P12A MCC: Hall D Monday 1330h

Extant Water on Mars: Its Abundance, Physical State, and Role in Modern Geologic Processes II Posters *(joint with C, A, H)*

Presiding: **M S Gilmore,** Wesleyan University**; P Lee,** Search for Extraterrestrial Intelligence (SETI) Institute

P12A-0357 1330h POSTER

Chemical Weathering on Mars: Constraints from Equilibrium Reaction-Path Modeling

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The aqueous and solid products of chemical weathering of Mars-analog materials have been predicted using a thermodynamic equilibrium reaction-path model. Aqueous and solid compositions are monitored as rock (CIPW normative compositions of terrestrial basalt or Shergotty SNC meteorite material) is titrated into 1 liter of aqueous solution, buffered by CO_2 and O_2 at fixed fugacity. Constraints on Mars weathering processes are inferred based on the predicted effects of varying fO_2, fCO_2, water/rock ratio, percent primary material weathered, and initial solution chemistry on the final equilibrium assemblage. The equilibrium products predicted from the interaction of meteoric water or Na-Ca-Cl brine with basalt and Shergotty composition rocks suggest that hydrologic systems on Mars were (are?) dominated by Na-Ca-Mg-K-Cl solutions that evolve to produce low-temperature (221-218K) eutectic brines through cooling/evaporation processes. Most importantly, such brines are stable at current Mars surface P, T conditions because of the lowered triple-point temperature and vapor pressure.

Secondary minerals predicted from the model include calcite, dolomite, kaolinite, hematite, dawsonite, clinoptilolite, and SiO_2. The equilibrium assemblage is unaffected by changes in water/rock ratio (100 to 0.1). The only change in weathering products predicted with varying fO_2 occurred at the hematite/magnetite buffer - hematite is stable above $fO_2=10^{-71}$, siderite is stable at lower fO_2. However, much smaller variations in fCO_2 result in significant changes in the equilibrium assemblage. At $fCO_2 > 10^{-4}$, dolomite, calcite, and dawsonite are stable; at lower fCO2, calcite is the only stable carbonate. Calcite abundance decreases when fCO_2 falls below 10^{-5}, and calcite is unstable at $fCO_2 < 10^{-7}$. Kaolinite, paragonite, saponite, prehnite, and analcime are only stable over limited ranges of fCO_2. The strong dependence of the weathering assemblage on fCO_2 offers the possibility to constrain past or present fCO_2 conditions on Mars based on in-situ mineralogical observations. The current fCO_2 of the Martian atmosphere is $10^{-2.2}$ and the fO_2 is 10^{-5}. In the model, $fCO_2 < 10^{-5}$ results in little or no carbonate precipitation. Because CO_2 solubility in aqueous solutions decreases with increasing salt content, highly saline aqueous fluids near the surface of Mars will not precipitate carbonates. The lack of carbonates observed on the surface of Mars suggests that high salinity brines are involved in chemical weathering processes on the planet.

P12A-0358 1330h POSTER

On the Role of Salt in Modifying Local Thickness of Martian Permafrost

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A previous model of hydrothermal convection in the Martian subsurface (Travis, Rosenberg & Cuzzi, JGR-Planets, in press) indicates that background geothermal heat flux should lead to substantial thinning of the permafrost layer above upwelling convection plumes. That model assumes pure water properties. However, subsurface liquid water is likely to have significant salt content. Salts generally depress the freezing point; e.g., a high salt (NaCl) content can depress water's freezing point by about 20 $^{\circ}$C. Further, brine is denser than pure water. These two properties may modify the nature of the predicted hydrothermal circulation, in particular, the amount of thinning of permafrost above upwelling plumes. Two and three dimensional simulations comparing pure water and brine circulation patterns will be presented.

