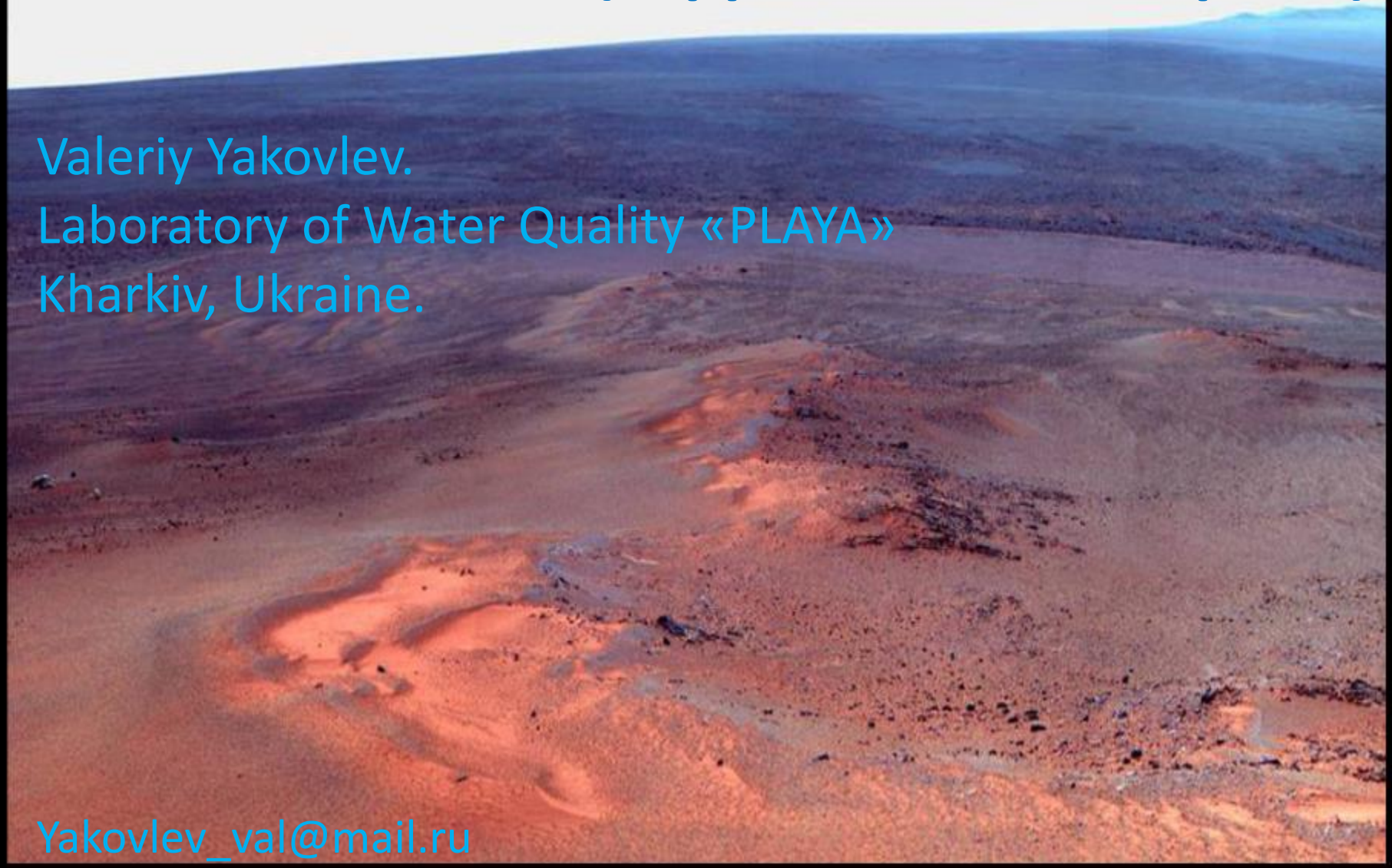
ZEPHYRIA PLANUM HILLS - A SOURCE OF DEEP RESOURCES (supplemented template)



