Geophysical Research Abstracts, Vol. 7, 05262, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05262

Interpretation of sulphate spikes from different sources at different EPICA-DC ice core depths

R. Udisti (1), S. Becagli (1), S. Benassai (1), E. Castellano (1,2), M. Severi (1,2), R. Traversi (1), P. Kaufmann (3), F. Lambert (3), B. Stauffer (3), M. Hansson (4), J.R. Petit (5), E. Wolff (6).

(1) DEPT. OF CHEMISTRY, UNIVERSITY OF FLORENCE, ITALY, (2) MNA, UNIVERSITY OF SIENA, ITALY, (3) PHYSICS INSTITUTE, UNIVERSITY OF BERN, SWITZERLAND, (4) DEPT. OF PHYSICAL GEOGRAPHY AND QUATERNARY GEOLOGY, UNIVERSITY OF STOCKHOLM, SWEDEN, (5) LGGE, CNRS, SAINT-MARTIN D'HERES, FRANCE, (6) BRITISH ANTARCTIC SURVEY, CAMBRIDGE, UK.

(udisti@unifi.it)

Fast Ion Chromatographic analysis (FIC) carried out on the EPICA-DC (EDC) ice core (Dome C – East Antarctica) allowed to obtain the longest sulphate record so far available (about 800 kyr, covering the last 9 glacial-interglacial cycles). The variations in this well-resolved (1.5 to 25 yr) sulphate record are due to changes in atmospheric transport circulation patterns, accumulation rate variations and, most interesting, variations of climatic forcing factors (volcanic eruptions) or feedback processes (oceanic biogenic production). Because sulphate is irreversibly deposited and buried in the snow layers, changes in sulphate peak width with depth are mainly due to diffusion and can be used in evaluating post-depositional migration and diffusional processes in the snow and ice. Very important is the attribution of sulphate spikes to volcanic eruptions in order to investigate possible climate impacts of single mega-eruptions or periods marked by high-frequency volcanic activity. Down to a depth of 2700 m (about 400 kyr) it is relatively easy to distinguish spikes caused by volcanic eruptions from variations caused by the background variability, due to changes in biogenic activity (via atmospheric oxidation of dimethylsulphide emitted by the phytoplanctonic activity). For depths larger than 2700 m, a progressive increase of diffusion processes attenuates and broadens volcanic peaks so that it becomes more difficult to distinguish

them from background variations. In the lowest part of the EDC ice core (deeper than 2900 m), unusual narrow and high sulphate spikes were observed again. If the sulphate in these layers is attached to dust particles, it would explain the much slowlier diffusion compared to dissolved sulphate. However, it is astonishing that such dust-sulphate events would occur only before 400 kyr BP. Aiming to clarify this topic, several sulphate spikes were selected by the FIC high-resolution stratigraphy at different depths and the chemical composition of the corresponding less-resolved ice core sections analysed by Ion Chromatography were studied. The ionic balances, together with the H^+ content, reconstructed by ECM stratigraphy or by ionic imbalance, allowed to differentiate between volcanic deposition and spurious sulphate spikes related to particular depositional events or, possibly, post-depositional artefacts due to migration of ionic compounds in the ice lattice. The counter-ion (cation) predominance in the different spikes give information about possible neutralising effects of sea spray or dust on volcanic sulphate deposition. Finally, the close relationship between sulphate and magnesium in the bottom part of the ice core raised new questions about the atmospheric source or the glaciological formation of some unusually narrow sulphate spikes.