P12A-0359 1330h POSTER

Evaluation of Melting Process of the Permafrost on Mars: Its Implication for Surface Features

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For supplying massive liquid water to the outflow channels, igneous melting of the permafrost layer could have played a significant role. We numerically simulate the melting process of the permafrost layer induced by magmatic intrusion. The point of our simulation is incorporation of thermal convection in porous media, which has not been modeled well in previous studies of the melting of the permafrost. Our results show that convection in the molten zone causes drastic change in heat transfer, which results in focussing in the growth of the melt region and enhancement of water generation. The resulting melt zone extends vertically up just next to the surface, like a plume with a single column (mushroom structure). The volume of molten water is considerably more than that expected in the conduction case. These characteristics suggest that a substantial amount of water should exist very near to the surface. We consider compaction should have occurred and segregated liquid water would erupt to the ground to form the fluvial features. The event would certainly accompany surface destruction, which we can see as chaotic terrains. We propose a consistent scenario of forming surface features around the outflow channels. We compare the above mentioned model with the martian morphology utilizing the MOLA (Mars Orbiter Laser Altimeter) data. We also discuss the process of forming closed depressions of various scales such as chasma and pit as well as chaos, being based on the observational data.

P12A-0360 1330h POSTER

Probing for Groundwater in the Northern Lowlands of Mars

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Current theory on the martian hydrological cycle suggests liquid groundwater may exist beneath a confining cryosphere to depths of $>$ 10 km [Clifford, S.M., 1993, J. Geophys. Res., 98, 10973]. This framework allows geologic tests of the subsurface hydrosphere to be made based on the concept that cryosphere disruption by geologic processes should enable groundwater under hydrostatic pressure to flow to the surface. Lyot crater (215 km diameter) in the northern lowlands is large enough to have physically and thermally breached the local cryosphere in a region where low planetary elevation implies hydrostatic pressure head should be greatest. Lack of evidence of hydrologic activity at Lyot suggests one or more of the following: 1) no groundwater is present beneath the cryosphere, 2) the pore space available to water is frozen all the way through ($>$ 10 km), 3) the upper crust is not well interconnected, 4) refreezing rates are fast enough to "reseal" the cryosphere before flow to the surface occurs, 5) impacts are not effective at disrupting the cryosphere and/or providing groundwater access to the surface. Subsequent similar investigation of the ten next-largest craters ($>$ 45 km diameter) in the northern lowlands reveals that results and implications gathered at Lyot are not due to a local anomaly but reflect conditions over $\sim$ 20 % of the planet. Two possible exceptions are filled craters at 70 degrees N which may have been filled by 1) impact-release and freezing of groundwater, or 2) deposition of volatiles in crater cold-traps, similar to processes acting in the nearby north polar cap. While the latter is suggested by correlation of filled craters with latitude in our sample, we have undertaken further modeling to distinguish between these two processes.

P12A-0361 1330h POSTER

High-Latitude Ice-Rich Mantle on Mars: Morphology, Morphometry, and Stratigraphy

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The latitudinal trend of the statistical characteristics of subkilometer-scale topography of martian surface (Kreslavsky and Head, J. Geophys. Res., 105, 26695-26711, 2000) has been interpreted as a manifestation of a high-latitude mantle of ice-cemented dust (Kreslavsky and Head, Geophys. Res. Lett., 10.1029/2002GL015392, 2002). This mantle is probably responsible for the high concentration of water ice (Tokar et al., Geophys. Res. Lett., in press, 2002; also Tokar et al, this conference) found recently in the shallow subsurface of high-latitude regions (Boynton et al., Science, 297, 81-85, 2002). We report on our new study of the statistical characteristics of subkilometer-scale topography of the mantled regions from MGS MOLA along-track altimetry data and a survey of morphology, stratigraphy and decameter-scale surface textures from the high-resolution MGS MOC images. Mantled high-latitude areas are characterized by: lower hectometer-scale roughness in comparison to geologically similar unmantled terrains; higher Hurst exponent, which means weaker increase of roughness with decrease of scale; and higher positive median curvature, which means strong prevalence of concave topographic profiles. These characteristics are consistent with preferential emplacement of the mantle in local hectometer- and kilometer-scale lows. Morphological observations with high-resolution images confirm that this is the case. Quantitative modeling of topography gives 1 - 2 m for a lower boundary for the mantle thickness; morphological observations indicate a thicker mantle in many locations. Morphological observations also point to a gradual decrease of the mantle thickness toward the low-latitude margins. In the northern plains the mantle has very typical meter- or decameter-scale patterns that shows local variations moderated by kilometer-scale topography and global variations moderated by latitude and absolute elevation. The mantle has a complex stratigraphy. The uppermost layer of the mantle is the most recent deposit in a large area of the northern plains. This layer is mostly contiguous at higher northern latitudes and disrupted only by very rare small impact and collapse features. In the circumpolar regions, dark dunes and bright ripples overlay this layer.

