KECK GEOLOGY CONSORTIUM

PROCEEDINGS OF THE TWENTY-FIFTH ANNUAL KECK RESEARCH SYMPOSIUM IN GEOLOGY

April 2012
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Keck Geology Consortium: Projects 2011-2012
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DEPTH-RELATED CARBONATE CYCLING IN A MODERN REEF: ST. JOHN, U.S. VIRGIN ISLANDS
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ELIZABETH WHITCHER**,** Oberlin College
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MACROBIOEROSION RATES OF IN-SITU CORAL COLONIES: ST. JOHN, U.S. VIRGIN ISLANDS

ELIZABETH WHITCHER, Oberlin College
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INTRODUCTION

Over the past four decades, the extent and severity of coral reef decline has increased dramatically. Researchers have observed widespread phase shifts within reef ecosystems around the globe, with coral colonies being replaced by vast macroalgal communities (Gardener et al., 2003; Bellwood et al., 2004). In light of climate change and predictions of accelerated sea-level rise, the disappearance of the reef's primary carbonate producers at alarming rates has become increasingly disturbing. Structural complexity of reefs throughout the Caribbean has been greatly reduced since the 1970s (Alvarez-Filip et al., 2011), which has the potential to negatively impact reef organisms that depend on spatial complexity. One of the major questions facing reef scientists today is whether reefs will be able to adapt to accelerating environmental change.

Reef accretion is a delicate balance of constructive processes that contribute carbonate to the reef, destructive agents that break it down, and forces that remove it from the reef. The balance of these elements within a reef can be expressed as a carbonate budget, which takes into account all sources of production and destruction of carbonate structure on the reef, as well as import and export of carbonate sediments to and from the reef system. Coral growth is the main constructive component of reef building, while activity by bioeroding organisms is considered to be the major destructive factor (Tribollet & Golubic, 2011). The term 'bioerosion' was first defined by Neumann (1966), as "the removal of lithic substrate by the direct action of organisms". Bioeroders can be separated into epifaunal and infaunal agents. Infaunal borers can be further divided by scale, as microscopic algae, cyanobacteria, and fungi, and macroscopic sponges, worms, and molluscs. Individual reefs vary greatly in the relative contribution of each of these major groups to the overall removal of coral skeleton (Osorno et al., 2005; Chazottes et al., 2002; Pari et al., 1998).

Bioerosion is a taphonomic process that generally begins immediately after the death of the coral colony. Studies attempting to quantify rates of bioerosion face the challenge of constraining the duration over which it occurred. While it is relatively simple to quantify the amount of coral skeleton removed by infaunal bioerosion, it is much more difficult to determine when the coral died, and therefore how long it took to create the end result. Previous studies have dealt with this either by reporting only intensity of boring in natural substrates, or by utilizing experimental substrates to constrain time of exposure. These experimental studies typically use uniform blocks cut from coral skeleton (Osorno et al., 2005; Chazottes et al., 2002; Pari et al., 1998). Their results have been widely accepted as an accurate characterization of bioerosion, but rely on the assumption that these artificial constructs will behave similarly to corals in the reef.

This study takes advantage of bimonthly to annual National Park Service monitoring studies to constrain time of death for individual corals. Repeated video monitoring surveys of coral communities have been conducted along a depth gradient in two bays off eastern St. John in the U.S. Virgin Islands. Video is used to determine time of death and subsequent duration of exposure to bioeroders of in-situ colonies of *Montastrea annularis*. This enables calculation of macro-bioerosion rates from in-situ coral colonies. The data described below characterize an important component of natural substrate destruction for these eastern St. John reef communities. In combination with other studies described in this volume, it will be possible to quantify carbonate cycling in St. John reefs and perhaps address questions about the changing balance between carbonate production and destruction in the face of accelerating environmental change.