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New imagery data from the Mars Observer Camera suggest that the equatorial canyon of Valles Marineris contained surface and ground ice relatively late in Martian history. Some troughs (or chasmata) of Valles Marineris contain large mounds and mesas of interior layered deposits (ILDs) that formed in the Late Hesperian to Early Amazonian. Although the origin of the ILDs remains controversial, their characteristics suggest that the strongest hypotheses origin are lacustrine or volcanic processes; some workers have suggested a compromise origin, noting that many MOC observations of ILDs are similar to those of terrestrial subice volcanoes that erupt in meltwater lakes. Lacustrine deposition and sub-ice volcanism require that chamata water or ice would have had to remain stable on the surface long enough to form either (1) extremely thick (1 km to > 4 km) deposits of fine-grained suspended lacustrine materials or (2) numerous sub-ice volcanic edifices with heights that compare to those of Hawaiian oceanic volcanoes. However, a dust cover on top of ice or an ice-covered lake could aid in preventing rapid sublimation. If the ILDs are sub-ice volcanoes than new MOLA topographic data can be used to (1) measure the heights of their subaerial caprock and (2) estimate corresponding volumes of ice. For example, the largest ILD mound in the 113,275 km3 void of Juventae Chasma resembles a capped sub-ice volcanic ridge. The mound is about 2 km high; with the highest point of the cap reaching an elevation of about +80 m. GIS measurement indicate that the maximum volume of ice below the elevation of +80 m is 56,423 km3, so roughly half of the Chasma could have been filled with ice. If the ILDs are lacustrine, then the heights of some other mounds that rival the surrounding plateau elevation would have required a volume of water almost equal to their enclosing chasma. Later in the Amazonian, after sublimation of any putative surface water or ice, MOC imagery attests to ground ice within some ILD mounds. Theatre-headed gullies cut into the flanks of mounds in Hebes, Juventae, Gangis, and Ophir Chasmata. At the MOC scale these gullies display no impact craters and could therefore be extremely young. Finally, one new image attests to possibly recent ground ice within floor material of Juventae Chasma. At the MOC scale, surfaces within this chasma have few impact craters, indicating a very young surface age. MOC image M0804669 shows some interesting geologic/geomorphic relations that occur within the chasma. For instance, on the south side of a chaotic knob, a talus deposit with a flat, possible pediment cap has been cut by late-stage erosion from wind, water, or ice. This relation indicates that relatively steady, talus-forming erosion was interrupted by a period of downcutting that incised the talus and caprock. On the north part of image M08-04669, an impact crater rim and its ejecta blanket are pitted with irregularly shaped depressions that appear similar to terrestrial thermokarst pits found in active glaciated and periglacial terrain due to the meltout of buried ice. The south end of this same image shows possible brittle fracture of channel-confined, dune-covered material. The possible thermokarst pits and brittle fractures may indicate melting of late-stage ground ice. Valles Marineris is a possible volcano-tectonic graben or collapse structure. Dark material within the chasma has been suggested to be very young volcanic material and MOC data appears to show several associated possible volcanic vents. Perhaps late-stage to recent volcanism drove water into the chasma, changed the local atmospheric circulation to create a unique microclimate, and issued forth a fine-grain, protective dust cover of dark ash.

P32C-07 1730h INVITED

Tropical Cold-Based Mountain Glaciers on Mars: Evidence for Significant Amazonian Climate Change

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Surface environmental conditions on Mars are presently extremely cold and hyper-arid, most equivalent to polar deserts on Earth. Coupling newly acquired Mars MOLA, THEMIS and MOC data with field-based observations regarding the flow, surface morphology, and depositional history of polar glaciers in Antarctica, we show that the multiple facies of extensive fan-shaped deposits on the western flanks of the Tharsis Montes and Olympus Mons, Tharsis Rise, are consistent with deposition from cold-based mountain glaciers. An outer ridged facies that consists of multiple laterally extensive, arcuate and parallel ridges, resting without disturbance on both well-preserved lava flows and impact craters, is interpreted as drop moraines formed at the margin of an ablating and predominantly receding cold-based glacier. Inward of the ridges lies a knobby facies that consists of irregular and closely spaced equidimensional knobs, each up to several kilometers in diameter; this facies is interpreted as a sublimation till derived from *in situ* downwasting of sediment-rich glacier ice. A third facies comprising distinctive convex outward lobes with concentric parallel ridges and aspect ratios elongated downslope likely represents rock-glacier deposits, some of which may still be underlain by a core of glacier ice, particularly at Olympus Mons. Taken together, these surficial deposits show that the western flanks of these volcanoes were occupied by extensive mountain glacial systems accumulating on, and emerging from, the slopes of the volcano in the case of the Tharsis Montes, or at the basal scarp in the case of Olympus Mons, and spreading downslope to form piedmont-like fans. These deposits occur in equatorial and near-equatorial regions where surface water ice is not currently stable. The presence of the tropical mountain glacier deposits suggests that several phases of late Amazonian-aged glaciation occurred in the equatorial Tharsis region. Recent climate models suggest that at obliquities approaching 45 degrees and greater, water ice is stable in tropical regions. Thus, these tropical mountain glaciers may record periods of unusually high obliquity in the recent history of Mars.

