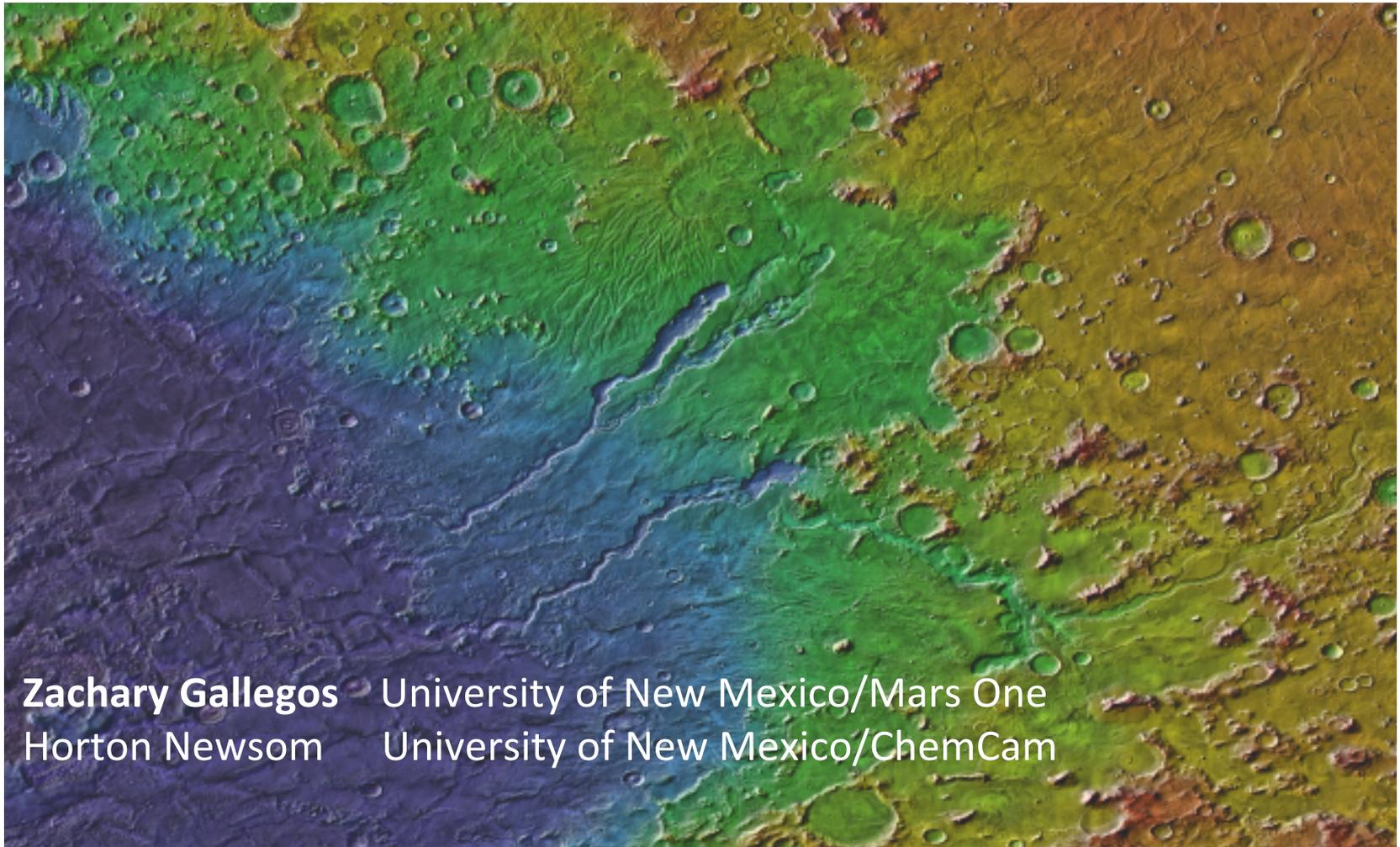


# The East Rim of Hellas: Mars' Mesopotamia



Abstract #1035

1<sup>st</sup> EZ Workshop for Human Missions to Mars

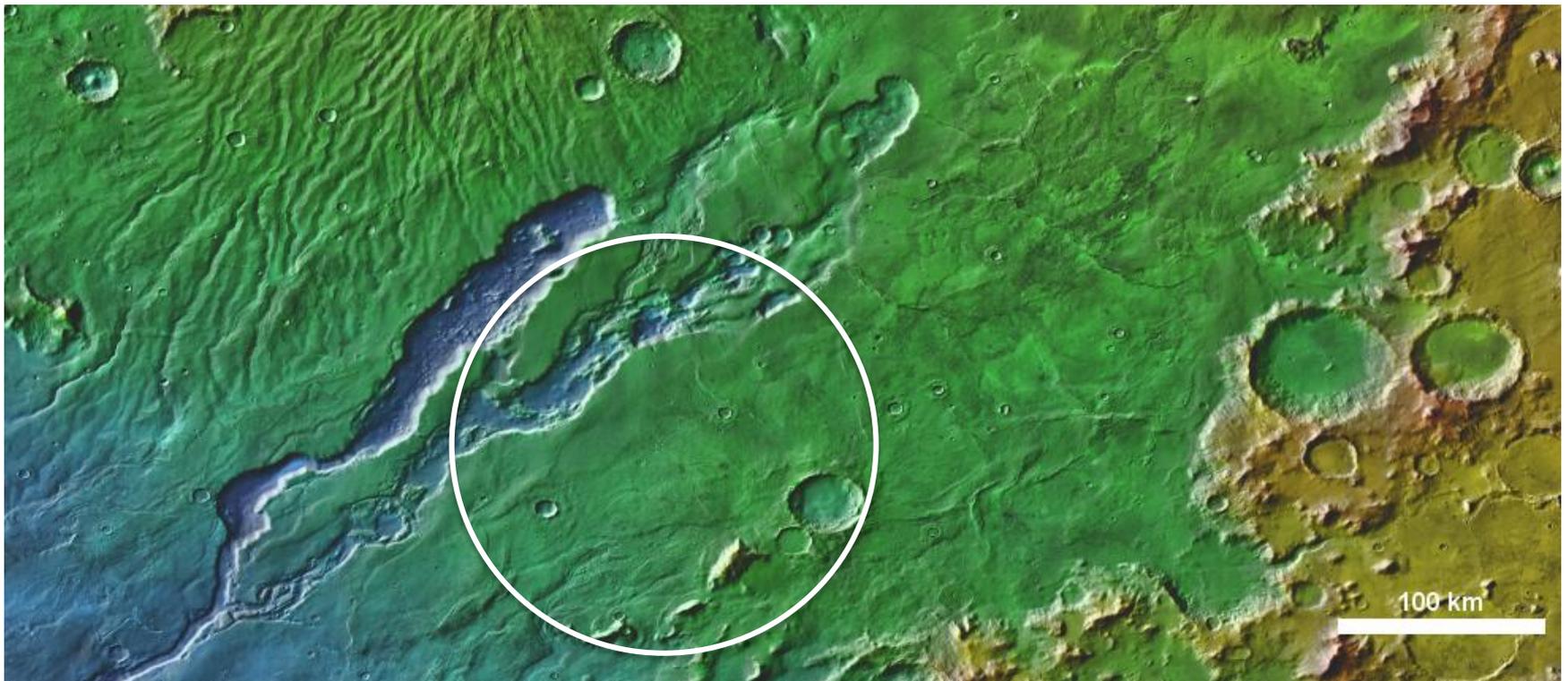


**Zachary Gallegos** University of New Mexico/Mars One  
**Horton Newsom** University of New Mexico/ChemCam

# EZ Close-up

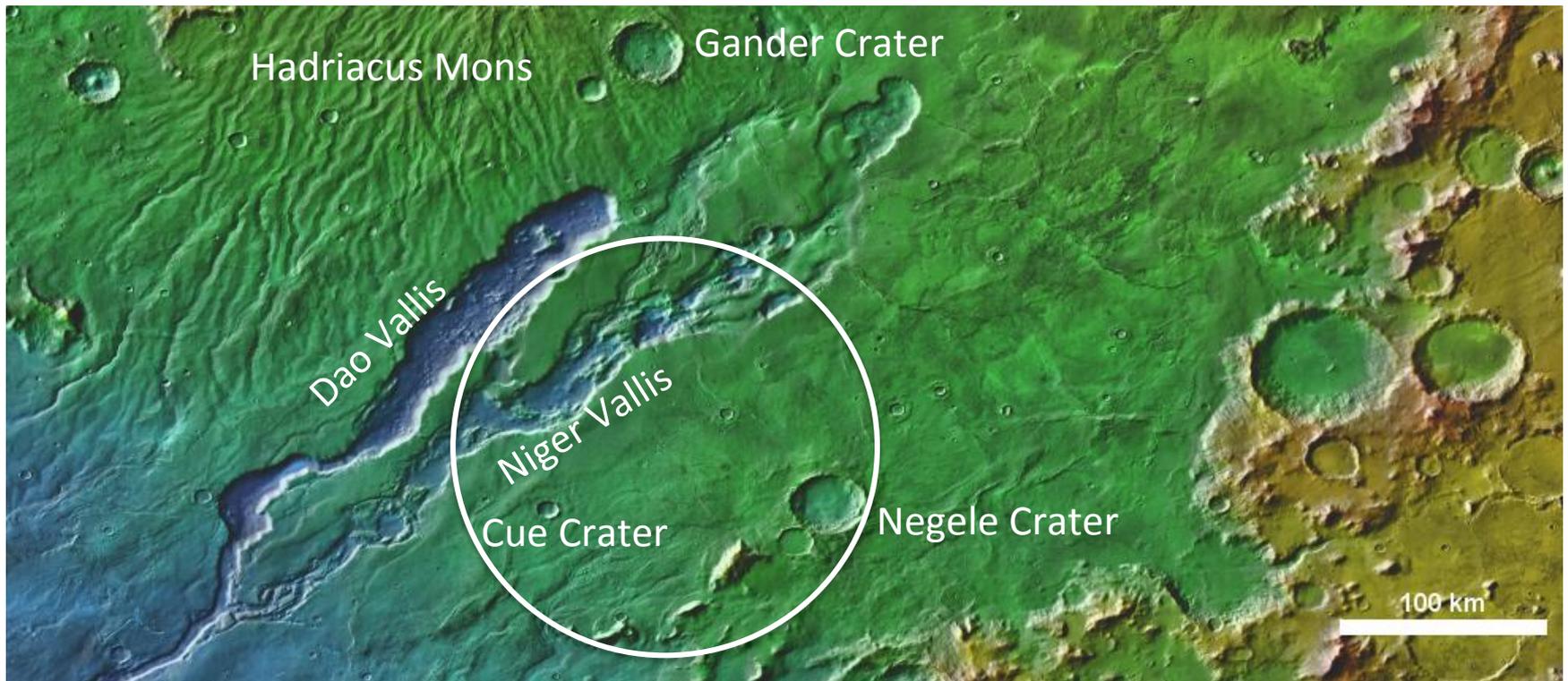
1<sup>st</sup> EZ Workshop for Human Missions to Mars

