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TITLE: Pan genome of the phytoplankton Emiliania underpins its global distribution

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ABSTRACT:

Coccolithophores have influenced the global climate for over 200 million years. These marine phytoplankton can account for 20 per cent of total carbon fixation in some systems. They form blooms that can occupy hundreds of thousands of square kilometres and are distinguished by their elegantly sculpted calcium carbonate exoskeletons (coccoliths), rendering them visible from space. Although coccolithophores export carbon in the form of organic matter and calcite to the sea floor, they also release CO2 in the calcification process. Hence, they have a complex influence on the carbon cycle, driving either CO2 production or uptake, sequestration and export to the deep ocean. Here we report the first haptophyte reference genome, from the coccolithophore Emiliania huxleyi strain CCMP1516, and sequences from 13 additional isolates. Our analyses reveal a pan genome (core genes plus genes distributed variably between strains) probably supported by an atypical complement of repetitive sequence in the genome. Comparisons across strains demonstrate that E. huxleyi, which has long been considered a single species, harbours extensive genome variability reflected in different metabolic repertoires. Genome variability within this species complex seems to underpin its capacity both to thrive in habitats ranging from the equator to the subarctic and to form large-scale episodic blooms under a wide variety of environmental conditions.

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