Position Description

1. General Information

Name of the position	**Ice core climate and chemistry**
Foreseen date of enrolment	1 October 2023
Position is funded by	• COFUND, Marie Skłodowska-Curie Actions (MSCA), Horizon Europe, European Union • Université Grenoble Alpes (UGA) • University of Tasmania (UTAS)
Research Host	Université Grenoble Alpes
PhD awarding institutions	Université Grenoble Alpes & University of Tasmania
Locations	Primary: Grenoble, France Secondary: Hobart, Australia
Supervisors	Joel Savarino (UGA, IGE) and Lenneke Jong (UTAS, AAPP and AAD)
Group of discipline	Environmental geosciences, paleoclimate and ice core chemistry

2. Research topics (only one of these projects will be funded)

Project 1: *Surface mass balance of the Antarctic Megadune plateau*

Antarctica holds 27 million km^3 of snow and ice that can affect sea level, ocean circulation, and weather patterns. Despite its importance, we lack basic knowledge on snow accumulation in Antarctica, such as how much is accumulating and how it varies over time and space, limiting our capacity to predict the sea level rise. In an attempt to answer these questions multiple ice cores have been drilled in the East Antarctic ice sheet through the East Antarctic International Traverse (EAIIST) projects. These cores come from a previously unsampled region of Antarctica known as the Megadunes for its unusual topography driven by an extreme environment of arid, wind and cold. They are presently stored in France, Italy and Australia.

Using volcanic horizons as time markers, coupled with ground penetrating radar (GPR) measurements, we propose to reconstruct the surface mass balance (SMB) of the Megadune plateau, both in time and space. To achieve this goal, the candidate will perform laboratory sampling and analysis of the raw geochemical data of the different ice cores, with capacity of stable isotope and electron microprobe analysis for unambiguous tie-point identification. In a second step, the candidate will treat the GPR data to reveal internal layers of the snow pack. Matching radar internal layers with well-dated ice core reference layers (e.g. volcanic layers) will allow to date and deduce the surface mass balance

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through time for the full EAIIST transect. The variability of the SMB observed will finally be studied in the context of past and current climate changes.

In addition to the data processing work (IGE), the student will gain expertise in advanced analytical techniques including separative techniques (IGE & AAD) and ultra-high-resolution mass spectrometer (ThermoFisher & IGE).

The candidate must have (or acquire) the basics of chemical analysis, an interest in environmental issues, and good skills to work in a team as well as independently. Proficiency in programming (R, Python) for data management and statistical analyses will also be required.

Supervisors:

Joel Savarino (UGA, IGE), Prof. Emmanuel Le Meur (UGA), Lenneke Jong (UTAS, AAPP and AAD), Andreas Hilkert (ThermoFisher)

Research Fields: climate change, glaciology

Project 2: *Spatial variability of signals in ice coring at low accumulation sites*

One of the most unresolved questions in ice core science is the local-scale spatial variability and its influence on the robustness of the signals recorded in ice and air bubbles. This variability is exacerbated at low accumulation sites precisely where the deep ice cores are generally drilled. Recent studies have emphasized the need to better consider spatial variability at the local scale. For instance, current volcanic reconstructions based on ice core analysis have significantly improved over the past few decades by incorporating multiple-core analyses with a high temporal resolution from different parts of the Polar Regions into a composite common volcanic eruption record. However, in many cases only single records at given sites are used for these reconstructions and past studies have found that local-scale variability, essentially attributed to snow drift and surface roughness, could lead to a non-exhaustive record of volcanic events when a single core is used as the site reference.

Following the success of the East Antarctic International Traverse (EAIIST) that took place in 2020, we have drilled 20 cores over a large area of the East Antarctic Plateau. This ice database, shared between Italy, France and Australia is the perfect tool to establish the spatial signal-to-noise ratio of different ice proxy markers.

In a common endeavor, we propose to carry out a spatial survey of the geochemical signals trapped in ice cores. Such “signal” could concern volcanic events recorded in the ice, nitrogen and sulfur stable isotope fingerprinting, sea-salt or halogen compounds. The goal first is to extract from this ice core database the signal-to-noise ratio and deduce the regional signal information through statistical analysis. In a second step, this regional information will be compared to other deep inland or coastal cores (e.g. EPICA, Law Dome Talos Dome, Mont Brown South, etc.) to reveal common and disparity between these cores and what could be the biases in the deep core records when only a single core is available.

As for the position 1, in addition to the data processing work (IGE), the student will gain expertise in advanced analytical techniques including separative techniques (IGE & AAD) and ultra-high-resolution mass spectrometer (ThermoFisher & IGE).

The candidate must have (or acquire) the basics of chemical analysis, an interest in environmental issues, and good skills to work in a team as well as independently. Proficiency in programming (R, Python) for data management and statistical analyses will also be required.

