MapX – An *in situ*, full-frame X-ray Spectroscopic Imager for Planetary Science and Astrobiology

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Microbial life exploits μ-scale disequilibria at boundaries where valence, chemical potential, pH, Eh, etc. vary on a length scale commensurate with the organisms – 10's to 100's of μms. The detection of accumulations of the biogenic elements C,N,O,P,S at appropriate concentrations on or in a mineral/ice substrate would constitute permissive evidence of extant life, but context is also required. Does the putative biosignature exist under habitable conditions? Under what conditions of P, T, and chemical potential was the host mineralogy formed?

MapX [1,2] is an *in situ* robotic spacecraft instrument that images the biogenic elements C, N, O, P, S, as well as the cations of the rock-forming minerals (Na, Mg, Al, Si, K, Ca, Ti, Cr, Mn, Fe) and important anions such as Cl, Fl. MapX provides element maps with ≤100 μm resolution over a 2.5 cm X 2.5 cm area, as well as quantitative XRF spectra from ground- or instrument-selected Regions of Interest (ROI). XRF spectra are converted to mineralogies using ground- or instrument-based algorithms. Either X-ray tube or radioisotope sources such as ^{244}Cm (α-particle and γ-ray fluorescence) can be used. Fluoresced sample X-rays are imaged onto an X-ray sensitive CCD through an X-ray MicroPore Optic (MPO). The MapX design as well as baseline performance requirements for a MapX instrument intended for life detection / identification of habitable environments will be presented.

[1] Blake *et al*. (2017) *LPSC* **XLVIII**, #1370.
[2] Thompson *et al*. (2017) *LPSC* **XLVIII**, #1602.