Over several decades, waters of the Southern Ocean have been warming, freshening, and decreasing in oxygen. The Antarctic Circumpolar Current, the largest oceanic current on our planet, has been gradually shifting southwards towards the Antarctic continent. The archipelago of South Georgia, with its unique position bisecting the stream of the Antarctic Circumpolar Current, is in the epicenter of these changes. Despite its sub-Antarctic location, South Georgia has also experienced a long history of industrial impact caused by whaling industry that ended in the 1960s. In consequence, the area of South Georgia is a fantastic place to observe environmental changes and ecosystem response to these changes. In their scale and duration, they exceed anything that can be seen during laboratory experiments.

Terrestrial ecosystems of South Georgia have attracted significant scientific attention focusing on the impacts of climate change and dispersal of invasive species. However, because of its remoteness, South Georgia marine ecosystems, including its numerous fjords, remain understudied. Fjords are among marine settings that are particularly exposed to environmental change. They are relatively shallow, next to land with its human settlements and industrial activity, and under an influence of natural factors such as fluctuations of glacial fronts and a decline of sea ice. The primary objective of this project is to document modern benthic communities inhabiting these fjords and explore how their local biodiversity has responded to the twin impacts of industrialization and global warming. It will be a part of a large international effort to establish South Georgia as a sentinel for climate change in rapidly changing and globally important sub-Antarctica.

The project will focus on foraminifera as a major component of benthic marine biodiversity and key microorganisms used for paleoenvironmental reconstructions and the monitoring of human influence in marine environments. The detailed goals of the proposed research are (1) documentation of the biodiversity and distribution patterns of modern foraminifera, including poorly-known monothalamids; (2) to improve taxonomy of foraminifera in South Georgia by description of new species; as well as (3) to reconstruct changes in foraminiferal faunas and (4) environmental conditions over the last 150 years in selected fjord locations.

The first two goals will be accomplished by using classical morphological methods for investigating calcareous and agglutinated (i.e., testate), as well as monothalamids benthic foraminifera, a group that has no fossil record but is especially important in high latitudes and fjord settings. It will provide a valuable baseline for recognizing future trends and an important insight into likely ecosystem changes linked to ongoing climate warming in the Antarctic Peninsula sector of Antarctica. It will also allow paleoenvironmental interpretations of core material.

To obtain a more complete understanding of faunal changes in these core records, parallel investigation utilizing routine micropaleontological methods as well as investigations of sedimentary ancient DNA (*sed*aDNA) will be conducted. We will compare records from fjord locations impacted by the whaling industry and those not impacted to assess resistance of South Georgia ecosystem to local but severe industrial impact and its capability to reestablishing natural communities, as well as ecosystem response to the ongoing warming. We will also reconstruct variations in sedimentation rates as well as depositional patterns in order to discriminate between the regional signal and local responses to increased meltwater discharge and fluctuating glacial fronts. They will provide a more precise paleoenvironmental context for faunal changes. The role of South Georgia fjords as sites of organic carbon burial will be also assessed.