

OMEGA/MARS EXPRESS OBSERVATIONS OF GALE CRATER. B. Gondet¹, J. Audouard¹, J.-P. Bibring¹, Y. Langevin¹, F. Poulet¹ and R. Arvidson². ¹IAS, batiment 121, 91405 Orsay Campus, France, gondet@ias.u-psud.fr, ²Washington University, Saint Louis, Mo, USA

Introduction: Following the spectacular landing of Curiosity within Gale crater, OMEGA, an hyper-spectral VIS/NIR imager on board the ESA Mars Express orbital mission, acquired a number of image-cubes, at a variety of spatial sampling and local times, so as to complement the data sets previously acquired both by Mars Express and MRO. In this paper, we focus on two types of information directly retrieved from the OMEGA data sets [1]: i) the spectral characterization in the range (0.35 to 1.0 μm), which enables a comparison with the *in situ* ChemCam and MAHLI relevant measurements, and ii) the day and night surface temperatures, extending at a variety of local times the maps produced by the THEMIS/Odyssey instrument.

Data sets: Table 1 summarizes the list of day (black) and night (red) observations made by OMEGA over Gale crater.

cube #	Ls	SEA	local time	altitude	over MSL
0436_2	37.9	46.3	9 :30	1360	NO
0469_3	42.	41.2	9 :00	1570	NO
1002_6	107.9	28.7	15 :40	274	NO
1577_3	190.	53.7	9 :34	3290	YES
1927_5	250.2	15.	17 :00	437	NO
1938_5	252.2	17.	16 :55	415	NO
2363_4	324.4	75.	11 :10	855	YES
2374_3	326.1	74.	11 :05	886	NO
2385_2	327.8	73.	10 :57	934	NO
3061_6	59.2	21.7	16 :17	302	NO
4572_3	284.	66.	10 :55	1900	NO
5273_5	29.5	39.3	15 :10	567	NO
6433_2	185.9	43.8	15 :04	753	YES
6676_4	228.	77.	12 :05	2320	YES
7217_0	323.3	19.8	16 :40	370	NO
7267_0	331.3	28.1	16 :08	434	NO
7549_1	12.7	68.8	13 :10	4561	YES
7756_3	40.3	66.7	11 :15	3660	YES
8763_4	177.9	79.5	12 :30	2400	YES
9152_0	246.6	-21.	19 :40	370	NO
9423_0	296.	32.7	15 :40	578	YES
9511_0	311.1	49.7	14 :30	876	NO
A963_1	153.2	70.8	11 :20	3780	YES
A979_0	155.6	-75.8	23 :10	1160	YES
B060_1	168.2	-64.	22 :15	800	YES
B141_2	181.2	-50.	21 :20	540	YES
B222_0	194.9	-36.	20 :27	410	YES
B303_1	209.	-20.	19 :28	340	YES
B377_1	222.2	-6.	18 :30	360	YES
B384_1	223.7	-5.	18 :25	365	YES
B458_0	237.	8.8	17 :30	450	YES
B539_0	251.	25	16 :15	650	YES

Table 1: OMEGA measurements over Gale crater. They cover a wide range of seasons (Ls) and local times (thus Sun elevation angles, SEA), and were acquired from a variety of altitudes (expressed in kms).

Up to August 2010, OMEGA operated in three spectral channels, covering the range 0.35 to 5.1 μm . At that point in time, the cryocooler of the SWIRC channel (0.9 to 2.6 μm) terminated its lifetime, leaving OMEGA covering the two spectral range (0.35 to 1.0 μm) and (2.5 to 5.1 μm).

Spectral diversity: OMEGA VNIR spectra over Gale crater exhibit variations both spatially and, at a given location, as a function of local time and season. As examples, seasonal variations over MSL are plotted in Figure 1, and spectral ratio between Mount Sharp and MSL (as in December, 2012) is plotted in Figure 2.

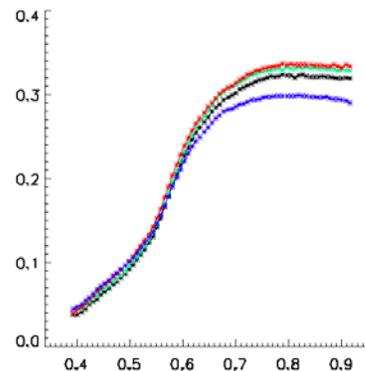


Figure 1: VNIR spectra over Curiosity, at distinct Ls: 190 (red), 20 (green), 325 (black) and 150 (blue).

