C-II8

Adsorption of Cadmium and Lead Ions on Calcite in Estuarine Waters and Seawater

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According to classification of **Whitfield** and **Turner** (1987), toxic cadmium shows deep-sea profiles characteristic of the recycled elements. It is held in the organic matrix via sulfur bonds. **Price** and **Morel** (1990) reported cadmium substitution for zinc in the marine diatom Thalassiosira weissflogii and have attempted to explain cadmium surface depletion relative to deep waters.

Regarding inorganic particles, we have shown that cadmium had very poor affinity for SiO_2, Al_2O_3 (Bilinski et al., 1976), for MnO_2 (**Bilinski et al.**, 1977), for bentonite and kaolinite (**Bilinski et al.**, 1990a). Cadmium could be adsorbed on synthesized northupite (**Vančina et al.**, 1986) and on calcite (**Bilinski et al.**, 1990b).

In the present work the primary interest is on the simultaneous interaction of cadmium and lead ions with calcite, which mineral is present in surface sediments in the Krka River Estuary.

Cadmium and lead ions were added to natural water samples in low concentrations (8×10^{-8} M) to have solutions undersaturated with respect to $CdCO_3(s)$ and $PbCO_3(s)$. Adsorption isotherms of simultaneously and individually adsorbed cadmium and lead ions show that the two ions do not compete for the same surface sites. This fact can be explained comparing ionic radii and chrystallographic space groups of corresponding metal carbonates. So, Ca^{2+} and Cd^{2+} have similar and Pb^{2+} has greater ionic radius ($r(Ca^{2+}) = 0.99$ A; $r(Cd^{2+}) = 0.97$ A; $r(Pb^{2+}) = 1.20$ A). Calcium and cadmium carbonates crystallize in R3C space group and show similar parameters of the unit cell (ASTM, 8-456 and 5-586) while lead carbonate crystallizes in Pmcn group (ASTM, 5-417). Behaviour of cadmium can be directly compared with one observed for zinc by **Zachara et al.** (1988). Zinc carbonate also shows R3C space group (ASTM, 8-449). Analogously to zinc ion, cadmium can exchange with calcium ion, present at the surface layer of calcite. As Ca^{2+} and CO_3^{2-} species have been identified as the only major surface ions on calcite (**Thompson et al.**, 1989), it can be concluded that lead ion adsorbs via surface CO_3^{2-} group.

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