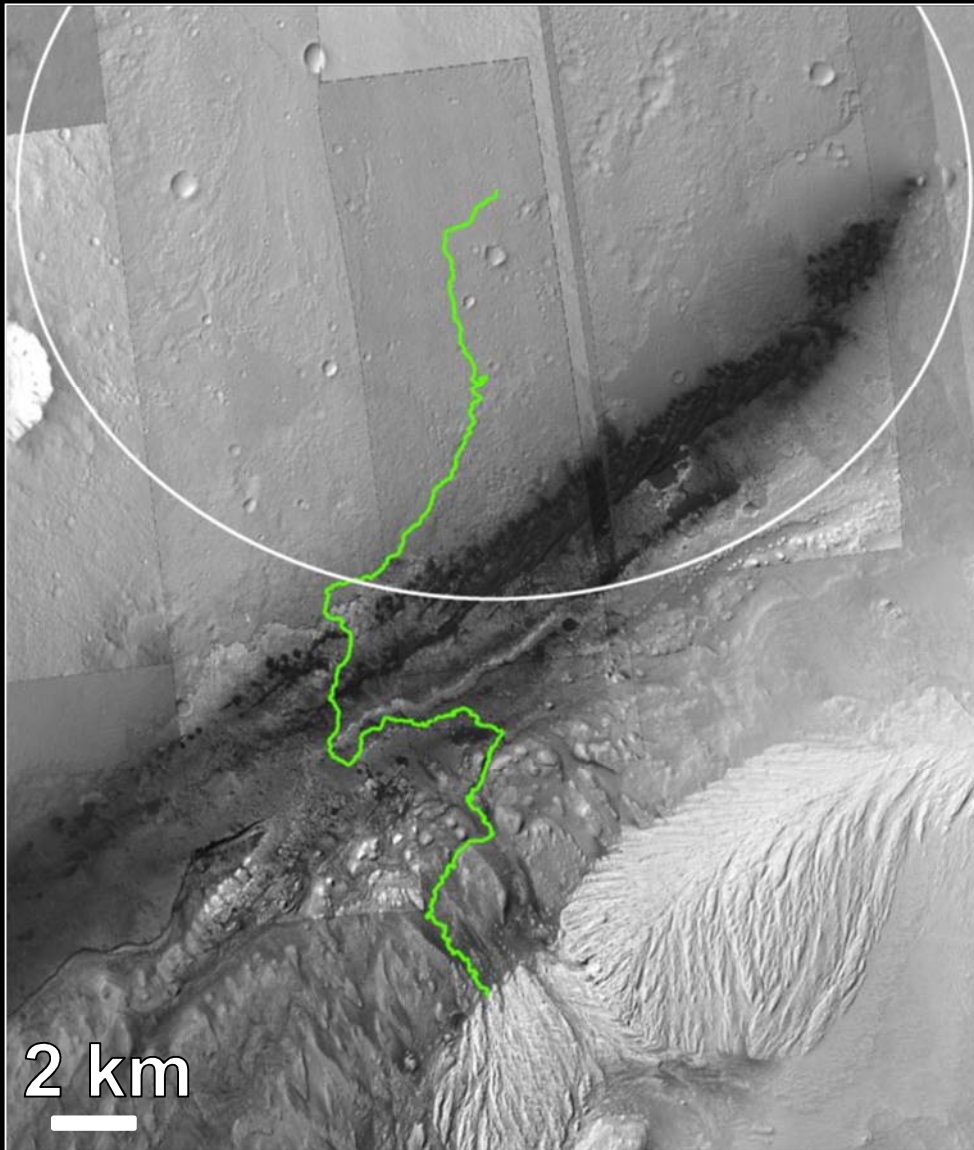


Science Targets Along a Proposed Gale Traverse

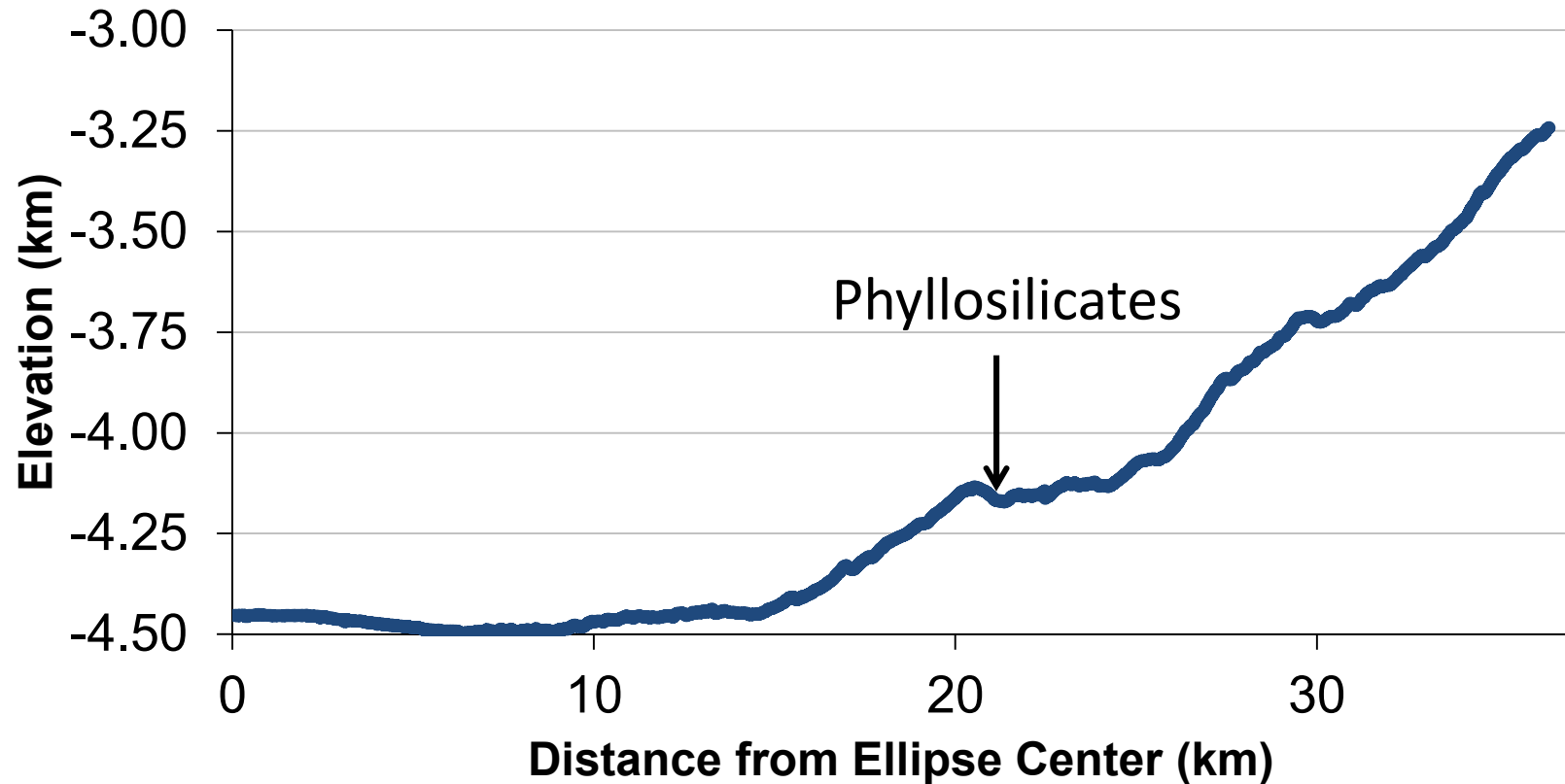
Ryan Anderson, Dawn Sumner & Jim Bell
5th Mars Science Laboratory Landing Site
Workshop
May 17, 2011

Traverse Overview

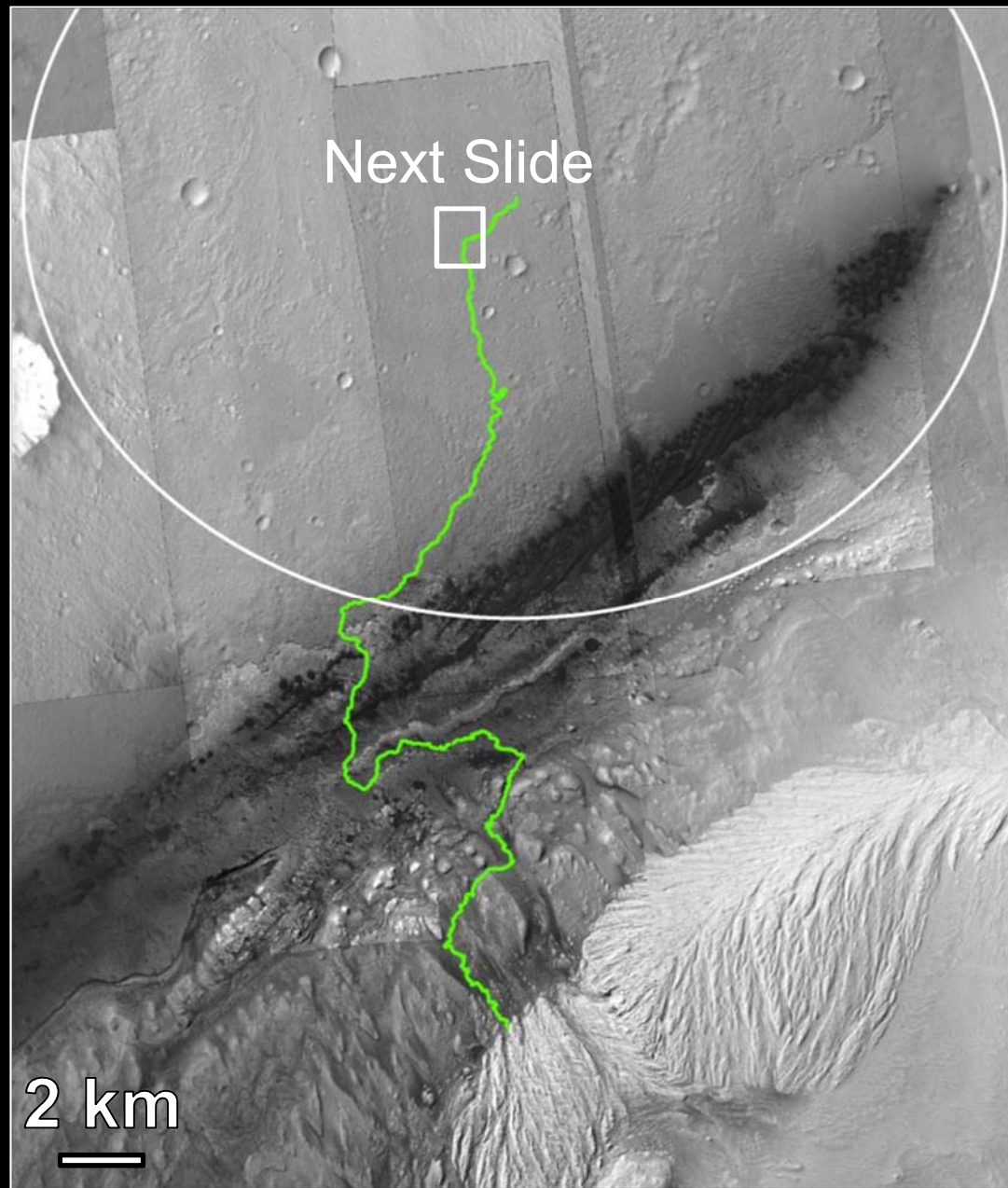


- This is a notional traverse.
- Based on:
 - Interesting targets
 - Traversability (HiRISE images and slope maps)
- An actual traverse at Gale would differ in detail.

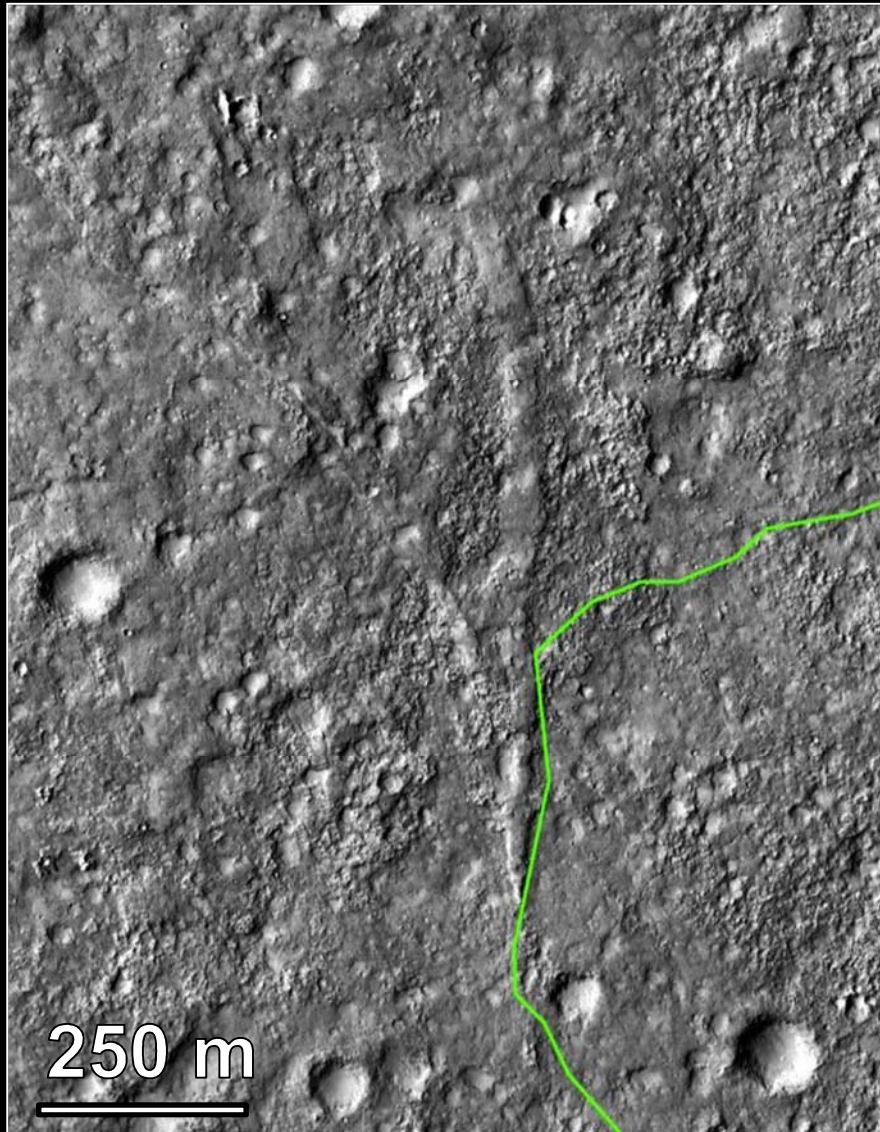
Traverse Profile



- Traverse distance: 36.43 km
- Starting elevation: -4.45 km
- Min. elevation: -4.5 km
- Max. elevation: -3.24 km
- Total climbed: 1.26 km
- Duration (assume 30 sols before 1st drive, 100m/sol on floor, 30m/sol on mound):
1.31 Mars Years (877 sols)

