Nitrogen isotopes of coral skeleton-bound organic matter: Proxy evalution at Bermuda

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Nitrogen isotopes of organic matter bound in coral skeleton (hereafter, skeletal $\delta^{15}N$) have the potential to be a high-resolution proxy for the marine nitrogen cycle. By adapting a previously developed foraminifera-bound $\delta^{15}N$ method, we have developed a sensitive method for measuring coral skeletal $\delta^{15}N$, requiring 5 mg of skeleton powder and yielding a precision of ~0.2‰. We evaluated the natural variability of this proxy in Bermudan brain corals. Ten live coral colonies (*Diploria labyrinthiformis*) from four locations around Bermuda were collected in 2005 and analyzed for skeletal $\delta^{15}N$ (Fig. 1). Skeletal $\delta^{15}N$ showed good reproducibility (< 0.5‰) among different colonies at the same location, suggesting coral skeletal $\delta^{15}N$ is a reliable proxy for the local nitrogen cycle. Among the four sampling sites, skeletal $\delta^{15}N$ decreased with distance from the island, from ~6.8‰ (inshore, Tynes Bay) to ~3.8‰ (offshore, HOG Reef). The annual calcification rate of each colony was estimated from image analysis of 3-D CT scans. Skeletal $\delta^{15}N$ at each site exhibits a strong, negative correlation with annual calcification rate (R^2>0.9). We propose that the efficiency of nutrient recycling between the symbionts and coral host is reduced when nutrient concentrations of reef seawater are elevated, resulting in higher skeletal $\delta^{15}N$ and lower calcification rates at our inshore sites.

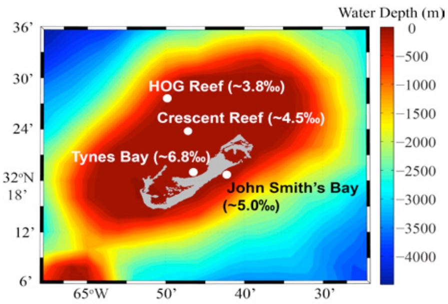

Figure 1 Sample locations and mean coral skeletal $\delta^{15}N$

Cokriging estimation of soil heavy-metal data obtained from portable X-ray fluorescence spectrometry

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Portable X-ray fluorescence spectrometry (P-XRF) is currently used as a cost-effective and rapid analytical tool for assessing the heavy metal pollution of soil. However, the *in-situ* measured data are frequently unreliable due to soil heterogeneity, which may result in a difficulty to accurately interpret the spatial patttern of pollution status. This study is purposed to evaluate the feasibility of P-XRF to obtain a reliable auxiliary dataset for the cokriging interpolation of soil heavy metal data. For this study, we used analytical results of arsenic concentrations in soil samples (n=156) from a metal-polluted site, which were obtained by the conventional chemical leaching method and P-XRF. The both arsenic levels showed a good correlation (R^2 = 0.72). The true As pollution map was initially established by an ordinary kriging of 156 data. Then, one third of the total samples (i.e., 52 P-XRF data) were randomly chosen to presume the virtual soil investigation, and two kinds of pollution maps were constructed using the ordinary kriging and cokriging methods. Comparison of the estimated As levels with the true data at total sampling points (n=156) showed that the cokriging map is more reliable (R^2 = 0.89) than the ordinary kriging map (R^2 = 0.40). This study shows the advantage of the cokriging interpretation of P-XRF data to evaluate the spatial distribution of heavy metal pollution of soil.

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