P12A-0362 1330h POSTER

Slope Gullies on Devon Island, Canadian Arctic: Possible Analogs for Gullies on Mars and Evidence for Recent Transient Environmental Change on Mars.

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The origin and evolution of the relatively youthful slope gully features on Mars first reported by Malin and Edgett (2000) remain enigmatic. Two prevailing hypotheses concerning their formation involve the discharge of subsurface H_2O at the gully sites: groundwater seepage (1) and/or the melting of ground-ice (2, 3). In the course of geologic field investigations on Devon Island, Canadian Arctic, we have identified morphologic and contextual analogs for the martian gullies that result from a radically different mechanism of formation (4). The gullies on Devon result mainly from the episodic melting of transient surface snow and ice deposits, with little contribution from subsurface H_2O reservoirs. Timescales for gully formation on Devon Island are 10^4 years (5). The gullies on Devon suggest that the formation of gully features on Mars might not necessarily have involved discharges of subsurface H_2O at the gully sites. Instead, gullies on Mars might be the result of transient surface snow and ice melting, which in turn might be the result of short-term changes in regional surface environmental conditions (on time-scales of 10^5-10^8 years?) possibly in association with high obliquity-induced climate change (6, 7) and/or volcanic activity. Acknowledgements: This research was conducted under the auspices of the NASA Haughton-Mars Project (HMP) with support from NASA and the National Geographic Society. References: (1) Malin, M. C. and K. S. Edgett 2000. Science 288, 2330-2335. (2) Mellon, M. T. and R. J. Phillips 2001. J. Geophys. Res. 106, 23165-23179. (3) Costard, F. et al. 2002. Science 295, 110-112. (4) Lee, P. et al. 2001. LPSC. XXXII, Houston, TX, Mar 12-16, 2001. (5) Lee, P, et al. 2002. LPSC XXXIII, Houston, TX, Mar 11-15, 2002. (6) Ward, W. R. (1973) Science 181, 260-262. (7) Touma, J. and J. Wisdom (1993) Science 259, 1294-1296.

URL: http://www.marsonearth.org

P12A-0363 1330h POSTER

Active Hydrogeomorphic Processes and the Formation of Dark Slope Streaks on Mars

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Mars Orbital Camera images reveal concentrations of dark slope streaks non-uniformly distributed within the equatorial region of Mars, where Late Hesperian and younger magmatic, tectonic, and fluvial activity often dominate the geologic record. Although originally ascribed to wet debris flows, all of the hypotheses published in the last ∼18 years have focused on these features being solely the result of eolian or dry mass-wasting processes, excluding a role for water. In light of (1) the information provided from the Mars Global Surveyor (i.e., high-resolution imagery and topography), (2) the correlation of dark slope streak concentrations to specific geologic environments and histories portrayed in published research, and (3) geomorphic and hydrologic considerations, we hypothesize that eolian or dry mass-wasting and aqueous processes represent endpoints on a continuum of progenitors for the formation of dark slope streaks. In our hypothesis, the hydrogeomorphic features result from artesian spring discharge, hypersaline aquifers, or any combination thereof. Due to observations of dark slope streak features appearing on annual and decadal time scales, and their inferred fading over time, a spring discharge origin for the formation of the dark slope streaks has profound implications. Specifically, that Mars has limited, but currently active, hydrogeomorphic processes acting on its surface. Although the Mars Odysseys Gamma Ray Spectrometer lacks the resolution to detect these features, its discovery of large amounts of near-surface ice provides further support for our hypothesis.

P12A-0364 1330h POSTER

Currently Forming Martian Slope Streaks

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Explaining the formation of slope streaks is an attractive goal because this feature is one of very few examples on Mars that presently exhibit dynamical changes. Among all high-resolution Mars Orbiter Camera images released to date, there are about 90 sites that contain slope streaks and have been imaged more than once. They reveal, in total, about 40 newly formed streaks. Such overlap images can be used to determine the rate and timing of creation of new streaks. The data suggest that the streak population is in a statistical steady state with the martian environment, further constraining the fading rates. Streak formation times can be compared with changes in surface temperature and hydrogen distribution.

