

Supporting Information for

Spectral diversity of rocks and soils in Mastcam observations along the Curiosity rover's traverse in Gale crater, Mars

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Caption for Data Set S1

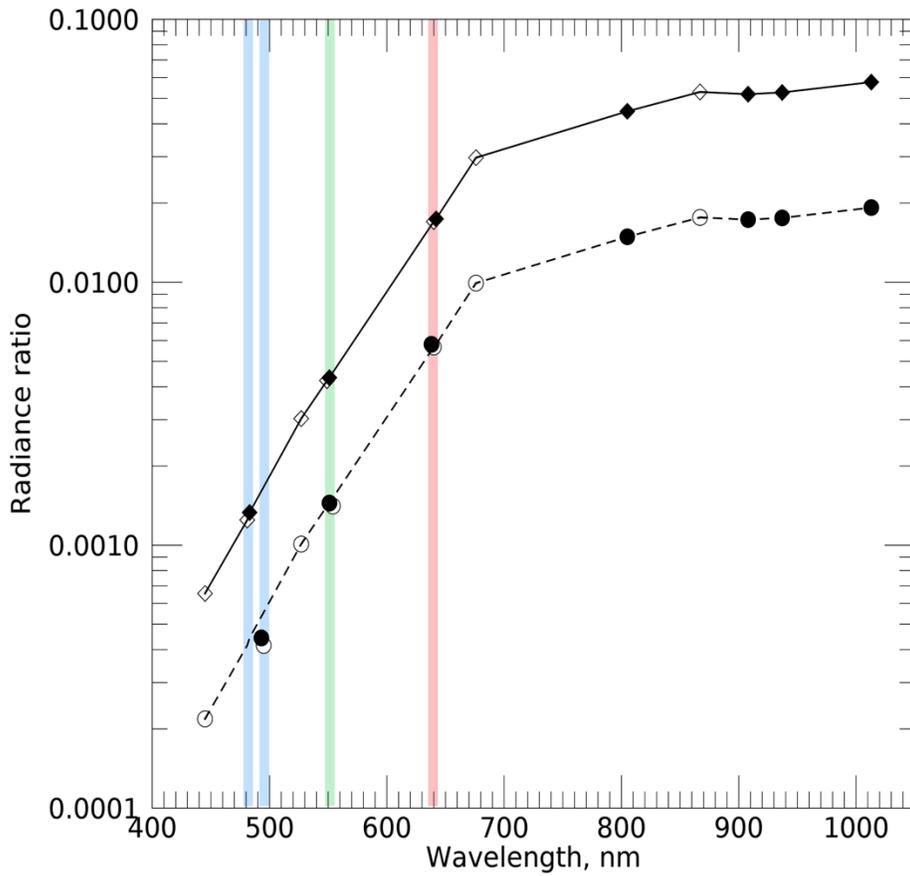


Figure S1. Sky/Sun radiance ratio using Mastcam multispectral observations of a deeply orange sky during the peak of the July 2018 global dust storm (sol 2086, mcam11116) and a faintly bluish Sun (sol 2100, mcam11211). Filled symbols are left-eye filters, open symbols are right-eye filters. The lower spectrum (circles) shows the sky/Sun ratio using Bayer blue band centers at 493 nm and 495 nm for Mastcam left and right, respectively (Bell et al., 2017), which fall below the expected smooth spectral profile (dashed line). The upper spectrum (diamonds) shows the same data (offset by +1/3) with the Bayer blue wavelengths revised to 481 nm and 483 nm, which complete the expected smooth spectral profile.