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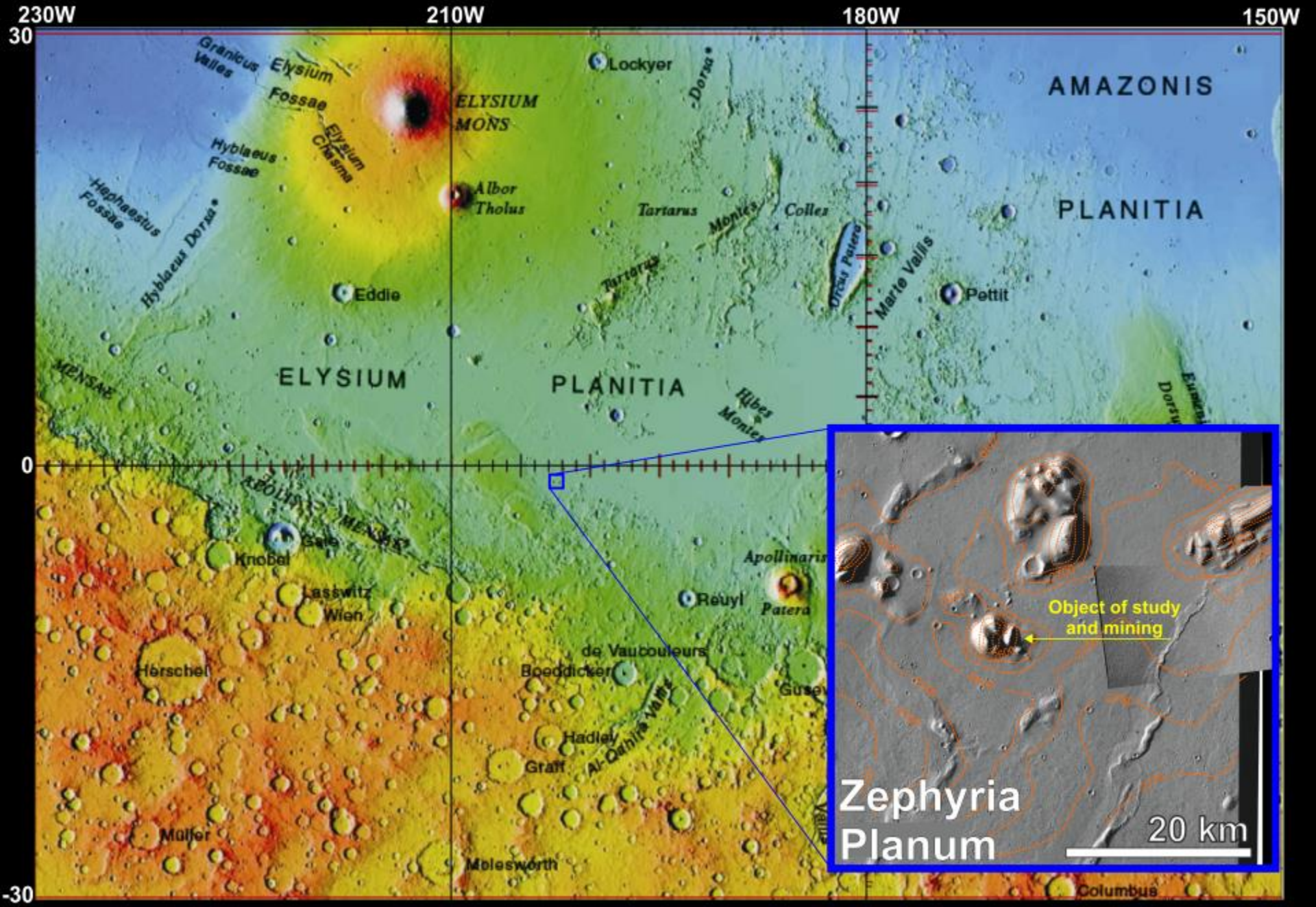
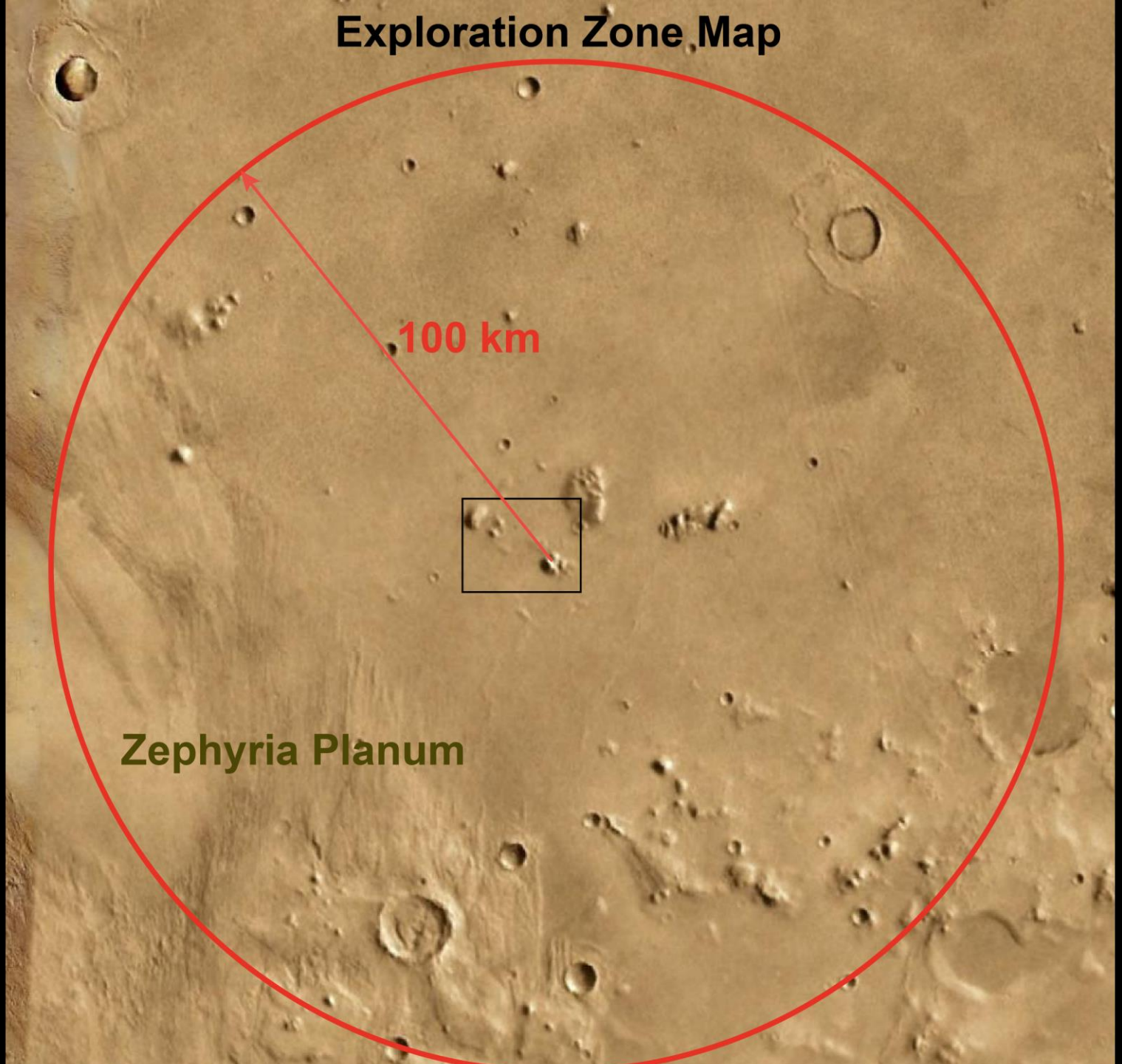
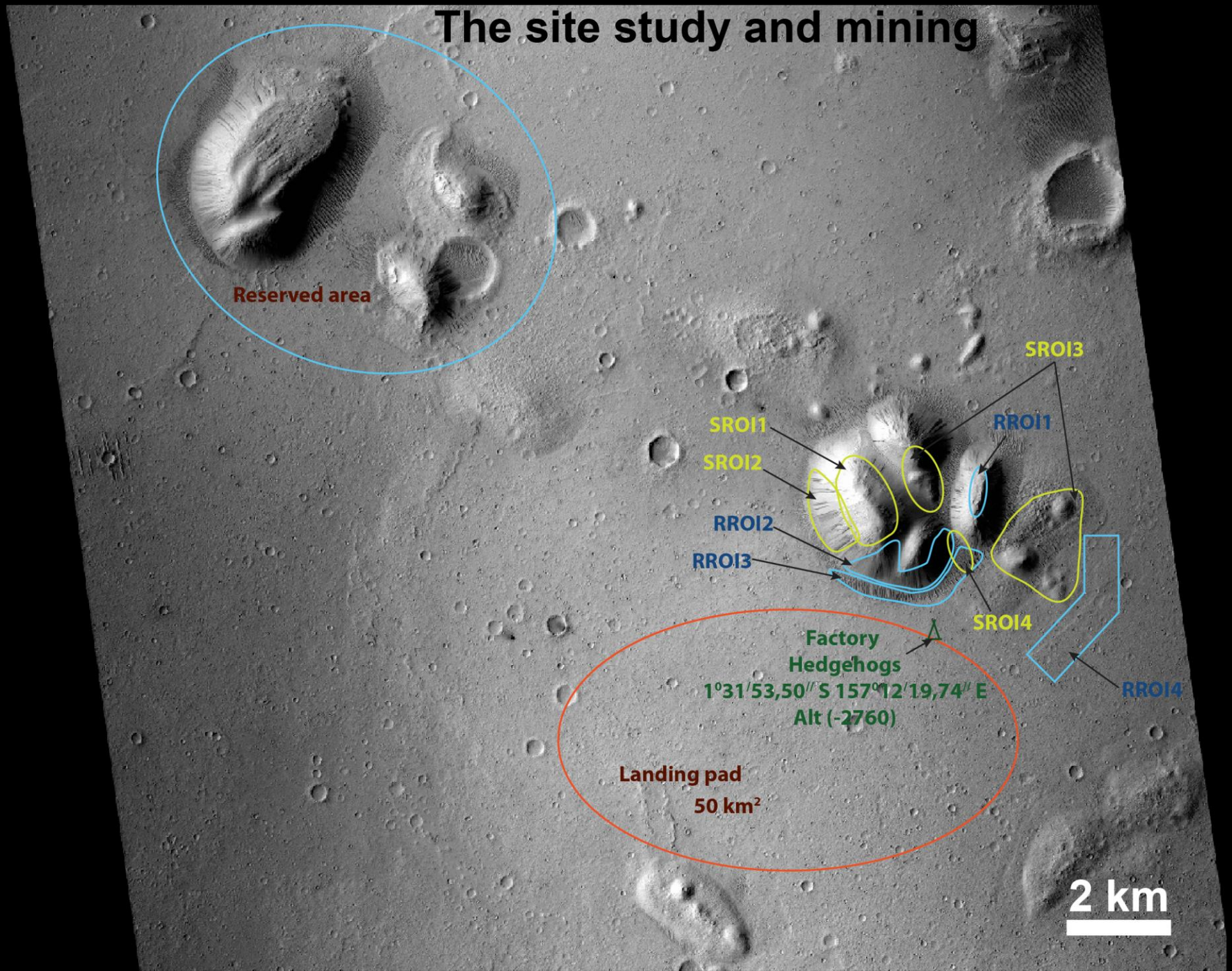
Zephyria Planum – is an equatorial plain stamped -2700 m, and an average temperature of the surface soil is around -40˚S



