SOME ANTICIPATED SCIENCE RESULTS FROM "LOCAL" MARTIAN SAMPLING SITE(S). L. E. Nyquist[1], M. N. Rao[2], and C.-Y. Shih[2]. [1]KR, NASA Johnson Space Center, Houston, TX 77058. laurence.e.nyquist@nasa.gov. [2]ESCG Jacobs-Sverdrup, Houston, TX 77058.

Introduction: Current planning for return of a surface sample of Mars is contained in [1]. Scientific aims and more detailed objectives relating to (a) past/extant life, (b) surface processes and interactions, (c) planetary evolution, and (d) human exploration are summarized there (Table 1). Here we consider how these aims and objectives might be addressed by samples from individual "local" area(s) (diameter <~1 km) based on experience with analyzing subsamples of Martian meteorites.

Fine Regolith: Sample types of interest for the "life" aim are subaqueous and hydrothermal sediments [1]. Isotopic biosignatures from such sediments may be contained in fine-grained Martian regolith. The only samples of Martian regolith available for laboratory study are the rare Gas Rich Impact Melt (GRIM) glasses [2]. They often contain FeS blebs, products of impact-shock reduction of sulfate minerals in the Martian regolith [3]. Strong enrichments in δ^{34}Sr are potential bio-signatures [4], but S-isotopic analysis by nanoSIMS of the FeS blebs in GRIM glasses showed no biologically mediated effects [5]. S-isotopic analyses of returned samples could be at the highest achievable precision, and would also address the "surface processes" aim.

Coarse Regolith and Sedimentary "Rocks": Sulfates are abundant on Mars, having formed predominantly during the Hesperian [6]. Centimeter-sized sedimentary concretions as well as impact-breccias and melts would provide additional opportunities for stable-isotope studies. High abundances of $MgSO_4$ (kieserite), $CaSO_4$ (gypsum), and $(K,Na)Fe_3(SO_4)_2(OH)_6$ (jarosite) were modeled as present at Meridiani Planum [7]. In a preliminary study, we found $^{87}Rb/^{86}Sr$ ratios ~0.0, ~0.05, ~0.09, and ~1.05 for terrestrial gypsum, Na-jarosite, kieserite, and K-jarosite, resp., a variation favorable for dating sedimentation times. K-jarosite should be a favorable mineral for dating by K-Ar methods, also. Carr and Head [6] postulate that most sulfates formed during the Hesperian ~3.0-3.7 Ga ago, but the sulfates captured in GRIM glasses formed more recently than the ~175 Ma age of their shergottite protolith. Weathering in nakhlites probably occurred ~600 Ma ago, and certainly more recently than their ~1.35 Ga age [8]. These observations suggest that aqueous activity may have extended to times relevant for human exploration.

Igneous Rocks: The sampling site(s) should be selected to ensure that "local" regolith, high-graded for return to Earth, would contain a sufficient number of igneous rocks so that the geochemical evolution of the planet can be addressed with the same rigor as shown in Martian meteorite studies (e.g., [9]), but within a known geologic context.

References: [1] MEPAG E2E-iSAG. 2011. *Astrobiology* 12:175-230. [2] Rao M. N. et al. 1999. GRL 26:3265-3268. [3] Rao M. N. et al. 2004. 35th Lunar Planet. Sci. Conf., abstract #1501. [4] Faure G. and Mensing T. M. 2005. Isotopes, 3rd Ed., pp. 825-828. [5] Rao M. N. et al. 2010. 41st Lunar & Planet. Sci. Conf., abstract #1161. [6] Carr M. H. and Head J. W. III. 2010. *Earth & Planet. Sci. Lett.* 294:185-203. [7] Clark B. et al. 2005. *Earth & Planet. Sci. Lett.* 240:73-94. [8] Shih C.-Y. et al. 1998. 29th Lunar & Planet. Sci. Conf., abstract #1145. [9] Debaille V. et al. 2009. *Nature Geoscience* 2: 548-552.