Barite cohesive layers formed on gypsum surface by a pseudomorphic replacement

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Mineral replacement reactions are critical in most geochemical processes, including diagenesis, the redistribution of elements in the Earth’s crust and hence the formation of secondary mineral and ore deposits. When a mineral surface is in contact with an aqueous fluid, replacement reactions may occur via interface-coupled dissolution-precipitation, resulting in the formation of a new phase. In these processes, dissolution of the parent phase occurs and consequently the solution at the mineral-fluid interface becomes supersaturated with respect to a new mineral phase that can nucleate at the surface of the parent mineral. In the present study, we provide experimental evidence suggesting that during the interaction of gypsum (CaSO4·2H2O) cleavage surfaces with Ba-bearing solutions, gypsum is pseudomorphically replaced by barite (BaSO4). A homogenous micron-sized layer of barite formed on gypsum cleavage surfaces within some hours of exposure to Ba-bearing solutions. This occurs most likely via an interface-coupled dissolution-precipitation mechanism. Interestingly, our observations show a certain degree of crystallographic control on the product layer by the structure of the parent substrate. This pseudomorphic replacement of gypsum by barite could be used as a conservation procedure for gypsum sculptures and plasterworks, increasing their resistance against water and humidity while preserving the surface features of the original mineral substrate.