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The role of ocean carbon cycle disruptions in past and present climate transitions

Humans have emitted an estimated 45 billion metric tons of carbon to Earth's surficial carbon cycle in less than 300 years. This massive perturbation to the natural balance of carbon fluxes poses profound consequences to 21st century climate and our society. The implications of this disruption depend greatly on Earth's oceans, which are the principal carbon reservoir in direct contact with the atmosphere, and which contain nearly sixty times more carbon than the atmosphere. Here I will discuss recent developments in geochemistry that allow quantitative reconstructions of past changes in ocean carbon cycling. I will present new data showing a stark change in deep ocean carbon content during the Pliocene transition, a fundamental shift in Earth's climate rhythms 1 million years ago. This past view on coupling between the ocean carbon cycle and global climate will be discussed in the context of today's anthropogenic carbon emissions and future climate projections.