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An extraordinary biogenic deposition event – massive diatom deposition within the Pleistocene subtropical South Atlantic

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Up to 1.5 m thick almost monospecific layers of the giant diatom Ethmodiscus rex (RATTRAY) HENDEY have been reported from Pleistocene calcareous sediments of the subtropical South Atlantic between 23˚ and 34˚S. The massive E. rex accumulation is situated below the South Atlantic subtropical gyre where typically calcareous nannofossil oozes constitute the biogenic fraction of the sediments. Sedimentation rates of this oligotrophic region are as low as 1 cm kyr^{-1} and surface waters are at present less favorable for diatom growth due to a low silica content. Since giant diatom species like E. rex are adapted to open ocean front conditions, sea-surface temperatures (SST) and salinities have been reconstructed based on planktonic foraminifer Mg/Ca and stable oxygen isotope measurements to test whether the extraordinary occurrence of an ocean frontal system could have provided the conditions to deposit such a layer.

According to benthic oxygen isotope stratigraphy, the diatom layer was deposited between 538.7 and 551.8 kyr (MIS 14) close to the end of the Mid-Pleistocene Transition. The reconstructed sea-surface temperatures and salinities show an anomalous high variability during the deposition of the E. rex layer. Minimum temperatures are even lower than temperatures observed in other glacial stages like MIS 12, and MIS 16. Local SST maxima are close to or even exceed interglacial temperatures from MIS 13 and MIS 15. The observed sudden changes in temperature and salinity are inter-

preted to result from an oceanic front which has crossed the core location several times between approximately 539 and 550 kyr.

But how could an open ocean front have formed within the subtropical gyre stabilized today by the continental boundaries and the Southern Hemisphere wind systems? It seems that these extraordinary diatom layers were synchronous to unusual paleoclimatic events in other regions like a peak magnetic susceptibilities in the loess deposits of China, or an anomalously thick sapropel layer in the Mediterranean Sea, and a minimum in Southern Hemisphere dust supply as recorded by the EPICA Antarctic ice core (EPICA 2004). This would indicate that the massive deposition of giant diatoms in the subtropical South Atlantic might have been related to a large paleoclimatic disturbance at the end of the Mid-Pleistocene Transition.