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This presentation illustrates results of topographic mapping and rover localization in Spirit and Opportunity landing sites. MOC/NA images, DIMES descent images, and surface Pancam and Navcam images are used to map regional and local topographic features of the landing sites. A new bundle adjustment method builds an image network with improved visual odometric data to supply enhance pointing data that are essential for high accuracy mapping and rover localization. Special 3D mapping products of the crater where Opportunity spacecraft landed are produced first time using rover images acquired from inside of a planetary crater. Traverse maps will show the comparison result of rover positions computed from the rover telemetry data with those from the image-based localization method. Analysis of the differences will be performed considering wheel slippage, IMU drift, and other factors. High quality topographic mapping products such as orthoimage base maps, 3D digital terrain models, and 3D interactive viewing tools are developed to support a series of mission operations and outreach activities, including long term science planning, rover path planning, geological mapping, wheel track property investigation, rock distribution estimation, crater modeling, and TV simulation scenes.

P33D-18 1330h POSTER

Web-based Data Information and Sharing System Using Mars Remotely Sensed Datasets

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It is well known within the planetary science community that a considerable amount of time can be dedicated to Mars data preparation before one is able to actually conduct remote sensing analyses. A prototype system developed at the Center for Nuclear Waste Regulatory Analyses (CNWRA) reduces such time by optimizing the process of locating, preparing, and retrieving MOLA PEDR, MOLA MEGDR and Themis VIS/IR datasets. A graphical user interface allows for searching data spatially, temporally, or by keywords. Spatial searches are done either by drawing a box around a map location or by entering coordinate values in planetographic/planetocentric latitude and west/east longitude coordinate systems. Temporal searches may be conducted by searching for specific Themis IR and VIS release dates. Key word searches may be conducted by searching for a particular MOLA PEDR orbit number. The retrieved data is provided in either a native format (such as ASCII for MOLA PEDR datasets) or in a format selected by the user and based on the chosen value-added product. In the case of MOLA PEDR datasets, the user can choose between two interpolation methods (Delaunay-based or natural neighbor) and may receive data in a TIFF or raster grid format. Natural neighbor interpolation produces fewer artifacts, but it is computationally intensive. The time required (minutes or tens of minutes compared with fractions of seconds used by the first method) makes it necessary to provide the user with an email notification once the interpolated dataset becomes available. The interpolated data provide effective resolution that approaches 150 m compared to the PEDR resolution of 300 m. In the case of Themis IR and VIS, data may be provided as one B/W single band image or as three-band color composite image in several raster formats. This system was successfully used to analyze Walla Walla Vallis (approximately 305.3 to 305.6E, 9.4S to 9.9S) and Aromatum Chaos/Ravi Vallis (approximately 315E to 322E, 1N to 2S) outflow channels. For Walla Walla Vallis (name provisionally approved by the International Astronomical Union), a small outflow channel, the integrated datasets helped resolve the locations of reaches that were indistinct in visible light images. For Ravi Vallis, the composite data system enhanced our understanding of how some chaotic terrain forms. As presented by Coleman, N.M. (2004 Lunar and Planetary Science Conference, Abstract #1299), thinning of the cryosphere by deep fluvial incision spawned secondary breakouts of groundwater, forming new chaos zones. The systems flexible design allows for incorporation of additional remote sensing datasets, such as those provided by MOC, TES, and MARSIS instruments. In summary, our integrated data-access system will make the wealth of new Martian data more readily available to planetary researchers enabling scientists to focus more time on analyses or algorithm development rather than on finding data and format conversions. Disclaimer: An employee of the U.S. Nuclear Regulatory Commission (NRC) made contributions to this work on his own time apart from regular duties. NRC has neither approved nor disapproved the technical context of this abstract.

P41A CC: 519 B Thursday 0830h

Physicochemical Properties of Planetary Cores I *(joint with S, T)*

Presiding: **J Badro,** Institut de Physique du Globe, Universite Paris VI**;** **R A Secco,** University of Western Ontario

P41A-01 0830h INVITED

Is Core Composition affected by Core-Mantle Interaction?

