Ecological processes of extinction

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Extinctions of species are affected by biotic and abiotic process. Studies of extinctions observed in modern communities suggest that biotic and abiotic factors may work together in the process of extinction. For example, extinction observed in modern community caused by human activity is more serious in the species adapted to stable habitat than in the species adapted to fluctuating habitat. Here I constructed a simple mathematical model to examine the relationships between environmental instability and long-term macroevolutionary trends. The model assumes that individual fitness is determined by quantitative genetic characters that are related to intrinsic growth rates and mean carrying capacity. I examine the likelihood of extinction under different degrees of environmental instability and for rapid change of environmental instability. The extinction probability of a population is the lowest for taxa in the most stable environment. However, the extinction probability of a species becomes lowest for the species with high intrinsic growth rate and a low carrying capacity living in the most unstable environment and for the species with low intrinsic growth rate and a high carrying capacity living in the most stable environment, and it becomes the highest for taxa living in a moderately unstable environment. Increasing environmental instability changes the extinction probabilities of different taxa in different ways, due to differences in phenotypes and environments. The effect of environmental change is most serious for the taxa in the most stable environment. This also suggests that a continuously stable environment increases the extinction probability of taxa when environmental change occurs. Although catastrophic changes in environments are not presumed, these results are consistent with the existence of two macroevolutionary regimes in which a taxons extinction rate and its characters differ for mass extinction and normal extinction. Major extinction can occur as a result of long-term adaptation to a stable environment following a minor change of environment without catastrophes.