

PHILIP R. CHRISTENSEN

Department of Geological Sciences
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Education

B.S.	Geology	1976	University of California, Los Angeles
M.S.	Geophysics and Space Physics	1978	University of California, Los Angeles
Ph.D.	Geophysics and Space Physics	1981	University of California, Los Angeles

Dissertation: The Nature of the Martian Surface as Derived From Thermophysical Properties

Professional Employment

2004-present	<i>Regents Professor, Arizona State University</i>
2000-present	<i>Ed and Helen Korrick Professor of Geological Sciences, Arizona State University.</i>
1995-2000	<i>Professor, Department of Geology, Arizona State University.</i>
1990-1995	<i>Associate Professor, Department of Geology, Arizona State University.</i>
1987-1990	<i>Assistant Professor, Department of Geology, Arizona State University.</i>
1987	<i>Visiting Assistant Professor, Department of Geology, Arizona State University.</i>
1981-1986	<i>Faculty Research Associate, Department of Geology, Arizona State University.</i>

Selected Funded Research Projects

- Principal Investigator, NASA, THEMIS Imaging Facility and Student Imaging Project 2000-present.
- Principal Investigator, NASA, Thermal Emission Imaging System, Mars 2001 Orbiter Mission, 1997-present.
- Principal Investigator, NASA, Miniature Thermal Emission Spectrometer for Mars 2001/2003 Rover Mission, 1997-present.
- Principal Investigator, NASA, Thermal Emission Spectrometer, Mars Observer/Global Surveyor Mission, 1986-present.
- Principal Investigator, NASA, Mars Fundamental Research Program, 2007-present.
- Manager, Planetary Data System, Thermal Emission Spectrometer Data Node
- Co-Investigator, NASA, ASU Astrobiology Institute, 1998-2003.
- Principal Investigator, NASA, Planetary Geology Program, 1986-present.

Principal Investigator, NASA, Mars Data Analysis Program, 1999-present.
Principal Investigator, NASA, Planetary Instrument Definition and Development Program, 1996-1998.
Principal Investigator, Scottsdale/NASA, Technology Infusion Program for Urban Environmental Monitoring, 1995-1999.
Co-Investigator, NASA, Planetary Data System Geoscience Sub-Node, 1990-1996.
Co-Investigator, NASA, Eos ASTER investigation 1990-present
Co-Investigator, NASA, Eos Thermal Infrared Ground Emission Radiometer (TIGER) 1989-1990
Principal Investigator, NASA, Mars: Volcanology, Tectonism, Volatiles Program, 1987-1990.
Co-Principal Investigator, NSF, Geophysics Instrument Proposal (1988-1990)
Principal Investigator, NASA, Planetary Instrument Definition and Development Program, 1984-1987.
Co-Investigator, NASA, Mars: Evolution of Climate and Atmosphere Program, 1984-1987.
Co-Investigator, NSF, Latin American Cooperative Program, 1984-1987.
Co-Investigator, NASA, Planetary Geology Program, 1981-present.
Co-Investigator, NASA/JPL. Analysis of the Shuttle Imaging Radar Data. 1983-1984.

Selected National Service

Chair, NASA Mars Reconnaissance Orbiter MOS/GDS Review Board (2003-2006)
Lunar and Planetary Institute (LPI) Science Council (2001-2002)
NASA Mars Reconnaissance Orbiter Science Definition Team (2001)
NASA Junior Review Panel (2000)
Chair, NASA Planetary Geology and Geophysics Review Panel (1994-1995)
National Academy of Sciences Committee on Planetary and Lunar Exploration (COMPLEX) (1994-1997)
NASA Mars Exploration Program Assessment Group (1999-2004)
NASA Mars Sample Return Working Group (1996-1996)
NASA 2001 Mars Odyssey Project Science Group (1997-present)
NASA Mars Exploration Rover Project Science Group (1997-present)
NASA Mars Global Surveyor Project Science Group (1986-present)
NASA Mars Science Working Group (1994-1996)
NASA Planetary Geology and Geophysics Review Panel (1993-1995)
NASA Solar System Exploration Management Council (1989-1992)
NASA Mars Geology Mapping Review Panel (1988-1991)
NASA Mars Observer Participating Scientist Review Panel (1991)
NASA Planetary Geology and Geophysics Review Panel (1989-1990)
NASA Earth Observing System Science Steering Committee (1985-1987)
NASA/EOSAT Thermal Infrared Working Group (1986)
NASA Mars Observer Review Panel (1985)
NASA Viking Thermal Infrared Mapping Team (1976-1981)

