

NORTHERN MEMNONIA AREA: A POTENTIAL SITE FOR “MODERN” GROUND WATER. Ronald Greeley¹ and Ruslan Kuzmin², ¹ Arizona State University, Dept. of Geology, Box 871404, Tempe, AZ 85287-1404, ² Vernadsky Institute, Russian Academy of Sciences, Kosygin St. 19, Moscow, 117975, GSP-1 Russia

Introduction: Locating “modern” (i.e., geologically young) sites of ground water activity is difficult because processes associated with water on the surface occurred primarily in the Noachian-Hesperian Periods [4]. Nevertheless, some regions display morphological signatures of more recent water-related processes [5-8]. The problem is to locate such sites that also meet the engineering constraints of landed missions. A potential area lies in Northern Memnonia.

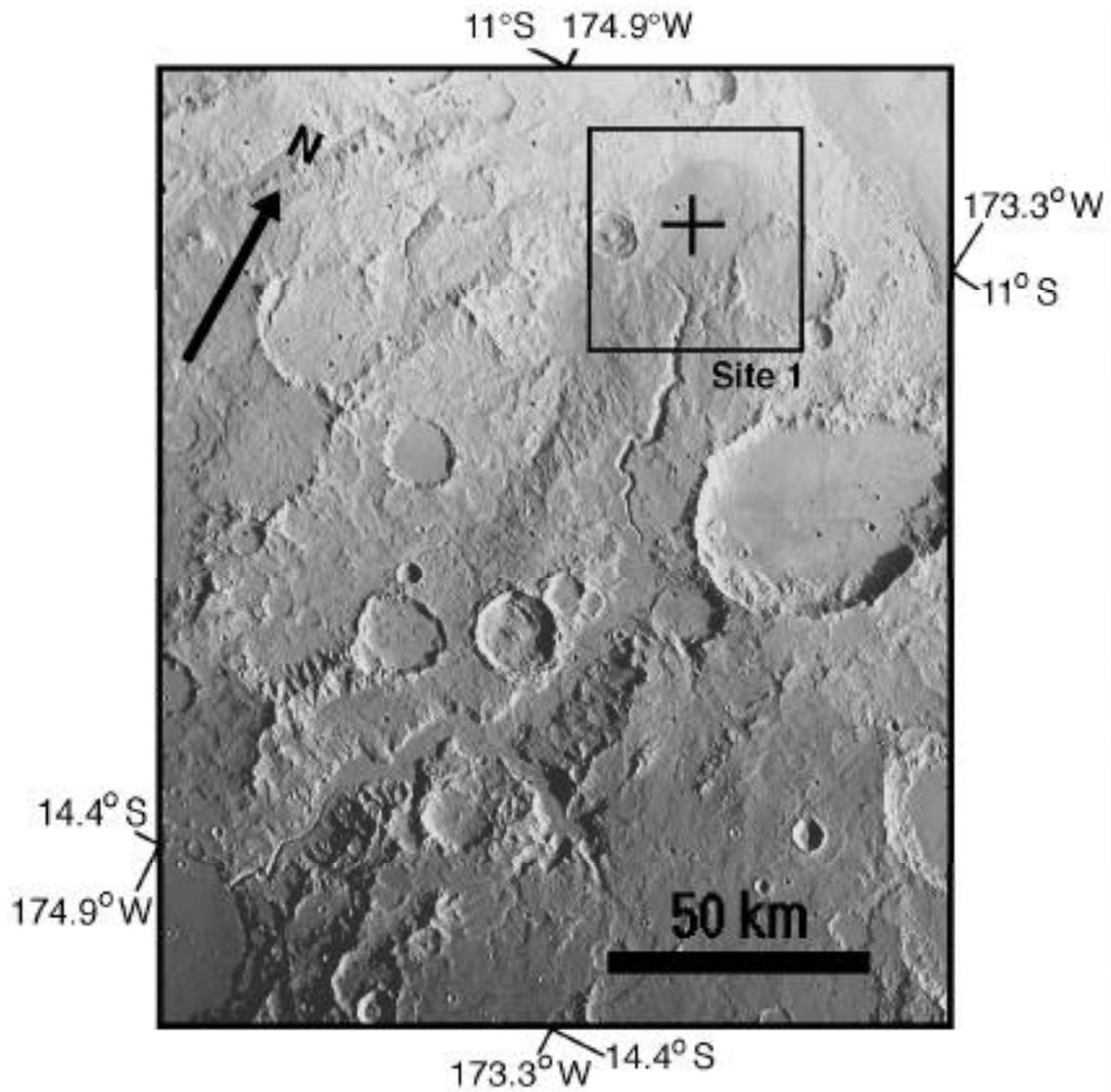
The region selected for detailed study is at the northern edge of Memnonia in the transition zone between the ancient highland plateau and young lowland plains. The plateau includes ancient cratered materials (unit Npl₁) and hilly materials (unit Nplh) [9, 5].