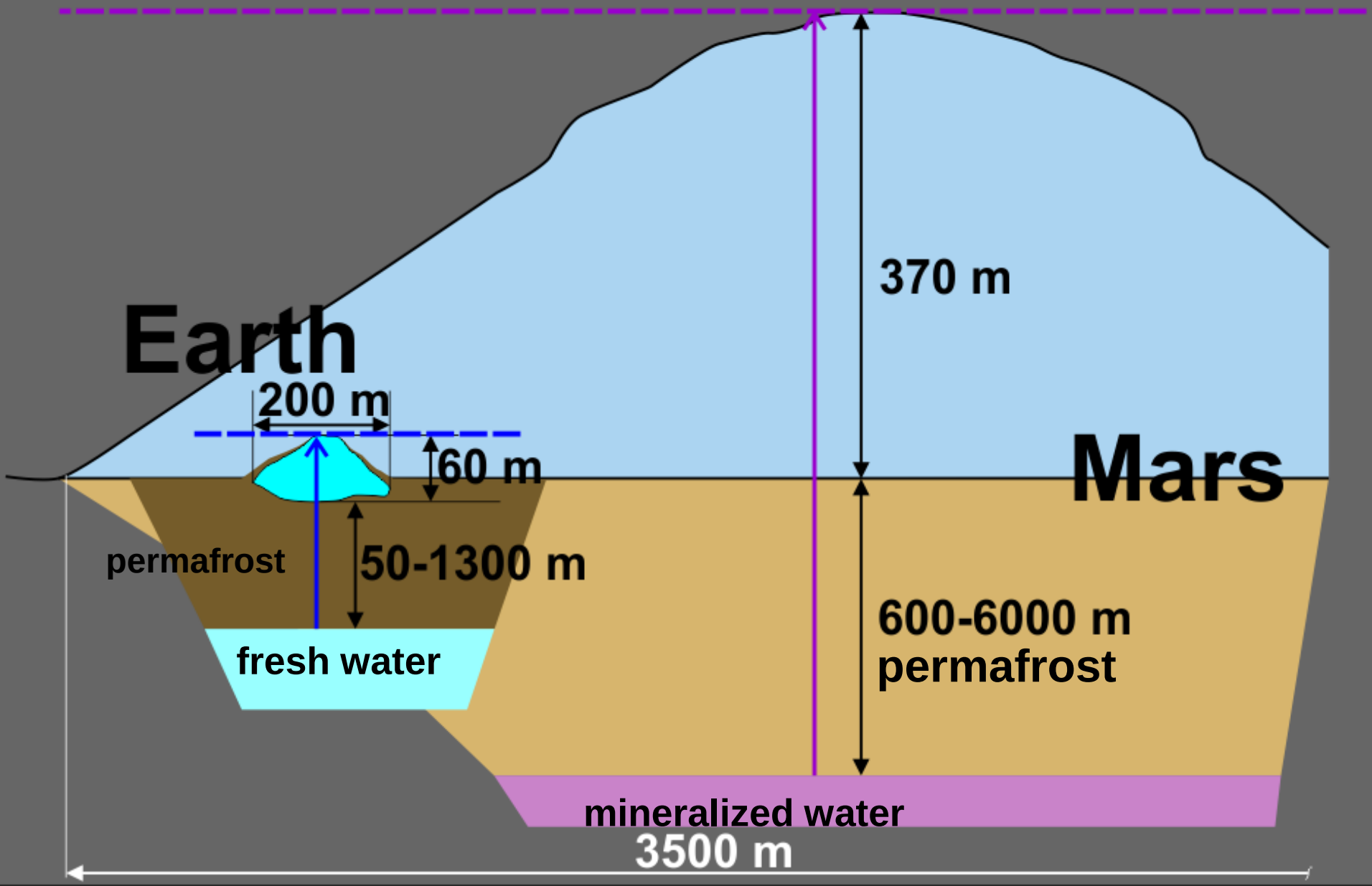
Exploration Zone Map



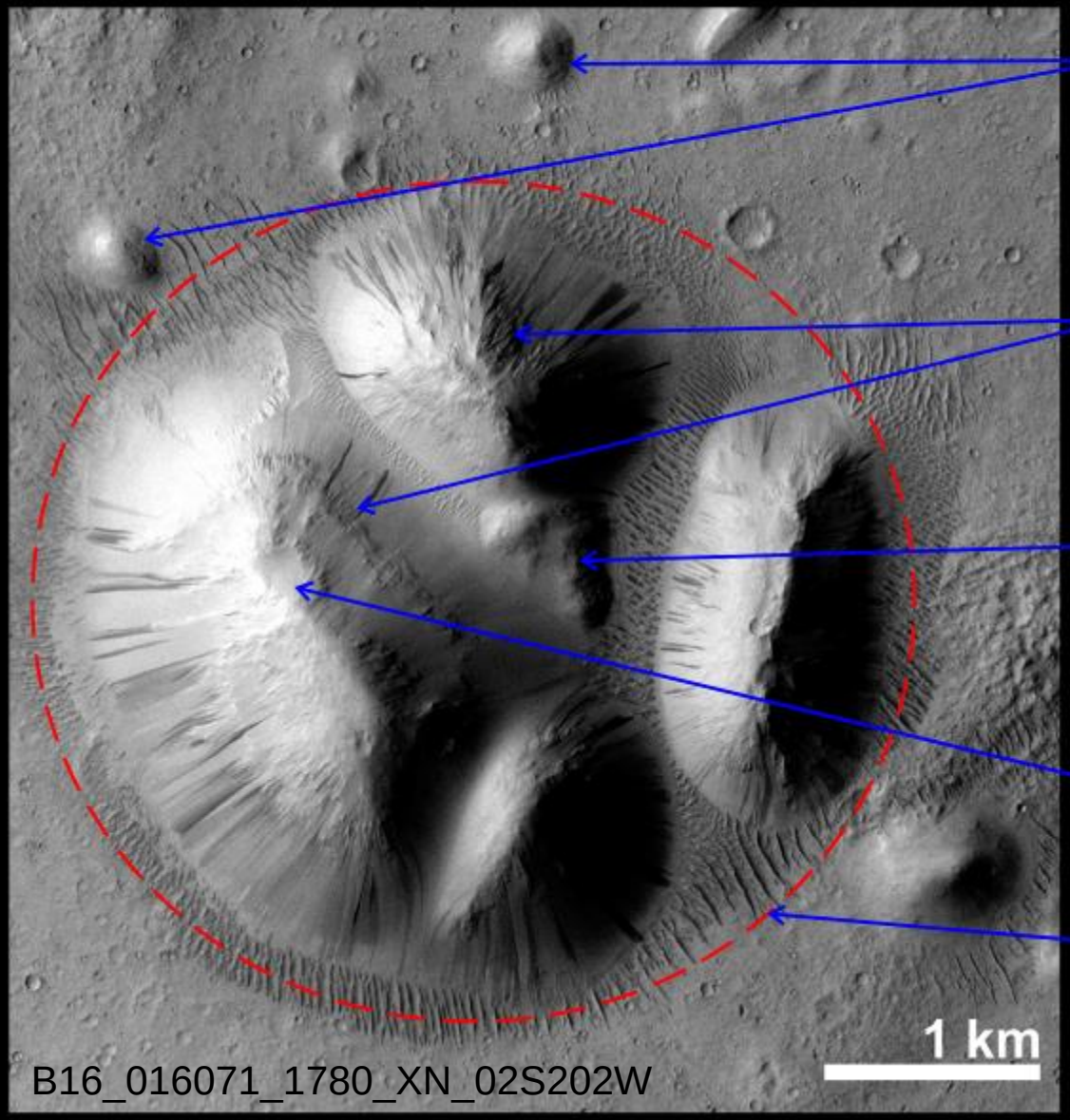
The site study and mining



Correlation the size of Earth and Mars hydrolaccolith



The geomorphological features of the injection origin of hills



Small hills have the appearance of pingo

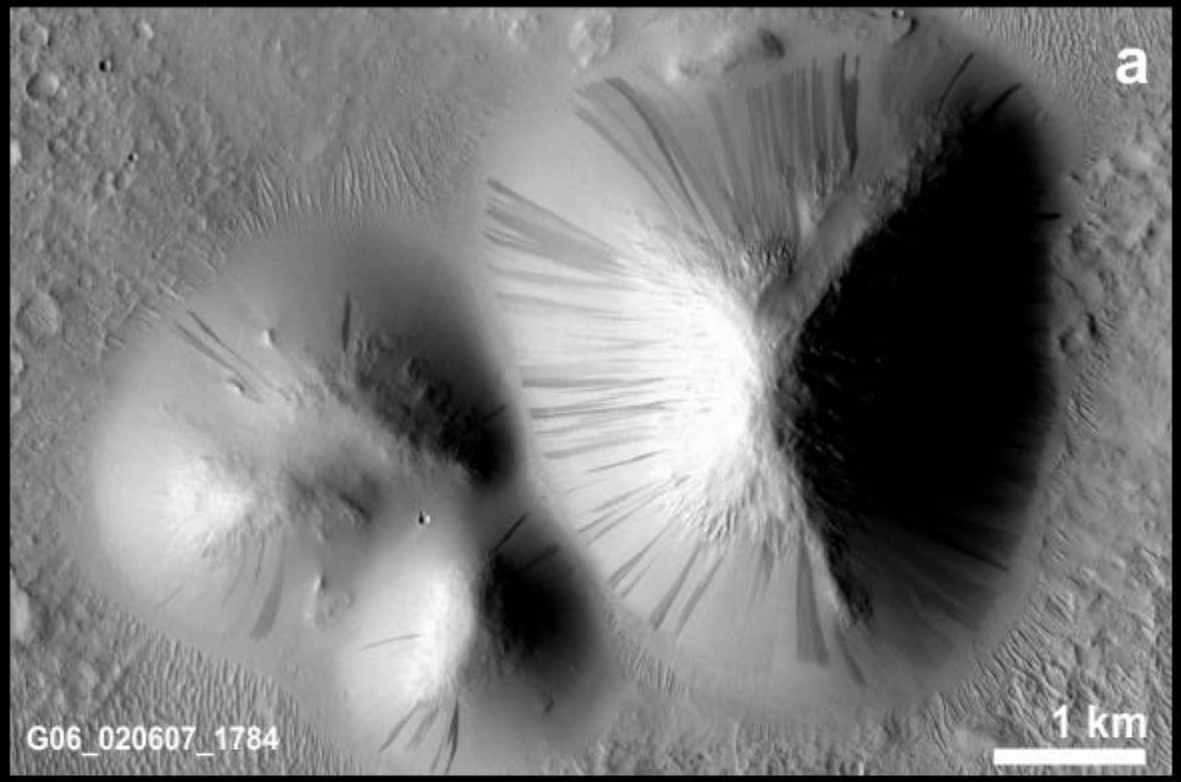
The sprawling of arrays and the lack of debris down the slope indicate the plastic and sublimating material, which can be crystal hydrates and ice

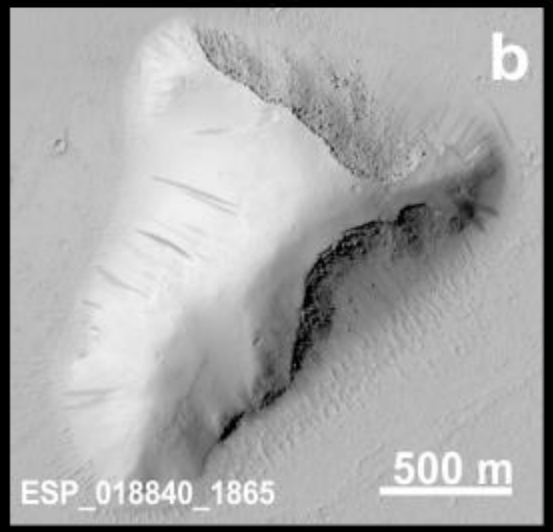
The formation of such secondary form is possible only with water flowing down from the hills in the saddle since the rise of a surface with preservation of relief and tightness can be ensured only with a platform of ice with water under it

