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A warming pulse in the subtropical North Atlantic in response to Oceanic Anoxic Event 1a at ODP Site 641C

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The early-Cretaceous greenhouse period is characterized by several major perturbations of the ocean-climate system which are documented in severe disturbances of the global carbon cycle. One of the more pronounced perturbations of global carbon cycle occurred during the early Aptian Oceanic Anoxic Event 1a (OAE 1a, Selli-Event, ca. 120 Ma) and is well documented by organic carbon-rich sediments from marine and terrestrial localities worldwide. The trigger mechanism and the environmental consequences of OAE 1a are still under dispute. Here we present a new TEX 86 (tetraether index of tetraethers containing 86 carbons) based temperature record from the Galicia Margin at ODP Site 641C which reveals a significant and sustained warming of subtropical North Atlantic surface waters directly linked with OAE 1a. Sea surface temperature (SST) progressively rises by more than 5°C to well above 30°C over the course of OAE 1a. High temperatures are sustained over several 100 hundred thousand years before a temperature decline of the same order of magnitude as the initial rise. The decline in SST marks the recovery period and termination of OAE 1a. The warming of the sea surface during OAE 1a is associated with intensified weathering conditions along Galicia Margin and a rise of the carbonate compensation depth in the North Atlantic Ocean. The onset of the warming pulse is correlated to the initiation of a long lasting volcanic episode in the Pacific Ontong Java area, suggesting that emission of volcanic greenhouse gases was the ultimate driver for warming during OAE 1a. Several intermittent SST decreases of 1 to 2.5°C are superimposed on the overall warming trend of the Galicia Margin record suggesting a link with similar, but even stronger, surface water cooling episodes in the central Pacific region. The exact nature and timing of these intermittent cooling periods and their direct relation to volcanic activity remains to be discovered but we suggest that global fluctuations in pCO2 in response to variations in the intensity of Pacific volcanic activity may have been responsible for the observed cooling episodes in both oceanic basins.