

# Chemical characterization of aerosol particles in Évora: comparison between summer and winter campaigns



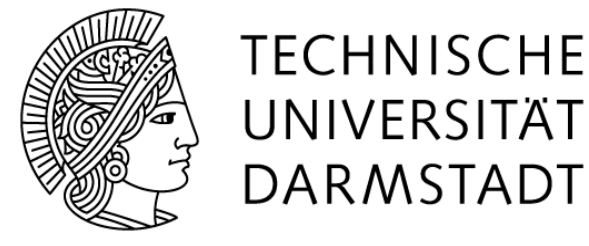
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## Introduction

Atmospheric aerosol particles play an important role in climate, air quality and human health.

In Portugal, extended time series on the chemistry and morphological parameters of atmospheric aerosol particles as well as on their seasonal dependency are still scarce and mostly confined to the North of the country. As part of a wider project on aerosol composition and distribution in Southwestern Iberia, in this study we compare aerosols collected in two intensive field measurement campaigns carried out in August 2011 and February 2012 in Évora, Portugal.

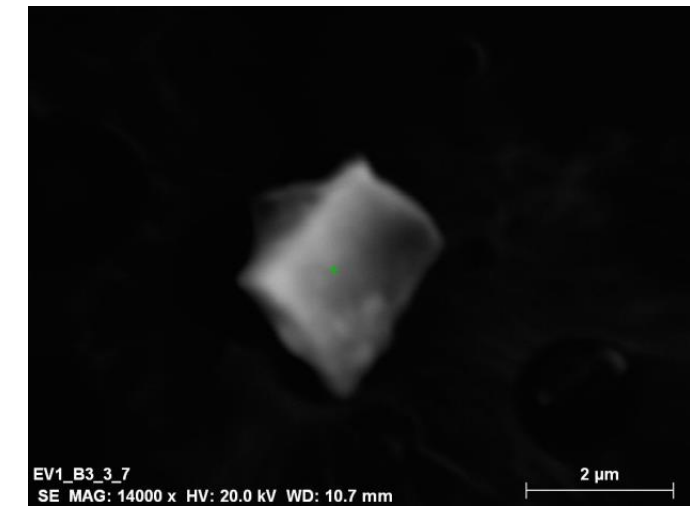


Évora is located inland about 130 km away from the Atlantic. No major air polluting industrial sources are present near the city.