General Geology: Hesperian ridged plains comprise the floors of some craters, along with mantles of younger fluvial and aeolian deposits. Rimless craters and networks of small valleys are common in the area. The valleys incised the highland surface, as well as the Medusae Fossae deposits [5]. Because some channels cut parts of the Lower and Middle Medusae Fossae deposits, Scott and Chapman [10, 5] suggested that water was available in Lower and Middle Amazonian epochs, younger than the youngest fluvial activity in the Gusev crater area. They also suggested that the fluvial activity may have been hydrothermally-driven by the ascent of magma leading to the eruption of Medusae Fossae materials. Consequently the area proposed for study could contain materials altered by ground water that was released to the surface by hydrothermal activity.

Potential landing site: The proposed landing site is in the lower, delta-like part of the channel system on alluvial deposits associated with more recent fluvial processes. Ejecta from two fresh craters are within the site and could provide samples of ancient highland materials and younger material of the Medusae Fossae Formation.

Scientific rationale: The landing site is in a geologically complex region. It includes evidence of late-stage fluvial activity (possibly triggered by regional magmatic activity), making the site important for sample return missions. The potential diversity of the rocks and sediments could enable understanding of the more recent climatic environments on Mars involving ground water, fluvial activity, and lacustrine sedimentation.

References: [1] Tanaka, K.L., D.H. Scott, and R. Greeley, 1992. Global stratigraphy, in Mars, H.H. Kieffer et al. Eds., Univ. of Arizona Press, 345-382. [2] Baker, V.R., M.H. Carr, V.C. Gulick, C.R. Williams, and M.S. Marley, 1992. Channels and valley networks, in Mars, H.H. Kieffer et al., Eds., Univ. of Arizona Press, Tucson, Arizona, 493-522. [3] Carr, M.H., 1981. The surface of Mars, Yale Univ. Press, New Haven, Connecticut. [4] Carr, M.H., 1996. Water on Mars, Oxford Univ. Press, New York, NY, 229 pp. [5] Scott, D.H. and M.G. Chapman, 1995. Geologic and topographic maps of the Elysium Paleolake Basin, Mars, scale 1:5,000,000, U.S.G.S. Misc. Inv. Series map I-2397. [6] Cabrol, N.A., R. Landheim, and E.A. Grin, 1997. Ma’adim Vallis paleocourses, Lunar Planet. Sci. Conf., 28, 195-196. [7] Cabrol, N.A., R. Landheim, R.O. Kuzmin, and R. Greeley, 1998. Duration of the Ma’adim Vallis/Gusev crater hydrogeologic system, Mars, Icarus, 133, 98-108. [8] Kuzmin, R.O., R. Greeley, R. Landheim, N.A. Cabrol, and J. Farmer, 1998. Geologic map of the Gusev crater-Ma’adim Vallis region, U.S.G.S. (in press). [9] Greeley, R. and J.E. Guest, 1987. Geologic map of the eastern equatorial regional of Mars, U.S.G.S. Misc. Inv. Series Map I-1802-B. [10] Scott, D.H. and M.G. Chapman, 1991. Geologic map of science study area 6, Memnonia region of Mars (MTM-10172), scale 1:500,000, U.S.G.S. Misc. Inv. Series Map I-2084.



Viking Orbiter mosaic of the northern Memnonia area. The landing site is located at 11.3°S, 174.2°W, +1 to +2 km.