# Recent results from the Greenland NEEM ice core

Anders Svensson[1] on behalf of the NEEM project members
[1]*Niels Bohr Institute, Ice and Climate Research, University of Copenhagen, Denmark (as@gfy.ku.dk)*

The latest of the Greenland deep drilling programs has been the North Greenland Eemian Ice Drilling (NEEM, 77.45°N 51.06°W) project that was initiated as part of the International Polar Year in 2008. The ice core drilling reached bedrock during the summer of 2011 at a depth of 2538.10 m, where meltwater entered the borehole. The project has an ambitious scientific program that involves science groups from 14 participating nations including the US and Canada, Japan, China, South Korea, and several European nations.

The ice core is studied in detail by a suite of different measurements, including stable water isotopes (past temperatures and moisture sources), the concentration and isotopic composition of greenhouse gasses, high-resolution dust and chemical measurements resolving annual variations, volcanic layer and tephra, black carbon, cosmogenic isotopes, visual stratigraphy, as well as physical properties of the ice. Japanese researchers are involved with several of those analyses including measurements of impurities, gases, physical properties, and cosmogenic isotopes.

In parallel with an extensive discrete sampling program several NEEM ice core analyses were performed continuously in the field., i.e. measurements were made 'online' on a continuous melt water steam. For the first time, not only chemical impurities and dust, but also stable water isotopes and methane gas concentrations were measured continuously by application of new laser analyzers. Those analyses provide records of past climate in unprecedented temporal resolution.

The NEEM ice core covers the Holocene (with brittle ice during the early Holocene), the entire last glacial period, with a climate record very similar to existing Greenland ice cores, as well as ice from the last interglacial, the Eemain, and the penultimo glacial period. Several results suggest, however, that this deepest part of the record is disturbed to some degree, and this is currently a topic of investigation. The occurrence of discontinuities in the deepest ice is supported by recent radar profiles that show large scale disturbances of the deep ice over large areas of Northern Greenland.

With the termination of the NEEM program it is time to consider potential future Greenland ice core projects. This year the main building at NEEM, the Dome, was successfully mounted on skies, which allows extension of the camp lifetime and possibly also relocation of the camp to a new drill location in Northern Greenland by traverse. Whereas there are no established plans for a new deep ice core drilling in Greenland, potential projects include yet another search for a site with an undisturbed record of the Eemain, coring at a location away from the ice divide e.g. in an ice stream with an active flow dynamics, or a new deep drilling in Southern Greenland that would provide a high resolution Holocene record and help constraining the extent of the Greenland ice sheet during the Eemian.