Selected Local Service

ASU SESE Director Search Committee, 2005-20006

Professional Societies

American Geophysical Union
American Astronomical Society, Division of Planetary Science
Geological Society of America
Optical Society of America

Honors and Awards

NASA Public Service Medal, 2005
Fellow, American Geophysical Union, 2004
NASA Exceptional Scientific Achievement Medal, 2003
Edgar and Helen Korrick Endowed Professorship, 2000
Arizona State University College of Liberal Arts and Science Distinguished Faculty Award, 2002
Arizona State University Alumni Association Distinguished Faculty Award for Research, 1998
ASU Liberal Arts and Sciences Alumni Association Outstanding Faculty Award, 1995
Arizona Science Teachers Association Distinguished Community Service Award, 1995
18 NASA Group Achievement Awards, 1993-2006

Recent Graduate Students/Post-Docs Advised

James	Ashley	Ph.D.	current
Alice	Baldrige	Ph.D.	current
Jonathan	Drake	Ph.D.	current
Chris	Edwards	Ph.D.	current
Sylvan	Piqueux	Ph.D.	current
Shawn	Wright	Ph.D.	current
Naomi	Goldenson	M.S.	current
Robin	Ferguson	Ph.D.	2006
Amy	Knudsen	Ph.D.	2006
Scott	Nowicki	Ph.D.	2005
Joe	Michalski	Ph.D.	2005
Deanne	Rogers	Ph.D.	2005
Tim	Glotch	Ph.D.	2004
Megan	Kennedy	M.S.	2007
Kara	Krelove	M.S.	2006
Lori	Fenton	Post-Doc	2004-2006
Joe	Michalski	Post-Doc	2005-2006
Mike	Wyatt	Post-Doc	2001-2006
Marsha	Presley	Post-Doc	2000-2007
Elisabeth	Schöpfer	Post-Doc	2005

Recent Refereed Publications

2007

- Christensen, P. R., J. L. Bandfield, R. L. Fergason, V. E. Hamilton, and A. D. Rogers (in press), The Compositional Diversity and Physical Properties Mapped from the Mars Odyssey Thermal Emission Imaging System (THEMIS), in *The Martian Surface: Composition, Mineralogy, and Physical Properties*, edited by J. F. Bell, III, Cambridge University Press.
- Christensen, P. R., J. L. Bandfield, A. D. Rogers, T. D. Glotch, V. E. Hamilton, S. W. Ruff, and M. B. Wyatt (in press), Global Mineralogy Mapped from the Mars Global Surveyor Thermal Emission Spectrometer, in *The Martian Surface: Composition, Mineralogy, and Physical Properties*, edited by J. F. Bell, III, Cambridge University Press.
- Ruff, S. W., and P. R. Christensen, Basaltic andesite, altered basalt, and a TES-based search for smectite clay minerals on Mars, *Geophys. Res. Lett.*, doi:10.1029/2007GL029602, in press.
- Rogers, A. D., and P. R. Christensen, Surface mineralogy of martian low-albedo regions from MGS TES data: Implications for crustal evolution and surface alteration, *J. Geophys. Res.*, 112, E01003, doi:10.1029/2006JE002727, 2007.
- Rogers, A. D., J. L. Bandfield, and P. R. Christensen, Global spectral classification of martian low-albedo regions with Mars Global Surveyor Thermal Emission Spectrometer (MGS-TES) data, *J. Geophys. Res.*, 112, E02004, doi:10.1029/2006JE002726, 2007.
- Stockstill, K. R., J. E. Moersch, H. Y. McSween, Jr., J. Piatek, and P. R. Christensen, TES and THEMIS study of proposed paleolake basins within the Aeolis quadrangle of Mars, *J. Geophys. Res.*, 112, 10.1029/2005JE002517, 2007.
- Christensen, P. R., S. W. Ruff, and A. Anbar, Finding terrestrial rocks and other "exotic" materials on the lunar surface, NASA Advisory Council Workshop on Science Associated with the Lunar Exploration Architecture, 2007.
- Dunn, T. L., H. Y. M. Jr., and P. R. Christensen, Thermal emission spectra of terrestrial alkaline volcanic rocks, *J. Geophys. Res.*, 112, doi:10.1029/2006JE002766, 2007.

