# 2A3) Single-particle Characterization of Antarctic Aerosols Collected at King George Island, Chile

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## 1. Introduction

The Antarctic region, isolated from anthropogenic sources, is one of the best places for monitoring the background (the cleanest) level of the earth's atmosphere(Hara et al., 2006). Sea-salt species, sulfate, and methanesulfonate (MSA) are reported to be the most abundant compounds observed in Antarctic aerosols. The significant number of studies have been carried out on summertime and wintertime Antarctic aerosols. However, the composition of aerosol particles has been studied mostly with bulk analyses. Herein, a single-particle analytical technique, known as low-$Z$ particle electron probe X-ray microanalysis (low-$Z$ particle EPMA), was applied to characterize aerosol samples collected at the King Sejong Station, a Korean scientific research station, located at the King George Island of the Antarctica, Chile. This work highlights the single-particle characterization of Antarctic aerosol samples based on secondary electron images (SEIs) and X-ray spectral data and the possible mechanism for the formation of sulfate-containing sea-salt particles.

## 2. Materials and Methods

Aerosol particles were collected during March 2009 at the King Sejong Station, King George Island, Chile (62° 13′ S, 58° 47′ W). Particles were sampled on Al foil using a three stage cascade impactor (PM10 Impactor, Dekati. Inc.). The particles of stages 2 and 3 of the impactor, corresponding to 2.5-10 $\mu$m (coarse fraction) and 1-2.5$\mu$m (fine fraction) aerodynamic size fractions at a flow rate of 10L/min, respectively, were measured using a JEOL JSM-6390-SEM equipped with an Oxford Link SATW ultra thin window energy-dispersive X-ray (EDX) detector. The net X-ray intensities for chemical elements were obtained by non-linear, least-squares fitting of the collected spectra using AXIL program. The quantitative analysis was performed by a modified CASINO Monte Carlo program (Ro et al., 1999). Based on SEIs data, elemental concentrations, and X-ray spectra, the individual particles were classified into different particle types.

## 3. Results and Discussion

Overall 1450 particles for 5 days samples (approximately 300 for each sample) were analyzed using low-$Z$ particle EPMA technique. Fig. 1. shows typical SEIs of individual Antarctic aerosol particles. Major chemical species frequently encountered in the Antarctic samples are genuine (on average 33%) and sulfate-containing (on average 63%) sea-salt particles (Fig. 2). Similar observations were reported by others: i.e., 92% (Biancato et al., 2006) and more than 94%(Wouters et al., 1989) sea salt particles in the Antarctic aerosol. The presence of more than 96% sea-salt particles and absence of nitrogen in all the measured particles along with the backward trajectories analysis (during the sampling period, all air masses for samples came from the ocean) revealed that the particles were not influenced by anthropogenic sources. Hence, the elevated sulfate-containing sea-salt particles in the Antarctic atmosphere are probably modified by heterogeneous reactions with volatile marine biogenic ninanosulfur species, (e.g., methylsulfonic acid (MSA) and dimethylsulfide (DMS) emitted by

phytoplankton). Furthermore, the particles were more frequently encountered in the fine fraction than in the coarse one (average values: 71% *vs* 56%), suggesting that the more sea-salt particles were transformed in fine fraction through heterogeneous reactions with gaseous sulfur species. Minor chemical species encountered in the samples consist of Fe-containing, $CaCO_3$, carbonceous, and aluminosilicate particles that are probably of local origin. The overall results of our work indicated the Antarctic atmosphere is greatly dominated by marine sources, without anthropogenic influence.

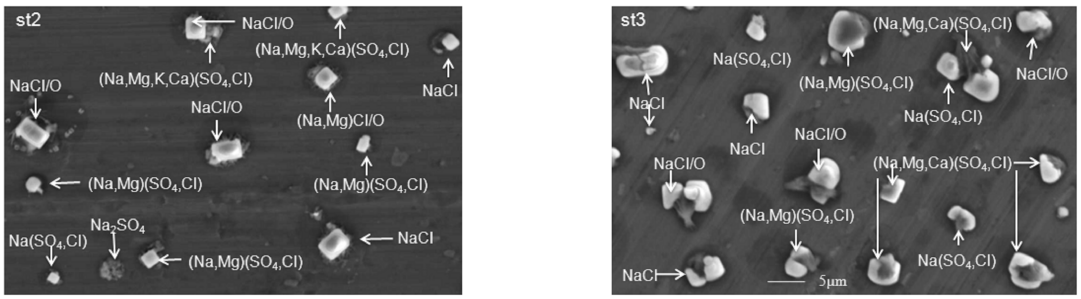


Fig. 1. Typical SEIs of Antarctic aerosol particles collected at King Sejong Station.

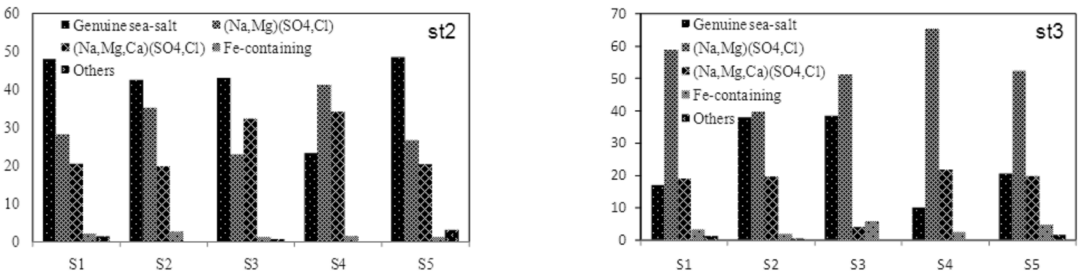


Fig. 2. Relative abundances of particle types encountered in five Antarctic aerosol samples.

## References


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