- 94.02E, 35.352S



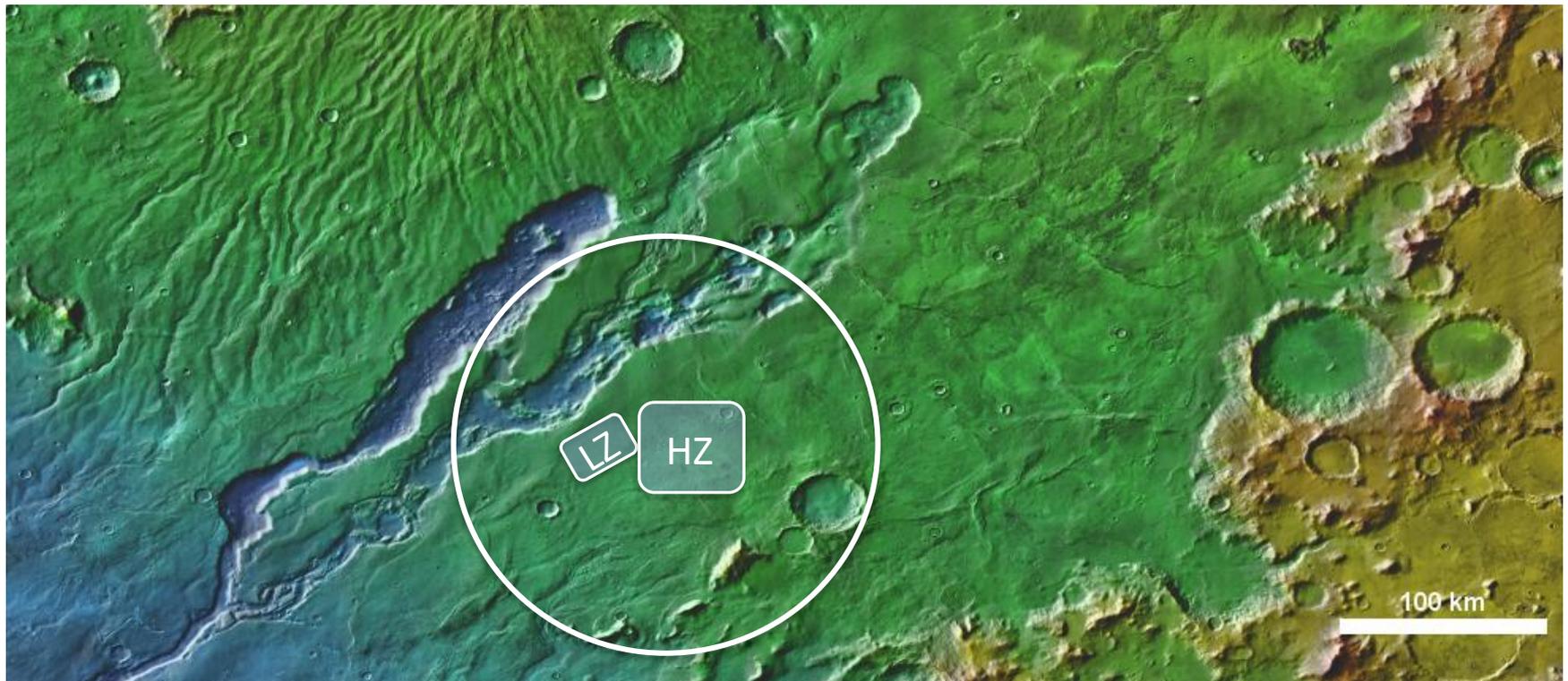
# Local Features

1<sup>st</sup> EZ Workshop for Human Missions to Mars



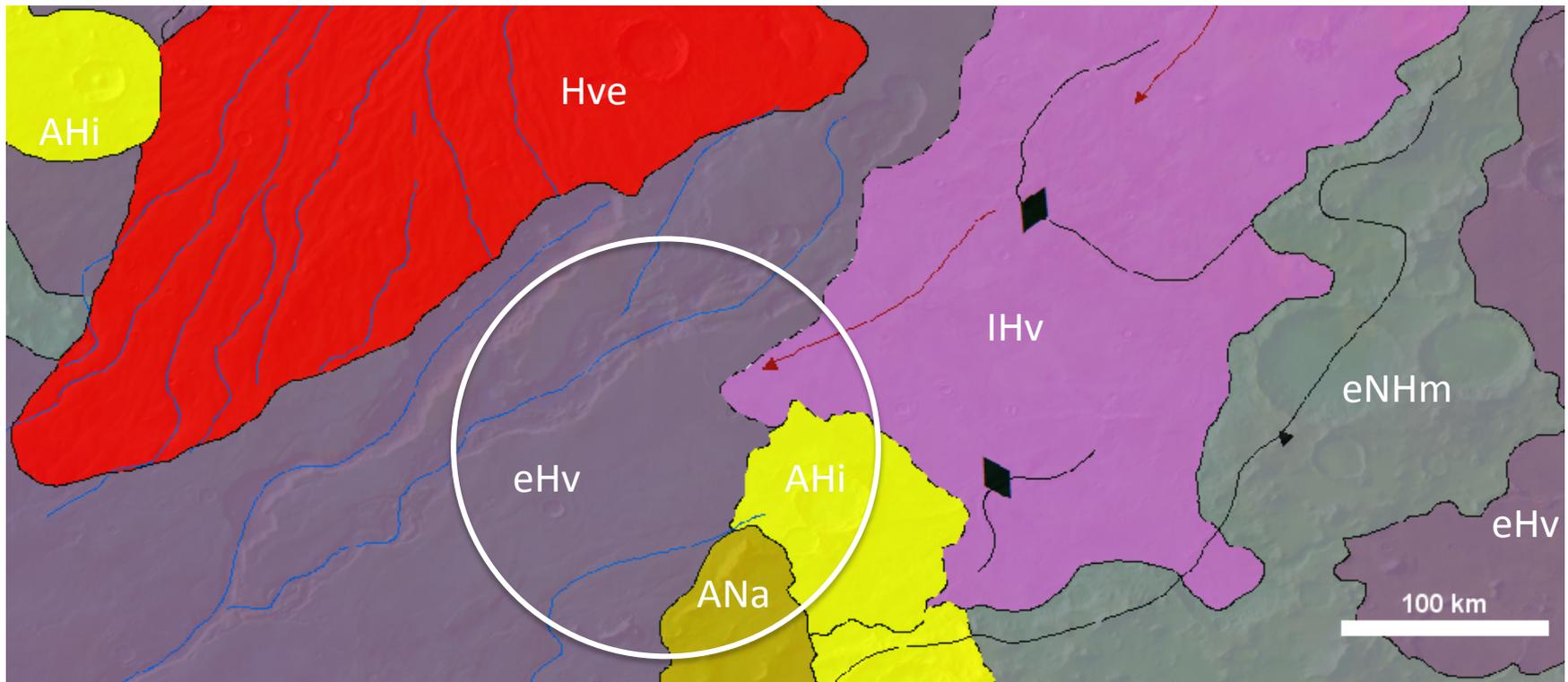
# EZ Close-up

1<sup>st</sup> EZ Workshop for Human Missions to Mars



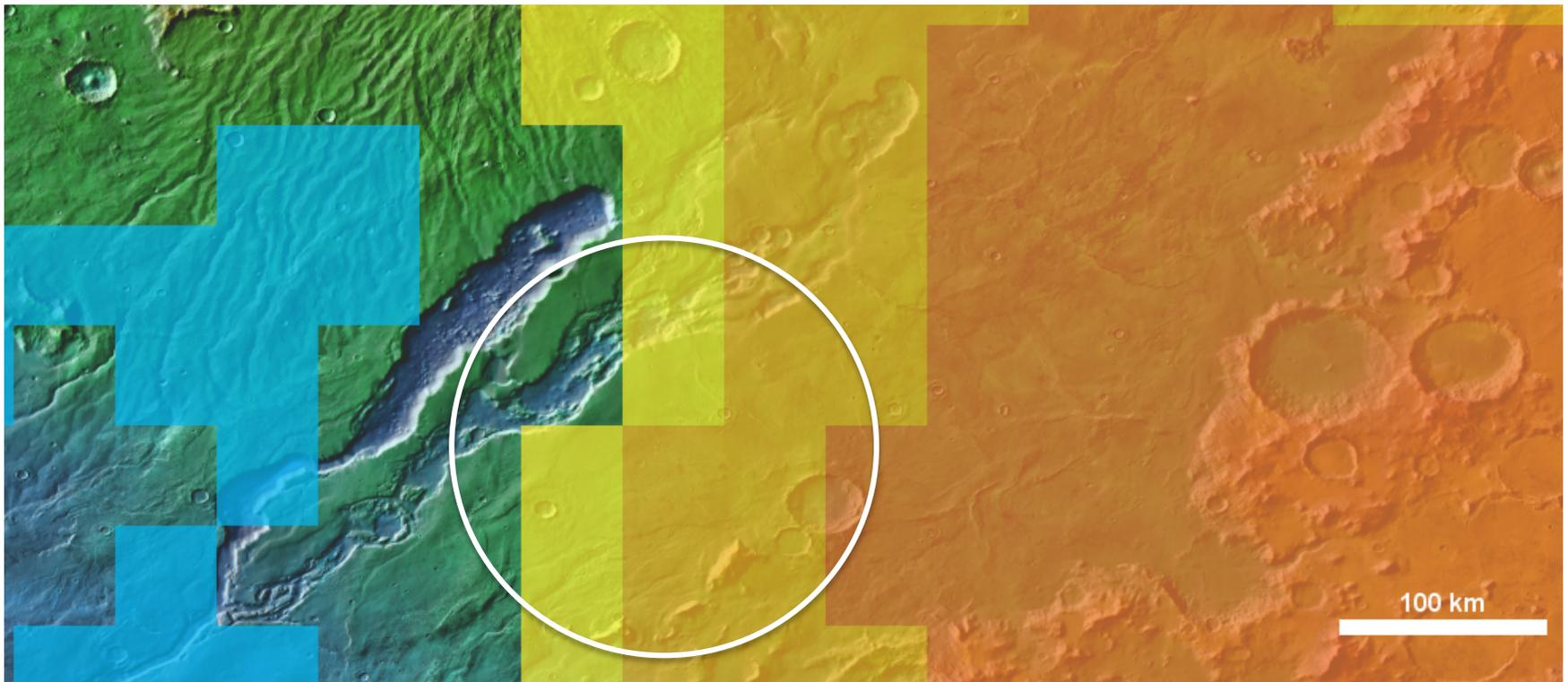
# Geologic Context

1<sup>st</sup> EZ Workshop for Human Missions to Mars



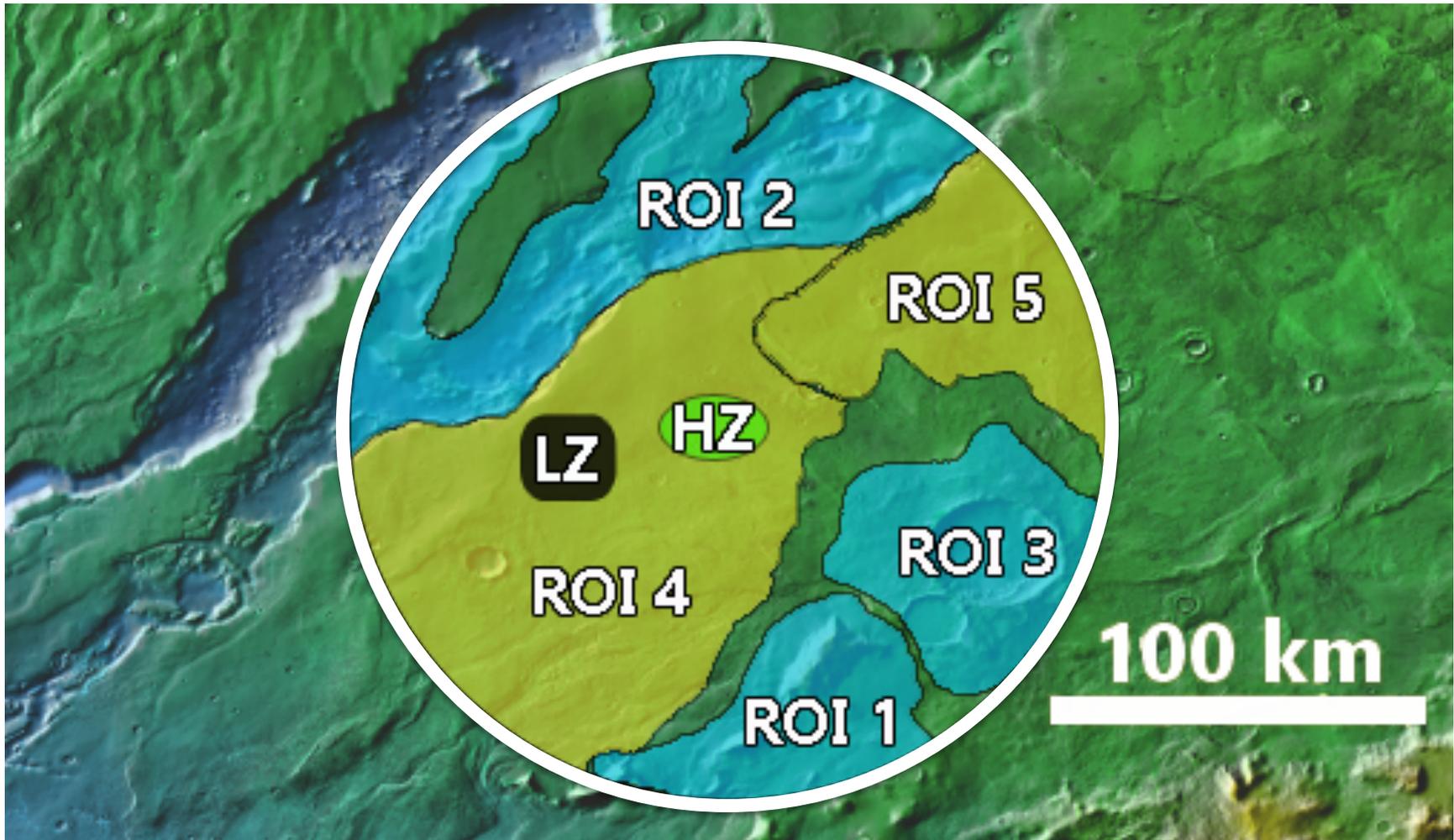
# Remnant Magnetism

1<sup>st</sup> EZ Workshop for Human Missions to Mars



# Exploration Zone Map

1<sup>st</sup> EZ Workshop for Human Missions to Mars

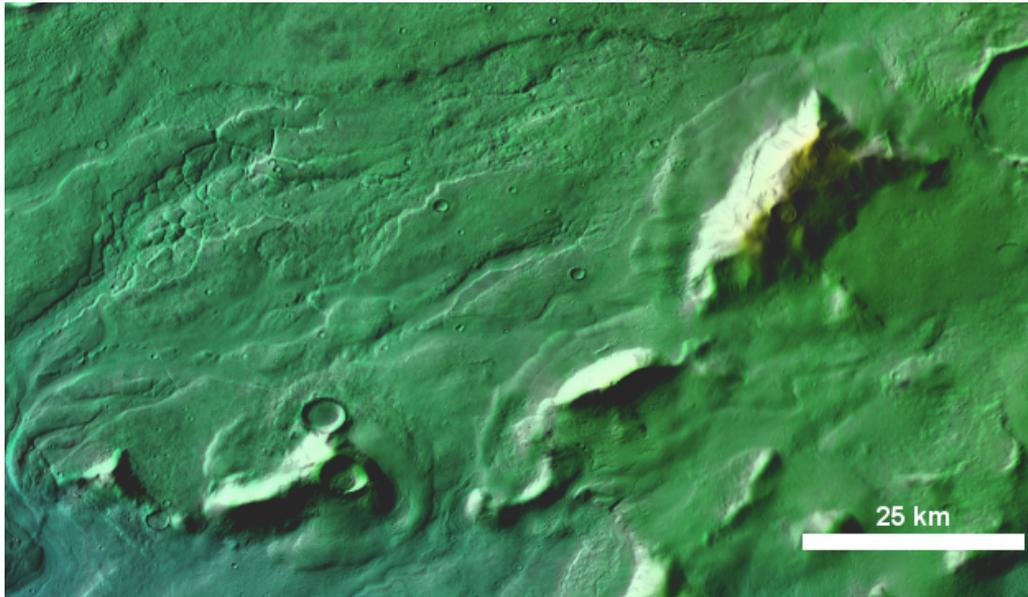


# SCIENCE ROIs

# Science ROI1

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## Amazonian-Noachian apron unit (ANa)



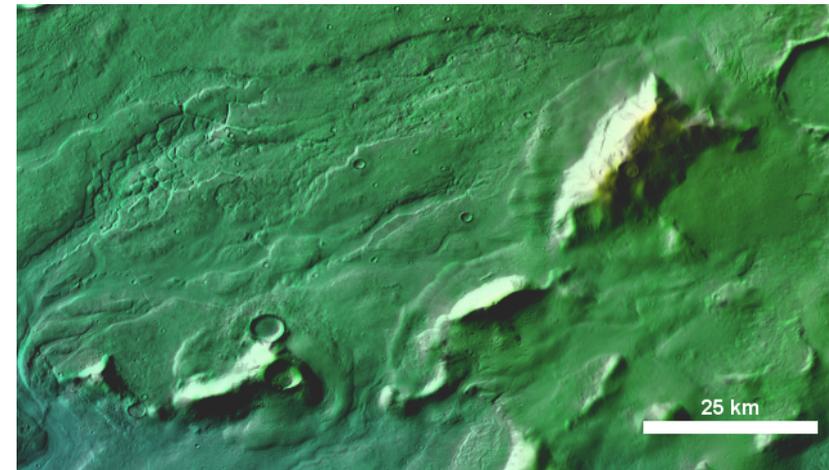
- 94.812E, -36.422
- Amazonian water ice
- Aqueous processes
- Noachian bedrock
- Remnant mag
- Impact processes

# Science ROI1 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars



Site Factors				SROI1	
Science Site Criteria	Astrobio	Threshold	AND/OR	Potential for past habitability	●
				Potential for present habitability/refugia	●
		Qualifying	Potential for organic matter, w/ surface exposure		?
	Atmospheric Science	Threshold	Noachian/Hesperian rocks w/ trapped atmospheric gases		●
		Qualifying	Meteorological diversity in space and time		●
			High likelihood of surface-atmosphere exchange		●
			Amazonian subsurface or high-latitude ice or sediment		●
		High likelihood of active trace gas sources		?	
	Geoscience	Threshold	Range of martian geologic time; datable surfaces		●
			Evidence of aqueous processes		●
			Potential for interpreting relative ages		●
		Qualifying	Igneous Rocks tied to 1+ provinces or different times		●
			Near-surface ice, glacial or permafrost		●
			Noachian or pre-Noachian bedrock units		●
Outcrops with remnant magnetization			●		
Primary, secondary, and basin-forming impact deposits			●		
Structural features with regional or global context			●		
Diversity of aeolian sediments and/or landforms			?		

