Atmospheric Aerosol at the Svalbard Islands in Year 2010. A Preliminary Analysis of Multielemental Data from Size-Segregated Samples: (III) Crustal Elements and Minor Elements

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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 content and of that of the corresponding problems in the analysis of the data.

Table 1.

El x	X_0	W	A ($ng \cdot m^{-3}$)	A/A_{Fe}
Al	2.50 ± 0.13	0.63 ± 0.03	57.3 ± 2.9	3.92 ± 0.57 0.5
Si	2.84 ± 0.17	0.70 ± 0.04	102.4 ± 6.5	7.01 ± 1.12
Fe	2.57 ± 0.24	0.65 ± 0.15	14.6 ± 1.4	1
Ti	2.82 ± 0.17	0.65 ± 0.04	1.33 ± 0.03	0.09 ± 0.01
Mn	4.14 ± 0.73	0.34 ± 0.27	0.20 ± 0.12	0.12 ± 0.01

LOGNORMAL REPRESENTATION OF ELEMENTAL MASS SIZE DISTRIBUTIONS FOR CRUSTAL-LIKE ELEMENTS

Sample GB2. The five elements Al, Si, Fe, Ti, Mn display a supermicrometric mode (see examples in figure 1 and figure 2). The values of position X_0 and width, W, do appear well compatible among these elements, whereas the orders of magnitude of the ratios A_x/A_{Fe}, between the area A_x of element X and that of Fe are consistent with average crustal values. These facts indicate the presence of a crustal-like geochemical component, whose parameters are well distinct from those of the sea-salt component presented in paper I. The above elements, except Mn, also display a submicrometric mode (see examples in figure 1 and figure 2), with compatible values of their respective X_0 and W parameters. Elements Mg, K, and Ca are also expected to contribute to the above crustal-like component. Their contributions to each distribution must however be superposed to that coming from the sea-salt component; it can thus only be evaluated and represented once the sea-salt contribution is subtracted. This process is now being performed.

Sample GB17. Only dispersed points survive the respective MDL values, for the five crustal-like elements, described in sample GB02 above and cannot, in particular, be lognormaly fitted. The only exception is Fe, which is however incompatible with a crustal interpretation, in this case.

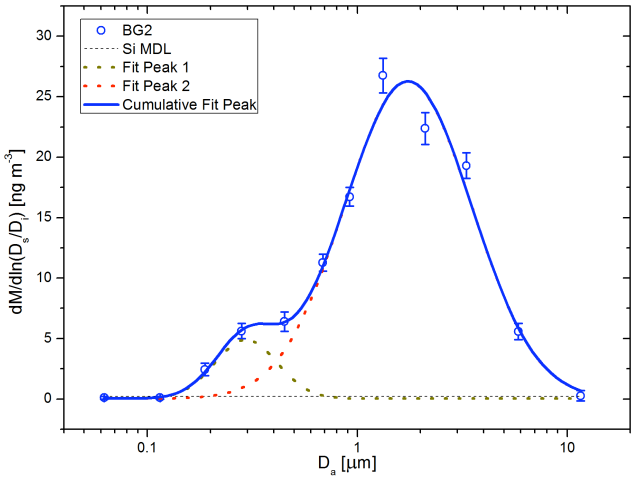

Fig. 1. EMSD of Si sample GB2.

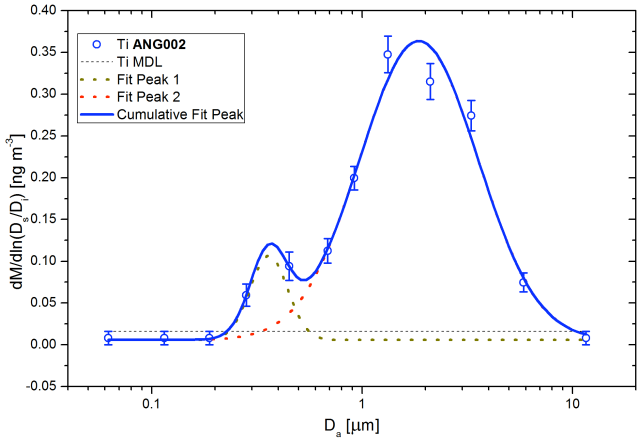

Fig. 2. EMSD of Ti for sample GB2.

LOGNORMAL REPRESENTATION OF ELEMENTAL MASS SIZE DISTRIBUTIONS FOR MINOR ELEMENTS

Sample GB2. Eight "minor" elements are detected. Five of them: V, Mn, Cu, Zn, Br display simple size distributions, with one or two easily fitted modes, all of them with X_0 included in the interval $0.25 < X_0 < 1.54$.

