ECOLE LEMANIQUE DES SCIENCES DE LA TERRE
DES UNIVERSITES DE GENEVE ET DE LAUSANNE

Master ès Sciences in Earth sciences

Southern Ocean Biological productivity fertilisation during the Last Glacial

Contact persons: Dr. Patrick Blaser *(patrick.blaser@unil.ch),*
Prof. Samuel Jaccard *(samuel.jaccard@unil.ch)*

Context

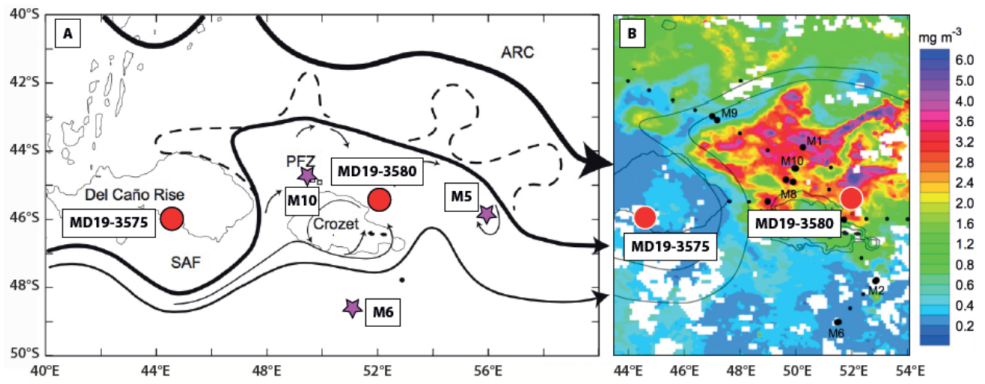
The deep ocean is a vast and dynamic storage of carbon. It appears that this carbon pool increased during glacial times and thus removed CO_2 from the atmosphere, and consequently reduced its warming green house effect. Two main factors determine the deep ocean carbon pool: ***reconfigurations in ocean circulation, and changes in biological productivity*** *at the surface, which binds carbon and exports it to depth via sinking organic matter. The Southern Ocean seems to have played a major role in* ***glacial carbon storage*** *through a vastly increased deep carbon pool. Higher biological production was supported by the fertilisation with iron from increased mineral dust delivery and the distribution of deep Southern Ocean water masses physically expanded and isolated the deep southern ocean carbon pool.*

Objectives and Methods

In this project the student investigates ***changes in biological export production and dust fertilisation*** *to Southern Ocean sediment core MD19-3580. The site is located on the* ***Crozet plateau*** *in the Indian Ocean sector of the Southern Ocean, where biological productivity today is enhanced by iron from sediments delivered from Crozet island. The different isotopes of the radioactive elements* ***thorium*** *(Th) and* ***uranium*** *(U) yield information about particle fluxes and sedimentation. Sediment samples will be dissolved with a new high pressure microwave digestion system. Subsequently, the liquid samples are prepared in the chemistry lab and isotopically analysed with a modern multi-collector inductively-coupled plasma mass spectrometer. Further standard geochemical methods yield information about the general composition of the sediment and thus allow to disentangle biological from mineral dust fluxes.*

Literature

Jaccard, S.L., et al. Covariation of deep Southern Ocean oxygenation and atmospheric CO2 through the last ice age. *Nature, 530, 207-210, 2016.*
Kumar, N., et al. Increased biological productivity and export production in the glacial Southern Ocean. *Nature, 378, 675-680, 1995.*
Pollard, R., et al. The Crozet Natural Iron Bloom and Export Experiment (CROZEX). *Deep-Sea Research II, 54, 1905-1914, 2007.*



Crozet Plateau *and location of sediment core 3580.* ***A:*** *regional ocean currents (ARC = Aghulas Return Current, PFZ = polar frontal zone, SAF = subarctic front)* ***B:*** *regional surface water chlorophyll concentration (i.e. biological productivity) in October 2004 (Pollard et al. 2007).*

Choice of orientation :

1) Sedimentary, Environmental and Reservoir Geology / 2) Geochemistry, Alpine tectonics, Ore Deposits