

Fig. 1 Overview of targets analysed by SHERLOC during the crater floor campaign. a, High Resolution Imaging Science Experiment (HiRISE) image of the region studied with the rover's traverse marked in white, the boundary between the Séitah and Máaz fm delineated by the light blue line, and each rock target labelled. Scale bar, 100 m. b, Average number of fluorescence detections (out of 1,296 points) from survey scans for each target interrogated by SHERLOC, arranged in order of observation. *The acquisition conditions were different for dust-covered natural targets as compared to relatively dust-free abraded targets, possibly resulting in reduced detections. c, WATSON images of natural (red box) and abraded targets (Máaz is the blue box, Séitah is the green box) analysed in this study, with SHERLOC survey scan footprints outlined in white. Two survey scans were performed on Guillaumes, Dourbes and Quartier. Sol 141 imaging on Foux had an incomplete overlap of WATSON imaging and SHERLOC spectroscopy mapping. Scale bars, 5 mm.

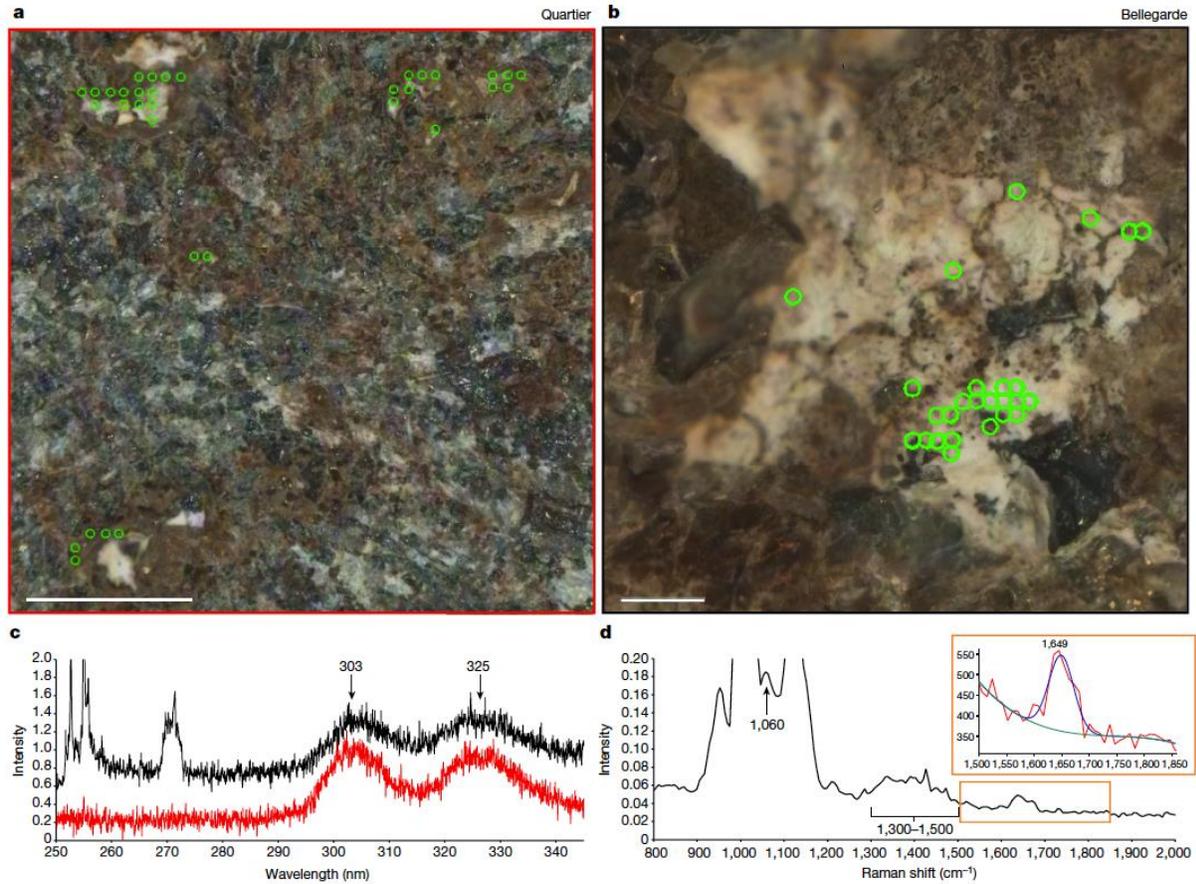


Fig. 3 Group 1 (roughly 303 and 325 nm) doublet fluorescence feature mineral associations in Bellegarde and Quartier. a, Colourized ACI image of a region where a survey scan (36×36 points over 5×5 mm²) was performed on the Bellegarde target from sol 186. Green rings (rough laser beam diameter) represent locations where the roughly 303 and 325 nm fluorescence doublet was detected. b, Colourized ACI image of a region where a detailed scan (10×10 points over 1×1 mm²) was performed on the Quartier target from sol 304. Green rings represent locations where the roughly 303 and 325 nm fluorescence doublet was detected. Scale bars, 1 mm. c, Median fluorescence spectra (unfiltered) from the green points indicated in Bellegarde (red, $n = 33$) and Quartier (black, $n = 26$) normalized to 303 nm band and offset for clarity. d, Median Raman spectra of four points with highest fluorescence band intensities from Quartier scans on sols 293 and 304. Roughly $1,010$ cm⁻¹ sulfate band is off scale; inset shows roughly $1,649$ cm⁻¹ band with Voigt fit (FWHM 53.737, area 12,559, height 192.79). In the inset, the unfitted spectrum (red), fitted spectrum (blue) and baseline (green) are shown; y axis is intensity.

