Characterization Of Atmospheric Aerosols In The Antarctic Region

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APECS INTERNATIONAL ONLINE CONFERENCE 20th MAY 2020

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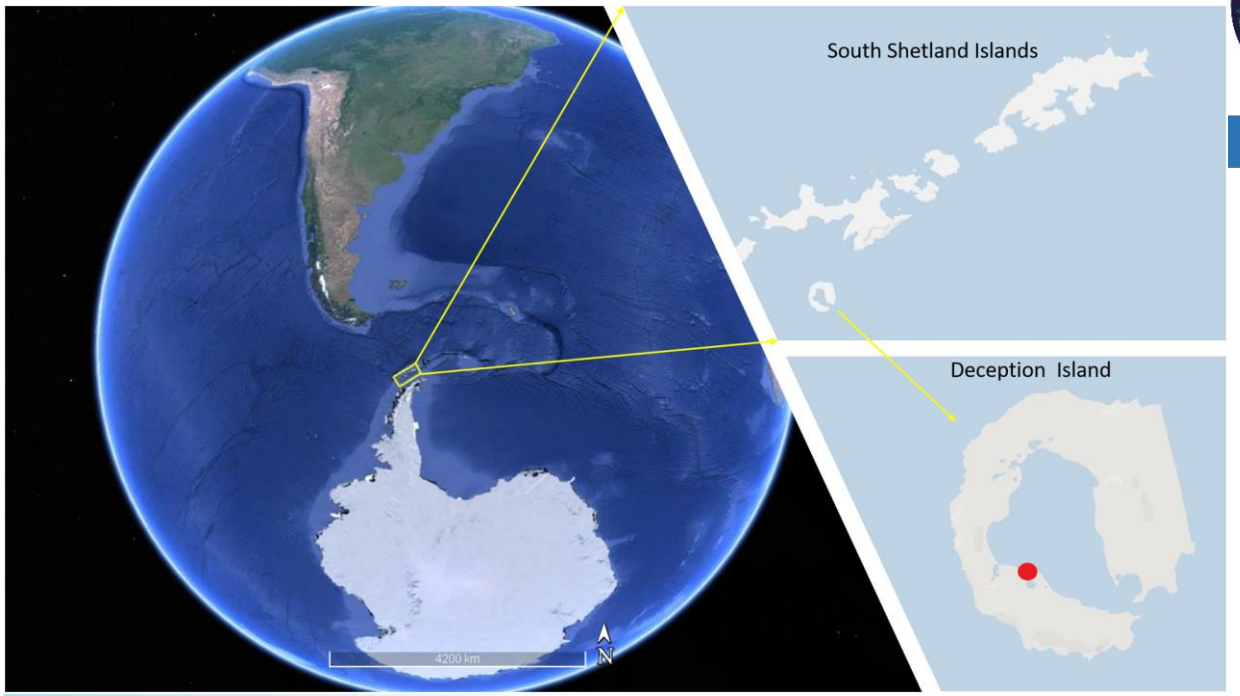
1. Introduction

- **Aerosols** are **suspended particulate matter** ($PM_{2.5}$ or PM_{10}) and act as **climate drivers**.
- **Antarctica's environment and ecosystem** can negatively be affected by PM, although its isolation.
- The study of atmospheric aerosols in the Antarctic region is important to understand their **impact** on the icy continent.
- It is essential to **identify** them and **determine** both the **natural** (sea salt, mineral dust, biogenic emissions, volcanoes, etc.) and the **anthropogenic sources** (fossil fuel combustion, mining, smelting, construction, agriculture, etc.) of Antarctic aerosols.

2. Methodology

- Aerosols samples were collected **on Deception Island** (Spanish Research base “Gabriel de Castilla”, South Shetland Islands, Antarctic region).
- Atmospheric PM was collected trough a **low volumen sampler** in circular quartz microfiber filter papers.
- PM was chemically analysed using Inductively Coupled Plasma-Mass Spectrometry (**ICP-MS**) and Inductively Coupled Plasma-Atomic Emission Spectroscopy (**ICP-AES**).
- Air mass backward **trajectories** and polar contour **maps** were implemented to better understand the potential local and remote sources of PM.



