

THE BRAC OLIVINE CUMULATE ROCK (JEZERO CRATER, MARS) COMPARED TO MARTIAN METEORITES.

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Introduction: In Jezero Crater, Mars, the Perseverance rover of the NASA Mars 2020 mission has analyzed and collected samples of rock units on the floor of the crater [1-5]. The analyzed units are basaltic igneous, and include the olivine cumulate rock Brac, analyzed in the Dourbes abrasion spot. The PIXL instrument [6] on the rover is a mapping X-ray fluorescence (XRF) spectrometer with multispectral (VNIR) imaging. Brac/Dourbes is similar in mineralogy and textures to chassignites and some ultramafic poikilitic shergottites, but not identical to any known martian meteorites. Here we compare Brac/Dourbes to martian meteorites.

Brac/Dourbes: The Brac outcrop is in the Séitah formation of the Jezero Crater floor, stratigraphically beneath the basaltic rocks of the Maaz formation [I,u]. The outcrop is massive, gray, and forms decimeter-scale benches, separated by discontinuous fracture or bedding surfaces [2]. On Brac, the Dourbes spot was abraded on Sol 253 of the surface mission [4].

PIXL took two XRF scans on the Dourbes abrasion, one of which is shown in Fig. 1. Most of the Dourbes surface is olivine (based on PIXL quantitative analyses) in euhedral crystals, with interstitial Ca-rich pyroxene, feldspar, mesostasis, Fe-Cr-Ti oxides, and alteration material including Mg-Fe carbonate, Ca sulfate, Na-Cl phase(s), and amorphous Si-rich material [7]. Olivine and pyroxene grains are chemically homogeneous ($\text{Fo}_{55\pm 1}$, $\text{Wo}_{35}\text{En}_{42}\text{Fs}_{18}$) [7]. Based on X-ray diffraction detected by PIXL [6], pyroxene grains enclose olivines in a poikilitic texture.

The geological setting of Brac/Dourbes is ambiguous [1-3]. The Séitah area could be a dome in crater-fill strata, suggesting that its rocks (including Brac) could have formed as a shallow sill.

Martian Meteorites. Dourbes is similar to some igneous cumulates among the martian meteorites. Its texture and mineral homogeneity are nearly identical to those of some chassignites [8,9] (Fig. 1) and poikilitic shergottites (e.g., [10]), implying similar thermal histories during emplacement and cooling. Chemically, Dourbes' olivine is more ferroan than many cumulate shergottites, more magnesian than nakhlites, and like that in the chassignite NWA 8694 [7,8]. Dourbes' pyroxene is augite, most similar to that in the nakhlites [11]; known chassignites and poikilitic shergottites contain abundant low-Ca pyroxenes (e.g., [7,8]).

Interpretation: The Brac/Dourbes rock is an olivine cumulate, similar to several types of martian meteorites. If it were found on Earth, it could reasonably be classified as an anomalous chassignite (in that it has augite rather than low-Ca pyroxene), or as an olivine cumulate from a nakhlite-like magma. Dourbes emphasizes the similarities between these meteorite groups [9]. However, Dourbes is likely much older than either meteorite group [9,12,13], suggesting similar processes of magmagenesis throughout Mars' history.

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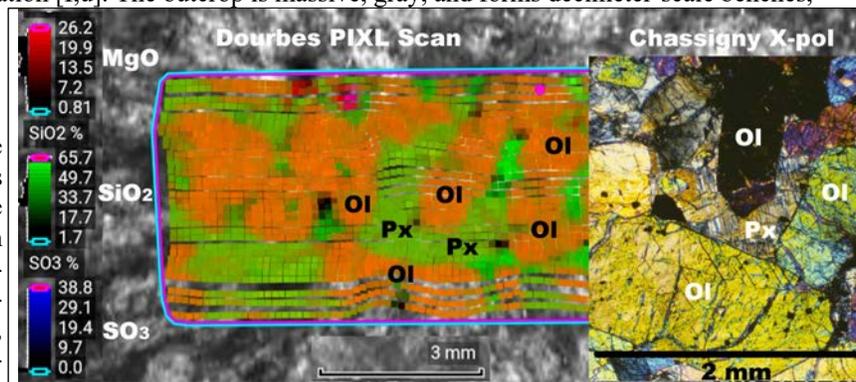


Figure 1. PIXL XRF scan on Dourbes abrasion (left, colors) on PIXL MMC optical image [6], compared to optical X-polar thin section image of Chassigny martian meteorite (right). In both, note euhedral olivine crystals (ol) surrounded by pyroxene (Px).