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THE WARM DEEP OCEAN CONVEYOR DURING CRETACEOUS TIME

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Deep-ocean water is usually associated with its high-latitude deep-water sources. In this understanding of deep-water production the warm deep ocean during Mesozoic-Cenozoic time is a challenge. It may be questioned whether warm deep-ocean water, which is direct geologic evidence, does reflect warm polar surface-ocean regions. The latter is a deduced supposition, rather than geologic fact. The problem is that for the warm Cretaceous, it is difficult to maintain strong poleward heat transport in the case of reduced oceanic thermal contrasts. Usually, atmospheric feedbacks, in conjunction with the increase of atmospheric concentrations of greenhouse gases, are employed in order to explain the warm equable Cretaceous-Eocene climate. However, there are indications that southern subpolar ocean was warmer than the northern oceans. There is no feasible physical mechanism – sea-water density depends on both temperature and salinity – that could maintain warm subpolar surface oceans in both hemispheres, an assumption often used in atmospheric modeling. This study explores a hypothesis that a warm deep ocean could coexist with relatively cool subpolar (high-latitude) sea surface in one hemisphere and a warmer subpolar sea surface in another hemisphere. Numerical ocean circulation experiments confirm that having one relatively cool high-latitude sea surface in at least one hemisphere is sufficient for driving a strong meridional overturning and corresponding poleward heat transport that might have kept the abyssal ocean warm during the Cretaceous and other warm-climate periods in geologic history.