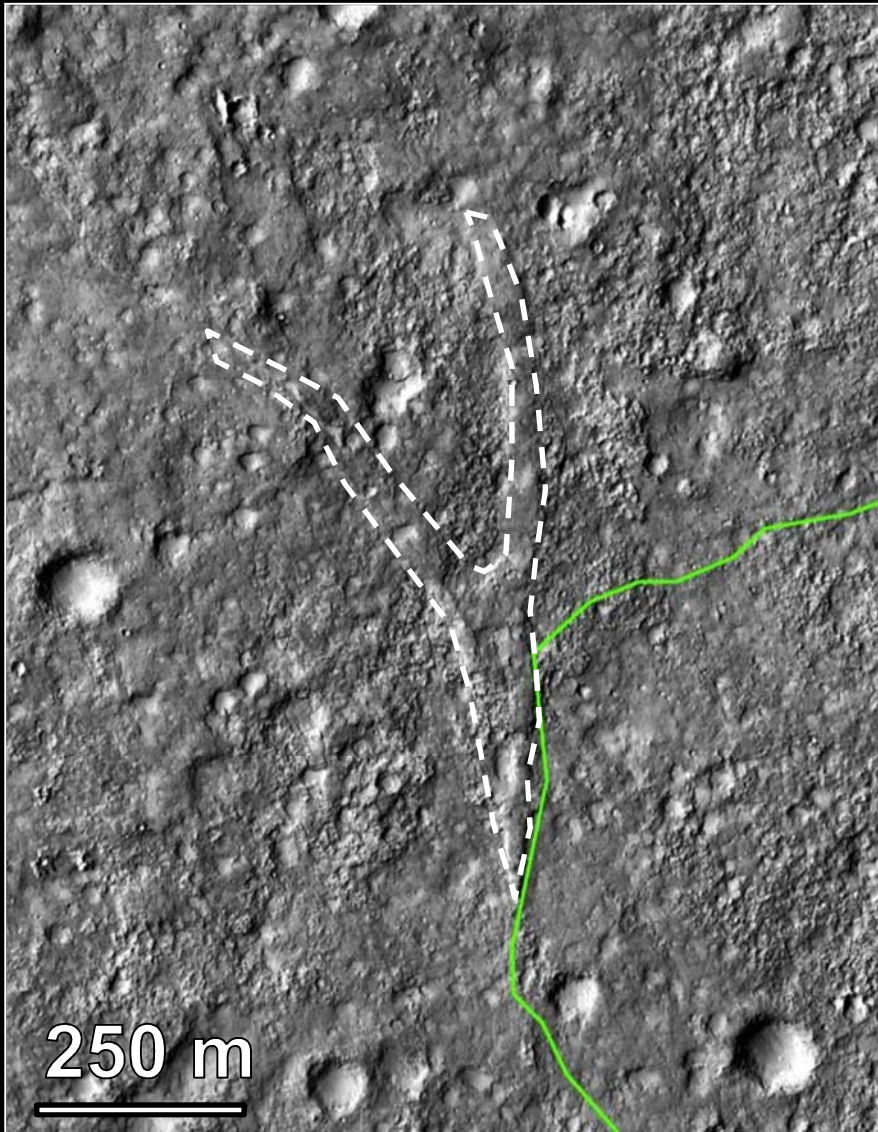


Inverted Feature



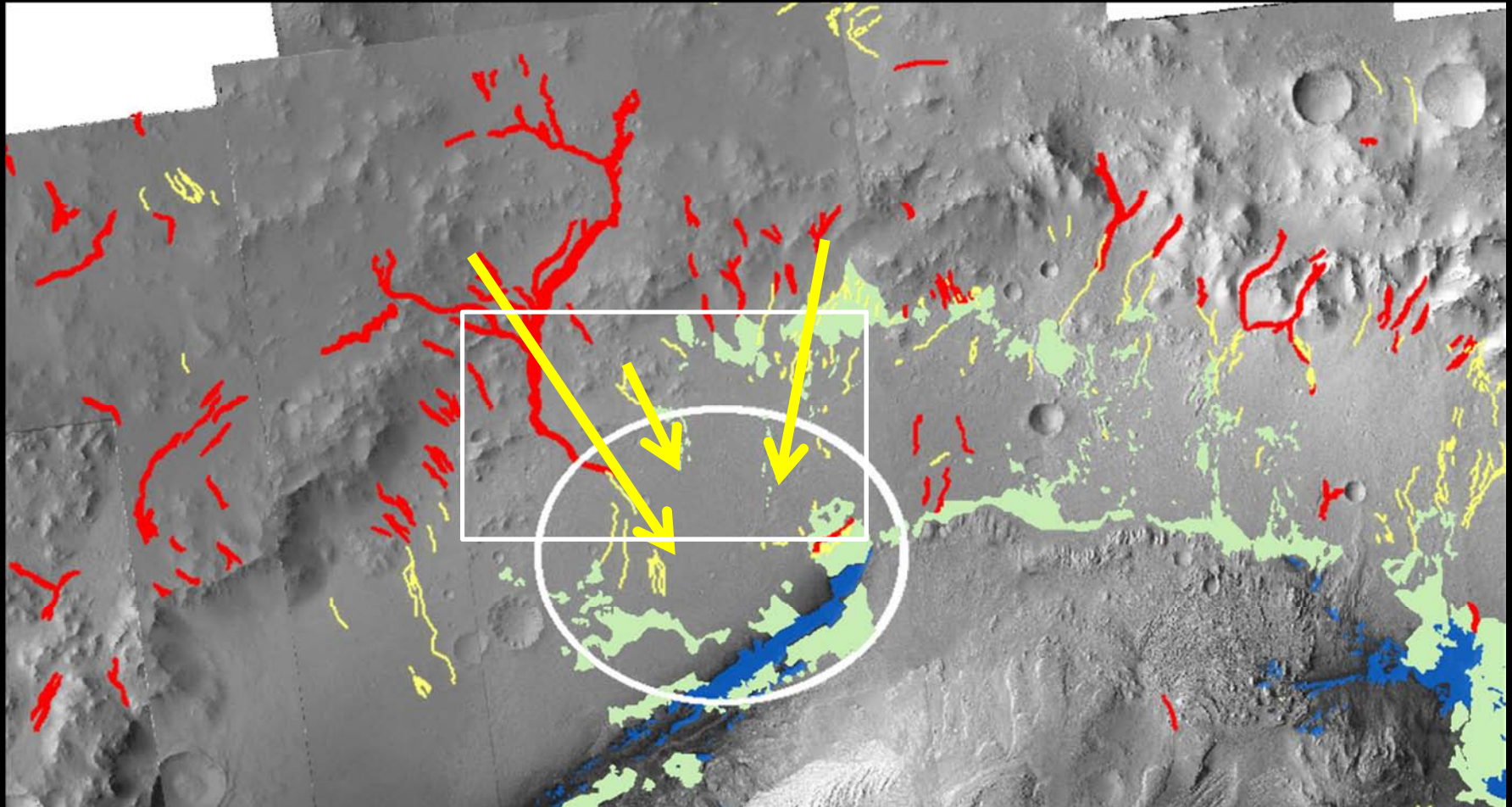
- Hypothesis: This is an inverted channel system. Crater wall rock was transported into the ellipse by fluvial processes.
- What MSL would do:
 - Determine flow conditions, frequency, and cement composition.
 - Analyze samples of crater wall rocks.
- Distance traversed: 2.16 km
- Elevation gained: -0.5 m
- # of Sols: 52
(0.08 Mars Years)

Inverted Feature

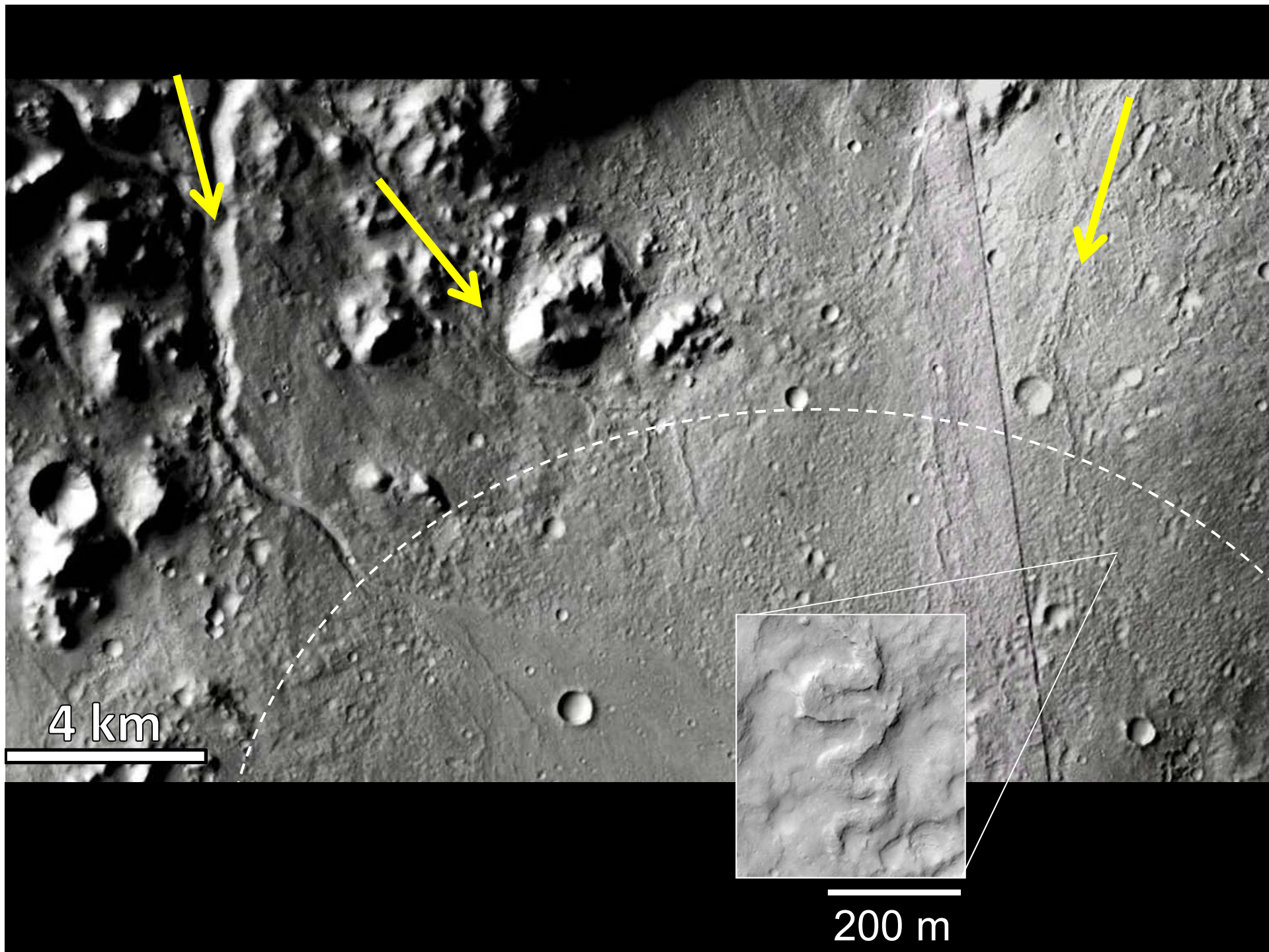


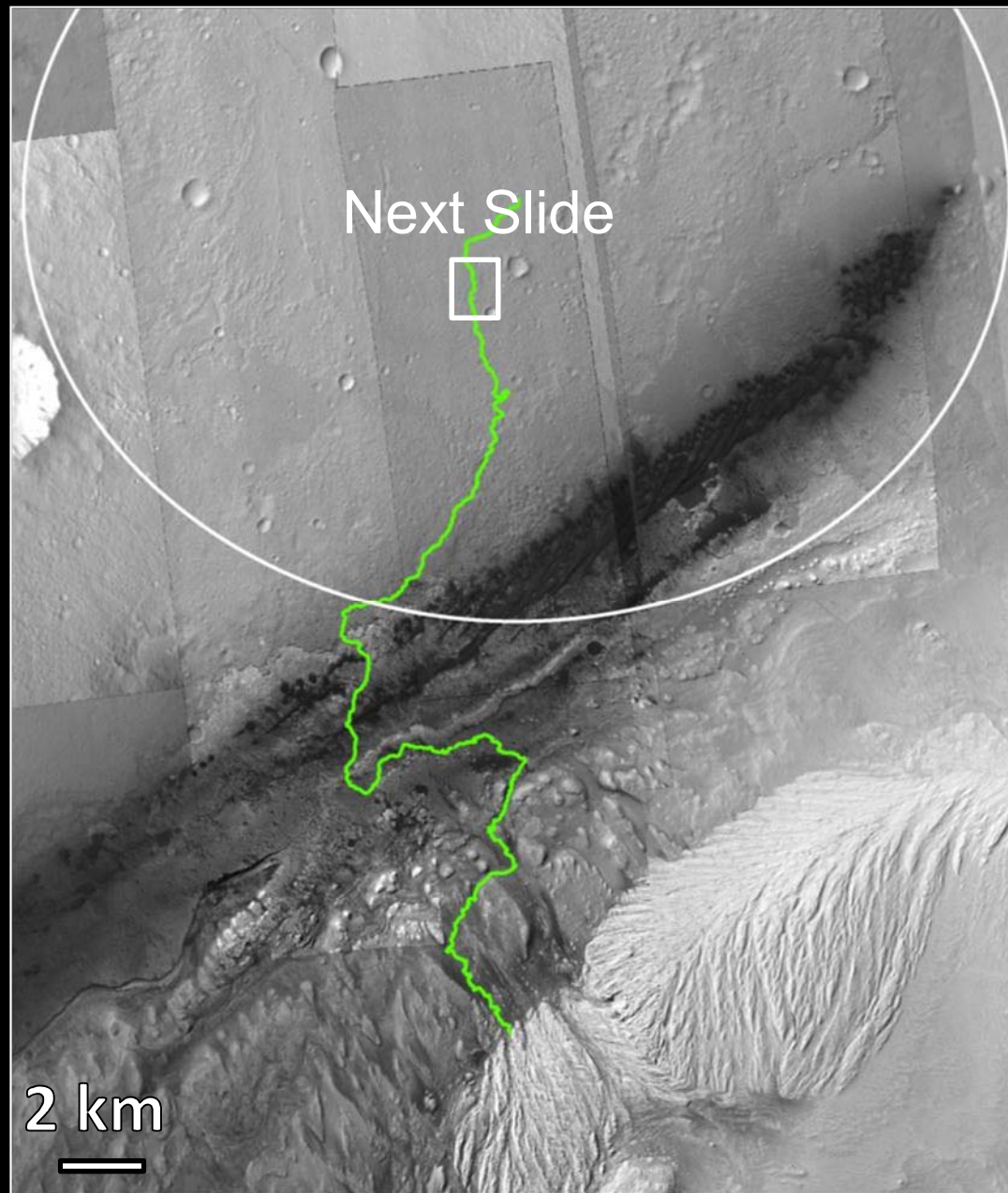
- Hypothesis: This is an inverted channel system. Crater wall rock was transported into the ellipse by fluvial processes.
- What MSL would do:
 - Determine flow conditions, frequency, and cement composition.
 - Analyze samples of crater wall rocks.
- Distance traversed: 2.16 km
- Elevation gained: -0.5 m
- # of Sols: 52
(0.08 Mars Years)

