Evolution and biogeography of marine organisms on seamounts and oceanic islands

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Abstract

Islands are natural laboratories for evolution and biogeography studies. From MacArthur and Wilson to present days, understanding processes such as dispersion, extinction, speciation and immigration is key to elucidate currents patterns of islands biogeography. However, these processes have been better investigated for terrestrial/aerial than for marine organisms, for which oceanographic features (*e.g.*, currents, tides) and marine geologic processes (*e.g.*, bioconstruction) limit the analogy between these two realms. Thus, we aimed to review the Island Biogeography Theory in light of marine organisms, to test how species evolutionary history fits theory. We analyzed the evolutionary history of reef fishes that are endemic to Vitória–Trindade Chain (VTC), in the south Atlantic Ocean, to understand their relations to island evolution and sea-level fluctuations. We found that most endemic species, intertidal and cryptobenthic reef fishes, have evolved recently, during recurrent sea-level changes of the Pleistocene epoch where repeated aerial exposure of seamounts provides intermittent connectivity. The pattern is consistent with an ephemeral ecological speciation process. The speciation rate for marine organisms on islands is negatively correlated with immigration rate, similar to findings for terrestrial biodiversity. However, dispersion process is easier for marine species than for terrestrial ones, most niches are filled by immigration and speciation increases with the random accumulation of species with low dispersal ability, with few opportunities for in situ cladogenesis and adaptive radiation. Overall, as the geological history of islands proceeds, they loose terrestrial area by erosion but gain marine area trought deposition of eroded material and bioconstruction. This process could represent more spaces for niche accommodation. Thus, marine speciation rates in oceanic islands seem to increase not only with isolation but also over time. Moreover, we confirm that sea-level fluctuations and seamount presence play critical roles in marine evolution, mainly by intermittent providing connection (*i.e.*, stepping-stones process) for island colonization.

Keywords: endemism, Pleistocene, reef fish, sea level fluctuations, speciation

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