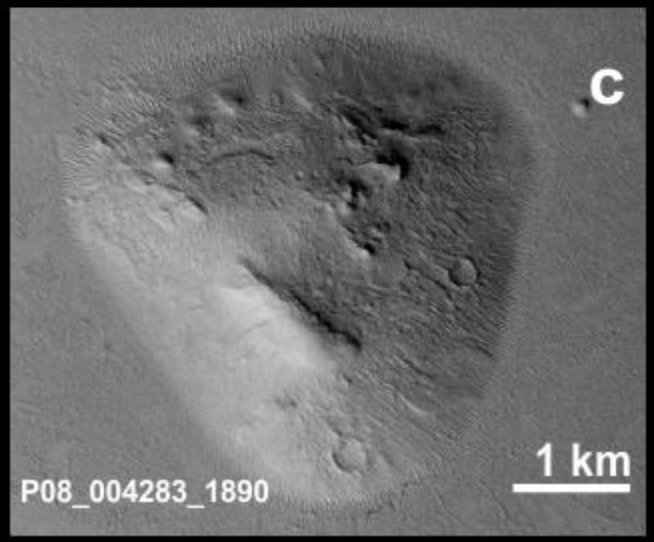
Depressions can be the result of subsidence of downstream chambers with a liquid

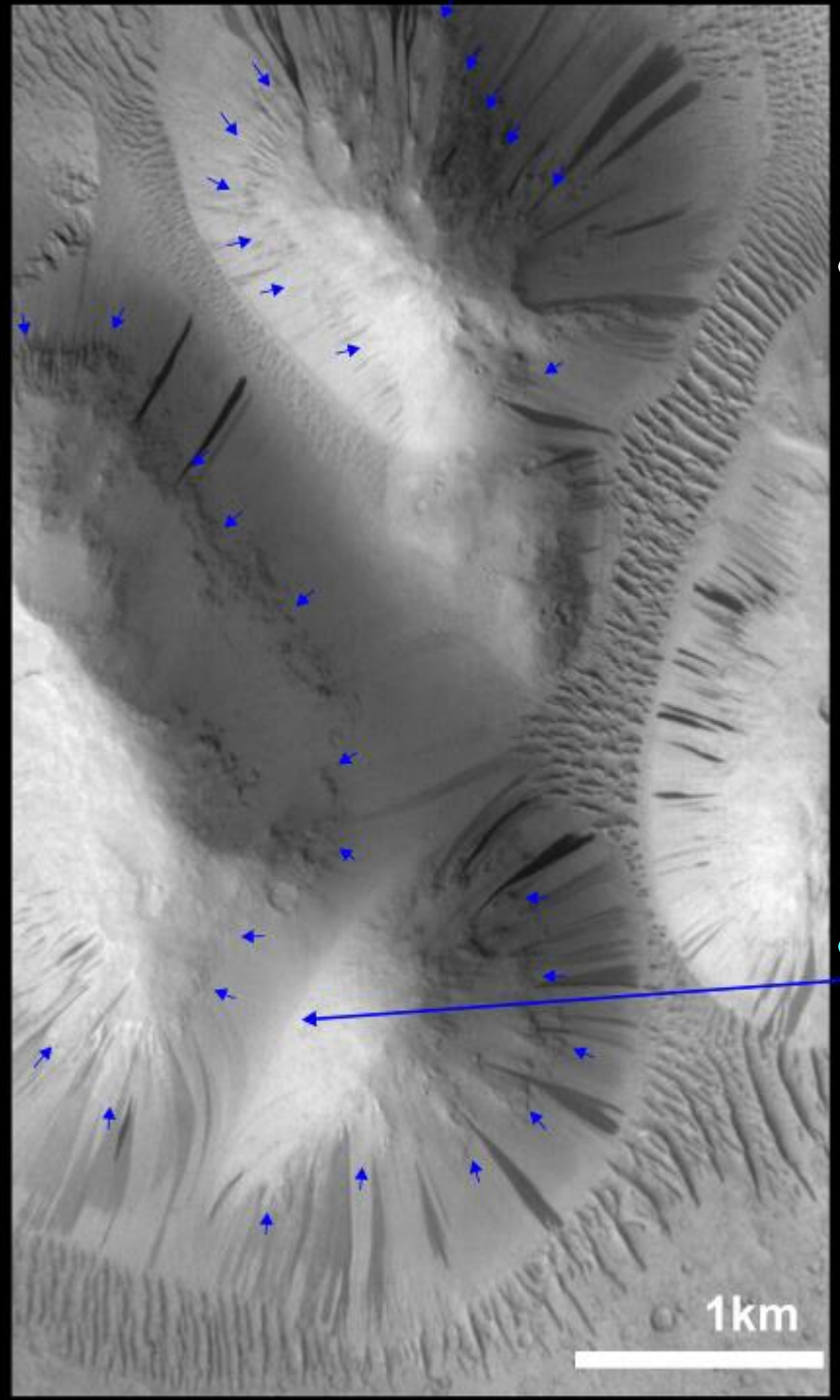
The hills form a circle, which indicates their common roots

Stages of the evolution of big hydrolaccoliths (BHL)





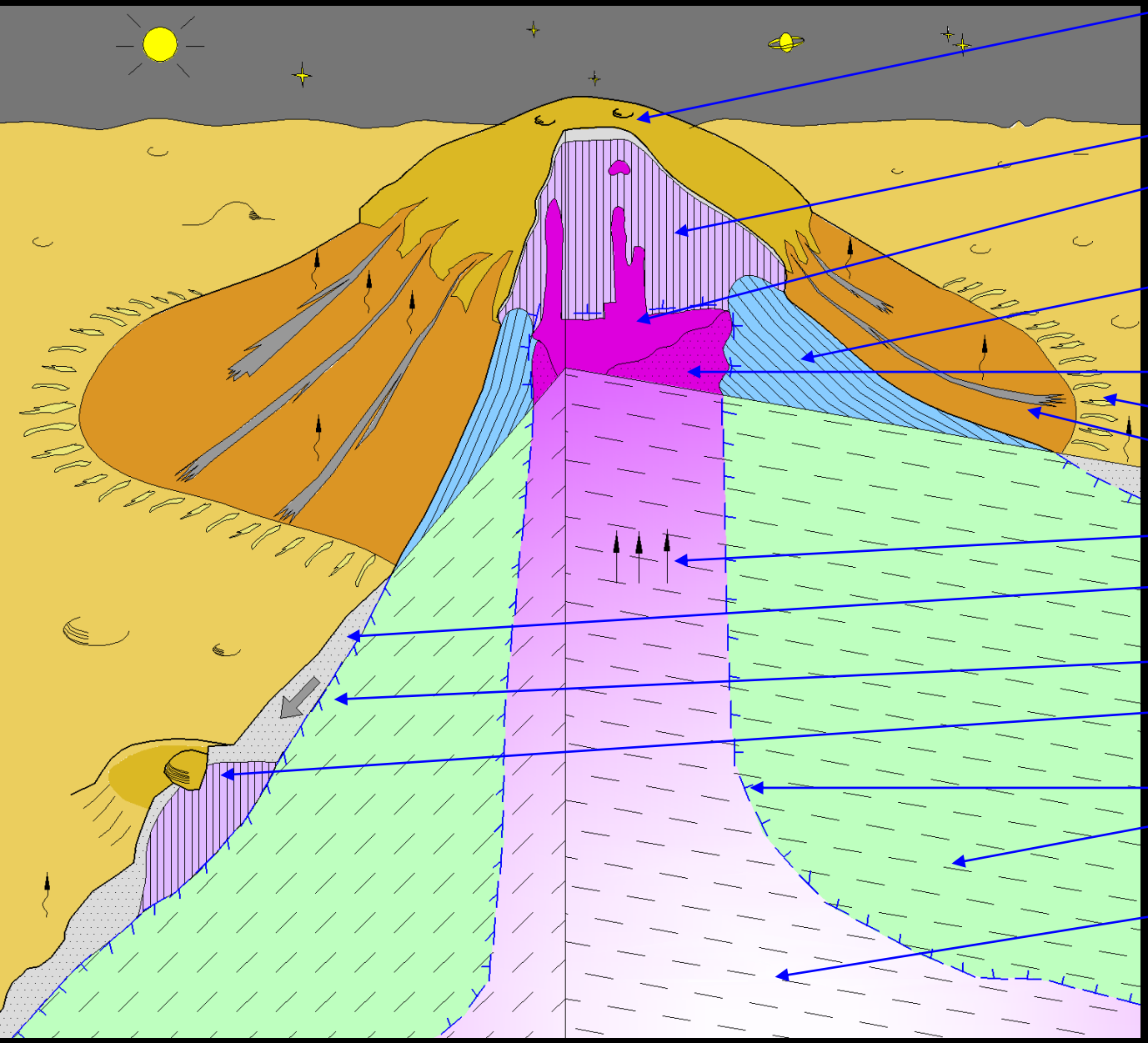




Signs of recent activity of BHL

- A distinct boundary of erosion and accumulative forms indicates younger years or a steady increase in the central parts of BHL. On the southern and northern Hedgehogs (Mom and Dad) can see two stages of the intrusion, the second of the which it has been associated with the breakthrough of brine close to the surface and led to the appearance of the central secondary structure.
- Such a line of the saddle is only possible at a constant admission of the demolishing material from the growing hills.

