

Gambling with Australian brachiopods

Understanding the differential extinction of taxa is one of the primary goals of paleobiology. Extinction can be thought of as a Gambler’s Ruin type process, with the eventual disappearance of a taxon being inevitable regardless of the odds of “winning” or “losing”. What is of interest, instead, is how long it takes for a gambler to “go bust”. We can imagine a genus as a “gambler” with its constituent species as betting pieces. How long it takes the genus to “go bust,” or the expected duration, is in part affected by properties of the genus and its constituent species. By comparing genera with similar properties to those with different, it is possible to estimate how differences in adaptive zone may “tip the scales” of generic extinction risk.

Using the Australian record of Permian brachiopods, I analyzed the effect of factors such as substrate and habitat preference, body size, and biogeographic occupancy on taxonomic durations in a parametric survival analytical framework. Substrate and habitat preference measured as the probability of occurrence in a given category while occupancy was estimated using a biogeographic network approach where modules are determined by taxon-locality association. This particular fossil sequence was chosen because it represents a relatively complete and well-worked sequence. During the Permian the east coast of Australia faced the Panthalassic Ocean and may have represented a partially isolated biogeographic province. This allows for the estimation of specific selective differences associated with the regional, as opposed to global, environment (*sensu* Simpson). In addition to biogeographic occupancy, the inclusion of factors unique to the different taxa greatly improves the model of taxon duration. This implies that extinction in brachiopods does not completely follow a Field of Bullets mode, but is instead at least partially selective with respect to biology.