LPSC Abstract 1137 Location 451

CURIOSITY ROVER MOBILITY ISSUES CROSSING MARTIAN MEGARIPPLE FIELDS

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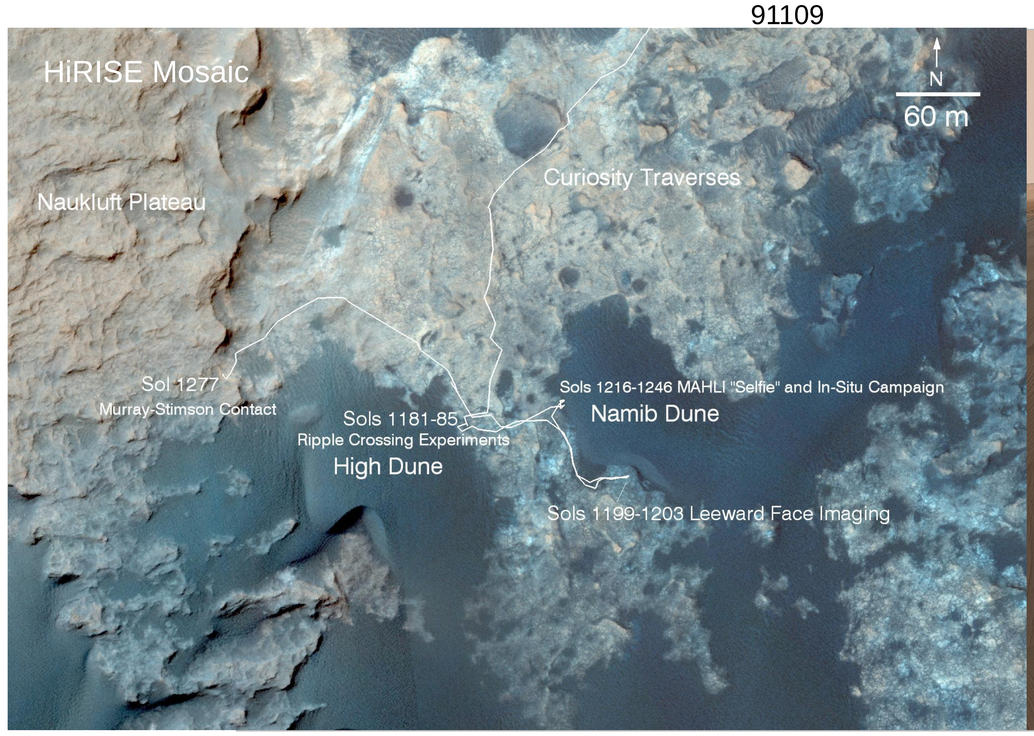
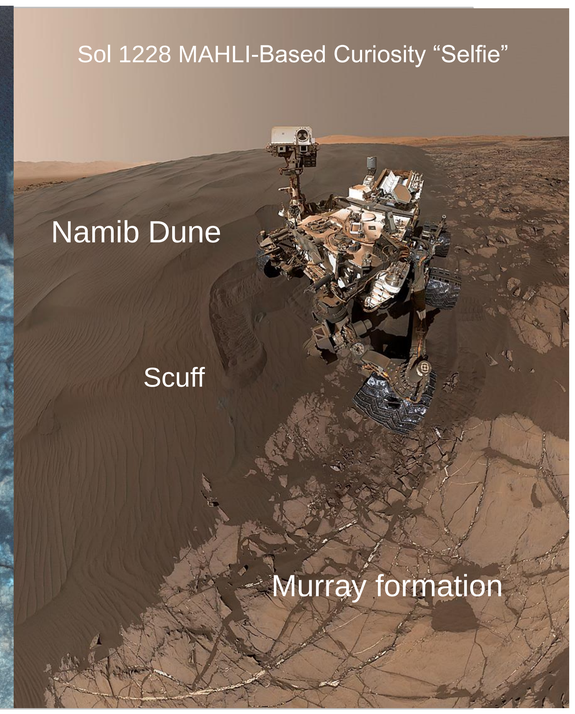
Sols 1181-1185 Megaripple Crossing Experiments