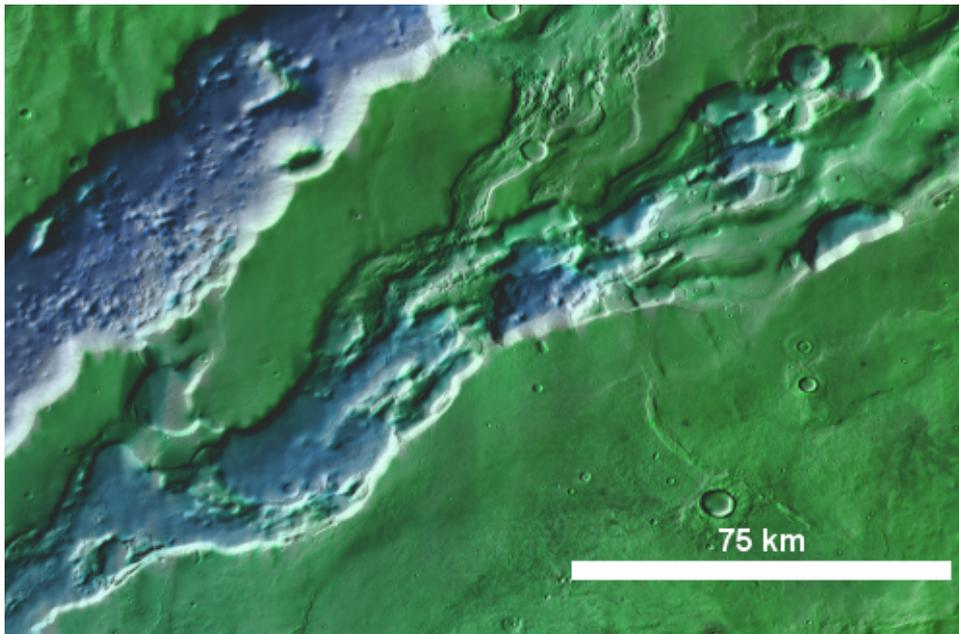


Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# Science ROI2

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## Niger Vallis



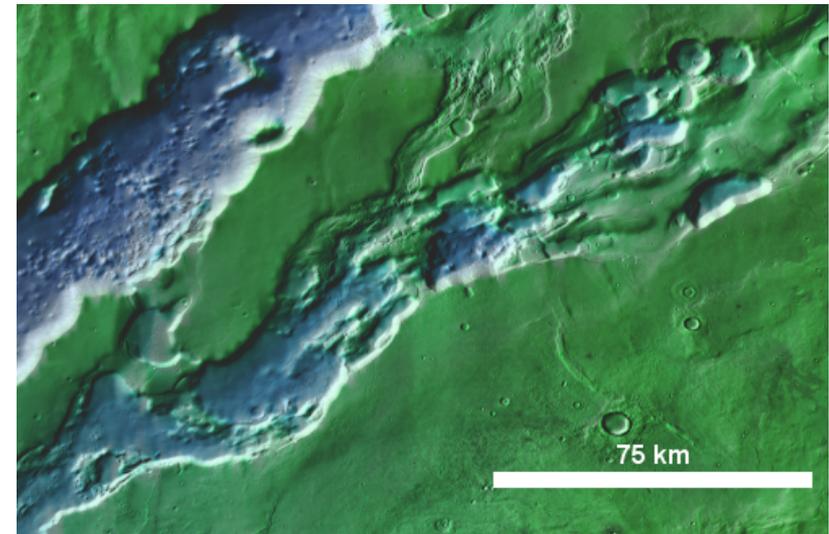
- 94.422E, -33.813
- Aqueous processes
- Hydrated minerals
- Potential habitability
- Water ice

# Science ROI2 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars

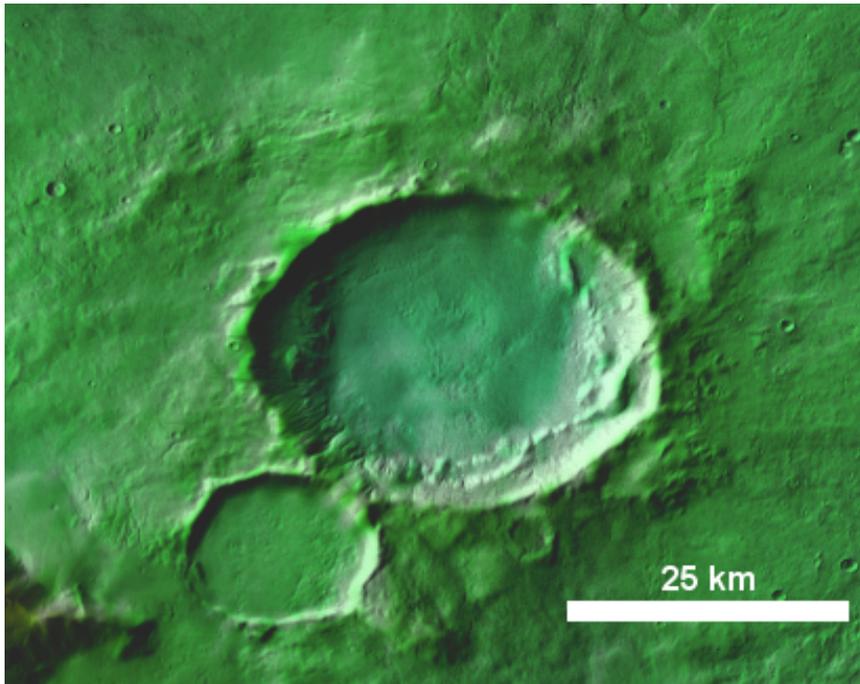


Site Factors				SROI2	
Science Site Criteria	Astrobio	Threshold	AND/OR	Potential for past habitability	●
				Potential for present habitability/refugia	●
		Qualifying	Potential for organic matter, w/ surface exposure		?
	Atmospheric Science	Threshold	Noachian/Hesperian rocks w/ trapped atmospheric gases		●
			Meteorological diversity in space and time		●
		Qualifying	High likelihood of surface-atmosphere exchange		●
			Amazonian subsurface or high-latitude ice or sediment		●
			High likelihood of active trace gas sources		?
	Geoscience	Threshold	Range of martian geologic time; datable surfaces		●
			Evidence of aqueous processes		●
			Potential for interpreting relative ages		●
		Qualifying	Igneous Rocks tied to 1+ provinces or different times		●
			Near-surface ice, glacial or permafrost		●
			Noachian or pre-Noachian bedrock units		●
Outcrops with remnant magnetization			○		
Primary, secondary, and basin-forming impact deposits			●		
Structural features with regional or global context			●		
Diversity of aeolian sediments and/or landforms			?		



Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

## Negele Crater – Amazonian Hesperian impact (AHi)



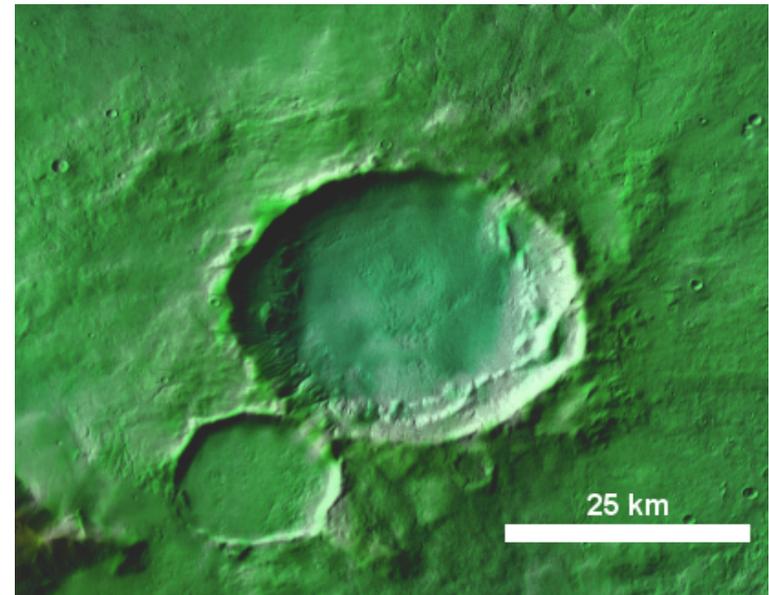
- 95.875E, -35.688
- Impact deposits
- Trapped atmospheric gasses
- Water ice

# Science ROI3 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars



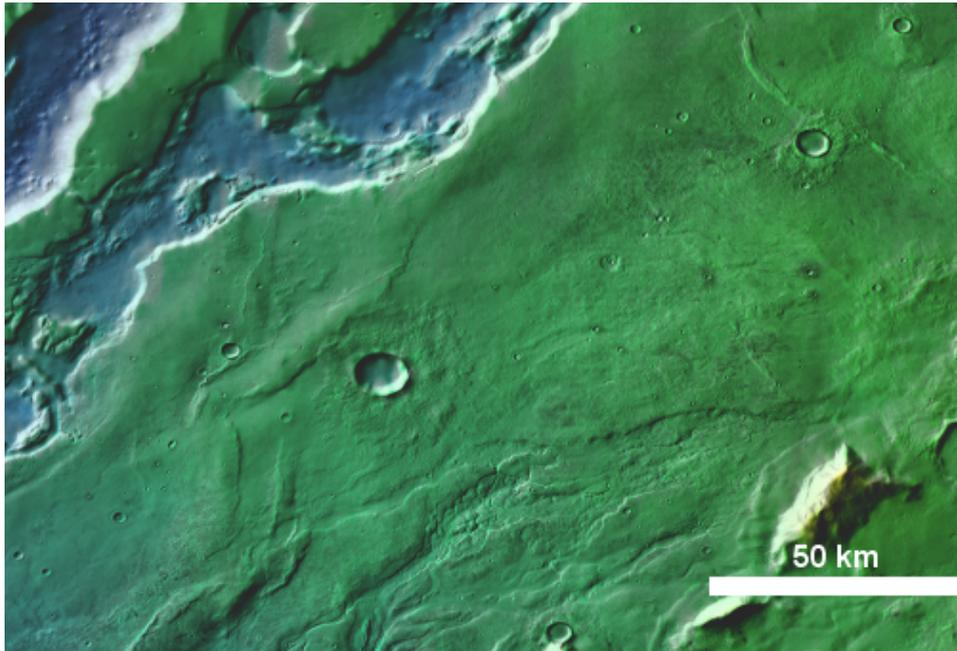
Site Factors				SROI3	
Science Site Criteria	Astrobio	Threshold	AND/OR	Potential for past habitability	●
				Potential for present habitability/refugia	●
		Qualifying	Potential for organic matter, w/ surface exposure		?
	Atmospheric Science	Threshold	Noachian/Hesperian rocks w/ trapped atmospheric gases		●
			Meteorological diversity in space and time		●
		Qualifying	High likelihood of surface-atmosphere exchange		●
			Amazonian subsurface or high-latitude ice or sediment		●
			High likelihood of active trace gas sources		?
	Geoscience	Threshold	Range of martian geologic time; datable surfaces		●
			Evidence of aqueous processes		●
			Potential for interpreting relative ages		●
		Qualifying	Igneous Rocks tied to 1+ provinces or different times		●
			Near-surface ice, glacial or permafrost		●
			Noachian or pre-Noachian bedrock units		○
Outcrops with remnant magnetization			●		
Primary, secondary, and basin-forming impact deposits			●		
Structural features with regional or global context					
Diversity of aeolian sediments and/or landforms			?		



Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate



## Early Hesperian volcanic unit (eHv)



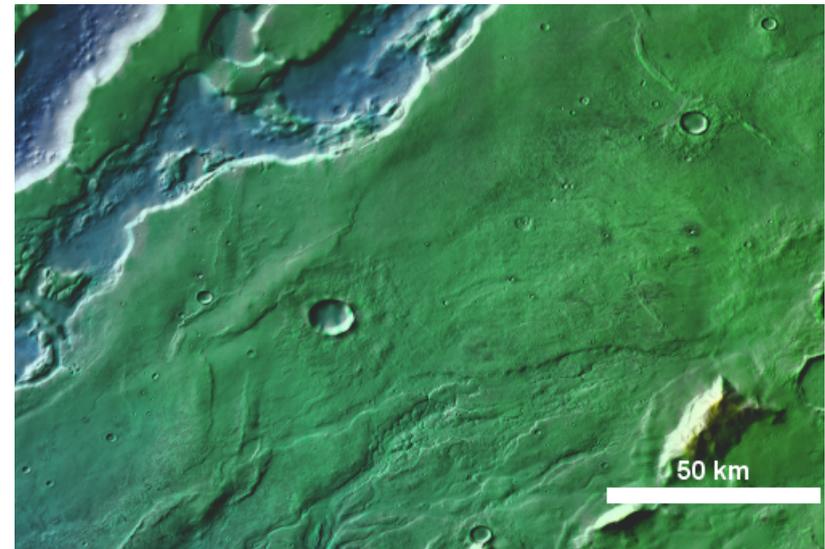
- 94.141E, -35.594
- Igneous rocks
  - Wrinkle ridges
- Datable surfaces
- Trapped gasses
- Impact deposits