P32C-08 1745h

Did Glaciers Exist Recently on the Tharsis Montes?

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Previous studies have documented the presence of ridged features on the NW flanks of the Martian volcanoes Arsia, Pavonis, Ascraeus and Olympus Montes. Several hypotheses modes of formation for these features have been proposed, including an origin attributed to glacial activity. We examine the areographic distribution and relative age of the ridges using MOLA topography, THEMIS IR and VIS images and MOC images to assess their spatial and temporal relationships on the four volcanoes. The majority of the ridged facies have an aspect facing between 270° and 360°. The lowest elevation reached by the distal ridge on each volcano varies between -2,100 m below Mars datum on Olympus Mons and 3,000 m above datum on Pavonis Mons. The highest elevations also exhibit a wide range, from -1,686 m for Olympus Mons, to 1,970 m (Ascraeus Mons), 4,385 m (Pavonis Mons) and 5,496 m (Arsia Mons). MOLA topography and THEMIS images of Arsia Mons and Ascraeus Mons reveal different morphologies at the same elevation and aspect on each volcano, something that is not expected if the ridges resulted from a regional climate effect. At $\sim$5,000 m above datum, there is a distinct distal ridge on Arsia Mons, whereas the flank of Ascraeus Mons is dissected by large pits and pit chains and lacking any obvious ridges. Preliminary crater counts using MOC images indicate that the ridged facies on Arsia Mons may be significantly younger than the ridged facies on Ascraeus Mons, with Pavonis Mons falling between. In all cases, the ridged lobes have some superposed impact craters, indicating that these are not extremely young. These results suggest that a purely glacial origin for the ridges on the Tharsis Montes and Olympus Mons needs to be reexamined. Objections have been raised in the literature about a conventional rapidly emplaced flow origin for the ridges because the observed periodicity and regularity is not typically associated with turbulence. However, one of the alternative mechanisms we are investigating is the rapid release of sediment-laden water. It appears possible that the ridges formed as deposits from "roll-waves" that naturally occur in high flow rate debris flows, sediment-laden floods, and long run-out fluid flows.

P41A MCC: Level 1 Thursday 0830h

Faulting and Fault-Related Processes on Planetary Surfaces II Posters *(joint with T)*

Presiding: **P H Figueredo,** Arizona State University**; D A Young,** University of Minnesota at Duluth

P41A-0391 0830h POSTER

Processes of Planetary Faulting Revealed Through High-Resolution Topography

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Faulting generates clear topographic signals at the planetary surface that can be related to the style and geometry of the faults at depth. The displacement distribution along a fault (its offset at the surface) reveals the strength of rock adjacent to the fault's tipline, the deformability of the surroundings, mechanical interaction and incipient linkage with nearby faults, and the presence of mechanically significant subsurface layers. DEMs that portray the amplitude and position of surface topography (uplift and subsidence) due to fault slip can be inverted for depth of faulting, which for sufficiently large faults is related to the stability of frictional sliding and thereby to the paleogeothermal gradient at the time of faulting. Knowledge of the 3-D fault geometry of faults in a region is then easily converted into the magnitude and direction of brittle strain accommodated by the fault population. Displacement-length scaling relations contain information on fault interaction, subsurface stratification, and variations between planets. Examples from Mars illustrate the power and utility of topography as a tool in planetary structure and tectonics.

