

Instructor: Dr. Philip R. Christensen

Office: Moeur 120

Office Phone: 965-7105

Office Hours: Tuesday 8:30-10:15, or by appointment

1. Objective: To gain advanced knowledge in the geology of Mars, the evolution of the planet and its atmosphere, the comparison of geologic processes on Mars and the Earth, and plans for future spacecraft missions to Mars.
2. Class Meetings: The class will meet on Tuesday and Thursday from 10:40 to 11:55.
3. General: The course will involve lectures, homework assignments, a term project, special assignments, and related activities.
4. Textbook: Mars, edited by H. H. Kieffer, B. M. Jakosky, C. W. Snyder and M. S. Matthews, University of Arizona Press, 1992
5. Assignments: Extensive reading assignments will be given from the textbook and journal articles.
6. Grades will be based on a curve with the following weights given to each aspect of the course:
 - a. Homework assignments 20%
 - b. Hour exam 30%
 - c. Term Project 20%
 - d. Final exam 30%
7. Important Dates
 - a. Term Project proposals due Oct. 6
 - b. Hour Exam Oct. 13
 - c. Written Term Projects due Dec. 6
 - d. Final exam Friday, Dec. 9 10:00-11:50

GLG 406/598
Fall, 1997

Dr. Christensen

The Geology of Mars
Tentative Schedule

<u>Week of: Lecture</u>	<u>Reading Assignment</u>
Aug. 22 Class Organization, General Characteristics, History of Mars Exploration	Ch. 1, 3
Aug. 29 Formation, Internal Structure	Ch. 5 p. 147-162
Sept. 5 Tectonics, Impact Craters, Cratered Terrains	Ch. 6, 8, 12
Sept. 12 Volcanic Terrains and Processes	Ch. 13, Selected papers
Sept. 19 Water, Channels	Ch. 15, Selected papers
Sept. 26 Water con't,	
Oct. 3 Canyon system, Ice Term Project Proposals Due	Ch. 14, 16
Oct. 10 Polar Regions; MID-TERM EXAM	Ch. 23
Oct. 17 Stratigraphy, Geologic History	Ch. 11, Selected papers
Oct. 24 Geochemistry - Remote Sensing	Ch. 17, Selected papers
Oct. 31 Geochemistry, SNC's	Ch. 18
Nov. 7 Landing sites – surface properties/processes	Ch. 21, Selected papers
Nov. 14 Aeolian Processes, Dust Storms, Sedimentary Cycles	Ch. 22, 29
Nov. 21 Atmosphere - Current State, Meteorology, Clouds, Thanksgiving	Ch. 24, Selected papers
Nov. 28 Climate Change, Term Projects (Oral)	Ch. 32
Dec. 5 Term Projects (Oral) All Term Project Written Reports Due	Dec. 6
FINAL EXAM - Dec. 9, 10:00-11:50	

The Geology of Mars Fall, 2005

Suggested Reading List

The Photographic Story of Mars, by E. Slipher. Shy Publishing Corp., 1962.

A photographic atlas of Mars acquired from the Lowell Observatory.

The Geology of Mars, by T. Mutch, R. Arvidson, J. Head, K. Jones, and S. Saunders. Princeton University Press, 1976.

General geology and history of Mars. Discussion of planet formation, geochemistry, and cratering processes. Pre-Viking view of Mars.

Scientific Results of the Viking Mission, published by American Geophysical Union, *J. Geophys. Res.*, 82, 3959-4681, 1977.

Collection of the first set of JGR papers published describing the initial results from the Viking missions.

Second Mars Colloquium, published by American Geophysical Union, *J. Geophys. Res.*, 84, 7909-8519, 1979.

Collection of the second set of JGR papers published describing the later results from the Viking missions.

Mars Volatiles - Special JGR Issue, published by American Geophysical Union, *J. Geophys. Res.*, 84, 2793-3007, 1979.

Collection of a set of JGR papers published describing the properties of the martian atmosphere.

Geology of the Planet Mars, edited by V. Gornitz. Dowden, Hutchinson, and Ross Publishers, 1979.