P12A-0365 1330h POSTER

Low-Gradient Debris Slopes and Implications for Water-Driven Sediment Transport Processes on Mars

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Topographic profiles of kilometer-scale debris slopes on Mars have weak upward concavity and mean slopes of $\sim 20^\circ$, well below the angle of repose. The debris slope gradients do not appear to vary systematically with aspect, latitude, presence or absence of the recently discovered gullies, or geologic context. Terrestrial debris slopes formed by dry rockfall are steeper than 20° and have straight profiles, but other sediment transport processes can produce concave slopes with comparably low gradients. Successive mass flows and gravitational creep are both known to produce concave debris slopes. Overlapping, lobate deposits, which are commonly observed on terrestrial slopes shaped by mass flows, are not visible on ungullied Martian slopes at the resolution of Mars Orbiter Camera (MOC) images ($\geq$1.4 m/pixel). The disturbance process most likely to cause gravitational creep on Mars is repeated freezing and sublimation of near-surface ground ice. Features resembling tensional cracks on some slopes suggest downslope movement of partially frozen debris, and surveys of both Viking [1] and MOC [2] images have identified a variety of landforms associated with cyclic freezing and thawing of ground ice on Earth. Furthermore, Mars Odyssey results [3] suggest that water ice is abundant at high Martian latitudes and that the volume fraction of ice may exceed the porosity of the regolith, a condition amenable to ice-driven creep.

Numerical simulations of debris slope development demonstrate that gravitational creep can reproduce the morphology of Martian slopes. Estimates of bedrock erosion rates on Mars and a model fit to a mean Martian debris slope profile suggest a time scale of debris slope development between 20 Myr and 2 Gyr. This range is consistent with estimated rates of ice-driven creep. The near absence of impact craters on the surveyed slopes implies recent resurfacing by emplacement of new material or reworking of existing material. Thus, the low-gradient debris slopes on Mars seem to be evidence of an extended period of Amazonian geomorphic activity involving water that has only recently been punctuated by the formation of gullies.

[1] Squyres, S.W., M.H. Carr, *Science* **231**, 249-252 (1986).
[2] Seibert, N.M., J.S. Kargel, *Geophys. Res. Lett.* **28**, 899-902 (2001).
[3] Boynton, W.V., W. C. Feldman, S. W. Squyres et al., *Science* **297**, 81-85 (2002).

P12A-0366 1330h POSTER

Cerberus Fossae and Athabasca Valles: Dike Formation, Cryosphere Cracking and Aqueous Flooding

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Recently Burr et al. (Recent aqueous floods from the Cerberus Fossae, Mars. GRL 29, 13-1 to 13-4, 2002, 0094-8276, 2001GL013345) described the Athabasca Valles channel system as being produced by a water flood and identified the source as segments of the Cerberus Fossae system, graben-like fractures trending ∼SE-NW in Elysium. We have examined the source areas in detail and also investigated the large-scale structure of the Cerberus Fossae. We infer that the fossae are produced by lateral injection of ∼200 m wide dikes radiating from Elysium. Stresses due to dike injection fractured the overlying cryosphere and water escaped from an underlying pressurized aquifer by travelling up the resulting fracture. Topography in the source area suggests that water was mainly released from a pair of fractures roughly aligned along strike and totalling ∼20 km in length. We estimate that the water formed a ∼100 m high linear fountain over its fissure vent, causing it to flow uphill for ∼6 km against a ∼0.1 degree regional slope before spreading sideways and back downhill around the ends of the active fractures, eroding a ∼50 m deep, ∼10-20 km wide, ∼30 km long depression in the process. Analysis of the dynamics suggests that the total water volume flux estimated by Burr et al., ∼1-2 million cubic meters per second, could be consistent with the eroded zone if the fracture releasing the water was ∼3 m wide with water flowing up it at ∼30 m/s. Feeding this water release, however, even invoking the most favorable aquifer geometry and a pressure gradient driven by a topographic water head involving the ∼800-km distant Elysium Mons edifice, requires the aquifer to be remarkably permeable. In any case, it seems likely that some of the presently observed post-flood depth of the fossae is due to collapse and water erosion aided by melting of cryosphere ice by magmatic heat, in some places revealing the top of the underlying dike.