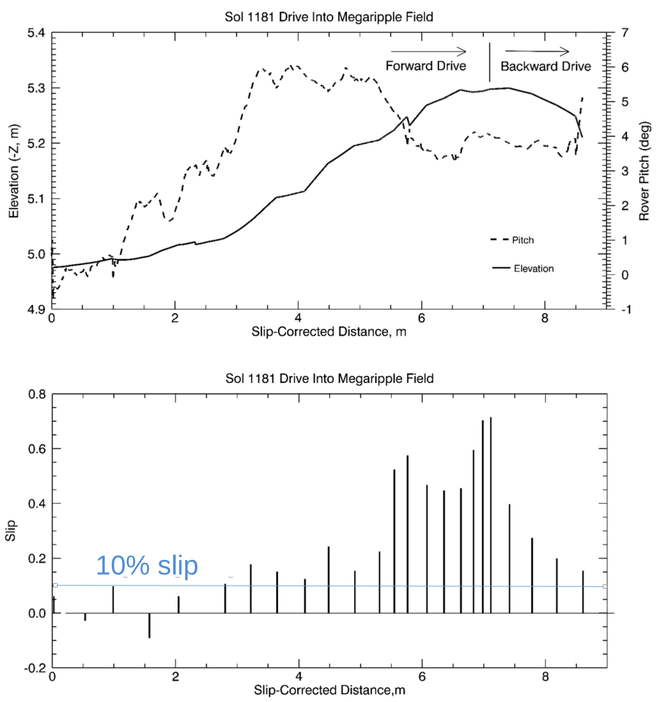
- Question posed was whether or not Curiosity could traverse relatively shallow megaripple fields without encountering high wheel sinkage and slip
- Controlled megaripple crossing experiment with a dense collection of engineering telemetry and science data was implement on sol 1181-1182, with subsequent crossings on sols 1183 and 1185
- Approximately 8 m of relatively shallow sands were traversed on sol 1181, slightly uphill, and rover 3D slip in places exceeded 70%
- Details retrieved from engineering telemetry and visual odometry shown in plots below

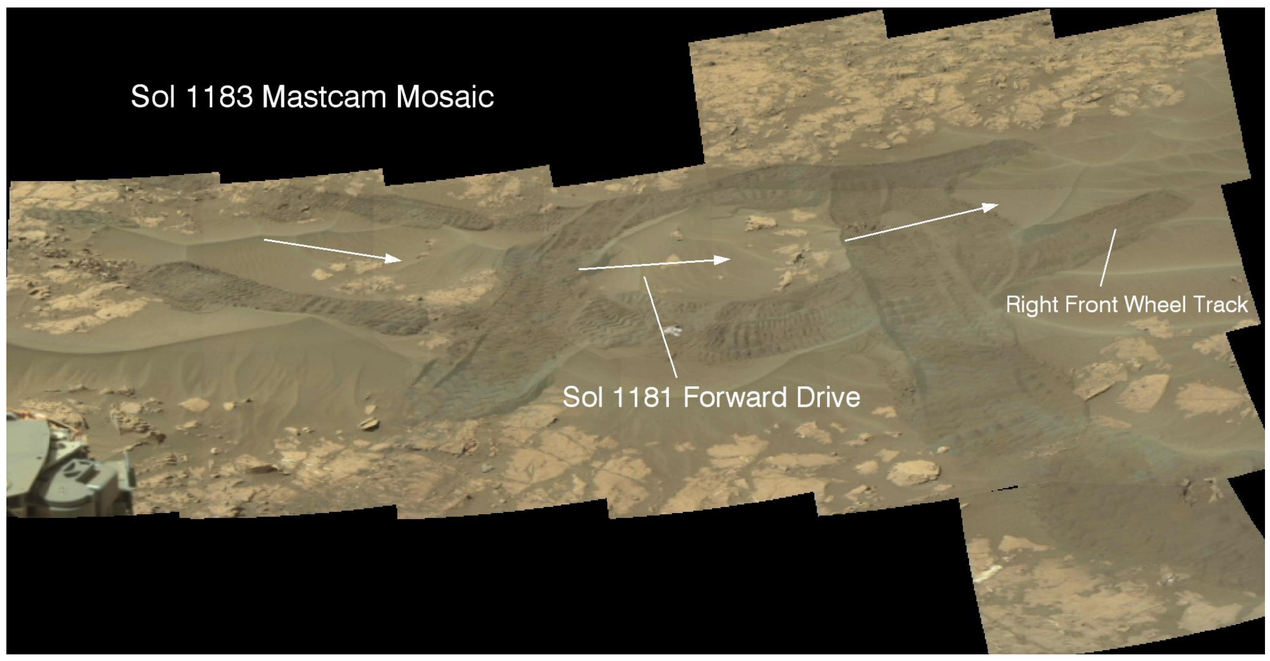




Prior Megaripple Crossings [1]