P41A-0392 0830h POSTER

Balanced crustal cross sections across wrinkle ridges on Solis Planum, Mars, from MOLA topography

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Models based on MOLA (Mars Orbiter Laser Altimeter) topographic data and Earth analogs indicate that wrinkle ridges are the surface expressions of folds that overlie blind thrust faults that collectively accommodate low bulk strains in comparison to terrestrial fold and thrust belts. Previous work based on elevation offsets across ridges and their backlimb geometry suggest blind thrusts on Solis Planum penetrate deeply into the Martian crust. As a continuation of this work, we undertook axial surface mapping and forward and inverse modeling of wrinkle ridge on Solis Planum using topographic data from MOLA in order to better constrain fault geometry and the depth at which thrust faults flatten. First and second derivative slope maps constructed along transects perpendicular to ridges on Solis Planum suggest wrinkle ridges there are defined by very gently curved (concave upward) and wide (10 km) backlimbs. We interpret these backlimbs as forming by uplift above listric blind thrusts that steepen towards the surface. Our maps also indicate that sharp bends are not present in backlimbs, suggesting that sharp bends in underlying thrusts are not present. The along-strike geometry of forelimbs of these ridges are interpreted as the surface expression of fault-propagation folds. Topographic profiles perpendicular to the strike of folds on Solis Planum yielded raw profiles, linearly detrended with respect to regional slope, and first and second derivative slopes were calculated. These topographic profiles and estimates for crustal thickness are then input into forward and inverse models in order to constrain the optimal depth to detachment and fault curvature for blind thrusts in Solis Planum.

P41A-0393 0830h POSTER

Did Tharsis have a detached cap? Insight gained from global thrust fault vergence frequencies.

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Current geophysical models of the mechanical structure of Tharsis can be delineated by the proposed strength of the base of the volcanic pile, at its interface with the Noachian crust. The 'welded base' class of models suggests that the base of the volcanic pile is brittle and effectively welded to the Noachian crust [e.g. *Solomon and Head,* 1982; *Phillips et al.,* 2001]. Alternatively, a 'detached cap' model proposes that much of the base of Tharsis was ductile and slippery [e.g. *Banerdt and Golombek,* 1990; *Tanaka et al.,* 1991]. In this abstract, we compare predicted thrust fault vergence frequencies for each class of models against a global set of MOLA-based thrust fault vergence frequencies. Determination of thrust fault vergence from topography is now possible (e.g. *Okubo et al.,* 2001, 2002 fall AGU). Within a thrust fault-related fold (i.e. a wrinkle ridge or lobate scarp), the thrust verges from the shallowest sloping fold limb toward the steepest sloping fold limb. Using this relation, we extract thrust fault vergence directions along 36 evenly spaced topographic profiles constructed in 10° intervals radial to Tharsis. These topographic profiles are based on the MOLA Mission Experiment Gridded Data Records at 128 pixel/degree (∼455 m/pixel at the equator) resolution. Our results show that the percentage of thrusts that verge away from Tharsis (47.5% - 48.8%) is subequal with the percentage of thrusts that verge toward Tharsis for thrusts within 9000 km, 6000 km, and 4500 km of Tharsis. Based on mechanical analyses of a brittlely deforming plate [*Davis and Engelder,* 1985; *Montési and Zuber,* 2003], we infer that welded base models would produce sub-equal thrust fault vergence frequencies on all parts of Tharsis and in the surrounding Noachian crust. By comparison, in the detached cap model, if the base of the Tharsis load were sufficiently hot and weak in shear, we would predict subequal vergence frequencies above the central, ductile part of the base. This area would then be ringed by an annulus of outward-verging thrusts near the edge of the Tharsis load, where basal ductility decreases toward the colder, brittle periphery, causing shearing. Alternatively, if the base of the detached cap was stronger but still ductile, then we would again predict the formation of thrust faults that consistently verge away from the center of Tharsis but in a much larger annulus. In both detached cap scenarios, we would also predict sub-equal thrust fault vergence frequencies within the surrounding Noachian crust. Neither of the 'bull's eye' patterns of thrust fault vergence frequencies predicted for the detached cap model is observed in our profile results. Instead, we find that our observations of sub-equal thrust fault vergence frequencies support the welded base class of Tharsis models. Therefore, at the time when the thrust-related folds were forming (e.g. late Noachian to early Hesperian), lateral spreading of Tharsis would have occurred independent of regional shearing along mid-lithospheric ductile horizons. If shearing did occur along a detached Tharsis base, this process would have had to take place before the formation of the thrust-related folds (and evidence of this event would be buried by subsequent Tharsis volcanics). Further, episodes of widespread Tharsis-radial graben formation, which are contemporaneous with or post date thrust fold formation, must have also occurred in the absence of mid-lithospheric shear zones due either to a detached Tharsis base, or to shallow volatile-rich layers (e.g. *Okubo and Schultz,* in review, *GSA Bulletin*).

