# THE KINETICS OF SILICA

# DISSOLUTION FROM VOLCANIC GLASS

# IN THE MARINE ENVIRONMENT

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## ABSTRACT

The rate of silica dissolution from volcanic glass in seawater and NaCl solutions can be described by a combination of simultaneous first order reactions. Models which contain parabolic--rate diffusion processes did not agree with these data. Laboratory experiments studied the silica dissolution rate from one rhyolitic and two basaltic glasses in the pH range of 7.3 to 8.3 and at temperatures of $25^o$, $60^o$, and $90^oC$. The early flux of silica from these samples was greatest for the basaltic reticulite pumice, less for the basaltic hyaloclastite glass, and least for the rhyolitic obsidian. The final silica flux at $3^oC$ is approximately $10^{-16}$ moles $cm^{-2}sec^{-1}$ for all three glasses. The Arrhenius energy of activation for the early silica dissolution period is 12, 14, and 16 kcal/mole for the reticulite, hyaloclastite, and obsidian samples respectively.

These data suggest that at $3^oC$ the silica flux for volcanic glass (per unit surface area per unit solution volume) is within one order of magnitude of the flux for biogenic opal in marine sediments. Based on these fluxes pyroclastic material may be the source of as much as 0.1 per cent and individual events such as the 1883 eruption of Krakatoa (Indonesia) may account for as much as 1 per cent of the annual silica input to the ocean.

Seawater collected adjacent to a basaltic lava flow as it entered the ocean was enriched in silica, iron, and manganese, but cobalt, copper, nickel, lead, chromium and

zinc concentrations were not significantly different from the control samples.