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This is the author's manuscript

Original Citation:

Availability:

This version is available <http://hdl.handle.net/2318/1659610> since 2018-02-06T17:21:26Z

Publisher:

Università di Salerno

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Major and Trace Elements in The Aerosol Of Central Antarctica, Dome C (Italo-French Station “Concordia”)

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Major and trace elements (Al, As, Ca, Cd, Co, Cu, Fe, La, Mg, Mn, Mo, Na Ni, Pb, Ti, Zn) were determined for the first time in the aerosol collected at Dome C, Concordia Station, in the Antarctic Plateau. PM10 samples were collected during summer 2005-2006 using three high-volume samplers in two different locations: the first was very close to the station (about 50 m downwind), while the other was at the Astrophysic Tent (~800 m far upwind of the station), with two samplers installed very close to each other (sites called Astrophysic Tent 1 and 2) (1). The aims were: i) to investigate the direct impact of the station on aerosol metal concentrations and ii) to determine concentrations in a clean area, under the hypothesis of no effect of the station, according to the prevailing wind direction. The availability of the aerosol mass, which was directly measured in Antarctica by differential gravimetry, allowed us to express metal contents in terms of both mass fractions and atmospheric concentrations (1-4). Determinations were carried out by Square Wave Anodic Stripping Voltammetry (SWASV) (4) and by Sector Field Inductively Coupled Plasma Mass Spectrometry (SF-ICP-MS) (5). Results, expressed in terms of atmospheric concentrations, showed that the major constituents (Na, Ca, Mg, Al, Fe) were present in the order of $\sim 1 \text{ ng/m}^3$, while for trace elements values increased from a few units of pg/m^3 (Cd, Co, As, La), to a few tens of pg/m^3 (Pb, Mo, Ti), to hundreds of pg/m^3 (Cu, Mn, Ni, Zn). In general, the highest element concentrations (e.g. Cd, Pb, Cu, Zn and As) were observed around the beginning of the expedition, for each sampling site. This can be attributed to a general contamination of the area connected to the intense activity at Concordia station, including aircraft arrivals/departures. Conversely very low values were observed subsequently especially at the Astrophysic Tent. Interestingly, when in a few days of the intermediate period the wind direction reversed with respect to the prevailing direction (i.e. from the North instead of from the South), the metal concentrations, especially of Cd and Pb, decreased at Concordia and increased at Astrophysic Tent. Principal Component Analysis allowed us to recognize three groups of elements, which were associated to typical sources, as generally recognized in the area also from measurements in snow and ice. In particular Al, La and Ti appear mainly related to crustal origin; Na, Ca, Mg, Ni, Co, Mo and Fe seem all associated to the marine source; Pb, Cd, Cu, Zn, As may be referred to the anthropic source, mainly the local human presence and activity.

References

1. A. Annibaldi, C. Truzzi, S. Illuminati, G. Scarponi, *Anal Chem* 83 (2011) 143.
2. C. Truzzi, A. Annibaldi, S. Illuminati, C. Mantini, G. Scarponi, *Air Qual Atmos Health* (2017), doi: 10.1007/s11869-017-0470-3.
3. C. Truzzi, L. Lambertucci, S. Illuminati, A. Annibaldi, G. Scarponi, *Ann Chim* 95 (2005) 867.
4. S. Illuminati, A. Annibaldi, C. Truzzi, G. Libani, C. Mantini, G. Scarponi, *J Electroanal Chem* 755 (2015) 182.
5. M. Malandrino, M. Casazza, O. Abollino, C. Minero, V. Maurino, *Chemosphere* 147 (2016) 477.