P41A-0394 0830h POSTER

Structural Origins of Martian Pit Chains

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Pit craters are circular to elliptical depressions found in alignments (chains), which in many cases coalesce into linear troughs, and are common on the surface of Mars. Pit craters lack an elevated rim, ejecta deposits, or lava flows that are associated with impact craters or calderas. It is generally agreed that these features are formed by collapse into a subsurface cavity. Hypotheses regarding the formation of pit crater chains require development of a substantial subsurface void to accommodate collapse of the overlying sediments. Suggested mechanisms of formation include: collapsed lava tubes, dike swarms, collapsed magma chamber, karst dissolution, fissuring beneath loose material, and dilational faulting. The research described here is intended to constrain current interpretations of pit crater chain formation by analyzing their distribution and morphology. The western hemisphere of Mars was systematically mapped using Mars Orbiter Camera (MOC) images to generate ArcView Geographic Information System (GIS) coverages. All visible pit crater chains were mapped, including their orientations and associations with other structures. We found that pit chains commonly occur in areas that show regional extension or local fissuring. There is a strong correlation between pit chains and fault-bounded grabens. Frequently, there are transitions along strike from (i) visible faulting to (ii) faults and pits to (iii) pits alone. We performed a detailed quantitative analysis of pit crater morphology using MOC narrow angle images, Thermal Emission Imaging System (THEMIS) visual images and Mars Orbiter Laser Altimeter (MOLA) data. This allowed us to interpret a pattern of pit chain evolution and calculate pit depth, slope, and volume. The information collected in the study was then compared with non-Martian examples of pit chains and physical analog models. We evaluated the various mechanisms for pit chain development based on the data collected and conclude that dilational normal faulting and subvertical fissuring provide the simplest and most comprehensive mechanisms to explain the regional associations, detailed geometry, and progression of pit chain development.

P41A-0395 0830h POSTER

Radial Features around Irnini Mons, Venus: Implications for Timing of Regional Compression

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Flows and other deposits from Irnini Mons are superimposed on an older, regional plains material. Wrinkle ridges are generally abundant on this regional plains material and are present in at least two sets: one trending east-west and another concentric to Irnini Mons. Radial features on top of the Irnini flows are mapped as lineations or grabens, as resolution allows. High resolution mapping at 75 m/pixel also reveals ridges radial to Irnini Mons on top of the Irnini flows. These radial ridges are located from approximately N60E to N75E. Radial grabens around a volcano have been explained mathematically, with the magma chamber of a volcano simplistically described as a pressurized hole in an elastic plate. However, magma pressure alone can not explain the presence of radial ridges. The regional east-west trending wrinkle ridges imply a regional north-south compression affecting the Irnini Mons area. The regional stress field around an empty hole in an elastic plate is perturbed close to the hole, although it remains unperturbed at infinity; the change in material properties from the surrounding rock to a magma-filled chamber allows us to consider the chamber as "soft" and thus effectively empty. The perturbation of a uniaxial regional compressive stress around a pressurized hole is such that at angles of 90 and 270 degrees (east-west) the maximum principal stresses close to the hole are compressive, while at angles 0 and 180 degrees (north-south) the maximum principal stresses are tensile. The angle at which maximum principal stresses change from tension to compression depends upon the distance from the hole and the relative magnitudes of magma pressure and the regional compression. While in the simple model resultant stresses would be symmetric around the hole, structural complexities to the south and west of Irnini Mons restrict the predicted pattern of radial ridges as well as grabens to the region northeast of the volcano. Thus, the existence of radial ridges on the Irnini flows implies that the regional north-south compression that caused the east-west trending wrinkle ridges was still active during the formation of Irnini Mons. A rough timeline for events in the region could be: 1) formation of east-west wrinkle ridges on regional plains, 2) formation of graben radial to Irnini due to magma pressure coeval with formation of radial ridges due to a combination of magma pressure and ongoing regional compression, 3) cessation of magma pressure and formation of concentric grabens, and 4) formation of concentric wrinkle ridges, perhaps due to gravitational relaxation of the topographic rise.