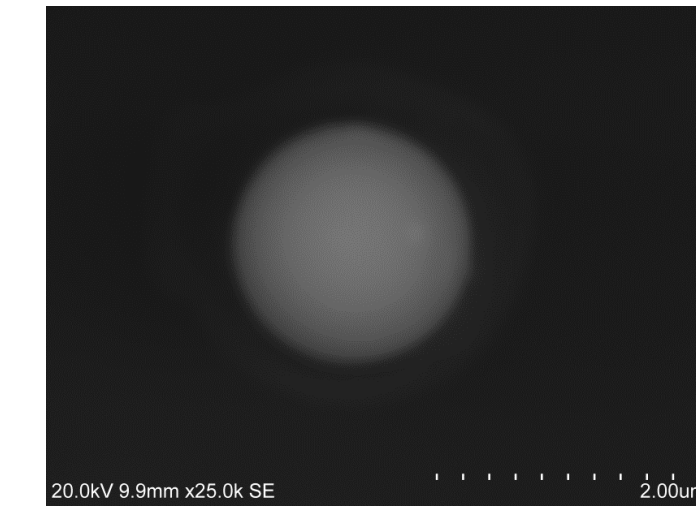
## Results

### Main particles analysed by SEM-EDS:

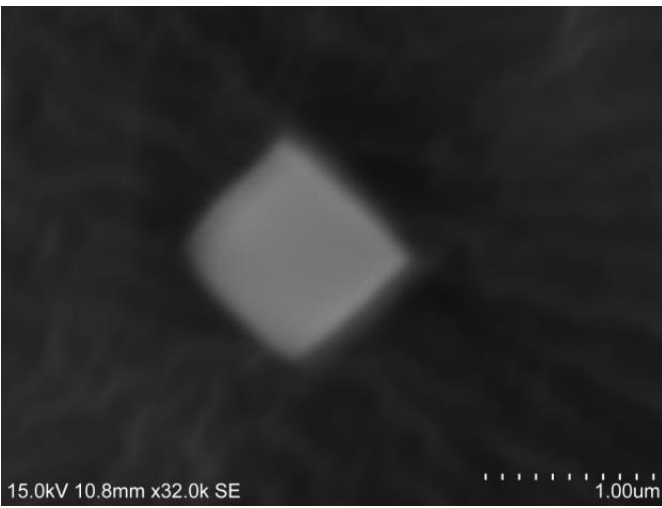
#### Quartz



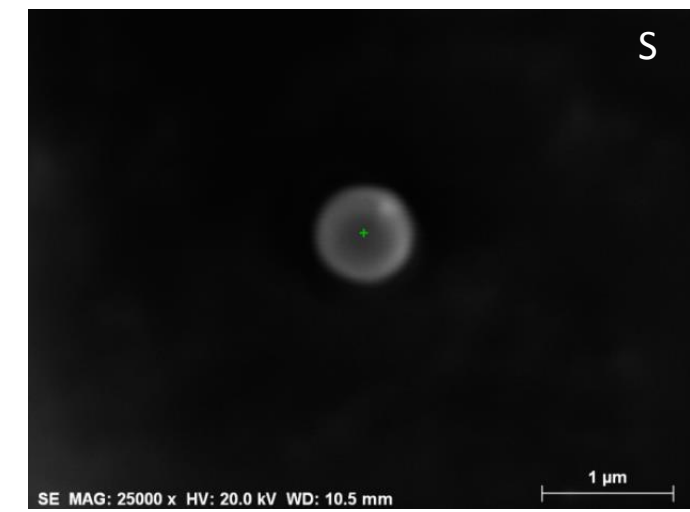
#### Aluminosilicate



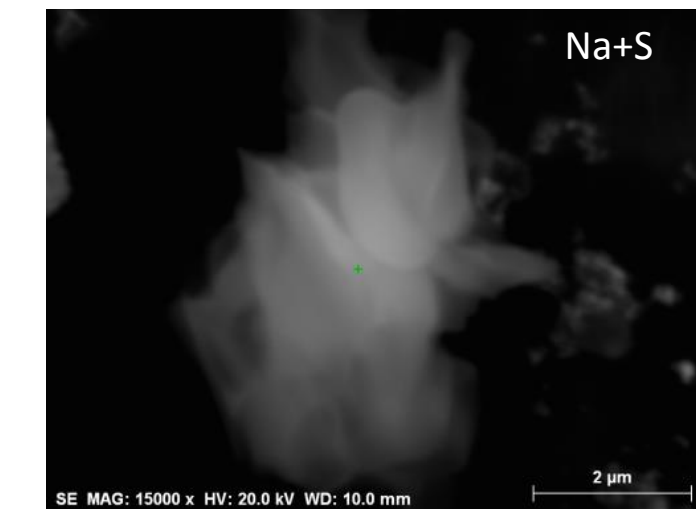
#### Sea salt



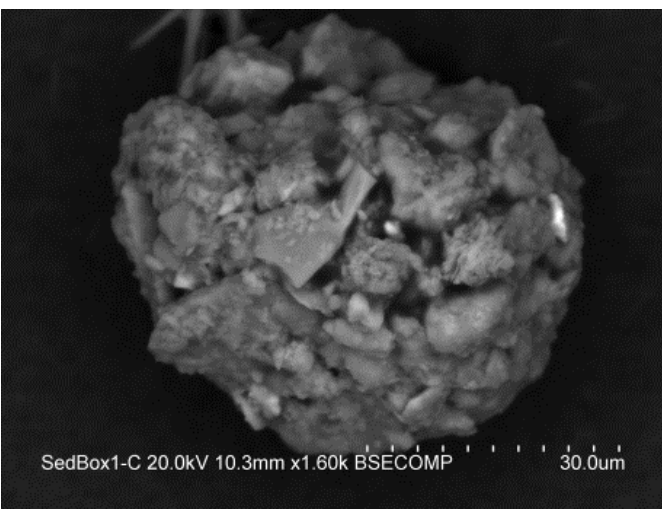
