Variations of atmospheric methane concentrations for the last 110,000 years deduced from Antarctic and Greenland deep ice cores

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Variations of atmospheric methane (CH4) concentration for the last 110,000 years were obtained form Greenland ice core (NGRIP) and Antarctic ice core (Dome Fuji). Quite similar variations of CH4 concentration were obtained from these cores. The CH4 concentration shows a rapid increase from the value of 350-400 ppbv to high value of 700-750 ppbv during the period of 20-10 kyr BP (Termination I), in association with the glacial-interglacial transition. During the glacial period of 110-20 kyr BP, the CH4 concentration decreased gradually toward the lowest value in the glacial maximum, showing a number of fluctuations with amplitudes of more than 100 ppbv. Such large concentration fluctuations are attributable to changes in the strength of CH4 sources and sinks on the Earth's surface, associated with global climate change. We also found small difference between the CH4 concentration of NGRIP core was always higher than that of Dome Fuji core. In order to translate the measured differences into quantitative contributions of CH4 sources in the tropics and the middle to high latitudes of northern hemisphere, we used a three-box model. The model results indicate that variations of CH4 concentration during the glacial and the Younger Dryas periods were mainly caused by changes in the CH4 sources in the middle to high latitudes of northern hemisphere. On the other hand, the variations of CH4 concentration were mainly attributable to the CH4 sources in the tropical region during the Termination I and the mid-Holocene.



図1上段:NGRIP(実線)コアおよびドームふじ(破線)コアから再現された過去の CH。濃度 の変動。NGRIP コアのデータの欠損期間についてはグリーンランドGISP2 コアの結果(灰線) も示す。下段:NGRI Pコアの氷の酸素同位体比(^{NB}0_{ice})。



図2 NGRIPコアおよびドームふじコアのCH4濃度データから推定された過去のCH4放出量の緯度 分布。横軸に記したそれぞれの期間は図1に示すとおりである。