P41A-0396 0830h POSTER

Geological Evolution of Venusian Deformation Belts : Examples from Poludnista Dorsa and Oya Dorsa and Implications

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Deformation belts are complex linear features in Venus' lowlands, analogous in scale to terrestrial mountain ranges. While the precise mode of origin remains unclear, they are clearly shaped by a complex interplay of folding and faulting at various scales. Detailed geological mapping of *Magellan* SAR images combined with radar altimetry profiles allow an examination of the sequence of deformation belt evolution.

Poludnista Dorsa, a complex 2000-kilometer long deformation belt in Rusalka Planitia, is segmented by orientation and tectonic style. Much of this belt is made up of topographic arches up to a kilometer high and a couple of hundred kilometers wide, overprinting a structural core of local ridges and lineaments approximately an order of magnitude smaller. The flacks of the arch component typically extending beyond the structural core into surrounding smooth materials, and control some of the regional short-wavelength deformation (wrinkle ridges). As the smooth materials locally embay the structural core, and if they represent a local stratigraphic marker, archs appears to be a late feature of the topography of Poludnista Dorsa. Simultaneous regional development of short and long wavelengths of deformation is not supported by the mapping; thus a mechanically stratified lithosphere of regional extent is not immediately required by the local geological history. Local lithospheric thinning within the belt (spatial localization) or progressive regional thickening of the mechanical layer (temporal evolution) better explain the observed sequence of events. While the broad arch topography may reflect in-plane contraction, the location of the arch may simply represent strain focused on an existing belt dominated by shorter-wavelength structures of more ambiguous origin. Evidence for coeval local volcanism, superposed contraction and extensional faulting, abrupt segmentation may indicate a role for out-of-plane forces (for example, delamination, detachment or crustal overthickening and collapse) in the structural core of the belt. Similar results are found for the simpler belt Oya Dorsa in Llorono Planitia. Evolution in the scale of deformation and the existence of intertwined volcanism demand an improvement in our models of these enigmatic features.

P41A-0397 0830h POSTER

Strike-Slip Faulting on Ganymede

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Galileo spacecraft images of Ganymede have revealed that strike-slip tectonism is common. We recognize three manifestations of strike-slip faulting, in both bright and dark terrains: (1) en echelon structures, (2) strike-slip duplexes, and (3) offset pre-existing features. We infer that en echelon structures link together as the degree of lateral offset increases, and that strike-slip zones in dark terrain may evolve into bright en echelon swaths with increased offset. Mapping of duplexes and duplex-like structures suggests a sequence of events in their progressive development, in which originally discontinuous structures link together and then their interiors imbricate to create mature duplexes; this may be an evolutionary sequence related to the transition from dark to bright grooved terrain. Evidence of offset pre-existing features furthers the case for common strike-slip deformation. In some structurally complex regions, these three elements of strike-slip faulting are all inferred, at various stages. Overall, strike-slip tectonism appears to be an integral part of the grooved terrain formation process, including the transition from dark to bright terrain.

P

P41A-0398 0830h POSTER

Land of Extremes: Faulting and Shear in Europa's North Pole

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Tectonic processes dominate the evolution of the north polar areas of Europa. Our study area, centered at ∼220° /67° N and imaged by Galileo at ∼170m/pixel, shows a complex tectonic history with

multiple generations of crosscutting lineaments. Structures associated with strike-slip and extensional deformation are dominant, and there is very little indication of cryovolcanic activity. All strike-slip displacements are left-lateral, in agreement with predictions of diurnal tidal stresses for these latitudes [1]. Offsets determined by plate reconstructions range from few km to ~92 km, the largest displacement measured so far on Europa (see also [2]). The variety of structures associated with strike-slip motions is surprising, and include simple fractures and ridged bands several km wide. There is no relationship between the amount of offset and the type of structure accommodating it, but it is possible that primary or secondary features (i.e., accommodating deformation elsewhere) might result in different morphologies. Extension and transtension occur across narrow (<15km wide) bands, cycloidal ridges, and triple points. Most extensional structures display axial symmetry and raised margins, indicating widening of original double ridges. We note that the relative albedo of the bands' interior does not always follow the "younger, darker" trend seen elsewhere [e.g., 3]. Precise stratigraphic analysis of the study area has allowed us to correlate the geologic histories of distant areas. In addition, the northern plains of Europa are a good location for examining temporal trends in tectonic processes without the influence of cryovolcanic activity. Changes in the style and degree of tectonic deformation are being studied by determining the different types of features and amounts of offset at different times. In addition, stereo observations are available for most of this area, and we are currently generating a digital elevation model of the local topography. Because of the extent of the stereo coverage, this information will allow us to examine the topographic signature of different kinds of structures in the same region. [1] Hoppa et al., Icarus, 141, 287-298, 1999; [2] Sarid et al., Icarus, 158, 24-41, 2002; [3] Geissler et al., Icarus, 135, 107-126, 1998.

