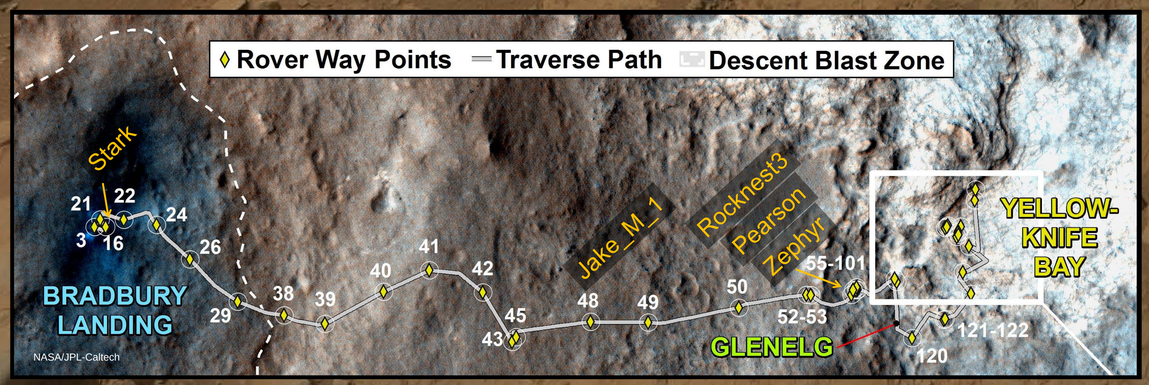
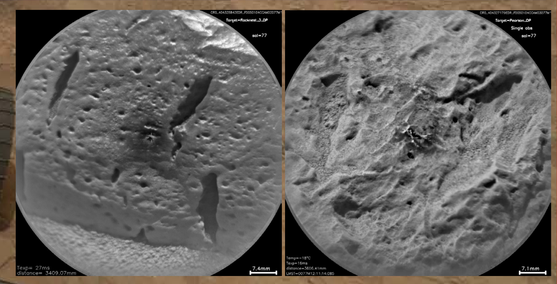
Evidence for rock surface alteration with ChemCam from Curiosity's first 90 sols?

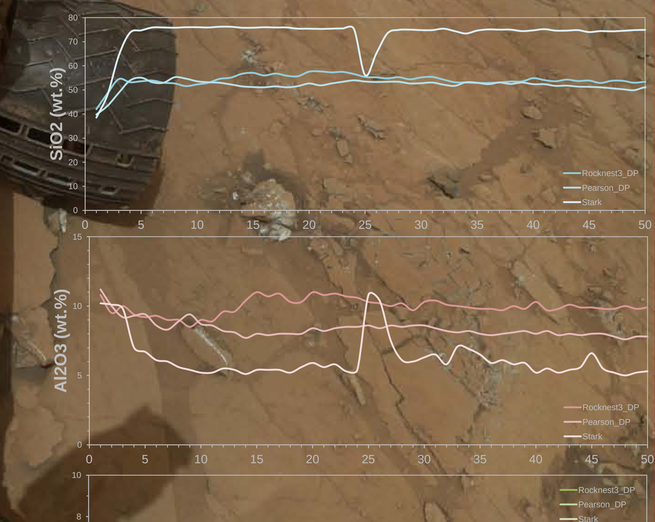
N. L. Lanza[1], R. B. Anderson[2], D. Blaney[3], N. Bridges[4], B. Clark[5], S. Clegg[1], D. Delapp[1], B. Ehlmann[6], C. Hardgrove[7], R. Leveille[8], N. Mangold[9], N. Melikechi[10], P.-Y. Meslin[11], A. Mezzacappa[10], H. Newsom[12], A. Ollila[12], R.Wiens[1], and the MSL Science Team. [1]Los Alamos National Laboratory (nlanza@lanl.gov), [2]USGS Flagstaff, [3]Jet Propulsion Laboratory, [4]APL, John Hopkins University, [5]Space Science Institute, [6]California Institute of Technology, [7]Malin Space Science Systems, [8]Canadian Space Agency, [9]University of Nantes, [10]Deleware State University, [11]Institut de Recherche en Astrophysique et Planétologie, [12]University of New Mexico.

Introduction: On Earth, rock coatings and rinds may develop in very arid environments through interactions between the rock surface, airborne dust, and moisture in the atmosphere. The composition and thickness of coatings and rinds provide much information about the style of chemical alteration (and amount of water) to which the rock has been exposed. As such, the potential observation of coatings or rinds on Mars provides information about both the climate and the presence and abundance of water in the surface environment. Previous studies have cited evidence for alteration on the surfaces of martian rocks [e.g. 1-3]. Here we show ChemCam-derived rock compositions by laser shot (e.g. composition by depth) from rock targets measured in the first 100 sols of the mission.

