

過去 250 年間の大気中メタンの同位体比変動の復元：フィルン空気・アイスコア測定とフィルン空気輸送モデルの適用

梅澤拓¹、菅原敏²、川村賢二³、杉山貴規⁴、森本真司⁴、青木周司⁴、中澤高清⁴

¹ 国立環境研究所

² 宮城教育大学

³ 国立極地研究所

⁴ 東北大学大学院理学研究科

Reconstruction of variations of isotopic ratios of atmospheric methane: measurements of firn air /ice core and applications of firn air transport model

Taku Umezawa¹, Satoshi Sugawara², Kenji Kawamura³, Takanori Sugiyama⁴, Shinji Morimoto⁴, Shuji Aoki⁴
and Takakiyo Nakazawa⁴

¹ *National Institute for Environmental Studies*

² *Miyagi University of Education*

³ *National Institute of Polar Research*

⁴ *Graduate School of Science, Tohoku University*

Methane (CH₄) is the second important greenhouse gas and plays an important role also in atmospheric chemistry. Atmospheric CH₄ abundance has increased over the industrial era due to enhanced anthropogenic CH₄ emissions. However, when and what types of CH₄ sources increased over the period remains as an open question. Air in porous layers above ice sheets (firn) and occluded in ice (ice core) can provide archived records of atmospheric CH₄ that cannot be traced in the worldwide systematic monitoring data of atmospheric CH₄ concentration initiated in the late 1970s. In addition, measurements of carbon and hydrogen isotopic ratios ($\delta^{13}\text{C}$ and δD) of CH₄ help to understand contributions of different types of CH₄ sources, since individual CH₄ sources are known to have characteristic $\delta^{13}\text{C}$ and δD signatures. We analyzed firn air samples collected in Antarctica (DF and YM85) and Greenland (NGRIP) as well as an Antarctic ice core (G15) for CH₄ concentration, $\delta^{13}\text{C}$ and δD . The datasets cover approximately 250 and 50 years back from the present in Antarctica and Greenland, respectively. Using a one-dimensional firn air transport model, we examine reconstructions of $\delta^{13}\text{C}$ and δD over the period of interest. Since simulated vertical profiles of isotopic ratios in the firn largely depend on atmospheric CH₄ concentration history and on diffusion effect given in the model, both of which however have substantial uncertainties, reconstructions of $\delta^{13}\text{C}$ and δD are not straightforward. In particular, reliable quantification of diffusion effect on $\delta^{13}\text{C}$ in the deep layers of firn (lock-in zone) is very challenging. In this presentation, we discuss plausible temporal changes of $\delta^{13}\text{C}$ and δD with range of uncertainties, inter-polar differences and implications for the global CH₄ sources.