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Gordaite as storage mineral for heavy metals from salt-rich solutions

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Heavy metals pose a potential risk to the environment. Many studies have been carried out to limit the impact of these elements as pollutants. Recently, heavy metals from the anthroposphere have increasingly been discussed as potential resources and accordingly, more and more studies deal with the recovery of heavy metals from aqueous solutions. However, only few studies consider salt-rich environments.

Gordaite, $NaZn_4SO_4(OH)_6Cl \bullet 6H_2O$, is a Zn-rich mineral observed in salt-rich natural environments, e.g. the San Francisco Mine in Sierra Gorda, Chile [1]. It is also a corrosion product in Zn and Zn-Mg-Al slag heaps due to marine environment [2]. Experiments show that Gordaite can incorporate Na, K, Ca, Li, NH_4, Sr, Ni, Co, Cu, Cl and Br [3-7]. Zn can be completely replaced by Co or by 50% Cu [3, 5].

We want to know: How much Cu can be incorporated into Gordaite? Is it possible to substitute Zn with Cd? Which effect has the substitution on the morphology of Gordaite?

Synthesis experiments were performed to investigate the solid solution of Zn-Cu-Gordaite: for Zn-Gordaite, ZnO-powder was mixed with a 1,5M NaCl and 0,5M $ZnSO_4$-solution and periodically stirred for 120h. For the end-member Cu-Gordaite, CuO and $CuSO_4$ were used. Four experiments were performed with $ZnSO_4$:$CuSO_4$ ratios 0:1, 1:1, 3:1 and 1:0. Furthermore, the cation exchange capacity of Gordaite was tested. For this, Zn-Gordaite was synthesized and 0,5M $CuSO_4$ solution was added and periodically stirred for another 120h. Cd and Zn are chemically closely related. To test the solid solution of Zn-Cd-Gordaite we performed the same experimental series with Cd.

The first results show, that Cu and Cd can be incorporated into the structure. The synthesis of the endmembers Cu-Gordaite and Cd-Gordaite needs to be verified. All residues are characterized by XRD and FTIR. In addition, SEM is used to determine a change in the morphology of the crystals depending on the incorporation of Cd & Cu into the structure.

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