

## Dissolution of a Lunar Glass Simulant: The Effect of pH and Organic Acids at 298K

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The dissolution rates and mechanisms of a high titanium simulated lunar glass were investigated at pH 3.0, 5.0, and 7.0 and at citric and oxalic acid concentrations of 2 and 20 mM. The organic acids were buffered at pH 7 to separate the effect of the organic molecule from the proton. The experiments were carried out in closed batch reactors at 298K for reaction times up to 1 year. Changes in major elemental chemistry were monitored as a function of time in the aqueous solution and changes in the surface were examined using electron microscopy (TEM and SEM). A leached layer was observable at pHs of 3 and 5 and was found to be depleted in all major elements except Si and Ti. Release rates into aqueous solution were parabolic for Ca, Mg, Al, and Fe and linear for Si. The glass was relatively unreactive at pH=7. Dissolution of the glass was accelerated in the presence of the organic acids with citric acid having a greater effect on the rate of dissolution than oxalic acid. Release rates were described equally well by both the parabolic and linear rate equations. No leached layer was observable in the organic acid experiments.

It is proposed that the dissolution at pH<5 proceeds via the diffusion of Ca, Mg, Al, and Fe through a leached layer rich in Si and Ti. Calcium and Mg are released via ion exchange with  $H_3O^+$  while Fe and Al are hydrolyzed and subsequently released from the glass. Silica is released via hydrolysis at the surface. Dissolution in the presence of organic acids is more complex and may be controlled by both surface reactions and complexation reactions in solution.