#### Sulphates



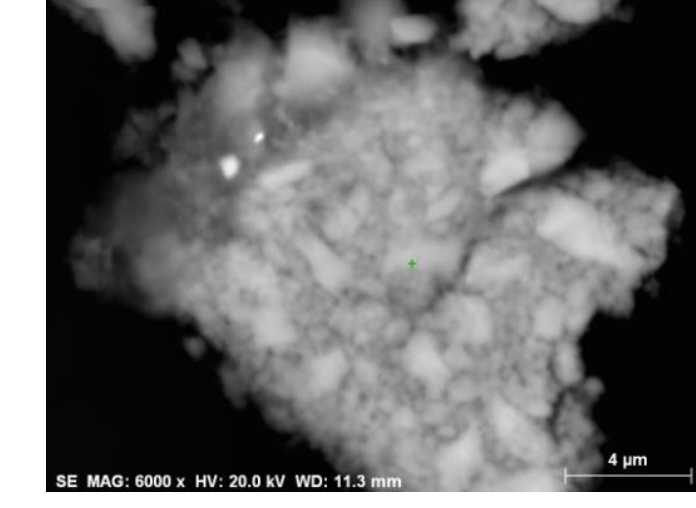
#### Mixtures



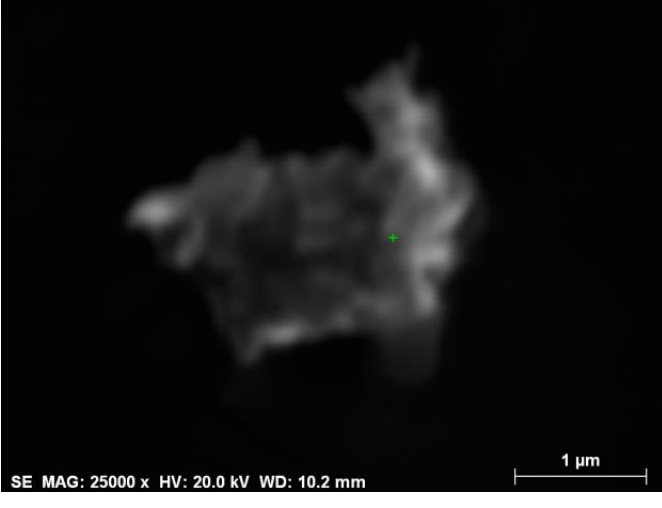
#### Fe-rich



#### Ca-rich



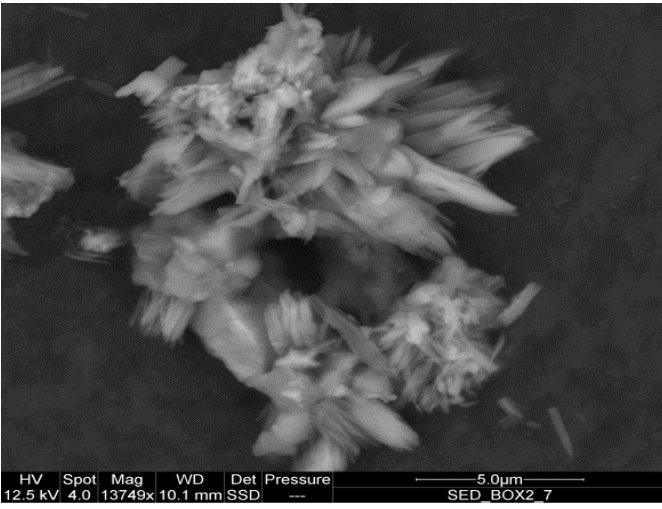
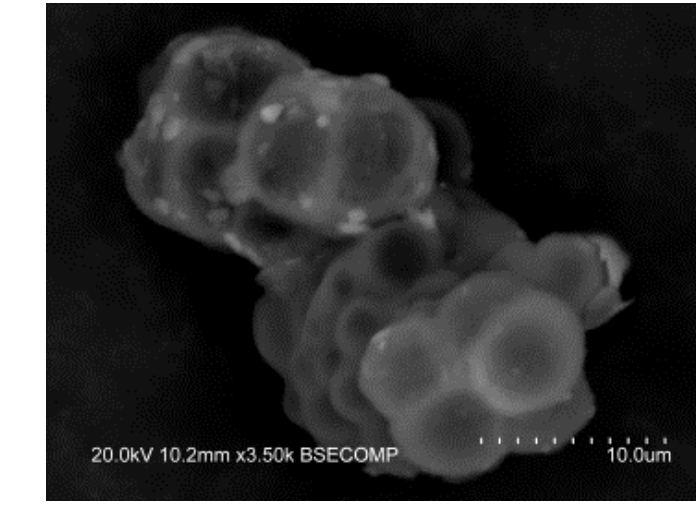
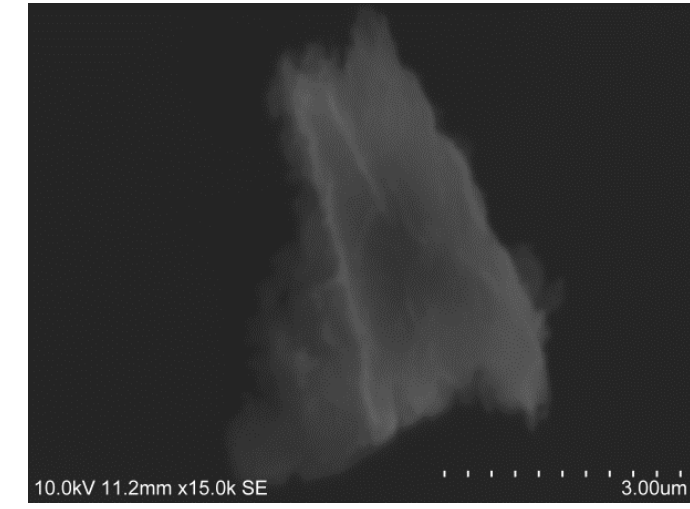
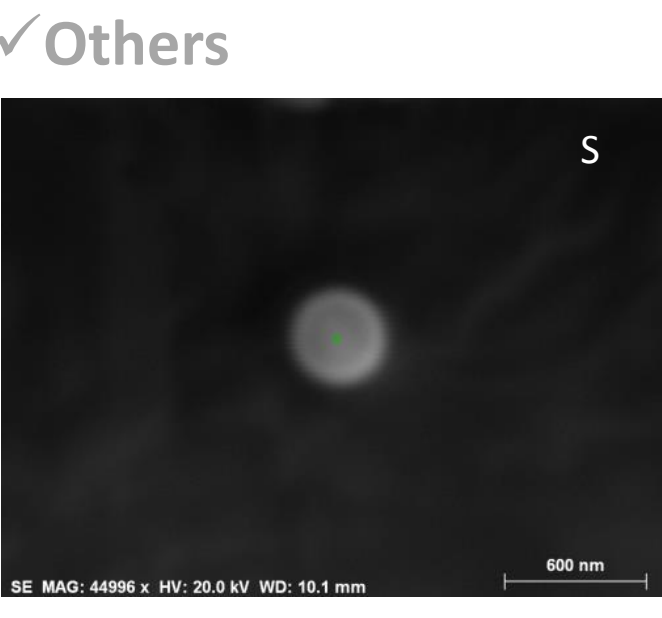
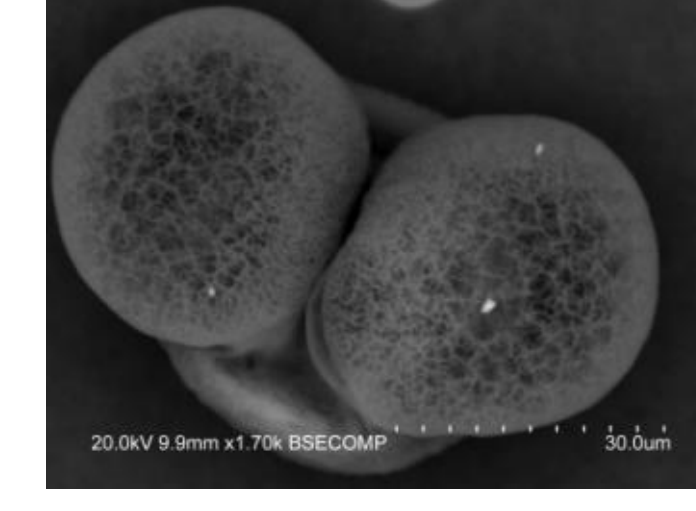
#### Na-rich



