CHEMCAM ANALYSIS OF JAKE MATIJIEVIC, GALE CRATER.

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Introduction

ChemCam [1, 2], the remote sensing composition and imaging instrument, acquired a large amount of data during the first 90 sols on Mars (overview in [3, 4]). Jake Matijevic was the first target analyzed by both ChemCam and APXS on Sols 45-46. ChemCam used 30 laser shots on each of 14 locations on the rock, for a total of 420 spectra. This poster focuses only on the CCAM observations on this target.

1. Visual Aspect

- Ventifacted dreskantler shape typically observed in desert environments.
- Differential erosion and cavities up to 2 mm diameter → heterogeneities in grain scale and composition?
- Colors from MastCam and Mahli images show a dark, shiny surface (also observed with RMI) with some reddish material, likely corresponding to the dust.

2. Observation Points

- Locations 3 and 4 show a mixing line from composition indicating a pyroxene to that of a plagioclase (figure 3).
- The 14 mean spectra show several variations → heterogeneity at laser beam scale.
- 4 end-members spectra observed (figure 2):
  - Jake_1 is rich in alkalis, and corresponds to an oxide.
  - Jake_2 is rich in Ti, and corresponds to an alkali.
  - Jake_10 is rich in alkalis compared to the others locations and shows more silicides.
  - Jake_14 shows the highest Ca peaks, with the highest variation in depth also.
- Global composition obtained by PLS technique [8] reflects an heterogeneity at CCAM scale, yielding to 3 principal minerals: plagioclase, pyroxene & olivine.
- Most of the grains plot along trends between typical feldspar, pyroxene, and olivine compositions (figure 3).
- Some locations show an heterogeneity with depth.
- The 14ª location shows the highest heterogeneity with depth, with a mixing line from composition indicating plagiooclase to that of a pyroxene (figure 3).
- Location 4 shows a mixing line from composition indicating a pyroxene to that of a plagiooclase.
- No-leaching observed (constant Na/K ratio [10]).

3. Is Jake a Homogeneous Rock?

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4. Does Jake have a surface coating?

- First 3 shots → Dust with less Alkalis, Fe, Al and Si, and more Mg and Ca.
- For 10 of the 14 locations, the first 10 shots after dust are different from spectra acquired after dust → Is this coating? Yes.
  - The surface after dust is richer in Alkalis in most cases.
  - Location 2 in an oxide and does not show significant variation with depth.
  - Location 4 is a pyroxene in surface.
- Composition obtained in surface is close to the overall composition (feldspathic component) → this is not a coating but the matrix.
- For more details about coatings, see posters [11, 12].

5. Minor elements in Jake

- Jake’s spectra show minor elements like Cr, Rh, Sr & Ba, in globally the same amount than others observed rocks during the first 90 sols [13].
- The 1ª location in Jake is much more enriched in Li and Mn. These elements are in the same amount than observed in Bathurst and Rocknest3, resp. Mn increases with depth.

6. Conclusion

1. Jake is heterogeneous at the laser beam scale.
2. The 14 LIBS analyses show an overall basaltic composition with plagioclase, pyroxene & olivine.
3. Nevertheless, [14] have shown that at least 20 analyses are required for an accurate whole-rock compositions of samples with mean mineral grain sizes larger than the spot size.
4. The PLS technique is still under progress to improve Alkalis results (training-set and technique).
5. Results from Jake confirm that ChemCam is a powerful tool to observe the mineralogical heterogeneities on a rock.

References