New Views of Mars Crust

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Résumé

Recent detections of 1) feldspars in VNIR (Visible Near-InfraRed) remote sensing spectroscopic data, interpreted as possible remnants of an anorthositic floatation crust (Carter and Poulet, 2013), and of 2) granodioritic float rocks in Gale Crater by the Curiosity rover, interpreted as conceivable evidence for continental crust (Sautter et al., 2015) have revolutionized our understanding of magmatic processes on Mars, and further questioned the nature of Mars's most external envelop. In the present contribution, we will present attempts to tackle the nature and stratigraphy of Mars crust, and the possible origins for Mars feldspathic rocks, through a combination of VNIR and thermal IR (TIR) remote sensing analyses, geophysical models and terrestrial analog studies. The global study of impact crater central peak morphologies revealed the dual-layered character of Mars upper crust (Brustel et al., EPSC2019, in review). Ongoing analyses of the lower endmember's composition with joint VNIR and TIR data, and spectral modeling, should bring more insight into the nature of the enigmatic Noachian crust (e.g., Flahaut et al., 2012; Ito et al., IMA2022). More recently, our newly developed denoising algorithm, Mineral Recognizer (Payet et al., 11mS32020), enabled the detection of feldspar-bearing rocks in the walls of the Valles Marineris grand canyon, unambiguously associated to a 200 meters thick lava flow (Flahaut et al., EGU2020, submitted). Ongoing analogue field and lab work of the ANR JCJC Mars-Spec project confirms that a range of feldspathic rocks can show feldspar absorptions, questioning the previous interpretations of such signatures as evidence for nearly pure anorthosite (Barthez et al., EPSC2021, in prep.). The ongoing construction of a reference spectral library acquired on whole rocks at CRPG (to be publicly shared on Mirabelle/SSHADE) should guide the interpretation of VNIR feldspar signatures on Mars in the future.

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