The Comparison of Venus and Mars in relation to Terraformation

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Introduction

Possible Futures for Earth

- Slow increase of greenhouse gases will eventually lead to increased trapping of infrared radiation that would increase the surface and atm temperatures of the planet.
- **End result: Venus-like planet**
- Deconstruction of Earth’s magneto sphere will lead to lack of atmosphere. Oxygen will be stripped away leaving nothing but sulfenic clouds and increase in harmful ultraviolet radiation.
- **End result: dark, desolate planet**

Materials and Methodology

Table 1. Major data of the orbits of Venus, Earth, Mars and Jupiter

<table>
<thead>
<tr>
<th></th>
<th>Venus</th>
<th>Earth</th>
<th>Mars</th>
<th>Jupiter</th>
</tr>
</thead>
<tbody>
<tr>
<td>M_M</td>
<td>0.82</td>
<td>1.00</td>
<td>0.11</td>
<td>31.79</td>
</tr>
<tr>
<td>e</td>
<td>0.007</td>
<td>0.017</td>
<td>0.093</td>
<td>0.048</td>
</tr>
<tr>
<td>R (AU)*</td>
<td>0.723</td>
<td>1.00</td>
<td>0.524</td>
<td>5.203</td>
</tr>
<tr>
<td>i (deg)</td>
<td>3.40</td>
<td>0.00</td>
<td>1.85</td>
<td>1.90</td>
</tr>
<tr>
<td>T (years)</td>
<td>0.62</td>
<td>1.00</td>
<td>1.88</td>
<td>11.86</td>
</tr>
</tbody>
</table>
* AU = Astronomical Unit

Similarities between Earth and Mars

- Mars has the same rotation rate as Earth = **similar force of gravity**. In addition, the distance from the Sun to Mars is nearly 1.52 times the distance from the Sun to Earth.
- The amount of sunlight Mars receives is **43% of terrestrial value**.
- more than enough for **photosynthesis** to occur.
- Surface temperatures reside in same range
  - **Mars: ~30°C || Earth: 15°C**

Similarities between Earth and Venus

- The surface of Venus can, in no shape, sustain life as we know it now.
- The atm of Venus is **one bar**, which is equal to the pressure of Earth’s surface.
- The atm is **Earth-like above the clouds**
  - In this zone, the temperature resides to about 350K, decreasing to 263 K, 10 km above that.

<table>
<thead>
<tr>
<th></th>
<th>Venus</th>
<th>Earth</th>
<th>Mars</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>92.5%</td>
<td>0.04%</td>
<td>96%</td>
</tr>
<tr>
<td>N₂</td>
<td>7.5%</td>
<td>0.96%</td>
<td>3%</td>
</tr>
<tr>
<td>H₂O</td>
<td>0.03%</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Discussion/Conclusion

- **Venus** requires a form of life adapted to harsh environments on Earth.
  - **Extremophiles** (thermophiles beyond boiling point) and acidophiles (pH level of 3)
- Life can thrive in the clouds (bacteria was known to exist in Earth’s clouds).
- **Hyper-acidophilic bacteria**

**Mars: Ecopoiesis** is human controlled process consisting in changes needed for anaerobic life to be established on planet surface.
- **Airtight biodomes** with synthesized oxygen and anaerobic bacteria

About the Author || Acknowledgements

**Studying at Embry Riddle Aeronautical University, Riya Joshi is working towards her B.S. in Aerospace Engineering with a focus on Astronautics and a minor in Applied Mathematics. She has published her research and presented it at the International Astronautical Congress (IAC) in Bremen, Germany in October 2018.**

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Abstract

The deterioration of Earth due to overpopulation, pollution, the increase in greenhouse gases in the atmosphere, and other conditions, is prompting the research of possible migration opportunities to other planets. Considerable, plausible futures for planet Earth end at the elimination of any forms of life currently present on its surface in its atmosphere, or in its oceans. The emigration of the human race to another cosmos is inevitable especially considering the rapid decline of the planet today. Two such probable habitable worlds include Venus and Mars, the second and fourth planets of our solar system, respectively. Temperature, pressure, atmospheric climate, surface climate, distance from the sun, and other such variables require key investigation to verify a possible life-affirming future for either Venus or Mars. This takes into account various fields of study, including geology, planetary science, meteorology, astronomy, spectroscopy, biology, and chemistry. To an outsider, the dry, rocky surface of Mars and the hot, sulfuric atmosphere of Venus mean that life could never survive, never mind thrive on either planet. However, further research indicates that with certain modifications, habitation on one, or both, planets is entirely possible. With a thorough analysis of the past climates of both planets, it is seen that in their early histories, both possessed environments that could very likely be home to many unknown, undiscovered, and unexplored life forms unimaginable to the human mind today. Evidence of bodies of water and a sustainable atmosphere of both planets has been found leading to additional, detailed research on potential futures for both Mars and Venus. Upon further analysis, researchers came to the conclusion that the surface of the Martian planet is more habitable, not its atmosphere, and visa versa for the Vesuvian planet. Several more differences between the two prove how possible a future home on either planet could be.