#### Organic and biological Particles



#### Others



### Aerosol sampling:

In order to determine aerosol particle chemical and morphological properties, two sampling modes were adopted at the sampling site located on the roof of the Évora Geophysics Center:

**Active sampling:** Particles were collected on TEM grids by a cascade impactor with nominal particle diameter cut-offs at 1, 0.65, 0.45 and 0.25  $\mu\text{m}$ . The samples were subsequently analysed by VP-SEM+EDS to obtain morphological and chemical compositional data.



**Passive sampling:** Particles were collected using a modified version of the aerosol passive sampler Type A “flat plates” by Ott and Peters (2008). The air could freely flow and particles were deposited by gravitation. The sampler was placed at the top of a university building about 15m above ground level. Sampling was performed weekly to account for the slow gravitational settling of particles.



### Aerosol analysis by VP-SEM-EDS:

Single particles were collected on TEM grids (active sampling), all days during two intensive campaigns: summer campaign (August 2011) and winter campaign (February 2012). 100 particles per sample were analyzed under the following conditions:

Analytical conditions: SEM-EDS	
Accelerating voltage	20 kV
W.D	10mm
Emission Current	120 mA
Probe current	70 mA

### Particles were classified according to their chemical composition and size respectively into 9 and 3 classes:

The graphs show the relative % of the most abundant aerosol classes during two periods: August 2011 and February 2012.

