Adsortion of cations, and adsorption isotherms

Unaltered mineral:

A model for adsorption of cations:

Adsorption of H₂O:

First dissociation of H₂O:

Dissociation of OH⁻ and adsorption of cation (which is partly to completely hydrated):

The extent of this dissociation will depend on pH (see below) and the cations in the mineral (see "An explanation of 'point of zero charge'").

Adapted from Figure 4.2 of Schindler and Stumm, in Stumm (1987) Aquatic Surface Chemistry.

Low pH:
H⁺ ions occupy surface; cations have no place to adsorb

High pH:
H⁺ ions leave surface, and cations occupy surface

Typical adsorption isotherm (plot of % adsorption at a given temperature) for a particular cation on a particular surface (e.g. Cd²⁺ on SiO₂ or Fe³⁺ on TiO₂)

Adsortion isotherms summarize data about adsorption across a range of pH:

% of potential solute adsorbed

% of potential solute actually in solution

Individual measurements

Railsback's Some Fundamentals of Mineralogy and Geochemistry