# Science ROI4 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars

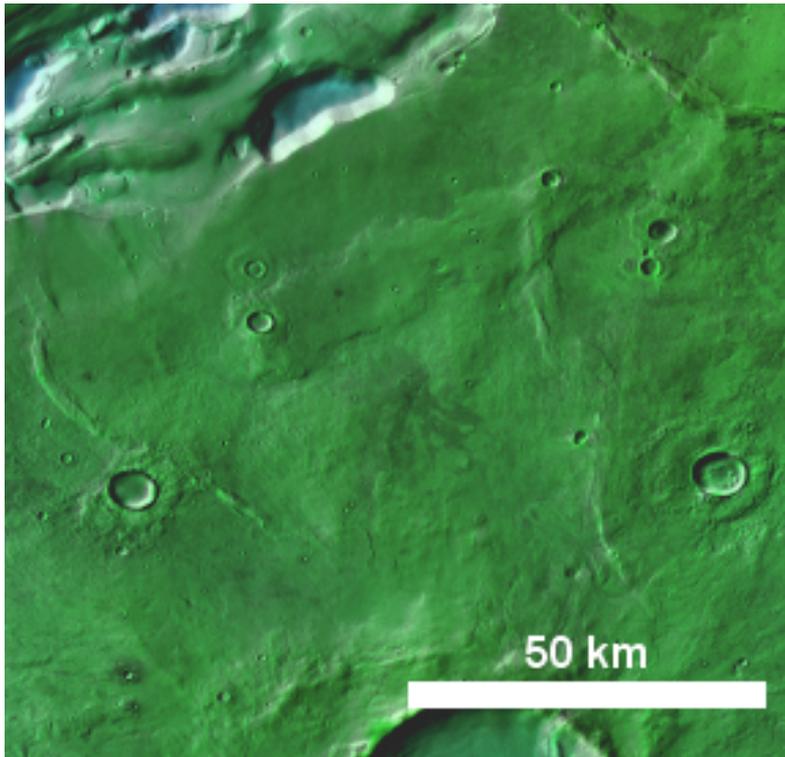


Site Factors				SROI4	
Science Site Criteria	Astrobio	Threshold	AND/OR	Potential for past habitability	
				Potential for present habitability/refugia	
		Qualifying	Potential for organic matter, w/ surface exposure		
	Atmospheric Science	Threshold	Noachian/Hesperian rocks w/ trapped atmospheric gases		●
			Meteorological diversity in space and time		●
		Qualifying	High likelihood of surface-atmosphere exchange		●
			Amazonian subsurface or high-latitude ice or sediment		○
		High likelihood of active trace gas sources		?	
	Geoscience	Threshold	Range of martian geologic time; datable surfaces		●
			Evidence of aqueous processes		●
			Potential for interpreting relative ages		●
		Qualifying	Igneous Rocks tied to 1+ provinces or different times		●
			Near-surface ice, glacial or permafrost		○
Noachian or pre-Noachian bedrock units					
Outcrops with remnant magnetization			○		
Primary, secondary, and basin-forming impact deposits			●		
Structural features with regional or global context			○		
Diversity of aeolian sediments and/or landforms			?		



Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

## Late Hesperian volcanic unit (IHv)



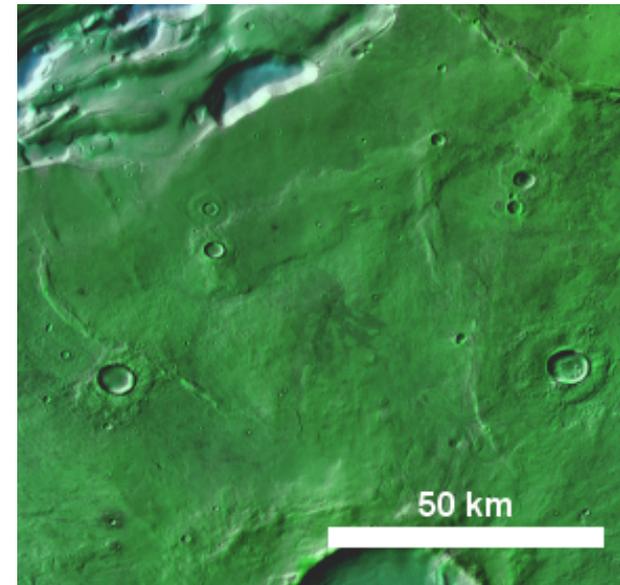
- 95.266E, -34.406
- Igneous rocks
  - Wrinkle ridges
- Datable surfaces
- Trapped gasses
- Impact deposits

# Science ROI5 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars



Site Factors				SROI5	
Science Site Criteria	Astrobio	Threshold	AND/OR	Potential for past habitability	
				Potential for present habitability/refugia	
		Qualifying	Potential for organic matter, w/ surface exposure		
	Atmospheric Science	Threshold	Noachian/Hesperian rocks w/ trapped atmospheric gases		●
		Qualifying	Meteorological diversity in space and time		●
			High likelihood of surface-atmosphere exchange		●
			Amazonian subsurface or high-latitude ice or sediment		○
	High likelihood of active trace gas sources		?		
	Geoscience	Threshold	Range of martian geologic time; datable surfaces		●
			Evidence of aqueous processes		●
			Potential for interpreting relative ages		●
		Qualifying	Igneous Rocks tied to 1+ provinces or different times		●
			Near-surface ice, glacial or permafrost		○
			Noachian or pre-Noachian bedrock units		
Outcrops with remnant magnetization			○		
Primary, secondary, and basin-forming impact deposits			●		
Structural features with regional or global context					
Diversity of aeolian sediments and/or landforms			?		



Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# Science Rubrics

1<sup>st</sup> EZ Workshop for Human Missions to Mars



Site Factors				SROI1	SROI2	SROI3	SROI4	SROI5	EZ SUM
Science Site Criteria	Astrobio	Threshold	AND/OR Potential for past habitability	●	●	●			(3,0)
			Potential for present habitability/refugia	●	●	●			(3,0)
		Qualifying	Potential for organic matter, w/ surface exposure	?	?	?	?	?	
	Atmospheric Science	Threshold	Noachian/Hesperian rocks w/ trapped atmospheric gases	●	●	●	●	●	(5,0)
			Meteorological diversity in space and time	●	●	●	●	●	(5,0)
		Qualifying	High likelihood of surface-atmosphere exchange	●	●	●	●	●	(5,0)
			Amazonian subsurface or high-latitude ice or sediment	●	●	●	○	○	(5,2)
			High likelihood of active trace gas sources	?	?	?	?	?	
	Geoscience	Threshold	Range of martian geologic time; datable surfaces	●	●	●	●	●	(5,0)
			Evidence of aqueous processes	●	●	●	●	●	(5,0)
Potential for interpreting relative ages			●	●	●	●	●	(5,0)	
Qualifying		Igneous Rocks tied to 1+ provinces or different times	●	●	●	●	●	(5,0)	
		Near-surface ice, glacial or permafrost	●	●	●	○	○	(3,2)	
		Noachian or pre-Noachian bedrock units	●	●	○			(2,1)	
		Outcrops with remnant magnetization	●	○	●	○	○	(2,3)	
		Primary, secondary, and basin-forming impact deposits	●	●	●	●	●	(5,0)	
		Structural features with regional or global context	●	●		○		(2,1)	
		Diversity of aeolian sediments and/or landforms	?	?	?	?	?		



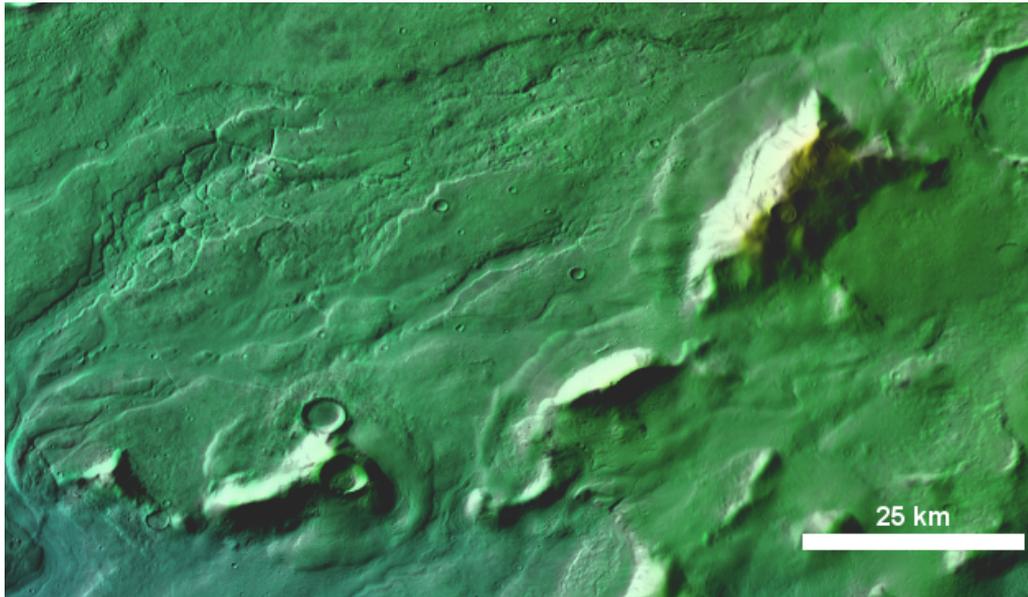
Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# RESOURCE ROIs

# Resource ROI1

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## Amazonian-Noachian apron ice (ANa)



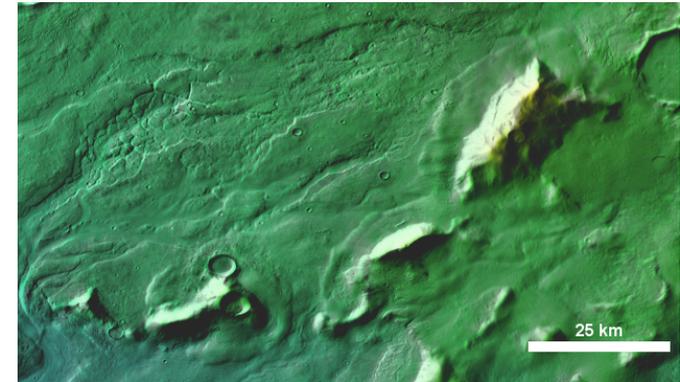
- 94.812E, -36.422
- Amazonian water ice
- Glacial till

# Resource ROI1 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars



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

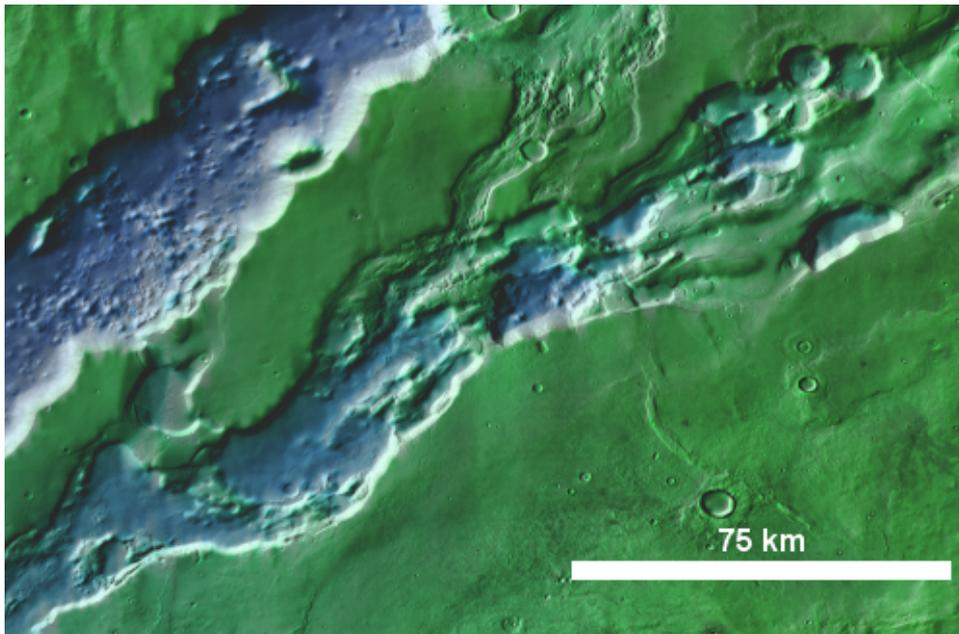


Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# Resource ROI2

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## Niger Vallis



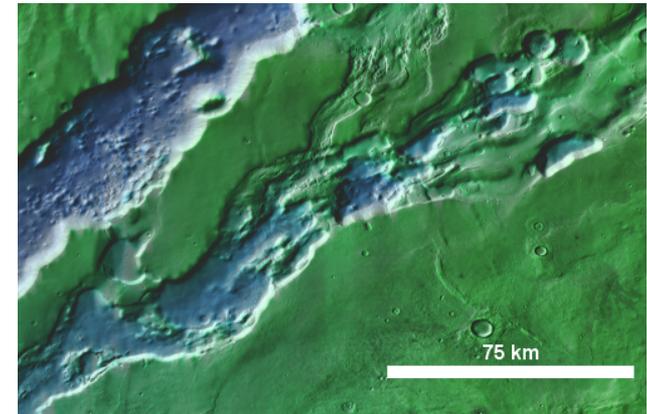
- 94.422E, -33.813
- Water ice
- Hydrated minerals

# Resource ROI2 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars



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

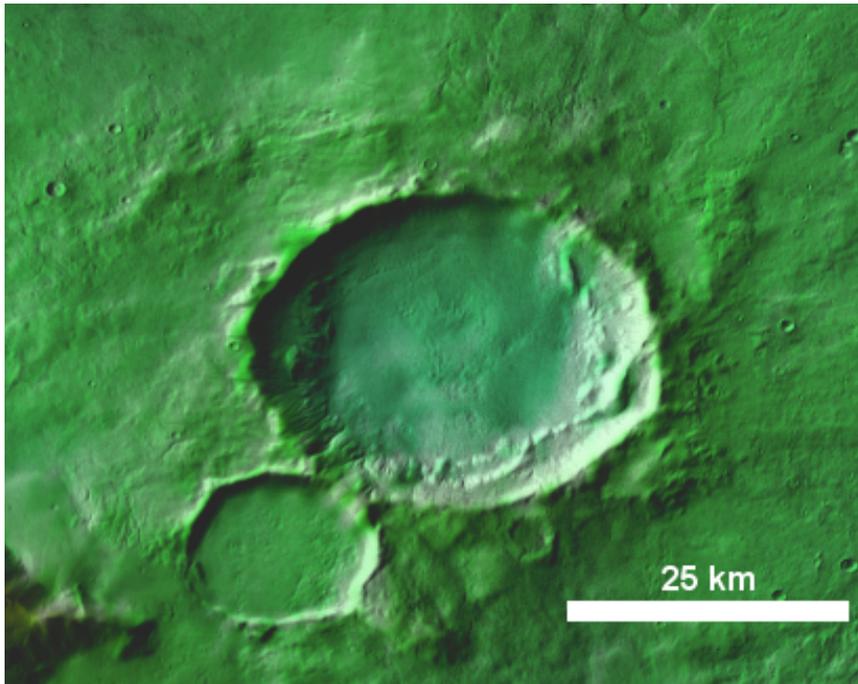


Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# Resource ROI3

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## Negele Crater (AHi)