P12A-0367 1330h POSTER

HUMIDITY TRANSMITTER FOR MARTIAN ENVIRONMENT, CONSTRUCTION AND PERFORMANCE ASSESSMENT

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Humicap is a miniatyre capasitic thin film polymer sensor for sensing relative humidity build in quantities for atmospheric sounding balloon applications by Vaisala inc. These sensors have been selected for the Atmospherical and Meteorological Instrument System (ATMIS) onboard NetLander mission to Mars. The four landers are to be deployed to areas in both Martian hemispheres in tropics to low mid-latitudes, launch 2007 and operations on Mars through 2008...2010.

Digihum is a complete Humicap sensor head including electrical transducer circuitry and quasi-digital interface making connection to digital microcontroller simple and easy. The Digihum will be exposed to raw martian environment with temperature range from min 150 K to max 290 K. Digihum is expected to produce humidity measurements down to 200 K temperatures. Qualification and calibration of the Digihum devices will be performed both in ambient atmosperic pressure humidity chambers as well as low pressure CO2 environments.

In situ humidity measurements provided by Digihum will be part of ATMIS measurement campaign through a full Martian year. The main operational objective of this meteorological experiment is to provide a regular time series of the meteorological parameters as well as accelerated measurement campaigns. Such a data set would substantially improve our understanding of the atmospheric structure, dynamics, climatological cycles, atmosphere-surface interactions, the cycles of CO2 and H20 and the role of water in current Martian atmosphere.

P12A-0368 1330h POSTER

The Naiades: A Mars Scout Proposal for Electromagnetic and Seismic Groundwater Exploration

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Detection of subsurface, liquid water is an overarching objective of the Mars Exploration Program (MEP) because of its impacts on life, climate, geology, and preparation for human exploration. Although planned orbital radars seek to map subsurface water, methods with more robust depth-penetration, discrimination, and characterization capabilities are necessary to "ground truth" any results from such radars. Low-frequency electromagnetic (EM) methods exploit induction rather than wave propagation and are sensitive to electrical conductivity rather than dielectric constant. Groundwater on Mars will likely be saline and therefore will present a near-ideal EM target, especially beneath very dry overburden.

The Naiades Mars Scout - named for the Greek mythological nymphs of springs, rivers, lakes, and fountains - comprise twin Landers directed to a high-priority region for groundwater investigation. Broadband measurements of natural EM fields will be used for passive magnetotelluric, wave-tilt, and geomagnetic-depth soundings. Active, time-domain electromagnetic (TDEM) soundings will supplement natural sources (lightning?) above 1 Hz. The two Landers are positioned within several tens of kilometers of each other so that remote references can improve natural-source data quality; useful results can, however, be acquired by a single Lander. The expected depth of exploration of the TDEM is several hundred meters or more, sufficient to determine whether putative groundwater near "gullies" is still extant. Low-frequency natural signals from the solar wind, ionosphere, and possibly crustal magnetospheres will enable passive soundings to 10 km or greater, sufficient to detect and characterize deep, stable groundwater.

Additional mission objectives include detection of ground ice, characterization of natural EM fields, measurement of electrical properties of the atmosphere, dust, soil, and interior, constraints on planetary heat flow (from the thickness of the cryosphere), measurement of crustal magnetism, characterization of seismicity, seismic imaging of the interior, and assessment of

landing-site geomorphology. A short-period seismometer and a wide-angle camera complete the payload to achieve these objectives.

The Naiades mission strongly resonates with the main "Follow the Water" theme of the MEP, but in ways that are not currently within the scope of the MEP or that of NASA's international partners. The combination of established terrestrial methods for groundwater exploration, robust flight systems, and cost effectiveness proposed for the Naiades is a relatively low-risk approach to answering key questions about water on Mars within the Scout framework.

