Geological Mapping of Mars

A Workshop on New Concepts and Tools

12-14 October 2009

Book of Abstracts

1. Geological Mapping of Mars workshop (Tuscany; October 2009)
2. NASA/USGS Planetary Geologic Mapping Program (June 2009)
3. Tunisia-Mars analogue site field trip (Int. Assoc. Sediment.; Sept. 2009)

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Fossil dunes being covered by active dunes (right)

Ken Tanaka (USGS) and Gian Ori (ASI)
MEPAG, 3/18/2010, Monrovia, CA
Why a Geological Mapping of Mars workshop?

- European Mars geologic mapping initiative
- High Resolution Stereo Camera and other new data, tools, approaches
- European planetary geoscience community due to MEX
- The need for coordination and collaboration with NASA/USGS Planetary Geologic Mapping Program
Conveners
Enrico Flamini--Agenzia Spaziale Italiana, Rome, Italy
Gian Gabriele Ori--IRSPS, Pescara, Italy
Ken Tanaka--U.S. Geological Survey, Flagstaff, Arizona, USA
Gerhard Neukum--Freie Universitat Berlin, Germany
Angelo Pio Rossi--ISSI, Bern, Switzerland

Coordinators
General--Angelo Pio Rossi, ISSI, Bern, Switzerland
GIS and imaging--Trent Hare and Jim Skinner, U.S. Geological Survey, Flagstaff, Arizona, USA, Stephan Van Gasselt--Freie Universitat Berlin, Germany
Geological Mapping--Monica Pondrelli, IRSPS, Pescara, Italy; Ken Tanaka and Jim Skinner, U.S. Geological Survey, Flagstaff, Arizona, USA
Local organization: Marinella Ercoli, ASI, Italy, Stefania Celenza, IRSPS, Italy, Adele Graziani, ASI, Italy
Workshop attendance

• 78 participants
• Most represented countries:
  • France
  • Germany
  • Holland
  • Portugal
  • United States
  • Italy
• Also Argentina, Australia…

Participants

• Geologists
• Physicists
• Engineers

From: Universities and research institutions, space agencies, geological surveys and space industry
New Concepts and Tools for Geological Mapping of Mars


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Geological mapping is a key tool for understanding the evolution of any planetary surface. The availability of ever growing data sets (e.g., multispectral and hyperspectral imaging and subsurface radar sounding) requires increasing effort in analyzing, integrating, and exploiting them for mapping purposes.

To discuss these issues, about 80 planetary geoscientists gathered in Italy at a workshop co-organized by the Italian Space Agency (ASI), the International Research School of Planetary Sciences (IRSPS), and the U.S. Geological Survey (USGS). The workshop focused on both data and concepts and covered a range of scientific and technical topics.

At the workshop, the importance of new data sets acquired by recent and currently orbiting Mars missions as the basis for revising previous geological mapping was stressed. Participants agreed that new mapping should involve the use and integration of hyperspectrally based surface compositional data, radar sounding–based subsurface data, topography, and imagery at multiple resolutions for describing and defining mappable geological units and other features and their relations in space and time.

Participants also pointed out that methodology, standards, and symbolization should be periodically updated to match the scientific and technical state of the art, keeping in balance standardization and scientific freedom and flexibility in mapping. Moreover, the long-standing issue of geomorphic versus geologic mapping should be tackled: How much geomorphology should be allowed in planetary maps and in the definition of geological units?

Geological mapping also provides important information for landing-site selection and characterization for current and future missions. Participants noted that diverse data sets can be integrated via thorough mapping, providing constraints on landing-site settings and potential risks. The importance of terrestrial analog mapping (from the scientific, technical, engineering, and procedural points of view) was also pointed out during the workshop.

Finally, a strong recommendation of the workshop is the need for coordination between current and future USGS mapping programs and newly emerging European geological mapping efforts, such as the ongoing Planetary Geographic Information System (PAGIS) program of the Italian Space Agency. The creation, implementation, and availability of mapping infrastructures and services can greatly improve the scientific exploitation of mission data. Participants noted several areas that would benefit by coordinated work, including cartographic and technical standards, symbology, and scientific outcome. Renewed efforts in geological mapping using state-of-the-art data sets, tools, and concepts will constitute the foundation for future international exploration of Mars.

A more extended summary of the plenary discussion, compiled by chairpersons, along with a list of sessions and session chairs, is available on the workshop wiki (http://www.irsp.s.unich.it/education/mapping09/wiki).