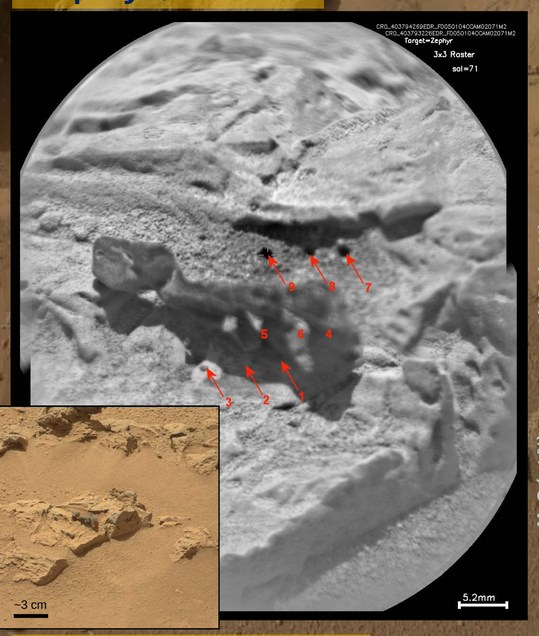


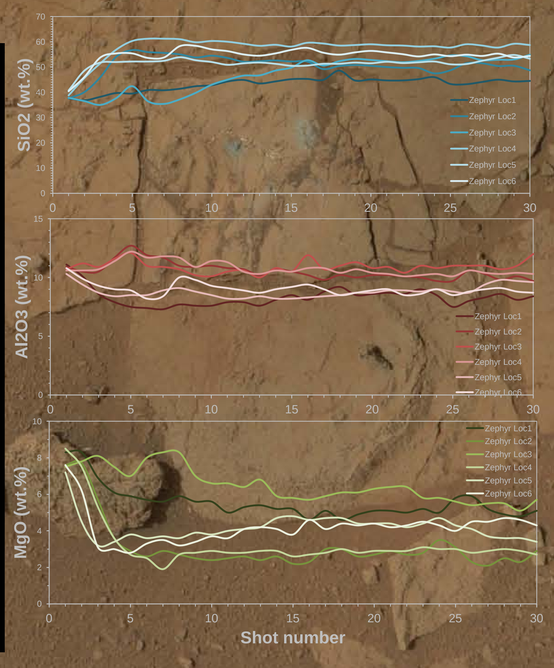
Rocknest3 + Pearson, Sol 77



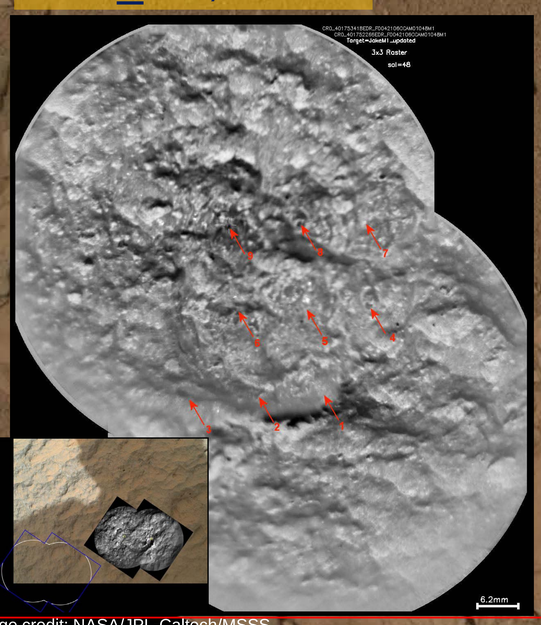


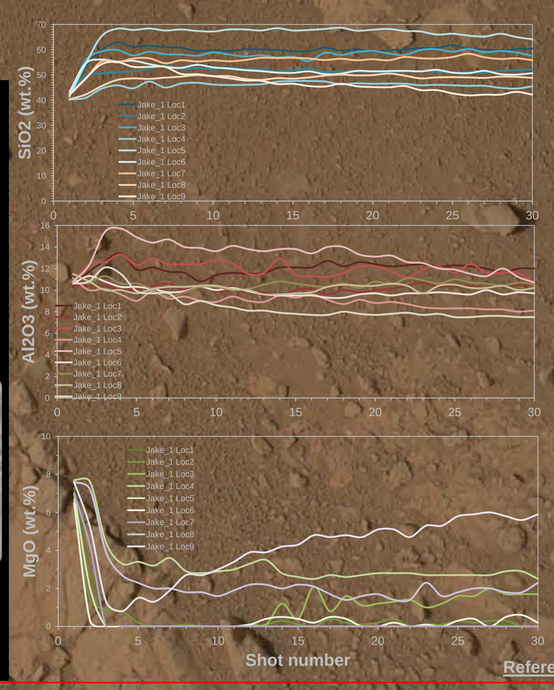
Zephyr, Sol 71



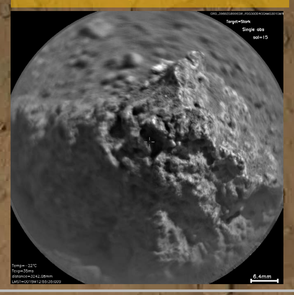


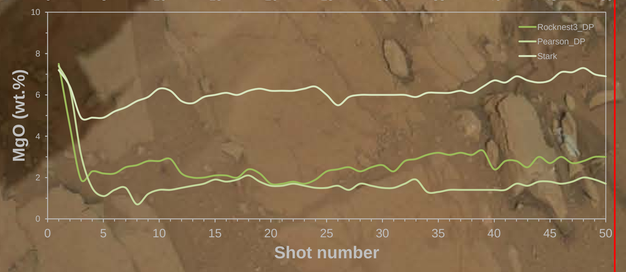
Jake_M1, Sol 48

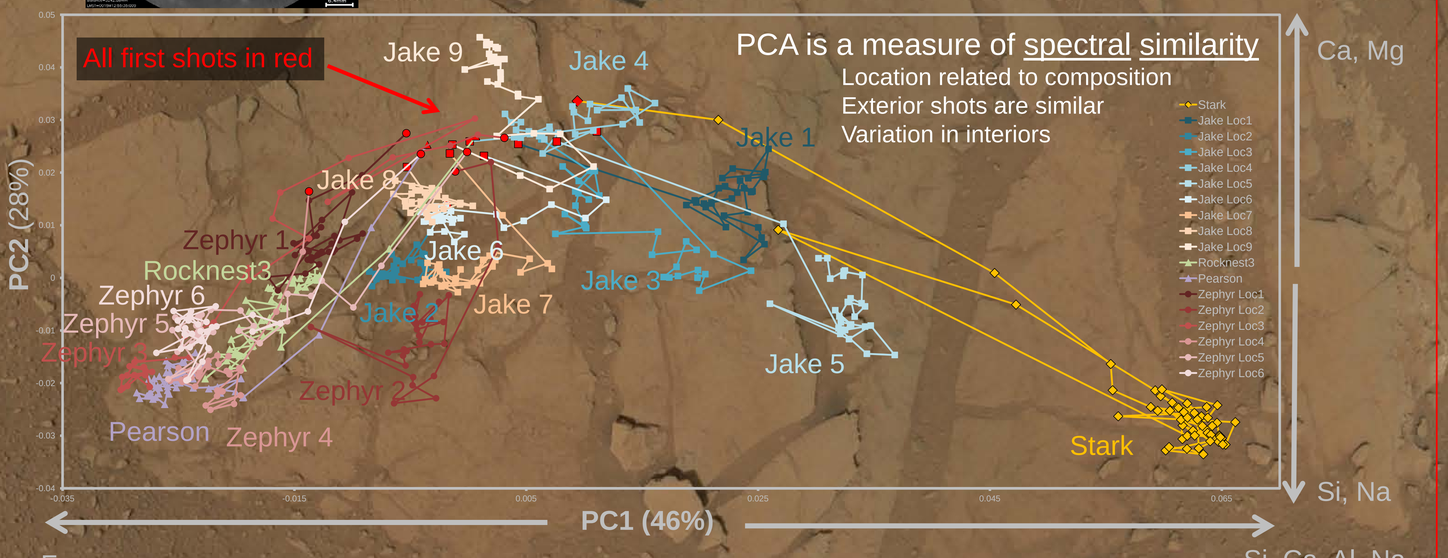




Stark, Sol 15







Dust versus coatings: How to differentiate?

- Results show that all rock surfaces have similar compositions, consistent with dust
- Rock surfaces are visibly dusty → but could there also be a coating?
- A layer of airfall-deposited dust would produce similar effects to a coating with a composition similar to the dust
- No sudden transition in LIBS spectra expected between a coating and host rock [4, 5]

To differentiate between these two models:

- Number of shots required to reach a stable rock composition
  - Loose material is easier to ablate than a coating
- Laboratory work on terrestrial coated rocks
- Additional experiments with the MSL payload
  - CCAM before brushing, CCAM after brushing, and CCAM after drilling

References: [1] Haskin, L. A. et al. (2005). Nature 436, 66–69. [2] McSween, H. Y. et al. (2004). Science 305, 842–845. [3] Arvidson, R. E. et al. (2004). Science 305, 821–824. [4] Lanza et al. (2012). Appl. Optics 51 (7), B74-B82. [5] Cousin, A. et al. (2011). LPSC no. 1963.

Image credit: NASA/JPL-Caltech/MSSS