NUCLEIC ACID SYNTHESIS MEASUREMENTS IN SEDIMENT MICROBIAL COMMUNITIES: METHODS DEVELOPMENT AND FIELD APPLICATION

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ABSTRACT

A technique for measuring rates of nucleic acid synthesis in sedimentary microbial communities has been adapted from methods developed for marine and freshwater microplankton research. The procedure measures the uptake, incorporation and turnover of exogenous [2, ^{3}H]-adenine by benthic microbial populations. With minor modification it is applicable to a wide range of sediment types. Measurement of ribonucleic acid (RNA) and deoxyribonucleic acid (DNA) biosynthesis rates are reported from benthic environments, including coral reef sediments (Kaneohe Bay, Oahu, Hawaii), intertidal beach sands (Oahu and southern California), and California borderland basin sediment (San Pedro Basin), and comparisons are made to rates observed in water column microbial communities. Biomass-specific rates of nucleic acid synthesis in sediment microbial communities were comparable to those observed in water column environments. Biomass-specific DNA synthesis rates ranged from 0.02-2.0 pmol deoxyadenine incorporated into DNA ng ATP^{-1} h^{-1} for the water column and 0.07-0.98 pmol deoxyadenine into DNA ng ATP^{-1} h^{-1} for sediments. Biomass-specific RNA synthesis ranged from 0.20-6.5 pmol adenine incorporated into RNA ng ATP^{-1} h^{-1} for microplankton and 0.59-8.9 pmol adenine into RNA ng ATP^{-1} h^{-1} for sediments. DNA synthesis rates were used to calculate carbon production estimates ranging from 1.9 µg C cm^{-3} day^{-1} in San Pedro Basin sediment to 807 µg C cm^{-3} day^{-1} in sediment from the Kaneohe Bay reef. Specific growth rate (µ) estimated from DNA synthesis rates and ATP biomass in surface sediments ranged from 0.18 day^{-1} in San Pedro Basin to 6.0 day^{-1} in Scripps Beach (California) intertidal sand.