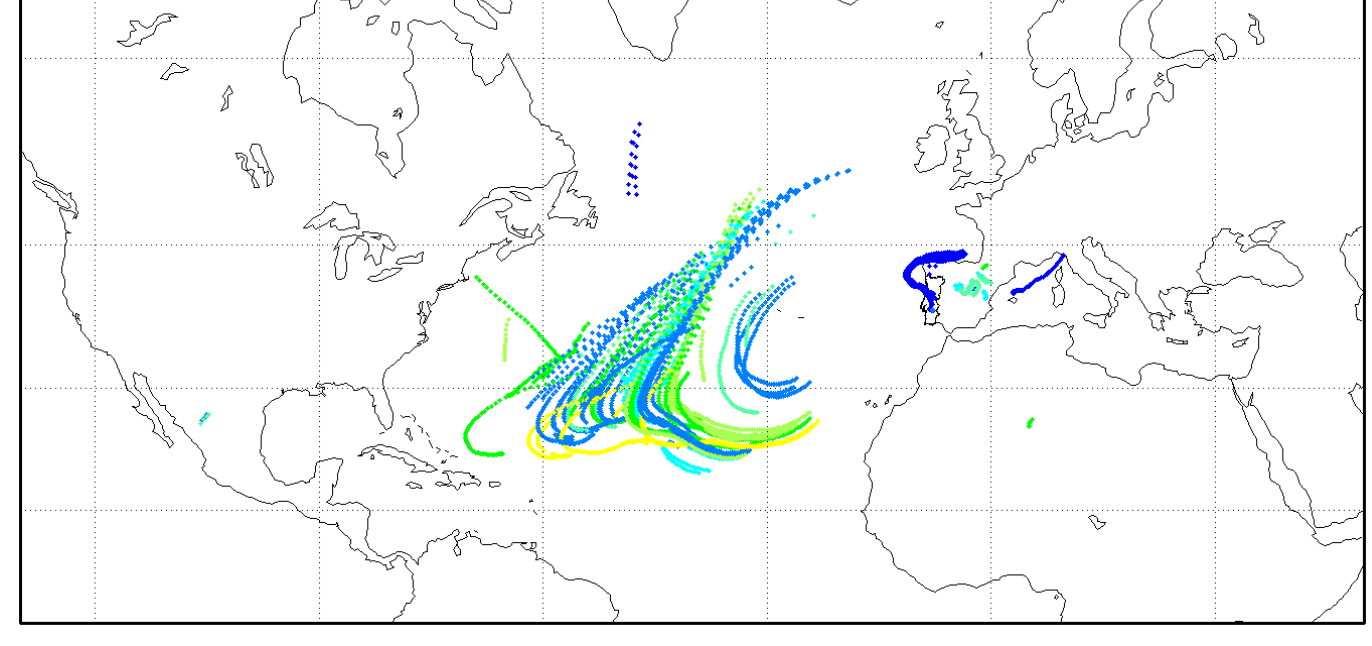
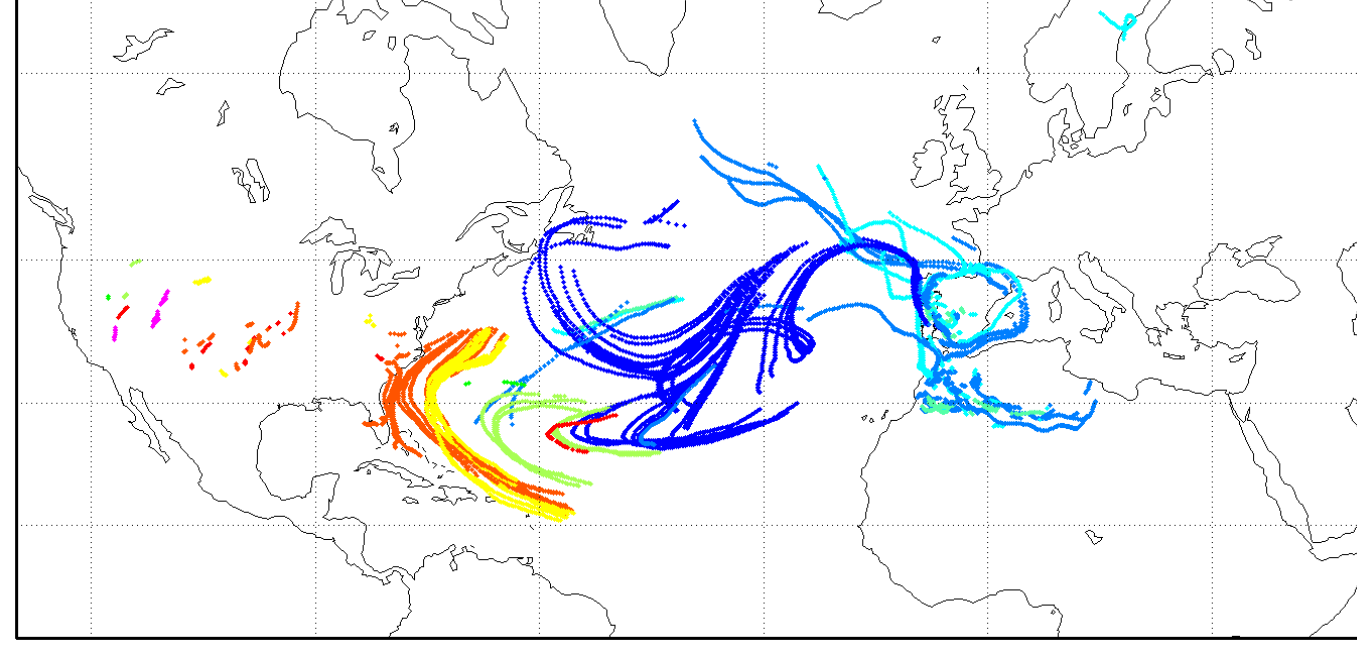
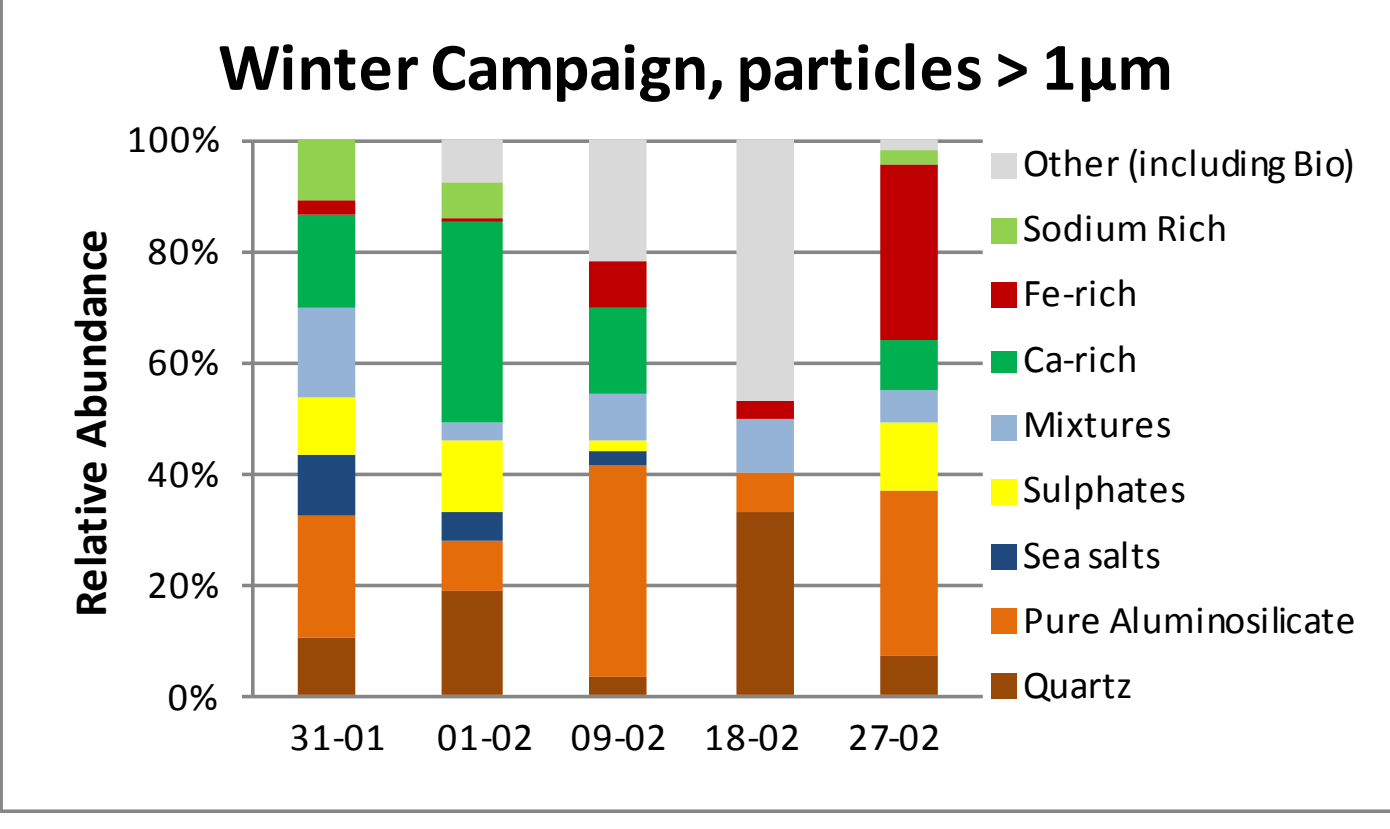
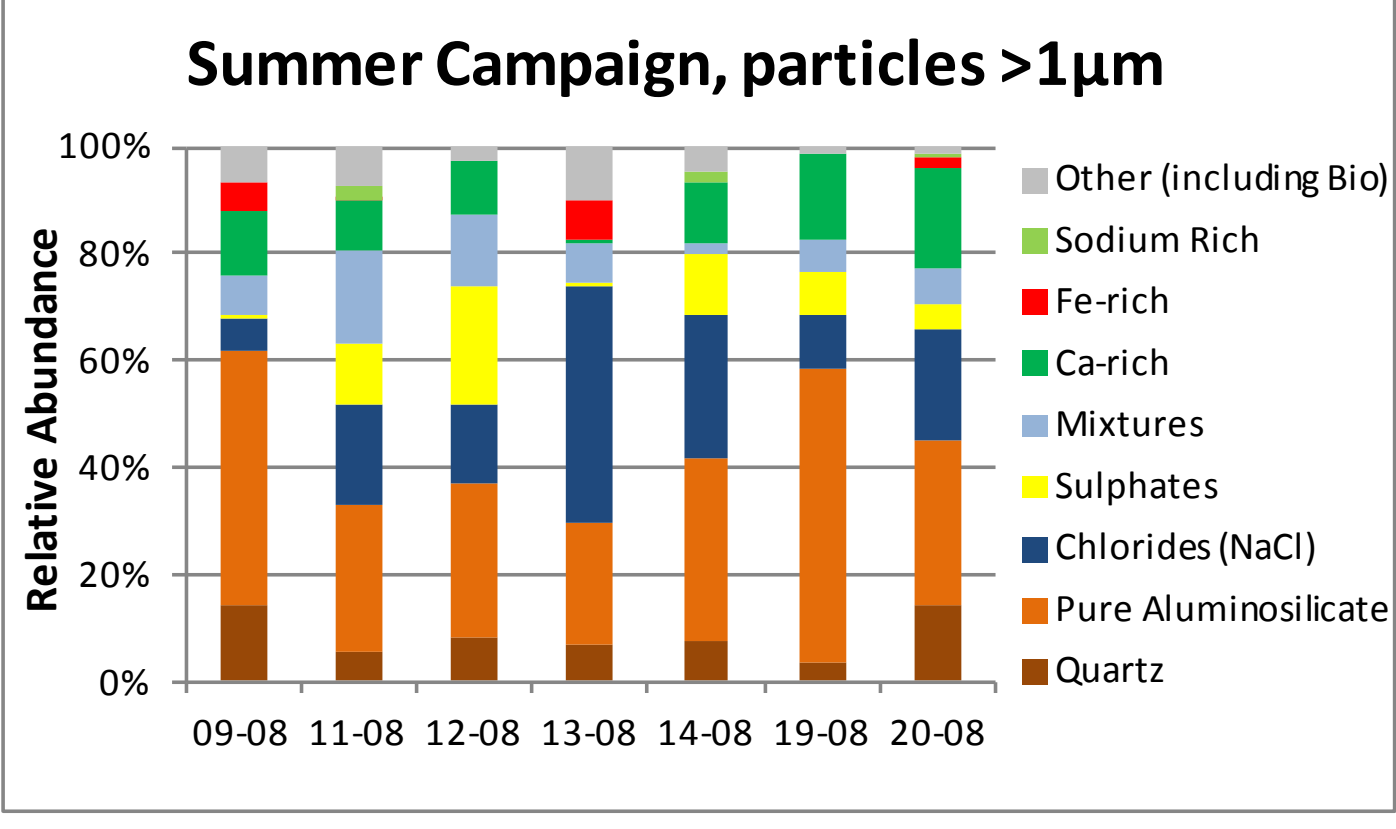