2006

- Arvidson, R. E., F. Poulet, R. V. Morris, J.-P. Bibring, J. F. B. III, S. W. Squyres, P. R. Christensen, G. Bellucci, B. L. Ehlmann, W. H. Farrand, R. L. Fergason, M. Golombek, J. L. Griffes, J. Grotzinger, E. A. Guinness, K. E. Herkenhoff, J. R. Johnson, G. Klingelhöfer, Y. Langevin, D. Ming, K. Seelos, R. J. Sullivan, J. G. Ward, S. M. Wiseman, and M. Wolff, Nature and origin of the hematite-bearing plains of Terra Meridiani based on analyses of orbital and Mars Exploration rover data sets, *J. Geophys. Res.*, 111, E12S08, doi:10.1029/2006JE002728, 2006.
- Arvidson, R. E., et al., Overview of the Spirit Mars Exploration Rover Mission to Gusev Crater: Landing site to Backstay Rock in the Columbia Hills, *J. Geophys. Res.*, 111, E02S01,

doi:10.1029/2005JE002499, 2006.

- Christensen, P. R., Water at the poles and in permafrost regions on Mars, *Elements*, 2, 151-157, 2006.
- Christensen, P. R., N. S. Gorelick, G. L. Mehall, and K. C. Murray, THEMIS Public Data Releases, *Planetary Data System node, Arizona State University*, <<http://themis-data.asu.edu>>2006.
- Ferguson, R. L., P.R.Christensen, J. F. Bell III, M. P. Golombek, K. E. Herkenhoff, and H. H. Kieffer, Physical properties of the Mars Exploration Rover landing sites as inferred from Mini-TES-derived thermal inertia, *J. Geophys. Res.*, 111, E02S21, doi:10.1029/2005JE002583, 2006.
- Glotch, T. D., J. L. Bandfield, P. R. Christensen, W. M. Calvin, S. M. McLennan, B. C. Clark, A. D. Rogers, and S. W. Squyres, The mineralogy of the light-toned outcrop at Meridiani Planum as seen by the Miniature Thermal Emission Spectrometer and implications for its formation, *J. Geophys. Res.*, 111, doi:10.1029/2005JE002672, 2006.
- Glotch, T. D., P. R. Christensen, and T. G. Sharp, Fresnel modeling of hematite crystal surfaces and application to martian hematite spherules, *Icarus*, 181, 408-418, 2006.
- Golombek, M. P., L. S. Crumpler, J. A. Grant, R. Greeley, N. A. Cabrol, T.J.Parker, J. W. Rice, Jr., J. G. Ward, R. E. Arvidson, J. E. Moersch, R. L. Ferguson, P.R.Christensen, A.Castano, R. Castano, A. F. C. Haldeman, R. Li, J. F. Bell, III, and S. W. Squyres, Geology of the Cusev cratered plains from the Spirit rover traverse, *J. Geophys. Res.*, 111, E02S07, doi:10.1029/2005JE002503, 2006.
- Greeley, R., R. E. Arvidson, P. W. Barlett, D. Blaney, N. A. Cabrol, P. R. Christensen, R. L. Ferguson, M. P. Golombek, G. A. Landis, M. T. Lemmon, S. M. McLennan, J. N. Maki, T. Michaels, J. E. Moersch, L. D. V. Neakrase, S. C. R. Rafkin, L. Richter, S. W. Squyres, P. A. de Souza, Jr., R. J. Sullivan, S. D. Thompson, and P. L. Whelley, Gusev crater: Wind-related features and processes observed by the Mars Exploration Rover Spirit, *J. Geophys. Res.*, 111, E02S09, doi:1029/2005JE002491, 2006.
- Haberle, R. M., M. A. Kahre, J. R. Murphy, P. R. Christensen, and R. Greeley, Role of dust devils and orbital precession in closing the Martian dust cycle, *Geophys. Res. Lett.*, 33, 10.1029/2006GL026188, 2006.
- Jakosky, B. M., B. M. Hynek, S. M. Pelkey, M. T. Mellon, S. Martínez-Alonso, N. E. Putzig, N. Murphy, and P. R. Christensen, Thermophysical properties of the MER and Beagle II landing site regions on Mars, *J. Geophys. Res.*, 111, doi:10.1029/2004JE002320, 2006.
- Johnson, J. R., J. Sohl-Dickstein, W. M. Grundy, R. E. Arvidson, J. Bell, III, P. Christensen, T. Graff, E. A. Guinness, K. Kinch, R. Morris, and M. K. Shepard, Radiative transfer modeling of dust-coated Pancam calibration target materials: Laboratory visible/near-infrared spectrogoniometry, *J. Geophys. Res.*, 111, E12S07, 10.1029/2005JE002658, 2006.
- Kieffer, H. H., P. R. Christensen, and T. N. Titus, CO₂ jets formed by sublimation beneath

translucent slab ice in Mars' seasonal south polar ice cap, *Nature*, 442, 793-796, doi:10.1038/nature04945, 2006.

