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Surface processes recorded by rocks and soils on Meridiani Planum, Mars: Microscopic Imager observations during Opportunity's first three extended missions

Ken E. Herkenhoff,[1] John Grotzinger,[2] Andrew H. Knoll,[3] Scott M. McLennan,[4] Catherine Weitz,[5] Aileen Yingst,[6] Robert Anderson,[7] Brent A. Archinal,[1] Raymond E. Arvidson,[8] Janet M. Barrett,[1] Kris J. Becker,[1] James F. Bell III,[9] Charles Budney,[7] Mary G. Chapman,[1] Debbie Cook,[1] Bethany Ehlmann,[8] Brenda Franklin,[7] Lisa R. Gaddis,[1] Donna M. Galuszka,[1] Patricia A. Garcia,[1] Paul Geissler,[1] Trent M. Hare,[1] Elpitha Howington-Kraus,[1] Jeffrey R. Johnson,[1] Laszlo Keszthelyi,[1] Randolph L. Kirk,[1] Peter Lanagan,[10] Ella Mae Lee,[1] Craig Leff,[7] Justin N. Maki,[7] Kevin F. Mullins,[1] Timothy J. Parker,[7] Bonnie L. Redding,[1] Mark R. Rosiek,[1] Michael H. Sims,[11] Laurence A. Soderblom,[1] Nicole Spanovich,[7] Richard Springer,[7] Steve W. Squyres,[9] Daniel Stolper,[2] Robert M. Sucharski,[1] Tracie Sucharski,[1] Rob Sullivan,[9] and James M. Torson[1]

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[1] The Microscopic Imager (MI) on the Mars Exploration Rover Opportunity has returned images of Mars with higher resolution than any previous camera system, allowing detailed petrographic and sedimentological studies of the rocks and soils at the Meridiani Planum landing site. Designed to simulate a geologist's hand lens, the MI is mounted on Opportunity's instrument arm and can resolve objects 0.1 mm across or larger. This paper provides an overview of MI operations, data calibration, and analysis of MI data returned during the first 900 sols (Mars days) of the Opportunity landed mission. Analyses of Opportunity MI data have helped to resolve major questions about the origin of observed textures and features. These studies support eolian sediment transport, rather than impact surge processes, as the dominant depositional mechanism for Burns formation strata. MI stereo observations of a rock outcrop near the rim of Erebus Crater support the previous interpretation of similar sedimentary structures in Eagle Crater as being formed by surficial flow of liquid water. Well-sorted spherules dominate ripple surfaces on the Meridiani plains, and the size of spherules between ripples decreases by about 1 mm from north to south along Opportunity's traverse between Endurance and Erebus craters.

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1. Introduction

[2] The Mars Exploration Rover (MER) mission includes two essentially identical rovers, Spirit and Opportunity [*Crisp et al.*, 2003]. The Athena science payload [*Squyres et al.*, 2003] on each rover includes a Microscopic Imager (MI). The MI is a fixed-focus camera mounted on a mechanical arm called the Instrument Deployment Device

[1]U.S. Geological Survey, Flagstaff, Arizona, USA.
[2]Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California, USA.
[3]Department of Organismic and Evolutionary Biology, Harvard University, Cambridge, Massachusetts, USA.
[4]Department of Geosciences, State University of New York at Stony Brook, Stony Brook, New York, USA.
[5]Planetary Science Institute, Tucson, Arizona, USA.
[6]Department of Natural and Applied Sciences, University of Wisconsin, Green Bay, Wisconsin, USA.
[7]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA.
[8]Department of Earth and Planetary Sciences, Washington University, St. Louis, Missouri, USA.
[9]Department of Astronomy, Cornell University, Ithaca, New York, USA.
[10]Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona, USA.
[11]NASA Ames Research Center, Moffett Field, California, USA.

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