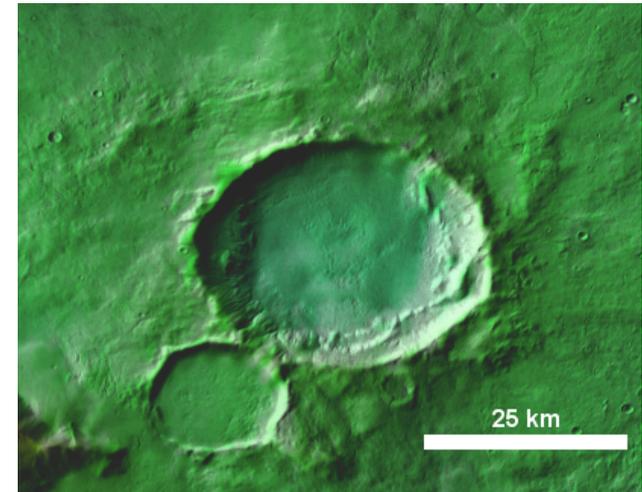
- 95.875E, -35.688
- Impact glass
- Water ice

# Resource ROI3 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars



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

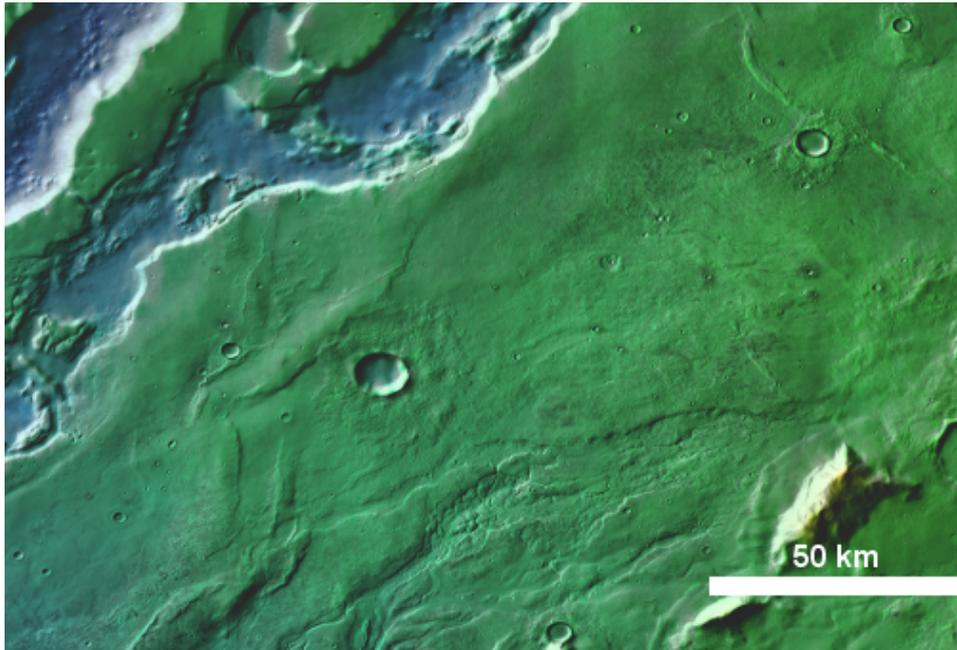


Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# Resource ROI4

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## Early Hesperian volcanic unit (eHv)



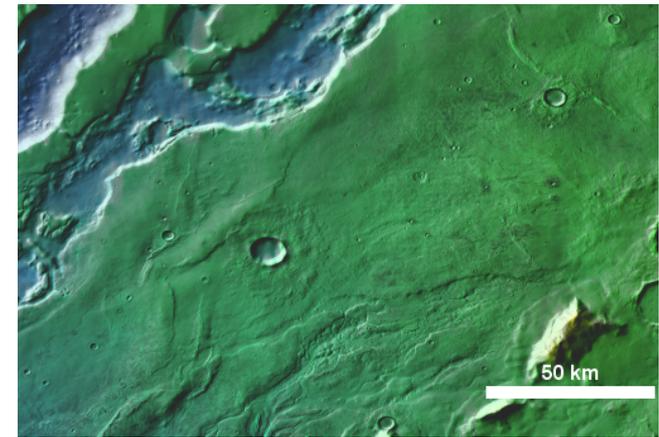
- 94.141E, -35.594
- Cobbles, rocks, regolith
- Metals?

# Resource ROI4 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars



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

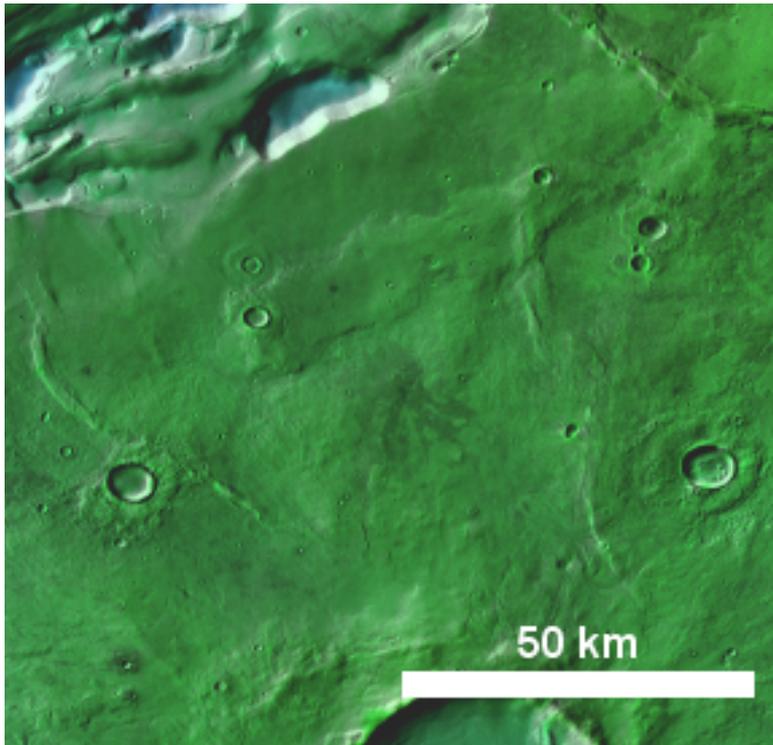


Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# Resource ROI5

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## Late Hesperian volcanic unit (IHv)



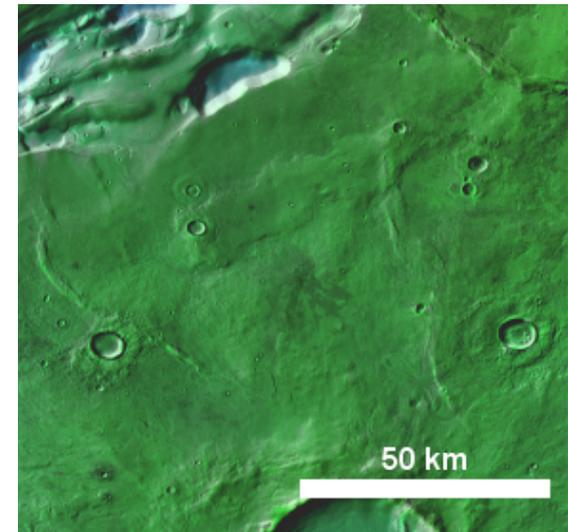
- 95.266E, -34.406
- Cobbles, rocks, regolith
- Metals?

# Resource ROI5 Rubric

1<sup>st</sup> EZ Workshop for Human Missions to Mars



Site Factors			RROI5		
ISRU and Civil Engineering Criteria	Engineering	Meets First Order Criteria (Latitude, Elevation, Thermal Inertia)	●		
	Water Resource	Threshold	AND/OR Potential for ice or ice/regolith mix	●	
			Potential for hydrated minerals	?	
			Quantity for substantial production	?	
			Potential to be minable by highly automated systems	●	
			Located less than 3 km from processing equipment site	○	
			Located no more than 3 meters below the surface	○	
			Accessible by automated systems	●	
			Qualifying	Potential for multiple sources of ice, ice/regolith mix <b>and</b> hydrated minerals	●
				Distance to resource location can be >5 km	●
				Route to resource location must be (plausibly) traversable	●
	Civil Engineering	Threshold	~50 sq km region of flat and stable terrain with sparse rock distribution	●	
			1-10 km length scale: <10°	●	
			Located within 5 km of landing site location	●	
		Qualifying	Located in the northern hemisphere		
	Food Production	Qualifying	Evidence of abundant cobble sized or smaller rocks and bulk, loose regolith	●	
			Utilitarian terrain features		
			Low latitude		
			No local terrain feature(s) that could shadow light collection facilities	●	
	Metal/Silicon Resource	Threshold	Access to water	●	
			Access to dark, minimally altered basaltic sands	●	
			Potential for metal/silicon	●	
			Potential to be minable by highly automated systems	●	
			Located less than 3 km from processing equipment site	○	
		Qualifying	Located no more than 3 meters below the surface	○	
			Accessible by automated systems	●	
			Potential for multiple sources of metals/silicon	●	
			Distance to resource location can be >5 km	●	
Route to resource location must be (plausibly) traversable			●		



Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# Resource Rubrics

1<sup>st</sup> EZ Workshop for Human Missions to Mars



Site Factors			RROI1	RROI2	RROI3	RROI4	RROI5	EZ SUM	
ISRU and Civil Engineering Criteria	Engineering	Meets First Order Criteria (Latitude, Elevation, Thermal Inertia)	●	●	●	●	●	(5,0)	
	Water Resource	Threshold	AND/OR Potential for ice or ice/regolith mix	●	●	●	●	●	(5,0)
			Potential for hydrated minerals	●	●	○	?	?	(2,1)
			Quantity for substantial production	●	●	●	●	●	(5,0)
			Potential to be minable by highly automated systems	●	●	●	●	●	(5,0)
			Located less than 3 km from processing equipment site	○	○	○	○	○	(0,5)
			Located no more than 3 meters below the surface	○	○	○	○	○	(0,5)
			Accessible by automated systems	●	●	●	●	●	(5,0)
	Qualifying	Potential for multiple sources of ice, ice/regolith mix <b>and</b> hydrated minerals	●	●	●	●	●	(5,0)	
		Distance to resource location can be >5 km	●	●	●	●	●	(5,0)	
		Route to resource location must be (plausibly) traversable	●	●	●	●	●	(5,0)	
	Civil Engineering	Threshold	~50 sq km region of flat and stable terrain with sparse rock distribution				●	●	(2,0)
			1-10 km length scale: <10°				●	●	(2,0)
			Located within 5 km of landing site location				●	●	(2,0)
	Qualifying	Located in the northern hemisphere							
		Evidence of abundant cobble sized or smaller rocks and bulk, loose regolith	○	○	●	●	●		(3,2)
	Food Production	Qualifying	Utilitarian terrain features				●		(1,0)
			Low latitude						
			No local terrain feature(s) that could shadow light collection facilities	●	●	●	●	●	
	Metal/Silicon Resource	Threshold	Access to water	●	●	●	●	●	(5,0)
Access to dark, minimally altered basaltic sands						●	●	(2,0)	
Potential for metal/silicon					●	●	●	(3,0)	
Potential to be minable by highly automated systems					●	●	●	(3,0)	
Located less than 3 km from processing equipment site					○	○	○	(0,3)	
Located no more than 3 meters below the surface				○	○	○	(0,3)		
Accessible by automated systems				●	●	●	(3,0)		
Qualifying	Potential for multiple sources of metals/silicon			●	●	●	(3,0)		
	Distance to resource location can be >5 km			●	●	●	(3,0)		
	Route to resource location must be (plausibly) traversable			○	●	●	(2,1)		