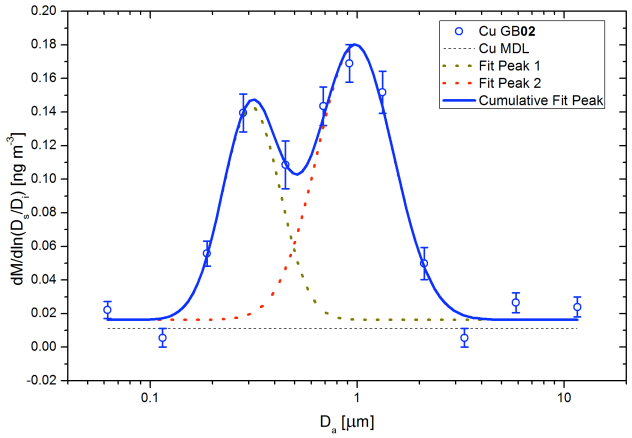

Fig. 3. EMSD of Cu for sample GB2.

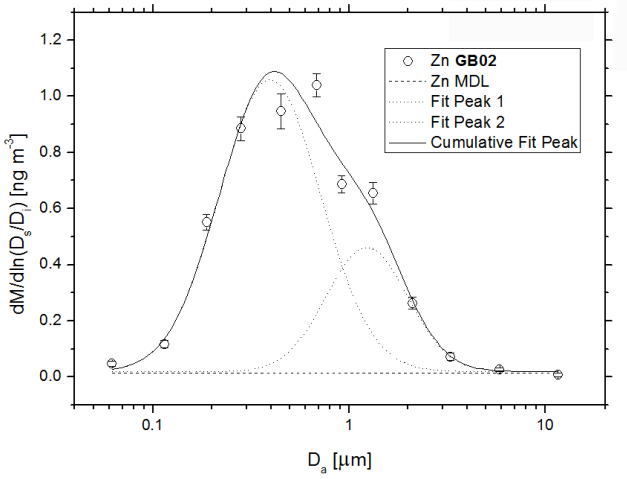

Fig. 4. EMSD of Zn for sample GB2.

Mn has a further, supermicrometric, mode already considered above as being of crustal-like nature. The supermicrometric modes of Mn, Cu and Br are possibly compatible as are, respectively, the modes around $X_0 \approx 1$, of the same elements. Zn and V display a possibly corresponding mode around $X_0 = 0.51$. Zn display a further mode at $X_0 = 1.54$. The structure of Ni and Pb is not easily representable. Cr is too poor (4 points over the MDL). Figures 3, 4 and 5 display, respectively, the EMSD's of Cu Zn and Mn. The EMSD of V is found in report II, figure 4.

Sample GB17. No significant amount of minor elements was found in this sample.

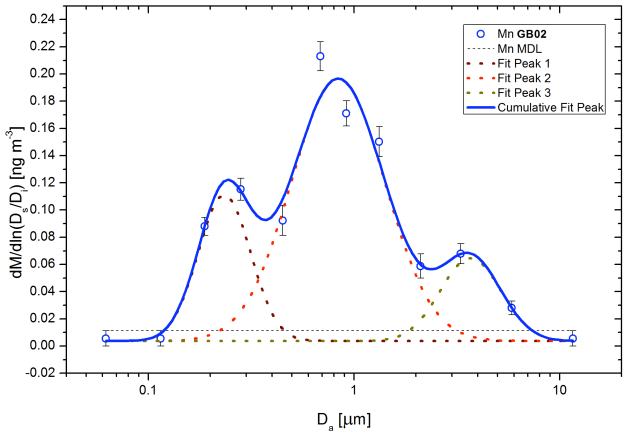

Fig. 5. EMSD of Mn for sample GB02.

GENERAL CONCLUSIONS OF THE THREE REPORTS

SDI size-segregated sampling, PIXE absolute multielemental analysis and lognormal representation of the elemental EMSD's appear well adequate to face the large variety of conditions we met. A particular effort was devoted to correct the effects of Na X-ray absorption within the samples.

[1] P. Mittner et al, Nucl. Instr. Meth. B, 109-110 (1996) 375.
[2] F. Chiminello et al., Proc. 16th ICNAA, Kyoto (2004), p. 649.
[3] P. Mittner et al., Proc. Int. Polar Year , Oslo (2010).