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### DEVELOPMENT OF A NEW FRACTIONATION STRATEGY FOR THE ELEMENTAL AND ISOTOPIC ANALYSIS OF ATMOSPHERIC PARTICULATE COLLECTED AT THE ANTARCTIC PLATEAU

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The identification of the potential source areas (PSAs) of the atmospheric particulate collected at the Antarctic plateau would be a significant step forward to better understand the present changes in the southern hemisphere atmospheric circulation, as a consequence of the global change, and to improve the interpretation of ice core stratigraphies. To achieve this goal, in the framework of the National Antarctic Research Program, the project SIDDARTA planned to carry out physical, geochemical, mineralogic and isotopic measurements on aerosol, surface snow and snow-pit samples collected at Concordia Station (East Antarctica) in the 2017-2020 period, and to compare them with similar measurements performed on soil samples from South America and Australia as potential PSAs.

Preliminarily to this study, however, it was necessary to develop and validate a suitable analytical procedure for the elemental and isotopic analysis of the atmospheric particulate. In particular, a new sample fractionation scheme was designed to differentiate between the soluble and insoluble phases of the particulate and to properly pre-concentrate the analytes for the following instrumental analysis. The aerosol filters were treated in two ways: 1. by re-suspending the particles in ultra-pure water and concentrating insoluble compounds by filtration through a small surface area filter; 2. by re-suspending the aerosol content in ultra-pure-water and concentrate soluble and insoluble compounds, by sublimation, on a membrane with a small surface area [1]. The first approach is useful to compare the aerosol composition with ice core data, whereas the second approach can provide further information on relatively soluble components, such as carbonates and sulphates.

The procedure to obtain the total fraction involved an ultrasonic extraction of the particulate from the 90-mm Teflon filters using ultra-pure water in 50-mL polypropylene tubes. Then, the solutions were transferred into special Teflon tubes for the sublimation step. These tubes have a conical end where a suitable 20-mm membrane is located to collect the particulate matter after sublimation of the water. In this way, both soluble and non-soluble fractions are collected on a smaller surface of an optimal support for the direct analysis by proton-induced X-Ray emission (PIXE) [2] or laser ablation inductively coupled plasma mass

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spectrometry (LA-ICP-MS) [3]. These membranes could also be treated by "wet chemistry" procedures, such as microwave-assisted acid digestion followed by elemental and isotopic analysis *via* inductively coupled plasma mass spectrometry (ICP-MS) techniques.

The entire procedure has been studied step by step to carefully evaluate the critical aspects that could negatively affect both blank levels and the analytical recovery. For this purpose, both ICP-MS and PIXE measurements were performed. The optimized method was then applied to analyze year-round samples of PM<sub>10</sub> aerosol collected at Concordia Station, with monthly resolution. The target analytes were major and trace metals (including REEs) and isotopes of Sr and Pb for the provenance determination [4].

### References

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