P12A-0369 1330h POSTER

Mars CryoScout: Subsurface Exploration of the North Polar Cap

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The well documented layering of the Mars PLDs suggests that the polar caps, and the north polar cap in particular, are repositories of a climate archive that possibly spans many millions of years. Far more accessible, terrestrial ice sheets have been studied by coring to retrieve the pristine record of past chemical and physical properties, and to evaluate modification induced by time and stresses within the ice. On Mars' north polar cap, thermal probes are feasible and can provide a means, analogous to coring, of making subsurface observations. To explore the dominant climate cycles, it is postulated that tens of meters of depth, corresponding to the vertical separation of the major "MOC" layers, should be explored. Optical and spectroscopic analyses of the layers, which are presumably demarcated by embedded dust, contributes to the reconstruction of a timeline. Meltwater analysis is a convenient way to determine the soluble chemistry of that embedded dust, and to monitor gradients of the isotopic ratios of hydrogen and oxygen that reflect atmospheric conditions at the time the layer was deposited. As on Earth, local thermal measurements can be used to determine bulk mechanical properties of the cap, as well as estimating the geothermal gradient. A proposed mission that performs these observations will be described.

P12B MCC: Hall D Monday 1330h

New Results From Mars Odyssey II Posters *(joint with C, G)*

Presiding: **A McEwen,** University of Arizona**; A B Ivanov,** Jet Propulsion Laboratory

P12B-0370 1330h POSTER

Thermophysical and Morphologic Unit Mapping of Gusev Crater Using THEMIS Infrared and Visible Imaging

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Gusev Crater (160 km diameter) is hypothesized to have been a lacustrine depocenter, making it a prime landing site candidate for Mars Exploration Rover (MER) missions. Primary flow and sediment transport originated from Ma'adim Vallis, a large channel that debouches into Gusev, with outflow through the NW crater rim. Interior units of Gusev have been interpreted as deposits from fluvial resurfacing during the Noachian, Hesperian, and early Amazonian periods. Previous crater counting work suggests that the Gusev-Ma'adim hydrologic system was active from 0.7-2 Ga. Geomorphic and topographic features in Gusev and Ma'adim Vallis are critical to the hypothesis that water emptied and ponded periodically in the basin. MOLA topography indicates Gusev's floor <2500 m below the adjacent highlands. Some interpretations of Viking imagery suggest shoreline terraces, dissected deltaic deposits, and sedimentary structures consistent with deposition in an ice-covered lake. Higher-resolution MOC images, however, reveal no obvious lacustrine features. Mars Odyssey's Thermal Emission Imaging System (THEMIS) provides visible (18 m/pixel) imagery, and when compared to Viking and MGS-MOC data, shows low-albedo material being re-distributed over the last 25 years. Visible imagery also reveals multiple (4+) wind directions. THEMIS visible and thermal infrared (100 m/pixel) data were also used to delineate 8 units based on thermophysical and morphologic properties. Thermophysical units were qualitatively characterized by albedo and daytime-nighttime IR determined temperature differences. Morphologic units were characterized by topography, crater densities, erosional features, lineations, etc. Six of the 8 units lie within the MER landing ellipse. Use of both THEMIS and MGS-MOLA data allows a stratigraphic sequence to be inferred; however, uniquely lacustrine features have not been identified. Comparisons with previous photogeologic maps of Gusev show some discrepancies between mapped units, which may relate to lithologic characteristics only observable in thermal emission data at high spatial resolution.

P12B-0371 1330h POSTER

THEMIS Spectral Mapping of Melas Chasma, Mars

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The Melas Chasma trough, in the central complex of Vallis Marineris, provides an ideal site for testing a preliminary approach of deriving surface emissivity from the thermal infrared data produced by the Thermal Emission Imaging System (THEMIS) on the Mars Odyssey spacecraft. Melas Chasma exhibits layered deposits, regional collapse deposits descending from amphitheatres in the walls of the canyon, and various aeolian features. This variety of morphologic features indicates a complex geologic history and a likelihood of compositional heterogeneity in the deposits. The Thermal Emission Spectrometer (TES) on Mars Global Surveyor (MGS) reveals some of the expected spectral variability in this region. However, the 3 km x 6 km pixel resolution of the instrument makes it difficult to associate these variations with geomorphic units visible in the MGS Mars Orbiter Camera (MOC) images or in the THEMIS temperature images. The 100 m pixel size of the THEMIS infrared bands should provide the spatial resolution to associate spectral variability with geomorphology and provide insight into the geologic history of this site.

