

## **Repercussions of size heterogeneity on the measurement of specific surface areas of colloidal minerals: Combination of macroscopic and microscopic analyses**

**MARIE-CAMILLE JODIN, FABIEN GABORIAUD,\* AND BERNARD HUMBERT**

Laboratoire de Chimie Physique et Microbiologie pour l'Environnement, UMR 7564, CNRS, Université Henri Poincaré, Nancy I, 405 rue de Vandoeuvre, F-54600 Villers-lès-Nancy, France

### **ABSTRACT**

The nature and the extent of reactive crystalline surfaces for colloidal particles is an essential factor for understanding of reactions at the solid-liquid interfaces. The measurement of this specific surface area for colloidal mineral particles is usually obtained from gas-adsorption isotherms. This measurement, based on adsorbate-adsorbent interactions, yields overall weight-averaged values that fail to display the distribution of geometrical specific surface areas of individual particles. The present work proposes to use three dimensional atomic force microscopy (AFM) images to characterize the distribution of geometrical features of hexagonal plate-like gibbsite  $[\text{Al}(\text{OH})_3]$  particles without microporosity. This sub-micrometer approach, which requires minute quantities of solids (picograms), demonstrates the broad distribution of specific surface areas (lateral, basal, and total) determined for each individual particle in our sample. The resulting weight-averaged specific surface area values of basal and lateral surfaces, calculated from this distribution, agree with values measured by Kr-adsorption isotherms. The lateral specific surface area values thus obtained confirm the estimates given by and are correlated with the infrared spectrum analysis proposed in our previous papers. Moreover, these results reveal the importance of the smallest particles in the overall distribution, whereas the weight-averaged value is monitored by high-mass particles that are few in number. This kind of specific surface area heterogeneity must be taken into account in describing the reactivity of anisotropic shaped mineral particles.