The alleged structure of BHL



Depressions

Crystal hydrates, ice

Reservoir of brine

Hard crystal of hydrates - dust caldera BHL

The precipitate of fine debris

Dunes

Slope streaks

Rising filtration

Drained area

Flow of water on permafrost

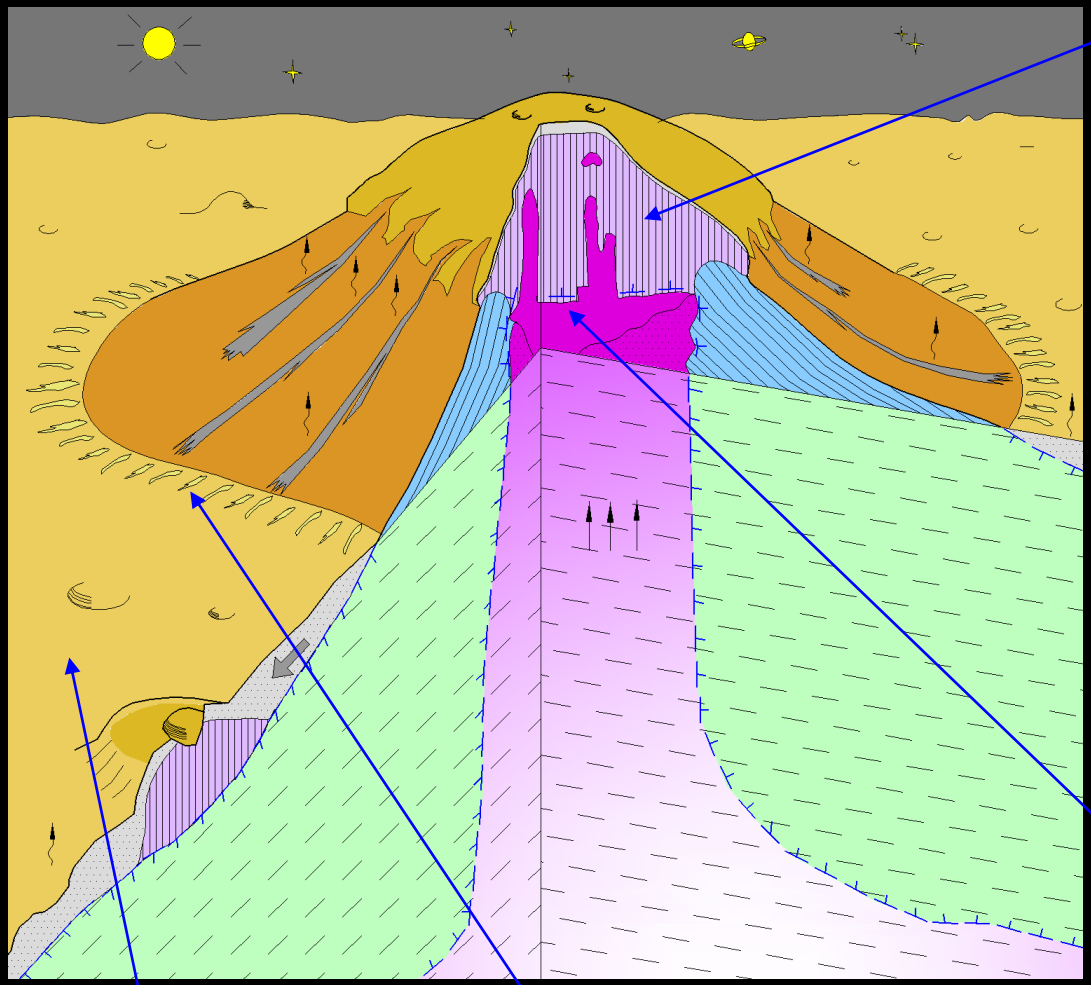
The secondary structure

The boundary permafrost

Permafrost

Mineralized water in the environment of clastic rocks

Resources for colony



Water

Likely hydrated salts are :

•magnesium perchlorate $Mg(ClO_4)\cdot 6H_2O$,
•antarktitsit $CaCl_2\cdot 6H_2O$,

•gypsum $CaSO_4\cdot 2H_2O$.

Even the first step of partial dehydration releases 16,5-17,5% of the water of these minerals.

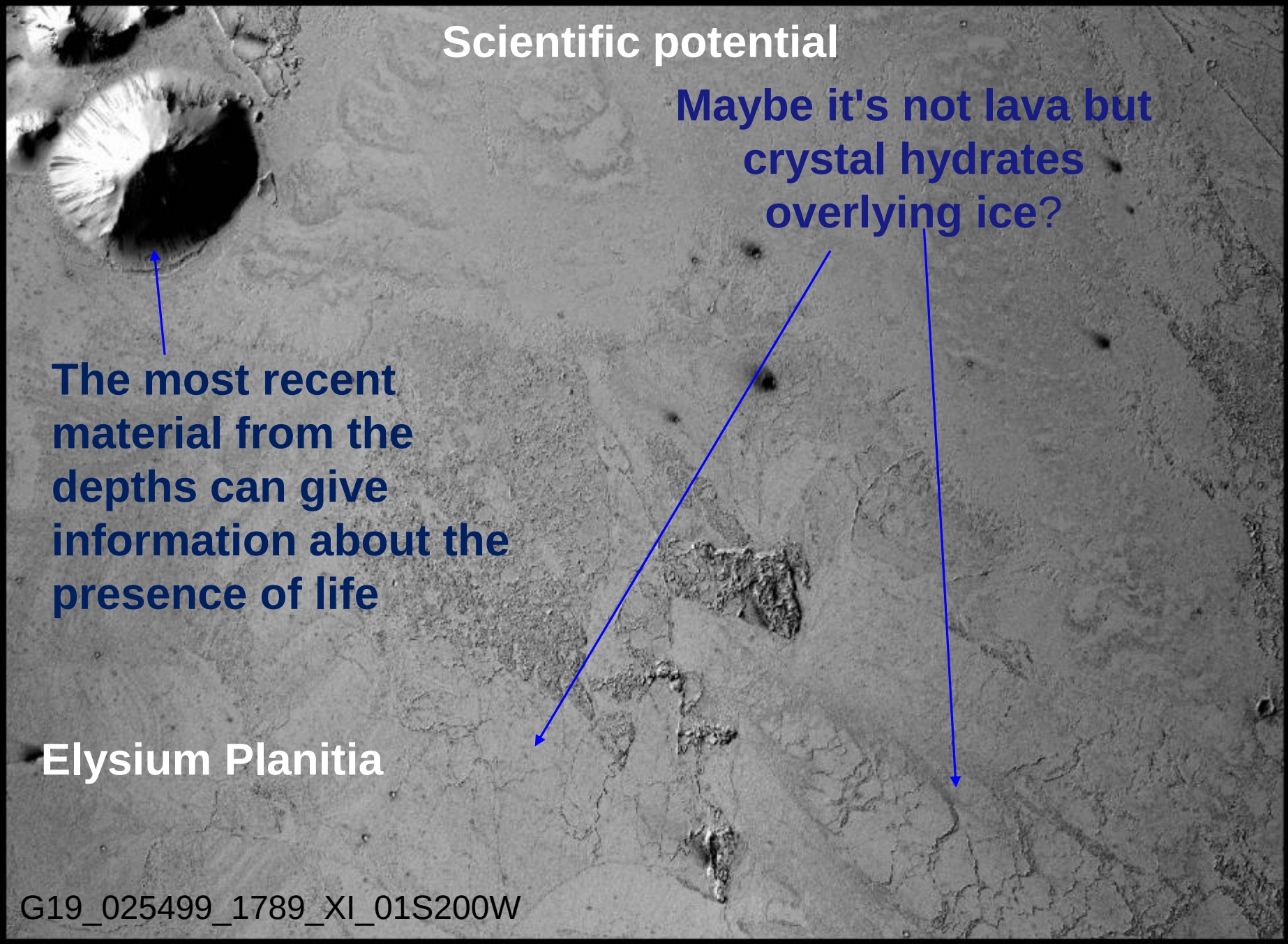
The volume of Hedgehogs (Mother, Little Son, Father and Daughter) is 1.05 km3, the volume of water-rich crystalline hydrates in them is 0,43 km3, and water which is easy to extract is 0,073 km3. This would ensure the colony of 10 000 people at a rate of 40 liters / person per day for a period of 500 years.

