

Dr Carme Huguet - Visiting professor (2014-2015)

Report of activities at Stellenbosch University, South Africa.

The visit took place from 10th of November to 2nd of December 2014 in order to accommodate both the visitor's (Dr Huguet) and the host's (Dr Fietz) schedules. During the visit I helped Dr Fietz to set up the sample preparation and extraction technique for alkenones and GDGTs in the general Geochemistry Lab, Department of Earth Sciences. Dr Fietz is starting the first organic biomarker research lab in Africa and has ready access to samples from the Southern Ocean (SANAP; R/V SA Agulhas II) austral summer and winter cruises 2015.

With the support of staff scientist Dr. Marietjie Stander at the Stellenbosch University, Central Analytical Facility, MS-Lab (<http://academic.sun.ac.za/saf/services/services1.html>) we started setting up the analytical procedures using the UPLC-MS (Ultra High Pressure Liquid Chromatograph coupled to a Mass Spectrometer; Figure 1). The method proposed by Becker et al., (2013; 2015) was strictly followed at the beginning. After running test samples and standards, it was modified considerably to improve the sensitivity to be able to detect compounds in Southern Ocean waters. For instance, measurements were done initially using a positive APCI (Atmospheric Pressure Chemical Ionization) source and results were promising (see Figure 2 for examples of peak detection and integration and Table 1 for example samples' outcome); however, sensitivity using the routine amount of sample available for this kind of work was low. A series of changes was made, e.g., replacing the APCI by an ESI (Electron Spray Ionization) source as well as temperature changes and source adjustments. The changes resulted in a satisfactory set-up for some applications. For instance, sediment core standard samples used in an intercalibration on indices used for paleo-reconstructions (Schouten et al., 2009) gave the correct, published index values (e.g., Table 1), and hence, the UPLC-qTOF-MS with ESI interface set-up could be used as long as sufficient sediment material is available; an estimated >2g dry sediment is currently needed for reliable pale-reconstructions. However, the target compounds in Southern Ocean water samples (one of the main aims for Dr Fietz' current research) were below detection limit. This hinders current objectives to provide a Southern Ocean calibration for the cold- or polar-water indicating OH-GDGTs.

For this reason a new machine (ACQUITY UltraPerformance Convergence Chromatography, UPC²) was tested following the recommendation of the staff scientist Dr. Marietjie Stander. This is a new type of chromatography that uses CO₂ in a critical state as the liquid phase to separate the compounds. This set-up has a much lower critical abundance for detection. Preliminary results using our Crenarchaeol standard and test samples were promising, as we detected all major targeted compounds, but we did not have time to complete the tests and I hope to be able to work remotely during 2016 together with Dr Fietz and Dr. Stander on further tuning of the method.

I also participated in the evaluation of the B.Sc. Honors' student projects, particularly in the examination of the written research thesis and evaluation of the oral defense of Ms Gillian Trollope's thesis on "The distribution and abundance of hydroxylated GDGTs and their use as a paleo-environmental proxy in the Southern Ocean". A new B.Sc. Honors student, Mr. Johan