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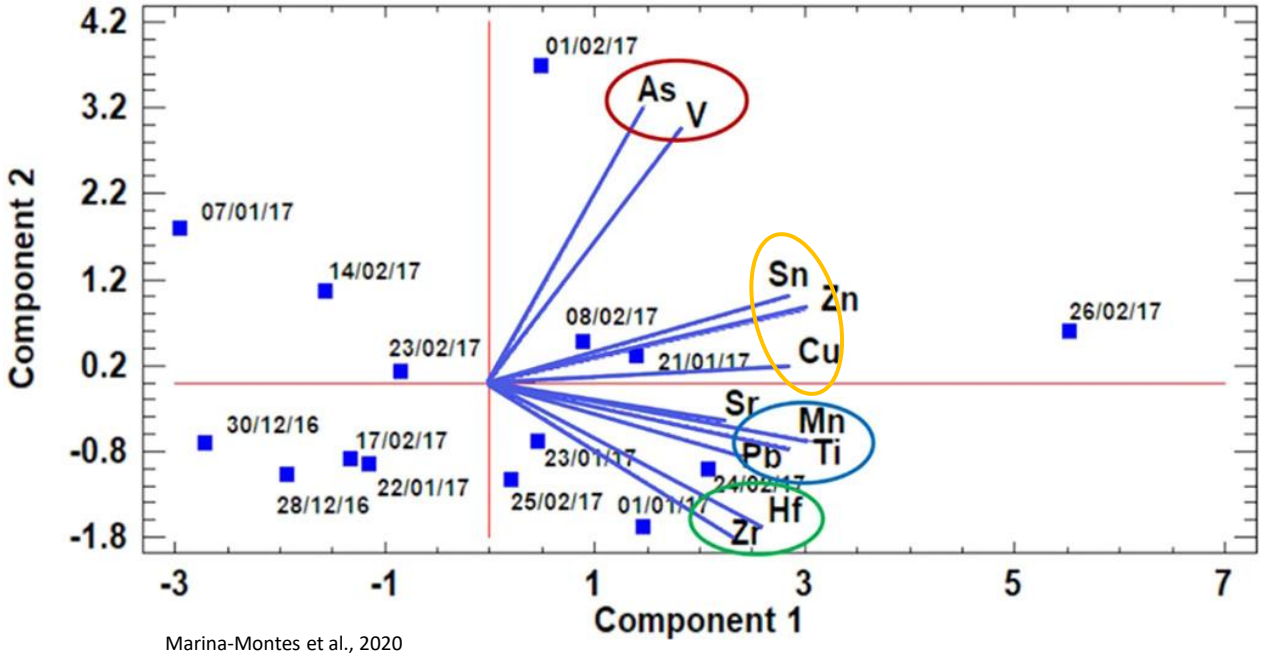
3. Results

3.1 Principal Component Analysis

Principal Component Analysis (PCA)



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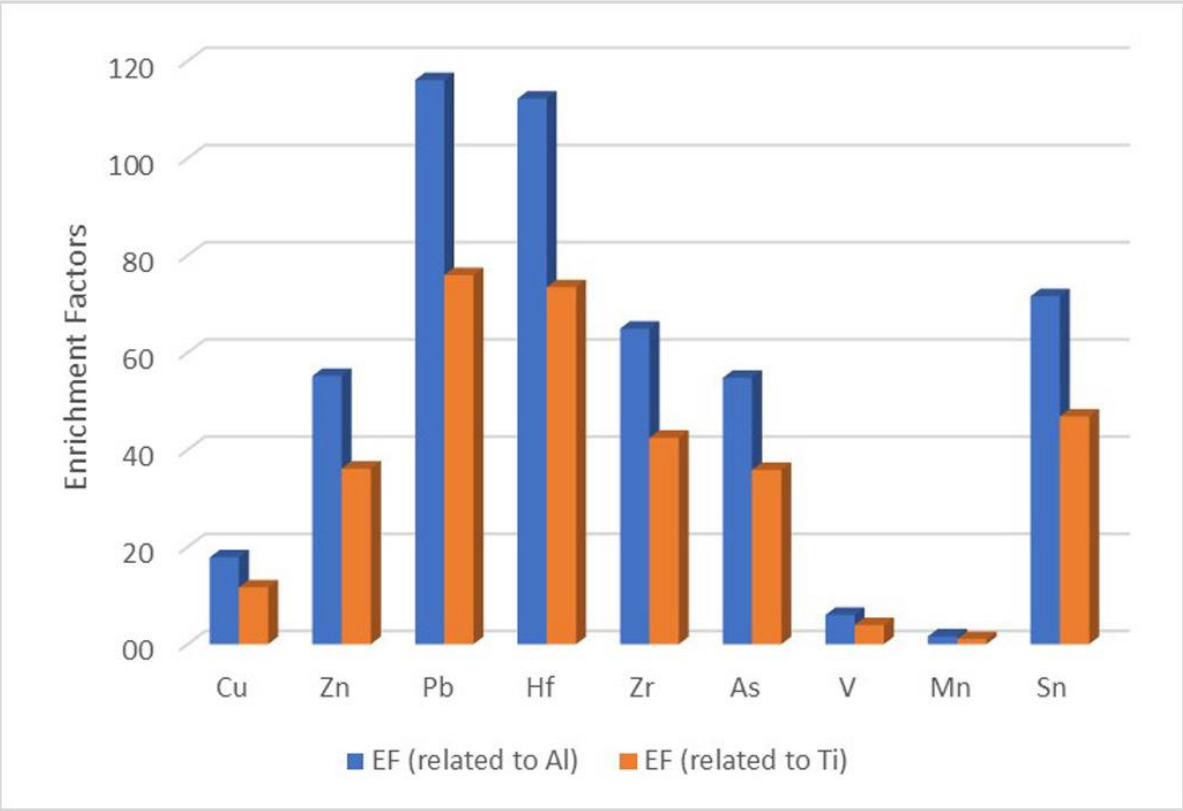
High vector **relationship** implies a **similar source**