Dust is a good natural insulator for shelters

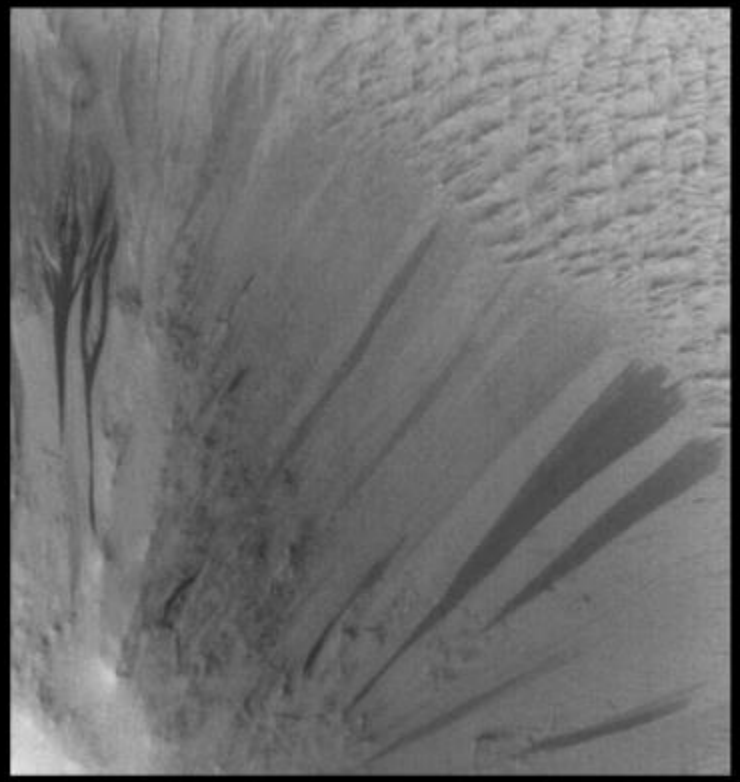
Dune **sand** can be a versatile Dune sand can be a versatile building material that requires only a bonding agent

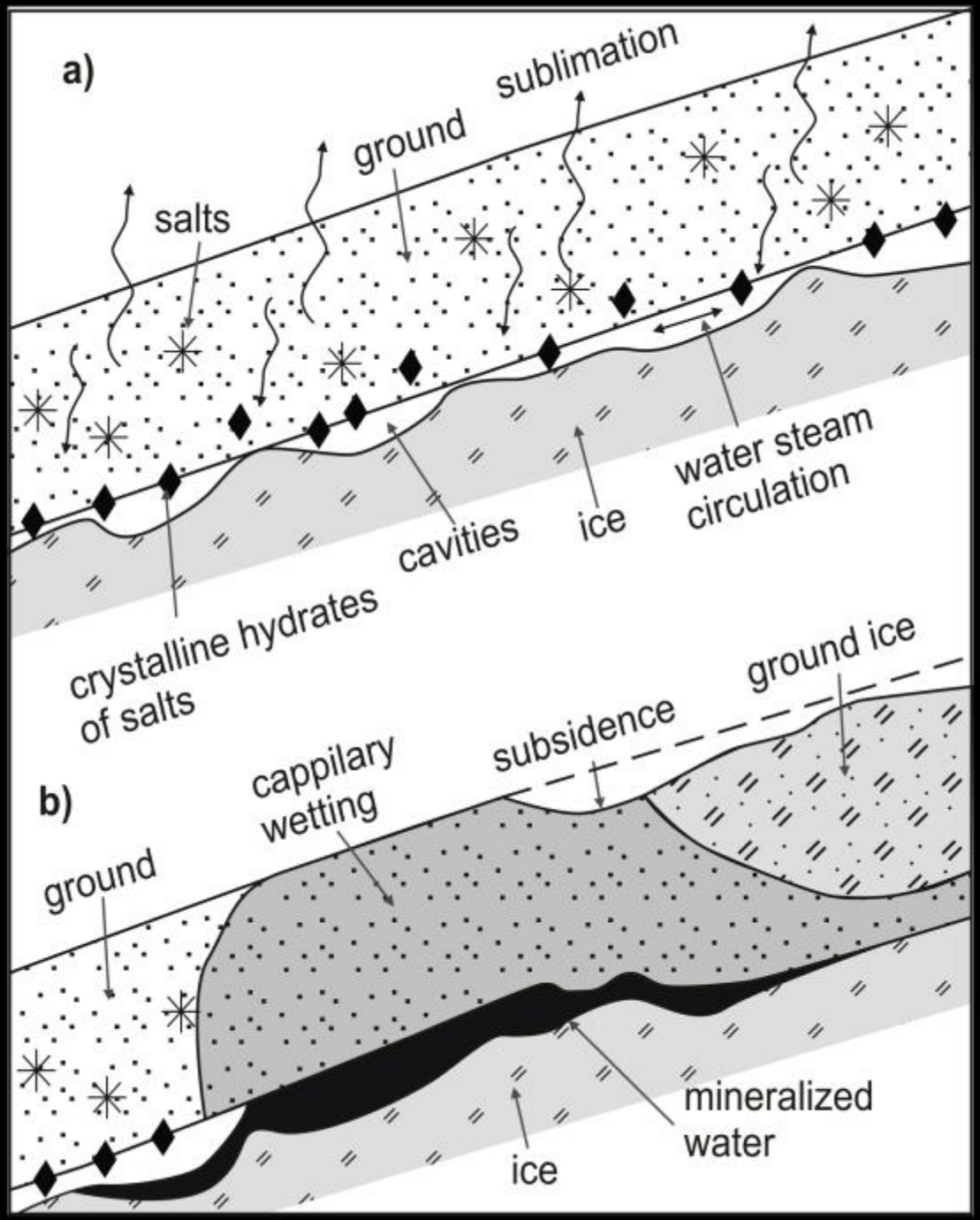
Dust and **sand** are bought from outside and should contain Fe, Al, Si, Ti, Mg

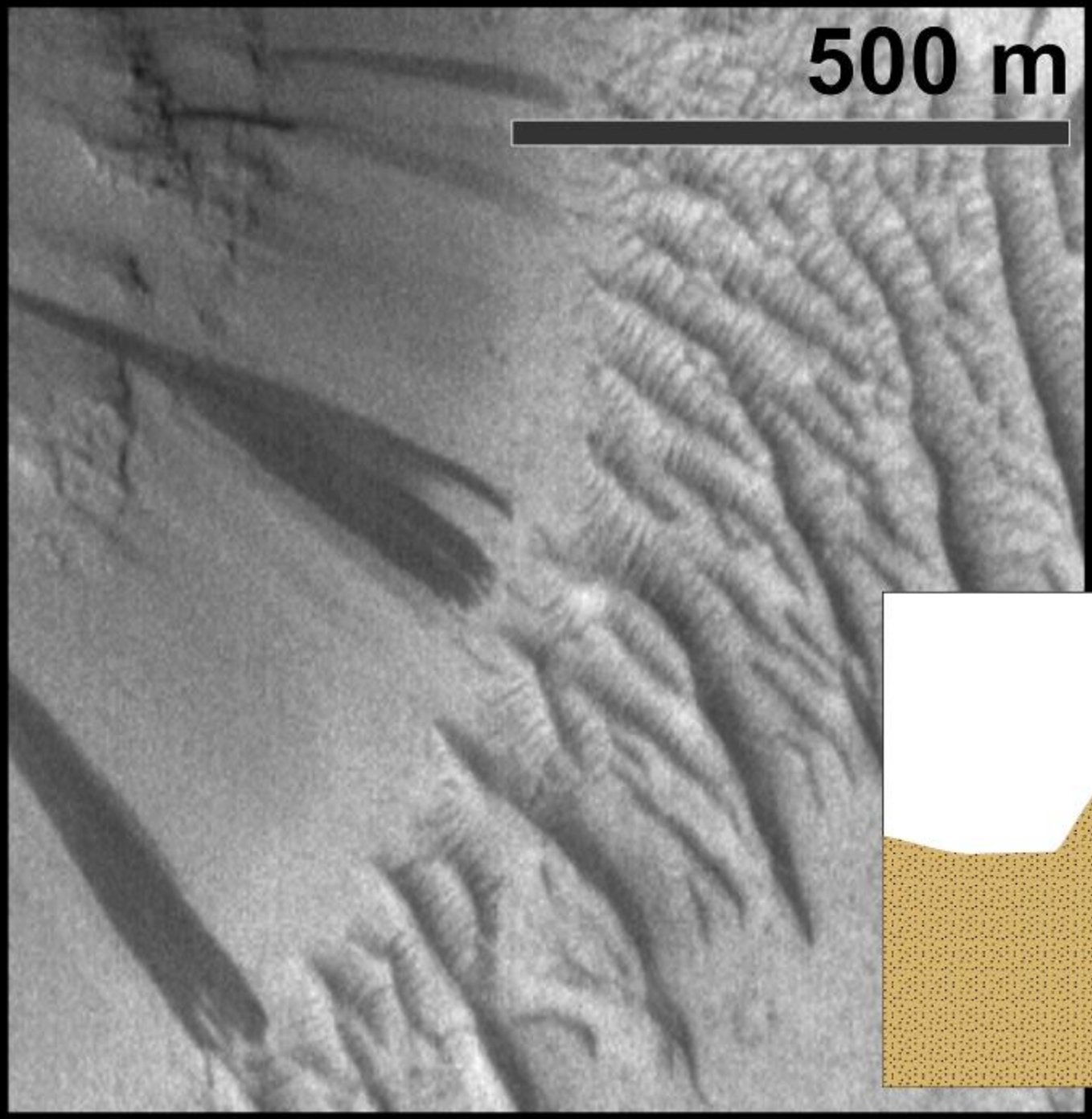
Brines - an additional source of water as well as Mg, Ca, Na, Li, Cl, Br, I, CH_4


