



Insights into peatland expansion and methane cycling on the East Antarctic continent in the early Eocene

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The high temperature, high $p\text{CO}_2$ world of the early Eocene (~55 to 49 Ma) greenhouse may be an analogue for the future response of the biosphere and global carbon cycle to recent anthropogenic, atmospheric CO_2 forcing. Here we present an early Eocene record showing that the expansion of peatlands and methanogenesis in coastal wetlands on Antarctica was an important part of the carbon cycle in this greenhouse world. Terrestrial biomarkers were analyzed from IODP Expedition 318 - Site U1356A, situated along the Wilkes Land margin of East Antarctica. Bacterial-derived, C31 ($17\alpha,21\beta$) homohopane within a relatively immature hopane assemblage from Site U1356A suggests that wetland environments were present on the Antarctica continent in the early Eocene. Fluctuations in the concentrations and the molecular structure – the $\beta\beta/(\alpha\beta + \beta\beta)$ ratio – indicate that the extent of these wetlands fluctuated in a coherent way, suggestive of an external forcing, presumably orbital. The compound-specific carbon isotope values ($\delta^{13}\text{C}$) of hopanes are consistently 5 to 10 permil lower than those of the higher plant n-alkanes, which suggest that the bacterial precursor organisms were likely a mixture of heterotrophs and methanotrophs. The long-term trends in these biomarker parameters are consistent with changes in the sea-surface temperatures recorded by the TEX_{86}^H proxy and suggest an important role for methanogenesis in wetlands on the early Eocene, Antarctic continent. We compare the hopane biomarker results with compound-specific, hydrogen-isotope measurements on higher plant n-alkanes and conclude that these wetland changes indicate an enhanced hydrological cycle in the southern high latitudes. We are currently exploring new biomarker data from other Southern Ocean, early Eocene sites proximal to the Antarctic margin to determine if the orbitally-driven expansion of peatlands along the Wilkes Land margin, East Antarctica applies to the whole of the Antarctic coastal environment, or if the peatland dynamics were specific to the Wilkes Land margin.