At least three sources of clasts from the rim

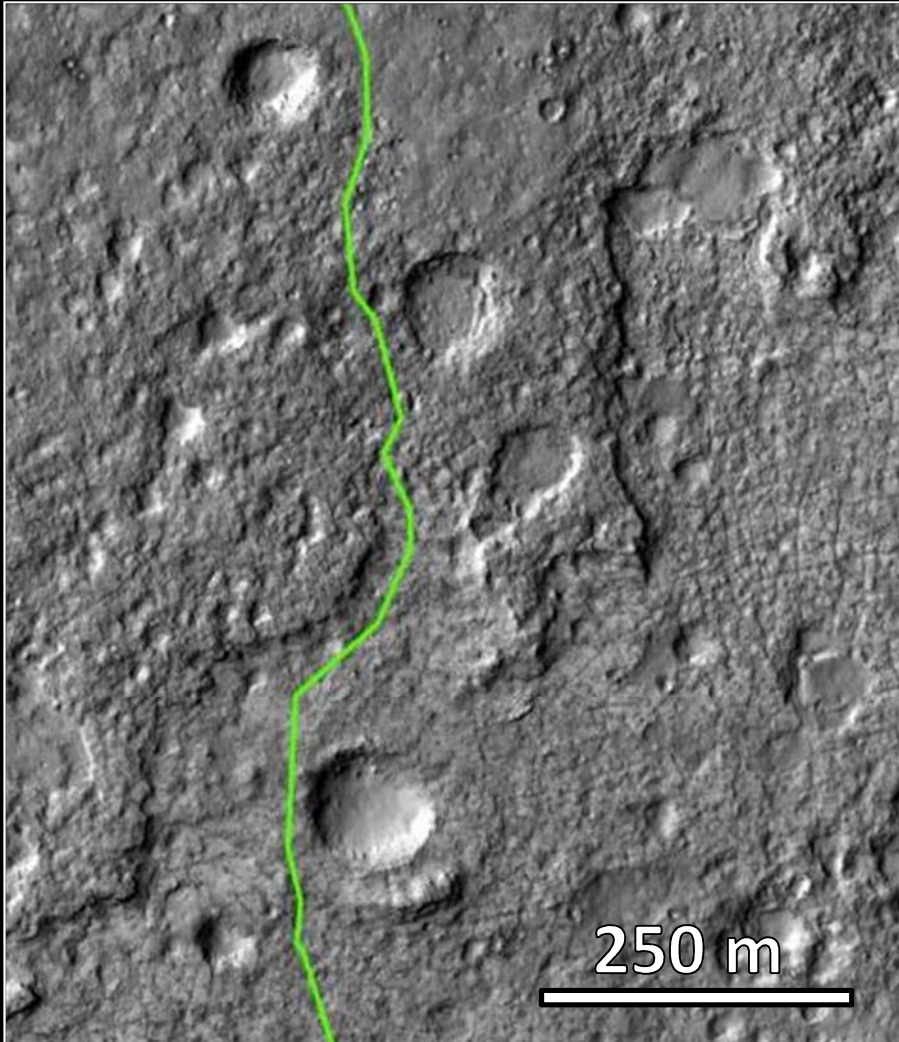


- | | |
|---|---|
|  Channels |  Inverted Channels |
|  Dark Sand Dunes |  Mound Skirting Unit
(or similar texture) |

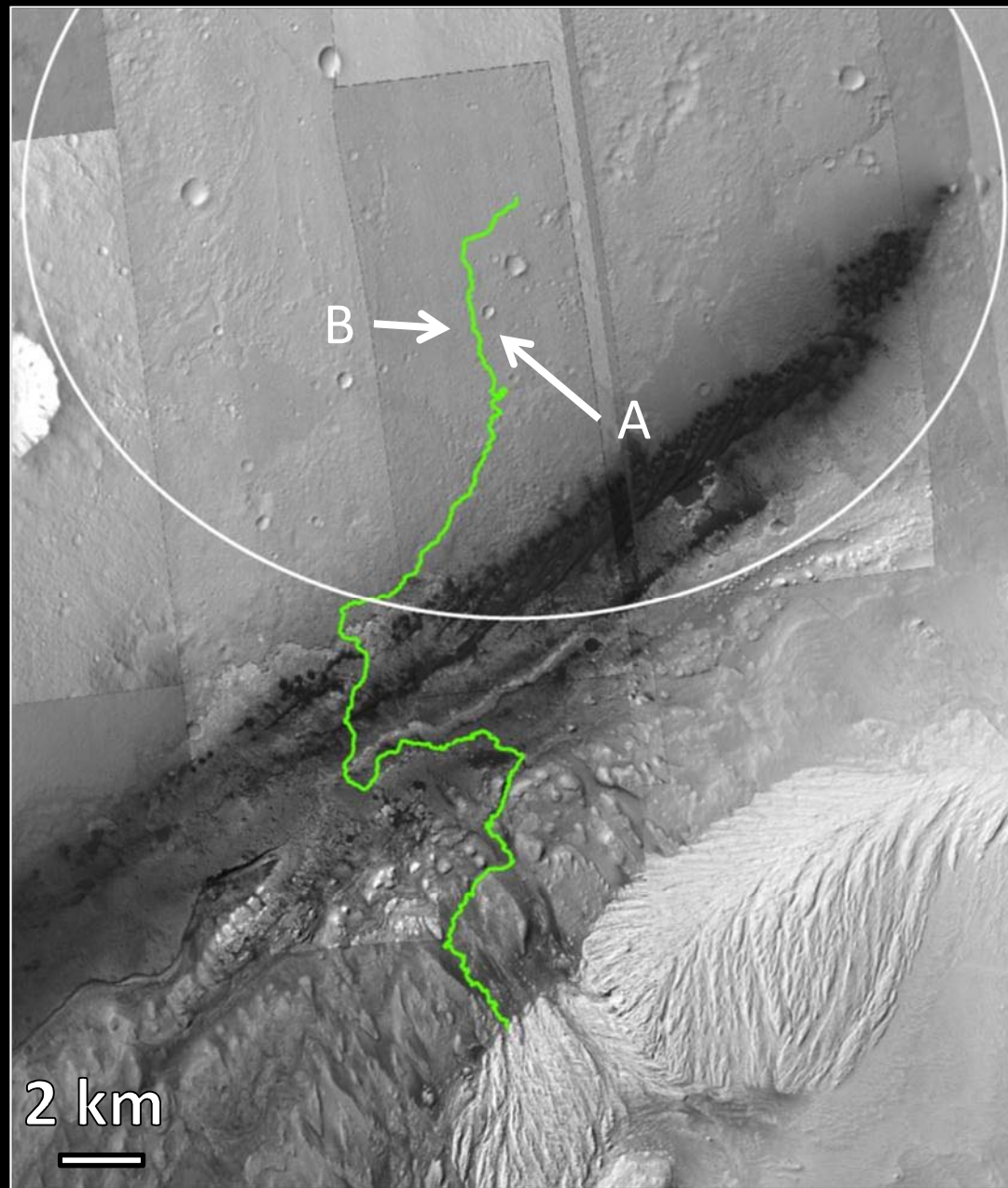




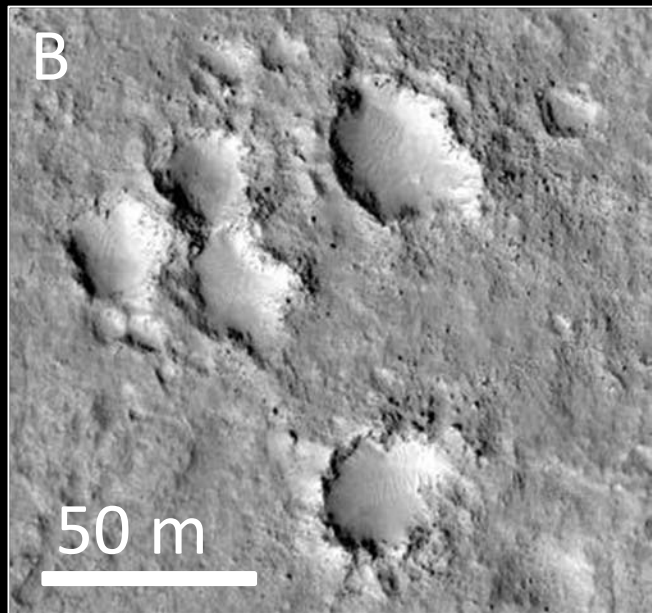
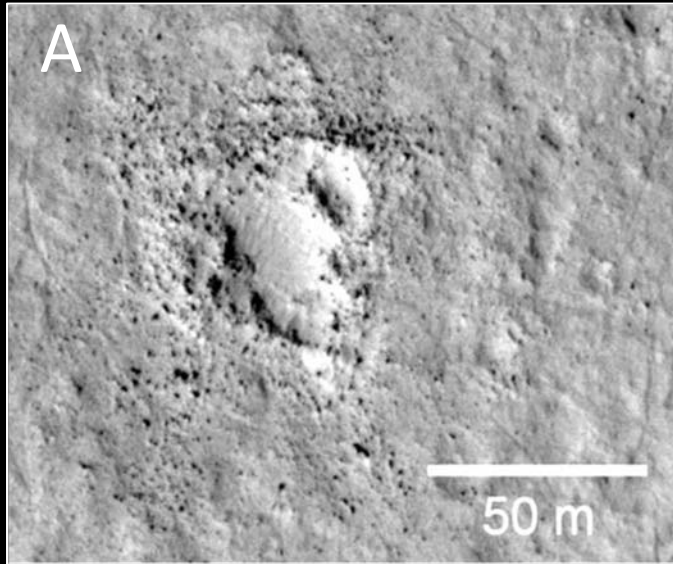
Transition to High TI Unit



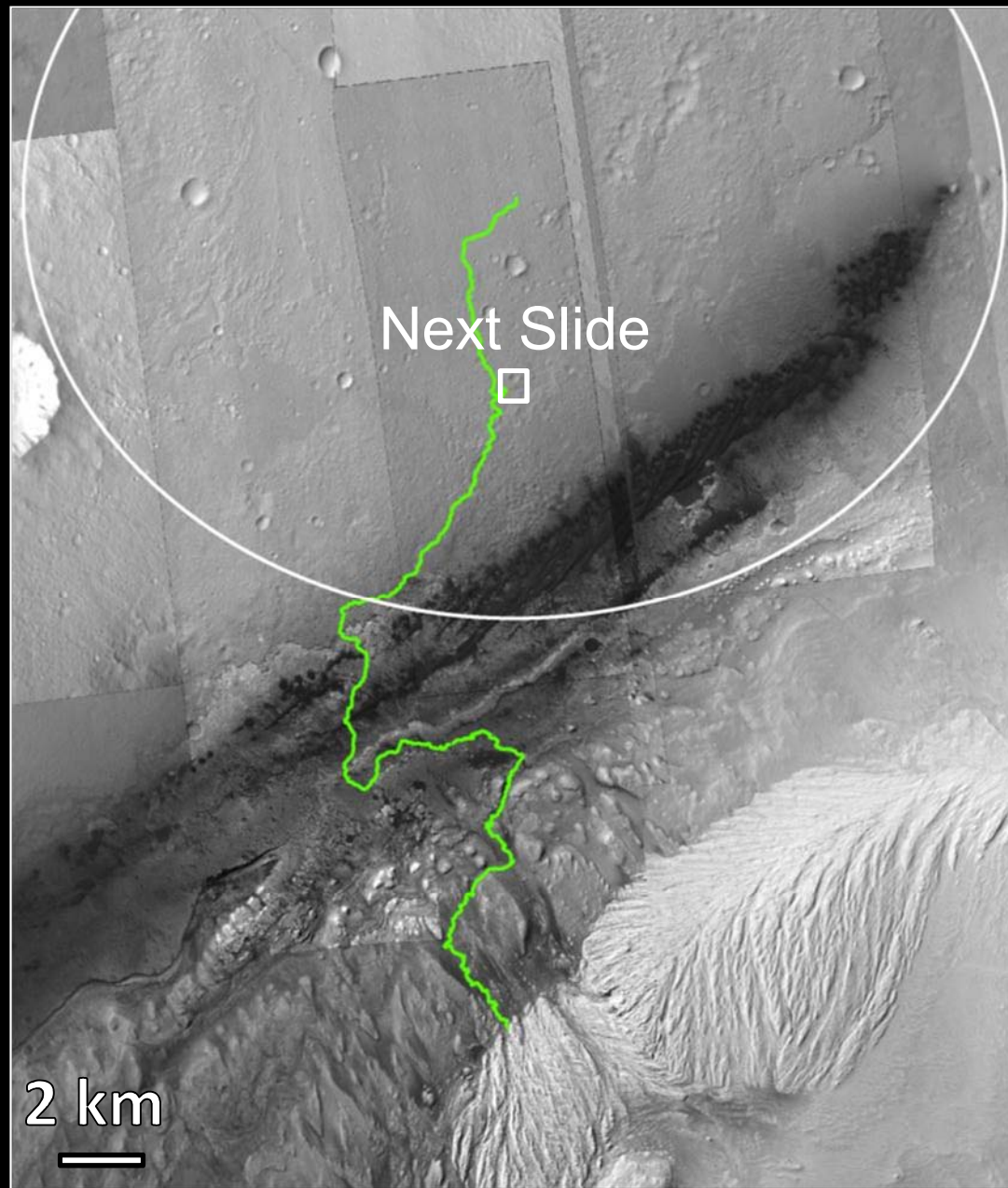
- Hypothesis: The high TI unit beneath the fan is cemented alluvial material, related to the evaporation of the last surface water in Gale.
- What MSL would do:
- Characterize a potentially new rock type on Mars.
 - Sedimentary structures, textures, grain size.
 - Chemistry and mineralogy of clasts and cement.
- Distance traversed: 3.11 km
- Elevation gained: -15.5 m
- # of sols: 61
- (0.09 Mars Years)



