A paper

SAMPLE OF

LITERATURE REVIEW

Mars: The Two-hundred Million Mile Mission

A Review of the Literature

ENC 1102 - Essay III

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Abstract

In recent years, a multitude of research has been conducted on Mars through the use of telescopes, robotic rovers that traverse the surface of the planet, satellites, and other technological instruments. The scientific interests stem from the very question of intelligent life on the planet, to the climate and geographical layout of the planet. At this time, there is a great need for future research to conclude the most basic questions being asked about Mars. With a schism in the research conclusions, even the most insightful scientific conclusions are continually being questioned and reassessed. Nonetheless, as the width of the research expands, more pieces can be added to solve the mystery of Mars.

Mars: The Two-hundred Million Mile Mission

A Review of the Literature

With the launch of several recent space probes to the planet Mars much research is being collected in various fields of scientific research. Geographers, sedimentologists, paleontologists, biologists, chemists, geochemists, mineralogists, and many other professional scientific fields are quite interested in the research available from the Mars robotic expeditions. However, as more research is conducted it seems more research is needed. To say that this is an area of interest that requires more future research is without question.

Two of the most fundamental questions raised about Mars include:

1. Is there currently water on Mars, or was there in its past?
2. Is there, or was there, biological life on Mars and is it intelligent?

The research has not yet come to a definitive resolution for either of these questions. If answerable, these questions will take years of research and large funding to form authoritative conclusions. The following will examine the research-to-date regarding these two elemental questions concerning our solar system's "Red Planet".

Mars is, in fact, being orbited and researched more than any other planet in the universe besides Earth. Prior to the first fly-by viewing of Mars in 1965, it was thought that Mars was a planet much similar to our own. It was thought, falsely, that Mars was divided by continents and containing large bodies of water surrounding them. The evidence for this was mere satellite imagery that showed dark and light regions of the planet's surface. This particular feature of Mars, its dark and light colored regions, is known as a planet's albedo. Albedo is measured by the amount of light that is reflected from the surface of any given planet. Thus, lighter areas reflect more light and darker regions absorb more light. Research is actually being conducted on

Mars' changing albedo. Darker regions of Mars' surface have been appearing over the last couple years. It is thought that winds have been blowing lighter colored dust around, exposing more of the darker colored areas beneath. On the other hand, as these darker colors are exposed, more light is being absorbed and, in turn, the planet's temperature is rising (Perkins, 2007). Thus, the research has proven Mars to be experiencing global warming in the same way Earth is.

Geologically, an interesting discovery has been made in low-albedo regions of the planet. Silica-rich volcanic rocks, known as andesite, have been found on Mars. Author David Mittlefehldt (2000) notes that andesite is generally found in volcanic regions on Earth where subduction is occurring in the oceanic lithosphere. Peculiarly, this process has not occurred on Mars, which means that the source of the rocks must stem from a different but unidentified process. One conclusion based on this research is that the evolution of the surface geography of Mars has occurred differently from that of Earth. Some sort of shift in Mars' volcanism is likely to be the source of the andesite, but return missions from Mars that provide specimens for study would be most helpful in discovering the origin of these rocks.

One particularly interesting feature of Mars is that among the planets in our solar system, Mars is the most likely planet for biological life to exist on due to its proximity to the sun. This, indeed, raises great curiosity for scientists. Studies of Mars' atmosphere have been most stimulating for this type of research. Several groups of scientists have discovered traces of methane in the atmosphere of Mars. As one author notes, methane is quite unstable in the Martian atmosphere and generally dissipates within several hundred years. Thus, there must be a source that is replenishing Mars' supply of methane in the atmosphere. Formisano (2004) presents three options for answering this supply dilemma. He states that the supply of methane can be from one of three sources, "Impacts from comets, volcanic activity, and biological

activity" (par. 2). The author states that there is no sign of recent comet impact and no volcanoes on Mars that seem to have been active in quite awhile. Therefore, the only two options left for the presence of methane in the atmosphere is biological activity, or what Formisano describes as "pseudo-volcanic activity," where gas is conceivably released from geothermal openings in the crust. Future research will include regional examinations of methane in the atmosphere to examine the alterations in the amount of methane present. Additionally, as Formisano notes, a study of the different types of carbon present in the atmosphere can assist in determining the source of the methane.

However, a different study may have found evidence that would prove that there is not life on Mars. Research has shown the possibility of gas avalanches on the surface of Mars, specifically, carbon dioxide gas. In reviewing the pictures taken from Mars, one scientist discovered the formation of gullies on the edges of craters and canyons. Most speculate that these gullies are created by streams of water, but Nick Hoffman, the scientist who discovered these gullies, believes that it is impossible during that time of year for water to create such gullies. Unfortunately, for those who wish to find water and life on Mars, if Hoffman's conclusion about the source of the formation of these gullies is correct, this conclusion would put a big hit in being able to prove Mars to contain water. Further research is needed to determine whether CO_2 can actually create such features on the surface (Nowak, 2003).

Research has conclusively proven false one proof for the existence of intelligent life on Mars. Commonly referred to as the "faces on Mars," intelligent life enthusiasts speculated that hills on Mars' surface that in fact looked like faces were sculpted by intelligent life. A European rover on Mars named the Mars Express recently imaged these facial hills and discovered they are merely eroded mesas (Covault, 2006).

Finally, the most debated and interesting study being conducted on Mars is answering the first fundamental question I proposed regarding Mars; is there currently water on Mars or has there been water on Mars in the past? The research at this point seems to support either case and scientists are continually altering their conclusions. One often studied phenomenon related to the study of water on Mars is called crossbedding. Crossbedding refers to tilted patterns found in cross-sections of sedimentary rock which are generally formed by water. As author Frank Morring Jr. (2004) also notes, the crossbedding features can *also* be formed by wind. In analyzing Opportunity's pictures, another Mars Rover, taken from the Microscopic Imager, Morring identifies rock that has been formed by wind, but also clear evidences of loose sediments that have been moved by flowing water. In fact, the stream may have been as much as five inches deep (Morring, 2004).

Another evidence for the existence of water is *inside* of the rocks. As author Michael A. Dornheim (2004) describes:

> Small 'vesicle' voids in the rock are the first clue for water. They typically have a bright interior, suggesting mineral deposits from a fluid like water. The brightness is unlikely to be atmospheric dust because the vesicles are small enough that they probably didn't connect to the outside. And it is unlikely to be grinding dust because that is shown to be dark at the edge of the cut (par. 10).

Dornheim describes the process by which water creates vesicular voids in rocks as it flows through it or across it. The bright inside of the veins through the rocks indicates that deposits of minerals have been made as water flowed through them. The author speculates other possible sources for the bright interior colors, but concludes the most likely source to be flowing water.

On the other hand, the most recent research has begun to move away from thoughts of ancient Mars as a warm wet planet and more towards a colder dryer planet. The Athabasca Valleys on Mars were thought to be sure evidence of structures created from flowing water. However, a layer of solidified lava has been found to cover this entire region, suggesting that lava flow instead of water flow created these valleys. Scenes that were once thought to be evidences of flowing water are now being thought to be created from flowing lava (Talcott, 2008).

It is quite obvious that there is a great need for future research of the planet Mars. Many questions have been raised, some answered. Definitive conclusions to some of Mars' most fundamental questions have not been made though with absolute integrity. Over two-hundred million miles away the second most studied planet in our universe still holds unthinkably large amounts of knowledge just waiting to be discovered. Although we know quite a bit more about Mars now than we did forty years ago, the future research conducted on Mars may potentially hold the keys to unlocking Mars' greatest secrets.

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