Nanoscale imaging at the calcite-water interface: Implications for potential environmental remediation.

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Advanced imaging techniques such as atomic force microscopy (AFM) allow for direct observations of reactions at mineral surfaces at the nanoscale. This enables reaction mechanisms to be clarified. Aqueous solutions passing over a calcite surface often control coupled reactions of dissolution and precipitation, whereby calcite is replaced pseudomorphically by a more stable phase that precipitates at the calcite-fluid interface. Both molar volume changes as well as solubility changes between parent and product phases most commonly result in a concomitant porosity that then allows the solution to penetrate within the calcite. In this way pollutant elements such as phosphate, from over fertilization of agricultural soils, or water contaminated with elements such as, selenium, arsenic, antimony, chromium (from both natural and anthropogenic sources), can be sequestered within more stable, less soluble phases. Calcium carbonate barriers (such as crushed limestone) within water channels may present an effective and simple method to remove contaminant elements from water systems.