以化學特性與鉛同位素探討2020年東南亞生質燃燒期間氣膠來源及傳輸過程

Tracing sources and transport of aerosols during Southeast Asia biomass burning by using chemical characteristics and Pb isotopes

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Abstract

During every dry season (February-April), Southeast Asia (SEA) biomass burning causes air quality deterioration to the environment in SEA and adjacent countries, even in remote areas and high mountains such as Mt. Lulin through westerlies. To understand the sources and transport processes of biomass burning aerosols, size-fractionated aerosol particles were sampled simultaneously in Thailand (Chiang Mai, during the onset of biomass burning) and at Mt. Lulin in March 2020. Samples were analyzed for water-soluble ion and metal concentrations, as well as Pb isotope ratios, to obtain detailed information on aerosol properties during Southeast Asia biomass burning activities.

Pb isotope ratio and metal ratios show that Mt. Lulin could have received aerosols from biomass burning activities, and the isotope ratios ($^{206}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$) are different from those observed in PM_{10} in central Taiwan. The aerosol $^{206}Pb/^{207}Pb$ ratio increased when biomass burning signals increased (elevated nss-K^+), possibly indicating the enhanced emission of crustal materials (with a high $^{206}Pb/^{207}Pb$ isotope ratio) during biomass burning and are consistent with those observations in previous studies. Other than biomass burning, contributions from anthropogenic sources (e.g., oil combustion or industrial source, characterized by low $^{206}Pb/^{207}Pb$ ratios) can also be identified in Chiang Mai aerosols, but the actual source of this Pb source needs further constraints. Overall, the results of this study suggest that the study on size-fractionated aerosol chemistry with Pb isotope ratio is useful for better understanding the source and transport of atmospheric particle matters. Further investigations, such as the O isotope, can provide additional information on NO_3^- or SO_4^{2-} formation processes during long-range transport, which will be implemented in the future.

關鍵字：來源與傳輸、氣溶膠、生質燃燒、化學特性、鉛同位素

Key words: source and transport, aerosol, biomass burning, chemical characteristics, Pb isotopes