Scientific potential
Maybe it's not lava but crystal hydrates overlying ice?
The most recent material from the depths can give information about the presence of life
Elysium Planitia
G19_025499_1789_XI_01S200W

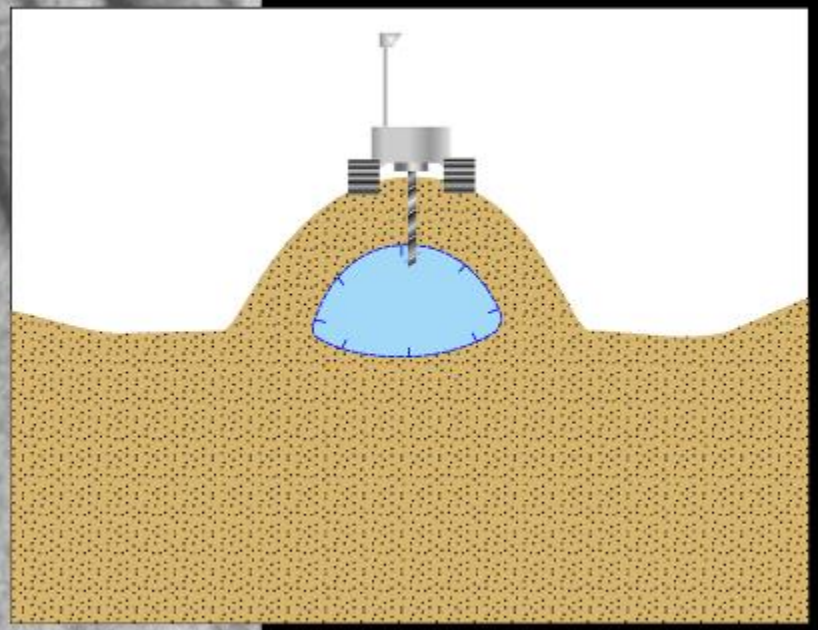
Slope streaks and proposed mechanism of their formation



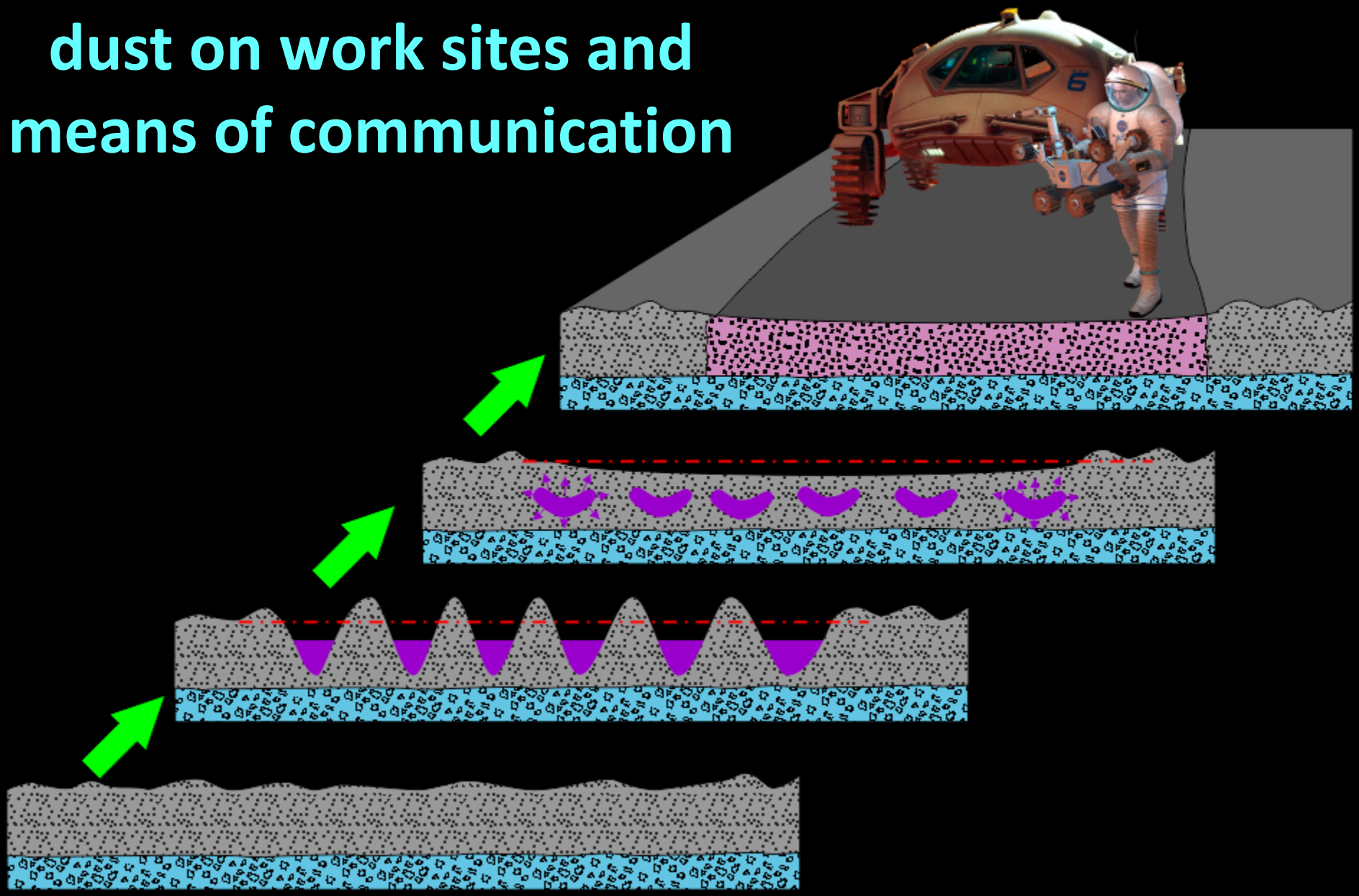




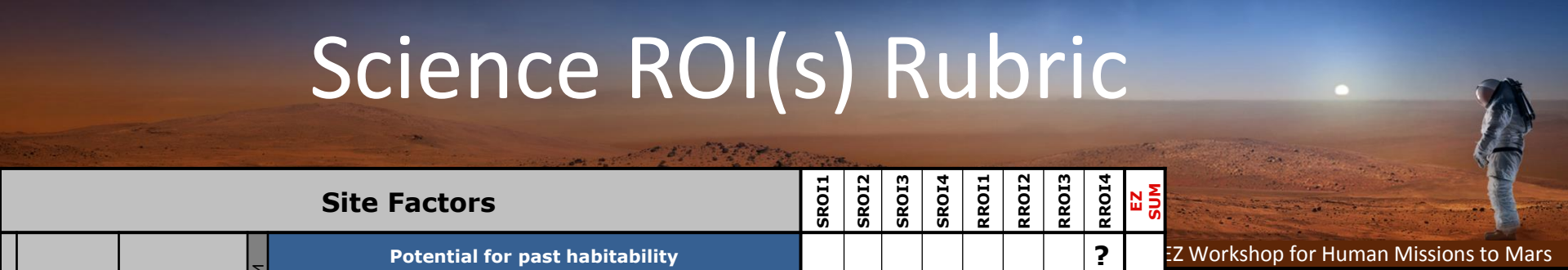
Dunes may contain fresh water condensation



Solving the problem of dust on work sites and means of communication



Science ROI(s) Rubric



EZ Workshop for Human Missions to Mars

Site Factors				SROI1	SROI2	SROI3	SROI4	RROI1	RROI2	RROI3	RROI4	EZ SUM
Научные критерии места	Astrobio	Threshold	и/или: **Potential for past habitability**								?	
			Potential for present habitability/refugia	●	○	?		●	?			2/1
		Qualifying	Potential for organic matter, w/ surface exposure	●	●	●		●	●			5/0
	Astrobio	Threshold	**Noachian/Hesperian rocks w/ trapped atmospheric gases**									
		Qualifying	Meteorological diversity in space and time									
			High likelihood of surface-atmosphere exchange	●	●	○	●	●	●	●		6/1
			Amazonian subsurface or high-latitude ice or sediment	●	●	●	●	●	●	●		7/0
			Amazonian subsurface or high-latitude ice or sediment	●	●	○		●	●			4/1
	Science	Threshold	**Range of martian geologic time; datable surfaces**	●	●	●	●	●	●	●	●	8/0
			Evidence of aqueous processes	●	●	●	?	●	●	?	●	6/2
			Potential for interpreting relative ages	●	●	●	●	●	●	●	●	6/1
			Igneous Rocks tied to 1+ provinces or different times									
			Near-surface ice, glacial or permafrost	○	●	●	?	○	●	?		3/2

