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HARVESTING GEOTHERMAL ENERGY ON MARS FOR FUTURE SETTLEMENT

Abstract

Geothermal Energy, heat energy that radiates from beneath the planet's crust, has the potential to be harvested into usable energy for sustainable civilization on Mars. Through the Mars Student Imaging Project, I analyzed the Gale crater to explore the properties and types of Martian surface pictures. Out of all the features analyzed, the most striking was the prominent lava flows that appear on the inner sides of the crater because of its indication of possible tectonic activity on Mars. Drawing similarities between Earth's landforms with the greatest potential to harbor geothermal energy and observed Mars platforms, I chose specific land features on Mars that could eventually impact the potential use of geothermal energy for future settlement. Specific regions of Mars oriented in lower elevation near volcanoes such as fissures, fault lines, and hot springs are highly suitable for geothermal energy. I specifically chose four testing sites on Mars – Vernal Crater, Arabia Terra (dominant hot spring); Cerberus Fossae, Elysium Quadrangle (prominent fissure); Elysium, Elysium Mons (large volcano); Valles Marineris (large canyon system containing faults and troughs). Through employing Java Mission-planning and Analysis for Remote Sensing (JMARS) software to render remote sensing images into multilayer images, I analyzed elevation and the nightside thermal inertia for each feature of interest. From the data collected, I drew two conclusions that set the trend for future research. Initially, I hypothesized that the elevation of a particular site shared an inverse correlation with nightside thermal inertia because the lower points of the Martian crust would be closer to the planet's mantle, thus the particular site would store and radiate more heat. I produced evidence supporting our prediction: every time thermal inertia was at its peak the nightside elevation would have a low point. I also formed a second prediction: as rock abundance increases, so does its surface area, thus it would have a high potential for heat storage. In essence, a direct correlation between thermal inertia and rock abundance. The direct correlation between the rock abundance and the thermal inertia goes along with our predictions proving that areas with greater rock area, would better retain the heat of geothermal energy. I recorded the overarching patterns and trends within the data collected for further analysis as a way to establish mathematical relationships between the measured quantities. Deeper research can provide a greater understanding of a sustainable source of energy for future Martian civilizations.