



Constraining the effect of variations in volume and isotopic composition of the Antarctic ice sheet on the oxygen-isotope ratio of seawater during the Middle Miocene.

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The melting or build-up of ice sheets affects the oxygen-isotope composition of seawater in two ways: through a change in (1) ice volume and (2) the isotopic composition of the ice.

We use an ice sheet-climate model to investigate the relative contribution of these two effects during the Antarctic glaciation event in the Middle Miocene. Our results show that the major part of the increase in the isotopic composition of seawater during this time period is caused by the build-up of the Antarctic ice sheet. Only approximately 15 % of the increase can be explained by a stronger isotopic depletion of the resulting larger ice sheet as compared to the small, initial ice sheet. We furthermore analyze the relationship between ice volume, its isotopic composition and the oxygen-isotope ratio in seawater in a range of possible scenarios. The change from a small to a large ice sheet induces a change in marine oxygen isotopes of at least 0.2 permille, but can be much larger. The modelled change in isotopic composition of seawater in the Middle Miocene can explain about 90 % of the increase found in the benthic marine records.