SOURCE RECOGNITION OF INHALED ATMOSPHERIC PARTICLES ACCORDING TO GEOCHEMICAL AND STATISTICAL EVALUATIONS OF TRACE ELEMENT SIGNATURES

PAOLO CENSI[1], ANGELA CUTTITTA[2], LOREDANA RANDAZZO[3]*, PIERPAOLO ZUDDAS[4], ELISA TAMBURO[3], ELVIRA OLIVERI[2]

[1]*Dipartimento DISTEM, Università di Palermo , Palermo, 90123, Italy;* [2]*I.A.M.C.-CNR –UOS di Capo Granitola, Campobello di Mazara (TP), 91026, Italy;* [3]*Dipartimento DISTEM, Università di Palermo, Palermo, 90123, Italy;* [4]*Institut Génie de l'Environnement et Ecodéveloppement & Département Sciences de la Terre, UMR 5125, Université Claude Bernard Lyon 1, Villeurbanne, 69622, France*

loredana.randazzo@unipa.it

During 2001 the Mount Etna had a large eruption producing a large amount of pyroclastic products consisting of a mixture of glass, minerals and soluble salt materials (SAF) encrusting solid particles. Inhalation of the finest of these materials induced pulmonary diseases in people living in subjected areas and gave us the possibility to collect bronchoalveolar lavages (BAL) from people in care in Catania hospitals. Concentrations of several trace elements measured in these BAL fluids (BALF) evidence strong enrichments in several trace elements compared to reference values. Related enrichments factors, calculated with respect to composition of volcanic ejecta (EFASH), show similar values in BALF and in SAF for V, Cr, Fe, Cu, As, lanthanides (apart from Ce), Pb and U, suggesting that these elements have originated by leaching of finest inhaled volcanic particles. EF values calculated with respect to Upper Continental Crust (EFUCC) for Co and Mn resulting close to 1 similarly indicate that these elements are probably released in human lungs from inhaled particles of non-volcanic, lithogenic nature. On the contrary, both EFASH and EFUCC values calculated for other investigated trace elements suggest the occurrence of further sources of inhaled solids, probably from anthropogenic sources. To test this hypothesis EF values of the latter elements with respect to a typical road dust composition (EFRD) have been calculated and this origin is strongly suggested for Ni, Cu, Cd and Pb. But La, Ce and Y EFRD values remain unexplained in terms of parent material and a further anthropogenic origin for these elements can be invoked probably originated by fluid catalytic converters used during hydrocarbon refinery activities, that are usually characterised by high Y, La and Ce contents. Statistical evaluation of BALF compositions according to Principal Component Analysis corroborates above mentioned suggestions identifying three main components in the variance space: the first one (46% of the variance) grouping the same elements previously attributed to the volcanic origin (except Pb), the second one (27% of the variance) grouping Ni, Cd, Y, La and Ce and a third component (12% of the variance) identified by Co, Ni, Cu, Pb and, secondarily, La and Ce. These results show that statistical and geochemical assessment of BALF analyses are together able to identify suspended atmospheric solids in the environment recognising mixtures of natural and anthropogenic products.

Keywords: bronchoalveolar fluids, lanthanides