Key	
●	Yes
○	Partial Support or Debated
	No
?	Indeterminate

# EZ Rubrics

1<sup>st</sup> EZ Workshop for Human Missions to Mars

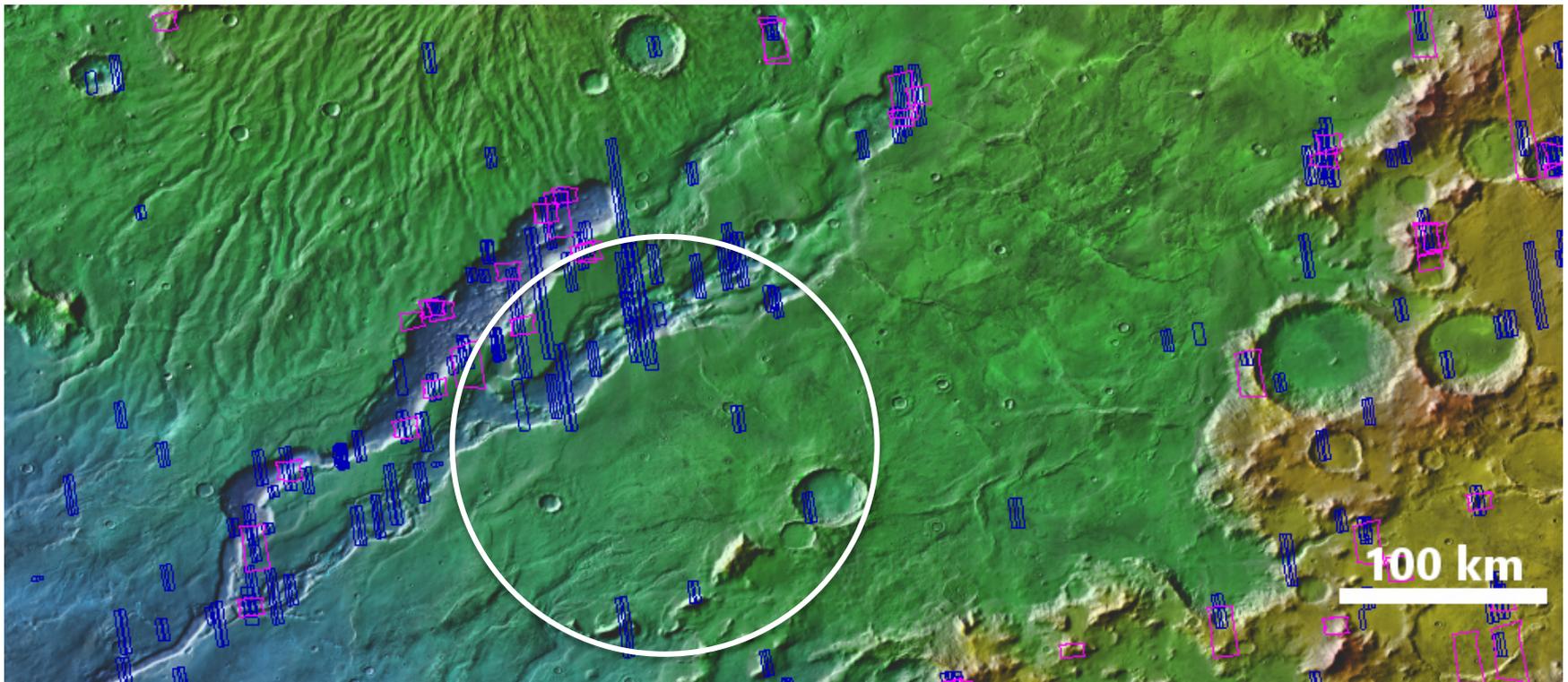


Science Site Criteria				EZ	ISRU and Civil Engineering Criteria				EZ	
Site Factors					Site Factors					
Astrobio	Threshold	AND/OR	Potential for past habitability	●	Engineering	Meets First Order Criteria (Latitude, Elevation, Thermal Inertia)			●	
			Potential for present habitability/refugia	●		AND/OR	Potential for ice or ice/regolith mix	●		
Qualifying	Potential for organic matter, w/ surface exposure		?	Water Resource			Threshold	Potential for hydrated minerals		●
	Atmospheric Science	Threshold	Noachian/Hesperian rocks w/ trapped atmospheric gases			●		Quantity for substantial production		●
Meteorological diversity in space and time			●	Potential to be minable by highly automated systems		●				
High likelihood of surface-atmosphere exchange			●	Located less than 3 km from processing equipment site		○				
Amazonian subsurface or high-latitude ice or sediment			●	Located no more than 3 meters below the surface		○				
Atmospheric Science	Qualifying	High likelihood of active trace gas sources		?		Accessible by automated systems		●		
		Range of martian geologic time; datable surfaces		●		Potential for multiple sources of ice, ice/regolith mix <b>and</b> hydrated minerals			●	
		Evidence of aqueous processes		●		Distance to resource location can be >5 km		●		
		Potential for interpreting relative ages		●	Route to resource location must be (plausibly) traversable		●			
Geoscience	Threshold	Igneous Rocks tied to 1+ provinces or different times		●	Civil Engineering	Threshold	~50 sq km region of flat and stable terrain with sparse rock distribution		●	
		Near-surface ice, glacial or permafrost		●			1-10 km length scale: <10°		●	
		Noachian or pre-Noachian bedrock units		●			Located within 5 km of landing site location		●	
	Geoscience	Qualifying	Outcrops with remnant magnetization		●	Food Production	Qualifying	Located in the northern hemisphere		○
			Primary, secondary, and basin-forming impact deposits		●			Evidence of abundant cobble sized or smaller rocks and bulk, loose regolith		●
			Structural features with regional or global context		●			Utilitarian terrain features		○
			Diversity of aeolian sediments and/or landforms		○			Low latitude		○
					●			No local terrain feature(s) that could shadow light collection facilities		●
					●			Access to water		●
					●			Access to dark, minimally altered basaltic sands		●
Metal/Silicon Resource	Threshold	Potential for metal/silicon		●	Metal/Silicon Resource	Threshold	Potential for metal/silicon		●	
		Potential to be minable by highly automated systems		●			Potential to be minable by highly automated systems		●	
		Located less than 3 km from processing equipment site		○			Located less than 3 km from processing equipment site		○	
		Located no more than 3 meters below the surface		○			Located no more than 3 meters below the surface		○	
		Accessible by automated systems		●			Accessible by automated systems		●	
				●			Potential for multiple sources of metals/silicon		●	
Metal/Silicon Resource	Qualifying	Distance to resource location can be >5 km		●	Metal/Silicon Resource	Qualifying	Distance to resource location can be >5 km		●	
		Route to resource location must be (plausibly) traversable		●			Route to resource location must be (plausibly) traversable		●	

# Current HIRISE and CRISM coverage



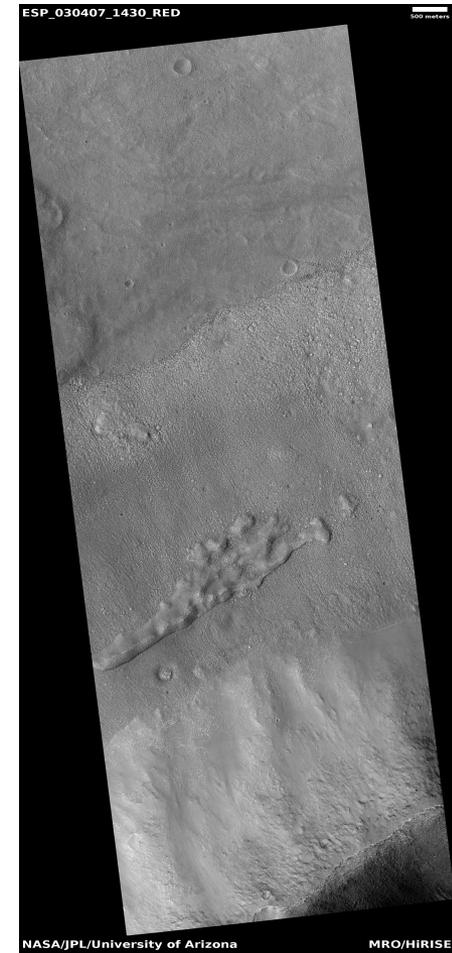
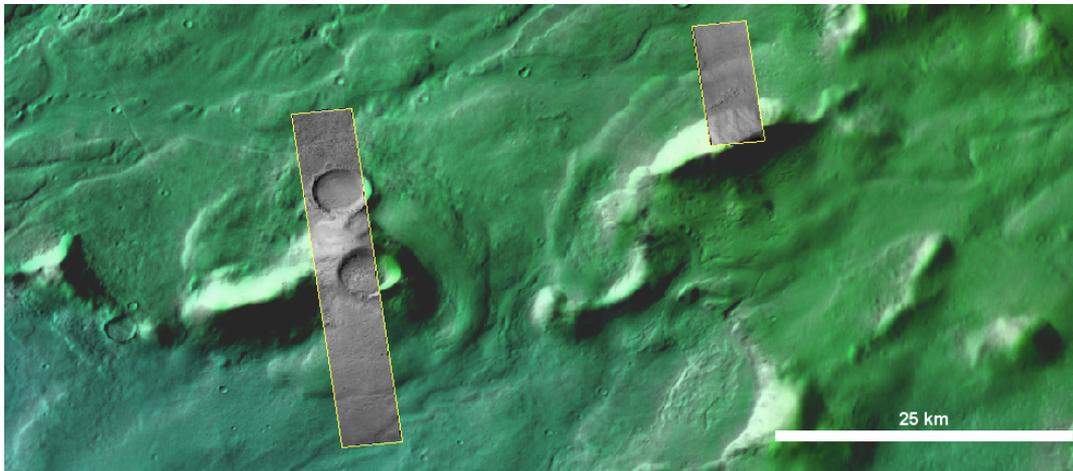
1<sup>st</sup> EZ Workshop for Human Missions to Mars



# HIRISE and CRISM

1<sup>st</sup> EZ Workshop for Human Missions to Mars

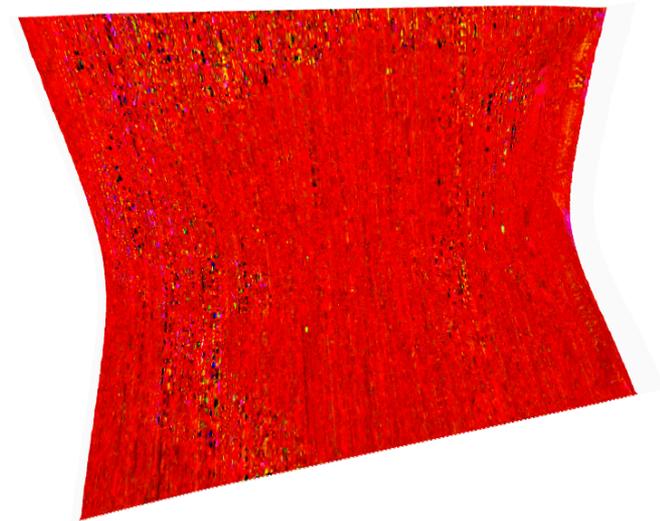
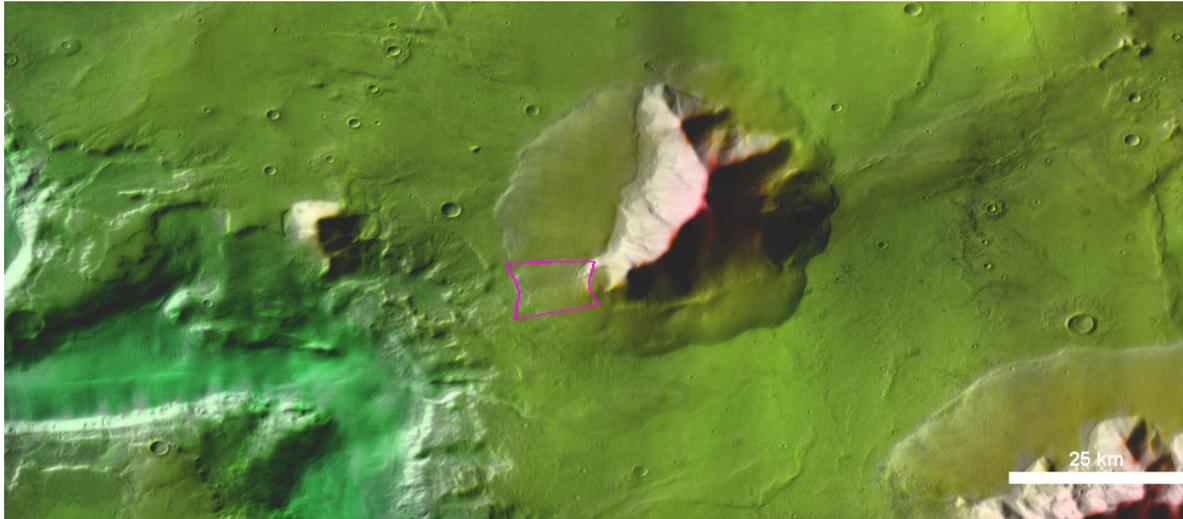
- Amazonian Noachian apron unit



# HIRISE and CRISM

1<sup>st</sup> EZ Workshop for Human Missions to Mars

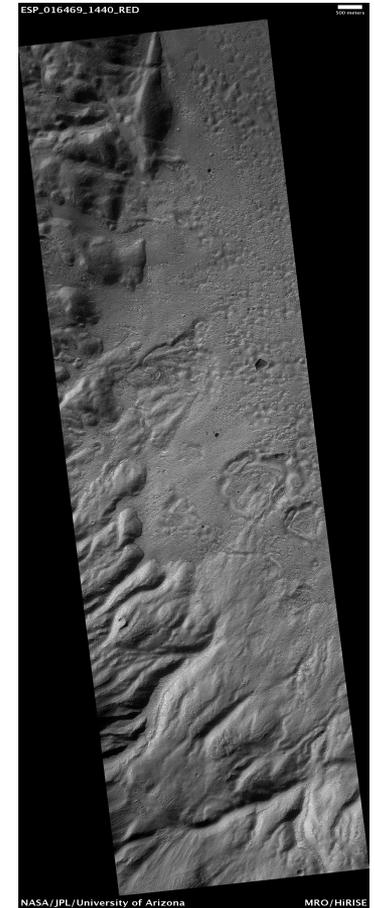
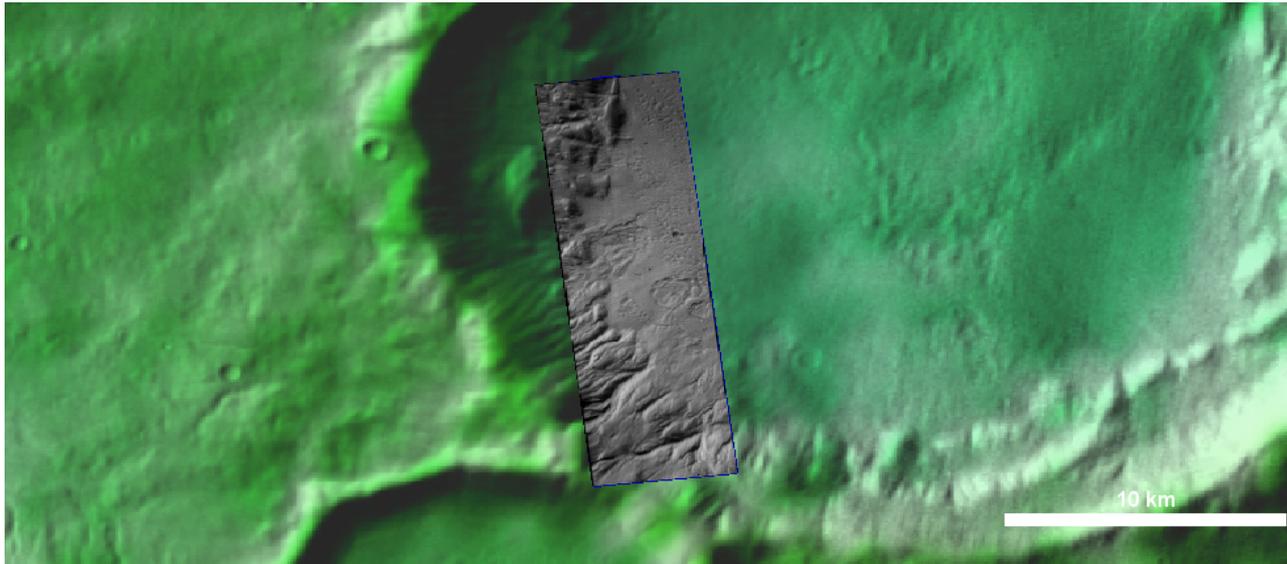
- Amazonian Noachian apron unit, south of EZ
- Bound water



