TARGETING IN-SITU LIQUID WATER ANALYSIS WITH NEW PROBES ON MARS. Sz. Berczi[1,3], A. Horvath[1,2], T. Pocs[1,4], A. Sik[1,3], E. Szathmary[1,3] A. Kereszturi[1,2] ([1]New Europe School for Theoretical Biology and Ecology, [2]Konkoly Observatory, [3]Eotvos Lorand University of Sciences, [4]Eszterházy Károly College, email: bercziszani@ludens.elte.hu).

Introduction: This abstract is to call the attention and show the possible benefit of a change in the view of restrictions used in landing site selection recently. Because of safety issues and long lifetime probes, most missions land at low latitude and altitude terrains – at the driest locations of Mars. Here we summarize parameters and reasons that present the rationality of a shift in the view of selecting landing sites toward higher latitudes.

For astrobiology related research it is important to reach such landing sites where possible existence of water is high. In the form of interfacial layer probably exist on Mars today, and bulk brines might also be present [1,2,3]. Previous missions failed to detect it exactly, however, Phoenix lander probably identified some droplet forming fluid [3].

Ideal locations: are those localities where the joint actions of H_2O + salts + solar insolation are present together and liquid water or brine flows appear on Mars today. The presence of liquids could be identified by spectral observation (no confirmation to date), by model computations or at sloping terrain by the rheologic consequences. We propose three such localities and flow-like features: 1: DDS – dark dune spot (85-50° latitude subpolar regions), 2. RSL – recurring slope lineae (30-50° latitude), and 3. Slope streaks (equatorial 0-30° region).

DDS-seepages (A): Beyond the general morphology, the most important feature of these flows are the accumulated pond-like features at the end of the flow [4,5,6,7,8]. The existence of the ponds prove the collecting downslope flow liquid at the bottom of the slope, where there is no preferred direction to continue moving of the liquid material. There is another "no preferred direction" action at the starting of the DDS formation, when the Kieffer model explains outburst of the heated CO_2 gas. However, the diffuse dust cover on the frost can be easily distinguished from the confined flow-like features of the downslope slow migration of the seepage [9,10].

Slope streaks (B) are low latitude flow-like features on dust covered terrains, that show anabranching pattern and usually darker than their surroundings. Based on Kreslavsky and Head and other author's work [11,12,13,14,15,16] they might form by the seepage of dense brines.

Recurring Slope Lineae (RSL, formerly TSL) (C): relatively dark albedo markings with sharp margins. They extend downslope on steep slopes. The narrow, some meters wide streaks have lengths up to 100s of meters. [17,18,19].

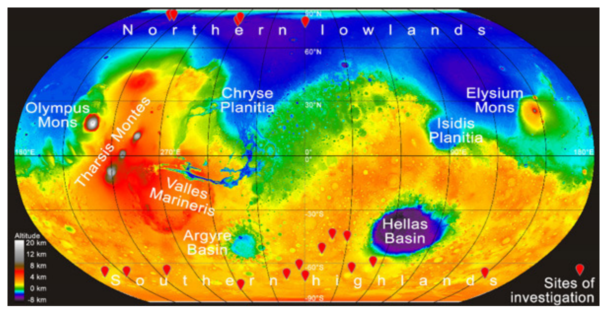

Figure 1. Distribution of the locations where DDS-seepages were observed

Observational argumentation: On the basis of the above mentioned issues site selection regarding only the observations, should focus on the following parameters:

1. The site should exhibit wintertime frost and early springtime heating up process on dunes, where in the first phase solid CO_2 crust should broken off by the Kieffer-type outburst from below, producing fan shaped, diffuse streaks (observable marker).
2. After the disappearance of CO_2 frost, H_2O should be observable there [20].
3. The site should exhibit seepage-like features on the slope probably produced by interfacial water or brines. Accumulation of the dark downslope material at the bottom of the seepages in pond-like features, strengthening the presence of liquid material there.

Site selection: On the basis of our comparisons we can conclude that DDS seepages are promisful candidates for liquid water or brine detection, for candidate landing sites see Table 1 and Fig. 1. The importance of DDS-seepages is strengthened by the presence of possible analog features on Earth in the Antarctic region [21]. However, the engineering requirement do not fit by such locations in the circum-subpolar area, we overview these issues below.