Li, R., B. A. Archinal, R. E. Arvidson, J. Bell, P. Christensen, L. Crumpler, D. J. D. Marais, K. Di, T. Duxbury, M. Golombek, J. Grant, R. Greeley, J. Guinn, A. Johnson, R. L. Kirk, M. Maimone, L. H. Matthies, M. Malin, T. Parker, M. Sims, S. Thompson, S. W. Squyres, and L. A. Soderblom, Spirit rover localization and topographic mapping at the landing site of Gusev crater, Mars, *J. Geophys. Res.*, 111, E02S06, doi:10.1029/2005JE002483, 2006.

McConnochie, T. H., J. F. Bell, D. Savransky, G. Mehall, M. Caplinger, P. R. Christensen, L. Cherednik, K. Bender, and A. Dombovari, Calibration and in-flight performance of the Mars Odyssey Thermal Emission Imaging System visible imaging subsystem (THEMIS VIS), *J. Geophys. Res.*, 111, 10.1029/2005JE002568, 2006.

McSween, H. Y., S. W. Ruff, R. V. Morris, J. F. Bell, K. Herkenhoff, R. Gellert, K. R. Stockstill, L. L. Tornabene, S. W. Squyres, J. A. Crisp, P. R. Christensen, T. J. McCoy, D. W. Mittlefehldt, and M. Schmidt, Alkaline volcanic rocks from the Columbia Hills, Gusev crater, Mars, *J. Geophys. Res.*, 111, E09S91, doi:10.1029/2006JE002698, 2006.

McSween, H. Y., et al., Characterization and petrologic interpretation of olivine-rich basalts at Gusev Crater, Mars, *J. Geophys. Res.*, 111, E02S10, doi:1029/2005JE002477, 2006.

Michalski, J. R., M. D. Kraft, T. G. Sharp, L. B. Williams, and P. R. Christensen, Emission spectroscopy of clay minerals and evidence for poorly crystalline aluminosilicates on Mars from Thermal Emission Spectrometer data, *J. Geophys. Res.*, 111, E03004, doi:10.1029/2005JE002438, 2006.

Ruff, S. W., P. R. Christensen, D. L. Blaney, W. H. Farrand, J. R. Johnson, J. R. Michalski, J. E. Moersch, S. P. Wright, and S. W. Squyres, The rocks of Gusev Crater as viewed by the Mini-TESS instrument, *J. Geophys. Res.*, 111, doi:10.1029/2006JE002747, 2006.

Spanovich, N., M. D. Smith, P. H. Smith, M. J. Wolff, P. R. Christensen, and S. W. Squyres, Surface and near-surface atmospheric temperatures for the Mars Exploration Rover landing sites, *Icarus*, 180, 314-320, doi:10.1016/j.icarus.2005.1009.1014, 2006.

Squyres, S. W., O. Aharonson, R. E. Arvidson, I. J. F. Bell, P. R. Christensen, B. C. Clark, J. A. Crisp, W. Farrand, T. Glotch, M. P. Golombek, J. Grant, J. Grotzinger, K. E. Herkenhoff, J. R. Johnson, B. L. Jolliff, A. H. Knoll, S. M. McLennan, H. Y. McSween, J. M. Moore, J. J. W. Rice, and N. Tosca, Bedrock formation at Meridiani Planum, *Nature*, 443, doi:10.1038/nature05212, 2006.

Tornabene, L. L., J. E. Moersch, J. McSween H. Y., A. S. McEwen, J. L. Piatek, K. A. Milam, and P. R. Christensen, Identification of large (2-10 km) rayed craters on Mars in THEMIS thermal infrared images: Implications for possible Martian meteorite source regions., *J. Geophys. Res.*, 111, doi:10.1029/2005JE002600, 2006.

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Christensen, P. R., The Many Faces of Mars, *Scientific American*, July, 293, 32-39, 2005.

