Diversity of igneous rocks at Gale, Mars

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Curiosity rover has observed a total of 53 igneous rocks along its traverse up to sol 800 (Martian day). We first identified these rocks by textural analyses from the MastCam [1] and ChemCam [2] [3] images. The objective of this study is to classify the Gale igneous rocks and show that Early Mars presents an interesting diversity of igneous products, some of them being evolved and not observed with previous *in situ* missions.

First, the rocks were classified as effusive or intrusive based on textural analyses. Among the effusive rocks, two groups present an aphanitic texture, one with dark rocks while the other one contains leucocrate rocks. We also observed porphyritic ones with cm-size light-toned minerals. The intrusive rocks are either dark and fine-grained with similar proportions of dark and light-toned minerals, or coarse- grained dominated by light-toned minerals. All of the igneous rocks have been observed as float rocks, except some intrusive leucocratic coarse-grained that are partially buried.

The combination of textural and whole-rock analysis revealed a nice alkali-trend up to trachytes, observed for the first time on Mars. This suggests a low-degree of partial melting in the Martian mantle at relatively low pressure [4]. Moreover, the light-toned coarse-grained intrusive rocks correspond to diorite/granodiorite with normative quartz, suggesting that Si-rich igneous rocks may constitute a significant portion of the martian crust [4].

We have shown that felsic rocks seem to have been transported from the northern part of the crater rim whereas the dark aphanitic ones are observed at the end of the traverse, probably coming from another source. Implications for early magmatism is detailed in [4].

[1] Bell III et al. *LPSC* #**2541** (2012); [2] Wiens et al., *SSS* **170** (2012); [3] Maurice et al., *SSS* **170** (2012); [4] Sautter et al., *LPSC* #**1943** (2015).