

Isotope exchange during Ostwald ripening, incorporating diffusion and recrystallization

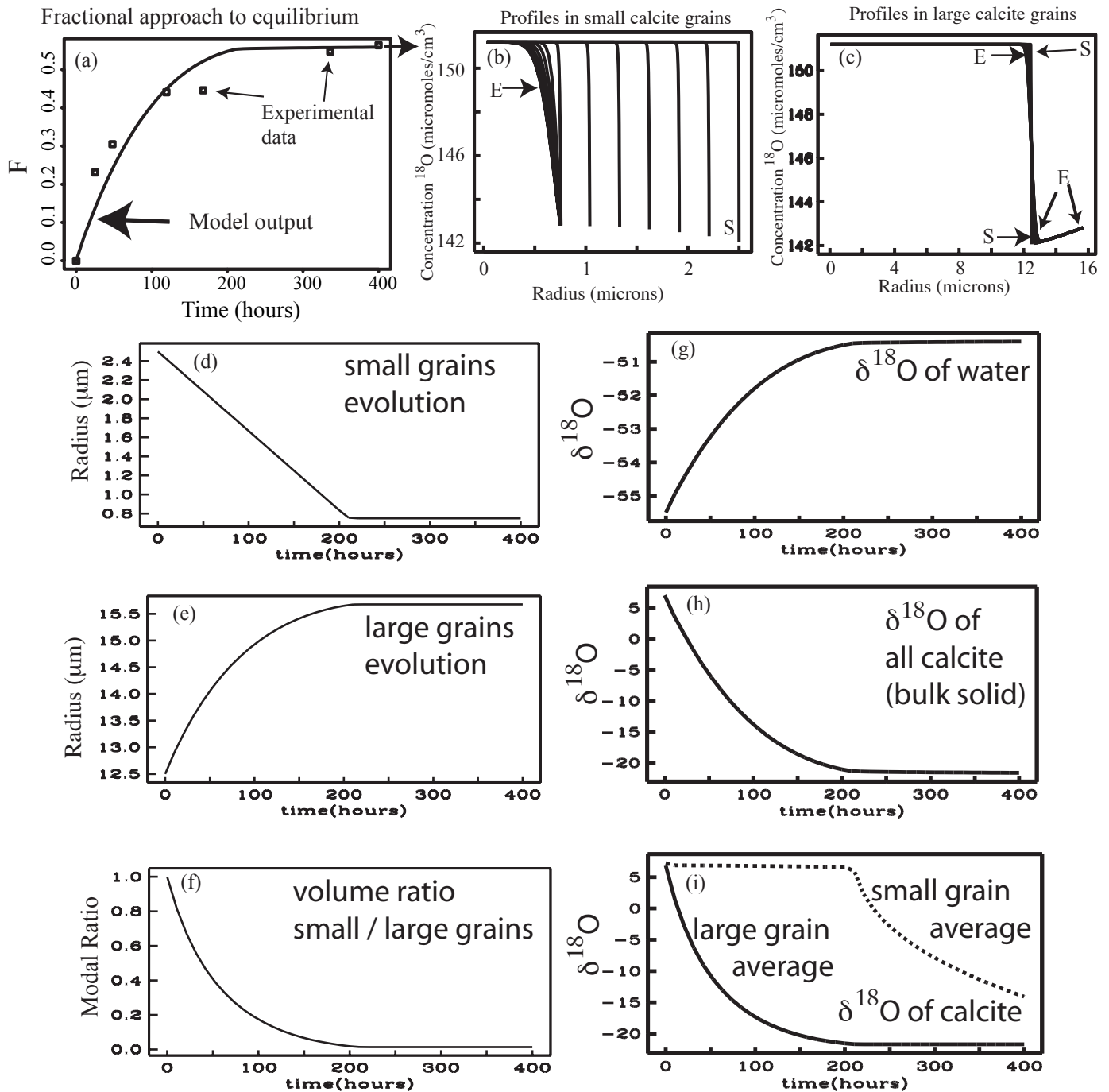


Figure 4. Sample calculation of isotopic diffusion in calcite grains at 500°C during Ostwald ripening compared to experiment. The volume fraction of small and large grains are equal at the start, then the small grains dissolve as the large grains grow. (a) fractional isotope exchange F evolution of model (curve) and Chai (1975) experiment \blacksquare . Early in the experiment isotopic exchange is dominated by dissolution of the small grains and reprecipitation on the larger grains. At later times, exchange is dominated by diffusion in the resulting larger grains. After very long times, profiles in the grains become flat, and F evolves to the equilibrium value of 1. Here, $F = (\alpha_t - \alpha_i) / (\alpha_{eqm} - \alpha_{init})$, with $\alpha = R_{min} / R_{fluid}$, and $R = [^{18}\text{O}] / [^{16}\text{O}]$ a concentration ratio; subscripts t: time evolving quantity; i: initial value; eqm: equilibrium value; init: initial value; min: mineral value (cf., Northrop and Clayton, 1966). Last data point with arrow is for $t = 672$ hrs. (b) profiles in the small grains at various times (S=start, E=end). (c) similar profiles for large grains (initially 12.5 μm radii), growing to about 16 μm . Note slight broadening of diffusion front with reverse zonation. Parts (d-i) represent: evolution of indicated quantities with time.