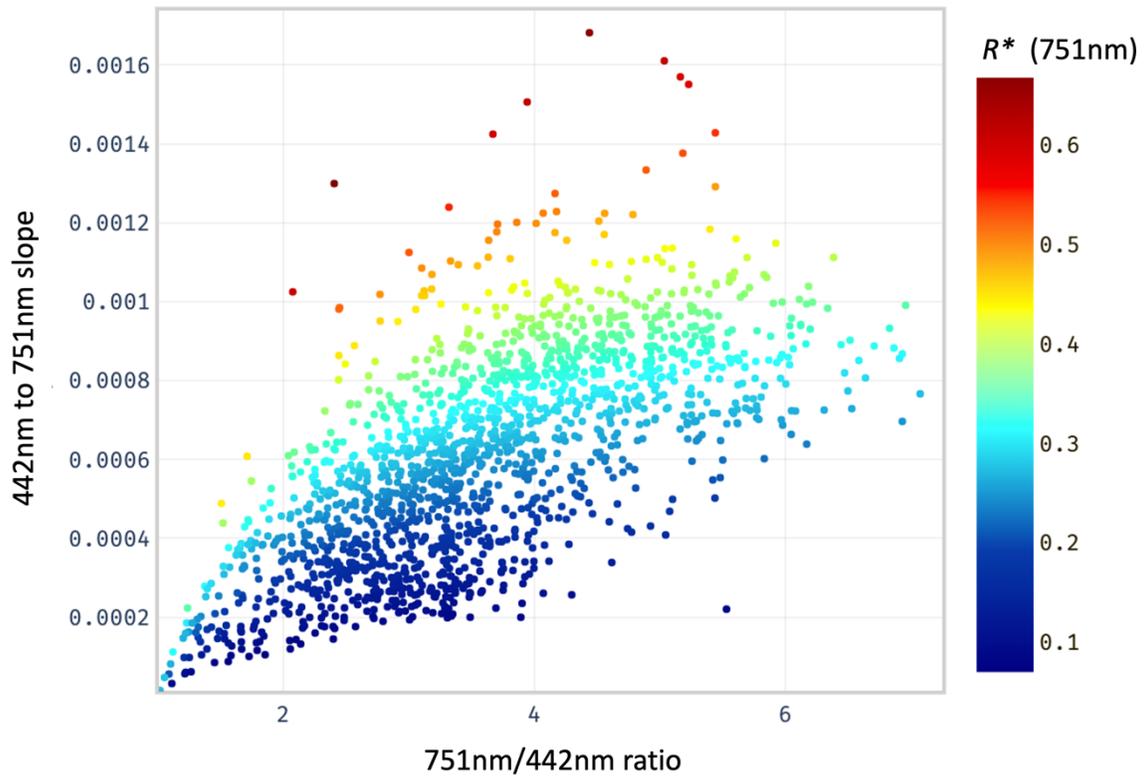


Figure S2. Example of how slope parameters are dependent upon overall reflectance: "red" slope ($R^*_{751} - R^*_{445} / (751 - 445)$) vs. "red" ratio ($R^*_{751} - R^*_{445}$) for all spectra in the Mastcam multispectral database, with point color scale indicating the overall reflectance of the spectrum (quantified as the R^* value at 751 nm).

