



SFI TRANSMISSION

COMPLEXITY SCIENCE FOR COVID-19

STRATEGIC INSIGHT: Beyond our response to the pandemic itself lie the longer-term effects, including new opportunities.

FROM: Doug Erwin, Smithsonian Institution;
Santa Fe Institute

DATE: 13 April 2020

NO: 014.1

When Rahm Emanuel, then President Obama’s Chief of Staff, said, “You should never let a serious crisis go to waste,” he was channeling Winston Churchill and the economist Joseph Schumpeter. The great mass extinctions and smaller biotic crises documented by the fossil record reveal that life long ago discovered the importance of not letting a crisis go to waste, if not in quite the same manner intended by Emanuel. My first paper in college was about the end-Permian mass extinction, the greatest of all mass extinctions, which wiped out perhaps 90 percent of all species in the oceans some 251 million years ago, and almost as many plants and animals on land. Yet the extinction itself really is not very interesting, at least not to me, because in the aftermath of that cataclysm came dinosaurs, mammals, modern insects, turtles, ichthyosaurs and probably the first flowering plants, as well as most of the invertebrate clades populating modern oceans. The great question (and the one that first drew me to SFI) is, what sort of opportunities were generated by this crisis, and how did life respond?

I in no way want to diminish the very real fear that many feel now, nor the frightening days that lie ahead for many in this country and elsewhere around the world. Many will die, even more will suffer serious illnesses, and myriad businesses and institutions will disappear. But, as treatments and vaccines come online, we will get through this, and knowing that allows us to begin to consider what we can learn from this event. And I see questions similar to the ones that I have been asking about the end-Permian episode: What factors favor survival, whether of people or of institutions? How do these factors relate to those favoring success prior to the pandemic? In many past crises, the factors favoring survival have had little to do with those that provide an advantage during “normal” times. Can we design models to evaluate alternative treatments that would modify these outcomes (aside from the obvious ones of more timely interventions at the outset)? Resilience has long been a central theme at SFI; like the 2008 financial crisis,

this pandemic provides an opportunity to articulate the factors underlying robustness in social, economic, and other systems, and to distinguish resilience factors that may be unique, either to this event or to pandemics in general, from those factors that enhance resilience more generally. Hurricanes, earthquakes, megafires in the western US, and, of course, climate change are just a few of the events in which resilience plays a critical role, and which argue for strengthening our portfolio in this area.

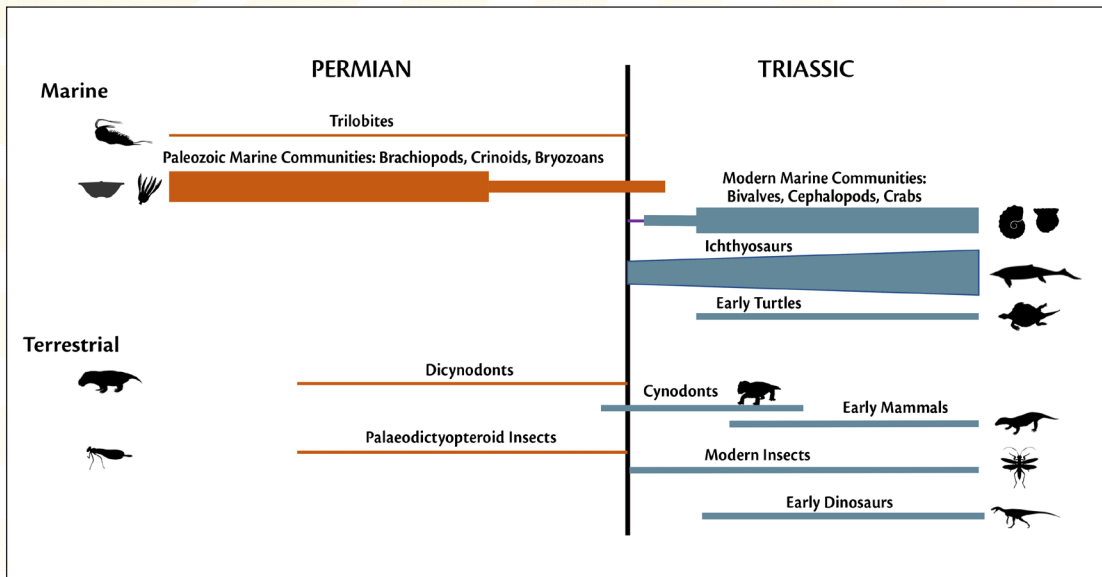


Figure: The disappearance of some Permian groups and appearance of some modern groups. Images from *Phylopic.org*.

Finally, the turtles — one of the oldest has been found near Ghost Ranch, just north of Santa Fe. There is no hint of an ichthyosaur or a turtle fossil pre-dating the end-Permian mass extinction. But ichthyosaurs and turtles exploded in diversity in the aftermath of the extinction as they helped construct entirely different ecosystems from those before the extinction. Beyond our response to the pandemic itself lie the longer-term effects, including new opportunities — social, political, economic, and otherwise. The deeper the crisis, the greater the subsequent opportunities, and the greater the possibility of shaping these opportunities.

Read more posts in the Transmission series, dedicated to sharing SFI insights on the coronavirus pandemic: santafe.edu/covid19