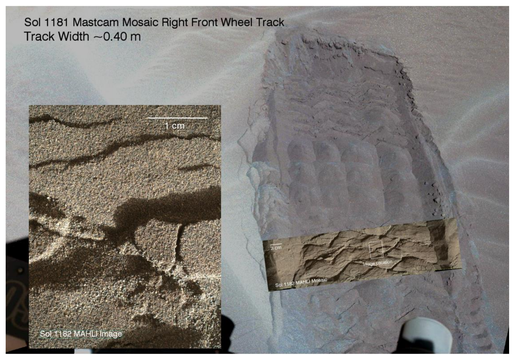
- Traverses on sols 672 and 709 across deep, complex megaripple fields in valleys were automatically terminated because of high rover 3D slip estimates based on visual odometry observations
- Corresponded to high wheel sinkage and increased compaction resistance, particularly when the wheels were on uphill ripple flanks
- Too close to embedding to plan additional traverses across megaripple fields





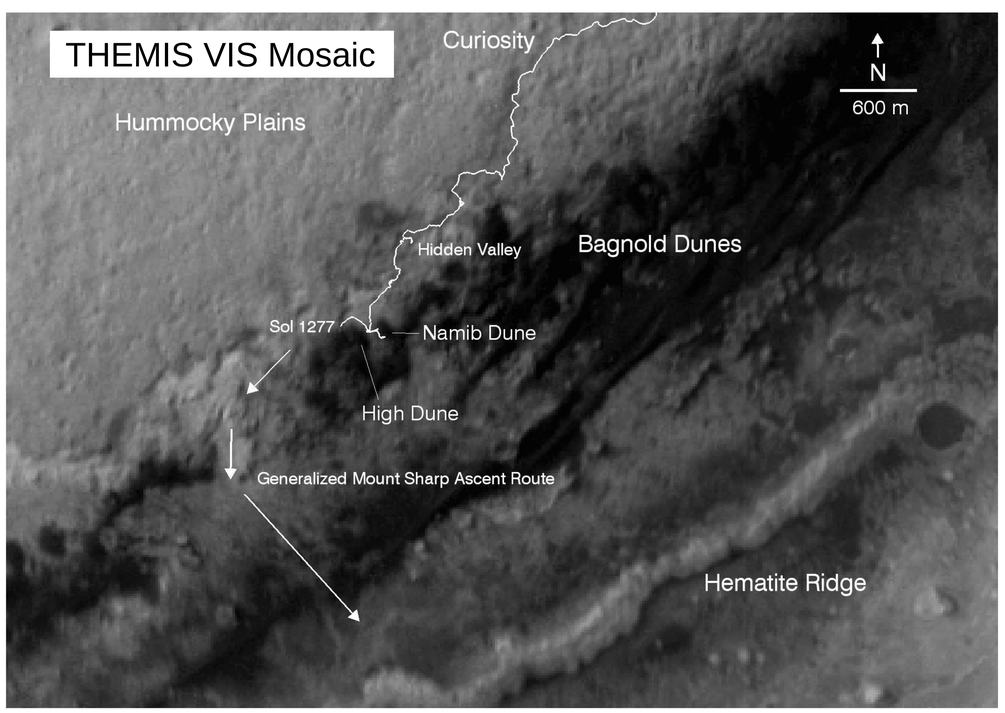
Geometry, sand depth and properties

- The sol 1181 experiment and previous drives [1] demonstrate that modestly cohesive sands with a shear modulus similar to what is found for terrestrial sands leads to significant slip when traversing up even modest slopes



Results and Implications for Mobility

- High sinkage and slip for megaripples traversed on sols 538, 672, 709, 710 [1], and now 1181 (but with only a few cm wheel sinkage) are beyond typical safety limits for traverses
- Megaripple traverses in which all wheels are in sands are now avoided, along with bedrock and boulders with sharp edges (because of wheel punctures)
- Traverses are planned to stay to the extent possible on regolith-covered surfaces [3], smooth bedrock [3], or where necessary, careful traversing through rough bedrock and boulder fields
- Even with these limitations Curiosity has traversed 12.441 km by sol 1277 (3/9/16) after landing in August 2012



Future Mobility Analysis and Route Planning

- Mount Sharp Ascent Route (MSAR) is being planned to the extent possible to avoid megaripple fields and regions with sharp rocks, traversing to the southeast, sampling outcrops, and approaching and ascending the hematite ridge
- Traverse planning will employ orbital (HiRISE, CRISM) and rover-based data sets (Navcam and Mastcam stereo imaging), along with retrospective analysis of engineering data, and modeling of the drives using the Artemis terramechanics modeling capability [1-3]

References
[1] Arvidson, R. E. et al. (2016) Journal of Field Robotics, DOI:10.1002/rob.26647
[2] Zhou, F. et al. (2014) Journal of Field Robotics, DOI:10.1002/rob.21483.
[3] Arvidson, R. E. et al. (2014) Journal of Geophysical Research, DOI:10.1002/2013JE004605.