or the martian crust and is likely to be much wetter. SNC meteorites have probably gained their water by assimilation of crustal materials, and thus are probably poor indicators of the abundance of water on Mars.

References: [1] Bogard D. D. and Johnson P. (1983) *Science, 221,* 651–654. [2] Karlsson H. et al. (1992) *Science, 255,* 1890–1892. [3] Bjoraker G. L. et al. (1989) *Proc. 4th Intl. Conf. on Mars,* 69–70. [4] Ott U. (1988) *GCA, 52,* 1937–1948. [5] McSween H. Y. Jr. (1985) *Rev. Geophys., 23,* 391–416. [6] Treiman A. H., personal communication. [7] Jones J. H. (1989) *Proc. LPS 19th,* 465–474. [8] Ott U. and Begemann F. (1985) *Nature, 317,* 509–512. [9] Jones J. H. (1986) *GCA, 50,* 969–977. [10] Harper C. L. Jr. et al. (1993) *Science,* in press. [11] Phillips R. J. and Ivins E. R. (1979) *Phys. Earth Planet. Inter., 19,* 107–148. [12] Johnson M. C. et al. (1991) *GCA, 55,* 349–366. [13] Treiman A. H. et al. (1987) *Proc. LPSC 17th,* in *JGR, 92,* E627–E632. [14] Wänke H. and Dreibus G. (1988) *Phil. Trans. Roy. Soc. London, A325,* 545–558. [15] Sheppard S. M. F. (1977) *Stable Isotopes and High Temperature Geological Processes* (J. W. Valley et al., eds.), 165–183, *Rev. of Mineralogy, 16.* [16] Watson L. L. (1993) Presentation to the 56th annual Meteoritical Society meeting. [17] Kerridge J. F. (1988) *LPS XIX,* 599–600. [18] Pepin R. O. (1985) *Nature, 317,* 473–475. [19] Pepin R. O. (1992) *Annu. Rev. Earth Planet. Sci., 20,* 389–430.

S20-91 ABS ONLY N94-33210

THE NORTHERN PLAINS MSATT MEETING, AND A CALL FOR A FIELD-ORIENTED SUCCESSOR TO MSATT.

J. S. Kargel, U.S. Geological Survey, Flagstaff AZ 86001, USA.

The Workshop on the Martian Northern Plains: Sedimentological, Periglacial, and Paleoclimatic Evolution (August 9–15, 1993) formally was devoted to a review of our knowledge of the martian northern plains and presentation of recent ideas pertaining to the geologic and climatic evolution of this interesting region. The meeting was held in Fairbanks to allow easy access to Mars-like terrains in central and northern Alaska. There is no place on Earth that is a close analog of the martian northern plains, but parts of Alaska come reasonably close in some respects, so we may expect that some of the processes occurring there are similar to processes that have occurred (or are hypothesized to have occurred) on Mars. The meeting was sited in Fairbanks because of (1) the accessibility of Mars-like landscapes, (2) the availability of logistical support facilities, and (3) the willingness of knowledgeable faculty at the University of Alaska to lead field trips.

The meeting organizers invited the participation of four scientists (T. Péwé, J. Begét, R. Reger, and D. Hopkins) with expertise in Alaskan geology, cold-climate geomorphology, and cold-climate physical processes. These scientists actively participated in the workshop and led us in two major field trips and a low-altitude overflight. Field Trip I (2 days) was to the Alaska Range and interior Alaska between Fairbanks and the Alaska Range; Field Trip II (1 day) was in the Fairbanks area; and the overflight (1 day) took us to Barrow (where we stopped and engaged in a brief field excursion), the Prudhoe Bay area, and the Brooks Range. The formal part of the meeting (2 days) was capped by an informal evening discussion, principally by the "terrestrial experts," that focused around a small selection of Mars slides that had engendered considerable discussion and controversy. A synopsis of this important discussion and of the field trips and overflight have been presented in the formal meeting summary [1].

