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Complex response of dinoflagellate distribution patterns to cooler early Oligocene global oceans

Mark Woods (1), Thijs Vandenbroucke (2), Mark Williams (3), James Riding (1), Stijn De Schepper (4), and Koen Sabbe (5)

(1) British Geological Survey, Nottingham, United Kingdom (maw@bgs.ac.uk), (2) UMR 8217 du CNRS : Géosystèmes, Université Lille 1, Avenue Paul Langevin, bâtiment SN5, 59655 Villeneuve d'Ascq Cedex, France, (3) Department of Geology, University of Leicester, University Road, Leicester, LE1 7RH, United Kingdom, (4) Department of Earth Science, University of Bergen, Allégaten 41, 5007 Bergen, Norway, (5) Protistology and Aquatic Ecology, Department of Biology, Ghent University, Krijgslaan 281-S8, 9000 Ghent, Belgium

Analysis of dinoflagellate cysts using two new global ocean datasets for the Mid Eocene (Bartonian) and Early Oligocene (Rupelian) reveals unexpected changes in their global distribution. The impact of Rupelian cooling appears to be globally asymmetric; the dinoflagellate cyst cooling signal is clearer in the southern hemisphere, but much less evident in the northern hemisphere. Additionally, a significant number of species with low and mid-latitude northern hemisphere occurrences in the Bartonian, unexpectedly extend their northward ranges in the Rupelian, including some 'warm water' forms. This may show that Rupelian dinoflagellate cyst distribution is a response to changes in a range of environmental variables linked to climate-cooling, for example changes in nutrient fluxes triggered by glacially-induced base-level fall, or complex reorganisation of ocean current systems between the Bartonian and Rupelian. Apparent lack of a clear climate-cooling signal in Rupelian dinoflagellate cyst distribution may in part reflect published evidence suggesting that summer SSTs in the early Rupelian northern hemisphere were only slightly reduced compared to the later part of the Eocene, despite much colder winters. The relatively broad temperature tolerance of many extant dinoflagellate species, and dormant cyst formation during short-lived environmental deterioration, may have contributed to allowing Rupelian dinoflagellates to thrive in more highly seasonal but otherwise hospitable, northern hemisphere oceans.