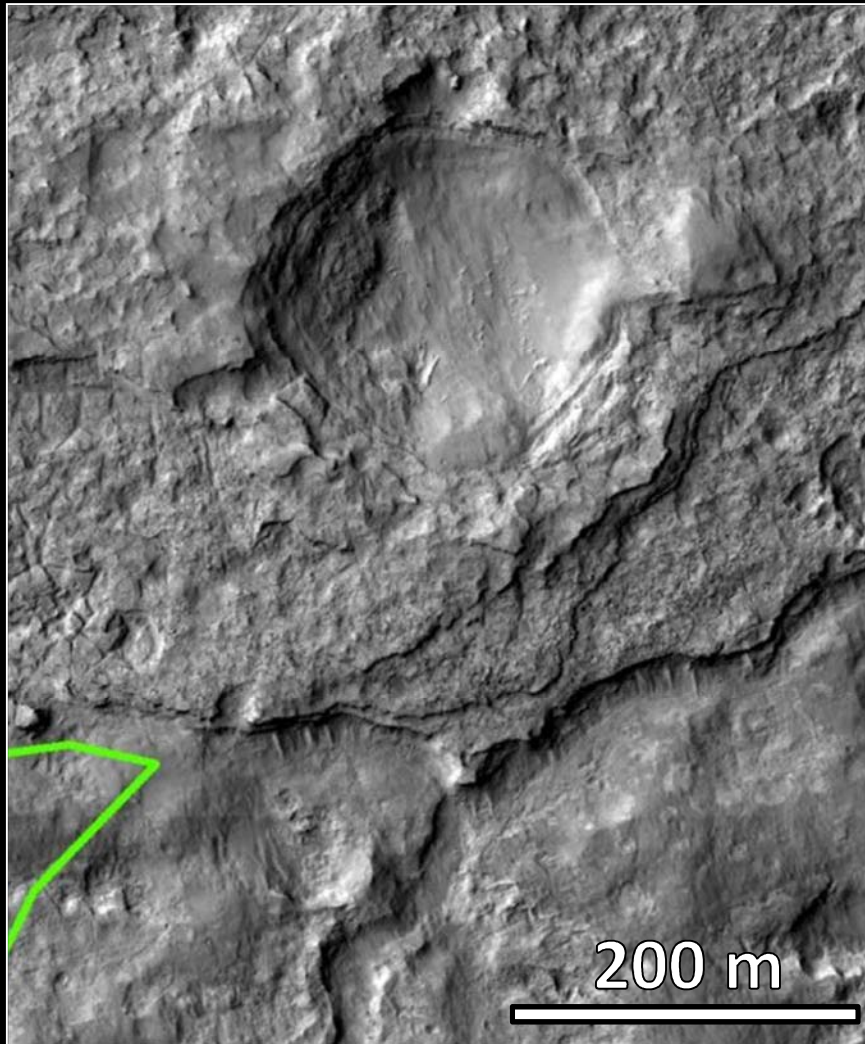
Fresh Craters



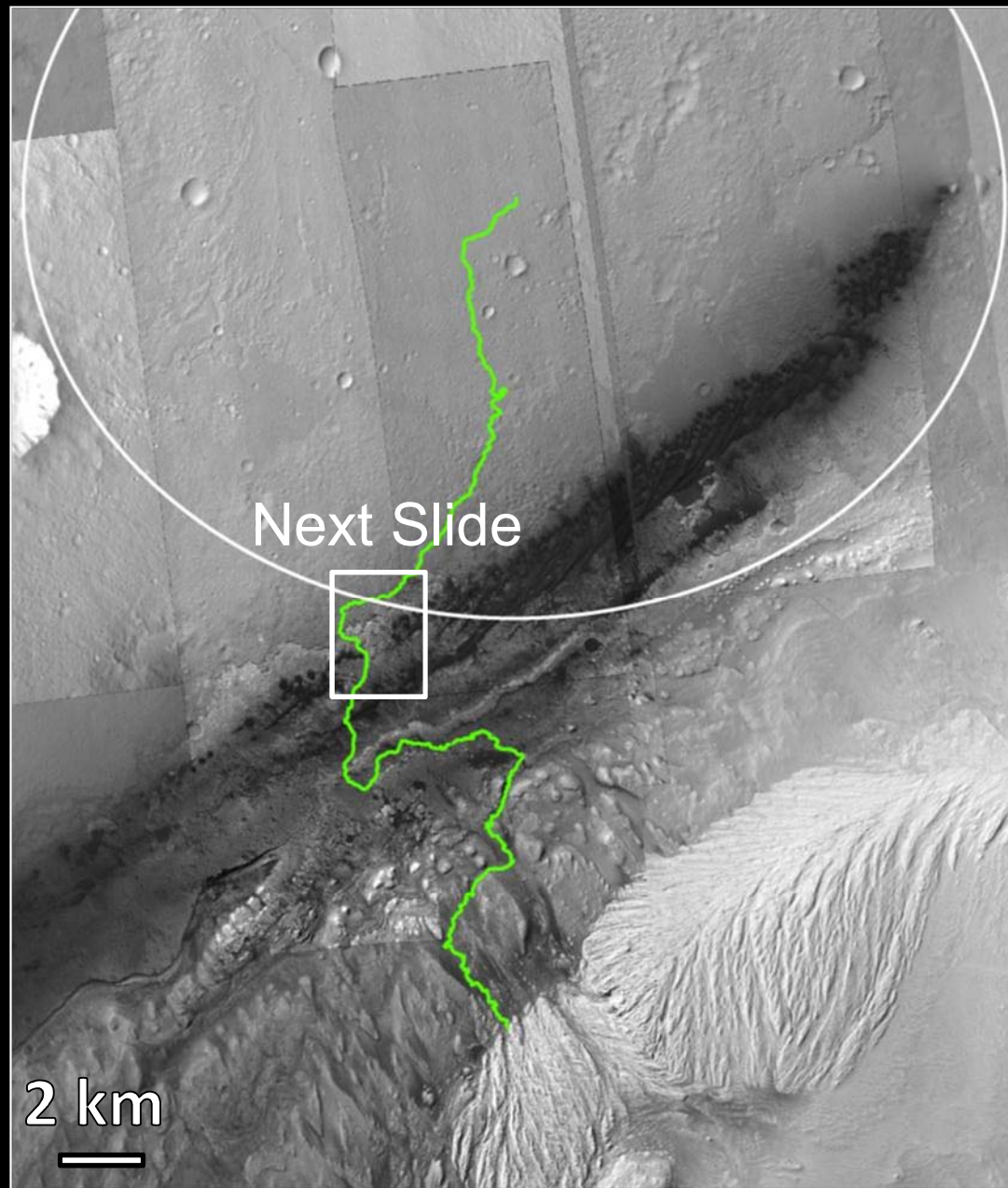
- Hypothesis: Ejecta blocks expose high TI sedimentary material that has been subject to less radiation and weathering.
- What MSL would do:
 - Investigate texture, chemistry and mineralogy.
 - Search for organics in “fresh” material in a sedimentary context.
- Distance traversed: 4.35 km
- Elevation gained: -23.9 m
- # of sols: 74 (0.11 Mars Years)



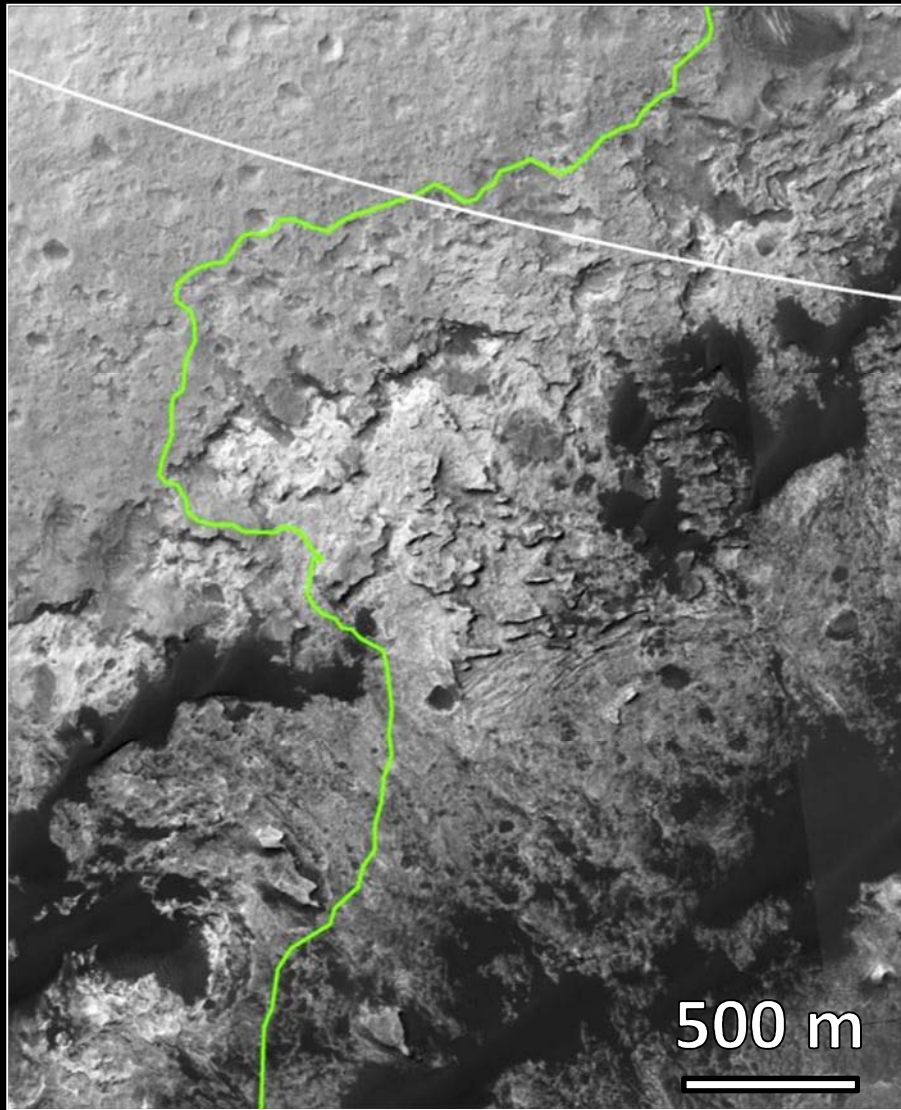
Layered High TI Outcrop



- Hypothesis: Layers in high TI unit record multiple stages of alluvial deposition and cementation.
- What MSL would do:
 - Determine depositional setting and stratigraphy.
 - Find composition and mineralogy of clasts and cement.
 - Look for changes across the unit (e.g. proximal to distal)
- **Distance traversed:** 6.47 km
- **Elevation gained:** -42.3 m;
- **# of sols:** 95 (0.14 Mars Years)

