Fungal spore contributions to subtropical aerosol particles

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Primary Biological Aerosol Particles (PBAPs), as derived from pollen, fungi, bacteria, viruses, algae, and plant fragments, have recently been shown to contribute sizeable portions of atmospheric particulate matter (PM) on global scale, specifically in coarse mode particles [1, 2]. Fungal spores in particular constitute an important type of PBAPs [3, 4]. A new method for estimating PBAP contributions was introduced by Bauer and coworkers by utilizing molecular source tracers, i.e., the polyols arabitol and mannitol [5]. While conversion factors from ambient tracer concentrations to fungal spore mass have been determined for a continental location in Europe [4, 5], there are no reports to date regarding the tracer characteristics of different types of fungal spores in other areas and specifically in Asia.

Our recent investigations have shown that fungal spore content in coarse PM can be rather high in tropical regions with contributions up to 26% of organic carbon and up to 18% of PM_{10} [6]. Ambient conditions, such as temperature and moisture, influence biological activity, including fungal spore release rates. Moreover, fungi species in different locations likely have varying polyol content. Therefore, it is crucial to determine the absolute and relative abundance of individual polyol tracers in different fungi species (i.e., source samples), as well as the concentrations of these tracers in ambient PM as a function of environmental conditions.

In order to address these open questions, size-resolved PM samples were collected at various sites across Taiwan, including coastal, urban, rural and high-altitude sites. In addition, various types of fungi were cultured. The polyol tracers arabitol and mannitol, along with other carbonaceous species, were quantified in the ambient and source samples by high-performance anion exchange chromatography (HPAEC). New insights into the size-dependent composition of fungal spore tracers in subtropical PM and in specific fungi species will be presented here.

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Hf-Nd isotope variations of late Cenozoic Arctic intermediate water reflect continental weathering

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The late Cenozoic glaciation history of the Arctic is important for understanding the global climate system and feedback mechanisms. However, such information from the Arctic basin itself is limited. The combined Hf-Nd isotope composition of past seawater in high latitudes has been suggested as a proxy for changes in intensity and regime of continental weathering due to fractionation processses as a function of weathering regime.Enhanced physical weathering during glaciations is expected to cause a more congruent release of Hf weathered from continental rocks. So far, there are, however, no records from the Arctic basin. We extracted combined seawater-derived Nd-Hf isotope compositions from the authigenic Fe-Mn oxyhydroxide fraction of two sediment cores recovered on Lomonosov Ridge (PS2185, ACEX), in order to reconstruct weathering regime and past circulation.

We produced ε_{Nd} (~-10.5) and ε_{Hf} (~0.4) signatures of AIW from the core-top sediments, which agree well with previously reported values directly determined on nearby water samples of AIW. Over time, Hf isotopes have in general become less radiogenic since 16 Ma, which is not observed for Nd isotopes. Similar to Nd isotopes, clear glacial-interglacial variations of Hf isotopic compositions were also observed in the late Quaternary, with more radiogenic Hf isotope signatures in glacial stages and less radiogenic Hf isotope compositions during interglacial stages. Unlike Nd isotope compositions of AIW, which are at present dominated by current inputs from the North Atlantic, Hf isotope signatures of AIW are apparently more influenced by input from local shelf sediments and surrounding rivers. Our interpretation for the long term Hf isotopic evolution is that they reflect progressively more congruent weathering of rocks of the continents surrounding the Arctic Ocean, associated with stepwise cooling of the Northern hemisphere. Glacial-interglacial variations of Hf isotopes also seem to have been controlled by the variable weathering regime as a function of climate and temperature changes.