have short crustal residence times and are easily lost from the stratigraphic record by dissolution. Thus, terrestrial evaporites are quite rare in Precambrian sequences. However, this may not apply to Mars. Given the early decline of a martian hydrological cycle involving liquid water, it is possible that Archean-aged evaporites have survived there.

Potential targets on Mars for subaqueous spring deposits, sedimentary cements, and evaporites are ancient terminal lake basins where hydrological systems could have endured for some time under arid conditions [19,20]. Potential targets for the Mars Pathfinder mission include channeled impact craters and areas of deranged drainage associated with outflows in northwest Arabia and Xanthe Terra, where water may have ponded temporarily to form lakes. The major uncertainty of such targets is their comparatively younger age and the potentially short duration of hydrological activity compared to older paleolake basins found in the southern hemisphere. However, it has been suggested that cycles of catastrophic flooding associated with Tharsis volcanism may have sustained a large body of water, Oceanus Borealis, in the northern plains area until quite late in martian history [21,22]. Although problematic, the shoreline areas of the proposed northern ocean (e.g., along the Isidis impact basin and the plains of Elysium, Chryse, and Amazonis) provide potential targets for a Mars Pathfinder mission aimed at exploring for carbonates or other potentially fossiliferous marine deposits. Carbonates and evaporites possess characteristic spectral signatures in the near-infrared [23] and should be detectable using rover-based spectroscopy and other methods for *in situ* mineralogical analysis.

Many terrestrial soils are known to preserve microbial fossils and biogenic fabrics within the mineralized subzones of soils, such as calcretes, silcretes, or other types of "hard-pans" [24]. For example, the oldest terrestrial microbiota are preserved in silcretes associated with 1.7-Ga karst. Viking biology experiments indicate that surface soils on Mars are highly oxidizing and destructive to organic compounds. However, mineralized soil horizons could protect fossil organic matter from oxidation and should not be overlooked as potential targets for exopaleontology. At the Viking Lander 2 site, soils showed the development of duricrust, suggesting cementation [25], and sulfate and carbonate minerals are inferred to be present in the martian regolith based on elemental analysis by X-ray fluoresence. Although Viking conclusively demonstrated the absence of organic compounds in the soils analyzed, the presence of cements in martian surface sediments suggests a possibility for hard-pan mineralization that could afford protection to organic materials against oxidation. The best places to explore for mineralized paleosols are deflational areas where wind erosion may have stripped away surface sediments, exposing indurated zones formed at depth. Such sites are widespread within the potential landing area for Mars Pathfinder.

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MARS PATHFINDER METEOROLOGICAL OBSERVATIONS ON THE BASIS OF RESULTS OF AN ATMOSPHERIC GLOBAL CIRCULATION MODEL. F. Forget, F. Hourdin, and O. Talagrand, Laboratoire de Météorologie Dynamique, E.N.S, Paris, France.

The Mars Pathfinder Meteorological Package (ASI/MET) will measure the local pressure, temperature, and winds at its future landing site, somewhere between the latitudes 0°N and 30°N.

Comparable measurements have already been obtained at the surface of Mars by the Viking Landers at 22°N (VL1) and 48°N (VL2), providing much useful information on the martian atmosphere. In particular, the pressure measurements contain very instructive information on the global atmospheric circulation. The large-amplitude seasonal oscillations of the pressure are due to the variations of the atmospheric mass (which result from condensation-sublimation of a substantial fraction of the atmospheric carbon dioxide in the polar caps), but also to internal latitudinal mass redistribution associated with atmospheric circulation.

The more rapid oscillations of the surface pressure, with periods of 2–5 sols, are signatures of the transient planetary waves that are present, at least in the northern hemisphere, during autumn and winter.

At the Laboratoire de Météorologie Dynamique (LMD), we have analyzed and simulated these measurements with a martian atmospheric global circulation model (GCM), which was the first to simulate the martian atmospheric circulation over more than 1 yr [1,2]. The model is able to reproduce rather accurately many observed features of the martian atmosphere, including the long- and short-period oscillations of the surface pressure observed by the Viking landers (Fig. 1).

Both the annual pressure cycle and the characteristics of the rapid oscillations have been shown to be highly variable with the location on the planet. For instance, simulated surface pressure obtained in the middle latitudes of the southern hemisphere look very different than the Viking landers measurements because of the effect of an opposite meteorological seasonal component. From this

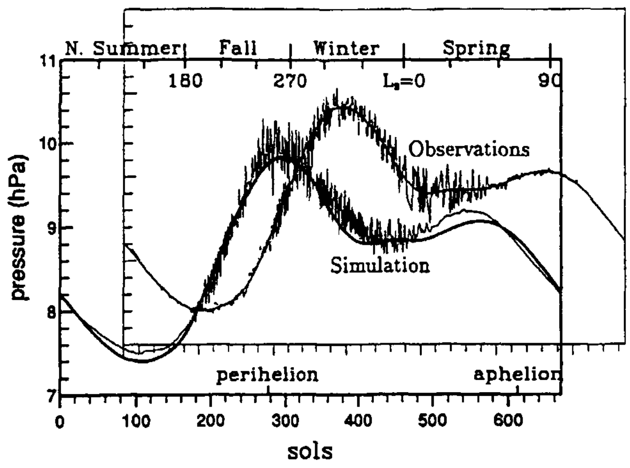

Fig. 1. Observations and simulation of the VL2 site surface pressure.

