

Contributors: Josephine Costa, Derya Kurt, Robert Wang, Chia-En Lee, John Rebuilda, Sarah Pal.

ASTR178 – Description Outline

Question: Mars currently appears to be a rather unpleasant place for life as we know it. Why?

There are several reasons as to why Mars cannot sustain life.

- A molten core requires active inner movement to create a magnetic field. The core of Mars solidified from cooling down long ago due to the speed of rotation and the size of the planet. As a result, Mars is not geologically active.
- As Mars does not have a sufficient magnetic field, it does not have a magnetosphere which is necessary to protect the planet from solar winds produced by the sun. Solar wind is a flow of charged particles, mainly protons and electrons that come from the sun, at rates of 900km/h and at 1 million degrees. Solar wind would be damaging to flora, fauna, and the atmosphere if it was not deflected by the global magnetic field.
- Mars does not have tectonic plates. This ebb and flow of tectonic activity is necessary in the atmosphere of Earth to replenish carbon dioxide to the atmosphere. As Mars does not have this necessary tectonic process, it is unsuitable for sustainable life as there is no replenishment of atmosphere.
- Mars has low gravity, approximately 38% gravity of what Earth contains. Gravity is the force that draws a body to the center of a planet, or to a body with mass. Without sufficient gravity, Mars is not capable of retaining an atmosphere. If there was an atmosphere, it would float out to space.. An atmosphere is the blanket of gases which envelop a planet
- Without a sufficient atmosphere, Mars cannot have a greenhouse effect to warm up the planet. This results in the climate of Mars being too cold to support habitable life.
- With no sufficient atmosphere, Mars does not have an Ozone Layer to protect the planet from harmful Ultra Violet radiation rays. These rays would be damaging to exposed life forms on the planet.
- Due to the axial tilt of Mars causes the seasons to be more severe. As a result, the climate is harshly unsuitable for sustainable life.
- The chemical composition of Mars is 95.3% Carbon Dioxide, 2.7% Nitrogen, 0.03% Water Vapor and 2% of other gases. Earth's atmosphere primarily contains Nitrogen and Oxygen. The lack of Oxygen provides an unstable environment for sustainable life.
- Furthermore, the low atmospheric pressure (4-5 millibars) also makes it impossible to retain water as a liquid. Water cannot remain liquid, it would vaporize or freeze. Liquid water is necessary for sustainable life.

- The heat Mars is exposed to results in convection currents. This results in Mars being prone to large dust storms composed of fine dust particles that rage at a wild rate of 100-200km/h. These dust storms would be difficult to sustain life as it would be dangerous to inhale, damaging to flora and fauna and would also damage any equipment, buildings and structures that are erected there.
- Mars does not contain the same natural resources as planet Earth which is necessary for sustainable life such as water and plants. Such resources are necessary for food and shelter.

Was it once more suitable?

- Mars shows evidence of containing water billions of years ago. This evidence is based on the canals that resemble dried up river beds and collapsed terrains on Mars seem to be the result of fast-moving water flow. Furthermore, the shape of Martian geological features suggests occurrence of flash flooding. As liquid water is necessary for sustainable life, Mars could once have been suitable for habitation.
- Mars was once geologically active, therefore the global temperatures on Mars could have been higher than it is now. Mars previously could have had a stable atmosphere to generate an adequate greenhouse effect. As a result, the temperature could have supported water to form in a liquid form.
- Martian meteorites from Mars reveal microscopic structures resembling the shape of fossilised bacterial organisms. This evidence suggests that micro-organisms may have existed on ancient Mars which suggests that water in the liquid form has previously existed on Mars.
- The above points infer that ancient Mars may have been able to sustain life as some life on Earth such as lichens can survive in extreme, Martian-like conditions, provided that there is liquid water to sustain them.