Evolution of Martian Surface Environment

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Fluvial landforms on Mars suggest that it was once warm enough to maintain persistent liquid water on its surface. The transition to the present cold and dry Mars is closely linked to the history of surface water, yet the evolution of surficial water is poorly constrained.

I have presented my recent study on the evolution of martian surface environment. I and my team co-workers from JSC/NASA and Carnegie Institution of Washington have investigated the evolution of surface water/ice and its interaction with the atmosphere by measurements of hydrogen isotope ratios (D/H: deuterium/hydrogen) of martian meteorites. Hydrogen is a major component of water (H_2O) and its isotopes fractionate significantly during hydrological cycling between the atmosphere, surface waters, ground ice, and polar cap ice. Based on *in situ* hydrogen isotope (D/H) analyses of quenched and impact glasses in martian meteorites, we provide evidence for the existence of a distinct but ubiquitous water-ice reservoir (D/H = ~2-3 times Earth's ocean water). The origin of this reservoir appears to predate the current martian atmospheric water (D/H = ~5-6 times Earth's ocean water) and is unlikely due to a mixture of atmospheric and primordial water retained in the martian mantle (D/H ≈ Earth's ocean water). We demonstrate that this reservoir could represent massive ground ice that has existed relatively intact over geologic time. Our results corroborate the hypothesis that a buried martian cryosphere could account for a large part of the initial water budget of Mars.