P41A-0399 0830h POSTER

Spherical Harmonic Analysis of Mountain and Volcanic Center Distributions on Io

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Mountains and volcanic centers on Io are broadly zonally concentrated and the two distributions are anticorrelated (e.g., Schenk et al. 2001, *JGR 106*, 33,201-33,222). The mountains are tectonic in origin and the interplay between volcanism and tectonism is key to understanding their origin (McKinnon et al. 2001, *Geology 29*, 103-106; McEwen et al. 2003, in press in *Jupiter - The Planet, Satellites and Magnetosphere*). Here we extend previous analyses of these distributions beyond simple (but informative!) smoothing by means of counting circles. We initially assign equal weighting to each mountain ($n = 115$) and volcanic center ($n = 541$) in the global data sets. Spectral power analysis for the mountains shows a strong peak at $l = 2$ and a smaller one at $l = 1$, little power at $l = 3$, and the rest of the spectrum is "white" (flat). The volcanic center distribution shows an even stronger $l = 2$ peak, a modest peak at $l = 1$, and low spectral power for $l > 3$. The result is that two concentrations of mountains are located at ~ 30° N, 80° W and 30° S, 260° W, with the first being substantially larger. The two volcanic center concentrations are more nearly equatorial and quite close to the sub- and antijovian points, at ~ 5° N, 170° W and 15° S, 345° W, again with the first being larger. We also weighted the mountains by mountain length, length x width, polygonal area (footprint), and area x height (a proxy for volume). For weighting by length, the peak at $l = 1$ increased slightly and the peak at $l = 2$ decreased, but both remained statistically significant compared with a random distribution. Power spectra of the distributions weighted by length x width or polygonal area lose much of their statistical significance at $l = 1$ and 2, however, due to several mountains of large areal extent outside the regions of concentration above. Nevertheless, mountain concentration positions (summing low degree terms) remain virtually the same for all weightings. Volume weighting is corrupted by the large fraction of mountains for which there are no height constraints. Lastly, a subset of only pateraе (calderas) was created from the volcanic center catalog. This set of 387 paterae compares well to the 417 counted by Radebaugh et al. (*JGR 106*, 33,005-33,020, 2001). Each patera was given equal weight, and the spectral power distribution is similar to that for the full volcanic center data set. A strong peak at $l = 2$ is present, with a smaller peak at $l = 1$, and the two concentration positions are shifted slightly to the east. However, a minor, but statistically significant peak, is found at degree 6. This causes regions of small, dense concentrations at the equator with longitudes ~ 140° W and 325° W surrounded by small, less dense concentrations and sparse areas. We will discuss the degree of correlation of the mountain and volcanic center distributions.

P41B MCC: Level 1 Thursday 0830h

Planetary Missions, Instruments, and Data Analysis Techniques Posters

Presiding: **V C Gulick,** NASA Ames/SETI Institute**; R C Anderson,** Jet Propulsion Laboratory, California Institute of Technology

