Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18204

Coupled change in ocean CO_2 chemistry and global climate in the Palaeozoic

MOLLY TRUDGILL[1,2], DR. HANA JURIKOVA[1], THEODORE PRESENT[3], ANDREA BURKE[4], KRISTIN BERGMANN[5], DAVID EVANS[6], SETH FINNEGAN[7], WILLIAM R GRAY[8], OLLE HINTS[9], AIVO LEPLAND[10], TONY PRAVE[1], JOSHUA B. ZIMMT[7] AND JAMES W. B. RAE[1]

[1]University of St Andrews
[2]CNRS - Laboratoire des Sciences du Climat et de l'Environnement (LSCE/IPSL)
[3]California Institute of Technology
[4]School of Earth and Environmental Sciences, University of St Andrews
[5]Massachusetts Institute of Technology
[6]University of Southampton
[7]University of California, Berkeley
[8]Laboratoire des Sciences du Climat et de l'Environnement (LSCE/IPSL)
[9]Tallinn University of Technology
[10]Geological Survey of Norway

Presenting Author: Molly.Trudgill@lsce.ipsl.fr

The Ordovician and Silurian periods were times of major environmental and biological change, including the Great Ordovician Biodiversification Event (GOBE) and the oldest of the five major mass extinctions (the end-Ordovician), which occurs at the culmination of major long-term cooling and glaciation followed by biological, and climatic, recovery in the early Silurian. However, the drivers of environmental change in this interval remain debated. CO_2 estimates are sparse and vary by almost an order of magnitude, and non-CO_2 drivers, including volcanic aerosols and meteoritic debris, have also been proposed. Here we present the first reconstruction of ocean pH, and thereby ocean-atmosphere CO_2 chemistry, for the Ordovician and Silurian using the boron isotope composition of well-preserved fossilised brachiopods. These data show a substantial rise in ocean pH and an associated fall in atmospheric CO_2 coincident with the large cooling trend and major radiation in biodiversity through the Ordovician. CO_2-driven cooling thus sets the stage for the glaciation thought to trigger the end-Ordovician extinction event, while rising CO_2 in the early Silurian would have driven climatic recovery. Our findings demonstrate persistent coupling of CO_2 and climate on geological timescales and the pervasive influence of CO_2 on the Earth system and biospheric evolution.