**Scientific report**

**Micro-DICE – Short visit grant** 6877

**Host scientist:** Dr. I. Weikusat, Junior Professor, Alfred Wegener Institute, Germany.

**Grant recipient:** Ernst-Jan Kuiper, Utrecht University

1. **Purpose of the visit**

The purpose of the visit is to prepare ice core samples from the NEEM ice core and transport the samples back to Utrecht while they are packed in dry ice. In Utrecht the samples will be studied in the Focused Ion Beam-Scanning Electron Microscope (FIB-SEM) which has an Electron Back Scattered Diffraction (EBSD) function. The EBSD maps made provide a high resolution surface misorientation map of (sub)grain boundaries, slip bands and other deformation features. These data will be used to identify active deformation mechanisms important for ice sheet dynamics.

1. **Description of the work carried out during the visit**

During the stay I used two core sections of the lower part of the NEEM core to make my samples. One of the core sections was bag number 4406-60 (~2423 meters depth) which is interglacial ice from the Eemian period. The other core section was bag number 4075-60 (2241 meters depth) which contains ice from the last glacial period. Both of these core sections are from the part of the NEEM core that is

First a thick section was made which was scanned with the Large Area Scanning Microscope (LASM) after it sublimed for about two hours. Then a thin section was made which was scanned in the fabric analyzer to get an impression of the C-axis orientation of the core section. After that, twelve EBSD samples of about 0,8 cm³ prepared out of both core sections. Each samples was scanned under a light microscope (LM) to be able to compare the sample surface in Bremerhaven to the sample surface in Utrecht when the EBSD measurements were made. After the LM scan, the samples were packed airtight to prevent sublimation and condensation during the transport from Bremerhaven to Utrecht.

The other part of the visit consisted of discussing the work to do on implementing the composite flow law developed by Hans de Bresser. The idea is that we use this flow law to determine at what depth in the EDML and NEEM ice core the creep is determined by grain size insensitive (GSI) or grain size sensitive (GSS) mechanisms. For this to be done, the script should be converted from excel to C++ and the reading in of the grain size distributions will be automatized. During this visit I discussed with Ilka Weikusat, Tobias Binder and Daniela Jansen about the current state of the composite flow law and what needs to be done in the next couple of months.

**3) Description of the main results obtained**

The 24 samples from the NEEM core are transported back to Utrecht without any problems. The EBSD measurements have been performed in the three weeks afterwards and currently I’m processing and interpreting the results.

I will soon start to work on the composite flow law. With the grain size distribution data from Tobias Binder and the model of Hans de Bresser, I will try to determine the GSI and GSS regions in the NEEM and ADML ice cores.

**4) Future collaboration with host institution**

I will stay in close contact with Ilka Weikusat, Tobias Binder and the other scientists at the AWI. Near the end of February 2015 I will visit the AWI again for a workshop on image analysis and in April-May I will visit the AWI to prepare another set of samples from the NEEM or EDML ice core.