

From greenhouse to icehouse: Climatic cooling during the Ordovician caused explosion of marine diversity

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Video Abstract

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Abstract

Over 470 million years ago, during the geological period known as the Ordovician, vast oceans dominated the globe. This period saw the rapid emergence of many life forms. In fact, fossil evidence suggests a tremendous expansion of marine life, unparalleled for hundreds-of-millions-of-years. But what led to this explosion of biodiversity? Scientists now believe it may have been abrupt climatic cooling and the onset of icehouse conditions that lit the fuse. Many past studies have concluded that a major increase in marine fauna began sometime during the mid-Ordovician. The Great Ordovician Biodiversification Event, as it's called, forever changed the biological composition and structure of oceans, with the evolution of many animal groups still present today such as jawed fish, corals, and cephalopods. Historical factors responsible for this event, however, have been highly debated. In an attempt to settle this debate, an international team of researchers collected and analyzed more than 45,000 trilobite and brachiopod fossils from present-day Russia and Estonia. From these, sea-level and climate data were obtained, that enabled the researchers to link the spike in diversity to a sudden drop in global temperature. It's likely that the icehouse conditions inferred in this study replaced greenhouse conditions, where ocean temperatures were much higher and, as a result, deep-water oxygen levels much lower. As temperatures dropped and deep-ocean currents developed, nutrient-rich waters were brought to the surface and oxygen was circulated to the ocean floor. The researchers speculate these important events opened new ecological space, thus driving one of the greatest expansions of marine biodiversity the world has ever seen.