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Leveraging X-ray coherence to probe the topography and reactivity of carbonate-water interfaces at the nanoscale

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The advent of the world's first coherent hard X-ray sources like the European Synchrotron Radiation Facility (in France) or the Advanced Photon Source (in USA) represents an unprecedented opportunity to conduct operando (*i.e.*, *in situ* and time-dependent) studies on the structure and behavior of mineral surfaces and single crystalline grains in reactive environments. In this talk, I will describe a new approach utilizing coherent X-ray scattering to observe the topography and the active sites for growth and dissolution of carbonate surfaces in a relevant model system: otavite ($CdCO_3$) thin films grown on dolomite ($Ca_{½}Mg_{½}CO_3$) surfaces [1]. I will show the wealth of structural information which is provided by coherent X-ray diffraction in the form of reciprocal space maps of the interface. This study represents the initial basis of a research program aiming to develop advanced coherent X-ray imaging methodologies to characterize the dynamic and chemical behavior of realistic mineral-liquid interfaces, and thereby, to unveil the atomistic mechanisms which govern the chemical reactions taking place in the Earth crust.

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[1] I.Calvo-Almazán, *et al.* Imaging otavite thin films on dolomite and calcite with coherent x-ray reflectivity *In preparation*