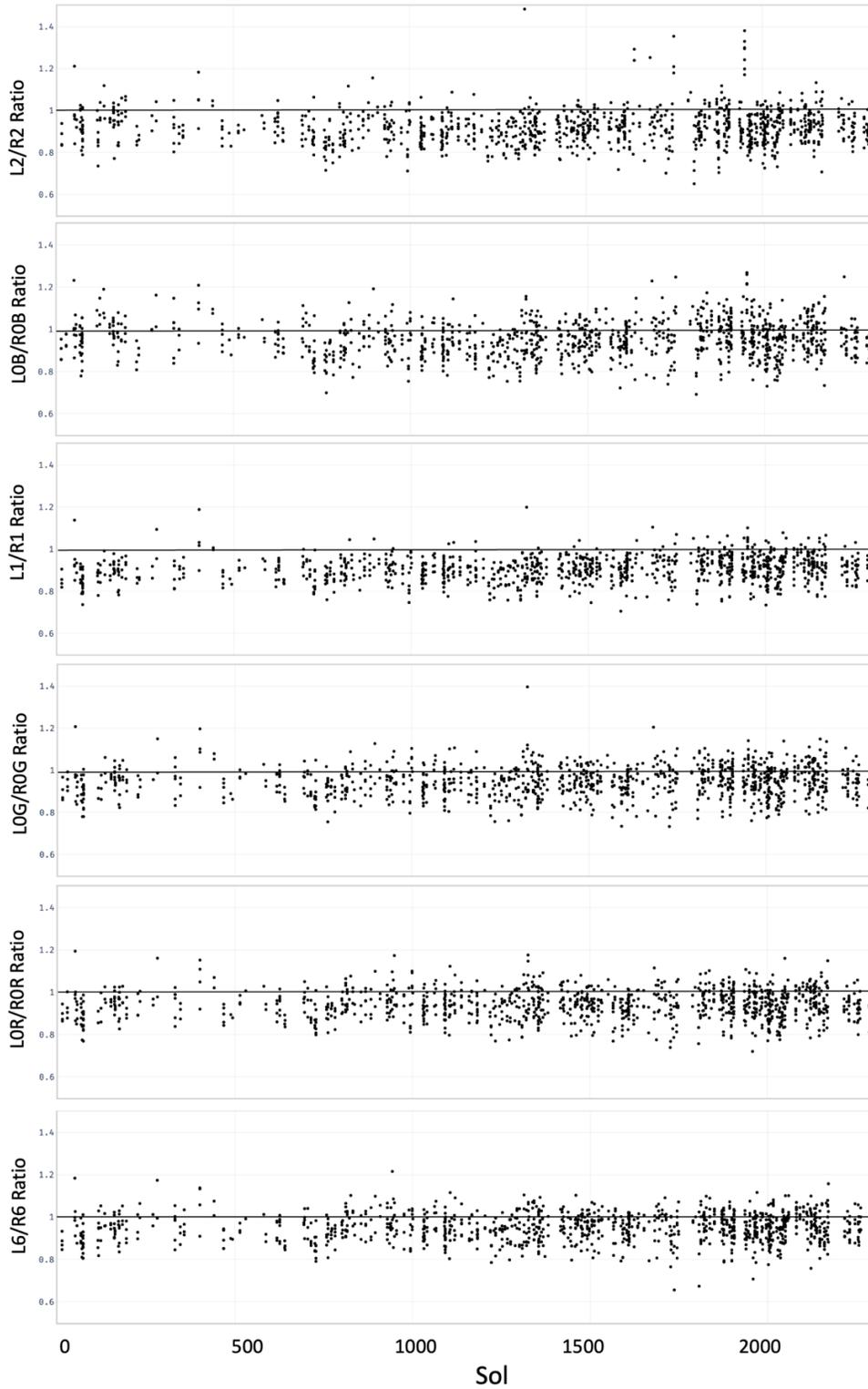


Figure S3. Comparison of reflectance values for the equivalent filters in Mastcam-left (M34) and Mastcam-right (M100) (shown as a ratio of left/right). Values below the line at 1.0 indicate Mastcam-left values that are lower than the Mastcam-right values extracted from the same ROIs.

