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Enhanced boreal connectivity and termination of the Toarcian OAE in NW-Europe

Sander Houben (1), Fabian Ercan (2), Guillaume Suan (3), Dario Harazim (4), Boris Nikitenko (5), Roel Verreussel (1), and Bas van de Schootbrugge (2)

(1) Geological Survey of the Netherlands - TNO, Utrecht, The Netherlands, (2) Marine Palynology and Paleoceanography, Faculty of Geosciences, Utrecht University, Utrecht, The Netherlands, (3) UMR CNRS 5276 LGLTPE, Université Lyon 1, Villeurbanne, France, (4) Howe-Russel-Kniffen Geoscience Complex, Louisiana State University, Baton Rouge LA, USA, (5) Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia

The Early Toarcian Oceanic Anoxic Event (T-OAE, ∼182 Ma ago), represents a major episode of organic-rich deposition, especially in the epeiric basins of NW-Europe. The T-OAE is accompanied by a substantial (3-7‰ negative carbon-isotope excursion (CIE), recorded in various marine and terrestrial carbon substrates. Consequently, the onset of the T-OAE has been linked to the combined effects of global warming, nutrient input driving high productivity, and basin restriction leading to poor ventilation. The processes that led to the termination of anoxia and organic-carbon burial remain elusive.

Here, we present new palynological and micropalaeontological data from Arctic Siberia (Russia), the Viking Strait (offshore Norway and the British northern offshore), and various locations in the Southern North Sea Basin (SNSB; UK, Netherlands) all spanning the Late Pliensbachian to Late Toarcian. Rather than a typical "dinocyst black-out", as recorded in T-OAE strata of the SNSB, the Arctic Siberian record shows high abundances of dinocyst genera throughout the T-OAE. Significantly, various species of the *Parvocysta* and *Phallocysta* suites make their first appearance already in strata corresponding the Early Toarcian falciferum Ammonite Zone. A similar “early” appearance of these suites corresponds to the T-OAE in hydrocarbon exploration wells drilled along the northern fringes of the Viking Strait. Subsequently, these successions herald a substantial late Early Toarcian facies deepening. In contrast, in successions from the SNSB, the *Parvocysta* and *Phallocysta* suites first appear substantially after the T-OAE (corresponding to the Bifrons Ammonite Zone).

We interpret the palynological patterns as a southward migration of Arctic species, driven by a combination of relative sea-level rise and tectonic subsidence of the Viking Strait. These processes led to the establishment of a substantial marine conduit between the SNSB and the Arctic realm. Trace element records from the SNSB reflect major changes at this level, likely due to mixing of different water masses and drawdown of trace metal inventories under dysoxic conditions. Hence, it appears that euxinic conditions in the SNSB were terminated by an opening of a marine boreal conduit and associated influx of cold polar waters.