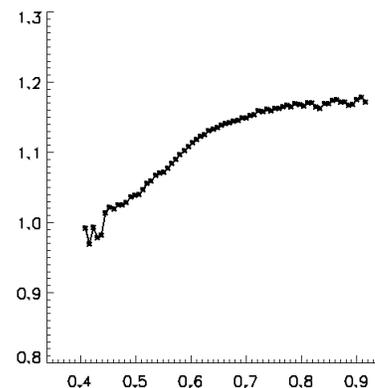


Figure 2: ratio of spectra acquired over Curiosity (December 2012) and Mound Sharp summit.

These OMEGA spectral data will be compared with the relevant data acquired *in situ* by the Chem-Cam and MALHI Curiosity instruments, whenever available.

Thermal inertia: The thermal inertia behavior of terrains within Gale crater can readily be derived from OMEGA data sets. Figure 3 is a global thermal map based on OMEGA daytime observations, in which high resolution strip acquired over Curiosity at distinct night times, are indicated. In figure 4, these three night observations are plotted, emphasizing the variety of thermal behavior of sites a few kilometers apart. Specifically, the spot corresponding to the location of Curiosity exhibits a high thermal inertia of 400 +/- 80 tiu, very close to that derived from THEMIS data.

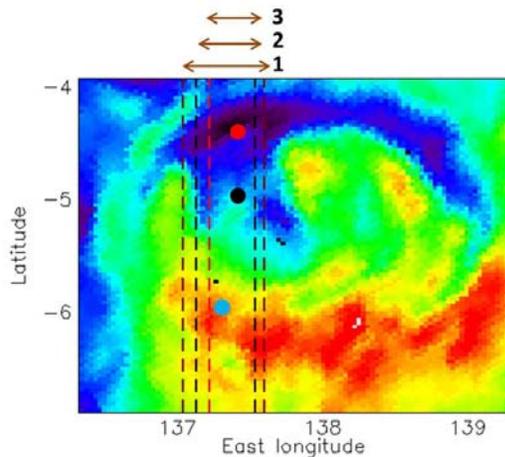


Figure 3: thermal map of Gale crater; Curiosity (red), Mount Sharp base (black) and summit (blue).

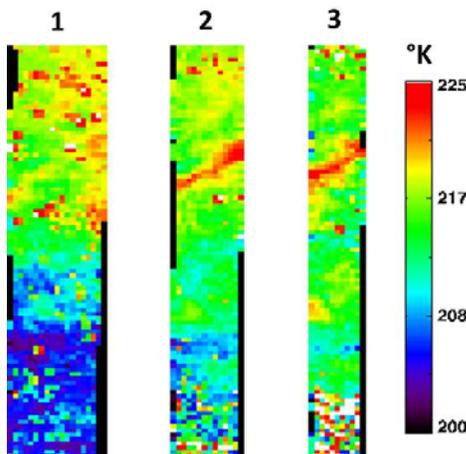


Figure 4: night temperature maps over Curiosity, at 22.35 pm (1), 21.30 pm (2) and 20.30 pm (3).

In Figure 5, the temperatures, retrieved from the ~5 μm part of the spectra, averaged over the entire set of cubes covering Gale crater, are plotted against the local times, independently of the season at which data were acquired. It illustrates the potential of OMEGA data to derive physical parameters through a thorough survey as a function of illumination.

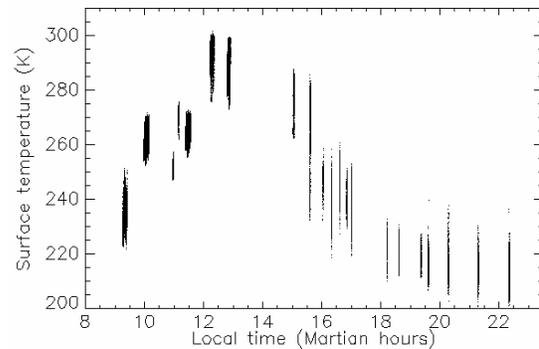


Figure 5: temperature variation with local time

Finally (Figure 6), temperature variation as a function of the local time are plotted for the three distinct spots within Gale, indicated in Figure 3.

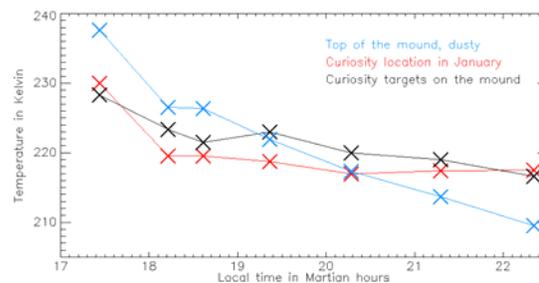


Figure 6: diurnal thermal variation at the three locations indicated in Figure 3

In the coming weeks and months, OMEGA/Mars Express will continue acquiring both day time and night time spectral images of Gale Crater, so as to enable a thorough monitoring of physical parameters of the site explored by Curiosity.

Reference: [1] Audouard J. et al. (2013), this conference