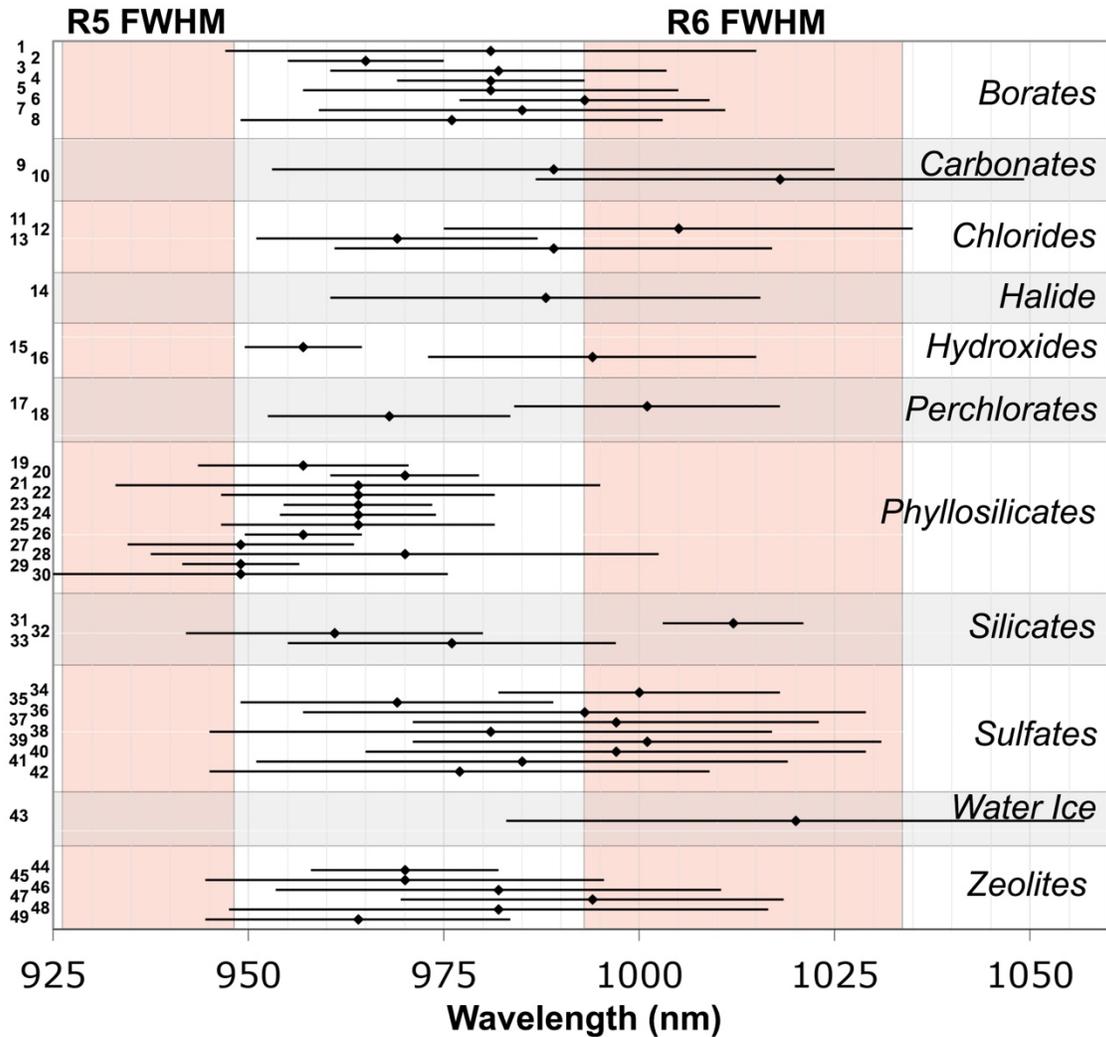


Figure S4. Band centers (black diamonds) and full width at half maxima (FWHM; black bars) for hydration absorptions (due to H₂O and/or OH) in the Mastcam spectral range (with band minima 950-1020 nm) for various hydrated minerals. Details of mineral spectra used are provided in Table S.2; reference numbers to the left correspond to the position in the table. Mastcam FWHM values for the R5 and R6 filters are indicated in red. Hydration absorptions that do not overlap with the R6 bandpass are unlikely to be detectable in Mastcam spectra.

(separate CSV file)

Table S1. Minerals with hydration absorptions (due to H₂O and/or OH) in the Mastcam spectral range (with band minima 950-1020 nm). Spectra of all minerals have been convolved to Mastcam bandpasses to calculate the 937 nm / 1013 nm ratio. Mineral spectra with 937 nm / 1013 nm ratios > 1.01 are most likely to have hydration bands that are detectable to Mastcam.

(separate CSV file)

Table S2. Spectra and metadata for all observations included in the multispectral database. LTST is given in units of seconds past midnight. ROVER_ELEVATION, FOCAL_DISTANCE, and ODOMETRY are given in units of meters. Spectra are given in columns U-AL, with effective wavelengths of each filter provided in Table 1.

Sol	Seq ID	Observation Name	Reason for Exclusion
25	mcam00121	Fractures 2x2	Never fully downlinked
69	mcam00487	Schmutz	Heavily shadowed
71	mcam00497	Glenelg NE, SE	Complicated mosaic, deferred for future analysis
100	mcam00666	workspace_Lall_Rall	Calibration issue
100	mcam00668	clast_survey_Lall_Rall	Calibration issue
164	mcam00883	Vein Crushing	Late afternoon observation, poor quality spectra
181	mcam00987	Divot (Drill)	Complicated mosaic, deferred for future analysis
189	mcam01016	Hydration 3, 3x3	Complicated mosaic, deferred for future analysis
200	mcam01048	hydration4_9x3_R056	Rover faulted during sequence execution
227	mcam01097	Hydration 5, 1x3	Complicated mosaic, deferred for future analysis
232	mcam01101	Hydration 6, 9x3	Complicated mosaic, deferred for future analysis
233	mcam01105	Hydration 7, 9x3	Complicated mosaic, deferred for future analysis
234	mcam01114	Hydration 8, 7x3	Complicated mosaic, deferred for future analysis
270	mcam01186	Hydration 9, 13x2	Complicated mosaic, deferred for future analysis
271	mcam01191	Hydration 10, 11x2	Complicated mosaic, deferred for future analysis
297	mcam01243	DAN Traverse 2x10	Complicated mosaic, deferred for future analysis
298	mcam01248	DAN Traverse 2x10	Complicated mosaic, deferred for future analysis
301	mcam01256	DAN Traverse 2x5	Complicated mosaic, deferred for future analysis
838	mcam03683	ccam_cal_target_Lall_1x2_Rall	Rover hardware only; no Mars surface included
1030	mcam04498	Lowary	Heavily shadowed
1039	mcam04546	Pistol R7x1	Complicated mosaic, deferred for future analysis
1424	mcam07031	marimba2_drill_tailings_Lall_Rall	Heavily shadowed, redone on sol 1425
1652	mcam08560	kennebago_divide_scuff_Lall_2Rall	Calibration issue
1836	mcam09620	VRR Hotazel 4x1	Complicated mosaic, deferred for future analysis
1925	mcam10043	Assynt Stereo L1x2 R1x4	Complicated mosaic, deferred for future analysis
1998	mcam10473	Red Cuillin 3x1	Complicated mosaic, deferred for future analysis
2013	mcam10608	CRISM Hotspot 5x1	Complicated mosaic, deferred for future analysis
2013	mcam10610	Galloway 4x1	Complicated mosaic, deferred for future analysis
2156	mcam11616	Stoer Area	Complicated mosaic, deferred for future analysis
2160	mcam11630	Ben Vorlich 9x4	Complicated mosaic, deferred for future analysis
2160	mcam11632	Tayvallich 2x2	Complicated mosaic, deferred for future analysis
2161	mcam11638	Drive Direction 5x1	Complicated mosaic, deferred for future analysis
2163	mcam11652	Loch Eriboll 5x1	Complicated mosaic, deferred for future analysis
2171	mcam11695	Loch Eriboll 2x1//4x1	Complicated mosaic, deferred for future analysis
2172	mcam11719	rockend_Rall	Rover faulted during sequence execution
2313	mcam12351	Gairloch	Complicated mosaic, deferred for future analysis
2390	mcam12686	Pediment 5x1	Complicated mosaic, deferred for future analysis
2403	mcam12736	Kilmarie Dump Pile	Heavily saturated
2464	mcam13076	Visionarium 3x1_Lall_6x1_Rall	Complicated mosaic, deferred for future analysis