—ANGELO PIO ROSSI, International Space Science Institute, Bern, Switzerland; E-mail: arossi@issibern.ch; and MONICA PONDERELLI, IRSPS, Università G. d'Annunzio, Pescara, Italy

- Articles in special issue of Planetary and Space Science
The NASA/USGS Planetary Geologic Mapping Program and Mars Geologic Mapping
History of USGS/NASA planetary geologic map publication

- ~220 maps total published
  - Starting in 1962
  - Moon, Mars, Mercury, Venus, outer planet satellites
  - 1:25,000 to 1:25,000,000 scales
- Published Mars maps
  - 30-quadrangle series at 1:5M scale
  - Science-driven topical maps
  - Landing-site maps
  - Global maps
- Maps of Mars in progress include:
  - Global map (1:20M)
  - Polar regions (1:2M)
  - W. Candor Chasma using HiRISE stereo (1:10K)
Current USGS/NASA mapping program

- Supported by NASA Planetary Geology and Geophysics Program
  - Finances map authors and USGS work; supports 4-8 published maps per year
  - Provides guidance through PGG’s Geologic Mapping Subcommittee (GEMS)
- USGS provides:
  - Map bases
  - GIS data, tools, training
  - Editorial and nomenclature support
  - Web page
NASA/USGS Planetary Geologic Mapping Program

NEWS

First Announcement -- Planetary Mappers Meeting and GIS workshop, Flagstaff, Arizona, June 21 - 23, 2010

The Astrogeology Team at USGS provides coordination of NASA's planetary geologic mapping program. Geologic mapping investigations of any mapped planetary body (except Earth) are proposed to NASA's Planetary Geology and Geophysics Program on an annual basis (generally due sometime between late April and early June) and then reviewed by the Lunar and Planetary Science Review Panel. USGS map coordination is conducted under the auspices of NASA's Planetary Cartography and Geologic Mapping Working Group and its Geologic Mapping Subcommittee. USGS provider (1) participation in working groups charged with developing planetary geologic mapping program plans, (2) management and coordination of individual mapping projects, (3) oversight and expertise in meeting the requirements of USGS map standards, (4) editorial support in map review and revisions, (5) generation of geologic base maps and databases for map investigators, and (6) progress preparation and printing of maps in the USGS Scientific Investigations Map (SIM) Series.

Mars
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Venus
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Moon
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Outer Planet Satellites
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Earth
- Table

Mapping Guidelines
- PSC Author Checklist
- Venus Symbols
- Layers Example
- Venus Geologic Mappers Handbook
- Additional Guidelines
- Venus SOMIIs (PDF)
- Rina Guidelines
- Use and Presentation of Magellan Quantitative Data in Venus Mapping
- Planetary Geologic Map Symbols 1 (PDF)
- Planetary Geologic Map Symbols 2 (PDF)
- Astrogeology Manuscript Submission Process
- Tips for Preparation of Astrogeology Maps

Nomenclature
- Gazetteer of Planetary Nomenclature
- Imager Showing Named Features
- Feature Name Request Form

Download Planetary Geologic Maps
- USGS planetary geologic maps
- Additional planetary geologic map products

Mars Geologic Maps in Progress

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Mars Mapping Chart
33N280

The colored areas in the image below indicate geologic mapping in progress or completed (see legend at bottom). Select a colored quadrangle to learn more about its status.

30282

Nili Fossae

Mars 1:500k Geologic Maps in Progress

Mapper
Leslie Blemaster

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Status
Mapping in Progress

Nomenclature
Nomenclature of Mars features

Back
Tunisia field trip, post-IAS conference, Sept. 2009 (led by Gian Ori, ASI)

Workshop

Exploring Mars Surface and its Terrestrial Analogues
25-29 September 2001, Tozeur (Tunisia)

Pre-empted by 9-11

Fossil dunes—seen by millions

FIELD TRIP GUIDEBOOK
Chott el Gharsa and Chott el Jerid

Scenes from “Star Wars Episode 1: The Phantom Menace”
- A. Gypsum evaporites, Chott el Gharsa
- B. Cut section of irregular laminae from outcrop
  - Cavities from subaerial exposure (white arrows)
  - Microbial mats along discontinuities (black arrows)
- C. Microbial map on top of gypsum lamina
- D. Desiccated microbial mat
- E. Extreme halophiles
1. Geological Mapping of Mars Workshop
2. NASA/USGS Planetary Geologic Mapping Program
3. Mars analogue site field trip, Tunisia

Questions?