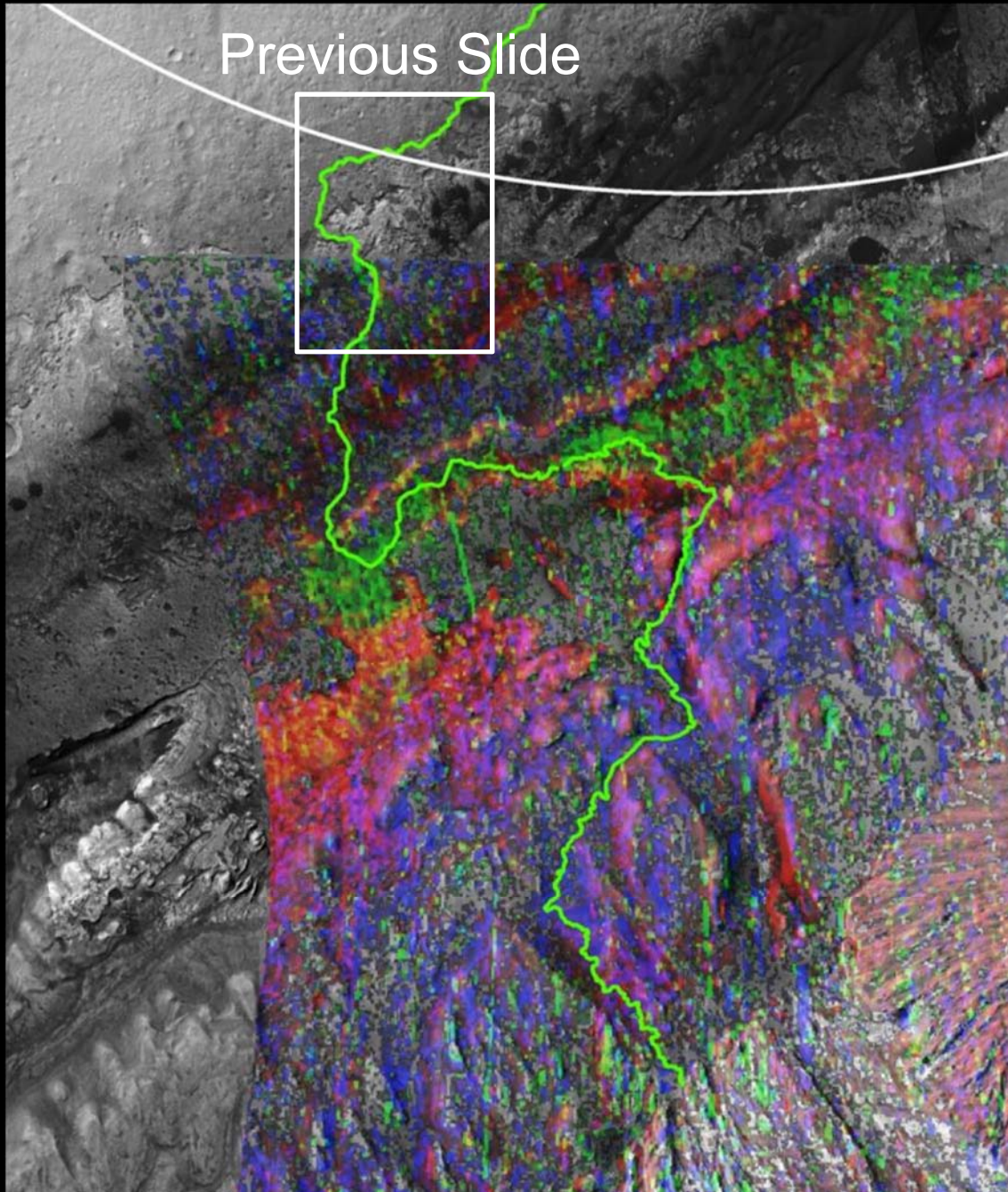


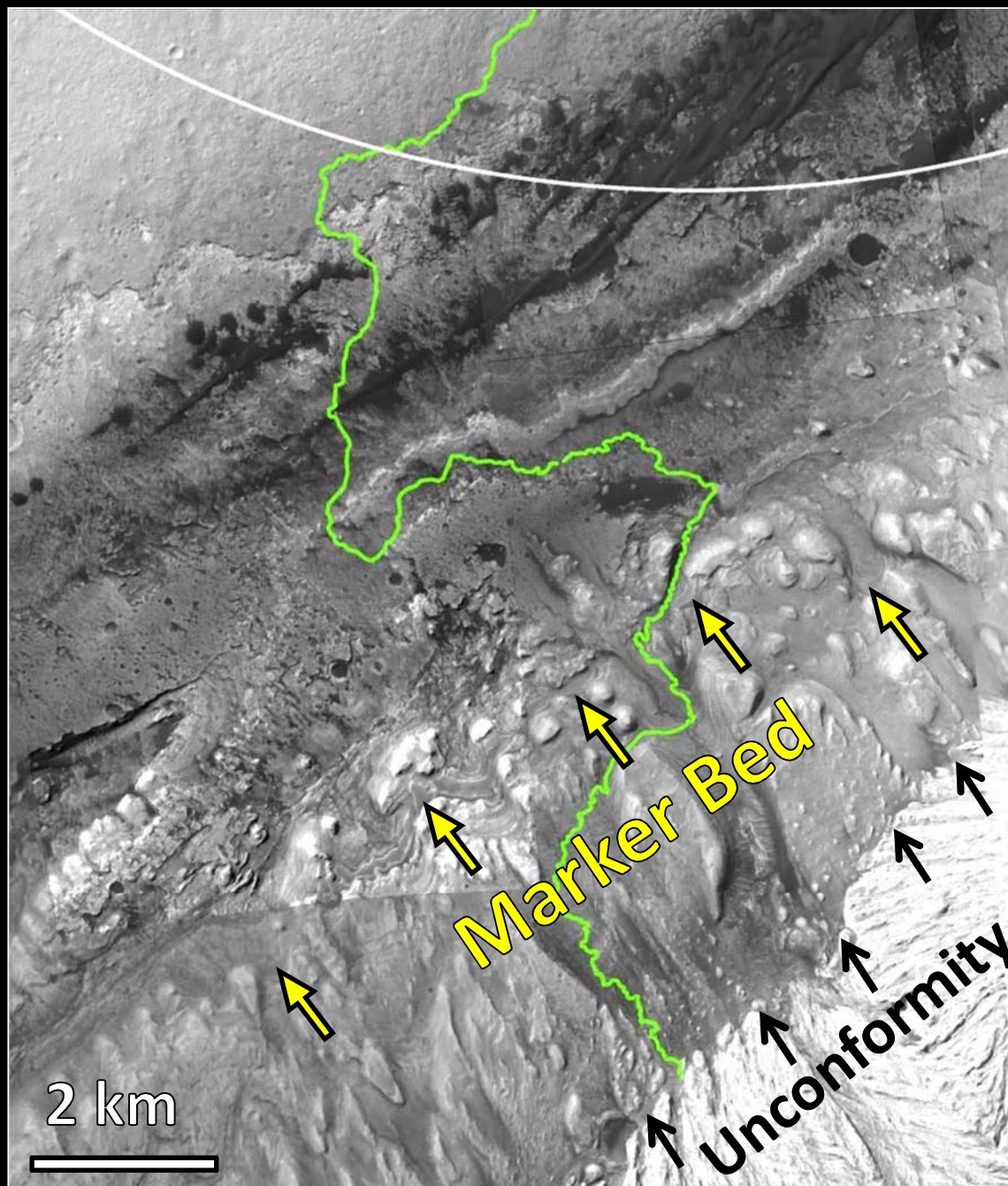
Floor-to-mound Transition and Ridged Mesas

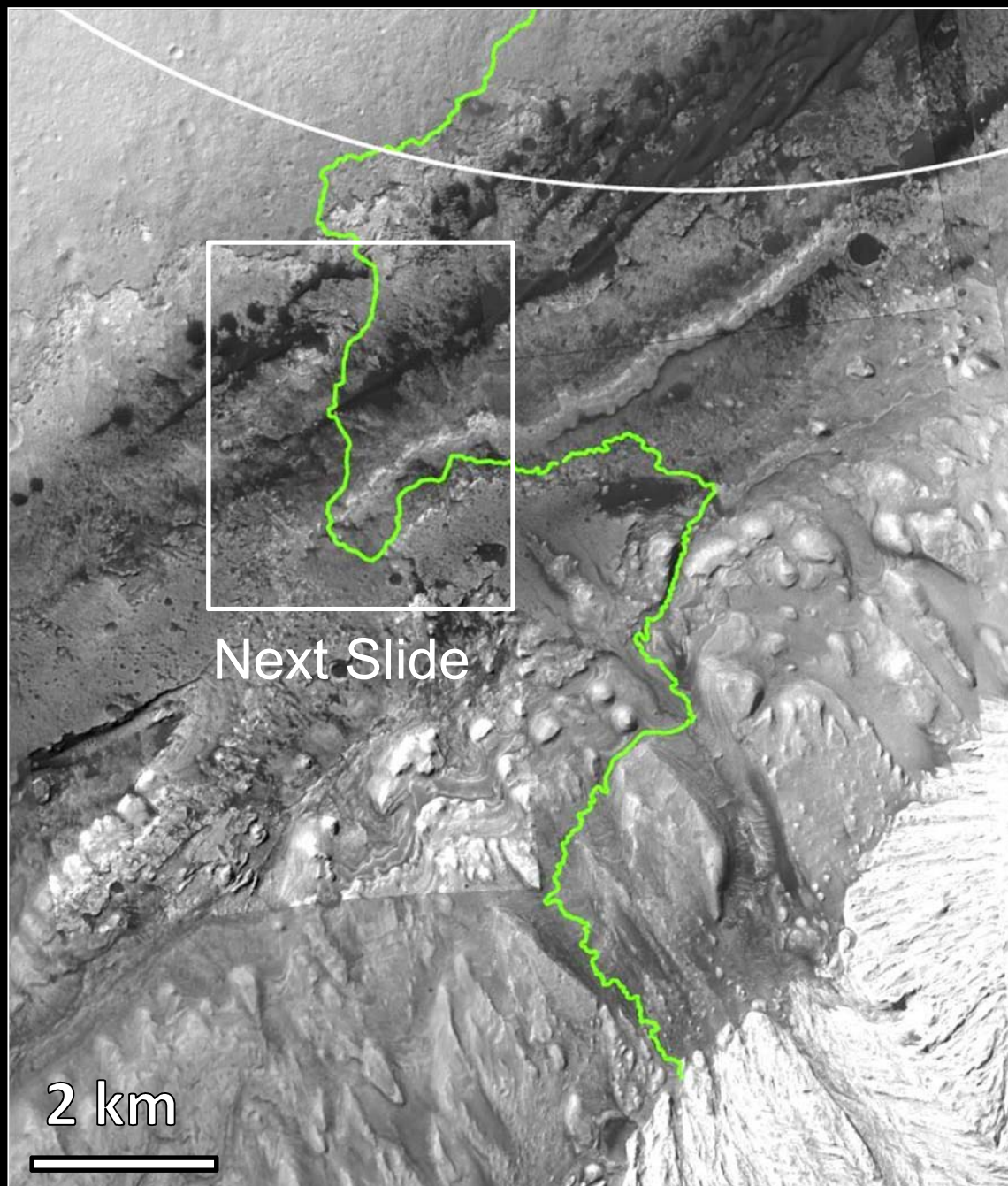


- Hypothesis: Ridged mesas are lithified aeolian bedforms that are younger than the mound.
- What MSL would do:
 - Characterize crater floor units.
 - Observe grain size and bedding of ridged outcrops.
 - Monitor composition and mineralogy changes across the scarp.
- Distance traversed: 15.76 km
- Elevation gained: 47.65 m
- # of sols: 188 (0.28 Mars Years)