THEMIS data is processed to produce calibrated radiance using the most current calibration model. Camera reflections and other image artifacts are removed or minimized in this process. Geometric corrections of the data are applied to co-register the bands and allow for accurate spectral analysis. Emissivity is produced through a Temperature/Emissivity Separation algorithm. An empirical atmospheric correction using TES derived surface emissivity is used as a proxy for the radiative transfer model atmospheric correction that is not yet available for THEMIS data analysis. Spectral maps are produced from the resulting THEMIS data and the spectral characteristics compared with atmospherically corrected TES and the uncorrected THEMIS data to assess the accuracy of this technique. Evaluation of the nature and composition of these deposits from spectral analysis will follow after a thorough assessment of the accuracy of our emissivity data and atmospheric corrections.

P12B-0372 1330h POSTER

Using THEMIS Visible and Infrared Data for Crater Population Studies of Mars

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Aboard the currently orbiting Mars Odyssey spacecraft is the Thermal Emission Imaging Spectrometer (THEMIS) that acquires both visible (VIS) and thermal (IR) wavelength images of the surface. The visible images can be used to conduct crater population studies as is traditional with visible photographic planetary data. However, this study shows that infrared images also may be utilized successfully for crater population studies. THEMIS collects both daytime (VIS and IR) and nighttime (IR only) data, but the nighttime data are less useful for the crater counting analyses than are either daytime data set because counts using the nighttime images are routinely underestimating the number of craters present. For this study, the THEMIS data were utilized to study the Sinus Meridiani landing site crater population.

P12B-0373 1330h POSTER

THEMIS Observations and TES Surface Compositions of Low-Albedo Intracrater Materials and Wind Streaks in Western Arabia Terra

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High-resolution thermal infrared images (100m/pixel) from the Mars Odyssey Thermal Emission Imaging System (THEMIS) are used for thermophysical analyses of low-albedo intracrater materials and wind streaks in Western Arabia Terra and comparisons with Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES) derived surface compositions.

Atmospherically corrected thermal emissivity data from TES have been used to identify two global-scale spectral surface units. The Surface Type 1 end-member is interpreted as largely unweathered basalt while the Surface Type 2 end-member has been interpreted as andesite and/or partly weathered basalt. Deconvolved TES spectra of low-albedo intracrater materials reveal both Surface Type 1 and 2 compositions within individual craters. Surface Type 1 compositions form a central core in dark features on crater floors while Surface Type 2 compositions form a surrounding arc on the dark downwind sides of crater walls. The transition between these compositions appears to occur near the floor-wall interface and is correlated with a transition from high-thermal inertia dune materials to low thermal inertia dune-free materials. Surface Type 1 and 2 compositions are also observed in adjacent low albedo wind streaks; however, a mixing trend is not as evident as within the impact craters.

THEMIS day/IR observations of low-albedo intracrater materials appear to show relatively lower average temperatures for Surface Type 1 compared to Surface Type 2 while THEMIS night/IR observations appear to reveal higher average temperatures for Surface Type 1 compared to Surface Type 2. There does not appear to be a discernable temperature trend for surface materials in adjacent low-albedo wind streaks.

Temperature variations observed in THEMIS images can be produced by a combination of topographic (solar heating) and thermophysical (thermal inertia and albedo) effects; however, combining multiple datasets can minimize uncertainties. The transition from Surface Type 1 to Surface Type 2 intracrater materials is interpreted to reflect decreasing particle sizes controlled by mineralogic differences between an unweathered basalt component and an andesite/altered basalt component. Relatively coarse dune materials are cool (dark) during the day while finer dune-free materials are warmer (bright). Intracrater floor materials are interpreted as eolian sediment blown into craters while wall materials are interpreted as either eolian sediment sorted by particle size, or eroded material from in-place crater wall lithologies.

P12C MCC: 131 Monday 1330h

Outer Planet Satellite Interiors II *(joint with GP, T, V)*

Presiding: **W B McKinnon,** Washington University**; T Spohn,** Westflische Wilhelms-Universitt

P12C-01 1330h INVITED

Inside Jupiter's Galilean Satellites: Uncertainties Abound

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