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Folds in the NEEM ice core (Greenland)

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Drilling of the deep ice core NEEM (North Greenland Eemian Ice Drilling) in North-West Greenland (77.45°N 51.06°W) has reached the bed rock last year[1]. As the name of the project indicates, the aim of the drilling was to retrieve an ice core through the last warm period (Eemian) resembling Holocene. For the first time, it was possible to measure many parameters (chemical and physical) in the field, just after drilling. For example, microstructure and fabric data were obtained, as well as stable water isotopes (temperature proxy) and entrapped gases, which follow a certain sequence of peaks if their occurrence is caused by the global climate circulation system. First analyses of these measurements show that the record of the NEEM ice core is disturbed below $\sim$ 2200 m depth, just where the first ice of Eemian oxygen isotopy signature occurs.

Important features, which directly characterize the type of disturbances, are folding or faulting of the stratigraphic layering. Visual stratigraphy (VS) was recorded continuously and, for the first time, in automatically processable intensity configurations along the whole NEEM core using a dark field method with a line scan camera and two indirect LED light sources. In periodic depth intervals and additionally in depths of certain interest, surface etch features in light microscopy (LM microstructure mapping[2]) and c-axis fabrics with an automated fabric analyser (FA) were measured. The combination of these methods allows the detailed analysis of the disturbance structures, various recrystallization processes and implications on flow organization and history (see accompanying abstract by Samyn et al.).

For example, we found that peculiar chains of small grains (LM microstructure mapping) align with the fold axis (VS) and exhibit a completely different fabric characteristic (FA) than the surrounding material. We will present some examples of such disturbance features with preliminary interpretation regarding their formation processes.

[1] Official NEEM website http://neem.nbi.ku.dk/

[2]Kipfstuhl, S.; Hamann, I.; Lambrecht, A.; Freitag, J.; Faria, S.; Grigoriev, D. Azuma, N. Microstructure mapping: a new method for imaging deformation induced microstructural features of ice on the grain scale. J. Glaciol., 2006, 52, 398-406