Atmospheric Aerosol at the Svalbard Islands in Year 2010. A Preliminary Analysis of Multielemental Data from Size-Segregated Samples: (II) Sulphur Compounds

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INTRODUCTION, EXPERIMENTAL AND METHODS OF DATA HANDLING

All the aspects being considered in this paragraph are exactly the same presented under the same title in the report concerning the sea-salt components, i.e. report I, to which, therefore, reference should be made.

We only want to remind here that the two samples under consideration are very different from both point of view of their respective aerosol containt and of that of the corresponding problems in the analysis of the data.

LOGNORMAL REPRESENTATION OF ELEMENTAL MASS SIZE DISTRIBUTIONS FOR SULPHUR COMPOUNDS

Sample GB17. Figure 1 displays the three modes of the measured sulphur, S, and, in addition, the quantity sea-salt sulphur, ssS. This last quantity, which is indicated as S(K), is obtained by multiplying the observed concentration of element K (belonging to sea-salt, see paper I, figure 2), by the S/K sea-salt ratio. Element K was chosen as reference, because it is unaffected both by X-ray attenuation and, presumably, by chemical depletion. Moreover, there is no crustal contribution to K, in this case.

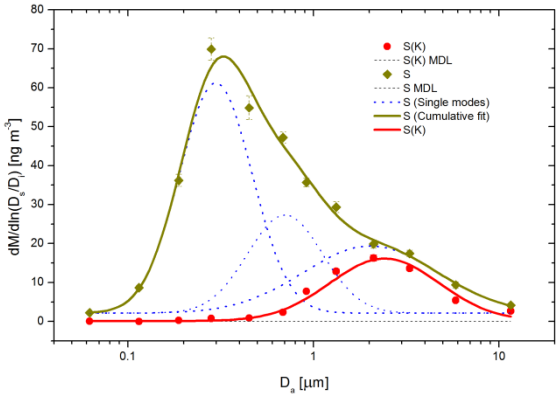

Fig. 1. EMSD of S and S(K) for sample GB17.

The lowest mode can be interpreted as the submicrometric S accumulation mode; the highest mode, largely, if not totally, corresponds to sea-salt sulphur, with some possible enrichment in S; the intermediate mode is more intriguing.

Significant hints concerning the properties of the above three modes can come from a comparison with results obtained by part of us in a 2003/2004 Antarctic campaign at the clean coastal site Campo Icaro (lat. 78' 55" 37º N, long. 11' 55" 58º E, near the M. Zucchelli Italian Base, on the Ross Sea). As a matter of fact, in Antarctica the lowest and the highest mode were observed always, whereas a clear intermediate mode was observed in several cases. As an example, we present in figure 2, which corresponds to the Antarctic sample AMG021, a clear three-modal distribution, whose modes are similar (except for intensity) to those of sample GB17.

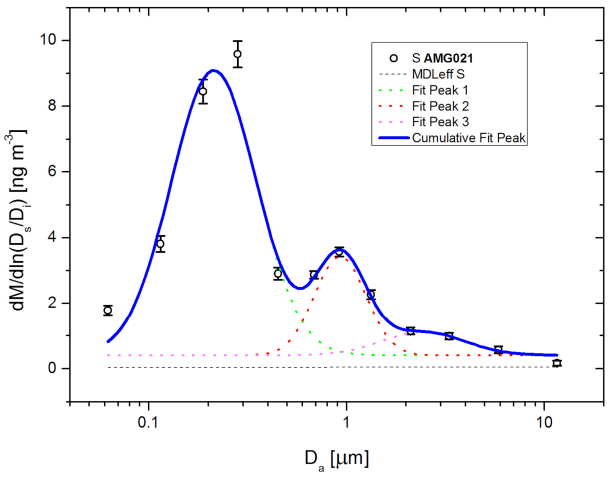

Fig. 2. Particle size distribution in sample AMG021.

The presence of the intermediate mode is however more explicit here than in sample GB17. Understanding the nature of the intermediate mode requires more work. A possible connection with an enrichment in S, occurring on sea-salt particle surface and thus favoring lower particle diameters in the size distribution, is being investigated

Sample GB2. Figure 3 displays a bimodal distribution very different from that of sample GB17. The submicrometric mode is considerably more intense (the ratio of the corresponding A parameter is ~10) and displaced towards larger diameters; the supermicrometric mode is much lower in intensity (the ratio of the corresponding A parameter is ~0.25). A major difference of sample GB2 with respect to sample GB17 consists in an important presence in the former and absence in the latter –

of a crustal-like component and of several minor elements of presumable anthropogenic origin, which could possibly interact with the processes giving rise to the submicrometric S mode.

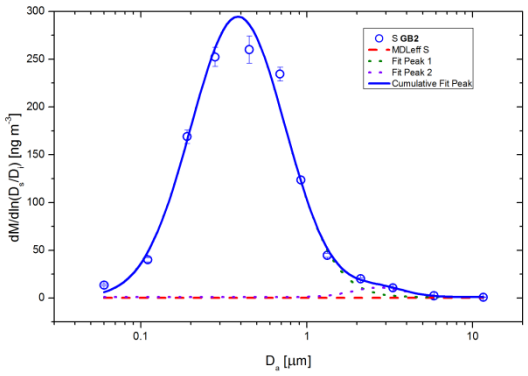

Fig. 3. Particle size distribution for sample GB2, element S.

As an example, we display in figure 4, the size distribution of element V, whose parameters are quite near those of the S submicrometric mode.

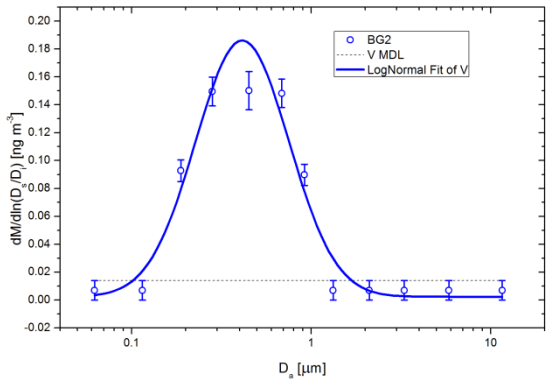

Fig. 4. Particle size distribution for sample GB2, element V.