

Organic coatings reduce mineral dissolution rate of ichthyocarbonate by an order of magnitude

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Marine carbonate production is an important component of the global carbon cycle and the marine alkalinity budget. Carbonate production by marine fish (ichthyocarbonate) is estimated to comprise as much as $4.5 \text{ Pg CaCO}_3 \text{ yr}^{-1}$, however, the fate of ichthyocarbonate is poorly understood. Although their high mol%MgCO₃ content suggests rapid dissolution under current marine conditions, prior studies have demonstrated the persistence of ichthyocarbonate in some sedimentary environments. Direct assessment of ichthyocarbonate impact on carbon cycling and Earth's climate using fully coupled carbon-climate models has not yet been achieved due to knowledge gaps surrounding their fate. Here, we aim to determine the role of organic coatings on the fate of ichthyocarbonate in marine environments. We applied a combination of petrographic, geochemical, and microCT approaches to assess the quantity and distribution of organic matter in ichthyocarbonate produced by two species of marine fish, the Gulf toadfish (*Opsanus beta*) and the Olive flounder (*Paralichthys olivaceus*). New compositional data suggest external coatings and embedded organic matter are volumetrically significant components of ichthyocarbonate, ranging from 8.5 to 32.3% of ichthyocarbonate by volume. Bleach oxidation of organic matter coatings increased the dissolution rate of ichthyocarbonate by more than an order of magnitude, suggesting these coatings serve to reduce reactive surface area. Incorporating new measurements from ichthyocarbonate produced by two species of marine fish into our model that predicts ultimate dissolution depth under simulated oceanic conditions, organic coatings increase ichthyocarbonate lifespan by $\sim 12\times$. Feedbacks between minerals and organic matter in these sinking particles appear to, in part, constrain the role of ichthyocarbonate on oceanic carbon cycling. Supported by NSF OCE award #2319245.