High significant correlations were found between:

- **V & As** → Anthropogenic source
- **Cu & Sn** → Anthropogenic source
- **Ti & Mn** → Crustal source
- **Hf & Zr** → Crustal source

3.2 Enrichment factor

Enrichment factor (EF)



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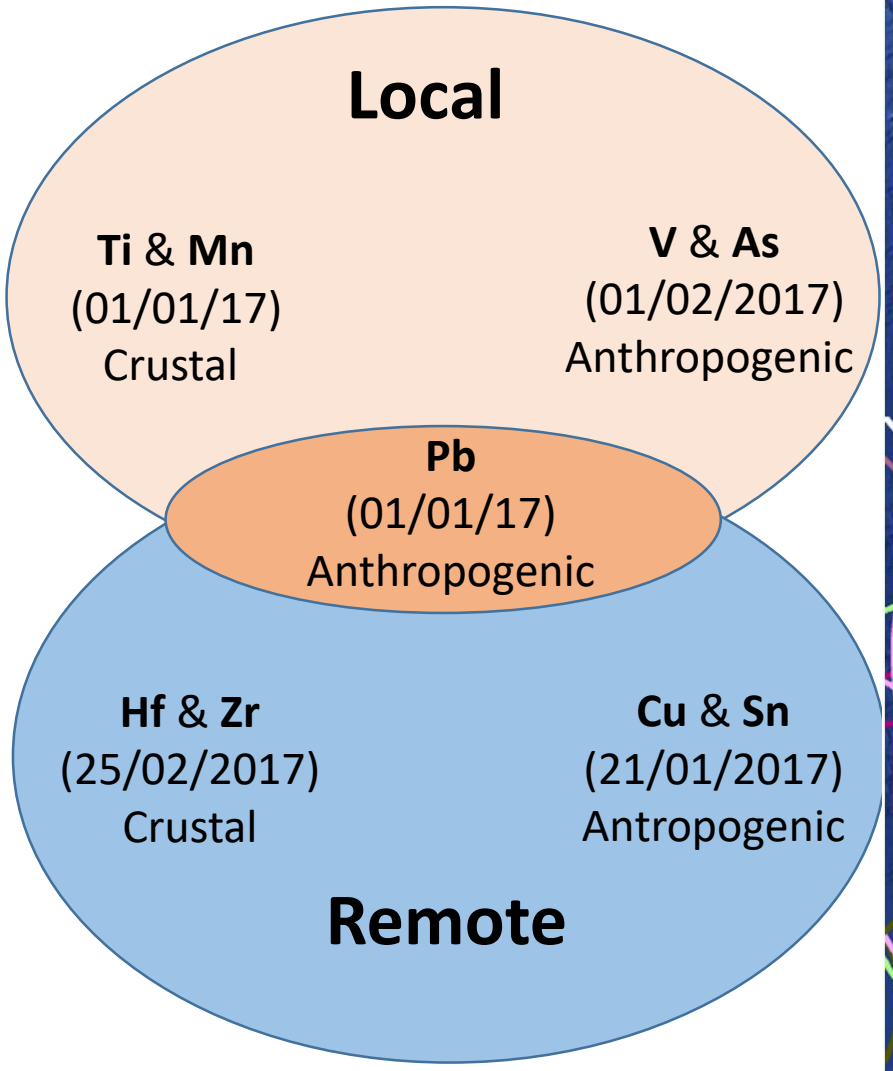
Calculated EF values **below 5** are explained as having a **crustal origin**, whereas values **higher than 10** correspond to **Supplementary sources**.