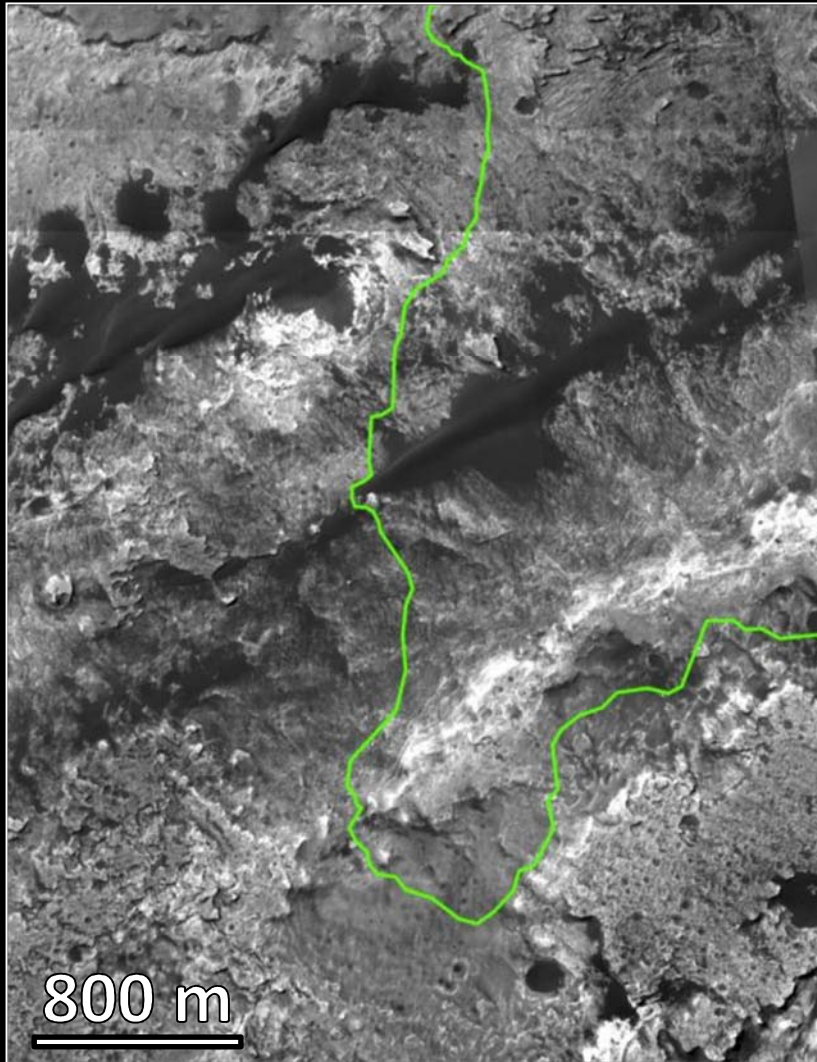
Previous Slide





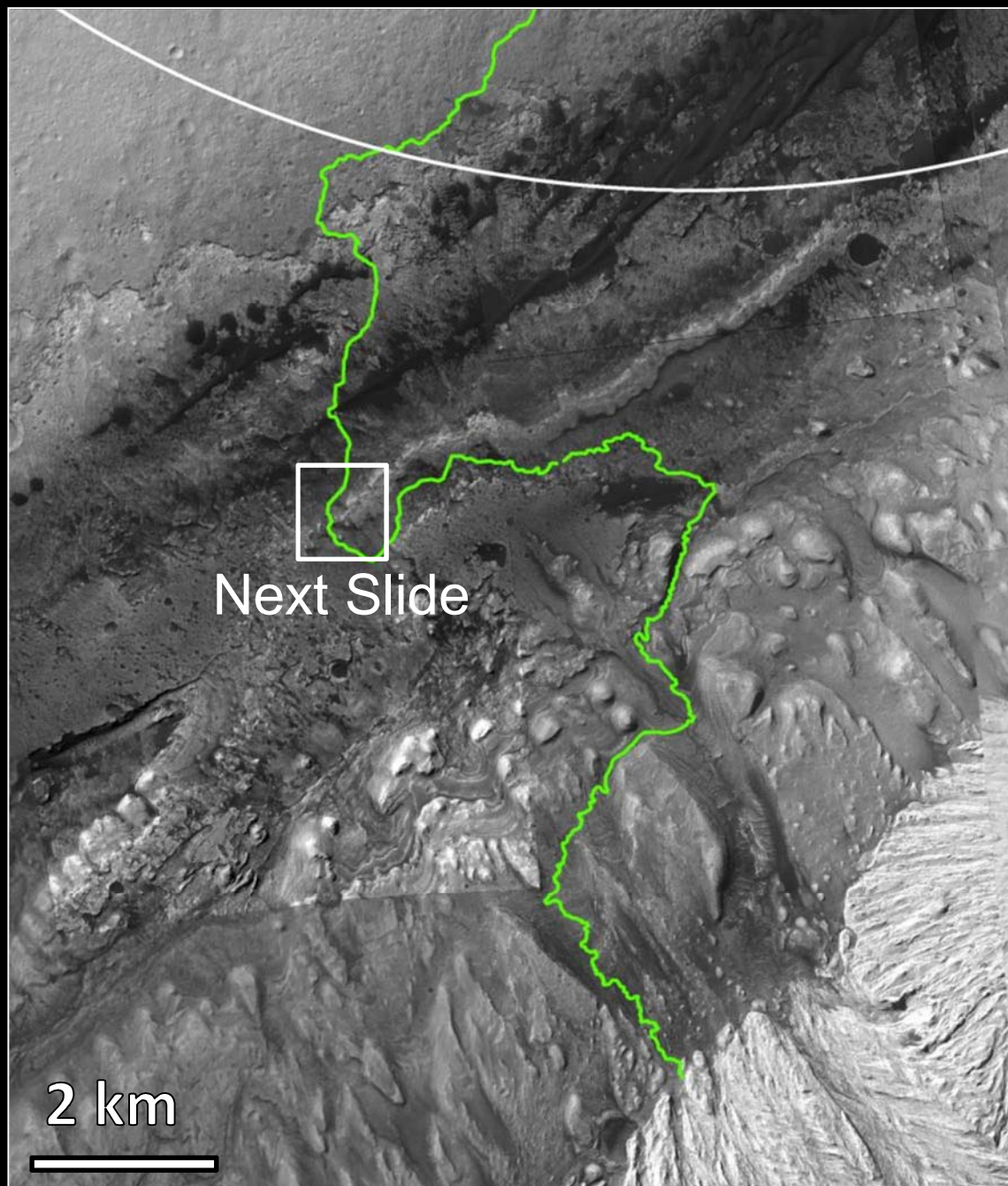


Dark Dunes

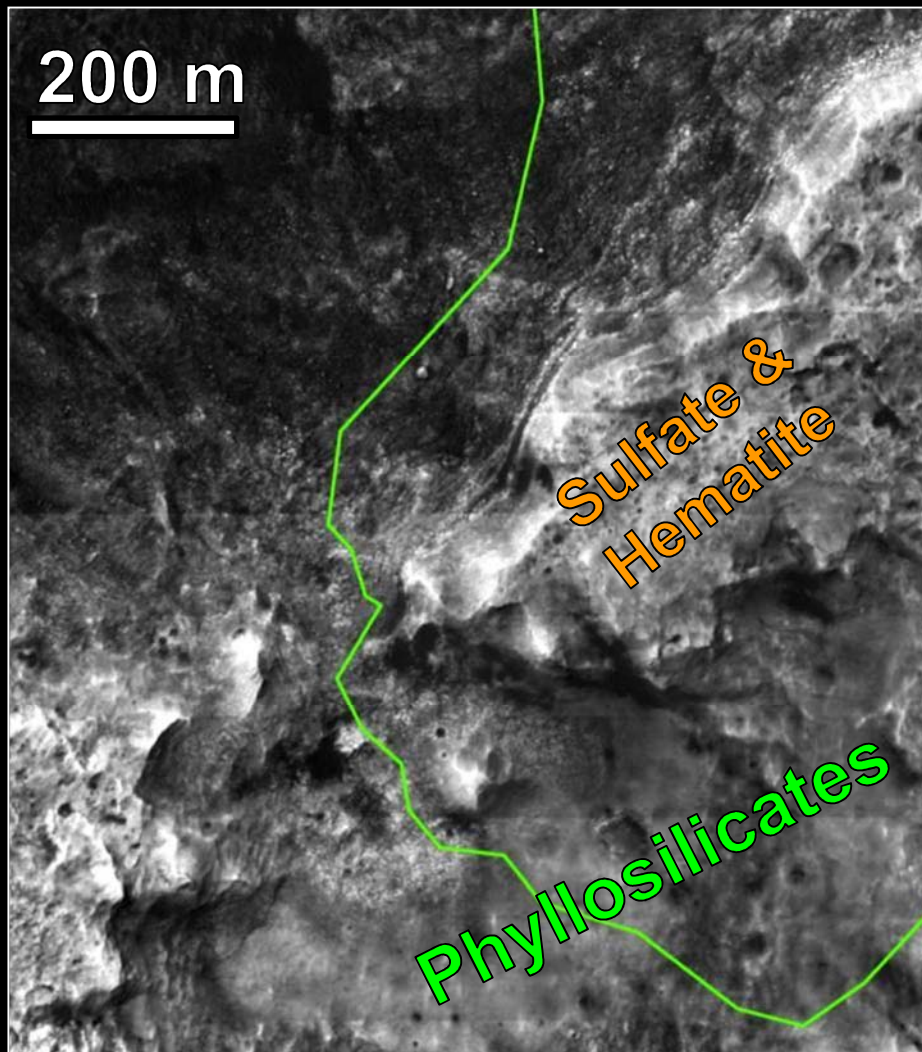


- Hypothesis: The dark dunes are active and derived from a source external to the crater.*
- What MSL would do:
 - Compare composition and mineralogy of the dunes to mound and wall material and orbital observations.
 - Monitor dunes for activity.
 - Search for evidence of modern cementation.
- Distance traversed: 18.07 km
- Elevation gained: 176.75 m
- # of sols: 210 (0.32 Mars Years)

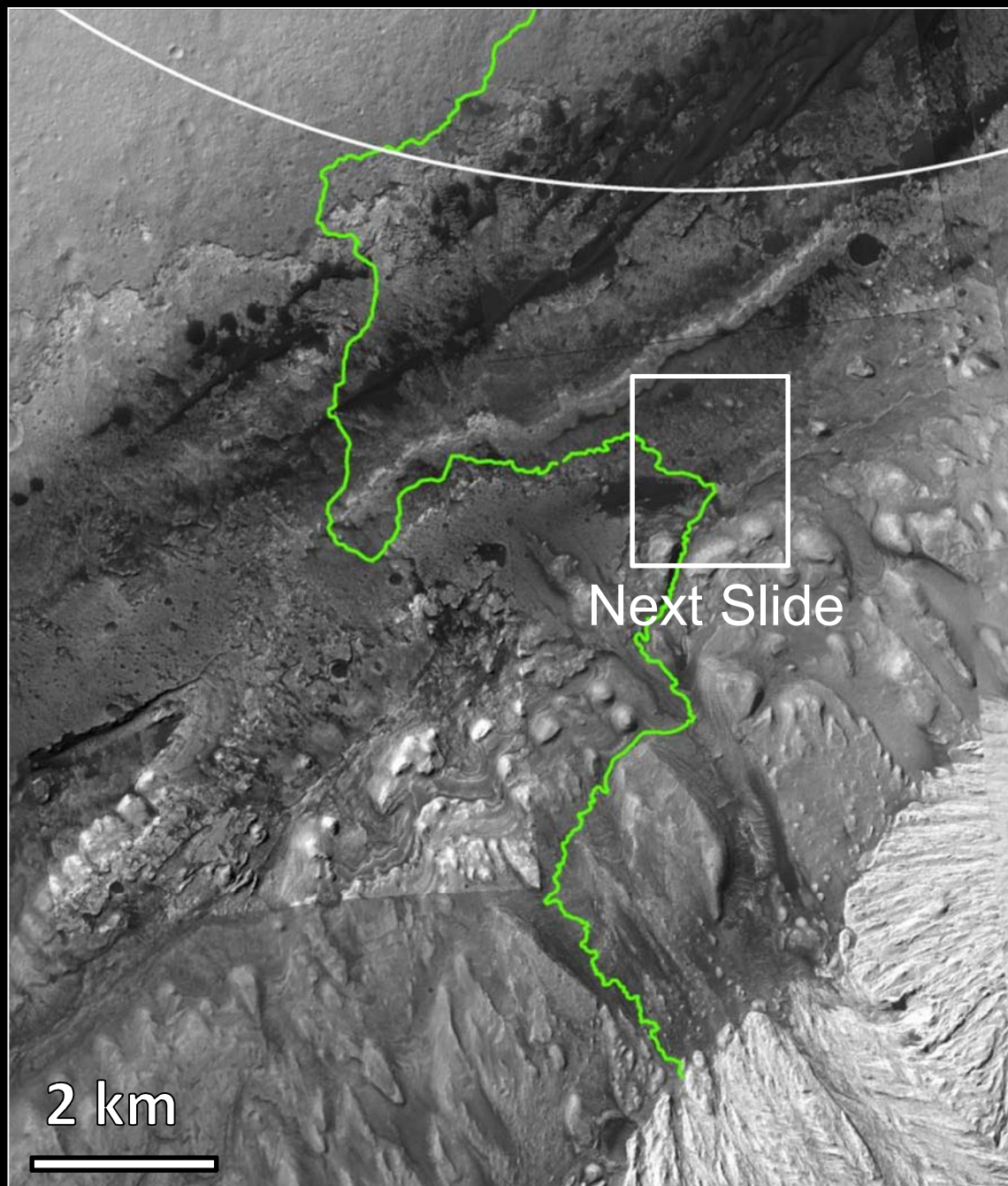
*Hobbs et al., 2010



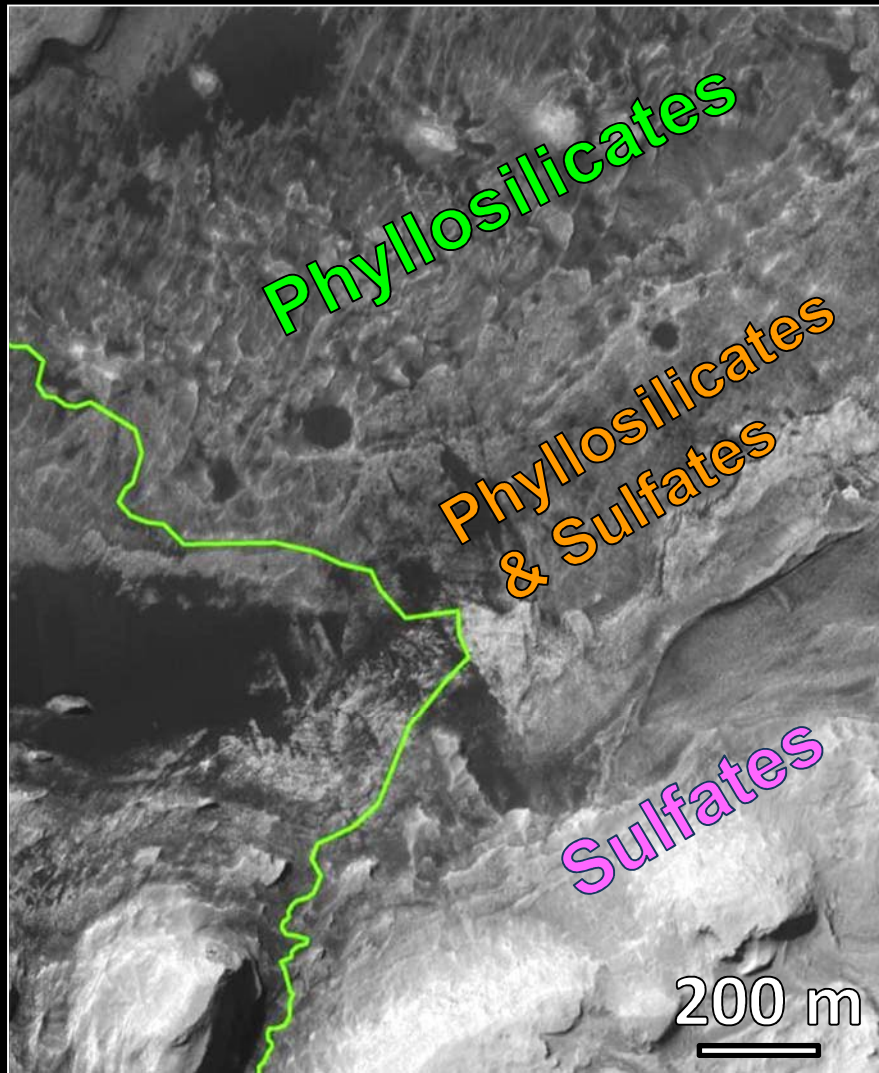
Light-toned Ridge Layers and Phyllosilicates



- Hypothesis: Some of the layered material in the lower mound is lacustrine.
- What MSL would do:
 - Determine depositional environment
 - Sedimentary structures, composition, mineralogy, etc.
 - Determine alteration history and search for biomarkers
- Distance traversed: 20.68 km
- Elevation gained: 314.94 m
- # of sols: 352 (0.53 Mars Years)