Approximately 20 cameras recorded our field activities and the highlights of our overflight, resulting in some remarkable images of thermokarst, pingoes, ice-wedge polygons, sorted stone stripes and stone circles, gelifluction sheets, ice-cored moraine, eskers, alpine glaciers, the Arctic coast, and many other periglacial and glacial landforms. Field trip participants were introduced to some landforms that they had never observed previously (many had not even heard of them), most notably the nivation hollow and the cryoplanation terrace, both of which are periglacial features that are produced through the action of melting snow packs over permafrost, and both of which may have Mars analogs. The interaction of eolian, glacial, and periglacial processes, the results of which were observed in the the field, left indelible images in the minds and on the films of many participants. For instance, classic ventifacts on the summit of a moraine, and thick deposits of loess composed of dust that was originally derived from outwash plains, attested to the importance of wind modification or eolian genesis of many landforms and rock units that are an integral part of the regional glacial geologic assemblage. This series of observations of the interplay of wind and ice processes became a sharply imprinted reminder that multiple processes are likely to have operated in concert on Mars as well.

The involvement of Earth scientists was a major factor in the success of this field-oriented workshop. Many participants left the meeting with the conviction that interaction between the Mars and Earth science communities, as exhibited at the northern plains meeting, should continue, and that the combination of formal workshops with field studies is the nominal way for the deepest interaction to occur.

Call for Future Field-oriented Meetings of the Mars Science Community: It is widely acknowledged that Mars is an Earth-like planet (relative to other objects in the solar system). Accordingly, virtually all geomorphological interpretations of Mars are based, in part, on analogical inferences drawn directly from (or modified from) observations and interpretations of terrestrial geologic features. This is a justifiable basis from which to proceed in our studies of martian geological history, climate evolution, and atmospheric evolution, because there are insufficient data to build a geology of Mars from a totally "martian" perspective.

Some of the most dynamic recent controversies in Mars science have centered on geologic (or geomorphologic) interpretations of features that seem to speak differently to different observers. The controversies and the interpretations, of course, are in the minds of the observers, not in the rocks of Mars! The rocks surely have their stories to tell in all their fine detail, and it is the planetary geologists' job to decipher these stories. A roughly consistent geologic explanation of the martian surface has eluded Mars geologists, as a group, thus far. The problem is that, with the data we have, there are too many processes on Earth that might have formed many of the varied martian landforms. One can excuse the physical modelers when they sieze on the geologists' consistent descriptions of a very few types of landforms (e.g., sand dunes and volcanos) and frame very specific, and sometimes overly conservative, models around these limited observations and interpretations. Many geologists consider much of the recent Mars modeling to have very little relevance to the most dynamic episodes in martian geologic history; this is perhaps inevitable until the Mars geologists reach a consensus on a few of the major issues, and this is not likely to happen until new types of data, especially "ground truth," are obtained.

N94-33211

Our individual experiences shape our perceptions of martian geologic history. Because these experiences differ, and especially because Mars data are barely skin-deep, our concepts of martian history differ, often by ocean widths. It is necessary for Mars geologists to share the geological bases for our differing views with one another and with nongeologists in the Mars science community more than we have in the past. Just as with Earth scientists, it may be necessary to get out of the lecture hall and into the field. Ideally, we would all go to Mars, of course, but less than ideally, we should settle for Earth analog terrains as our field experiences. If expertly guided by Earth science specialists (who may or may not be members of the Mars science community), and if attended by representatives of all the subareas of Mars science, these field experiences may (1) teach the Mars community much about Mars, (2) educate the Mars community in the latest twists and turns and bruising battles in evolving thought of the Earth science community, and (3) inform Earth scientists of the latest shifts in thinking about Mars, including hypotheses and models that just might have bearing on matters pertaining to terrestrial geologic and climate evolution.

Probably all members of the Mars science community have something considerable to learn about somebody else's concepts of Mars. Of course, this is partly why we go to conferences and workshops. This is also the major reason why each of us should attend Mars-oriented field workshops, if such were available. At least in recent years, there has been no consistent framework in which anyone's field expertise could be shared with the wider Mars science community. Particularly now that it will be several more years before we can expect the next major infusion of Mars data, the time is right to establish a formal, Mars-oriented series of field workshops in which funded organizers would have a limited amount of money available for (1) preworkshop field work required for field trip planning, (2) organizing and conducting of the workshop and associated field trips, and (3) payment of expenses incurred by key invited personnel, who may include invited geological field experts, climate modeling specialists, and others who may be crucial to the success of the meeting (and who may or may not be members of the regular Mars science community).