particular point of view, much could be learned from a future lander located in the southern hemisphere. As we were able to simulate the surface-pressure variation from any point on the planet, we have used the LMD GCM to investigate the climatological properties of the different possible landing sites. Figure 2 shows the surface pressure as simulated at three different points in Isidis Planitia. As in the other possible landing areas, the amplitude of the transient eddies is found to decrease with latitude. Longitudinal differences between the areas below 0 km are small, except that the VL1 site in Chryse Planitia seems to be surprisingly more active than any other possible landing site at the same latitude. The seasonal meteorological component of the annual pressure cycle is minimum at the

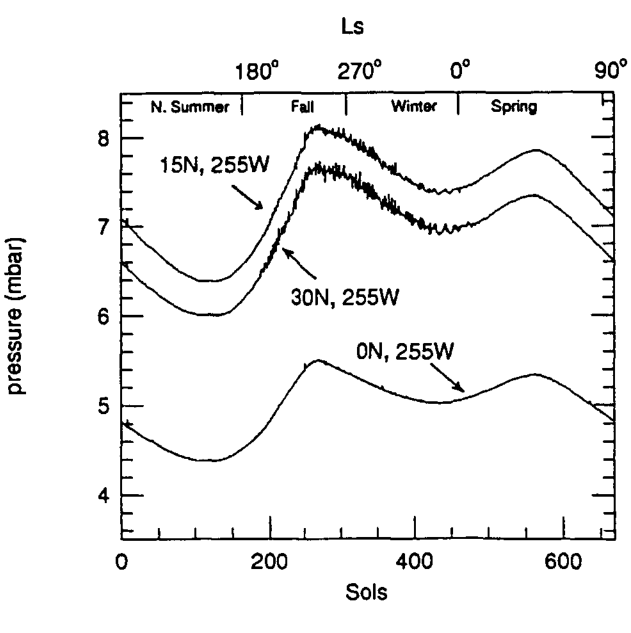

Fig. 2. Simulation of the surface pressure of Isidis Planitia.

equator, thus the local pressure oscillations should reflect the oscillation of the planetary averaged surface pressure, providing a more accurate estimation of the total atmospheric mass than with the Viking data. Such a location near the equator would extend the latitudunal coverage of the Viking Landers. It should also be interesting to observe the behavior of the atmospheric waves and local winds, where the Coriolis force is negligible. Therefore, from a meteorological point of view, we think that a landing site located near or at the equator would be an interesting choice.

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PATHFINDER LANDING SITES AT CANDIDATE SNC IMPACT EJECTION SITES. M. P. Golombek, Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA 91109, USA.

If Mars Pathfinder were able to land at a site on Mars from which the SNC meteorites were ejected by impact, the Pathfinder mission would essentially represent a very inexpensive sample return mission. If this were possible, a particularly significant benefit to Mars science would be having a radiometric age date on a sample from a known location on Mars, which would enable a more precise assignment of absolute ages to the crater/stratigraphic timescale for Mars. Providing such a date would substantially improve our interpretation of the absolute age of virtually all events in the geological, climatological, and atmospheric evolution of Mars. This abstract evaluates the possibility of landing at potential SNC ejection sites and the ability of Pathfinder to identify the landing site as the place from which a SNC meteorite came. Unfortunately, although considerable information could be gained from Pathfinder that might support the hypothesis that the SNC meteorites have indeed come from Mars, it is likely not possible to uniquely identify a site on Mars as being a SNC meteorite ejection site.

Shergottites, nakhlites, and Chassigny (SNC meteorites) are unique mafic to ultramafic meteorites with young crystallization ages that are believed to have been ejected from the martian surface by impact and traveled to Earth [1,2]. Recent interpretations suggest that the shergottites have different crystallization ages and cosmic ray exposure times from Chassigny and the nakhlites (180 m.y. and <2.5 m.y. vs. 1.3 b.y. and 11 m.y. respectively), implying different impact ejection events on Mars [see 3 and references therein]. The young ages of these meteorites and crater-absolute age timescales [4] related to martian stratigraphy [5] limit their place of origin on Mars to Upper Amazonian (shergottites) and Middle or Early Amazonian (Chassigny and the nakhlites) volcanics on Mars. Tharsis is the only area on Mars that has regionally extensive lava flows of Middle and Upper Amazonian age with fresh impact craters larger than 10 km diameter, required to eject the rocks from Mars [6]. Nine fresh (young) impact craters greater than 10 km diameter have been identified on Amazonian volcanics around the Tharsis region [6]. Of these, craters 1 and 2 are below 2 km elevation and within 10° latitude of 15°N. In addition, two other craters in Middle Amazonian lava flows of Amazonis Planitia, northwest of Olympus Mons, are possible SNC craters that are between 20°N and 30°N latitude and below 0 km elevation. Geologic units in which these craters are found could be visited by Pathfinder. These four sites are described below.