

Single-crystal plagioclase feldspar dissolution rates measured by vertical scanning interferometry

ROLF S. ARVIDSON*, MIKALA S. BEIG, AND ANDREAS LUTTGE

Department of Earth Science MS-126, Rice University, P.O. Box 1892, Houston, Texas 77251-1892, U.S.A.

ABSTRACT

Here we introduce a technique for simultaneous measurement of surface normal retreat rates of specific cleavage faces by vertical scanning interferometry and the bulk dissolution rate of a mineral powder. A hydrothermal reactor is used to contain both a well-characterized powder and oriented single crystals with a masked reference surface at elevated temperatures. We show examples using both anorthite and albite reacted at temperatures between 150 and 200 °C. In the case of albite, dissolution rates of fine-grained powders are substantially enhanced compared to those prevailing on large single-crystal cleavage surfaces. Rates developed on the (010) albite cleavage surface are also substantially faster than those on the (001) face, where etch-pit development was relatively modest and surface normal retreat was not detectable within the time frame of the experiment. The reasons for this difference are not immediately clear, but may be related to anisotropy in the distribution of Al-O-Si vs. Si-O-Si bonds in the albite structure, (010) twinning expressed on the (001) surface, and possible disruption of kink propagation across the twin plane.