The proposed field meetings do not need to be conducted in association with every topical meeting of the Mars science community, nor does every field trip have to be a multiday affair, complete with overflights. It would be relatively easy, if a few individuals are interested enough to put out a little effort, to organize day-long field trips to be conducted after or just prior to several meetings each year. Perhaps once each year there might be a more extensive field meeting, when the major purpose is to get scientists into the field in classic field areas that may pertain to Mars. The organizers of the northern plains MSATT meeting, and of the earlier Lake Bonneville field workshop (which was conducted in association with the Mars mappers' meeting in 1992), have found that it is all too easy to excite members of the Earth science community about Mars, and to obtain their expert leadership in the field. The Mars science community, as a community, should be taking full advantage of our existence on a very dynamic and, in some ways, a very Mars-like planet; we should not forget that there are many Earth science specialists who may want to share what they know about Earth so that we may learn more about Mars.

References: [1] Kargel et al., eds. (1993) *LPI Tech. Rpt. 93-04*.

S21-91 ABS ONLY

TEMPORAL AND SPATIAL MAPPING OF ATMOSPHERIC DUST OPACITY AND SURFACE ALBEDO ON MARS.

S. W. Lee[1], R. T. Clancy[1], G. R. Gladstone[2], and T. Z. Martin[3], [1]Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder CO 80309, USA, [2]Southwest Research Institute, P. O. Drawer 28510, 6220 Culebra, San Antonio TX 78228, USA, [3]Mail Stop 169-237, Jet Propulsion Laboratory, 4800 Oak Grove Dr., Pasadena CA 91109, USA.

The Mariner 9 and Viking missions provided abundant evidence that eolian processes are active over much of the surface of Mars [1,2]. Past studies have demonstrated that variations in regional albedo and wind streak patterns are indicative of sediment transport through a region [3,4], while thermal inertia data [derived from the Viking Infrared Thermal Mapper (IRTM) dataset] are indicative of the degree of surface mantling by dust deposits [5–9]. The visual and thermal data are therefore diagnostic of whether net erosion or deposition of dust-storm fallout is taking place currently and whether such processes have been active in a region over the long term. These previous investigations, however, have not attempted to correct for the effects of atmospheric dust loading on observations of the martian surface, so quantitative studies of current sediment transport rates have included large errors due to uncertainty in the magnitude of this "atmospheric component" of the observations.

We are making use of the method developed by T. Z. Martin to determine dust opacity from IRTM thermal observations [10,11]. We have developed a radiative transfer model that allows corrections for the effects of atmospheric dust loading on observations of surface albedo to be made. This approach to determining "dust-corrected surface albedo" incorporates the atmospheric dust opacity, the single-scattering albedo and particle phase function of atmospheric dust, the bidirectional reflectance of the surface, and accounts for variable lighting and viewing geometry. The most recent dust particle properties [12,13] are utilized. The spatial and temporal variability of atmospheric dust opacity strongly influences the radiative transfer modeling results. This approach allows the atmospheric dust opacity to be determined at the highest spatial and temporal resolution supported by the IRTM mapping data; maps of "dust-corrected surface albedo" and atmospheric opacity can be constructed at a variety of times for selected regions. As a result, we obtain information on the spatial and temporal variability of surface albedo and atmospheric opacity and inferences of the amount of dust deposition/erosion related to such variability.

Analyses of IRTM mapping observations of the Syrtis Major region, covering a time span of more than a martian year, will be presented.

References: [1] Veverka J. et al. (1977) *JGR, 82*, 4167–4187. [2] Thomas P. et al. (1981) *Icarus, 45*, 124–153. [3] Lee S. W. et al. (1982) *JGR, 87*, 10025–10042. [4] Lee S. W. (1986) *LPI Tech. Rpt. 87-01*, 71–72. [5] Kieffer H. H. et al. (1977) *JGR, 82*, 4249–4295. [6] Christensen P. R. (1982) *JGR, 87*, 9985–9998. [7] Christensen P. R. (1986) *JGR, 91*, 3533–3545. [8] Christensen P. R. (1986) *Icarus, 68*, 217–238. [9] Jakosky B. M. (1986) *Icarus, 66*, 117–124. [10] Martin T. Z. (1986) *Icarus, 66*, 2–21. [11] Martin T. Z. (1993) *JGR*, in press. [12] Clancy R. T. and Lee S. W. (1991) *Icarus, 93*, 135–158. [13] Clancy R. T. et al. (1993) *Abstracts for the MSATT Workshop on Atmospheric Transport on Mars*.