Scientists have long considered the world's fossils to be an incomplete chronicle of the past. Charles Darwin called the geological record a "history of the world imperfectly kept, and written in a changing dialect." Darwin wasn't wrong—after all, only some organisms in some places leave behind fossils, and only a small fraction of those fossils have been found—but scientists are now learning how to make best use of that incomplete history. Kidwell has combined geological fieldwork, experiments in the lab and measurements in modern environments to investigate how the fossil record is formed and how to best use it to understand the past and anticipate the future of today's biodiversity. In comparative analyses along environmental gradients and across geologic time, she determined the major controls on how and where marine life is preserved, providing a strategy for extracting the most reliable data from the fossil record. That has opened new opportunities for discoveries about the ecology and evolution of ancient life. She showed that misfits between live populations and the seashells they leave behind on modern seafloors signal not poor preservation but a recent ecological shift, almost always driven by human activities such as pollution or seafloor dredging. This research has fostered a new field of science, conservation paleobiology, which uses the youngest part of the fossil record to determine the baseline condition of ecosystems and evaluate the effects humans have had on biodiversity.