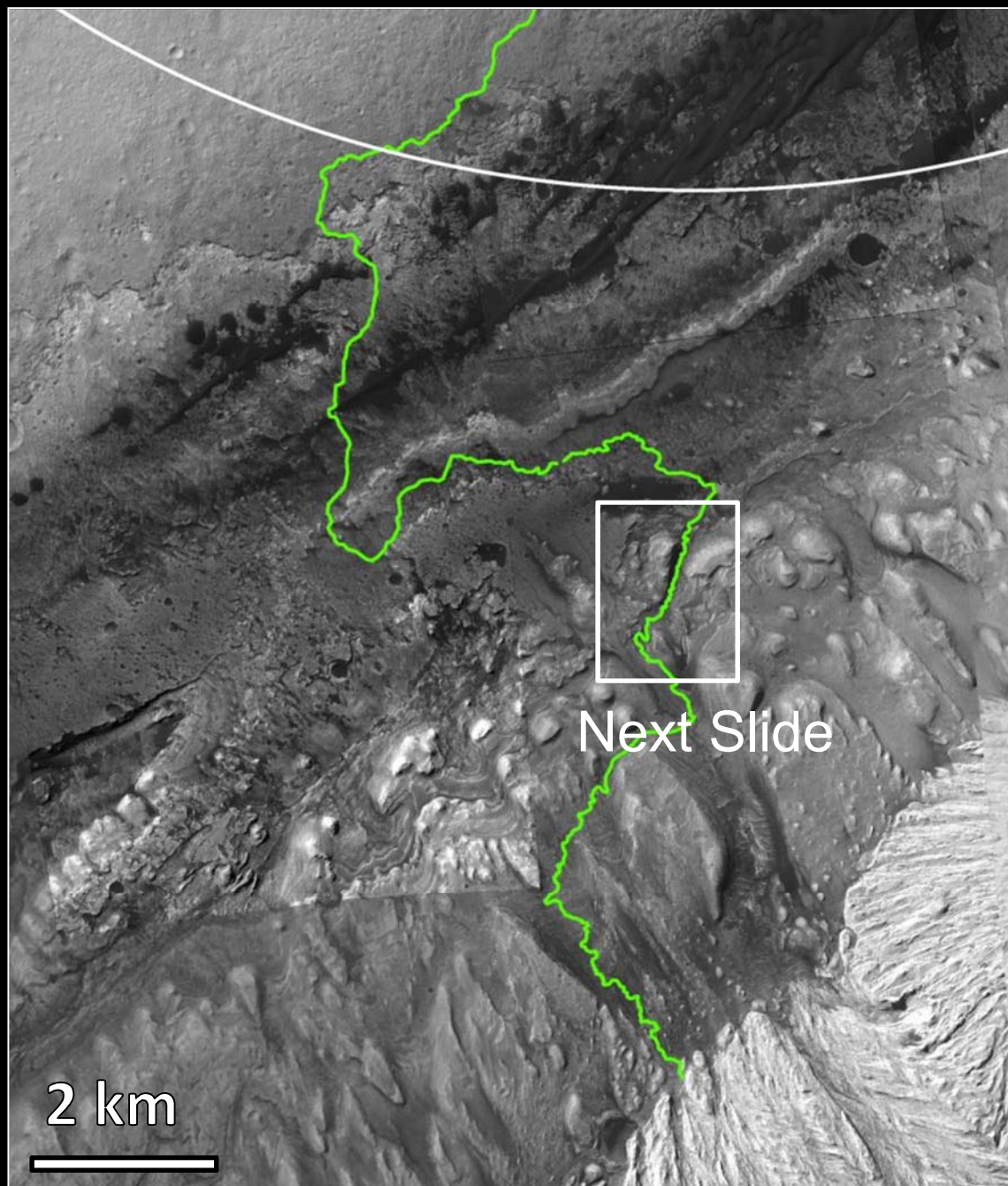


Phyllosilicate to Sulfate Transition

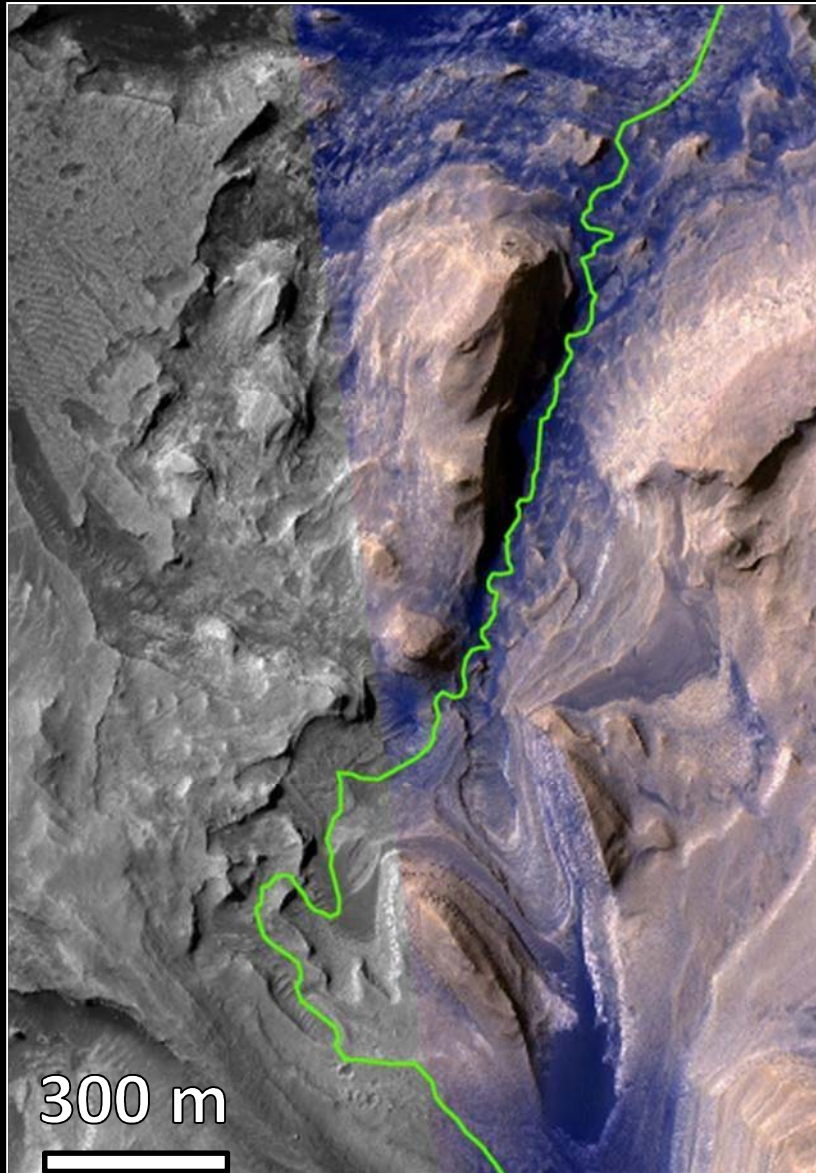


- Hypothesis: Changing mineralogy reflects changing climate and depositional environment.*
- What MSL would do:
 - Look for evidence of this change based on chemistry, mineralogy, grain size, sedimentary structures, etc.
 - Search for biomarkers.
- Distance traversed: 27.70 km
- Elevation gained: 391.28 m
- # of sols: 519 (0.78 Mars Years)

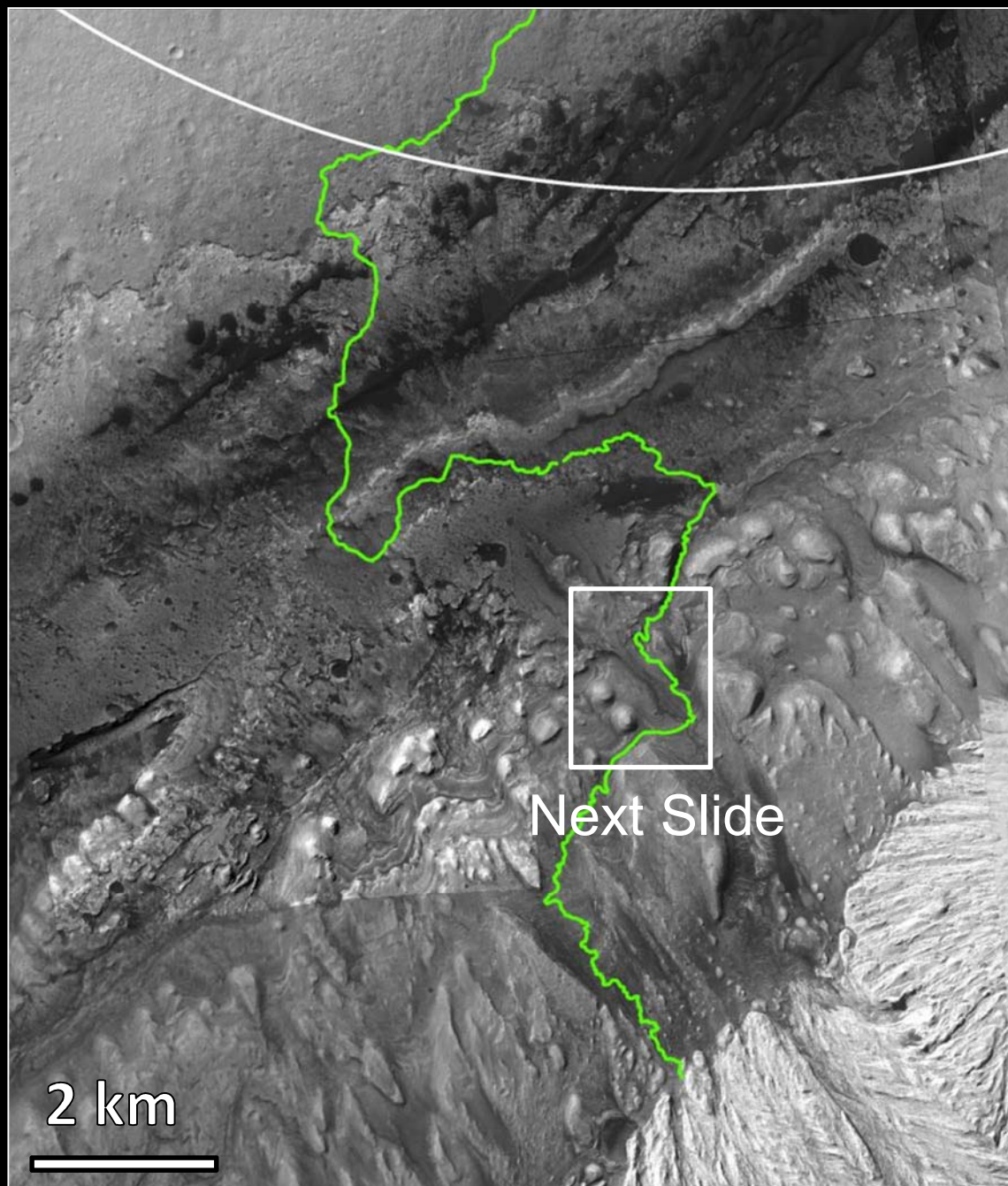
*Milliken et al., 2010



Climb to the Marker Bed



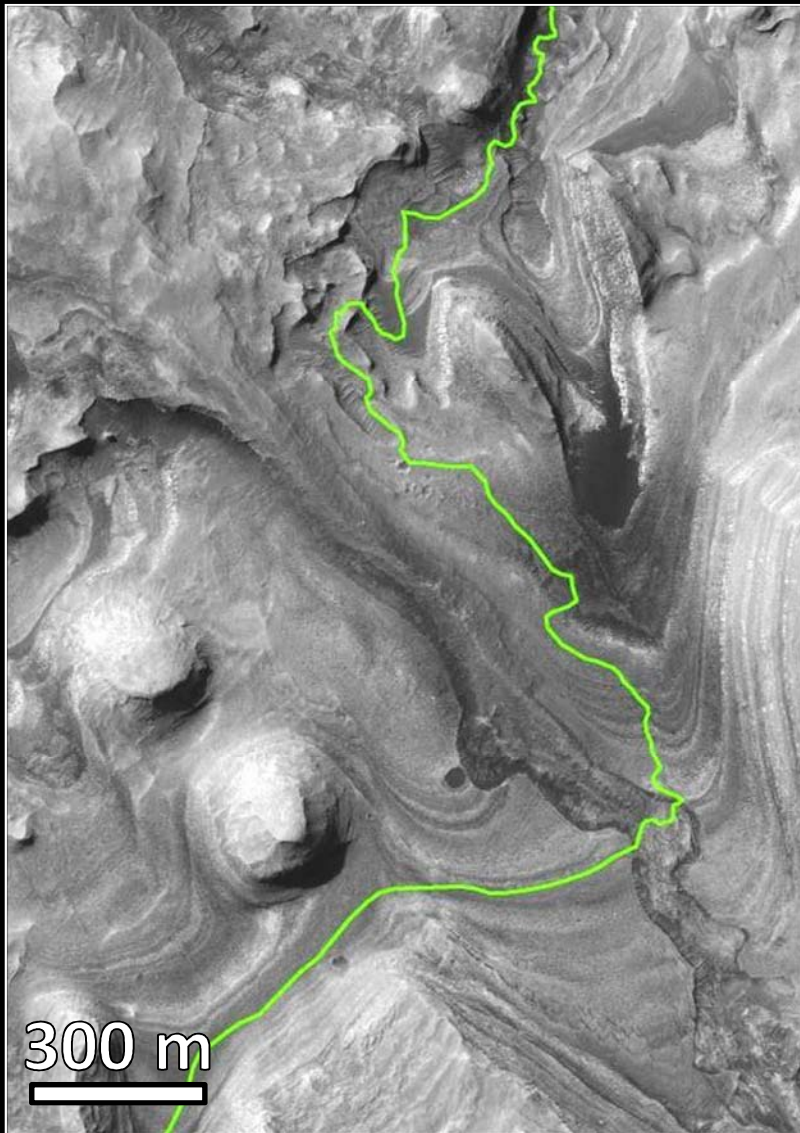
- Hypothesis: Marker bed is a pyroclastic deposit. Mound layers preserve a variety of environments.
- What MSL would do:
 - Continue compiling mound stratigraphy, including marker bed
 - Observe texture, grain size, sedimentary structures, composition, mineralogy.
 - Search for biomarkers (if preservation potential is high)
- Distance traversed: 27.88 km
- Elevation gained: 607.80 m
- # of sols: 592 (0.88 Mars Years)