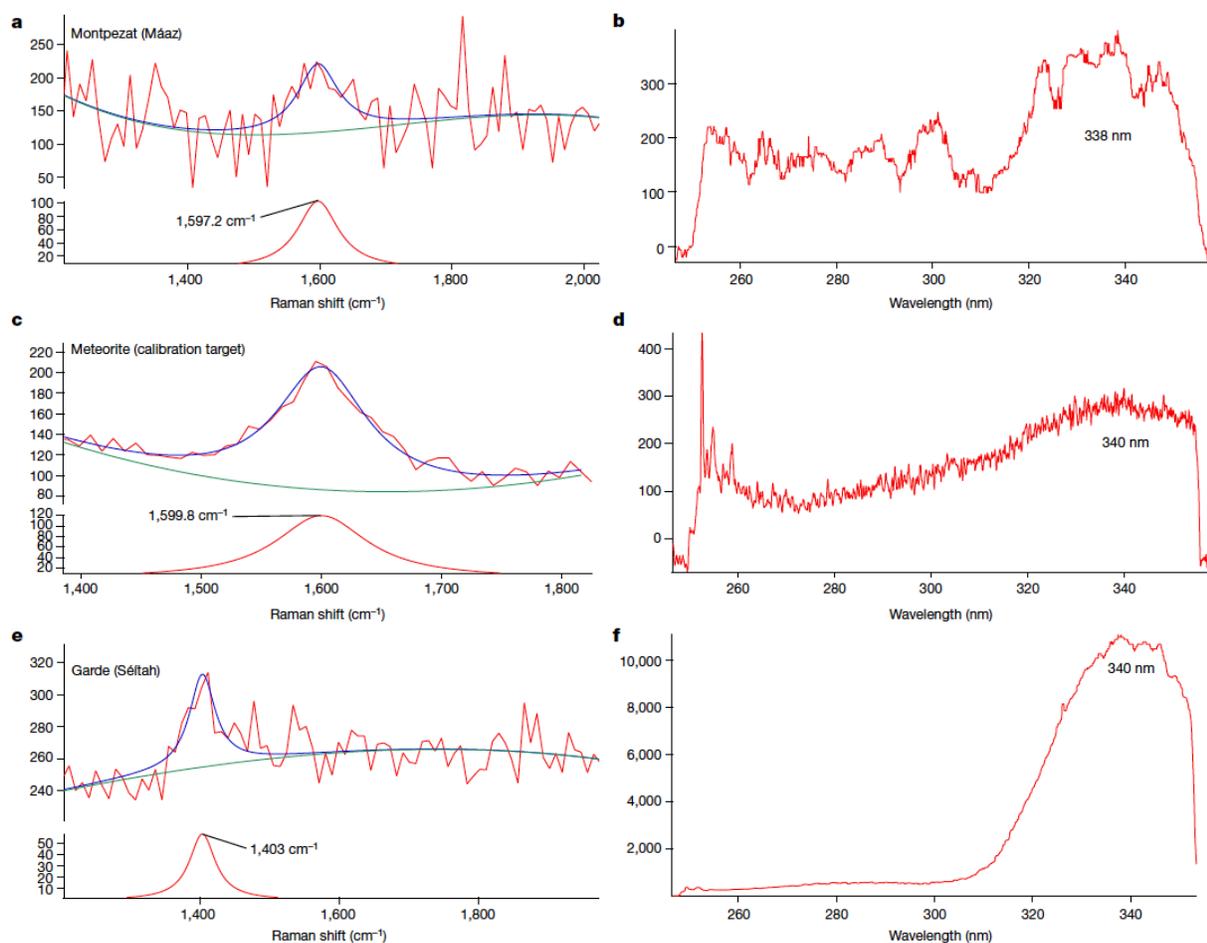


Fig. 4. Raman features of possible organic compounds. a, Raman spectrum from point 40 of an HDR scan on Montpezat (sol 349) with a Lorentzian fit (FWHM 49.873, area 8,069.1, height 103). b, Corresponding average fluorescence spectrum to a (lambda max roughly 338 nm). c, Median Raman spectrum (n = 100) from an HDR scan on the SaU008 meteorite calibration target (sol 181), which contains the known graphitic (G) band, with a Lorentzian fit (FWHM 61.784, area 11,646, height 120). d, Corresponding average fluorescence spectrum to c (lambda max roughly 338 nm). e, Average Raman spectrum of points with the highest group 2 fluorescence (n = 28) on Garde (sol 207–208) with a Lorentzian fit (FWHM 47, area 4,500, height 60.953). f, Corresponding average fluorescence spectrum to c (lambda max roughly 340 nm). In all graphs, the unfitted spectrum (red), fitted spectrum (blue) and baseline (green) are shown; the y axis is intensity.

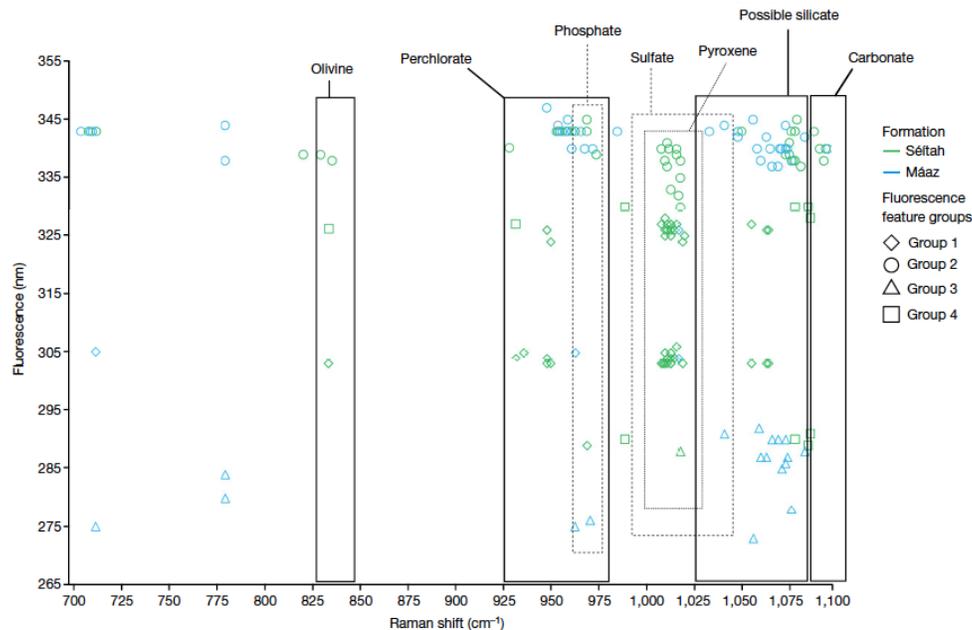


Fig. 5. Summary of SHERLOC fluorescence-mineral associations across features and formations. Select mineral detections (Raman shift, cm^{-1}) and their fluorescence features (λ_{max} , nm) for abraded