Abstract

This study explores the dynamics of porosity and reactive surface area changes during porous limestone dissolution by CO_2-rich water. The Sr and Ca concentrations in both the rock and the outlet solution are used to evaluate the reactive surface area changes of the two rock-forming calcites, i.e. micrite grains and sparite crystals, which have different trace element signatures. The geometric surface area measured with X-ray microtomography decreases slightly whereas the reactive surface area increases continuously with increasing porosity from 20.3 to 30.2%. Surprisingly, changes in reactive surface areas are very different between the two calcites. The reactive surface area changes in the micrite are parabolic while the reactive surface area of sparite increases greatly. The numerical model HYTEC is used to model the change in reactive surface areas during the experiment. Different geometrical models are tested. The model based on spherical-grain dissolution and spherical-pore growth fails to reproduce the experimental results, while the sugar-lump model provides reasonable agreement with the experiment.