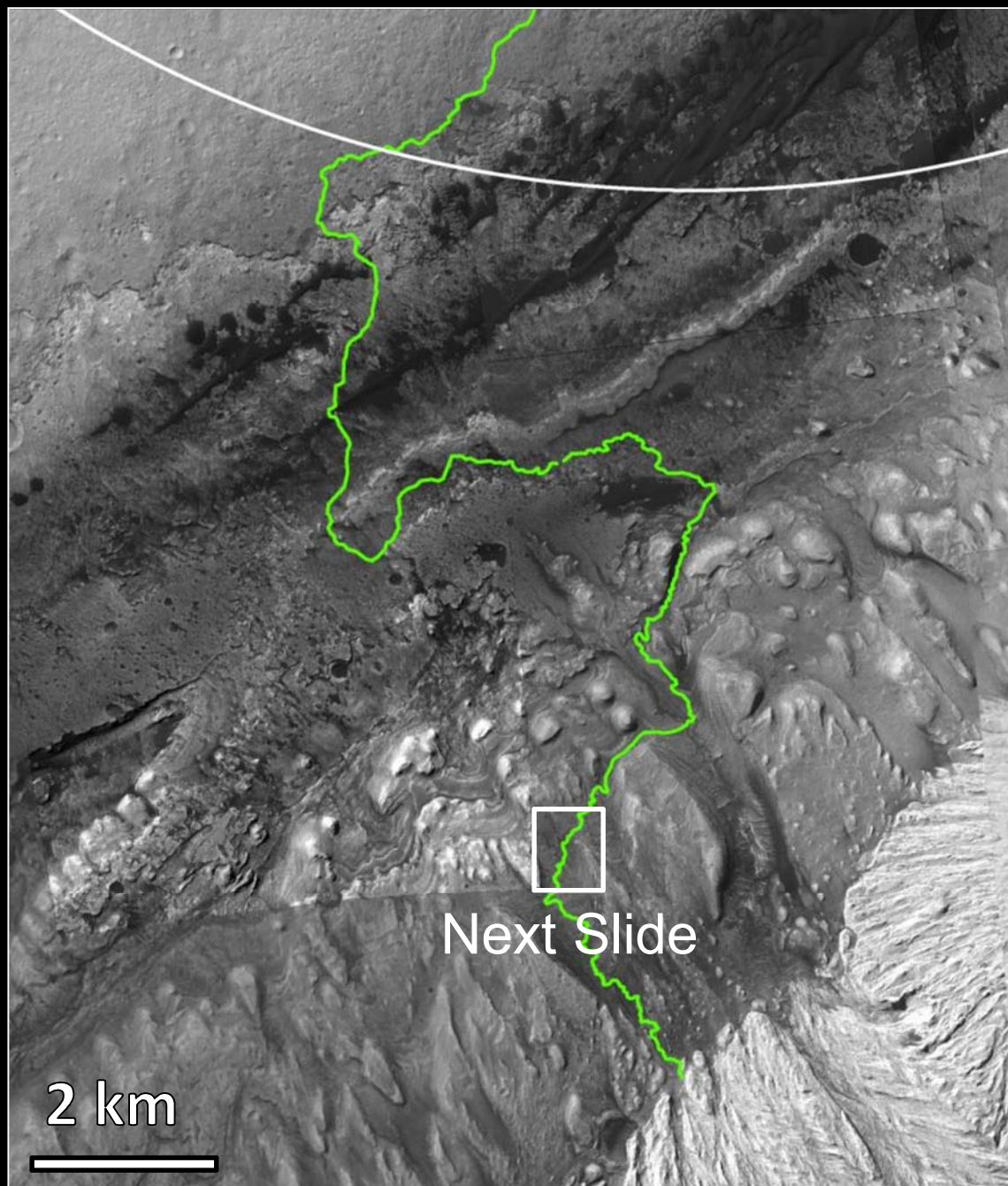
Next Slide

2 km

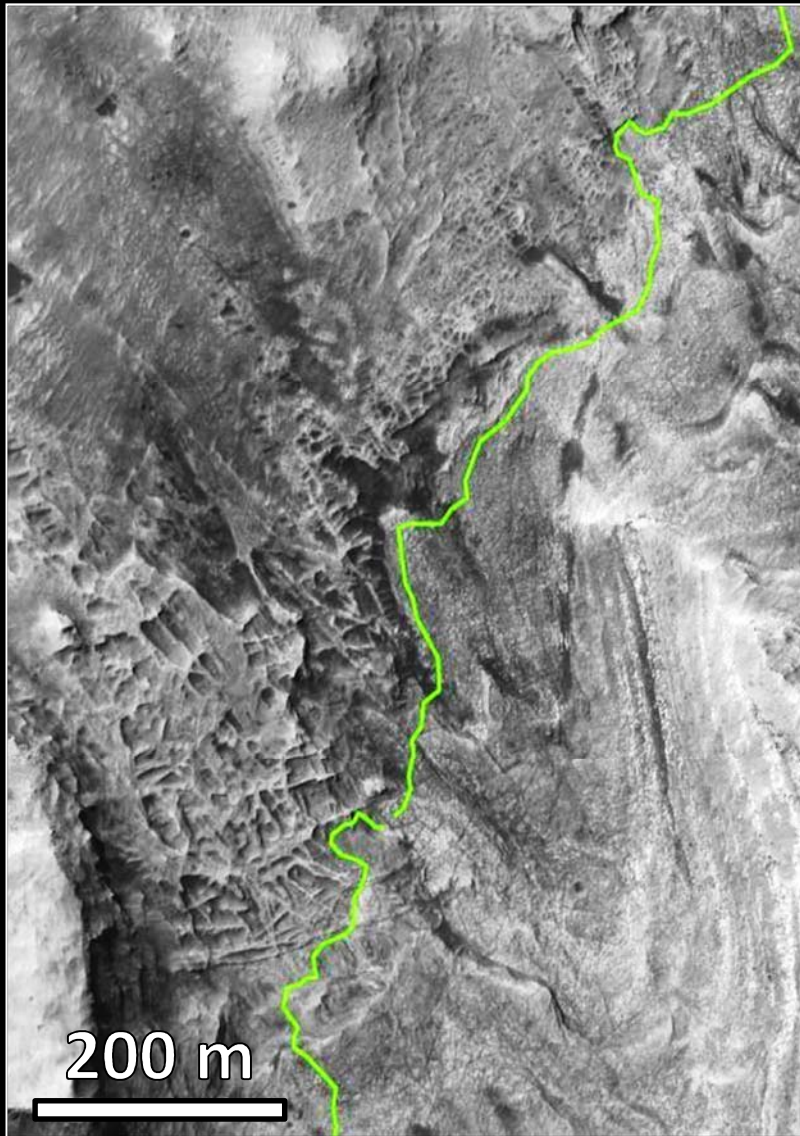
Canyon and Channel Fill



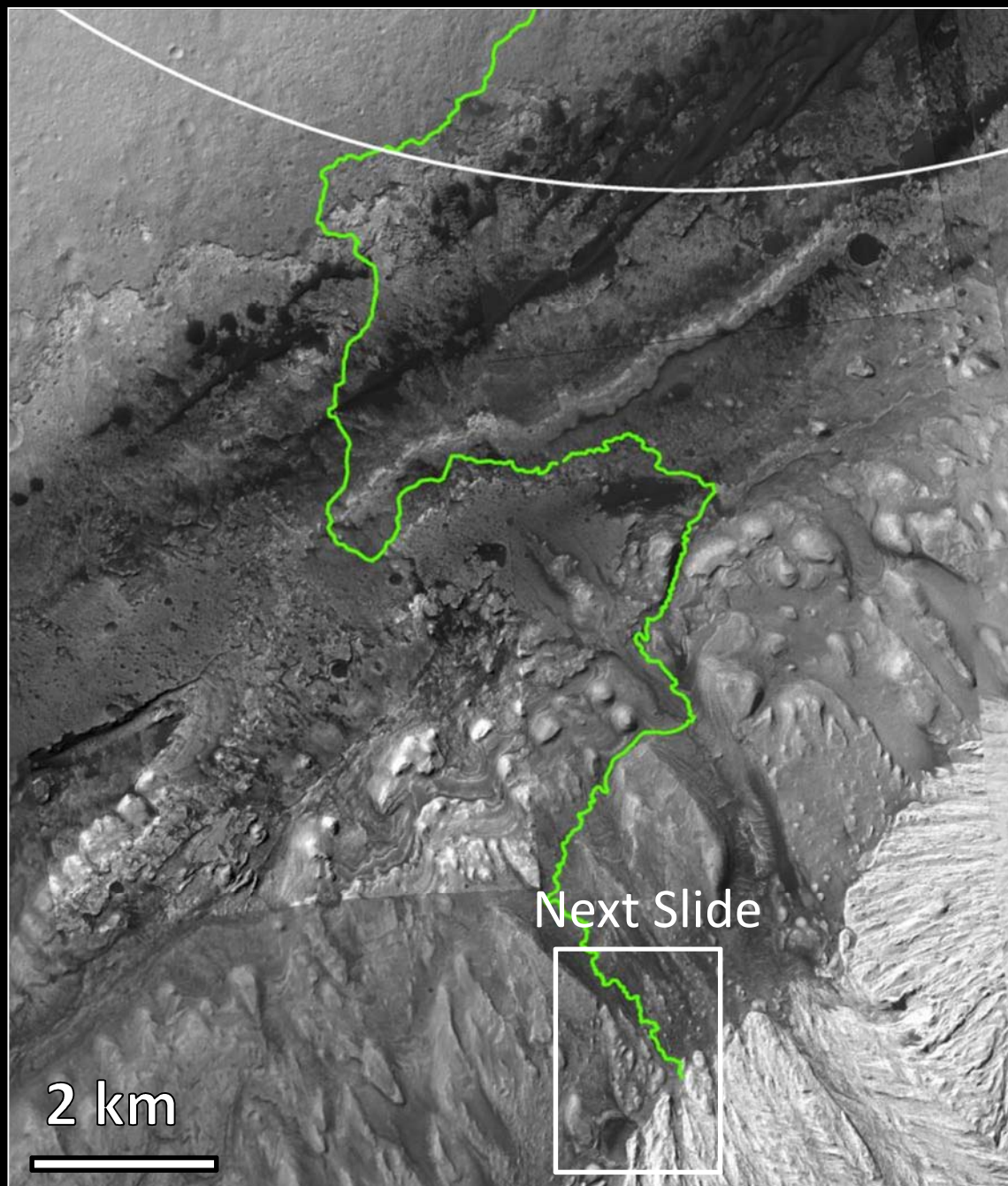
- Hypothesis: Channel fill is fluvial debris from higher on the mound.
- What MSL would do:
 - Continue compiling mound stratigraphy.
 - Observe texture, grain size, sed. structures, composition, mineralogy.
 - Characterize channel fill to find flow/deposition conditions and properties of stratigraphically higher material.
- Distance traversed: 29.51 km
- Elevation gained: 737.80 m
- # of sols: 646 (0.97 Mars Years)



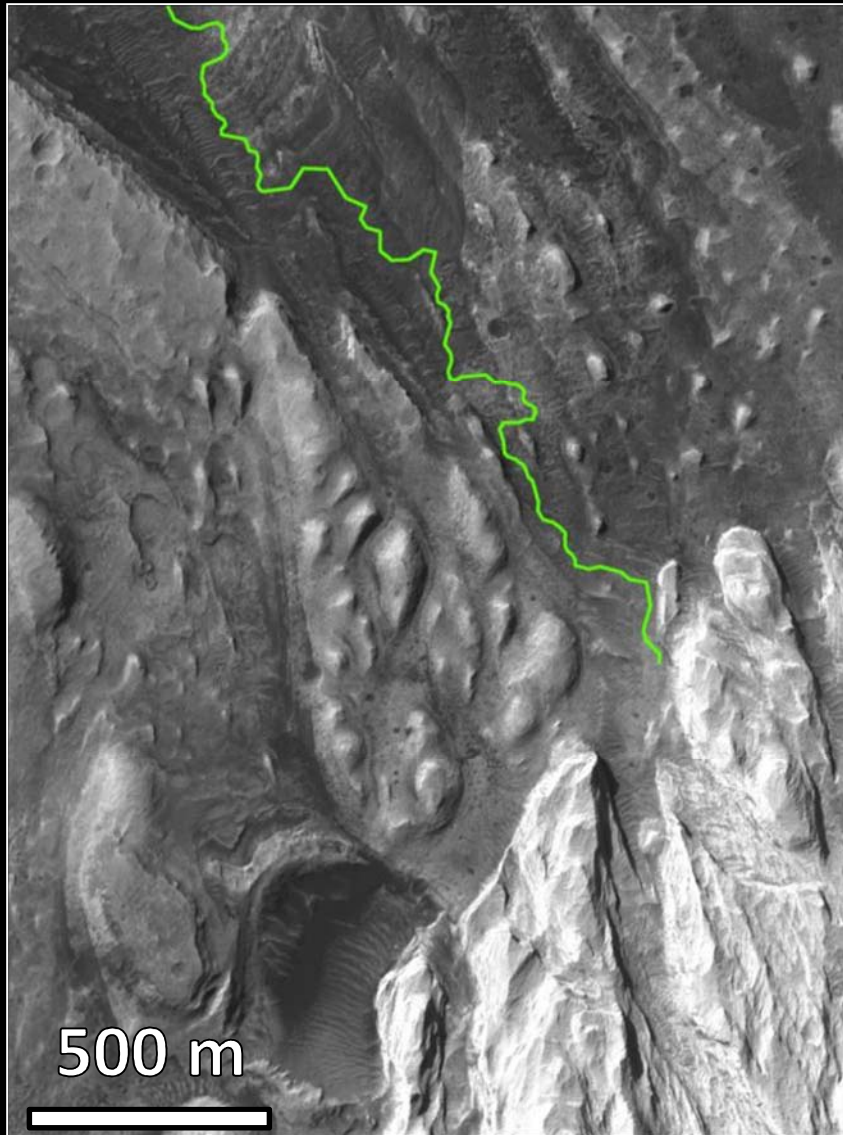
Polygonal Ridges



- Hypothesis: Diagenetic alteration of mound layers by groundwater led to fracturing and differential cementation.
- What MSL would do:
 - Continue compiling mound stratigraphy.
 - Study alteration history of the polygonal ridges.
 - Compare properties of ridges to surrounding rocks and previous targets.
- Distance traversed: 32.26 km
- Elevation gained: 841.39 m
- # of sols: 738 (1.10 Mars Years)

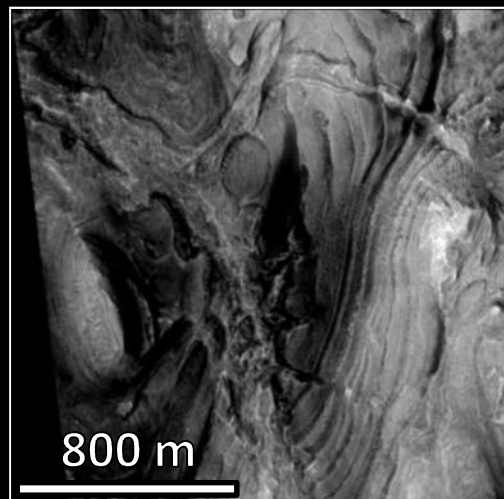
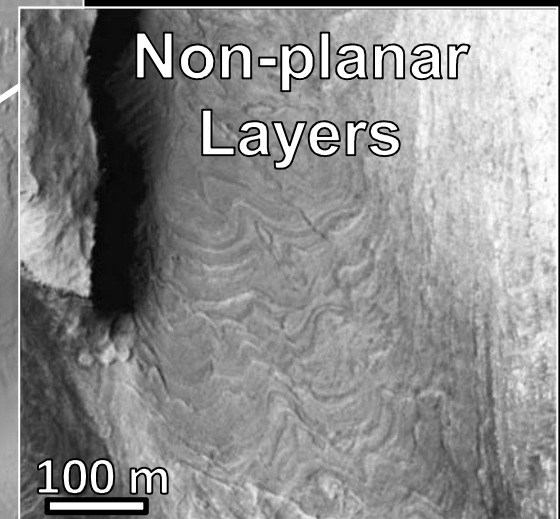
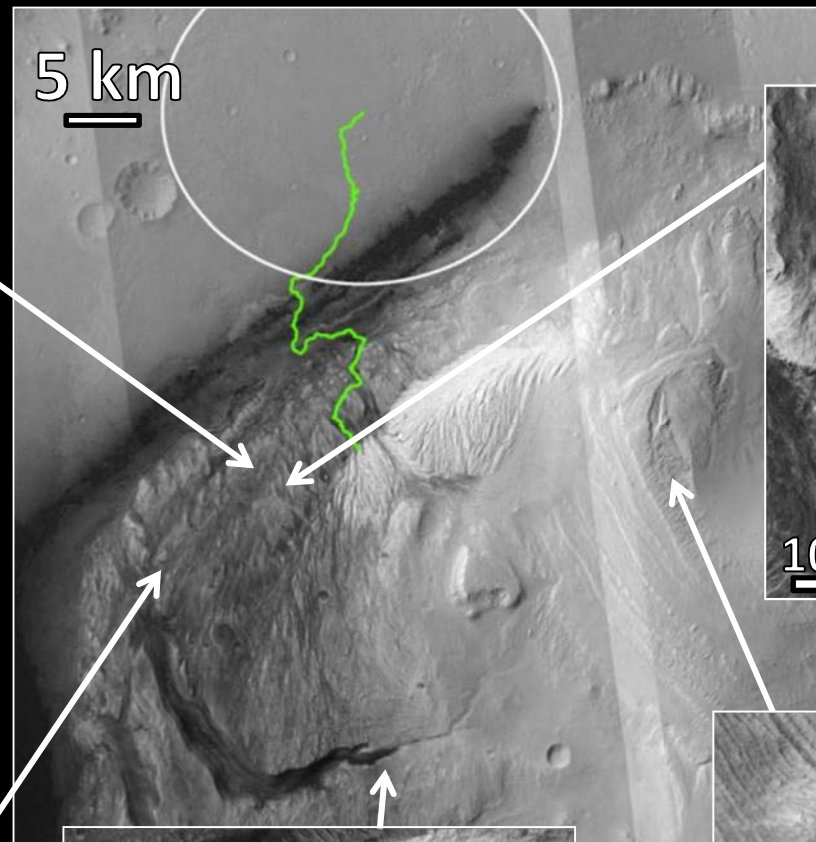


Light-toned Unit

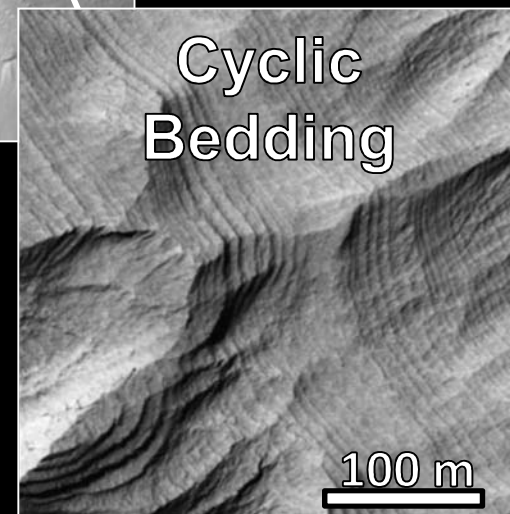


- Hypothesis: The light-toned unit is a thick deposit of cemented and altered ash or dust.
- What MSL would do:
 - Determine depositional setting and alteration history of the light-toned unit.
 - Examine the unconformable contact between LTU and lower mound.
- Distance traversed: 36.43 km
- Elevation gained: 1211.87 m
- # of sols: 877 (1.31 Mars Years)

Extended Mission Possibilities



Branching Fill Features



Conclusions

- There are multiple science targets in the ellipse on the way to the mound
 - Inverted channel systems
 - High TI unit
 - Fresh craters
 - Crater floor units
 - Ridged mesas
 - Dunes
- Phyllosilicates and sulfates are easily accessible.
- There are multiple possible paths to higher strata and additional targets.
- Potential access to >1 km stratigraphic section recording a significant portion of Martian history.
- Lots of potential for extended mission targets.
- Bonus: Spectacular scenery!