

From the Molecular Scale to the Macro-Scale: Insights of Mineral Geochemistry through X-ray Spectroscopy and Imaging

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The career of Georges Calas has been inspirational to the field of geochemistry, particularly in the pioneering use of synchrotron radiation to approach questions of mineral interactions with their environment. Georges, along with many of his colleagues, have used synchrotron-based techniques to probe the chemistry and speciation of elements at the molecular scale and have been instrumental in the popularization of x-ray spectroscopy as applied to the geosciences. These uses have led to critically important results across a diverse set of disciplines, from environmental geochemistry to nuclear glasses, spanning over many decades.

This presentation will discuss the application of x-ray spectroscopy, as combined with x-ray fluorescence imaging, to provide novel insights into geochemical mineral interactions. This combination of techniques, effectively measuring the spatial distribution of an element's fluorescence at a series of selected incident energies, provides atomic-scale spectroscopic information over relevant micro- and macro- scales. This process not only can deepen the understanding of mineral geochemistry, that can be applied in a range of diverse applications from major to minor elements, from sulfur to uranium, but can also be used to guide effective data collection at the synchrotron facility. Developments in detector technologies and data analysis strategies will be discussed in framing the future potential of environmental geochemical imaging.