

Biogeography and the tempo of speciation in strombinid gastropods

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Land barriers and distances are still considered the most obvious trigger for speciation in the sea, but increasing biogeographic and genetic evidence show population discontinuities suggesting that mechanisms like currents and gradients can lead to isolation and species origination in contiguous marine populations. Unfortunately, most of these studies lack historical perspective on the amount of speciation related to each of these factors, resting on the fundamental assumption that the species involved are indeed the closest relatives to one another. The well documented formation of the Isthmus of Panama during the late Neogene, and the existence of large molluscan fossil collections, allow an evaluation of species level evolution and of the speciation events that occurred within a single ocean or across the developing land barrier. Cladistic phylogenies based on 49 shell characters were constructed for 42 fossil and recent species of the tropical American gastropod genus *Strombina* ranging from Trinidad to Panama through Florida to Columbia in the Caribbean sea, and from Mexico to Ecuador in the Eastern Pacific. Results show that the two main clades [*S.*(*Strombina*) and *S.*{*Lirastrombina* | *Spiralta*}] were dominant in one of the two oceans from the start and did not mix since the Middle Miocene. Only one out of five new subgenera originated across the isthmus and only eight out of 41 speciation events are transisthmian events. The evaluation of geographic distributions for each ancestral/descendent pair show that 90% of all speciation events occurred in a single ocean over distances smaller than 1000 Km regardless of mode of larval development. Overall results show that speciation tends to occur over very short distances and barriers need to be sought in changing paleoceanographic conditions.