Table S3. Mastcam observations acquired from sols 0-2302 that have been excluded from the multispectral database.

Elevation Bin (m)		Rock Spectral Classes									Soil Spectral Classes						
Min.	Max.	1	2	3	4	5	6	7	8	9	TOT.	1	2	3	4	5	TOT.
-4150	-4140	82	35	8	9	1	1		2		138		1		32	1	34
-4160	-4150	54	31		1						86				20	1	21
-4170	-4160	41	46	2	9						98				20	1	21
-4180	-4170	13	8		4						25				6		6
-4190	-4180	12	11	1							24		1		3		4
-4200	-4190	16	13	1	2				1		33				7	2	9
-4210	-4200	2	9	2							13				1		1
-4220	-4210										0					1	1
-4230	-4220		1	1							2					1	1
-4240	-4230										0				1	2	3
-4250	-4240	4	8								12				4	1	5
-4260	-4250	1									1				1		1
-4270	-4260	2	3								5				1	1	2
-4280	-4270	5									5				3	1	4
-4290	-4280	4									4				3	1	4
-4300	-4290	1	1								2				1	3	4
-4310	-4300	1	4	1							6				2	4	6
-4320	-4310	8	12	8	1						29				6	2	8
-4330	-4320										0						0
-4340	-4330	4	13	7							24		1		5	2	8
-4350	-4340		5		1						6		1				1
-4360	-4350	1	2								3				2		2
-4370	-4360	6	9								15		1		4		5
-4380	-4370	12	9	1							22		1		4		5
-4390	-4380	1									1						0
-4400	-4390	2	1								3		2				2
-4410	-4400										0						0
-4420	-4410	10	8	1			1				20				6		6
-4430	-4420	41	4	2			6				53		7		16	7	30
-4440	-4430	62	1			3	6				72		6		15		21
-4450	-4440	31					6				37		4		11	1	16
-4460	-4450	59		1		12					72	2	10		18	4	34
-4470	-4460	11								3	14		4		4		8
-4480	-4470	6				4			2		12	1	1		4		6
-4490	-4480	3				1					4		4		1		5
-4500	-4490	9	3	1							13		1				1
-4510	-4500	6				3		4			13		2	4			6
-4520	-4510	17						6			23	12	9				21
-4530	-4520	25						1			26	4	11		4		19
	TOTALS	552	237	37	27	24	20	11	5	3	916	19	67	4	205	36	331

Table S4. Numbers of spectra in the Mastcam multispectral database that have been assigned to each spectral class, as plotted in Figures 22 and 26. Spectra were filtered to include only those with small average errors (<0.02 reflectance units) and those acquired near noon (10:30 < LTST < 13:30).

(two separate zip files: sols 0-1500, sols 1501-2302)

Data Set S1. Context images for Regions of Interest (ROIs) for each Mastcam multispectral observation in the database (Table S2). ROIs are shown as polygons overlain on decorrelation stretch (DCS) color composite images for Mastcam-left and/or Mastcam-right frames. The ROI color in each image corresponds to a unique spectrum in the database (Table 2). Filenames are given as "solXXXX_mcamYYYY_MZZZ_do_MN.jpg," where XXXX is the sol number, YYYY is the sequence identifier number, M is the camera (L or R), ZZZ is the 3-filter combination used to create the DCS, and N is the pointing number (when applicable). ("do" in the filenames is shorthand for "DCS overlay.")