Isotopic equilibration during dissolution-reprecipitation reactions?

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The interpretation of isotopic data from metamorphic and metasomatic rocks can only be geologically meaningful if the extent of elemental and isotopic equilibration during crystallization is known. Limited equilibration leads to inheritance of isotopic information, which in turn might cause misinterpretation of the extracted data. In order to surround such misinterpretations the mechanisms of mineral crystallization and -transformation as well as the processes of element exchange between reactant and product phases must be known. Dissolution and reprecipitation is a very common mineral reaction mechanism in the solid Earth and believed to be fast and thorough with respect to the isotopic exchange between the rock matrix and the mineral interiors. However, element and isotopic exchange during such mineral reactions is thought to occur via aqueous solutions, but new experimental data as well as observations in natural samples indicate that the element transfer can also occur via formation of an amorphous material that might not be in thermodynamic equilibrium with the intercrystalline matrix. Furthermore, we can show that such an amorphous transport medium can form directly by depolymerization of the crystal lattice and that precipitation of product minerals can occur directly by repolymerization of the amorphous material at the product surface. Hence, the entire element and isotopic transfer between reactant and product mineral might not involve equilibration with the intercrystalline transport medium. This lack of isotopic re-equilibration during the repolymerization process which facilitates the inheritance of isotopic information from precursor minerals.

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