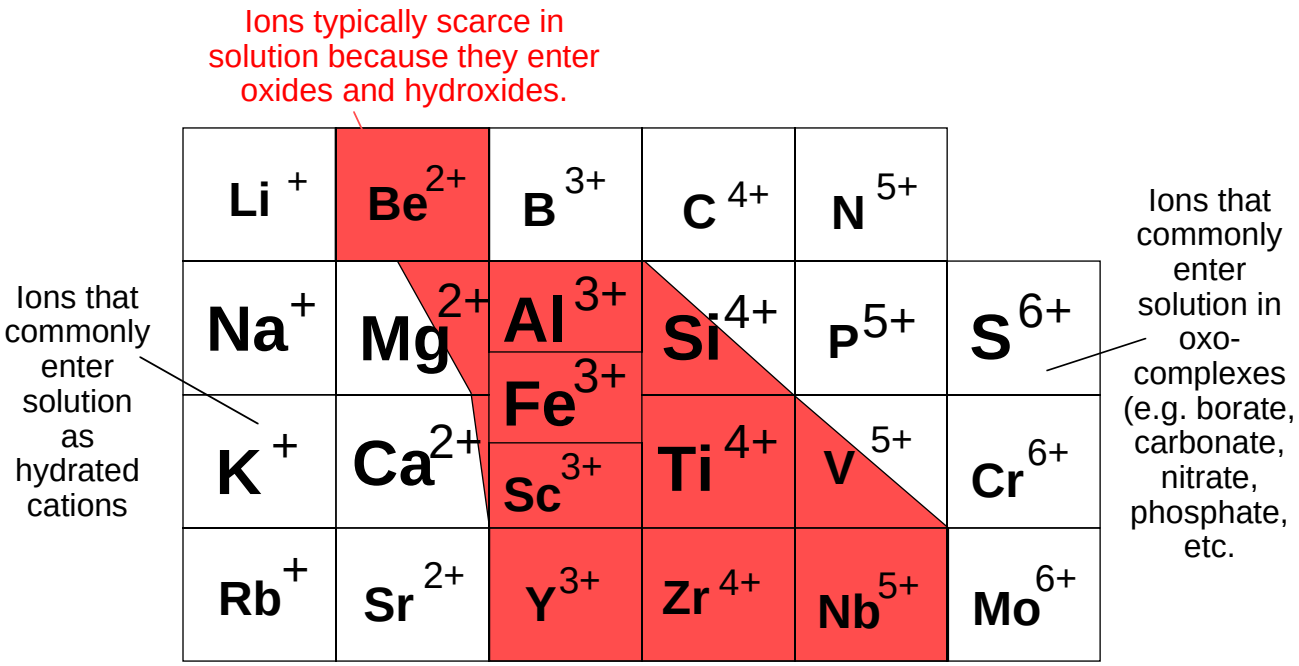
Why Clay is Clay

Why do clay minerals (Al- and Fe- bearing minerals, and especially Al-bearing phyllosilicates) make up clay (natural mineral material less than 4 microns in size)? Most minerals are too soluble at such small sizes to survive in nature - they dissolve. Why don't the clay minerals?

1. Al^{3+} and Fe^{3+}, and to a lesser extent Si^{4+} and Mg^{2+}, bond to oxygen to make very stable minerals (see the Earth Scientist's Periodic Table of the Elements and Their Ions). They thus make relatively insoluble minerals that will survive as small particles at sizes at which other minerals dissolve.



2. The planar nature of phyllosilicate particles causes fewer steps and thus fewer chemically reactive sites for dissolution, compared to equant minerals.

Given two crystals of same cross-sectional area, the planar one has a third as many reactive sites: