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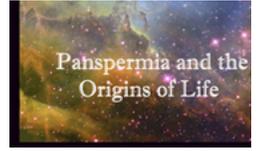
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## **Martian Geology Investigations. Planning for the Scientific Exploration of Mars by Humans. Part 2.**

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### **Abstract**

This paper addresses planning for the scientific exploration of Mars by humans in the area of geology. The current state of knowledge of Mars geology is summarized and areas for future human investigation in Mars geology are discussed. The geological history of Mars with the three major geological periods (the Noachian, the Hesperian and the Amazonian) and their significant events and processes are reviewed. 58 candidate landing sites for the human exploration of Mars are identified and their scientific significance discussed. Human Science Reference Missions (HSRMs) for Mars geology investigations are outlined. More detailed human traverses at several different sites of geological interest are discussed including the Jezero Crater, Mangala Valles and Arsia Mons.

**Key Words:** Noachian Period, Hesperian Period, Amazonian Period, Mars geology, Jezero Crater, Mangala Valles, Arsia Mons

### **1. Geology Investigations on Mars**

This article, Martian Geology Investigations, is Part 2 of the results of the Human Exploration of Mars Science Analysis Group (HEM-SAG) which are presented in five papers in this issue of the Journal of Cosmology (Levine et al., 2010a,b,c,d,e).

The geology of Mars poses a number of fundamental questions. While current and future robotic Mars missions would provide insight regarding the geology of Mars, HEM-SAG which was chartered by the Mars Exploration Program Analysis Group (MEPAG) in 2007, concluded that the top-level questions would likely remain broadly the same over the next 20 years. Among those questions are:

1. What is the volcanic history of the planet, and is Mars volcanically active today?
2. What was the nature and evolution of the Martian magnetic field?
3. What is the climate history of Mars?
4. What is the hydrologic history of Mars?
5. Is Mars hydrologically active at the present time?

These questions have wide-ranging implications with regard to the evolution of the Solar System, the nature and evolution of Earth's surface and climate, and the feasibility and likelihood of biology on another planetary body. The complex history of the Mars, and the evolution of Mars from the potentially "warm and wet" periods of its early Noachian history to the later "cold and dry" period of the Amazonian, strongly suggest that an exploration strategy that addresses the characteristics and processes of the three major periods would be required (Fig. 1).