TNA User Report

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Project title	Chemical characterization of the African dust precursor that contributes to dust suspension and deposition at the NE Antarctic coast.
Name of the accessed chamber	CESAM
Number of users in the project	3
Project objectives (max 100 words)	The literature indicates that main source of dust reaching Antarctica is mainly South America. But secondary sources also exist, and they could be significant at the Antarctic coast. In this sense, Namibia is considered a major dust supplier to Antarctica and this kind of studies in this area are not constrained. We propose to investigate the trace elements and the isotopic compositions of dust from Namibia. To do so, we propose to use the CESAM chamber at LISA which is equipped with a state-of-the-art generation system for mineral dust generation and protocols for suspension and multi-parametric analysis.
Description of work (max 100 words):	Dust aerosols were generated by mechanical shaking of natural soil samples, to reproduce the saltation and sandblasting processes responsible for the release of mineral dust in natural conditions. 10 g of soil were placed in a Buchner flask which is shaken by a sieve shaker. The dust suspension was injected into the chamber by flushing N_2. Dust samples were collected on Teflon filters 2 μm. We performed a total of 7 analysis. Each experiment was dedicated to a sample from a different soil type from a known emitting dust region in Namibia, in this case, the Huab region.

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[1]Physics; Chemistry; Earth Sciences & Environment; Engineering & Technology; Mathematics; Information & Communication Technologies; Material Sciences; Energy; Social sciences; Humanities.
[2] UNI= University and Other Higher Education Organisation;
RES= Public Research Organisation (including international research organisations and private research organisations controlled by public authority);
SME= Small and Medium Enterprise;
PRV= Other Industrial and/or Profit Private Organisation;
OTH= Other type of organization.
[3]UND= Undergraduate; PGR= Post graduate; PDOC= Post-doctoral researcher; RES= Researcher ENG= Engineer; ACA= Academic; TEC= Technician.
[4]Reproduce the table for each user who accessed the infrastructure

Trans-National Access (TNA) Scientific Report

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Instructions

Please limit the report to max 5 pages, you can include tables and figures. Please make sure to address any comments made by the reviewers at the moment of the project evaluation (if applicable, in this case you were informed beforehand). Please do not alter the layout of the document and keep it in Word version. The report will be made available on the eurochamp.org website. Should any information be confidential or not be made public, please inform us accordingly (in this case it will only be accessible by the European Commission, the EUROCHAMP-2020 project partners, and the reviewers). Please include:

- Introduction and motivation
- Scientific objectives
- Reason for choosing the simulation chamber/ calibration facility
- Method and experimental set-up
- Data description
- Preliminary results and conclusions
- Outcome and future studies
- References

Name of the PI: Nadine Mattielli
Chamber name and location: CESAM chamber.Faculté des Sciences – 61 avenue du Général De Gaulle F-94010 Créteil CEDEX
Campaign name and period: 14/5/2018 to 17/5/2018
Text:

1- Introduction and motivation

Atmospheric composition change is a main driver of present and near-future climate change with airborne particles (AP) playing a major role, e.g. in the formation of clouds because they affect both the radiative properties of clouds and precipitation like rain and snow. In addition, these AP are a major source of micronutrients (e.g. Fe) in the so-called "High Nutrient Low Chlorophyll" oceanic zones (like the Southern Ocean) that affects the global CO2 cycling, illustrates the close and complex relationships between the composition of AP and global climate. However, the aerosol fluxes and sources in Antarctica and its closely associated Southern Ocean are poorly constrained, in particular the particle chemistry. In this sense, dust recovered from Antarctic ice represents an important record of the fluctuations of Southern Hemisphere atmospheric circulation during the last glacial and interglacial periods. Dust preserves the chemical and isotopic compositions of the region where it was deflated. Over the last few decades, many studies have demonstrated clear and increasingly evidence that dust trapped in Antarctic ice originates mainly from southern South America (SSA) (e.g., Basile et al., 1997;