- Christensen, P. R., H. H. Kieffer, and T. Titus, Infrared and visible observations of south polar spots and fans, *Eos Trans, AGU*, 86(52), *Fall Meet. Suppl.*, Abstract P23C-04, 2005.
- Christensen, P. R., H. Y. McSween, Jr., J. L. Bandfield, S. W. Ruff, A. D. Rogers, V. E. Hamilton, N. Gorelick, M. B. Wyatt, B. M. Jakosky, H. H. Kieffer, M. C. Malin, and J. E. Moersch, Evidence for igneous diversity and magmatic evolution on Mars from infrared spectral observations, *Nature*, 436, doi:10.1038/nature03639, 2005.
- Christensen, P. R., S. W. Ruff, R. L. Fergason, T. D. Glotch, N. Gorelick, B. M. Jakosky, M. D. Lane, A. S. McEwen, H. Y. McSween, Jr., G. L. Mehall, K. Milam, J. E. Moersch, S. M. Pelkey, A. D. Rogers, and W. B. Wyatt, Mars Exploration Rover candidate landing sites as viewed by THEMIS, *Icarus*, 187, 12-43, 2005.
- Clark, B. C., R. V. Morris, S. M. McLennan, R. Gellert, B. Jolliff, A. H. Knoll, S. W. Squyres, T. K. Lowenstein, D. W. Ming, N. J. Tosca, A. Yen, P. R. Christensen, S. Gorevan, J. Bruckner, W. Calvin, G. Dreibus, W. Farrand, G. Klingelhofer, H. Waenke, J. Zipfel, J. F. Bell III, J. Grotzinger, H. Y. McSween, and R. Rieder, Chemistry and mineralogy of outcrops at Meridiani Planum, *Earth Planet. Sci. Lett.*, 240, 73-94, 2005.
- Crumpler, L. S., et al., Mars Exploration Rover Geologic traverse by the Spirit rover in the Plains of Gusev Crater, Mars, *Geology*, 33, 809-812, 2005.
- Cushing, G. E., T. N. Titus, and P. R. Christensen, THEMIS VIS and IR observations of a high-altitude Martian dust devil, *Geophys. Res. Lett.*, 32, L23202, doi:23210.21029/22005GL024478, 2005.
- Edwards, C. S., J. L. Bandfield, P. R. Christensen, and R. L. Fergason, Global distribution of bedrock on Mars using THEMIS high resolution thermal inertia, *Eos Trans. AGU*, 86(52), *Fall Meet. Suppl.*, Abstract P21C-0158, 2005.
- Glotch, T. D., and P. R. Christensen, Geologic and mineralogic mapping of Aram Chaos: Evidence for a water-rich history, *J. Geophys. Res.*, 110, E09006, doi:09010.01029/02004JE02389, 2005.
- Golombek, M. P., R. E. Arvidson, I. J.F. Bell, P. R. Christensen, J. A. Crisp, L. S. Crumpler, B. L. Ehlmann, R. L. Fergason, J. A. Grant, R. Greeley, A. F. C. Haldemann, D. M. Kass, T. J. Parker, J. T. Schofield, S. W. Squyres, and R. W. Zurek, Assessment of Mars Exploration Rover landing site predictions, *Nature*, 436, 44-48, doi:10.1038/nature03600, 2005.
- Greeley, R., R. Arvidson, J. F. Bell, III, P. R. Christensen, D. Foley, A. F. C. Haldemann, R. O. Kuzmin, G. Landis, L. D. V. Neakrase, G. Neukum, S. W. Squyres, R. Sullivan, S. D. Thompson, P. L. Whelley, and D. Williams, Martian variable features: New insight from the Mars Express Orbiter and the Mars Exploration Rover Spirit, *J. Geophys. Res.*, 110, DOI: 10.1029/2005JE002403, 2005.
- Hamilton, V. E., and P. R. Christensen, Evidence for extensive olivine-rich bedrock in Nili Fossae, Mars, *Geology*, 33, 433-436, 2005.
- Haskin, L. A., et al., Water alteration of rocks and soils on Mars at the Spirit rover site in Gusev

crater, *Nature*, 436, 66-69, doi:10.1038/nature03640, 2005.

McEwen, A. S., B. S. Preblich, E. P. Turtle, N. A. Artemieva, M. P. Golombek, M. Hurst, R. L. Kirk, D. M. Burr, and P. R. Christensen, The rayed crater Zunil and interpretations of small impact craters on Mars *Icarus*, 176, 351-381, 2005.

McLennan, S. M., et al., Provenance and diagenesis of the evaporite-bearing Burns formation, Meridiani Planum, Mars, *Earth Planet. Sci. Lett.*, 240, 95-121, 2005.

