U/Ca ratio as a paleo ocean carbonate chemistry

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Carbondioxide is the most important greenhouse gas in the atmosphere, controlling the Earth's head balance. The atmospheric CO2 level has already increased from the concentration of 280 to 360 ppm in the pre-industrial age, and it is projected to reach more than 560 ppm before the end of the 21st century. Due to their capacity to adsorb carbon dioxide from atmosphere, the oceans are a significant reservoir of carbon in the Earth system. The initial reaction between CO2 dissolved in the oceans with carbonates produces carbonic acid upon which lowers the oceanic pH. Ocean acidification influences calcium carbonate (CaCO3) equilibrium of the ocean due to the decrease in carbonate (CO32-) ion concentration, an essential element to form outer skeleton of several marine carbonate organisms. The dissolved carbondioxide is able to be released back from the oceans into the atmosphere, suggesting the oceans are an imperative point in the carbon cycle. The role of ocean carbon cycle has created a center of attention to the coral metabolism (i.e. photosynthesis and calcification). Changes in the partial pressure of CO2 (pCO2) due to photosynthesis and calcification processes occurred into two opposite ways, i.e. photosynthesis reduces pCO2 while calcification enhances pCO2. During calcification process of marine carbonates (such as coral), some trace elements can be incorporated into carbonate skeleton. Since the elevated atmospheric CO2 reduces the oceanic pH, and the alteration of oceanic pH governs both the ocean carbonate chemistry and speciation of elements, the mechanism of trace elements incorporated into coral skeleton will also affected. Uranium is thought to be one of the elements can incorporate into carbonate as uranyl (UO22+) ion. In carbonate skeleton, UO22+ forms complex ions such as UO2[CO3]0, UO2[CO3]22-, and/or UO2[CO3]34-. However, the mechanism of their incorporation into coral skeleton based on the pH changes is remain poorly understood. Therefore, study of such complex uranyl ions incorporated into coral skeleton is significantly needed to establish basic concept of uranium uptake by coral.