PRESS RELEASE

30 October 2020

Marine plankton hunt to survive mass extinction

- Scientists shed new light on recovery of ocean ecosystems following dinosaur extinction
- Fossils prove some marine organisms turned to hunting in order to survive
- The findings are to be published in an influential journal

Scientists have compiled a comprehensive fossil record that shows how some marine organisms evolved into hunters to survive the prolonged darkness after the asteroid impact that wiped out the dinosaurs 66 million years ago.

A team that includes an ocean ecologist from the Lyell Centre, a partnership between Heriot-Watt University and the British Geological Survey, and colleagues from London, Southampton, Bristol, Paris and California, examined fossilised plankton cells in combination with a new eco-evolutionary model.

They developed an in-depth record of fossil plankton skeletons, with a focus on a group known as the coccolithophores, which reveal a striking shift in lifestyle, shedding light on the mass extinction kill mechanism itself and why some marine organisms survived whilst others perished.

The findings will be published this week in the journal Science Advances (30 October 1800 GMT).

Dr Alex Poulton from the Lyell Centre has collaborated on the research over the past two years and is an expert on coccolithophore ecology in the modern ocean.

He explains: “We know that most modern coccolithophores rely on the ability to photosynthesise to support their nutrition, similar to plants, though we suspect that some can combine photosynthesis with the ingestion of prey when nutrients are exhausted. Examination of pristine fossilised cells has shown us that after the asteroid impact, when there was a long period of darkness, coccolithophores turned to this ability to ingest prey to survive and prosper.

"They evolved into different forms that had the ability to both photosynthesize and ingest prey to survive, something we term mixotrophy."

Around 66 million years ago, the Cretaceous-Paleogene (K-Pg) mass extinction was triggered by an asteroid impact leading to an estimated 90 percent of all plant and animal species on Earth to die out.

Known as the Cretaceous–Paleogene extinction event, the impact plunged the planet into darkness with a vast amount of debris, aerosols and soot thrown into the atmosphere, causing cooling and acidification over days and years.

Dr Poulton adds: "With almost all life dying out on land there would have been a huge amount of organic material washed into the ocean, creating a nutrient-rich 'soup' for bacteria and in turn an abundance of food for small planktonic organisms that could consume them. Abundant food allowed mixotrophic coccolithophores to thrive, with new species evolving with larger cells until eventually light conditions in the ocean recovered, photosynthesis could again become dominant and more complex food webs could form.

"We understood that the period of darkness led to the shutdown of what is known as the biological carbon pump – a key mechanism for the transfer of carbon from the surface ocean into the deep-sea – and this shutdown lasted for hundreds, if not thousands of years. What our research shows is the critical role of coccolithophores in maintaining oceanic ecosystems and getting the carbon pump back up and running."

Dr Sam Gibbs of Southampton University, lead author of the study, adds: "If marine plankton hadn't had this ability to adapt to the sudden prolonged darkness by relying more on their hunting nature, it's likely that marine life would have been reset all the way back to very primitive organisms, and its questionable whether we would now have the complex ecosystems we have in today's ocean – they certainly would have looked very different."

As one of the co-authors of the study, Andy Ridgwell, a Professor of Geology at the University of California, summed up the research as: "It's the ultimate Halloween story – when the lights go out, everyone starts eating each other."

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Media contact: Craig McManamon, Communications Officer on 07933 701003 or email mediaenquiries@hw.ac.uk

Notes to editors

Images attached available for use.

Image 1: Shows high-resolution scanning electron microscope (SEM) images of fossil cell coverings of nannoplankton (coccolithophores) highlighting holes that would have allowed flagella and haptonema to emerge from the cell and draw in food particles (red dots). Please credit image: Courtesy of Paul Brown.

Image 2: A Scanning Electron Microscope (SEM) view of a seafloor after the extinction showing the abundance of these cells with flagellar openings. These cells are around 7 microns in diameter (7/1000ths of a millimetre) with the scale bars next to each image showing the size of a micron (1/1000th mm). Please credit image: Courtesy of Paul Brown.

The research was published in Science Advances:
https://advances.sciencemag.org/lookup/doi/10.1126/sciadv.abc9123

About the Lyell Centre

The Lyell Centre is a strategic partnership between Heriot-Watt University and the British Geological Survey, funded by the Natural Environment Research Council (NERC), the Scottish Funding Council and Heriot-Watt University. The partnership enables them to work together combining their expertise in land and marine geoscience. Exploring themes ranging from geology and geophysics to marine ecosystems, the centre's combination of pure and applied expertise employs innovative methods and technologies to society's most important environmental science and energy challenges.

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