A CANDIDATE LANDING SITE WITHIN A FLUVIALLY BREACHED CRATER IN THE SOUTHERN HIGHLANDS OF MARS. James R. Zimbelman[1] and James W. Rice, Jr.[2], [1]CEPS/NASM MRC 315, Smithsonian Institution, Washington, DC 20560-0315, jrz@ceps.nasm.edu, [2]Lunar and Planetary Laboratory, 1629 E. University Blvd., University of Arizona, Tucson, AZ 85721-0092, jrice@lpl.arizona.

Preparations are underway to identify candidate landing sites on Mars that both satisfy engineering constraints for the landers and provide good prospects for significant science results [1]. Landing sites are sought both for the Mars '01 mission, with its Sojourner-like rover, and subsequent landings where the sophisticated Athena science package will allow sample collection and caching using an enhanced rover design. We have carried out photogeologic and remote sensing analysis of a potential landing site within a crater breached by a fluvial channel, located in the equatorial highlands of Mars; the crater floor has a target area large enough to accommodate the proposed landing ellipse and which satisfies all engineering constraints, with the one exception of high resolution Viking imaging.

Proposed Landing Site: Palos Crater (55 km diameter)
Region: Terra Cimmeria
Mars Map Quad (MC-22NW)
Viking image 379S45

The candidate site is within a 55-km-diameter crater in the ancient highlands of northern Hesperia Planum. The target crater is located at 2.5°S, 249.5°W, and is cut by a channel that drains the highlands south of the crater. We propose that this crater be named Palos, after the home port for Columbus; this name will be submitted to the appropriate IAU subcommittees for consideration. No high-resolution Viking data exist for this crater, but even at ~250 m/pixel resolution (Viking frame 379S45), it is clear that the crater floor will include materials transported from the surrounding highlands via flow through the channel that has breached the crater rim [2, 3, 4]. This crater is a highly desirable landing site because it appears to have been the site of a lake/playa. The crater rim is dissected in the southwest at the confluence of three valley networks; we propose that the channel system be named Tinto Valles, after the river leading to the port of Palos. The largest channel has a fresh v-shaped morphology and is a single branch 130-km-long valley network. This channel may have karst or thermokarst topography at its source, perhaps indicative of sustained subsurface flow. The channel has a solution-pitted appearance near 5.5°S, 248°W, and this texture is also evident to the west of the channel near 5°S, 249°W and continuing westward ~90 km. There is also evidence of either the channel heading back underground or, more likely, a section of intact roof material ~15km to the east of where the channels enter the crater.

We have produced a geologic map of the crater and its surroundings at a scale of 1:2,000,000 in order to assess the history of the region and to evaluate the types of rocks traversed by the channel flow through the crater [4]. Our results are consistent with the global-scale (1:15,000,000) geologic mapping of the area [5], in which the crater and its immediate surroundings are part of the Noachian Plateau sequence, dissected unit (Npld), interpreted to be ancient cratered highland materials that have been eroded significantly by fluvial processes. The channeled portion of the crater floor may be part of the regional Amazonian smooth plains (Aps), present immediately north of the crater, interpreted to be of diverse origin but with a probable aeolian component [5]. The smooth crater floor along with the inlet channels suggests that this basin was once the location of a lake. The basin also has an outlet channel incised along its northern rim. The smooth floor also displays a darker albedo patch located near the mouth of the inlet channels, which may be a deltaic deposit. The extensive Npld plains encompassing the target crater meet the science objective of selecting target localities that will allow sampling of the oldest materials on Mars, as well as areas subjected to fluvial processes where the water may have transported and deposited evidence of possible early biogenic activity [1]. Remote sensing data for the area is of relatively low spatial resolution [6], but the albedo is 0.18, lower than the planet-wide average of 0.25 and thus likely not deeply buried by aeolian dust [7], and the thermal inertia is 339 J m-2s-1/2K-1 (equal to 8.1 X 10-3 cal cm-2 s-1/2K-1), which is higher that the planet-wide average of 6.5 X 10-3 cal cm-2 s-1/2K-1 [8], again consistent with a relatively dust-free location [7]. Rock abundance in the vicinity of the crater is estimated to be 8 to 14% areal coverage of ~10-cm-scale bare rock exposures [from Figs. 5 and 12 of 9].

We do not believe that the lack of high resolution Viking images should automatically eliminate this site from consideration, for two main reasons. 1. Using the best Viking images, with resolutions down to 10 m/p, will not "guarantee" a safe landing. 2. History has shown that orbital images have not (yet) accurately portrayed the true landing hazards at the scale of the spacecraft. VL1 barely missed Big Joe, as well as numerous small impact craters in the area; all of these obstacles could have prevented a safe landing. VL2 was targeted to land in a dune field, based on Viking images better than 50 m/p. MPF landed just 780 meters from the slopes of Twin Peaks and only meters from the boulder Yogi. The best Viking images can not accurately show what a landing site is like at the meter scale; even MOC images, with resolutions down to 1.5 m/p [10], may not assure a safe site. We encourage both the Mars Surveyor project and the science community at large to not abandon investigation of scientifically attractive sites simply because they do not happen to coincide with existing high resolution Viking images.

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