A collection of papers on the geology and geophysics of Mars including pre-Viking papers.

Atlas of Mars, by R. Batson, P. Bridges, and J. Inge. NASA, 1979

An atlas of 1:5,000,000 series photomosaic, shaded relief, and topographic maps of Mars.

The Surface of Mars, by M. Carr. Yale University Press, 1981.

Textbook. Good view of general geology and geologic history of Mars. Post Viking assessment.

Basaltic Volcanism on the Terrestrial Planets, by The Basaltic Volcanism Study Project. Pergamon Press, 1981.

A good overview of basaltic volcanism and much more. It covers many aspects of basalt petrology, and also includes cosmochemistry, planetary formation, internal structure, thermal history, remote sensing, age dating through cratering studies, and isotope geochemistry.

The Channels of Mars, by V. Baker. University of Texas Press, 1982.

Detailed discussion of the distribution, age, and geologic relationships of channels on Mars.

Icarus Special Issue, *Icarus*, 50, 127-472, 1982.

Collection of a set of Icarus papers devoted to climate change, dust storms, and polar properties.

Planetary Science: A Lunar Perspective, by S.R. Taylor. Lunar and Planetary Institute, 1982.

A discussion of planetary formation, chemistry, and evolution from the perspective of lunar geochemistry determined from the returned Apollo samples.

The Geology of the Terrestrial Planets, by M. Carr, S. Saunders, R. Strom, and D. Wilhelms. NASA SP-469, 1984.

General review of the geology and history of the terrestrial planets. Well illustrated.

On Mars: Exploration of the Red Planet 1958-1978, by E. Ezell and L. Ezell. NASA SP-4212, 1984.

Good review of the history of Mars exploration, with emphasis on the Viking Project

Polar Processes on Mars, JGR Special Issue, Vol, 95, 1990.

Collection of papers on Mars polar regions, with theme of north-south differences and the consequences for present and past climate.

Water on Mars, M. C. Carr, Oxford University Press, 1996

Good review of the geomorphology of features indicating water on Mars, and the stability and history of water on the planet.

Initial Results from the Mars Global Surveyor Mission, Science Special Section, Vol. 279, 1998

Good set of papers from each science team on Mars Global Surveyor.

Results from the Pathfinder Mission, JGR Special Issue. Vol. 104, 1999.

Excellent set of papers from the Mars Rover mission

Results from the Mars Global Surveyor Mission, JGR Special Issue. Vol. 106, 2001.

Excellent set of papers from the Mars Rover mission

Initial Results from the Spirit Rover at Gusev Crater, Science Special Section, Vol. 305, 2004

Excellent set of papers from the Mars Rover mission

Initial Results from the Opportunity Rover at Meridiani, Science Special Section, Vol. 306, 2004

Excellent set of papers from the Mars Rover mission

Undergraduate Term Project: A paper dealing with some aspect of martian science is due Dec. 9. The topic is open and may be either original research or may be developed from the literature. The paper is to be typed, double-space, about 12 pages long, plus illustrations, and follow JGR journal format.

Graduate Term Project: An original term project dealing with some aspect of martian science will be carried out. The topic is open, and may include geologic, geophysical, or geochemical aspects of Mars. Substantial materials are available for photogeologic projects. Topics involving computer/image processing studies using JMARS or a similar GIS systems.

- 1) **Oct. 6.** Submission of PROPOSAL for the problem: proposal is to include: 1) a brief statement of the objective, 2) a paragraph on the background and relevance (what work has been done on the problem and why it is important), 3) a statement as to the approach you use to meet the objective, and 4) the expected outcome - not a prediction of the results but what the final products will be -- how our data base of Mars will be increased from this study, e.g. maps, knowledge of a particular region.

The proposal will be graded and returned with suggested changes.

- 2) **Dec. 6.** Final written reports due; to be typed, double-space with illustrations, following-JGR journal format. The content must address aspects of the original proposal, and include an abstract, summary and conclusions, and references cited.
- 3) **Dec. Nov. 29, Dec. 1, 6.** A fifteen minute oral presentation (10 min. + 5 min. discussion), AGU-style, will be given in class.