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SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 2 (3B)

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EVOLUTION OF MARTIAN LANDSCAPE : INFLUENCE OF STRATIGRAPHY ON GEOMORPHOLOGY IN THE NORTH POLAR REGION

Abstract

Lithology and physical properties of strata exposed at the Earth's surface have direct influence on the erosion and geomorphic expression of landforms. While this is well known on our planet, examples on Mars are just coming to light among the tens of thousands of airphoto-quality images (resolutions 1.5–12 m/pixel) acquired since 1997 by the Mars Global Surveyor Mars Orbiter Camera (MOC). Specific examples occur among Martian north polar layered materials, which MOC images reveal are divided into two distinct stratigraphic units: a lower, dark-toned layered unit and a younger, upper, lightertoned layered unit. The lower unit is less resistant to wind erosion than the upper unit. The upper unit most likely consists of stratified dust and ice, while the lower unit contains abundant, poorly-cemented sand. Sand is more easily mobilized by wind than dust; the lower resistance to erosion of the lower unit results from the presence of sand. Where wind erosion in polar troughs has penetrated to the lower unit, geomorphic change has proceeded more rapidly: sand has been liberated from the lower unit, and arcuate scarps have formed as the upper unit has been undermined. Wind erosion of the lower unit thus influences the geomorphology of the north polar region; this result likely explains the genesis of the large polar trough, Chasma Boreale, and the relations between dunes and arcuate scarps that have puzzled investigators for nearly three decades. The properties of the stratigraphic units suggest that the upper limit for the amount of water contained in the north polar layered materials may be 30–50% less than previously estimated.