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Ground-level airborne particulate matter near important Portuguese Cultural Heritage sites in high polluted (Lisbon) and low polluted (Evora) urban environments

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As part of a wider project on aerosol composition in the Southwestern part of the Iberian peninsula, an intensive field monitoring/sampling/analytical campaign has been conducted in August and December 2011 to assess indoor and outdoor atmospheric aerosol optical and microphysical parameters (Nephelometry), number/mass/size distribution (TEOM, MAAP, OPS) and single particle minero-chemical composition on filter collected samples (VP-SEM+EDS, XRD) at several sheltered and unsheltered locations close to important Cultural Heritage monuments in Evora and Lisbon, Portugal. Sites investigated included the Igreja do S. Francisco in Evora, the Cristo Rei sanctuary, Jeronimos Monastery, and Lisbon Castle in Lisbon. At Cristo Rei measurements at sea level, around 100m and around 180m were carried out in order to determine the vertical profile of the particle size distribution. Measurements were taken at different times of day reflecting changes in atmospheric mixing and air pollution levels. Measurements were also performed near an air quality monitoring station at Avenida de Libertade (the busiest traffic artery in Lisbon city center) during traffic peak hour.

One of the aims of the campaign was to determine differences in airborne particulate matter compositions and concentrations between an urban coastal high pollution (Lisbon) and a low pollution (Evora) environments and how these could affect the nature of decay patterns and processes in the building materials of the monuments under investigation. Preliminary results indicate significant differences in particle properties between the 2 cities as well as between indoor and outdoor locations.

One interesting result was the detection of considerable amounts of particle of oceanic origin (such as sodium chloride) in the Evora site even at 130 km away from the coast. Despite its relatively unpolluted location, single particle analysis by SEM+EDS at the Evora site reveals the presence of significant numbers of particle of anthropogenic origin, especially the one typical of diesel exhaust emission (nitrates, sulphate and carbon submicron particles). This finding can be explained by the location of the sampling site, about 100m away from the circular ring road – a major source of traffic emissions – in Evora.