.

EARLY MARS

Like Earth, the climate of Mars has been changing over time. Today, Mars is cold and dry, and liquid water is not stable on the surface. However, very early in the planet's history (3.5 billion years ago), climatic conditions appear to have been favorable for the presence of liquid water on the surface. The evidence for this comes from the presence of flowing features on the surface of Mars, such as valley networks and open lake systems, that likely indicate precipitation and runoff.



The photo from the probes sent to Mars is a piece of significant evidence for a rover on Mars. This photo shows a delta, which is formed at the mouth of a river. The photo shows deposits that can be developed due to water erosion. Hence by looking at this, we can say that Mars had water in the liquid form.

WHAT HAPPENED TO WATER ON MARS

Almost all water on Mars today exists as ice, though it also exists in small quantities as vapor in the

atmosphere. But If water existed in the liquid state and now it is all frozen what happened for this to occur.

Mars is a small planet and as it cooled, Mars started to lose its magnetic field which would leave its atmosphere vulnerable to the damaging solar winds coming from the sun. These solar winds strip of the atmosphere slowly and as Mars could not protect itself, the atmosphere was slowly taken off by the solar winds. Hence at last Mars was left with a very thin atmosphere, 1% of the Earth at this pressure water does not exist as a liquid state it is similar to the set of carbon dioxide in Earth's atmosphere.

Therefore all the water on Mars converted into ice as the atmosphere was lost due to the solar wind.

Today all the water is present as ice on the polar caps along with dry ice. It was in a liquid form, and there was a massive ocean in the north pole. This evidence of water is related to its presence as ice right now and the signs of following and erosion on the surface of Mars.

PAST CLIMATES

Past climates of Mars are classified into two major terms Early Mars and the Post- Noachian Mars. The two eras of mars are divided not in the middle, but one contains the period between the formation of Mars, 4.5 billion years ago, and ended at 3.5 billion years ago this period is known as the Noachian era.

The Noachian era is believed to be the era in which climate was suitable for the water to be in its liquid form (more than 3.5 billion years ago). There are pieces of evidence that prove that early Mars was warm; there was water present on the surface; the evidence lies the delta and the marks for the flow of water on the surface. Other compelling reasons to believe early Mars was warm and wet come from the detection of phyllosilicates (clays) in localised outcrops on these same ancient surfaces.
Phyllosilicates are the end product of basaltic weathering, and their presence suggests water flowed on the surface for an extended period.

The Post Noachian Mars.
Though the warmer and wetter conditions on early Mars did not last much beyond the end of the Noachian epoch (~ 3.5 billion years), the gradual increase in the Sun’s luminosity with time, and the large quasi-periodic variations in Mars’ orbit parameters must have led to significant climate variations. Variations in Mars’ obliquity, eccentricity, and longitude of perihelion alter the latitudinal and seasonal distribution of sunlight, which controls the climate system

Some of the consequences of these oscillations include:

- the collapse of the atmosphere at low obliquity
- an increase in atmospheric dustiness at high obliquity
- and the mobilisation and redistribution of surface water ice reservoirs at all obliquities

WATER ON MARS, THE FUTURE

Water is present as ice on the poles of Mars, and having a way to make drinkable water through the water on Mars polar ice caps would be great for future missions on Mars and even having a martian base. For the future mission, it would decrease the amount of water they would need to take on the mission, and then the problem of water on a martian base would be Easier to solve the problem for water for the people on board the martian base.

Water also solves another problem. Going to Mars and back would require double the amount of fuel taken for one side and hence bigger fuel vessels would be needed, which would increase the weight of the vessels. Water can be useful in the situation it can be used to make fuel.

Making rocket fuel with the help of electrolysis of water and separating hydrogen and oxygen. By this, we get oxygen which can be liquified, and hydrogen, which can also be liquified to get rocket fuel. Hence the total amount of rocket fuel that has to be carried by the craft decreases.

MARTIAN BASE

more Even in the wake of managing the issue and water, there would be marginally troublesome issues anticipating. As we probably are aware, Mars is little and subsequently doesn't have an attractive field so people should be shielded from the hazardous sunlight-based flares an individual would be presented to multiple times the radiation that is on Earth. The martian temperatures are freezing, there is a charming temperature on the Equator, yet all the water is on the shafts; thus the base ought to be close to the posts for the doggy of water. These two issues can be unraveled by making a base underground and close to the shafts. There is one more issue of energy we can utilize sun oriented force yet the sun would leisurely affect the blemishes than it is on Earth consequently more sun powered boards would be needed, on damages, there are dust storms which dark daylight for quite a long time. So we would require another wellspring of energy, wind and geothermal energy would not work either as there is not any climate and the inside of Mars is freezing. Atomic combination energy appears to be the exit from this, yet there are exceptionally less radioactive components on Mars, so it is should have been shipped from Earth, and a reactor would be required. For the climate, we would need to make a counterfeit one as air on Mars isn't appropriate for relaxing. There is likewise the issue of Mars dust, this residue is a lot better and has extremely poisonous perchlorate salts, and as it is dry it is

electrostatically charged, it would adhere to everything even space suits, and once in the Martian base it could get into the lungs of laborers and it would be dangerous. This could be explained by making space suits that stay away for the indefinite future to the base, they would be appended so that it very well may be worn and disconnected from the shuttle yet could never come inside, making a gap in the spacesuit joined to the entryway straightforwardly. The last issue food and detachment food should be delivered on the base itself as the boats would take two years two arrive at Mars. Food can be developed by utilizing strong handling it and afterward and afterward utilizing it with manure which would be people squander. This can be joined with rearing fish using the water, and space travelers can get an assortment for food. Subsequently, by vanquishing all the issues, we have effectively settled a martian base, and we are multi- planetary animal types now.

LIFE ON MARS

Life could have evolved on Mars as it once had all the suitable elements for life, containing water bodies and conditions which were ideal to generate life. The major problem for life on Mars would be the distance and the size of Mars. Due to the distance, it receives very little sunlight and hence less solar power. The size is a significant problem as with the smaller size comes the challenge of a smaller magnetic field, and with that, the radiation from the sun cannot be blocked which is harmful to life. So even if there was life when there was water, it would not have lived long and would have perished once Mars lost its magnetic field and solar radiation coming towards Mars destroying life.

There could be another way to help mars get its gift of life back, human settlement can be possible on our neighbor planet by settling on the planet

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