Michalski, J. R., M. D. Kraft, T. G. Sharp, L. B. Williams, and P. R. Christensen, Mineralogical constraints on the high-silica Martian surface component observed by TES, *Icarus*, 174, 161-177, 2005.

Mouginis-Mark, P. J., and P. R. Christensen, New observations of volcanic features on Mars from the THEMIS instrument, *J. Geophys. Res.*, 110, doi:10.1029/2005JE002421, 2005.

Rogers, A. D., P. R. Christensen, and J. L. Bandfield, Compositional heterogeneity of the ancient martian crust: Analysis of Ares Vallis bedrock the THEMIS and TES data, *J. Geophys. Res.*, 110, DOI:10.1029/2005JE002399, 2005.

Yen, A. S., et al., An integrated view of the chemistry and mineralogy of martian soils, *Nature*, 436, 49-54, doi:10.1038/nature3637, 2005.

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Christensen, P.R., B.M. Jakosky, H.H. Kieffer, M.C. Malin, H.Y. McSween, Jr., K. Nealson, G.L. Mehall, S.H. Silverman, S. Ferry, M. Caplinger, and M. Ravine, The Thermal Emission Imaging System (THEMIS) for the Mars 2001 Odyssey Mission, *Space Science Reviews*, 110, 85-130, 2004.

Christensen, P.R., and S.W. Ruff, The formation of the hematite-bearing unit in Meridiani Planum: Evidence for deposition in standing water, *J. Geophys. Res.*, 109, E08003, doi:10.1029/2003JE002233, 2004.

Christensen, P.R., S.W. Ruff, R.L. Fergason, A.T. Knudson, R.E. Arvidson, J.L. Bandfield, D.L. Blaney, C. Budney, W.M. Calvin, T.D. Glotch, M.P. Golombek, T.G. Graff, V.E. Hamilton, A. Hayes, J.R. Johnson, H.Y. McSween, Jr., G.L. Mehall, L.K. Mehall, J.E. Moersch, R.V. Morris, A.D. Rogers, M.D. Smith, S.W. Squyres, M.J. Wolff, and M.B. Wyatt, Initial results from the Miniature Thermal Emission Spectrometer experiment at the Spirit landing site at Gusev Crater, *Science*, 305, 837-842, 2004.

Christensen, P.R., M.B. Wyatt, T.D. Glotch, A.D. Rogers, S. Anwar, R.E. Arvidson, J.L. Bandfield, D.L. Blaney, C. Budney, W.M. Calvin, A. Fallacaro, R.L. Fergason, N. Gorelick, T.G. Graff, V.E. Hamilton, A.G. Hayes, J.R. Johnson, A.T. Knudson, H.Y. McSween, Jr., G.L. Mehall, L.K. Mehall, J.E. Moersch, R.V. Morris, M.D. Smith, S.W. Squyres, S.W. Ruff, and M.J. Wolff, Mineralogy at Meridiani Planum from the Mini-TES Experiment on the Opportunity Rover, *Science*, 306, 1733-1739, 2004.

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- Glotch, T.D., R.V. Morris, P.R. Christensen, and T.G. Sharp, Effect of precursor mineralogy on the thermal infrared emission spectra of hematite: Application to martian hematite mineralization, *J. Geophys. Res.*, 109, E07003, doi:10.1029/2003JE002224, 2004.
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- McSween, H.Y., Jr., *et al.*, Basaltic rocks analyzed by the Spirit rover in Gusev Crater, *Science*, 305, 842-845, 2004.
- Saunders, R.S., R.E. Arvidson, G.D. Badhwar, W.V. Boynton, P.R. Christensen, F.A. Cucinotta, R.G. Gibbs, C.K. Jr., M.R. Landano, R.A. Mase, M.A. Meyer, G.D. Pace, J.J. Plaut, W.P. Sidney, G.W. McSmith, D.A. Spencer, T.W. Thompson, and C.J. Zeitlin, 2001 Mars Odyssey Mission Summary, *Space Science Reviews*, 110, 1-36, 2004.
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- Soderblom, L.A., *et al.*, Soils of Eagle crater and Meridiani Planum at the Opportunity rover landing site, *Science*, 306, 1723-1726, 2004.
- Squyres, S.W., *et al.*, The Opportunity Rover's Athena Science Investigation at Meridiani Planum, Mars, *Science*, 306, 1698-1703, 2004.
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