



ANTARCTIC 2023-2024

NANO(SOUTH)GATE

LEAD INSTITUTION, PI

PI: Julien Gigault, International Research Laboratory (IRL) TAKUVIK Université Laval, CA

ABSTRACT

NANO(south)GATE

The main goal of NANO(South)GATE is to characterize the presence and the biogeochemical cycling of anthropogenic nanoparticles (ANPs) in the Southern Oceans (SO). Nanoplastics, TiO₂, and nano-soots are targeted due to their extensive release from anthropogenic activities, high sorption capacity of secondary contaminants in the environment, and expected ubiquity in the SO. More specifically, we will document the distribution and quantify the fluxes of ANPs from the different SO reservoirs (sea ice, snow, water, sediment, Phyto- and zooplankton). Despite its relatively small size and lower direct contact with human activities, the SO is one of the most exposed oceans to anthropogenic impacts due to its interactions with adjacent abiotic compartments to the South (atmosphere and hydrosphere). To our knowledge, there is no data concerning anthropogenic nanoparticles in the SO. However, as for the Arctic Ocean, it is expected that the SO is more likely to accumulate and concentrate these anthropogenic materials, mainly due to the Antarctica Circumpolar Current (ACC). Our recent results demonstrate that the millimeter and micrometer fractions of the ocean's anthropogenic materials are relatively negligible compared to the nanoscale one. Compared to the microparticles, even at (ultra)-trace concentration, and due to their high surface specificity, diffusivity and reactivity, ANPs are more likely to adversely impact biota, especially these primary producers' phytoplankton, and zooplankton, and to impact the main biogeochemical cycles. In this context, several questions are raised: what is the distribution of ANPs in the SO? What are the transportation pathways of ANPs to Antarctica? What is the impact of ANPs on living organisms and the food web? There is an urgent need to address and document the presence and the effects of ANPs on the Poles. To do so, we asked for two berths in the itinerary: CC080124 or CC060224 (similar itinerary) and CC030324. Based on our first experiences in the Arctic with "Le Commandant Charcot," two berths are required. During the expeditions, we will deploy our analytical strategies to concentrate the micro- and nanoparticles from various matrices in low volume (10 mL). Sea ice, snow, organic particles, and seawater will be collected using the in-situ pump of the vessel and the different facilities (ice corer, snow tanks, marine snow catcher) when ice activities are planned. The final volume of concentrated nanoparticles and microparticles will be stored at five °C until reaching the Takuvik laboratory. In Takuvik, we have developed high-resolved analytical methods to detect, identify and characterize (size, shape, source) trace

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*Access to the Southern Ocean on board the Polar Exploration
Ship "Le Commandant Charcot" (PONANT, France)*



concentrations of ANPs in environmental media. In addition to the scientific communication, we will propose showing, demonstrating, and participating ("open science" program) in our sampling and characterization strategy for nanoplastics to the cruise passengers. In the laboratory and some dedicated space, we will present our work on posters showing our first results obtained in 2022. Different outreach activities will be planned, such as a large conference and short presentations (10 minutes) called "Recap," showing our day-by-day activities and our first observations.