# HIRISE and CRISM

1<sup>st</sup> EZ Workshop for Human Missions to Mars

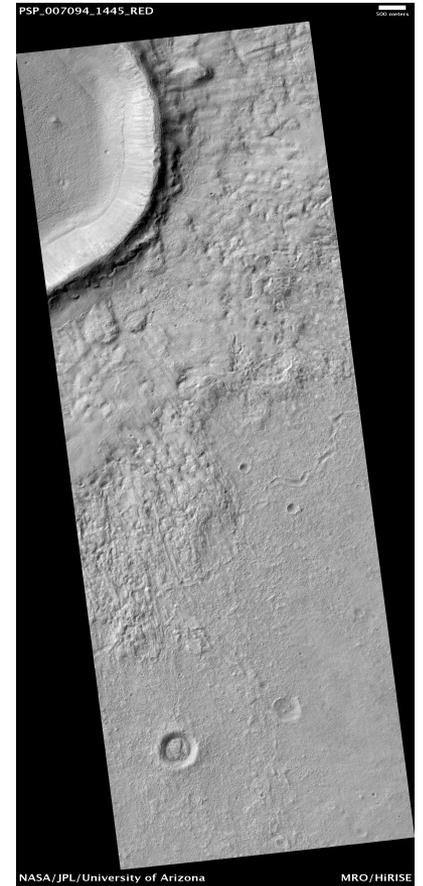
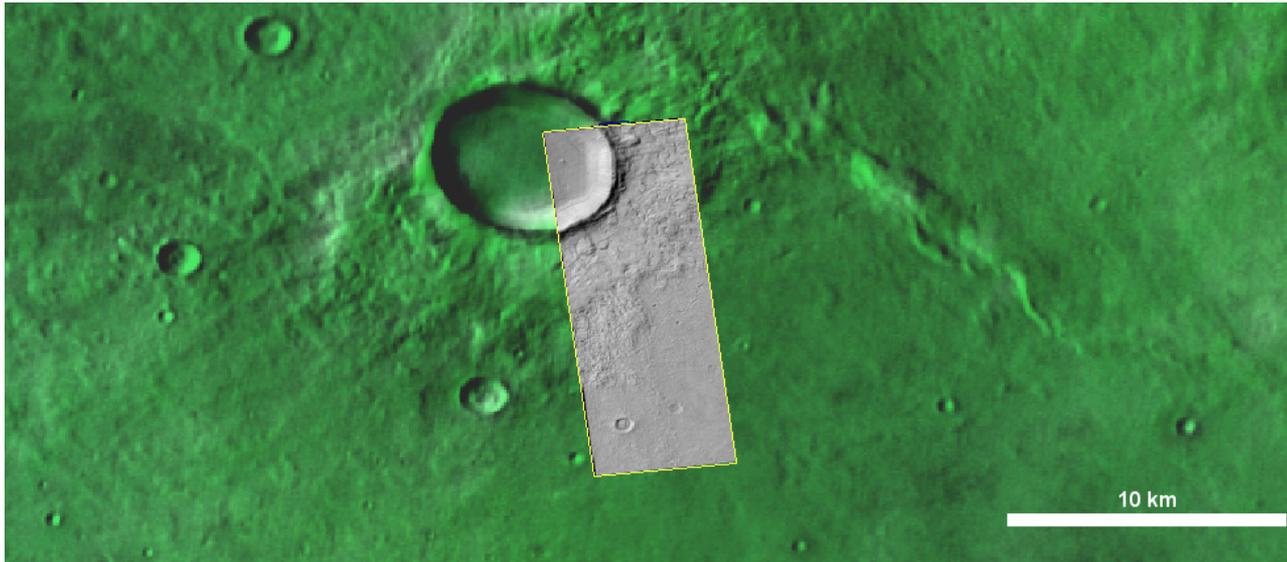
- Negele Crater



# HIRISE and CRISM

1<sup>st</sup> EZ Workshop for Human Missions to Mars

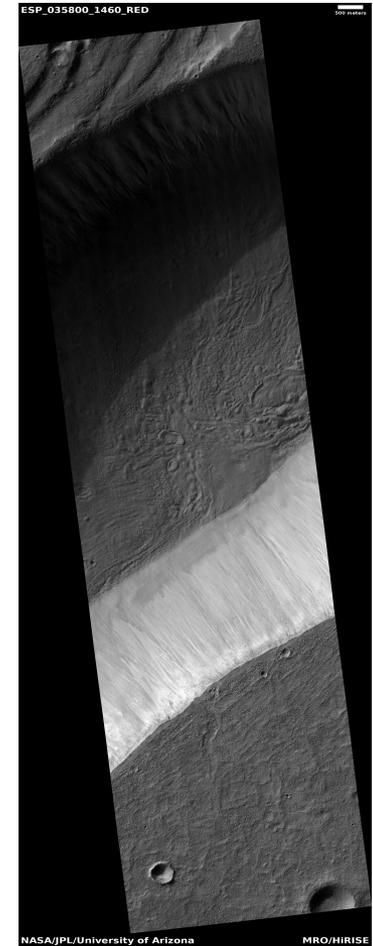
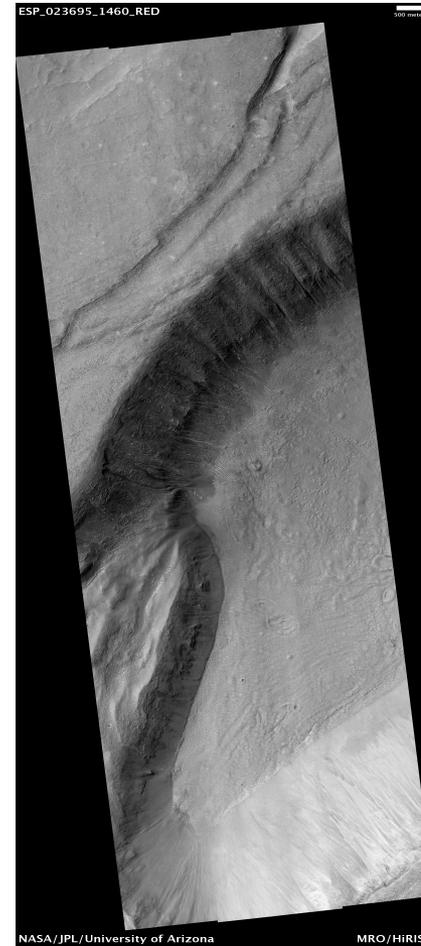
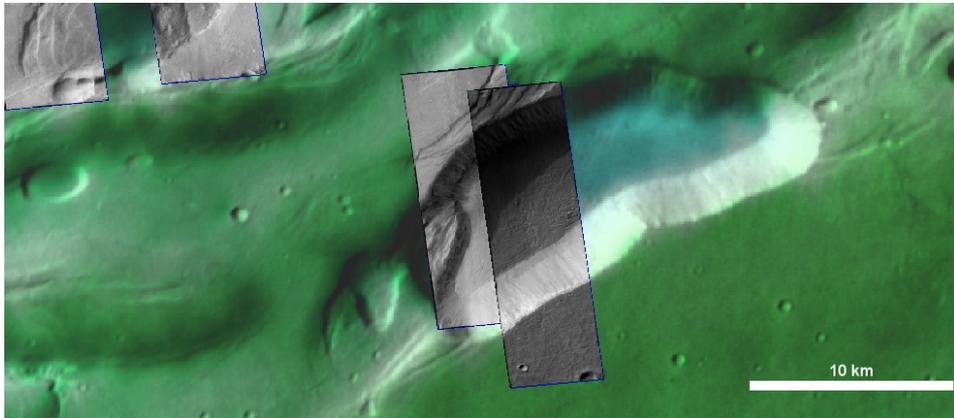
- Crater near habitation zone



# HIRISE and CRISM

1<sup>st</sup> EZ Workshop for Human Missions to Mars

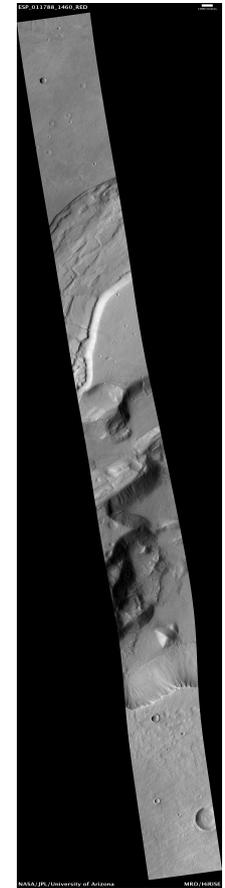
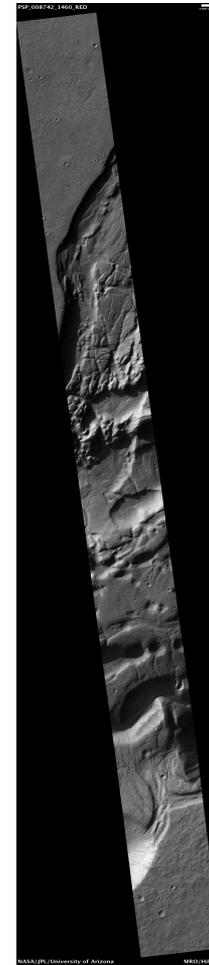
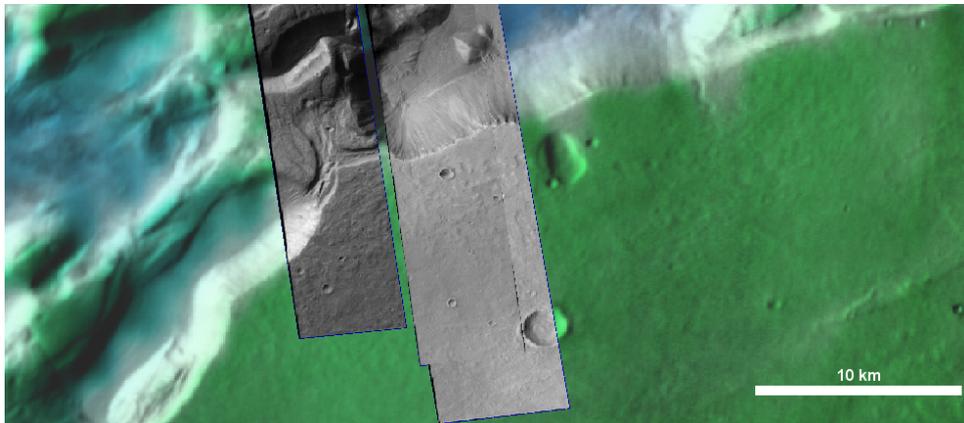
- Niger Vallis, east



# HIRISE and CRISM

1<sup>st</sup> EZ Workshop for Human Missions to Mars

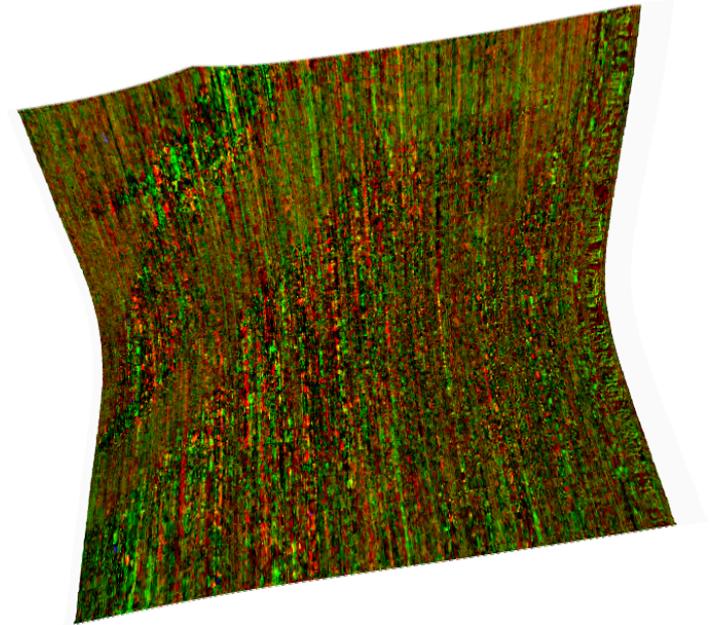
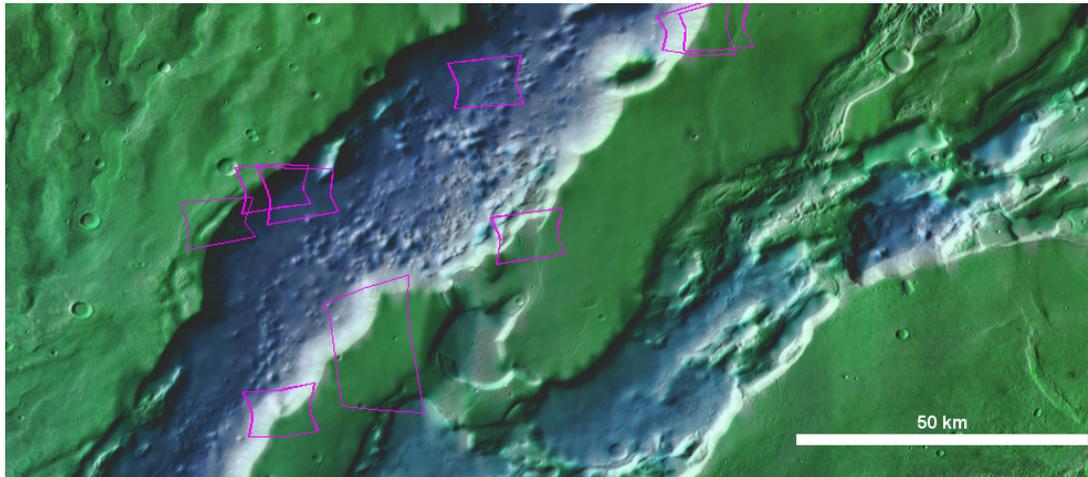
- Niger Vallis, west



# HIRISE and CRISM

1<sup>st</sup> EZ Workshop for Human Missions to Mars

- Niger Vallis
- Bound water



# EZ Science Data Needs

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## 1. Orbital data

- High-resolution imagery
- Spectroscopy

## 3. MSL class rover

- Science reconnaissance

# EZ Resource Data Needs

1<sup>st</sup> EZ Workshop for Human Missions to Mars

## 1. MSL class rover

- Resource reconnaissance
  - ANa ice (sell the mission as exploring Mars glaciers!)
  - Impact glass and metals

## 2. Orbital data

- High-resolution imagery
- Spectroscopy
- More radar data

# EZ Engineering Data Needs .

A small image of an astronaut in a white spacesuit standing on the reddish, rocky surface of Mars, looking towards the horizon under a clear sky.

