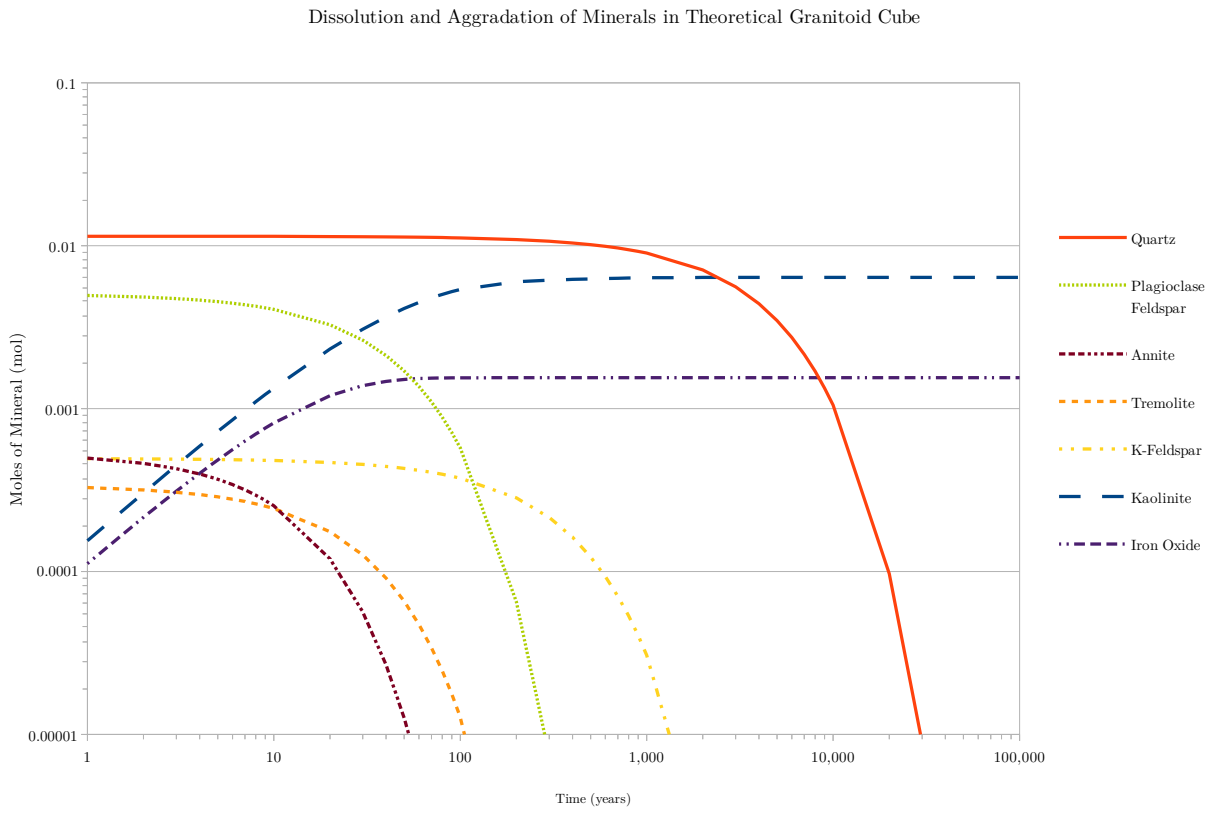

Figure 1: Time dependent log-log plot of dissolution of minerals in a theoretical 1cm^3 granitoid cube in a soil at pH 5, through time. Dissolution rates taken from Bandstra et al. (2007) and Palandri and Kharaka (2004). Initial weathering rates of all minerals at the start of the experiment (quartz, plagioclase feldspar, annite, tremolite, and potassium feldspar) are faster than all subsequent weathering rates rates due to continually decreasing surface area of the mineral through time. Aggradation of kaolinite is dependent on the dissolution rates of plagioclase feldspar, potassium feldspar and annite. Iron oxide aggradation is dependent on annite weathering rate. Minerals reach "zero-value point" at 0.00001 moles of mineral. These times are roughly 50 years for annite, 100 years for tremolite, 300 years for plagioclase feldspar, 1,500 years for potassium feldspar, and 30,000 years for quartz.

