

LETTER

Direct observations of pseudomorphism: compositional and textural evolution at a fluid-solid interface

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ABSTRACT

Solid-fluid interactions often involve the replacement of one phase by another while retaining the morphology and structural details of the parent phase, i.e. pseudomorphism. We present in situ observations of the evolution of both the solid and fluid compositions at the interface during such a replacement reaction in the model system KBr-KCl-H₂O, in which a single crystal of KBr is replaced by a single crystal of KCl. The pseudomorphism is initiated by epitaxial growth at the fluid-mineral interface, when the dissolution of the parent phase results in an interfacial fluid layer that is super-saturated with respect to a different solid composition. The subsequent evolution of the coupled dissolution and growth can be related to local equilibrium defined by a Lippmann diagram. The reaction features, including the development of porosity in the new solid phase, share many characteristics of replacement reactions in nature as well as in technical applications.