Delmonte et al., 2004; Gaiero, 2007; Delmonte et al., 2010; Gili et al., 2016, 2017). In particular, Rare Earth Elements concentration and radiogenic isotopes have been shown to be the most reliable means to identify the sources of dust in paleoarchives such as the Antarctic ice cores. But secondary sources, also exist and they could be significant at the Antarctic coast, especially during dust storm events. Moreover, this kind of studies are not constrained, especially dust from South Africa area (including Namibia). In that geographical area, Namibia is considered a major dust supplier to Antarctica and indeed a geochemical (REE and Pb, Nd, Sr isotopes) characterisation is needed to improve our understanding about this region. This has motivated us to investigate the trace elements and the isotopic compositions of dust from Namibia, one of the expected sources of the dusts collected in Antarctica. To do so, the use of CESAM chamber at LISA represent a great opportunity since it is equipped with a state-of-the-art generation system for mineral dust generation and protocols for suspension and multi-parametric analysis, as described in Di Biagio et al., (2017) and Caponi et al., (2017).

2- Scientific Objectives

- Study more comprehensively the dust source region of Namibia by analyzing Rare Earth Elements concentrations and Sr, Nd and Pb isotope compositions.

- Improve the understanding about how the atmospheric transport pathways from this area can reach East Antarctica.

3- Reason for Choosing the Chamber

As mentioned before the CESAM chamber it has a very well design allowing a multi-phase, multi-parametric study of composition, size and optical properties of aerosol particles. Moreover, it has the possibility to generate dust aerosols by mechanical shaking of natural soil samples, which reproduces the saltation and sandblasting processes responsible for the release of mineral dust in natural conditions.

4- Methods and Experimental Set up

Experiments were done according to the protocol developed by Di Biagio et al., (2017) and Caponi et al., (2017). Approximately 10 g of natural soil were placed in a Buchner flask which was shaken by a sieve shaker (Retsch AS200). The dust suspension in the flask was then injected into the chamber by flushing dry N2. Due to the amount of material we need to be able to measure isotope concentrations, dust was kept in suspension for a period of 3 hours while the sampling was on and dust samples were collected on teflonfilter 47 mm 2μm. In total we performed 2 experiments a day during a total campaign of 4 days. The experiments were dedicated to collect samples from one of major active regions in Namibia supplying dust (the Huab region).

5- Data Description

Soil samples were collected by J. Stephen King and his team in Namibia from three different valleys during a 4 week campaign. Those soil samples are considered as representative of dust precursors from one of the major active region in Namibia - the Huab region.

CESAM sampling date	**# spl = clé prima GPS**
14/05 am	H127
14/05 pm	H137
15/05 am	H139
15/05 pm	H135
16/05 am	ChamberCleaning no sampling
16/05 pm	H131
17/05 am	H133
17/05 pm	H132

6- Preliminary Results and Conclusions

The analysis of the samples has not started yet. We will start with the analysis of 3 samples (H129, 139 and H131). This is because during the experiment we experienced some technical problems with the filters and 3 of them were not loaded with dust once we opened the chamber. Due to this, we have agreed with people from LISA to collect more samples next time they perform experiments in the chamber.

7- Outcome and Future Studies

This study is the beginning of promising futures studies. The exchange of expertise and results between the two research groups is beneficial to improve our understanding about dust sources that reach Antarctica and the Southern Ocean. The use of the chamber allowed us to collect and geochemically characterise the fine dust that is susceptible to be uplifted from South Africa and travel long range until eventually is deposited in Antarctic. Moreover, these samples constitute a first step to develop a more comprehensive and comparative study in the future that will allow to establish to what extent Namibia is a potential dust source reaching Antarctica's coasts.

Another important aspect we will evaluate once we get the first results is the possible Fe bioavailable, which is well know that for example after dust storms, blooms of phytoplankton are shown, especially in the Southern Ocean.

8- References

Basile, I., F. E. Grousset, M. Revel, J. R. Petit, P. E. Biscaye, and N. I. Barkov (1997), Patagonian origin of glacial dust deposited in East Antarctica (Vostok and Dome C) during glacial stages 2, 4 and 6, Earth Planet. Sci. Lett., 146, 573–589.

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