

Grumet, N. and K. Hughen. 2006. Biomonitor of environmental stress: coral trace metal analysis. Eos Trans. AGU, 87(52), Fall Meet. Suppl., Abstract PP23D-1802.

Abstract:

Tropical reef corals are extremely sensitive to changes in environmental conditions and, as a result of environmental degradation and global climate change, coral reefs around the globe are severely threatened. Increased human population and development in tropical regions is leading to higher turbidity and silt loading from terrestrial runoff, increased pesticides and nutrients from agricultural land-use and sewage, and the release of toxic trace metals to coastal waters from industrial pollution. The uptake of these metals and nutrients within the coral skeletal aragonite is a sensitive biomonitor of environmental stresses on coral health. We analyzed 18 trace metals from the surface of coral skeletons collected in Bermuda, Indonesia and Belize to assess a range of threats to coral reef health - including climate change, agricultural runoff and pesticides, and coastal development and tourism. This surface sample network also includes samples representing 4 different coral species. Trace metal analysis was performed on an inductively coupled plasma mass spectrometer (ICP-MS) to a high degree of accuracy and precision at extremely low (ppb) concentrations using a protocol we developed for samples less than 2 mg. Proper cleaning techniques were employed to minimize blank level concentrations for ultra-trace metal ICP-MS solution analysis. However, Zn/Ca and Ni/Ca concentrations remain below analytical detection limits. Initial results indicate that sea surface temperature proxies (e.g., Sr/Ca, B/Ca and Mg/Ca) display similar ratios between the different sites, whereas those metals associated with anthropogenic activities, such as Co, Pb and Cu, are site-specific and are linked to individual environmental stressors. Results from this study will be applied to down core trace metal records in the future. In doing so, we aim to understand the impacts of compounding environmental stresses on coral health, and to identify regional threshold values beyond which corals become susceptible to disease, bleaching and death.