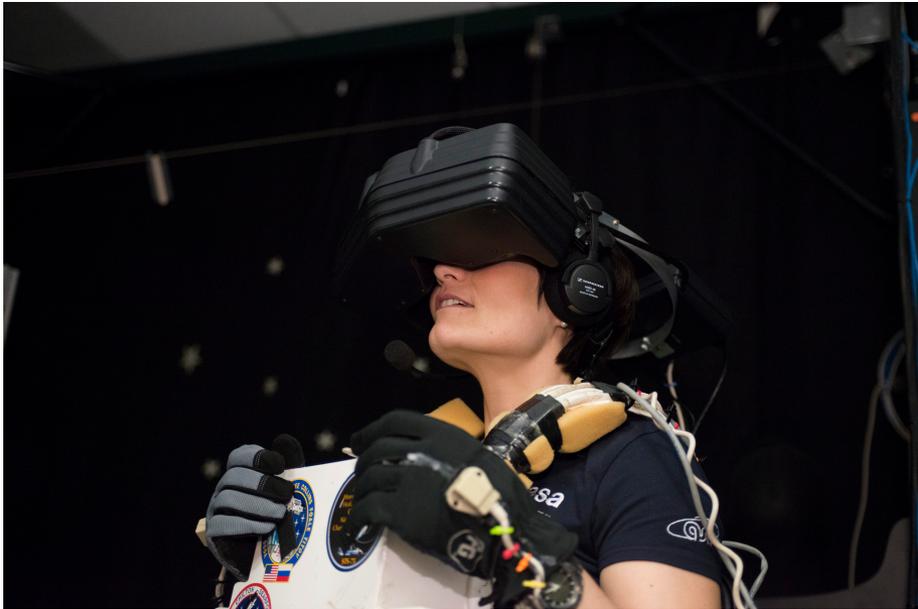
1<sup>st</sup> EZ Workshop for Human Missions to Mars

## 1. High-resolution orbital imagery

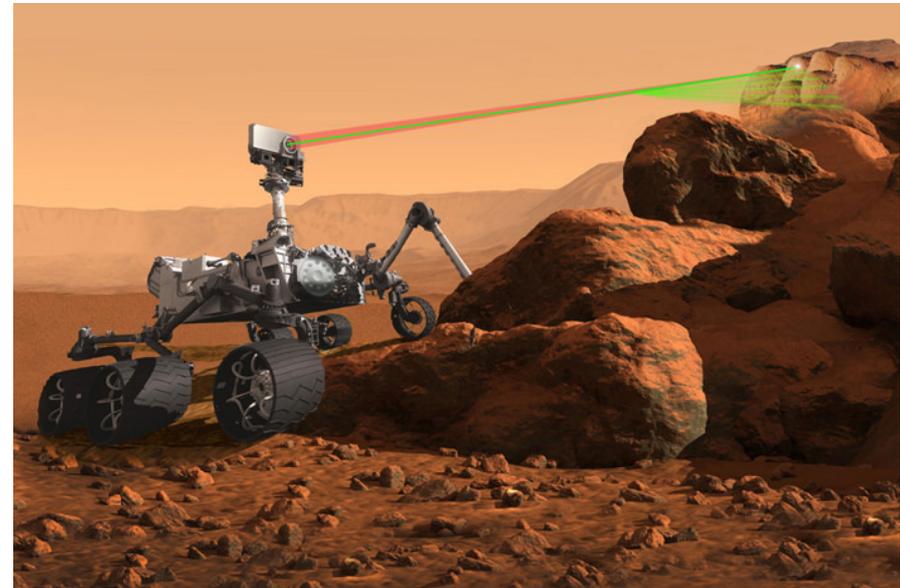
- Landing site conformation
- Traverse capabilities
- Rock abundance

# Rover Tele-operations

1<sup>st</sup> EZ Workshop for Human Missions to Mars



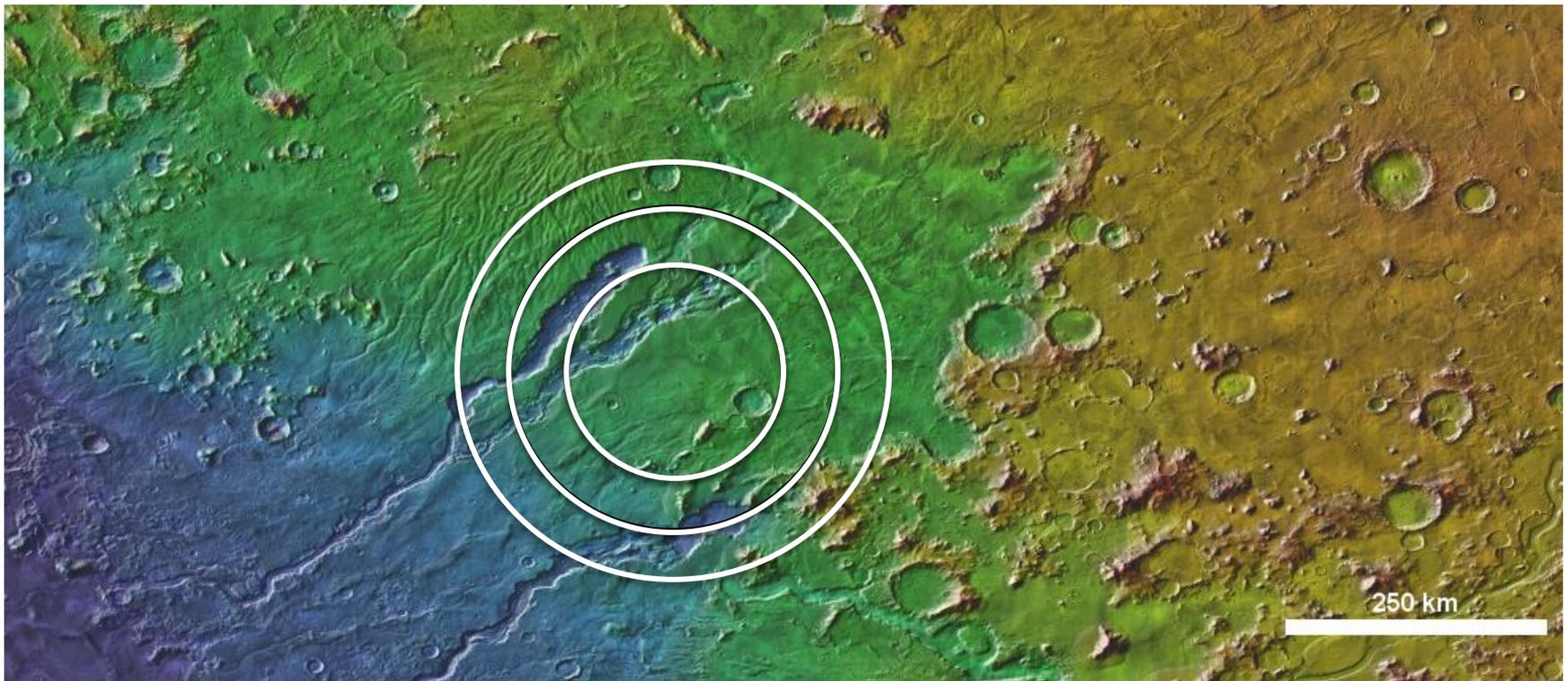
- Gives astronauts something to do
- Faster, more capable than Earth-based operations



- Increases EZ area/radii
- More science potential

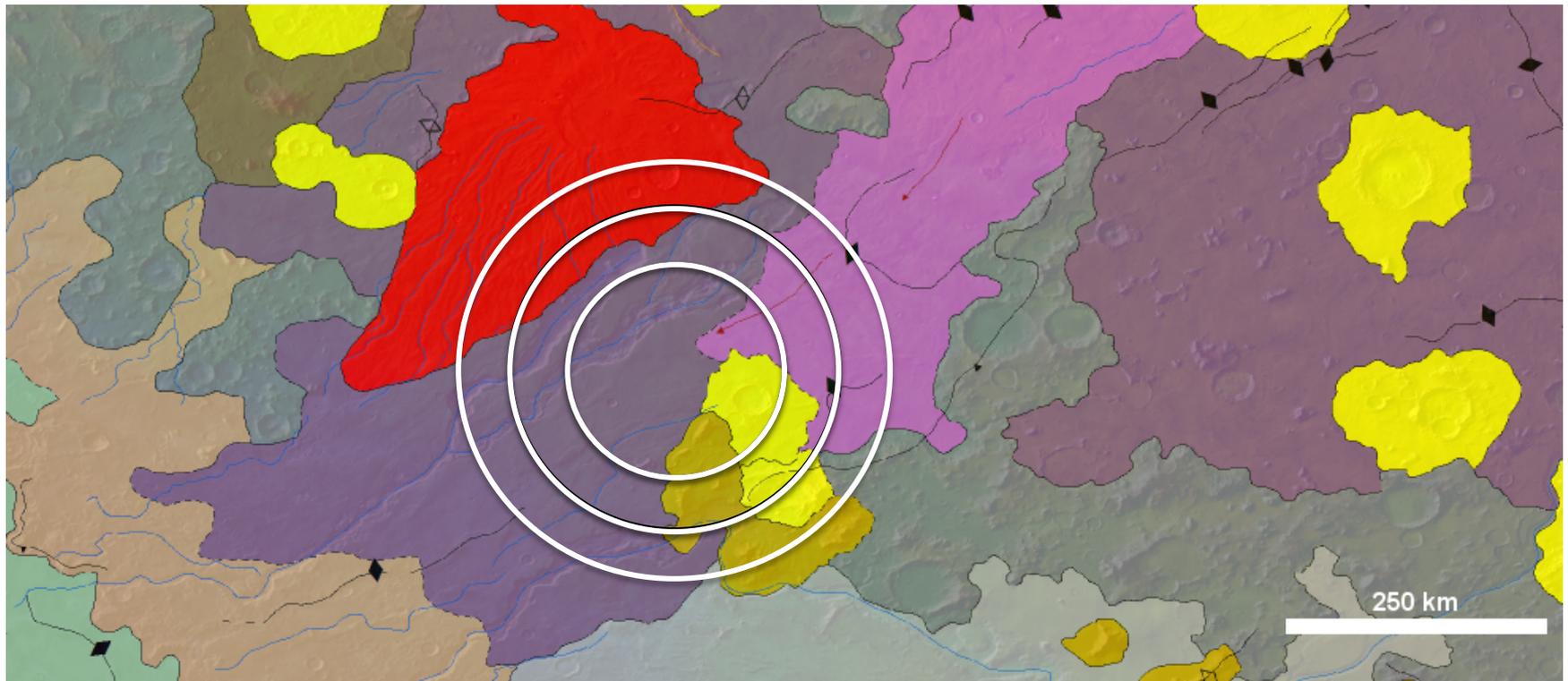
# Extended EZ

1<sup>st</sup> EZ Workshop for Human Missions to Mars



# Extended EZ

1<sup>st</sup> EZ Workshop for Human Missions to Mars

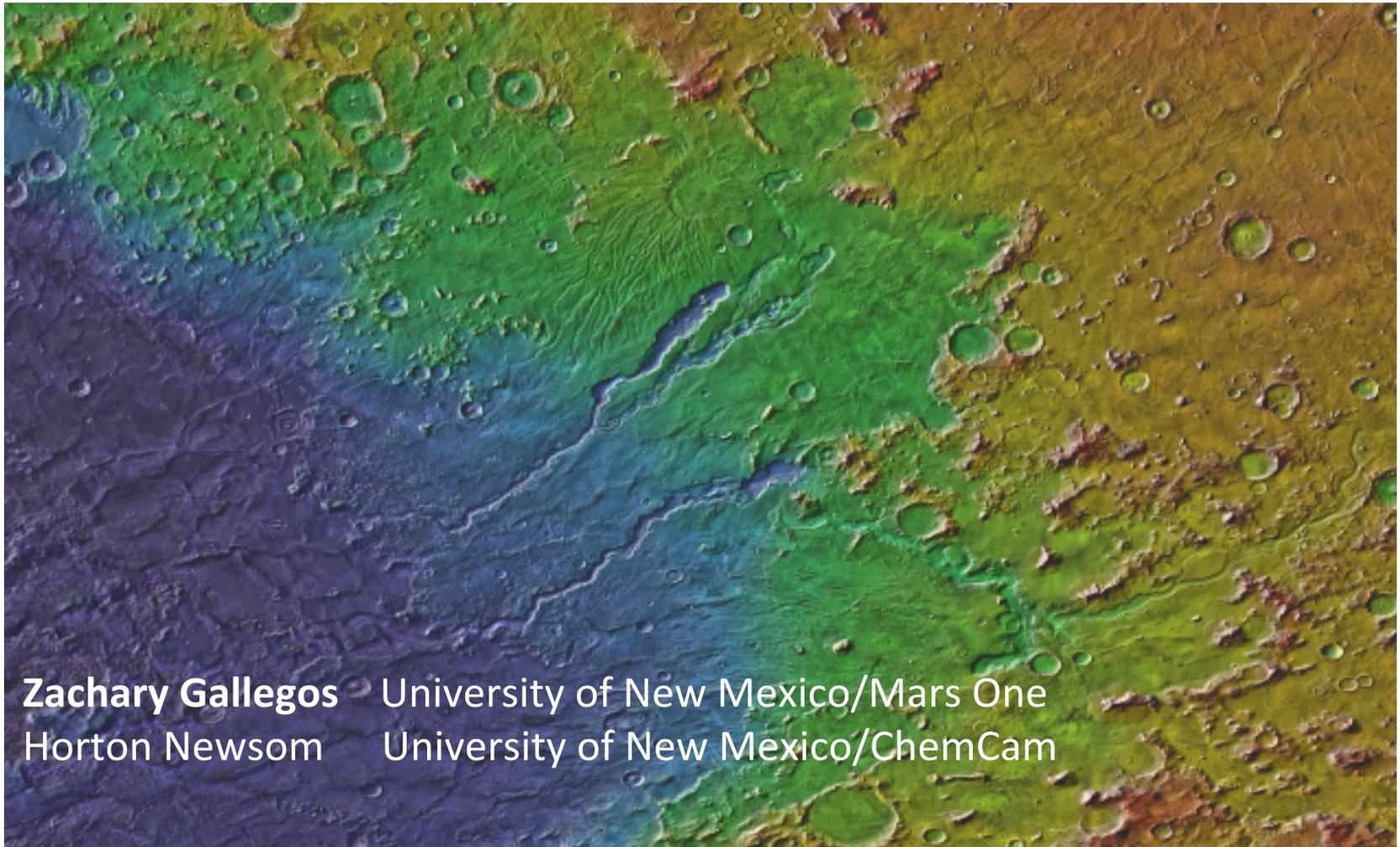


# The East Rim of Hellas: Mars' Mesopotamia



Abstract #1035

1<sup>st</sup> EZ Workshop for Human Missions to Mars



**Zachary Gallegos** University of New Mexico/Mars One  
**Horton Newsom** University of New Mexico/ChemCam

# Extra Slides



1<sup>st</sup> EZ Workshop for Human Missions to Mars

# Communications Blimp

1<sup>st</sup> EZ Workshop for Human Missions to Mars

