A Phanerozoic Paleo-environmental Timeline

The timeline at right attempts to summarize some of the major changes in the global environment over the last 540 million years. That period of time, the Phanerozoic Eon, is significant because it is the time in Earth history in which organisms have generated easily-recognized fossils. It is thus the time both in which we have an easy-to-see record of life and within which we can use fossils to determine the ages of sedimentary strata.

The four curves that make up most of the diagram are generally correlative (or inversely correlative) with each other. Thus, for example, the Ordovician to mid-Devonian was a period of continental separation, high P_{CO2}, high sea level, and generally warm global climate. The same generalizations hold for the late Jurassic to Paleogene, whereas the opposites were true in the Pennsylvanian to Permian.

There are explanations of why those correlations exist. Collision of the continents may involve stacking of continental crust (as presently exists under the Tibetan Plateau), lessening the area of the continents and thus allowing lower sea level. On the other hand, if sea level is (or is also) a function of the rate of sea-floor spreading and thus size of the mid-ocean ridges, then greater volcanism may account for the correlation of greater P_{CO2} with high sea level. The Devonian decrease in P_{CO2} is also tied to the evolution and diversification of land plants shown at the top, and other drops in P_{CO2} may result from weathering of rocks exposed in orogenies associated with collision of the continents. Variation in the atmospheric concentration of CO_2 (a greenhouse gas) is easily linked to changes in global climate. However, the greater albedo (reflectance of solar radiation) of the sea than the land also explains part of the link between sea level and climate. Finally, although plant evolution influenced change in P_{CO2} in the Devonian, conversely decreasing P_{CO2} in the Neogene favored the evolution of C4 photosynthesizers shown at the top.

One might look at this timeline and say "Global climate has changed greatly in the past, so why worry about human-induced climate change now?" Two answers might be "Life and ecosystems could respond to global change over tens of millions of year in the past, rather than over just decades to centuries" and "the dinosaurs didn't have to worry about Jurassic sea-level rise because they hadn't build most of their infra-structure along the shores of the Jurassic oceans".