Geochemistry of Atmospheric Aerosols in Andalusia (Southern Spain)

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The localization of Andalusia, in the boundary between the continents of Africa and Europe, and Mediterranean Sea and Atlantic Ocean make this region strategic in research projects concerning climate change. Since 1999, several research works have received founding by the Department of Environment of Autonomous Government (Junta de Andalucia) to study the geochemistry of atmospheric aerosols. The main interests of theses studies were the characterization of chemical composition of PM10 and PM2.5 of cities around Industrial States (e.g. Ría de Huelva, Campo de Gibraltar and Bailén). In this initial stage, the research was leading by the Spanish Council for Scientific Research (CSIC) and the University of Huelva. Multilineal regression models of source contributions have permit the characterization of main geochemical profile of industrial source emissions, and make a diagnostic of the atmospheric pollution (e.g.: Querol et al. 2002; Alastuey et al. 2006; Sánchez de la Campa et al. 2007; 2010).

The results of these studies were used in others studies about the levels and chemical composition of atmospheric aerosols in Spain (e.g.: Querol et al. 2004a; 2004b; 2008). A high interest has received the study of arsenic in atmospheric aerosols around the Ría of Huelva. Several works have focussed on the levels of arsenic and his species (III and V).

Since 2007, a network of monitoring stations of PM10 and PM2.5 was established around the main cities and villages of Andalusia in order to know the quality of the air using geochemical composition of atmospheric aerosols.

The proximity to North Africa favours the impact of the atmospheric particulate matter from North African deserts, contributing between 3-4 μgm^{-3} in Western Andalusia and 4-7 μgm^{-3} in Eastern Andalusia.

In comparison to other stations in Spain and mainland Europe, PM10 in Andalusia is characterised by high levels of crustal matter and secondary inorganic components (SIC). This has been attributed to the following causes: 1) High road traffic and industrial emissions, 2) High frequency of North African air mass outbreaks, and 3) Climate factors such as low rainfall, dry soils favouring resuspension, and high photochemical activity.

Atmospheric particulate matter of urban areas in vicinity to industrial estates is enriched in secondary inorganic compounds and metals. Three main hot spots have been identified according the high trace element concentrations: Huelva (As, Cu, Zn, Se, and Bi), Gibraltar Strait (V, Ni, Cr, and Co) and Bailén (V and Ni). The transport of pollutants from cities and industrial estates to areas of ecological interest (e.g. Doñana National Park) has been found to cause the increase background levels of a number of trace elements (e.g. As) in the air. Non industrial traffic hot spot cities (e.g. Granada and Málaga) display high concentrations of Cnm and specific metals, such as Zn, Ba, Cu, V, Ni, Sn, and Sb. Geochemical maps of atmospheric matter have powerful tool for illustrating spatial variation patterns of geochemical components and identify specific pollution hotspot.

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