HR 3D element distribution by SR-XRF tomography of CM2 material as analog for material returned in Hayabusa2

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High resolution SR-XRF tomography was performed on several samples from two CM chondrites (Murchison and NWA 5797) as analog material for the samples collected by the Hayabusa2 spacecraft from the C-type asteroid Ryugu. A combination of wavelength dispersive (WD) and confocal energy dispersive (ED) XRF was applied. Confocal ED-XRF provided HR 3D elemental distribution information over large areas for elements ranging from Ca to Zr at sub-second dwell times with a voxel size of 0.5×0.5×10 µm³. WD-XRF spectroscopy, assisted by an ED array detector, allowed for simultaneous detection of La to Ho in a single measurement from a sub-micron area.

We present HR 3D elemental distributions showing CAIs, chondrules, metal grains and Ca-rich grains. CAIs were identified in NWA 5797 on account of their Ca-Ti-V-enrichment and Fe-depletion. In contrast, 3D elemental distributions of Fe, Ca, Cr, Ti, V across a Ca-rich spot and matrix of Murchison revealed Fe-Ti-V-enrichment in the matrix and -depletion in the Ca-rich spot (Fig. 1). Results will be applied to samples returned next year in Hayabusa2.

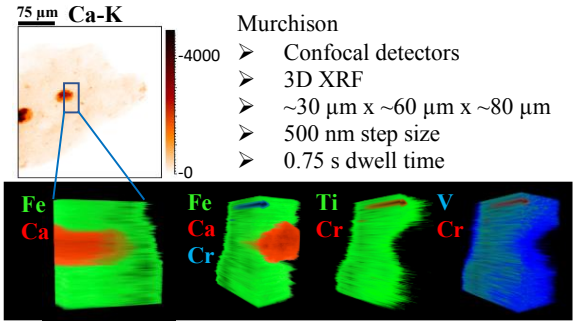

Fig. 1: HR 3D elemental distributions of Fe, Ca, Cr, Ti, V in Murchsion.