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A COMPARATIVE TECHNICAL ANALYSIS ON THE OCCURRENCE, ABUNDANCE, AND  
PROSPECTION OF WATER ICE ON THE LUNAR AND MARTIAN EXTERIORITIES.

**Abstract**

Ever since the declaration of the confirmation of the presence of water ice on extraterrestrial land back in the year 2008, that is, on Lunar and Martian land, significant research has been carried out to study the causes of the occurrence and abundance of water ice on the surface of both the celestial bodies, especially at the poles. This paper outlines an extensive comparative analysis highlighting the origin of water ice, the effect, and action due to various interactions of gaseous elements within the atmosphere. The study of the impact of solar activity in indulgence with the hydroxides and oxygenous compounds found within the chemical and geographical composition of the lunar surface has been run through a comparative analysis relevant to the origin of water ice on Mars. Observations suggest that the existence of water ice on the surfaces of the Moon and Mars may be due to the synthetic consolidation of hydrogen atoms in the solar winds with the oxygen atoms present in the surface minerals. Hydrogen ions (protons) in solar wind may continuously impact oxygen-bearing minerals or may be created by bombarding water-bearing comets, asteroids, and meteoroids. This includes the comparison of the origin of lunar water ice with the origin of Martian water ice and various phenomena that govern the production of the same. This may include water ice clouds, gaseous interactions within the Martian atmosphere, or solar interaction with the compounds abundant on the surface of Martian land. The paper also outlines the utilization of water ice for various research, human extraterrestrial colonization, and space tourism in the near future. Moreover, it discusses the potential of technology as we step into the Artemis era. Construction of the gateway in the lunar orbit would facilitate better access to lunar resources, thus making liquid fuel propellant a viable option for space modules for deep space missions. The goal is to highlight significant differences within the production of water ice on both the celestial bodies and the relevant technology required for resource utilization. The future aspects of human space exploration have also been discussed as a part of an in-depth review-based study on the probability of the inculcation of advanced technology utilizing extraterrestrial resources for human sustainability and deep space exploration.

Keywords: Water Ice, Lunar Surface, Martian Surface, Artemis, Gateway.