Formation of laurionite in saline, geothermal brine

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The heavy metal lead (Pb) is a frequently occurring element in geothermal brines. It was found to precipitate from saline fluids predominantly as laurionite (PbOHCl) forming one of the most dominant scaling minerals identified at the geothermal site Groß Schönebeck (Germany). Laurionite is a little known mineral in that was hardly found in natural environments so far. In this study, its formation conditions were investigated between 25 and 133 °C by adding, various amounts of NaOH to solutions containing 3 M NaCl, 1 M $CaCl_2$, and 10 mM $Pb(NO_3)_2$. The formed precipitates were analyzed by X-ray diffraction and scanning electron microscopy. Laurionite had formed as the predominant mineral in nearly all experiments. Experimental results showed the same trends as equilibrium calculations performed with the code PhreeqC and the database “geodat”. Results indicate that the formation of laurionite from geothermal, Pb-bearing saline brine is very probable with the pH value as the main controlling parameter for its formation. It can be assumed that laurionite plays an important role in geothermal systems not only by removing Pb from the brine but also by buffering the pH- value to neutral values.