targets analysed using unsmoothed data from HDR and detail scans; both Raman and fluorescence data are measured on the same point. Mááz scans (blue) used between 250 and 500 ppp, yielding low signal-to-noise ratio (less than 2) in some cases that were not included; Séítah scans (green) all used 500 ppp, allowing for comparatively more Raman detections. Mineral classifications based on high confidence Raman detections of major peaks are indicated by boxed regions: olivine (roughly $825\text{--}847\text{ cm}^{-1}$)^{2,19,26}, range of hydrated and dehydrated perchlorate (roughly $925\text{--}980\text{ cm}^{-1}$)^{26,46}, phosphate (roughly $961\text{--}975\text{ cm}^{-1}$)^{19,26,46}, pyroxene (roughly $1,000\text{--}1,026\text{ cm}^{-1}$)¹⁹, sulfate (roughly $990\text{--}1,041\text{ cm}^{-1}$)^{2,19,26}, amorphous silicate (broad peak at roughly $1,020\text{--}1,080\text{ cm}^{-1}$)^{2,26} and carbonate (roughly $1,085\text{--}1,102\text{ cm}^{-1}$)^{19,46}. Markers outside a boxed region do not have a mineral assignment. Disambiguation of overlapping regions can generally be resolved by consideration of minor Raman peaks (not marked here) and corroboration by other instrument(s) (for example, PIXL/SuperCam)⁴⁷.