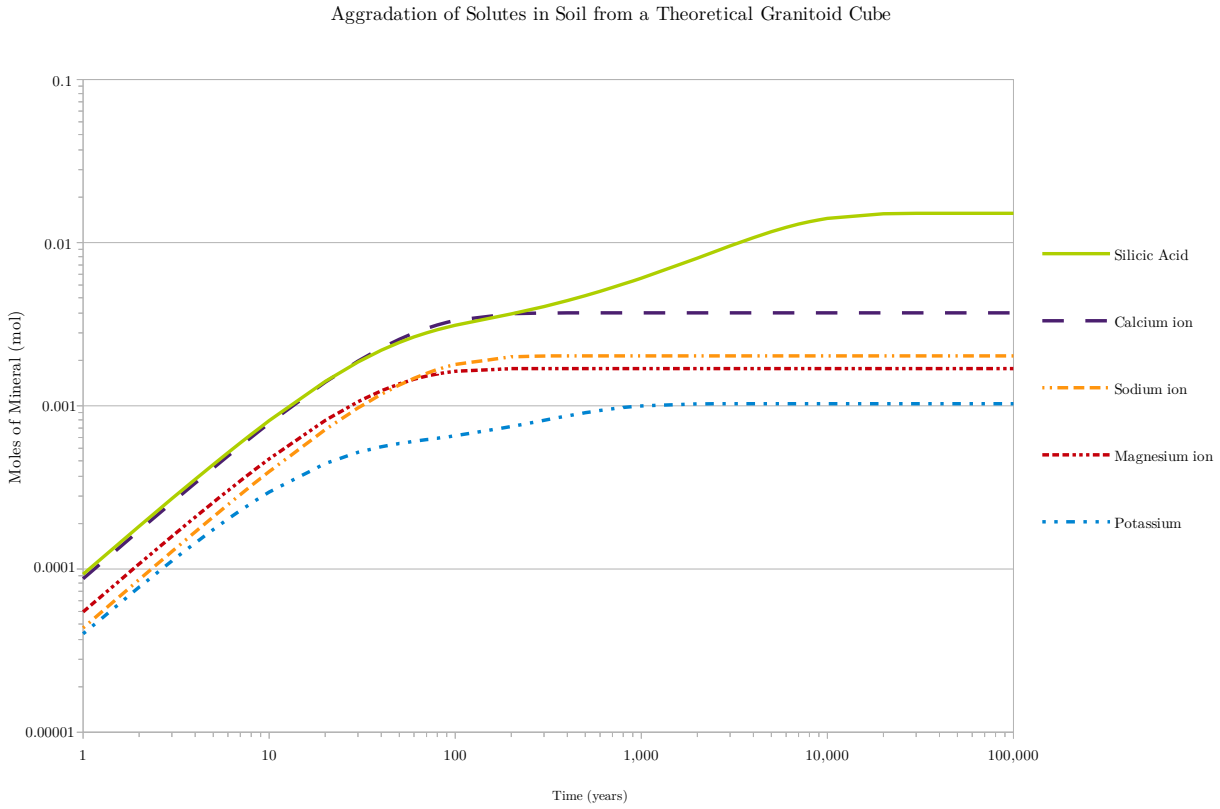

Figure 2: The aggradation of solutes from the same granitoid cube described in Figure 1, in a soil. The aggradation is entirely dependent on the weathering rates of the primary minerals in the granitoid cube. Plagioclase feldspar yields calcium and sodium ions into solution, quartz yields silicic acid, annite yields potassium ions, tremolite yields calcium and sodium ions and silicic acid, and potassium feldspar yields potassium ions and silicic acid.

Assumptions

For the purpose of keeping this assignment from becoming too involved, a series of assumptions were made. Beyond the assumptions given with the assignment, the assumptions made fall mostly into the category of stoichiometric problems. Specifically, the relative quantities of secondary minerals that a single mole of primary mineral weathers into. Stoichiometry was worked through with stoichiometric equation balancing as best as possible for all minerals except annite, where it was assumed that half the mass of weathered annite went to kaolinite and half went to iron oxide. Additionally, the moles of solute yielded for every mole of primary mineral dissolved was determined for all minerals by stoichiometrically balancing equations with the addition of H_2O and H^+ ions where needed. Lastly, and unrelated to stoichiometry, molar weights for all minerals were obtained from `http://webmineral.com/` and selected based on the average abundance of the different polymorphs of the minerals.

References

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