Difficulties at the proposed landing sites are:

- high altitude: the proposed sites (Table 1.) on the southern highland are above the MOLA 0 km datum, as a result atmospheric deceleration with parachutes is problematic. The overcome this issue new landing methods should be developed and tested, and this might decrease the safety. The rare atmosphere in the southern hemisphere also decreases the effect of horizontal and slope winds close to the surface that might increase the safety.
- high latitude: with the cold wintertime, above all the presence of seasonal CO_2 frost limits the lifetime of a mission at high geographic latitude. This fact is taken as a drawback in the general view - but at the same time it decreases the mission cost. Shorter lifetime circumpolar missions might provide important data despite they work only for several months (see Phoenix as an example).
- southern hemisphere is a difficult terrain to analyze on Mars in general, because of the above mentioned factors (high altitude and short summertime), but it has benefits too: because of the strong insolation in summertime, the solar panels might provide relatively large amount of electricity, and the probe could realize more actions (sampling, tests its internal laboratory).
- landing close to sandy terrain is a dangerous factor, but it could be possible in the next years to overcome it, as with the precision landing systems high accuracy and small ellipses could be achieved. Using this method, missions could land close by the target dune field on a smooth terrain and than drive to the target. Another dangerous issue there is that rovers might got trapped in dunes as it happened with Spirit. In this case the better control on the rovers, and improved decision making software with artificial intelligence will eliminate this issue. Such a precise (self and remote) control on the rover driving is also a useful benefit during the development of such probes that help future missions.

Recommendation: Summarizing the scientific benefits of a southern circumpolar mission (as a model approach for future directions) it is possible to land on the most ancient terrains (with possibly ancient biosignatures), high latitude locations provide observation of water ice and possibly liquid phase, and strong insolation gives lots of energy using only inexpensive and moderate sized solar panels - and together a low cost mission (excluding the development of required new landing method).

Table 1. List of proposed landing sites

Latitude (South)	Longitude (Western)	Name / feature of interest	Crater diameter
– 66.5°	324.5°	Pityusa Patera	~ 200 km
– 81°	65°	Inca City	
– 69°	151°	seepages	~ 60 km
– 65°	15°	inner structure	
– 79°	136°	pits	~ 20 km
– 70°	16°	Lyell Crater	~ 131 km
– 61°	5°	parallel dunes	~ 30 km
– 64°	318°	circular	~ 20 km
– 71°	113°	doughnuts	
– 63°	164°	flat	
– 69°	169°	Charlier Crater	~ 113 km
– 70°	206°	Jeans Crater	

Mission related specifications: A mission like the above mentioned does not fit into the current engineering constraints, but it is not impossible to develop the required technology. Such a development could provide various innovative methods in the landing process on Mars that help future, larger, more difficult missions too, including manned expeditions.

Acknowledgment: This work has been supported by the ESA ECS-project No. 98076 (Co 4000105405).

References: [1] Möhlmann 2008 Icarus 195, 131-139. [2] Chevrier et al. 2009 GRL 36, LXXXXX, [3] Renno et al. 2009 LPSC 1440, [4] Horváth et al. (2002) *33rd LPSC*. #1108, LPI, Houston [5] Gánti et al. (2003) *Origins of Life and Evolution of the Biosphere*. **33**(4-5) pp. 515-557; [6] Horváth et al. (2005) *36th LPSC*, # 1128; [7] Horvath et al. (2009) *Astrobiology*, 9, Iss. 1, 90-103; [8] Kereszturi et al. (2010) *Icarus*, **207**, Issue 1, 149-164; [9] Hansen, et al. (2011) *Science,* **331,** pp. 575-578; [10] Hansen, et al. (2010) *41st LPSC*. #2029, LPI, Houston [11] Kreslavsky et al. (2009) *Icarus* 201 517–527.) [13] Reiss et al. (2009) *42nd LPSC*, #2152; [13] King et al. (2010): *42nd LPSC*, #1542; [14] Schorghofer et al (2011): *Icarus*, **216**, 159-168. [15] Head et al (2007) GSA Denver Annual Meeting, 103-16. [16] Kreslavsky et al. (2007) *7th International Conference on Mars*, #3203 [17] Ojha et al. (2011) *42nd LPSC* #2101, [18] McEwen et al. (2011) *42th LPSC* #2314; [19] McEwen et al. (2011): *Science*, **333,** pp. 740-743; [20] Kereszturi et al. (2011) *Planet. Space Sci.* 59, 26-42. [21] Head et al. (2007) *7th International Conference on Mars*, #3114.