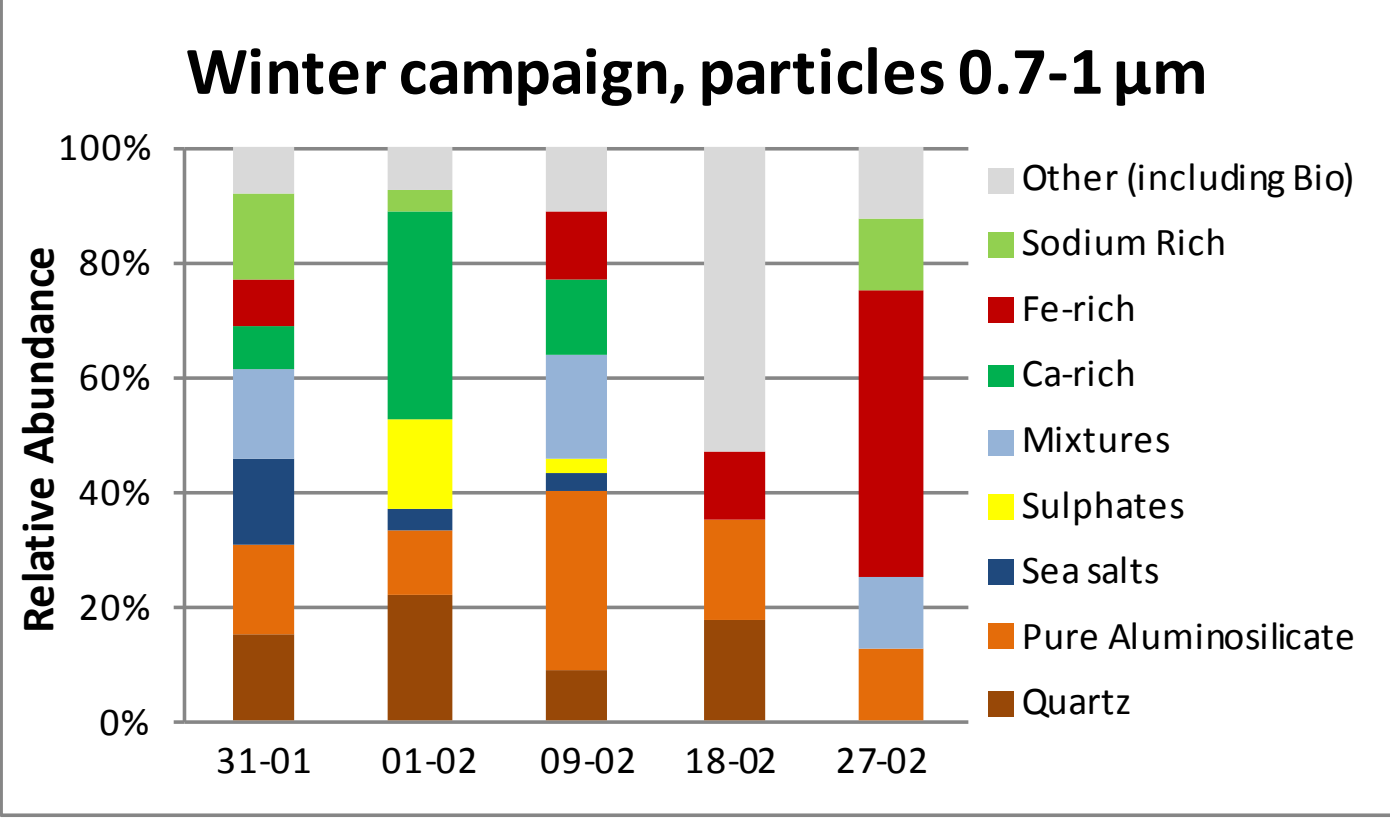
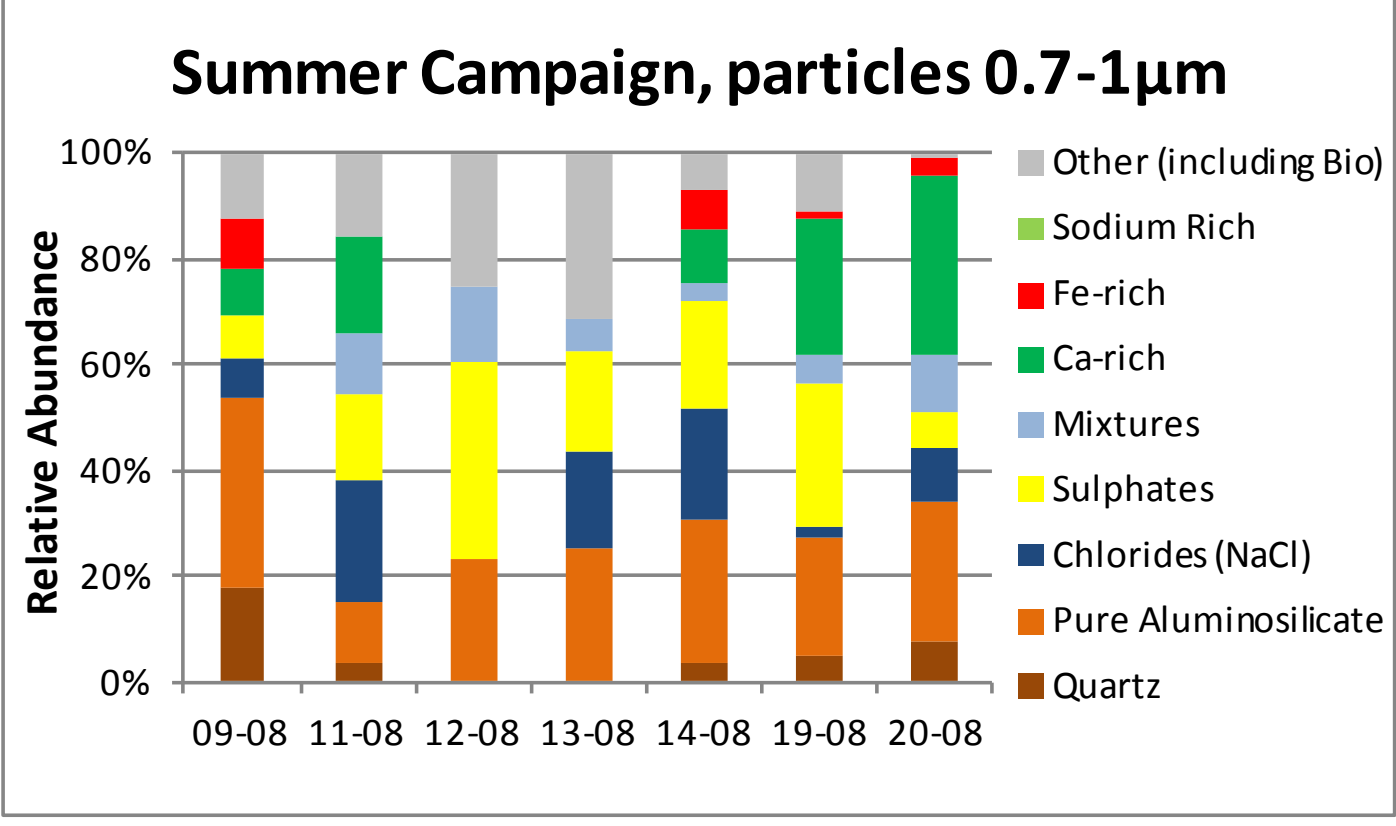
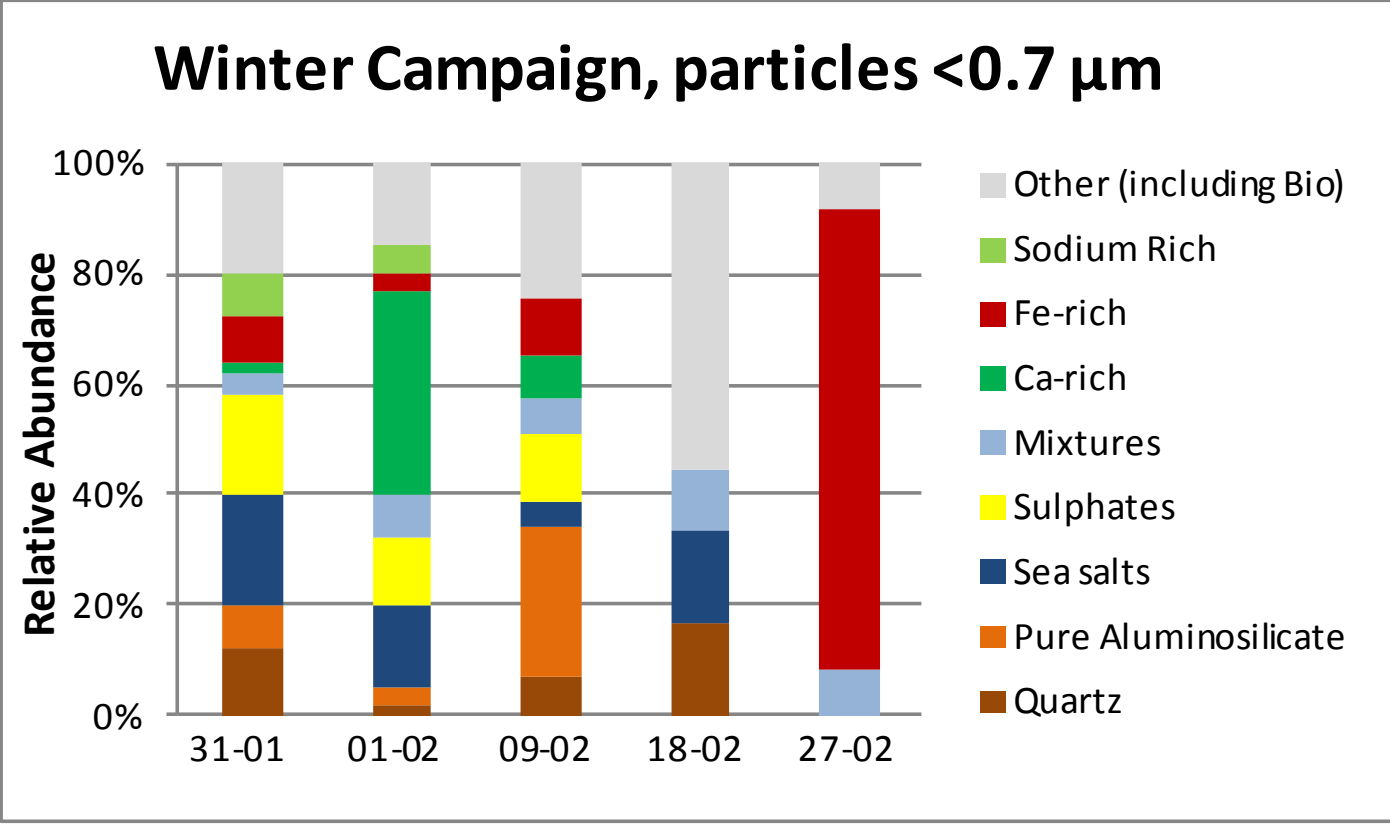
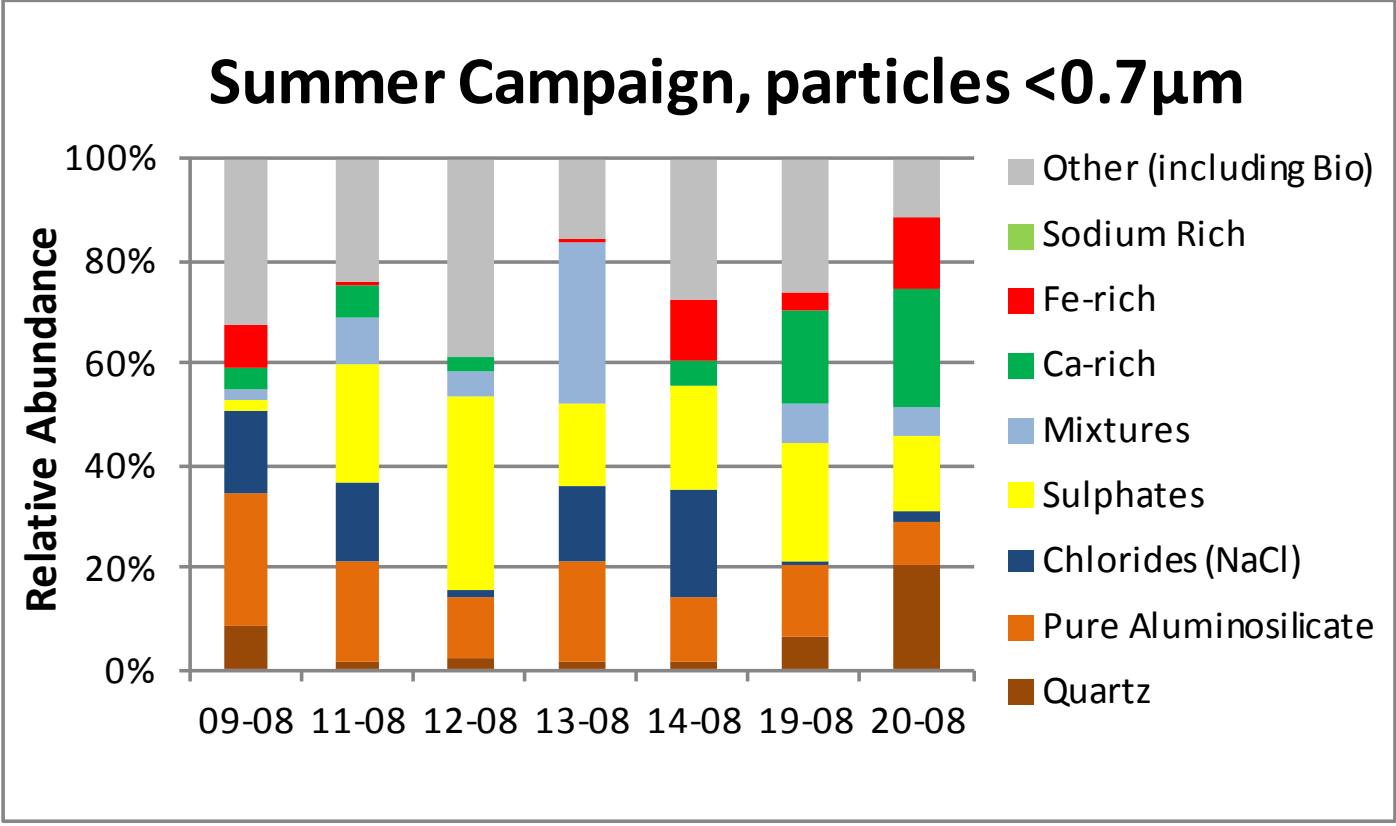
During summer campaign, the larger particles are mainly sea salts and silicates; the sulphates and “other particles” predominate in smaller particles.

