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The coupled apatite dissolution-pyromorphite precipitation process: A novel method for cleaning polluted waters.

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Coupled apatite dissolution-pyromorphite ($Pb_5(PO_4)_3OH$) precipitation experiments have been performed to 1) quantify the effect of mineral coatings on apatite dissolution rates, and 2) to explore the possible application of this coupled process to the remediation of polluted waters. All experiments were performed at 20° C in open-system, mixed-flow reactors. Two different apatite solids were used in the experiments: inorganic apatite and ground bone powder. Precipitation was induced by the presence of $Pb(NO_3)_2$ in the inlet solution, which combined with aqueous phosphate liberated by apatite dissolution to supersaturate pyromorphite. The precipitation of a thin pyromorphite layer on fluorapatite surfaces stops its dissolution. In contrast, pyromorphite coatings are far less efficient in lowering bone dissolution rates. The difference in behavior is interpreted to stem from the relative crystallographic structures of the dissolving and precipitating minerals. As pyromorphite is isostructural with inorganic apatite, it precipitates by epitaxial growth directly on the apatite, efficiently slowing dissolution. In contrast, pyromorphite's structure is appreciably different from that of ground bone. Thus, it will precipitate by random three dimensional heterogeneous nucleation, leaving some pore space at the pyromorphite-bone interface. This pore apace allows ground bone dissolution to continue relatively unaffected by thin layers of pre-

cipitated pyromorphite. Due to the inefficiency of pyromorphite coatings to slow bone dissolution, and its faster dissolution rate, bone appears to be a far better Pb scavenging material for cleaning polluted waste waters.

This data will be used together with oxygen isotope measurements to determine the degree to which the coupled dissolution/precipitation process leads to isotopic fractionation.