Geophysical Research Abstracts, Vol. 9, 08541, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08541

Foraminiferal assemblage responses to naturally-induced high arsenic concentrations in a shallow-water hydrothermal system in northeastern Papua New Guinea

B. McCloskey, P. Hallock
University of South Florida, Florida, USA (bryanm@marine.usf.edu)

Many faunal assemblages are adversely affected by elevated concentrations of potentially toxic heavy metals. Benthic Foraminifera in particular are especially sensitive to sedimentary heavy metal exposure due to factors such as high surface-to-volume ratios and intimate association with sediment grains and interstitial pore-water. However, environmental heavy-metal contamination often occurs as a result of anthropogenic influences (industrial, municipal, and agricultural runoff; ship anti-fouling agents; mine tailings; etc.), and thus often occur in complicated suites, and along with other pollutants, which makes analysis of the effects of individual stressors difficult. Tutum Bay, Ambitle Island in northeastern Papua New Guinea contains several shallow-water hydrothermal vents wherein a high concentration of dissolved arsenic (up to 1 mg/kg) is delivered in high volume to a largely anthropogenically untouched reefal ecosystem. While macrofauna in the water column and larger, elevated benthic macrofauna may exhibit fewer detrimental effects due to rapid flushing and dilution of the arsenic-laden vent water, smaller epifauna and infauna, such as foraminifers, are more directly impacted by hydrothermal fluid seeping through pore-water, bottom boundary layers, exposure to sediment grains that may be adsorbing arsenic, etc. This unique setting thus allows examination of the effects of a single toxic metal on infaunal populations. However, relationships are complicated by the co-occurrence of several non-metallic but potentially stressing environmental variables within the hydrothermal vent fluid; namely elevated temperature, lowered pH, and reduced salinity. Lowered pH may be of particular importance in controlling distributions of calcifying organisms such as foraminifers. In transects taken moving away from the main vent sources, we ob-

served a largely barren zone, extending ˜150 m from vent mouths, where virtually no foraminiferal tests are found in surface sediment samples, and where very few tests are found adhering to rubble surfaces. Beyond this distance, the number of foraminiferal tests found in sediment and rubble samples quickly rises to levels comparable to samples far removed from venting areas. Foraminiferal assemblages do not appear to show elevated incidence of morphological anomalies. This, along with the fact that planktic globigerinid tests are more abundant further from venting areas, indicate that pH is a more important control of distribution than heavy-metal exposure. Laboratory experiments demonstrate that exposure of foraminifers to As3+ is more toxic than exposure to As5+. Arsenic exposure at concentrations of 0.2 mg/kg is enough to kill foraminifers in several days, and lower concentrations can adversely affect growth rates.