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Supervisors: Joel Savarino (UGA, IGE), Andrea Spolaor (Ca' Foscari University of Venice), Lenneke Jong (UTAS, AAPP and AAD), Andreas Hilkert (ThermoFisher)
Research Fields: climate change and atmospheric chemistry

Project 3: *Variability of aerosol deposition in ice cores from coastal and interior locations in East Antarctica*
Ice core records of aerosol trace chemicals, cosmogenic isotopes and dust are used to produce multi-proxy records of past climate and to infer the origin of air-masses. The mechanism through which sea salt aerosols are deposited changes from wet, cyclonic precipitation in coastal areas to dry, "diamond dust" deposition inland. The sea salt records from new cores from the EAIIST traverse using high resolution CFA techniques will complement other records such as from Law Dome, Mount Brown South and Aurora Basin North, to study of the changes in the depositional regimes spatially. This project will compare sea salt aerosols and volcanic sulfate records in these ice cores to study how the dominant type of deposition mechanism, and hence snow accumulation patterns vary in ice cores from the Antarctic coast to the interior. The second part of this project will use this to inform how the snow accumulation regimes may have changed within glacial-interglacial cycles with changing ice sheet extent causing sites to become more coastal or inland over time. As for the position 1, in addition to the data processing work (IGE), the student will gain expertise in advanced analytical techniques including separative techniques (IGE & AAD) and ultra-high-resolution mass spectrometer (ThermoFisher & IGE). The candidate must have (or acquire) the basics of chemical analysis, an interest in environmental issues, and good skills to work in a team as well as independently. Proficiency in programming (R, Python) for data management and statistical analyses will also be required.
Supervisors: **Senior Scientist Joel Savarino (IGE), Lenneke Jong (AAPP UTas and AAD), Research engineer Andreas Hilkert (ThermoFisher, Bremen)**
Research Fields: *stable isotope geochemistry, climate, atmospheric chemistry*

3. Employment Benefits and Conditions

The Université Grenoble Alpes offers a 36-months full-time work contract (with the option to extend up to a maximum of 42 months). There is a probation period of 2 months and the total working hours per week is 36h40.

The remuneration, in line with the European Commission rules for Marie Skłodowska-Curie grant holders, will consist of a gross annual salary of 27,907 EUR. Of this amount, the estimated net salary to be perceived by the Researcher is 1,870 EUR per month. However, the definite amount to be received by the Researcher is subject to national tax legislation.

Benefits include

- Access to all the necessary facilities and laboratories at Université Grenoble Alpes and University of Tasmania, including cold rooms, chemistry labs, clean rooms, ion chromatography, analytical platforms (HPLC, IRMS, Orbitrap, LC/MS/MS, ICP-MS, PICARRO, etc.).

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- Tuition fees exemption at both PhD awarding institutions.
- Yearly travel allowance to cover flights and accommodation for participating in AUFRANDE events.
- 10,000 EUR allowance to cover flights and living expenses for up to 12 months in Australia.
- 45 days paid holiday leave.
- Sick leave.
- Parental leave.

4. PhD enrolment

Successful candidates for this position will be enrolled by the following institutions and must comply with their specific entry requirements, in addition to AUFRANDE's conditions.

Université Grenoble Alpes

To enrol in a Doctorate program you must meet the general conditions, namely:

- to hold a French diploma conferring the degree of master at the end of a training programme establishing the aptitude for research;
- to hold a foreign diploma of equivalent level (obtained at the end of a training programme establishing the aptitude for research). In this case, you should request an exemption from the Master's degree when you apply;
- benefit from the validation of prior learning as provided for by the Education Code.

More information: https://doctorat.univ-grenoble-alpes.fr/preparing-a-phd/doctorate-enrolment/apply-and-register-in-doctoral-school-890537.kjsp?RH=1611137559271

University of Tasmania

The minimum course entry requirements for a Doctoral Degree are:

i. Completion of a previous qualification in a relevant discipline that includes a substantive thesis, where the research component of that degree comprises:
   - 50% of a Bachelor Honours (equivalent to AQF Level 8) with an overall grade of at least Second Class Upper (Class IIA) standard, or
   - 25% of a two-year Masters Coursework degree (equivalent to AQF Level 9) with a thesis component grade of at least Distinction grade, or
   - Masters Research degree (equivalent to AQF Level 9) of at least Distinction grade.

OR

ii. A record of research or professional qualifications deemed by the Dean, to be of a standard equivalent to at least Bachelors Honours degree Second Class Upper (Class IIA) and providing a suitable background for the Doctoral research the candidate is proposing to undertake.

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In addition, an applicant must provide evidence of their English language proficiency in accordance with the University of Tasmania's requirements at the time they submit their application. Note that results of an English language proficiency test must have been awarded within 2 years of application date.

Furthermore, international applicants must satisfy the Australian Department of Home Affairs English language proficiency criteria to obtain a student visa to study in Australia. This requirement is in addition to the applicant meeting the University's English language proficiency requirements.

More information: https://www.utas.edu.au/policy/procedures

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