P41B-0400 0830h POSTER

NASA's New Millennium ST-9 Project

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NASA's New Millennium Program (NMP), has inaugurated the Space Technology 9 (ST9) mission, an integrated system validation project. DT-9 is the latest of a series of in-space technology validation activities which began in 1996 with Deep Space 1. The ST-9 mission will validate one of five technology capabilities which NASA Associate Administrator has selected as candidates for flight validation. The five technology capabilities under consideration are of great relevance to the full breadth of the NASA's Space Science endeavor. After careful review NASA is preparing a NASA Research Announcement (NRA) soliciting proposals for technology advances to provide needed capability for the following technology capability areas: 1) Solar sail capability-design metrics, scaling, deployment, propulsion and attitude control. 2) Large Space Telescope-structure and control dynamics, materials, structures, actuators, controls for fabrication, packaging and deployment, optical correction and active figure control, thermal control at cryogenic temperatures. 3) Formation Flying- autonomous operations, intersatellite communications, spacecraft formation control, and relative position estimation. 4) Aerocapture- system and performance modeling, aerodynamics and aerothermodynamics, thermal protection systems and structures, and guidance, navigation, and control. 5) Pinpoint Landing and Hazard Avoidance-sensors/algorithms for guidance and navigation, aerodynamic/propulsive maneuvering system options, terrain sensing and hazard recognition systems, and terrain sensors. It is expected that NASA will issue the NRA for technology providers for each capability area in 2003 and that at least one these five technologies capability areas will be subsequently selected for the New Millennium ST-9 technology validation experiment.

P41B-0401 0830h POSTER

An Advanced Dust Telescope

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A dust telescope is a combination of a dust trajectory sensor together with an analyzer for the chemical composition of dust particles in space. Dust particles' trajectories are determined by the measurement of the electric signals that are induced when a charged grain flies through a position sensitive electrode system. The objective of the trajectory sensor is to measure dust charges in the range 10^{-16} to 10^{-13} C and dust speeds in the range 6 to 100 km/s. The trajectory sensor has four sensor planes consisting of about 30 wire electrodes each. Two adjacent planes have orthogonal wire direction. The distance between planes is about 40 mm and the distance between electrodes in one plane is about 20 mm. The expected noise on each electrode is about 3×10^{-17} C. The signal on each electrode is sampled at 25 MHz rate. Simulated charge signals have been analyzed and dust charges and trajectories at a signal-to-noise ratio of 3 have been recovered. The dust chemical analyzers will have a sufficient mass resolution in order to resolve ions with atomic mass number up to 100. The annular impact area of the mass analyzer will be $0.1 m^2$. We have constructed a numerical (SIMION) model of the mass spectrometer consisting of the target area with an acceleration grid and the single-stage reflectron consisting of two grids and the central ion detector. Ions of varying starting positions at the target, emission angles 0 to 90 degrees and energies 0 to 50 eV are flown through the spectrometer. A first result is that ions with different perpendicular (to the target normal) energies will arrive at the ion detector at different radial positions, with zero perpendicular energy in the center. A mass resolution of $M/\Delta M > 150$ can be obtained for impacts onto the annular target between 120 and 240 mm from the center. An Ion Detector of 110 mm radius is necessary to collect all generated ions. Acknowledgements: This research is supported by NASA grant NAG5-11782 and by DLR grant 50OO0201.

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Possible use of the Passive Remote Sensing for the Study of a two Layered Crust on the Europa Satellite

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On December 7th 1995, the Galileo mission began the study the jovian system. Among the results that his mission has obtained, it is the evidence of the existence of a liquid water ocean beneath the icy crust of Europa. Liquid water is one of the main factors that make life possible, so then life might exist in Europa. Some of the scenes that have been settled out to explain how living organisms could be present in such an extreme environment involve suppositions about the width of the icy crust. The explanation of other geological structures on the satellite also implies an estimation of the crust's width, that is why a good estimation about this parameter is very important in the geological study of this satellite. In this work, we analyze one electrodynamic model of the crust considering a two layered crust. The purpose is to obtain the optimal electrophysical parameters of measurement that permit us to estimate the crust's width. These parameters are calculated from the inverse elements of the Fisher matrix. The results obtained from this work can be used to plan future space missions to jovian satellites (in particular it could be useful for JIMO mission). The optimal algorithms for these measurements can be modified to be used in active systems of remote sensing.

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Minor Body Surveyor: A Multi-Object, High Speed, Spectro-Photometer Space Mission System Employing Wide-Area Intelligent Change Detection

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Detection and characterization of the small bodies of the outer solar system presents unique challenges to terrestrial based sensing systems, principally the inverse 4th power decrease of reflected and thermal signals with target distance from the Sun. These limits are surpassed by new techniques [1,2,3] employing star-object occultation event sensing, which are capable of detecting sub-kilometer objects in the Kuiper Belt and Oort cloud. This poster will present an instrument and space mission concept based on adaptations of the NASA Discovery Kepler program currently in development at Ball Aerospace and Technologies Corp. Instrument technologies to enable this space science mission