The relative amount of dust-related aerosols (quartz + silicates), increases generally with particle size. Dust aerosols seem to be more abundant, probably due to the incidence of desert storm episodes. (08-12/19-22 August 2011).

The sulphate concentrations are much higher in summer suggesting a stronger sea salt contribution.

On the other hand, during the winter campaign, sea salts are less abundant than in summer campaign. The relative amount of dust-related aerosols, decreases in smaller particles ( $< 0.7\mu\text{m}$ ). As during winter winds are predominantly from the North, larger sea-salt particles may have been subjected to deposition BEFORE arriving in Évora.

Fe-rich particles are abundant in winter, specially on 27 February. This could be explained by the stronger contribution of combustion process, as suggested by frequent spherical dendritic morphologies.

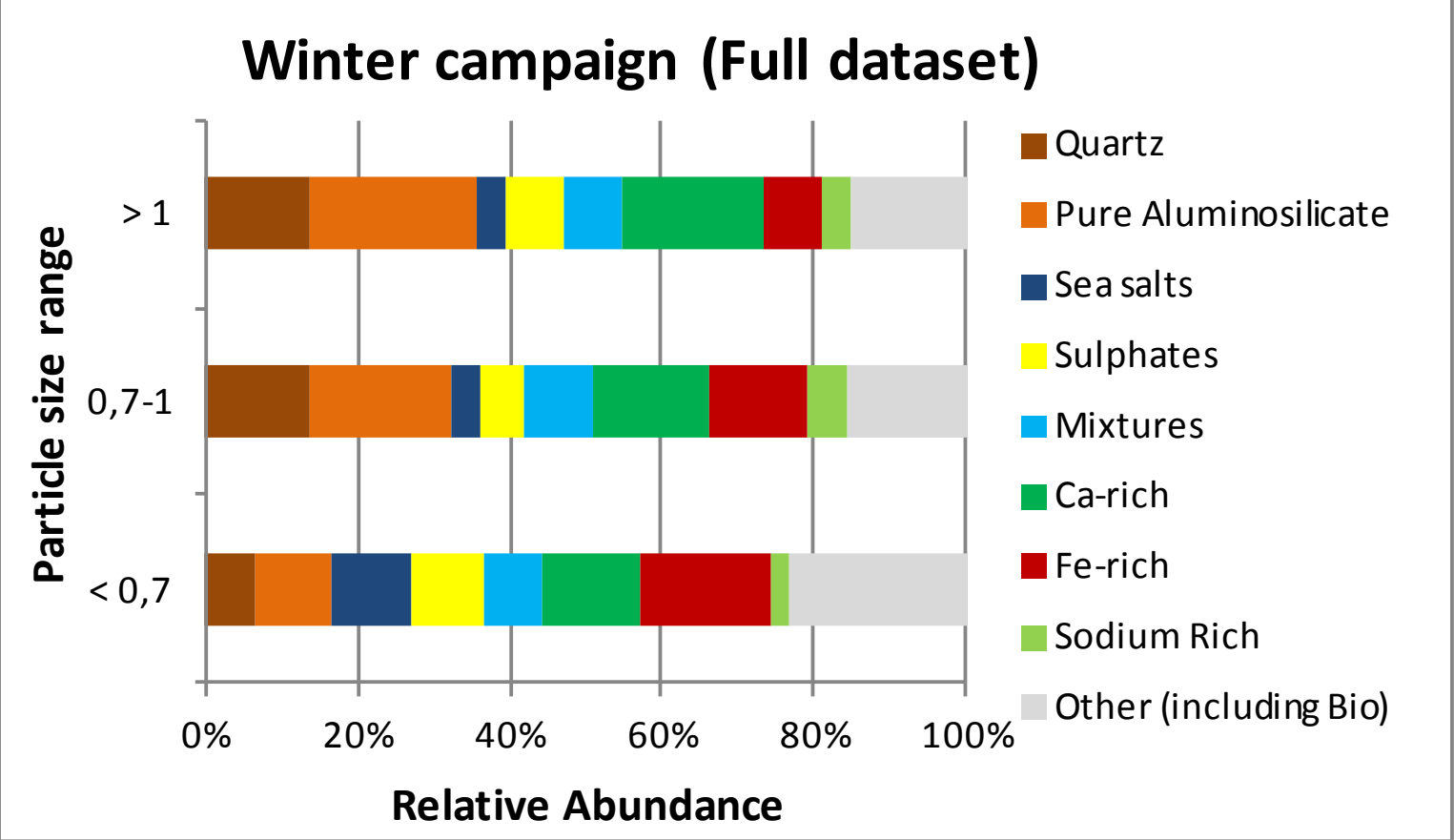
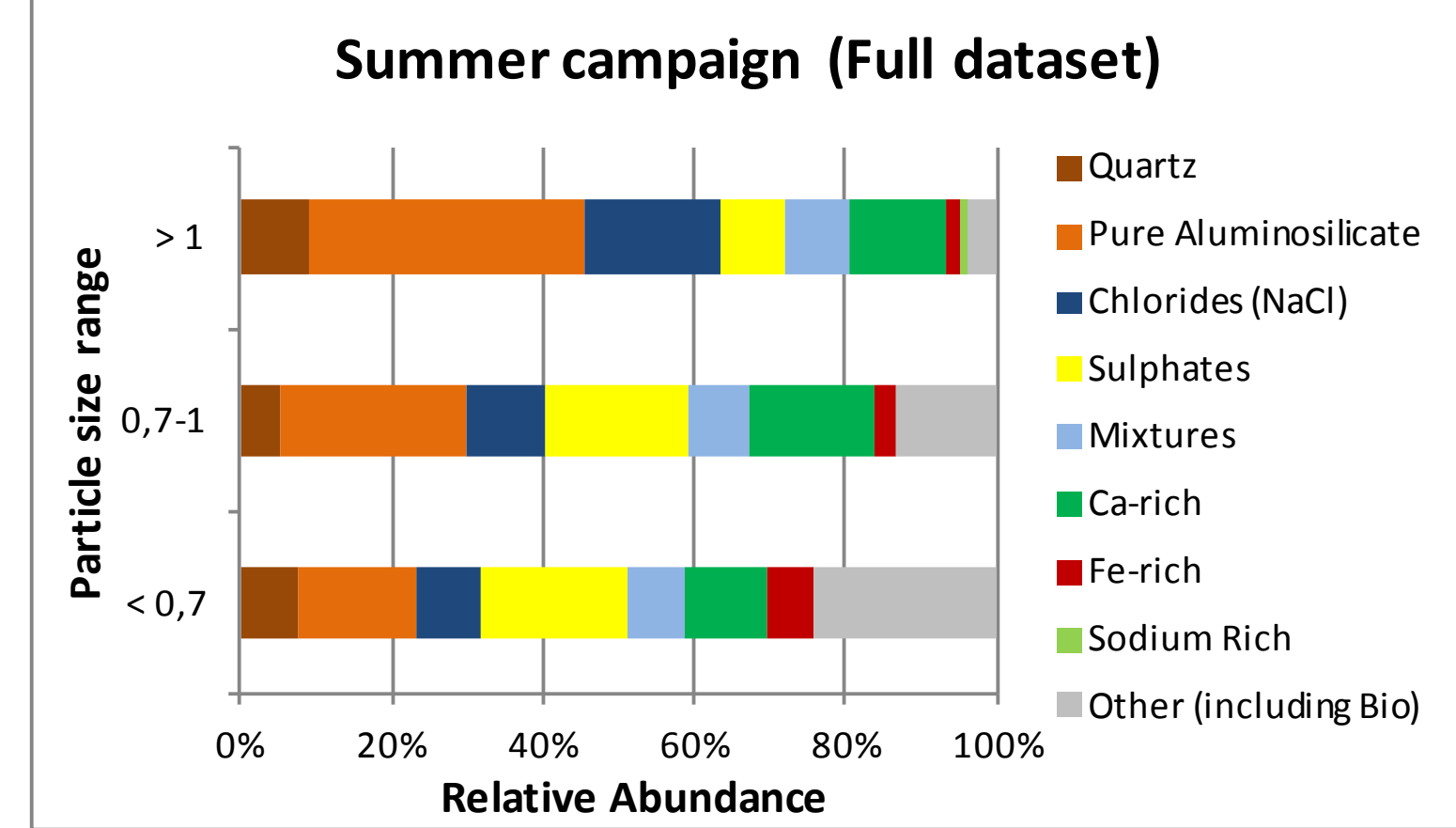


Sines Coal Power Plant Portugal located at Sines, Beja, Portugal. This infrastructure is of TYPE Coal Power Plant with a design capacity of 1192 Mwe.

The majority of particles assigned to this “other class” did not display a EDS spectrum.

Other particles include organic and biological particles, Cu particles, Ti-rich particles, alloys, etc. Metal particles are found sporadically.

The presence of organic and biological particles (with a low EDS signal also due to the C stub support) is to be expected if one takes into account the widespread use of wood as fuel for domestic heating and cooking in Évora during winter time.



## Acknowledgements

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## References

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Wagner, F., Schiavon, N., Kandler, K., Tobias, L., and Mirão, J. (2012): Long-term atmospheric aerosol deposition Southern Portugal: first results on chemical and morphological characterization of particles by VP-SEM+EDS, EAC conference.