

Chemistry, stable isotope and physical properties of the Dome C surface snow (East Antarctica)

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During the 1997-98 Italian Antarctic Programme (PNRA) summer season, two snow pits were dug 3km north-westward of the Italian-French Dome C Station (East Antarctica, 75° 09'S, 123° 06'E, 3200m a.s.l.) and the EPICA project drilling site. These 4 m depth pits were done upwind of the station to avoid the risk of pollution. In the first pit, after cleaning of walls, a high resolution sampling was carried out for chemical (anions, cations, organic acids), stable isotope ($\delta^{18}\text{O}$ and δD), tritium and dust (concentration, size distribution, Al concentration) measurements. In the second pit, dug 50cm apart, visual stratigraphy was done.

The concentration/depth profiles and any eventual correlation between chemical components were examined to obtain environmental information about primary and secondary aerosol sources, transport phenomena and any evidence of relevant trends in the temporal series of some components. Particular attention was spent on the relative contribution of sea spray components (Na^+ , Cl^- , Mg^{2+}) and substances from biogenic origin (nssSO_4^{2-} and MSA) to atmospheric aerosol. Using Na^+ and MSA as source tracers, fractionating phenomena induced variations of Cl^-/Na^+ and $\text{nssSO}_4^{2-}/\text{MSA}$ ratios were valued. $\text{nssSO}_4^{2-}/\text{MSA}$ relationship with MSA reveals the importance of long range transport effects and the presence of other nssSO_4^{2-} sources. Temporal data series for Ca^{2+} , K^+ , NO_3^- , F^- and some short chain carboxylic acids are also reported. For almost all the components ng/g or sub-ng/g concentration levels were found, as expected for a station located at a very long distance from the most part of aerosol sources and at high altitude. Tritium analyses were carried out in order to identify the peak related to the thermonuclear tests performed in the atmosphere in the early sixties as a reference horizon for dating purpose. The seasonal signal in the stable isotopes was not observed due to the low accumulation of this site, but nevertheless the main trends were compared to other Antarctic sites and to temperature records available from the main East Antarctica automatic weather stations. The dust concentration, size distribution (Particles Counter) and Al (Atomic Absorption) measurements show records of continental influences on the Dome C insoluble aerosols.

The very low annual accumulation rate, 3 to 3.5 cm (W.E.) and, probable, wind erosion are the main reasons of the absence of seasonal variations. Because of this limitation, of more interest is the correlation of the measured records with the visual stratigraphy. The main topics from these pits measurements can provide: 1) the study of the last tens years of atmospheric deposition in the Dome C area, 2) define the atmosphere-snow transport processes, also on the comparison with EPICA ice core, 3) identification of primary and secondary sources at this site.