Glacial Geomorphology: A Proceedings Volume Of The Fifth Annual Geomorphology Symposium Series, Held

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High Resolution Imaging Science Experiment (HiRISE) observations of glacial and periglacial morphologies in the circum-Argyre Planitia highlands, Mars

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[1] The landscape of the Argyre Planitia and adjoining Charitum and Nereidum Montes in the southern hemisphere of Mars has been heavily modified since formation of the Argyre impact basin. This study examines morphologies in the Argyre region revealed in images acquired by the High Resolution Imaging Science Experiment (HiRISE) camera and discusses the implications for glacial and periglacial processes. Distinctive features such as large grooves, semicircular embayments in high topography, and streamlined hills are interpreted as glacially eroded grooves, cirques, and whalebacks or roche moutonnée, respectively. Large boulders scattered across the floor of a valley may be ground moraine deposited by ice ablation. Glacial interpretations are supported by the association of these features with other landforms typical of glaciated landscapes such as broad valleys with parabolic cross sections and stepped longitudinal profiles, lobate debris aprons interpreted as remnant debris covered glaciers or rock glaciers, and possible hanging valleys. Aligned boulders observed on slopes may also indicate glacial processes such as fluting. Alternatively, boulders aligned on slopes and organized in clumps and polygonal patterns on flatter surfaces may indicate periglacial processes, perhaps postglaciation, that form patterned ground. At least portions of the Argyre region appear to have been modified by processes of ice accumulation, glacial flow, erosion, sediment deposition, ice stagnation and ablation, and perhaps subsequent periglacial processes. The type of bedrock erosion apparent in images suggests that glaciers were, at times, wet based. The number of superposed craters is consistent with geologically recent glacial activity, but may be due to subsequent modification.

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1. Introduction

[2] The history of ice on Mars provides important information about Martian geologic and climatic history driven by variations in orbital parameters and insolation geometry, volatile mass balance, large impacts, volcanic eruptions, and solar luminosity. Evidence of glacial flow has been suggested in several areas on Mars including the Argyre Planitia [e.g., *Hodges*, 1980; *Kargel and Strom*,1990, 1992; *Baker*, 2001; *Hiesinger and Head*, 2002; *Kargel*, 2004], east and south of Hellas basin [e.g., *Kargel and Strom*, 1992; *Kargel*, 2004; *Head et al.*, 2005], the northern fretted terrain [e.g., *Moore and Davis*, 1987; *Kargel and Strom*, 1992; *Kargel*, 2004; *Head et al.*, 2006], the outflow channels [*Lucchitta*, 1982], and the Tharsis volcanoes [e.g., *Head and Marchant*, 2003; *Head et al.*, 2005; *Shean et al.*, 2007].

[3] The Argyre Planitia is a prominent Martian impact basin with a diameter in excess of 1500 km. The Argyre Planitia and adjoining mountainous ring ranges, Charitum Montes (on the basin's southern side) and Nereidum Montes (on the basin's northern side), are located in the southern hemisphere of Mars centered at 51°S and 317°E (Figure 1) [*Tanaka et al.*, 1992]. This region appears to have been heavily modified by a combination of processes since the formation of the Argyre impact structure; processes that are

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