

The formation of celestite through the replacement of calcium sulphates

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Celestite (SrSO_4 ; $K_{ps}=10^{-6.63}$) is a relevant industrial mineral, whose large massive deposits are associated to coastal sedimentary rocks. The origin of these deposits has been related to the development of dissolution-crystallization reactions upon the interaction between natural waters and calcium sulphate (gypsum and anhydrite) evaporites [1]. This interaction would initially result in the precipitation of the much less soluble barite (BaSO_4 ; $K_{ps}=10^{-9.97}$). Celestite would only form after, through continued barite precipitation, the aqueous phase became strongly depleted in Ba and its Sr/Ba ratio reached extremely high values [1]. In this work, we aim to test the feasibility of Hanor's genetic model for massive celestite deposits by studying the sequence of dissolution-crystallization processes that take place during the interaction of gypsum and anhydrite with aqueous solutions that bear either Sr or Sr and Ba. Our results evidence a much slower kinetics for interaction with anhydrite, regardless the composition of the aqueous phase. In contrast, gypsum becomes rapidly replaced by newly formed sulphates. In both cases, the interaction with solutions that only bear Sr results in the formation of celestite (Fig 1a). Interestingly, whenever the fluid contains Ba the first phase to precipitate is Sr-bearing barite, followed by the precipitation of pure celestite only when the interaction takes place with gypsum (Fig 1b). These results provide experimental support to Hanor's genetic model.

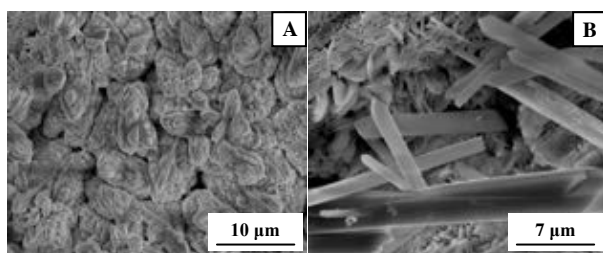


Figure 1: Gypsum surfaces covered by secondary crystals of (a) celestite and (b) both barite and celestite, respectively.

[1] Hanor (2004). *J Sediment Res* **74**, 168-175.