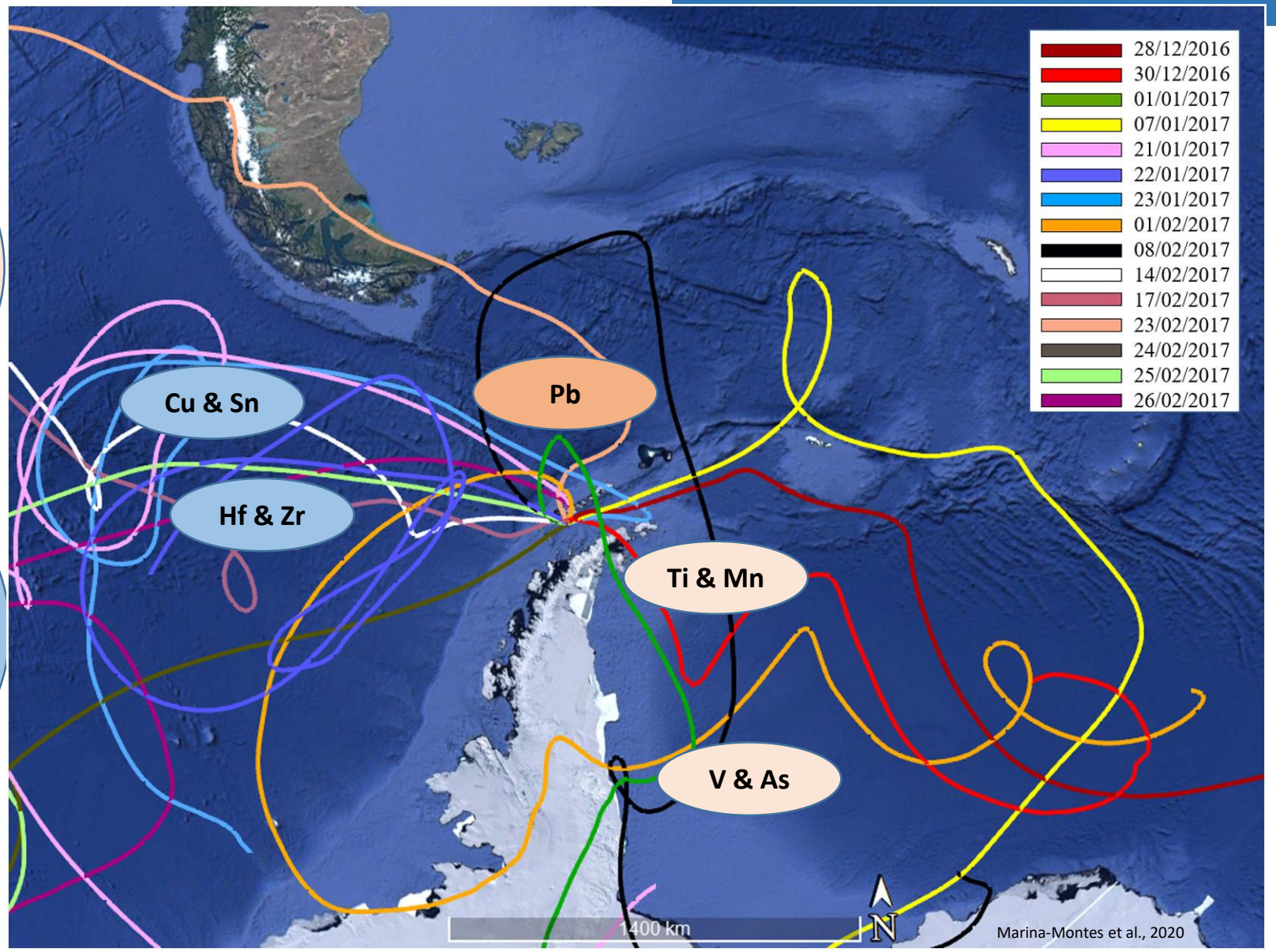
Mn — Local crustal source

Remaining elements — Remote crustal source

Anthropogenic source

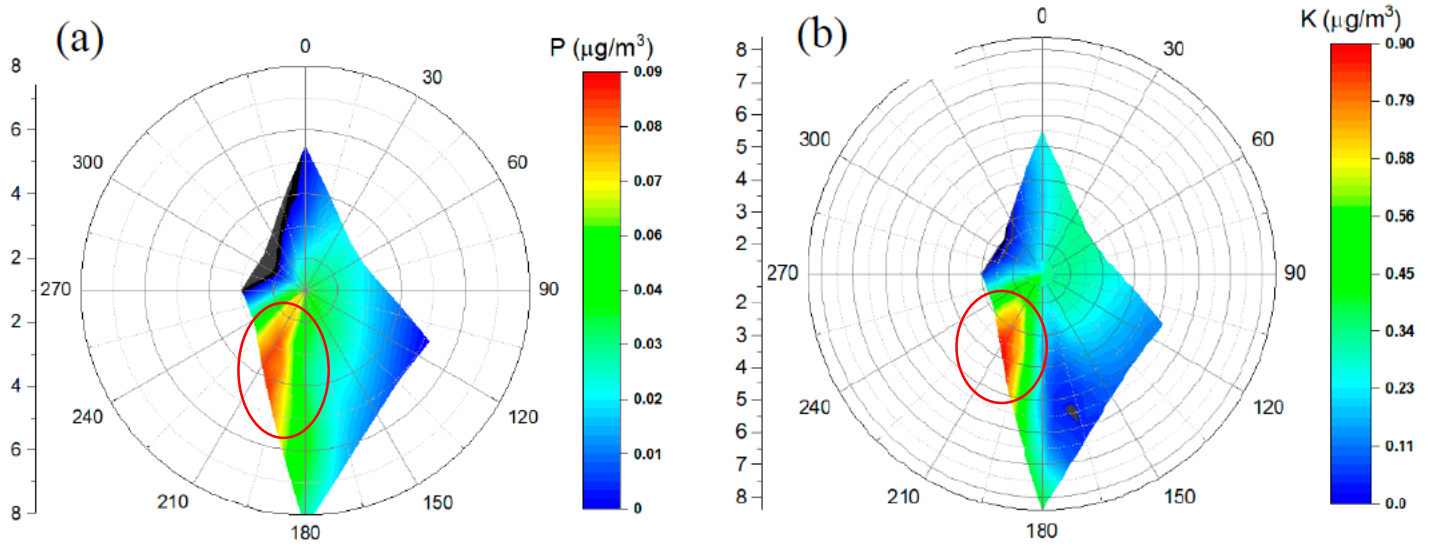
3.3 Air mass backward trajectories





3.4 Polar contour maps

P & **K**: Natural Source (Guano from Pinguin Colony)



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Punta de la Descubierta pinguin colony

4. Conclusions

Potential Sources

Anthropogenic

- **V** & **As**: combustion of fossil fuels, produced mainly from the Gabriel de Castilla base, adjacent research station and tourist cruises.
- **Cu** & **Sn**: the highest Cu and Sn concentrations correspond with pathways crossing South America and Drake's passage (high maritime traffic zones).
- **Pb**: anthropogenic pollution from local (combustion of fossil fuels on the base/adjacent research station and/or local tourist cruises) and remote sources (transport from the upper atmosphere from remote places, such as Patagonia).

Natural

- **Ti** & **Mn**: resuspension of local soils.
- **Hf** & **Zr**: resuspension of remote soils.
- **P** & **K:** excrement (guano) in Punta de la Descubierta pinguin colony (Deception Island).

Most air masses were transported following the Antarctic Circumpolar Pattern

5. References

- Cáceres JO, Sanz-Mangas D, Manzoor S, Pérez-Arribas LV, Anzano J. **Quantification of particulate matter, tracking the origin and relationship between elements for the environmental monitoring of the Antarctic region**. *Science of The Total Environment*. 2019; 665: 125-132.

- Marina-Montes C, Pérez-Arribas LV, Escudero M, Anzano J, Cáceres JO. **Heavy metal transport and evolution of atmospheric aerosols in the Antarctic region**. *Science of The Total Environment*. 2020; 721: 137702.

- Marina-Montes C, Pérez-Arribas LV, Anzano J, Cáceres JO. **Local and Remote Sources of Airborne Suspended Particulate Matter in the Antarctic Region**. *Atmosphere*. 2020; 11(4):373.

Thanks for listening!
Any questions?

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