Key

- ● Yes
- ○ Partial Support or Debated
- No
- Indeterminate

Resource ROI(s) Rubric

op for Human Missions to Mars

			Site Factors	SROI1	SROI2	SROI3	SROI4	RROI1	RROI2	RROI3	RROI4	EZ SUM
ISRU and Civil Engineering Criteria	Engineering		Meets First Order Criteria (Latitude, Elevation, Thermal Inertia	?	?	?	•	?	?	?		1/?
	Water Resource	Threshold	И/ AND/OR ИЛИ **Potential for ice or ice/regolith mix**	●	●	●	●	●	●	●	?	7/0
			Potential for hydrated minerals	●	●	●	?	●	●	?	○	5/1
			Potential for hydrated minerals	●	●	●	?	●	●	?	○	5/2
			Potential to be minable by highly automated systems	●	●	●	●	●	●	●	●	8/0
			Located less than 3 km from processing equipment site	●	●	●	●	●	●	●	●	8/0
			Located no more than 3 meters below the surface	●	●	●	●	●	●	●	?	7/0
			Accessible by automated systems	●	●	●	●	●	●	●	●	8/0
		Qualifying	Potential for multiple sources of ice, ice/regolith mix **and** hydrated minerals	●	●	●	●	●	●	●	?	7/0
			Distance to resource location can be >5 km									
			Route to resource location must be (plausibly) traversable	●	●	●	●	●	●	●	●	8/0
	Civil Engineering	Threshold	**~50 sq km region of flat and stable terrain with sparse rock distribution**								●	1/0
			1–10 km length scale: <10°								●	1/0
			Located within 5 km of landing site location									0/0
		Qualifying	Located in the northern hemisphere									0/0
			Evidence of abundant cobble sized or smaller rocks and bulk, loose regolith								●	1/0
			Utilitarian terrain features								●	1/0
	Food Production	Qualifying	Low latitude	●	●	●	●	●	●	●	●	8/0
			No local terrain feature(s) that could shadow light collection facilities	○	○	○	○	○	○	○	●	1/7
			Access to water	●	○	?	?	●	●	?	?	3/1
			Access to dark, minimally altered basaltic sands									
		Threshold	**Potential for metal/silicon**	?	?	•	?	?	?	●	●	3/2

ответы

- ● да
- ○ Частично отвечающин или спорные
- нет
- ? неопределяемые

Briefly summarize on a single slide:

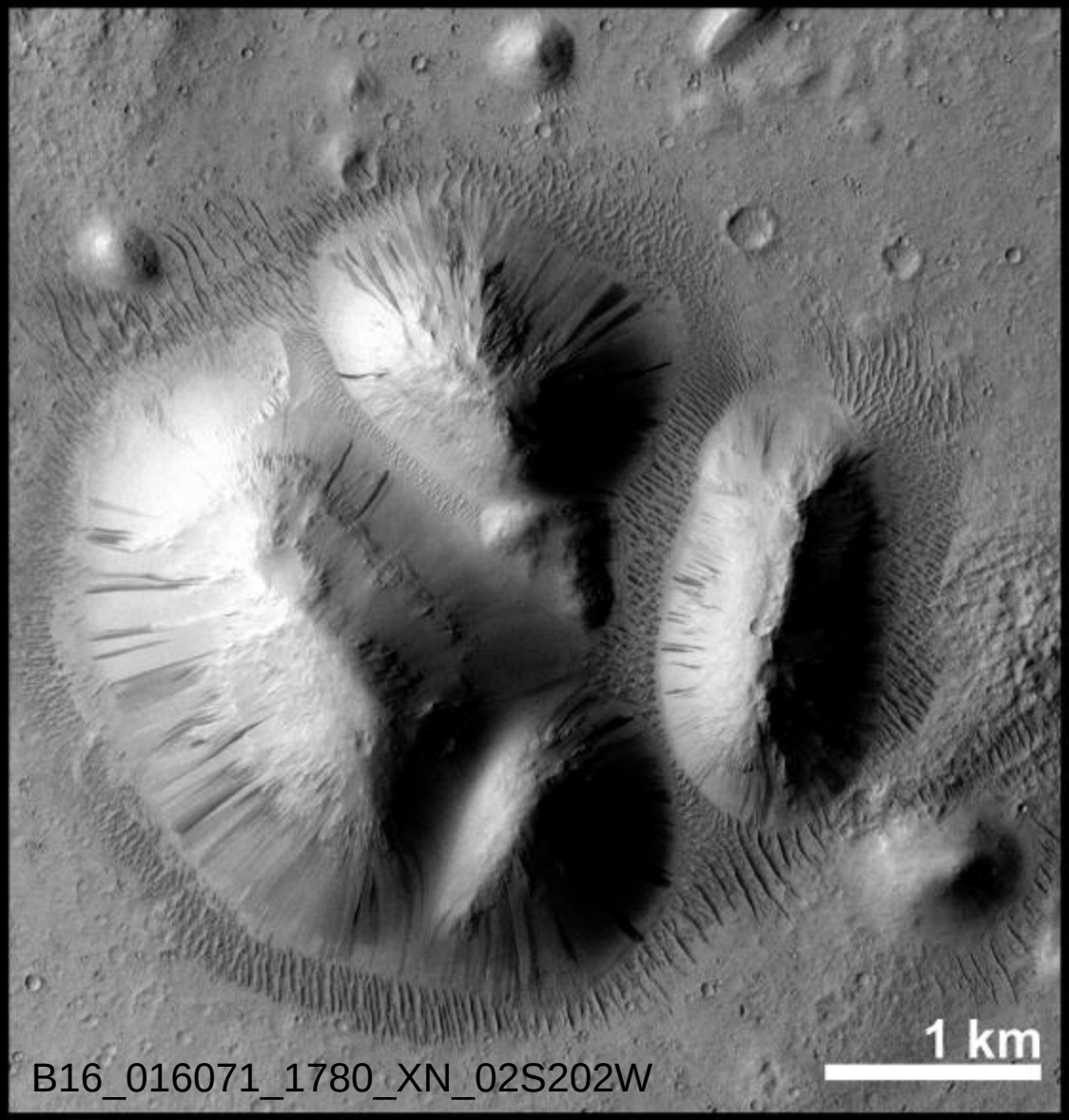
- 1. Возможность иметь доступ к активным каналам из подмерзлотной гидросферы стоит того, чтобы осуществить их предварительную разведку с помощью ровера 2020. Всесторонние исследования позволят объективно оценить активность Ежей и повысить шансы найти следы современной жизни в подмерзлотной гидросфере Марса. Попутными задачами этой миссии могут быть: изучение запасов гидратированных минералов, механизма образования склоновых полос, изучение условий посадки, строительства и передвижения.
- 2.Для повышения убедительности гипотезы о больших гидролакколитах целесообразно заказать нескольким независимым специалистам в области геоморфологии и гляциологии выполнить анализ фотоматериалов Ежей и аналогичных структур в низких широтах с целью прояснения их природы и признаков активности (3-4 месяца). Затем встретиться для выработки совместного заключения и обоснования организации специальной миссии.

Список определение приоритетности потребностей EZ данных

На участок с центром 1˚ 28´12˝ S; 157˚ 12´ 09˝ E размером 32X32 км нужны карты с разрешающей способностью 0,2-0,3 м:

- Карта в видимом свете
- Карта рельефа
- Карта тепловой инерции
- Карта геологическая

Conclusions



- For the first humanitarian mission and the of the colony foundation the areas this the active hydrolaccoliths have advantages of equatorial plains, are provided with large reserves of water and promising for the study of mineral resources and a life in the depths of Mars.

- Therefore exploration of hydrolaccoliths from orbit and by robotic missions is acute now, in particular, the important information of Curiosity about Mount Sharp hydrolaccolith.

References:

- 1.Clifford S. M., Lasue J., Heggy E., Boisson J., McGovern P., Max M.D. Depth of the Martian cryosphere: Revised estimates and implications for the existence and detection of subpermafrost groundwater. Jornal of Geophesical Research: Planets (1991-2021)115 (E7) 2010.
- 2.Yakovlev V. Conditions and mechanism of Mars big hydrolaccoliths formation. Fifth Mars Polar Science Conference (2011) 6026.
- 3. Yakovlev V.V. Large basins of water on Mars. European Mars Science & Exploration Conference: Mars Express and ExoMars (2007) p.161;
- 4. Yakovlev V.V. Large basins of water in equatorial regions of Mars .The Conference “THE SOLAR SYSTEM BODIES: FROM OPTICS TO GEOLOGY” (Kharkov, 2008) p.129-131;
- 5. Yakovlev V.V. Slope streaks on Mars – gravity-capillary displays of water. 41st Lunar and Planetary Science Conference (2010) 1333;
- 6. Yakovlev V.V. Conditions and mechanism of Mars dig hydrolaccoliths formation/ Fifth Mars Polar Science Conference (2011) 6026;
- 7. Yakovlev V.V. The hydrolaccoliths of Holden crater – the possible storage of life traces /42nd Lunar and Planetary Science Conference (2011) 1115;
- 8. Yakovlev V.V. The nature of the central structure of the Martian crater Gale. Scientific publication UkrDGRI №3.K2012-S.102-113.

Thank you for attention!