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Geosci 541

April 18 2016

Reading 12

The Red Queen and Court Jester: Species Diversity and the Role of Biotic and Abiotic Factors Through Time

Author: Michael J. Benton (2009)

Summary: This paper really dives into what the Red Queen and Court Jester hypotheses are and their relevance to the fields of paleontology and conservation biology. The Red Queen model is evolution controlled by biotic factors such as competition and predation, buoyed by Charles Darwin’s ideas on natural selection, while the Court Jester model supports evolution through the control of abiotic factors such as habitat size and climatic controls. According to the paper, the difference between the two models may depend only on scale. It is important, therefore, to study species diversity in order to understand the interactions of the two models. One way of studying species diversity through time is by using the taxic approach which considers species, genera and families as independent variables against other controls. The phylogenetic approach is to use cladograms to study clade histories. The author chooses to focus on global taxic studies to try to determine some possible correlations with the Red Queen and Court Jester models.

He does this in three steps. First, he considers the global pattern of diversification through time which may be explained through two other models: the saturation/equilibrium model which implies biotic controls (Red Queen), and the expansion model which becomes “dampened” by limiting factors which (seemingly) can be biotic or abiotic. He then goes on to talk about large-scale controls on species diversity and the importance of phylogenetic studies of clade histories. To sum it all up, he basically says that these two models are inter-related to each other and not truly independent, and that it may be necessary to consider them both when looking at fossil data. He favors the Court Jester model for extinctions that are “coordinated” on a large scale and associated with biotic changes, while he favors the Red Queen model for extinctions on a smaller temporal scale.

What I liked: I liked that this paper was short and in some aspects it was very detailed. For example, the author was very clear on the interaction of biotic vs. abiotic factors and I liked that he pointed that biologists traditionally favor the Red Queen model while geologists who think on larger time-scales prefer the Court Jester model. I think that what Benton says in this paper makes sense, that the model used depends on the scale you’re investigating at.

What I disliked: On the surface this paper seems very well-presented and thoroughly explained. However I found myself having to go to other papers for explanations. I found a book (Google Books) called “Darwinism and its Discontents” by Michael Ruse. I read only a few pages but he was very clear in just a few sentences explaining the differences between the logistic/equilibrium model and the expansionist model (for example, what does Benton mean by “damping” when he explains the expansionist model? I found out what it means but I was super confused while reading his paper. Also, “dampened” is a weird word to use. I think a better word would have been “curbed” or “impeded”). I also don’t think he defined a logistic model very well. I also think this paper, while interesting, was pretty repetitive when it talked about biotic and abiotic factors. I don’t think the author needed to list them all out each time he mentioned them.

Diagrams: Figure 1 shows the differences between the Red Queen and Court Jester models at different temporal and geographic scales. I definitely think this is a great diagram to have in this paper. It shows that the Court Jester works better over larger ranges on the continental scale and well as over the genus life span (3-6 My). Figure 2 shows a plot of the marine animal diversification through the Phanerozoic and shows estimates for both corrected and uncorrected data. Figure 3 shows phylogenetic relationships and morphospace occupation for Triassic archosaurs. 3A shows that Dinosauria expanded in two steps (two black dots on the diagrams). 3B shows their morphospace, which is moderate in comparison especially to crurotarsan morphospace.