TEMPO AND MODE IN DEEP-SEA BENTHIC ECOLOGY: PUNCTUATED EQUILIBRIUM REVISITED

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The deep-sea floor is traditionally perceived as a remote and deliberate environment; a habitat where a gentle rain of detrital food particles and sluggish bottom currents force biological processes to proceed at slow, steady rates. In this view, benthic community structure is controlled by equilibrium processes, such as extreme levels of habitat partitioning (e.g., "grain matching") made possible by remarkable ecosystem stability. A number of recent discoveries indicate, however, that the deep-sea floor may be neither remote nor deliberate. Pulses of food and kinetic energy rapidly reach the seafloor from the dynamic upper ocean, and endogenous disturbances may be surprisingly frequent and intense. The biological processes driven by these events can be highly variable in space and time, exhibiting disequilibrium dynamics. I briefly review three types of events (large food falls, pulses of phytodetritus, and biogenic mound building) that "punctuate" the apparent "equilibrium" of the deep-sea floor, and describe how these events may change patterns of macrofaunal feeding, growth, recruitment and/or competitive exclusion. I then discuss how these changes may affect processes of paleoecological significance, including (1) the dispersal and evolution of chemosynthetic communities, (2) mechanisms and rates of trace production/destruction, and (3) maintenance of macrofaunal diversity at the ocean floor.