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The initial composition of a planetary core is the legacy of formation (the T and P paths of the constituent materials and the extent to which chemical equilibrium with the mantle phase is possible along those paths). It is conventional to consider the subsequent evolution as "closed", with the only changes arising through the redistribution across the inner core-outer core boundary as central freezing proceeds. This is reasonable if one thought that transport across the CMB were limited by solid state diffusion, since this process is inefficient even on billion year time scales. However, there are three reasons to question "core closure": (1) As the core cools, it is likely to become supersaturated in the least soluble mantle constituents, probably MgO and perhaps a high pressure phase of silica or magnesium perovskite. This material will sediment upwards to the underside of the CMB, helping to drive core convection and possibly providing an energy source for the geodynamo. If a wet adiabat develops (analogous to earth's troposphere), it may change the convective and even seismic properties of the outermost outer core. The outer core need not be compositionally uniform vertically in this picture (but still must have horizontal uniformity of density), despite vigorous convection. (2) Seismic evidence suggests that the lowermost mantle is partially molten. One possible aid to this melting is the presence of excess hydrogen fugacity in the core relative to the partially degassed mantle. Hydrogen is particularly interesting as the only chemically active element that also may have fast solid state diffusivity. In addition, the presence of liquid pathways may provide much higher chemical interaction because of the much higher diffusivity in liquid coupled with circulation or transport of the melt. (3) Independent of this, metasomatism of the topographic relief (a kilometer) at the CMB can arise to the extent that core fluid develops permeable pathways in the mantle rock (a property that depends on unknown surface tension properties).

P41A-02 0900h

Experimental Study of U,Th Solubility in Earth's Core: Toward a Solution of the Core Cooling Paradox

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Radioactive heating in the core has recently become a topic of renewed interest in core dynamics and inner core growth. We present our experimental results on the solubility of U and Th in Fe and Fe-S liquids under different temperatures and pressures using a Walker module multi-anvil press. Recovered run products were analyzed by LA-ICP-MS. Our results show that U and Th are both soluble in FeS and Fe melts. At 3 GPa , 1750°C, D_U, the partition coefficient of U (concentration of U in FeS or Fe / concentration of U in silicate), ranges from 0.03 to 0.33, which is much larger than 0.013 from Murrell et al (1984) at 1.5 GPa, 1450°C. At 9.4 GPa, 1750°C, D_U reaches 0.094. Considering only the samples with FeS, including the result from Murrell et al, there is a trend of increasing D_U with pressure. Similarly, D_{Th}, the partition coefficient of Th ranges from 0.011 to 0.152 at 3 GPa, 1750°C. When pressure is increased to 9.4 GPa and at1750°C, D_{Th} reaches 0.101. A similar trend of increasing D_{Th} with pressure is observed. These experimental results indicate that under high temperature and high pressure, U and Th can enter the Fe and FeS phases in significant amounts. The implications for U and Th radioactive heating in the core of Earth and other planetary bodies will be discussed.

P41A-03 0915h

A Seismically Constrained Composition Model of Earth's Core

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We measured longitudinal sound velocities in light-element alloys of iron (FeO, FeSi, FeS, and FeS_2) at high pressure by inelastic x-ray scattering. This data set provides a mineralogical constraint on the composition of the Earth's core, and completes the previous set formed by the compressibility and density of these compounds. The combination of these data sets and their comparison with the reference Earth models derived from seismology enables us to determine an average composition of the Earth's core. We show that the incorporation of small amounts of silicon or oxygen alone is compatible with geophysical observations and geochemical abundances.

P41A-04 0930h INVITED

Iron Melting at the Physical Conditions of the Core

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We will report new and re-analyzed sound velocity measurements of shock compressed iron at Earth-core conditions. The sound velocity data show that melting starts at 225±3 GPa (5100±500°K) and is complete at 260±3 GPa (6100±500°K), both on the Hugoniot. This is a lower melting pressure than previously reported. Also, no statistically conclusive evidence for a previously reported solid–solid phase transition on the Hugoniot near 200 GPa was observed. We will discuss the implications of these findings on the Fe phase diagram. Our recent efforts on temperature measurement at high pressure-temperature conditions, and dynamic compression along planetary isentrope will also be reported.

P42A CC: 519 B Thursday 1030h

Physicochemical Properties of Planetary Cores II *(joint with S, T)*

Presiding: **J Badro,** Institut de Physique du Globe, Universite Paris VI**;** **R A Secco,** University of Western Ontario

P42A-01 1030h INVITED

Liquid Core Materials: Pressure-effect on Their Density, Structure and Chemical Properties.

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